

*He who believes in Me, as the Scripture has said,
out of his heart will flow rivers of living water.*

John 7:38

Constructing a Pipe-Bound City

A History of Water Supply, Sewerage, and Excreta
Removal in Norrköping and Linköping, Sweden, 1860-1910

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Linköping Studies in Arts and Science

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Linköping 15 November 2002
Jonas Hallström

Introduction

In the mid- to late 19th century, Swedish and Scandinavian cities were relatively small compared to their counterparts on the Continent and in Great Britain. Despite their size, mortality levels in Swedish cities often surpassed those of British industrial cities, which contemporaries believed was a result of un-sanitary conditions. In the period 1846 to 1851 the average Swedish urban mortality was 29 per thousand, and between 1852 and 1856 it rose to 33 per thousand (the rural figures were 19 and 20‰, respectively). The crude mortality of Stockholm was more than 45 per thousand, almost twice what was considered excessive in Britain (above 23‰). A committee set up in 1858 to propose a national Public Health Act concluded that Sweden stood “as far as sanitary conditions are concerned, on the bottom rung among the civilized nations of the world.”¹ Piped water and sewerage were considered a possible solution to this problem by many Swedish city authorities. When the urban mortality rates began to go down at the end of the century many engineers and physicians were also quick in attributing the decline to the introduction of water supply and sewerage.²

Faith in progress through science and modernization was great in the Western world in the late 19th century, and the cities in particular embodied this idea. Urban social, sanitary, and environmental problems, themselves to a great extent products of modern industrial society, were to be solved through health and building legislation, different preventive health measures, as well as “city improvement,” that is, the application of modern technologies. Decreasing mortality rates seemed to confirm that this was the right path to tread.³

The confidence in science and technology is a potential problem for any historian studying the period, since it is likely to affect the interpretation of its achievements. It is especially true of technologies such as piped water supply

¹ Nelson and Rogers 1994 p. 21-23 (quote on p. 23).

² In 1883 the city physician in Norrköping ascribed the mortality decline in the city to the piped water and wastewater (NSA, Norrköping Board of Health Archives, AI a:1, 1883-02-13 §15). Professor Elias Heyman studied the frequency and propagation of typhoid fever in Stockholm, related to the mortality rates before and after sewerage. He also made the connection between the mortality decline and the installation of underground sewers, but was more careful in his conclusions (Heyman 1882 p. 537).

³ Edvinsson and Rogers 2001 p. 541-542; Goubert 1988 p. 116-118; Hohenberg and Lees 1995 p. 132, 315-320; Leijonhank 1853 p. 6-11; Mayne 1993 p. 17-22; Tarr 1988 p. 159-160.

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and sewerage, which were motivated with reference to their salubrious effects on human health.⁴ Such a historiography would not be lacking in truth, for technology was important, the mortality rates actually went down, and the urban environment was improved all over Europe. Nevertheless, success stories written in retrospect often conceal the complexities of introducing and evaluating new technologies.⁵ Many factors other than public health and technology were in fact involved when piped water and sewerage were introduced in the first place, and they were not in themselves the sole factors behind the decreasing mortality and morbidity rates and the cleaner cities.⁶

Problematique and Aim

Water and sewerage were consequently not constructed as a matter of course. The central problematique of this dissertation is why piped water supply and sewerage were introduced in two Swedish cities at this particular time in history, and why they were subsequently extended technically, geographically, as well as functionally in evacuating excreta. The introduction on a large scale of sanitary technologies such as water and wastewater in Europe after 1850 was at least partly related to public health and city planning aspirations, but in addressing the central problem we must dig deeper, which is why two Swedish cities have been studied. Norrköping and Linköping were neighbors but with very different social and economic structures, and they will therefore serve well as case studies of the introduction and evolution of water supply and sewerage in late 19th- and early 20th-century Sweden (1860-1910) in the European context.⁷ It is only when

⁴ Davies 1996 p. 759-766, 790-794; Hamlin 1988 p. 55.

⁵ Hamlin 1988 p. 55; Hamlin 1992 p. 680; Nilsson 1994 p. 193-210. What has been called “Whiggish historiography” often confirms the views of the powerful and hails successful technologies in retrospect (Bowker 1992 p. 53-55; Burke 1992 p. 102). Examples of historical studies that at least partly embrace such a historiography are Ackerknecht (1982), Davies (1996), and Hörberg (1998) (Ackerknecht 1982 (1955) p. 210-217; Davies 1996 p. 774-777; Hörberg 1998 p. 211-212). The more popular historical essay Ajanki (1999) is a more clear-cut example (Ajanki 1999).

⁶ Indeed, it is impossible to draw any unidimensional conclusions about the mortality decline, according to van Poppel and van der Heijden: “A model suitable to the task of explaining mortality declines would have to recognize improvements in medicine and medical care, changes in virulence of disease-producing organisms, changes in the economic well-being of the population, and changes in sanitation and public health not as competing explanations ... but as co-existing complexly-interrelated causes of mortality decline” (van Poppel and van der Heijden 1997 p. 145).

⁷ Between 1814 and 1905, Sweden and Norway constituted a united kingdom, but this study only aims to deal with Sweden as the so-called national context or level. The two countries were formally one but largely minded their own business. They therefore essentially had very different political, cultural, and economic developments, which affected the evolution of water and sewerage as well. A comparison between the two would surely be fruitful, but it is something for future research.

we compare the local, national, and international levels that there can be a meaningful history of these technologies.

The Urban Arena: Historical and Academic Context

This dissertation relates to research in several different fields, the most central of which will be outlined below. At the same time this will constitute the historical background and context, both from a Swedish and from a European point of view. This study is essentially to be placed in an urban history tradition, focusing on governance, public health, environment, and technology in the urban context. It also touches upon cultural history or intellectual history in studies that deal with dirt, pollution, and cleanliness as cultural constructs rather than as physical phenomena.

Industrialization, Urbanization, and Revolution

A liberal industrial class, the bourgeoisie, was rising to power in most nations of the Western world in the mid- to late-19th century. It had its roots in the industrial revolution in Great Britain and the liberal revolution in France in the late 18th century, but it was not until the early and mid-19th century that its position was beginning to be stable and its culture spread even to the periphery of Europe, including Sweden. Industrialization also meant the emergence of a working class, and the revolutionary year of 1848 became a reminder of the monsters that the bourgeoisie felt breeding under their feet, to paraphrase the English lawyer and social reformer Edwin Chadwick.⁸ Yet the fear of the working class, whose revolution came to be symbolized by the *Communist Manifesto* by Karl Marx and Friedrich Engels,⁹ proved exaggerated, and bourgeois power remained virtually unchallenged into the 20th century, when democratic pursuits intensified.¹⁰

Cities symbolized modernity and bourgeois power in the late 19th century, but the question is to what extent industrialization and urbanization were dependent on each other. Generally speaking they co-evolved, but this statement needs some modification. First of all, there is the matter of how these concepts are defined. Industrialization may be defined in a broader sense as an increasing industrial share of production and employment, or as technical change leading to mechanized instead of manual production. Urbanization may refer to economic, demographic, or social processes. Secondly, industria-

⁸ Lewis 1952 p. 46.

⁹ Marx and Engels 1952 (1848).

¹⁰ Hobsbawm 1975 p. 1-26; Briggs 1999 p. 205-228; Schmidt and Kristensen 1986 p. 44.

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lization generally started in the European countryside, in areas dominated by protoindustry, and it was only after 1840 or so that there was rapid urban industrial growth. Sweden is a good example of a country whose industry originated in the countryside, although this development occurred some decades after that on the European Continent (see Table 2 below). Thirdly, there was also an overlap between old manufacturing and the new mechanized industries. In other words, industrialization was more a process than a revolution in the literal sense.¹¹

The Urban Environment, the Poor, and Public Health

When the period of investigation begins in 1860 industrialization had thus long since “gone urban” in Europe. Since the 1830s and 1840s there had been a growing concern about the congestion of workers’ dwellings and the deteriorating urban environment in several larger cities. Mortality was much higher in the cities than in the countryside, largely due to the high infant mortality in the former. Fires and epidemics, notably cholera, were the most urgent problems, as well as air contamination due to coal burning, for example, in London and Manchester.¹² Congested housing (in Scandinavia often built of wood) contributed to these threats, as did insufficient water supply, lack of drainage, and poor excreta management. Dry closets were often used, but in Britain the water closet was also fashionable. In the mid-19th century, contamination of waterways was reported as a major problem in, for example, Great Britain and France.¹³

This was an environment with a potential for social revolution, which was glowingly described by Friedrich Engels in his *The Condition of the Working Class in England* of 1845:

Everywhere barbarous indifference, hard egotism on one hand, and nameless misery on the other, everywhere social warfare, every man’s house in a state of siege ... one shrinks before the consequences of our social state as they manifest themselves here undisguised, and can only wonder that the whole crazy fabric still hangs together. ... These houses of three or four rooms and a kitchen form, throughout England, some parts of London excepted, the general dwellings of the working class. The streets are generally unpaved, rough, dirty, filled with vegetable and animal refuse, without sewers or gutters, but supplied with foul, stagnant pools instead.¹⁴

¹¹ Hohenberg and Lees 1995 p. 2-3, 179-180; Schön 2000 p. 77-78.

¹² Brimblecombe 1987 p. 136-160; Hohenberg and Lees 1995 p. 248-249, 258, 315-320.

¹³ Hallström 2000 p. 188; Heyman 1877 p. 179-190; Hietala 1987 p. 189; Hohenberg and Lees 1995 p. 316-317.

¹⁴ Engels 1987 (1845) p. 69, 71.

The revolutions of 1848 resulted in the building of wide avenues and boulevards all over Europe, so as to hinder the lower classes from barricading the streets. Paris, the host of several revolutions after 1789, became the great example through the work of Baron Georges Haussmann, who renewed the city from 1853 to 1870, both above ground via the famous boulevards, and below by means of new piped water, gas, and sewer systems.¹⁵

The poor housing and sanitary situation also reverberated in the public health aspirations of the time. In the late 18th and early 19th centuries public health had been developed in theory by the German physician Johann Peter Frank, and France had provided a model for public health even in practice. But around the mid-19th century, with the British “sanitary idea,” public health was turned into an ideology of centralized scientific control of the physical environment, primarily through the work of Edwin Chadwick. His 1842 *Report on the Sanitary Condition of the Labouring Population of Great Britain* became widely read and very influential.¹⁶ In the words of Martin Melosi:

What made the report so radical was its denial of disease in fatalistic terms, as God’s will, and also its rejection of a more current view that poverty was the main cause of ill health. It turned that argument on its head, stating that ill health was a cause of poverty because disease had environmental roots.¹⁷

The idea of the environmental roots of disease had a long tradition. In antiquity Hippocrates and Galen formulated a miasmatic theory of disease, according to which epidemics arose through foul-smelling air, which had attained that status through climatic, seasonal, or astronomical influences. Disease was not contagious, but emerged independently in each place due to local environmental factors, which is why Peter Baldwin calls this etiology “localist.”¹⁸ Earlier these environmental factors were by and large considered beyond human control, but from the mid-18th century potentially controllable conditions such as stagnant water, filthy and crowded housing, and putrefying organic matter came to be seen as generating various diseases, especially fevers. The Scientific Revolution emphasized the analytic capacity of the senses, and from the mid-18th century chemists and physicians became increasingly preoccupied with smells and odors. The foul and putrid, which was thought to emanate from the earth in numerous ways, caused fear among

¹⁵ Benevolo 1993 p. 169-188; Hobsbawm 1975 p. 208-211; Reid 1991 p. 27-36.

¹⁶ Melosi 2000 p. 43-57; Schmidt and Kristensen 1986 p. 25-49.

¹⁷ Melosi 2000 p. 46.

¹⁸ Arvidsson 1971 p. 180; Baldwin 1999 p. 3. Cf. Schmidt and Kristensen 1986 p. 11-17.

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(upper class) people into the 19th century. In addition, there was also the new fear of the allegedly “filthy,” “sweaty,” and “bad-smelling” working class.¹⁹

The idea of contagion probably has as long a history as that of miasma, and the book of Leviticus in the Bible is a good example. At least since the 16th century certain diseases had been regarded as contagious, even by proponents of the miasmatic theory – for instance, smallpox, syphilis, and ophthalmia (an inflammation of the eye) – although by what medium they were transmitted was a matter of debate. It was epidemics such as yellow fever and especially cholera, which first appeared in Europe around 1830, that divided physicians into contagionists and localists. The prophylaxis associated with the contagionist paradigm²⁰ was typically quarantine and with the miasmatic the removal of the causes of disease, such as improving water supply, drainage, and housing in the way that Chadwick promoted. To both groups the disposition of the individual also played a great part in how epidemics were thought to strike. In practice, these theories and prophylaxes were often mixed, and most physicians and medical men could be found on a continuum between these extremes.²¹ John Snow’s idea in 1854 that cholera was transmitted via water contaminated by excreta from a cholera victim did not immediately boost the contagionist view, and miasmatic etiology actually gained momentum just before the breakthrough of bacteriology in the 1880s and 1890s.²²

According to Chadwick, disease and thereby poverty had their origins in a contaminated, odorous environment, and for him epidemics such as cholera spread via bad smells from putrefying matter. Therefore public health should be preventive in character, and the appropriate solution to these sanitary problems was technological systems such as piped water supply and sewerage, to which water closets were connected in order to transport fecal matter and waste to farmlands outside the city. The residue would pay for the sanitary improvements in the cities, but would also benefit agriculture.²³ As Chadwick

¹⁹ Baldwin 1999 p. 3; Corbin 1986 (1982) p. 11-56, 229-232.

²⁰ The concept will be used in much the same way as Thomas Kuhn uses it (Kuhn 1962 p. 23-34).

²¹ Arvidsson 1971 p. 180-186; Baldwin 1999 p. 2-5. Neither miasmatic nor contagionism were unified paradigms, so there were variants of both. Of special importance to this study are a few versions of the former. Whenever the terms “miasmatic” and “localist” are used, issues common to all variants are discussed, but sometimes the particulars of, for instance, the variants “sewer gas theory” and “zymotic theory” (which was really a significant development of miasmatic) may be dealt with (Hamlin 1985 p. 382-383; Hamlin 1990 p. 127-133; Tarr 1996 p. 137-144). Terms on the continuum between the miasmatic and contagionist paradigms before bacteriology also appear in the Swedish source material, for example, *sjukdomsämnen* and *smittämnen*, and I have tried to do them justice in the English translation. However, their etiologies were too obscure to be fruitfully analyzed.

²² Arvidsson 1971 p. 187-188; Hamlin 1990 p. 127-128.

²³ Binnie 1981 p. 4-30; Goddard 1996 p. 275-276; Melosi 2000 p. 43-50.

claimed, “we complete the circle, and realise the Egyptian type of eternity by bringing as it were the serpent’s tail into the serpent’s mouth.”²⁴

Most British engineers and sanitarians agreed on the main features of preventive public health. However, issues of technical design were often complicated and generated lively debate. For instance, although Chadwick was what we would call a “technocrat,” he was not an engineer himself, and most prominent water engineers of the day did not approve of his integrated system of glazed earthenware pipes. Instead, they advocated a combination of such pipes and of brick sewers, depending on a city’s topography and economy. Furthermore, the best techniques for applying sewage to arable land – the dominant way of purifying waste in the middle of the 19th century – were the subject of heated controversy for decades, for instance, water closets with sewage irrigation versus dry closets with municipal collection.²⁵

Despite these controversies, the public health ideology was largely successful in Great Britain in that cities built water and sewer systems on an unprecedented scale in the last half of the 19th century. Furthermore, British public health and modern water and sewerage technologies became very influential across the Western world for decades, despite continual controversies over such question as technical design, and in Europe this led to a veritable “water mania” in the mid- to late 19th century. What was essential here was the successful British linking of public health *and* technology.²⁶

Modern Water and Wastewater Technologies

Modern networked technologies can be said to have been both a prerequisite for and a consequence of the industrial revolution in Europe. On the one hand, canals and railroads were of immense importance for early industrialism, which has sometimes been called the coal-based *first* industrial revolution, and electrical networks similarly generated the so-called *second* industrial revolution. On the other hand, when the cities of Europe grew and became congested, sanitary and environmental problems overwhelmed city governments to a greater degree than ever before, and modern technology was often seen as the solution.²⁷

Water and sewer systems were certainly not new 19th century inventions. They had existed for millennia, from the most rudimentary forms of drainage to the more advanced systems of the Mesopotamian and Indian civilizations or the Roman Empire, and even of medieval and early modern Europe.²⁸

²⁴ Quoted in Binnie 1981 p. 12.

²⁵ Hamlin 1985 p. 393-394, 400-411; Hamlin 1992 p. 680-682, 696-709.

²⁶ Nelson and Rogers 1994 p. 21-26; Reid 1991 p. 27-28; Tarr 1996 p. 135-137.

²⁷ Hohenberg and Lees 1995 p. 315-316; Kaijser 1994 p. 21-29.

²⁸ Squatriti 1998 p. 10-21; Sundin 1991 p. 52-55; Westholm 1995 p. 7-17.

However, from the 18th century onwards, modern water and wastewater technologies began developing, mainly in Great Britain, concurrent with the industrial revolution. One of the main characteristics of modern water technology was a significantly *higher capacity* due primarily to steam-driven water pumping and cast-iron pipes, the latter having become more competitive with the development of metallurgy. Previously wooden or lead pipes had been common. The technological improvements made it possible to extend the system citywide – to fire hydrants and into private yards and houses – and to centralize organization. With the slow sand filter, water of a substantially better *quality* could be supplied as well. Modern wastewater technology was mainly characterized by circular or egg-shaped sewers for *self-cleaning* sewerage, either with small glazed earthenware pipes (circular) or larger brick sewers (egg-shaped). Even here a citywide system with central organization could be achieved.²⁹

Other factors were also crucial for the building of modern water and sewer systems in European cities, for instance, the status of municipal organization. Investment in these systems was extremely expensive for cities, both as regards construction and administration costs, and the ability to afford such an investment depended on economic legislation (for example, the right to levy taxes and take loans), previous wealth, and other municipal revenue sources. Consequently, only in cities where these conditions were favorable, notably large and wealthy cities, were water supply and sewerage built before 1900. Furthermore, financial capital through institutions such as the *crédit mobilier*,³⁰ investment banks, commercial banks, and sometimes savings banks were necessary for cities to be able to seek the loans required.³¹

Urban History of Governance, Health, Environment, and Technology

Since the field of urban history and urban studies is very extensive, the literature discussed here emphasizes the evolution of water supply and sewerage in relation to governance, health, environment, and technology in the urban context. In fact, this can be regarded as a field in itself, and its practitioners may also be found within such sub-disciplines as history of public health, environmental history, and history of technology. As the Swedish development in the late 19th century was primarily modeled on that of other European countries, this disser-

²⁹ Hansen 1904 p. 413; Melosi 2000 p. 17-42, 48-57, 73; Richert 1869 p. 53-63; Tarr 1996 p. 117-118, 135-137.

³⁰ A finance company designed specifically to do industrial financing, sometimes in competition with regular banks (Hobsbawm 1975 p. 214).

³¹ Millward and Sheard 1995 p. 501-506, 527; Petersson 1999 p. 25-32; Hobsbawm 1975 p. 214-216.

tation primarily draws on work about Europe, although a few studies dealing with the USA need to be mentioned as well.

The great model country for Sweden, most other European countries, as well as the USA as regards water supply and sewerage was Great Britain, to which numerous study tours were directed in the mid- to late 19th century. John Hassan has written extensively about the history of water in England and Wales during the 19th and 20th centuries from the viewpoint of economic history, especially in *A History of Water in Modern England and Wales*.³² G. M. Binnie has made a valuable contribution to our knowledge about the most prominent Victorian water engineers, including also the layman Chadwick.³³

Studies about sewerage alone are few, but Dale Porter's *The Thames Embankment* partly treats the building of the London intercepting sewers in the mid-19th century.³⁴ Water contamination has attracted more attention. The urban historian Bill Luckin's study of water contamination of the Thames related to epidemics and demography in London during the 19th century, *Pollution and Control*, is a classic.³⁵ Lawrence Breeze has also treated this subject, but during a much shorter period.³⁶

Christopher Hamlin has written extensively on this topic in *What Becomes of Pollution? Adversary Science and the Controversy on the Self-Purification of Rivers in Britain, 1850-1900*,³⁷ and in *A Science of Impurity*, which mainly revolves around the issue of water quality.³⁸ Hamlin is maybe the most important authority – at least for the British case – on the kind of urban history that this dissertation attempts to deal with. He has conducted numerous studies that relate to this field, and the evolution of water supply and sewerage in particular, such as “Providence and Putrefaction,”³⁹ “Muddling in Bumble-dom” (a local, comparative case study),⁴⁰ “Edwin Chadwick and the Engineers,”⁴¹ and *Public Health and Social Justice in the Age of Chadwick*.⁴²

Germany⁴³ became a major source of influence for Swedish engineers from the 1880s onward, which is why its development was important for what happened in Sweden. There is a wealth of studies about German cities, for

³² Hassan 1998. See also Hassan et al. 1996.

³³ Binnie 1981.

³⁴ Porter 1998.

³⁵ Luckin 1986. Luckin also does studies on urban risks and epidemiology, see, for instance, Luckin 1993 and Luckin and Mooney 1997.

³⁶ Breeze 1993.

³⁷ Hamlin 1987.

³⁸ Hamlin 1990.

³⁹ Hamlin 1985

⁴⁰ Hamlin 1988.

⁴¹ Hamlin 1992.

⁴² Hamlin 1998.

⁴³ For the period before 1871, Germany means the German principalities.

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instance, Peter Münch's *Stadthygiene im 19. und 20. Jahrhundert* about water, sewerage, and waste removal in Munich,⁴⁴ and Georges Knaebel's study of the origins of sewerage in the town of Bielefeld.⁴⁵ Richard Evans' book on cholera in Hamburg also has a lot to say about water supply and sewerage, especially how the status of water affected the spread of the 1892 epidemic.⁴⁶ Marjatta Hietala studies the building of waterworks in several German cities around 1900 in her *Services and Urbanization at the Turn of the Century*. It is also about British and Finnish cities. Her main focus is the diffusion of innovations and how this affected urbanization.⁴⁷

Gottfried Hösel's *Unser Abfall aller Zeiten* is a cultural history overview of water, sewerage, excreta and waste collection in the Middle East and later Europe (Germany) from the dawn of time until the 20th century.⁴⁸ Engelbert Schramm has written an intellectual history of the evolution of recycling models throughout history, *Im Namen des Kreislaufs*.⁴⁹ There is also the handbook genre, for example, *Abwasser: Handbuch zu einer zukunftsfähigen Wasserwirtschaft*, which includes a section on the history of wastewater and excreta collection.⁵⁰

Although France was not as influential as Britain and later Germany, it was yet part of the context to which the Swedish water and sewer systems were related, so a few studies about France should be mentioned. Jean-Pierre Goubert's *The Conquest of Water* deals with water and wastewater from scientific, technological, hygienic, and cultural points of view.⁵¹ Goubert and André Guillerme also sketch the history of water supply and sewerage in France from 1800 to 1950.⁵² Donald Reid's study *Paris Sewers and Sewermen* takes up various facets of the cleaning of Paris, through its sewers, sewermen, and sewage irrigation fields.⁵³

Mention must also be made of American scholars in the field of urban environmental and technological history, although some write primarily about the USA. Martin Melosi's *The Sanitary City* is a comprehensive overview of the evolution of water supply, sewerage, and waste removal in the USA since colonial times, but it also includes a section on the British development in the early to mid-1800s. Furthermore, it shows how European technology was

⁴⁴ Münch 1993.

⁴⁵ Knaebel 1988.

⁴⁶ Evans 1987.

⁴⁷ Hietala 1987.

⁴⁸ Hösel 1987.

⁴⁹ Schramm 1997.

⁵⁰ Lange and Otterpohl 1997.

⁵¹ Goubert 1989 (1986).

⁵² Goubert 1988; Guillerme 1988.

⁵³ Reid 1991.

transferred and eventually developed in America and even addresses general issues in the field.⁵⁴ Joel Tarr's *The Search for the Ultimate Sink* shows how one can address environmental degradation problems related to urban technology through historical examples of wastewater and water quality issues.⁵⁵ The sanitary engineer M. N. Baker's classic *The Quest for Pure Water* begins in the ancient world, but places emphasis on modern Europe and the USA.⁵⁶

The Construction of Urban Filth in the Late 19th Century

Filth and dirt, and the ways they were dealt with in the urban arena through public health efforts, sanitation, and cleanliness, are more than their material constitution. A changing society reflected and was reflected in changing values about dirt and waste, that is, the definition of what was dangerous and what was innocuous varied depending on the interests of different actors in a given historical situation.

From 1860 to 1910, the period of investigation, we see the final breakthrough of an important aspect of Western society, culture, economy, and politics: what is often referred to as modernity.⁵⁷ The process of modernization began at least a century earlier (in fact, according to some historians, as early as the Middle Ages⁵⁸), but in the late 19th century industrialization and urbanization made the inherent ambiguities of modern life stand out, which can be seen in the works of such disparate modernist thinkers as Charles Baudelaire, Karl Marx, and Friedrich Nietzsche.⁵⁹ The late 19th century belief was that modern science and technology would conquer disease, poverty, tyranny and ignorance, but epidemics continued to kill, poverty increased and environmental degradation went on, especially for the growing urban working class. The turn of the century, and especially World War I, was a turning point, and modernist thinking became more polarized between the critics and proponents of modernity and modern society.⁶⁰

For centuries, maybe even millennia, man had used his waste as fertilizer in rural and urban agriculture and horticulture, but from the mid-19th century it was done on a bigger, industrial scale.⁶¹ At this time, cities also increasingly came to be regarded as the epitome of modern capitalist society.⁶² Surely, the

⁵⁴ Melosi 2000.

⁵⁵ Tarr 1996.

⁵⁶ Baker 1948.

⁵⁷ Liedman 1997 p. 6-7.

⁵⁸ Levine 2001. Cf. Harrison 2002 and Nordin 1997.

⁵⁹ Berman 1982 p. 15-36.

⁶⁰ Davies 1996 p. 764-782; Hohenberg and Lees 1995 p. 317; Berman 1982 p. 23-26; Edvinsson and Rogers 2001 p. 541-543.

⁶¹ Duby 1979; Mårald 2000 p. 150-159; Mårald 2002; Drangert and Hallström 2002.

⁶² Mayne 1993 p. 17.

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urban hinterland played an important part in this development, and in Paris, for instance, some observers saw the sewage farms as a technological feat of modern urban capitalist society. Here man and his waste products were integrated in a common cycle.⁶³ Urban wastes were thus seen as belonging to the hinterland. Agriculture provided the city with food, and by using urban sewage and solid waste as fertilizer the waste could be purified at the same time as the nutrients in the waste were reused.⁶⁴

Dirt also played a decisive role in the works of many 18th and 19th century social thinkers, as Christopher Hamlin, Donald Reid, Dominique Laporte, and others have pointed out.⁶⁵ Hamlin argues for dirt and its consequent health and environmental problems as an important impetus in the creation of local government in early 19th century England. The question of dung and nuisances became a way of dealing with private – public problems.⁶⁶ Reid and Laporte refer to social thinkers in the 19th century, such as Victor Hugo and the socialist Pierre Leroux, who tried to find a way of overcoming Malthus' pessimistic visions of food and population growth. This was to be done by utilizing urban waste in agriculture, which not only returned nutrients to the urban hinterland, but also made the noxious waste innocuous. Social visionaries such as Maxime du Camp, Jules Verne, and the Russian anarchist Pjotr Kropotkin came to see sewage farms as urban utopia.⁶⁷

Ultimately, however, the recycling ideas had to give way to ideas of linear flows in sewage management around 1900, a development which was promoted by artificial fertilizers and powerful economic interests in cities, such as industry. What the French called *tout-à-l'égout* (everything in the sewer) was considered to be cheaper than irrigation fields and different purification techniques, an idea that was further enforced by prevalent theories of the self-purification of rivers. According to physicians, hygienists, and sanitary engineers, sewage and waste were also potential hotbeds of disease (particularly cholera) and had to be disposed of swiftly, preferably through water closets.⁶⁸

At the turn of the century, then, disposal became the predominant way of dealing with waste and dirt. According to Joel Tarr, the result of this idea was

⁶³ Reid 1991 p. 66.

⁶⁴ Hamlin 1985; Mårald 2000 p. 150-159. This argument is somewhat simplified, because sewage and waste were, of course, disposed of even before the 20th century. But the ideology of reuse and recycling was surprisingly wide-spread as late as the 1890s, and even into the 20th century (Hamlin 1980; Drangert and Hallström 2002).

⁶⁵ Hamlin 1985 p. 402-404; Reid 1991 p. 54-70; Laporte 2000 (1978) p. 126-132. Cf. Sheail 1996 p. 193.

⁶⁶ Hamlin 1985 p. 402-404.

⁶⁷ Reid 1991 p. 47-49, 53-57, 65-70; Laporte 2000 (1978) p. 126-132.

⁶⁸ Arvidsson 1971 p. 180-190; Hallström 2000 p. 185, 195-205; Mårald 2000 p. 175-179; Reid 1991 p. 79-83; Tarr 1996 p. 120-121.

that “one locality’s gain became another’s loss; legislation or legal action often caused the pollution burden to shift from place to place and from medium to medium (from water pollution to air pollution, for example)”.⁶⁹ This “search for the ultimate sink,” as Tarr calls it, was not only limited to space, but also came to be pursued in time, that is, the solution of environmental problems were postponed to a near or not too distant future, sometimes with expectations of the development of new technologies.⁷⁰ Indeed, this is typical of late 19th- and early 20th-century modernity, as Sven-Eric Liedman has noted.⁷¹

Studies of Urban Pollution and Purity in the Realm of Cultural History

Several historians, sociologists, and anthropologists have written the history of Western civilization from the point of view of dirt and cleanliness. The most well known is probably Norbert Elias’ classic *The Civilizing Process*, which has attracted both praise and criticism. This study in historical sociology and psychology describes the process of modernization as a societal civilizing process, where the Freudian superego gradually emerges from the Middle Ages to the modern age. It began among the aristocracy at the medieval courts, and spread to the bourgeoisie and other classes as more and more domesticated and differentiated instincts. The 19th century bourgeois preoccupation with cleanliness and the disciplining of sexuality thus become a part of this process.⁷²

The French psychoanalyst Dominique Laporte has written a short book with the somewhat provocative title *History of Shit*. It is also essentially an account of a civilizing process from the 16th century until the 20th, but it is more fixated with filth and shit, in a true Freudian and Lacanian sense. It shows how Western society has remained “stuck in the muck”, despite gradually purging language of excremental elements and cleaning dirt and odors from the urban environment, concurrent with the rise of the bourgeoisie and the hygienic movement.⁷³ Alain Corbin in *The Foul and the Fragrant* does not argue in explicit civilizing terms, but he explores the bourgeois fascination with the olfactory senses, the fear of the putrid and the attraction of the fragrant or deodorized, primarily in 18th and 19th century France.⁷⁴ Christopher Prendergast’s *Paris and the Nineteenth Century* includes a chapter on subterranean Paris and the sewers, whose analysis draws on both Walter

⁶⁹ Tarr 1996 p. xxxi. Tarr’s comment is about the USA, but in my view this is relevant for most of the Western world, including Europe.

⁷⁰ Tarr 1996 p. 7-35; Lundgren 1991 p.152; Jakobsson 1999 p. 138.

⁷¹ Liedman 1997 p. 455-462.

⁷² Elias 2000 (1939). Cf. Ekenstam 1993.

⁷³ Laporte 2000 (1978). The French title is *Histoire de la merde (Prologue)*.

⁷⁴ Corbin 1986 (1982).

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Benjamin, Roland Barthes, Karl Marx, Sigmund Freud, Alain Corbin, and Mary Douglas.⁷⁵

Studying the evolution of European public health and hygienism, Schmidt and Kristensen write that the rationality of Western modernity has always relied on different rituals of purification, and, in keeping with Mary Douglas, that impurity and dirt have thus equaled disorder. Therefore, sterilization is not only the doing away with disease, but also a symbol of order. In accordance with this thinking, dirt and pollution, and especially the way these are treated in Western society, should be analyzed through the concept of order.⁷⁶

Swedish Politics and Industrialization

In the latter half of the 19th century, Sweden commenced the transition from an agricultural nation to an industrial one, although this was not completed until the late 1930s. The winds of change were blowing as early as the 1840s, however, when an era of liberal reforms began in Swedish politics. At his death in 1844 the conservative Karl XIV Johan was succeeded by his son Oscar I, in whom liberals such as Johan Gabriel Richert placed great hopes of a change. His supposed liberalism turned out to be exaggerated, however, especially after the Swedish counterpart to the revolutions on the Continent in 1848 (some 30 people died in the Stockholm riots). And yet, a few liberal reforms were achieved during his reign, for instance, equal inheritance rights of men and women in 1845, and the beginning of a humanization of both secular and ecclesiastical punishment. There were some important economic reforms such as the abolition of compulsory membership in trade and craft guilds in 1846, which meant that merchants and craftsmen could freely establish enterprises in the countryside, as well as the 1848 law permitting joint-stock companies. The latter legislation was built on the principle of limited liability.⁷⁷

One person in particular came to personify the new era of economic liberalism in the 1850s and 1860s, the Minister of Finance from 1856 to 1866, Johan August Gripenstedt (1813-1874). He was behind the introduction of the total freedom of trade for Swedish men and women (*näringsfrihetsförordningen*), which was introduced in 1864 and was an extension of the 1846 legislation. After a Swedish foreign economic policy that had oscillated between liberal and protectionist during the 1850s, in 1865 Gripenstedt managed to

⁷⁵ Prendergast 1992.

⁷⁶ Schmidt and Kristensen 1986.

⁷⁷ Norborg 1993 p. 138, 162-167; Schön 2000 p. 154-157. Limited liability meant that a shareholder was only responsible for a company's debts to the extent that he owned shares, not personally. This made it possible to concentrate large amounts of capital to industries and other businesses (Schön 2000 p. 154-155).

carry through his vision of making Sweden a member of the international free-trade network. However, this epoch came to an end as early as the mid-1880s in the wake of a fierce debate about customs duties, *tullstriden*. Together with André Oscar Wallenberg he also reformed Swedish banking into modern institutions, by promoting the establishment of business banks – Wallenberg’s own *Stockholms Enskilda Bank* being the most important one – and investment banks, *crédit mobiliers* (joint-stock banks were also free to establish themselves from 1864). Their assimilated capital was based on deposits from the public rather than on the issuing of banknotes.⁷⁸

Gripenstedt’s liberalism was not of the Manchester kind, however. He promoted a certain degree of state intervention, which could be seen in the 1857 financial crisis following the Crimean War, when the state gave generous loans to business banks in jeopardy. This was also obvious in the building of railroads from the 1850s onwards. Gripenstedt’s opinion was that there were to be public, state-owned main lines which connected different provinces, improved Sweden’s military defense, and boosted industrial development. The smaller, local lines were to be private or municipal, and they belonged to the private sphere. According to Svenbjörn Kilander, there was no contradiction in this view. Most Swedish liberals of the day saw society as divided between the public and private spheres. The state could only act directly in the former, and in the latter through legislation. It was not a question of intervention or non-intervention, but in what areas the state could act. This was the dominant ideology of the time and persisted until the end of the century.⁷⁹

During the 1860s, when Oscar I:s son Karl XV was a very popular but weak king, two other reforms of importance were carried out. In a sense his reign symbolized what was to come: the weakening of royalty and the growing strength of the parliament. The first reform was the Communal Law of 1862, which in principle granted autonomy to Swedish cities and gave them the right to levy taxes, take large loans, and deal with education, health care, and poor relief. In practice, however, this self-government was restricted by various national urban laws, for instance, fire, building, and health regulations in the 1870s, and soon became even more so, a tendency that continued into the 20th century.⁸⁰

In 1865 and 1866 the question of representation in the Swedish Parliament (the *Riksdag*) was finally resolved. It had caused debate ever since the beginning of the 19th century, for even then it was clear to many intellectuals that the

⁷⁸ Lindgren 1993 p. 241-245; Magnusson 1996 p. 258-268; Nilsson 2001 p. 139-207.

⁷⁹ Kilander 1991 p. 18-65, 124-134; Magnusson 1996 p. 265-268.

⁸⁰ Bokholm 1995 p. 76-77, 315-316; Drangert, Nelson, and Nilsson 2002 p. 173; Magnusson 1996 p. 264. Apart from the cities, the law also concerned rural communes and regional bodies called *landsting*.

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four estates (peasants, burgers, clergy, and the nobility) did not represent social reality. Many conservatives had interests in stopping the reform, and the liberals were divided as to its design. Minister of Justice Louis De Geer eventually managed to propose a compromise between these interests, and the result was in many ways a *status quo*. Through high economic thresholds the propertied classes and the industrial bourgeoisie together with wealthier farmers retained power. Less wealthy farmers, artisans, rural proletarians, and “dangerous workers” were excluded.⁸¹

The reign of Oscar II, the brother of Karl XV, extended from 1872 until 1907. He was conservative and wanted to stop the liberalization of Swedish society, which proved impossible. During this period we see the rise of party politics on the national level, initiated in the debates about customs duties (*tullstriden*) and the Swedish national defense (*försvarsfrågan*) in the 1880s. These debates had their origins in the competition of inexpensive American and Russian grain, as well as the rising nationalism, the quest for colonies, and the increased protectionism of the leading European countries. The Social Democratic Party was founded in 1889 and the workers’ union, *Landsorganisationen* (LO), in 1898, which further boosted the liberal opposition. In 1909 male suffrage was introduced, but it was not until 1918 to 1921 that universal suffrage finally prevailed.⁸²

Industrialization came relatively late to Sweden, compared to the rest of Europe and North America. The industrial breakthrough in Great Britain came as early as the latter half of the 18th century, and in the rest of the Western world it occurred about a century later. It was not until the 1890s that the agricultural population of Sweden began decreasing in absolute numbers, and consequently this decade is generally seen as the breakthrough for industrialization.⁸³ The industrial breakthrough meant a much more increased pace of growth in the whole Swedish economy, as well as a marked increase of the industrial sector’s share of the economy.⁸⁴

⁸¹ Norborg 1993 p. 84-88.

⁸² Hobsbawm 1987 p. 56-83, 142-165; Johannesson 2001 p. 214-216; Norborg 1993 p. 1-4, 103-112, 172. All adult Swedish men could vote to the Second Chamber of the Swedish Parliament as early as 1909, and in the cities there were some restrictions on the companies’ power. Eligible women could also be elected to the City Council, but these were very few in practice (Andersson 2000 p. 231).

⁸³ Olsson 1993 p. 61; Svensson, Godlund, and Godlund 1972 p. 180.

⁸⁴ Magnusson 1996 p. 301-302.

The Swedish Urban Environment, Public Health, and Sanitary Technology

As was written in the introductory paragraphs, the Swedish urban environment was actually in many ways worse off than its British counterpart, at least if we look at the mortality figures. By 1850 Sweden was still an agrarian country and industry was only dawning, and industry was initially concentrated to the countryside. Still Swedish cities were congested, and water supply, drainage, and sanitation were often rudimentary. In Göteborg⁸⁵ and some other places there were older water systems but very rarely drainage systems. In most cities waterways, wells, and springs constituted the water supply, and gutters evacuated the waste- and stormwater. Urban fires were very common, and the 19th century cholera epidemics hit some cities very hard, for example, Jönköping and Vadstena in 1834, killing more than one tenth of their population. This often led to some public health initiatives. Jönköping was the third Swedish city to construct a modern water system, which was very likely related to the 1834 and 1857 epidemics, but it is still surprising that it took until 1864 before it was finished.⁸⁶ Other local actors and factors must thus also have been involved.

Swedish Urban and Cultural History Studies of Sanitary Public Works

The history of modern Swedish water supply, sewerage, and sanitation is a rather unexplored area. A few memorial publications for waterworks of certain cities were written before the 1970s.⁸⁷ In the 1980s histories of water supply and sewerage were published for Stockholm,⁸⁸ Göteborg,⁸⁹ Ulricehamn,⁹⁰ and others. Ingvar Hörberg's book about the Kalmar water supply came in 1998.⁹¹ In the 1990s there were also studies in the history of public health, for example, Hans Nilsson's dissertation about Linköping,⁹² a few

⁸⁵ The city of Göteborg used to be translated Gothenburg, but nowadays the Swedish name is more commonly used even in the English language, which is why it will be employed in this study.

⁸⁶ Drangert and Hallström 2002; Drangert, Nelson, and Nilsson 2002 p. 174-177; Isgård 1998 p. 9-36; Nelson and Rogers 1994 p. 28-29.

⁸⁷ See, for example, Lyttkens 1935; *Minnesskrift med anledning av Göteborgs vattenledningsverks 150-årsjubileum* 1937; Östman, Malmberg, and Liander 1945; *100 år: 1861-1961: Minnesskrift* 1961; Jönsson and Blomquist 1963.

⁸⁸ Anderberg 1986; Cronström 1986.

⁸⁹ Bjur 1988.

⁹⁰ Boger 1989.

⁹¹ Hörberg 1998.

⁹² Nilsson 1994.

studies of Jan-Olof Drangert,⁹³ as well as Marie C. Nelson and John Rogers' "Cleaning up the Cities" about Uppsala and Jönköping.⁹⁴ Lari Pitkä-Kangas has studied the town of Umeå and the national development.⁹⁵

Anders Romås has discussed the issue of water quality related to regional development.⁹⁶ In 1998 Erik Isgård published the first comprehensive study of the national development of water supply and sewerage in Sweden from 1850 onwards, from an engineer's point of view.⁹⁷ Drangert, Nelson, and Nilsson in 2002 published their article on the introduction of water and wastewater in several Swedish cities.⁹⁸ Lars J. Lundgren's *Vattenförorening. Debatten i Sverige 1890-1921*⁹⁹ was the first modern academic study in environmental history in Sweden. Lundgren later followed up the topic of water contamination on a national level from this book with some shorter articles.¹⁰⁰

Ola Wetterberg and Gunilla Axelsson have written the history of sanitation (*renhållning*) in Göteborg from 1860 to 1930.¹⁰¹ Erland Mårald has analyzed the evolution of urban sanitary infrastructure and sanitation from a rural perspective by looking at the emergence of agricultural chemistry in Sweden and Europe.¹⁰²

Jonas Frykman and Orvar Löfgren, as well as Claes Ekenstam, have used Mary Douglas in their studies of bourgeois culture and attitudes to the body in late 19th- and early 20th-century Sweden.¹⁰³ From their cultural perspective they view hygiene as one of the marks of Swedish modernity. The bourgeoisie defined itself by a strong sense of inner and outer purity, and in a similar way the working class was defined by the bourgeoisie by its *lack* of cleanliness and moral rectitude.¹⁰⁴

Lidskog et al, however, have focused on the environmental aspects in their interpretation of Douglas' theory.¹⁰⁵ According to them, an environmental problem can be defined as the wrong amount of some substance in the wrong place, but what this is more exactly depends on the cultural rules of purity,

⁹³ See, for instance, Drangert 1996.

⁹⁴ Nelson and Rogers 1994.

⁹⁵ Pitkä-Kangas 1996; Pitkä-Kangas 1998.

⁹⁶ Romås 1985.

⁹⁷ Isgård 1998.

⁹⁸ Drangert, Nelson, and Nilsson 2002.

⁹⁹ Lundgren 1974.

¹⁰⁰ Lundgren 1991; Lundgren 1992; Lundgren 1994.

¹⁰¹ Wetterberg and Axelsson 1995.

¹⁰² Mårald 1998; Mårald 2000; Mårald 2002.

¹⁰³ Ekenstam 1993; Frykman and Löfgren 1987 (1979).

¹⁰⁴ Ekenstam 1993 p. 68-74, 114-120, 234-247; Frykman and Löfgren 1987 (1979) p. 216-220, 250-272. Cf., the same situation in Great Britain, Denmark and generally in Europe (Schmidt and Kristensen 1986), and in France (Prendergast 1992).

¹⁰⁵ Lidskog, Sandstedt, and Sundqvist 1997.

which, in their turn, protect the social order. Environmental problems therefore mean that the order and survival of a particular society are threatened, and demands for a cleaner environment also mean a corresponding change in the societal realm.¹⁰⁶

The Local Context – Norrköping and Linköping

The cities of Norrköping and Linköping were very small compared to towns and cities on the Continent and in Great Britain, as can be seen in Table 1 as well as Table 5.2. Yet they were considered to be cities and were both being rather urbanized during the period (see Figure 1). Urbanization¹⁰⁷ is a complicated process with a number of possible causes and driving forces. Industrialization and economic forces are generally seen as important factors in this process, and in the case of Norrköping its industry was naturally very important. In-migration and out-migration – as well as nativity, to some extent – fluctuated with industrial prosperity and depression. Despite its status as a large industrial city, Norrköping's industrial production and urbanization were quite modest by national standards, if they were studied over a longer period of time, that is, up to World War I (see Figure 1).¹⁰⁸ Another factor which partly explains urbanization is infrastructure, especially transport systems such as the railways.¹⁰⁹ In Norrköping, it was consequently not only industrial prosperity but also the completion of the main Eastern railway line (1866) that spurred migration to the city at the beginning of the 1870s.¹¹⁰

Table 1. Population in Linköping and Norrköping 1860-1920

	1860	1870	1880	1890	1900	1910	1920
Linköping	6,138	7,257	8,752	12,649	14,552	18,149	26,920
Norrköping	19,956	23,850	26,735	32,826	41,008	46,393	58,098

Source: Historisk statistik för Sverige. Del 1. Befolkning 1720-1967 1969 p. 61-65.

¹⁰⁶ Lidskog, Sandstedt, and Sundqvist 1997 p. 148-149.

¹⁰⁷ Urbanization is here defined as demographic urbanization, that is, the shift of population from the countryside to the cities, either by migration from the former to the latter and/or by better reproductive conditions in the latter than in the former (Larsson 1913 p. 5-6; Nilsson 1989 p. 13).

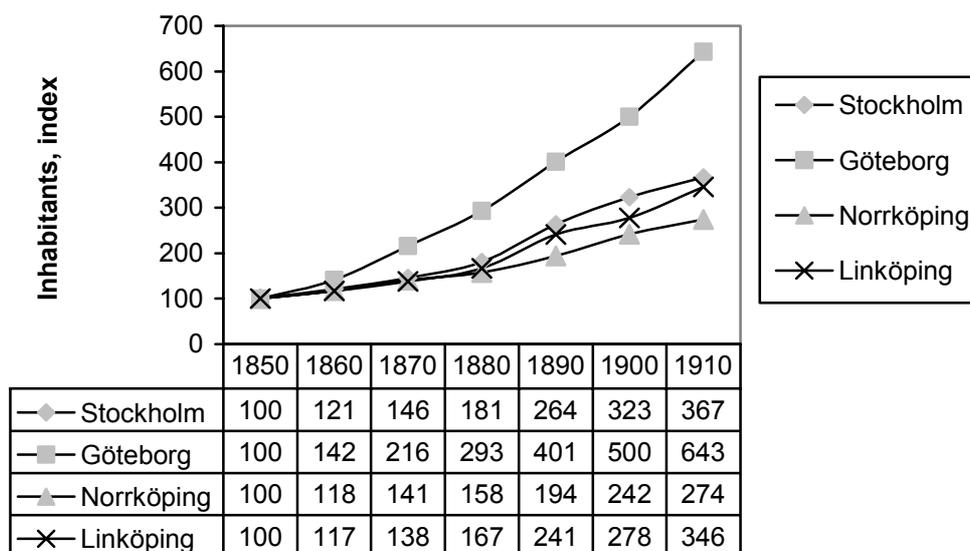
¹⁰⁸ Nilsson 1989 p. 16-17; Svensson, Godlund, and Godlund 1972 p. 2, 10-20, 180-181, 239-253.

¹⁰⁹ Nilsson 1989 p. 17.

¹¹⁰ Larsson 1913 p. 105; Myrdal 1972 p. 301-303; Svensson, Godlund, and Godlund 1972 p. 10-20, 117; Stafsing 1904 p. 271.

As can be deduced from Table 1, the relative population growth of Linköping was actually greater than that of Norrköping in the 1880s (45 compared to 23%), and Figure 1 also points to the fact that the Linköping increase in population was greater than that of Norrköping from 1880 until 1910, when compared to the index year 1850. Industrialization was apparently not the only driving force behind urbanization. Rural population growth caused the rural lower class especially to move to the cities in search of housing and work. Industrial cities such as Norrköping were attractive in this general transfer of people from country to city, but it even affected cities like Linköping. It was a central place on the plain and therefore attracted numerous migrants from the surrounding countryside. Another important factor was an increasing nativity surplus in Linköping during the period.¹¹¹

Figure 1. Population growth as an indicator of urbanization in four Swedish cities, 1850-1910, related to the index 100 in 1850.



Source: Historisk statistik för Sverige. Del 1. Befolkning 1720-1967 1969 p. 61-65.

Social, Economic, and Political Life in Norrköping and Linköping

Norrköping is situated on the river Motala Ström in the eastern part of Östergötland County, just before the river reaches the bay Bråviken and the Baltic Sea (Östersjön). The river has been the lifeblood of the city for hundreds of

¹¹¹ Hellström 1978a p. 13-20.

years. Louis de Geer made Norrköping the center of his manufacturing empire in the early 17th century, when he established the first paper and brass mills there, and a few years after this the textile manufactory Drags was established. The river made this possible, both as a source of water and power.¹¹² The manufactories utilized handicraft in large-scale production, and, as time went on, they increased in number. In the 18th century they benefited from protective economic measures from the state, and by the mid-19th century Norrköping was dominated by several smaller woolen manufactories.¹¹³

¹¹² The significance of the river as a source of power was not very great before mechanization in the early to mid-19th century. The rapid increase of textiles (mainly woolen) and Norrköping's success as a textile city in the early 1800s were not as dependent on water power as one may think either. The utilization of water power for the first textile machines was very limited (manual power was often used to begin with), and the type of companies that thrived still relied mainly on manual craftsmanship (Schön 2000 p. 107-108; Söderberg 1968 p. 160-163). Klas Nyberg claims that it was instead the fact that many merchants also started textile manufacturing, and that they knew how to market their products throughout Scandinavia, that spurred the city's success (Nyberg 1999 p. 168-172). See below.

¹¹³ Horgby 1989 p. 38; Söderberg 1968 p. 17-73; Hugerth 1996 p. 2; Schön 2000 p. 97-98.



Panorama of Norrköping, by P. L. Andersen, 1876 (Source: Norrköping City Archives).

In the 1840s and 1850s the popularity of finer cloth declined, and the demand among workers and farmers for cheap fabrics increased. The textile manufacturers consequently had to mechanize production to be able to mass produce this cloth. Mechanization meant enormous investments for the small woolen manufacturers, and some instead invested in the cotton industry, which became more technically advanced due to the acquisition of British spinning machines. The new Holmens cotton spinning mill built in 1856 was regarded as a technical wonder by contemporaries. The remaining woolen companies either disappeared or merged with others into larger modern joint-stock companies in the 1860s and 1870s. The dominance of the woolen industry was great – in 1870, 52 percent of the city’s industrial workers worked there (See Table 2) – and it was at this time the foremost in the country. In the 1860s Norrköping was also one of the most successful industrial cities in Sweden, second only to the capital Stockholm. In the new mechanized production, craftsmanship was no longer as important as before, so the artisans were replaced by machine operators, who often were women.¹¹⁴

The cotton industry, which entailed mainly spinning and weaving, became concentrated to a few large companies, Holmens, Bergs, and Norrköpings Bomullsväfveri. By 1870 they employed more than 300 workers each. The woolen industry, on the other hand, was generally less mechanized and confined to smaller units, although its field of activity was broader – it included spinning, weaving, dyeing, and tricot¹¹⁵ manufacturing. Drags and Bergsbro were the largest woolen factories in the 1870s, and G. Wiechels was the sole, large tricot factory with over 500 workers. There were also Holmens paper production, Swartz’ tobacco factory, von Leesen’s sugar factory, the printing house Norrköpings Lithografiska, breweries, mechanical engineering workshops (the British Malcolm Brothers being the most important), as well as several handicraft businesses. Twenty-five percent of the industrial workforce of Östergötland County worked in the countryside, and some of those industries were situated just outside Norrköping, notably the Fiskeby papermill, the engineering workshop Norrköpings Mekaniska Verkstad, and the shipbuilding yard Motala varv.¹¹⁶

¹¹⁴ Hallström 2000 p. 189; Horgby 1989 p. 38-41; Schön 2000 p. 98-100; Svensson, Godlund, and Godlund 1972 p. 2, 10-11, 78-80, 95-97, 180-181, 239-245; Nyberg 2000 p. 623-624.

¹¹⁵ Knitted woolen cloth.

¹¹⁶ Svensson, Godlund, and Godlund 1972 p. 77-105. In the official Swedish statistics on factories and handicraft manufactures from the period there is no clear-cut way of distinguishing the one from the other. This is only logical given the above discussion of the obscure boundary between industry and handicraft in the 19th century, and the transition between the two forms of production in Sweden was under way until the turn of the century 1900. The basis for the industrial statistics used in this study is therefore revisions made by Swedish local historians, notably Almroth and Kolsgård (1978) for Linköping, and Svensson, Godlund, and Godlund

Table 2. *Number of industrial workers related to different types of industry in Norrköping in 1865.*

Type of industry	Number of workers	Percentage of total number of workers
Woolen	2,207	56.6
Cotton	656	16.8
Tricot	548	14.0
Lithographic	155	4.0
Sugar	82	2.1
Tobacco	26	0.7
Paper	56	1.4
Engineering workshops	130	3.3
Dyeing & bleaching	42	1.1
Total	3,902	100.0

The total number of inhabitants in the city was 20,000 odd in 1865, and thus the workers constituted almost one fifth of the city's population (Source: Svensson, Godlund, and Godlund 1972 p. 87; Historisk statistik för Sverige. Del 1. Befolkning 1720-1967 1969 p. 61-65).

The Swedish Communal Reform of 1862 placed power in the hands of the City Council and the Council of Magistrates (*Magistraten*) in each city. The latter embodied the administrative authority of the state and had a supervising function, as well as being responsible for law and order. Appeals against decisions of state authorities such as the County Governor (*Konungens befallningshafvande*) or the Swedish Government (*Kungl. Maj:t*) also had to go through the magistrates. The actual city government was the City Council.¹¹⁷

Industry and trade dominated Norrköping economically and politically. Anyone who paid a certain amount of tax and was considered a good citizen had the right to vote in Swedish communal elections. Since the right to vote was determined by income and wealth, and a graduated scale regulated how many votes each person, or even company, possessed, it was the merchants, factory owners, and public officials who constituted the City Council. Consequently,

(1972) for Norrköping (Almroth and Kolsgård 1978 p. 350-352; Svensson, Godlund, and Godlund 1972 p. 95-96).

¹¹⁷ Wallin, Andersson, and Andrén 1966 p. 76-77; Bokholm 1995 p. 78-79. *Kungl. Maj:t*, literally the Royal Majesty, in reality constituted the Swedish government or some state department, at least in legislative or appeal matters.

the bourgeois upper class ruled in Norrköping until universal suffrage was introduced in Sweden in 1921. The majority of the inhabitants in Norrköping – workers, artisans, and poor people – had little or no say in local politics.¹¹⁸

The social composition of the Norrköping City Council reflected this, and the political stability of the council before 1900 was therefore solid. During the whole period from 1863 to 1910 the allocation of representatives was 40 to 50 percent industrialists, 40 to 50 percent merchants and wholesale dealers, and 10 to 20 percent civil servants, clergy, teachers, physicians, and the like. “Intellectuals” such as clergy and teachers were underrepresented at the beginning. Workers were not represented at all until 1906, when the first worker and Social Democrat was elected, but in the communal elections of 1909 and 1914 a few more were elected. There were conflicts about certain issues over the years, as we shall see, but few of these concerned basic ideological issues (except in the question of customs duties in the 1880s). Bourgeois ideology and culture in Norrköping was thus very stable.¹¹⁹ A potential source of conflict might have been the sometimes opposing interests of wholesale trade and industry, but a special characteristic of Norrköping was that many wholesale dealers also were factory owners, especially textile industrialists.¹²⁰

Linköping lies on the river Stångån just south of Lake Roxen, around 40 kilometers southwest of Norrköping. Linköping had been an ecclesiastical and educational center for centuries, and the seat of the County Government since 1634. It was also the agricultural center of the surrounding fertile plain, the so-called *Östgötaslätten*, and some of the landed gentry owned houses in the city. Ever since the Middle Ages Linköping had been a so-called *uppstad*, which meant that the town’s merchants were not allowed to trade with the international market directly, but had to go through the nearest Swedish *stapelstad*, an international port. The closest one was Norrköping, although in 1874 Linköping also received the right to direct international trade. Prior to that date local trade, handicraft, and small businesses thrived thanks to the close proximity to the farming district. Linköping was also a garrison city with a military base outside the city limits, at Malmslätt, and after 1900 there was an expansion of the military presence even in the city.¹²¹

¹¹⁸ Myrdal 1972 p. 7-12.

¹¹⁹ Myrdal 1972 p. 7-30.

¹²⁰ Nyberg 2000 p. 624; Svensson, Godlund, and Godlund 1972 p. 109. Given this fact, it may seem strange that the City Council was so clearly divided between industrialists and wholesale dealers, but these categories were based upon each person’s title. A person with the title “factory owner” may also have been a wholesale dealer.

¹²¹ Andersson 2000 p. 298-299; Bagge 1922 p. 50-60; Förhammar 1981 p. 287; Hellström 1978a p. 11-13; Marks von Würtemberg 1955 p. 81-100; Torbrand 1978a p. 92-94.



Panorama of Linköping, by G. Pabst from around 1875 (Source: Östergötlands länsmuseum).

In contrast to Norrköping, Linköping was no industrial city, at least not if we look at the economic activities within the actual city boundary. The difference from Norrköping as regards industrial activity was astounding (see Table 3). If the industries on the other side of the river in the St. Lars rural commune are also taken into account, the city stands out as a little more industrialized, but it was still far behind Norrköping. The few industries within the city were mostly situated along the river: for example, the brewery Linköpings bryggeri; the foundry, Linköpings gjuteri; the chemical industry Gripen; and Asklund's tobacco factory, which was the largest one with around 50 workers in the 1860s. On the eastern bank of Stångån, in Ladugårdsbacke, lay L. T. Brogren's brewery, as well as mills, textile factories, and a distillery at Tannefors and Nykvarn.¹²²

Table 3. Allocation of those employed in industry in Östergötland County 1870 to 1911, expressed as a percentage of the total.

	1870	1880	1890	1900	1911
Linköping	1	2	3	4	7
Norrköping	73	69	64	47	45
Other cities	1	1	1	2	2
The countryside	25	28	32	47	46
Entire county	100	100	100	100	100

Norrköping's share gradually decreased during the period, whereas the percentage of the other cities and the countryside increased. Rural industry grew remarkably strong, although some of it was located directly outside the large cities, for instance, in Tannefors and Nykvarn outside Linköping and the northern suburb outside Norrköping (Source: Almroth and Kolsgård 1978 p. 114).

Just as in Norrköping, political life in Linköping was very stable during the whole period, and there was a conscious balancing act of the different interests represented in the City Council. The social composition of the Linköping City Council was quite different from that in Norrköping. It was more differentiated, and other groups dominated. During the period studied 40 to 50 per cent were civil servants, teachers, clergymen, and officers, which reflects the city's identity as a center of the County Government, the school, the bishopric, and the military. The strong element of military members was explained by

¹²² Almroth and Kolsgård 1978 p. 111-143; Hellström 1978a p. 11-13.

the Malmslätt garrison, and it is noteworthy that many military officers served as chairmen up until 1906.¹²³

Linköping also had its bourgeoisie, although it was not industrial in composition but rather consisted mostly of self-employed merchants, artisans, and other businessmen (including a few factory owners). They made up 40 to 50 percent of the City Council, which made it about equal to the civil servant group.¹²⁴ In social life there was a strict hierarchy between these two groups, keenly observed by Robert Marks von Würtemberg. At the finest annual balls “there was an invisible chalk line: on the one hand the County Governor and his wife, civil servant and officer families, and families from the great estates around Linköping, on the other hand the bourgeoisie. None of the latter readily crossed the chalk line . . .”¹²⁵ Those working with public health, that is, physicians and others, made up around 10 to 15 percent of the council in the beginning and less than 10 percent after 1900. Only up to two percent of the members were workers during the whole period.¹²⁶

The Drafting Committee (*Beredningsutskottet*) was also a powerful political body in Linköping at the time, and it was a part of the City Council that prepared important political questions. It was established by the Communal Law of 1862, but had an unusually great influence in Linköping compared to other Swedish cities. It consisted of the chairman and deputy chairman of the City Council, as well as the chairmen of some other municipal boards. In 1869, the so-called reinforced Drafting Committee (*Förstärkta Beredningsutskottet*) was created for particularly important questions, such as communal elections and, for instance, the question of keeping the city clean (the 1885 investigation).¹²⁷ The extent of its powers is not only shown by its composition, but also by the fact that its proposals to the City Council were most often accepted.

¹²³ Hagård 1978 p. 242-248.

¹²⁴ Hagård 1978 p. 242-248.

¹²⁵ Marks von Würtemberg 1955 p. 67.

¹²⁶ Hagård 1978 p. 242-243.

¹²⁷ Hagård 1978 p. 248-250.

Theoretical and Methodological Framework

To be always looking at the map when there is a fine prospect before you shatters the ‘wise passiveness’ in which landscape ought to be enjoyed. But to consult a map before we set out has no such ill effect. Indeed it will lead us to many prospects; including some we might never have found following our noses.

C. S. Lewis, *The Discarded Image* (1964)¹²⁸

Here the “map” for the historical exploration of this dissertation will be drawn. Although the metaphor of the map is appealing, there is also that of a tool. Theory is a tool that helps the historian in lifting his or her empirical material above the unique events. Peter Burke has written: “What theory can do . . . is to suggest new questions for historians to ask . . . or new answers to familiar questions . . . To be open to new ideas, wherever they come from, and to be capable of adapting them to one’s own purposes and of finding ways to test their validity might be said to be the mark of a good historian and a good theorist alike.”¹²⁹

My view of theory is heuristic, and theory is thus more a map or a tool than something that is to be tested. The sheer usefulness of the theory will be the judge of its “validity”. Since no theory alone will help explain the problematic, I will also bring in several different theoretical perspectives below and adjust and adapt them for my own purposes, which may not be exactly those intended by the originators. This eclectic approach suits the heuristic perspective well, because usefulness and a good analysis of the empirical material is the main objective.

The Constructivist Study of Technology

My intention is to embrace a much broader perspective than reductionist views of science and technology, especially so-called technological determinism. This view implies that science and technology evolve independently of society and human actors, propelled, as it were, by some inherent life-force, and sometimes directed by an individual scientific genius.¹³⁰

¹²⁸ Lewis 1964 p. vii.

¹²⁹ Burke 1992 p. 165.

¹³⁰ Bijker 1995 p. 10-11, 280-281, 326; Law and Callon 1992 p. 50; Latour 1987 p. 132-136.

Technological determinism is not one unified perspective, however. In the present discussion it is sometimes broken down into “hard” and “soft” determinism, the latter being more prone to human intervention and societal influences than the former (Wengenroth 1998). There are other traditions in the STS field than the one(s) depicted below, but here I am mostly concerned with historicizing and contextualizing my own sociology of science and technology.

This view has been challenged in the last decades, particularly since Thomas Kuhn's *The Structure of Scientific Revolutions* (1962), in which he sees the evolution of science as a socially and historically contingent process.¹³¹ Kuhn's book inspired the subsequent development in the 1970s and 1980s of the new academic sub-disciplines sociology of science and technology and history of technology.¹³² Kuhn's book had a great impact, but it was part of a more profound reorientation in the history of science that had been going on since the 1930s with the externalism-internalism debate, initiated by Boris Hessen, Robert Merton, and others. The proponents of externalism were of the opinion that the causes of scientific development should be sought primarily in external factors such as society and economy.¹³³

I will adhere to a constructivist perspective on technology, which goes back to Kuhn and David Bloor's 1976 *Knowledge and Social Imagery*. Here Bloor argues that "ideas of knowledge are based on social images" and that "objectivity is a social phenomenon". This book constituted the beginning of the Strong Program in the sociology of scientific knowledge.¹³⁴ The relation between inside and outside has been taken up also by the adherents of this program, for instance, by Steven Shapin:

If science is to be understood as historically situated and in its collective aspect (i.e., sociologically), then that understanding should encompass all aspects of science, its ideas and practices no less than its institutional forms and social uses. Anyone who wants to represent science sociologically cannot simply set aside the body of what the relevant practitioners *knew* and how they went about obtaining that knowledge . . . There is as much "society" inside the scientist's laboratory, and internal to the development of scientific knowledge, as there is "outside."¹³⁵

The constructivist perspective on technology has partly evolved in a different direction in comparison with the Strong Program, and there are two main branches that will inform this dissertation: the Social Construction of Technology (SCOT), with Wiebe E. Bijker as its foremost spokesman, and primarily the Actor-Network Theory (ANT), as developed by Bruno Latour, Michel Callon, and John Law.¹³⁶ Although two distinct perspectives on the

¹³¹ Kuhn 1962.

¹³² Jakobsson 1996 p. 42-43; Summerton 1998 p. 28-29.

¹³³ Rigné 1998 p. 187-209; Shapin 1992 p. 333-345. See Shapin (1992) for a more extensive account of the externalism-internalism debate. Similar ideas were also discussed in the 1930s, for instance, by the physician Ludwik Fleck (cf., Graninger 1997 p. 16). In the 1960s ideas similar to Kuhn's emerged even in other fields, such as in the history of literature (Lewis 1964).

¹³⁴ Bloor 1991 p. ix-x, 3-8, 157-161, 163 (quotations from p. 157-158).

¹³⁵ Shapin 1996 p. 9-10.

¹³⁶ The systems perspective on technology, primarily developed by Thomas P. Hughes (see, for instance, Hughes 1987), is usually included in the constructivist approach as well (Bijker 1995 p. 6).

evolution of technology and society, they share a common theoretical foundation in Kuhn and Bloor,¹³⁷ and they frequently overlap in their conceptual frameworks. My main approach is ANT, but some SCOT ideas will complement and improve the theoretical tools.

The starting point for the constructivist study of technology is that science, technology, and society interact in a “seamless web”.¹³⁸ This concept goes back to Bloor’s idea of symmetry in the study of scientific knowledge, that is, that false as well as true, failed as well as successful ideas should be treated symmetrically and impartially by sociologists of science. Bijker developed this idea for its application to the study of technology – successful as well as failed technologies must be studied symmetrically by the historian or sociologist of technology.¹³⁹

Callon and Latour (1981) applied the idea of symmetry to the classic distinction between macro and micro in sociology: “*There are* of course macro-actors and micro-actors, but the difference between them is brought about by power relations and the constructions of networks that will *elude analysis* if we presume *a priori* that macro-actors are bigger than or superior to micro-actors.”¹⁴⁰ This was further elaborated into a theory of “general symmetry” by Callon (1986). In his view, the construction of science, technology, society, and even nature should be conceived symmetrically. They all interact, and therefore both human and non-human actors are to be studied on equal terms. This concept is paramount in the ANT interpretation of the “seamless web”, but has also been taken up by Bijker (1995), who earlier leaned toward a more sociological interpretation.¹⁴¹

It can be argued that such an interpretation completely deletes any border between inside and outside, technology and society, and non-human and human. But in my opinion it should instead be seen as a principle of how to study the “seamless web”. It is not to be presumed beforehand that technology is changed by society or nature, or vice versa, that any actor is human or non-human, more or less powerful, but it must be studied empirically in each case and with the same type of analysis, that is, symmetrically.¹⁴² However, agency

¹³⁷ Callon’s, Latour’s, and Law’s ANT approach has sprung from the Strong Program, but the former have also developed some ideas in direct opposition to their predecessor, for example, that the sociology of science cannot be restricted only to laboratory milieus, and that the opposition between science and society should be annulled. They are one and the same (Asdal, Brenna, and Moser 2001 p. 34-35; Latour 1987 p. 103-144). See also the discussion below.

¹³⁸ This often-quoted term was coined by Hughes 1986. It was further developed in Bijker, Hughes, and Pinch 1987 p. 9-15.

¹³⁹ Bijker 1995 p. 275-276; Bloor 1991 (1976) p. 3-8.

¹⁴⁰ Callon and Latour 1981 p. 280.

¹⁴¹ Bijker 1995 p. 273-276; Bijker, Hughes, and Pinch 1987 p. 12-13; Callon 1986.

¹⁴² Law and Bijker 1992 p. 290-294.

primarily lies with humans, for too much stress on non-human agency leads us back to the pitfalls of technological determinism.¹⁴³

Actor-Network Theory, Power, and Heterogeneity

The pursuit of cleanliness and a healthy environment in the city through public health and technology was essentially a quest for order and control of reality, both from a cognitive and a social point of view. The achievement of social order and the preservation of identity with technology were crucial in this pursuit, and it follows that creating social order was also an exertion of power.¹⁴⁴ During the late 19th century there was growing concern about public health and introduction of modern sanitary technologies in all of the western world. One crucial point is what really prompted the development on the local level, what actors defined or constructed public health, environmental problems, and the particular technological solutions, and what particular interests and strategies were involved in such negotiations.

Here we have come to the level of the historical actors and their interests. The practical implementation of sanitary science and technology in the municipal political context meant negotiations between different actors and interests. This involved social groups such as the bourgeois elite, middle and lower classes, and decision makers, building owners, scientific experts (sanitary engineers, physicians, and chemists), financiers, workers, and other actors or groups of actors. The negotiations took place in a formal political framework, since dealing with common issues in a local context must necessarily go through the local government, in this case the City Council. However, since politics is a social process there were also a great many negotiations which were informal and “off the record.”¹⁴⁵

The concept of power is crucial here, and the ANT approach offers tools to use this concept without begging the central issues.¹⁴⁶ An actor “grows,” that is, becomes more powerful, through what Callon and Latour call *translation*:¹⁴⁷

By translation we understand all the negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or force takes, or causes to be conferred on itself, authority to speak or act on behalf of another actor or force . . . Whenever an actor speaks of ‘us’, s/he is translating other actors into

¹⁴³ Wengenroth 1998.

¹⁴⁴ Frykman and Löfgren 1987 (1979) p. 157-166; Schmidt and Kristensen 1986 p. 15-20; Asdal, Brenna, and Moser 2001 p. 9-10; Johannisson 1997 p. 221-227.

¹⁴⁵ Åberg 1998 p. 13-31.

¹⁴⁶ Bijker is of the opinion that the concept of power often conceals and leaves unanswered the most interesting power questions (Bijker 1995 p. 11).

¹⁴⁷ Callon and Latour 1981 p. 280-281.

a single will, of which s/he becomes spirit and spokesman. S/he begins to act for several, no longer for one alone. S/he becomes stronger. S/he grows.¹⁴⁸

The term translation is a relational power concept, that is, power is exerted in relation to another actor, which can be attributed to human as well as non-human actors (“actants”). These can act alone or as networks.¹⁴⁹

ANT takes a somewhat unusual approach to the concept of power; at least it was when Callon and Latour’s Leviathan article was published in 1981 (except, of course, Michel Foucault, who had come up with a similar concept of power¹⁵⁰). Traditionally, political philosophers and sociologists have studied the essence of power, what power really is – what has been called the Hobbesian project. Power has been regarded as causal and emanating from one single center of power.¹⁵¹ In “Unscrewing the big Leviathan” Callon and Latour question the Hobbesian concept of power, and instead introduce a new one, which concentrates on the mechanism of power. It is, rather, a Machiavellian power concept. How does power work in practice? This is very important, as we do not want to presume power relations beforehand. They can only be analyzed empirically.¹⁵²

ANT thus uses a network metaphor, and views the evolution of science and technology through translations.¹⁵³ In translation engineers, decision makers, or other actors “speak in the name of new allies that they have shaped and enrolled.”¹⁵⁴ The *enrolled* or *enlisted* allies could be other scientists, engineers or any other actors, as well as non-human actors, actants, such as knowledge,

¹⁴⁸ Callon and Latour 1981 p. 279.

¹⁴⁹ Latour 1999 p. 15-16, 174-177, 304. Non-human actors, actants, be it natural or technological or anything else, participate and sometimes play a crucial part in the actor-networks, but they are not conscious in the human sense. In that case ANT would be a form of natural or technological determinism. Actors and actants interact in the actor-networks, but it is the actors and thus human agency that is at the heart of the story (Law 2001 (1992) p. 2). Cf., Ulrich Wengenroth, who says that “technology, at least to date, is no conscious subject, it doesn’t act of itself. It forms, however, most visible and often daunting environments, which are enabling and forbidding at the same time” (Wengenroth 1998).

¹⁵⁰ See, for instance, Foucault 1977 (1975) and Foucault 1986 p. 229-242.

¹⁵¹ Callon and Latour 1981; Stenlås 1998 p. 41-44.

¹⁵² Callon and Latour 1981 p. 291-292; Stenlås 1998 p. 43-46.

¹⁵³ ANT differs quite much from “traditional” network theories in the social sciences. The concept of network is not new, but was applied in studies of social relations in African towns as early as the 1950s and 60s. Here there was an emphasis on the morphological characteristics of personal networks, such as size, density, and frequency of interaction (see, for example, Mitchell 1969 p. 1-50 and Lourenco-Lindell 2002 p. 26-28). In recent years the concept of network has informed some Swedish historical studies. Martin Åberg has done a more quantitative analysis of social networks in modern local politics (Åberg 1998), and Niklas Stenlås has uncovered the political ambitions of the Swedish economic elite in the 1940s by constructing social networks as processes (Stenlås 1998). Cf., Brusman 2000.

¹⁵⁴ Latour 1987 p. 259.

institutions, technological artifacts, and natural resources. When the associations in the ally network are strong enough and the elements together act as one, then a scientific “fact” or a finished technological artifact or system has been made.¹⁵⁵ Consequently, no precise borderline between science and technology, technology and society, or society and nature can be drawn, but they are instead interwoven – the “seamless web.”¹⁵⁶

The history of human society and technology thus also involves the natural environment. As Raymond Williams writes, “the idea of nature contains an extraordinary amount of human history. What is often being argued, it seems to me, in the idea of nature is the idea of man; and this not only generally, or in ultimate ways, but the idea of man in society, indeed the ideas of kinds of societies.”¹⁵⁷ C. S. Lewis poignantly describes the power struggle embedded in humankind’s scientific exploration of nature: “[W]hat we call Man’s power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument.”¹⁵⁸ ANT thus views reality as a whole, but it is far from a consensus perspective. Rather, society, technology, and nature co-evolve through conflict.¹⁵⁹

Steven Lukes writes of the quest for a fitting and all-inclusive definition of the power concept:

Perhaps a generally satisfying definition can be devised by fitting . . . various insights together into a single picture? Perhaps, but I doubt it. It is more likely that the very search for such a definition is a mistake. For the variations in what interests us when we are interested in power run deep . . . and what unites the various views of power is too thin and formal to provide a generally satisfying definition, applicable to all cases.¹⁶⁰

Bijker would rather we abolish the concept of power completely, since it is so imprecise.¹⁶¹ The definition of power as translation is general and all-inclusive, but also a bit too abstract to be a useful tool as it is. However, since I believe

¹⁵⁵ Callon and Latour 1981 p. 279, 284-285; Latour 1987 p. 108, 124-132; Latour 1999 p. 16-17, 303.

¹⁵⁶ Bijker, Hughes, and Pinch 1987 p. 9-15; Latour 1998; Asdal, Brenna, and Moser 2001 p. 9.

This has wide-ranging implications for how we view the history of science and technology, environmental history, and social history. Instead of being eradicated, I would argue that through the ANT approach they become more closely connected. Instead of epistemological specialization we get interdisciplinarity, for ontologically everything is connected. (Cf., for instance, White 1995 p. ix-xi).

¹⁵⁷ Williams 1980 p. 70-71.

¹⁵⁸ Lewis 1978 (1943) p. 35.

¹⁵⁹ Hård 1993.

¹⁶⁰ Lukes 1986 p. 4-5.

¹⁶¹ Bijker 1995 p. 260-262.

that it adds something new to the study of power I will make use of it in this dissertation, but it first needs to be complemented with other tools.

Translation has to do with the most central aspect of power – the actors' *interests*. The powerful actor is the one who can translate the interests of others into his own.¹⁶² But what determines how powerful an actor can get and to what extent he can fulfil his interests? It is dependent upon what *power resources* an actor or group of actors can enlist or mobilize, and what *strategies* are used. A power resource is anything that boosts an actor in the process of becoming more powerful, for instance, social prestige, (expert) knowledge, money, or influential friends, in the actor-network or other actor-networks (the concept of power resource resembles Pierre Bourdieu's concept of capital).¹⁶³ Translation, that is, power in its actual practice, thus depends on what resources are available in a given historical situation or relation, and also on how well an actor can enroll and make use of these resources.¹⁶⁴

It is very central to the constructivist stance that at every point in history there are alternative ways of thinking and acting. History does not follow a predetermined path, but could have been otherwise. Translation suits this view very well, for it stresses the freedom of the actors. Bijker as well as Law and Callon emphasize the *interpretative flexibility*¹⁶⁵ of relevant *social groups*, that is, the fact that a technological project or system can mean different things to different social groups. This will affect the translations and thus the distribution of power in the local context, where the relevant social groups are often well-defined.¹⁶⁶

The freedom of choice for the actors is not unlimited, however. There are structural restrictions of varying degrees in economic factors, natural conditions, technological systems, class identity or norms of social groups, organizational structures, and even the political system of the day. For example, in the era studied the right to vote in Sweden was reserved for men and was graduated according to income.¹⁶⁷ As regards water supply and sewerage Martin Melosi points out:

A commitment to permanence . . . often locked in specific technologies and thus limited choices for future generations. Problems could arise if systems were either too well built or too poorly constructed. In the case of the former, an

¹⁶² Lukes 1986 p. 7.

¹⁶³ Åmark 1989 p. 37-41. Bourdieu divides capital into four categories: economic, cultural, social, and symbolic capital (Bourdieu 1989).

¹⁶⁴ Stenlås 1998 p. 43-60; Björn Horgby, personal communication, 2001-04-04.

¹⁶⁵ This concept has been borrowed from the Empirical Program of Relativism, EPOR, in the sociology of scientific knowledge, to which SCOT is related (Bijker 1992 p. 75-76).

¹⁶⁶ Bijker 1987; Bijker 1992 p. 75-76; Law and Callon 1992 p. 42.

¹⁶⁷ Norborg 1993 p. 90-96.

existing system could prove resistant to change; in the latter case, it might be in desperate need of replacement. As a consequence, decisions made about sanitary systems in the nineteenth century had a profound impact on cities more than 100 years later.¹⁶⁸

Bijker talks of *closure* and Latour of a *black box* when the meaning of a technology has stabilized and the interpretative flexibility has diminished. One then only focuses on the inputs and outputs, and the freedom of choice has been reduced.¹⁶⁹

From the ANT perspective, a black box or closure occurs when a dominating actor has managed to translate the interests of others into a finished actor-network – a technological artifact or system. More and more decision makers, physicians, engineers, house owners, and actants such as money, pipes, and water have been enlisted, and the result is a *heterogeneous network*, which patterns and restricts freedom of choice to some degree. But embedded in the term heterogeneous network is also the negotiable, unstable character of technology. So even though closure results in certain restrictions, which may resemble a technologically deterministic situation, technology is still contingent and negotiable:¹⁷⁰ “There is, however, no *necessity* about such progress. If all is smooth, this is because contingency has operated in that way.”¹⁷¹

There are several concepts to denote structural limitations on human agency in social science theory and constructivist technology studies: path dependence,¹⁷² momentum,¹⁷³ and the above-mentioned concepts. These all account for a balance between agency and structure, between the actors’ freedom of choice and structural restrictions, but especially momentum has been regarded as having a deterministic flavor by some scholars.¹⁷⁴ This seems a bit like hairsplitting to me, for whichever concept is to be used, the scholar in question must always contextualize it and define what he or she means. The

¹⁶⁸ Melosi 2000 p. 10. Melosi deals with North American conditions, but this case is applicable to the European situation as well.

¹⁶⁹ Bijker 1995 p. 262-264; Latour 1999 p. 304. Embedded in the concept of the black box, according to Latour, is also, paradoxically, the fact that “the more science and technology succeed, the more opaque and obscure they become” (Latour 1999 p. 304).

¹⁷⁰ Law 2001 (1992) p. 2-4; Law and Bijker 1992 p. 290-291; Law and Callon 1992 p. 49-50. Cf., Osborn and Marvin 2001 p. 68-77.

¹⁷¹ Law and Callon 1992 p. 50.

¹⁷² Melosi 2000 p. 10; Nee and Cao 1999 p. 800.

¹⁷³ Hughes 1987 p. 76.

¹⁷⁴ For criticism of momentum, see, for instance, Bijker and Law 1992 p. 1-4. Cf., Summerton 1998 p. 31-35. According to Hughes himself, however, it is only a “soft” determinism, which means that a technological system acquires inertia of motion because of technical, organizational, and economic investments in the system, when it matures and consolidates: “Old systems like old people tend to become less adaptable . . .” (Hughes 1987 p. 54-55, 76-77, quotation on p. 54).

important thing in this study is to interpret the concept used in the heterogeneous spirit of ANT. Structures exist and are made up of actors and actants, that is, they are actor-networks, but to the degree that an actor manages to enroll them in his or her actor-network structural limitations can be overcome or by-passed.¹⁷⁵

There are also certain structural restrictions in the way the actors think about and thereby construct such pivotal concepts as “cleanliness,” “dirt,” “pollution,” “environment,” and “public health.” Of course, the list of possibly constructible phenomena is longer than this, but these are the most central for the subject matter of this dissertation. Since water supply and sewerage were problem-solving technologies, one of the most efficient strategies for their introduction is expected to have been the construction of a problem in need of a solution.

These constructions are contingent upon the material conditions, but also follow structural ways of thinking to some extent. For Mary Douglas the dichotomy purity – impurity/dirt/pollution is pivotal to all societies in time and space, whether modern or primitive. Douglas defines culture as the public, standardized values of a society, and it provides in advance some basic classifications and dichotomies, which in turn create order. In Douglas’ definition, dirt and pollution are “matter out of place,” which means a disorder in the cultural structure of ideas and classifications, as well as in social life. In the same way, the removal of pollution is a positive action to restore cultural and social order.¹⁷⁶

In Douglas’ view dirt is disorder, but there are examples of the use of dirt and waste as manure in agriculture, which seem to contradict this. In those cases dirt quite simply becomes something valuable.¹⁷⁷ As Douglas writes, “dirt, which is normally destructive, sometimes becomes creative.”¹⁷⁸ Consequently, dirt must either be disposed of in a place clearly defined for waste, for

¹⁷⁵ The ANT balance between agency and structure resembles Bourdieu’s, cf., for instance, Bourdieu 1989.

¹⁷⁶ Douglas 1966 p. 1-6, 36-41, 114 (quote on p. 36).

¹⁷⁷ Although in quite a different setting, Cyrus C. M. Mody observes the same thing about the role of dirt in materials science (Mody 2001 p. 32-33).

¹⁷⁸ Douglas 1966 p. 160. The British anthropologist Michael Thompson also recognizes this double character of dirt and rubbish, but focuses more on what it says about the value we attach to things in late 20th-century Western society. In Thompson’s definition, rubbish is an intermediate stage between declining and increasing value of an object. For instance, a second-hand object will lose value until it is valueless – the rubbish state – but at some point it becomes a collector’s item and all of a sudden increases in value (becomes creative, Douglas would say). Value is thus socially constructed, and it may as well be a child at a Manila dump attaching value to rubbish. Thompson’s definition is valuable since it recognizes dirt in other forms than Douglas’, which concentrates on the symbolism of the human body and consequently mainly bodily or human waste (Thompson 1979 p. 1-12).

example, a rubbish heap, a dump, or a waterway, where it can no longer create disorder, or it has to be made a creative force. The latter can only be achieved when the dirt decays and putrefies, and thus is made formless and undifferentiated.¹⁷⁹ Therefore, in my interpretation of Douglas, ideas of disposal and “recycling” of waste both come from the same basic structure of ideas and dichotomies in the human mind – purity versus impurity – and it is all a question of protecting the social order. Pollution is the transgression of that order, which can be restored either by the removal or reuse of the dirt.¹⁸⁰

It is particularly bodily waste which concerns Douglas. The body is a so-called “natural” symbol, whose universality should not be confused with something biological, and it expresses the relationship of an individual to his or her society:

The social body constrains the way the physical body is perceived. The physical experience of the body, always modified by the social categories through which it is known, sustains a particular view of society. There is a continual exchange of meanings between the two kinds of bodily experience so that each reinforces the categories of the other. . . . Here I seek to identify a natural tendency to express situations of a certain kind in an appropriate bodily style. In so far as it is unconscious, in so far as it is obeyed universally in all cultures, the tendency is natural. It is generated in response to a perceived social situation, but the latter must always come clothed in its local history and culture.¹⁸¹

The social experience of disorder, Douglas goes on, is then expressed through symbols of impurity and danger. Whether we talk about pollution, dirt or impurity they are all modeled on the human body (but may, of course, in practice be any kind of human waste).¹⁸²

My conclusion, following Douglas’ line of thought, is that the modern bourgeois response to unclean cities – in this case the building of piped water supply, sewerage, and excreta collection – not only made the cities cleaner and healthier to live in from a sanitary point of view, but also restored moral and

¹⁷⁹ Douglas 1966 p. 160-162.

¹⁸⁰ Douglas 1966 p. 3, 114, 160-163.

¹⁸¹ Douglas 1996 (1970) p. 69, 72-73.

¹⁸² Douglas 1996 (1970) p. 86-87. One of Douglas’ missions has been to bridge the gap between the so-called primitives and moderns (Douglas 1992 p. 3-21; Lidskog, Sandstedt, and Sundqvist 1997 p. 144-149). Douglas has developed her theory since the 1960s and 1970s, notably in *Risk and Culture* (Douglas and Wildavsky 1982) and *Risk and Blame* (Douglas 1992). It was concluded, just as it was to a certain extent also in *Purity and Danger* and *Natural Symbols*, that issues of purity, pollution, and danger are present even in our own Western society. This was highly controversial in the 1980s, at least according to Douglas herself, and disturbed the notion of a rational risk analysis in a rational Western culture. In these studies, however, Douglas is mainly concerned with her own time and the focus is on risk analysis rather than on pollution itself (Douglas 1992 p. ix-xii, 3-54).

social order. Like the British sanitary reforms in the mid-19th century and onwards, the Swedish health reform and hygiene later came to rest on this ideology as well – hygiene and cleanliness had both physical and moral implications.¹⁸³ Late 19th-century ideals of the *healthy city* and metaphors of society as a *sound* or *healthy body*, had their origins in the same ideas of purity and dirt, as did the consequent dichotomy health – sickness.¹⁸⁴

Clearly Douglas' theory has many merits and also explains a lot about the modern construction of dirt. However, her emphasis is too much on the structural (cf. "structure of ideas"¹⁸⁵). The distinction between purity and dirt, and the dangers of pollution, just exist as a universal structure, without any fully satisfying explanation of why this is so. The theory of actor-networks, however, can shed light on this process, and complement Douglas' perspective. It will reveal what interests lay behind the construction of dirt, public health, sanitary dangers, environmental problems and the like, and how they were used as strategies. Hence the cultural construction of different pollution-related urban problems should also be heterogeneous; it is "clothed in its local history and culture."

Actor-Networks and Ideology

In order to maintain their legitimacy the actors enlist ideology. Ideology could be a kind of defense mechanism, which justifies the achieved position, but could also be strategic and aggressive.¹⁸⁶ The concept of ideology is here defined as a set of ideas which explain and legitimate social action, whether it is political or not. An ideology is made up of different ideas – abstract ideas about man's place in society and the world (world-view) and more action-oriented, normative ideas – the aim of which is societal change.¹⁸⁷ It would yet be wrong to see these ideas as some essence of ideology, because, as Terry Eagleton writes:

¹⁸³ Graninger 1997 p. 211-215; Jones 1986 p. 5-24; Karlsson 1993 p. 18-21, 33-48; Palmblad 1990 p. 9-21, 193.

¹⁸⁴ Johannisson 1997 p. 221-234; Karlsson 1993 p. 18-21; Schmidt and Kristensen 1986 p. 17; Wetterberg and Axelsson 1995 p. 43-46. According to Christopher Prendergast, the healthy city became the modern definition of a city. With examples from Paris, he shows how a clean and deodorized city became the *proper* city, freed from the "dirty," "smelling," and "polluted" lower classes, which were potentially dangerous in the wrong place (Prendergast 1992 p. 78-79).

¹⁸⁵ Douglas 1966 p. 114.

¹⁸⁶ Callon and Latour 1981 p. 285; Stenlås 1998 p. 57-59.

¹⁸⁷ Eagleton 1991 p. 6-7; Liedman 1989 p. 11, 23-29; Linnér 1998 p. 126.

The phrase ‘bourgeois ideology’, for example, is simply shorthand for an immense range of discourses scattered in time and space ... it is doubtful that one can ascribe to ideology any *invariable* characteristics at all. We are dealing less with some essence of ideology than with an overlapping network of ‘family resemblances’ between different styles of signification.¹⁸⁸

Consequently, the intention is not to try and construct ideologies as Weberian ideal types, but to expect fragments of different ideologies to be constructed in the actor-networks. It is important to study the practice of ideology as well, not merely because it is the only way of investigating the impact of ideology, but also because human actions, buildings, technological artifacts or systems are implicitly or explicitly, unconsciously or consciously, ideological.¹⁸⁹

Actor-Network Theory, Relativism, and Cultural Reductionism

The actor-network approach can be reproached for its relativistic tendencies. It can be interpreted as an attempt to dissolve boundaries between science and technology, technology and society, as well as culture and nature. According to Latour, ANT is “a deliberate attempt at terminating the use of the word ‘social’ in social theory to replace it with the word ‘association’.”¹⁹⁰ Since anything can be an actant, it is clear that even culture and nature can be reduced to the semiotic interplay between different actants, different associations that only acquire meaning in relation to other actants, signs. This would mean a relativistic epistemology as well as ontology.¹⁹¹

But if we turn the argument the other way around, the actor-network theory helps illuminate the complex web of interrelations in our world, both living and non-living. ANT thus takes the social construction of science and technology a step further than the proponents of the Strong Program and SCOT, but not necessarily towards either a more relativistic or culturally reductionist stance. Since the actor-networks even incorporate the natural world (the environment) and the material world (for instance, technology and economy) the associations are not determined only by the human actors, but also the (active or passive) constraints and possibilities of that which is not human or social. In investigating the world, every possible association – whether human or non-human, living or non-living – must be taken into account.¹⁹²

¹⁸⁸ Eagleton 1991 p. 193, 222.

¹⁸⁹ Liedman 1989 p. 40-43.

¹⁹⁰ Latour 2001 p. 1. See also Latour 1987 p. 127-132.

¹⁹¹ Asdal, Brenna, and Moser 2001 p. 30-36, 72-74.

¹⁹² Latour 1998 p. 10-12. See also Callon 1986 and Asdal, Brenna, and Moser 2001 p. 30-36, 70-74.

Operationalizing Actor-Network Theory in Local Technological Projects

Here the ANT approach will be given a more tangible form, for its implementation in this study. We are concerned not so much with invention and innovation, which are the subject matter of most constructivist technology studies, but with the construction and evolution of technological systems in a local context. From the actor-network perspective the dissertation therefore essentially deals with a number of bigger or smaller, proposed and/or realized technological projects in Norrköping and Linköping from circa 1860 to 1910, in which different actor-networks acted, interacted, or counteracted.

The actors who want to carry out a technological project must first enroll and stabilize a working actor-network that will prevail in a first discussion and planning phase. The success will depend on the enlistment of sufficient power resources, which in turn result in economic and other resources to enable the realization of the project. In Norrköping and Linköping it was primarily the City Council, Financial Department, and waterworks administration that constituted the stage for this phase, although other municipal units were sometimes involved. The building phase is practical and not often accounted for in official municipal source material, especially when the water and wastewater systems became institutionalized and more and more a part of the city's ongoing administration. The administrative phase is the result of effective translations by actor-networks in the two preceding phases, but, as the systems evolved, planning and building phases for sub-projects were interwoven with the ongoing administration.

The success of the projects ultimately depended on central figures, and if we elaborate the network metaphor they can be called "spiders in the web," or in the language of Law and Callon (1992) obligatory "points of passage."¹⁹³ Central to the argument of this dissertation is the interrelatedness of things, that actors associate themselves with other actors and actants to become more powerful. But in each actor-network there are one or several centers of power, from which translation originates.

All these actor-networks were mobilized for different temporary projects in the cities, apart from the national networks of engineers and physicians, which were more durable. The local actor-networks were parts of more permanent, class-bound networks, which due to the scope of this study cannot be examined in their entirety, but the analysis should be able to make them surface to a certain degree. Since the actor-networks could be hidden or subconscious even to the actors themselves, it follows that they have to be constructed by the

¹⁹³ Law and Callon 1992 p. 21-33, 41.

historian in order to carry out the analysis, but the important thing is what can be achieved with this network tool.¹⁹⁴

The network analysis will identify four different traits for each actor-network, in order to evaluate its role in the technological projects. First of all, the *content* of the actor-networks will be analyzed, that is, quite simply what actors and actants were part of the networks. The object is not to depict the whole networks, but instead to identify the key actors in each situation or project, especially the so-called “spiders in the web.” Secondly, there will be an analysis of what the possible *interests* of the actor-networks were. Thirdly, analyses will be carried out of what *power resources* the actor-networks enlisted, that is, what enabled the success of a particular network. Fourthly, the *durability* of the actor-networks will be studied over time in order to evaluate their historical significance.

The Main Questions

This dissertation deals with two cities and how their inhabitants – categorized in several more or less class-bound actors and actor-networks – dealt with mainly sanitary and environmental municipal problems by using technology, namely water supply and sewerage. The issues of water and wastewater, as well as the related question of excreta collection and keeping the city clean (*renhållningsfrågan*), generally were very complex and took many years to carry out for Swedish cities (Norrköping and Linköping being no exceptions),¹⁹⁵ and therefore we have to follow the actors in their work for or against these technologies.¹⁹⁶ The object is thus to investigate what roles different factors, actors, and actor-networks played in the evolution of water and sewerage. The theoretical tools outlined above will be utilized in the investigation.

There are three main questions for the comparison between the water and sewer systems in the two cities, each of which corresponds to a part of the dissertation. The outline is thematic in that each main question and part correspond to a theme which is followed from 1860 to 1910: Why and how were piped water supply and sewerage discussed, planned, constructed, and technically extended in Norrköping and Linköping, and what roles did different actor-networks – actors and actants – play (Part I: Technology and Organization)? Why and how did (or did not) actor-networks extend these systems geographically within and outside the respective cities (Part II:

¹⁹⁴ Brusman 2000 p. 41.

¹⁹⁵ Bjur 1988 p. 37-60; Edvinsson 1992 p. 75; Hallström 2000 p. 195-205; Isgård 1998 p. 13-18.

¹⁹⁶ Latour 1987 p. 1-20.

Geography)? Why and how was the function of sewerage and water extended and used for excreta collection and the solution of the so-called question of keeping the city clean, *renhållningsfrågan* (Part III: Function)?

Method

Apart from the method for the network analysis, there are three main methods utilized in this study. In Swedish historiography *source criticism* at least used to be seen as the mother of all historical methods, which is why it has been called just that – the “historical method.” It has also been regarded as the only method that really unites all the various historical sub-disciplines. I would argue that, although it is nowadays only one of many methods at the historian’s disposal, it is the foundation of the historian’s craft. Without it there can be no reliable analysis of the empirical material. Hence, it cannot be dismissed or compromises made, as will hopefully be evident throughout the dissertation.¹⁹⁷

The rules of source criticism could be summarized in five criteria to be followed when evaluating a particular source: whether it is genuine, whether it is dependent upon another source or not, whether it is biased, how distant in time it is from the event or process it describes, and whether what the source says is at all likely to have happened from the point of view of “common sense” or the laws of nature.¹⁹⁸ These criteria need to be qualified to be usable. What is a bias or what is reasonable, for instance, is largely dependent on the historian’s interpretation, as well as on the central problematique, the theoretical framework, and the other methods that are used.

How sources are evaluated and what the historian can get out of them therefore depend on interpretation. Hence the second method for this study is a *hermeneutic method*, that is, a method of interpretation. Just as source criticism it will be used throughout the dissertation, from the evaluation of the empirical material to the analysis of arguments, ideologies, interests, and actor-networks. The source material is mainly different texts (apart from a few maps and drawings), and central to this method is that the historian constructs the meaning of the texts. Interpretation might thus seem to be just in the eyes of the beholder, such as in literary reception theories of, for instance, Stanley Fish and Norman N. Holland.¹⁹⁹ Talking about constructing meaning could also imply that this historical research is only one of many discourses of the

¹⁹⁷ Dahlgren and Florén 1996 p. 184-190; Skovdahl 1996 p. 35-37.

¹⁹⁸ Jarrick and Söderberg 1993 p. 116-131.

¹⁹⁹ MacLean 1986 p. 138-143.

past without any reference to what really happened, as in so-called deconstructionist history.²⁰⁰

Although these latter postmodern theories pinpoint certain problems of interpretation and historical endeavor, they are too sceptical. The stance put forward here is rather *historicist*, that is, that meaning is determined by the context in which the text was written as well as the historian's own context. Therefore, all forms of historical context – discursive, ideological, scientific, social, economic, and environmental – must be taken into account in the analysis of the different texts so as to make the interpretation plausible.²⁰¹ The genre of the text is also important, since this also affects interpretation.²⁰²

The third method is the *comparative method*, which will also be applied throughout on different levels and in different contexts. The primary comparison is between the water and sewer systems of the cities Norrköping and Linköping – the politics, interests, ideologies, organization, and social and economic structures. These cities were chosen because they are both similar and different, which is usually a good basis for comparison. Why are they different despite the similarities, and vice versa? These results will, in turn, be compared with different aspects of the evolution of water supply and sewerage in other Swedish and European cities as well.²⁰³

Comparison is difficult to do without some kind of simplification of past processes, events, or categories. Therefore, typologies will sometimes be used to facilitate the comparison, for instance, Weber's "ideal types" in accounting for the views of different groups in the City Councils or a typology of social geography or different cities.²⁰⁴ All class categories are also more or less constructed, and thereby simplified, by historians. The bourgeoisie and the working class were heterogeneous groups not so easily lumped together under a single heading, which will hopefully be made clear in the study.²⁰⁵

Delimitations and Primary Source Material

The above main questions, and theoretical and methodological choices will be brought into the analysis of the empirical material, which has been largely collected at the Norrköping (NSA) and Linköping (LiSA) City Archives. The period of investigation begins around 1860, a date chosen partly due to the passage of the new Swedish Communal Reform of 1862. The period ends about 1910, when large water and wastewater extension and renovation pro-

²⁰⁰ Munslow 1997 p. 1-35. For a modernist response to this view, see, for instance, Evans 1997.

²⁰¹ MacLean 1986 p. 122-124, 136-138. Cf., Hedrén 1994 p. 33-37.

²⁰² Anshelm and Kylhammar 1996 p. 80-90. Cf., Kylhammar 2002 p. 66.

²⁰³ Burke 1992 p. 22-28; Müller and Nováky 1997 p. 1-2, 13-14.

²⁰⁴ Burke 1992 p. 28-33.

²⁰⁵ Bourdieu 1989 p. 17-18. Cf., Hedin and Tydén 1998 and Plymoth 2002 p. 48-58.

jects were being completed in both cities and symbolically crowned by the building of the water towers.

A wider range of material has been researched at the archives for the first part of the period, that is, up to around 1885 to 1890. The assumption was made that studying the introduction of new technology requires broader empirical material in order to answer questions about actor-networks and interests, than when it has been institutionalized. Yet the minutes and supplements of municipal bodies that were involved in this issue other than the City Council – for instance, the Financial Department, the Drafting Committee (*Beredningsutskottet*), the Waterworks Board, the Board of Health, the Building Board (*Byggnadsnämnden*), and the Linköping Department of Sanitation (*Renhållningsstyrelsen*)²⁰⁶ – are almost always included in the City Council minutes or supplements, which thus makes even the period from ca. 1890 to 1910 rich in material.

The primary source material is first of all the minutes, supplements, and other material (investigations, maps, etcetera) of Norrköping and Linköping City Councils (*Stadsfullmäktige*), where the formal decisions concerning the introduction and evolution of water supply and sewerage were made. This material was used from 1863 to 1910. In Norrköping it has been complemented by the minutes of the City Council's Financial Department, *Drätselkammaren*, at the beginning of the period, since this body then administered the question of water supply. In Linköping, the minutes of the Drafting Committee were included in the City Council minutes from the beginning, but in Norrköping only from 1899, when such a unit was formed there. The minutes of the Council of Magistrates, *Magistraten*, have also been studied for Linköping at the end of the 1860s (from VaLa, *Vadstena landsarkiv*).

The minutes (1872-1888), supplements, annual reports (for 1872-1913), and different accounts and registers of the Waterworks Board (*Vattenledningsstyrelsen*) and after 1898 the Financial Department, which then came to administer the water and sewer systems, have been utilized for Norrköping. For Linköping the minutes of the Water Company's (*Vattenledningsaktiebolaget*)²⁰⁷ shareholders' meetings have been used (1873-1890), as well as the annual reports of its board for 1874 to 1907 (and the municipal waterworks for 1908 to 1910). Also, the minutes of the Norrköping and Linköping Boards of Health (*Hälsovårdsnämnden*, 1875-1885) have been included for the more

²⁰⁶ The material for the first years of the department has been utilized.

²⁰⁷ Due to time restrictions I have not been able to go through the more detailed material from the Water Company – the minutes of the board. To make up for this I have used an undergraduate thesis that has made a good analysis of these sources, Dagersten and Staaf 1976.

explicit sanitary point of view.²⁰⁸ The minutes of the predecessor of the Board of Health, *Sundhetsnämnden*, have unfortunately been lost in both cities. The same goes for the minutes of the fire-protection board in Norrköping in the 1860s. The point of view of fire prevention is well represented in other sources, which is why the sources of the fire authorities have not been pursued any further in either city.²⁰⁹

Other official local material that has been studied for this dissertation are maps of the cities and plans for water supply and sewerage, which have largely been collected at the Linköping City Library, Norrköping City Archives, *Norrköping Miljö & Energi* (NME) Technical Archives (the present-day Norrköping waterworks organization), and *Tekniska Verken* Archives (Linköping's present waterworks organization). To complement the official municipal material, local newspapers have also been used – *Norrköpings Tidningar* (NT) for Norrköping and *Östgöta Correspondenten* (ÖC) for Linköping.²¹⁰ The most frequently utilized sources here are accounts of City Council meetings, articles, letters to the editor, and advertisements. Certain volumes of the Swartz Family Archives were also used.

Official statistical material for Sweden (*Bidrag till Sveriges offentliga statistik*, BiSoS) was studied for the beginning of the period (1861-1871 as well as various years in the 1880s). The annual reports of the first provincial physician of Östergötland County (1891-1895) have been collected from the *Landstingsarkiv*, Linköping, as well as the minutes and supplements of the *Svenska kommunaltekniska föreningen* (SKTF; 1902-1909) at *Svenskt vatten* (VAV), Stockholm.²¹¹

These minutes, supplements, accounts, reports, investigations, and maps have to be studied with the usual historical criticism, that is, it is not to be taken for granted that all the information is correct, despite their being official

²⁰⁸ For Linköping, the annual reports of the Board of Health from 1875 to 1885 have been studied as well. For Norrköping there were no annual reports until 1894, but these have not been scrutinized. For the period after 1885 I have occasionally used excerpts from the Norrköping Board of Health minutes, collected by Börje Hjort.

²⁰⁹ According to Inez Ek at the Norrköping City Archives (NSA) and Nilsson 1994 p. 113.

²¹⁰ The conservative *Norrköpings tidningar* was by far the largest newspaper in Norrköping during the last half of the 19th century, and it appealed to readers of different social groups. The same goes for the liberal *Östgöta Correspondenten* in Linköping. There was also the liberal-radical *Östgöten*, which was published in Linköping, intended for both Linköping and Norrköping readers, but it does not cover the whole period and some issues are also missing from the Linköping City Library (late 1872-). In Norrköping there were also the small *Proletären* (*The Proletarian*), published during certain periods from 1888 to 1893, and *Östergötlands dagblad* (1895-) (Hellström 1978b p. 187-213; Johannesson 2001 p. 166-179; Lundstedt 1902 p. 297, 300).

²¹¹ All translations of Swedish source material into English, be it council minutes or literature, are my own, unless otherwise noted.

documents, accounts of such, or accounts of official discussions. Critical reading and comparison with other sources are thus important. In the minutes of the different boards and other municipal bodies in Norrköping and Linköping (including the Water Company) generally only the official resolutions were recorded, and most of the time some or all of the discussions were left out. This means that not only was there a subjective selection of arguments, but also sometimes a colored account of the arguments which were selected. This goes also for the accounts in the newspapers. In a sense, then, the minutes may obscure conflict, especially as they can be checked and corrected afterwards.²¹²

A general problem in all the source material is the lack of references to women and children. In fact, the material is strictly masculine in all respects. Men wrote the reports, minutes, and newspaper articles, and these were mainly for and about men. It is easy to see that this is a problem for the analysis, since the material excludes a great many of the inhabitants of both Norrköping and Linköping. This goes for the poor and the working class as well, but not at all to the same degree, for they are at least mentioned and recognized (often as a problem). For Norrköping this is particularly troublesome as a great part of the workforce was made up of women and children at the beginning of the period (see Table 4). Women continued to constitute around 50 percent of the industrial workforce throughout the period of investigation.²¹³

²¹² Norborg 1968 p. 165-167; Thurén 1986 p. 3-94.

²¹³ Plymoth 2002 p. 62.

Table 4. *Percentage of female labor and workers under 18 (both men and women) in the Norrköping industry in 1865.*

<i>Type of industry</i>	<i>Percentage of female labor</i>	<i>Percentage of workers under 18</i>
Woolen	35	18
Cotton weaving	74	19
Cotton spinning	69	46
Total for cotton industry	73	24
Tricot	96	8
Lithographic	19	51
Sugar	-	-
Tobacco	-	4
Paper	53	-
Engineering workshops	-	-
Total for textile industry	52	17
Total all industries	47	17

Source: Svensson, Godlund, and Godlund 1972 p. 104.

A gender study of technology would have greatly benefited this study, had the source material been what it so obviously is not. All historians of this period are painfully aware of the male-dominated source material, and it is something we have to live with. Hence, given the status of the material, gender issues will only play a minor role. In the last chapter, however, whatever conclusions can be drawn as regards gender will be outlined together with all other conclusions.

As regards the geographical expansion of these technological systems in part II, only two and three suburbs respectively in each city are treated in detail – the southern and northern suburbs in Norrköping, and Stolplyckan, Tinnerbäckslöckan, and Ladugårdsbacke in Linköping. In both cities the first-mentioned lay within the city's jurisdiction, and the northern suburb and Ladugårdsbacke outside. These suburbs were picked to display class, geographical, and legislative differences. However, if arguments about or extensions to other suburbs affected the development of the whole systems, they are sometimes also treated in the analysis.

PART I

Technology and Organization

Great Britain was the “workshop of the world” in the late 19th century, not only as regards industrial production and development generally, but also concerning technologies that were developed to brighten up the shady side of industrial society – the unsanitary urban environment. These sanitary technologies were transferred to the Continent and to Sweden at this time, largely due to the indigenous engineers of the recipient countries.

Swedish Civil Engineering and British Technology Transfer

There was no higher education for engineers in Sweden until the mid-19th century. For instance, the engineers who participated in the construction and building of canals such as the famous Göta Canal, completed in 1832, were often, in a sense, self-taught. 1846-48 these conditions changed, when the Technological Institute of Stockholm, *Teknologiska institutet*, was reorganized and given resources for scientific higher education. It was renamed the Royal Institute of Technology, *Kunliga tekniska högskolan*, in 1877.¹

The Royal Corps of Engineers, *Kunliga Väg- och vattenbyggnadskåren*, had been founded a few years earlier, in 1851, and it consisted of the first Swedish engineers with higher technical education, either from the military academy at Marieberg or the Technological Institute. Their task was to assist in large public works such as canals and railroads, as well as to supervise the military engineering in times of war. As Sweden did not take part in any wars, the Corps was almost entirely dedicated to *civil* engineering in the true sense. The influence of Chadwick, and the existence of urban environmental problems which were even more alarming than in Britain, made the field of activity for these engineers vast. In their view, the poor social and sanitary conditions in Swedish cities were to be overcome with modern technology.²

¹ Bjur 1988 p. 38-39.

² Bjur 1988 p. 38-40; Nelson and Rogers 1994 p. 21-26; KRA-215, H215, Väg- och vattenbyggnadskåren, 1851-1960, introduction by Anders Degerström 1987.

The water pioneer in Sweden was Fredrik Wilhelm Leijonancker (1818-1883), teacher in engineering at Marieberg and later the Technological Institute, as well as officer in the Royal Corps of Engineers. Josef Gabriel (J. G.) Richert (1828-1895), son of the liberal reformer Johan Gabriel Richert, became engineer for quay and bridge constructions in Göteborg and captain in the Corps around 1860. He was also one of the first and most important water engineers, together with the Lieutenant in the Corps, Abraham Blix (1835-1884).³

British water supply technology arrived in Sweden around 1860, and construction of a modern waterworks was finished in 1861 in Stockholm, 1864 in Karlskrona, and 1865 in Jönköping. The first modern sewers were constructed for Göteborg in 1866, but it took around 20 years to finish them completely. These very first Swedish systems were constructed by the above-named water engineers from the Royal Corps of Engineers.⁴

The General Swedish Development of Modern Water Supply and Sewerage

Before the 1860s, the primary ways of obtaining fresh water in urban areas was from wells, springs, and waterways. There were a few smaller water pipes in certain cities, the most famous one being *Kallebäcksledningen* in Göteborg, but modern piped systems were wholly missing and urban residents had mainly to resort to manual, decentralized water supply. In the 1870s and onwards modern water systems proliferated in Sweden, just as in Great Britain, Germany, and several other Western countries. Water seems to have preceded sewerage in many cases, and it was the bigger cities which first constructed a water pipe. Many of the smallest towns did not introduce piped water until the 1920s (see Appendix 1, Table 1).⁵

Generally speaking, urban drainage and sewerage were rudimentary in Sweden up until the 1870s and 1880s. Storm- and groundwater were drained in gutters and ditches, and household wastewater was often emptied in the gutter in the street. In the early 19th century some cities had sewers, for example Vänersborg, which was said to have a sewer system as early as 1845. These kinds of systems were not centralized modern ones, however, and were not seldom dysfunctional. Modern sewerage began to be introduced after 1860, but in many cities the haphazard, decentralized building of a sewer here and there continued into the 20th century. Even in cities with a planned system, such as

³ Grill and Lager-Kromnow 1979 p. 454-456; Nilzén 1998 p. 145-147; Lindequist 1904 p. 516-517.

⁴ Isgård 1998 p. 13-28.

⁵ Bjur 1988 p. 24-36; Drangert, Nelson, and Nilsson 2002 p. 175.

Stockholm and Göteborg, the building could go on for decades (see Appendix 1, Table 2).⁶

Breaking Down the Main Question

In the examination of the technological and organizational aspects here in Part I the main question is: Why and how were piped water supply and sewerage discussed, planned, constructed, and technically extended in Norrköping and Linköping, and what roles did different actor-networks – actors and actants – play? This overarching question can be broken down into several smaller and more concrete questions, such as: What was the status of the earlier water supply and drainage of Norrköping and Linköping, and why were these abandoned? What (potential) urban problems, and what actors' interests, strategies, and networks prompted the introduction and subsequent technical extension of water supply and sewerage? What arguments were put forward as reasons for or against the introduction of these technologies, and whose interests were eventually decisive? Where was the line drawn between the public and private domains as regards access to and payment for the water and sewerage? How were water supply and sewerage organized and financed?

The Actors and their Possible Interests

Here will be outlined shortly the actors involved in the introduction and subsequent evolution of water supply and sewerage in Norrköping and Linköping, as well as their potential interests. To begin with, the state set the urban political stage through legislation: the Communal Law of 1862 and further liberal reforms such as the National Public Health, Fire, and Building Acts of 1874 (the so-called urban laws). The state supervising units and courts of appeal were the magistrates, the County Governor, and *Kungl. Maj:t*, the Swedish government. Then we have the official, municipal actors, centered around the City Council and the other departments and boards. The council was itself the most powerful municipal authority, which eventually also resolved to build the water and wastewater systems.

But we must take a step further and disentangle the different interests that were represented in the city administration. Suffice it to say here that the members of the City Council and other municipal units were primarily representatives of a bourgeois upper class with both specific class interests, more individual interests, or interests related to a specific issue, as well as striving to

⁶ Drangert, Nelson, and Nilsson 2002 p. 174-177; Isgård 1998 p. 34-36. Cf., Olsson 2001.

keep municipal expenditure low. In Linköping there may have been a more consciously corporatist balancing of interests in the City Council, which is typical of a smaller town.⁷

There were professionals such as engineers, physicians, and other public health representatives, both indigenous and from elsewhere, who had a potential interest in promoting such a project. Industries and larger businesses possibly supported an introduction especially of piped water. Insurance companies, banks, other financial institutions and donors supplied the necessary capital, and regulated loans and bonds. One would expect them to be positive to a large infrastructure project. The local newspapers *Norrköpings Tidningar* and *Östgöta Correspondenten* generally supported the bourgeoisie, but could sometimes also pursue their own policies. The residents themselves may also have had an interest in, for example, increased safety from devastating fires.

There were house owners⁸ in the cities and property owners in close proximity to the planned waterworks with potentially divergent interests. The new municipal infrastructure could intrude upon their own interests both literally (property rights where pipes were laid) and in the more abstract sense through taxation, if these actors lived within the city's boundaries. Water vendors were very likely opposed to something that would put them out of work. The numerous working and artisan/business classes were also potentially against a project that meant an increased tax burden, but we have here a source problem, for these groups were largely absent both in the official municipal sources and in sources such as the newspapers.

⁷ Hagård 1978 p. 242-245.

⁸ The original Swedish term is *fastighetsägare* or *husägare*, which in many cases meant the owner of a residential house, a house owner or home owner. However, this group may also have included owners of industrial or other commercial buildings, so a relevant translation must be sought in each case. The terms building owner, meaning an owner of either a residential, commercial, or industrial building, or property owner, will also be used.

CHAPTER 1

Managing Water and Sewerage in Norrköping

Traditional Water Supply and Drainage

Compared to many rivers in southern Sweden, for example, Stångån in Linköping and Fyrisån in Uppsala, the flow and quantity of water in Motala ström, which runs through Norrköping, are significantly greater.¹ Not surprisingly, Motala ström has been the predominant source of water in Norrköping for centuries, and wells have probably played a lesser role. Dye-works and other factories associated with the textile industry, sugar refineries, and tanneries used large volumes of water that could only be found in the river, not in the wells (it seems that the Norrköping industry generally took its water directly from the river). They also discharged the wastewater directly into the river. Consequently, the river water in the city cannot have been very clean, and there are many testimonies to that effect. Leaking dunghills and latrine pits, as well as overflowing gutters, added to the pollution. Since the river was situated at a comfortable distance for most women, the household water was generally taken directly out of it from special piers or from flights of stairs in the embankment. The places for fetching water were often located near other polluting activities, such as the cleaning of coaches and waggons.²

In the late-18th and the 19th centuries, several of the city's squares, such as Karl Johans torg, were equipped with either wooden or iron pumps. They were constructed to take water from the river, both for household use and for fire protection, but since hard groundwater sometimes seeped in, the water from some pumps was not considered good for washing. There was even some industrial use of these pumps, for instance, for a spirit distillery.³

Wells and springs were used, even though they were few. In the late-18th century, three private wells and springs in the city were praised by the clergyman and historian Hans Olof Sundelius. He even considered the water of these

¹ For figures of the water flow in Motala ström and rivers in a few other Swedish and European cities in the late 19th century, see Table 5.2.

² Hillmo 1994 p. 21-22; Lundgren 1974 p. 18, 34; Östman, Malmberg, and Liander 1945 p. 5-17; Söderberg 1968 p. v, 106; Drangert and Hallström 2002.

³ Östman, Malmberg, and Liander 1945 p. 5-13.

superior to the river water as far as taste was concerned.⁴ When in dry summer weather there was little (and probably contaminated) river water, springs and wells were resorted to. It was yet difficult to find other water than that in the river, because according to contemporary sources, it was necessary to dig deep to find water, and few people had the means to do so. There were a few public wells, however, such as the much-frequented well at Gamla torget. Its water was said to be good and healthy.⁵

Fire and Water

Throughout the history of city planning, fire prevention has been vital, in Norrköping as well as generally. Thus, the risk of fire was not restricted to industrialization, but was an urban environmental problem centuries before. For instance, in the 17th century, the city government wanted to spread out the dense wooden built-up area and plan the city according to a checkered pattern, but this could not be carried out until after the great fire of 1719. A Russian army then burned down the city, and in the rebuilding it was possible to start anew.⁶

Despite these efforts, fires continued to be a real threat to people and buildings in Norrköping. The fires of June 1822 and April 1826 devastated almost all of the old buildings. After the first fire, which made 3,254 out of around 10,000 people homeless and caused damages for about 1 million Swedish kronor – an immense amount at the time – the police commissioner demanded more and better water pumps along the river, for the previous pumps had been difficult to operate during the winter. The water taken from these pumps was also important for daily domestic use. During the 1826 fire, which made 2,000 people homeless, the insufficiency of the fire defense became all too evident and the County Governor intervened. At a meeting between the burgers (*Borgerskapets Äldste*), the Council of Magistrates, and the County Governor it was decided that the city pumps would be increased substantially. However, this decision did not lead to any major improvements, because the pumps continued to be a problem, particularly during the winter.⁷

In the wake of the 1826 fire, the first proposal for piped water for Norrköping was made by the clerk J. P. Kjellberg. He told the Council of Magistra-

⁴ Sundelius 1798 p. 17-18.

⁵ Östman, Malmberg, and Liander 1945 p. 11-13; *Norrköpings tidningar (NT)*, 1866-04-17; NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1877-07-28 §2. Almén (1868) said that from the point of view of hardness (13°) this water was very poor, but in view of its little organic material it could also be seen as fairly good for drinking (Almén 1868 p. 103-104).

⁶ Horgby 1989 p. 16.

⁷ Horgby 1989 p. 16; Östman, Malmberg, and Liander 1945 p. 5, 8-10.

tes that he had promoted this idea both before and after the previous fire of 1822, but had been misunderstood. His description of the water supply was rather detailed, and the water was to be conveyed through wooden pipes from an elevated reservoir. He pointed to its advantages for fire defense as well as for building owners and individual tenants, since they would all come to “own a healthy and continuous source of water.” Nevertheless, this proposal did not gain a hearing.⁸

From the 1830s onward, several new attempts to protect the city from fire were made. According to the fire regulations of 1830 and building regulations of 1836, the house owners were to dig their own wells, if it was possible, but it is difficult to say to what degree this was carried out.⁹ In the building regulations, inflammable wooden buildings were forbidden, except for outhouses, which meant that new buildings were to be built in stone and old wooden ones were to be either tiled or plastered.¹⁰

In 1844, the leading merchant and manufacturer John Swartz proposed to the burgers a water supply with wooden pipes, constructed by the engineer Carlsund, with fire hydrants and the possibility for certain building owners to install water. The work started in the spring of 1844, but had to be abandoned a year later and the pipes were just left in the ground. Carlsund had evidently miscalculated and overestimated the capacity of the water pipe, and the work came to an end. Swartz took the moral and economic responsibility for the failure of the project by personally paying for all the costs. There was a new proposal with cast-iron pipes, drawn up by an engineer from Göteborg, Alexander Keiller, who was to construct the gasworks a few years later. This new water system proposal met the same fate, however, probably due to its economic magnitude.¹¹ In 1854, it became incumbent on horse owners to transport water in case of fire, and eleven years later, a special fire-protection board was established in Norrköping.¹²

⁸ Östman, Malmberg, and Liander 1945 p. 15-17 (quote on p. 16).

⁹ Östman, Malmberg, and Liander 1945 p. 8-9; *Kongl. Maj:ts förnyade Nådiga Byggnads-Ordning för staden Norrköping. Gifven Stockholms slott den 26 Oktober 1836; med de sedermera deruti gjorda ändringar och tillägg* (Norrköping 1862), §26.

¹⁰ *Kongl. Maj:ts förnyade Nådiga Byggnads-Ordning för staden Norrköping. Gifven Stockholms slott den 26 Oktober 1836; med de sedermera deruti gjorda ändringar och tillägg* (Norrköping 1862), §10.

¹¹ Östman, Malmberg, and Liander 1945 p. 17-19; Ekström 1993 p. 20-21; Dahl 1949 p. 358-359; Kaijser 1986 p. 116-134.

¹² NSA, Ringborg index 1904 (brandväsande): ”1854-02-28, Om hästägares wattenkörnings skyldighet wid eldswådor. Hertzman 1.319” (Hertzman 1858); ”1865-01-20, Om inrättande af särskild Brandstyrelse. Hertzman 2.187” (Hertzman 1873).

The Local Newspaper and the “Generosity of a Magnanimous Donor”

When the question of piped water was brought up again in the mid-1860s, *Norrköpings Tidningar* was probably the initiator of the public debate with an article in early 1865. The author – unknown to us, but with the pen-name “r.” – used a casual and modest rhetoric, and addressed the City Council in particular but also the inhabitants of Norrköping in general, public opinion. He began the article by mentioning most of the modern conveniences that Norrköping was already endowed with, some of which are quoted in the following:

We have had a gasworks for nearly 15 years; we have street paving *à la* Berlin; we have sidewalks; we have a telegraph office; . . . we soon have a ‘poudrette factory’. Yes, we have so much of what the latest innovations have brought the age in which we live, for the preparation of comfort and well-being within communities that can afford to pay for such, that it is impossible hurriedly to enumerate everything.¹³

Water supply was not absolutely essential, in his view, but was more a question of comfort and of keeping pace with the progress of modern society and the most modern European cities. The existing “simple” system for water supply – “constructed by nature before the birth of Christ”, and characterized by its wells, pumps and water buckets – was insufficient as regards water quantity. Surely, there were sanitary advantages to be had from a piped water supply, but the question of keeping the city clean was more a matter of esthetics and comfort than of remedying any really poor sanitary conditions.¹⁴

Having thus motivated a piped water supply, he went on to the requirements for carrying out such a project, namely technology and economy. He foresaw no technical difficulties due to the then advanced engineering technology. What might be a problem was the source of water supply and its quantity, but Norrköping was fortunate to have two sufficient sources in close proximity – the lakes Glan and Ensjön. The latest and most advanced piped-water technology would then, according to the writer, “make us as great wizards . . . as blessed Moses, when he struck water out of the rock.”¹⁵ As regards the financial side, he found it the least difficult, despite the tough economic situation for the city. He was of the opinion that when a good

¹³ ”Wattentankar” [”Reflections on Water”], *NT* 1865-02-11. It is possible that ”-r” simply stands for *redaktören*, the editor, who was at this time the owner Fredrik Törnequist (Dahl 1955 p. 73).

¹⁴ *NT*, 1865-02-11.

¹⁵ *NT*, 1865-02-11.

enterprise was at hand, there was always good will and thereby ways of raising money, either by a loan or by constituting a joint-stock company. This good enterprise was a piped water supply, for the public good and as “a convenient way of quenching the thirst of thousands of people with a fresh, pure . . . water.”¹⁶

Although this article was partly addressed to the City Council to make its members take note of the water question, they cannot have been unaware of it. It had been discussed in the city before, and in the first years of the 1860s Stockholm, Karlskrona, and Jönköping had built modern waterworks (see Appendix 1, Table 1).¹⁷ The article may have at least put some pressure on the decision makers, as well as alerted the public. *Norrköpings Tidningar* was liberal-conservative but was broad enough to appeal even to the rank and file – the middle class and the large working class.¹⁸ Since piped water would result in fees or increased taxation it was important to enlist public support.

In the autumn of 1865, the question of water supply was discussed in the City Council. It was not the council itself nor the fire-protection board that took the initiative, but one of the most prominent industrialists in the city, Jacob von Leesen. On 9 November he delivered a deed of gift (*gåvobrev*) to the Norrköping City Council, in which he donated 300,000 kronor to the city for a piped water supply, on conditions that he or his wife Ulrika Charlotta, as long as either of them lived, would receive an annual interest of four percent on the capital. Under the terms of the gift, the city was obliged to finance a plan and an estimate of the costs for a water system by an expert immediately. Von Leesen stimulated a fast investigation on the part of the City Council, by promising that a greater or lesser part of the interest would be remitted, as soon as he had received the plan. The City Council showed great exultation at von Leesen’s generosity, and it was decided that the gift should be received on von Leesen’s conditions.¹⁹ The following day, members of the City Council went to von Leesen’s home to thank him, on behalf of the city.²⁰

¹⁶ NT, 1865-02-11.

¹⁷ Hallström 2001 p. 189.

¹⁸ Johannesson 2001 p. 166-179.

¹⁹ Norrköping City Council minutes 1865-11-09 §6 (in *Handlingar rörande frågan om wattenledning i Norrköping med anledning af brukspatronen och riddaren J. von Leesens donation (HRFOW)*, Norrköping 1871, Norrköpings stadsarkivs småskriftssamling 25:1, 1871, p. 1). Von Leesen did not motivate in his deed of gift why he donated the money.

²⁰ NT, 1865-11-11.



Jacob von Leesen (Source: Östman, Malmberg, and Liander 1945).

Jacob von Leesen (1802-1876) is today primarily remembered as a donor to various municipal projects, particularly towards the end of his life. For instance, he donated money for the education of “ill-mannered children” (*van-artade barn*), and the care of incurable poor people. He could make these donations thanks to a successful sugar refinery, Gripen, which had earned him a considerable fortune. His business was converted into a joint-stock company in 1865, but he continued his leadership as a member of the board.²¹ The sugar industry was very water intensive and given the close proximity to the river, von Leesen had very likely taken water from Motala Ström all along. In fact, so much water was required that a water system would not have been able to provide enough of it, and the demands of purity on the water used for washing the sugar beets were not so great.²² Improving his production cannot therefore have been a decisive argument for von Leesen to donate money to a piped water supply. It is very likely that his donation to the water pipe was instead a paternalistic move, for his workers and the city. Furthermore, there was prestige involved as a donor and promoter of modern, publicly beneficial technology. Von Leesen had also been one of the leading men behind the gasworks in 1848-1849.²³

From the point of view of the City Council, it seems that the main motivation for piped water at this point was to improve fire prevention, at

²¹ Dahl 1948 p. 503-504; Myrdal 1972 p. 192, 227; NT, 1866-04-17.

²² Sondén 1914 p. 167-173. The sugar refinery *Östergötlands Sockerfabriks AB* was established in 1905 in Linköping. The daily water consumption of the refinery, which had its own water intake, in 1910 roughly tripled the total daily consumption of the whole town of Linköping (Almroth and Kolsgård 1978 p. 132-133; Sondén 1914 p. 167-168).

²³ Kaijser 1986 p. 116-119.

least according to *Norrköpings Tidningar*. It commented on the above City Council meeting and visit to von Leesen a few days later. The question of water supply had not been seriously considered thus far, according to the newspaper, largely because the prospects of realizing such a project had been small, although its importance, especially for fire protection, had been understood. The best thing about the proposed construction of a piped water system was therefore that fire protection finally could get a satisfactory solution.²⁴ Even in the two earlier proposals presented here the main motivation had been the improvement of fire prevention.²⁵

As can be seen in the article from early 1865, arguments for piped water supply other than the fire argument were discussed, mainly the comfort argument. Presumably the fire argument was so well-known and obvious that there was no point in mentioning it. The proposals from 1826 and 1844 also took up similar positive effects of piped water: convenience for the inhabitants of the city, that is, above all those who could pay, since it was possible to install water taps in the yards²⁶ and the houses, and healthy and pure water. (The latter also implies that Motala Ström was contaminated even in the early 19th century.)²⁷ The convenience argument in the article was also connected to prestige and the idea of “keeping up with the Jones’s,” that is, that Norrköping needed to be as modern as the greatest European cities.²⁸ The newspaper’s own interests in piped water are not so clear, apart from confirming and securing bourgeois identity, in which cleanliness and comfort played an integral part.²⁹

The sanitary advantages of water supply were not stressed either by the City Council or the newspaper. The cholera epidemic of 1853 was devastating for Norrköping. 2,907 people turned sick, 822 of whom died.³⁰ Several other Swedish cities started planning for modern piped water supplies, allegedly as a result of the cholera epidemics at the beginning of the 1850s, for instance,

²⁴ NT, 1865-11-11.

²⁵ Östman, Malmberg, and Liander 1945 p. 15-19.

²⁶ To every building belonged a yard. The yards were either private or shared with other building owners around the block. In that case it could also be designated a courtyard, but the term yard will be used throughout.

²⁷ Östman, Malmberg, and Liander 1945 p. 15-19.

²⁸ Hamlin 1996 p. 98-99. Marjatta Hietala sees civic pride and rivalry as a paramount factor in the rapid diffusion of innovations between European cities in the late 19th and early 20th century (Hietala 1987 p. 394-395).

²⁹ The newspaper also knew the value of modern networked technologies such as the telegraph and the railroad, which had improved news distribution enormously (Johannesson 2001 p. 181-188).

³⁰ Horgby 1989 p. 286. Norrköping then had around 17,000 inhabitants (*Historisk statistik för Sverige. Del 1. Befolkning 1720-1967* 1969 p. 61-65).

Stockholm and Göteborg.³¹ On a general level, poor sanitation was probably a major driving force for the introduction of water supply and sewerage in Sweden from the 1860s onward (the National Public Health Act of 1874 contributed to this), although it was not the only one and the question is whether cholera really was related to a poor water supply.³² The best source material for gaining knowledge of sanitary conditions and measures in Norrköping in the 1860s would have been the minutes of the *Sundhetsnämnd*, but this material has been lost.³³

Norrköpings Tidningar continued to be an active actor in the water question, and published a series of articles at the beginning of 1866 – “A Few Words on Account of the Coming Water System in Norrköping.”³⁴ The newspaper thus took it for granted that the water system would be built. These long articles took up virtually anything that there was to know about piped water – advantages, aspects of water quantity and quality, technical design, water pressure, water consumption, water fees, and public and private costs – and they overflowed with examples from Great Britain as well as a few from Hamburg. The anonymous author’s thoroughness and sense of technical detail suggest that he was a person with expert knowledge. In a sense, this was true, because the articles were largely made up of a compilation of word-for-word excerpts from F. W. Leijonancker’s introduction to his 1853 proposal for piped water supply in Stockholm. However, they were compiled and slightly altered by the editor, who also wrote the introductory and concluding paragraphs, which concerned Norrköping. So, in this context the message should primarily be ascribed to *Norrköpings Tidningar*.³⁵

While it was the explicit purpose of the articles to imprint on the inhabitants of Norrköping gratitude toward what was referred to as “the generosity of a magnanimous donor,” they were also published as a kind of information campaign about new urban technology that the City Council

³¹ Isgård 1998 p. 13; Bjur 1988 p. 37; Drangert, Nelson, and Nilsson 2002 p. 183.

³² In Stockholm and Göteborg the connection to sanitation is evident, as well as in some smaller cities and towns, for example, Uppsala, Karlskrona, and Jönköping (Bjur 1988 p. 15-42; Drangert, Nelson, and Nilsson 2002 p. 178-184; Gullberg 1998 p. 108-112).

³³ See Chapter Six for an explanation of what the *Sundhetsnämnd* was.

³⁴ Its original Swedish title is “Några ord med anledning af den blifwande wattenledning i Norrköping,” and it was published in three parts: 1866-01-25, 1866-01-27 and 1866-01-30.

³⁵ Leijonancker’s proposal was printed the same year as it was presented (Leijonancker 1853). It was based on a study tour in 1853 to some fifty different cities in England and Scotland (Hietala 1987 p. 206). Apart from what was omitted, the excerpts were adjusted to fit the situation in Norrköping in 1866. Certain words and figures were changed, since some of the information did not fit, was dated, or concerned Stockholm only. Leijonancker’s ‘I’ was changed, for instance, and prices were adjusted according to the exchange rate of early 1866, instead of 1853. We do not know whether the newspaper had Leijonancker’s permission to compile and print the articles, or whether it was a case of plain plagiarism (there were no references whatsoever).

recently had decided upon, “for those who do not want to receive a blessing thoughtlessly.”³⁶ These tributes to von Leesen reinforce the view of the newspaper as a mouthpiece of the bourgeois and paternalistic elite. It is also quite possible that influential City Council members were behind the articles to influence the public opinion.

Water was a gift of God, according to the newspaper, which was essential for all organic life, and there were three aspects of water supply that were particularly important. First of all, it was necessary for health and cleanliness to have an ample supply; secondly, and even more importantly, the supply was to yield “good and healthy” water; and lastly, the water was to be readily available. Modern science and engineering had made piped water technology capable of providing all these three, for more people, more different uses and at lower costs than ever before.³⁷

The newspaper was very specific about what was good water quality, and this argument was backed up by a very long quote from an English parliamentary committee. Piped water systems most often used surface water as the source of water supply, and this water was usually soft. Soft water, that is, water with few dissolved salts, was very healthy to drink compared to the often hard ground-water. Hard water could result in kidney stones and even cholera, although the exact circumstances of the latter were not yet clear. Cholera originated from a bad water supply anyway – be it hard water or water that had been contaminated by human excreta – and a good water supply was always the best promoter of health and morality. This was clearly shown by the decreasing mortality rates in English cities with piped water, even though there were also contributory causes other than a better water supply and improved cleanliness.³⁸

According to Christopher Hamlin, the debates about water quality in Great Britain during the whole 19th century, parts of which were referred to here, were fraught with conflict. In 1849, the question of water supply in London became the subject of a heated debate, which would last for another three years. Edwin Chadwick was one of the most prominent debaters. Since the Public Health Act of 1848 was to be implemented in the provinces but not in London, Chadwick prepared a report to help find a solution to the problems of water supply in the capital, which the General Board of Health published in 1850. In this report, Chadwick claimed that hard water was dangerous to human health, maybe even more dangerous than water contaminated by excreta, since it disrupted digestion. This opinion would dominate the discussion on

³⁶ *NT*, 1866-01-25 (including the quotations).

³⁷ *NT*, 1866-01-25 and 1866-01-27. Some of this information *NT* originally took from Leijonancker 1853 p. 3-4, 22.

³⁸ *NT*, 1866-01-25 and 1866-01-27. *NT* originally took this information from Leijonancker 1853 p. 7-10, 18-20.

water quality in Great Britain throughout the 1850s,³⁹ and was evidently influential in Sweden as well.

The extension of water supply to every house and room, and even to the poor, was considered very important, and this argument was built upon British studies. The fear of a working class revolution was evident in this passage. According to these studies, since the lower classes had neither sufficient insight nor the capacity for an orderly way of living, it was necessary to start them on a better path indirectly. This path was what was called “Sanitary Economy” – that is, everything that promoted personal cleanliness, clean housing, and clean cities including introduction of water supply – and it had proved to induce much sounder ways of living among the working class. As proof of this, the newspaper quoted “one of England’s most eminent engineers”, who was in fact Thomas Hawksley in the *Health of Towns Enquiry* of 1844:⁴⁰

My own observations and inquiry convince me that the character and habits of a working family are more depressed and deteriorated by the defects of their habitations than by the greater pecuniary privations to which they are subject. The most cleanly and orderly female will invariably despond and relax her exertions under the influence of filth, damp and stench, and at length ceasing to make further effort, probably sink into a dirty, noisy, discontented, and perhaps gin-drinking drab – the wife of a man who has no comfort in his house, the parent of children whose home is the street or gaol. The moral and physical improvements certain to result from the introduction of water and water-closets into the houses of the working classes are far beyond the pecuniary advantages ...⁴¹

Hawksley (1858) and Richert (1869) argued against public wells and public taps since they often prevented the installation of internal water taps in the dwellings, which were the only means of sanitary and moral improvement of the poor.⁴² According to Hamlin, in mid-19th century Britain arguments were also made in favor of internal fittings on the grounds that public pumps and water taps were places for inappropriate social behavior, for example, gossip, especially among women.⁴³

The newspaper anticipated objections against helping the lower classes: “Against this may be said that higher mortality among the poorer class is not a great misfortune, but this would only be possible to defend as long as people unfit for work died; but . . . often men between 25 and 40 years old die . . .”.

³⁹ Hamlin 1990 p. 99-100, 108, 301-302.

⁴⁰ *NT*, 1866-01-25 (including the quotation) and 1866-01-27. *NT* originally took this information from Leijonancker 1853 p. 4-5, 14. Binnie 1981 p. 15.

⁴¹ *NT*, 1866-01-25. *NT* originally took this quotation from Leijonancker 1853 p. 5. The original English quote was taken from Binnie (1981), who quotes Hawksley (Binnie 1981 p. 15).

⁴² Hawksley 1858 p. 4-6; Richert 1869 p. 49-52.

⁴³ Hamlin 1998 p. 176-178.

It was from the poor families these men left behind that those who needed poor relief mostly came, and by improving the sanitary conditions, poor relief costs could be reduced.⁴⁴ It is impossible not to wonder what the reactions to these derogatory views may have been among the female and working class readers in Norrköping, but it was only typical of the Victorian public health movement. As Hamlin notes: “[It] was not a systematic campaign to eliminate excess mortality. Its concern was with *some aspects* of the health of *some* people: working-class men of working age.”⁴⁵

The sanitary advantages were given the most space, but the question of fire prevention was also considered “one of the most important.” Piped water supply would make fire protection “so complete that a greater fire is nearly impossible.” In Hamburg, the last big fire was maybe the primary reason for building such a large-scale water system, and the city’s fire-protection board was consequently the prime mover. Further advantages of piped water supply were also mentioned, for instance, for industry great quantities of pure water could be supplied at a cheap price almost anywhere in a city. The importance of soft water for the textile industry was not mentioned, however.⁴⁶ Water could also be used for hydraulic purposes in water turbines and hydraulic cranes, as well as for fountains, street cleaning, washing facilities, and baths, with their “salutary effects.”⁴⁷

The newspaper was very clear as to its view of the administrative and financial side of the project:

Since the purpose of piped water is not merely the achievement of a greater convenience or luxury, but also the supply of a necessary good to the inhabitants, the furthering of the cleanliness and health of the city, as well as, to some extent, the improvement upon the conditions of the lower classes, it must be obvious to everybody that such an establishment must never be seen as economic speculation in any other sense than that it pays its way.⁴⁸

The constitution of a joint-stock company was viewed as the exploitation of the most necessary needs of the inhabitants, even though the newspaper admitted that the striving for profit often had been the best incentive for building satisfactory water systems. However, nothing could be better than the carefulness, sensibility and thrift of municipal organization. Furthermore, the great donation that the city had received would cover almost the whole cost, which

⁴⁴ *NT*, 1866-01-25 (including the quotation). *NT* originally took this information from Leijonancker 1853 p. 10.

⁴⁵ Hamlin 1998 p. 12.

⁴⁶ Hassan 1998 p. 14-15.

⁴⁷ *NT*, 1866-01-25 (including the quotes). *NT* originally took this information from Leijonancker 1853 p. 10-13.

⁴⁸ *NT*, 1866-01-30. *NT* originally took this quotation from Leijonancker 1853 p. 43.

would be 351,268 kronor or one sixth of the estimated costs of the Stockholm system, based on the fact that Norrköping's population was one sixth of Stockholm's. Thus the donation would make the water in Norrköping cheaper than in most other cities.⁴⁹

The articles from early 1866 emphasized the sanitary issues particularly. Whether the newspaper used this emphasis only because it was what the "great" Leijonancker (or Edwin Chadwick, on whose "sanitary idea" Leijonancker's book was largely based)⁵⁰ thought crucial, or because it really was of the opinion that the sanitary conditions of Norrköping were poor and dangerous, is difficult to say.⁵¹ Yet the attention paid to the topic suggests that the living conditions of the workers and the poor were in fact very bad. This was also confirmed by the reports of the Board of Health in the 1870s and 1880s.⁵² A very condescending view of the workers was presented in the articles, but it was in line with the ideology of the 19th-century bourgeoisie.⁵³ Personal cleanliness, clean housing and streets would protect society against the danger of pollution. The fear of the total destructiveness of dirt and filth was not only a fear of disease and alcohol abuse, but also of the threat to the social order: the working class, the metaphorical pollution of society.⁵⁴

When the most serious discussion about piped water supply up to that time began in late 1865, it yet seems that the main motive for the city was still to improve the largely defective municipal fire protection. This was also common in many other Swedish cities, where inflammable, densely-built wooden houses were predominant.⁵⁵ The argument of improved fire defense was thus based upon actual material needs. However, it was also in a way constructed, for the newspaper and probably the City Council now decided that fire protection was in fact so poor that piped water was absolutely essential, unless we see the evolution of urban infrastructure as a simple outgrowth of a city's environmental situation. It is therefore paramount to try and uncover the interests of the local actors, for local politics and economy are too complex to be reduced to unidimensional explanations. Why were financial resources

⁴⁹ *NT*, 1866-01-30. *NT* originally took some of this information from Leijonancker 1853 p. 43-44.

⁵⁰ Hamlin 1998 p. 84-187; Melosi 2000 p. 43-57.

⁵¹ *NT* 1866-01-25, 1866-01-27, and 1866-01-30. *NT* originally took some of this information from Leijonancker 1853 p. 3-46.

⁵² See for instance NSA, Norrköping Board of Health Archives, AI a:1 and AI a:2, minutes 1883-04-10 §2, 1883-06-12 §3, and 1884-08-14 §59.

⁵³ *NT* 1866-01-25, 1866-01-27 and 1866-01-30; Leijonancker 1853 p. 3-46; Schmidt and Kristensen 1986 p. 43-49.

⁵⁴ *NT* 1866-01-25, 1866-01-27 and 1866-01-30; Corbin 1986 (1982) p. 29, 242; Douglas 1966 p. 114; Prendergast 1992 p. 78-79.

⁵⁵ This seems to have been at least partly the case in, for example, Kalmar and Uppsala (Drangert, Nelson, and Nilsson 2002 p. 179-184; Hörberg 1998 p. 21-27).

allotted and why was piped water discussed at all in the mid-1860s? After all, the matter had failed twice before.

If we break down “the city” into the various involved actors other arguments emerge. *Norrköpings Tidningar*, which seems to have been an influential actor in Norrköping, initiated the public discussion about piped water in early 1865, and in the discussion that followed it considered many other motivations and arguments important. In several quite long articles in 1866 most of the existing arguments for piped water were put forward. However, all these arguments cannot have been decisive in Norrköping. On a general level these were real motives in many other cities in Great Britain, on the Continent, and in Sweden.⁵⁶ But when studying a local example they cannot just be taken at face value.

The question we have to ask is how typical these arguments were of different actors, for example, the members of the City Council, von Leesen (a member of the council), the public, and *Norrköpings Tidningar* itself. At this stage it is impossible to tell, not the least because we really only have knowledge of different motivations filtered through the newspaper. The arguments presented here had also become part of a common armory of arguments used by many other cities. What we do know thus far, therefore, is that the bourgeois City Council (including von Leesen) wanted to build a waterworks, based upon interests and motives that are hitherto rather obscure, except for the improvement of fire protection, and that they were supported by the newspaper, which made itself the spokesman of both the public and the decision makers.

The Swartz Family and its Concerns for Piped Water

An actor-network was being enlisted with the above actors, together with the actants improved fire protection and possibly modern convenient technology, sanitary improvements, industrial development, as well as fear of the “dirty” working class. When the newspaper articles were being published, a proposal for water supply was already in the making. John Swartz’ son Erik Swartz (1817-1881), one of the most prominent industrialists in Norrköping and on several occasions the city’s representative in the Swedish parliament, played a central role here. Östman et al. assume that Swartz encouraged von Leesen to donate the 300,000 kronor, but this is difficult to prove. We do know that as early as a few days after the resolution was passed by the City Council on 9 November 1865, Swartz wrote a letter on his own authority to the most well-

⁵⁶ Drangert, Nelson, and Nilsson 2002 p. 181-184.

known and respected Swedish water engineer of the time, F. W. Leijonancker. He asked if Leijonancker would take upon himself the construction of a piped water supply for Norrköping.⁵⁷

At a meeting in the city's Financial Department a few days later, it was officially decided to contact Leijonancker, whose costs Swartz would pay for, should he accept the assignment.⁵⁸ Due to the conditions of von Leesen's donation, the question was very urgent and offers from other engineers were not even considered.⁵⁹ Leijonancker felt honored by Swartz' request and assumed the task, but due to illness and some practical problems, it took almost a year before his plan was finished.⁶⁰

As was mentioned above, John Swartz had been engaged in the building of a failed water pipe in the 1840s, and the concern for a good water supply for Norrköping was evidently very strong in the Swartz family. Erik Swartz was originally an engineer and was educated at Uppsala University and the Technological Institute of Stockholm in the 1830s. Although he started working in his father's tobacco company after finishing his studies, he does not seem to have altogether abandoned his engineering career. He was involved in the building of the failed water system, probably as a foreman, when John was on a trip to Hamburg in the summer of 1844.⁶¹ It is likely that this failure made him long for revenge on his own and his father's behalf, but there was also a patriarchal concern for the inhabitants of the city, which can be seen in his work to improve the living and working conditions for his workers (in 1853, at the death of his father, he had taken over the tobacco factory).⁶²

⁵⁷ NSA, Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872," letter from Erik Swartz to F. W. Leijonancker, 1865-11-12; Dahl 1949 p. 359; Östman, Malmberg, and Liander 1945 p. 20.

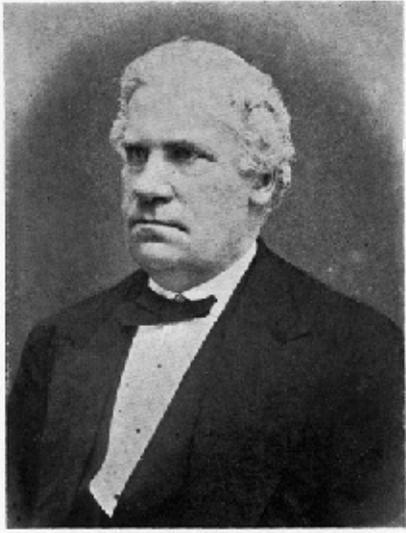
⁵⁸ NSA, Norrköping City Council Archives, AI a:5, minutes 1867-01-03 §5, with minutes of the Drätselkammare 1865-11-17 as supplement.

⁵⁹ The civil engineers English and Hanssen of Copenhagen, Denmark – who had been involved in the building, administration, and/or maintenance of, for instance, the waterworks in Copenhagen, Christiania (present-day Oslo, capital of Norway), Halmstad, and Malmö in Sweden – offered to draw up a proposal for water supply in Norrköping, as well as to lead and carry through the project. But when the offer arrived, it was already too late (NSA, Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872," letter to the Norrköping City Council, 1865-11-18; Aremar 1990 p. 188).

⁶⁰ NSA, Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872," letters from F. W. Leijonancker to Erik Swartz, 1865-11-18, 1865-12-21, 1866-08-13, and 1866-08-23.

⁶¹ Dahl 1949 p. 359; Ekström 1993 p. 20-21.

⁶² Dahl 1949 p. 359.



Erik Swartz (Source: Östman, Malmberg, and Liander 1945).

The above letter to Leijonancker shows that Erik Swartz, for his part, had asked for and been promised a proposal for a piped water supply in Norrköping more than a year before, that is, in the summer of 1864. But there was nothing he could do about it until he had the city's commission, so presumably he had done a lot of – to use a modern word – lobbying up until von Leesen's donation in 1865. This may also be the reason why he wrote to Leijonancker before the official decision in the Financial Department about what expert to contact, on 17 November. He knew beforehand what the outcome would be. Swartz was obviously very eager to launch the project, “as the circumstances make the matter urgent and the inhabitants of the city impatiently expect to see a first step taken towards the accomplishment of the big plan ...”.⁶³ What these circumstances were is unclear (maybe von Leesen's donation).

Not only Erik, but also his younger brother Johan Gustaf (1819-1885) was committed to the building of a waterworks. He was the chairman of the City Council from 1863 to 1881, and he was a merchant and owner of a flour-mill business in the city. His greatest interest lay in farming and stock-raising, however, both as a practitioner, writer, and leading man in the Östergötland County Agricultural Society (*Hushållningssällskap*). In 1863 he invented an internationally renowned method for the separation of milk, which became

⁶³ NSA, Norrköping Drätselkammare Archives, FX:1, “Handlingar rörande vattenledning för staden 1865-1866, 1872,” letter from Erik Swartz to F. W. Leijonancker, 1865-11-12 (including quotation); Norrköping City Council Archives, AI a:5, minutes 1867-01-03 §5, with minutes of the Drätselkammare 1865-11-17 as supplement.

dominating in Sweden for the next couple of decades. In the 1870s he was elected an honorary member of the Royal Swedish Academy of Agriculture and Forestry (*Kungl. Skogs- och Lantbruksakademien*) and a member of the Royal Swedish Academy of Sciences (*Kungl. Vetenskapsakademien*). His greatest international merit was becoming honorary member of the Royal Agricultural Society of England in 1877. His interest in sanitary technologies had probably been founded during travels to the Continent and Great Britain (see Chapter Five).⁶⁴

In the spring of 1866, a banquet in von Leesen's honor was held on his 64th birthday in the city hall. All social classes were represented, according to the newspaper. Von Leesen was celebrated with music, works of art, and a miniature water pipe with a fountain. As chairman of the City Council, J. G. Swartz proposed a toast and held a lengthy speech in which he made himself the interpreter and spokesman of public opinion (in this category was included the "thinking citizen").⁶⁵ For Swartz, von Leesen was an outstanding example of civic love (*samhällskärleken*) and love of one's neighbor. His deeds would be a guiding light for the whole country and for future generations, just as similar deeds in the past had inspired this one.⁶⁶

Swartz went on to give his view of piped water. He explained that the reason why a waterworks had not already been built in Norrköping was that, however salubrious it was, particularly for the poor inhabitants, first things must go first. There had been other more urgent municipal commitments (he did not mention which) that had had to be solved first, especially since the river water was so abundant and easily accessible. In Swartz' view River Motala ström had two purposes, as power source for all the factories along it and as sewer for the industrial waste. The river existed as a servant, a guarantor of industrial success, and as such it should be exploited as completely as possible. It was, to paraphrase Richard White, an organic machine in the service of man and industry.⁶⁷ Since the river water was not as pure and appropriate for drinking as before, continued Swartz, a piped supply was needed so that the dual use of the river – power source and sewer – could go on. The third use, as a water source, would be piped and taken further upstream.⁶⁸

Johan Gustaf Swartz had a powerful position in Norrköping, and I believe that this speech is a key to understanding his, his brother's, and the whole industrial elite's primary interests – industrial development (there could of course be other interests as well). Through Erik the Swartz brothers tried to become

⁶⁴ Dahl 1949 p. 359; Ekerot 1907 p. 63-65; Myrdal 1972 p. 24-26; Schött 1914 p. 159-161.

⁶⁵ In reality this "public" thus included only the bourgeois elite. See Habermas 1989.

⁶⁶ NT, 1866-04-17.

⁶⁷ White 1995 p. 108-113.

⁶⁸ NT, 1866-04-17.

“spiders in the web”, central figures that could enlist power resources and see the water project through. Until 1865-1866 piped water really had not been necessary, but now industrial progress in the city was threatened and the economic resources of the bourgeoisie was enrolled, first of all through von Leesen but also through Erik and J. G. Swartz. The object of the amazing communal spirit J. G. talked about was to be an industrial guiding light for Sweden, of which a paternalistic care of all inhabitants was also an integral part.

The poor quality of the river water in the city was thus enrolled into the actor-network as an argument for piped water taken upstream. Ironically, it was very likely the prospect of further industrial development and thereby contamination of the river that prompted this. It could go on if the inhabitants were provided with pure piped water. A water system may also have been an asset for the textile industry, sugar and paper manufactures, which needed great amounts of soft and pure water.⁶⁹ However, as we have seen, the industries generally had their own water intakes already, and great consumers could probably extend their intakes upstream at a lower cost than a potential water fee, should the water quality deteriorate too much. Neither Erik nor Johan Gustaf were themselves owners of very water intensive industries – tobacco and milling factories respectively – but they primarily needed a smooth way of removing wastewater, and the convenience of piped water was naturally attractive at any rate.

Leijonancker's Proposal Postponed

In broad outline, Leijonancker in late 1866 proposed Lake Glan, which lay upstream from the city and from whence the river flowed, as the source of water. The water was to be pumped from there by turbine power (taken from the waterfall at Borg) via slow filters to a reservoir. The estimated pump capacity was around 80 liters per second, but the pumps would run only 12 hours a day. The waterworks could deliver about 90 liters per person and day – including any kind of consumption for households, industry, street cleaning, etcetera – for a total of 37,000 inhabitants. (In 1865 Norrköping had about 24,000.) Leijonancker's water system would be rather expensive (750,000 kronor), but he also proposed a smaller, yet expandable, system for the first years. In his proposal he even included an estimate of the costs of administration, as well as how much money the city could make on water fees from households and factories. The proposed water fee was four kronor per room and year for household use (75% of the inhabitants were expected to connect) and one kronor for about

⁶⁹ Hassan 1998 p. 14-15; Isgård 1998 p. 48; Lundgren 1973 p. 215.

5,000 liters for industry. From a sanitary point of view, he deemed it absolutely necessary to extend water indoors.⁷⁰

Leijonancker also required that an analysis of the water in Motala ström be carried out, which can be seen in his early correspondence with Swartz.⁷¹ Apparently he was content with the water analysis carried out by C. J. Keyser, chemistry teacher at the Technical school (*Tekniska skolan*) in Norrköping, in December 1865. He investigated river water samples taken from three different places upstream from the city – Fiskeby (Borg), Himmelstahlund, and Gryt. The sole parameters of his analysis were the amounts of organic material ("remains after evaporation") and carbonated lime, a kind of salt. The investigation was thus very simple and only measured the parameters which were considered the most essential by the British models at the time, at least this goes for the organic compounds. Hardness was no longer an indicator of the healthiness of the water, but for the Norrköping industry and, for example, washing and cooking it was necessary to have it measured.⁷²

In January 1867, the Financial Department presented the whole plan, including alterations and the estimate of costs, to the City Council, but it was only decided that all the documents be given to von Leesen. In June, the plan was discussed again, only to be postponed "until the question could be given further consideration."⁷³ We do not have much direct knowledge of why they suddenly dropped the question of water supply, for the minutes of the City Council and its Financial Department do not account for the discussions that took place. However, it is possible to look at the correspondence between Leijonancker, Swartz, and the Financial Department, as well as the fiscal and other material from the decision makers in Norrköping during 1866 and 1867, in order to venture some possible explanations.

First of all, as regards finances, it is likely that the members of the City Council and the newspaper expected the donation to cover more of the water supply than it eventually did, according to Leijonancker's estimate of 12 October 1866.⁷⁴ Erik Swartz and the Financial Department met with Leijonancker in November 1866 to discuss the high costs of the proposal and suggest changes. He was asked to try and plan the waterworks closer to the city (Himmelstahlund) in order to save money, but Leijonancker strongly discouraged this on the grounds that the waterfall was so small and the water quality could not be guaranteed. Another revision was suggested by the city, but he rejected

⁷⁰ Norrköping City Council minutes 1867-01-03 §5 (in *HRFOW* p. 2-12).

⁷¹ NSA, Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872," letter from F. W. Leijonancker to Erik Swartz, 1865-11-18, and letters from Swartz to Leijonancker, 1865-11-28 and 1865-12-21.

⁷² *HRFOW* p. 14; Hamlin 1990 p. 127, 134-135.

⁷³ Norrköping City Council minutes 1867-01-03 §5 and 1867-06-06 §18 (in *HRFOW* p. 15).

⁷⁴ Leijonancker's proposal, 1866-10-12 (in *HRFOW* p. 2-11); *NT* 1866-10-23.

it once again since it would impair the quality of the system.⁷⁵ Leijonancker's revisions would make the project a little less expensive, but in the spring of 1867 only the original plan of 750,000 kronor was discussed.⁷⁶

The great cost of the project should also be viewed in the light of municipal expenditure and taxation. The expenses involved were large for the city to cope with, which is shown by the fact that von Leesen's donation, which amounted to about two thirds of Norrköping's total annual budget (463,000 kronor for 1867), was required before preparations could even start. Furthermore, the city's finances were already strained by the costs for the new secondary school (240,000 kronor) and the repairs necessary for the Berg bridge, which had been destroyed by the spring flood of 1867.⁷⁷

When the donation proved not to cover the costs, one wonders why the city did not consider taking a long-term loan. First of all, the new Communal Law of 1862 required that loans with a longer repayment time than two years be submitted to the Government.⁷⁸ Secondly, even a long-term loan would make necessary either fees or increased taxation to make the payments, and, in either case, especially the less wealthy house owners would feel an increased financial burden, apart from the cost of service pipes in the yard. The artisan home owners had been opposed to the introduction of the gasworks in 1848 and 1849, but the pipe network was then unevenly extended throughout the city, to the artisans' disadvantage.⁷⁹ Although the proposed water supply was to be completely extended, there is a possibility that less wealthy house owners were against the project for these financial reasons.⁸⁰

The textile industry was also heading towards a recession at the end of the 1860s. This situation was worsened by poor harvests and famine in parts of Sweden. In the fall of 1867, the so-called "bread war" took place in Norrköping. A group, consisting of mostly factory workers, protested to the mayor and the wholesale dealers against the high prices of bread and grain in the city. Both within and outside the city the effects of the hunger crisis were felt, and

⁷⁵ NSA, Norrköping City Council Archives, AI a:5, minutes 1867-01-03 §5, with the minutes of the Drätselkammare 1866-10-12, 1866-11-16, 1866-12-07, and 1866-12-21 as supplements. Leijonancker's two additions/changes of 1866-11-30 and 1866-12-13 are supplements to the minutes of the City Council 1867-01-03 §5, in *HRFOW* p. 12-15; Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872," letter from Erik Swartz to F. W. Leijonancker, 1866-12-03.

⁷⁶ *NT*, 1867-01-12; NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4.

⁷⁷ Östman, Malmberg, and Liander 1945 p. 23.

⁷⁸ Bokholm 1995 p. 76-79, 105-107.

⁷⁹ Kaijser 1986 p. 128-132. A similarly unevenly extended water supply was discussed in Stockholm in the 1850s, and even there lesser house owners in the peripheral parts of the city protested (Gullberg 1998 p. 110).

⁸⁰ *HRFOW*, appendix VI.

sales decreased for the textile industry, which meant that the wages decreased and workers were fired.⁸¹

Secondly, there was a serious cholera epidemic in the summer of 1866 (753 people turned sick, 270 of whom died), which made the need for a good water supply more urgent than ever, but probably only added to the other practical difficulties. It also seems that the origin and spread of the disease were not put in relation to a bad water supply in Norrköping. It was instead contamination of air and soil that worried the medical experts.⁸² I believe that this epidemic proved a paralyzing factor for the water discussion. It was an actant that contributed to the dissolution of the actor-network that had been shaped up to that time.

Financing a public service such as water supply had to do with priorities, but not at any price. Because of economic and environmental pressure, von Leesen and Erik Swartz therefore would not or were not able to fully enroll the emerging actor-network for piped water. Leijonancker was the only enlisted actor from the small, national actor-network of water engineers. This actor-network, and particularly Leijonancker, was generally very important for the introduction of water systems in Sweden, but it was powerless when its services were not in demand on the local level.⁸³

At the very end of the 1860s, the factory owner Bergström in Stockholm (we do not know much about him) seems to have begun to work out a proposal for Norrköping on his own initiative, which shows that the news of the failed water project had spread to the capital. He wanted to see if it was possible to construct a satisfactory water supply for Norrköping that was about equivalent to von Leesen's donation in its construction costs. Erik Swartz, who had no personal communication with Bergström but found out about the plan by hearsay, thought that it compromised too much and would result in poorer water quality and inadequate pressure. Leijonancker had been very anxious to place the waterworks far upstream the city and to use slow sand filters, so as to achieve good water quality, which was very likely the reason why the proposal was so expensive. Evidently nothing came of Bergström's proposal in the end.⁸⁴

⁸¹ Horgby 1989 p. 38-41, 82-98, 286.

⁸² NSA, Norrköping Drätselkammare Archives, FI a:7, "Sundhetsnämnden 1864-1874"; Horgby 1989 p. 286. The purity of the London water supplies, including the Thames, had been questioned for decades, due to recurring epidemics and "stinks". In the 1866 cholera epidemic, there were those who connected cholera to a bad water supply – notably Edward Frankland and William Farr – although most professionals wondered what this "water poison" was and how exclusively bad water contributed to the emergence of cholera (Hamlin 1990 p. 99-177; Luckin 1986 p. 69-96).

⁸³ NSA, Norrköping Drätselkammare Archives, FX:1, "Handlingar rörande vattenledning för staden 1865-1866, 1872."

⁸⁴ NSA, The Swartz Family Archives, AI:13, unsigned memorandum 1870-11-05, very likely written by Erik Swartz.

The Shaping of a New Water Supply Project

In December 1870, the fire-protection board proposed new fire regulations for Norrköping, which were entirely built upon the old water supply with fire pumps along the river and watering carts.⁸⁵ These regulations were discussed again two months later at a heated City Council meeting. During the discussion the deficiencies of both the proposal and the existing fire protection became evident, and a committee was appointed to examine the proposed new regulations. In that situation, the question of water supply – according to the newspaper the city’s “question of vital importance” – was brought up again by the factory owner Herman Wahren. In his view, fire protection would be substantially cheaper with a piped water supply, and it would not be difficult to achieve this considering the existing capital (von Leesen’s donation) and the prospect of taking a loan. The newspaper reported that most of the members of the council agreed with Wahren.⁸⁶

Erik Swartz, who in the eyes of the newspaper writer had “worked and sacrificed a great deal for the achievement of piped water here in the city,” took advantage of the situation.⁸⁷ He wanted to examine “the prospects of carrying out a suitable piped water supply for the city in a more appropriate way, and at a lower cost, than the proposal by Lieutenant-Colonel Leijonancker.” He suggested that the city contact Captain Josef Gabriel Richert in Göteborg and have him “examine this question thoroughly and ... draw up a complete proposal on the subject.” The City Council commissioned the fire-protection board to contact Richert and see if he was interested in the above task, and Swartz offered to pay all the costs involved.⁸⁸ During the summer of 1871, Swartz had all the previous documents in the question of water supply, including Leijonancker’s 1866 plan, printed and delivered “to several people in the community,” probably as a way of gaining public support for the issue.⁸⁹

As was mentioned above, the City Council let Leijonancker’s proposal rest in 1867. When the question was again put on the agenda in 1871, Leijonancker’s proposal seems not only to have been at rest but had been completely discarded, despite it having been printed and thereby publicly displayed. Swartz did not even bother to contact Leijonancker for possible modifications or additions. One explanation for this might be the failure of the many attempts to modify and thereby make the plan less expensive as early as the

⁸⁵ NSA, Norrköping City Council Archives, AI a:8, minutes 1870-12-15 §22.

⁸⁶ Account of the City Council meeting 1871-02-09 §§3 and 4, *NT* 1871-02-11.

⁸⁷ Account of the City Council meeting 1871-02-09 §4, *NT* 1871-02-11.

⁸⁸ NSA, Norrköping City Council Archives, AI a:9, minutes 1871-02-09 §4.

⁸⁹ *NT*, 1871-06-06 (including quote); *HRFOW*.

fall of 1866. In any event, a whole new plan by another engineer was thought to be the best.

Another explanation could be the engineering debate that Leijonancker and Richert were involved in from 1865 to 1867 in Göteborg, of which Erik Swartz was presumably aware. In Göteborg there were several proposals for piped water and sewerage during the 1850s and 1860s, but for various reasons they were never realized. In 1864, the Göteborg City Council decided to build a piped water supply, and in the spring of 1865 Leijonancker was hired to construct it. It had already been decided that the lake Delsjöarna would be the source of water, but there was nevertheless uncertainty whether it would suffice for the estimated future water needs, which led to a heated debate. J. G. Richert, who was chief construction engineer for the harbor, the streets and the waterworks (*Kallebäcksledningen*, the old waterworks from the late 18th century), participated in this debate and presented a very different view of the problem than Leijonancker. Richert's proposal was at last successful, and he was appointed constructing engineer for the piped water supply instead of Leijonancker.⁹⁰

In 1870 and 1871, the building of Richert's water system was finished. Richert also constructed the sewerage for Göteborg (1866), and as chief engineer was responsible for the whole extension of water supply and sewerage until 1888.⁹¹ In early 1869, he published his book *Om vattenledningar och vattenaflopp* [*On Water and Sewer Systems*], the first of its kind in Sweden. In the 1850s and 1860s there were no textbooks on sanitary engineering in Sweden, and this was an attempt to fill that gap. It was based upon study tours abroad, primarily to Great Britain, but also his own practical experience in Göteborg. As was the case with Leijonancker, Richert was primarily influenced by British examples, although he referred to a few German, French, Dutch and American examples as well. The book and his achievements in Göteborg made Richert a very respected water engineer in all of Sweden at the beginning of the 1870s, and he was to be hired for construction of water supply and sewerage in many other cities for years to come.⁹²

⁹⁰ Bjur 1988 p. 46-54.

⁹¹ Bjur 1988 p. 58-61, 85.

⁹² Richert 1869, foreword, p. 2, 6, 9-11, 36, 59, 67-73; Bjur 1988 p. 48, 54, 62, 74-77; Wetterberg and Axelsson 1995 p. 58-60; Dahl 1949 p. 275-276; Nilzén 1998 p. 146. Richert refers to British examples such as the General Board of Health and its report of 1850, the parliamentary committee of 1850, and the engineers Thomas Hawksley and Joseph Bazalgette (chief engineer of the modern sewerage of London, 1856-1874), but also to Scandinavian examples such as Colding in Copenhagen (he had constructed an early proposal for sewerage in Göteborg).



Josef Gabriel Richert (Source: Lindequist 1904).

Leijonancker was known as the great pioneer of primarily piped water in Sweden, and he had constructed the three first modern waterworks, in Stockholm, Karlskrona, and Jönköping. However, apart from the one in Gävle (1874-1876), of all his plans for water supply these were the only that had been carried out completely, and from 1870 until his death he served as County Governor of Halland County and had other duties.⁹³ Richert, on the other hand, was up-and-coming (see Appendix 1). This was probably known by Erik Swartz, who turned to him instead of Leijonancker.



Fredrik Wilhelm Leijonancker (Source: Smedberg and Johnson 1937).

Richert's power resources had consequently increased in terms of enlisted scientific knowledge, prestige and important connections. Not only had he

⁹³ Grill and Lager-Kromnow 1979 p. 454-456; Lindequist 1904.

added to his actor-network a scientific and technological foundation including water chemists and engineers from Great Britain and France (as outlined in the book), but also contractors and suppliers in Great Britain, and entrepreneurs, foremen and connections among the local elite in Göteborg.⁹⁴ Richert's actor-network was thus stronger and more appealing to Swartz than Leijonancker's, and Swartz started renewing the actor-network for piped water in Norrköping. Even though the fire-protection board (*Styrelsen för stadens brandväsen*) was formally responsible for the contacts with Richert, letter correspondence shows that Swartz with his continual contacts acted as a kind of middleman. He thus increasingly became the "spider in the web" for this new actor-network.⁹⁵

When the fire-protection board submitted J. G. Richert's proposal to the City Council at the beginning of 1872, it also included its own report on the subject. It was of the opinion that the great advantages of piped water for the sanitary conditions as well as fire prevention were so well known that further arguments were superfluous. There were nonetheless many other advantages which, in contrast to the above two, could be assessed in economic terms, and the board presented these in the report.⁹⁶ The idea that von Leesen's donation would cover almost the whole cost of the water system had obviously disappeared by now. However, with the previous development in mind, we can presume that it was necessary for the fire-protection board to argue in economic terms for Richert's proposal to be accepted by the City Council.

It is clear from the board's arguments that it was not only the economic advantages for the city administration itself that were estimated, but also those of the inhabitants. First of all, the building of piped water supply would very likely mean a 20 percent reduction (5,600 kronor) of the annual insurance fees for buildings to *Städernas Allmänna Brandstodsbolag* (the General Fire-Insurance Company). Secondly, the annual insurance fees for the personal property of the inhabitants would probably also decrease by about 6,000 kronor.⁹⁷ Thirdly, the 178 horse owners of the city whose duty it was to

⁹⁴ NSA, Norrköping Waterworks Board Archives, AI:1, see, for example, minutes 1872-05-11 §2, 1872-07-02 §2, and 1873-11-11§2.

⁹⁵ Law and Callon 1992 p. 31-33; Callon and Latour 1981 p. 279, 284-285; Latour 1987 p. 259; NSA, Norrköping Waterworks Board Archives, AI:1, letters with supplements from J. G. Richert.

⁹⁶ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5, supplement No. 2 1872.

⁹⁷ Property owners who wanted to insure property against fire had to become joint owners of fire-insurance associations or companies, in order to – to use modern vocabulary – spread the risk and get a large enough financial base. It was the joint owners themselves who had to contribute financially in case of a fire, even if they were not directly affected. The two biggest companies were *Städernas allmänna brandstodsbolag*, for fire insurance of real estate, and *Städernas bolag till försäkring av lösegendom*, for insurance of personal property. In case of a

transport water in case of fire would save 25 kronor per person annually, that is, altogether around 4,400 kronor. Fourthly, if water for household use was free of charge, as in Göteborg, the inhabitants of Norrköping would save the costs of transporting water from wells and the river. Since these costs were difficult to estimate, the board assumed that each household was prepared to pay five kronor annually for the service of piped water. (It was very important for sanitary reasons that water was available in the houses, according to the board.) Since there were about 5,000 households in the city, the total annual savings for the households would amount to 25,000 kronor.⁹⁸

To these savings, the board added 10,000 kronor annually in water fees from users other than households, and subtracted 14,000 annually for the maintenance of the waterworks, arriving at a sum of 37,000 kronor in annual public savings from a piped water supply. The board was thus of the opinion that the financial aspects alone could motivate piped water. Other benefits could also be derived: sanitary improvements and better fire protection, as well as indoor convenience, cleanliness and comfort, easy access to water for industry, water for street cleaning, the washing of house facings, baths, washing facilities and fountains. If these non-economic advantages were also taken into account, the city would be fortunate the sooner a water system could be built.⁹⁹

The argumentation of the fire-protection board is very interesting, and it is evident that its interests lay in more than just fire defense. As all other municipal boards, it was made up of representatives of the bourgeois industrial elite: the textile manufacturer and one of the foremost patriarchal donors John Lenning, his technical supervisor at the Drags woolen factory Fredrik Blombergh, the director of Holmens textile industry Herman Wahren, the civil engineer J. G. Olson, and the judge and member of *Magistraten* Paul F. Risberg. Lenning, Blombergh, and Olson also had a higher technical education, for instance, from the Technological Institute in Stockholm.¹⁰⁰

fire, in Norrköping, Linköping, or any other Swedish city with other joint owners of *Städernas allmänna brandstodsbolag*, all the joint owners nation wide were obliged to contribute to the fire indemnities. In 1872, an annual fee was introduced, so that the financial burden would be small and continual instead of immense and haphazard (*Förslag till vattenledning och dränering i Linköping* (FTVD), Linköping 1870, p. 43-44; Ahlström 1879 p. 443-463).

⁹⁸ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5, supplement No. 2 1872.

⁹⁹ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5, supplement No. 2 1872.

¹⁰⁰ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5, supplement No. 2 1872; Grill and Lager-Kromnow 1979 p. 560.

It is remarkable how the board (and Swartz, who probably influenced this report) enlisted all possible arguments for piped water.¹⁰¹ The object of the financial argument seems to have been to make the building owners feel that piped water was profitable for all. The reduction on the insurance fees would be 20 percent for all, and all household use was to be free of charge.¹⁰² This was important to enlist *all* building owners into the actor-network before the decision of the City Council, for neither the affluent nor the artisans were desired as opponents of the project. The factory owners would also get quite a substantial fire-insurance reduction on their industrial buildings. It is very interesting that easy access to water for industry was enrolled as a *non-economic* argument, but it may be because most industries already had their own water intakes. Most factories could presumably not supply a water pressure high enough for good fire protection, however.

Richert had made two alternative proposals, with the source of water supply either at Borg or Gryt. The latter would be around 50,000 kronor cheaper, but since Gryt was located very close to the city, the proposed water-works was more vulnerable to fires and the water was also more likely to be contaminated by future industrial activity. Hence, Richert definitely preferred the Borg alternative, and so did the fire-protection board, despite the fact that it was more expensive (500,000 kronor). The board also found that Richert's proposal still would be more than 200,000 kronor cheaper than Leijonancker's counterpart, and it would have a six-meter higher water pressure. The water was to be pumped by turbin power from Motala ström just upstream Borg to the slow filters, and from there with another pump to the reservoir at Borgsmon. The estimated pump capacity was around 80 liters per second, and they would run for 12 hours a day. Richert constructed the water pipe for around 37,000 inhabitants, and he estimated a consumption of roughly 90 liters per person and day.¹⁰³

There was no new analysis of the river water in connection with Richert's proposal, which must mean that Keyser's was still considered valid. In 1868 Professor August Almén had published a book with analyses of water samples from a great many lakes, rivers, wells, and even seas around Scandinavia, including Motala ström and some wells in Norrköping. We do not know whether this investigation was noted in Norrköping at the time. Almén's

¹⁰¹ These were primarily taken from Leijonancker 1853 p. 3-46 (cf., the discussion on the "armory of arguments" above).

¹⁰² This was an influence from Richert. He wrote in his book that lower water fees for the poor were desirable, so that they could afford indoor fittings, but he does not seem to have been a proponent of free household water. This idea had instead come out of discussions in the Göteborg City Council, and he conveyed it to Erik Swartz (Richert 1869 p. 49-52; Bjur 1988 p. 58-59).

¹⁰³ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5 and supplement No. 2 1872; Doctor Klas Linroth's report, supplement No. 36 1886.

appraisal of the river water upstream from the city was that it was not of very good quality, although it was not so contaminated during its course through the city (this view contradicted some contemporary observations, see above). Although he measured several parameters, for example, ammonia and hardness, it seems that Almén's indicator of drinking water quality was primarily the amount of organic material. The river water was not good because it contained too much organic matter.¹⁰⁴

After this City Council meeting, the economic means of the bourgeois aristocracy began to be mobilized for pipe-bound water. At the same time, Erik Swartz also elaborated the practical issues in collaboration with Richert.¹⁰⁵ At the next meeting, on 22 February, some economic obstacles were eliminated, and the water project came one step nearer a solution. On account of Richert's proposal, von Leesen explained to the City Council that he was willing to remit all of the interest on the 300,000 kronor, promised in his deed of gift from 1865. The conditions were that the City Council had to decide to build a piped water supply during 1872, and distribute water free of charge for household use within the city. According to the newspaper, the latter would be to the great advantage for the poor. The City Council again expressed its gratitude to von Leesen for his "self-sacrificing benevolence and care for the good of the city." Henning Trozelli, owner of the Holmens paper industry, donated the property called Borg's mill (*Borgs kvarn*), where the planned waterworks was to be built, including the water rights.¹⁰⁶

Trozelli and von Leesen donated money together for other purposes as well. A few weeks later, von Leesen, Trozelli, and the cloth manufacturer Jean Adolf Arnberg together donated 1,200 kronor to the Swedish Hunting Society (*Svenska jägareförbundet*) in Norrköping. This sum was, of course, much smaller than the donations to the proposed waterworks, but it shows the personal and economic connections between von Leesen, Trozelli, and other bourgeois industrialists and merchants.¹⁰⁷ Together with von Leesen and Trozelli, J. A. Arnberg had also been a very active promoter of the gasworks at the end of the 1840s, and he was also among the 15 prominent donors of March 1872 (see below).¹⁰⁸

Legal problems related to property ownership when the waterworks and pipes were to be laid, and when future access to the pipes for repairs was to be

¹⁰⁴ Almén 1868 p. 4-8, 101-103.

¹⁰⁵ NSA, Norrköping Waterworks Board Archives, AII:1, letters from J. G. Richert to Erik Swartz, for instance, 1872-01-20, 1872-01-28, 1872-02-05, and 1872-02-26.

¹⁰⁶ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4 (including quotation); Account of the City Council meeting 1872-02-22 §4, NT 1872-02-23.

¹⁰⁷ *Östgöta Correspondenten* (ÖC), 1872-03-18.

¹⁰⁸ Kaijser 1986 p. 117-124; NSA, Norrköping City Council Archives, AI a:10, minutes 1872-03-21 §2.

ensured were common in the years to come.¹⁰⁹ Preparations for the building of the waterworks and the laying of pipes from there to the city proved to involve quite a complex legal operation and complicated negotiations with one property owner. The Borg's mill property that Trozelli donated in February 1872 was originally owned by Count August von Schwerin at Borg. He sold the property to Erik Swartz, who in his turn sold it to Carl Ekman, the owner of the other part of the waterfall at Borg, all on the very same day. Ekman then sold it to Trozelli, but also limited the rights to the waterfall to 100 Swedish horsepowers, which was thought to be more than enough.¹¹⁰

Yet, since the water main would be laid in von Schwerin's adjacent property, negotiations between the city (notably Erik Swartz) and von Schwerin had been carried out prior to the donation, which can be seen in letters from Richert to Swartz in early 1872. Von Schwerin actively resisted the city's plans by requiring substantial compensation, despite the fact that he also lived in the city and could benefit from the piped water.¹¹¹ Swartz had asked about similar cases in Göteborg, and Richert responded that he thought von Schwerin's demands of free water consumption were too high. In Göteborg, demands of free water had been made by property owners outside the city, but these had been denied, as they would have required one fourth of the capacity of the waterworks. Now each of them paid the same fee as industrial facilities. When it seemed as though von Schwerin was unyielding and would not relinquish his demands, Richert replied that it was yet easier to pay von Schwerin in water than in money.¹¹²

Eventually, however, a reasonable settlement was arrived at. If the Borg's mill property was to be used for a waterworks for Norrköping, von Schwerin would be allowed to connect a service pipe to the main. He would be under the same regulations as all other users in this category: he was to be allowed seven water taps and the water fee would be 150 kronor per year.¹¹³ Von Schwerin continued to harass the city in the years to come and was probably the most serious opponent to the project since he threatened its technical heart, although it was apparently possible to come to some sort of reconciliation.¹¹⁴

¹⁰⁹ NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1874-09-26 §4 and 1875-03-30 §6.

¹¹⁰ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4; Östman, Malmberg, and Liander 1945 p. 24-26.

¹¹¹ Horgby 1989 p. 69.

¹¹² Richert estimated that the capacity of his proposed waterworks to supply water was tantamount to *at least* four million kronor.

¹¹³ NSA, Norrköping Waterworks Board Archives, AI:1, letters from J. G. Richert to Erik Swartz 1872-01-20, 1872-01-28 and 1872-02-05; Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4.

¹¹⁴ In 1875, he demanded compensation for "inconvenience" and for various damage to his property, and the Waterworks Board consequently signed a contract with him to ensure future ownership and access to the pipes on his property, in case he would argue about that too.

During the February 22 meeting, Erik Swartz made a lengthy speech, which was accounted for by *Norrköpings Tidningar*. He spoke for Richert's proposal and emphasized its advantages, at the same time as he carefully outlined the proposal and its details with what the newspaper thought "great expert knowledge." He also explained the reasons for the long delay. Norrköping's municipal expenditures had been too large during the last few years, but better times had arrived, which should mean a solution before long. Furthermore, he defended supplying household water free of charge, for it would not cause any economic loss to the city. The city of Göteborg had made around 30,000 kronor on water fees from industrial and other commercial establishments in the last year.¹¹⁵

This idea of free household water can exemplify how Swartz argued to impose himself as a central figure or passage point for the water project. To tie the actor-network together he had to use different rhetoric depending on what actors he was enrolling. To enlist the building owners he and the fire-protection board emphasized the free nature of the water, although someone of course had to pay for the pipes within the yard, but to enroll the city fathers he stressed how profitable it would be for the city. Instead of working for a closure of the water project and deciding what different social groups wanted, Swartz used the interpretative flexibility of what a future water system would look like, in order to further his interests and build the actor-network.

But free household water was more than rhetoric. The enormous quantities of water in Motala ström had been an ever-present feature of every-day life in the city, and charging for this commodity must to some have seemed very strange, resident and factory owner alike. In the newspaper articles from early 1866, water was viewed as a gift of God. J. G. Swartz also saw the river water as a resource of nature, free to exploit and pollute in the name of industry. Free household water was also a paternalistic way of helping the workers and the poor to a good and ample water supply, contrary to what Leijonancker and other sanitarians and philanthropists of the day thought. But it was a paradoxical help. The fear of the working class, who lived in "dirty" dwellings and areas, was strong, and this was also presumably a way of ensuring *both* a physically and morally clean city.¹¹⁶

However, he was also promised future compensation for further damage, which he made use of (NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1875-02-04 §9, 1875-03-02 §3 and 4, and 1881-07-06 §4).

¹¹⁵ Account of the City Council meeting 1872-02-22 §4, NT 1872-02-23.

¹¹⁶ NT 1866-01-25; Leijonancker 1853 p. 40-42; Schmidt and Kristensen 1986 p. 32-33, 43-49. See also Richert 1869 p. 49-50.

The Reluctant Enlistment of Sewerage

When Richert handed over the plan for water supply to the fire-protection board, he also pointed to the fact that the sanitary advantages of water supply could not be fully realized without sewerage. It would also be the least expensive to lay down both kinds of pipes at the same time. The board liked this idea and recommended it, but Swartz sped up the communal decision-making process on his own authority by commissioning Richert to draw up a plan for a sewer system.¹¹⁷

While Richert was designing it, Swartz wrote and asked him how it had worked so far in Göteborg. Swartz incorporated the reply into his 22 February speech, which had now changed the subject from promotion of water supply to sewerage. The Göteborg sewerage had “yielded the most favorable results,” according to Richert. He also accounted for his ideas of sanitary conditions and health, and he emphasized that a city needed both water *and* sewer systems:

In my opinion, there is nothing that contributes to the health, comfort and well-being of a city more effectively than an appropriate removal of damp and floating filth, and the sanitary goals are promoted maybe to an even higher degree through sewerage, than through a good water supply.¹¹⁸

Richert gave other examples of advantages of sewerage too, and transformed them into economic arguments. For instance, it was difficult to drain fire hydrants and gutters without sewerage, especially where there was a piped water supply. (The easy access tended to increase water consumption.) In the cold Swedish winter climate, then, this would mean high costs for the removal of ice from gutters and streets. Sewerage could also make dry basements a reality for house and building owners. Finally, Richert estimated the costs for a wastewater system in Norrköping to amount to around 150,000 kronor.¹¹⁹

These were partly sales arguments on his part, but having solely a water system could indeed generate problems, for example, overflowing latrine pits and gutters, which neutralized the water system’s good sanitary effects. In this sense, a water supply without sewerage was incomplete, but with sewerage the central aspects of the modern city could be achieved: “health, comfort and

¹¹⁷ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-01 §5 and supplement No. 2 1872.

¹¹⁸ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4, letter from J. G. Richert to Erik Swartz, 1872-01-31 (including quotations); Account of the City Council meeting 1872-02-22 §4, NT 1872-02-23.

¹¹⁹ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4, letter from J. G. Richert to Erik Swartz, 1872-01-31.

well-being.”¹²⁰ The sewers would transport dirt, “matter out of place,”¹²¹ to its rightful place, the river, which, in its turn, would clean or dilute the dirt, or finally send it to the immense sea, where it would disappear.¹²² The rationale of the sewer system was thus perfectly logical to the actors, both in its theory and practice: it freed the city of harmful substances, and the running water of the river purified them, thus restoring the categories and the social order.¹²³

The City Council thanked Erik Swartz for his careful and untiring work for the city’s water supply. In the end, the feasibility of the whole project – now of both water supply *and* sewerage – depended on the city’s economic means, which is why the issue was submitted to the Financial Department. This department also had the executive responsibility and had thus far been formally responsible for the project.¹²⁴ Leijonancker’s and Richert’s respective proposals were here compared and analyzed in detail, both from a technological and economic point of view. At a general level, the two proposals were considered similar, but Richert’s was less complete in the sense that there were, for instance, fewer shut-off valves. On the other hand, there were important advantages to his proposal, such as a 20 percent bigger reservoir, a six-meter higher water pressure and a double, and therefore safer, inflow of water into the city (see Figure 1.1). The most obvious advantage was the fact that Richert’s proposal was 250,000 kronor cheaper than Leijonancker’s (although iron prices were rising), which had been enabled by inexpensive contractors in Göteborg and Great Britain. The Financial Department thus chose Richert’s proposal “without any hesitation,” and then approved of the whole water supply and sewerage project.¹²⁵

Despite this approval by the Financial Department, the City Council was hesitant both about water supply and sewerage. The solution for the water came when fifteen prominent industrialists and merchants donated a sum of 120,000 kronor (only two of these were *not* members of the City Council), on

¹²⁰ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4, J. G. Richert’s letter to Erik Swartz, 1872-01-31 (quote); Prendergast 1992 p. 74-79.

¹²¹ Douglas 1966 p. 36.

¹²² NSA, Norrköping Board of Health Archives, AI a:1, minutes 1877-06-12 §2; Norrköping City Council Archives, supplement No. 34 1896.

¹²³ Corbin 1986 (1982) p. 32-33; Douglas 1966 p. 35-41; Tarr 1996 p. 120-121. The water flow and velocity required for purification, and thus at what distance from the source of pollution the water was considered clean, were unclear. But it was very common to try and calculate these parameters, which was done in Norrköping on several occasions (cf., the sources of the previous footnote).

¹²⁴ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4; Account of the City Council meeting 1872-02-22 §4, NT 1872-02-23; Bokholm 1995 p. 77.

¹²⁵ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-03-14 §2, letter from the Financial Department to the City Council, 1872-03-08 (including quote); Account of the City Council meeting 1872-03-14 §2, NT 1872-03-15.

condition that the City Council as soon as possible reached a favorable decision in the water pipe question. Consequently, in late March 1872 the City Council decided to build a piped water supply according to Richert's plan, which then included the acceptance of the donations with their respective conditions. Thus it was only necessary for the city to loan 130,000 kronor to be able to afford the total cost of 600,000. The originally budgeted 500,000 kronor was no longer sufficient, mainly due to rising iron prices and calculated future extensions and installation of service pipes. The chairman of the council, J. G. Swartz, expressed the deep gratitude that the inhabitants of the city felt towards the generous donors, and the newspaper praised this great example of communal spirit, which it thought even would be an example for other cities.¹²⁶

In April, the City Council decided to build the sewerage according to Richert's proposal (even though it was not yet finished), parallel to the water supply. One of the first assignments of the Norrköping Waterworks Board,¹²⁷ which earlier had been appointed for the building, administration and extension of the water supply and now became responsible for the sewerage as well, was to scrutinize Richert's sewer proposal.¹²⁸ In the early summer of 1872, then, the Financial Department and the City Council approved of Richert's proposal, and the work could start. The sewers were estimated to be a little more expensive than expected (214,000 kronor, 210,000 of which would be covered by loans).¹²⁹ In the end a total of 340,000 kronor was thus to be covered by loans, and the interest on this sum had to be raised through some sort of taxation. In other words, in reality the water would not be free of charge.

Richert's wastewater system was designed according to the combined sewerage technology, that is, both household wastewater, storm- and ground-water were discharged of in the same pipe. The small circular pipes and the

¹²⁶ NSA, Norrköping City Council Archives, AI a:10 and AI a:11, minutes 1872-02-01 §5, 1872-02-22 §4, 1872-03-14 §2, 1872-03-21 §2, and 1873-02-06 §6; Account of the City Council meetings 1872-03-14 §2 and 1872-03-21 §2, NT 1872-03-15 and 1872-03-22; Ekström 1993 p. 16-17. The donors who contributed to the 120,000 kronor were: W. M. Ekelund (20,000), John Lenning (10,000), John Philipson (10,000), Herman Wahren (10,000), Carl David Philipson (10,000), Erik Swartz (10,000), P. A. Enhörning (10,000), Litografiska Inc. through Frithiof Åberg (5,000), Christian Eberstein (10,000), G. Wiechel (3,000), Hugo Ekelund (3,000), Gustaf Wahren (3,000), Titus Lundmark (3,000), T. Söderberg (10,000), and J. A. Arnberg (3,000). This money, together with von Leesen's donation of 300,000 plus 50,000 in interest, meant that it was necessary to take a loan of 130,000 kronor (= altogether 600,000).

¹²⁷ In the beginning, the Waterworks Board had all kinds of different names, but the name I will use is a rough translation of the name which was established in 1876, *Vattenledningsstyrelsen*.

¹²⁸ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-03-21 §2 and 3, as well as 1872-04-11 (accounted for in minutes 1872-05-30 §6).

¹²⁹ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6 (including 1872-04-11), letter from the Financial Department, 1872-05-24. It is interesting that the three people who signed the letter from *Drättselkammaren* - T. M. Bååth, Erik Swartz, and J. A. Anderson - were all members of the Waterworks Board.

cesspools were made of glazed earthenware, which in the case of the pipes was to make them self-cleaning and to ensure swift disposal of the sewage. According to Richert, these kinds of pipes had caused a sanitary revolution in Britain, since they were inexpensive and affordable even for small cities. In Norrköping, the primarily upland topography was favorable for the self-cleaning process, and the sewage was to be disposed of directly into Motala ström through 42 different outlets (only around 30 of these were built initially, see Figure 1.2). Richert's proposal indicated that each building owner should pay for the cesspool and the pipes in his yard, and the public pipes were to be laid up to the property boundary.¹³⁰ At least in theory, the sewers were not intended for water closets and the disposal of excreta. The sewers were constructed to make the city dry (see Part III).

Thus Erik and Johan Gustaf Swartz and von Leesen had performed a successful translation by enlisting an actor-network of different municipal actors and actants – Trozelli, the 14 other donors, the fire-protection board, the building owners, free water, public health, fire protection, paternalism, modern technology, bourgeois identity, civic pride, industrial development, profit, and finally the City Council and the Financial Department – so as to obtain resources and time to build the water and sewer systems. The only obvious opponent, von Schwerin, was won over to the side of the project, although it is likely that he did not really favor it. The artisans' and workers' possible reactions to the project are not accessible in the sources, but there was presumably no serious opposition from them. It would have been visible in the official sources or the newspaper.¹³¹

Richert's Actor-Network and the Building and Administration of Water Supply and Sewerage

In further elaborating and shaping the actor-network built above, even other actors and actor-networks than those cited above were enrolled. Erik Swartz and the engineer-dominated Waterworks Board became the politically elected central point, and in the actor-network plumbers, waterworks attendants, workers, and the regular users were also enlisted, all of which in different ways influenced, and were influenced by, the physical manifestation of the water and sewer systems. The active involvement of Richert and his actor-network was crucial in this development.

¹³⁰ NSA, Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6, including "Proposal for Sewerage in Norrköping" by J. G. Richert, 1872-04-13; Melosi 2000 p. 92; Richert 1869 p. 60.

¹³¹ Law and Callon 1992.

Municipal Administration of Water Supply and Sewerage - The Waterworks Board

In late March 1872, the Waterworks Board was thus appointed to carry out J. G. Richert's plans for water supply and sewerage for Norrköping, as well as to maintain and administer them after they had been finished. It was placed under the City Council, but was also financially responsible to the city's Financial Department. It was made up of five members and two deputy members, and several of them were engineers or had an engineering background, for instance, Erik Swartz, who chaired the board until his death in 1881. Apart from these, the city engineer Bror Leonard Hellström was an ex-officio member, since he was the chief executive engineer of the water supply and sewerage. Richert's task was to serve as advisory engineer, which he did on several occasions until the end of 1874,¹³² when his assignment was considered completed.¹³³

The practical work for the Waterworks Board was primarily to deal with the technical and economic problems that might arise in the building and administration of the systems. Richert contributed with his expert knowledge, contacted and negotiated with contractors in Great Britain, as well as with suppliers, entrepreneurs and foremen in Göteborg. This meant that his actor-network cooperated with and was incorporated into Norrköping's water and sewerage actor-network.¹³⁴

As early as the beginning of 1873, the board had considerable economic problems due to the situation in Britain. Richert quoted in a letter to Swartz what the journal *Engineering* had to say about the increasing iron prices in Great Britain: "The existing state of matters, however, differs so much from anything that has previously occurred that all former experience is of little avail in enabling one to prophesy what may be the ultimate result."¹³⁵ This was the

¹³² Richert wanted to keep a low profile about this assignment, and asked Swartz not to mention his name officially if possible. He was employed by the city of Göteborg, but it seems that he had worked so much for other towns that his position there had been questioned (NSA, Norrköping Waterworks Board Archives, AII:1, letter from J. G. Richert to Erik Swartz, 1872-02-26).

¹³³ NSA, Norrköping City Council Archives, AI a:10 and AI a:12, minutes 1872-03-21 §2 and 3, 1874-10-08 §7, and 1874-10-29 §2; Norrköping Waterworks Board Archives, AI:1 and AI:2, minutes 1872-05-07, 1872-05-11 §2, 1874-12-29 §3, and 1881-07-06 §1. The original five members of the Waterworks Board were Erik Swartz, Johan August Anderson (civil engineer), T. M. Bååth (judge), Fredrik Blombergh (technical supervisor at the Drags woolen factory) and J.G. Olson (civil engineer). Blombergh and Olson were also members of the fire-protection board. J. A. Andersson originally came from Göteborg and settled down in Norrköping when he led the building of the gasworks (finished in 1851). He subsequently became a nationally renowned gasworks engineer – he built for instance the one in Linköping (1861) and Jönköping (1862) – and was consequently familiar with modern piped technologies (Kaijser 1986 p. 134).

¹³⁴ NSA, Norrköping Waterworks Board Archives, AI:1, see, for instance, minutes 1872-05-11 §2, 1872-07-02 §2, and 1873-11-11 §2, AII:1, letter from J. G. Richert to Erik Swartz, 1872-02-19.

¹³⁵ *Engineering*, 1872-01-19, in NSA, Norrköping Waterworks Board Archives, AII:1, letter from J. G. Richert to Erik Swartz, 1872-02-14.

beginning of what was to be called the Great Depression in Victorian Britain (usually dated from 1873 to 1896). For the time being, it had no equivalent in Sweden, where there was an economic boom until the end of the 1870s.¹³⁶

Owing to increasing prices for iron, coal, and labor, for example, the pumps from Göteborg increased in price and the Waterworks Board simply could not afford to order enough cast-iron pipes from Great Britain. The board had to ask the City Council for more financial resources, so that it could complete its tasks on schedule, that is, during 1874. Later the same year, the board found it essential to ask for still more financial aid, but this time the demands were more radical. The costs of both labor and material were now much higher than what was initially estimated, and the water system alone would cost about 750,000 kronor, compared with the 600,000 originally budgeted. Because of this, the Waterworks Board asked for the means to be able to continue the work at the same pace as before, without being limited by earlier grants and regardless of future costs. The City Council approved this request. The project was to be carried out as planned, no matter what.¹³⁷

During the fall of 1874, the water supply of Norrköping was sufficiently complete for distribution of water to begin. On 25 September the water was turned on in the southern part of the city, and on 25 November in the northern. On 17 November 1874, the King of Sweden, Oscar II, visited the waterworks at Borg together with the most prominent financial donors, and afterwards it was decided that no official inauguration was needed.¹³⁸ A visit by the King must have been about the most official and worthy an opening conceivable, not only as a sign of the importance of this new technological system, but also that of its donors. A tablet had been placed on the reservoir with the inscription, "The generosity of Jacob von Leesen founded the Norrköping Waterworks," and in the waterworks itself there was a tablet with the inscription "Henning Trozelli donated the waterfall and the site in 1872."¹³⁹ What had been invested financially now returned as glory and prestige to the

¹³⁶ Hobsbawm 1975 p. 5; Schön 2000 p. 187-191.

¹³⁷ NSA, Norrköping City Council Archives, AI a:11, minutes 1873-02-06 §6 and 1873-10-23 §2; Norrköping Waterworks Board Archives, AI:1, minutes 1873-10-10 §3 and 1873-10-17 §2.

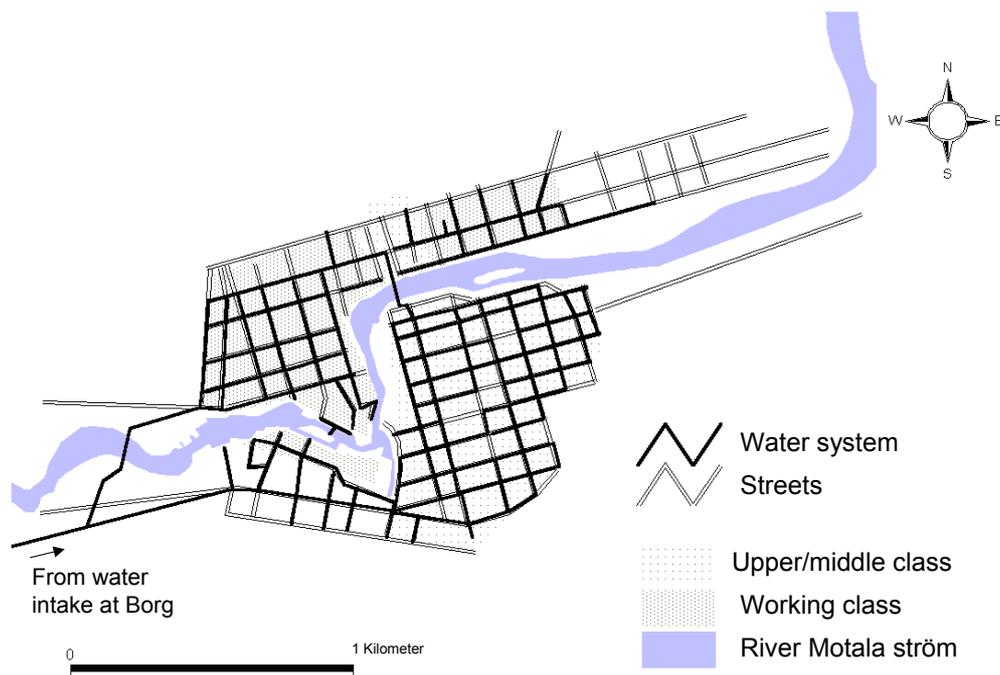
Most of the parts of the water and sewer systems were ordered from Great Britain, the "workshop of the world." For instance, cast-iron pipes were ordered from Cochrane Grove & Co, Middlesbrough on Tees, and Hopkins Gilkes & Co, glazed earthenware pipes and cesspools via Fred Sutton in Hull (for example, from The Farnley Iron Co), fire hydrants from Guest & Chrimess, Rotherham, etcetera. Pumps and turbines were ordered from Göteborg's Mechanical Engineering Workshop (GMV) and parts of the cesspools from the ironworks Stafsjö and Wirå bruk in the Norrköping region (Waterworks board minutes 1872-1873; Söderberg 1968 p. 61).

¹³⁸ NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1874-09-26 §1, 1874-11-17, 1874-11-25 §6.

¹³⁹ NSA, Norrköping City Council Archives, AI a:11, minutes 1873-02-06 §7.

actor-network, especially the donors, and the reservoir and the waterworks were the pinnacle of this symbolic value.¹⁴⁰

Figure 1.1. GIS view of the extent of J. G. Richert's finished water system in late 1874, related to a typology of working class and middle- and upper class areas.



Despite Norrköping being segregated, the pipe network was extended almost equally across the city (Source: Schmid and Hallström 2001).

A number of workers participated in the building of the waterworks, filters, and reservoir, as well as the digging and laying of pipes during the years of construction. In the summer of 1872, there were at most as many as 190 workers, in the fall there were slightly fewer, and at the end of the year the number had dropped to 60. In the summer of 1874, there were 300 workers altogether. This was casual and seasonal employment, so the workers had to be taken from the lowest class, that is, those who had no permanent employment. But in this way the project also resulted in lowered unemployment, which must have satisfied the city fathers. (In the late 1860s unemployment had been a huge

¹⁴⁰ Hamlin 1996 p. 98-99.

problem for the city.)¹⁴¹ Those who were employed as network supervisor and waterworks attendants had a much higher rank, however. The city engineer Hellström initiated the practice of having the supervisor wear a badge with his title. The attendants were also to have nameplates with the inscription, “Waterworks Attendant No. 1-4,” both on their dwellings and on their blue work-caps.¹⁴² This worked to further confirm the prestige and importance of this modern technology, even among the employees.

Regulations for the Waterworks Board as well as the water and sewer systems had been thoroughly discussed by the board, and they were approved by the City Council in the fall of 1874. These regulations were copied from Göteborg, except for some adjustments to local conditions. They decreed, for instance, that the Waterworks Board should pay for water and sewer service pipes up to the yard boundary, but the owner had to pay for pipes in the yard and the building. The water for household use was free of charge, including water for fire fighting, baths, the cleaning of vehicles, streets and yards. However, there was a fee for watering horses and cattle (annually 2.50 kronor each), as well as on water to public buildings, hospitals, hotels, and factories, and contracts were signed with the users concerned. To begin with, an annual fixed rate was applied for public institutions and lesser businesses, for example, five kronor for heating a church with a steam engine, 40 for a smaller brewery, or 5-40 kronor for different sizes of butcheries. For industrial use water consumption was gauged by a meter that was rented from the Waterworks Board, and the fee was 0.19 kronor per 1,000 liters.¹⁴³

In 1877, the city accountants made a study of the uses of the city water. They claimed that only 16 percent of the total amount of water that potentially could be sold against a fee – that is, the total capacity of the waterworks related to the population, minus the free water consumption – had been used. The accountants made comparisons with the results of the Göteborg Waterworks, which earned much more on industrial use, although it also charged more. Since Norrköping had a larger share of industries than Göteborg, there should also be a greater demand for pure water. But due to the easy access to river water for most Norrköping industries, and because of the water fees, most factories were satisfied with non-filtered, impure river water. To remedy this situation the accountants suggested that the water fees be lowered for the

¹⁴¹ NSA, Norrköping Drätselkammare Archives, FI a:9, annual report of the Waterworks Board for 1872; Östman, Malmberg, and Liander 1945 p. 29.

¹⁴² NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1877-04-23 §7.

¹⁴³ NSA, Norrköping Waterworks Board Archives, AI:1 and AI:2, minutes 1874-10-03 §1, 1874-12-07 §§4,5, 1875-03-02 §6, and 1877-01-30 §6; Norrköping City Council Archives, AI a:12, minutes 1874-10-08 §7 and 1874-10-29 §2; Account of the City Council meeting 1874-10-08 §7, NT 1874-10-10; *Reglementen m.m. för Norrköpings stads vattenledning och vattenafledning* (Norrköping 1875); Myrdal 1972 p. 323-324.

largest consumers, that is, mainly industries. More users subject to a charge meant a greater income for the city (the cost per liter for the waterworks would also decrease with a higher production). The Waterworks Board dismissed this proposal, however, and thought that this was the responsibility of the City Council.¹⁴⁴

Despite this reply, large consumers and even public institutions, such as hospitals, were gradually given discounts on their consumption in the years to come, a practice which was formalized in the new regulations of 1888. These new regulations were evoked by the Swedish transition to the metric measurement system, but at the same time other changes were made.¹⁴⁵ The annual fixed rate, an increasingly subjective, arbitrary, and impractical solution, was now abolished in favor of metering. Metering was also motivated by activities or apparatuses that were thought to waste water. The annual water fee for water closets was originally six kronor, but in late 1882 the rate was increased to 10 kronor for the ones that were not metered, a sum that could be higher for offices or hotels. From 1886 fountains were also required to use meters.¹⁴⁶

The Waterworks Board controlled the new water and sewer systems, as well as their users, meticulously. There were demands of written reports as soon as anything broke or would be changed, and only plumbers approved by the board were allowed to carry out such work. There were also threats of shutting off the water for or fining the person concerned, if there was an illegal installation, such as by a non-approved plumber, or if the water was used for other purposes than what was agreed upon in the contract (including wasteful use). Repeatedly, the board considered it necessary to advertise reminders about the fines for the wrongful use of water, as well as the regulations themselves, in the newspaper. When there were serious cases of illegal installations, a list of the approved plumbers was advertised.¹⁴⁷

¹⁴⁴ NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1877-07-28 §2. The city accountants were Otto J. Lind, factory owner Hugo Ekelund, managing director Gustaf Ringborg, and J. L. Rudholm.

¹⁴⁵ The correct conversion from the earlier 0.50 kronor for 100 cubic feet was really 0.19105 kronor per cubic meter (1,000 liters), but the Waterworks Board now saw the opportunity of raising the price. So it was decided that the fee would be 0.20 kronor per 1,000 liters, and the discounted price was to be 0.14 kronor for the consumption over 1 million liters every three months (NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1888-11-24 §3; *Reglementen m.m. för Norrköpings stads vattenledning och vattenafledning* (Norrköping 1889), §4).

¹⁴⁶ NSA, Norrköping Waterworks Board Archives, AI:1 and AI:2, minutes 1875-11-11 §5, 1875-11-22 §5, 1882-10-18 §4, 1882-12-01 §4, 1885-08-08 §6 and 7, and 1888-11-24 §3; Norrköping City Council Archives, minutes 1888-11-29 §11 and 1890-04-17 §12; *Reglementen m.m. för Norrköpings stads vattenledning och vattenafledning* (Norrköping 1889), §4.

¹⁴⁷ NSA, Norrköping Waterworks Board Archives, AI:1 and AI:2, minutes 1874-10-03 §1, 1874-12-07 §§4 and 5, 1877-01-30 §6, and 1884-05-28 §§2, 3 and 6; Norrköping City Council Archives, AI a:12, minutes 1874-10-08 §7 and 1874-10-29 §2.

In a sense, there was not a clear-cut distinction between the public and private in local bourgeois ideology and politics (a typical characteristic of local politics, perhaps). Private industrialists largely sponsored public urban technologies, but, on the other hand, these private interests also constituted the city administration through the voting system. However, from other perspectives this distinction was very clear. The fact that the city paid for and maintained service pipes from the main to the yard boundary, and that it controlled the pipe networks, entrepreneurs (plumbers), and users meticulously implies that water supply and sewerage were regarded as belonging to the public sphere – it was a public possession – and consequently the distinction between the public and private was upheld. In this sense, technology was also a tool for social control and the maintenance of power relations in the city.

It is also possible to interpret this from a gender perspective. Previously, it was mainly women who went to the public well or pump,¹⁴⁸ but with piped water they came to be confined to the tap in the yard or the house – the private sphere. All those who administered and worked with the water supply were men, to whom the bourgeois public space rightfully belonged, according to the thought of that day.¹⁴⁹

At the end of 1875, Richert's plans for water supply and sewerage had been completely carried out, apart from a few alterations (improvements, according to Richert). Thus, Richert and a representative of the fire-insurance company *Städernas Allmänna Brandstodsbolag* inspected them. The fire-insurance fees were consequently lowered for the policy-holders of the city.¹⁵⁰ Richert's plans encompassed almost the entire city, but the city had grown since the proposals were finished in 1871-1872, and continued to do so, which came to affect the expansion of the pipe networks (see Chapter Three). In 1876, according to the city engineer Hellström, around 800 out of 870 yards (including factories, public buildings, etcetera) were connected to the water supply and sewerage. In 1885, when the National Board of Health did a national survey of the health conditions in many Swedish cities, the health inspector Klas Linroth observed that all of the 1,000 yards of the city had water supply and sewerage and around half of these had indoor fittings.¹⁵¹ It was not until the late 1890s that almost all building had indoor water taps.¹⁵²

¹⁴⁸ Östman, Malmberg, and Liander 1945 p. 13.

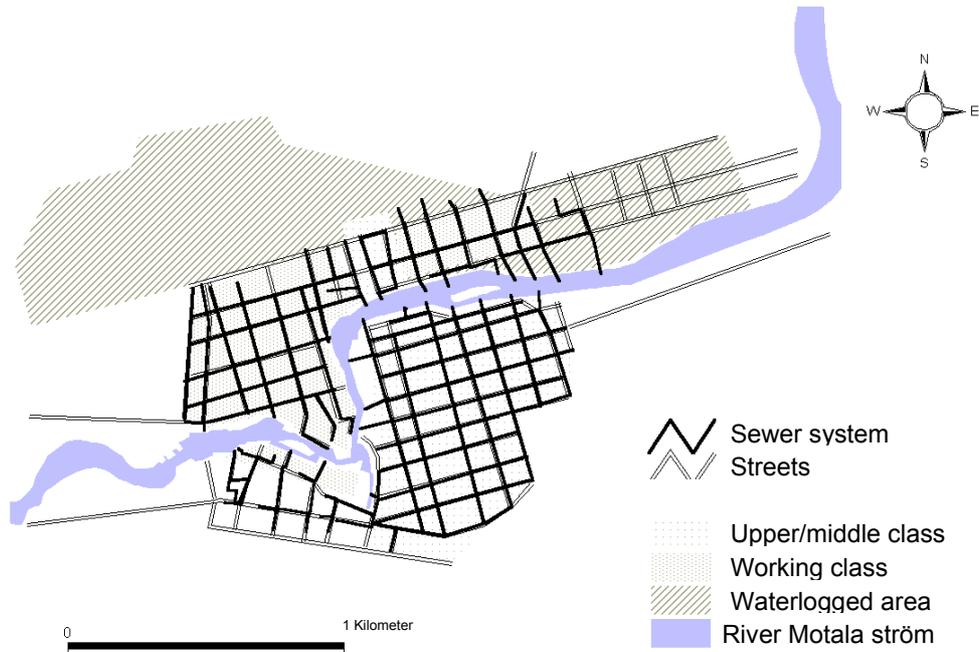
¹⁴⁹ Gunn 1999 p. 12-20.

¹⁵⁰ NSA, Norrköping City Council Archives, AI a:13, minutes 1875-11-25 §9; Norrköping Drätselkammare Archives, FI a:9, Hellström's annual reports for 1874 and 1875.

¹⁵¹ NSA, Norrköping Drätselkammare Archives, FI a:8, Hellström's annual report for 1876; Norrköping City Council Archives, Klas Linroth's report, supplement No. 36 1886. Hallström 2000 p. 189-190.

¹⁵² Norrköping Miljö & Energi Technical Archives, No. 3623, "The Water Supply and Sewerage of Norrköping in 1896", B. L. Hellström 1897-03-31.

Figure 1.2. GIS view of the extent of J. G. Richert's finished sewerage in late 1874, related to a typology of the "social topography" and the waterlogged area.



The marshy district within the city's planned area, Saltängen, was largely lower class, but was sewered just as most other parts of the city (Source: Schmid and Hallström 2001).

The Waterworks Board that was appointed in 1872 had fulfilled its mission and therefore resigned at the beginning of 1876. It was immediately replaced by a new board with all but the same people as before. It presented the final statement of accounts for the water supply and sewerage project in the spring. The total cost of construction for the water supply was 758,000 kronor, that is, over 50 percent more than Richert had estimated, and about the same as the estimated cost of Leijonancker's proposal. Increasing prices, delays and some improvements by Richert account for the increased costs of the project. The final cost of the sewerage was about 190,000 kronor, which was actually a good deal less than the estimated amount.¹⁵³ The water system was more complex than the sewerage in the sense that it included several disparate parts that had to

¹⁵³ NSA, Norrköping City Council Archives, AI a:12, AI a:13 and AI a:14, minutes 1874-10-29 §2, 1875-12-09 §12 and 1876-05-18 §3; Norrköping Drätselkammare Archives, FI a:9, annual report of the Waterworks Board for 1875.

work together – turbine-powered pumps, filters, a reservoir, and the distribution network – which may be why it caused the biggest problems financially. The increasing prices in Great Britain also affected the water supply more than the sewerage (for instance, for cast iron).

The Afterglow of the Water Project: Technical Extension and Organization in the Years to Come

At the end of the 1880s the waterworks pumping station was very strained, and in 1890 the Waterworks Board asked for money to complement it with a new pump and a steam engine. Water consumption in the city had increased with 250 percent since 1876, and at times the pump had to work all but around the clock in order to satisfy the need for water. A further problem was that ice slush sometimes jammed the turbines in the winter. The proposed pump would thus serve as back-up both when the old pump could not cope with the high consumption and when there was an interruption in the water distribution (ice slush or worse). The idea was that the pumps could be both turbine and steam driven. The new pump was to be of the same model as the old one, which would be convenient and inexpensive when spare parts were needed, and the waterworks engineer B. L. Hellström thought that the expanded waterworks would be capable of supplying at least 50,000 people with water. He also suggested another slow sand filter, for the existing ones were also often overstrained.¹⁵⁴ At the end of 1892 this work was finished, but the costs had increased with almost 10 percent, to just over 120,000 kronor.¹⁵⁵

One aspect of this expansion of the waterworks that was not addressed was fire protection. In 1897, however, the fire-insurance company *Städernas Allmänna Brandstodsbolag* expressed its concerns about the state of the Norrköping waterworks from a fire-protection point of view. In late 1896 the company's inspector Herman Gustafson had shown how the water pressure in the pipes had decreased substantially since his previous inspection in 1890. In his view, this was partly due to rust in the pipes, but could be attributed mostly to the enormous physical expansion and consequent extension of piped water that had taken place in Norrköping during the same short period. The effect of the recent expansion of the waterworks was neutralized by the fact that all water was still pumped to the insufficient reservoir. The few fire engines were not enough to alleviate this situation. Gustafson suggested that

¹⁵⁴ NSA, Norrköping City Council Archives, minutes 1890-11-27 §10 and 1890-12-11 §4, supplement No. 49 1890.

¹⁵⁵ NSA, Norrköping City Council Archives, minutes 1891-04-06 §11, 1892-12-01 §20, and 1892-12-15 §27, supplement No. 63 1892.

the city change to thicker water pipes in some areas, and that a water tower or at least a new reservoir be erected.¹⁵⁶

The company had also called on the prominent water engineer Johan Gustaf Richert, the son of the elder J. G. Richert, to make an expert statement. Richert started his statement by praising the Norrköping Waterworks, and he ranked it as “one of the best in Sweden.” This was not very surprising since his father had constructed it. The younger Richert was also a personal friend of one of the most eminent representatives of the city, Carl Swartz,¹⁵⁷ who was a member of the Waterworks Board and whose father Erik was perhaps the most central person behind the initial building of the waterworks and knew the elder Richert. But Johan Gustaf was probably right in that the water supply was excellent from a bacteriological viewpoint, and that the pumping station, filters, reservoir, and distribution network were also well constructed and maintained: “The general impression of the whole waterworks is thus very good, and testifies to the most insightful and professional management.”¹⁵⁸

Richert continued by referring to Gustafson’s report and the allegedly unsatisfactory condition of the water supply as far as fire protection was concerned. While he shared Gustafson’s view, he also pointed to the fact that the present fire-fighting demands on water systems

were not known when the Norrköping Waterworks was built. Water pipes were at that time quite rare, not only in our own country but all over Europe, and their advantages were not so well known and appreciated as now. A city government that wanted to carry through such a grand and expensive project as early as 20 years ago had to overcome such strong resistance and such deep-rooted prejudice that the prospect of succeeding was completely dependent upon the possibility of keeping construction as well as operative expenses within reasonable limits.¹⁵⁹

¹⁵⁶ NSA, Norrköping City Council Archives, minutes 1897-05-06 §21, supplement No. 39 1897, p. 1-3.

¹⁵⁷ The tobacco manufacturer Carl Swartz (1858-1926), educated at Uppsala and Bonn, Germany, was a leading figure in the political and cultural life of Norrköping at the time. He was a politician who managed to bridge different priorities and interests among the bourgeois elite of Norrköping. Swartz was elected a free-trade member of the Swedish parliament by the otherwise largely protectionist Norrköping City Council in 1900. Swartz became Swedish Minister of Finance in 1906 and even Prime Minister briefly in 1917. He was a promoter of the arts and sciences, and in 1915 he became a member of the Royal Swedish Academy of Agriculture and Forestry and the Royal Swedish Academy of Sciences (Bohman 1954 p. 357-362; Hallendorff 1928 p. 357-358).

¹⁵⁸ NSA, Norrköping City Council Archives, minutes 1892-12-15 §7 and 1897-05-06 §21, supplement No. 39 1897, p. 4 (including quotes); The Swartz Family Archives, AI:13, dedication from Johan Gustaf Richert to Carl Swartz on a book from 1900.

¹⁵⁹ NSA, Norrköping City Council Archives, supplement No. 39 1897, p. 4-5.

But since then, wrote Richert, many Swedish cities had been ravaged by serious fires, and the demands on the water supplies had been enhanced accordingly by fire-insurance companies.¹⁶⁰

Richert showed with mathematical formulas that inspector Gustafson was right. The Norrköping water system was inadequate for satisfactory fire protection. This had to do with water pressure, but as we have seen, the waterworks had not been able to keep up with the increased consumption either (a major cause of the lowered pressure, of course), due to the underdimensioned size of the works and technical difficulties. A rebuilding of the whole water system was thus necessary.

Richert proposed a new pump as back-up to the existing ones, a high and a low reservoir which would work together, as well as new water mains all over the city. The high reservoir was to be located just south of the hospital in the southwestern part of the city. The cost of the whole project was far more than the 1890-92 expansion – 350,000 kronor. But Richert was sure that Norrköping's renowned communal spirit would prove victorious even this time, both for the relationship to the fire-insurance companies and for the safety of the inhabitants.¹⁶¹

Just as in the original building of the waterworks in the 1870s the question of fire protection played a central role, but this time it was even more pivotal. Faced with the possibility of losing the 20 percent reduction on the fire-insurance fees, the city had no other alternative but to initiate a renewal of the water supply. This was not unusual in Swedish cities at the time. In Kalmar, for instance, there were initiatives to introduce piped water in the 1880s and 1890s, but it was not until *Städernas Allmänna Brandstodsbolag* threatened to increase the fire-insurance fees with up to 50 percent that the town made the decision to build a piped water supply in 1897.¹⁶²

The Waterworks Board was commissioned by the City Council to investigate the technical improvement of the water system further. The board realized that this question was so big that other factors than fire protection had to be considered, for example, how to supply the continually increasing urban population with daily fresh water even in the future. Therefore, Richert was asked to further elaborate his proposal. It was cheaper than to look for another equally skilled engineer, but he probably would have been the board's choice anyway because of his dominant position among Swedish engineers at the time. In late 1898 the Waterworks Board presented Richert's plan to the City Council. The improved water system could supply up to 60,000 people with water. Apart from further expansion of the pumping station, a new main

¹⁶⁰ NSA, Norrköping City Council Archives, supplement No. 39 1897, p. 4-5.

¹⁶¹ NSA, Norrköping City Council Archives, supplement No. 39 1897, p. 5-15.

¹⁶² Hörberg 1998 p. 25-39.

from there to the city, and a full-size water tower, the proposal was virtually the same as the year before, but it ended up being a great deal more expensive than the former. It would now cost 600,000 kronor, or 480,000 for a less comprehensive alternative, that is, the changes that could not be delayed.¹⁶³

Since not only fire-fighting needs were looked to, the purity of the water was also enlisted, and Richert therefore suggested three new slow sand filters. He was of the view that the speed of filtration in the old filters was far too high (around 230 millimeters per hour):

Modern hygiene requires that surface water which is exposed to possible contamination through infectious matter [*smittämnen*] should be carefully filtrated, *slowly and continuously*. Only under these circumstances is the filter capable of separating and retaining the microorganisms of the water to a satisfactory degree ... The largest admissible filter speed for a water of suspicious quality is indicated as 100 millimeters per hour by Koch ...¹⁶⁴

This speed had been applied to the new waterworks of Göteborg, according to Richert, since River Göta Älv was rather contaminated. The water in Motala ström, however, had been purified through precipitation in several lakes before reaching Norrköping and was not being contaminated to any larger degree.¹⁶⁵ Therefore the speed of filtration could be a little higher than Koch's prescription, and each filter was equipped with a regulating device to ensure the right speed.¹⁶⁶

¹⁶³ NSA, Norrköping City Council Archives, minutes 1897-05-06 §21, 1897-11-25 §13, 1897-12-09 §37 and 1898-11-28 §8, supplement No. 88 1898, p. 1-13; Account of the City Council meeting 1897-12-09 §37, NT 1897-12-10.

¹⁶⁴ NSA, Norrköping City Council Archives, minutes 1898-11-28 §8, supplement No. 88 1898, p. 4-5.

¹⁶⁵ August Almén was not as satisfied with the river water in the late 1860s. It seems that the major reason for his hesitance was the existence of humus (organic material), which in the late 1890s was no longer considered an indicator of poor water quality, unless it was pathogenic organic matter. With the introduction of bacteriology it was primarily the existence of pathogens that decided what was poor water quality, and in this regard humus was not considered a problem (Bjur 1988 p. 139-146; Drangert, Nelson, and Nilsson 2002 p. 177).

¹⁶⁶ NSA, Norrköping City Council Archives, supplement No. 88 1898, p. 4-5.



Johan Gustaf Richert (Source: Isgård 1998).

By this time, Johan Gustaf Richert (1857-1934) was maybe the foremost water engineer in Sweden. He had graduated from the Royal Institute of Technology in Stockholm in 1880, and had soon gone on to work with his father Josef Gabriel in Göteborg. There he was primarily involved in the practical building of water supply and sewerage, since his father still designed the different constructions and proposals. When Josef Gabriel became the head of the Royal Corps of Engineers in Stockholm in 1888, his son took over the responsibilities in Göteborg together with a colleague. During the late 1880s and 1890s Johan Gustaf gained a national and international reputation as a water engineer due to his work with the new waterworks Alelyckan and the so-called “groundwater factory”, as well as the extension of the sewerage in Göteborg. Richert’s study tours to primarily Germany, where groundwater was mostly used, gave impetus to his interest in groundwater. It was particularly his knowledge of groundwater and his artificial infiltration technology that was new and innovative at the time, and around the turn of the century he was an international authority on the subject.¹⁶⁷

In 1897 Johan Gustaf started his consulting agency for water engineering, which a few years later was named *Vattenbyggnadsbyrån* (VBB) and became

¹⁶⁷ Bjur 1988 p. 80-116; Isgård 1998 p. 15-17. Artificial filtration meant that surface water was artificially filtrated, for example, through a boulder ridge, and when it had reached down to the groundwater it was considered pure. In this way it was possible to “manufacture” freshwater, hence the term groundwater factory. Apart from the first such waterworks in Göteborg in 1897-1898, they were not very common in Sweden in Richert’s own time, but became increasingly popular in the latter half of the 20th century (Isgård 1998 p. 15-17). It is interesting that German water technology was maybe more influential in Sweden than British at this time, although perhaps half of the German water and sewer systems had been constructed by British engineers (Bjur 1988 p. 85-87).

leading in Sweden and internationally for decades. His father, who had been a municipal and government official throughout his career, did not sympathize with this development. For the elder Richert the public domain was the natural habitat for an engineer, not the private. From 1898 Johan Gustaf was also a teacher in water, sewerage, and hydro-power engineering at the Royal Institute of Technology in Stockholm, thus securing the connection between higher education and the engineers and entrepreneurs in the field. He managed to enroll some of the best engineers of the time in his company, but also utilized his colleagues at the Institute, for instance, for the work in Norrköping. In 1903 he became the first Swedish professor of water engineering at the Royal Institute of Technology.¹⁶⁸

Very likely due to Norrköping's municipal reorganization of 1898 the water project was tabled. However, by this time it was evident that several of the older water mains needed to be replaced anyway, both to improve fire protection (which required thicker pipes) and to improve the overall performance of the pipe network (some mains were just worn out). So a part of Richert's plan was actually implemented already during the following years, together with certain modifications made by the chief engineer Wilgott Carling and the city's Building Department (*byggnadskontoret*). But a decision on the whole plan was not taken yet.¹⁶⁹

Furthermore, during the whole 1890s the city had been growing at a greater pace than before and was still growing, which meant that the water and sewer systems had to keep pace with the expansion. This resulted in a greater pressure on the finances of the waterworks. The physical extent of the pipe network around the turn of the century was such that it sometimes also tended to collide with other technological systems, both old (gas pipes) and new (electrical and telephone cables). At this time a truly piped or networked city

¹⁶⁸ Althin 1947 p. 27-28; Isgård 1998 p. 15-17; NSA, Norrköping City Council Archives, supplement No. 88 1898, p. 2-18.

¹⁶⁹ NSA, Norrköping City Council Archives, minutes 1898-11-28 §8, 1899-03-16 §21, 1899-09-22 §11, 1899-12-14 §36, 1901-04-02 §12, supplements No. 64 and 105 1899, and No. 12 1901. Account of the City Council meeting 1898-11-28 §8, *NT* 1898-11-28. The *byggnadskontor* and its director Wilgott Carling assumed the role of the Waterworks Board from 1899 onwards, and it was administratively under the Financial Department. The former city and waterworks engineer, B. L. Hellström, had served the city of Norrköping from 1859 to 1897. At his retirement, and in connection with the municipal reorganization of 1898, his former duties were taken over by two people. (The city now had around twice as many inhabitants as when Hellström became city engineer.) The new city engineer, civil engineer Robert Weisse, came to be involved only in building issues, and the waterworks and other infrastructure were left to civil engineer Wilgott Carling. His title was in Swedish *byggnadschef*, that is chief constructional engineer, but he was not involved in building issues, which is why he will only be called chief engineer henceforth (Myrdal 1972 p. 291-292).

began to take shape.¹⁷⁰ Because of this it was important for the city to be more strict towards industries that wanted to lay down their own water and sewer pipes as well. Brücks Woolen Factory, for instance, had to submit its plans to the chief engineer, pay an annual fee to the city, be responsible for possible future damage through broken pipes or leakage, and even move the pipes if the city found that such pipes were in the way for its own pipes. It was thus crucial for the city administration to take control of the underground.¹⁷¹

In late 1901, finally, the chief engineer had scrutinized – or rather remade – Richert’s proposal. He claimed to have made mostly economic but also some technical improvements. Carling was of the opinion that it was financially extravagant not to use the old reservoir at Bergsmon, which was still almost in mint condition, and in that case only a smaller water tower had to be built. A further advantage of this solution was that the existing turbines and pumps could continue to be used, and the reservoir and tower would complement each other in the water distribution. It was a so-called low- and high-zone construction, which Richert had also suggested, but for him it was mainly the water tower that should be used.¹⁷²

Carling thought that the building of three new sand filters was a waste of money as well, and suggested merely one larger filter. In Carling’s view

it seems quite likely that in those places where naturally pure water (ground-water) is not accessible for a reasonable price purification through ozonization will soon replace filtration. This latter water purification method has progressed so much in recent years . . . that the possibility of soon introducing it must be allowed for . . .¹⁷³

He did not propose ozonization at this stage, however. Carling also added what he thought indispensable modern accessories, such as electrical sensors for measuring the water levels in the water tower and reservoir, and devices for bacteriological investigations. In spite of a water pressure equal to that of Richert’s proposal, this was to end up being almost 100,000 kronor cheaper, according to Carling.¹⁷⁴

Johan Gustaf Richert replied by doing an “impartial comparison” between the two proposals. He did not enroll any scientific allies, but relied on his own authority and on his original proposal. Not surprisingly, he found that his

¹⁷⁰ Tarr 1999; Tarr 1988.

¹⁷¹ NSA, Norrköping City Council Archives, minutes 1900-03-22 §13 and 1900-12-27 §7, supplements No. 12 and 81 1900.

¹⁷² NSA, Norrköping City Council Archives, minutes 1902-02-27 §6, supplement No. 6 1902, p. 1-6.

¹⁷³ NSA, Norrköping City Council Archives, supplement No. 6 1902, p. 5. Ozonization was invented by Baron Tyndal, and air containing ozone was led through the water that was to be purified, thereby sterilizing it (Almquist and Richert 1898 p. 27, 31-32).

¹⁷⁴ NSA, Norrköping City Council Archives, supplement No. 6 1902, p. 1-11.

own was the best. As regards the finances, eventually the costs would be about the same for both, when comparing the costs to what was actually achieved. Technologically, Carling's intermittent distribution network was also inferior to his own, "according to which there is continuous pumping to a reservoir and a pipe network, whose mains form a harmonious whole with good circulation of water and an even pressure." Carling's keeping the old pumps was "an impairment of the 'heart' of the water system," according to Richert. The sole sand filter would also mean an impairment from a hygienic point of view. Richert concluded by promoting the artificial infiltration technique, of which he was the foremost spokesman in Sweden, but he was aware that this would require a more thorough investigation.¹⁷⁵

As regards the economy of the project, Carling and Richert calculated entirely differently, and the former withstood his earlier calculations – his proposal would be almost 100,000 kronor cheaper. With references to the local conditions and technical details Carling tried to prove that his system was every bit as good as Richert's, but less expensive. Carling reasoned about adaptation to local conditions much as Richert's father Josef Gabriel once did, that sometimes the best solution must give way to a practical, yet suitable, solution. On these grounds, he also rejected artificial groundwater as too complicated and expensive.¹⁷⁶

The claim that Carling's system was inferior was of course repudiated: "There is no evidence for this, however. General statements of a harmonious whole, good circulation of water, and an even pressure, etc., are not the same as convincing evidence, in my view." It seemed strange to Carling that there would be no variation in water pressure in Richert's system, since there was a difference in altitude of 30 meters. Carling also thought that Richert's opinion of the filter speed was based on arbitrary presumptions and not on empirical

¹⁷⁵ NSA, Norrköping City Council Archives, supplement No. 6 1902, p. 11-15 (quotes on p. 12 and 13); Bjur 1988; Richert 1910. Richert's silence about ozonization in his reply must not be taken as a dismissal of it, but rather that it was not considered the ultimate solution. In 1897, he had expressed great hopes in this technique: anything from less pure drinking water to stinking sewage could be made crystal clear, palatable, and free from bacteria. The problem then was that the technique was not developed enough to be applied in full-scale water treatment. By 1902 ozonization had been implemented fully in mainly a few German cities, but still in no Swedish city. Later on in the early 20th century a few smaller towns either came to test the method temporarily or install ozone apparatuses permanently, but it was primarily Germany and Russia that dominated until chlorination entered the stage. Whatever Richert's feelings about ozonization in 1902, he yet thought that untreated groundwater (artificial or natural) or surface water was the best from an esthetic point of view, provided it was otherwise good and hygienically safe. And he had already commended the Norrköping water source (Almquist and Richert 1898 p. 28-32; Hansen 1903 p. 267; Isgård 1998 p. 40).

¹⁷⁶ NSA, Norrköping City Council Archives, minutes 1872-05-30 §6, supplement No. 6 1902, p. 15-20.

investigation of the filtered water. He referred to German technical literature and experience, and concluded that observations in Norrköping and these other examples showed that his single filter was not a hygienic impairment. After all, it could always be complemented by another filter or ozonization. Nevertheless, he described how the filter could be enlarged fairly easily right away, if necessary.¹⁷⁷

This had now become a technological controversy between two engineers with very different actor-networks and therefore unequal power resources. Richert was perhaps the most respected and well-educated water engineer in the country. His scientific knowledge together with his passion for social questions, prestige, and his famous company were his power resources, together with influential connections among physicians, hygienists, engineers, public officials, entrepreneurs, and decision makers in Norrköping, Sweden, and even abroad. Carling, on the other hand, was not so well-known and respected nationally, but had instead a more thorough knowledge of the local conditions in Norrköping than Richert, which he repeatedly mentioned. Apart from his being a good and respected engineer in his home town, this local expert knowledge was enrolled as his ally in the discussion, together with, primarily German, scientific authorities. Nobody, not even the great Richert, knew the local environment and water system as well as he did.¹⁷⁸

Richert had been trained as a working, executive engineer under his father in Göteborg, but in recent years his work had changed in two ways. First of all, he had become more of an academic, through his teaching at the Royal institute of Technology in Stockholm, by writing scientific and technical literature on especially the artificial groundwater technology and related subjects, and as an investigator for various water projects. Furthermore, as the head of a successful consulting company in great demand all over Sweden he probably increasingly relied upon standard, ideal solutions, since it was impossible to have the time to gain knowledge of the local conditions in each city.¹⁷⁹

The Swedish water engineering field was thus as dominated by a few skilled engineers as in the 1860s and 1870s, but the difference now was that there had been a strong indigenous development of knowledge in the field. Swedish water engineering was about to stand on its own feet. At the turn of the

¹⁷⁷ NSA, Norrköping City Council Archives, supplement No. 6 1902, p. 15-20 (quote on p. 18). According to Latour, as a scientific or technological controversy gets more heated the literature also becomes more technical (Latour 1987 p. 21-62).

¹⁷⁸ Ironically enough, in 1894 Richert had to resort to similar arguments when his proposal of sewerage for the lower parts of Göteborg was examined by Dr. Hobrecht of Berlin. In that case Richert was the local engineer who knew the local technology and environment the best, and Hobrecht was the external expert who had to rely more on general principles (Bjur 1988 p. 112-114). Cf. Knaebel 1988 p. 202-203.

¹⁷⁹ Isgård 1998 p. 15-17.

century, there was so much to do that the construction work had to be left to private consulting companies such as VBB and AIB (*Allmänna Ingenjörbyrån*). A number of cities either built their first waterworks and sewers or extended their existing ones, for instance, Stockholm, Göteborg, Norrköping, Linköping, and Kalmar.¹⁸⁰

There were also competent local, municipal engineers (*kommunaltekniker*) with higher education and good knowledge of how to construct, develop, and run public works in the cities. Wilgott Carling in Norrköping and Johan Bernhard Carlsson in Linköping were two of these, and in 1902 the municipal engineers joined together to form the first national association, *Svenska kommunaltekniska föreningen* (SKTF). It also included some of the private consulting engineers such as Richert, although they also formed an own organization in 1910. Both Richert (secretary) and Carling (deputy) served on the SKTF board. In SKTF, therefore, the municipal engineers met the nationally well-known and more influential engineers, which must have led both to interesting cooperation concerning technical standards, but also to a clash of culture and interests.¹⁸¹

New engineers with higher education in general were connected to the Swedish Association of Engineers (*Svenska teknologföreningen*) and its journal *Teknisk tidskrift*. This new elite had its own views on how the newly-industrialized Swedish society should be organized, namely through reforming state administration, politics, and industry with the engineers' help. However, at this time there were also disagreements between engineers rooted in municipal or state administration, who were of the view that the engineer should be an impartial actor, and engineers in industry, who had taken sides as to how to go about the modernization of Swedish society. The consulting engineers were somewhere in between, and Richert was one of those who tried to balance engineering, industrial, and state interests.¹⁸²

The Financial Department and the Drafting Committee agreed that Carling's proposal, including a slightly enlarged filter, was the best, but Richert wanted to have another say. The issue was not really whether Richert's proposal was good or not from a technical standpoint, but he still must have felt humiliated and set aside when the city of Norrköping did not pick his original version.¹⁸³

¹⁸⁰ Bjur 1988 p. 85-87, 122-147; Hörberg 1998 p. 25-52; Isgård 1998 p. 41-45.

¹⁸¹ VAV, Documents of Svenska Kommunaltekniska föreningen, 1902 and 1903; Sundin 1991 p. 250.

¹⁸² Jakobsson 1996 p. 70-74, 105, 251-259; Sundin 1991 p. 247-256. Cf. Hansen 1917.

¹⁸³ Carling's proposal was based on Richert's, but since the former altered all the important parts of the water supply – the pumping station, the filters, the reservoir(s), and parts of the pipe network – one can understand if Richert felt that it was not "his" plan anymore.

He also had economic interests in the issue through his consulting firm. So he wanted a neutral examination of his and Carling's proposals from three external water-engineering experts. He tipped the city about a good water engineer that it could turn to – the chief engineer of the Stockholm Waterworks and Captain of the Royal Corps of Engineers Fredrik Vilhelm Hansen. The connections between Richert and Hansen must have been all too obvious to the City Council. In connection with the development of Swedish hydro-power, they were both part of a small influential actor-network of engineers and public officials, and they also participated in the SKTF actor-network. Instead, it was decided that there was to be only one evaluating expert, and the Major of the Corps Per Axel Lindahl was chosen. While Richert did not have his way completely, it is yet interesting that he could convince the city to reconsider his proposal. He was apparently a powerful actor in the field of water engineering at the time.¹⁸⁴

Lindahl found that what really distinguished the two proposals from one another were different economic priorities, which were not always even comparable. So he first attempted to evaluate each of the proposals on the basis of its own assumptions, and then compared them according to a common price index. The economic difference turned out not to be so great (only around 50,000 kronor, to Carling's disadvantage), but that did not automatically mean that he preferred Richert's, although his enlargement of the pumping station was favored. Carling's technical solutions were sometimes considered the best, and Lindahl even contributed with his own technical expertise. Lindahl's job here was not to choose any one of them, but to point to advantages and disadvantages of both Richert's and Carling's proposals, and it seems that he performed this task impartially.¹⁸⁵

The Financial Department, which only commented on the economic side of the issue, did not take a stand but just simply approved the slightly increased costs in either case. The Drafting Committee, however, thought that Lindahl's examination had fundamentally altered the whole issue, and had tipped the scales in favor of Richert: “. . . Major Lindahl . . . rather decidedly recommends the approval of engineer Richert's proposal concerning such principal components of the water supply as the pumping station and the reservoir . . .”. After some calculating, the committee also found the financial differences between the systems virtually negligible. Therefore it was of the view that the extension of Norrköping's water supply should be carried out according to the proposal of Johan Gustaf Richert, except for minor improvements recommended by Carling (for instance, the filter construction in his proposal) and

¹⁸⁴ NSA, Norrköping City Council Archives, minutes 1902-02-27 §6 and 1902-03-25 §3, supplements No. 6, p. 22-26, and No. 22 1902; Jakobsson 1996 p. 102-109, 251-259.

¹⁸⁵ NSA, Norrköping City Council Archives, supplement No. 62 1902, p. 1-9.

Lindahl, which was also what the City Council resolved. Around 400,000 out of the 550,000 kronor for the extension was to be covered by a loan, which had to be approved by *Kungl. Maj:t*.¹⁸⁶

The Drafting Committee consequently made a complete turnaround from February, when it supported Carling, to May, when Richert all of a sudden was favored. Looking from today's perspective, the committee seems to have over-interpreted the report by Lindahl, for he did not take a clear stand for Richert, but tried to stay as neutral as possible. What caused this complete change of opinion? Obviously, neither of the two proposals had changed since then, and Lindahl did not favor either of them. Of course, the pumping station was the "heart" of the water supply and Richert's proposal was maybe the best in this regard, but this need not mean an exclusion of Carling on all the other points. If we look at who was the chairman and deputy chairman at the meetings in February and May, we find that at the former meeting it was Eric Ringman and C. J. Andersson and at the latter Ringman and Carl Swartz. Swartz was a good friend of Richert's, which may have influenced this turnaround, but we cannot know with certainty. At any rate, Richert's actor-network and power resources proved stronger, whether it was his technical competence, influential connections, or something else that tipped the scales in his favor.¹⁸⁷

The extension work started the very same year, 1902, but met with opposition almost immediately. For the building of the new slow sand filters and the low reservoir, the city wanted to buy more land at Borg. This was not only a question of the space required for building, but also for preventing contamination from the nearby company Borgs säteri. The city even sought to prevent any future industrial activities or housing areas in close proximity to the filters, for the same reason. Borgs säteri could conceivably sell this piece of land, but only at a high price, which caused the city to invoke national expropriation legislation (much as the city of Linköping did in 1879, see Chapter Two). Not surprisingly, the company resisted and countered the arguments of the danger of contamination from their property. The Swedish Government, *Kungl. Maj:t*, based its opinion on those of the County Governor and the Swedish Civil Engineering Authority (*Väg- och vattenbyggnadsstyrelsen*). Norrköping was given the right to expropriate in 1904, not on the grounds

¹⁸⁶ NSA, Norrköping City Council Archives, minutes 1902-04-21 §3, 1902-05-29 §13, and 1902-05-29 §19, supplements No. 56 and 62 1902, p. 9-12 (quote on p. 10); Account of City Council meeting 1902-05-29 §13, NT 1902-05-30.

¹⁸⁷ NSA, Norrköping City Council Archives, supplement No. 6 and 62 1902.

that they needed the space, but in order to avoid potential contamination from nearby housing areas in the growing suburb Borgs villastad.¹⁸⁸

The work progressed and in 1906 much of the extension was finished, but some things had still to be completed. There were also further additions that Carling thought had to be made. Carling was commissioned to add minor improvements from his original proposal, but it was never stipulated exactly *what* improvements. It was supposedly up to him to decide, for he was the chief executive engineer of the extension, so he both made improvements from his counter proposal (for instance, thicker pipes in some places) and new additions, such as a sewer from the water tower. There were as yet some streets left where new pipes had to be exchanged for older ones, both pipes proposed by Richert and pipes to replace those that Carling thought would not withstand the higher water pressure. It was also necessary to complement the steam engine with two new steam boilers. (The one from 1891 had proven unreliable.) All in all, the delays involved due to the expropriation at Borg and other obstructions, as well as improvements and additions, had made the project around 100,000 kronor more expensive.¹⁸⁹

The whole extended and improved water supply was complete in the summer of 1907, and it was also then inspected by F. V. Hansen. The only entirely new component of the system was the water tower, which was given the most attention in the inspection. The water tower was of a rather new construction it seems: a sheet-metal tank inside a tower of brick work. Carling had already checked the reliability of the construction with some experts in Germany, Professor Barkhausen in Hannover and Chief Engineer Scheuss of the F. A. Neumann factory in Eschweiler, as well as German handbooks. Yet Hansen calculated and checked the construction all over again, and found that it was solid.¹⁹⁰

So was the new reservoir for the low zone, which was placed close to the waterworks at Borg, and the new pumping station. The two new filters were deemed to be of a good construction on the whole, but due to the increasing water consumption, it was recommended that the third one, which had been postponed for the time being, should be built as soon as possible, according to

¹⁸⁸ NSA, Norrköping City Council Archives, minutes 1902-10-23 §6, 1903-03-02 §11, 1904-06-09 §5, and 1904-10-27 §2, supplements No. 90 1902, No. 24 1903, and No. 44 and 82 1904. According to the King's ordinance about the relinquishing of land or buildings for public need of 1866-04-14, a city could appeal to *Kunzgl. Maj:t*, the Swedish Government, for such a permission.

¹⁸⁹ NSA, Norrköping City Council Archives, minutes 1906-05-25 §16, supplement No. 70 1906.

¹⁹⁰ NSA, Norrköping City Council Archives, minutes 1907-03-26 §3 and 1907-09-26 §20, supplement No. 93 1907.

Hansen.¹⁹¹ Carling made some changes in the pipe network, which Hansen had nothing against, and the water pressure was also judged to be satisfactory.¹⁹²

When in 1908 Wilgott Carling summed up the past decade of work with the extension of the water supply, we see a slightly different picture than in Richert's proposal, which was really the extension of a water system as an ideal. As we have already seen, the practical implementation of the proposal in the local context meant dealing with unforeseen economic, technical, legal, and environmental problems. Due to the legal dispute about the adjoining land at Borg, the low reservoir was also postponed, and it finally had to be moved to a more geologically difficult place, which required blasting into rock. The brickwork of the water tower caused financial concern, and a new architect was hired as well (W. Northun).¹⁹³

Due to the extremely low water pressure around the turn of the century, many water mains were exchanged for new ones then and in the years to come, and after a fire raged in Saltängen (the northeast district), the water system was extended geographically there. Some of these were part of Richert's plan and some not, so the pipe network was gradually renewed simultaneously with the implementation of the plan. In all, almost 20 kilometers of pipe were laid between 1899 and 1907. This happened more in response to local needs and conditions than to Richert's grand engineering plan. Carling was the mastermind behind it, and thus in a way had the last word regarding the pipe network but also, to some extent, concerning the rest of the project. In theory he built largely according to Richert's plan, but in reality his influence on the whole project was substantial, and the water system came to include several of his own improvements and constructions.¹⁹⁴

¹⁹¹ This third slow filter, originally proposed by Richert, was built in 1908-1909 (NSA, Norrköping City Council Archives, minutes 1908-05-14 §14, supplement No. 58 1908; Account of the City Council meeting 1908-05-14 §14, *NT* 1908-05-15).

¹⁹² NSA, Norrköping City Council Archives, minutes 1907-03-26 §3 and 1907-09-26 §20, supplement No. 93 1907.

¹⁹³ NSA, Norrköping City Council Archives, minutes 1908-05-14 §8, supplement No. 51 1908. The pipes for the project were delivered by, for example, Hannoversche Giesserei, Hannover, and Friedrich Wilhelms Hütte, Mühlheim a.d. Ruhr in Germany. The concrete constructions of the new filters and the low reservoir were made by the Swedish Skånska Cementgjuteriet (present-day Skanska), and the sheet-metal tank in the water tower was built by the local engineering workshop Mekaniska Verkstaden Vulcan.

¹⁹⁴ NSA, Norrköping City Council Archives, minutes 1908-05-14 §8, supplement No. 51 1908; Porter 1998.



The first Norrköping water tower, completed in 1907 (Source: Östman, Malmberg, and Liander 1945).

One supposedly unexpected result of the new improved water system was that water consumption increased dramatically. The high consumption was ascribed to an increased water pressure and flow in the taps, as well as to sheer waste of water, which had existed before but had become even worse, according to some. Richert also attributed it to leaking pipes. 162 liters per person and day was a larger consumption than ever before, and the Drafting Committee was of the opinion that the normal amount would be around 60 liters and that any consumption above that should be subject to a fee. Luckily for the committee, the question of annulling von Leesen's donation conditions of free household water had already been taken up by Edward Ringborg earlier in 1908. His arguments were mainly economic, for he saw water fees as a way of improving the city's finances, but he also wanted to do something about the waste of piped water. In his view, to get water fees from only 25 percent of the total water production (1906) was not good economics, and he suggested an investigation of the possibility of an annulment. He did not want to altogether revoke free household water for workers and poor, so smaller apartments could get a reduced fee.¹⁹⁵

¹⁹⁵ NSA, Norrköping City Council Archives, minutes 1908-01-23 §15, supplements No. 58 1908 and No. 149 1912, p. 1-4; *NT* 1908-05-15. Edward Ringborg's father Gustaf had been one of the four city accountants who in 1877 scrutinized the finances of the newly-built waterworks (see above). Like Edward, they thought that the water supply more explicitly should be used to strengthen the city's finances and support its industry. But in contrast to the 1908 case, the

The investigation showed that the water consumption in Norrköping was indeed excessive compared to other Swedish cities. (Linköping was not far behind, however.) It was also comparable to the mean consumption in German cities without metering. The main reason for this extravagance was the free and unmonitored distribution of household water, according to the investigation. The best way to remedy this was to install meters in each house (not in each apartment, for that could lead to an unhealthily thrifty use), which was also confirmed by such installations in other cities. 60 liters per person and day was considered an ample supply, and the idea was that anything over this should be charged with the usual industrial fee (0.20 kronor per 1,000 liters). The intended result of the donor's conditions was to avoid a situation where poor tenants or landlords had to lower their consumption to an unhygienic level, but instead there had been an ever-increasing waste of water with resulting expansions of the waterworks. The proposed solution was seen as a perfect compromise – the donor's intentions would still be satisfied, while the drawbacks would be avoided. Jacob's grandson, James von Leesen, the sole rightful heir, had also given his consent.¹⁹⁶

There would not be any direct economic advantages of the solution advocated by the investigation, since, if people really did not consume more than their allotted share, the income for the waterworks would be the same as before. But indirect financial advantages were pointed to, for instance, not having to extend the waterworks again soon, as well as technical and economic control over the water supply. In a manner typical of classical economics, the fact that almost 1.5 million cubic meters of water would be saved annually was not seen as an economic advantage or of any value in itself.¹⁹⁷

Both the Financial Department and the Drafting Committee liked the solution, apart from Alfred Haglund, a member of the latter. He opposed it on the grounds that it would not be an economic boost to the city's finances, and the donor's wishes should in any case be respected. Furthermore, Wilgott Carling had already made improvements in the water system to decrease the consumption. In 1911, Carling had been commissioned to introduce a low zone (old reservoir) and high zone (water tower) in the distribution network, which was originally included in his adjustment of Richert's proposal ten years before. In late 1912 this had just been carried out, so no one knew for sure what the outcome would be, but Carling estimated a decrease in water

accountants were still limited by the conditions of the then quite recent donation, and instead focused on enhancing the industrial use of water and thereby increasing the city's income from the water (Norrköping Waterworks Board Archives, minutes 1877-07-28 §2).

¹⁹⁶ NSA, Norrköping City Council Archives, supplement No. 149 1912, p. 4-18. For ideas on ample water supply related to health, also see Leijonancker 1853.

¹⁹⁷ NSA, Norrköping City Council Archives, supplement No. 149 1912, p. 4-16.

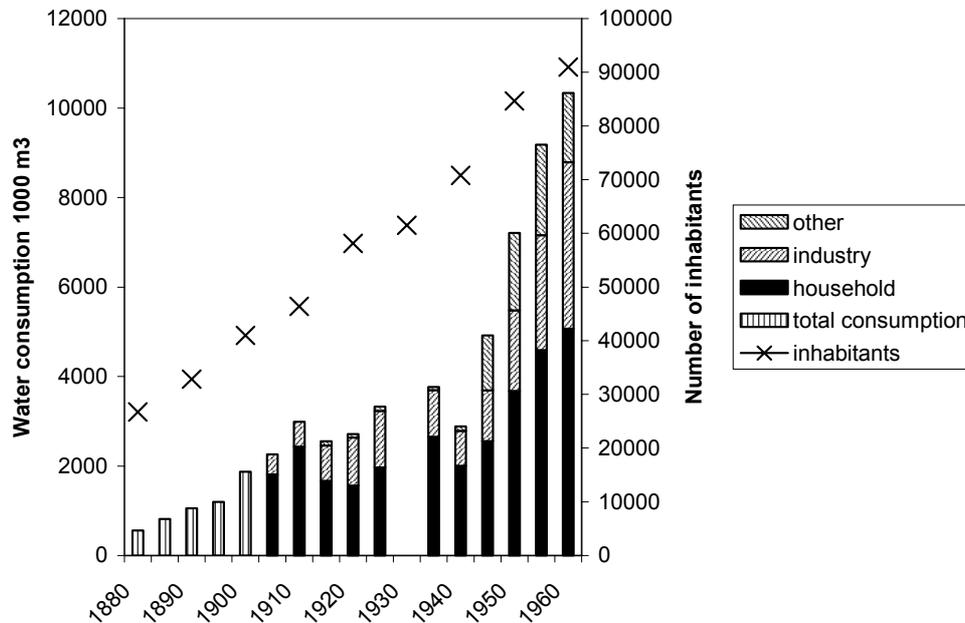
consumption with 11.5 percent due to lower pressure, with a corresponding smaller economic gain. At the same time, in case of a fire it was possible to switch back to high zone only in 10 to 15 minutes.¹⁹⁸

When the issue of the donation and the water fees was dealt with by the City Council in late 1912 there was a heated debate that eventually led to the tabling of the topic altogether. In 1921, the Swedish government finally annulled von Leesen's donation conditions, but the issue continued to be a hot potato in Norrköping until the mid-1930s. The necessity of a fee for household consumption was agreed upon, but house owners resisted the metering of each house. They feared that this would be a great disadvantage for the house owners, who would pay the fee in the end. The metering of each apartment, or rather a fixed fee for each room (like in late-19th century Linköping) would be more fair, in their view. However, metering of each house was made compulsory for all users in 1935, and it was applied fully from 1937 onward. As can be seen in Figure 1.3, however, the increasing water consumption was only temporarily halted.¹⁹⁹

¹⁹⁸ NSA, Norrköping City Council Archives, minutes 1911-10-12 §7, supplement No. 106 1911 and No. 149 1912, p. 18-21; Account of the City Council meeting 1911-10-12 §7, *NT* 1911-10-13.

¹⁹⁹ NSA, Norrköping City Council Archives, minutes 1912-12-19 §8, 1921-09-15 §16, 1935-05-16 §6, and 1935-12-19 §19, supplement No. 57 1935; Östman, Malmberg, and Liander 1945 p. 34-36.

Figure 1.3. Annual household, industrial, and other water consumption in Norrköping, 1880-1960, related to population figures.



Until 1900 there are only figures for the total water consumption, and the consumption figure for 1930 is missing. The population figures are given for every ten years (Source: NSA, Norrköping City Council Archives, annual reports of the Waterworks Board and the Financial Department for 1880 to 1925; Statistisk årsbok för Norrköpings stad, 1938-1970; Historisk statistik för Sverige. Del 1. Befolkning 1720-1967 1969 p. 61-65).

Conclusion

In the 1870s, the most respected water engineer of the day, J. G. Richert, was hired to construct modern, piped water and sewer systems in Norrköping, instead of the previous candidate, F. W. Leijonancker. The bourgeois elite enrolled in the actor-network for piped water and sewerage saw piped water as something very attractive, even financially profitable. Especially textile, paper, and sugar manufacturers had interests in soft *and* pure water, but they often had their own water intakes since long, and consumed too much for a waterworks to cope with and for them to be willing to pay the water fees. However, a municipal waterworks could supply potable water to the residents, many of whom worked in the factories. The industries could also

continue polluting the river, which was for them economical waste management. Piped water was also to boost the cities' finances, as well as the private finances of companies and building owners, for example, in offering free water and ensuring lowered fire-insurance fees. Furthermore, a pipe-bound water system would lead to a safer urban environment, by modernizing fire defense. Together with the economic depression, the cholera epidemic of 1866 initially shocked the ongoing discussion of water. Prevalent disease etiology prevented the city fathers from seeing the relation between a poor water supply and cholera.

In Norrköping it was evident that sewerage was not as attractive as water, for it was decided to build it at the eleventh hour. Wastewater was probably built mainly for sanitary reasons, but only after Richert had pointed out the advantages. There were no serious problems of waterlogging in the central parts of Norrköping, or rather where the bourgeois elite lived, which is also why the cholera epidemic was not an immediate driving force in this regard. Due to the attraction of particularly water the actor-network was easily enrolled, and it therefore became strong and easily defined. It is also likely that Johan Gustaf and Erik Swartz and Jacob von Leesen in particular had been working actively for piped water even before there were any official records, thereby facilitating the official political process.

There was little or no resistance to the water supply and sewerage projects, because it was the financially and politically powerful people that enlisted and were enlisted. Water vendors, for instance, were too few and too powerless to have a say in the matter. There is a chance that there were protests from less well-off house owners, who would not have been able to pay for service pipes, but these were enrolled through the free supply of water for household use. Von Schwerin, who was a true representative of the old land-owning aristocracy and no friend of industrial development, could finally be bought with water.

The durability of the actor-network for piped water and sewerage practically lasted as long as the water project itself, that is, until construction of the systems was completed, and administration was subsequently taken over by the Norrköping Waterworks Board. In the years to come there continued to be bigger or smaller technological projects, but the actor-networks were not always distinguishable, for a number of reasons. First of all, several of the projects were too small to cause any political concern at all. Secondly, there was a growing institutionalization of the water and sewerage services through the Waterworks Board. When these services were thus more and more incorporated into the other municipal administration, the conflicts lessened and hence also the enlistment of actor-networks.

CHAPTER 2

Administering Water and Wastewater in Linköping

Traditional Water Supply and Drainage

Linköping had not been often ravaged by big fires, despite being a town largely made up of small wooden houses. The most important conflagration, the great fire of 1700, had been devastating enough. Sanitary conditions, on the other hand, had been a constant problem since at least the 18th century, and the topography of the city was especially unfavorable for adequate drainage. Underground veins and the sloping topography resulted in seasonally waterlogged places in the central parts of the town.¹ Limited water sources, mainly the vulnerable river Stångån and dug wells, were also noted by the inhabitants and the local authorities.² Linköping thus had quite a different history than Norrköping as regards sanitary, environmental, and settlement conditions, and perhaps the high number of wells may account for the few major fires. Up to the mid-19th century, the inhabitants of Linköping took their water from the wells or directly from Stångån. Water vendors existed and continued their activity even some years after the introduction of piped water.

The importance of the wells is well documented, especially through archaeological findings in recent decades. As early as the Middle Ages Linköping had a number of wells lined with wood or stone, some of which were in use until the 19th century. A majority of the wells were connected to the underground water veins, which run from the highest points in the western part of the city down to the river, and Lake Roxen to the north.³ The wells were located either in private yards, or in public places such as Stora torget (the main square), just outside S:t Lars Church, or near the residence of the

¹ These places will be referred to below as waterlogged or marshy, both in the text and in different figures. However, they were not completely waterlogged, nor were they so all the year round, since these areas were built and frequented. Nonetheless, they constituted a serious sanitary and environmental problem in mid-19th century Linköping.

² Lindberg 1976 p. 36-40, 95-103; Nilsson 1994 p. 141, 148; *Vattenförsörjningen i Linköping* 1968 p. 5-8.

³ *Vattenförsörjningen i Linköping* 1968 p. 5-8.

bishop (Skolkällan). There were also wells outside the actual city, for example, Djurgårdskällan and Örkällan to the south.⁴

Water was drawn from the river in many different places along the western bank, but the most frequented public pumps were situated just beneath Nygatan. A public water pier had previously been located further downstream, by the street Ågatan, but due to increasing contamination it had been moved upstream to Nygatan in 1817. However, in the 1860s and early 1870s Ågatan was still in use together with several other spots for fetching water that were located downstream of potential sources of contamination, such as tanneries, slaughter houses, and the gasworks. Wastewater from overflowing latrine pits also ran through gutters and ditches down to the river. The groundwater was contaminated by all these forms of filth.⁵

The question then arises as to what water was the best, or rather the least poor, for drinking, cooking, washing, hygienic and other purposes – the groundwater or river water? As early as the mid-18th century, a well-known architect, Carl Hårleman, and the provincial doctor Johan Otto Hagström both concluded that the best drinking water was to be found in the river and not in the wells, even though, for example, tanneries dumped their waste into the river. The general contamination levels were probably rather high even at that time, despite the fact that Linköping only had around 1,800 inhabitants.⁶ In 1869, the physician and chemist Axel Wimmerstedt analyzed four different water sources in Linköping, and concluded that either the water in the river at Tannefors waterfalls, upstream the city, or the well Djurgårdskällan was the best. (This well was located outside the built-up area.) The well Skolkällan, which was quite central, was considered the worst of them all.⁷ Generally speaking, in spite of substantial pollution the river was still regarded as the best source of household water, an assessment very likely based not only on practical experience but also on the common understanding that running water purifies itself.⁸

⁴ Nilsson 1994 p. 146-147; *Förslag till vattenledning och dränering i Linköping (FTVD) [Proposal for Piped Water Supply and Drainage in Linköping]* (Linköping 1870), p. 6; Lindberg 1976 p. 36-37.

⁵ Lindberg 1976 p. 37-40; Sandberg 1978 p. 273-274; ÖC 1872-02-03; Nilsson 1994 p. 146-147.

⁶ Lindberg 1976 p. 12, 37.

⁷ FTVD p. 6-9. The four analyzed water sources were the river Stångån at Tannefors, Djurgårdskällan (well), Örkällan (well) and Skolkällan (well).

⁸ Corbin 1986 (1982) p. 32-33; Tarr 1996 p. 120-121. The analysis from 1869 is perhaps not the best one for comparing the degree of contamination of different water sources in the city at the time, since Tannefors is situated southeast of and upstream the city. However, the argument that the running river water in the city was better off than that in the wells is supported even by present-day water chemists. For instance, Allan Hansson, chief water chemist at the sewage treatment plant in Linköping, is of the same opinion (Personal communication, 1999-04-20). The

The First Plans for Piped Water Supply

At the beginning of the 1830s, the first cholera pandemic swept across Europe, and it became compulsory for each city in Sweden to establish a local health board, apart from quarantine and other regulations. The health board, *Sundhetsnämnd*, became permanent in the 1857 epidemic regulations.⁹ As early as 1831, a local health board was formed in Linköping. In 1834, the inhabitants of the city guarded its main entrances so as to prevent potentially infected visitors from entering the town. Perhaps due to this and other quarantine measures, the effects of the cholera epidemic were mitigated. Some 20 people turned sick, 10 of whom died.¹⁰ Similar measures were taken when cholera threatened the city again in 1850 and 1853, but no inhabitant died during these epidemics.¹¹

The first proposal for a general piped water supply for Linköping was made one year after the 1853 cholera epidemic. In 1854, a committee with the mayor as chairman was appointed to allocate the costs for maintaining the city streets. The land-surveyor F. H. Schött suggested that the committee also investigate the possibility of building a piped water supply from Örkällan in the rural Slaka parish, to get good drinking water. Another cholera outbreak took place in 1857, while the committee was working, but it was not considered very grave: seven people died. The committee submitted its proposal in 1858, but did not even mention the water supply. Schött allegedly drew up a plan for a water system himself, but obviously nothing resulted from it. Maybe the costs involved for piped water were regarded as too high a price to pay.¹² Although it is doubtful that these cholera epidemics were related to contaminated water by the residents, they presumably constituted one factor that contributed to a deeper concern for public health issues in Linköping around the mid-19th century.

In 1866 cholera struck Linköping severely, although it came as no surprise and had been successfully contained earlier. Great efforts were made to stop the epidemic from spreading, and according to the city physician Per Reinhold Bergman the keywords for this campaign were “order, cleanliness and watchfulness.” The *Sundhetsnämnd* took an active part, and all available physicians were engaged. The war against cholera was fought by preventive measures, such as the removal of dung and the cleaning of ditches and gutters, as decreed in the newly-established general regulations. Many people were fined for failure

Board of Health considered the well and river water of equally poor quality, however (LiSA, Linköping Board of Health Archives, AI:1, annual report of the Board of Health for 1875).

⁹ Nelson and Rogers 1994 p. 21.

¹⁰ Lindberg 1976 p. 41-42.

¹¹ Nilsson 1994 p. 112-113.

¹² Lindberg 1976 p. 40-42; *FTVD* p. 13-14.

to observe these regulations during 1866 and 1867.¹³ It was also fought by means of active medical measures, such as by different forms of opium or salt-solution treatments. In the end, out of more than 400 sick people, 216 died.¹⁴

Hans Nilsson has studied the 1866 epidemic in detail, and according to him the areas where it started and had its greatest impact were the marshy areas that the proponents of drainage and water later wanted to drain. The *Sundhetsnämnd* was of the opinion that water supply, and to an even greater degree drainage, would protect the city from cholera and improve sanitary conditions. In Nilsson's view, the 1866 cholera epidemic was an alarm clock, and undoubtedly an, if not *the*, incentive to do something about the water question.¹⁵ On the Continent and in other Swedish cities, the cholera epidemics of the early and mid-19th century had been alarm clocks for deficient urban sanitary conditions. In Paris, for instance, the sewer system was enlarged after the epidemic of 1832 (see also Introduction).¹⁶

According to the mayor of Linköping at the time, Fredrik Stånggren, there was a general realization of the advantages of water supply and drainage after the cholera epidemic in the fall of 1866. Stockholm had coped with the epidemic quite well, in his view, due to the sanitary advantages of its piped water supply.¹⁷ In early 1867, the postmaster Bengt Carl Bergman asked the City Council to take action for the removal of stagnant water from yards and gutters, since it "spread exhalations that were greatly noxious and harmful to health." A few months later, Stånggren suggested that a more thorough investigation of this matter be made, and the City Council decided that an expert should be employed.¹⁸

¹³ VaLa, Archives of the Linköping Council of Magistrates, AV:4, see for instance minutes 1867-01-07 No. 5, 1867-03-07 No. 58, 1867-04-04 No. 85, 1867-04-25 No. 108, as well as inspection of cesspits from 1867-03-20.

¹⁴ Nilsson 1994 p. 118-120; Sandberg 1978 p. 276-277.

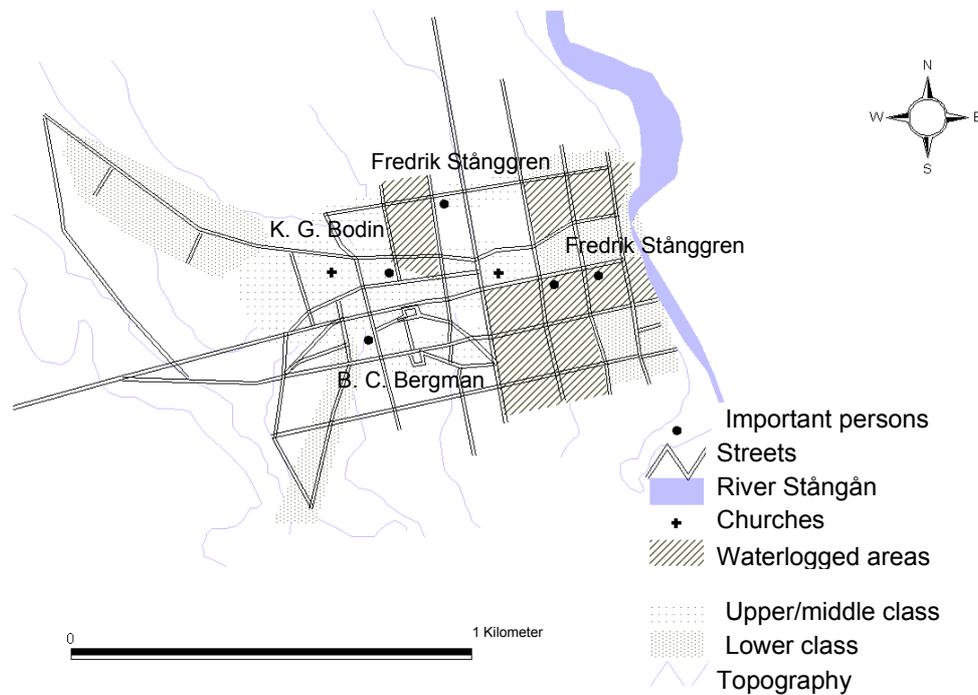
¹⁵ Nilsson 1994 p. 118, 147-149.

¹⁶ Barles 2000 p. 3-4. Cf., Bjur 1988 p. 37-46.

¹⁷ FTVD p. 14.

¹⁸ LiSA, Linköping City Council Archives, AI:5, minutes 1867-04-12 §51 and 1867-06-15 §78; Lundberg and Nordström 1962 p. 179.

Figure 2.1. GIS view of where persons important for initiating the water and sewerage question lived in the late 1860s, related to a typology of the social topography and the waterlogged areas.



Stånggren and Bodin were directly affected by the waterlogged topography. Stånggren moved twice during these years, hence his three dots (Source: Schmid and Hallström 2001).

In the miasmatic paradigm epidemics were thought to breed in contaminated air and soil, as well as in stagnant water. Therefore drainage of the seasonally waterlogged central areas was essential. These areas were inhabited by the bourgeois and aristocratic elite to a higher degree than in Norrköping, which may be a reason why the sanitary conditions were considered so serious in Linköping.¹⁹ The prosperous civil servants, merchants, and craftsmen of Linköping could not escape squalid conditions, while their counterparts in Norrköping inhabited better areas and also often had summer houses outside the city (cf. Figure 1.2 and 2.1).²⁰ Considering the development in Norrköping, however, it is likely that it was not only the sanitary situation in the city that

¹⁹ NSA, Norrköping City Council Archives, minutes 1892-09-24 §6, supplement 1892 No. 53; Account of the City Council meeting 1892-09-24 §6, NT 1892-09-26.

²⁰ Nilsson 1999 p. 85-86.

prompted Stånggren to take action. He presumably had to enroll interests other than public health in order to shape his actor-network.

Fredrik Stånggren thus began to pull the strings of an actor-network for a drainage *and* water project. This was not something out of the ordinary, for Stånggren was at this time beginning to dominate the political scene in Linköping. He was one of the most powerful persons in Linköping at the end of the 19th and beginning of the 20th century. As mayor, he was a member of the Council of Magistrates and had many other important municipal functions, including chairman of the Board of Health and the Building Board. He also frequently participated in the meetings of the City Council, although he was not formally a member. From 1891 to 1893 Stånggren was a member of the Swedish Parliament.²¹



Fredrik Stånggren (Source: Hagård 1978).

Commissioned by the Magistrates, the civil engineer and city builder Henrik Elfving made some preparatory investigations and carried out a study tour in Sweden, to Karlskrona, Jönköping, and Lund. He subsequently suggested that both water supply and sewerage should be built in Linköping. The solution of the drainage problems was left to the sanitary engineer C. H. Schlüschen from Lund, and his proposal included the drainage of groundwater from the waterlogged areas of the city. The chief engineer of the Karlskrona waterworks and officer in the Royal Corps of Engineers, Abraham Blix, was commissioned to construct the water supply.²²

²¹ Hagård 1978 p. 242-267; *Linköpings byggnadsnämnd 100 år, 1875-1975* 1975 p. 64.

Unfortunately, not very much is known about Fredrik Stånggren's life. No biographies or other information exist, and one is almost tempted to draw the conclusion that he did not want to be remembered by posterity for anything else than his political achievements.

²² *FTVD* p. 14, 30-36; Nilsson 1994 p. 148; Elfström 2001 p. 112-114.

Fredrik Stånggren's Presentation and the Approved Proposals

In early 1870, Stånggren presented Schlüschen's and Blix's proposals along with an introduction from his own pen in a neatly-printed booklet, the purpose of which was to promote piped water supply and drainage in Linköping.²³ Apart from the proposals, he enlisted many of the ideas of the time on water supply, interwoven with his own arguments. The booklet preceded its counterparts in Norrköping, notably the booklet on water supply for Norrköping that Erik Swartz had printed in 1871, and the report of the fire-protection board in 1872. The content was similar to that in the water-engineering manifesto that *Norrköpings Tidningar* published in 1866, and long excerpts from both Leijonancker's 1853 proposal and Richert's 1869 book were quoted.²⁴

Stånggren's presentation is a textbook example of all the ideas of the advantages of water and sewerage technologies that were common at the time. Just as in Norrköping, many of these ideas were taken up in support of these technologies on a more general level. To publicly justify such great economic investments, it was necessary for Stånggren to inform everyone in the city of as many advantages of these modern technological systems as possible.

According to Stånggren, there were two important questions that attracted municipal attention in Sweden at the time, namely the improvement of urban sanitary conditions and fire protection. That the outcome of these discussions would markedly affect the future development of the cities was only natural, since the neglect of the health and property of the inhabitants would lead to uncertainty and discomfort: "The lack of fresh air and of healthy dwellings as well as of a pure and good drinking water and of easily available and fast, effective fire-extinguishing, therefore cannot be deprecated enough."²⁵ To make his point, he referred to Swedish cities – Stockholm, Karlskrona, Jönköping, and Göteborg – that recently had taken advantage of "the innovations and improvements of the age." The fact that several cities had already built water and sewer systems proved that "through experience confirmation had been achieved of their great benefit and wholesome effect."²⁶

The most recent five years of the city's history showed the importance of good sanitation and fire-protection, in Stånggren's opinion. The cholera

²³ FTVD.

²⁴ LiSA, Linköping City Council Archives, AI:8, minutes 1870-05-06 §46; FTVD; HRFOW; NSA, Norrköping City Council Archives, AI a:10, supplement No. 2 1872; NT 1866-01-25, 1866-01-27 and 1866-01-30; Leijonancker 1853; Richert 1869.

²⁵ FTVD p. 3.

²⁶ FTVD p. 3.

outbreak of 1866, which afflicted the city severely, even caused large costs, as well as greater subsidies to poor relief. It was clear to him that water and sewerage would have been “capable of mellowing the character of the disease as well as preventing its violent advance.”²⁷ Furthermore, the inhabitants of the city who held interests in insurance companies had lost substantial amounts of money on fire indemnities the past few years, notably for the great fire of the town of Gävle in the north. Now insurance companies offered up to 25 percent reduction on insurance fees for buildings and personal property, if a complete piped water system with fire hydrants was installed in a city. Stånggren estimated that the construction costs for such a water supply would about equal the fire indemnities for Gävle, or the above reduction on insurance fees.²⁸

The argumentation by Stånggren also reveals that water was viewed as a drink, and a piped system as a means of transporting and supplying this. Consequently, in his view, the inhabitants of the city should have an interest in the establishment of a joint-stock company, due to the poor quality of the existing drinking water. When in Linköping and most other cities malt liquor was delivered through private companies, he reasoned, it should be possible to establish a company in Linköping for the distribution of “pure, fresh, and good water, whose salutary influence on human health . . . is indisputable.” There could be no doubt in his mind that a water supply would not only pay its way but also yield a good return.²⁹

Stånggren enlisted improved sanitary conditions and fire protection in his argumentation, particularly the former, but there was also an economic argument embedded in these, notably decreased costs for poor relief and fire insurance. The financial argument was carried even further, for water supply and sewerage were seen as a business that could yield a surplus in the hopes of enrolling the merchants, businessmen, artisans, and all other presumptive shareholders. Finally, there was the argument of civic pride and Linköping’s future development as a city. In local policy making, the question of water

²⁷ *FTVD* p. 43.

²⁸ *FTVD* p. 43-44.

²⁹ *FTVD* p. 41-47 (quotation on p. 46). The sale of alcohol in Linköping was administered by a private company, which relinquished its profits to public purposes in exchange for a total monopoly in the city. Not surprisingly, the business was so good that the municipal taxes could be kept low for many years, and order was restored in the most troublesome pubs as well. In 1870 the profit constituted 20 percent of the town’s total revenues (see Appendix 2, Table 3). In late 1870, the alcohol distribution was reorganized and 19 members of the City Council made up the private liquor company of the city, but on the same conditions as before. The shareholders were said to grant themselves exorbitant salaries (Hellström 1978b p. 173-174; Hagård 1978 p. 261; LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-27 §114). In Jönköping, proceeds from the liquor company had paid almost half the cost of the water system, according to Stånggren (*FTVD* p. 29).

supply and drainage thus concerned much more than improved health and environment; these other arguments were necessary to enlist shareholders as part of a profitable actor-network. Even though Stånggren did not mention it, the question of economy and civic pride was integrated with commercial and industrial development. Admittedly, Linköping was definitely no industrial city during the period of investigation, but the ambition was probably there, especially to promote the few manufactures and businesses that existed.

Abraham Blix's water system was designed to transport water from upstream the river Stångån, and the waterworks was to be located at Tannefors, a few kilometers southeast of Linköping. Blix preferred the river water to the well water, mainly because the wells would be insufficient as regards the quantity. He also considered the quality of the river water better. The water would run in a chute from upstream the locks at Tannefors to the slow sand filters, and from there be pumped by water-turbine power (used about 10 hours a day) to the reservoir on Kanberget, west of the actual city center (see Figure 2.2). A smaller system for the central built-up area was suggested to begin with, due to the large construction costs, but it could easily be expanded as connections were added. The estimated water consumption was slightly more than 50 liters per person and day, based on a future population of 10,000 inhabitants and including industrial use. Blix thought that a building owner should pay for the whole service pipe from the water main in the street to the building, but exceptions could be made for poor people. (Public water taps were to be avoided.) Blix did not doubt that piped water would be profitable in the near future, "apart from the great moral and sanitary profit a piped water supply always results in."³⁰

³⁰ FTVD p. 5-6, 15-30, 41-42 (quote on p. 28); LiSA, Linköping City Council Archives, AI:14, minutes 1876-08-29 §111. Blix was inspired by Leijonancker, who was his uncle and whom he had worked with on several occasions, for example, in constructing the waterworks in Karlskrona. Blix also drew inspiration from Richert and Thomas Hawksley. All these were referred to in the proposal more or less explicitly (Grill and Lager-Kromnow 1979 p. 455; Hawksley 1858; Leijonancker 1853; Richert 1869 p. 13, 18-19).



Abraham Blix (Source: Smedberg and Johnson 1937).

The proposed water system was to cover the planned city area, including the smaller workshops, manufactories, and a few industries (see Introduction). The factories outside the town itself were not seen as belonging to it from a piped water perspective. Asklungs tobacco factory and the chemical factory Gripen on the river, as well as the three breweries, can perhaps be designated the few real industries in Linköping. The breweries in particular were dependent on plenty of pure and soft water. Given the importance of these breweries and of entertainment places such as restaurants and theaters, in which alcoholic beverages were consumed, it is likely that they had to be enrolled in the actor-network for piped water.³¹

Several pages of Stånggren's presentation were devoted to water quality issues, both on a theoretical and a practical level. Stånggren used long quotes from Leijonancker's and Richert's books, but put them together so as to make his own point. Richert focused primarily on the practical and economic problems of hard water, such as problems of using soap or cooking tea or vegetables. Hard water was, in Richert's view, "less healthy" to drink. Nor was extremely soft water good, since it could cause lead poisoning if transported by lead pipes. By quoting Leijonancker, Stånggren showed his readers what the unhealthy results of drinking hard water were – kidney stone and

³¹ Almroth and Kolsgård 1978 p. 120, 135-140. Supplying good and plentiful water to breweries was also crucial for other Swedish cities at the end of the 19th century. In some cases this can be said to have been a major, if not the only motive for introducing piped water. Halmstad, a coastal town in the south of Sweden, was dominated by a large brewery of Bavarian beer, Appellofftska Bryggeriet, as well as a number of smaller breweries. In 1870, the Bavarian brewery built a cast-iron water pipe from a spring in the town to its premises. It was public in the sense that a reservoir and fire hydrants were built, and private persons and companies could connect to the pipe. In 1885 and 1886, a modern municipal waterworks was built (Aremar 1990 p. 184-190). In Stockholm in 1884, five percent of the total water consumption and 25 percent of the industrial use was consumed by breweries (Drangert, Nelson, and Nilsson 2002 p. 177). See Appendix 1.

cholera – but the nuances and uncertainties of Leijonancker’s original text had been omitted (see Chapter One).³²

Leijonancker’s and Richert’s respective views on water quality reflected a change among British water chemists in the transition from the 1850s to the 1860s. According to Christopher Hamlin, the issue of hardness, which previously had seemed convenient since it was so easy to measure and quantify, had become inadequate as a single parameter. Cholera continued to haunt London, and in the 1860s some chemists admitted that whatever caused cholera was beyond their ability to measure.³³

Against this background, Richert’s broad and practical view of what good water quality was seems logical. Apart from factors that appealed to common sense, such as good taste, Richert emphasized particularly the importance of the degree of hardness and the amount of organic material in the water. In Richert’s opinion, a high degree of hardness had nothing to do with sickness or epidemics, but rather digestion. Dissolved organic matter easily putrefied, and a regular consumption of this kind of water was thought to cause endemic diarrhea, dysentery, and other diseases. Aerated water was seen as the best guarantor of good water quality, for it neutralized the ill effects of organic matter; thus he concluded that running river water was the best for drinking as well as any other purpose.³⁴

Although the influence of British examples on Richert’s book was great, other influences, French, German and American, can also be seen. On the whole, Richert took a more independent stance than Leijonancker, which was a sign that by the end of the 1860s Swedish engineers had freed themselves somewhat from the previous almost total dependence on British science and technology. In the actual examination of water quality, Richert drew inspiration mainly from a French committee of physicians and chemists, which had presented its results in *Annuaire des eaux de la France pour 1851*.³⁵ However, in the end it seems that the primary parameters that Richert thought were quantitatively measurable with a chemical analysis at the same time as they meant something in a general public health context were hardness and the amount of organic material.

³² *FTVD* p. 10, 13. Stånggren originally took this information from Richert 1869 p. 1-2 and Leijonancker 1853 p. 7-9.

³³ Hamlin 1990 p. 107-109, 127-129, 152-153.

³⁴ Richert 1869 p. 1-5; This information is quoted on p. 10-12 in *FTVD*.

³⁵ Richert 1869. This enormous report, which was co-published by the French National Academy of Medicine and the National Society for Agriculture, originated and embodied a mid- to late 19th-century ideal to conduct annual scientific evaluations of water and waterworks, for the public good. Other countries later came to imitate this, for instance, Great Britain (The Water Company Directory), Germany (Städtische Wasserversorgung), and the USA (Manual of American Waterworks) (Goubert 1989 (1986) p. 113-115).

Axel Wimmerstedt gave priority to the same parameters in his quite extensive water analyses in the spring of 1869 (see above). He measured a number of parameters, for instance, dissolved organic and inorganic matter, chlorine, ammonia, and different salts, but the crucial parameters were considered to be organic matter and the content of salts, that is, hardness. On these grounds, Stångån or Djurgårdskällan were seen as the best sources of water.³⁶

Schlüschen's proposal for drainage of groundwater for three (or five) of the main streets of Linköping, Stånggren viewed as unsatisfactory from a sanitary point of view.³⁷ Instead, he promoted the inexpensive glazed earthenware sewer pipes that, according to Richert, had caused a sanitary revolution for smaller cities in Great Britain.³⁸ He suggested that *complete* sewerage be installed, including not only the drainage of groundwater but also of surface water and household wastewater. The mayor fully supported Blix's proposal for water supply, and held that it should be carried out and administered by a joint-stock company, because the city already had two big loans and water supply and sewerage were to be seen as a business venture.³⁹ A substantial profit was anticipated, especially on the water, and according to the agreement the city could take over the company's activities whenever it wanted to.⁴⁰

Nothing was officially done about this matter until 1872, and unfortunately there is no record of any unofficial events either. Stånggren most probably continued shaping the actor-network for piped water and sewerage. In April 1872, the Drafting Committee expressed the opinion that, for the reasons described in detail in Stånggren's presentation, it was of the greatest importance "under the present propitious economic situation" to launch the described project as rapidly as possible. The committee suggested that a joint-stock company for water supply and sewerage be established. In order to contribute to this, the city would pay for the drainage according to Schlüschen's propo-

³⁶ FTVD p. 6-9.

³⁷ FTVD p. 30-42, 46-47, 56. In Schlüschen's proposal, main drainage pipes were to be laid in the three streets Nygatan, Storgatan and Ågatan, but the drainage could be expanded even to include the adjacent streets Drottninggatan and Kungsgatan. The cost of 6,000 kronor, which Stånggren had estimated, was for the first three streets and did not include service pipes. Schlüschen was an eager proponent of urban drainage, allegedly for sanitary reasons, but quite naturally he also had professional and economic interests in this kind of work: "It is no longer a wish, no! it is a duty for . . . the authorities not to shun any kind of sacrifice in order to achieve that which the inhabitants can rightly claim: to give them the opportunity to get dry and healthy dwellings through public drainage . . ." (FTVD p. 30-39, 41, quote on p. 31).

³⁸ FTVD p. 42. Stånggren originally took some of this information from Richert 1869 p. 60.

³⁹ This may not only have been a remark about the profitability of piped water, but also an interpretation of the Communal Law of 1862, according to which it was forbidden for cities to be engaged in speculative business ventures. The "positive" interpretation made by Stånggren here was supported by the committee that prepared the law in 1859 (Bokholm 1995 p. 105-108).

⁴⁰ LiSA, Linköping City Council Archives, AI:8, minutes 1870-05-06 §46; FTVD p. 14, 41-47.

sal, despite the mayor's objection, and pay 20 percent of the construction costs for the water supply by subscribing for shares (B series) in the company. Furthermore, the water system was to be extended to the entire city so that fire hydrants could be installed and the fire-insurance fees lowered for all. Water for fire fighting and street cleaning was to be free of charge. The City Council unanimously approved what the committee had proposed.⁴¹ The building of water and drainage systems in Linköping had thus been decided upon, but the extension and technical design of the sewerage were still contested.

The central role of Fredrik Stånggren was very similar to that of Erik Swartz in Norrköping. Stånggren seems to have been held in great respect by most people in Linköping, an important power resource. He was quiet and unobtrusive, but when he spoke people seem to have listened.⁴² He had managed to become a "spider in the web," and successful arguments and enrollments had secured him an actor-network strong enough to allow him to have his way. He does not seem to have encountered resistance, but enlisted actors such as the Drafting Committee and the City Council and actants such as sanitation, cholera, fire, pure water, financial profit, civic pride, and commercial and industrial development, which made the further shaping of the actor-network easier. Cholera was an important actant, since many inhabitants had felt its effects either directly or indirectly a few years before, as were various kinds of profit. The City Council and prominent civil servants, merchants, factory owners, and even ordinary people, were finally enrolled as financiers in a semi-private company. Administering public services through private enterprise was a cherished idea generally in Linköping.

As regards civic pride, the decision to build piped water in Norrköping had come a month before and therefore very likely affected the decision in Linköping.⁴³ The relationship between the two cities has not always been a smooth one, the location of the County Governor in Linköping having been a bone of contention since the 17th century.⁴⁴ Whatever the relation between the two cities at other times in history, however, at the end of the 19th century Norrköping was looked up to by many inhabitants of Linköping as a model of communal spirit, and industrial and technological progress, Norrköping being often called "Sweden's Manchester."⁴⁵

⁴¹ LiSA, Linköping City Council Archives, AI:10, minutes 1872-03-19 §40 and 1872-04-22 §58 (quotation).

⁴² Marks von Württemberg 1955 p. 54-55.

⁴³ ÖC 1872-03-25.

⁴⁴ Andersson 2000 p. 298-299.

⁴⁵ See, for instance, articles in ÖC 1872-02-26 and 1872-03-25. In the latter article, which is about the donation of the 15 merchants and industrialists for a piped water supply in Norrköping on 21 March 1872, we find the following quote: "Norrköping is, they say, Swe-

The main local newspaper *Östgöta Correspondenten* seems to have promoted this view, but in contrast to *Norrköpings Tidningar* it did not otherwise comment on the indigenous water project, more than very casually. The accounts of the meetings of the City Council most often did not disclose any of the newspapers opinions, and apart from that I have found only one or two sentences about the water issue.⁴⁶ The liberal-conservative editor Carl Fredrik Ridderstad was interested in local and regional development, for instance, infrastructure projects such as railroads (important for news distribution), as well as housing and poor relief. He was also actively involved in national politics, both as a member of the Swedish Parliament on several occasions and as the editor of *ÖC*, but until the 1870s comments or debates on local community issues were in general few.⁴⁷

The only comment in *Östgöta Correspondenten* that I found was written by Reinhold Eriksson, a contributor to the newspaper, just before the question of water supply and sewerage was to be decided, which shows that the newspaper at least wanted to influence the decision. Eriksson wrote a comment on recent developments in the city, and though the tone was cheerful he was by no means uncritical of the city fathers and certain common services and infrastructural problems. But as he added that “nothing remarkable had happened” recently, the discussion on water supply and drainage must either have been rather quiet and “non-public” in character or not considered very interesting to the newspaper. Or it may have been a piece of good news, which only needed the brief comment to the city’s “financial magnates” that “a water company surely would pay its way.”⁴⁸

There is no source material that has revealed what happened during the following 12 months, but we do know that J. G. Richert had finished a proposal of sewerage for groundwater, stormwater, and household wastewater in April 1873. Stånggren presumably contacted Richert after the failure to gain support for complete sewerage at the City Council meeting in April 1872, and now he had a finished proposal to use in the bargaining, just as Erik Swartz had a proposal-in-the-making to bargain with in Norrköping in the spring of 1872 (see Chapter One). Nevertheless, it took until the fall of 1874 before he brought up the question again in the City Council. It is likely that he wanted to see the

den’s Manchester. As far as sacrifices for the public good are concerned, we must nevertheless doubt that Manchester is England’s Norrköping.”

⁴⁶ I have examined some issues in 1867 and 1870, and most issues in the spring of 1872.

Dagersten and Staaf have examined all issues from 1865 to 1875, and have likewise found nothing (Dagersten and Staaf 1976 p. 2).

⁴⁷ Hellström 1978a p. 187-190.

⁴⁸ *ÖC*, 1872-04-06.

constitution of the Water Company through before he devoted himself to this task, since the company was to build the drainage (see below).⁴⁹

It was easier to change the design once it had been decided to build sewerage at all, and once the actor-network had been further consolidated, primarily through the constitution of the Water Company. Thus Stånggren enrolled a more powerful ally than Schlüschen, J. G. Richert, who could serve in this capacity because his own actor-network of enlisted allies, his power resources, were stronger. Schlüschen's drainage was incomplete, in Stånggren's view, in that it only drained groundwater and was limited to certain areas of the city. These two problems were remedied in Richert's proposal, which he now presented to the City Council. The Drafting Committee was assigned the task of examining the proposal. Inspired by Richert's ideas, it reached the consensus that drainage of groundwater alone would be insufficient in achieving a drained city, especially after the installation of a piped water supply, and the maintenance would also be difficult and expensive. The committee proposed that water and complete sewerage be built at the same time. Richert had estimated the cost of his sewerage to be almost 60,000 kronor, but the committee thought that 50,000 kronor was sufficient to cover the expenses involved. The City Council approved of Richert's, instead of Schlüschen's, proposal.⁵⁰

Richert began his proposal with the following quote, which has its exact counterpart in the Norrköping proposal from the year before:⁵¹

The healthiness of a place is above all dependent upon the rapid removal of all superfluous water, so that it cannot stay either on the surface or in the ground and thus form what is called moisture. This is all the more important in a city where the water is always accompanied by a good deal of organic waste and other filth, through whose putrefaction are created highly harmful and poisonous gases, which have an injurious influence on the functions of organic life.⁵²

Richert constructed a combined sewer system, and the pipes and cesspools were made of glazed earthenware. The topography was favorable for the self-cleaning process in the pipes, and the sewage was discharged into Stångån through four different outlets (see Figure 2.3).⁵³

⁴⁹ LiSA, Linköping City Council Archives, AI:12, minutes 1874-09-22 §96 and 1874-10-01 §101, "Proposal for Sewerage in Linköping" by J. G. Richert, 1873-04-12.

⁵⁰ LiSA, Linköping City Council Archives, AI:12, minutes 1874-09-22 §96 and 1874-10-01 §101; Bokholm 1995 p. 76-79.

⁵¹ See NSA, Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6, "Proposal for Sewerage in Norrköping" by J. G. Richert, 1872-04-13.

⁵² LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-01 §101.

⁵³ LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-01 §101.

Profitable Water and Undesirable Wastewater: Building and Administering the Systems

In further shaping and elaborating the actor-network more actors than the above were enrolled. Fredrik Stånggren and the Linköping Water Company board became the center of power, and plumbers, workers, and the regular users were also enlisted in the network. The water and sewerage projects came to differ considerably, the former being more attractive than the latter, which the following discussion will show.

Building, Administering, and Selling Water - The Water Company and the City Council

Stånggren's shaping of the actor-network was not quite finished, because the shareholders had to be formally enlisted and the Water Company officially constituted. In the fall of 1873, the Linköping Water Company (*Linköpings Vattenledningsaktiebolag*) was constituted at the hotel Stora Hotellet, "in the presence of a numerous assembly." The subscriptions for 100-kronor shares had not yet reached the goal of 1,600 shares (A series) excluding the city's 400 (B series), that is, 200,000 kronor altogether. The constitution of the company was nevertheless unanimous. A provisional board was also formed, consisting of four people elected by the Water Company and one by the City Council, and it was also decided to draw up articles of association.⁵⁴

At the beginning of 1874, when the contract between the city and the company was in the making, the City Council discussed the delicate relations between the two. As early as this, confusion arose as to what role the city really would have in this enterprise. Was it to be seen as just a regular joint owner, or did it primarily represent public interests? Was the city a joint owner in the company or was the company contracted by the city to carry out a certain project? This situation was further complicated by the fact that several of the private joint owners were also members of the City Council. This problem was by no means solved, but a few things were straightened out. For instance, *Magistraten* was made the supervising authority for the company instead of the City Council, which would otherwise in reality have supervised itself. In the end, the City Council approved the official contract, with some minor changes.⁵⁵

⁵⁴ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1873-10-28 §§1, 2, 4-6, 8; Linköping City Council Archives, AI:11, minutes 1873-10-28 §140.

⁵⁵ LiSA, Linköping City Council Archives, AI:11 and AI:12, minutes 1873-12-30 §181 and 1874-01-09 §6. *Kontrakt om Vattenledning emellan Linköpings stad, å ena, samt det derstädes den 28 Oktober 1873 bildade Vattenledningsaktiebolag, å andra sidan. Antaget af Stadsfullmäktige den 9 och af bolaget den 12 Januari 1874* (Linköping 1874), §§4 h/ and j/, and 23.

At the next shareholders' meeting, the company approved of the revised contract. This contract stipulated that the role of the Water Company was primarily to build a piped water supply according to the City Council decision of April 1872, to follow Blix's larger plan and supply filtered water to public and private places in the city, and to erect a sufficient amount of fire hydrants for fire-protection and -insurance (even in case of expansion to new areas).⁵⁶ The company was also to carry out the installation of service pipes and supply water for a fee. The role of the city was to contribute 20 percent of the total capital in shares, as well as put streets for the laying of pipes, a supply depot, and the property Kanberget for the reservoir at the company's disposal free of charge. The company was to grant water for certain uses without cost: for extinguishing fires, street cleaning, and the cleaning of cesspools. In return for these services, the city relinquished its right to share dividends on its B-series shares. The city also reserved its right to elect a member of the five-person Water Company board and an accountant, and it possessed 20 percent of the votes at the shareholders' meetings. The contract was to last for 30 years, unless both parties agreed to dissolve it prematurely, in which case the city had the right to redeem the company.⁵⁷

Furthermore, a permanent board was elected, and the company's elected persons were, by a wide margin, the County Governor Robert De la Gardie, the mayor Fredrik Stånggren, the bank clerk Karl Gustaf Bodin, and the former tanner and court judge Adolf Stånggren (brother to Fredrik). Apart from being substantial shareholders, De la Gardie and Stånggren had very respected and influential official positions in the county and the city.⁵⁸ Bodin

⁵⁶ Expansion beyond, or changes in, Blix's plan were to be submitted to the City Council, and then the shareholders' meeting. If the City Council approved the extension, the shareholders only had to muster an ordinary majority, that is, more than 50 percent. If not, they could still carry through the project with an absolute majority (at least 2/3 of the votes). In other words, if the company really wanted to extend the water supply, it had the power to do so without the consent of the city (cf., the contract in the previous note).

⁵⁷ *Kontrakt om Vattenledning emellan Linköpings stad, å ena, samt det derstädes den 28 Oktober 1873 bildade Vattenledningsaktiebolag, å andra sidan. Antaget af Stadsfullmäktige den 9 och af bolaget den 12 Januari 1874* (Linköping 1874). LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1874-01-12 §2; Linköping City Council Archives, AI:13, minutes 1875-01-26 §16. At the same shareholders' meeting, the company's articles of association were drafted. They were based on the National Regulations Concerning Joint-Stock Companies of 6 October 1848 and regulated all the formalities of the company, such as number of shares and votes, times for board and shareholders' meetings, annual reports, the settling of accounts, etcetera. Furthermore, a number of paragraphs just repeated what was decreed in the contract between the city and the company (*Bolags-Ordning för Linköpings Vattenlednings-Aktiebolag* (Linköping 1874), established by the Government 1874-02-06).

⁵⁸ Robert De la Gardie (1823-1916) was a very prominent member of society, born as he was into an aristocratic family of French origins. He was educated at Lund and Uppsala universities in the 1840s, and continued thereafter as agriculturist and civil servant. From the 1860s he was a member of the Swedish Parliament on several occasions, and participated in a number of its

was also very influential in municipal matters. He was the chairman of various boards and was actively involved in the building of the park Trädgårdsföreningen in 1859. He wanted to give the city-dwellers the possibility of escaping the troublesome odors of the inner city. The judge and City Council member Clas Livijn, who was also a shareholder, tried to be elected at the shareholders' meeting, but received far too few votes. He made a new attempt to become a member of the board when the City Council was to elect its own member a few weeks later. He was successful and thus became the fifth member.⁵⁹



Robert De la Gardie (Source: Förhammar 1978).

By late 1874, subscriptions to the necessary 2,000 shares had been made by 200 private persons and companies, representing a wide variety of people. Since Linköping then had around 8,000 inhabitants, two and a half percent of the total population were shareholders. Around 40 percent of the shareholders were manufacturers, craftsmen, and businessmen, about 25 percent were

committees. He was County Governor of Östergötland County from 1869 until 1901, and also held many positions significant for the county's agricultural life, for instance, as chairman of the Östergötland County Agricultural Society (*Hushållningssällskap*), 1867 to 1901. As County Governor he was generally respected and popular, and due to his positions he made many acquaintances also among the Norrköping bourgeoisie (Boëthius 1931 p. 606, 762-766).

⁵⁹ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1874-01-12 §§2-5 and 1874-09-26; Linköping City Council Archives, AI:12, minutes 1874-01-27 §14; Lundberg and Nordström 1962 p. 178-189; Elfström 2001 p. 49-52, 102-103; Marks von Würtemberg 1955 p. 55.

various kinds of public administrators (state or city), and the rest were married women or widows, farmers, house owners, or people without titles. Among the first group we find the three most prominent industrialists and businessmen in Linköping at the time – Jon Asklund (tobacco manufacturer), Anders Petter Andersson (restaurant owner), and Ludvig Theodor Brogren (brewery owner) – who supposedly had professional interests in a good water supply. In the last group there were several physicians, with other professional interests. Twenty-three out of the 200 shareholders (11.5%) were members of the City Council, and the social composition of the two groups was fairly similar. Many of the shareholders, especially women, were not eligible for the council, however, but could take part in the shareholders' meetings (see Appendix 3, Table 1).⁶⁰

A good deal of the capital otherwise came from different financial institutions, either by direct investment or loans. The Linköping Savings Bank, whose explicit policy it was to invest in public enterprise, purchased 200 shares, and Östgöta Hypoteksförening (of which K. G. Bodin was clerk) bought 100. G. R. Westman, managing director of Östergötlands Enskilda Bank, personally invested 5,000 kronor. The same bank gave the Water Company temporary loans of over 50,000 kronor in 1874 and 1875, since not all the capital from the shares was paid until late 1875.⁶¹

Abraham Blix was hired as chief executive engineer, and was thus in charge of all the practical work with the building of the water system and thus finally to realize primarily his own but also Richert's plan.⁶² Rather soon after the work with the water supply had started in late 1874 economic problems arose, mainly due to the depression in Great Britain (see Chapter One). Blix explained in a report how things had changed since his survey in 1868. First of all, the city had selected his large system for 143,000 kronor, excluding Säg-

⁶⁰ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1874-09-26; Almroth and Kolsgård 1978 p. 135-140; Hagård 1978 p. 242-245. Since the full number of City Council members was 30, 77 percent of council members were shareholders. Most of them did not buy many shares, though (see Appendix 3, Table 1).

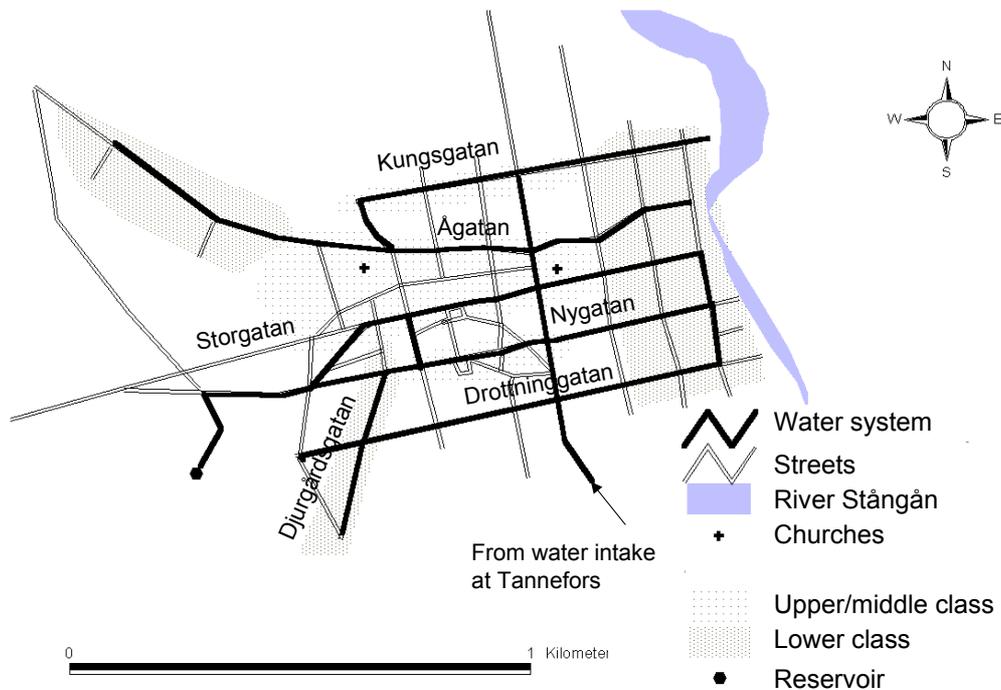
⁶¹ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1874-09-26, 1875-05-18 and 1876-05-31, annual reports of the Water Company board for 1874 and 1875; Almroth and Kolsgård 1978 p. 135-136.

⁶² *Bolags-Ordning för Linköpings Vattenlednings-Aktiebolag* (Linköping 1874), §§1, 12, and 17; LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-05-18, annual report of the Water Company board for 1874. Just as in the case of Norrköping, most of the pipes, cesspools, etcetera for the Linköping water and sewer systems were ordered from Great Britain, in many cases even from the same companies and factories (see Chapter One). For instance, cast-iron pipes were ordered from Hopkins Gilkes & Co., and glazed earthenware pipes from The Farnley Iron Co. However, pumps and turbines were ordered from Göteborg's Mechanical Engineering Workshop and hatches from H. Alpen, also in Göteborg (LiSA, Linköping Water Company Archives, AI:1, annual report of the Water Company board for 1874, and report by Blix, May 1875; Dagersten and Staaf 1976 p. 12-13).

holmen (the spot where the waterworks was to be built) and the water rights. Richert's complete sewerage required water for flushing and had forced Blix to increase the capacity of the reservoir and the filters by 50 percent. Secondly, the prices on material and labor had increased by 25 to 80 percent, both in the city and in England. Thirdly, the town had expanded both in terms of population and industrial activity. Blix's new all-inclusive estimate for the water supply was 250,000 kronor, that is, 25 percent more than the total capital stock. The Water Company had to decide to borrow 75,000 kronor in the spring of 1875, and the next year, when the installation of water pipes was finished, this sum had increased to 100,000 kronor. The Water Company's constitution was also changed, so that new preferred shares could be issued. However, this step required two subsequent approvals by the shareholders and permission from the Swedish Government, and thus took until 1879.⁶³

⁶³ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1875-09-18 §3, 8, report by Blix, May 1875, 1876-05-31 §5, annual report of the Water Company board for 1875 & letter from the board, May 1876, 1877-05-31 §5 and 1879-05-30 §6; Linköping City Council Archives, AI:14, minutes 1876-08-29 §105.

Figure 2.2. GIS view of the extent of Abraham Blix's finished water pipe in 1875 and 1876, related to a typology of the social topography.



The system was extended equally across the city, but was only laid in main streets (Source: Schmid and Hallström 2001).

The construction work continued despite these economic problems. A few people were supplied with water in late 1875, but the construction of Blix's water supply was not completed until early 1876, and from March that year anyone could be connected. However, there had been many changes of and additions to the original plan. The city engineer of Norrköping, B. L. Hellström, and the Linköping engineer Axel Lindeberg inspected the waterworks in August 1876, and found that everything had been carried out satisfactorily.⁶⁴ The fire-insurance inspector C. A. Nyström was not all that positive, however, although he approved of the waterworks itself. From the point of view of fire-protection, the water supply lacked necessary accessories such as hose pipes, hose carts, and mouthpieces. The final construction cost was 283,000 kronor. During 1876, out of a total of 330 yards in Linköping 143

⁶⁴ One such improvement was the building of two parallel water mains from Tannefors to the reservoir, in case one of them should fail or have to be shut off (LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-05-18 §4; Linköping City Council Archives, AI:13, minutes 1875-06-29 §73).

were connected to the piped water supply, and during 1877 another 72 (215 in all). Central streets were continually added, which tells us that Blix's distribution network was not complete from the beginning (see Figure 2.2).⁶⁵

The Water Company administered the installation of water service pipes in individual houses and buildings, and the work was carried out by its own entrepreneurs. The building owner paid for the service pipe from the main in the street to the yard or building, as well as for taps and all the digging and plumbing work. This could amount to 20 kronor or more for an average building, and the board considered the cost of installing water very cheap compared to other cities. The annual water fee for household or limited commercial use was three kronor per room. (If the commercial use was substantial, there could be an extra fee.) The building owner was responsible for paying the fee. A room was defined as such if there was a stove or some kind of heating in it, or if it was a shop or an office.⁶⁶

The Water Company also charged building owners for the watering of yards (five kronor annually) and of horses and cattle (three kronor annually each). For public buildings and technical purposes, by which they presumably meant industry, the water fee was to be determined either by agreement or by a rented meter. The cost was calculated at 0.10 kronor per day plus around 0.30 kronor per 1,000 liters. That the water fee was very significant for the company is shown by the fact that new extensions of the water system could only be made if the expected fee from the new users covered at least 10 percent of the construction costs for the extension (the "10 percent rule").⁶⁷

One delicate problem for the new Water Company (and the city) was to access property and water rights. The Water Company could fairly easily buy the place for the waterworks, Sågholmen at Tannefors.⁶⁸ Owners of property and water rights for the mill and other industries at Tannefors close to the waterworks were not happy about the proposed intake, however. They thought that they had lost enough water power in the waterfalls with the building of the Kinda Canal and its locks, and now they were afraid that they

⁶⁵ LiSA, Linköping City Council Archives, AI:13 and AI:14, minutes 1875-09-28 §117, 1876-07-31 §89, 1876-08-29 §111 and 1876-08-29 §112; Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1876-05-31 §4, report by Blix 1876 & letter from the board, May 1876, 1877-05-31, annual report of the Water Company board for 1876, and 1878-05-21, annual report of the Water Company board for 1877; *FTVD*.

⁶⁶ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-09-18 §4, annual report of the Water Company board for 1875; *Linköpings Wattenlednings-Aktiebolags Reglemente och Ordningsstadga* (Linköping 1883), §§ 13, 15, in Dagersten and Staaf 1976.

⁶⁷ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-09-18 §4, 5 and 7; Linköping City Council Archives, AI:13, minutes 1875-09-28 §117.

⁶⁸ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1873-10-28 §8 and 1875-05-18, annual report of the Water Company board for 1874.

would lose even more power through the continual drawing of water above the waterfalls. In their view, the Water Company had intruded on their ownership, and they demanded economic compensation. The company simply answered that it would consider the question if and when the mill owners could prove that any damage had been caused by the water pipe.⁶⁹

The first extension of the waterworks required more space at Tannefors, and, according to the contract with the city, the Water Company could expropriate property with municipal help and approval from the Swedish Government, *Kungl. Maj:t*. A request to the Government was written, but the property in question, belonging to flour-miller C. Ringström, was eventually purchased at the reasonable price of 15,000 kronor.⁷⁰ The purpose of buying the mill property was so that the Water Company could build a steam engine there as back-up, in case the turbines failed. The experience of the first years of running the waterworks had showed that there tended to be too little water during certain periods, notably the summer, and too much ice in the winter for the waterworks to continually work properly. The responsibility for the construction of the new equipment including buildings was placed on the shoulders of the city engineer of Norrköping, B. L. Hellström, who, in turn, left construction of the steam engine to the engineering workshop Mekaniska Verkstaden Vulcan of Norrköping (in sum, around 18,500 kronor).⁷¹

At the beginning of the 1880s, the town had expanded and water had been installed in some 350 yards, and the waterworks was therefore under greater pressure than before. According to the Water Company board, much water was wasted by the users. So in 1883 the company adopted a tougher attitude and introduced regulations. The Water Company was inspired by similar regulations in Stockholm, Göteborg, and Norrköping. The main issue was the control of the users. The regulations concerned different aspects of contracts and payment, as well as fines and penalties for wasteful water use and negligence in the handling of the taps and pipes in the yard. If all else failed, the water could be turned off.⁷²

⁶⁹ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-05-18 §5.

⁷⁰ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1879-07-07 §4, annual report of the Water Company board for 1879; *Kontrakt om Vattenledning emellan Linköpings stad, å ena, samt det derstädes den 28 Oktober 1873 bildade Vattenledningsaktiebolag, å andra sidan. Antaget af Stadsfullmäktige den 9 och af bolaget den 12 Januari 1874* (Linköping 1874), §4 mom. h/.

⁷¹ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1881-05-31 §7 and 1881-07-22 §3; Linköping City Council Archives, AI:19, minutes 1881-06-22 §72.

⁷² *Linköpings Vattenlednings-Aktiebolags Reglemente och Ordningsstadga* (Linköping 1883) in Dagersten and Staaf 1976 p. 17-18; LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1883-05-31 §7, annual report of the Water Company board for 1883.

The Water Company board introduced further measures to control water consumption. Meters were to be used for all users with an expected high consumption (not households), and the water fee was to be paid accordingly. But the fee was considered too high in comparison with Stockholm, Göteborg, and Norrköping, and, for example, the physician L. A. Åman thought that it was unfair to charge private fountains, which primarily had a sanitary aim, at the same rate as for industrial use. The fee was consequently lowered to 0.19 kronor per 1,000 liters, just as in Norrköping. A rent for the meters on a progressive scale was introduced in 1887 for those who paid less than 25 kronor per year in water fee.⁷³

The board was sceptical of a discount for large users, such as the one in Norrköping from 1888 onward, where an official discounted fee for the metered consumption over a certain amount was introduced (see Chapter One). There were requests for cheaper water from the state-owned railway (Statens Järnvägar) and the new public hot bath facilities (*warmbadhuset*). Both the railroad and the bath facilities got a discounted price of 0.11 kronor per 1,000 liters, probably because the railroad threatened to build their own pumping station and the bath facilities said it would go bankrupt otherwise. In the case of the bath house, they still could not make ends meet and built their own pipe to the river, which was approved only because it had already been laid.⁷⁴

In the mid-1880s, the water system had been extended to most of the city. However, the evidence concerning how well extended the system was in terms of the number of connected houses and buildings is somewhat contradictory. It seems that at least some of the poorer building owners, who were responsible for the installations in every apartment in the building, could not afford the cost (see Appendix 1 and 2). Pipes and installation work also had to be paid for, and in some cases the water pipe was only laid to a tap in the yard, and not into the house.⁷⁵ However, a number of sources confirm the observation of Klas Linroth in his inspection of 1885, that most buildings had

⁷³ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1883-05-31 §§6, 8, and 1887-05-27 §7, annual reports of the Water Company board for 1884 and 1886.

⁷⁴ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1883-05-31 §8, 1884-05-27 §7, 1885-05-29 §10, annual report of the Water Company board for 1884; Dagersten and Staaf 1976 p. 17-18.

⁷⁵ Marks von Würtemberg 1955 p. 25. This is also confirmed by the accountants of the Water Company, who criticized the many debts the company had to claim from house owners who had installed water supply and sewerage. They suggested a penal interest, but the board rejected this as it believed that it would prevent house owners from installing water and sewer service pipes in their houses and yards, which would, of course, affect the company through a lesser income. It was expensive enough already for the house owners (LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1885-05-29 §5, annual report of the Water Company board for 1884).

indoor fittings.⁷⁶ It is very likely that the Linköping building owners were charged for the total number of rooms of the tenants utilizing the water, whether the dwellings were connected or there was merely a tap in the yard. In this way there was a strong incentive for the installation of internal fittings.⁷⁷

Reluctant Administration of Sewerage - the City Council and the Water Company

The building and administration of the sewerage was not such a success story as the water. It was really the responsibility of the city, but already in connection with the decision to build Richert's plan the City Council's Drafting Committee suggested that the Water Company take care of all the practical matters – to purchase sewer pipes and cesspools, to lay down these pipes at the same time as the water pipes, and to see to it that this work was carried out properly. The Water Company accepted.⁷⁸ The financing of both the city's 20 percent share in the Water Company (40,000 kronor) and the sewerage (50,000 kronor) was a problem, despite the economic prosperity of the time, and the city did not want to take a loan that was so large that it had to be submitted to the national Government. However, the Financial Department was inventive when it came to finding economic resources. The water supply and sewerage project, together with a couple of smaller infrastructure projects, were financed by redistributing other municipal loans and funds, for example, by using the proceeds of the liquor company from the preceding year, but also by taking a temporary loan.⁷⁹

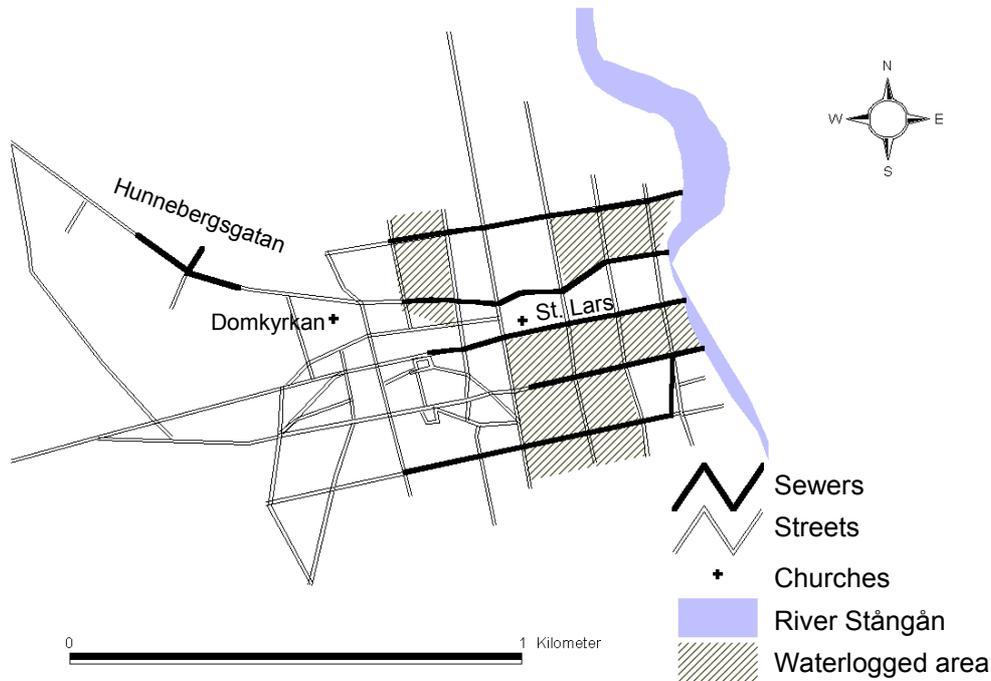
⁷⁶ Nilsson 1994 p. 146-153; LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-09-18 §4; Linköping City Council Archives, AI:45, minutes 1907-02-26 §63, EI:28, 1907 §63, "Taxa för Linköpings Vattenledning."

⁷⁷ LiSA, Linköping City Council Archives, AI:45, minutes 1907-02-26 §63, EI:28, 1907 §63, "Taxa för Linköpings Vattenledning"; Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1883-05-31 §6.

⁷⁸ LiSA, Linköping City Council Archives, AI:12 and AI:13, minutes 1874-10-01 §101 and 1875-01-26 §15.

⁷⁹ LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-27 §114; Bokholm 1995 p. 76-79.

Figure 2.3. GIS view of J. G. Richert's finished sewers in 1875, related to a typology of the waterlogged areas.



The sewers were very sparsely extended across the city, and those in the street Hunnebergsgatan ended in an open trench (Source: Schmid and Hallström 2001).

In 1875, the laying of water and sewer pipes started, and it soon became obvious that Blix's distribution network and Richert's sewerage did not quite match. Richert had been commissioned by Stånggren only to sewer the five main streets down to the river, and evidently sewerage was needed in a great many other streets in between. The Water Company had to ask the City Council if it was not the original intention to lay sewer pipes in all the places where it was necessary, concurrently with the water pipes. The council agreed, but it seems improbable that both the city and the company should have missed what must have been clear from the beginning: Richert's sewers were the fewest possible, and cannot have been very different from Schlüschen's as far as spatial distribution was concerned. Maybe it was believed that service pipes could compensate for this. The building of Richert's sewerage was considered all but finished at the end of 1875 and the Water Company handed

over responsibility for it to the city (see Figure 2.3). For years to come sewer pipes were being laid in some of the most central streets of the city.⁸⁰

In early 1876, the city and the Water Company together decided to hire an engineer, Fritz Ljunggren, for the further public and private work with the water supply and sewerage. The local building regulations contained rules about private connections to sewers, but Ljunggren was placed under the Board of Health. However, both the City Council and Financial Department could commission him to construct sewer pipes for streets or blocks in the city, and he was also available for construction of private service pipes. He was to supervise all the sewerage work in the city – public or private – and be responsible for all the pipes and cesspools in stock.⁸¹

The status of the Board of Health in Linköping seems to have been different from the one in Norrköping, at least concerning water supply and sewerage. The engineer Ljunggren was directly subordinated to the Board of Health in sewerage questions, in contrast to Hellström in Norrköping, who was only placed under the Waterworks Board and the City Council. The property owner who wanted to install a sewer service pipe was to notify the sewerage engineer, who in his turn reported this to the Board of Health. The board made inspections in yards whenever necessary, and it could also request the engineer to construct sewerage for a street or a yard.⁸²

The Linköping Board of Health was also actively involved in the inspection and subsequent sewerage of streets and public places in Linköping. The Board of Health was acting under the authority of the first Public Health Act of 1874, and it could, for instance, assert that a street was “utterly unhealthy,” and that sewer pipes were “necessary from a sanitary point of view.”⁸³ The requests of the board were often treated favorably by the City Council.⁸⁴ The board also acted for good sanitary conditions where it was perhaps most

⁸⁰ LiSA, Linköping City Council Archives, AI:12, AI:13, and AI:14, minutes 1874-10-01 §101, 1875-08-04 §95, 1875-12-28 §156, and 1876-08-29 §106; Linköping Water Company Archives, AI:1, minutes of the shareholders’ meeting 1876-05-31, annual report of the Water Company board for 1875; *FTVD*.

⁸¹ LiSA, Linköping City Council Archives, AI:13, AI:14 and AI:15, minutes 1875-12-28 §156, 1876-01-25 §10, 1876-02-29 §30, and 1877-05-04 §65.

⁸² LiSA, Linköping City Council Archives, AI:14, minutes 1876-02-29 §30.

⁸³ LiSA, Linköping Board of Health Archives, AI:1 and AI:2, minutes 1875-09-13 §58, 1876-06-12 §24 and 1876-07-10 §32; Linköping City Council Archives, AI:14, minutes 1876-07-31 §88 and 1876-08-29 §106.

⁸⁴ LiSA, Linköping Board of Health Archives, AI:3, minutes 1877-09-10 §34; Linköping City Council Archives, AI:15, AI:16 and AI:19, minutes 1877-09-25 §131, 1877-10-16 §138, 1878-12-17 §143 and 1881-08-30 §94.

needed – the city hospital – and thus promoted the connection of water and sewer pipes.⁸⁵

After only a few months, the city wanted to return the practical administration of sewerage to the Water Company. It is likely that the organization of sewerage had not worked very well as a municipal project, either economically or administratively, but there were of course advantages of having both water and wastewater under the same administrative unit. Again the Water Company agreed to take over the sewerage. The contract with Ljunggren was terminated by the end of 1876, and the city did not hire a new engineer to replace him.⁸⁶ After all, this was now the responsibility of the company. However, the company was of the opinion that a sewerage engineer was the city's business, which is why it hired Axel Lindeberg as engineer only for the waterworks. As bewildering as this may have been, for those who wanted to install sewer service pipes these administrative arrangements were of little importance, for there were no regulations whatsoever. There were, for instance, many illegal service pipes. The city charged building owners for the pipe from the yard boundary to the cesspool and then into the building, but paid for the rest.⁸⁷

One problem that particularly absorbed the Board of Health was the fact that the laying of sewer pipes lagged behind. There were even cases of inhabitants laying sewer pipes in the streets on their own. Then afterwards they asked for permission and financial support from the City Council, requests that were sometimes successful, sometimes not. In the 1870s, the sewers had to be supplemented in the central city, but at the beginning of the 1880s it was the outskirts of the city that attracted attention. This was problematic from a legal point of view, because the National Public Health Act, as well as the local building regulations, demanded good sanitary conditions and drainage in the city. As the city grew, it became difficult to define exactly where the city ended, and what criteria should be used to decide this. The city sometimes used this uncertainty to its advantage, and claimed on legal grounds that only yards formally a part of the city could have their street sewered.⁸⁸

⁸⁵ LiSA, Linköping Board of Health Archives, AI:1, AI:2 and AI:3, minutes 1875-09-13 §57, 1876-11-13 §45, 1876-12-11 §52, 1877-09-10 §33 and 1877-09-24 §40; Linköping City Council Archives, AI:14 and AI:15, minutes 1876-12-29 §191, 1877-01-30 §16 and 1877-09-25 §130.

⁸⁶ Several professionals continued doing some of Ljunggren's former work. These were the city engineer Ernst Wiman, his successor J. Kraft, the city builder A. Lundqvist, the land-surveyor A. Th. Calén (who later became city engineer), and the excavator C. J. Stenmark.

⁸⁷ LiSA, Linköping City Council Archives, AI:14 and AI:17, minutes 1876-05-30 §74, 1876-07-31 §90, 1876-08-29 §101, and 1879-09-30 §93; Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1877-05-31, annual report of the Water Company board for 1876; *Byggnads-Ordning för Linköpings stad* (Linköping 1876), §6.

⁸⁸ LiSA, Linköping City Council Archives, AI:14, AI:15, AI:16, AI:17, AI:20 and AI:21, minutes 1876-08-29 §106, 1877-08-28 §111, 1877-09-25 §132, 1877-10-16 §138, 1878-07-16 §69, 1878-

In some cases, the sanitary conditions were very serious, and were perhaps even caused by the city itself, so the city had no other choice but to arrange for proper sewerage. For instance, some of the buildings of the Linköping Housing Company (*Linköpings Bostadsaktiebolag*) had been damaged by water from one of the city's cesspools nearby. The chairman of the Housing Company Board, Adolf Wallenberg, who lived in close proximity, had also suffered from this nuisance. This was a clear-cut case, and Wallenberg by virtue of his position in the county administration was also very influential, so the city took the responsibility for arranging new and better sewerage.⁸⁹

The Board of Health pointed out that the sewer main in *Ågatan* did not reach the higher parts of the city, which caused numerous problems, including sanitary ones (see Figure 2.3). First of all, the public areas around the cathedral (*Domkyrkan*) and the castle, which were increasingly frequented for each year, were often flooded. Furthermore, these areas lacked public urinals and private sewers for the yards. An extension was approved in 1881 both by the City Council and the Financial Department.⁹⁰ The blacksmith N. Davids-son lived in the western and most upland area, and the sewer main in the street *Storgatan* ended just below his house. He complained that much of the storm- and wastewater from above him ran through his yard down to another sewer main in *Sankt Korsgatan*. He had suffered from major overflows in his house and outhouses, and claimed that the situation had worsened since the building of the sewers. There was no discussion about whether the city was responsible for this increased flow, but presumably due to the low costs, around 200 kronor, the city agreed to remedy the problem.⁹¹

The first Linköping sewerage can be regarded as an example of a less successful translation, because Fredrik Stånggren and the Water Company board did not manage to, or perhaps never intended to, effectively administer it. Although deficient drainage was the starting point for the whole project, it seems to have lost its appeal during the enrollment process. The two proposals presented in 1870 show that water supply was something to invest in, for moral, sanitary, and financial profit, while drainage was only worth around five percent of water (the initial construction cost of Schlüschen's drainage). Stånggren succeeded in getting a better solution with Richert's complete sewerage, and Richert tried to point out its indispensable role in sanitation. But sewerage never really attracted the city fathers – maybe they thought that the sewers were not only self-cleaning but also self-maintained and self-

08-27 §78, 1878-09-12 §101, 1878-12-17 §137, 1879-01-28 §18, 1879-11-25 §119, 1882-09-26 §95, 1882-11-28 §113 and 1883-02-27 §26.

⁸⁹ LiSA, Linköping City Council Archives, AI:17, minutes 1879-11-25 §119.

⁹⁰ LiSA, Linköping City Council Archives, AI:19, minutes 1881-07-26 §86 and 1881-08-30 §94.

⁹¹ LiSA, Linköping City Council Archives, AI:21, minutes 1883-08-28 §100.

administered – and the system was small and occasionally neglected. It seems that water was what the actor-network really had been enlisted for.

Technical Extension and Organization in the Years to Come

By 1890, it had become quite clear that the waterworks at Tannefors had to be enlarged. The Water Company board's annual report for the previous year showed that the pumping station had been running around the clock 12 and 15 days in a row during May and June respectively, and for many more days almost that long. The extremely cold winter of 1887 and 1888 resulted in greatly impaired water distribution, mostly due to some frozen pipes, but the waterworks also had to rely heavily on the back-up steam engine. The conclusion was clear: there needed to be an enlargement of the pumping station and at least one new slow sand filter.⁹²

However, the company was not only concerned about water quantity, but also water quality, and concern grew toward the end of the 1880s. In Norrköping the faith in the good water quality of Motala ström would last for many more years, but in Linköping the Water Company initiated regular water analyses in 1886. The engineer C. Ekendahl, who was in charge of water analyses at the Stockholm Waterworks, analyzed three water samples during the year, in April, July, and October, and concluded that the filtration was working well. The fact that the company wanted to build another slow sand filter must then primarily have been to match the higher water production.⁹³

Through the managing director Adolf Stånggren the board turned to the city engineer B. L. Hellström in Norrköping to have him construct and install the new technical features. According to Hellström, the existing pumping station from the engineering workshop Göteborgs Mekaniska Verkstad could easily supply around 100 liters per person and day, which was a kind of standard estimate for Swedish cities, but apparently this did not suffice. (Sometimes double the amount was consumed.) The reason for this was the uneconomical and even wasteful consumption of water in Linköping, which in Hellström's opinion could only be remedied fully by metering all water consumption, even for households. The Water Company board, in contrast, was of the view that the large consumption was due to the flushing of sewers,

⁹² LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1890-05-30 §7, annual reports of the Water Company board for 1881, 1885, and 1889; Dagersten and Staaf 1976 p. 17-20.

⁹³ LiSA, Linköping Water Company Archives, AI:1, annual reports of the Water Company board for 1885 and 1886.

which had to be done regularly for sanitary reasons. A restriction of the private water consumption, either by metering or by stricter supervision, would therefore be potentially dangerous from a sanitary point of view. Furthermore, the new sanitary regulations (*renhållningsstadga*) required regular cleansing of the cesspools in each yard, and in case of a big fire large quantities of water would be needed at once. This was how the board argued at the shareholders' meeting in May 1890.⁹⁴

Despite his personal belief, Hellström suggested the building of a new, more powerful pumping station while keeping the old one as back-up. The new one would also be turbine driven and could in only 12 hours provide 20,000 inhabitants with water, in contrast to the old one, which was able to supply merely 15,000 in 18 hours. In Hellström's opinion the new pumping station, together with the new slow sand filter that he had designed, would be enough to supply a population twice Linköping's present one with water. Apparently, the board's arguments and Hellström's proposal impressed the shareholders, so the matter was submitted to the City Council. The City Council and its Financial Department approved the cost of 63,000 kronor. The department was thus commissioned to take a temporary loan to cover the city's 20 percent share of the project. The whole project was completed in 1893.⁹⁵

To finance the steam engine in 1881, the company decided to issue new A shares, which became a huge success. Knowledge of the company's prosperity had apparently become widespread among the inhabitants of Linköping, and there were requests for nearly three times the allotted amount – 428 shares compared to the planned 150. The company then decided that those who already owned shares should receive priority over those who did not, and the former were allowed to buy according to their previous shareholding. Thus the previous concentration of ownership and power in the company was maintained. The extension decided upon in 1890 also demanded financial capital, and again A shares were issued. The company's profit and dividends from the shares had increased even more throughout the 1880s, and to avoid oversubscription similar conditions to the 1881 case were imposed (see Appendix 3, Table 2).⁹⁶

⁹⁴ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1890-05-30 §7.

⁹⁵ LiSA, Linköping Water Company Archives, AI:1 and AI:2, minutes of the shareholders' meetings 1890-05-30 §7 and 1890-09-26 §§4 and 5, annual reports of the Water Company board for 1891 to 1894; Linköping City Council Archives, AI:28, minutes 1890-06-13 §62 and 1890-08-26 §68; Account of the City Council meeting 1890-08-26 §68, ÖC 1890-08-29.

⁹⁶ LiSA, Linköping Water Company Archives, AI:1 and AI:2, minutes of the shareholders' meeting 1881-05-31 §9, annual reports of the Water Company board for 1881, 1882, 1891, 1892, and 1893; Dagersten and Staaf 1976 p. 17-21.

In the 1890s, the city became more active in the Water Company's business. The boundary between the public and private engagement in the company was drawn a little more clearly when the City Council decided that its representatives in the Water Company should not themselves be shareholders. This change was disputed by the Drafting Committee on the grounds that it was impractical. Still a majority of the council members were probably shareholders and these members were also supposedly the most knowledgeable and appropriate to be assigned to the Water Company board. However, a majority of the council were for the restriction.⁹⁷

After the death of Adolf Stånggren in 1890 the Financial Department also wanted to influence the appointment of the new managing director, since, in its view, the city would soon come to redeem the company. Here one can discern criticism towards Stånggren, who was a man without any formal water engineering education, and it was implied that he had not been entirely capable of running the company. This must have been from an engineering point of view, not economic. The department therefore proposed that a skilled engineer be hired to head the company. Since it was expensive to employ such a person, it was suggested that he should also work part time for the city as head of its public works.⁹⁸

The company's representatives, the County Governor Robert De la Gardie and the baron and officer C. M. Lagerfelt, explained at a meeting between the company and the city that the proposed arrangement would be complicated and without any real advantages for the company. So they rejected the proposal, and as a minority shareholder the city had no other alternative but to comply. Lagerfelt was a City Council member up to 1890, but the city representatives Wilhelm Hallin and Fredrik Carlsson did not have any overt conflicts of interest in this question. Tension between the city and the company began to increase.⁹⁹

Baron Ulf Sparre, son-in-law to Robert De la Gardie, was elected to replace Adolf Stånggren as a member of the board in late 1890, and soon became managing director. Thus the aristocratic civil servants continued to dominate the board, and there was still no director with a higher technical education. In 1895, however, the city at least had its way in getting back the sewer administration completely, which the company was probably only happy to get rid of.¹⁰⁰

⁹⁷ LiSA, Linköping City Council Archives, AI:27 and AI:28, minutes 1889-12-30 §158 and 1890-01-31 §6.

⁹⁸ LiSA, Linköping City Council Archives, AI:28 and AI:29, minutes 1890-10-28 §92, 1891-01-27 §19, and 1891-02-24 §39; Account of the City Council meeting 1890-10-28 §92, ÖC 1890-10-31. The pursuit of professionalism regarding the city's public works continued for the rest of the 1890s, until the city engineer J. B. Carlson was hired.

⁹⁹ LiSA, Linköping City Council Archives, AI:29, minutes 1891-02-24 §39 and 1891-06-30 §79.

¹⁰⁰ Elfström 2001 p. 117-118; Nilsson 1994 p. 154.

New Water and Wastewater Challenges in the 20th Century

Around the turn of the century, a number of burning questions were calling for the city's and the Water Company's attention. As was mentioned above, there had been total freedom regarding the installation and use of private sewers in Linköping, and this may partly account for the poor quality of the sewer system around the turn of the century. In late 1902 the City Council commissioned the Financial Department to draw up a proposal for the regulation of the private sewer service pipes to yards and houses in Linköping. This task was then assigned to the city engineer J. B. Carlson, who presented his proposal in the spring of 1903.¹⁰¹

Carlson was of the view that private sewer regulations should be strict in order to make the whole system work properly. Large cities had already introduced such regulations (Norrköping as early as 1874), but now even mid-sized Swedish cities such as Skövde, Skara, Filipstad, and Arvika had followed suit. For example, a building owner had to report his interest in a service pipe to the Financial Department, only an authorized entrepreneur could be employed for the installation, and the pipe had to be approved by the department before use. A sewer could not be installed in a yard with no water pipe (risk for blockage), and generally not more than one sewer per yard was permitted.¹⁰²

On the whole, the Financial Department responded positively and accepted the proposal. The Building Board, however, had several reservations, and three of these in particular made Carlson take a defensive position. First of all, the board suggested that large yards should still be allowed to have cesspools, for collecting ground-, storm- and wastewater, as well as urine from latrines and stables.¹⁰³ Carlson was part of the national SKTF actor-network of municipal engineers, and supported by the latest scientific knowledge he enrolled arguments and allies with confidence. He replied that

all engineers of any merit unanimously condemn the old cesspool system . . . All the filth which the board has enumerated is of such a nature that one would rather not collect and hide it. For the most important aspect of the new hygiene is to draw off all filth before it starts to decompose and putrefy instead of collecting it, and . . . the water seals cannot hinder the wastewater in the cesspools from

¹⁰¹ LiSA, Linköping City Council Archives, AI:40 and AI:41, minutes 1902-12-05 §119 and 1903-05-26 §72, supplement EI:22, 1904 §62.

¹⁰² LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62; *Reglementen m.m. för Norrköpings stads vattenledning och vattenafledning* (Norrköping 1875).

¹⁰³ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62.

putrefying. Since the board's proposal is not supported by either facts or experience, I have to recommend its rejection.¹⁰⁴

Although the cesspools were regarded as something belonging to the old miasmatic, pre-bacteriological paradigm, it is remarkable how similar the medical arguments for cleaning up the city's yards were. It was considered imperative that the filth was removed before it started to decompose. However, the importance of swift removal was reinforced with bacteriology, and applied to solid waste as well as liquid waste in cesspools.¹⁰⁵

Secondly, the Building Board brought up the organization of private sewers.¹⁰⁶ The drainage of private yards was regulated in, for example, §6 of the local building regulations and §§6, 9, and 22 of the National Public Health Act. The acts decreed that a private yard must not be saturated with water or cause a neighboring yard to become so. In 1876, when the city temporarily had taken over the administration of the sewer system and hired the sewerage engineer Ljunggren, the above regulations were monitored primarily by him and the Board of Health. Ljunggren's instructions also regulated the installation of service pipes, although not as strictly as Carlson now proposed.¹⁰⁷

Since the instructions were written explicitly for Ljunggren, and as no new sewerage engineer was hired, they ceased to be in force in 1877. The Board of Health continued to inspect the yards in the city, but concentrated on another paragraph of the local building regulations: the compulsory drainage of cesspits through the sewers.¹⁰⁸ There was no attempt on the part of the board to monitor the private sewer installations, only in so far as it had to do with the cesspits. The Water Company only carried out the actual sewer work and

¹⁰⁴ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62.

¹⁰⁵ Lundgren 1992 p. 28-30. Cesspools and septic tanks in the yards were considered ineffective and expensive by most Swedish professionals at the time. It was contrary to the maxim of swift removal to collect the filth in the cesspools, and there were also nuisances when emptying them. The septic tank, a cousin of the cesspool, was only accepted as a large-scale solution, where it could be effectively monitored. In the private tanks there was often either leakage or stoppage (Lundgren 1974 p. 94-99; Andersson 1908 p. 272-279).

¹⁰⁶ This question was discussed a great deal in the beginning of the 20th century in other Swedish cities and on the national level, for instance, in the SKTF (see VAV, Documents of SKTF, 1907 to 1909, especially 1909).

¹⁰⁷ LiSA, Linköping City Council Archives, AI:14, minutes 1876-02-29 §30, supplement EI:22, 1904 §62. See also Chapter Five.

¹⁰⁸ Cesspits and cesspools should not be confused. A cesspit was a modified form of a traditional latrine pit in the ground, mainly for excreta disposal, and it was often lined with cement to make it less leaky. A cesspool was an earthenware tank under ground, which in Linköping and Norrköping collected storm- and wastewater from buildings, yards, and streets. The liquid part continued to the sewers, while the solid part at least in theory remained in the cesspool. The sewered cesspit was connected to the sewers via the cesspool, just as all other connections from the yard.

had no supervisory function. Hereafter, what Carlson referred to as the “absolute freedom in the use and installation of private sewer pipes” came to be the standard.¹⁰⁹

What also happened in the general confusion over sewer administration was that the Building Board became increasingly involved in the drainage of streets, building lots, and other large-scale sewerage projects, often together with the Financial Department. From a legal perspective this was logical, since much of drainage regulation actually was decreed in the building laws.¹¹⁰ But the Financial Department was the main administrative unit for the sewerage, not just from 1895, when the city again assumed full responsibility for it, but probably as far back as 1877, when the company largely took care of the building work.¹¹¹

In the discussion of the private sewer regulations in 1903, the Building Board wanted to assert its position regarding the sewer system and claimed that the central administrative responsibility for the sewer service pipes should be in their hands, instead of those of the Financial Department and the city engineer. Carlson, however, dismissed the board’s interpretation of the law, and claimed that the Building Board was not competent enough to assume this responsibility. The Financial Department, under which Carlson primarily worked, should remain the central authority for the sewers.¹¹²

Carlson criticized the decentralized and, in his view, dysfunctional management of the sewer system:

The Building Board is not an executive authority that is obliged to have competent technical assistance concerning sewers at its disposal, and has previously never had such. Nor can the Building Board in any way concern itself with the management and maintenance of the sewerage, which are at least as important as the construction. While this is true it is also obvious that the Building Board does not deal with such issues with the same interest as those

¹⁰⁹ LiSA, Linköping Board of Health Archives, AI:3-AI:11, minutes 1877-1885, annual reports of the board for 1876, 1877, and 1885; Linköping City Council Archives, supplement EI:22, 1904 §62 (quote).

¹¹⁰ LiSA, Linköping City Council Archives, for example, AI:16, AI:17, AI:20, AI:21, AI:30, and AI:34, minutes 1878-07-16 §69, 1878-08-27 §78, 1878-09-12 §101, 1879-08-26 §82, 1879-09-30 §87, 1882-05-30 §64, 1882-08-29 §84, 1883-08-28 §100, 1892-04-26 §68, 1892-11-29 §114, 1892-11-29 §115, and 1896-08-31 §70.

¹¹¹ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62; Dagersten and Staaf 1976 p. 22. It is likely that the responsibility for the sewerage going back and forth between the city and the company also added to the administrative confusion. For even when the company handled all the practical issues, that is, from 1877 to 1894, the city still was the formal administrator. This is shown, for instance, by the fact that the company’s annual reports during this period only take up the water supply (there are no annual reports or maps of the sewerage at all from 1877 to 1906).

¹¹² LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62.

who are responsible for the sewerage in its entirety [that is, the Financial Department].¹¹³

Carlson imagined a scenario where a tiny detail might be treated by the Building Board, changed by the Financial Department, and then sent on to the City Council in an endless circle. This was presumably a well-known scenario to anyone who had any experience of municipal politics and administration.¹¹⁴

Thirdly, the strict rules that Carlson wanted to introduce did not appeal to the Building Board. In his view, sewers that conflicted with the regulations should just be cut off. The board thought that this could cause sanitary inconvenience, but he claimed that a few days off the sewerage would not lead to any sanitary dangers, and that since the regulations were so clear-cut such situations would not occur very often anyway. He was surprised that the board would not want to protect the public works against arbitrary damage from private persons. Besides, he claimed, this was definitely the most effective and fast way of managing such issues, instead of sending appeals between different municipal units.¹¹⁵

The City Council discussion was bound to be heated after the city engineer's quite heavy criticism of the Building Board, and indirectly its chairman Fredrik Stånggren. Stånggren defended the view of the Building Board, and managed to win support. With a very slim majority (16 to 14), the proposal of the board was approved. Carlson's criticism of the cesspools was taken seriously. They were still to be allowed, but could only receive ground- and stormwater, as well as wastewater from the yards. Sewer connections from buildings and houses were to by-pass the cesspools. It was prohibited to build a sewer to drain latrines or cesspits. Piped water was a prerequisite for all sewer installations. Thus the strict control of the private sewer service pipes that Carlson had promoted actually was to come about, but it was the Building Board that would be the administrative unit.¹¹⁶

After a rejection by the County Governor, certain formalities were resolved, but it took another five years. In the meantime the proposal went another round among the various municipal units, and was consequently rewritten. However, only two major changes were made. First of all, Carlson's all three bones of contention with the Building Board – the abolition of cesspools for household wastewater (including excreta from water closets), the Financial Department as the sole administrator of the sewerage, and the stricter rules – had now been resolved in his favor. They were also approved by the Building

¹¹³ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62.

¹¹⁴ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62 (including quote).

¹¹⁵ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §62.

¹¹⁶ LiSA, Linköping City Council Archives, AI:42 and AI:44, minutes 1904-04-29 §62 and 1906-03-27 §56, supplement EI:26, 1906 §56.

Board itself, at a time when Fredrik Stånggren had been replaced as chairman. The second change was a prohibition to discharge substances harmful to the sewers, for instance, coffee grounds, ashes, vegetable refuse, different corrosive chemicals, as well as putrefying, foul-smelling matter.¹¹⁷

Due to rising water consumption, and possibly pressure from fire-insurance companies, the waterworks needed to be augmented again in 1900, as did the whole water system. The Water Company consequently started planning an enlargement.¹¹⁸ In 1901 Johan Gustaf Richert was commissioned to improve fire protection in the suburbs (see Chapter Four). He also ventured to sketch a plan that would ensure the future sustainability of the whole water system, especially for fire fighting, so as to meet the demands of the day. He was not as positive to the existing water supply as he was in Norrköping in 1897, and he rendered a great deal of criticism. (His father had not built this system.) He approved of the turbine-powered pump, but considered the steam-driven one inadequate. De Laval's steam turbine, Swedish state-of-the-art technology of the day, was recommended instead.¹¹⁹

Richert argued that the distribution network was underdimensioned and that pressure was insufficient, particularly in the suburbs. There was a huge waste of water in Linköping – consumption was 50 percent higher than, for example, in Göteborg – and it could partly be due to leaking pipes. Tougher control and general metering were ways of reducing such waste, so that the future quality of the water system could be sustained until 1933(!) The elevation of the reservoir was too low to ensure the pressure. Instead, a water tower was suggested, to be placed by the belvedere in the park Trädgårdsföreningen in the south.¹²⁰

Richert also looked at the hygienic requirements. The slow sand filters were deficient, primarily because the filtration speed of 360 millimeters per hour was too high and did not ensure water of good enough quality. The total filter area was too small and the filters were regulated together, which meant that they had to work under the same pressure, regardless of the amount of sludge in them. To take care of this problem Richert suggested a new filter, combined with a basin for purification through precipitation placed before the filters. The filtered water was to be collected in a low reservoir when the pumping

¹¹⁷ LiSA, Linköping City Council Archives, minutes 1908-06-12 §148, 1911-10-31 §259, and 1911-12-08 §363, supplement No. 12 1911, p. 32-43; *Reglemente rörande enskilda afloppsledningar i Linköping* (Linköping 1912).

¹¹⁸ LiSA, Linköping City Council Archives, AI:38 and AI:39, minutes 1900-09-25 §57 and 1901-05-28 §64; Dagersten and Staaf 1976 p. 22.

¹¹⁹ LiSA, Linköping City Council Archives, AI:40, minutes 1902-04-29 §51, supplement EI:18, 1902 §51.

¹²⁰ LiSA, Linköping City Council Archives, supplement EI:18, 1902 §51.

station was not in use. In this way the filtration would be continuous, and the filter speed only 130 millimeters an hour.¹²¹

Richert was of the opinion that these very costly improvements could not be imposed on the Water Company, although he urged the company to see this as an investment before the city's possible takeover. He also appealed to their professional pride: to update the water supply according to modern technical and hygienic requirements was also a matter of honor.¹²²

In 1902 the Financial Department reminded the City Council that the 30-year contract between the city and the Water Company was to expire by the end of 1904, in case the city wanted to buy the water supply. Otherwise the contract was to be in force for another 10 years. Given the fact that the Water Company did extremely well, this reminder is not very surprising. The department and its chairman Fredrik Gustafson were of the view that it was practical that such an important service as water supply was in the hands of the city, and that it was also crucial for the city's finances. The City Council decided to notify the Water Company board of the city's intentions.¹²³

Not surprisingly, the Water Company did not agree with the city about the deadline for the expiration of the contract. According to the company, the contract said that the 30-year period was to be counted from the year after the water supply came into use, that is, from 1877 until the end of 1906. It was obvious that the company did not want to relinquish a successful business, but the city accepted its interpretation. Before the takeover, the monetary value of the water supply had to be estimated by three impartial experts, two of which were to be appointed by the city and the company respectively. The third expert would be chosen by the other two together. The company appointed the chief engineer of Norrköping, Wilgott Carling, whereas the city chose the Lieutenant of the Royal Corps of Engineers, Otto Nordenstrahl. Their common choice of the third expert was the Captain of the Royal Corps of Engineers, John Ekelund.¹²⁴

The inspection was carried out in the summer of 1905. The three engineers were of the opinion that the water supply was well maintained, but that it was

¹²¹ LiSA, Linköping City Council Archives, supplement EI:18, 1902 §51.

¹²² LiSA, Linköping City Council Archives, supplement EI:18, 1902 §51.

¹²³ LiSA, Linköping City Council Archives, AI:40, minutes, 1902-06-19 §79 and 1902-12-05 §122, supplement EI:19, 1902 §122; Account of the City Council meetings 1902-06-19 §79 and 1902-12-05 §122, ÖC 1902-06-20 and 1902-12-06. *Bolags-Ordning för Linköpings Vattenlednings-Aktiebolag samt Kontrakt om Vattenledning emellan staden och bolaget* (Linköping 1874), §§27, 28, and 29; Dagersten and Staaf 1976 p. 32-33.

¹²⁴ LiSA, Linköping City Council Archives, AI:43, minutes 1905-05-30 §100 and 1905-10-31 §197; *Bolags-Ordning för Linköpings Vattenlednings-Aktiebolag samt Kontrakt om Vattenledning emellan staden och bolaget* (Linköping 1874), §§27, 28, and 29; Dagersten and Staaf 1976 p. 23.

also technically inferior (cf., Richert's statement of 1901). They estimated the total worth of the entire piped water supply, including both real estate and other property, to 341,000 kronor. This price was probably inexpensive for the city compared to what it was to get from it, although this was to be debated. The Drafting Committee and the Financial Department approved the purchase. The City Council was more hesitant, but there was a majority of votes in favor of a takeover for the said price.¹²⁵

This hesitance was partly due to the fact that some City Council members were also shareholders. The most prominent of them, the managing director Ulf Sparre, wrote his own statement to the city. In his view, the contract stipulated a price not lower than the shareholders' part of the construction costs (A shares), and this alone amounted to around 380,000 kronor for 1904, including the free water to the city. He added 200,000 for the necessary technological and other extensions to bring the water supply up-to-date, and other capital and property, in sum around 640,000 kronor. He also tried to show how the city would actually lose money on the takeover, for instance, through loss of dividends. Sparre's argument was built upon a positive estimate of the quality of the water supply, which was partly confirmed by the three water engineers, but the 200,000 to improve it also pointed in the other direction. The water system needed thorough rebuilding, and who else was responsible for its being deficient than the company itself and its managing director?¹²⁶

The Financial Department made a very negative appraisal of the water supply, through an internal committee. The committee made an estimate of the costs involved in the takeover. 334,000 kronor was payment for the existing water system, based on the capital stock. Based on the younger Richert's 1901 investigation they calculated that improving the water supply, including, for example, the water tower, would cost merely 110,000 kronor. The committee questioned the water supply itself, primarily because it could not provide "pure and good water." They quoted almost Richert's entire investigation, and echoed his criticism. The committee also found that Richert's statement was a perfect outline of all improvements needed to make the water supply up-to-date. The implication was that the company had not maintained and improved the water system well enough, and that it thus should be taken over by the city.¹²⁷

Out of 56 Swedish cities with piped water, Linköping was the only one with a privately owned water supply, and the committee argued that experien-

¹²⁵ LiSA, Linköping City Council Archives, AI:43, minutes 1905-10-31 §197 and 1905-11-21 §207.

¹²⁶ LiSA, Linköping City Council Archives, AI:43, minutes 1905-10-31 §197 and 1905-11-21 §207, supplement EI:25, 1905 §207.

¹²⁷ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

ce had shown that such a service should not be in the hands of the private sector. The committee did not motivate why this was so, however. The establishment of a private company in the 1870s was seen as a temporary solution because of the less profitable nature of the project, according to the committee. This was not true, for if anything is clear about the intentions of the city fathers who initiated the company it is that they saw at least the water as very profitable, and so it was.¹²⁸

Furthermore, the committee took up the necessity of having the full control over the sewer *and* water systems: “As the city owns the sewer network it cannot be regarded as anything less than a nuisance, an obvious evil, that a private company owns the water supply, since both kinds of pipes . . . have the most intimate relation to each other.”¹²⁹ An administrative combination of the two could not be achieved if they were under two different, and potentially opposing, owners. The committee presumably had the disorganization of the previous decades in mind.¹³⁰

The committee depicted the company as a dictatorship of a small shareholding majority, which only looked to their own personal interests. This was particularly true at the time, according to the committee, when many non-indigenous Linköpingers owned shares. In the early days of the Water Company, the overlap with the City Council was also great, but as time went on the shareholders came increasingly from outside the ranks of the council. (The number of shareholders among members of the Financial Department had always been lower, however.) The committee claimed, for example, that the company would raise the water fees, should it continue for another ten years, while the city would sell the water at cost.¹³¹

The committee also indirectly accused the company of having promoted the growth of the suburbs:

[I]t is furthermore a fact that the Water Company – which has the right to extend water pipes according to §9 in the contract, perhaps in direct opposition to what the City Council decided – through extending its pipes to the so-called suburbs, has greatly encouraged and supported the appearance of these unregulated communities. . . . the city can regulate the development of the suburbs with the water supply in its hands, which is extremely desirable.¹³²

¹²⁸ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207. The Financial Department’s committee consisted of the merchants J. Almqvist and F. O. Petersson, the printer August Billsten (these were also City Council members), Karl L. Andersson, H. Hertzman, as well as the city engineer J. B. Carlson.

¹²⁹ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

¹³⁰ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

¹³¹ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

¹³² LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

The city engineer, who was a member of the committee, was an outspoken opponent of the city's involvement in the suburban areas, which may explain this fit of criticism. The present study shows, however, that the city was as responsible as any other actor for this development; the company always submitted proposed extensions to the City Council beforehand (see Chapter Four).¹³³

Some council members were very critical of how the city had handled the question of the takeover thus far. (We do not know whether they were shareholders.) Captain Per Tollin thought that the company had administered the waterworks well, especially from an economic point of view. Wilhelm Heyman was of the opinion that the investigation of the Financial Department committee was incomplete and even unreliable. Sparre's statement was better, in his view. K. Beckman, on the other hand, defended the city. It had merely abided by the instructions in the contract, and he also believed that the city could make the waterworks profitable.¹³⁴ Like Beckman, most members were for the takeover, and it was decided in November 1905 to carry it through.¹³⁵

The mushrooming suburbs caused demand for extension of the water pipes, and at the same time the waterworks was already very strained, especially with the possible incorporation of the area east of the river, belonging to the St. Lars rural commune. Richert's plan of 1901 showed that a piped supply able to fulfill fire-fighting capacity in the suburbs would be costly. Therefore the city wanted to examine possibilities of finding local water sources. In 1906, the year before the takeover, the City Council commissioned Richert to draw up a plan for the rebuilding and improvement of the water system. An investigation of groundwater sources around the city, which would either replace or complement the existing water supply, was also to be carried out.¹³⁶

The groundwater study, carried out primarily by Richert and his colleague at VBB Nils Westerberg, did not meet the council's expectations, however. Samples were taken in several places north of the city in 1907 and 1908, and the water was of a good quality, although hard and ferriferous, according to the Norrköping Chemical Analysis Institute (*Norrköpings stads kemiska undersökningsanstalt*). But there was uncertainty as to whether the groundwater would suffice for the present and estimated future needs of the city,

¹³³ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207.

¹³⁴ LiSA, Linköping City Council Archives, supplement EI:25, 1905 §207; Account of the City Council meeting 1905-11-21 §207, ÖC 1905-11-22.

¹³⁵ LiSA, Linköping City Council Archives, AI:43, minutes 1905-10-31 §197 and 1905-11-21 §207, supplement EI:25, 1905 §207.

¹³⁶ LiSA, Linköping City Council Archives, AI:44 and AI:45, minutes 1906-09-11 §162, 1907-02-26 §39, and 1907-03-26 §75; Account of the City Council meetings 1907-02-26 §39 and 1907-03-26 §75, ÖC 1907-02-27 and 1907-03-27.

which city engineer Carlson estimated to at least 70 liters per second. In 1908 one can really feel the desperation with which the city handled the water question.¹³⁷

The city engineer saw Lake Ärlången upstream River Stångån as the only solution, because the groundwater was not sufficient. Although no analysis had been done, the lake water was very likely of good quality and sufficient quantity for many years to come, and by using this source the city would take its water upstream of all existing industries. As a first step toward the achievement of his plan, Carlson proposed the building of Richert's 1901 new mains between the waterworks and the city. Richert and Westerberg were asked to comment on Carlson's idea. They favored a combination of ground- and surface water, since most of the old water system, including the Tannefors waterworks, could remain in use. This would save money, the pressure in the pipe network would become more even, and the quality of the water would be very good. The City Council rejected Carlson's proposal about Lake Ärlången with the slimmest majority (16 to 14) in late 1908, but it approved of building the mains. Richert and Westerberg were commissioned to continue the groundwater investigations.¹³⁸

The issues of groundwater and the future of the water system, as well as how the city dealt with these matters, led to a political crisis in 1908, only a year after the takeover. In October and November the Financial Department met with massive criticism from several members of the City Council, and the department threatened to resign. The criticism centered around two things: neglecting administration of the finances and the audit of the waterworks, and the achieving of too few improvements of the water system. Above all, a general plan of improvement was lacking.¹³⁹

The foremost critics were the deputy chairman C. Thorngren and Captain K. von Feilitzen, and Hjalmar Suber, Anders Sterner, and the physician Karl Sederblad also joined in. Thorngren accused the Financial Department of not having carried out a sufficient audit and not keeping adequate accounts, as well as presenting an annual report that was misleading. Von Feilitzen was disappointed at the low technical achievements of the new waterworks administration, and he and Thorngren thought that the department had given in to the city engineer and discontinued the groundwater investigation too

¹³⁷ LiSA, Linköping City Council Archives, minutes 1908-05-26 §118 and 1908-11-24 §211, supplement No. 14 1908, p. 19-35.

¹³⁸ LiSA, Linköping City Council Archives, minutes 1908-05-26 §118, 1908-06-12 §136, 1908-10-27 §195, and 1908-11-24 §211, supplement No. 14 1908, p. 19-35; Account of the City Council meetings 1908-10-27 §195 and 1908-11-24 §211, ÖC 1908-10-28 and 1908-11-25.

¹³⁹ Account of the City Council meetings 1908-10-27 §195 and 1908-11-24 §211, ÖC 1908-10-28 and 1908-11-25.

soon. They suggested that a special Waterworks Board be appointed to solve all these problems.¹⁴⁰

The engineers C. A. Sylvan and M. Beckman defended the department. Beckman believed that it had done its best, and the slowness with which change was effected was due to old mistakes made by the company. For instance, because the company had not secured the property where the main was laid from Tannefors to the city, it was now difficult to lay the new one. Sylvan doubted that there was enough groundwater, and thought that the city should not simply follow what VBB proposed.¹⁴¹ As it turned out, the Financial Department did not resign. Nor did their critics want them to. Resignation would only have led to continued administration by a new set of members instead of an entirely new administrative body. Not only did the department finally strengthen its position and continue as administrative unit for the waterworks, but it actually did so for many years to come.¹⁴²

Despite the lack of a finished plan for a complete rebuilding of the Linköping water supply, in 1909 it was decided to build a water tower. The architectural design of the tower was made by the nationally renowned Linköping architect Axel W. Brunskog. The tower was constructed by Richert and Westerberg of VBB, in cooperation with J. B. Carlson. The need for improvement was urgent, for the water pressure was too low for effective fire protection and the old reservoir was beginning to fall to pieces, according to Richert and Westerberg. Linköping still had abnormally high water consumption: 162 liters per person and day in 1900. Richert and Westerberg attributed the excessive water consumption to the poor water quality, which usually led to waste of water, and to leakage in the distribution network and the reservoir. The waste would increase even more with the water tower, because of increased pressure. But by mending the leaks, improving water quality, and introducing metering the water waste could be counteracted. The water tower project was handled with great speed, and all municipal units agreed that it should be approved. The construction cost of 105,000 kronor was covered by a loan, which would in its turn be paid by the income from the waterworks. In December 1910 the water tower was ready for use (see book cover).¹⁴³

The groundwater alternative eventually proved to be a dead end, despite Richert's suggestion to build his specialty, the so-called groundwater factory. The city thus returned to the Ärlången alternative, only to reject it anew. A

¹⁴⁰ ÖC 1908-10-28 and 1908-11-25.

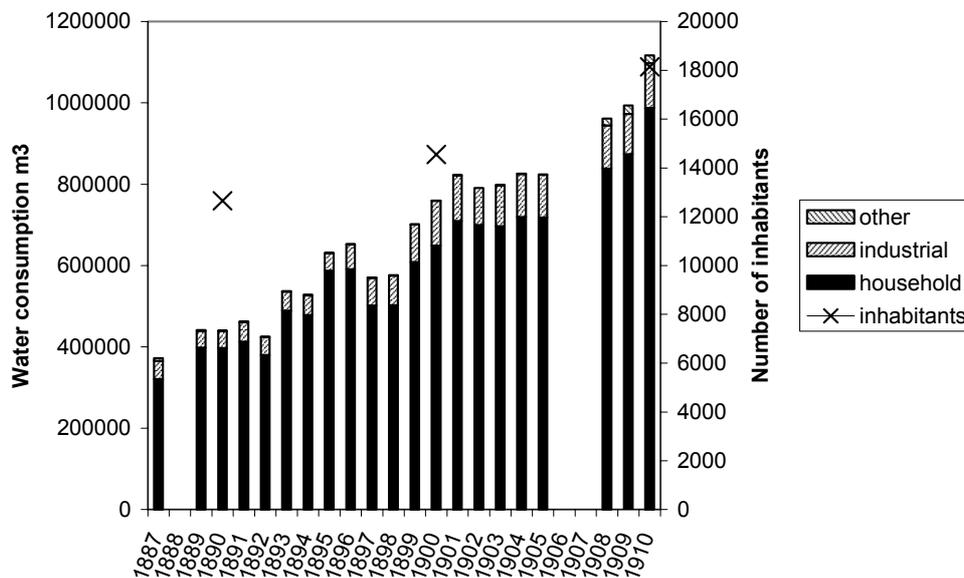
¹⁴¹ ÖC 1908-10-28 and 1908-11-25.

¹⁴² ÖC 1908-10-28 and 1908-11-25.

¹⁴³ LiSA, Linköping City Council Archives, minutes 1909-05-25 §102 and 1909-06-11 §125, supplement No. 10 1909, p. 10-18; Account of the City Council meeting 1909-06-11 §125, ÖC 1909-06-12; *Linköpings Vattenledningsverks nyanläggningar vid Råberga* (Linköping 1918), p. 18-19.

satisfactory improvement of the water system in Linköping was not achieved until the Råberga waterworks was opened in 1917 and 1918. It was located a few hundred meters upstream from the Tannefors waterfalls, and could, if necessary, be complemented with a connection to Lake Ärlången.¹⁴⁴

Figure 2.4. Annual household, industrial, and other water consumption in Linköping, 1887-1910, related to population figures.



There were no consumption figures for 1888, 1906, and 1907, and population figures are given for every tenth year. Industrial use included the few real industries that there were, as well as other commercial consumers (Source: LiSA, Linköping Water Company Archives, AI:1 and AI:2, annual reports of the Water Company board for 1887 to 1905; Linköping City Council Archives, annual reports of the waterworks for 1908 to 1910; Historisk statistik för Sverige. Del 1. Befolkning 1720-1967 1969 p. 61-65).

Conclusion

Abraham Blix and J. G. Richert, the most prominent actors in the water engineering field in the 1870s, constructed the Linköping water and sewer

¹⁴⁴ LiSA, Linköping City Council Archives, minutes 1908-11-24 §211, 1910-02-22 §48, and 1911-04-25 §112, supplements No. 11 1908, p. 42-44, and No. 6 1911; *Linköpings Vattenledningsverks nyanläggningar vid Råberga* (Linköping 1918), p. 6-8, 20-25.

systems. The aristocratic and bourgeois actor-network for piped water and sewerage viewed water as financially profitable, for the Linköping Water Company and the city itself. Breweries were presumably the primary industrial consumers, although we do not know for sure whether any such interests were enrolled. Water was probably also intended to boost local economic development, as well as the private finances of buildings owners, for example, to ensure lowered fire-insurance fees.

Piped water was also to ensure a safer and cleaner urban environment, through a modern fire defense and the prevention of epidemics. Cholera was thought to emanate from filth and stagnant water in the city. There were those who connected cholera to a poor water supply, but the cholera epidemic of 1866 was a major driving force primarily for improved street cleaning and drainage. Linköping was not as segregated as Norrköping, and hence all classes were almost equally affected by the detrimental environmental and sanitary conditions. The drainage venture remained halfhearted until the decision makers, notably Fredrik Stånggren, knew that there would be a waterworks. Only then was Richert consulted to construct a sewer system, although his plan did not cover the whole city and was accompanied by many administrative and technical problems.

Civic pride was crucial here as well. Although it is difficult to prove, it is likely that the decision to build a water system in Norrköping in 1872 affected the city fathers in Linköping, but they did not blindly follow the lead of their counterparts in Norrköping. Fredrik Stånggren had been working with this question for many years and had looked to examples in other cities, but the Norrköping resolution may have been at least one of the triggers for Linköping. The attractiveness of water meant that the actor-network was easily enrolled, and it became strong and easily defined.

There was no open resistance to the water supply and sewerage projects, because it was the financially and politically powerful people that enrolled and were enrolled. Water vendors, for instance, were too few and too powerless to be able to influence the matter. The building owners and tenants were potentially burdened by the water and sewerage project as a whole and the water fees in particular, but there is no record of any protests.

The durability of the actor-network for piped water and sewerage practically lasted as long as the project itself, that is, until construction of the systems was completed, and administration was subsequently taken over by the Linköping Water Company and the Financial Department. In the years to come there were bigger or smaller technological projects, but the actor-networks were not always distinguishable. First of all, several of the projects were too small to cause political concern at all. Secondly, in Linköping separ-

ate administration of the Water Company resulted in a low profile, at least until the 1890s.

There was presumably also a growing institutionalization in the company, perhaps to the extent that it mismanaged its primary material assets: the waterworks and the pipe network. The important thing was dividends on the shares. However, municipalization was not much of a solution initially, for the city was not accustomed to having the administrative and technical responsibility for a water system. Sewerage was an unwanted child to begin with, but, when it finally came under the city again in 1895, it began to be substantially improved, although this scheme took many years to finish.

PART II

Geography

The population of Norrköping and Linköping grew in the late 19th century, and their rates of growth were fairly similar, although they were rather modest by national standards (see Figure 1, Introduction). The growth meant both physical expansion and extension of infrastructure. Extending water supply and sewerage, both within and outside the planned city area, became an issue in Norrköping and Linköping soon after the construction was completed in 1875 and 1876. Many were those who wanted to utilize this new municipal infrastructure. With the appearance of suburbs, water supply and sewerage became crucial issues for housing, sanitary, and financial reasons, both for the suburbs and the cities. However, many ideological, economic, legislative, and technological questions often made this expansion of municipal infrastructure a difficult matter.

Local studies of water and sewerage extension to suburbs are largely missing in European historiography, but a few general comments can be made about the social geography of European cities in the mid- to late 19th century. Continental cities often had an old core that was inhabited by the upper class, and core areas were often prioritized when water and wastewater systems were constructed. New industrial centers such as Birmingham had a congested downtown, and the middle and upper classes therefore moved to suburbs. Generally speaking, streets, districts, and suburbs received a social label; they were fashionable, filthy, or middle class. The middle and upper class also came to dominate planned areas, while unplanned districts became working class due to inexpensive housing.¹

Main Question and Sub-Questions

Spatial extension of water supply and sewerage within Norrköping and Linköping and to some of their suburbs is investigated in this part. The main question for part II is: Why and how did (or did not) actor-networks extend

¹ Goubert 1988 p. 116-118; Hohenberg and Lees 1995 p. 295-297, 315-318; Mayne 1993 p. 57-62.

water and sewer systems geographically within and outside the respective cities? The following questions will also be dealt with: Why did the question of expanding water and wastewater services arise, and how were different districts and suburbs treated? In Linköping, what was the relationship between the city and the Water Company, and how did it affect growth of the systems? What actor-networks dominated in the discussions about geographical extension, and what do these debates tell us about municipal policy and ideology, public health and environmental interests, and class and pollution, with particular regard to public services such as water supply and sewerage?

Actors and Interests

Most actors from Part I reappear in Part II, at least if we look at larger groups or units: the state, municipal boards, city engineers and physicians, building owners, newspapers, and the like. Many individual actors are the same as well, although there are some new persons, since the questions dealt with were different. Geographically speaking, there are also additional actors: the suburbs and rural communes adjacent to the cities of Norrköping and Linköping, whose main interest it was to get access to piped water and sewerage. There were also partly other actor-networks involved in the spatial questions of Part II than in the technical and organizational introduction and extension of water and sewerage in Part I.

CHAPTER 3

Urban Growth and Geographical Extension of Water and Wastewater in Norrköping

Water and Sewerage Extension Within the City's Jurisdiction – Planned Areas and a Suburb

Erik Swartz played a central role for the idea of transforming Norrköping into a planned, modern city à la Paris, Stockholm, and other international cities, encircled by boulevards and parks.¹ In 1856 he presented this idea to the city fathers. A plan by the landscape gardener Knut Forsberg, who had won a competition for the planning of the Boulogne Forest in Paris and was employed by the Swedish King Oscar I, was exhibited, in which Norrköping was surrounded by boulevards and adjacent parks. Swartz worked in all possible ways to implement this plan until the end of his life, and, although it was revised several times, much of it was finally realized around the turn of the century 1900.² These boulevards still frame Norrköping city center.

The Planned Area and New Building Lots

City planning was regulated in the national building regulations, and it was the planned area or city plan that constituted the real city, even though there were often areas outside it that belonged to the city's jurisdiction.³ In Norrköping in the 1870s, there was rather rapid population growth, and the housing shortage led to crowded living conditions. This in turn meant physical expansion, and consequently the built-up planned area, as well as necessary infrastructure had to keep up. However, there were no public initiatives to alleviate the housing shortage. It was left to private enterprise, but the selling

¹ Some of the research on which this chapter is based has also provided material for Jonas Hallström. 2002. The Growing Pains of the Pipe-Bound City: The Extension of Water and Sewerage to Suburban Areas in Norrköping, Sweden, 1860-1890, *Public Works Management & Policy* 6(3): 186-199. © Sage Publications.

² Gejvall-Seger 1976 p. 57-69. See also Johansson 1987 p. 397, 630.

³ *Kongl. Maj:ts nådiga Byggnadsstadga för rikets städer*, 8 May 1874, SFS, 1874, No. 25, §§9, 10.

of building lots in new districts within the planned area went slowly. In a case from 1878, when the southeastern part of the city was being planned, the Financial Department decided that water and sewer pipes should be laid to a few blocks in this area, so as to make the building lots attractive to buy. The city engineer Hellström drew up a plan for water supply and sewerage as well as for the paving of sidewalks and the macadamizing of streets.⁴

In the beginning of the 1880s, the so-called northeastern district, east of Saltängen along the river, was being planned. The street department had been commissioned by the City Council to macadamize and drain the streets surrounding the blocks by the riverside. The Waterworks Board suggested a full extension of the water supply, fire hydrants and sewerage, which would include also several blocks north of the ones in question.⁵

However, there was disagreement about whether piping was necessary or not. The banker and director of the sugar refinery Gripen (and member of the board of some other Norrköping industries), John Philipson, opposed the plan on the grounds that the area was not very frequented and was mostly used for storing lumber. An extension to the workers' dwellings to the southwest was a more important project in his view, and the environmental conditions there were just as poor as in the northeast. Since the municipal taxes were so high, it was not a good idea to do this work at this time, he argued, so he proposed that the extension of water supply and sewerage, as well as macadamization, which was settled already, be postponed.⁶

In the discussion about Saltängen, Philipson had a number of influential opponents, all of whom were (or had been) either members or deputy members of the Waterworks Board. The technical director of Drags woolen factory Fredrik Blombergh was of the view that this area was not as short of people as Philipson had claimed and that the timber storage increased the risk of fire. What he thought was most important was to macadamize and lay pipes at the same time – anything else would be mismanagement of resources. The woolen manufacturer Per Ulrik Boëthius and the civil engineer Johan August Anderson thought that drainage was a prerequisite for macadamization, because the area was so marshy. Water pipes might also be laid at the same time. The bank director Christian Eberstein, who was chairman of the City Council and a former member of the Waterworks Board, agreed entirely with Blombergh. Besides, since he owned property in the southeast, he could affirm that this

⁴ Gejvall-Seger 1976 p. 62-67; Svensson, Godlund, and Godlund 1972 p. 10-11; NSA, Norrköping City Council Archives, AI a:16, minutes 1878-03-21 §3.

⁵ NSA, Norrköping City Council Archives, minutes 1883-05-17 §13, supplement No. 12 1883.

⁶ NSA, Norrköping City Council Archives, minutes 1883-06-21 §3. Account of the City Council meeting 1883-06-21 §3, NT 1883-06-22; NSA, Directory of Norrköping City Council Members, 1863-1970; Myrdal 1972 p. 26-27.

district was far better off as far as water supply and sewerage were concerned than the northeast.⁷

There was no room for a compromise – it was either water, sewerage, and macadamization, or nothing. The issue was put to a vote, and the votes turned out to be equally divided across the council. The chairman's vote thus decided the matter. Water pipes and sewers were extended to the northeastern district of the city. John Philipson was right in that the area was not so frequented, at least if we look at how many people actually lived there. But the fire-protection argument was still valid, and this question concerned the future as much as the present. By extending these technical systems, the northeastern district was prepared for expansion.⁸

Philipson may also have been right about the southeastern district, which was without doubt in a process of expansion. Towards the end of the 1880s the existing sewer pipes could not drain all the storm- and wastewater from the area, since even new building lots were connected to the old mains. Hellström therefore suggested a new main, which would cover the new area. Although only about half of the project plan was approved by the council, it became more expensive than what was estimated from the beginning. The project was financed by the capital obtained from the sale of city-owned buildings and houses.⁹

It is clear that the status of certain districts was higher than others. Around 1890, the city projected expansion of the planned area to the northwest, outside the northern boulevard. This new area was located near the city border in the northwest, adjacent to the western part of the northern suburb, Marielund (see Figure 3.1). N. J. Andersson had bought a building site there, and since he planned to start building very soon he asked the city to extend water pipes at once. The Financial Department was of the opinion that even though it was responsible for selling new building lots in this area, extension of the water supply was outside its jurisdiction. However, the department felt legally obligated to arrange for this service, since the area was now officially a

⁷ Account of the City Council meeting 1883-06-21 §3, *NT* 1883-06-22; NSA, Directory of Norrköping City Council Members, 1863-1970.

⁸ NSA, Norrköping City Council Archives, minutes 1883-06-21 §3, supplement No. 10 1884, annual report of the Waterworks Board for 1883. Account of the City Council meeting 1883-06-21 §3, *NT* 1883-06-22. As late as 1913 most of the streets that had been piped in 1883 were still uninhabited, but fires could yet attack the carpenter's workshops and timber stocks of the area, as for instance in 1906 (Map "Norrköping år 1913" in Myrdal 1972; Norrköping City Council Archives, supplement No. 51 1908).

⁹ NSA, Norrköping City Council Archives, minutes 1889-12-12 §27, 1890-11-27 §14, and 1890-12-11 §9, supplement No. 42 1889.

part of the city and building sites had already been sold.¹⁰ The extension of sewerage was also absolutely essential, as this was part of the marshy district north of the river. Once again the project was financed with money from buildings that were sold.¹¹

In the very northwest corner of the city's planned area was the notorious Beckershof. The city physician C. W. Engelbrecht was horrified by the deficient sanitary conditions at Beckershof when inspecting it in 1888. Drainage was the worst problem, with a shallow ditch in the yard with virtually no inclination. Solid and liquid waste was disposed of anywhere in the yard. The well water was surprisingly good, however. The city physician concluded that Beckershof was becoming a hotbed of disease and misery.¹²

The Board of Health had repeatedly ordered the owner G. W. Eriksson to remove the reported nuisances, but he argued that the whole area was swampy, which made the drainage of waste-, storm-, and groundwater completely impossible. The only solution was to extend piped water supply and sewerage. Eriksson's houses were inhabited by working class families, and at the time around 400 people (including children) shared 100 apartments, with one, two or three rooms including kitchen. He feared both for himself and his tenants if the cholera epidemic on the Continent reached Norrköping, and thus asked the city to "lend him a helping hand," which was his only chance of improving the sanitation. He offered to contribute 200 kronor annually during twenty years if his request was approved.¹³

At the time the wastewater was collected daily by the Board of Health, at the expense of the building owner. Eriksson could certainly be reproached for not having considered the topography, which was totally inappropriate for building and the achievement of tolerable sanitary conditions. He had simply erected one barrack after another. But the Board of Health was in favor of the extension. The Financial Department was divided as to what position it was to take. Some members thought that the sanitary danger which threatened the city from the overcrowded Beckershof provided sufficient motivation to approve the request, especially as Eriksson would contribute financially. The extension of water and sewer pipes in that direction was also unavoidable, since it was now part of the planned area. Others, including the chairman Paul F. Risberg, were of the opinion that the advantages for the city were yet only a drop in the bucket when considering the great sanitary danger that emanated

¹⁰ According to the water regulations, all inhabitants within the planned area could require piped water up to the yard boundary (*Reglementen m.m. för Norrköpings Stads Vattenledning och Vattenafledning*, Norrköping 1889).

¹¹ NSA, Norrköping City Council Archives, minutes 1891-09-03 §6, supplement No. 33 1891.

¹² Horgby 1989 p. 228-229.

¹³ NSA, Norrköping City Council Archives, minutes 1892-09-24 §6, supplement No. 53 1892, p. 1-3 (including quote).

from the “unhealthy” and “filthy” northern suburb, which was even closer to the city. Therefore, he said, Eriksson should contribute even more than the 4,000 kronor for it to be worthwhile. A slight majority finally approved Eriksson’s request.¹⁴

At the following City Council meeting the discussion was not long in coming. On the whole two different actor-networks can be distinguished in this matter, and they roughly followed the divide in the Financial Department. The foremost representatives of the one actor-network were the two physicians C. W. Engelbrecht and C. O. Björck, as well as the deputy chairman, banker, Russian consul, and industrialist Axel Swartling and the school inspector Ivar Lyttkens. They enlisted what must be seen as a humanitarian public health ideology. The poor sanitary and overcrowded conditions in Beckershof threatened the workers who lived there as well as the city itself with cholera and other epidemics, which was considered to be a more important issue than the costs involved: “But what is 2, 3, or 4 thousand kronor against the 30, 40, or 50 thousand which would be at stake, should an epidemic come here? . . . It is not a few thousand kronor that is jeopardized here but human life,” said Björck. And as far as the northern suburb was concerned, it was better off since it had fresh water, according to Engelbrecht. Lyttkens thought that it was the duty of the city to help the workers at Beckershof, who would soon be on poor relief if the present situation continued. Since Eriksson offered to pay a great deal and as water supply and sewerage sooner or later had to be extended anyway, this actor-network thought that the proposal should be approved.¹⁵

The fear of cholera must be seen against the city’s background – notably the 1866 cholera outbreak – but also in the 1892 European context. The great epidemic in Hamburg as well as outbreaks in Russia were taking many human lives at this time, and there was a general fear that it would soon plague Swedish cities. By the 1890s, the Pettenkofer – Koch debate had resulted in most Swedish medical experts adhering to Koch’s bacteria-based theory. A combination of more old-fashioned contagionist quarantines and the more modern practice of inspections were imposed all over Sweden in 1892. Everything had to be done to stop cholera from entering the country.¹⁶

From August to October 1892 this cholera epidemic ravaged Hamburg. It was not a major outbreak compared to earlier cholera epidemics in Europe or

¹⁴ NSA, Norrköping City Council Archives, minutes 1892-09-24 §6, supplement No. 53 1892, p. 3-8.

¹⁵ Account of the City Council meeting 1892-09-24 §6, NT 1892-09-26. Lyttkens pointed to the fact that the drainage from Beckershof was then discharged in the river upstream the city, which was considered a sanitary danger (see Chapter Five).

¹⁶ Baldwin 1999 p. 176-180; Graninger 1997 p. 266-268.

North America during the 19th century, but it was very devastating to the city in terms of increased mortality. However, most of the other German principalities and even the neighboring city of Altona were not affected to the same degree. With the advantage of hindsight, recent research has concluded that the reasons for this unusually serious outbreak was a combination of an unfiltered water supply, a long heat wave which facilitated the spread of the cholera germ, and a slack response to the reports of physicians by local public health officials.¹⁷

The other actor-network, represented by the mayor and chairman of the Board of Health Carl Axel Rudolf Lothigius and the bank director Christian Eberstein, took a stance based on economics. With no consideration for his tenants at all, they wanted to squeeze as much money from Eriksson as possible, since he had built his houses on poor land and should have realized the costs of improvement. Otherwise, they reasoned, he had better continue arranging the whole matter himself through the daily manual collection of wastewater, excreta, kitchen refuse, and other solid waste. The sanitation at Beckershof could not be as poor as it sounded. Eberstein thought that the situation had been “painted too vividly,” to which Björck retorted: “[W]hen the epidemics come, it is not I who will paint, and the colors will be all the more vivid.”¹⁸

As it turned out, the proposal of Engelbrecht and his actor-network eventually passed by acclamation, and most members of the City Council were thus convinced that it was now right to extend water supply and sewerage.¹⁹ The public health network was driven by a presumably genuine concern for the workers at Beckershof, but also by a fear of epidemics and the exorbitant costs for poor relief that would follow. The enlistment of cholera was therefore a logical strategy, particularly as it was a real threat at the time, and it evidently was successful.²⁰

In his annual report for 1893, the first provincial physician praised the substantial and costly sanitary improvements that the city of Norrköping had achieved at Beckershof. Water supply and sewerage had been installed, the

¹⁷ Evans 1987 p. 285-306.

¹⁸ Account of the City Council meeting 1892-09-24 §6, NT 1892-09-26 (including quotes).

¹⁹ NSA, Norrköping City Council Archives, minutes 1892-09-24 §6; Account of the City Council meeting 1892-09-24 §6, NT 1892-09-26.

²⁰ Eriksson contributed two kronor per apartment and year, which was reasonable compared to the water fees in other Swedish cities (see Appendix 1, Table 1). However, since water for household use was free and as water was to be extended for free upon request within the planned area of Norrköping according to the regulations, he can yet be said to have contributed quite a bit to the solution of this question.

cesspits had been rebuilt, and arrangements had been made for the collection of solid waste.²¹

Norrköping's Southern Suburb – A Nice Middle-Class Area

In the early 1860s new housing areas arose outside the city, such as the northern suburb and the southern suburb.²² To escape housing shortage and high rents downtown, many of the city's industrial workers settled in the northern suburb, where no building regulations whatsoever existed. This suburb was said to be a shanty town of the worst sort.²³ The conditions in the southern suburb were better, and it was largely inhabited by the middle class.²⁴ In the following the evolution of these two suburbs will be outlined.

The southern suburb, the first acknowledged in Norrköping, originated in 1861. Elis Grenander – one of Norrköping's two mayors at the time, and the owner of large estates south of the city – had the city engineer Bror Leonard Hellström draw an unofficial overall plan for a big area just south of the actual city. This area was beautifully situated, ideal for a suburb with middle-class one-family houses. It was not included in the city plan, but was under municipal jurisdiction and was consequently taxed like all other parts of the city.²⁵ Just as in the shanty town north of the city, there were social and sanitary problems, but not to the same degree.²⁶

In 1869, some house owners in the southern suburb wrote to the City Council to ask for the same kind of public service that people had in the city – paving, street lighting, and police supervision. The request was denied, according to the Financial Department on the grounds that, first, the city had no legal obligation to extend these services outside the border of its planned area (the city plan). Secondly, the suburb had no legal right to demand these services since it had come about without the approval of the city authorities

²¹ Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1893 (Linköping 1894), p. 6-7.

²² Apart from the two suburbs singled out for analysis, there were also the suburbs *Borgs villastad* to the west (emerged in the 1890s, well-planned with a spa: Kneippen), *Vilbergen* to the south (arose in the 1890s), and *Sylten* to the east. The latter was a summer house area that began to be populated all year round in the 1870s (Kvarnström, Malmsten, and Nilsson 2000 p. 31-36; NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1874-1875).

²³ Larsson 1913 p. 13, 105; Myrdal 1972 p. 283; Svensson, Godlund, and Godlund 1972 p. 261; Horgby 1989 p. 31-33.

²⁴ Gejvall-Seger 1976 p. 84-85.

²⁵ Gejvall-Seger 1976 p. 81-85; NSA, Norrköping City Council Archives, AI a:14, minutes 1876-12-14 §4.

²⁶ Horgby 1989 p. 32-33.

and therefore did not have a legally established plan, approved by the Swedish Government, as required by the building law.²⁷

The Expansion of Water Supply and Sewerage to the Southern Suburb

In late 1876, some house owners in the southern suburb again wrote to the City Council to request the same municipal services as in 1869, as well as the city's latest piece of infrastructure – water supply. The most urgent of these services was water supply, both from a sanitary and an economic (reduction of insurance fees) point of view. The request was motivated by the fact that the suburb paid tax in the same way as all the other parts of the actual city. One member of the City Council contradicted this, and argued that the house owners in question should have realized from the beginning that property in an unplanned area could not receive the same services as in a planned area. In return, property in an unplanned area was much less expensive.²⁸

In response to the suburb's request, the Financial Department referred to the arguments and the resolution of 1869, as if to emphasize the power of not only the city authorities but also of local and national legislation. Nevertheless – and here came an interesting turn in the argumentation – they considered the relatively large population in the southern suburb (about 800 people) reason enough for the extension of at least water pipes, especially as it could be done without high costs. Furthermore, as early as 1874, when the building of water supply and sewerage in Norrköping was being finished, the Waterworks Board had received permission from the City Council to extend these to the southern suburb and, according to its plan, this was to be carried out during 1877. These three factors in combination – a substantial population, inexpensive realization of the project, and, perhaps most of all, the fact that the Waterworks Board was for the project – probably provided sufficient impetus for the application from the southern suburb to be approved this time, despite the fact that the city had no legal responsibility. The water supply and sewerage were extended only to the end of a street in the suburb, where a water tap and a fire hydrant were installed. In the summer of 1877, some house owners in the southern suburb (Elis Grenander and others) re-

²⁷ Letter from *Drättselkammaren* to the City Council, NT 1877-01-13. In 1874, new national building regulations were established, and they confirmed the previous law as regards the status of the city plan (*Kongl. Maj:ts förnyade Nådiga Byggnads-Ordning för staden Norrköping. Gifven Stockholms slott den 26 Oktober 1836, med de sedermera deruti gjorda ändringar och tillägg*, Norrköping 1862, §1; *Kongl. Maj:ts nådiga Byggnadsstadga för rikets städer*, 8 May 1874, SFS, 1874, No. 25, §§9, 10).

²⁸ NSA, Norrköping City Council Archives, AI a:14, minutes 1876-12-14 §4; Account of the City Council meeting in NT 1876-12-15.

quested that water and sewerage be installed in their houses. This request was granted with the condition that the extension be financed by the house owners themselves.²⁹

Provisions for the extension of water supply and sewerage outside the city were only partially stipulated in the regulations, so a praxis gradually evolved after the completion of the systems in late 1874 and 1875. The water and sewer systems were originally built for the city itself, that is, the planned area, but the city authorities were ready to extend them outside the planned area upon request. Water was free for household use within the city, and here the authorities paid for the water and sewer service pipes up to the yard boundary. Outside the city, on the other hand, users would have to pay for the water as well as for pipes (even mains) from the border of the planned area to the site in question. The southern suburb was both a confirmation of and an exception from praxis. The property owners had to pay for the water and their installations, but the city paid for the work and the pipes to the suburb, and water was distributed without cost from the water tap in the street.³⁰

Why was there a deviation from praxis? On an ideological level, the fact that the City Council and the Financial Department so clearly stressed the legal power of the border between the city plan and the unplanned area outside meant that they wanted to uphold the distinction between the public and the private. During the 1860s and 1870s this ideology was prevalent as a way of upholding the social order in Sweden, and it basically legitimated very conservative values. The city belonged to those who “owned” it, namely the members of the City Council. Their interests guided much of public policy in the city, and it was important for them not to let anyone violate the legal means that existed to uphold this ideology, in this case the city plan and the urban laws.³¹ On the other hand, it was clear that the southern suburb would get water supply (and sewerage). A paternalistic responsibility for the city’s residents also existed among the city fathers, and the southern suburb was turning into an informal part of the city. It was already under municipal

²⁹ NSA, Norrköping City Council Archives, AI a:12, AI a:14, and AI a:15, minutes 1874-10-29 §3, 1876-12-14 §4 and 1877-01-11 §3; Accounts of these minutes are to be found in *NT* 1874-10-30, 1876-12-15, 1877-01-12 and 1877-01-13; Norrköping Waterworks Board Archives, AI:2, minutes 1876-11-23 §3 and 1877-08-10 §2. J. G. Richert had also included a pipe to the southern suburb in his plan for sewerage of April 1872, but it seemed to be optional and was not intended to be built at the initial stage (Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6).

³⁰ NSA, Norrköping City Council Archives, AI a:10 and AI a:12, minutes 1872-05-30 §6, 1874-10-08 §7, and 1874-10-29 §2. Examples of praxis in minutes 1881-08-18 §2, 1881-09-29 §5, and 1882-10-19 §6, as well as Norrköping Waterworks Board Archives, AI:2, minutes 1877-08-10 §2, 1882-10-18 §3, and 1888-10-18 §2; *Reglementen m.m. för Norrköpings stads vattenledning och vattenafledning* (Norrköping 1875).

³¹ Kilander 1991 p. 18-33, 44-55, 64-65.

jurisdiction. The board must then have seen the southern suburb as a very suitable direction for the city's expansion.

Another way of interpreting the case of the southern suburb is by looking at the technological and economic impetus that especially the new water supply had. Piped water had presumably a kind of magic power for the inhabitants of the suburb, which is shown by the fact that modern services like street lighting (from the gasworks) and water were requested, but not less glamorous services such as sewers. However, piped water appealed to the members of the Waterworks Board as well, as was also seen in the case of the northeastern district in 1883. Here lies a kind of modernist force. The entrepreneurs of a new technology expand it almost for its own sake. This drive is probably the strongest when it is new, when there is a higher technological and economic potential for expansion than after some years. Construction costs must be amortized, for instance. According to the ideology of the day, the inhabitants of the southern suburb should arrange for water supply on their own, since the suburb was considered a private project.³² On the other hand, the Waterworks Board wanted to renew the city with this new technology, even outside the planned area.

From a more pragmatic, economic point of view, one can assume that the city also expected the 1876-77 case to be quite easily solved. The topography of the area was good and it was not so large, because it basically consisted of only two streets. On the other hand, quite a few people lived there, around 800, so there were some sanitary problems, although they were not as poor as in the northern suburb. But from a fiscal point of view the slight overcrowding was thought positive: It would mean relatively low construction costs per capita for the water and sewer pipes, which would make the sanitary conditions better and decrease insurance fees, while still maintaining a very good tax base. The inhabitants of this suburb were reliable middle class taxpayers and constituted a much better tax base than the northern suburb would have done, since it mainly consisted of workers and poor people.³³

The southern suburb grew modestly in the following decades, but around the turn of the century there was intense building activity there and the population grew more rapidly. Thus a similar situation to that in the 1870s occurred, and several house owners in the suburb again asked for public services. This time the area was about to be included in the city plan, which meant that they acted on legal authority: they both paid tax *and* were part of the planned city area. The home owners gave a lively depiction of a suburb in which the roads were either pools of mud (in the fall and spring) or on dry

³² Kilander 1991 p. 54-55.

³³ Gejvall-Seger 1976 p. 81-85.

summer days generators of dust, from the roads themselves and from dry horse dung.³⁴ Furthermore, during the winter it was pitch dark most of the day, for there was as yet almost no gas lighting. Therefore, they asked for the paving of the streets and sidewalks, and for street lighting.³⁵

The Financial Department and the Drafting Committee found this reasonable, but to ensure future expansion contracts were signed with the house owners about the buying of property. The city had also purchased a lot of land from the former mayor Elis Grenander. Unutilized property and parts of the house owners' yards along the streets were needed to widen them. Gas, water, and sewer pipes were also to be extended, apart from the few that were already in place. Some old sewers had broken due to subsidence of the soil. The total cost for all this was 27,000 kronor.³⁶

If the Waterworks Board and the city fathers thought that the city would expand in a southerly direction, they were consequently not entirely wrong. But it took another 20 years before anything of significance happened. Early on, the northern boulevard (*Norra promenaden*) and the railroad hindered expansion to the north, although there was unregulated building in the northern suburb, but there was space and a good topography to the south. It was difficult to get people to build houses in the new areas, however, so the city promoted them indirectly by building a square (*Stor-torget*), workers' dwellings, as well as new schools. The schools were to be situated in spacious places with plenty of trees and plants, according to the elementary school ideology of the day. In this way, the new areas encircled by the southwestern, southern, and eastern boulevards were finally finished and became attractive places towards the end of the century.³⁷

In 1898, it was decided to include the southern suburb in the city plan. Current architectural ideologies promoted the establishment of new districts as "garden cities", in which the old checked pattern with right-angled streets was abandoned in favor of curved roads, and was surrounded by a vivid agricultural landscape. In short, city planning was to imitate nature, which was maybe particularly suitable to the southern suburb. The two architects Per Hallman and Gunnar Fredrik Sundbärg were commissioned to draw up a new plan for the area, and they were inspired by the ideas of Camillo Sitte.³⁸

³⁴ Tarr 1996 p. 323-333.

³⁵ NSA, Norrköping City Council Archives, minutes 1900-11-15 §11 and 1901-06-13 §19, supplement No. 37 1901.

³⁶ NSA, Norrköping City Council Archives, minutes 1901-06-13 §19 and 1902-05-29 §2, supplements No. 37 1901 and No. 41 1902. Account of the City Council meeting 1902-05-29 §2, NT 1902-05-30.

³⁷ Gejvall-Seger 1976 p. 60-67; NT, 1872-05-28.

³⁸ Gejvall-Seger 1976 p. 84-88; Johansson 1987 p. 630.

The shift from the checked pattern – the so-called renaissance ideal – to Sitte's more medieval, organic city planning model may have implied a beginning dissolution of bourgeois power in the city. The checked pattern had dominated since the great fire of 1719, and symbolized order, harmony, and bourgeois power. Sitte's ideas could have been regarded as a critical, subversive perspective, but it is more likely that Norrköping was influenced by it because it was in vogue at the time. It was, after all, the bourgeois elite that took the initiative. Since several roads existed that did not follow the pattern in the actual city, it was also easier to apply this city planning perspective.³⁹

Reaching Out or Holding Back? – Water and Sewerage Outside the City Border

The Northern Suburb – a Shanty Town

A consequence of industrialization and urbanization in Sweden was the appearance of shanty towns. Housing shortage, with accompanying high rents and increased land prices, drove the working class in particular outside the city border, where building was not restricted by urban building and fire-protection laws.⁴⁰ The northern suburb, which belonged to the Östra Eneby rural commune, was seen by many as just such a shanty town. The area was not suitable for farming, so it was divided into building sites, which were then sold. Since city planning did not apply, it emerged over a number of years. The northern suburb had its origins around 1860 and at that time had only about 60 inhabitants. The area was situated along the main Eastern railway line, which was under construction from 1863 to 1866, but did not grow much during the 1860s.⁴¹ The transformation into a suburb with enough people to be considered a problem area by local and regional authorities occurred in the 1870s, when population increased incredibly rapidly.⁴²

The housing and sanitary conditions in Swedish industrial towns at this time were generally poor, but in Norrköping these conditions were probably even worse, particularly in its suburbs.⁴³ In the northern suburb houses were often crowded and built of poor materials; even stables were sometimes turned into apartments.⁴⁴ Sanitary measures of any kind were lacking, water supply was rudimentary, and the suburb sewers ended in open trenches. These

³⁹ Andersson 1989 p. 131-151.

⁴⁰ Larsson 1913 p. 13, 105.

⁴¹ Arvidsson 1995 p. 10-11; Myrdal 1972 p. 301-303, 396; Gejvall-Seger 1976 p. 81, 90.

⁴² Horgby 1989 p. 31-33; Larsson 1913 p. 105; Arvidsson 1995 p. 11.

⁴³ Svensson, Godlund, and Godlund 1972 p. 259-267.

⁴⁴ Horgby 1989 p. 31-33.

conditions differed within the northern suburb, however: there were better and worse places to live.⁴⁵

The Expansion of Water Supply and Sewerage to the Northern Suburb

According to praxis, pipes outside the city plan had to be paid for by the house owners themselves, and this meant that few in the northern suburb could afford piped water. A company just north of the city border, the engineering workshop Norrköpings Mekaniska Verkstad, was granted the right to distribute water to the inhabitants of the eastern part of the suburb, Fredriksdal, particularly those living in close proximity to its premises. In this way, the City Council could attend to the needs of this poor suburban district and still make some money from it, since the company had to pay for their water.⁴⁶

In the 1880s, the number of inhabitants in the northern suburb grew fast, reaching the level of some 3,000 inhabitants.⁴⁷ In 1885, the suburb became a *municipalsamhälle*. It was really a part of the rural commune Östra Eneby, adjacent to the city of Norrköping, but by being designated a *municipalsamhälle*, the suburb came under the national urban laws (general regulations as well as building, health and fire-protection laws), while remaining a part of the rural commune administratively, judicially and ecclesiastically.⁴⁸ For instance, the building of houses and latrines hereby came under the urban building codes, although it is difficult to say how much effect the regulations had in practice.⁴⁹

In the middle of the 1880s, the inhabitants of the northern suburb began demanding help from the city with necessary infrastructure and services. Water taps, for instance, were too few. In 1886, a committee from Fredriksdal wrote to Norrköping Waterworks Board to ask if a water pipe could be extended from the engineering workshop (now renamed Mekaniska Verkstaden Vulcan) along one of the streets. The Waterworks Board was not in favor

⁴⁵ NSA, Norrköping City Council Archives, supplement No. 15 1893; Svensson, Godlund, and Godlund 1972 p. 267. The northern suburb consisted of three distinct areas. *Marielund* was the western part, *Fredriksdal* the eastern part, and *Sandby* the northern part.

⁴⁶ NSA, Norrköping City Council Archives, AI a:12 and AI a:13, minutes 1874-11-26 §6 and 1875-09-09 §6; Svensson, Godlund, and Godlund 1972 p. 178-179; Hallström 1999 p. 16. However, we do not know whether the engineering workshop in its turn charged the inhabitants.

⁴⁷ Arvidsson 1995 p. 11, 20.

⁴⁸ Arvidsson 1995 p. 12; Nilsson 1989 p. 53-56; Larsson 1913 p. 107; Gejvall-Seger 1976 p. 82. NSA, Norrköping City Council Archives, supplement No. 43 1893 and No. 1 1894.

⁴⁹ "Byggnadsordning för Norrköpings Norra Förstäders område", *Kongl. Maj:ts Befallningshafvandes i Östergötlands län allmänna kungörelser*, Serien B, No. 43 1885 (Norrköping 1922).

of any new extensions of the water supply, so the committee instead wrote to the City Council, which, in turn, submitted the letter to the Waterworks Board. In the board's response, which contained some reservations, it expanded on the subject. Water consumption was increasing, and the waterworks' pumps were already achieving their maximum yield, so expansion outside the city plan could not be allowed. If allowed, it would also be very difficult to say no if other suburbs made similar demands. The board was also of the opinion that more water would increase rather than decrease sanitary problems, since sewerage and drainage were so poor in the suburb.⁵⁰

Not only was the Waterworks Board divided in this question, but so was the City Council, which became apparent at a meeting in late 1886. There was a long discussion and there were several proposals, some of which were put to the vote. Eventually, there was a slight majority in favor of a proposal that on the whole resembled the suburb committee's original proposal, but with some additional requirements. The water pipe was to be about 200 meters long, and it would supply those living adjacent to it with city water for a fee (see Figure 3.1). The pipe was to be supervised by Norrköping's waterworks engineer, B. L. Hellström, and the committee had to see to it that proper drainage was arranged. Obviously, even the slightest improvement of water supply and sewerage in the northern suburb was rife with conflict. The proponents of the extension of water were successful in the end, but it was a close shave. A detailed account of the discussion, which was published in the local newspaper *Norrköpings Tidningar* the day after the meeting, reveals deep disagreement among the members of the City Council in this question.⁵¹

The opponents of the extension were represented primarily by members of the Waterworks Board, a powerful actor-network in this issue, since it was the administrative unit of the water system and was considered an expert group. J. A. Andersson, Carl Swartz, the director of the cotton factory Norrköpings Bomullsväveri AB Daniel Engelke, and the principal Axel W. Molin (deputy) made up this group. Per Ulrik Boëthius, who was director of the woolen factory Ströms AB and until 1884 a deputy of the Waterworks Board and a member of the Board of Health, and the engineer Johannes Ringborg, also belonged to this actor-network. The proponents were headed by a lone, dissident member of the Waterworks Board, Fredrik Blombergh, together with the city physician C. W. Engelbrecht, Herman Wahren, member of the Board of Health Axel Swartling, school inspector Ivar Lyttkens, and former chaplain

⁵⁰ NSA, Norrköping City Council Archives, minutes 1886-10-21 §4; Norrköping Waterworks Board Archives, AI:2, minutes 1886-09-22 §2 and 1886-11-06 §3.

⁵¹ NSA, Norrköping City Council Archives, minutes 1886-11-18 §16; Norrköping Waterworks Board Archives, AI:2, minutes 1887-03-19 §3; Account of the City Council meeting 1886-11-18 §16, NT 1886-11-19.

to the King, Edward Rodhe. Apart from Blombergh, who represented engineering interests, this actor-network was dominated by public health and humanitarian interests, and several members also promoted such interests in the Beckershof case in 1892.⁵²

The proponents of the water extension – the public health network – started out by contradicting the Waterworks Board’s *technical* argument, namely that the pumps were running at their maximum rate. Fredrik Blombergh was of the opinion that the pumps were capable of working either a little faster or a little longer per day (four to five minutes) without actually straining them, and thereby both the city and the northern suburb could be supplied with water. The opponents, who basically supported the Waterworks Board, did not share this optimistic view of the capacity of the city’s water supply, and they were afraid that the city itself soon would lack water.⁵³

Issues of quality, quantity, and availability of the water were also enrolled, and the assumption was that these aspects influenced the *sanitary* conditions in the suburb one way or another. The public health network thought that the northern suburb needed not only a pure and ample supply of water, which was necessary from a sanitary point of view, but also a readily available supply, that is, pipes had to be extended, if not to each household, at least in close proximity to them. The suburb had been under the national building code since 1885, but most buildings were still not in any condition to have service pipes installed.⁵⁴

Extended pipes were important also for *convenience*, according to the public health network. The actor-network of the Waterworks Board, on the other hand, regarded the water tap at the premises of the engineering workshop Vulcan as quite enough, since it delivered pure city water. An extension would certainly mean convenience for the people in the area, but was not at all necessary for sanitary purposes. The single water tap was good enough, for if they wanted more water they could dig their own wells, which would also be cheaper for them: “Would it be . . . more difficult for the inhabitants of the suburb than for others to provide themselves with springs and wells?”, Boëthius asked rhetorically. Thus convenience was only for the bourgeoisie: for workers it was the same as laziness.⁵⁵

Another *sanitary* aspect was the fear of epidemics (especially cholera), which was rather widespread among both actor-networks, particularly since,

⁵² Bohman 1944 p. 410-411; NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1880-11-24 §4; Norrköping City Council Archives, minutes 1883-12-06 §10 and 1885-12-10 §11.

⁵³ NT, 1886-11-19.

⁵⁴ NT, 1886-11-19; “Byggnadsordning för Norrköpings Norra Förstäders område”, *Kongl. Maj:ts Befallningshafvandes i Östergötlands län allmänna kungörelser*, Serien B, No. 43 1885 (Norrköping 1922).

⁵⁵ NT, 1886-11-19.

in their view, it was very likely that it would spread to Norrköping as well: “[Epidemics] hang, . . . because of the suburb, like a sword of Damocles over the city of Norrköping,” as Axel Molin said.⁵⁶ The public health network was of the opinion that it would then be an advantage for the city itself if the northern suburb had piped water (but they had to arrange better sewerage first), while the opponents argued that the extension of water would in such a situation only mean an even bigger threat to the city because of the bad drainage in the suburb (cf., the argument of the Waterworks Board above).⁵⁷

In connection with this, *humanitarian* arguments were enlisted by the public health network. Since so many inhabitants of the northern suburb worked in Norrköping, it was the duty of the city to help: “It is the duty and obligation of the city to extend a helping hand to the inhabitants of the suburb,” said Blombergh, and Rodhe added that “the inhabitants of Norrköping have a moral obligation toward the northern suburb.”⁵⁸ The Waterworks Board network, on the other hand, wondered where to draw the line if other surrounding areas, notably working-class areas, demanded the right to water on the same grounds.⁵⁹

At this time, it was known by the City Council that the northern suburb intended to ask to be incorporated in the city of Norrköping, but both actor-networks favored the separation between the suburb and the city in the long run, even though neither group explained how this was to be realized. For the public health network, helping the suburb with the water extension was a way of making the future separation smoother. The other actor network feared that expanding the water system would either draw the suburb and the city closer to each other (not only water but also other public services would then be demanded) or make the suburb grow even faster. Both these developments would lead to a more difficult process of separation.⁶⁰

It is interesting to note that the direct economic arguments were few, even though some of the above arguments could be interpreted in economic terms. In the discussion everybody assumed that the northern suburb would pay for the water, which was in line with praxis. However, this was apparently no consolation for the Waterworks Board network, whose members saw even

⁵⁶ NT, 1886-11-19. Epidemics probably lived in the memories of the city’s inhabitants as the city had been hard hit by cholera in 1853 and 1866 (Gullberg 1968 p. 114-115; Svensson, Godlund, and Godlund 1972 p. 268).

⁵⁷ NT, 1886-11-19; “Byggnadsordning för Norrköpings Norra Förstäders område”, *Kongl. Maj:ts Befallningshafvandes i Östergötlands län allmänna kungörelser*, Serien B, No. 43 1885 (Norrköping 1922).

⁵⁸ NT, 1886-11-19.

⁵⁹ NT, 1886-11-19.

⁶⁰ NT, 1886-11-19.

greater expenses coming with the extension, and even more so with a possible incorporation.⁶¹

According to Svenbjörn Kilander, the 1880s and 1890s saw the beginning of an ideological change regarding social policy in Sweden. The strict division between public and private interests gave way to a more holistic view of society, and the state and public interests were now able to intervene directly in social issues, in the interests of all of society. In this discussion, one notices that the strict legal argumentation about the border of the city plan and the absence of legal building plans from the case of the southern suburb has disappeared. The members of the City Council did not categorize the water question as public or private, or as the city versus the suburb, but more as an interrelationship. In this sense, at least fragments of the new ideology could be seen on the local level in Norrköping.⁶²

However, this relationship was not regarded as anything positive. Discussing otherwise humanitarian issues, both actor-networks saw the northern suburb as a *growth* (in Swedish *utväxt*, implying a tumor, something sick or unnatural which has grown out of something else): “As it now is, the northern suburb is undeniably a serious growth on the city of Norrköping; sooner or later it will be necessary to operate on it, and this operation will not be easy,” said Blombergh.⁶³ The suburb was also referred to as *weed*, which should not be watered in order to avoid spreading it.⁶⁴ As a matter of fact, the suburb itself also noted that it had become a “sewer for . . . the worst and basest elements” of the city.⁶⁵

These were not mainly criminal “elements”, but mostly workers and poor people. At times, it seems to have been the city’s tacit policy to rent dwellings for its poor people in the northern suburb, so that the rural commune Östra Eneby eventually was obliged to support them.⁶⁶ Other sources also show that the city’s workers sometimes felt driven out of the city. This can be seen in a letter to the editor in *Norrköpings Tidningar*, from a worker who complained about the building of new worker’s dwellings in a building lot at the outskirts of the city: “[I]s the spot most suitable for worker’s dwellings in order to separate the worker from the city as much as possible? So it seems . . . since everyone knows that there are other spacious, healthy, and good building sites in the city itself . . .”⁶⁷

⁶¹ NT, 1886-11-19.

⁶² Kilander 1991 p. 219-227.

⁶³ NT, 1886-11-19.

⁶⁴ NT, 1886-11-19.

⁶⁵ Larsson 1913 p. 555.

⁶⁶ Horgby 1989 p. 32.

⁶⁷ NT 1872-05-28.

In reality, then, this pathological rhetoric was just a way of rephrasing the old ideology of the distinction between the public and the private, the city and the suburb, and one cannot help interpreting it as an expression of hygienist views of the filthy working class and poor.⁶⁸ As it happened, however, the northern suburb got its water pipe in the end, and in that sense one can say that a humanitarian strand of this ideology, which dominated in the public health network, was victorious.

This shows that humanitarianism did exist in the City Council after all. For an industrial city like Norrköping, with its paternalistic traditions, the health and well-being of the workforce were naturally very important. In the light of this the poor sanitary conditions in the northern suburb were bound to catch the attention of the city. Both actor-networks feared the terrible consequences an epidemic in the suburb might have for the city. The Waterworks Board network gave priority to the city in this question, while the public health network often used humanitarian arguments to help the suburb for the good of the city as well – what was good for the northern suburb was good for Norrköping. They were of the opinion that the suburb needed much water of good quality in order to avert an epidemic as well as other diseases, but the Waterworks Board and its actor-network thought that, due to the poor drainage, the water would have the opposite effect, which is why the board was so hard on people who installed illegal water taps. This was presumably also a way of counteracting the problem of overflowing sewers in the northern suburb and the spread of smells from the sewage trenches there.

However, the reluctance on the part of the Waterworks Board network to extend water also had to do with technical factors and, in the end, economic factors and the whole question of incorporation. According to them, the waterworks pumps could not provide both the city and the suburb with water. In all fairness, water consumption was in fact soaring, from 0.2 million cubic meters in 1875 to 1 million in 1890.⁶⁹ The early, expansive days of the new and modern water system were gone, and the Waterworks Board thought it impossible even to extend a 200-meter pipe.

The Waterworks Board (except for Blombergh) was as central an actor-network in this question as it had been in the introduction of water supply and sewerage in Norrköping, and in the issue of extending these technologies to

⁶⁸ Mary Douglas sees dirt as “matter out of place”, a potential danger to the social order on a symbolic level. According to Schmidt and Kristensen, that which is out of place is often also regarded as *pathological*. In this sense, metaphors of the working class as *dirty* or as a *growth* originate in the same ideology, the object of which is to keep the – morally – filthy and unhealthy out of the city (Douglas 1966 p. 1-6, 35-41, 129; Schmidt and Kristensen 1986 p. 15-17). For empirical examples of this ideology from other European and North American cities, see Prendergast 1992 p. 74-101 (Paris) and Rome 1996 p. 9, 23 (Edinburgh and New York).

⁶⁹ Östman, Malmberg, and Liander 1945 p. 34.

the northeastern district in 1883. Thus far one would have concluded that it was always interested in technological expansion – that is, the more pipes the better – especially in the initial, expansive phase. It is easy to see how the board would have benefited from this, for instance, to confirm its own existence and professional identity, as well as the confidence in the profitability of the water and wastewater systems. Traditionally a deterministic interpretation would perhaps have seemed appropriate here, because these technological systems seemed to be made for continual expansion, boosted by the Waterworks Board.

However, the 1886 case does not confirm such a conclusion, rather the contrary. Most members of the Waterworks Board were against extending water and sewerage. The actor-network centered around the board was for technological expansion, but only within the city's jurisdiction. The issue of Beckershof a few years later also suggests that the city border was the limit of the generosity of the board, although, for example, Christian Eberstein did not even want to extend it to the outskirts. At any rate, "filthy" working class areas outside the border were definitely beyond the scope of the city's generosity, according to this financially and technically oriented actor-network.

Both this 1886 northern suburb case and the Beckershof issue show that there was nevertheless a majority in the City Council that wanted to extend these technologies as a helping hand to those who needed it, be it in or outside the city boundary. This humanitarian public health network was dominated by physicians, but there were also industrialists and representatives of the church and the school.

Apparently, the water and sewage question in the northern suburb was by no means solved by the very short extension of a water pipe that this in fact was. Some of the inhabitants therefore made illegal installations, and the issue came to be the installation of new water taps. One member of the previously mentioned committee from the eastern area defended an illegal installation by claiming that his part of the suburb needed at least one more water tap, particularly from a sanitary point of view. Those who lived there were mostly workers, and during the short time they were at home they needed good and healthy water. He could not understand the logic of the Waterworks Board. In his opinion, more water would hardly be consumed just because there were two water taps instead of one, when all the water had to be paid for in any case. The Waterworks Board was implacable, and Vulcan, which was responsible for the water pipe, was instructed to remove the tap immediately.⁷⁰

⁷⁰ NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1887-04-22 §2, 1888-10-18 §3, and 1888-11-24 §2.

The Question of Incorporation

In order to understand the complexity of these sanitary problems and the often unyielding attitude of the city of Norrköping when it came to expanding infrastructure to the northern suburb, it is also necessary to examine the parallel discussions about an incorporation of the suburb. In 1886, the council (*municipalstyrelse*) of the northern suburb made an appeal to the Swedish government. The suburb wanted to be incorporated into the city of Norrköping, and the reasons for this were threefold. First of all, it was impossible to uphold law and order, since there was no effective police force, and because criminal elements settled down in the suburb for this reason. Secondly, there were no economic means to arrange education for the 700 children who were of school age. Thirdly, the suburb had emerged due to a housing shortage in the city, and most of its inhabitants either worked in factories in the city or received poor relief from the city. They were thus really city dwellers.⁷¹

The Communal Council of Östra Eneby wanted to get rid of this “sick growth on the city of Norrköping,” and the County Governor also approved of the reasons for the incorporation. Norrköping City Council and its Financial Department did not, however. They were of the opinion that the city was not responsible for the appearance of the northern suburb, since there had never been serious housing shortage in the city.⁷² They were also of the view that an incorporation would be far too expensive for the city, due to the need for the expansion of municipal services and infrastructure such as education, police supervision, fire protection, health care, poor relief, roads as well as water supply and sewerage.⁷³

In 1888 the latter was investigated by the waterworks engineer, who was to make an estimate of the costs involved in expanding water and sewerage to the northern suburb. His analysis of the current situation was similar to that of the first provincial physician in 1891 in that he also expressed dismay at the long open sewage trenches (see below). They spread unhealthy offensive smells, especially in the summertime. The engineer had in mind a large-scale solution, where all the sewage from the northern suburb would be discharged in a bay downstream from Norrköping. The extension of the water supply was to a large extent governed by fire-fighting needs. His estimate was then revised by the Waterworks Board, which added more costs. The final estimate of the board showed that great costs were involved as far as water supply and sewerage were concerned. The fixed costs would amount to more than 70

⁷¹ Arvidsson 1995 p. 13-14; Myrdal 1972 p. 284; Larsson 1913 p. 106, 554-556.

⁷² This statement was obviously not true. All the sources that I have read, both contemporary sources and present-day research, confirm the existence of a severe housing shortage in Norrköping in the late 1800s.

⁷³ Arvidsson 1995 p. 13-18; Larsson 1913 p. 107-108 (including quote).

percent of the total fixed costs for the whole incorporation, and the variable costs would be 20 percent of the total variable costs, based on one of the general estimates.⁷⁴

Not surprisingly, the *municipalstyrelse* of the northern suburb thought that the figures produced by the city of Norrköping were exaggerated. In 1892, however, the Swedish Government rejected the proposal of the suburb; there was to be no incorporation. The main reason for this was Norrköping's refusal, due to the great costs that would accompany the incorporation.⁷⁵ There was no Swedish incorporation legislation at the time, so *Kungl. Maj:t* followed a fairly well-established praxis. According to Yngve Larsson, the city of Norrköping was very likely indirectly responsible for the emergence of the northern suburb through its building and poor relief policies. Nevertheless, since the suburb inhabitants had freely moved from the city to another administrative area, the Östra Eneby rural commune, the city could not be forced to do anything for them against its will.⁷⁶

The Escalation of the Conflict in the 1890s and Early 1900s

So far, the question of extending sanitary infrastructure to the northern suburb had mostly concerned water supply. However, in the beginning of the 1890s the question of sewerage was at the heart of a very long, heated, and complex conflict between the suburb and the city. It also involved the County Governor, the first provincial physician, and the Swedish Government, and it is therefore necessary to present only the central issues. In 1890, the Norrköping Board of Health made complaints to the County Governor of Östergötland, Robert De la Gardie, about a trench originating in the western part of the northern suburb, Marielund, which caused a horrible and unhealthy odor in the city. Obviously, the improved drainage that was required in the 1886 decision about piped water to the northern suburb had not been arranged.⁷⁷

An inspection of the sanitary conditions in the western part of the suburb in September 1891, made by the first provincial physician Henning Nordenström (employed by the County Governor), illuminates the range of the problem. Privies and cesspits were most often leaking, and stormwater, household wastewater, and often urine were discharged in cesspools and were then led to open trenches. The conclusion was that all the waste in the bigger trench that was under debate originated in the western part of the northern

⁷⁴ NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1888-03-20 §11 and 1888-04-10 §2. Arvidsson 1995 p. 15-17.

⁷⁵ Arvidsson 1995 p. 17; Larsson 1913 p. 107, 554-559; Myrdal 1972 p. 284.

⁷⁶ Larsson 1913 p. 1-48, 554-558.

⁷⁷ NSA, Norrköping City Council Archives, supplement No. 43 1893, p. 1-2.

suburb, and that 500 meters of the open trench ran through built-up city areas, a situation which was alarming both from an esthetic and a sanitary point of view. The only solution was to discharge the sewage in glazed earthenware pipes to the city's sewer system, but Nordenström had no suggestion as to who should arrange and pay for this.⁷⁸

The County Governor was of the opinion that the suburb could not be forced on legal grounds to do anything about this, a decision which did not satisfy the Board of Health. The Swedish Government was called in, and it forced the County Governor to reconsider, which resulted in another resolution in late 1892 with the opposite message. The suburb now had to build a sewer of glazed earthenware pipes, which was to be connected to the city's sewer system, in order to alleviate the problem. Of course, this was not popular with the many poor inhabitants of the suburb. Some inhabitants of Marielund made a complaint about this decision: they claimed they were only responsible for remedying the problem of the trench up to the city border.⁷⁹

Nor was the governor's decision popular with the city. If the sewer was built and connected to the city's sewer system, the sanitary situation in the western part of the northern suburb would undoubtedly become better, but the city's sewerage would very likely be overloaded and too much filth would be dumped in the river (with increased costs for dredging).⁸⁰ Eventually, the County Governor also wanted to hear the opinion of the City Council. The Financial Department, which had been made "spokesperson" for the whole issue on the part of the city, voiced what all the municipal bodies agreed upon: The City Council should have been involved in this issue from the beginning, and thus it should be remitted to the County Governor to be reconsidered once again. The Swedish Government enacted this decision in late 1893, and round three began.⁸¹

The issue of the northern suburb was a very precarious matter. Legally, ideologically, and economically the city did everything in its power to keep the suburb at arm's length. However, both the city and the suburb suffered from the swampy topography north of the river, with all the sanitary dangers that resulted from it. Axel Molin, who had been against the water extension in 1886, largely because he feared epidemics from the suburb, suggested in 1893 that the sewer system of the whole northern side should be rebuilt. He

⁷⁸ NSA, Norrköping City Council Archives, supplement No. 1 1894, p. 2-3; Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1891 (Linköping 1892), p. 6.

⁷⁹ NSA, Norrköping City Council Archives, supplement No. 43 1893, p. 1-2, 5-8.

⁸⁰ NSA, Norrköping City Council Archives, minutes 1893-02-01 §7, supplements No. 9 and 43 (p. 3-4) 1893.

⁸¹ NSA, Norrköping City Council Archives, minutes 1893-03-09 §3, 1893-06-19 §7 and 1893-12-28 §5, supplements No. 9 and 43 1893, as well as No. 1 1894.

mentioned the great cholera epidemic of the previous year, which had touched Höganäs in the very south of Sweden, and thought that if nothing was done about the bad drainage in the northern part of the city there was great danger of cholera in Norrköping the coming summer. The Financial Department, however, would not pay to alleviate drainage problems outside its jurisdiction. It also questioned whether improved drainage really was the most appropriate way of solving the sanitary problems there.⁸²

Norrköping City Council was the first body to be called on for round three, and the issue was again dealt with by the Financial Department. It was about time that the sanitary problems north of the river were remedied, according to the department, for the city had been plagued by the foul-smelling and unhealthy vapors from the trenches originating in the northern suburb for many years. Certainly, the suburb was obliged to take care of its excreta and other waste in containers, but this would very likely never be implemented in a satisfactory way unless the city took the initiative. But the suburb had to pay the lion's share of the costs involved. In order to achieve all this a meeting between the two parts was requested (this was also suggested by the first provincial physician), which the City Council and the County Governor approved.⁸³

The committee from Norrköping was made up of the mayor and chairman of the Board of Health, C. A. R. Lothigius, the judge and chairman of the Financial Department Paul F. Risberg, and the banker and chairman of the City Council John Philipson. The meeting was held in the beginning of September 1894, and the city stuck to its previous position, that it was willing to help as long as the suburb paid for itself. In April 1895 and February 1896, the *municipalstämma* of the northern suburb, that is, the inhabitants there with the right to vote, decided that the suburb should accept a sewerage proposal by the land-surveyor Gustaf Lövstrand for the whole northern suburb, apart from the northern part, Sandby, whose inhabitants could not afford it. The conditions were that the city financed the continuation of the sewerage on its property, and that water from the city's water system also was installed in every yard for an annual fee. The communal council of Östra Eneby had guaranteed a loan for the project.⁸⁴

⁸² NSA, Norrköping City Council Archives, minutes 1893-03-09 §12 and 1893-04-10 §10, supplements No. 15 and 23 1893. The same year, the water engineer Henrik Holmberg also proposed intercepting sewers on both sides of the river in order to facilitate general use of water closets (see Chapter Five).

⁸³ NSA, Norrköping City Council Archives, minutes 1894-02-10 §4 and 1894-08-28 §2, supplements No. 1, 3 and 33 1894; Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1894 (Linköping 1895), p. 4.

⁸⁴ NSA, Norrköping City Council Archives, minutes 1894-08-28 §2, 1894-12-13 §28, and 1896-07-02 §19, supplements No. 33 1894, No. 43 1896, p. 1-8, and No. 57 1896, p. 5-6.

The first provincial physician Nordenström approved of this initiative, and thought that the suburb had shown a willingness to make a “not insignificant sacrifice” in order to bring about a solution to the long-debated and hygienically important sewerage question. He was also of the opinion that this would interest the city of Norrköping maybe even more. A solution could not possibly be achieved without its financial aid, and there did not seem to be any other way left of solving this. Finally, he brought up the humanitarian advantage of the proposal, since most of the northern suburb’s population worked in and originally came from Norrköping.⁸⁵

In contrast to the state-employed first provincial physician, the municipal bodies of Norrköping were sceptical of the above proposal, for economic, sanitary, and technical reasons. The Board of Health was afraid that extending the water supply would cause the “ample and free access to good water from the city’s water supply” to be restricted for the city dwellers, which was unfortunate from a sanitary point of view. The fact that Sandby was not able to participate also meant that the intended sanitary effects of the sewerage could not be fully achieved. The Financial Department agreed with the board on the above, especially the limitations of the pumping station, which had been recently expanded for the future needs of *the city*.⁸⁶

Together with the Waterworks Board it just could not accept distributing water against an annual rate. In order to prevent waste of water the suburb would have to accept water metering and the laying of water pipes only in the streets, that is, not in the yards. The Financial Department was very hesitant about the whole project, especially since it would lead to increased contamination of the river, and demanded that the suburb be *completely* drained according to the proposal of Lövstrand (cesspits must not be connected). Despite these restrictions, the department was willing to help the northern suburb, and it made some concessions, for instance, about free water for flushing the sewer pipes.⁸⁷

The city’s offer was not unlike the suburb’s proposal in the end. The city would continue the sewerage, of Hellström’s construction, on city property on the above conditions, but the water supply in the suburb would have to be financed by its inhabitants, and water was to be metered. There was also a charge for fire hydrants, but water for fire fighting was to be free of charge. The rhetoric of the Financial Department was very clever. Initially it em-

⁸⁵ NSA, Norrköping City Council Archives, minutes 1896-07-02 §19, supplement No. 43 1896, p. 8-9 (quote on p. 8).

⁸⁶ NSA, Norrköping City Council Archives, minutes 1896-07-02 §19 and 1896-11-05 §6, supplement No. 43, p. 9-10 (quote on p. 10), and 57 1896.

⁸⁷ NSA, Norrköping City Council Archives, minutes 1896-07-02 §19 and 1896-11-05 §6, supplement No. 43, p. 9-10, and 57 1896.

phasized the many disadvantages for the city if the suburb's proposal was to be accepted. Gradually, however, the generosity of the city, despite the disadvantages, was stressed: "[O]nce again the city ought to extend a helping hand towards the so-called suburbs." The City Council accepted the answer of the Financial Department, and sent this to the County Governor.⁸⁸

The tone in the response of the suburb's representatives was not as neutral as before, and it shows that they felt somewhat insulted by the accusation that the suburb had "tried to obstruct a rational solution of the drainage question." They thought that the very fact that the city chose to appeal to the County Governor in 1890 instead of trying to solve the matter together with the suburb showed that the city wanted a conflict instead of a peaceful solution. The modifications and restrictions that the city had imposed on the suburb's original proposal were tight-fisted and led to an even greater financial burden on the suburb. Several of these limitations were to keep the water consumption down, but the representatives defended their own view of this. They wondered whether the Norrköping City Council was really serious in its expressed fear of increasing water consumption – and that it would affect the city to such a degree that its inhabitants would be forced to decrease its consumption – if meters were not used. Besides, according to figures from 1895, the city would profit from the annual fees from the suburb, which would be maybe up to 0.10 kronor per cubic meter.⁸⁹

The representatives of the suburb stuck to the original proposal, and enrolled every possible ally to convince the Norrköping City Council. They referred to Jacob von Leesen, the main donor to the city's waterworks, the purpose of which was supposedly to supply free household water for the poor workers of Norrköping. It was argued that, since most of the suburb's inhabitants came from, worked, and spent their money in Norrköping, and as a great many of the city's poor people lived there, they ought to be supplied with piped water at least for a low fee. Most of these people had been compelled to move out of the city, and, at any rate, the donor had not been concerned whether people lived in or in close proximity to the city, had he?⁹⁰

⁸⁸ NSA, Norrköping City Council Archives, minutes 1896-11-05 §6, supplement No. 57 1896, p. 1-8 (quote on p. 7).

⁸⁹ NSA, Norrköping City Council Archives, minutes 1897-04-08 §23, supplement No. 31 1897, p. 1-9 (quote on p. 2). The fee for commercial establishments was 0.20 kronor, but the city's prime cost was only 0.03 kronor per cubic meter.

⁹⁰ As a matter of fact, the donation concerned piped water and free household consumption only for what was formally seen as the city, that is, the planned area, and not the areas outside it (NSA, Norrköping City Council Archives, AI a:10, minutes 1872-02-22 §4).

Furthermore, they argued that the city would benefit as much from the drainage as the suburb, which was also Nordenström's opinion (see above).⁹¹

By this time the issue had developed into full-blown trench warfare, and the city also stood by its previous view in the matter. According to the Financial Department, however, this was not a "controversial question," as the representatives of the suburb had called it, but simply a matter of order. It was decreed in the Public Health Act – which even the northern suburb, being a *municipalsamhälle*, was subject to – that sanitary nuisances such as the sewage trench *must* be remedied. Apart from the powerful position the city already had compared to the suburb, it now even enrolled allies such as the Public Health Act, its interpreters the Norrköping Board of Health, the first provincial physician, the National Board of Health as well as the Swedish Government.⁹²

When the County Governor's resolution came on the last day of 1897, all the negotiations, complaints, and written reports had come to naught. De la Gardie could just note that an agreement between Norrköping and the northern suburb could not be attained. It was not in his powers to force the city to contribute to the water supply and sewerage for the northern suburb either, as it simply had refused. However, he could refer to the Public Health Act, and have the northern suburb comply with it, just as the Financial Department had thought appropriate. The inhabitants of the northern suburb thus finally had to take care of their sanitary situation, which they obviously had not done until then (cf., Nordenström's reports). But since the initial complaint had only concerned the trench from the western part, it was the inhabitants there who were told to comply with the Act, and thus collect their liquid or other waste in tight, portable containers.⁹³

One would have guessed that this was the end of the matter, but it was not. The trench war continued, but with some of the ambivalence on the part of the city that was seen during the 1880s. One of the reasons the western and eastern part of the northern suburb had wanted water supply was for the flushing and cleaning of Lövstrand's sewer pipes. At the turn of the century, however, it seems that the *municipalstyrelse* concentrated more on getting a good water supply than sewerage. This was not only necessary from a fire-fighting point of view, but also for economic reasons. The suburb had very likely been pressured by the fire-insurance companies to install piped water.

⁹¹ NSA, Norrköping City Council Archives, minutes 1897-04-08 §23, supplement No. 31 1897, p. 6-8.

⁹² NSA, Norrköping City Council Archives, minutes 1897-05-06 §12, supplement No. 31 1897, p. 9-12.

⁹³ NSA, Norrköping City Council Archives, minutes 1898-02-03 §10, supplement No. 5 1898, p. 9-10.

Otherwise they could not benefit from the reduced fees, which was important for the often poor inhabitants.⁹⁴

In 1902 the suburb consequently asked the city if the western part could use the city's fire hydrants in case of fire. Since this part was so close to the city the hydrants were located just across the street. The city representatives were now divided as to whether they should help the suburb or not. The Building Department (*byggnadskontoret*) – which was under the *Drätselkammare* and had replaced the Waterworks Board in the reorganization of 1898 – was positive, but was careful with the city's own water resources and would not relinquish its control. If the suburb notified the head of the fire department in advance, which would have been tricky when a fire was spreading in the suburb, the request could be granted.⁹⁵

The Financial Department was opposed and referred to the city's statement of late 1896. The suburb should first be sewerred, and it had to finance its own hydrants. A majority of City Council members agreed, and eventual decision was in line with the department's opinion. The merchant and deputy chairman of the City Council Eric Ringman, together with the engineer Edward Blombergh, thought that the city could extend a helping hand if necessary, but this was no emergency and the inhabitants of the suburb were seen as lazy and not ready to any sacrifice on their own part. The city's water supply was not in a condition to be extended either.⁹⁶

The judge Nils Stråhle and the house painter Wilhelm Ljungberg, on the other hand, were of the opinion that a strictly economic interpretation would not suffice in this question, for the suburb residents were not lazy but poor. Stråhle commented on the view of the department:

The statement of the Financial Department reminds the speaker of an analogous relationship: is it not the same as saying to a drowning person, who pleads for help: "Yes, I will save you, provided you only return the 10 kronor you owe me?"⁹⁷

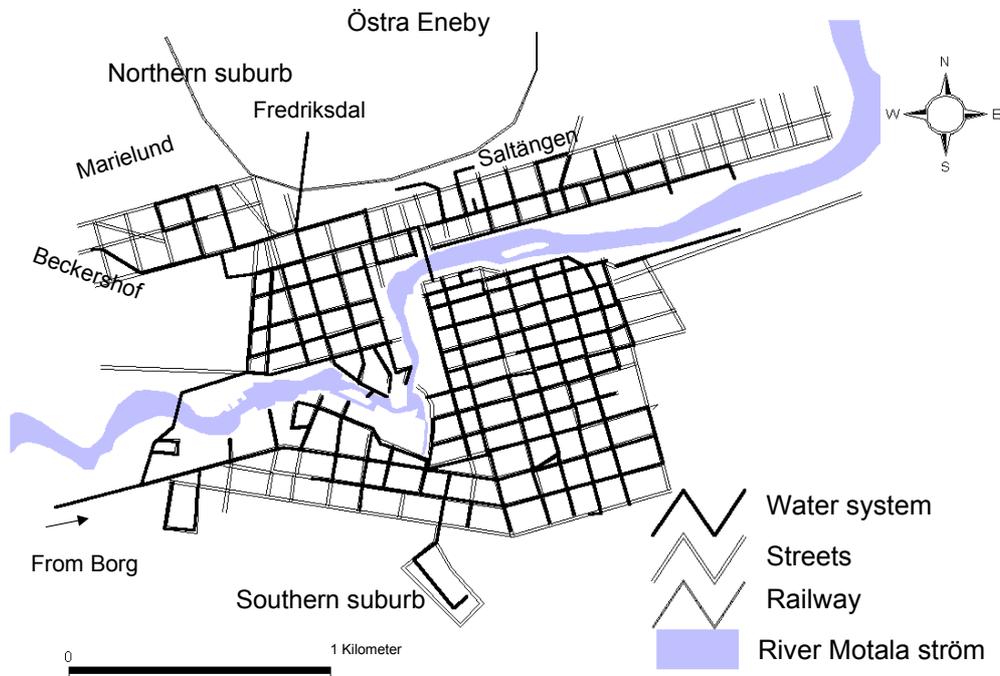
⁹⁴ NSA, Norrköping City Council Archives, minutes 1900-06-11 §4 and 1902-04-21 §9, supplements No. 41 1900 and 34 1902; NT 1902-04-22.

⁹⁵ NSA, Norrköping City Council Archives, minutes 1902-04-21 §9, supplement No. 34 1902; Description and history of Norrköping Drätselkammare Archives.

⁹⁶ NSA, Norrköping City Council Archives, supplement No. 34 1902; Account of the City Council meeting 1902-04-21 §9, NT 1902-04-22.

⁹⁷ Account of the City Council meeting 1902-04-21 §9, NT 1902-04-22 (including quote).

Figure 3.1. The Norrköping water system in 1896.



Source: Schmid and Hallström 2001.

The Early 20th Century and New Solutions

In the beginning of the 20th century, the northern suburb was thus still without satisfactory water supply and sewerage. Overall sanitation did not work and a lot of sewage and waste were still discharged in the different trenches, which was in defiance of the Public Health Act. Of course, this was the responsibility of the suburb. Yet, as we have seen, the suburb had on several occasions tried to achieve a large-scale technical solution with the help of the city, but all these efforts had been in vain. From a legal point of view, the city of Norrköping had not acted wrongly in denying much of what the suburb asked for. The suburb had disposed of all the waste that plagued itself and the northern part of the city. But from a humanitarian viewpoint, the city – an actor with a great deal of economic, administrative, and technological power resources – had done nothing more than keep the suburb and all its problems at a distance, despite its own role in its creation. Little had changed since the 1880s.

The city had also tried to prevent the emergence of other suburbs by buying land outside the city's planned area. In this way they could promote regulated building, and, if the land was within the city border, eventually incorporate it

in the planned area. Especially in the topographically difficult northern part of the city, where surface runoff and sewage always drained into the city and caused sanitary nuisances, this was desirable if not urgent. This was a lesson that the city of Norrköping had learnt especially during the last 10 to 15 years of the 19th century in connection with the northern suburb.⁹⁸

With the city constantly turning its back on the suburb, it could not have come as a surprise when in 1902 the northern suburb wanted to be separated from the Östra Eneby rural commune to form its own administrative unit – *köping* (cf., the English word borough). The sanitary situation was one of the things that the *municipalstyrelse* wanted to improve, as well as the economic conditions and the decision-making processes. The cooperation with the rest of the rural commune was not easy.⁹⁹ The Östra Eneby Communal Council was only happy to get rid of what must have been a financial burden, especially as regards poor relief.¹⁰⁰

In 1903, the County Governor submitted the issue of the northern suburb becoming a *köping* for consideration to the Norrköping authorities, but the governor preferred incorporation by the city. Was this something that the city was willing to do now? The city answered that incorporation of only the northern suburb was out of the question, since the costs for improving the conditions there (for example, police supervision, sanitation, fire protection, and poor relief) would not be matched by the taxes from the inhabitants. Instead the original city dwellers would have to carry this economic burden without receiving any real advantages. Besides, this would also encourage the appearance of new suburbs in Östra Eneby, close to the city. However, an incorporation of several parts or all of Östra Eneby, as well as other adjacent rural communes, such as St Johannis, Borg, and Styrestad, would be another thing. In that case it would be possible for the city to prevent unregulated building, and to hinder the out-migration of industrial establishments to the less expensive countryside, thus keeping tax revenues from businesses in the city.¹⁰¹

In the beginning of the century several industries such as a sawmill and an engineering workshop had moved out to Östra Eneby, very likely due to cheaper land there and the lack of suitable land in the city.¹⁰² The city was willing to have the larger incorporation investigated by a committee, which was to be made up of a chairman appointed by the County Governor, as well

⁹⁸ NSA, Norrköping City Council Archives, minutes 1903-04-27 §4, supplement No. 41 1903; Kvarnström, Malmsten, and Nilsson 2000 p. 27-31.

⁹⁹ NSA, Norrköping City Council Archives, supplement No. 16 1903.

¹⁰⁰ Arvidsson 1995 p. 19.

¹⁰¹ NSA, Norrköping City Council Archives, minutes 1905-02-16 §3, supplement No. 5 1905.

¹⁰² Arvidsson 1995 p. 22; Godlund and Godlund 1972 p. 64-65.

as representatives from the city and all the rural communes.¹⁰³ Nothing ever came of the idea of turning the northern suburb into a *köping*.

In 1908, finally, the question of water supply and sewerage to the northern suburb came much closer to a solution, although at first it seemed it would end as it had earlier. On behalf of the eastern part of the suburb, Fredriksdal, the *municipalstyrelse* asked the Norrköping City Council if the 200-meter water pipe from 1887 could be extended to circa 800 meters, and if the number of water taps could be increased from three to eight. The existing water taps were located far from most of the inhabitants, and the resulting trouble in accessing the water was not good from a sanitary viewpoint. The suburb hoped that since the city had recently expanded its waterworks and the risk of water scarcity was removed, there would be no obstacles to a solution.¹⁰⁴

The *municipalstyrelse* could not have been more wrong. The chief engineer Wilgott Carling, who was the head of the waterworks, replied that the water consumption during the warm summer months was “abnormally large.” As an extension “without doubt” would lead to increased consumption and, in this case, it would not benefit the city, he was against it. So was the Financial Department, which used the same argument.¹⁰⁵

However, the Drafting Committee, headed by Axel Swartling and Pehr Swartz (Carl’s brother), was of another opinion, which eventually made the scales tip in favor of the suburb. It did not fear an increase in the water consumption, but would not dismiss Carling’s argument without further investigation. On its commission, Carling thus presented statistics about water consumption in the suburb and the city, the capacity of the waterworks and the filters, as well as the costs involved. The mean consumption per day was ca. 7,600 cubic meters in the city, but only 40 in the suburb, and despite the recent expansion of the waterworks the cost per cubic meter was still only 0.05 kronor (25 to 35% of what the suburb was charged). The committee approved the proposal of the *municipalstyrelse*, but as the consumption *could* increase due to the extension, it was only temporary and no discounts were to be allowed.¹⁰⁶

The Drafting Committee realized that this was a question of principle: Was it compatible with the interests of the city to supply piped water to areas

¹⁰³ NSA, Norrköping City Council Archives, minutes 1905-02-16 §3, supplement No. 5 1905.

¹⁰⁴ NSA, Norrköping City Council Archives, minutes 1908-11-26 §11, supplement No. 127 1908, p. 1.

¹⁰⁵ NSA, Norrköping City Council Archives, minutes 1908-11-26 §11, supplement No. 127 1908, p. 2 (including quotes).

¹⁰⁶ NSA, Norrköping City Council Archives, minutes 1908-11-26 §11, supplement No. 127 1908, p. 3-8. For the city there was still a discount of 30 percent on everything over 1,000 cubic meters of the quarterly consumption (see Chapter One).

outside the city border? In another similar discussion Pehr Swartz expanded on his own view of the subject, echoing arguments from the past:

It would generally be beneficial if the cities more took care of the small communities that are emerging around them, especially concerning the water question, if a satisfactory arrangement could be achieved. In this way the incorporation of the small communities into the city is best prepared, for if the former built water systems this would be an obstacle to the incorporation. . . . they should pay . . . a higher price than the city residents for the water they thus obtain from the city's water pipe. The issue has been treated this way in both Stockholm and Göteborg.¹⁰⁷

The Drafting Committee's collective answer to the question was that it could not be solved as an arithmetical problem, and should generally be answered in the negative. But exceptions could be made in cases when a substantial advantage was to be had for the public good of the city. Such an example was if improved hygiene in the area in question was arranged on its own expense as a condition for the water extension, because unsatisfactory sanitation in this area affected even the neighbor, that is, the city. It was clear that the committee had the northern suburb in mind, and it therefore required that the suburb arrange for sewerage before October 1910 as a prerequisite for the city's help. After all, the suburb had everything to gain from this. The city was also to oversee the laying of both water and sewer pipes. The City Council approved of the committee's report in its entirety.¹⁰⁸

However, the crucial point in the water question between the city and the northern suburb had been whether piped water could be installed in each yard, and this had still not been obtained. In the winter of 1909 this issue was raised again, as it had been so many times before. As usual it was the northern suburb that asked for help, and even this time the poor sanitary conditions were the reason for the request. Besides, the cholera epidemic that was then threatening Sweden would also "find a suitable soil for its well-being in the suburb." The sanitary situation was so poor that there was no giving up until it had been remedied, and the only way to do this was, according to the *municipalstyrelse*, to install water taps in each yard. (Even Sandby was included now.) The tax-paying inhabitants were not ready to accept an increased fiscal burden for an unsatisfactory solution, that is water pipes only in the streets. The suburb saw no other way of handling this problem than through the city, especially since the capacity of the waterworks had been improved so much. The fear on the part of the city that the consumption

¹⁰⁷ Account of the City Council meeting 1908-05-14 §4, NT 1908-05-15.

¹⁰⁸ NSA, Norrköping City Council Archives, minutes 1908-11-26 §11, supplement No. 127 1908, p. 8-9.

would increase was unfounded, for with private taps would also come private meters, “and on that account the negligent person alone has to take the consequences of his carelessness and mismanagement.”¹⁰⁹

What (almost) everybody in the City Council and the other municipal units agreed upon was that water and sewer mains should be extended to the northern suburb according to a plan by Wilgott Carling and that the suburb should supply the city with land for the main pipes. This land was to be forever at the disposal of the city, and the pipes would be the property of the city, which implied that the city was responsible for maintenance. The city would pay around two thirds of the construction costs for the mains, while the suburb would pay the rest of this as well as all the other pipes including service pipes, but the whole systems were still to be under the city’s full control. Water fees would be 0.20 kronor per cubic meter, except for fire-protection use, which would be covered by an annual fee of 100 kronor. The condition was that sewers were laid according to Carling’s plan, but were not to be connected either to cesspits or water closets. When these systems were ready for use the old water contracts with Marielund and Fredriksdal would expire and new ones were to be in force for the coming 25 years. All this was approved by the City Council.¹¹⁰

Naturally one wonders why this matter was solved at this particular time, when the suburb had made repeated requests during the years past? The Drafting Committee and the Financial Department hinted at the answers in their statements. First of all, according to the committee, the northern suburb was now financially capable of seeing its own part of the project through. Secondly, the capacity of the waterworks was now so great that the water supply could be extended to the northern suburb without threatening ample water distribution in the city. Thirdly, the project would now be even financially profitable for the city.¹¹¹

The constant fear in Norrköping that the water consumption of the northern suburb would soar should it get more water taps proved well founded. As Table 3.1 shows, the water consumption of the suburb increased rapidly from 1910 onward. On the other hand, this amount was small compared to the total city consumption.

¹⁰⁹ NSA, Norrköping City Council Archives, minutes 1909-05-03 §4, supplement No. 47 1909, p. 1-2 (including quotes).

¹¹⁰ NSA, Norrköping City Council Archives, minutes 1909-05-03 §4, p. 2-6, supplement No. 47 1909, p. 3-8, 10-17; Account of the City Council meeting 1909-05-03 §4, NT 1909-05-04.

¹¹¹ NSA, Norrköping City Council Archives, supplement No. 47 1909, p. 3-8, 12-16.

Table 3.1. Annual water consumption in cubic meters in the northern suburb and Norrköping compared to the total water distribution from the waterworks at Borg, 1905-1913.

Year	Water Consumption Northern Suburb, m ³	Water Consumption Norrköping, m ³	Total Distribution from the Waterworks
1905	22,815	2,235,261	2,258,076
1906	23,078	2,387,830	2,410,908
1907	29,470	2,646,567	2,676,037
1908	34,016	2,731,084	2,765,100
1909	29,024	2,711,620	2,740,644
1910	38,541	2,945,834	2,984,375
1911	46,457	2,917,558	2,964,015
1912	48,300	2,813,674	2,861,974
1913	70,897	2,304,620	2,380,586 ¹¹²

These figures also include leakage. The decreasing consumption in the city and totally from 1910 is mostly attributed to the division of the distribution network into high and low zones, and the ensuing lower pressure. The relative increase of the northern suburb's share was thus even greater than in absolute terms after 1910 (Source: Compiled from NSA, Norrköping City Council Archives, annual reports of the waterworks for 1905 to 1913; Östman, Malmberg, and Liander 1945 p. 34).

Conclusion

Two actor-networks in particular were identified in the questions of expanding the water and sewer systems: a network around the Waterworks Board, with P. U. Boëthius, J. A. Andersson, and Christian Eberstein as central figures, and a public health network, primarily represented by C. W. Engelbrecht, Axel Swartling, and Ivar Lyttkens. The Waterworks Board was the center of an actor-network which generally wanted to extend the water and sewer systems as much as possible, at least within the city. The southern suburb got water and sewerage only a couple of years after the systems had been introduced, for this was considered a suitable direction for the city's expansion, and it was also financially viable. In the 1883 case of the north-eastern district, this actor-network also promoted an extension. Its interests

¹¹² 5,069 cubic meters of this was also distributed to the suburb Borgs villastad.

were very likely to confirm its professionalism, to boost the city's physical expansion, and to help the carpenters' workshops and timber yards of the area with fire protection. This actor-network enrolled power resources through its links to the Waterworks Board, but also enlisted the potential economic advantages that might be gained by an extension for the city.

It would be misleading to assume that this actor-network always promoted expansion, however, for in relation to areas outside the city limit it was instead restrictive. Especially in the 1886 case of the northern suburb this actor-network was contrasted with the public health network, which considered health and humanitarian aspects rather than strictly technological and economic ones. By a slim majority, the water pipe was extended in 1887, thanks to the public health network and the fact that it had enrolled humanitarian arguments. It was presumably also convincing to suggest piped water to the suburb as sanitary protection for the city. It is noteworthy that the public health actor-network had more adherents in the City Council when it came to extending water and sewerage within the city than outside it. Apparently, pollution came particularly from workers outside the city. Not until 1909 and 1910 were there any new water and sewer extensions there.

The tough attitude towards the northern suburb did not change in the early 20th century, but the ambiguous feelings remained. Although some of the old actors were replaced, council discussions still often took place in the clash between a more technical-economic actor-network and a more humanitarian one (cf., the 1902 case of fire-protection). The suburb had very small power resources compared to the city, and tried to enroll legal allies, for instance, by appealing to the County Governor, or the terms of von Leesen's donation. Ultimately, though, the suburb seemed always to be at the mercy of the city. However, at this time incorporation suddenly appeared imminent, probably because of increased pressure from the state and the prospect of its economic viability, which also prompted the new extensions.

CHAPTER 4

Growing Pains and Geographical Expansion of Water and Sewerage in Linköping

Completing the Water and Sewerage Within the City

Water extensions were administered by the Water Company, but it was also accountable to the city according to the contract, since the city was a 20 percent shareholder. Furthermore, the company's task was to build a water supply in accordance with Abraham Blix's plan, and any changes, additions, or extensions (within or outside the planned city area) were to be submitted to the City Council. Since hardly any such extensions within the city were submitted to the City Council during the 1880s and 1890s, one could easily draw the conclusion that the water supply was not extended spatially within the city during the period.¹

This is a misleading conclusion, however, and can be explained as follows. Not very much was said about sewerage in the contract, but a certain City Council decision from 1875 affirmed that sewer pipes should be laid whenever necessary and whenever a water pipe was laid. During the 1880s and 1890s, this was often interpreted the other way around by the company, that is, whenever a sewer pipe was laid a water pipe was to be laid as well. In this way, as the sewerage was complemented, so was also the water system, both as regards minor work and extension to several streets. What determined a water extension in the end was the "10 percent rule," for a main could not be laid unless there were annual water fees sufficient to cover 10 percent of the construction cost.²

¹ LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1875-09-18 §§6 and 7; Linköping City Council Archives, AI:24-AI:38, minutes 1886-1900; *Kontrakt om Vattenledning emellan Linköpings stad, å ena, samt det derstädes den 28 Oktober 1873 bildade Vattenledningsaktiebolag, å andra sidan. Antaget af Stadsfullmäktige den 9 och af bolaget den 12 Januari 1874* (Linköping 1874), §§2, 9, 13, and 14.

² LiSA, Linköping City Council Archives, AI:13, minutes 1875-08-04 §95; Linköping Water Company Archives, AI:1 and AI:2, annual reports of the Water Company board for 1885, 1886, 1893, 1895, and 1897.

The company deviated from the contract and laid water mains on its own initiative, when the main was rather small and concerned perhaps only a street, without submitting the extension in question to the city. In maintaining and repairing the water supply the company abided by the contract, but it was probably sometimes difficult to separate renewal of old pipes from new extensions. There was very likely enough negotiation space for the company to be able to go about its business without the city interfering all the time, which is shown by the fact that the accountants seldom had any complaints. The city could also see to it that its interests were safeguarded through its representative on the company board.³

In Norrköping, the water extensions within the city sometimes generated lively debate, but in Linköping similar discussion seems to have been absent. First of all, there were few water extensions in the late 1880s and the 1890s. The major ones were to the suburbs. Most new water mains were laid to complement the pipe network in the city center. Secondly, as long as the Water Company fulfilled the requirements for successful business, the 10 percent rule, the shareholders were happy and there were few protests. (See also Appendix 3, Table 2.) In the early 1900s, the main concern of both the city and the company was the imminent takeover of the latter by the former.

The sewerage had originally been built only for the inhabitants around the five main streets of the inner city, and main sewer pipes were continually being laid for years after 1876, first in the streets of the inner city and then on the outskirts (see Chapter Two). In the expansive late 1880s and 1890s, the pipe network continued to be extended to new areas within the planned area and to the suburbs in order to keep up with the city's growth. In 1893 a great effort was made and around 1,000 meters of sewer pipe was extended, mainly in the northwestern district and to the suburb Stolplyckan.⁴

The people of Linköping were repeatedly reminded of the poor condition of the sewerage; overflowing street drains and broken sewers – with accompanying soil contamination – were increasingly common occurrences. The sewerage was quite simply not dimensioned for the city's population, neither in the 1870s nor towards the end of the century, particularly with the then rapid expansion of the city and its suburbs. In some places the sewerage was also insufficiently extended according to the original plan. For instance, the

³ LiSA, Linköping Water Company Archives, AI:1 and AI:2, annual reports of the Water Company board for 1881, 1888, 1892, and 1896; *Bolags-Ordning för Linköpings Vattenlednings-Aktiebolag samt Kontrakt om Vattenledning emellan staden och bolaget* (Linköping 1874), §§13, 14, 23-25.

⁴ LiSA, Linköping City Council Archives, AI:30, AI:31, and AI:33, minutes 1892-04-26 §68, 1892-11-29 §114, 1892-11-29 §115, 1893-03-28 §47, and 1895-05-28 §57, supplement EI:10, 1895 §57; Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland County for 1893 (Linköping 1894), p. 6.

Storgatan sewer main was not all underground pipe but long ended in a 5-meter open trench before it reached the river, which caused a sanitary nuisance particularly when tanners poured their wastewater in it.⁵

The first comprehensive local sanitary investigation of 1885 (see below) was satisfied with the extent of the sewerage generally speaking. There were, however, some areas with insufficient or non-existing sewerage which demanded attention, particularly the northwestern district and the infamous street Hunnebergsgatan. This street had received piped water in 1876 but no connection to the sewer system. Instead the wastewater from Hunnebergsgatan and Kattbrunnsgatan was led through earthenware pipes to a stone conduit, and then on to a trench, which ended in the river north of the city (see Figure 2.3). The problem was that the wastewater often remained in the ditch, and caused sanitary problems.⁶

Hunnebergsgatan had low social status and poor sanitary conditions before the introduction of piped water, and infant mortality was very high. With piped water Hunnebergsgatan still had a rather high infant mortality, which was probably due to the bad drainage. In the 1880s, the city grew and many people settled in this area, which led to further deterioration.⁷ The sanitary investigation suggested that the sewer in Kungsgatan be extended in a westerly direction so as to collect the sewage from the northwestern area of the city, including Hunnebergsgatan, and thereby improve conditions.⁸

The sewer was laid to the street Vasavägen instead, but was a cheaper alternative, partly with an open trench, and it proved not to be entirely satisfactory.⁹ In the early 1890s it became necessary to extend the sewer all the way down to the river. The city was then growing in a northern and northwesterly direction, and new building lots there had to be drained. The northwestern

⁵ LiSA, Linköping City Council Archives, AI:31 and AI:38, minutes 1893-03-28 §47 and 1900-03-27 §22; Linköping Board of Health Archives, AI:9, minutes 1883-09-28 §42; Sandberg 1978.

⁶ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 2-4. It was very difficult to clean out the trench from a legal point of view. In late 1884, the Board of Health required it to be cleaned out, after an inspection by the city police. So all the building owners and tenant farmers with property adjacent to the trench met at the police office to discuss the matter. The question was who really contributed filth to the trench, the building owners or the farmers? It was eventually decided that the cost should be divided equally between the two parties (LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-07-02 §38 and 1884-10-30 §58).

⁷ Nilsson 1994 p. 139-142; Noreen 1978 p. 74-75.

⁸ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 2-4, 28.

⁹ LiSA, Linköping City Council Archives, AI:24 and AI:25, minutes 1886-02-23 §30, 1886-05-25 §75, 1886-10-26 §111, 1886-11-30 §125, 1887-05-31 §79, and 1887-12-20 §159; *Handlingar till frågan om förbättrade Helsovårdsanordningar i Linköping* (Linköping, 1886), p. 4-16; Account of the City Council meeting 1887-12-20 §159, ÖC 1887-12-23. Both the Board of Health, Fredrik Stånggren, Fredrik Carlsson, and Nils Östling approved of this inexpensive solution.

suburb Gottfridsberg and the area down to Hunnebergsgatan constituted the highest points on the slope down to the river, so there was also a fear of filth flowing down to the city center. In connection with the cholera outbreak in Hamburg in the fall of 1892, the provincial physician and member of the Board of Health Hjalmar Suber repeatedly warned of the sanitary dangers of the present situation and demanded better drainage. The first provincial physician Henning Nordenström also pointed this out on several occasions (see below).¹⁰

The Board of Health thus asked the engineer C. J. Stenmark to draw up a proposal for a sewer that would collect all the sewage from the above areas as well as the reservoir area on Kanberget, which would end up in the Vasavägen and St. Larsgatan sewers. In the City Council discussion the city physician Ernst Boman talked about the indispensability of sufficient public health measures in case of a cholera epidemic. Not only the extended sewer was approved but also a sewer outlet in Drottninggatan, so as to hinder overflowing street drains and cellars. There was too much sewage even here, mainly due to sewer extensions to, and thereby an increased sewage contribution from, south of the city.¹¹

There was also another problem with the drainage and sewerage; their sometimes haphazard propagation in the city did not tally with the local building regulations, which Fredrik Stånggren, chairman of the Building Board, pointed out in 1896. According to the first paragraph, the city was to have a plan for the drainage of water from the planned area as well as for the control of lesser waterways (such as the creeks Kåringbäcken and Tinnerbäcken south of the city). The Financial Department agreed that such a plan should be made, and wanted it assigned to the city engineer. However, the city engineer Corlin felt that this project was too much to be included in the city engineer's tasks. It would certainly be considered an additional qualification if he was to do it himself, but it would require extra education and study tours on his part. He thought an expert should instead be hired. In 1900 the City Council decided that an external water engineer should take on the sewerage project, in cooperation with the Building Board. The fact that the existing sewerage did not work well and therefore caused many complaints by building owners, made the new plan urgent.¹²

¹⁰ LiSA, Linköping City Council Archives, AI:30 and AI:31, minutes 1892-11-29 §115 and 1893-03-28 §47.

¹¹ LiSA, Linköping City Council Archives, AI:31, minutes 1893-03-28 §47.

¹² LiSA, Linköping City Council Archives, AI:34, AI:35, and AI:38, minutes 1896-05-29 §63, 1896-08-31 §70, 1897-10-26 §86, and 1900-03-27 §22, supplement EI:11, 1896 §63; Account of the City Council meetings 1896-08-31 §70 and 1897-10-26 §86, ÖC 1896-09-01 and 1897-10-27.

A sewerage project was thus launched, and the initiative lay primarily with the Building Board. Johan Gustaf Richert and his company *Vattenbyggnadsbyrån* were hired to design a plan. The plan was ready the following year, but it was not until the end of 1902 that it was approved by the Linköping City Council. Richert had designed a greatly improved sewer system, with new sewer mains and street drains in certain parts of the city. Entirely new mains would be laid where there had been none before, but old ones were to be exchanged as well. The most important components of Richert's sewerage plan were the two large intercepting concrete sewers that would collect all the city's sewage (see Figure 4.2).¹³

Linköping's new city engineer, J. B. Carlson, had his own ideas about how Richert's proposal could be best implemented in Linköping, in spite of the fact that the building had already started in 1903. Carlson enlisted his better knowledge of the local conditions, as had chief engineer Wilgott Carling in Norrköping (see Chapter One):¹⁴

These changes by no means lessen the value of Professor Richert's proposal, but the same thing goes for sewers as for all other proposals: No one has yet succeeded in drawing up a proposal for an unfamiliar place which has not needed some minor alteration in its implementation. For however carefully it has been constructed, some changes must be made in carrying it out, since a proposal cannot know all the local conditions.¹⁵

Carlson's main revisions of Richert's proposal were associated with specific local conditions, such as over-all city planning, topography, property rights, local economy, as well as related technical details.¹⁶

It was probably both mishaps that had already occurred during the building in 1903 and foreseen ones that prompted Carlson to write his proposal. First of all, the old sewer in the street Vasavägen, which Richert had suggested be temporarily used as an outlet for interceptor number two, Carlson thought was too small and risky to use. It was already increasingly being strained by more and more sewage from the suburbs Stolplyckan and Gottfridsberg, and during 1903 it had broken in several places. Secondly, the intercepting sewers were planned to merge just before the property of the state-owned national railroad, where cesspools were not allowed, and the National Railroad Board (*Jernvägsstyrelsen*) could easily obstruct the building. So Carlson proposed

¹³ LiSA, Linköping City Council Archives, AI:39 and AI:40, minutes 1901-10-29 §105, 1902-02-25 §27, and 1902-12-05 §119, supplement EI:22, 1904 §63.

¹⁴ LiSA, Linköping City Council Archives, AI:42, minutes 1904-03-08 §32 and 1904-04-29 §63, supplement EI:22, 1904 §63.

¹⁵ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §63.

¹⁶ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §63.

what he thought was a better place for their merger. He thought his solution would be technically better, since Linköping's sewage would be more evenly distributed between the two interceptors. The sewers would also be laid in less marshy soil, and he also expected the whole project to become around 10,000 kronor cheaper.¹⁷

The Financial Department appointed a two-person committee consisting of the builder Oscar Nylander and Karl L. Anderson to scrutinize Carlson's proposal. All in all, they approved of Carlson's alterations, as did the Financial Department, the Building Board, and the Board of Health during the spring of 1904. Fredrik Stånggren, who was chairman of the two latter boards, was of the opinion that Richert at least should have a say in these changes of his original proposal. Richert was therefore given a chance to defend himself. In a letter to Stånggren he wrote that he did not have enough information to be able to assess the changes properly. However, he could not see that the principal part of the plan was significantly impaired by Carlson's changes and left it at that. It is therefore likely that Carlson was right in that he knew the local conditions better than Richert. Stånggren yet wanted to postpone any resolution regarding this matter, on the grounds that Richert should be consulted, and he must have interpreted Richert's reply as negative. Obviously most council members thought that Richert had had his chance, and Carlson's proposal was approved.¹⁸

There is evidence which suggests that Stånggren was the person in Linköping who handled the contacts with Johan Gustaf Richert, which may be why Stånggren would do anything in his powers to defend Richert's plan for sewerage in Linköping, even when he was nearly alone. This was presumably a matter of prestige, since, as in Norrköping, the changes were not very big and Richert already had been paid. On the other hand, Richert himself did not seem as concerned as Stånggren, so presumably he accepted Carlson's changes as improvements. The conflict of who was to have the local control of the rebuilding of the sewer system instead came to be between Carlson and Stånggren.¹⁹

The process of building the intercepting sewers took several years, because it virtually meant the rebuilding of much of the sewer system, and there were also a great many other sewerage projects that were carried out at the same time, such as, for instance, the extension to different suburbs. The suburbs Stolplyckan and Gottfridsberg as well as the new area in the north of the city

¹⁷ LiSA, Linköping City Council Archives, supplement EI:22, 1904 §63.

¹⁸ LiSA, Linköping City Council Archives, AI:42, minutes 1904-04-29 §63, supplement EI:22, 1904 §63; Account of the City Council meeting 1904-04-29 §63, ÖC 1904-04-30.

¹⁹ LiSA, Linköping City Council Archives, AI:42, minutes 1904-04-29 §63 and 1904-06-01 §81, supplement EI:22, 1904 §63.

could be sewered thanks to interceptor No. 2, which was finished in late 1906.²⁰ But the adventures of the interceptors were to continue (see below).

Sprawling Water and Sewerage: Extensions Outside the City

The Suburbs of Linköping

Today, River Stångån runs through Linköping much like Motala ström runs through Norrköping, but this was very different in the latter half of the 19th century. Linköping then was restricted to the slope west of the river, and the area east of it was not even under the city's jurisdiction (see panoramas in Introduction). It belonged to St. Lars rural commune, which surrounded the city, and one of Linköping's several suburbs, Ladugårdsbacke, was situated there. Like Norrköping's northern suburb, it was considered to be a shanty town and sanitation was poor. It was also a working-class area, in close proximity to the industrial districts Nykvarn and Tannefors on the river (see Figure 4.1).²¹ The city did not do very much to help working-class immigrants, so they had to build their own houses or rent apartments outside the city's planned area (in this case also outside its jurisdiction), where the urban laws were not in force and the prices of property and rents were lower.²²

To the southwest and outside the planned area lay Stolplyckan, an outgrowth of the street Djurgårdsgatan. There was also a suburb to the northwest called Gottfridsberg, which was also an outgrowth of a street, Hunnebergsgatan, and there was Tinnerbäckslöckan to the south and several smaller suburban settlements in close proximity to the city (see Figure 4.1).²³ As a delimitation Ladugårdsbacke, Stolplyckan, and Tinnerbäckslöckan have been singled out for special analysis in this chapter, although the suburbs are also dealt with as a common phenomenon (sometimes exemplified with other suburbs, for example, Gottfridsberg).

²⁰ LiSA, Linköping City Council Archives, AI:44, minutes 1906-05-07 §88, supplements EI:26, 1906 §88 and No. 11 1908, p. 36.

²¹ The city water was taken upstream the industrial establishments, so as to avoid contaminated river water.

²² Almroth and Kolsgård 1978 p. 111-124; Nilsson 1994 p. 140-141; Torbrand 1978 p. 25-32. Ladugårdsbacke consisted of several smaller areas such as *Ladugårdsbacke*, *Ladugårdsgårde* and *Tomteboda*, but the former will hereafter be used as a common name for the whole area (it is the most frequently used in the literature).

²³ *Ibid.* Just as in the case of Ladugårdsbacke, each of these other suburbs also included smaller areas, for instance, Westanå in Gottfridsberg.

The Power of the City Border – The Question of Ladugårdsbacke

The first suburb to catch the attention of the city as regards the extension of water was Ladugårdsbacke in 1881. The brewery owner Ludvig Theodor Brogren and 16 home owners in Ladugårdsbacke wanted to connect to the city's water supply, and expected to be given water on the same conditions as people in the city. The Linköping Water Company acted quickly, and within two days their engineer C. J. Stenmark had drawn up a plan and made an estimate of the costs. It showed that the income from water fees would surpass 10 percent of the costs of construction by far. Brogren's brewery was a large consumer and alone would pay 400 kronor a year. This extension would consequently benefit the company economically, and they asked the city to approve it.²⁴

With the influential Brogren at the head of this matter, one would think that it should have been settled quite easily, especially since he was a member of the City Council, its Drafting Committee, as well as a shareholder in the Water Company. But the city was strongly opposed to extending a water pipe to Ladugårdsbacke, despite Brogren's objections. The Drafting Committee first of all maintained that this area lay outside the city border. Secondly, the waterworks pumping station was already very strained, and an extension would hasten the installation of a new pump at Tannefors. The view of the committee thus differed from that of the Water Company, which should have had the best knowledge of the capacity of the waterworks. Thirdly, there was no guarantee that further expansion in Ladugårdsbacke was possible. Lastly, the committee feared that other areas around the city would ask for water pipes if this case was approved. The City Council decision was not unanimous, but the proposal of a water pipe to Ladugårdsbacke was rejected. Linköping was obviously not as concerned about its industry as Norrköping, although the argumentation echoed that of its neighbor concerning extension of water to working class suburbs (see Chapter Three).²⁵

During the City Council meeting, Brogren argued for his and the suburb's request. There had been no objections to it among the shareholders of the Water Company, and the pipe would be of great importance from a sanitary point of view and in case of a fire. There can be no doubt that Brogren and the company both had economic interests in the extension.²⁶ Nils Östling, lecturer

²⁴ LiSA, Linköping City Council Archives, AI:19, minutes 1881-06-22 §73; Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1881-05-31 §8; Account of the City Council meetings 1881-06-22 §73 and 1881-07-26 §81, ÖC 1881-06-25 and 1881-07-28.

²⁵ LiSA, Linköping City Council Archives, AI:19, minutes 1881-07-26 §81; Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1882-05-30 §7; Account of the City Council meeting 1881-07-26 §81, ÖC 1881-07-28.

²⁶ ÖC 1881-07-28.

in Latin and Greek and a member of the Swedish Parliament, expanded on the opinion he expressed during the Drafting Committee's meeting. He believed that the proposed extension would not pay due to lack of any guarantees that there would be continued and extended water consumption in Ladugårdsbacke. Besides, the contract with the Water Company did not allow for extensions outside the city. He was also of the view that the advantages of piped water in case of epidemics or fire would not be so much greater, due to the existing easy access to an ample supply of river water. This latter argument should not have convinced either people in the suburb or in the city – on the other side of that same river – as there was growing concern about the deteriorating quality of the river water. The very fact that the committee accepted this argument only attests to its negative attitude to Ladugårdsbacke.²⁷

On the surface, this debate concerned public health and environmental issues, but the bottom line was economic interests, public as well as private. The city eventually protected the economic interests of the city, and the argument was that an inclusion of Ladugårdsbacke would very likely mean requests for more, supposedly unprofitable, suburb extensions. In this case the economic interests of the city prevailed over the private interests of the suburb, the company, and Brogren's brewery. It is fair to say that public health and environmental actor-networks could only seriously challenge economic ones when there was a true concern about sanitation and environment. Around 1880 the belief in the salutary effects of piped water supply and sewerage for the city was still so great that the city authorities shut their eyes to actual sanitary problems in and especially outside the city. The ironic consequence of this was that Ladugårdsbacke had to be content with the contaminated river water, instead of enjoying the city's piped water.

A public health actor-network was beginning to challenge the economic networks, however (see Chapter Six). The first comprehensive sanitary investigation in the city, which was initiated by the Council of Magistrates in 1882 and carried out by a special health committee, contributed to this. When the investigation was presented in 1885 and 1886, it was clear that the suburbs had become a substantial problem in the eyes of the committee, especially those that were under municipal jurisdiction but outside the planned area – Stolplyckan, Gottfridsberg, and Tinnerbäcksläckan. Above all, it was the sanitary conditions that were alarming, and they were thought to have resulted in higher morbidity in the suburbs, which had greatly endangered the city itself. A serious outbreak of typhoid fever (*nervfeber*) in 1883 actually did

²⁷ ÖC 1881-07-28.

start in Tinnerbäcksslyckan, according to the investigation, and thence spread into the city (130 fell sick, out of whom 22 died).²⁸

The health committee therefore suggested that these suburban areas be subjected to the National Public Health Act of 1874, one of the four urban laws applicable only to cities. However, a paragraph in the law permitted that such areas could be *regarded as* parts of the planned city in public health matters.²⁹ The Linköping Board of Health agreed, but wanted to include Ladugårdsbacke and Tannefors as well, since they were also a potential threat to the city's health. An epidemic could easily spread to the city from there. The inspector of the National Board of Health, Klas Linroth, had warned about the threats to the health of the city from these suburbs – particularly from Ladugårdsbacke – in his 1885 inspection. In a City Council discussion in late 1887, for example, the civil servant H. Petri and the city physician Oscar Segerdahl agreed with the Board of Health.³⁰

Public health interests were up against the economic interests of the city. The Drafting Committee was for the extension of the urban Public Health Act to all the suburbs within the city's jurisdiction, but they had to pay for themselves. (They already paid tax to the city.) On the other hand, the committee was entirely against extending these public health services outside the city limit. In 1887, this actor-network, headed by Fredrik Carlsson, won with a slight majority. The County Governor did not accept this double taxation, however. In 1889, there was again a lengthy debate in the City Council, but most members managed to agree on a compromise accepted both by the Board of Health and the Drafting Committee. The city's own suburbs, within a 500 meter radius from the planned area, would be considered

²⁸ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 27, 39-40. According to the annual report of the Board of Health for 1882, the typhoid fever started late 1882, and it was believed that the causes were unfinished and damp housing and the dredging of the creek Tinnerbäcken, which collected sewage from Käringbäcken and was a tributary to Stångån (LiSA, Linköping Board of Health Archives, AI:8).

²⁹ *Ibid. Kongl. Maj:ts nådiga helsovårdsstadga för riket, 25 september 1874*, SFS, 1874, No. 68, §25. The public health act for the countryside was not as strict as the urban one.

³⁰ LiSA, Linköping City Council Archives, AI:24, AI:25, AI:26 and AI:27, minutes 1886-02-23 §30, 1886-05-25 §75, 1886-10-26 §111, 1886-11-30 §125, 1887-07-14 §94, 1887-10-25 §131, 1887-11-29 §143, 1888-11-27 §130, 1889-02-26 §38, 1889-03-26 §48 and 1889-08-27 §86; Account of the City Council meeting 1887-11-29 §143, ÖC 1887-12-02. This national inspection is not to be confused with the previously mentioned local sanitary investigation. In 1884, the National Board of Health made a survey of the sanitary situation in several Swedish cities. The alarming results of this prompted the 1885 inspection of the cities (LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-10-30 §61). See Chapters Five and Six.

beneficiaries of the city's health services without an extra fee (Ladugårdsbacke and Tannefors were excluded).³¹

Fredrik Carlsson and the court judge Pehr Orre still did not accept the city's help to the suburbs, primarily because it would mean greatly increased future costs. Yet, as Orre said, it was not necessary to do anything about these areas right away, but could be postponed until there was a need. However, the city physician Ernst Boman was of the view that the sanitary situation in nearby suburbs was urgent due to the threat of typhoid fever, although he showed no such concern for Ladugårdsbacke and Tannefors. It is obvious that there was an actor-network in the Linköping City Council that was dominated by the city's economic interests, and there was also one oriented towards public health interests. But the limit to the generosity of the latter was the city border.³²

Once again Ladugårdsbacke, which was seen as a shanty town, had been denied the help it so desperately needed. Water supply, sewerage, and public health in general were critical issues which called for the attention of the city authorities, and there was not much that the Communal Council of St. Lars could or would do. However, in the 1890s people in Ladugårdsbacke got the right to use the city's epidemic hospital, should they suffer from some kind of infectious disease, and in 1894 the suburb became a *municipalsamhälle*. In 1894, a new national ordinance from the Swedish Government concerning densely built-up suburbs prompted the 1896 inclusion even of Ladugårdsbacke, Tannefors, and Nykvarn into the realm of the National Public Health Act for cities. Since they were not situated within the city's jurisdiction, the rural commune had to finance the increased public health work that the law required.³³

³¹ LiSA, Linköping City Council Archives, AI:24, AI:25, AI:26 and AI:27, minutes 1886-02-23 §30, 1886-05-25 §75, 1886-10-26 §111, 1886-11-30 §125, 1887-07-14 §94, 1887-10-25 §131, 1887-11-29 §143, 1888-11-27 §130, 1889-02-26 §38, 1889-03-26 §48 and 1889-08-27 §86; Account of the City Council meetings 1887-11-29 §143 and 1889-03-26 §48, ÖC 1887-12-02 and 1889-03-29; Nilsson 1994 p. 140. The County Governor also approved the extension of the National Public Health Act to all suburbs within a 500-meter radius from the city plan, but only within the city's jurisdiction.

³² Account of the City Council meetings 1887-11-29 §143 and 1889-03-26 §48, ÖC 1887-12-02 and 1889-03-29.

³³ Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1894 (Linköping 1895), summary of the annual reports of provincial physicians, p. 27; Larsson 1913 p. 177; Nilsson 1994 p. 127-128; Sandberg 1978 p. 283. To begin with, the general regulations, fire and building laws for cities were not applicable, however.

The Question of Incorporating Ladugårdsbacke

This did not mean that the water supply and sewerage issues were solved right away, however. (Some smaller private water pipes and rudimentary drainage had been laid earlier.) As we have seen, there were those who wanted to delay the extension of these services to all suburbs as much as possible, and most actors definitely excluded the areas outside the city boundary, except for Segerdahl, Petri, and some others. But all in all, the relationship between the city and Ladugårdsbacke seems to have been much better than the one between Norrköping and its northern suburb. In 1907, the city started buying land in St. Lars to be able to control the suburban growth, while at the same time it started negotiations about an incorporation of the whole rural commune. In this case it was the city that wanted to incorporate, but the rural commune refused. Despite income from the industrial establishments in the commune it was very poor, so in 1908 it agreed to the incorporation.³⁴

In the fall of 1910, the Swedish Government resolved that the St. Lars rural commune, including Ladugårdsbacke *municipalsamhälle*, was to be incorporated into the city of Linköping from 1 January 1911. Thus a committee consisting of members of both the Linköping City Council and the Communal Council of St. Lars was appointed, to try and settle the administrative and juridical matters involved in the incorporation. The framework for this was decreed in a resolution from the Swedish Government, while the committee was to address the practical matters. For instance, roads as well as the property and finances of the rural commune were to be taken over by the city. The extension of the planned area and thus the urban laws should be restricted to certain areas of the rural commune, according to the committee, but after a discussion in the City Council it was decided to include the whole area east of the river, that is, the former *municipalsamhälle*, Tannefors, and a number of other farms and estates. This area was now sometimes referred to with the common name Tannefors, which it retains even today.³⁵

In 1911, when Ladugårdsbacke was officially a part of Linköping, and 30 years after the last request, 12 house owners in the suburb requested the extension of a water pipe. The present water situation was intolerable, in their view. The water in the few wells was unsatisfactory both regarding quality

³⁴ Larsson 1913 p. 65-66, 177-179.

³⁵ LiSA, Linköping City Council Archives, minutes 1910-10-25 §§198 and 199, 1910-11-29 §232, 1910-11-29 §241, 1910-12-13 §254, and 1910-12-29 §270, supplements No. 14, p. 7, No. 15, p. 1-5, No. 18, p. 43-60, and No. 21, p. 16-22, 1910. It is obvious from the minutes of the Council of Magistrates (quoted in the above sources) that there was not enough time to settle all the legal issues of the incorporation before 1 January 1911.

and quantity, the latter of which was also a problem from a fire-fighting point of view.³⁶

The city engineer Carlson, who was absolutely no friend of the suburbs, questioned whether the incorporation gave the inhabitants of the suburb any right whatsoever to demand this service. The poor water situation had nothing to do with Ladugårdsbacke's incorporation anyway. As drainage was so poor, there could be no connection. Furthermore, the new city plan for this area was not completed yet, and it would thus be unwise to lay water and sewer pipes at this stage. But Carlson was confident that the Financial Department would extend water and wastewater as soon as it was financially defensible, that is, when the suburb could itself bear the expense or the city could profit from it.³⁷

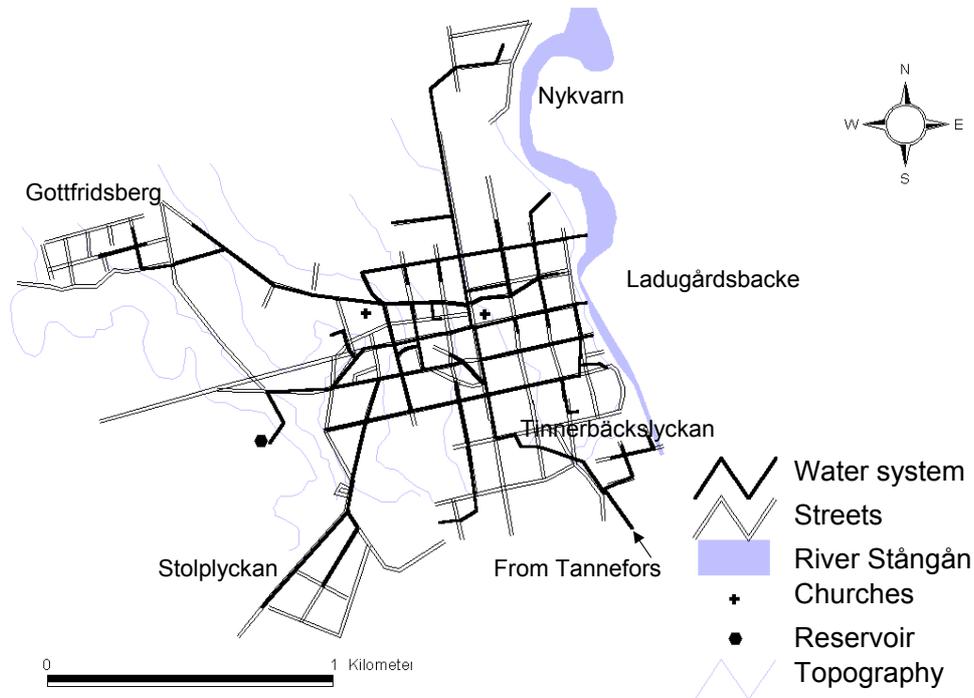
In the City Council there was a majority in support of the city engineer's views, and there was consequently no extension. The old image of Ladugårdsbacke as a "filthy" working class shanty town was probably difficult to remove, and Carlson did nothing to facilitate this. As it turned out, this area and the whole of Tannefors did not get municipal piped water until 1921, when the new waterworks at Råberga took over and the Tannefors pumping station was completely closed. A main was then laid from Råberga, through the whole Tannefors area, under the river and up to the city center. The first large consumer to connect was the brewery Förenade Bryggerierna, a descendant of Ludvig Brogren's company that had been denied piped water in 1881 and had continued to use water of a less good quality directly from the river.³⁸

³⁶ LiSA, Linköping City Council Archives, supplement No. 15 1911, p. 12.

³⁷ LiSA, Linköping City Council Archives, minutes 1911-09-26 §243 and 1911-12-08 §339, supplement No. 15 1911, p. 12-15.

³⁸ LiSA, Linköping City Council Archives, minutes 1911-12-08 §339; Annual report of the Linköping Waterworks for 1921, supplement No. 19 1922, p. 72-73; Almroth and Kolsgård 1978 p. 139-140.

Figure 4.1. The Linköping water system in 1900.



Source: Schmid and Hallström 2001.

Stolplyckan and Tinnerbäcksluckykan

In 1884, some house owners in Stolplyckan asked the Linköping Water Company to be connected to the water supply, and according to the 10 percent rule such an extension would be very profitable for the company. Since the contract between the company and the city required that the latter approve water extensions outside the planned area, and as it was also decided in 1875 that sewer pipes should be laid simultaneously with water pipes, the company had to consult the City Council (see Chapter Two). Apart from the case in question – Stolplyckan – this was also a matter of principle. Was the decision from 1875 to be applied even outside the planned area? The company motivated its request by pointing to the sanitary advantages of the sewer pipe, as contamination of the creek Kåringbäcken – which ran through the suburb, down to the southern part of the city, and flowed into the slightly bigger creek

Tinnerbäcken – could be avoided. It would also be cheaper to lay both kinds of pipes at the same time.³⁹

The Drafting Committee acknowledged the sanitary advantages for the area, but was of the opinion that the house owners through whose property the pipe would be laid were the ones that would benefit mostly from it. The purity of the creek water or the sanitary conditions for city residents downstream were not considered. The committee also feared that other residents within the city border, but outside the planned area, would request the same service, should the city pay for the whole pipe. So, in the end the city would not pay for the sewer pipe any further than to the boundary of the planned area.⁴⁰

Here, as in the Ladugårdsbacke case three years earlier, the private nature of the Water Company and the public nature of the city became very evident. For the company, the direction of a water pipe was less important as long as it benefited from it financially. The city was faced with a more complicated decision. People in Stolplyckan paid tax to the city, but it was yet not a part of the city plan, and therefore should not benefit from the city's public services. Stolplyckan was a private area, built on cheap property without regard for building regulations. Furthermore, there were no fees attached to sewage management that could finance the extension. The refusal on the part of the city to pay for sewerage in Stolplyckan must also have been taken as a no to water supply by the Water Company. Nothing happened with either piece of infrastructure for another three years.

When the Board of Health in 1887 appealed to the Drafting Committee, arguing that the urban Public Health Act should be extended outside the planned area, the board also argued that, if this area was to be considered a part of the city in public health matters, then its environmental problems had to be alleviated by public means. The lack of drainage caused poor sanitary conditions in Stolplyckan, and the board proposed a sewerage pipe as a solution. At the same time, it would also be easy to extend water supply.⁴¹

Apparently, extension of public works to the suburbs now caused more discussion than a few years before. Fredrik Stånggren claimed that the building activity in Stolplyckan was so intense that there was no point in comparisons with 1884. The suburb was a potential hotbed of disease for the

³⁹ LiSA, Linköping City Council Archives, AI:13 and AI:22, minutes 1875-08-04 §95 and 1884-07-29 §67; *Kontrakt om Vattenledning emellan Linköpings stad, å ena, samt det derstädes den 28 Oktober 1873 bildade Vattenledningsaktiebolag, å andra sidan. Antaget af Stadsfullmäktige den 9 och af bolaget den 12 Januari 1874* (Linköping 1874), §9.

⁴⁰ LiSA, Linköping City Council Archives, AI:22, minutes 1884-08-26 §74; Account of the City Council meeting 1884-08-26 §74, ÖC 1884-08-28.

⁴¹ LiSA, Linköping City Council Archives, AI:25, minutes 1887-07-14 §93 and 1887-08-30 §106; Account of the City Council meeting 1884-08-26 §74, ÖC 1884-08-28.

city, particularly due to the creek (and sewer) Kåringbäcken. The well water was said to be impure and unhealthy. Stånggren thought that the cost for the sewer would be relatively low if at the same time the house owners were induced to install piped water. Oscar Segerdahl also promoted the board's proposal. At the time there was a typhoid epidemic in the suburb, which could easily spread to the city, and it was therefore primarily the city that would benefit from the sewer. For these, both of them members of the Board of Health, public health was more important than economy, but it was the health of the city inhabitants that was the most crucial.⁴²

Fredrik Carlsson, who represented the economic interests of the Drafting Committee, asked "if the city should do everything for the individual, but the individual nothing for his own good?"⁴³ He doubted that the inhabitants of Stolplyckan really would use the sewer if it was extended. Segerdahl, on the other hand, "could not imagine anything so absurd as the inhabitants not using a sewer, should they get one."⁴⁴ In Carlsson's view, as the Board of Health had no authority there, and as the city might have to sewer all the suburbs if the sewer was extended to Stolplyckan, the proposal should be rejected.⁴⁵

In this question, an actor-network representing the public health interests of the city and very likely the commercial interests of the Water Company, had to confront an actor-network centered around the Drafting Committee. In this and the previous cases of extension, the committee guarded the interests of the city (and the city's interests in the Water Company), that is, it wanted to keep municipal spending as low as possible and the city should not finance anything that it did not benefit from, directly or through the company. It may seem strange that it was opposed to an extension of water pipes that would have been very profitable, but we must remember that it was primarily the company that could take advantage of this.

What eventually may have tipped the scales in favor of the public health actor-network and the Water Company in the 1887 case was the suggestion by the engineer Axel Lindeberg, shareholder of and former accountant for the Water Company, that Stolplyckan should receive sewerage on condition that the inhabitants arranged for water supply themselves (Stånggren had also implied this). The Water Company would be consulted, for there was no other way for the many poor inhabitants in the suburb to arrange for piped water. We have already seen that the extension of water was expected to be good business by the company, because the City Council would pay them for the

⁴² LiSA, Linköping City Council Archives, AI:25, minutes 1887-08-30 §106; Account of the City Council meeting 1887-08-30 §106, ÖC 1887-09-02.

⁴³ ÖC 1887-09-02.

⁴⁴ ÖC 1887-09-02.

⁴⁵ ÖC 1887-09-02.

sewerage and the residents would finance the water. Around 50 percent of the members of the City Council were shareholders in the Water Company.⁴⁶ By a slim majority (17 to 15), the expansion of sewerage and water supply to Stolplyckan was decided upon, and in 1889 the whole extension was finished.⁴⁷

There were still problems to be solved, for instance, the creek Kåringbäcken. Its reputation was anything but good, both in Stolplyckan and the city. The 1885 local sanitary investigation had suggested that the creek be drained with sewer pipes and the wastewater led into the river, via Tinnerbäcken. The Board of Health was of the same opinion. Not surprisingly, the Drafting Committee did not want to do anything about the contaminated creek, which was also what the City Council decided after much debate. Consequently, despite the protests of the Board of Health, the city's own interests came first. Since the (waste) water in the creek actually affected the city, it is likely that the faith in the new piped sewers in Stolplyckan was great, and that they were expected to lessen the contamination.⁴⁸

In 1892, the fifth great pandemic of Asiatic cholera swept across Europe, and there was a widespread fear that it would reach Sweden as well. Cholera epidemics lived in the memories of Linköping's inhabitants, as the city had been hard hit by cholera particularly in 1866. Outbreaks on the Continent during the 1870s and 1880s had not been in any way uncommon either, so there was general vigilance, both locally and on a national level.⁴⁹ In late July and in August 1892 the Board of Health expressed its concern about the situation. It wanted 5,000 kronor for several preventive measures against the dreaded cholera.⁵⁰

⁴⁶ In 1874, 23 out of 30 City Council members were shareholders in the Water Company. In 1884, the City Council was enlarged to include 40 members. We can assume that most of the 23 still owned shares in 1887, although some of them had resigned and other people had taken their places. All in all, the figure may have been at least around 50 percent. The figure was maybe a little higher, as the company had issued new shares since 1874, even though these had been restricted to former owners (Hagård 1978 p. 243). See Appendix 3, Table 1.

⁴⁷ LiSA, Linköping City Council Archives, AI:25, minutes 1887-08-30 §106; Linköping Water Company Archives, AI:1, minutes of the shareholders' meetings 1874-09-26, 1883-05-31, 1889-05-24, with annual report of the Water Company board for 1888, and 1890-05-30, with annual report of the Water Company board for 1889; ÖC 1887-09-02.

⁴⁸ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 4; LiSA, Linköping City Council Archives, EI:7, *Handlingar till frågan om förbättrade Helsovårdsanordningar i Linköping* (Linköping, 1886), supplement to minutes 1888-05-29 §70, p. 5; Linköping City Council Archives, AI:24, AI:25 and AI:26, minutes 1886-11-30 §125, 1887-05-31 §73 and 1888-05-29 §70; Södergren 2000 p. 183-186.

⁴⁹ Sandberg 1978 p. 282.

⁵⁰ LiSA, Linköping City Council Archives, AI:30, minutes 1892-08-30 §84; Linköping Board of Health Archives, AI:3 and AI:10, minutes 1877-11-12 §52 and 1884-10-30 §61.

In Linköping two state-employed physicians – Henning Nordenström and his subordinate Hjalmar Suber, who was also a member of the Board of Health – suggested several improvements of the sanitary conditions in order to avert a cholera outbreak. Nordenström had been an assiduous promoter of improved sanitary conditions in Linköping during his many years as provincial physician, and he now brought to the fore the situation in the suburbs with his newly-attained authority as *first* provincial physician. As such he was responsible for the whole county, that is, even Norrköping, other smaller towns, and the countryside.⁵¹ Around half the yards in the suburbs had piped water supply and sewerage, and the rest had to rely on deficient wells and open trenches as sewers.⁵²

There were thus still many house owners in Stolplyckan who did not have access to municipal water and sewerage, and Kåringbäcken was considered particularly problematic due to the potential spread of disease from there. The Board of Health was of the opinion that by connecting the rest of the home owners in Stolplyckan to the sewerage even the problem of the creek would be solved, since the main source of pollution would then be cut off. In September 1892, the board commissioned the engineer C. J. Stenmark to construct sewer pipes for the remaining yards. Stenmark then also proposed that these house owners be ordered to install piped water, since the cesspools needed to be cleaned in order not to develop and spread disease and as the sewers often were clogged. The Board of Health agreed and proposed a solution similar to that in 1887, which the City Council approved in the spring of 1893. By the end of the year, both water and sewer pipes had been laid to the remaining property owners in Stolplyckan.⁵³

Henning Nordenström seemed to be rather content when summing up the year 1893. Eighty-six percent of the yards in the suburbs (presumably, again, excluding Ladugårdsbacke) were sewered, which was a significant improvement. In most suburban yards there was also piped water, according to his annual report. However, the collection of excreta, manure, and solid waste was still deficient, both in the city and the suburbs, despite the new regulations

⁵¹ The first provincial physician was placed under the County Governor and the National Board of Health (*Medicinalstyrelsen*) in public health matters from 1891 onwards, and was appointed to oversee the public health work and see to it that the Public Health Act was implemented. He regularly made inspections throughout the county, both in the cities and the countryside, and a number of provincial physicians were subordinated to him. In the case of Nordenström, he also kept his previous responsibility as provincial physician for Linköping even after 1891 (Nilsson 1994 p. 131-132).

⁵² Sandberg 1978 p. 282-283.

⁵³ LiSA, Linköping City Council Archives, AI:30 and AI:31, minutes 1892-11-29 §115, 1893-03-28 §47 and 1893-04-25 §62; Linköping Water Company Archives, AI:2, annual report of the Water Company board for 1893; Account of the City Council meeting 1893-04-25 §62, ÖC 1893-04-26.

(see Chapter Six).⁵⁴ Kåringbäcken continued to be a problem, partly due to the tributary streams, partly because of continued discharge from Stolplyckan. The city and its suburbs grew fast in the 1890s, and both filling up and sewerage of the creek were discussed. But it was not until 1896 and the overall investigation of the city's sewerage that Kåringbäcken, Tinnerbäcken, and other smaller waterways came under professional investigation.⁵⁵

Around the turn of the century both Stolplyckan and Gottfridsberg had grown so much that it was considered necessary to complement the water supply to improve fire protection. These suburbs had a high percentage of wooden buildings and the fire regulations were not in force. The fire-protection board had pointed to this unsatisfactory situation for some years, and the whole city was threatened from these suburbs. They lay at the highest points of the city, and their water pressure and supplies were considered insufficient for a major fire. They were also far from the river, and had only one fire hydrant each. Gottfridsberg had lower pressure and lay farther from the city, which meant that it could not utilize nearby city hydrants. By 1900 the situation in Gottfridsberg was considered so urgent by the Financial Department that the water system just had to be extended. Stolplyckan, on the other hand, had a fairly good supply and, if they wanted to improve it, they were advised to turn to the Water Company.⁵⁶

The fire-protection board was commissioned by the Drafting Committee to further investigate the matter. Johan Gustaf Richert was consulted again. He suggested a complete renovation of the whole water supply, but this was not implemented at the time (see Chapter Two). So Richert proposed two new mains to secure reasonable water pressure in Stolplyckan and Gottfridsberg, as a temporary measure.⁵⁷ The Water Company had an extra shareholders' meeting regarding this question and approved of Richert's new mains, which would cost 17,400 kronor, slightly altered by city engineer J. B. Carlson. The 10 percent rule was not applicable as the city and not the building owners had asked for the extension, but somehow the company must have considered it profitable.⁵⁸ In the spring of 1902 the city also approved of these mains. The

⁵⁴ Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1893 (Linköping 1894), p. 6.

⁵⁵ Sandberg 1978 p. 283; Södergren 2000 p. 183-186; LiSA, Linköping City Council Archives, AI:38 and AI:44, minutes 1900-03-27 §22 and 1906-06-12 §130.

⁵⁶ LiSA, Linköping City Council Archives, AI:40, minutes 1902-04-29 §51, supplement EI:18, 1902 §51.

⁵⁷ LiSA, Linköping City Council Archives, AI:40, supplement EI:18, 1902 §51.

⁵⁸ LiSA, Linköping City Council Archives, AI:40, minutes 1902-04-29 §51, supplement EI:18, 1902 §51; Linköping Water Company Archives, AI:2, minutes of the shareholders' meeting 1901-12-13 §4.

work was carried out by the Water Company, but the city contributed with 20 percent as usual.⁵⁹

At the very end of 1905, the controversial teacher and liberal-leftist member of parliament Anders Sterner submitted a motion about drainage in the suburbs Tinnerbäckslyckan, Stolplyckan, and Gottfridsberg during the next summer. According to him, regardless of the person's social class or political ideology, one of the most popular ideas of the day was that of owner-occupied houses ("*egnahemsidén*"), and in many "civilized countries" the national authorities had therefore sponsored this idea with a great deal of money. In Linköping the suburbs Tinnerbäckslyckan, Stolplyckan, and Gottfridsberg were concrete manifestations of this idea, although they had had to fight for their existence against the city authorities:⁶⁰

These suburbs have been and still are the stepchildren of urban society, with which it has graciously shared a little of its affluence from time to time. . . . they have had to contribute to the taxation burdening the rest of the city, but have alone had to pay for the maintenance of their streets . . . their drainage and lighting. As far as drainage is concerned, it is also in such a condition that it shows signs of becoming what is popularly denoted as "a cancer on society."⁶¹

Sterner appealed to the "sound sense of justice and sense of esthetic and hygienic reason" of the City Council members concerning this case.⁶²

In 1906 city physician Carl Schoug made a health campaign for the suburbs. He had been concerned about a severe typhoid epidemic in Gottfridsberg a couple of years earlier, but the new suburb Karlberg, which had recently emerged adjacent to Stolplyckan, had even worse sanitary conditions. This was mainly because Stolplyckan and the approximately 20 houses in Karlberg still used Kåringbäcken as a sewer, which caused sanitary dangers both for the inhabitants of this suburb and the city. The Board of Health had recently attempted to prevent discharge of wastewater, but without success. Schoug's suggestion was to sewer Karlberg with a pipe through the street Föreningsgatan on to interceptor No. 2, which was to be finished in a couple of months.⁶³

⁵⁹ LiSA, Linköping City Council Archives, AI:40, minutes 1902-04-29 §51; Linköping Water Company Archives, AI:2, minutes of the shareholders' meeting 1901-12-13 and annual report of the Water Company board for 1902.

⁶⁰ LiSA, Linköping City Council Archives, AI:43 and AI:44, minutes 1905-12-30 §241 and 1906-10-30 §193, supplement EI:27, 1906 §193.

⁶¹ LiSA, Linköping City Council Archives, supplement EI:27, 1906 §193.

⁶² LiSA, Linköping City Council Archives, AI:43 and AI:44, minutes 1905-12-30 §241 and 1906-10-30 §193, supplement EI:27, 1906 §193.

⁶³ LiSA, Linköping City Council Archives, AI:42 and AI:44, minutes 1904-09-27 §115, 1906-02-27 §42, 1906-09-11 §135, and 1906-11-27 §213, supplement EI:27, 1906 §135 and §213.

It is difficult to know who was really behind this proposal, the inhabitants of the suburb or the city physician. But it is clear that the latter had the power to do something about this and that both the public health interests of the city and the sanitary and other interests of the people in the suburb were favored by this solution. The Financial Department had earlier put off the question of what to do with Kåringbäcken and now saw the opportunity to solve both these questions. In 1904 a committee appointed by the department, in which the city engineer was a member, had suggested the draining of most of the creek through Richert's interceptor No. 2, and the filling of the rest of it.⁶⁴

In the fall of 1906 Schoug's proposal about Karlberg and the filling of Kåringbäcken were approved by the City Council with minor modifications. There were legal difficulties concerning Karlberg and Stolplyckan that delayed the building of the sewer. The house owners would not give up their right to the streets, but after a couple of years it was decided to start the work anyway. Water and fire hydrants as well as gas lighting were also to be extended.⁶⁵

Regarding Kåringbäcken, the problem was that the intended drainage of the water and wastewater was not complete, that is, the whole catchment area was not included in the drainage plan. The Council of Magistrates, which did not usually interfere with the city's business, pointed this out to the city authorities. Storm- and wastewater from within the park Trädgårdsföreningen and a few yards near it would still run through the lower part of the creek, which was considered dangerous from a sanitary viewpoint. The Magistrates therefore suggested a sewer from the western to the eastern end of the park, so as to completely resolve these problems and totally do away with the creek (the Board of Health and the park board consented). The city engineer made a proposal that would cost around 4,000 kronor, which was approved by the City Council without any discussion.⁶⁶

Whatever the impact of Schoug's and Sterner's proposals, city engineer J. B. Carlson had completed sewerage plans for the Stolplyckan and Gottfridsberg areas during the spring of 1906, when they were to be incorporated into the city plan. As regards sewerage for Tinnerbäcksläckan, connection to interceptor No. 1 was already part of Richert's plan.⁶⁷ The interceptors were

⁶⁴ LiSA, Linköping City Council Archives, supplement EI:27, 1906 §135.

⁶⁵ LiSA, Linköping City Council Archives, AI:44, minutes 1906-09-11 §135, 1908-04-28 §84, 1908-05-26 §102, and 1908-09-29 §165, supplements EI:27, 1906 §135, No. 9 1908, p. 27-34, and No. 12 1908, p. 11-16; Account of the City Council meeting 1908-05-26 §102, ÖC 1908-05-27.

⁶⁶ LiSA, Linköping City Council Archives, minutes 1908-01-28 §21 and 1908-02-25 §33, supplement No. 4 1908, p. 6-11; Account of the City Council meeting 1908-02-25 §33, ÖC 1908-02-26.

⁶⁷ LiSA, Linköping City Council Archives, AI:44, minutes 1906-10-30 §193 and 1906-11-27 §213, supplements EI:24, 1905 §114, and EI:27, 1906 §193 and §213.

under construction from 1903 and 1904 onward, and in late 1906 interceptor No. 2 and parts of No. 1 were finished. The last part of No. 1 was very important as it would collect the sewage from the whole eastern part of the city, that is, the old city center. Here there were now seven different outlets for household wastewater and stormwater, which according to Carlson contaminated the river water. The discharge from Tinnerbäcksläckan also contributed, causing sanitary dangers (see Figure 4.2). Carlson's idea was to build the rest of interceptor No. 1 over a number of years, until 1910, so as to spread the financial burden and have access to the same crew of workers.⁶⁸

However, the Financial Department thought that the 300,000 kronor that had already been spent from 1903 to 1906 was enough, and wanted to postpone this last part of the work. It was really only intercepting sewer No. 2 that was advantageous for people in the city, because it hindered wastewater, and thereby sanitary nuisances, from running down the slope into the city center. No. 1 stopped the river from being contaminated, but this was less important, at least for those who prioritized the city's economic interests. But in late 1907, the Financial Department changed its mind, for reasons not entirely apparent. The department was still hesitant about the enormous expenses that would burden the city for several years, but it had also come to its knowledge that the railroad was to be extended, which would make the sewer even more expensive if postponed. There had presumably been a shift of power within the department as well. The city engineer's modified version of Richert's original plan for interceptor No. 1 was thus approved in 1908 (see Figure 4.2).⁶⁹

⁶⁸ LiSA, Linköping City Council Archives, minutes 1908-01-03 §4, supplement No. 11 1908, p. 36.

⁶⁹ LiSA, Linköping City Council Archives, minutes 1908-06-12 §154, supplement No. 11 1908, p. 33-35; Account of the City Council meeting 1908-06-12 §154, ÖC 1908-06-13.

Figure 4.2. The Linköping sewerage of 1914, including the newly-built interceptors one and two.



Source: Schmid and Hallström 2001.

Once again Carlson made a successful translation, and confirmed his central position for the whole project of the intercepting sewers. By enlisting his superior knowledge of the local conditions of Linköping and the technical practicalities of the city's sewer system as power resources, he convinced the city authorities and even Richert himself that his altered direction of the sewer was the best. The Financial Department decided to favor Carlson's plan without even consulting Richert. This improvement made the sewer cheaper and was better adjusted to the new city plan, and it also made the sewerage in Tinnerbäckslucky as good as Richert had originally intended it to be.⁷⁰

We must not underestimate Richert's role, however. As Carlson said, every plan needed adjustment at the local level, and this was also easier for Carlson than to design the sewer plan himself from scratch. Grand water and sewer designs were Richert's strength, and he constructed numerous water and sewer systems in Swedish cities and even internationally around the turn of the

⁷⁰ LiSA, Linköping City Council Archives, minutes 1908-06-12 §154, supplement No. 11 1908, p. 33-42.

century 1900. Together with, for example, F. V. Hansen, Richert was a very central figure for a national actor-network of civil and water engineers involved in large public works in Swedish cities at the time.

Conclusion

Within the planned city area of Linköping the water supply was only extended in certain streets. Conflicts over these extensions were few, mostly because the Water Company handled them and was responsible for financing and building. The sewers required quite substantial expansion, on the other hand. Generally there seemed to be a consensus on trying to keep the municipal expenditure low and favor less expensive sewer solutions.

To begin with the city was markedly reluctant to help its suburbs, particularly Ladugårdsbacke that was outside the city's jurisdiction. There was an actor-network that was protective of the economic interests of the city, personified by Fredrik Carlsson of the Drafting Committee. An actor-network that promoted public health and humanitarian interests existed as well, but it was more easily distinguishable, more powerful, and more durable than the one in Norrköping. The city physician Oscar Segerdahl was the "spider in the web." Thanks to this actor-network there were some sanitary improvements through the extension of water and wastewater pipes, notably in the suburbs. The Water Company was also a central actor, and its interests primarily lay in the success of its business and in satisfying the shareholders, of whom the city was one of the most important.

The situation in Linköping was complicated by the existence of the Water Company, whose economic interests sometimes helped the public health network in achieving its goals. The company wanted to extend water wherever it was profitable, but in the case of Ladugårdsbacke in 1881 neither this nor the power of the influential Linköping brewer L. T. Brogren helped. At this point in time the public health actor-network had not yet formed, and the bottom line of the talk about sanitation in Ladugårdsbacke was the city border and economy rather than public health. Contrary to Norrköping, Linköping after 1900 saw an incorporation as good business, but still neglected this suburb.

In 1887, the Board of Health and two of its members, Segerdahl and Stånggren, promoted the extension of water supply and sewerage to Stolplyckan. Presumably both the threat of an epidemic from Stolplyckan via the creek Kåringbäcken, and the possibility of financial profit through the company, prompted the majority of City Council members to approve of the extension of sewerage, which was to be on the condition that the inhabitants arranged

for piped water themselves, that is, through the Water Company. This was the idea of two shareholders, Stånggren and Axel Lindeberg. The interests of the public health network and the company consequently fused to prevail over the Drafting Committee actor-network, but it was a close shave.

The large sewerage plan for Linköping and its suburbs came to involve a minor conflict between Johan Gustaf Richert and the city engineer of Linköping, J. B. Carlson. Carlson enlisted his superior knowledge of the local conditions of Linköping, but Richert eventually accepted this. Richert was one of the foremost constructors of sewerage in Sweden at the time, and at the local level the city engineer could help him implement it in the best way. Without a doubt, the major water and sewer extensions in Linköping after the 1870s were to the suburbs within the city's jurisdiction. This is also obvious in Richert's sewerage plan, which covered both the city itself and the suburbs.

In the early 1900s, the new city physician Carl Schoug focused on sanitation in the suburbs, and again enlisted Kåringbäcken and epidemics for arguing his case. Anders Sterner approached this problem from different angles, namely the ideological and juridical. Despite the flowering of suburban owner-occupied housing on the Continent, in Sweden such suburbs were still the "stepchildren of urban society." And the drainage situation in the Linköping suburbs, Sterner feared, would soon result in them becoming a "cancer" (cf., Norrköping: "growth"). The city engineer Carlson, who was directly hostile to the suburbs, was more or less forced to alleviate these problems through the intercepting sewers, since Richert had designed them also for the suburbs, although it took several years before they were finished. Richert and Carlson also helped improve sanitation in Stolplyckan and Gottfridsberg through the improved fire protection – new water mains and fire hydrants.

PART III

Function

In the preceding chapters it became quite clear that the sewerage of Norrköping and Linköping were originally intended as drainage systems, that is, mainly for the drainage of marshy areas and stormwater as well as disposal of certain kinds of floating filth. In reality both cities very early allowed cesspits to be connected to the sewers, which meant that even excreta and probably manure and solid waste were discharged there. Official statistics for Sweden show that Norrköping, Stockholm, and Linköping had the most water closets in the whole country in the late 1880s (250¹, 100, and 10 respectively), and that Norrköping in 1910 had the very highest percentage of yards with water closets (49%).² Apparently, there was a discrepancy between the image of the sewerage and what it actually was used for, especially in the beginning of the period.

The Question of Cleaning up the Cities – the European Context

The fact that the sewerage in Norrköping and Linköping in the 1860s and 1870s were primarily seen as drainage systems was quite unusual from a British viewpoint, for there water closets had been in use for decades. In Germany, on the other hand, the water-carriage technology was long in coming and sewer systems were built only in the very biggest cities at this time. This meant that the disposal of fecal matter through underground pipes was still unusual in the late 19th century. Cesspits and other dry toilet alternatives were frequently used.³

¹ Most of these were not real water closets, however, since the feces were collected in a bucket and only the urine was discharged through the sewer system (NSA, Norrköping City Council Archives, supplement No. 28 1893).

² "Helsovårdsnämnderna", *Bidrag till Sveriges officiella statistik. K/ Helso- och sjukvården I. Medicinalstyrelsens årsberättelse för 1887*, Stockholm 1889, p. 2. (These statistics are somewhat uncertain, since all cities with water supply and sewerage were not included.) Fröman 1912 p. 201.

³ Evans 1987 p. 131-138; Lange and Otterpohl 1997 p. 13-14; Richert 1869 p. 62. Hamburg was one of the few cities in the German principalities that had built water and sewer systems in the 1850s. The building of waterworks on a large scale began in the 1860s and 1870s and many of

As early as the mid-19th century there was a debate in countries such as Great Britain, France, Germany, and the Netherlands about the use of sewerage with water closets *or* various forms of receptacles or pits for collection of the excreta. Due to the low topography in the Netherlands, the Dutch engineer Charles T. Liernur constructed a pneumatic technological system for removing excreta from houses, which was also discussed and even implemented in a few Dutch and German cities. The proponents of water closets and water-carriage technology emphasized odorless and swift removal, both from the point of view of sanitation and transportation, whereas the opponents were of the view that water closets contaminated the water and wasted the nutrients in the sewage. The dry alternative solved both these problems.⁴

The value of sewage⁵ for agriculture was one of the central aspects of this discussion. In the mid-19th century the increasing waste of large cities together with higher costs for the fertilizer guano⁶ prompted farmers to promote the use of sewage as fertilizer in agriculture. The scientific basis for this had been provided by the German chemist Justus von Liebig. Edwin Chadwick and other British sanitarians, inspired by the alleged success in Edinburgh, saw a potential way of paying for urban sanitary and infrastructural improvements, while at the same time promoting national food production. Particularly in Great Britain but also on the Continent, such different engineers and social visionaries as J. Bailey Denton, Frederick Charles Krepp, Jules Verne, and Pjotr Kropotkin in various ways came to regard the application of sewage to arable land as the road to national prosperity, health, and equality.⁷ Victor

the larger cities were not sewered until the 1880s and 1890s, for example, the capital Berlin. Most cities with a population below 25,000 inhabitants were not that fortunate, however, and in these cities introduction of water and sewerage services took even longer (Evans 1987 p. 133-138; Hietala 1987 p. 192-203; von Rothstein 1852).

⁴ Heyman 1877 p. 104-105; Wetterberg and Axelsson 1995 p. 55, 72-75. To the Dutch engineer F. C. Krepp, Liernur's pneumatic sewerage would almost be salvation itself for the cities and nations that introduced it, resulting in "moral, social, and national progress" and "improved public morality, consequent upon increased cleanliness among the masses of the people" (Krepp 1867 p. 178).

⁵ In theory sewage was thought to contain mainly human excreta in this discussion, although animal dung, kitchen refuse, and street sweepings often were included, depending on the city's sewerage and local conditions. Generally, British cities used water closets early on, whereas for example Paris converted to *tout-à-l'égout* only around 1900. A lot of human sewage was travelling in the Paris sewers even before that, however (Hugo 1987 (1862) p. 1256-1260; Reid 1991 p. 80-82).

⁶ Guano was dry bird droppings collected off the coast of Peru in South America (Márald 2002 p. 76).

⁷ Goddard 1996 p. 274-277, 285-287; Hamlin 1985 p. 381-386; Reid 1991 p. 65-70. Cf. Denton 1877 p. 248-249. Krepp did not primarily favor the water-carriage technology. Yet one of the main results of urban sanitation was in his view the production of sewage for farmland application (Krepp 1867 p. 1-4, 201-202).

Hugo, one of the most well-known popular debaters, wrote in a famous passage in *Les Misérables*:

This garbage heaped up beside the stone blocks, the tumbrils of mire jolting through the streets at night, the awful scavengers' carts, the fetid streams of subterranean slime that the pavement hides from you, do you know what all this is? It is the flowering meadow, it is the green grass, it is marjoram and thyme and sage, it is game, it is cattle, it is the satisfied lowing of huge oxen in the evening, it is perfumed hay, it is golden wheat, it is bread on your table, it is warm blood in your veins, it is health, it is joy, it is life.⁸

In the latter half of the 19th century, sewage application to farmland was carried out in Great Britain in, for instance, Warwick, Rugby, and Edinburgh, and on the Continent in Paris and Berlin. The great hopes that were initially placed on this way of recycling the nutrients of sewage eventually failed in many cases. There were technical and management difficulties in getting the farms to work, which often resulted in the spread of offensive odors to nearby areas. The farms were often not financially sustainable either. There was also uncertainty among some people as to whether crops grown on sewage-irrigated land were really healthy. Toward the end of the 19th century the main focus more and more became the effective, inexpensive, and hygienic disposal of sewage, which led to the downfall of, especially, the British farms, although the one in Paris continued operating.⁹

The Constructor's Intentions

It is clear from J. G. Richert's sewerage proposals for Linköping and Norrköping that his main concern was damp conditions and to remove all kinds of water from the city. To him damp and foul, stagnant water were the roots of all sanitary evil, especially when they were mixed with different organic material. By this he meant street waste and maybe waste from butcheries and tanneries rather than excreta, which supposedly was to be collected manually. Indeed, Richert was critical of the discharge of excreta from cesspools and WC's through the sewer system, especially since solid waste often was disposed of as well and blocked up the pipes, as in England. He wrote in 1869 that "water closets . . . probably will not be commonly used in our country."¹⁰

⁸ Hugo 1987 (1862) p. 1257.

⁹ Goddard 1996 p. 281-287; Hamlin 1988 p. 67-68; Reid 1991 p. 53-68.

¹⁰ LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-01 §101; NSA, Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6; Richert 1869 p. 62 (quote).

Richert either had mixed feelings about water closets or, more likely, he had recently changed his opinion about them, for in his 1866 proposal for sewerage in Göteborg he wrote:

The only fully rational system for the drainage and sanitation in Göteborg would therefore be to remove excreta and other floating filth by means of plenty of water in underground sewers, which would end in a common reservoir . . . from which the water would be pumped and purified before being discharged in the river.¹¹

This was the Chadwickian vision of an “arterial-venous” waste disposal system for a city, with a constant water supply, water closets, separate sewers, and sewage irrigation fields at the outskirts of the city for purification. However, Richert found it difficult to apply in practice.¹²

When his book was published in 1869, and also after that in the construction of sewerage for Norrköping and Linköping, he had evidently changed his view of how effective wastewater management was to be carried out. He now proposed combined sewerage with self-cleansing glazed earthenware pipes. It was the kind of design that had come out of the so-called “pipe-and-brick sewers war” in England. His own experience was that the large brick sewers were better, since it was possible to maintain them manually, but they were too expensive, and should be used, he thought, only in exceptional cases. In a sense, therefore, Richert sided with Chadwick and the General Board of Health in that he promoted a full system with (almost) only glazed earthenware pipes. However, relying on his own experience and that of engineers such as Thomas Hawksley, he used larger and better pipes than those Chadwick had suggested, although they were still not considered large enough for water closets to be used.¹³ The reasons for Richert’s choice were mainly economic. If Swedish cities were to choose brick sewers, he argued, there would be a delay in the improvement of sanitary conditions, but with the earthenware pipes this goal could be achieved soon and for comparatively little money.¹⁴

¹¹ Bjur 1988 p. 72.

¹² Binnie 1981 p. 12; Bjur 1988 p. 72; Hamlin 1992 p. 683, 695-696.

¹³ Even when Richert investigated into new latrines for the Sahlgrenska hospital in Göteborg in the mid-1860s he preferred manual collection of excreta to water closets, since the excreta in the latter case were to be flushed straight into the moat and contaminate the water (Wetterberg and Axelsson 1995 p. 55-60).

¹⁴ Hamlin 1992 p. 690-709; Richert 1869 p. 53-75; LiSA, Linköping City Council Archives, AI:12, minutes 1874-10-01 §101; NSA, Norrköping City Council Archives, AI a:10, minutes 1872-05-30 §6.

Main Question and More Questions

In part III the intended and actual use of the sewers will be dealt with, partly because it says something about the interests behind the introduction of the sewerage. The disposal of excreta and other waste in the sewers – first through the cesspits and later the water closets – mirror the different medical trends in Sweden and Europe during the period. The sewered cesspits were almost unanimously rejected by medical expertise, while water closets were instead promoted by physicians, engineers, and other advocates of public health and sanitary improvements. They saw water closets as the best way to solve the question of keeping the city clean (*renhållningsfrågan*). Thereby they also augmented the general notion of sewerage as a sanitary system.¹⁵

In both cities, the medical profession and health authorities thought that the *renhållningsfråga* could only be addressed relevantly if the defective management of excreta and other solid waste was solved. The introduction of water and wastewater systems had been the first and rather unproblematic step in this direction, solving the excreta collection was the next, more difficult step. Sewerage was central to the discussion and practice of excreta management throughout the period of investigation, and changing ways of collecting excreta resulted in a functional development of the sewer system, for example, from merely drainage to sewered cesspits to water closets. This also affected the water system, since water increasingly came to be used to flush sewers and water closets.

The main question for part III is thus: Why and how was the function of sewerage and water extended and used for excreta collection and the solution of the question of keeping the city clean, *renhållningsfrågan*? Further questions are: What was the view of the different actors in Norrköping and Linköping of the *renhållningsfråga*, with special regard to the water and sewer systems, and excreta collection (put in a Swedish and European context)? What was the sewerage used for, and what interests lay behind such uses? What actor-network(s) had the upper hand, for instance, regarding economic alternatives, different technological solutions, and how contamination of soil, air, and water was to be defined?

Actors and Interests

On a general level, the actors in Part III are largely the same as in the two previous ones, although the actor-networks of which they were a part differed. The conflict-ridden *renhållningsfråga* was one that demanded strong actor-

¹⁵ Hallström 2000; Lundgren 1992.

networks, and medical expertise in particular was enlisted to enforce various solutions. Of great importance was the introduction of the first Swedish Public Health Act of 1874, which decreed that a Board of Health be established in each city. It was to be made up of seven members: the police commissioner, a member elected by the Council of Magistrates, the city physician, and four members elected by the City Council.¹⁶

¹⁶ *Kongl. Maj:ts nådiga helsowårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68, §1.

CHAPTER 5

The Healthiest City in Europe? The Question of Keeping Norrköping Clean

It is probably not unknown to anyone that the efforts of our time to achieve reduced morbidity and mortality mainly concern the removal of the causes of disease. The measures that have been taken here in the city in this regard through the introduction of water supply and sewerage have displayed the most auspicious results in this respect. Moreover, if the collection of excreta was arranged in a modern way, our community would undoubtedly, with its fortunate location on a waterway large and rich with water, become maybe the healthiest city in Europe; and towards this goal we ought to strive.¹

Local and National Health Legislation

In the 1860s, Norrköping had no public health law or sanitary regulations (*renhållningsstadga*). In 1868 new general regulations (*ordningsstadga*) were passed for the cities of Sweden, which replaced earlier local regulations. These regulations and the National Public Health Act of 1874 (*hålsovårdsstadga*) came to regulate sanitation and public health in the city throughout the period, in an interaction between the central regulations and local laws, for local interpretations of the central decrees were permitted within certain limits.² The Public Health Act was broad in scope and encompassed many different aspects of public health, but there was an emphasis on environment and sanitary conditions, for example, water supply, drainage, and excreta management. The committee behind the Act had a miasmatic view of disease,

¹ NSA, Norrköping City Council Archives, supplement No. 34 1886. Some of the research on which this chapter is based has also provided material for Hallström 2000 and Drangert and Hallström 2002.

² NSA, Norrköping City Council Archives, AI a:12, minutes 1874-08-06 §9; Norrköping Board of Health Archives, AI a:1, minutes 1875-01-15; *Kongl. Maj:ts nådiga helseovårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68, §24. The first Norrköping Board of Health was made up of the following members: Elis Grenander (mayor), Wilhelm Sebarot (judge), C. W. Engelbrecht (city physician), W. Moberg (physician, Doctor of Medicine), P. U. Boëthius (woolen industrialist), P. F. Garström (brewer), and G. C. Nyström (brewer).

and they used Chadwick and the British Public Health Act of 1848 as a model for the Swedish one.³

The central general regulations were transformed into local statutes for Norrköping, but many of these had probably long been in use. The regulations concerned public street cleaning as well as the private cleansing of the pavement outside the house, removal of the contents of the cesspits, which was to be done after dark and with closed receptacles, as well as the prohibition of discharging poisonous or foul-smelling water in the gutter.⁴ Street cleaning in Norrköping had been carried out by the city's poor since mid-century, and they continued to do this, even though this work was debated. They were said to be a slow, but cheap, workforce.⁵

Animal droppings and, above all, human excreta were said to cause soil, air and water contamination, as well as corresponding health problems, in the crowded industrial city. Through different announcements about the decrees of the Public Health Act and through supervision by the police, the Board of Health monitored the cleaning and emptying of cesspits and pigsties, in order to "prevent the emergence and diffusion of bad smells." When the solution of the poor sanitary conditions demanded engineering knowledge or had to do with the water and sewer systems, the city engineer Hellström was called upon.⁶

Cemented Cesspits for the Storage of Excreta

At the same time as there was great faith in the new piped water and sewerage, the problems of the existing latrines were also put into focus, as the introductory quote shows. Traditional excreta management utilized a pit in the ground, in which not only human excreta but also animal manure, kitchen refuse, and other solid waste were collected. In theory this so-called cesspit should be emptied when it was full, but in reality overflowing pits were a big problem in Swedish cities in the mid- and late-19th century. The bottom and walls of the pits were paved or boarded at best, but the liquid content easily permeated through the soil and could contaminate the groundwater. On top

³ *Kongl. Maj:ts nådiga helsowårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68; Nelson and Rogers 1994 p. 21-26; Hamlin 1990 p. 106.

⁴ NSA, Norrköping City Council Archives, minutes 1882-06-01 §10, supplement No. 18 1882.

⁵ NSA, Norrköping City Council Archives, AI a:12, minutes 1874-08-06 §7.

⁶ NSA, Norrköping Board of Health Archives, AI a:1 and AI a:2, minutes 1875-07-23 §1, 1884-05-13 §33, and 1884-06-10 §41; Supplement to the Public Health Act, "Råd och anvisningar" in Kullberg 1877 p. 501. The supplement was a kind of instruction of how to interpret the Public Health Act, issued by the National Board of Health in 1875.

of the pit an outhouse was built, which was often part of a larger building that might even contain a stable, a woodshed, or a store room.⁷

The building owners were responsible for emptying the cesspit in their yards, and if they were farmers they utilized the content of the pit as fertilizer on their own fields in or outside the city. If they were not farmers themselves, gardeners and farmers in or in close proximity to the city were hired to collect the waste (*budning*), which was then used as manure in garden patches, tobacco fields, or other arable land.⁸ Since the building owners also were the ones who should clean the part of the street adjacent to their buildings, sometimes even the predominant street waste – horse droppings – was taken care of as a fertilizer.⁹

The comparatively small Swedish cities did not face imbalance between city and country as regards the recirculation of nutrients, in the way large cities did in producing much more dung than what the hinterland could make use of.¹⁰ In Norrköping the supply of and demand for dung fluctuated with season. During the harvest or the winter (with a lot of snow) the farmers could be prevented from or uninterested in collecting human excreta and animal manure, but during sowing time manure was all the more necessary. The city's production could also vary over the year, as well as over the years as the city grew. However, Norrköping does not seem to have suffered from the said imbalance in the last half of the 19th century. Depending on supply and demand either the building owner or the farmer paid for the collection of the dung.¹¹ The traditional excreta management in Norrköping was thus both a

⁷ Horgby 1989 p. 239; NSA, Norrköping Board of Health Archives, AI a:1, minutes 1880-04-13 §3; Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till Kommitterades Förslag för ordnande af Renhållningen i Norrköping. I. Öfversigt. Motiv. Kostnadsberäkningar.", p. 1; Städernas allmänna brandstodsbolag, Norrköpings brandstodskommitté, Brandförsäkringsbrev, 43025, 1876-11-07, vol. 17; Tell 1972 p. 13. These conditions were not restricted to Norrköping only, but were similar in most Swedish and Scandinavian cities at the time. Cf. Chapter Six, and, for example, Wetterberg and Axelsson 1995 p. 55-64 and Nygård 2000 p. 40-78.

⁸ NSA, Norrköping City Council Archives, supplements No. 28 1893 and No. 48 1898, "Bilagor till . . . I", p. 1; Tell 1972 p. 17; Hertzman 1866 p. 139, 172-173. *Budning* was the act of hiring a farmer to collect one's waste *when the cesspit was full*, that is, the property owner took the initiative, in contrast to all forms of centralized, regular collection (see Chapter Six).

⁹ Hallström 1999 p. 17; Tell 1972 p. 12; NSA, Norrköping City Council Archives, A IV ö:3, "Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920", report 1915, p. 17.

¹⁰ Mårald 2000 p. 162; Wetterberg and Axelsson 1995 p. 20.

¹¹ NSA, Norrköping City Council Archives, supplements No. 28 1893 and No. 48 1898, "Bilagor till . . . I", p. 1-3; Norrköping Board of Health Archives, AI a:2, minutes 1885-06-09 §59; Wetterberg and Axelsson 1995 p. 20.

way of keeping the growing, insanitary industrial city clean and of attending to the needs and interests of agriculture, the rural as well as the urban.¹²

In the National Public Health Act of 1874 the importance of a swift removal of dirt and filth such as excreta from the city was very clearly emphasized. To the extent that the question of neutralizing the waste was taken up, deposition seems to have been preferred to reuse. Despite a rather negative attitude to pig breeding there was no question of completely forbidding it, maybe because of the positive effect it had in reducing kitchen refuse. In Norrköping, however, many of the city fathers wanted to have the pigs completely abolished within the town, and it was in connection with such discussions that excreta management was also taken up during the 1870s. Cesspits were prohibited in the law and the excreta were instead to be collected in tight movable receptacles¹³ above ground, so as to avoid leakage of floating filth and unhealthy odors.¹⁴

The Norrköping Board of Health was of the opinion that these receptacles spread decidedly more offensive smells than carefully lined cesspits. At the end of the 1870s, the board permitted a model of cesspit, which was not approved by the Public Health Act. "Completely tight" paved cesspits, lined with cement, could be connected to the municipal sewer system via a cesspool.¹⁵ It was then also assumed that the decreased depth of the new cesspits would lead to an increasing need for emptying them. So it was decided that the public refuse dump by *Ståthögavägen*, which was used by the entrepreneur C. R. Holmberg for the waste from public places in the city, could now be used by the house owners.¹⁶ This possibility did not change the habit of using excreta in agriculture, and did not lead to any more frequent collection.

¹² Mårald 2000 p. 149-172.

¹³ The Swedish term is *kärl*, which could also be translated into the English words bucket or container.

¹⁴ See, for instance, §§9, 17-21 in *Kongl. Maj:ts nådiga Helsowårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68 and Supplement to the Public Health Act, "Råd och anvisningar" in Kullberg 1877 p. 485, 499-501; NT 1874-08-28.

¹⁵ NSA, Norrköping City Council Archives, supplement No. 11 1885; Norrköping Board of Health Archives, AI a:1 and AI a:2, minutes 1879-04-08 §3 and 1885-04-14 §33. The Norrköping model, which was really only a modified version of an ordinary pit, was motivated also from the perspective of agriculture. The excrements were considered the valuable part of the excreta – both for the content of nutrients and the easy transport and application to arable land – and the liquid waste (urine and wastewater) was therefore rightly disposed of through the sewers (J. G. Swartz in NT, 1885-05-05). However, these paved, sewer pits were not only a local construction, but could also be found in other Swedish cities, for instance, in Linköping, where they were approved of to begin with, and in Göteborg, where they were considered illegal. Abroad, in Leipzig, they were approved, although most German cesspits seem not to have had a connection to the sewer (Wetterberg and Axelsson 1995 p. 60-61). Cf., Chapter Six.

¹⁶ NSA, Norrköping Board of Health Archives, AI a:1, minutes 1878-09-10 §2, 1879-04-08 §3, 1879-04-16 §§3 and 4, 1879-05-13 §3, and 1879-06-17 §3.

The Early History of Water Closets in Norrköping

Water closets had existed in Norrköping for years, but when studying their introduction it is important not to presume that they were installed only when the centralized piped water and sewer systems were built in the 1870s.¹⁷ The ones that were connected to the municipal sewerage were not the first. The first water closets were supposedly installed in the new Holmens cotton spinning mill in 1856. This mighty industrial building, with its five stories and many modern inventions, was admired by all. Apart from the water closets, there were gas lighting, an elevator, and an internal piped water system for fire protection, which probably was used for the WC's as well.¹⁸

In 1874, water closets were connected to the new sewers, but only via cesspools in the yards. The idea was that excrements sedimented in the cesspool. The sewer mains in the streets ended in the river.¹⁹ Before installing a water closet, the applicant had to be approved by the Waterworks Board, and it charged a water fee of six kronor per year, despite general household consumption being free of charge.²⁰ Yet in the beginning of the 1880s, the water closets consumed more water than had been expected at first, and consequently the water fee was raised to 10 kronor for those who did not have meters. The fear that water closets would consume too much water was obvious in the Waterworks Board, as it was in other Swedish cities at the time, for instance, Göteborg and Stockholm.²¹

Thus, it seems as though there was an implicit consensus on the water closets in Norrköping well into the 1880s, despite the fact that there was some uncertainty whether they were lawful or not, especially among members of the Board of Health. The Public Health Act did not even mention water closets.²² In 1889, there were some 260 water closets in Norrköping, and in 1894 there were about 600, used by around 3,000 people (out of more than 30,000) in 250 yards.²³ Consequently, 10 percent of the inhabitants of Norrköping had access to a water closet in the middle of the 1890s, which was a great deal compared to the rest of the country, where they were still often prohibited.

¹⁷ Ogle 1996 p. 2-3.

¹⁸ Horgby 1989 p. 22-24; Södergren 1998.

¹⁹ NSA, Norrköping City Council Archives, supplement No. 19 1896, report by Henning Nordenström about the contaminating effects of water closets on Motala ström, 1895-08-28.

²⁰ NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1874-12-07 §4; Myrdal 1972 p. 323.

²¹ NSA, Norrköping Waterworks Board Archives, AI:2, minutes 1882-10-18 §4 and 1888-10-18 §4; Gullberg 1998 p. 116; Isgård 1998 p. 35.

²² *Kongl. Maj:ts nådiga Helsowårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68; Lundgren 1974 p. 30.

²³ NSA, Norrköping City Council Archives, supplements No. 28 1893 and No. 19 1896; *Historisk statistik för Sverige. Del 1. Befolkning 1720-1967* 1969 p. 62.

The first to install water closets were members of the bourgeoisie, who wanted these modern conveniences in their homes. Water closets were also installed in public facilities such as the new isolation hospital. In 1877 the Board of Health gave an account of the features of the new hospital to the National Board of Health:

There is in the building a water pipe with a corresponding sewer pipe, available in each and every one of the bigger wards and corridors. On each floor two water closets are installed with outlets in the river. The latter state of things will probably not lead to any nuisance, since the amount of water that flows in the river at the lowest water level is 31,400 liters a second. At the highest level it is at least ten times that much, and the river falls 15.4 meters during its course through the built-up area. Besides, nowadays, water from the river is not used for household consumption in the city, as almost every yard is provided with eminently good water from the city's water system . . .²⁴

The quote indicates that the idea of dilution and self-purification was strong. The board could not have been very anxious about the lawfulness of the water closets either, at least not as long as they stayed under its own scientific control.

The Debate about Excreta Management Initiated

By the early 1880s, it was obvious to the authorities in most Swedish cities that the comprehensive and high ambitions of the Public Health Act had not been achieved. In Norrköping, this kicked off what would become a very long and heated debate. The debate focused on what was generally seen as one of the most important issues of the act, the storage and collection of human excreta, animal manure, and other solid waste, a very central component of the question of keeping the city clean (*renhållningsfrågan*). This was discussed in the Board of Health, the City Council, and the local newspaper, and many prominent factory owners, merchants, and physicians as well as several house owners participated.

In line with this, the city physician C. W. Engelbrecht was not satisfied with the unsalaried superintendents of the city's public health districts, who had been engaged since 1875. In his view, they "did not work for the removal of the causes of disease, which are considered the result of lack of cleanliness and tidiness in the yards of the city, with the interest or care required . . .". He recommended a "health policeman," who would be employed by the Board of

²⁴ NSA, Norrköping Board of Health Archives, AI a:1, minutes 1877-06-12 §2. In the original Swedish quote the flow was 1,200 cubic feet a second and the height of fall 52 feet.

Health. Mauritz Hök, former superintendent for the municipal street cleaning, was hired.²⁵ Hök's reports show horrible living conditions in certain yards, for example, where there were a butchery and a pigsty in the same cramped yard, which had caused the soil to be permeated by foul-smelling liquids, or where rooms were let next to a cesspit.²⁶

In the summer of 1883 there were cholera outbreaks in Africa and in ports in southern Europe, and early the next year there was fear of another outbreak in the Mediterranean. Due to earlier epidemics in the city (particularly the one in 1866), and the fact that Norrköping was a seaport with trade relations with these areas, there was widespread anxiety about cholera in early 1884. Johan Gustaf Swartz wrote a letter to the Board of Health on account of the threat of cholera in late April, and complained about the stinking and therefore unhealthy cesspits in Norrköping, "where otherwise relatively propitious sanitary conditions ought to prevail due to the water supply and sewerage." The problem was not the cesspits themselves but the extremely infrequent collection and consequent putrefaction of their contents, which also made the city unbearable to live in during the hot summer months due to the strong odors.²⁷

Apparently, J. G. Swartz was a person to whom one listened, because the board did exactly as they were asked to do. It commissioned the city police to see to it that the cesspits were emptied and cleaned at least once a month. The board also took other precautions. The city engineer B. L. Hellström was to have the street drains cleaned regularly, especially during the summer. Most importantly, the city physician C. W. Engelbrecht suggested that the board appoint a committee to investigate possible ways of improving both excreta collection in the yards and the public cleansing of streets and squares. The board agreed and appointed the committee, in which Engelbrecht himself, as well as the physician H. van Unge and factory owner P. U. Boëthius became members.²⁸

At the same time the local newspaper *Norrköpings Tidningar* ran a series of anonymous articles about the sanitary conditions in the city. The author was a physician from Norrköping, unknown to us, but to many readers it must have been fairly easy to find out his identity. After all, the number of physicians in the city was limited, and he had a thorough knowledge of the

²⁵ NSA, Norrköping Board of Health Archives, AI a:1, minutes 1882-05-09 §2 (including quote), 1882-06-13 §3, 1882-09-05 §2, 1882-09-12 §2 and 1882-09-30 §1.

²⁶ NSA, Norrköping Board of Health Archives, AI a:1 and AI a:2, minutes 1883-04-10 §2, 1883-06-12 §3 and 1884-08-14 §59.

²⁷ NSA, Norrköping Board of Health Archives, AI a:1 and AI a:2, minutes 1883-07-10 §3 and 1884-05-13 §32.

²⁸ NSA, Norrköping Board of Health Archives, AI a:2, 1884-05-13 §§32 and 36, 1884-06-10 §40, and 1884-07-08 §49.

subject and seemed to know much about the issues that the Board of Health was dealing with.²⁹ The author was well aware of the current sanitary investigation by the Board of Health, and he saw as his mission as publicly paving the way:

No wonder that the general public lacks a clear notion of the necessity of sanitary reform when its conception of such questions most often is dim and undeveloped. It is therefore the duty of the expert to shed light and clarity on such questions as well as to open up and level the road to conviction.³⁰

Even for him the threat of cholera was the starting point, and knowing that he would have to criticize the public health work in the city a great deal he began by absolving the Board of Health and the city authorities. They had done all they could, and it was perhaps only the police that could have been more strict in their supervision of the implementation of the Public Health Act. It was instead the national authorities that were to be blamed for what he considered the almost complete failure of the public health reform, at least as regards the collection of excreta. It was natural for local authorities to try and escape new financial burdens, and therefore clear instructions and active control of central inspectors were essential to enforce the law. These were surely the physician's views, but they were very likely also meant to avoid offending any of his local colleagues, for in the other articles he yet criticized the local implementation.³¹

According to the physician, it was primarily the quality of the water and the air that determined the sanitary conditions. The first issue had been solved with the building of the water supply, which was shown by a substantially lowered mortality and morbidity (primarily typhoid fevers). This was a common conclusion at the time. Engelbrecht assumed that the decreased mortality rates in Norrköping from 1874 onward were a result of the construction of piped water and sewerage (see Table 5.1).³²

²⁹ The articles were published in *NT*, 1884-07-26, 1884-07-29, 1884-07-30, 1884-07-31, 1884-08-02, and 1884-08-08.

³⁰ *NT*, 1884-07-30.

³¹ *NT*, 1884-07-26.

³² *NT*, 1884-07-29; NSA, Norrköping Board of Health Archives, AI a:1, minutes 1883-02-13 §15.

Table 5.1. Mortality in Norrköping from 1867 to 1882, measured in per thousand, per year.

Mortality in ‰ per year	
1867	25,3
1868	27,5
1869	27,3
1870	22,4
1871	24,3
1872	25,1
1873	29,3
1874	24,9
1875	23,0
1876	22,0
1877	21,8
1878	19,2
1879	20,5
1880	21,7
1881	17,2
1882	19,0

Source: NSA, Norrköping Board of Health Archives, AI a:1, minutes 1883-02-13 §15.

The quality of the air was determined by the character of the soil, according to the anonymous physician. He continued by listing the different kinds of latrines that there were in Norrköping, and concluded that the essence of the Public Health Act regarding the latrines – to stop filth from penetrating the soil – had almost completely failed. The wooden boxes above ground were not tight and placed directly on the ground or on some porous foundation, and the cesspits were all too often leaky. Furthermore, the fact that the latter were connected to the sewer system made them even more unstatutory. He guessed that the board had seen the large water quantity and water flow in the river as a guarantee that there would be no contamination. But, he argued, “since the state has decreed that there is to be no draining of the cesspits, this has been done to protect the waterways, that the water in them must not be poisoned by fecal matter and that the bottom of the waterways should not be contaminated by excremental deposits.”³³

³³ NT, 1884-07-30 (including quote). The physician added that he had his own opinion about the sewered cesspits, although he had no evidence with which to support it. His view was that excrement was so gluey that it soon stopped up the outlet to the sewer pipe, and thereby there

At least as important was the question of collection, and here he thought that Norrköping was on a particularly primitive level. He shared J. G. Swartz's view, that is, that the latrines were emptied and the contents collected all too seldom, in most cases only when they were overflowing. The result was "a real plague boil for the yard within which it is situated, and it forms together with the latrines of the surrounding yards a coherent network of poisonous hotbeds of disease." Few people mixed the excreta with solid waste, dry earth or something else to make it smell less. The author thought that this practice would go on forever unless the city intervened forcibly, for the building owners would always see sanitary improvements in the yards as costly, unnecessary, and unpleasant.³⁴

Water closets were definitely the most appropriate solution for Norrköping, according to the writer. Both soil and air were protected from contamination, and very little organization was necessary. Since there already was an existing sewer system the costs involved were not great and Norrköping was also situated on a watercourse with a great waterflow. Apparently, fecal matter from WC's was not as dangerous as that from cesspits.³⁵ The quest for pure water had been carried out under much more favorable conditions, for von Leesen and Swartz had sacrificed a lot for the project: "But where is there a Jacob von Leesen, who allows the city the financial means, where is there an Erik Swartz, who places his influence, his time, his capacity at the city's disposal?"³⁶

At the end of 1884, the National Board of Health requested accounts of the sanitary conditions in several Swedish cities, since it was of the opinion that many cities had not complied with the Public Health Act. This failure on the part of the cities was alarming for public health in general, but more particularly due to the spread of cholera in Europe again. The National Board asked for an account of, for example, the access to and quality of water for drinking and cooking, as well as the conditions of sewerage and drainage.³⁷ The Norrköping Board of Health responded by accounting for the good status of water supply, sewerage, excreta collection, and other aspects of public

could be only very little contamination of the waterway from the cesspits. This view was confirmed some years later by Henning Nordenström, although, according to him, it was the mixing with other wastes which caused this gluey effect (*NT*, 1884-07-30; NSA, Norrköping City Council Archives, supplement No. 19 1896).

³⁴ *NT*, 1884-07-31 (including quote).

³⁵ *NT*, 1884-08-02. The last article was devoted to public health reforms that the city could attend to after the most urgent had been solved, that is, excreta management. These were primarily the improvement of housing, but also the improvement of butcheries and tanneries, the question of pig breeding in the city, the control of food and liquor distribution (these were also mentioned in the public health act) (*NT*, 1884-08-08).

³⁶ *NT*, 1884-07-31 (including quote).

³⁷ NSA, Norrköping Board of Health Archives, AI a:2, minutes 1884-10-14 §68.

health in the city.³⁸ The board's faith in the water and wastewater systems was obviously great, and the response also testifies to a solid confidence in the existing system of excreta collection, which the board tried to legitimize.

In early 1885 the newly-appointed mayor and chairman of the Board of Health C. A. R. Lothigius wrote a couple of articles in the local newspaper to inform the public about the present investigation of the board. Despite the Public Health Act having been in force for over ten years not much had been achieved in Norrköping, and according to the mayor the decrees had to be complied with. Lothigius knew very well that the cesspits were forbidden, but maintained that the question of collection was much more important than storage, for if the collection worked well the excreta and other waste did not have to remain long enough in the yards to cause sanitary nuisances. And the reason why the collection had not been carried out often enough was the great dependence upon the farmers. Therefore the investigation had been launched to achieve cooperation between the building owners and the city concerning the rapid and inexpensive collection of excreta and other waste. Lothigius expressed great hopes about this: "It is certain that just as a number of human lives have been saved through the water supply, at least as many will be spared through well-organized collection of excreta."³⁹

The greatest challenge of the committee was how to cope with the expenses of the collection, which is why it turned to the agronomist Carl Nissen. He drew up a comprehensive proposal for the collection of all kinds of waste in the city, and how it could be used for poudrette production and pig feeding. A joint-stock company, with the building owners and the city as co-investors, was to buy property and farm land outside the actual city, where the waste from the city was to be utilized. To make this work, it was necessary to sort the waste at the source, so that each building owner separated excreta and kitchen refuse in different receptacles. The idea was that the collection would be self-sustaining, and the goal was to collect the excreta every second or third day.⁴⁰

In March 1885 the association of building owners (*fastighetsägarföreningen*) and some others met to discuss this proposal, whose initiation they really ascribed to Lothigius (He had actively promoted it through the articles in the newspaper.) The building owners thought that a poudrette company was unnecessary, as they themselves could see to it that collection was done. They also agreed that the present construction of sewerred cesspits – the filth of which was discharged in Motala ström – was the best for the collection of excreta. Therefore they wanted the Board of Health to have the cesspits

³⁸ NSA, Norrköping Board of Health Archives, AI a:2, minutes 1884-11-11 §73.

³⁹ NT, 1885-02-24 (including quote).

⁴⁰ NT, 1885-02-24 and 1885-02-25; NSA, Norrköping Board of Health Archives, AI a:2, minutes 1885-02-10 §23 and 1885-03-11 §27.

declared legal, so that they did not have to rebuild them again at great expense. The board agreed and started working on making the pits legal by submitting the matter to the City Council and by investigating the quality of the cesspits (an examination in 1885 claimed that out of the 23 selected 22 were in excellent condition).⁴¹

Johan Gustaf Swartz, who had followed the previous discussion and the present intense City Council debate through the newspaper with deep concern, had a long article published in *Norrköpings Tidningar* in early May 1885. Articles were usually found on pages two or three, for page one was for advertisements and public announcements, but Swartz' article covered the whole first page. Presumably he wanted to influence the decision of the City Council in this matter, and he defended the keeping of the cesspits on what he claimed to be scientific grounds. In his view, the cesspits were not unanimously condemned by scientists, but it all depended on how well they were built and maintained, which was confirmed by examples from Germany and Italy. Many of these cesspits had, for example, suction apparatuses but did not have connections to a sewer system.⁴²

⁴¹ NSA, Norrköping Board of Health Archives, AI a:2, minutes 1885-03-11 §29, 1885-04-14 §33, and 1885-06-09 §§53 and 59; Norrköping City Council Archives, minutes 1885-04-16 §9 and 1885-05-28 §9, supplement No. 11 1885.

⁴² NT, 1885-05-05; NSA, The Swartz Family Archives, AI:12, J. G. Swartz' material on the *renhållningsfråga* 1884-1885. Swartz took his examples from his own study tours to, for instance, Stuttgart and Milan, and from the German literature on the subject. According to him cesspits were still prevalent in Stuttgart, Strassbourg, Munich, Dresden, Darmstadt, Metz, Diedenhofem, Heidelberg, and Milan. He also studied different dry alternatives during his study tours, for example, *Torf-mull-streu-closets* by Bischleb & Kleucker, Braunschweig. Cf. Lange and Otterpohl 1997 p. 13-14.



Johan Gustaf Swartz (Source: Myrdal 1972).

Swartz defended the Norrköping construction, but suggested a metal plate in the bottom to prevent leakage and to separate the fluid from the solid, so that the latter could easily be turned into *poudrette*. In the end, the important thing was to collect the content as well as to clean the pits often enough. Swartz supported the idea of smaller associations of building owners to organize this, and would, he said, come back with another article on the subject. As it turned out, however, J. G. Swartz passed away on 1 December 1885.⁴³

The board's letter to the City Council resulted in a heated debate during the spring of 1885. In this debate it is not as easy to reconstruct the dominant actor-networks (or any actor-networks at all), as it was in the different cases of extension in Chapter Three. In extension questions there was a fairly common notion of who belonged to the city community and who was to be excluded from it, although the humanitarian actor-network sometimes prevailed. The debate about excreta collection concerned the city only, and divided the bourgeois elite in Norrköping according to ideas of how the management of excreta was to be carried out that were not always so easily distinguishable.⁴⁴

Apart from C. A. R. Lothigius and Christian Eberstein, none of the City Council members who were for the cesspits enlisted medical expertise, probably because the cesspits were so universally condemned among physi-

⁴³ NT, 1885-05-05; NSA, The Swartz Family Archives, AI:12, J. G. Swartz' material on the *renhållningsfråga* 1884-1885; Dahl 1949 p. 359.

⁴⁴ NSA, Norrköping City Council Archives, minutes 1885-04-16 §9 and 1885-05-28 §9; Account of City Council meetings 1885-04-16 §9 and 1885-05-28 §9, NT 1885-04-17 and 1885-05-29.

cians. However, proponents such as the industrialists Jöran Sääf and Gustaf Wahren, Eberstein, and the engineer Wilhelm Eneström enrolled the decreased morbidity and mortality in Norrköping or a recent positive appraisal of the cesspits. They agreed with the building owners that the cesspits were fine from a sanitary point of view, if only they were managed correctly. The teacher Yngve Nyberg and school inspector Ivar Lyttkens, on the other hand, thought that the cesspits were unsanitary. They did not enroll medical science, which several other opponents did, such as P. U. Boëthius, the engineer Ivar Steffenburg, and the teacher A. Rydhammar. The latter referred to the recent findings in bacteriology, according to which the cesspits were considered unsanitary.⁴⁵

From the building owners' point of view this issue had a lot to do with money, and it is likely that many City Council members owned buildings. There was not one sole, dominant construction used for the storage and collection of excreta in Norrköping at the time, even though one may get this impression from the following the debate. In 1885, the sewered cesspits existed in around 55 percent of the yards, but there were also wooden boxes in about 40 percent of the yards, and in a few even receptacles and water closets. It seems likely that the building owners who participated in the discussion were wealthy enough to have either cesspits or WC's. Otherwise this issue would probably not have aroused so much debate. The teacher Nils Rosengren, who was probably not one of these, remarked that building owners constituted only around four percent of the city's population, and together with Sääf he thought that the Board of Health only acted on behalf of their interests.⁴⁶

Yet there were few who were completely for or against, for most of them were uncertain as to what was really the best way of storing and collecting excreta. John Philipson best exemplifies this, for he simultaneously supported the proposal of the Board of Health and suggested further examination of this question by an expert. The legal aspect was also a stumbling-block, and Sääf disentangled the confusion around the legal status of the cesspits: How could the building owners, who acted on an ordinance from the Board of Health (a municipal authority with legal powers from the state), be regarded as having done something illegal? It seems as though a majority of council members – proponents and opponents alike, represented by, for example, Lothigius, Philipson, Fredrik Blombergh, Nyberg, Steffenburg, Eneström, and Rosengren – saw the legal and scientific ambiguities embedded in the cesspits and the Public Health Act, and quite simply wanted the Swedish Government and the

⁴⁵ NT 1885-04-17 and 1885-05-29.

⁴⁶ NT 1885-04-17 and 1885-05-29. NSA, Norrköping City Council Archives, supplements No. 11 1885 and No. 36 1886.

National Board of Health to decide once and for all if the cesspits could live up to the legal and scientific requirements of the day.⁴⁷

The Board of Health required more frequent collection for the summer of 1885. Instead of once a month, collection was made once a week. This resulted in complaints both to the County Governor and as letters to the editor of the newspaper from several house owners, some of which thought that even once a month was too often. Their principal argument was that it was difficult to get farmers to collect excreta during the summer, thus causing the expense of hiring transportation, which would eventually be passed on to their tenants. The board was bewildered, for at the meeting of the building owners in March they had given an assurance that collection could be carried out without any centralizing initiatives. The board thus yielded to these house owners, and reverted to collection once a month, which the County Governor also approved.⁴⁸

There was an initiative to start a poudrette factory in the mid-1860s, and it was in operation in the 1880s at *Dragsgärdet*. It is doubtful that it worked very well, it supposedly spread a repugnant smell, but its activity was not very substantial. In July 1885 another proposal for a poudrette factory was made by Carl Nordström, and it was to be placed at *Butängen*. This was probably thought to be lucrative business, at least by some people, as there were two subsequent proposals in the same year. Although Nissen's idea of a poudrette company had been rejected by the building owners, the Board of Health continued to investigate into possible poudrette manufacturing through Nordström's alternative. It is likely that Nordström's plan was realized and was in operation for some time, but its activity was small and the effect on the excreta collection of the city was very little.⁴⁹

The 1885 Inspection of the National Board of Health

In the summer of 1885, the National Board of Health sent its inspector Klas Linroth to investigate into the public health conditions in Norrköping. After the inquiry the year before, which had shown that the Public Health Act had not been implemented well enough in Swedish cities, the National Board now

⁴⁷ NT 1885-04-17 and 1885-05-29.

⁴⁸ NSA, Norrköping Board of Health Archives, AI a:2, minutes 1885-04-30 §40, 1885-06-09 §§59, 60, and 1885-08-19 §82; NT 1885-05-13.

⁴⁹ NT 1865-02-11; NSA, Norrköping Board of Health Archives, AI a:2, minutes 1885-06-09 §59 and 1885-07-29 §76; Norrköping City Council Archives, A IV ö:3, "Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920", report 1915, p. 1.

inspected several of these.⁵⁰ Linroth was not quite so positive to the lined, sewered cesspits. In his opinion it was instead important for the decision makers in Norrköping to make excreta management a municipal matter as fast as possible, so that the Public Health Act could be fully implemented. The act approved of the previously mentioned receptacles, but also of water closets, according to Linroth. The latter could very well be introduced in Norrköping, since the “volume and high speed of the water” in the river Motala ström were enough to prevent any nuisance.⁵¹

The Board of Health presented Linroth’s report together with its own statement in late 1886. Its view was that the city should continue the process of having the cesspits declared legal, which was also the view of the City Council, although the latter wanted to emphasize that the whole question was on the board’s initiative. Thus, despite earlier indications from the state that the sewered cesspits would not be approved, the City Council in 1887 applied for the right to use them in Norrköping. But the request was denied both by the County Governor and the Swedish Government: there could be no exceptions from §17 of the Public Health Act.⁵²

This was the kiss of death for this local project. Yet it would take another six years before the City Council finally banned the cesspits, presumably due to the pertinacity of the building owners, and even longer before the pits were completely extinct.⁵³ In the meanwhile, the Board of Health continued working on the question of excreta management, and it looked to solutions in other Swedish and European cities, particularly dry toilet alternatives. In Germany the use of peat litter and peat poudrette had been pioneered and in Norrköping both the board and the newspaper issued reports about this “incredible” substance. Allegedly, peat absorbed all poisonous liquids and gases, and was completely odorless, which was considered important from a

⁵⁰ NSA, Norrköping Board of Health Archives, AI a:2, minutes 1884-10-14 §68 and 1884-11-11 §73; Circular letter of the National Board of Health, 1886-02-19, and report by Robert Schultz and Klas Linroth to the said Board in December 1885, in *Hygiea* 1886 p. 167-184.

⁵¹ NSA, Norrköping City Council Archives, minutes 1886-12-11 §24, supplement No. 36 1886 (including quote).

⁵² NSA, Norrköping City Council Archives, minutes 1887-01-20 §5, 1887-05-17 §16, and 1887-12-15 §32, supplement No. 36 1886; Account of the City Council meetings 1887-01-20 §5, 1887-05-17 §16, and 1887-12-15 §32, NT 1887-01-21, 1887-05-18, and 1887-12-16; NT 1887-05-17.

⁵³ After 1893, the receptacles actually came to dominate. In 1896 there were officially 3,616 receptacles, 448 manure- and waste boxes, 1,500 receptacles for kitchen refuse and other waste, as well as 111 so-called *våningsklosetter* in the city (NSA, Norrköping City Council Archives, supplement No. 48 1898).

sanitary viewpoint. It was also an excellent fertilizer, which would make reuse of nutrients possible.⁵⁴

The Local Debate About Excreta Collection and Water Closets until 1895

After Linroth's inspection and the definitive disapproval of the sewer cesspits by *Kungl. Maj:t*, it was clear that the city had to be involved in some way to solve this question, particularly in the management of excreta and solid waste. Captain Henrik Holmberg of the Royal Corps of Engineers was asked to draw up a plan for the solution of excreta and waste collection problems in Norrköping. The medical inspector and first city physician in Stockholm, Klas Linroth, was also contacted for a stated opinion about Holmberg's proposal. At the end of 1889, Holmberg proposed three different solutions:

- Water closets connected to the existing sewer system.
- Receptacles (decreed in the Public Health Act). The city was to have its own poudrette factory (*renhållningsverk*) and also take care of the collection.
- Receptacles just as the previous one, except that peat litter was to be mixed with the excreta before the collection.

Holmberg also had a proposal for the collection of street waste, kitchen refuse, and other solid waste to the poudrette factory, independent of which solution was chosen. Consequently, there were to be two parallel collection systems, one for excreta and one for kitchen and other solid waste.⁵⁵

⁵⁴ NSA, Norrköping City Council Archives, supplements No. 34 and 37 1886, No. 12 1895, and No. 19 1896, p. 7; NT 1887-12-14; Mårald 2000 p. 149-181. In the spring of 1893 several house owners complained about the imminent rebuilding of their latrines. The Board of Health, knowing that there could be no compromise anymore with the Public Health Act, but also realizing its part in the house owners' earlier costs, offered to pay for the gravel to be used in the filling of the pits (NT 1893-04-13).

⁵⁵ NSA, Norrköping City Council Archives, supplement No. 28 1893; NT 1895-11-29.



Henrik Holmberg (Source: Smedberg and Johnson 1937).

Holmberg made no secret of which system he thought was the best for excreta management:

Few cities are as appropriate for an introduction of the water closet system as Norrköping. The large amount of water in Motala ström is quite enough to transform the wastewater from the city of Norrköping, even if its population grows significantly. The correctly built water closet . . . [is] in every respect the most perfect and satisfactory. The excreta are here tidy and odorless through the repeated flushing with water; all collection with its inconveniences is cleared away; there is no storage of putrefying excrement, and the resulting running expenses and maintenance are cheaper than for any other system.⁵⁶

He was of the opinion that both the water quantity and the dimensions of the existing sewer system were enough for a general installation of water closets. However, the sewerage would have to be complemented by intercepting sewers on both sides of the river, as well as a pumping station on the north side, in order for the sewers to discharge the contaminated wastewater far downstream the actual city.⁵⁷ Linroth criticized details of Holmberg's proposal, but regarding water closets he agreed on the whole. They were definitely preferable to the other two alternatives, both from economic and sanitary viewpoints.⁵⁸

⁵⁶ NSA, Norrköping City Council Archives, supplement No. 28 1893. Holmberg even convinced the Board of Health to install a water closet in an outhouse of the police office yard, so that the public could see for themselves the advantages of WC's (NSA, Norrköping Board of Health Archives, minutes 1888-02-22).

⁵⁷ Ibid. Holmberg suggested mechanical-subsidence purification of the wastewater in a sedimentation dam (*avlagringsbassäng*), but only if there was any nuisance. This was unlikely since the outlets of the proposed interceptors were planned to be built so far downstream the city. Cf., Denton 1877 p. 271-272.

⁵⁸ NSA, Norrköping City Council Archives, supplement No. 28 1893.

In the spring of 1893, the Board of Health thus commended the water closet in a proposal to the City Council, based on Holmberg's proposal and Linroth's comments:

The foremost hygienists of the day agree that where the local conditions allow it . . . there is no more splendid way of managing excreta than through the water closet. Soil and air are thereby protected from contamination. Probably few cities are better suited to water closets than Norrköping.⁵⁹

The board was of the opinion that in a "not too distant future" the water closets would be the most common way of managing excreta: ". . . and it is certain that the person who has once become used to this convenience will find it quite difficult to do without."⁶⁰

Despite this view, the board did not want to decree water closets as the sole method for excreta collection, since it would be expensive for both the city (intercepting sewers) and less well-off building owners. Installation of water closets had not been formally legal before – at least not from the perspective of the Board of Health – but the suggestion was now to let them be authorized.⁶¹

As the main alternative the Board of Health proposed receptacles combined with peat litter. This was advantageous because, when the peat litter had been mixed with the excreta, it was possible to transport the receptacles "without causing a nuisance" around the clock. The excreta would also have economic value as fertilizer in this condition. A municipal Department of Sanitation was to be responsible for the mixing of peat litter, collection of receptacles, cleaning of cesspools as well as collection of kitchen refuse, other solid waste, and refuse from tanneries, butcheries, and sausage factories.⁶² The building owner could choose whether he would have this done by the department for a fee or do it himself. This liberty was allowed partly because many inhabitants were also farmers and wanted to take care of their own waste in order to use it in agriculture. But this freedom was also a result of the liberal ideology of the Board of Health: "All forms of coercion are hateful and should be avoided as far as possible." The board also considered the feasibility of the whole proposal, and claimed "not to be able to find anything that could more easily

⁵⁹ NSA, Norrköping City Council Archives, minutes 1893-04-10 §26, supplement No. 28 1893 (quote).

⁶⁰ Ibid.

⁶¹ NSA, Norrköping City Council Archives, minutes 1893-04-10 §26, supplement No. 28 1893. The Board of Health thus interpreted the public health act as prohibiting water closets, since they were not mentioned, and it wanted to be granted an exemption in Norrköping. This may seem like an odd interpretation when so many professionals saw no legal difficulties, but Swedish jurists generally shared this strict interpretation (Lundgren 1974 p. 147).

⁶² According to the board these latter wastes were even more dangerous from a sanitary point of view than the cesspits.

be carried out, since it intrudes as little as possible on people's right of self-determination."⁶³

After some discussion the City Council responded by appointing a sanitary committee to examine the proposal. It was deemed necessary to have not only public health interests and the interests of the public finances represented in the committee, but also those of the building owners, as they were the ones that would be the most affected by the method of collection eventually chosen.⁶⁴

The committee's scrutiny took over a year, but it eventually resulted in a proposal that was similar to that of the board, except for one crucial point. The committee was totally against water closets, which would, in its opinion, dominate the city if they were legalized. One of the committee's arguments was that the soil and the air would not be protected from contamination, because the ground in some parts of Norrköping could subside and thereby break the sewer pipes. Holmberg had also implied that the sealing material between the glazed earthenware pipes was not tight enough for transporting fecal matter. But his argument that the contamination would not permeate through the clayey soil of the city to any greater extent did not win the committee.⁶⁵

The next objection to the proposal of the Board of Health had to do with the likelihood of the transmission of disease via water, which the board had not even mentioned. Holmberg had mentioned it, but did not see it as a problem.⁶⁶ In Linroth's view this fear "was . . . mainly based upon theoretical reflections." Investigations had shown that "disease matter" (*sjukdomsämmen*) died rapidly in wastewater, and in Norrköping there was also the great effect of dilution in River Motala ström.⁶⁷ The committee, however, thought that the disease matter would not be completely neutralized in the water, and the location of the city near the river was therefore not seen as a refuge from the threat of epidemics. Even if contamination from excrements were very small compared to everything else that was discharged via the sewer system "this would not be a reason," according to the committee, "to further increase the

⁶³ NSA, Norrköping City Council Archives, minutes 1893-04-10 §26, supplement No. 28 1893 (including quotes).

⁶⁴ NSA, Norrköping City Council Archives, minutes 1893-05-18 §4 and 1893-06-19 §15; Account of the City Council meeting 1893-05-18 §4, NT 1893-05-19. The sanitary committee consisted of C. A. R. Lothigius, the court judge T. Zetterstrand, the merchant and industrialist Carl Swartz, the city physician Fredrik Bunth, the officer F. Frökenberg, the merchant Gunnar Larsson, and the brewer C. V. Bergman. The latter was in June replaced by Ivar Lyttkens.

⁶⁵ NSA, Norrköping City Council Archives, supplements No. 28 1893 and No. 52 1894. The mayor C. A. R. Lothigius, who was the chairman of both the Board of Health and the committee, protested against the proposal of the committee since he had already promoted the proposal of the board, that is, he was for water closets.

⁶⁶ NSA, Norrköping City Council Archives, supplements No. 28 1893 and No. 52 1894.

⁶⁷ NSA, Norrköping City Council Archives, supplement No. 28 1893 (including quote).

volume of filth that is already discharged into the river. We should rather in every way try to prevent the river from further contamination . . .”⁶⁸

To be sure, different forms of contamination were regarded as a hygienic and to a certain degree esthetic problem by most professionals of the day, but few were worried about the spread of disease in watercourses.⁶⁹ It may seem strange that the committee was so sceptical and contradicted the prevalent view among physicians and engineers concerning this question, but there was criticism against different forms of water contamination even on a national level. The committee thought that the river Motala ström was already contaminated enough, which also implies criticism against the discharge of industrial waste. Otherwise there was virtually no discussion about industrial discharge and contamination of the river in Norrköping at this time, although there was some debate on the national level.⁷⁰

As was mentioned above, it was the committee’s view as much as the Board of Health’s that the legalizing of water closets would mean a rapid increase in the number of installations. But according to the committee this would mean increased public expenditure for the city due to the interceptors and the pumping station, which would fall upon all the inhabitants of the city in the form of taxes “so that some people, who belong to the wealthier class, could enjoy the advantage of using a water closet.”⁷¹ The board’s idea of freedom to install WC’s would thus become a source of power for the bourgeois elite and economic bondage for less wealthy building owners and the working class. A critical question here was thus who should pay for, in relation to who would benefit from, the new technology. One is here again reminded of the discussion about the introduction of the gasworks in the city around 1850 (see Chapter One). The house owners of less means then protested to the County Governor against having to pay tax for something that they would not benefit from, as the gas lighting would primarily benefit the factories.⁷²

⁶⁸ NSA, Norrköping City Council Archives, supplement No. 52 1894 (including quote). The elementary-school inspector Ivar Lyttkens also protested against the proposal of the committee, but he thought that *all* use of water closets should be forbidden, even for those who had already installed them (the committee only wanted to prohibit new installations). Lyttkens was of the opinion that this was necessary so as to achieve the intended effects of the prohibition, probably to lessen contamination. Lyttkens was associate professor (*docent*) of zoology and wrote his dissertation on the skeleton and muscles of the lobster. It is likely that this background gave him scientific power resources and legitimization for the work in the committee, and that he also represented some kind of conservationist ideology (Lager-Kromnow 1982-1984 p. 472-474).

⁶⁹ NSA, Norrköping City Council Archives, supplement No. 28 1893; Lundgren 1974 p. 40-56.

⁷⁰ Lundgren 1974 p. 44-45, 56. Cf. Henning Nordenström’s investigation and the discussion below.

⁷¹ *Ibid*; NSA, Norrköping City Council Archives, supplement No. 28 1893.

⁷² Kaijser 1986 p. 116-132.

Furthermore, agriculture would miss out on valuable manure, despite the fact that the Board of Health's proposal had ensured everyone's liberty to use their excreta as fertilizer. The committee's view was due to the expected rapid growth of water closets, which would lead to loss of nutrients for agriculture in any case, but also to Holmberg's och Linroth's negative attitude to farmers' use of excreta. They thought that a city had to prioritize economy and health, and see the interests of agriculture as secondary.⁷³

When the City Council discussed the committee's proposal, there was again a lengthy discussion, but those who participated were mostly the members either of the committee or the Board of Health. What is particularly interesting is that a new important actor participated. It was Arvid Palmgren, owner of the engineering and plumbing workshop Arvid Palmgren's Mekaniska verkstad, who emerged as a great defender of the water closets. He was a plumber for the water supply, but also manufactured pumps, pipes, water closets, and other equipment for bathrooms. He made a rather long speech in which he spoke for the board's proposal and against the committee's, and he also proposed an investigation to find out whether the river had been contaminated by the city's sewage or not.⁷⁴

Palmgren began his speech, his water closet manifesto, by enlisting the building owners and their interests. In his view, there had been too many changes regarding the storage and collection of excreta in the last years, which had led to great expense for the building owners. To promote the water closet he refuted the arguments of the committee. To begin with, the network supervisor had assured him that to his knowledge subsidence of the soil had never broken any sewers in the city. Palmgren could also show that the sewers normally did not contaminate the soil either; the talk about the glazed earthenware pipes as not being reliable was just nonsense. Furthermore, in each yard there was a cesspool that collected solid excrement, and since it always sank to the bottom it could by no means reach the river and contaminate the water. If the water closets were to be prohibited, argued Palmgren, then the same must be true for the kitchen sink, through which raw fish, scraps of meat, and urine went.⁷⁵

The likeliness of the spread of disease, should the excrement reach the river, was also addressed by Palmgren. He referred to the prevalent Swedish medical opinion of the day, for instance to Elias Heyman and Klas Linroth,

⁷³ Ibid; NSA, Norrköping City Council Archives, supplement No. 28 1893.

⁷⁴ NSA, Norrköping City Council Archives, minutes 1894-12-27 §12 and 1895-01-10 §4; Account of the City Council meetings 1894-12-27 §12 and 1895-01-10 §4, NT 1894-12-28 and 1895-01-11; NT 1893-05-19.

⁷⁵ Palmgren's speech is partly referred to and partly quoted in a later sanitary investigation in NSA, Norrköping City Council Archives, supplement No. 48 1898, p. XIII-XV.

who were of the view that the danger of excrement spreading epidemics via water was exaggerated. It was the urine which was dangerous, according to Heyman. Besides, Norrköping's source of water was filtered and situated far upstream the city, and the large river would dilute any contamination before it reached places further downstream. To Palmgren's knowledge there had not been any complaints from people downstream the city, and places downstream Hamburg had not been affected by the 1892 cholera epidemic either.⁷⁶

Later in the spring of 1895, the Financial Department was the next municipal body to voice its opinion in this matter. It generally shared the opinion of the Board of Health that water closets had to be allowed together with the receptacles, complemented by peat litter. The department did not see water closets as a sanitary danger, except for when epidemics threatened the city. The people who had already installed the closets would be at a disadvantage compared to other building owners if WC's were banned. But the department wanted better control over the water closets than before, and consequently suggested special regulations.⁷⁷

The Water Closet at a Crossroads – Contamination or Dilution?

At this time, bacteriological theories were already spreading on the Continent. In Sweden it took until the end of the 1890s before medical experts accepted them and even longer before they were applied in practice, although there were single proponents as early as the 1880s.⁷⁸ The views of the Board of Health, Holmberg, Linroth, and Palmgren on contamination and the origin of disease were consequently to a great extent based on miasmatic theories – that is, disease was thought to breed via foul smells from putrefying matter – and preventive sanitary measures in the physical environment were emphasized.⁷⁹

Putrefying organic matter could contaminate the soil and air, and the results were disease or generally unhealthy sanitary nuisances. Thus it was crucial that the excreta were swiftly removed from the city, before the putrefying processes started, and therefore the water closet was considered the decidedly best. Water was seen as a transporting medium, which removed,

⁷⁶ NSA, Norrköping City Council Archives, supplement No. 48 1898, p. XV-XVI. In retrospect, we know that the reason why a community downstream such as Altona was not affected by cholera at all to the same degree as Hamburg was that it filtered its piped water supply, which Hamburg did not (Evans 1987 p. 291-292). Cf. Bjur 1988 p. 87-90.

⁷⁷ NSA, Norrköping City Council Archives, minutes 1894-10-30 §16, 1895-01-10 §4, and 1895-03-19 §10, supplement No. 4 1895.

⁷⁸ Graninger 1997 p. 266-268.

⁷⁹ Arvidsson 1971; Melosi 2000 p. 43-57.

diluted, and purified the contamination, without any risk of nuisance or disease. As regards Norrköping, the proponents of this view pointed to the city's advantageous location on Motala ström, which would easily dilute all the filth from the water closets.⁸⁰

Around the turn of the century, the contamination of waterways was a well-known phenomenon elsewhere in Europe, but in Sweden these kinds of problems were only beginning to be recognized. To be sure, part of the explanation for this can be found in the ample water resources of Sweden as well as the comparatively moderate urbanization and industrialization. Only a few cities expressed fear of water pollution due to WC's, for example Falun, Kristianstad, Uppsala, and Linköping, and these all discharged their sewage in small recipients. Even the largest cities were hesitant, partly for fear of water contamination (see below).⁸¹ It is likely that at least parts of River Motala ström in and downstream Norrköping were grossly contaminated in the mid-19th century. The dominance of the woolen industry, which was known to be very contaminating, makes this logical, although the great amounts of river water diluted the contaminants to a certain degree. There are also accounts by eyewitnesses who testified to the bad quality of the river water in the city as well as to the increasing amounts of sludge.⁸²

Yet these problems were seldom or never taken up in public discussion, and it is therefore necessary to look at the interests of the actors that defined, did not define, or prevented others from defining what was considered as contaminated. Palmgren had asked for a survey of the water quality of the river, maybe because he knew that the results would turn out in his favor and would support the interests of all those who supported water closets and general discharge of filth in the river. In 1895, A. W. Cronander was commissioned to analyse the river water, partly by the city to investigate into water quality, and partly by the industrial establishments, which needed information on water speed and directions for future improvement of water power utilization. This

⁸⁰ NSA, Norrköping City Council Archives, supplement No. 28 1893; Corbin 1986 (1982) p. 33; Tarr 1996 p. 120-121.

⁸¹ Heyman 1877 p. 79-90; Lundgren 1974 p. 44-45, 56, 99; Börje Hjort, "Vattenklosetternas historia' i Uppsala stad", unpublished manuscript, p. 1-4. Cf. *Third Report of the Commissioners Appointed to Inquire into the Best Means of Preventing the Pollution of Rivers* (London 1867) and *Third Report of the Commissioners Appointed in 1868 to Inquire into the Best Means of Preventing the Pollution of Rivers. Pollution Arising from the Woollen Manufacture, and Processes Connected Therewith* (London 1871), in *House of Commons Parliamentary Papers*, 1867 Vol. XXXIII p. 186-471 and 1871 Vol. XXV p. 676-755, microfiche University of Notre Dame Library.

⁸² For the contaminating processes of the textile industry, see the previous footnote or for instance Hillmo 1994 p. 21-22. For testimonies of the deteriorating river water quality in Norrköping, see Östman, Malmberg, and Liander 1945 p. 13-17 more generally, and NT 1872-02-02 concerning the consequences for fishing.

was the first official water analysis since Keyser's in 1865 and Almén's in 1868, and the first one ever to examine the water downstream the city.⁸³

Cronander examined, first of all, the amount of water per second in the river, which was regarded as important from a hygienic point of view. He realized that to make a correct estimate of the degree of contamination several different factors had to be considered, for example the number of inhabitants and factories, but he only took up the former. The population figure was thus multiplied with the estimated maximum amount of sewage per individual and day (125 liters per day, but converted into seconds, based on the water consumption), and was then related to the mean water flow (see Table 5.2). Norrköping was in this respect very fortunate in comparison to Swedish cities such as Stockholm and Göteborg, but also larger European cities such as Munich, Berlin, Paris, and London. Norrköping was also situated close to the sea, where, according to Cronander, the water would "purify itself." He also examined whether the current was strong enough to carry the filth out to the sea, and with a few exceptions it was, at least as far as a bay downstream the city. In a few places there was black mud at the bottom, a sign of rotting organic matter.⁸⁴

⁸³ NSA, Norrköping City Council Archives, minutes 1895-04-16 §19 and 1895-05-21 §5, supplement No. 25 1895.

⁸⁴ NSA, Norrköpings stadsarkivs småskriftssamling, 28:6, *Hydrografisk Undersökning af Motala ström af A. W. Cronander* (Norrköping 1896), p. 1-8. Cronander's sources for the European cities were German, the then well-known *Handbuch der Hygiene* by Max von Pettenkofer (probably the edition von Pettenkofer 1882), as well as *Die Verunreinigung der Gewässer* (Jurisch 1890). The rationale behind these and Cronander's investigations was that running water purifies itself, especially if the flow is great, and it also permeated the investigations by Holmberg and Linroth a few years earlier (NSA, Norrköping City Council Archives, supplement No. 28 1893). River Stångån in Linköping was not part of Cronander's survey, but in 1895 Linköping had around 13,000 inhabitants. The water flow at medium level is today 13 m³ per second, and at low level 2 m³. (The water flow has not changed significantly the past 100 years.) The relationship between the amounts of sewage and river water would have been 1:600 at medium level and 1:100 at low level in Linköping (water flow figures, Allan Hansson, personal communication, 2002-11-27).

Table 5.2. Sewage contamination of rivers in Swedish and European cities, based on the part sewage compared to the total amount of river water at different flows and levels, by A. W. Cronander.

City	Inhabitants	River	Water Flow m³/s	Water Level	Quantity Sewage:River
Norrköping	34,816	Motala ström	366	High	1:7,266
"	"	"	65	Medium	1:1,290
"	"	"	31	Low	1:623
Stockholm	264,585	Stockh. ström	316	High	1:825
"	"	"	202	Medium	1:528
"	"	"	144	Low	1:376
Göteborg	111,234	Göta Älv	58	Medium	1:359
Vienna	1,365,600	Donau	7,667	High	1:3,881
"	"	"	4,360	Medium	1:2,206
"	"	"	2,040	Low	1:1,032
Frankfurt	179,985	Main	174	High	1:938
"	"	"	81	Low	1:438
Hamburg	569,260	Elbe	494	High	1:599
"	"	"	347	Low	1:421
Munich	350,594	Isar	50	High	1:144
"	"	"	30	Low	1:86
Berlin	1,579,244	Spree	43	Medium	1:18
"	"	"	13	Low	1:6
Paris	2,448,000	Seine	45	Low(?)	1:13
London	4,211,000	Thames	23	Low(?)	1:4

Source: NSA, Norrköpings stadsarkivs småskriftssamling, 28:6, Hydrografisk Undersökning af Motala ström af A. W. Cronander (Norrköping 1896), p. 3.

The year before, the factory owner C. E. Jonsson in Östra Eneby rural commune had complained to the Communal Council about contamination of the water downstream Norrköping, which he thought was caused by fecal matter from the water closets in the city. For him and many other people in the commune the river constituted the primary fishing grounds and contained the only available drinking water. According to §28 in the National Public Health Act for the countryside the commune was obliged to attend to such a situation, but the Östra Eneby council first wanted proof that the said state of things was really dangerous for the public health of the commune. The council also questioned whether the river really was the sole source of drinking water,

and also referred to the opinion of medical expertise, that water closets were actually excellent implements in sanitation.⁸⁵

The Swedish Government rebuked the council and thought that it had been nonchalant; it should have listened more to Jonsson's complaints. In 1895 the first provincial physician was called in to investigate the matter, and he subsequently took a boat trip to visit all the places that could have been affected. Nordenström used his visual and olfactory senses to examine both the shoreline and the river water, and could perceive only modest contamination. But when speaking to residents and fishermen in the area he became convinced that it had increased in recent years. Nordenström concluded that Motala ström just below the city was "very contaminated," and so was the water further downstream, to degrees varying with the distance from the city. The trench Lillån also contributed. However, he did not think that the water closets were the cause of contamination, since they were few and not many had replaced the forbidden cesspits. Most fecal matter was now collected in receptacles. Furthermore, new and better cesspools were installed in some yards, which should stop most solid excrements from reaching the river. Nordenström's only concern was possible outbreaks of cholera, in which case he thought that the WC's should be temporarily forbidden.⁸⁶

Swedish physicians were on the verge of accepting the bacteriological theories of Pasteur and Koch, but evidently the same thinking and practice that they had pursued for decades were still prevalent. Nordenström and Cronander expressed the same rationale about the self-purification of abundant, running water as had been common for decades or centuries and was still promoted by leading engineers, physicians and chemists such as Pettenkofer, as well as ordinary people. Nordenström also used vision and smell to detect filth and contaminants, which was long established practice among medical men. Chemists and engineers were beginning to analyse bacteria, however, and the Waterworks Board started bacteriological tests of filtered piped water and the river water in several places upstream and in the city in 1897, which were carried out by Cronander.⁸⁷

This confirms the results of research on the impact of bacteriology on the medical profession in Sweden at this time. The transition from one paradigm to another was very slow, especially since many doctors did not have a theoretical foundation to begin with. Furthermore, the miasmatic emphasis on

⁸⁵ NSA, Norrköping City Council Archives, supplement No. 19 1896.

⁸⁶ NSA, Norrköping City Council Archives, supplement No. 19 1896. According to an acknowledged estimate, referred to by both Holmberg, the Board of Health, and now Nordenström, the excrements only constituted 1/300 of the total amount of wastewater.

⁸⁷ Corbin 1986 (1982) p. 1-34; Graninger 1997 p. 243-247, 253-255; NSA, Norrköping City Council Archives, supplement No. 33 1898, annual report of the Waterworks Board for 1897.

the environment and preventive medicine had proved so successful in the past decades, resulting in lowered morbidity and mortality rates, that there was strictly speaking little need for a new approach to medicine. However, it is also important not to contrast the miasmatic and contagionist views too much, for in practice many physicians combined both ideals.⁸⁸

Was Nordenström right about the small contribution of the water closets? I believe that he was, for there were as yet only around 600 in a city with a population of between 30,000 and 40,000 people, although he thought that the water closets were a potential future problem. He acknowledged that the river was very contaminated, but instead blamed the total amount of filth from kitchens, stables, yards, streets, and factories, which would increase with the city's growth. This was the second time that anyone, however carefully, criticized industrial discharge in the river, and the contaminants downstream the city may well have been caused by industry. The sanitary committee of 1893 was the first to imply this. However, Nordenström's sensory "tools" for analyzing the water were too blunt to prove anything, which may also have been his intention. To confront the Norrköping industry regarding its alleged contamination of the river would at best have been frowned upon, at worst professional suicide.⁸⁹

The final outcome was that the use of water closets was prohibited only in case of an epidemic. The Financial Department issued such a decree. Otherwise Jonsson's complaints were denied, and the whole matter was submitted to the "new" sanitary committee of 1895 (see below). Apparently, Cronander's examination had not been submitted yet, so C. O. Björck expressed hopes that it would clear the water closets of the accusation that they contaminated the river. It was important to have scientific evidence that the WC's were innocuous. Eberstein, who had read Cronander's report, was of the opinion that it showed that the WC's contaminated the river insignificantly.⁹⁰

⁸⁸ Baldwin 1999 p. 2-10; Graninger 1997 p. 243-255; Schmidt and Kristensen 1986 p. 69-75.

⁸⁹ NSA, Norrköping City Council Archives, supplement No. 19 1896; Hillmo 1994 p. 21-25. The Norrköping industry was generally untouchable as regards the disposal of its waste. The case of Brücks Woolen Factory, owned by Dominicus Brück who originated from Luxembourg, was the first to include a clause on sewage treatment. However, this probably had to do with the fact that the wastewater was not discharged in the city's pipe network and thus was not under its control. The factory had to treat the sewage in an appropriate way before it left the facilities *if necessary*. This was maybe a rhetorical statement, for who was to decide if it was necessary or not? The city presumably did not want to be on bad terms with one of the most successful woolen manufacturers in Norrköping around the turn of the century (Norrköping City Council Archives, minutes 1900-03-22 §13 and 1900-12-27 §7, supplements No. 12 and 81 1900; Svensson, Godlund, and Godlund 1972 p. 194-197).

⁹⁰ NSA, Norrköping City Council Archives, minutes 1896-04-07 §10, supplement No. 19 1896; Account of the City Council meeting 1896-04-07 §10, NT 1896-04-08.

In his last inspection report of Norrköping before retirement, Nordenström in 1897 commented on his observations of water closet malfunctions. Hellström had earlier remarked on jerks in the pipes when installing Palmgren's so-called frost-free water closet, which had a direct connection to the water pipe, instead of via the flush tank. Nordenström complained about insufficient water for flushing in Palmgren's closets, but rather attributed this to the low pressure in the water system (it became worse the higher the closet was situated). What was worse was that ventilation and sewer pipes were built along the exterior wall of the house, which sometimes caused the sewage to freeze and led to overflows.⁹¹

Gradual Acceptance of WC's and Continued Debate of other Alternatives 1895-1910

The council meetings in 1895 show the extent of the controversies that still permeated the issue of excreta collection. Despite the actor-networks having been rather difficult to discern so far in the discussion, it is clear that the building owners were powerful and dominated the City Council. The industrialists and merchants owned their industrial and commercial facilities and often also their homes, and therefore had to arrange for proper storage and collection of excreta. Several of the less wealthy council members also owned their houses, such as for instance the physician C. O. Björk. We could define the building owners as an actor-network that had thus far indeed been very successful in promoting its interests, which were low personal expenditure. This was achieved even when the matter was tabled again and again. But there were also conflicts between the financially more powerful building owners and the lesser ones. Thus they can also be said to constitute two different actor-networks.⁹²

In May 1895 all the previous proposals were up for discussion, but it was only the sanitary committee's and Fredrik Blombergh's plans for the collection that were discussed. Water closets never came up, despite the explicit wish expressed at the beginning of the meeting to do so. Basically the wealthier building owners or those who supported them, represented by Lothigius, Swartz, Lyttkens, and Eberstein, supported the committee's suggestion for a

⁹¹ NSA, Norrköping Waterworks Board Archives, minutes 1888-10-18 §4; Norrköping Board of Health Archives, minutes 1898-04-18, inspection report for Norrköping 1897 by the first provincial physician. Cf. Arvidsson 2002 p. 111.

⁹² Account of the City Council meetings 1895-04-16 §8 and 1895-05-21 §6, *NT* 1895-04-17 and 1895-05-22. Most building owners in the City Council can be discerned, but it is difficult to know exactly who were more or less wealthy. These are therefore somewhat artificial and idealized constructs, based primarily on how the actors argued (cf., Introduction).

municipal Department of Sanitation (the three former were also members of the committee), which was thought to be most effective in enforcing good excreta collection, especially in case of cholera. They regarded the sanitary conditions as still poor. Lothigius also enlisted arguments concerning successful municipal takeovers of excreta management in both London and Göteborg.⁹³

In Fredrik Blombergh's proposal the work of the municipal department was instead left partly to the Board of Health and a special health police, and partly to private enterprise. This would make the whole project cheaper as regards the public financing, but would also ensure the freedom of the less well-off building owners to arrange for the collection in the cheapest possible way, probably themselves. This appealed to for instance Carl Otto Björck, Palmgren, G. P. Olander, and the builder C. J. Andersson. In contrast to the other more affluent actor-network at least C. O. Björck, the physician, was of the opinion that the sanitary conditions of Norrköping were not so bad. It is also interesting that both the actor-network in favor of Blombergh's proposal and that in support of the committee tried to enroll the support of these less wealthy house owners. The proposals were both said to further their interests.⁹⁴

During the City Council meeting in November 1895, similar opinions were voiced again by the same people, and the crucial point was again whether excreta were to be managed by a municipal department or by the Board of Health and private enterprise. Which was the least expensive for the building owners? One bone of contention was also how good or poor the sanitary conditions of Norrköping really were. Was it really necessary to change anything at all, and if so, how much was to be done, that is, how much was it going to cost?⁹⁵ Blombergh – for whom the threat of epidemics in the city primarily came from the poor sanitation in the northern suburb – Olander, and the physicians Engelbrecht and Björck toned down the poor sanitary conditions in Norrköping.⁹⁶ In the case of extending sanitation and sewerage to Beckershof in 1892, Björck and Engelbrecht represented a public health network, but here they apparently had other interests (see Chapter Three).

Christian Eberstein claimed that the centralized alternative was better than the private both as regards economy and hygiene. Carl Swartz talked about

⁹³ NT 1895-05-22. The Board of Health had also proposed a municipal Department of Sanitation, but it was probably felt among this actor-network that it was not centralized and coercive enough.

⁹⁴ NT 1895-05-22.

⁹⁵ Account of the City Council meeting 1895-11-28 §6, NT 1895-11-29.

⁹⁶ Account of the City Council meeting 1895-11-28 §6, NT 1895-11-29. Björck had made a survey of the management of excreta in several mid-sized and smaller Swedish cities, for example, Jönköping, Örebro, Falun, Kalmar, Gävle, Sundsvall, Lund, Uppsala, Västerås, and Linköping, from which he drew his conclusions (NT 1895-11-30).

the high morbidity in the city, which he saw as a result of bad sanitation. For Swartz cheaper private collection “was to strain at a gnat and swallow a camel. The greatest thrift would come from keeping the city clean. For with dirt come poverty, disease, and destitution.”⁹⁷ In Swartz’ view dirt thus polluted the city not only in the literal sense but also culturally. It is remarkable that the wealthy bourgeoisie enlisted public health more than the physicians themselves, but we must remember that for the former good sanitation and cleanliness were also a way of protecting and confirming bourgeois identity and of keeping the workforce healthy.⁹⁸

Towards the end of the meeting most members seemed to agree that the whole matter should be reexamined. Several other issues than the above had also been debated, for instance, whether farmers were willing or capable of sustaining the private collection and how often collection was to be carried out. New ideas and proposals in the whole question had also been put forward. Thus the City Council decided to appoint a new committee, “to which the matter in its entirety” should be handed over.⁹⁹

The water closets disappeared from the discussion quite unnoticed at the same time as other questions gained in recognition. All actors and actor-networks that participated in the debate in the early 1890s either were positive to the water closets or did not see them as a problem. It was only the first sanitary committee, particularly Ivar Lyttkens, that maintained an explicitly negative view of them, but they did not gain much hearing in the debate. The fact that the water closets did not become an issue in the very heated debates about the management of excreta in 1895 only confirms the view that they continued to be accepted by a majority.¹⁰⁰

This impression was further confirmed by the “new” committee, that is, the sanitary committee of 1895, which finished its work in 1898. It was of the view that the water closet was most convenient, perfect from a sanitary point of view, and it based this on statements by Linroth and Cronander. Norrköping was also particularly fortunate to have Motala ström as recipient for its waste. Thus water closets came more and more to be regarded as the best solution for effective collection of excreta, and this prevailing attitude in the debates, even

⁹⁷ Account of the City Council meeting 1895-11-28 §6, *NT* 1895-11-29.

⁹⁸ Account of the City Council meeting 1895-11-28 §6, *NT* 1895-11-29; Douglas 1966 p. 2-6, 36-41; Ekenstam 1993 p. 68-74, 114-120, 234-247; Frykman and Löfgren 1987 (1979) p. 216-220, 250-272.

⁹⁹ NSA, Norrköping City Council Archives, minutes 1895-11-28 §6 (quote) and 1895-12-12 §2; *NT* 1895-11-29. As members of the “new” sanitary committee were elected Fredrik Blombergh, the wholesale dealer Eric Ringman, C. O. Björck, the builder C. J. Andersson, and the civil servant Aug. Wockatz.

¹⁰⁰ NSA, Norrköping City Council Archives, supplements No. 4, 12, and 48 1895.

when it was not explicit, contributed to a greater acceptance of the water closet in Norrköping into the 20th century.¹⁰¹

When considering who the members of the 1895 sanitary committee were, it is not surprising that the outcome of the investigation was very similar to the views of the actor-network which enlisted decentralization and the less wealthy building owners. The suggestion was to build the excreta management upon water closets, regulated by the Financial Department's statutes of 1895, and receptacles with peat litter as "desinfection". Peat litter was not believed to have any special salutary effects, but was added to reduce the smell, which in the bacteriological paradigm did not cause disease in itself. Collection was to be carried out at least once a week during the summer, and once a month the rest of the year. This seems to have been the most common in comparison with other Swedish cities.¹⁰²

The committee's appraisal of the sanitary conditions in Norrköping was very positive, and this was partly based on a statement by the first provincial physician Nordenström from 1896, that "sanitation was generally in a good condition." According to the new sanitary committee, "it is also well known that Norrköping . . . is a cleanly city." It enlisted sanitary improvements that had been carried out by the Board of Health recently: the exchange of wooden cesspools for ones of glazed earthenware in 1891, and the prohibition of the sewered cesspits in 1893.¹⁰³

The Board of Health took on the committee's report of 1898 and returned with a statement in late 1904. It pointed out that its original proposal of 1893 was to be preferred, particularly as this included the idea of a municipal Department of Sanitation. What is especially interesting in the board's statement is that water closets were promoted even more than in 1893. They were motivated in the usual way, but the board now wanted to "most actively recommend the introduction of this system . . . and consequently that the implementation of this as far as possible is facilitated and promoted." The board even wanted to supply water to the closets free of charge, but realized

¹⁰¹ NSA, Norrköping City Council Archives, minutes 1898-06-06 §19, supplement No. 48 1898.

¹⁰² NSA, Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till . . . I and II". C. O. Björck had complemented his earlier survey of excreta collection in several Swedish cities, and this came as an appendix to the sanitary investigation. He concluded that in several cities, for instance, Falun, Landskrona, Kalmar, Jönköping, and Uppsala, the development of general sanitation was very slow, and that Norrköping was better off in this regard.

¹⁰³ NSA, Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till . . . I" (including quote), and A IV ö:3, "Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920", report 1915, p. 1-6.

that there had to be a fee, 10 kronor a year at the most. In this way it wanted to promote water closets and discourage further expansion of the receptacles.¹⁰⁴

Nothing came of the new proposal of the Board of Health, at least not in the form of new sanitary regulations and a Department of Sanitation. In practice this led to further promotion of the already popular water closets. The Drafting Committee also wanted to pursue a new way of cleaning up the city in combination with agricultural production.¹⁰⁵ The so-called Eskilstuna system – named after the city where it was first introduced, and popular all over Sweden at the time¹⁰⁶ – meant the building of a mechanized poudrette factory and introduction of a swine feeding farm, in which all the city's excreta and other waste were to be processed. The 1909 sanitary committee was appointed to examine this proposal.¹⁰⁷

The 20th Century and the Victory of the Water Closet

Installation of water closets had not been frequent in Swedish cities before 1900, and it was not until after 1910 that they mushroomed. In Stockholm, Göteborg, and Malmö, the three largest cities, it was only in the beginning of the 20th century that the use of water closets became legal, although there had been exceptions. Before that the fear of excessive water consumption¹⁰⁸ and the contamination of waterways, together with the protection of the municipal poudrette manufacturing, had prompted the respective city governments to

¹⁰⁴ NSA, Norrköping City Council Archives, minutes 1898-09-01 §13 and 1904-11-24 §15, and A IV ö:3, statement of the Board of Health, 1904-12-14. Ironically, the filth from the northern suburb was somehow regarded as more dangerous than that from the city. In 1909, water closets were banned in the northern suburb, and the merchant Edward Ringborg even thought that the suburb should be made to share the future costs of purifying the contamination of the river (NSA, Norrköping City Council Archives, minutes 1909-05-03 §4, p. 2-6, supplement No. 47 1909, p. 9-10, 16-17).

¹⁰⁵ P. A. Petterson, factory owner and member of the Poor Relief Board (*Fattigvårdsstyrelsen*), also suggested in 1903 that the city should combine poor relief, agriculture, and excreta collection, so as to bring down the high costs for the poor. The idea was to start an agricultural school at Ståthöga, to which the poor would contribute with work and the collected manure. Nothing came of this grand proposal, however (NSA, Norrköping Poor Relief Board Archives, minutes 1903-01-19 §21).

¹⁰⁶ Mårald 2000 p. 172-179. See Chapter Six for further discussion of this.

¹⁰⁷ NSA, Norrköping City Council Archives, minutes 1909-02-25 §6, supplement No. 20 1909. The members of this committee were the builder Edvin Eriksson, the cashier Emil Kindahl, the teacher P. Lundahl, the butcher G. R. Sandqvist, and the factory owner Jacob Wahren.

¹⁰⁸ Apparently this was a general phenomenon all over Europe, and, for instance, in France the Parisian company Paul Gadot marketed a water closet with a two-part flush tank to save water (Tarr and Dupuy 1988 p. 198).

limit the spread of WC's. There was also uncertainty as to whether the sewers would be able to collect all the new sewage content.¹⁰⁹

Johan Gustaf Richert, Klas Sondén, and other professionals in the national actor-network of engineers and physicians also thought that there was a deep-rooted prejudice against the water closet among the public, which was discussed at the Nordic Meeting of Engineers (*Nordiska teknikermötet*) in Stockholm in 1897. Some 30 years after his father had claimed that WC's would not generally appeal to Swedes, Richert asked the rhetorical question "Why are water closets not used in Sweden?" His answer was that the public was afraid of water pollution, enormous costs for rebuilding the sewers, and the loss of valuable manure for agriculture. He contradicted these arguments by claiming that most urine was discharged in the sewers already, and since it constituted 90 percent of the excreta only slightly increased contamination would result from the excrement. As urine contained the most valuable nutrients, this meant that agriculture had already been robbed of the best fertilizer. Richert also claimed that sewers did not need much rebuilding at all; sewers should be constructed in roughly the same way whether WC's were installed or not. Interceptors might be needed, however. He also praised the achievement of the German cities Frankfurt, Altona, and Hamburg (after 1892), where water closets were spread throughout.¹¹⁰

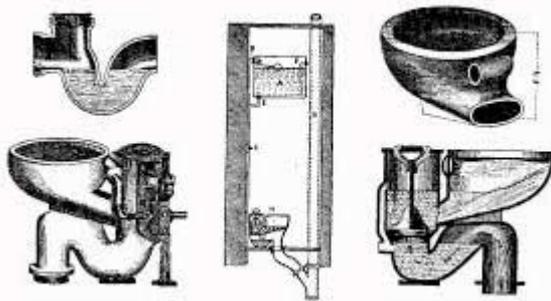
According to Richert the water closet was a "hygienic axiom," and in the early 20th century not only the medical and engineering professions but also decision makers became increasingly positive. The importance of a fast removal of rotting matter was reinforced by the new bacteriological theories. In the miasmatic paradigm there was a qualitative difference between water that was contaminated by excrement or putrefying organic matter, and water that was not. The former was dangerous to human health, although it was debated in what ways, how much, and whether hardness or other parameters were worse. John Snow even suggested in 1854 that something *in* the excreta of a cholera victim could spread through water. Ironically, when in the early 20th century the existence of pathogens and their spread through water was known, this only facilitated the diffusion of WC's. Richert was of the view that unless the water was infected by pathogens, there was no difference at all between water with or without excreta, either bacteriologically or chemically,

¹⁰⁹ Bjur 1988 p. 101-105; Gullberg 1998 p. 115-117; Isgård 1998 p. 34-39; Jakobsson 1999 p. 138-139; Olsson 2001.

¹¹⁰ *Förhandlingarna vid Nordiska teknikermötet i Stockholm den 15-19 juni 1897* 1898 p. 232-234.

and should there be an epidemic it could spread equally easily through other media than water.¹¹¹

In the early 20th century Norrköping strengthened its position as one of the forerunners in promoting water closets, and it was the magnificent river that still was believed to make this possible. J. G. Swartz' vision of the river as a sewer was thus still relevant (see Chapter One). This can be explained in two ways. First of all, the city was an example to other cities, and the attitude of the Waterworks Board and later the Board of Health led to a fairly rapid propagation of WC's in Norrköping. The great water flow of the river prevented the worst nuisances, and thereby also any measures taken against the closets. Secondly, Arvid Palmgren was successful in promoting the "Palmgren system" – consisting of WC's connected to a cesspool – in Norrköping and in other cities. This system was discussed and probably also introduced in yards both in Norrköping, Stockholm, and Uppsala in the late 19th century.¹¹²



Jenning's water closet, manufactured by Arvid Palmgren in Norrköping (Source: Furhoff 1949).

In the early 20th century the increase of water closets continued in Norrköping, but at a little slower pace. In 1910 around half of the yards in Norrköping had water closets, which was more than in any other Swedish city. But the number

¹¹¹ Bjur 1988 p. 101-105; Lundgren 1974 p. 99; Hamlin 1990 p. 90-129; *Förhandlingarna vid Nordiska teknikermötet i Stockholm den 15-19 juni 1897* 1898 p. 233.

¹¹² Hallström 2000 p. 190; Jakobsson 1999 p. 123-130; Lundgren 1974 p. 94-99; Börje Hjort, "Vattenklosetternas historia' i Uppsala stad", unpublished manuscript, p. 1-7; NSA, Norrköping City Council Archives, supplement No. 28 1893. Palmgren's system was not developed when the sewer system was built in Norrköping, so the cesspools of the original sewerage were of a British construction. As the city grew more and more of Palmgren's cesspools were installed, and they had strainers to collect the excrements mechanically, so that only the liquid part was discharged in the river. In Stockholm and Uppsala eventually septic tanks were used instead, since they were thought to be better, although most experts condemned them in the early 20th century.

of water closets continued to increase even more.¹¹³ During the 1910s the water closet became an integrated and generally accepted innovation in sanitation in Norrköping as well as in all of Sweden. Among medical and hygienic expertise the WC was still promoted, even though its drawbacks were more acknowledged than in the 1890s.¹¹⁴

The sanitary committee of 1909 wrote in 1915 that the water closets were a part of the sewer system – they were for the removal of excreta and filth in liquid form – and was consequently something that did not have anything to do with the dry collection of excreta, animal droppings, kitchen refuse, and other waste.¹¹⁵ The management of dry waste continued, and it was in many ways a working class concern. In 1918 all households with a maximum of two rooms and a kitchen in Norrköping were studied, that is, the homes of the workers and the poor. Of them around 74 percent still disposed of excreta in receptacles in the yard, while the rest had water closets, either in the apartment, the attic, or in an outhouse.¹¹⁶

Dry closets were also installed in new houses, such as in Marielund in the western part of the former northern suburb. Röda stan, which the area was called, means the “red town” and alluded to the color of the houses, which symbolized an idyllic rural Swedish atmosphere. The ideology behind the area was the garden city ideal, with influences from Great Britain and Austria, and the Swedish *egnahemsrörelse* (the movement for owner-occupied houses). The object was to give the worker his own yard, so as to mitigate social and class tensions (cf. Sterner’s ideas, Chapter Four).¹¹⁷ A number of two-family houses were erected in 1917, the year after the incorporation with Norrköping. Operational instructions said that “cold water is installed in the kitchen up to an enamelled sink, and a peat-litter closet by *Örebro klosettfabrik* type 2F with drainage for the urine is installed. The sink and the urine pipe are connected to the municipal sewerage.”¹¹⁸ Thus the class inequality concerning

¹¹³ According to Fröman (1912), in the rest of the Swedish cities only a small percentage had water closets, apart from Stockholm and Sundsvall, in which 18 percent of the yards had such installations (Fröman 1912 p. 201; NSA, Norrköping City Council Archives, A IV ö:3, ”Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920”, report 1915, p. 14-15, 35).

¹¹⁴ NSA, Norrköping City Council Archives, supplement No. 48 1898 and A IV ö:3, ”Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920”, report 1915, p. 14-15; Lundgren 1974 p. 145-149, 227-230.

¹¹⁵ NSA, Norrköping City Council Archives, A IV ö:3, ”Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920”, report 1915, p. 14-15, 26, 31.

¹¹⁶ Fröman 1912 p. 201; SOS 1918, *Undersökning rörande mindre bemedlades bostadsförhållanden i vissa städer*, Norrköping: Socialstyrelsen, p. 39.

¹¹⁷ Kvarnström, Malmsten, and Nilsson 2000 p. 33-35. Cf. also the southern suburb (Chapter Three) and Anders Sterner and the suburbs of Linköping (Chapter Four).

¹¹⁸ Norrköpings stads fastighets- och länekontor, juni 1917.

water closets that the first sanitary committee feared in 1894 proved to have been right, and this remained even at the end of World War I.

Epilogue

The 1909 committee noted in 1915 that “the city of Norrköping is still lacking the simplest regulations for reasonably satisfactory sanitation in the yards, namely sanitary regulations [*renhållningsstadga*], which nowadays are hardly missing even in the smallest of cities . . .”¹¹⁹

The sanitary report of 1915 emphasized the final neutralization of the excreta from a hygienic point of view, but it is obvious that by neutralizing the investigators also meant utilization in agriculture. The leading idea in the report was the reclamation of waste. The farmers in and around the city in the 1910s were still dependent upon the city’s excreta and animal manure, which were collected in the same way as before and still were partly mixed with kitchen refuse and other waste. However, the latter contained more and more metal and glass waste, which made it less valuable as fertilizer. By suggesting separation of the waste at the source in the yards and by turning excreta into peat poudrette the committee wanted to solve these troublesome conditions.¹²⁰

The proposal for the dry collection of excreta and other waste that the sanitary committee of 1909 finally submitted to the City Council in early 1921 basically built on the same principles as the report of 1915. The reason for this was that the collection quite simply had not changed very much during these six years, or even the last 60 or 70 years. Apart from shifting ways of storing the excreta and other waste in yards (pits, receptacles, or boxes) – and of course the emergence of the water-carriage technology (the sewered cesspit and the water closet) – the same fundamental principles remained in the 1920s as in the 1850s. All different types of waste were mixed in receptacles, which were collected by farmers in or outside the city.¹²¹

The solution of the question of keeping the city clean and excreta management was put off until 1957 (!), when sanitary regulations were finally approved by the City Council.¹²² In the light of this maybe the goal of the

¹¹⁹ NSA, Norrköping City Council Archives, A IV ö:3, ”Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920”, report 1915.

¹²⁰ NSA, Norrköping City Council Archives, A IV ö:3, ”Renhållningskommittén: Renhållningsförslaget med tillhörande handl, 1916-1920”, report 1915, p. 10-17, 19-23, 26, 32. This was inspired by the prevalent waste management ideology of the day (cf., VAV, Documents of SKTF, 1903 §10, supplement No.2, ”Några synpunkter i fråga om det torra stadsaffallets eller sopornas uppsamling och undanrödjande”, Karl Tingsten).

¹²¹ NSA, Norrköping City Council Archives, supplement No. 2A 1921, p. 2, 29.

¹²² Färm and Helmfrid 1976 p. 119-120.

healthiest city in Europe was one of the ironies of history, but it is also important to remember that, in contrast to water and wastewater, the introduction of sanitary regulations and systems for the collection of excreta generally took a long time in Swedish cities.¹²³

Conclusion

In Norrköping, the conflicts in the *renhållningsfråga* revolved around three major issues, which involved different actor-networks. First of all, when the management of excreta was taken up in the early 1880s, it was the question of the sewerred cesspits which triggered debate. Just as an almost unanimous medical community, the physician-writer in *Norrköpings Tidningar* condemned the cesspits as unsanitary. However, J. G. Swartz and C. A. R. Lothigius, as well as the association of building owners, defended them, primarily on economic grounds, for it would be expensive to rebuild them and empty them regularly. When the question of the cesspits was taken up by the City Council, the discussion became quite bewildering. Lothigius, John Philipson, Fredrik Blombergh, and many others were really uncertain as to whether the cesspits were lawful. Clearly, as many council members were building owners and would save money on the *status quo*, they also wanted to see what the national authorities had to say about the cesspits from a sanitary and legal point of view. As it turned out, those who promoted the cesspits failed in the end, for the law clearly forbade cesspits, and medical expertise condemned them, whether they were sewerred or not. They were prohibited in Norrköping in 1893.

Secondly, after the sewerred cesspits had been forbidden, the debate mainly came to concern whether the collection of excreta should be a municipal task or remain in private hands. If the building owners could loosely be designated an actor-network in the question of the cesspits, here they were divided into the well off and the less prosperous, and those who supported the former or the latter without being property owners at all. The less well off building owners were often enlisted to further the interests of both actor-networks. The continued postponement of the matter resulted in the retention of the decentralized collection principles even after 1910.

Thirdly, parallel to this development the water closet was gradually accepted by all actors, including medical expertise and both these actor-networks, with the exception of the first sanitary committee. Water closets

¹²³ At the turn of the century 1900, only 38 out of 92 Swedish cities had introduced sanitary regulations, *renhållningsstadga* (Edvinsson 1992 p. 75; *Historisk statistik för Sverige. Del 1. Befolkning 1720-1967* 1969 p. 43).

were therefore both in theory and practice more and more separated from dry collection and became integrated into the sewer system. The Board of Health had been positive to water closets all along, but in the early 1900s it became an active promoter of them, so much so that they were seen as the major way of collecting excreta. As manufacturer and promoter of water closets, Arvid Palmgren can also be said to have been a central actor in both local and national WC development. Motala ström, with its rapid and abundant flow of water, was enrolled as the primary ally by Palmgren and all the other promoters of water closets. The national actor-networks of sanitary engineers and physicians were also crucial, and some of their members operated temporarily in Norrköping, primarily Holmberg, Linroth, and Richert.

Excreta Down the Drain? The Question of Keeping Linköping Clean

National Health Legislation and the Linköping Board of Health

At least from 1862, a permanent health board, *Sundhetsnämnd*, existed in Linköping, with a chairman and eight members. The responsibility of the Council of Magistrates was public order, health and morals, and it was natural that it had a representative in the *Sundhetsnämnd*. The mayor, Fredrik Stånggren, was chairman of the Magistrates, and he came to head the public health work in Linköping for decades, both in the *Sundhetsnämnd* and from 1875 in the Board of Health.¹ The *Sundhetsnämnd* made health organization better in Linköping, but yet a severe outbreak of smallpox struck the city in 1863. 271 people turned ill and 30 died, most of whom were children. The most important outcome of the epidemics was an increased interest on the part of the *Sundhetsnämnd* in preventing new ones, and the concrete results were for instance new general regulations for, and police supervision of, the cleansing of streets and yards, as well as new building regulations.²

Both the general and building regulations of 1866 had main objectives other than regulating sanitary and, what we would call, environmental conditions, but yet included many such provisions.³ The general regulations decreed, for example, the responsibility for building owners to clean pavements and gutters, to store manure and excreta in the cesspit, and to cover wells sufficiently.⁴ These decrees were inspired by a proposal for general regulations for Swedish cities that were under consideration by the cities at the time.⁵ The building regulations dealt with all aspects of building in the city, but also had much to say about drainage and environment. All public places, streets, buildings, and private yards had to be sufficiently drained with gutters, so as

¹ Nilsson 1994 p. 113-114, 147.

² Nilsson 1994 p. 115-117.

³ LiSA, Linköping City Council Archives, AI:1, AI:2 and AI:4, minutes 1863-10-27 §139, 1864-05-24 §59, 1864-07-12 §77 and 1866-02-06 §6.

⁴ Nilsson 1994 p. 117.

⁵ Sandberg 1978 p. 276.

not to be a nuisance to anyone. New tanneries and dye-works had to be built in the outer margins of the city, but not near River Stångån, in order not to contaminate it. The latter decree was also applicable to outhouses, pigsties, and dung hills. Cesspits were to be 1 to 1.5 meters deep, made of granite, and lined with cement, to protect the soil and the groundwater from pollution. The Council of Magistrates was responsible for supervision, assisted by the police.⁶

The newly established Linköping Board of Health expected much from the water and sewer systems, which can be seen in its first annual report for 1875.⁷ The board observed that the water in the wells of the city was more or less dirty, and that the river water was not very pure either. However, there was also the piped water, used by a limited number of inhabitants by the end of 1875, “which in all likelihood will be of good quality.” The following year the board verified that this piped water *was* in fact good. The nuisance and contamination resulting from leaking latrine pits and other floating filth would also be remedied to a great extent by the sewerage, according to the board. In late 1875, new local building regulations were established, and they decreed that every building owner was obliged to drain all stormwater and floating filth from his yard through the cesspool connected to the sewer system. The Board of Health, which was to oversee these particular sanitary regulations, believed this would make the yards clean and healthy, provided the decrees were followed.⁸

The daily supervision of the sanitary conditions of Linköping was done by the city police. The Board of Health did not have unsalaried inspectors such as the ones in Norrköping until 1878, but these only carried out larger inspections.⁹ In the summer of 1877, an inspection of all the yards in the city was started by the members of the Board of Health, although it was not finished that year. It had come to their knowledge that many building owners

⁶ LiSA, Linköping City Council Archives, AI:4, minutes 1866-02-06 §5. *Byggnadsordning för Linköpings stad* (Linköping 1866), §§1, 6, 10, 29 and 30.

⁷ The first Board of Health had the following members: Fredrik Stånggren, chairman, C. A. J. Wallin, city physician, Anders Fredrik Wigander, pharmacist, Carl Johan Fagerström, saddler, Carl Johan Sandin, merchant, Philip Svanfelt, manufacturer, and Johan Hjalmar Liedbergius, pharmacist (Nilsson 1994 p. 121).

⁸ LiSA, Linköping Board of Health Archives, AI:1 and AI:2, annual reports of the Board of Health for 1875 and 1876. *Byggnads-Ordning för Linköpings stad* (Linköping 1876), §6 mom. 2. These building regulations were built upon the national law *Kongl. Maj:ts nådiga Byggnadsstadga för rikets städer*, 8 May 1874, SFS, 1874, No. 25, for example, §§12, 22, 27, and 28. Building legislation existed also in Norrköping, but did not play the same role regarding the sanitary issues as in Linköping. Because building, health, and general regulations from 1875 onward overlapped, different cities emphasized or applied the laws differently, depending on the issue.

⁹ LiSA, Linköping Board of Health Archives, AI:3, AI:4, AI:7, and AI:11, minutes 1877-06-11 §26, annual report of the Board of Health for 1878, and minutes 1881-09-28 §28 and 1885-04-30 §18.

had not yet complied with the local building regulations. From 1878 the inspectors came to carry out these annual surveys.¹⁰

In the 1877 inspection, the yards in the city were to be checked. All the yards which were recorded, 106 altogether, had received some kind of remark. Almost all of these had some kind of defect on the cesspit or dunghill, often that they were leaking or overflowing. One example from the street Trädgårdsgatan, recorded in the notes of the city physician Carl Adam Johan Wallin, reads as follows: “Full, putrefying, open cesspit, which is leaking into No. 16 *Galgbomsgatan*. At the western boundary of the yard there is a ditch, which is filled with the most repulsive muck from No. 12 and 14 *Galgbomsgatan*.” Many inspected yards also had defective pigsties, which were often too crowded or leaking, but there were not many complaints about the stables.¹¹

Sewered Cesspits and Public Health Aspirations

The Public Health Act prohibited cesspits – even those that had been approved in the 1866 and 1876 local building regulations – and prescribed easily removable and watertight receptacles, which were to be placed above ground on a waterproof floor. However, with the building of the sewerage in 1875 many building owners saw an opportunity to improve their cesspits, which were already lined with cement and considered watertight, by connecting them to the mains in the streets. After all, in their view this was prescribed in the building regulations, which had taken the new sewer system into account. All yards should be connected to the sewerage, where it was extended, in order to drain the yard of stormwater and floating filth. The Board of Health also shared this interpretation of the building act.¹²

It was the view of the Board of Health that the sewer system was mainly for the drainage of groundwater and stormwater, but it is easy to see why the board also interpreted the building regulations as promoting the sewerage of cesspits. From 1877 onwards, it carried out annual inspections of all the city’s yards, and, as we have seen, cesspits, dung hills, and pigsties were often in a very poor condition. Despite the unlawfulness in the eyes of the National Board of Health, the draining of cesspits was a way of mitigating these poor

¹⁰ LiSA, Linköping Board of Health Archives, AI:3, minutes 1877-06-11 §23.

¹¹ LiSA, Linköping Board of Health Archives, AI:3, notes from inspections of the Board of Health in June and July 1877.

¹² *Kongl. Maj:ts nådiga Helsewårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68, §17; *Byggnadsordning för Linköpings stad* (Linköping 1866), §10; *Byggnads-Ordning för Linköpings stad* (Linköping 1876), §6; LiSA, Linköping Board of Health Archives, AI:2, annual report of the Board of Health for 1876, and AI:3, minutes 1877-05-23 §19, 1877-06-11 §22, and 1877-10-08 §44.

environmental conditions without too much trouble. After all, it was very difficult for the board to assert its authority and really to make a change as regards the sanitary conditions. By sticking to this interpretation of the local building act, it could achieve supposedly lawful improvements, while at the same time it did not have to ask property owners to fill in their cesspits and buy tight receptacles, which would have been expensive for them.¹³

In the early 1880s, the difficulties in bringing about any real sanitary improvements in the yards of the city became all too obvious, despite the existence of water supply and sewerage in 88 percent of the yards in 1884.¹⁴ In 1882 the Council of Magistrates suggested a comprehensive sanitary investigation of Linköping, for several reasons. First of all, the council was influenced by the national development, for the question of cleaning up the cities had begun to attract the attention of city governments all over Sweden. Any shortcomings could easily result in higher morbidity and mortality, so the Magistrates wanted to examine the sanitary conditions before anything serious happened. But, secondly, there had been a number of unexpected side-effects of the sewers. The cesspools sometimes did not function properly, and solid waste therefore reached the mains in the streets and caused stoppage. The river water was also contaminated by effluent from the cesspits, the few water closets, and from commercial and industrial activities. Thirdly, the Magistrates were concerned about health aspects of general sanitation, especially storage and collection of excreta, and wanted to appoint an investigative committee.¹⁵

The investigation took three years to finish, and, meanwhile, the newly-appointed city physician Oscar Segerdahl worked to intensify the public health efforts in the city. At a meeting with the Board of Health in the spring of 1884 he expressed his concerns about the increased cases of epidemic disease the past few years (see Table 6.1). He was especially worried about the typhoid fever epidemic of 1882 and 1883, which had resulted in 22 deaths. What was especially troubling was the fact that the epidemic had not been confined to any particular part of the city but was evenly spread throughout, which meant that poor conditions in a certain district could not be the cause.¹⁶

¹³ LiSA, Linköping Board of Health Archives, AI:1, annual report of the Board of Health for 1875, AI:3, notes from inspections of the Board of Health in June and July 1877, AI:6, minutes 1880-10-30 §43; Nilsson 1994 p. 120-125.

¹⁴ Nilsson 1994 p. 153.

¹⁵ LiSA, Linköping City Council Archives, AI:20, minutes 1882-08-29 §89 and 1882-09-26 §94.

¹⁶ LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22.

Table 6.1. *Excerpts from annual reports to the National Board of Health about epidemic disease in Linköping, 1878-1883, number of people taken ill.*

Disease	1878	1879	1880	1881	1882	1883	Total
Scarlet fever	48	5	4	2	10	84	153
Diphtheria	10	0	2	2	24	72	110
Typhoid fever	23	5	5	13	61	69	176
Total	81	10	11	17	95	225	439

There was a pandemic of these diseases in Europe and Sweden from the 1860s until the turn of the century 1900 (Source: LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22; Nelson 1994).

Since not only typhoid but also other epidemics increased in the beginning of the 1880s there must have been another factor at work, and Segerdahl's conclusion was that it had to be a factor common for the whole city. Crucial, in Segerdahl's opinion, was the still very widespread and leaky cesspits that contaminated the soil with organic material and thereby dramatically increased the danger of epidemic disease, particularly typhoid fever:¹⁷

In almost every yard in the city there are still the so-called latrine pits, which are nothing else than excavated pits, often without stone paving in the bottom and usually with very leaky covering of stone or wood on the sides. Because of this there is absolutely no guarantee that the content of these pits – which is solid as well as floating excrement from humans, domestic refuse, sweepings, animal droppings, etcetera – will not penetrate and contaminate the soil around them.¹⁸

Segerdahl enlisted contemporary medical expertise – which unanimously condemned the cesspits, even those sealed with cement or made of brick stone – primarily because the pits sooner or later contaminated the soil and thereby generated potentially dangerous miasmas.¹⁹

¹⁷ LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22.

¹⁸ LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22.

¹⁹ LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22. Segerdahl referred to the member of the National Board of Health, O.F. Hallin, and his book *Allmän Helse- och sjukvårdslära*, which was published with another title the year after (Hallin 1885 p. 96-97). He also enlisted the German public health administrator Dr. Gustav Wolffhügel of the Hygienic Institute in Munich, a follower of Pettenkofer and eager promoter of the water-carriage technology (Münch 1993 p. 102).

Apart from these arguments, there was also the legal one. The Public Health Act clearly condemned the cesspits, and Segerdahl even cited the supplement to the act, which underlined this. He also suggested that the health inspectors and even the board itself had misunderstood the law, since they regularly made inspections and yet the cesspits were still there. The practice of connecting the cesspits to the sewerage, which was an illusory improvement since they were often leaky anyway, was also an obvious violation of the act. Segerdahl demanded a very strict inspection this year, with minute observation of each and every cesspit, and, if they were not satisfactory, he recommended that they should be replaced with tight receptacles above ground, in line with the Public Health Act. He thus yet seemed to be willing to accept the cesspits if they were in very good condition, which was probably a compromise in order to see his improvements through. The board accepted both his requests.²⁰

The city physician continued his health crusade in Linköping, thereby making himself the central figure for an actor-network in favor of improved public health. The following year he proposed more frequent emptying of the cesspits than only two to three times a year or when the pits were overfull. He proposed that the cesspits should be emptied and cleaned once a month from October to May, and once every two weeks from June to September. The supervision of these new rules was to be carried out by four policemen. The board eventually resolved to use the one-month interval all year.²¹

The board's new tough attitude in matters of public health and sanitation in Linköping had begun to be implemented in 1884 and 1885, but it met with resistance from rather an unexpected direction – the County Governor. After all, the National Public Health Act clearly forbade cesspits. The County Governor was the arm of this law in the city and the court of appeal in questions concerning its application, and still he accepted them. The judge Emil Schreiber was the representative of the widow and house owner Göta Frisell, who in 1884 had been requested by the Board of Health to rebuild her cesspit in accordance with §17 of the Public Health Act. Schreiber pointed out to the County Governor that the cesspit was legal according to earlier regulations (the 1866 local building act), and that it was now lined and would meet the requirements of §17, which meant that it was unnecessary to rebuild it. Besides, latrines above ground could also be a sanitary nuisance to

²⁰ LiSA, Linköping Board of Health Archives, AI:10, minutes 1884-04-26 §22, 1884-06-10 §23, 1884-07-02 §33, and 1884-09-29 §46; *Kongl. Maj:ts nådiga Helsowärdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68, §17; Supplement to the Public Health Act, "Råd och anvisningar" in Kullberg 1877 p. 500-501.

²¹ LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-02-27 §12, 1885-03-30 §16, and 1885-04-30 §19.

neighbors. Schreiber was also of the view that before cesspits were rebuilt in the city, the question of collection should be addressed properly.²²

The Board of Health was asked to reply to this, and by and large, it repeated Segerdahl's arguments. He may have actually written the reply. The Council of Magistrates was also asked to comment on this question and its letter is quite remarkable. The council acknowledged the power of the Public Health Act and its supplement, and also seemed to agree about the health hazards of cesspits. Nevertheless, the council argued against the rebuilding of Göta Frisell's cesspit. The bottom line of the argument was that the Public Health Act could be adjusted to fit earlier local regulations or conditions, if it was financially necessary, that is, if it was too expensive for the owner to obey the national act. Furthermore, the collection issue had to be dealt with if the act was to have any effect at all. Since there was a sanitary investigation going on it would be wiser not to spend money in vain on isolated cases, but rather to await its report. The County Governor found these and Schreiber's arguments convincing, and thus invalidated the decision of the Board of Health. Since the cesspit had been sufficiently improved, there was now no potential sanitary danger.²³

A parallel case was also dealt with by the County Governor on the same day. Captain Gustaf Bäckström, who was a member of the health committee, Carl Fredrik Ridderstad, the owner of the local newspaper *Östgöta Correspondenten*, as well as 13 other building owners had been told to rebuild their latrines in accordance with §17 of the Public Health Act. As yet there was no overall plan for the management of excreta in the city, but since there was an investigation of this matter going on, they asked to be allowed a respite until the study was completed. A sudden change to a new construction was not good, especially when there was no plan for collection. Collection was not in any way facilitated by the city, but the building owners were completely in the hands of the farmers, according to them. The Board of Health dismissed this indefinite postponement of compliance with the act, for the investigation was not yet finished and could be further delayed. The Magistrates again opposed the board, on the grounds that the investigation was soon to be finished, and so did the County Governor.²⁴

It is possible to discern two opposing actor-networks in the controversy over the cesspits – the one promoting public health interests, represented by Oscar Segerdahl and a majority of the Board of Health, and the other promoting economic interests, represented by a majority of the Council of

²² LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-04-30 §24.

²³ LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-04-30 §24.

²⁴ LiSA, Linköping Board of Health Archives, AI:10 and AI:11, minutes 1884-09-29 §46, 1884-11-28 §71, and 1885-04-30 §25.

Magistrates. Whose economic interests did the latter want to defend? It was probably local economic interests, primarily the building owners' financial interests. It is ironic that *Magistraten*, which was the state representative in the city, opposed a law imposed by the state. However, the Council of Magistrates generally played a very ambiguous role in town administration, since it was to watch over both the interests of the city and the state.²⁵

The Board of Health was thus effectively hindered from implementing the National Public Health Act and trying to improve the sanitary conditions in Linköping. The main obstacles were, surprisingly enough, the County Governor and the Council of Magistrates. A resigned board now decided to have the above building owners, as well as a great many others who had received similar notations in the last year's inspection (altogether around 40), either line their cesspits *or* replace them with tight receptacles above ground. Furthermore, there was to be no annual inspection of the cesspits in 1885.²⁶

In 1885, the board instead relied on the regular police inspection of the city's cesspits. However, these inspections show that the police had great problems in getting people to empty their latrines. Few people had emptied them at the first inspection, but most of them did after being ordered to do so, although the first "monthly" inspection lasted from the beginning of March through the month of May. The annual report for 1885 expresses resignation about the cesspits in Linköping. Most yards still had cesspits, which were sometimes paved and lined with cement but were often very leaky. Some pits were just holes without any covering at all.²⁷

The Local Sanitary Investigation, 1882-1885

In early 1885, the local sanitary investigation was finished. The investigation was comprehensive in character and addressed all kinds of sanitary and public health issues in Linköping, also including, for example, sanitary measures for the cemetery and the gasworks (see also Chapter Four). Due to the central inspection by Klas Linroth the same summer, it was not until almost a year later that the local report was discussed in the City Council. The mayor and the Council of Magistrates had expected the central inspection to be a good guide for the local public health work, but in early 1886 no report had yet

²⁵ Kaijser 1986 p. 24-25.

²⁶ LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-05-19 §§31 and 32, annual report of the Board of Health for 1885.

²⁷ LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-06-25 §§37 and 38, annual report of the Board of Health for 1885.

arrived from the National Board of Health, so the local report was submitted to the City Council.²⁸

Here it will suffice to concentrate on the management of excreta in relation to the sewer system. The primary target of the committee's criticism was the defective cesspits (see Table 6.2). The potential health hazards of the cesspits were taken up in much the same fashion as Segerdahl did in the Board of Health in 1884 (he was also a member of the committee). The bottom line was that fecal matter and other floating filth invariably penetrated and contaminated the soil, which led to such epidemics as typhoid fever, dysentery, and cholera. It was not just the leaky cesspits that were dangerous, however, for even well-sealed cesspits would inevitably become leaky and cause contamination. The practice of connecting them to the sewers was completely condemned as well, which was strengthened by English experience, although the English actually tolerated an improved form of brick cesspits.²⁹

Table 6.2. Results of the Board of Health's inspection of the city's sanitary installations in May 1884.

	Number of latrines	Latrines in %
Stone-paved cesspit, lined with cement or other material (seemingly tight)	54	14.0
Stone-paved cesspit, but poorly lined or unlined	142	36.9
Pit with defective stone or wood covering, or no covering at all	108	28.0
Big or small, tight wooden box	57	14.8
Big, leaky wooden box	6	1.6
Tight bucket	5	1.3
Box with cement floor, above ground	7	1.8
Water closet	6	1.6
Total in 368 yards	385	100

Source: Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885 (*Linköping 1885*), p. 8.

²⁸ LiSA, Linköping Board of Health Archives, AI:11, minutes 1885-05-19 §33; Linköping City Council Archives, AI:24, minutes 1886-02-23 §30; *Handlingar till frågan om förbättrade Helsovårdsanordningar i Linköping* (Linköping, 1886), p. 3; *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885). *Magistraten* and the City Council jointly appointed the members of the committee, who were the following: The mayor and chairman of *Magistraten* and the Board of Health Fredrik Stånggren, the city physicians Oscar Segerdahl and Ernst Boman, the bank director August Neuman, the judge Fredrik Carlsson, the postmaster Karl Westman, and Captain Gustaf Bäckström.

²⁹ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 8-9.

The argument drew strength from the most prominent Swedish medical authorities of the day, for example, the member of the National Board of Health O. F. Hallin (1885)³⁰ and Professor Elias Heyman (1877).³¹ From the latter the committee cited several pages about the disadvantages of the cesspits. Apart from what has already been mentioned the committee continued, in the words of Heyman: “Contamination of soil and house foundation, possible infection of drinking water in wells, impure air in dwellings are the sanitary nuisances that . . . are the results of this system of sanitation.”³² The transportation of the content of the cesspits, Heyman continued, was often taken care of by farmers, but the sanitary nuisances of the collection were great, particularly in the summer. There was also the problem of supply and demand, which was the same in Norrköping and most other Swedish cities (see discussion in Chapter Five).³³

The health committee put forward three different alternatives for the collection of excreta in Linköping. The first one was the cesspits, which had already been condemned. The second alternative was the water closet, and the board listed the usual advantages and disadvantages, stressing the former (see Chapter Five).³⁴ But the committee picked out the arguments it thought fit. Elias Heyman, on whose book the argument was based, advanced many other arguments, particularly against water closets. He was not worried about the self-cleaning glazed earthenware sewers, for English, German, and American experience showed that, provided the inclination of the pipes and the water supply were sufficient, fecal matter was easily disposed of. He prescribed very strict regulations for water closets, however. For example, there had to be an ample water supply, good ventilation of the sewers, and strict sewer supervision. He even considered it necessary to purify the sewage if a city was situated far upstream or on a very small river, due to the great danger of contaminating the watercourse.³⁵ He quoted examples from France (the Seine)

³⁰ Hallin 1885.

³¹ Heyman 1877. Heyman was one of the earliest to write extensively and comprehensively about sanitation and the question of cleaning up the Swedish cities. The committee drew a good deal of inspiration from Heyman’s work, and Heyman, in his turn, took nearly all his examples from abroad, from Great Britain, Germany, France, Switzerland, and the USA.

³² *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 10. This quote was taken from Heyman 1877 p. 29.

³³ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 10-11; Heyman 1877 p. 30-31.

³⁴ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 14-15; Heyman 1877 p. 103-104.

³⁵ This view was also shared by, for example, the British sanitary engineer J. Bailey Denton (Denton 1877 p. 248-272).

and from British cities where waterways were very contaminated due to excrements and industrial waste.³⁶

The committee did not want to recommend WC's generally, because further contamination of the water in the river Stångån could be detrimental for the city, but the Board of Health would be allowed to approve the installation of individual water closets, if they did not cause any sanitary nuisance. In other words, the water closets were only for the few well-to-do in the city, most of whom were also members of the City Council, ensuring convenience for the upper class. They were thus the only ones who could afford and had the right to contaminate the river water with excrement from water closets.³⁷ Elias Heyman had also warned against installing water closets in the dwellings of the poor. They were not capable of using and maintaining this ever-so-simple apparatus, which, he thought could lead to stoppage in the pipes, overflowing sewers, and eventually danger to the public health.³⁸

Water closets were used in Linköping, but were not introduced as early as in Norrköping. The water flow in Stångån was decidedly lower, and, in contrast to Norrköping, the buildings along the water were inhabited mostly by the lower class and there were few industrial establishments. The Board of Health came to grant the permits for WC's, and the first ones were installed in early 1878. It was the bank director G. R. Westman and the physician L. A. Åman, both members of the City Council and prominent citizens, who wanted to have water closets installed in their new houses on Kungsgatan, a popular new street for the affluent.³⁹

There continued to be some installations the following years, and the city physician C. A. J. Wallin was to oversee that they were lawfully installed. What exactly was considered legal or not is uncertain, since neither the Public Health Act and its supplement nor the building regulations had anything to say about the installation of water closets. They were installed in houses, public buildings, and outhouses in the yards. In 1887 there were still only about 10 water closets in the whole city, and in 1898 they were around 30.

³⁶ Heyman 1877 p. 70, 78-90, 103-104. Heyman took most of his British examples from *Third Report of the Commissioners Appointed to Inquire into the Best Means of Preventing the Pollution of Rivers* (London 1867) and *Third Report of the Commissioners Appointed in 1868 to Inquire into the Best Means of Preventing the Pollution of Rivers* (London 1871).

³⁷ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 15. Cf., the argument of the sanitary committee in Norrköping, Chapter Five. See also Lundgren 1994 p. 62 for a similar argument about the water closets and the ruling elite.

³⁸ Heyman 1877 p. 77.

³⁹ LiSA, Linköping Board of Health Archives, AI:4, minutes 1878-03-11 §11; Lundberg and Nordström 1962 p. 178-189; Marks von Würtemberg 1955 p. 49-50.

While the number may seem small it was more than in most Swedish cities at the time.⁴⁰

The third alternative was tight removable receptacles above ground, which was what the Public Health Act decreed. The receptacles, which were to keep excreta, kitchen refuse, and other solid waste apart, should be collected frequently and be replaced by clean ones. In this way contamination of both soil and air could be prevented, infectious matter could easily be neutralized, and excreta could conveniently be used as fertilizer in agriculture, either in itself or in the form of poudrette. The committee could only see one drawback, the tricky business of carrying out *frequent* collection. This was a major problem in many Swedish cities. Therefore it was important to keep them under strict supervision, and this could only be done effectively if they were collected by the city for a fee.⁴¹ There was also a fourth alternative, the pneumatic Liernur system,⁴² which was dismissed right from the beginning without even any discussion of it.⁴³

The committee's conclusion was that the receptacles were preferable for Linköping. They were motivated with the above argument but also with the fact that they were prescribed by the Public Health Act. The committee even studied how the collection of excreta was carried out in other Swedish cities, for instance, in Stockholm, Göteborg, and Malmö, which strengthened the conclusion that receptacles were the best, although there were to be practical difficulties in the implementation. These difficulties could be overcome if municipal organization and strict regulations were imposed. (Prominent British experts rejected the receptacles, however.) Although the committee

⁴⁰ LiSA, Linköping Board of Health Archives, AI:4, AI:5, and AI:11, minutes 1878-04-08 §13b, 1879-08-27 §24, and 1885-11-30 §60; "Helsovårdsnämnderna", *Bidrag till Sveriges officiella statistik. K/ Helso- och sjukvården I. Medicinalstyrelsens årsberättelse för 1887*, Stockholm 1889, p. 2; NSA, Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till . . . II. Om Renhållningsfrågan och Renhållningsväsendet i åtskilliga svenska städer" by Carl Otto Björck, p. 48.

⁴¹ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 15-16, 24-25; *Kongl. Maj:ts nådiga Helsovårdsstadga för riket*, 25 September 1874, SFS, 1874, No. 68, §9.

⁴² This technology utilized atmospheric pressure instead of water to transport excreta in tight receptacles through underground pipes. Although there were great expectations both in Sweden and other European countries on this technology, by the mid-1880s it had been applied on a large scale only in a few European cities, and therefore had lost some of its initial attraction. It had sanitary and environmental advantages since it prevented contamination of soil, air, and water, and the waste could be used as manure. But stoppage in the pipes was common, and a Liernur system was also very expensive (Lange and Otterpohl 1997 p. 14-18; Wetterberg and Axelsson 1995 p. 72-75). Elias Heyman acknowledged both advantages and disadvantages, but believed that the Liernur technology was primarily something for the future (Heyman 1877 p. 104-114).

⁴³ The outline of sanitation technologies in this manner was partly taken from Heyman 1877 p. 28-114.

agreed with the medical expertise and the National Board of Health that the cesspits were to be condemned, it also saw the practical difficulties in abolishing them altogether in the city. The decrees in the National Public Health Act of 1874 were quoted, and so was its supplement. In the latter the committee found support for a broader interpretation; it wanted to permit tight cesspits.⁴⁴

The County Governor, the Magistrates, and the health committee compromised with contemporary public health ideals in allowing for continued use of the sewered cesspits. The reasons for this were economic, and they interpreted the Public Health Act to suit their own view. For there were economic interests at stake here, particularly for the building owners, because a good deal of money would be needed to change from the pits to receptacles. In contrast to Norrköping, a great majority of the Linköping latrines were cesspits (ca. 80%, see Table 6.2), which explains the political force of the building owners in this matter. And many of these were influential citizens, represented in *Magistraten*, the committee, and on other boards.

The committee's view of the best ways of collecting excreta was included in a proposal for sanitary regulations for Linköping. The mayor Fredrik Stånggren did not entirely agree with all the proposals of the committee. His main point was that the receptacles were not as good as had been claimed by the committee, and that the important thing was that the collection of excreta was made a public concern, sponsored by public means. So, he proposed municipal organization and regulation of the collection. Furthermore, he thought that even the older and less tight pits should be approved, for the important issue was public regulation, not the collection itself.⁴⁵

The Aftermath of the Investigation – A Lengthy Public-Health Debate

The investigation was directly submitted to the Board of Health, which discussed it at a meeting in May 1886, and was utterly divided regarding the

⁴⁴ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 12-13, 16-26, 34-35; Supplement to the Public Health Act, "Råd och anvisningar" in Kullberg 1877 p. 500-501; Wawrinsky 1887 p. 5-6. It was human excreta that was considered dangerous, which was why the leaky cesspits were so feared. But since the tight cesspits continued to be accepted for human excreta even animal droppings, kitchen refuse, and other solid waste were allowed in the pits, just as it used to be. The ambition to separate different kinds of waste was therefore not pursued, not even in the mind's eye (Drangert and Hallström 2002).

⁴⁵ *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 29-35.

key issue about the receptacles versus the old cesspits. Oscar Segerdahl adhered to his previously asserted position, which he very likely did in the committee too. However, the committee also consisted of the defenders of the cesspits and the building owners' economic interests – Gustaf Bäckström, who had refused to fill in his cesspit, and partly Stånggren, who also represented the Magistrates. We do not know what interests the rest of the members defended, but Segerdahl probably only had his public health comrade Boman and perhaps someone else at his side, and the result of the committee's work was a compromise, a clear defeat for a person who had invested so much prestige in getting rid of the cesspits. It is therefore possible that Segerdahl waited for this opportunity to express his opinion.⁴⁶

Segerdahl repeated his previous arguments but could now enlist a new powerful ally in his actor-network. The County Governor's decision about the cesspits of Bäckström, Ridderstad, and others had now been appealed to the Swedish Government. After having also heard the opinion of the National Board of Health, *Kungl. Maj:t* had decided to declare this decision null and void, which thus gave Segerdahl the power to condemn the cesspits on behalf of the very highest medical and political authorities. Furthermore, he referred to the central health inspector Klas Linroth's rejection of the committee's proposal as regards the cesspits. The wholesale dealer Carl Thorngren and the pharmacist and member of the Magistrates Johan Hjalmar Liedbergius agreed with Segerdahl, and were thus also enrolled in his actor-network.⁴⁷

The factory owner Germund Linde, the saddler Carl Johan Fagerström, and the pharmacist Anders Fredrik Wigander all supported the committee's proposal, that is, they wanted to allow for both receptacles and cesspits, which also meant support for the actor-network promoting the economic interests of the building owners. They dismissed all the medical expertise that Segerdahl had enlisted, and instead leaned on an examination by the Norrköping Board of Health of a number of cesspits in Norrköping, which had shown that the adjacent soil had not been contaminated (see Chapter Five): “[E]xperience thus does not seem to support the assumption that even a well-cemented cesspit should cause contamination of the soil,” they concluded. They also believed that the receptacles would be too expensive.⁴⁸

Fredrik Stånggren represented a third view on the issue, which can be said to have been somewhere in between the other two, but closer to the com-

⁴⁶ LiSA, Linköping City Council Archives, AI:24, minutes 1886-05-25 §75; *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 4-7.

⁴⁷ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 4-11.

⁴⁸ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 7-8 (including quote).

mittee's than to Segerdahl's. Stånggren stuck to what he had said in connection with the committee's investigation. He emphasized that a prerequisite for a complete implementation of the receptacles was well-functioning transportation, which was missing in the proposal. He relied on the report by the central health inspectors Robert Schultz and Klas Linroth, based on their inspections of the Swedish cities: "[W]ithout the said prerequisite the system of receptacles entails so many nuisances that we have to regard it as inferior to a well-organized system of cesspits, that is, where the pits are cemented and not emptied too seldom." Stånggren therefore proposed that the cesspits should be accepted *until further notice*.⁴⁹

The Board of Health thus could not come to agreement on a statement, but just accounted for the three different views that had surfaced at the meeting. The City Council appointed a so-called reinforced Drafting Committee to deal with this particularly difficult case. The rules of the game had changed since the last resolution of *Kungl. Maj:t* in early 1886, which condemned the cesspits of Bäckström and others. The Drafting Committee thus suggested that the City Council appeal to the Swedish Government that it should be permitted to build and use well-sealed and -drained cesspits in Linköping on certain conditions. They had to be placed in spacious yards, at least 6.5 meters (20 feet) from the nearest house or street, and they also had to be approved by the Building Board. The provincial physician Nordenström and the chairman A. G. Örn had reservations about this decision.⁵⁰

The only person who very actively worked against the cesspits was Oscar Segerdahl – his colleague Nordenström, as well as some members of the Board of Health were also part of his actor-network – but he was fighting an uphill battle. The actor-network promoting the cesspits was bigger and more powerful, from the County Governor Robert De la Gardie, a majority of the Magistrates, and the reinforced Drafting Committee to the building owners with Bäckström and Ridderstad at the head. Furthermore, those who did not work actively for them, such as Stånggren, still wanted to have the cesspits, at least for the time being.

⁴⁹ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 8 (including quote). The report was published in *Hygiea* 1886 p. 169-184 (quote on p. 181). This quote was taken out of context by Stånggren, for in the next paragraph Schultz and Linroth wrote that the best way of collecting excreta from a hygienic point of view was using receptacles. Their point was that there had to be a central, municipal organization of the collection, regardless of what system was used. Nevertheless, the report gave some support to the argument that what was failing was primarily the collection, not the storage.

⁵⁰ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 4, 14; LiSA, Linköping City Council Archives, AI:24, minutes 1886-05-25 §75, 1886-08-31 §87, and 1886-10-26 §111. The five extra members of the Drafting Committee were the pharmacist Frans Gustaf Lundgren, the builder Oscar Nylander, the judge Emil Schreiber, the provincial physician Henning Nordenström, and the merchant J. Almqvist.

In early 1887, the engineer Axel Lindeberg joined the ranks of the cesspit-proponents. He had been informed that Kungl. Maj:t had made some exceptions from the Public Health Act in Stockholm, and hoped that this was an opportunity to have the cesspits approved. Linköping had such an advantageous sewer system, laid in sharply inclined slopes down to a larger waterway. According to Lindeberg, when the act came into force in 1875 no Swedish city as yet had piped sewerage, which was why he thought cesspits connected to sewerage would be accepted by the Swedish Government. In other words, this was a good solution and in Linköping the conditions were particularly favorable. Lindeberg cannot have had much contact with the medical community, for sewerage cesspits had often been condemned, as we have seen. There were Swedish sewer systems in existence before 1875 in Göteborg and Norrköping (see Appendix 1, Table 2), and even there cesspits had been connected. His proposal was submitted to the reinforced Drafting Committee.⁵¹

A few months after this, the Drafting Committee presented its new proposal for sanitary regulations for the city. It was largely based on the health committee's previous proposal. For instance, there was to be no municipal responsibility for the collection, as Fredrik Stånggren had wished (for once, he had not participated in the investigation). It was still to be in the hands of either the private property owners, or entrepreneurs approved by the Board of Health, who would regularly collect the human excreta, animal manure, kitchen and other solid waste from the yards for an annual fee. As in Norrköping, the freedom of the individual building owner was obviously holy, and in Linköping urban agriculture that utilized the nutrients in the waste was also important.⁵²

The most controversial issue so far had been the cesspits, and the Drafting Committee actually seemed finally to have proposed their definitive abolition, in order to comply with the Public Health Act. But when reading §1 of the proposed regulations one is struck by the vagueness of the formulation – it is actually very difficult to understand the meaning – something which the provincial physician Henning Nordenström also pointed out and for which he demanded an explanation. Receptacles, water closets, and even cemented boxes above ground with connection to sewerage were allowed, and it almost

⁵¹ LiSA, Linköping City Council Archives, AI:25, minutes 1887-02-22 §38, supplement EI:7, 1888 §70.

⁵² *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1888), p. 1-7; LiSA, Linköping City Council Archives, AI:25, minutes 1887-05-31 §73; Drangert and Hallström 2002; Hellspång and Löfgren 1994 p. 204-206.

seems as though the obscure wording was deliberate so as to allow even for the old cesspits.⁵³

This was at least how the Board of Health interpreted the formulation in a letter in early 1888, which also included the board's own proposal for sanitary regulations. The board brought forth new arguments against the cesspits, this time solely of a legal nature. It was now very clear that the Swedish Government would not overlook the cesspits anymore, because both the Government and the County Governor in Östergötland had rejected the Norrköping City Council's request to be allowed to use the sewerred, cemented cesspits, instead of what was prescribed by law. The National Board of Health had also written a letter to the board to state that the cesspits were in fact not legal. Furthermore, the proposed above-ground boxes were equally poor, which was confirmed by the health authorities in the city of Lund, the only Swedish city with such installations. Otherwise the proposals for regulations made by the Drafting Committee and the Board of Health were almost identical, and even very similar to the first proposal by the committee.⁵⁴

Emil Schreiber issued his own statement in defense of the cemented boxes above ground. The interpretation of the Board of Health in its recent letter was in his view completely wrong, for the intention was to improve all old latrines and to comply fully with the Public Health Act. He resolutely contradicted such interpretations that the boxes above ground were the same as cesspits, but at the same time the boxes were not removable, so they were not entirely legal anyway. The boxes were by no means as dangerous as the board wanted to make out, and Schreiber at least wanted to prevent the city from unnecessary experimentation with different solutions for collecting excreta. It is unclear whether Schreiber's intention was to defend these boxes, which were very unusual in Linköping (see Table 6.2), or to force through legislation that would ultimately allow retention of the cesspits.⁵⁵

The Public Health Debate Comes to a Close

After much discussion the City Council in 1888 approved tight removable receptacles, as decreed by the Public Health Act, with the exception of boxes above ground temporarily. Water closets were also to be allowed, after having been approved by the Board of Health. Not only floating filth from stables but

⁵³ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1888), p. 1-8.

⁵⁴ *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1888), p. 9-15.

⁵⁵ LiSA, Linköping City Council Archives, AI:26, minutes 1888-05-29 §70.

also urine from the latrines could be drained to the sewer system. Thus, in practice, the City Council accepted the sanitary regulations of the Board of Health, except for §1 and a few minor additions.⁵⁶ But these additions were significant for the proponents of the cesspits, since they allowed for fixed cemented latrines and connections for liquid waste to the sewerage, installations that were sometimes difficult to discern from cesspits.⁵⁷

The County Governor, who had to approve the regulations before they could come into force, required less frequent collections. He also wanted to relax the regulations for manure on the outskirts of the city, probably as a way of facilitating the work of urban farmers.⁵⁸ The County Governor made the attempts on the part of the local authorities to introduce strict, uniform sanitary regulations for the whole city more difficult. In a sense, therefore, he added to the ambiguity of the sanitary regulations. The debate about the receptacles had resulted in a compromise, and the issue of excreta and waste transportation in Linköping also seemed half-hearted. Fredrik Stånggren had been a strong proponent of municipal takeover of the collection, but the proposal of the Board of Health did not support this view. It was instead in favor of the voluntary hiring of special entrepreneurs for those building owners who wished to have their waste collected. For those who did not want to pay the entrepreneurs there was also the possibility to make other arrangements.

Implementing the Sanitary Regulations in the 1890s

Finally, with the above changes the sanitary regulations for Linköping were approved by the County Governor in June 1889.⁵⁹ The 1890s became a decade of trying out the new regulations. First of all, the city needed to hire entrepreneurs for those who did not want to take care of the excreta collection themselves, and eventually one person was appointed for this assignment, the

⁵⁶ LiSA, Linköping City Council Archives, AI:26, minutes 1888-05-29 §70; Account of the City Council meeting 1888-05-29 §70, ÖC 1888-06-01.

⁵⁷ The only member of the reinforced Drafting Committee who were part of Segerdahl's actor-network was Henning Nordenström, but he had a patient to attend to out of town when the meeting was held and was therefore absent. The pharmacist Frans Gustaf Lundgren was a new member of the Board of Health since 1887, and his views of the cesspits are therefore unknown. Those who supported the addition about the cases were Nils Östling, A. G. Örn, H. Petri, Frans Gustaf Lundgren, and O. Nylander.

⁵⁸ LiSA, Linköping City Council Archives, AI:26 and AI:27, minutes 1888-11-27 §129, 1889-02-26 §37, and 1889-03-26 §49.

⁵⁹ LiSA, Linköping City Council Archives, AI:27, minutes 1889-08-27 §86; *Renhållnings-Stadga för Linköping. Af Konungens Befallningshafvande i Östergötlands län fastställd den 11 Juni 1889* (Linköping 1889).

builder A. G. Johansson. Another important thing was to find appropriate dumps for all the waste. The decreed collection of human excreta, animal manure, kitchen refuse, and other waste once every two weeks meant moving the storage problem somewhere else, since fertilizer was not needed all the year around. Hence there was a need for rather large repositories in close proximity to agricultural fields. When manure was in demand it was easy and inexpensive for farmers to fetch it there. A combined effort in 1890 by the Financial Department and the Board of Health resulted in the establishment of three such spots.⁶⁰

The Question of the Health Police

The sanitary investigation of 1885 pointed out some general problems with the Linköping sewerage. According to the health committee, Richert's self-cleaning sewer pipes were necessary in order to avoid the harmful sewer gas.⁶¹ But since gravity was utilized the sewage had to be discharged into the river where it was topographically most appropriate. Unfortunately, as in so many other cities, the sewage outflows were therefore placed in the city instead of as far downstream as possible. The committee thus suggested the clearing out of the river near the outlets at least twice a year, as well as the cleaning and flushing of cesspools at least twice a month. In each yard with sewerage there also had to be piped water. Over all, a sewerage inspector was needed to oversee both the sewer mains and street drains, the private service pipes and cesspools, as well as most other public health issues. In practice this was a health policeman.⁶²

The Board of Health approved of the combined sewerage inspector and health policeman and his tasks in early 1886, but most members wanted there

⁶⁰ Nilsson 1994 p. 129; LiSA, Linköping City Council Archives, AI:27 and AI:28, minutes 1889-08-27 §91, 1889-12-30 §151, and 1890-05-27 §56; *Renbållnings-Stadga för Linköping. Af Konungens Befallningshafvande i Östergötlands län fastställd den 11 Juni 1889* (Linköping 1889), §§3-6.

⁶¹ Sewer gas was the gas emanating from putrefying fecal and organic matter in the sewers. Being based on a version of the miasmatic theory, the sewer gas was thought to return through the pipe network into houses, yards, and streets, and cause disease. Thomas Southwood Smith, British physician associated with Chadwick, believed the remedy against sewer gas was self-cleaning sewers, flushed with a lot of water. The American sanitary engineer George E. Waring Jr., on the other hand, promoted separate sewers with flush tanks to avoid the sewer gas, as the excreta could be flushed out of houses more quickly, before decomposition started. Most engineers thought that a good engineering construction was the most important thing, however, and that neither the separate nor the combined design was to be preferred from an etiological point of view. Well-built sewers were by definition clean and free from whatever putrefying matter caused disease (Hamlin 1998 p. 17, 239-240; Tarr 1996 p. 137-144).

⁶² *Förslag till Förbättrade helsovårdsanordningar i Linköping afgifvet af en för detta ändamål tillsatt Komité år 1885* (Linköping 1885), p. 2-4, 6-7, 28, 36-37, 47.

to be freedom for each home owner to clean the cesspool himself, not through the health police. Oscar Segerdahl and Fredrik Stånggren, on the other hand, were in favor of central organization of the public health work, and therefore stuck to the view of the health committee, of which they were also part. The reinforced Drafting Committee confirmed the view of the health committee about a year later, but one member defended the right of the building owner to clean the cesspool himself, the brewer J. W. Svensson. When the issue was submitted to the Board of Health again, the majority accepted the whole proposal, except for Anders Fredrik Wigander and Carl Ferdinand Köhler, who thus still guarded the property owners' interests. In the spring of 1888, the Drafting Committee again considered the matter, and now all the members sided with the building owners regarding the cesspools, which eventually was what the City Council did.⁶³

Out of 36 applicants, a health policeman was appointed in 1889, but the first years his work was ineffective, mainly because he was alone. The supervision of excreta management was insufficient, for collection was irregular and the receptacles were often wrongly constructed or broken. Nordenström, who was now the newly-appointed first provincial physician, worked hard to improve the sanitary conditions in Linköping, especially in 1892 with the threatening cholera epidemic from across the Baltic. Then he suggested the appointment of another health policeman. Together with Hjalmar Suber he also continued the battle against the cesspits, which Segerdahl and Nordenström had begun in the 1880s. Even though the somewhat ambiguous §1 of the local sanitary regulations might have led to the keeping of the sewered cesspits, this did not happen. In late 1892 there were only 20 of them left. The threat of epidemics was the main incentive, and during the fall of 1892 most of the pits were filled in, both in the city and the suburbs.⁶⁴

In 1893 the Board of Health again considered the possibility of making the collection a municipal matter, but in the end decided that it would be too expensive for the city. Instead the existing organization was improved by hiring new entrepreneurs and a new health policeman. A uniform model of receptacles

⁶³ LiSA, Linköping City Council Archives, AI:24, AI:25, and AI:26, minutes 1886-02-23 §30, 1886-05-25 §75, 1886-08-31 §87, 1886-10-26 §111, 1886-11-30 §125, 1887-05-31 §73, 1888-02-28 §38, 1888-03-27 §45, 1888-05-29 §70; *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1886), p. 4-5, 14; *Handlingar till frågan om förbättrade Helsevårdsanordningar i Linköping* (Linköping, 1888), p. 1-15. The County Governor also approved this order of things (*Renhållnings-Stadga för Linköping. Af Konungens Befallningshafvande i Östergötlands län fastställd den 11 Juni 1889* (Linköping 1889)).

⁶⁴ Nilsson 1994 p. 128-129; Sandberg 1978 p. 282-283; NSA, Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till . . . II.", p. 50; LiSA, Linköping City Council Archives, minutes 1893-03-28 §47; Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1892 (Linköping 1893), p. 5, 10, annual reports of boards of health, p. 16.

was also introduced. According to C. O. Björck in Norrköping and Nordenström the sanitary conditions were therefore fairly satisfactory towards the end of the century. The first provincial physician who succeeded Nordenström in 1898 was of another opinion, however. He had serious criticism about pigsties and stables, not to mention the entrepreneurs, who carried out the collection of excreta utterly unsatisfactorily. (Odors supposedly poisoned the surrounding air all day long.) The latter was also confirmed by the health police the same year.⁶⁵

The Early 1900s and Municipal Takeover of Excreta Collection

Thus the sanitary conditions were not satisfactory, according to the new first provincial physician. The existing collection of excreta, manure, and other refuse did not work properly, for the entrepreneurs still collected irregularly and cleaned the receptacles poorly. In 1903, the new city physician Carl Schoug made a proposal to the City Council about municipal takeover of the collection. There was no immediate reaction, but in 1905 the Board of Health appointed a committee that reported the next year and basically supported the same idea.⁶⁶

The issue apparently needed much investigation, so the Financial Department appointed its own committee in 1906, and its examination took half a year.⁶⁷ This committee supported the creation of a municipal Department of Sanitation with its own facilities, but did not approve swine feeding, which the committee member J. B. Carlson had promoted. The Department of Sanitation was to be financed by fees and taxes. The Drafting Committee, which examined this proposal, thought that the waste should be sorted in the yards from the beginning, to facilitate the future transition to swine feeding. The department could then also increase its income through the selling of kitchen refuse, the most valuable part of the waste. It was estimated to be worth around 4,000 kronor per year. The total cost for the department, according to the Drafting Committee's estimate, would be almost 130,000 kronor, with an

⁶⁵ NSA, Norrköping City Council Archives, supplement No. 48 1898, "Bilagor till . . . II.", p. 50; Landstingsarkivet i Östergötland, Annual report of the first provincial physician of Östergötland county for 1895 (Linköping 1896), p. 8; LiSA, Linköping City Council Archives, supplement EI:10, 1895 §60, annual report of the health police for 1897; Nilsson 1994 p. 131-133.

⁶⁶ LiSA, Linköping City Council Archives, AI:41, minutes 1903-11-24 §139; Sandberg 1978 p. 282-283.

⁶⁷ The committee's investigation of 1907 was unfortunately unobtainable at the LiSA, where it is supposed to be, either by the chief archivist Bo Persson or myself.

annual expenditure of 36,000 kronor, 6,000 of which was to covered by taxes.⁶⁸

For hundreds of years it had been customary to feed pigs with kitchen refuse, both in cities and the countryside, but city, and later health, authorities had repeatedly tried to abolish them. At this time, swine feeding was *à la mode* in Germany and the USA, especially New England, from whence much inspiration on sanitation came. There were hygienic arguments both for and against pig feeding, but in the Linköping discussion economic arguments dominated. According to the advocates, there were examples of successful Swedish swine projects, for instance, in Eskilstuna, Örebro, Helsingborg, and Uppsala. They pointed out that the profitability depended on the collection fees. Those who opposed it seem also to have had mainly economic reasons, and referred to cities such as Uppsala, which ran their farms at a loss. It is also possible that they had heard about the pioneering swine project that failed at Lövsta outside Stockholm at the turn of the century. The pigs had been fed with any kind of garbage, and they eventually died.⁶⁹ There were certainly grounds for hygienic skepticism, for in the USA studies showed that cases of trichinosis increased among pigs fed with refuse.⁷⁰

In May 1908, then, the proposal by the Financial Department's committee, modified by the Drafting Committee, was approved. A board was also appointed for the Department of Sanitation, and it was to draw up a plan for its facilities including a factory for peat poudrette, as well as a proposal for new sanitary regulations (*renhållningsstadga*).⁷¹ The board went on a study tour to Uppsala and Örebro, the two cities that had the best reputation for their peat poudrette factories, and it was the construction of the latter which was chosen in the end. Eskilstuna, Karlskrona, and Helsingborg had implemented the same construction, while the one in Uppsala was otherwise untried. Transportation was to be carried out by horses, and for longer distances the railway track would be extended to the factory. The architectural design was left to Axel W. Brunskog. The total cost of the board's proposal

⁶⁸ LiSA, Linköping City Council Archives, minutes 1908-04-28 §97 and 1908-05-26 §109, supplement No. 7 1908, p. 42-46.

⁶⁹ LiSA, Linköping City Council Archives, minutes 1908-05-26 §109 and 1908-06-12 §128, supplement No. 7 1908, p. 42-46; Account of the City Council meeting 1908-05-26 §109, ÖC 1908-05-27; Drangert and Hallström 2002; Wetterberg and Axelsson 1995 p. 178-180; Melosi 2000 p. 180. The members of the board were Captain P. Reutersvärd, the builder A. Ohlsson, and the agricultural consultant Ingemar Gezelius. In 1908, the City Council also decided that street cleaning should be a municipal concern from 1909 (Linköping City Council Archives, minutes 1908-10-27 §192).

⁷⁰ Melosi 2000 p. 180.

⁷¹ LiSA, Linköping City Council Archives, minutes 1908-05-26 §109 and 1908-06-12 §128; ÖC 1908-05-27.

was as much as 167,000 kronor, because it had enlarged the store room for the poudrette and suggested concrete floors to avoid soil contamination.⁷²

New sanitary regulations were to be a complement to the National Public Health Act of 1874 and the general regulations of 1868, and they were very clearly divided into different categories of waste. Liquid kitchen refuse, dishwater, and urine should be disposed of through the sewers or in tight receptacles of a unified model. Feces were also to be collected in such receptacles and then turned into poudrette at the factory. The “dry” waste was to be separated according to three different categories – pig food (kitchen refuse), sweepings (ashes, garden refuse, and horse droppings, to be used as fertilizer), and other refuse (that which did not fit the other two categories, such as paper, glass, and metal rubbish). Cleanliness in stables was heavily regulated, and liquid waste had to be drained to the sewers and the solid either collected in tight dung pits or receptacles.⁷³

The collection was to be voluntary, that is, the building owners were to call on the department as soon as the receptacle was full, which was contrary to the principle of emptying at specified intervals.⁷⁴ But the head of the Stockholm Department of Sanitation, Karl Tingsten, had confirmed that this so-called *budning* was satisfactory from a hygienic point of view. In Linköping there was to be a fee on the collection of excreta per receptacle and year, regardless of how frequently it was carried out, so that there would be no incentive for mismanagement by the building owner. The collection of the other waste by the department was free of charge, and it could also be collected and used by the building owner for fertilizer.⁷⁵

Karl Tingsten was one of the foremost Swedish promoters of three-part separation of dry waste, as depicted above. Kitchen refuse was considered good as pig food, and together with ashes and sweepings it could also be used as fertilizer. The last category, other refuse, could also be recycled, but the important thing was not to mix these categories, since they would become polluted and unusable. However, in the Linköping regulations there were some tricky exceptions, for all waste was not so easily categorized. Sweepings and manure might be mixed with certain industrial waste and other refuse, but it was not specified which. Consequently, sometimes very complicated rules had to be set to avoid mixing the categories, although these were often open to negotiation. In practice it was also difficult to keep up these distinctions,

⁷² LiSA, Linköping City Council Archives, minutes 1909-03-30 §55, supplement No. 5 1909, p. 1-18, 28-29; Archives of the Board of the Department of Sanitation, EI:1, supplements 1909-1912.

⁷³ LiSA, Linköping City Council Archives, supplements No. 5, 9, and 11 1909.

⁷⁴ Putrefying industrial waste and, for example, urine from urinals had to be collected at least once every one or two weeks, however.

⁷⁵ LiSA, Linköping City Council Archives, supplements No. 5, 9, and 11 1909.

especially since the urban waste continued to increase both in terms of volume and the sorts of refuse.⁷⁶

The various municipal units that were involved in examining the board's proposal – the Financial Department, the Drafting Committee, and the Board of Health – had all approved of it by and large in 1909. The Financial Department adjusted the estimate of the costs a bit, so that the total expenditure would amount to 175,000 kronor. The County Governor approved of the sanitary regulations the same year.⁷⁷ When the overall plan was approved the issue of different fees could be attended to, and the board worked out fees for collecting excreta receptacles and dry closet receptacles (so-called *våningsklosetter*, often the Marino brand) – five kronor per year apiece for the former, and 10 kronor for the latter.⁷⁸

The following year changes in the sanitary regulations were suggested by Carl Schoug, Carl Ferdinand Köhler, Axel Karlsson, and J. Almqvist before the official launching of the Department of Sanitation. They thought that the regulations meant unnecessary trouble and great costs for the building owners, without any hygienic improvements. The board did not tolerate any compromise with the regulations concerning the watertight foundation for the latrines, for example. However, a paragraph was added that allowed the Board of Health to permit certain exceptions from the regulations in special cases, and thus the board made a concession to the building owners. The most substantial change was the almost unanimous decision by the City Council to require collection of excreta at least once a month, which in practice put an end to the voluntary character of the *budning*.⁷⁹ Certainly, this meant less frequent collection than in the 1889 regulations, but there was now a municipal department to enforce the law.

In the spring of 1911, the poudrette factory and its premises were inaugurated. Inspector Eric Sandstedt became the first director, and 11 coachmen were hired to carry out the collection and three workers for the factory. In 1912, farmland was bought for agricultural utilization of some of the waste. In the beginning of World War I there was again a proposal to the

⁷⁶ LiSA, Linköping City Council Archives, supplements No. 5, 9, and 11 1909; VAV, Documents of SKTF, 1903 §10, supplement No.2, "Några synpunkter i fråga om det torra stadsaffallets eller sopornas uppsamling och undanrödjande", Karl Tingsten, p. 28-33; Douglas 1966 p. 36-41; Thompson 1979 p. 1-12.

⁷⁷ LiSA, Linköping City Council Archives, minutes 1909-05-25 §110, 1909-06-11 §134, and 1909-09-28 §167, supplements No. 5, 9, and 11 1909. The board of the sanitation department was also complemented with two new members, Erland Uggla and Henning Ekman.

⁷⁸ LiSA, Linköping City Council Archives, minutes 1910-10-25 §195 and 1910-11-29 §234, supplement No. 14 1910, p. 1- 4. Cf. Drangert and Hallström 2002.

⁷⁹ LiSA, Linköping City Council Archives, minutes 1910-09-27 §184, 1910-12-29 §275, and 1911-03-28 §86, supplement No. 21 1910, p. 22-35.

City Council for a pig feeding farm in connection with the facilities, and after a few years it was realized. Up till then the pig food had been boiled and sold. Early on there were complaints about deficiencies in the excreta and waste management, and after some years the department had such great economic difficulties that it was nearly discontinued. However, the activity continued until 1960, when the municipal electricity department took over. In 1961 excreta and waste collection, sewerage, and water supply all came under the new municipally owned company *Tekniska Verken*, by which they are administered to this day.⁸⁰

Sewer Regulations and the Water Closets

The interest in the wet alternative for excreta disposal had not diminished in the early 20th century, but the drawbacks of the WC's were also realized. The Board of Health wanted to enforce WC connections via septic tanks.⁸¹ In 1907, water fees were discussed in the City Council.⁸² C. A. Sylvan and M. Beckman suggested that there be a lower water fee for WC's connected through a septic tank than not, three compared to 10 kronor annually. This would be more fair since WC's connected directly to the sewers required extra flushing of the pipes. (The city engineer's proposal that WC's by-pass the cesspools was evidently already practiced.) The lowered fee would also promote the purification of the wastewater with septic tanks. Nothing came of the idea of septic tanks, however, and the fee was finally set at six kronor annually. It was considered high enough to correspond to the water use, and sufficiently low to promote the supposedly hygienic WC's.⁸³

The proposal by J. B. Carlson about the regulation of sewer service pipes and cesspools in Linköping, which was finally approved in 1911, also contained decrees about the management of excreta, manure, and other organic waste (see Chapter Two). These decrees regulated misuse of the sewers, and prohibited using sewers for waste, such as coffee grounds, corrosive chemicals, and vegetables. They also confirmed and reinforced usage of the sewerage that was established as early as the 1870s and confirmed in the 1889 sanitary regulations: the sewer system was not only for drainage, but also for discharging waste, primarily excreta from water closets. As before, WC's had

⁸⁰ Lundberg 1984 p. 13-16, 32-35, 40.

⁸¹ Lundgren 1974 p. 99.

⁸² No big changes compared to before were introduced. The fee per room was still three kronor, and by metering 0.20 kronor per cubic meter, with advantageous reductions the more one consumed.

⁸³ LiSA, Linköping City Council Archives, AI:45, minutes 1907-02-26 §63, EI:28, 1907 §63, "Taxa för Linköpings Vattenledning"; Account of the City Council meeting 1907-02-26 §63, ÖC 1907-02-27; ÖC 1908-05-27;

to be approved in advance by the Board of Health, and were connected directly to the sewer. Sewers could be built to drain dung pits, which meant that discharging manure (and probably other organic waste) through the sewers was also allowed. There were very likely no sewered cesspits left in the city, however.⁸⁴

Conclusion

In Linköping there was also a significant conflict concerning the question of keeping the city clean, but the actor-networks were clearer than in Norrköping. Basically public health interests in the city were opposed by the economic interests of building owners; receptacles stood in opposition to sewered cesspits. The city physician Oscar Segerdahl was the central figure of the public health network and tried to impose a general introduction of receptacles only. He was opposed by most of the Magistrates and some members of the Board of Health, as well as the County Governor Robert De la Gardie, who all constituted an actor-network supporting the cesspits. The governor was indeed surprising as he was the representative of the state and rejected a request from Norrköping to keep the cesspits.

Segerdahl's actor-network grew as his colleagues Boman, Nordenström, and a few members of the Board of Health were enlisted. He could also enroll the power of the Swedish Government, which had definitely condemned the cesspits in late 1885. But the actor-network protecting the interests of the building owners was evidently strong, and the sanitary regulations of 1889 became a compromise. Tight boxes above ground were to be allowed and it was feared that they would legitimate the keeping of the cesspits. But thanks to the fear of the 1892 cholera epidemic on the Continent it was relatively easy for Henning Nordenström to continue Segerdahl's work and almost eradicate the cesspits in the 1890s.

The medical profession generally argued in favor of water closets at the time, but only in cities near a large, swift-flowing watercourse. WC's were allowed in Linköping but not actively promoted, which was due to the strong position of the physicians. The by-passing of cesspools for household and WC wastewater in the early 20th century yet pointed to the increasing prevalence of end-of-pipe thinking in the city, and consequently household waste was flushed into the river. Linköping lay on a small and sensitive river, and the Board of Health and other actors tried to have people use septic tanks, but this

⁸⁴ LiSA, Linköping City Council Archives, AI:41, AI:42, and AI:44, minutes 1903-05-26 §72, 1904-04-29 §62, supplement EI:22, 1904 §62, and 1906-03-27 §56, supplement EI:26, 1906 §56; *Reglemente rörande enskilda afloppsledningar i Linköping* (Linköping 1912).

never came to be. Obviously, water closets which discharged directly into waterways were invading even cities by small rivers.

The establishment of a municipal Department of Sanitation in 1909 and the transition to compulsory, regular collection in 1911 marked the first step away from the by and large decentralized excreta management that had been prevalent in Linköping ever since 1889 and before. The building owners had until then opposed this, but had to make concessions to a public health network, which had other members this time.

Concluding Analysis

The period from 1860 to 1910 in the Swedish cities Norrköping and Linköping was one of improved water supply, sanitation, and environment, thanks at least partly to the introduction of modern water and sewer systems, and improvements in excreta collection. In this chapter this development will be analyzed and evaluated, and whatever conclusions we can draw from the preceding chapters will be outlined. Of particular interest is a comparison of the two cities, their actor-networks, and technological systems, and their place in the Swedish and European context. The period 1860-1910 constitutes the dawn of the establishment of political parties in Sweden. However, the actor-networks are not analyzed primarily in party-political terms, since local party politics was virtually non-existent before 1900 and as the actor-networks reveal more deep-rooted power relations.

Essentially two types of actor-networks were active in the local issues of water, sewerage, and excreta management. There was, on the one hand, what we can call an *economic* kind of network, which primarily looked to the financial side of the issue at stake. On the other hand, there was what may be designated a *public health and humanitarian* actor-network, which prioritized aspects not always measurable in monetary terms or likely to yield a profitable return, such as public health and poor relief. These networks should not be seen as opposed to one another by definition, nor as intrinsically evil or good. Instead they represented differing views of what water and wastewater meant in local municipal politics. Water and sewer systems were not simply applied in the local context, but, in the constructivist terminology, there was *interpretative flexibility* for the actor-networks to decide what these systems were to be.

In the analysis of the evolution of the actor-networks, the main questions will be taken into consideration. Why and how were piped water supply and sewerage discussed, planned, constructed, and technically extended in Norrköping and Linköping, and what roles did different actor-networks play? Why and how did (or did not) actor-networks extend these systems geographically within and outside the respective cities? Why and how was the function of sewerage and water extended and used for excreta collection and the solution of the question of keeping the city clean, *renhållningsfrågan*? The

object is to describe how the actor-networks evolved over time, and to identify *key actors, interests, power resources, and durability* in the above issues related to the evolution of water and wastewater systems, as well as excreta removal.

Evolution of the Local Actor-Networks Prior to 1880

Water Supply and Sewerage

Urban growth necessitated a reform of the old water and sanitation practices, but the experience of large infrastructure projects in Swedish towns was small, and the state did not offer subsidies. Basically Swedish cities had to rely on the local community to solve these issues, while scientific and technological impulses often came from engineers in the larger cities or abroad.

Although influences from outside were important, the local actor-networks definitely determined the urban infrastructure development in the end. If we look at the introduction of water supply and sewerage in the 1870s, the bourgeois and aristocratic/bourgeois actor-networks in Norrköping and Linköping saw piped water as something very attractive, even financially profitable, either for industry, trade, the Linköping Water Company, or the cities themselves. In Norrköping textiles, paper mills, and sugar refineries had interests in soft *and* pure water, but they had long had their own water intakes and consumed more than a water system could readily supply and the factories were willing to pay for. However, a municipal waterworks could supply pure water from upstream to the residents, so that the industries could continue polluting the river without affecting the health of their workforce. In Linköping flourishing breweries were the primary industrial consumers, although we do not know with certainty whether any such interests were enrolled.

Furthermore, piped water was to lead to a safer and cleaner urban environment, providing modern fire protection and prevention of epidemics. The modernization of the fire defense was a major driving force, particularly in Norrköping, given its history of devastating fires. Both factory and property owners welcomed piped water as protection against fire, and as a guarantor of lower fire-insurance fees. The cholera epidemic of 1866 was probably not as crucial an actant as one might think for improving water supply in the Norrköping case. Together with the economic recession, the epidemic initially paralyzed the ongoing discussion of piped water. Even though there was a general notion that contaminated water was unhealthy, prevalent miasmatic disease theory hindered the city fathers from seeing the direct relation between a poor water supply and cholera. The river water, although polluted and

generally unhealthy, was thought to clean itself. Cholera was instead believed to emanate from filth and stagnant water. In the long run, therefore, the epidemic probably influenced the introduction of sewerage. A sewer plan was not proposed by the city itself but by J. G. Richert, and it was only approved when the decision to construct the waterworks had already been made.

In Linköping cholera was a driving force, with subsequent improved street cleaning and a discussion of drainage, although a decision on sewers had to wait until the Water Company had been established. The importance of piped water for abating cholera was discussed by the *Sundhetsnämnd* and Fredrik Stånggren, maybe because the poor wells of the town were so closely connected to the stagnant water. (The underground veins supplied the wells with water and caused the seasonal waterlogging.) Furthermore, piped water promoted general cleanliness. The prospect of keeping down the enormous costs for poor relief after an epidemic also helped promote water and sewerage. Cholera as an actant thus worked very differently in the two cities, primarily due to the miasmatic theory of disease.¹

Linköping was not as segregated as Norrköping, and hence all classes were almost equally affected by the detrimental sanitary conditions in the planned city area. The city fathers of Linköping could not escape, which, on the other hand, their counterparts in Norrköping could do. In Norrköping they avoided even entering a swampy working class area such as Saltängen. Both cities were hard hit by cholera in 1866, but it was only in Linköping that the epidemic was directly connected to poor drainage. Consequently, sewerage was more easily enlisted in Linköping than in Norrköping, even though the continued administrative concern for the sewer system in Linköping after 1876 was minimal.

The attractive force of and interests in piped water took on other forms. Health resorts and spas had a renaissance in mid- to late 19th-century Europe, and water was thought to have a curative effect, both in different hydrotherapies and baths, and in drinking the waters.² Water became a symbol of cleanliness, physical as well as moral. It was no coincidence that the bourgeois upper class, particularly in Norrköping, emphasized the importance of water,

¹ The laying of the main eastern railway line through the two cities in the late 1860s and early 1870s may also have been important, for this piece of infrastructure was water intensive and also boosted the local and regional development. In Jönköping, the state in the early 1860s put the local government under pressure to build a piped water supply, so that the railway could benefit from it (Gullberg and Améen 1971 p. 143). There is no record of any such state intervention in either Norrköping or Linköping, but it is likely that the local authorities felt obliged to assist in providing adequate water supplies. For a comparison with France in this regard, see Goubert 1988 p. 117.

² Bergmark 1985 p. 216-292; Goubert 1989 (1986) p. 135-138; Hassan 1998 p. 12; Palmblad 1990 p. 41-52.

bearing in mind the previous development in industrial Britain. A water system was a piece of infrastructure which confirmed not only the identity of a modern industrial city, but also the specific clean and moral bourgeois class identity. Piped water was enlisted by an actor-network based in the bourgeoisie not only as a shield against disease, immorality, and revolution, but also out of concern for those who were thought to breed these calamities – the workers and the poor. The sanitary conditions of Linköping were probably worse, but bourgeois identity there was not so distinctive and there were few workers.

The bourgeois ideology was also shared by J. G. Richert and Abraham Blix, for they belonged to the same class and also conveyed ideas from abroad. Norrköping was, more than Linköping, an international city, and the industrial elite there had connections among the bourgeoisie in the larger European cities, particularly the German, British, and French.³ Civic pride was thus crucial. Although it is difficult to prove, it is likely that the decision to build a water system in Norrköping in 1872 affected the city fathers in Linköping. Not that they just blindly followed the lead of their equals in Norrköping. Fredrik Stånggren had been working with this question for years and had also looked to examples in other cities, but the Norrköping resolution may have been at least one of the triggers for Linköping. Even afterwards Robert De la Gardie, who was a real asset as “figure head” for the Water Company, and Blix corresponded with the Norrköping Waterworks Board. B. L. Hellström was also consulted by the company on several occasions.⁴

Due to the attraction of water in the various ways depicted above, the actor-networks were easily enrolled in both Norrköping and Linköping, and they became strong and easily defined. It is also likely that Johan Gustaf and Erik Swartz, Jacob von Leesen, and Stånggren, the primary “spiders in the web,” had been working actively for piped water even before there were any official records. The actor-networks cannot be constrained to the official, municipal political arena, but had other unofficial fields of activity as well, which were based on personal relationships and bonds. These relationships were maintained by a regular exchange of gifts to one another and to the city. A distinctive trait of these central figures was that they managed both the formal and informal political relations and arenas in each city. This was a power resource not only for the questions of water and sewerage but also for other local political issues. The informal network-building presumably allow-

³ Plymoth 2002 p. 42-43.

⁴ LiSA, Linköping Water Company Archives, AI:1, minutes 1874-08-19 §2; NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1875-03-30 §5. Cf., Hietala 1987 p. 394-395.

ed the questions of water and sewerage to “ripen” before they were confronted with the City Council and the public.⁵

The fire and public health motives were enlisted, some of which were copied from other Swedish cities, from abroad (primarily Great Britain), or from F. W. Leijonancker and Richert, especially since in both cities there had been, and still were, real and tangible problems related to fire and health. But there also had to be a local trigger at this particular point in history, for some of these urban problems had existed for decades, or even centuries. It had to be profitable and beneficial for the actor-networks, the city and its development. No donor or other financial contributor would otherwise want to invest in such a project, regardless of improved fire protection and sanitary conditions. Neither of the municipal governments would take that risk themselves, in the Linköping case perhaps quite simply because the city was too small and its financial resources too limited. Apparently the early 1870s was a time when the urban environment and other actants combined to form a compelling argument in both cities, at the same time as a water and wastewater project became financially viable. There was also a financial boom in Sweden at the time. Richert and Blix and their actor-networks had been involved throughout much of this process and could now be definitely enrolled.

There was little or no resistance to the water supply and sewerage projects, either in Norrköping or in Linköping, because it was the financially and politically powerful people that enlisted actors and were also enlisted. Water vendors, for instance, were too few and too powerless to have a say in the matter. In Norrköping, there may have been protests from less well-off home owners, who would not have been able to pay for service pipes, but these were enrolled through the free supply of water for household use. Von Schwerin, who was a true representative of the old land-owning aristocracy, could eventually be literally bought with water. In Linköping, the building owners and tenants were potentially even more burdened by the water and sewerage project as a whole and the water fees in particular, but there is no record of any protests. Most tenants probably could afford the fees (see below and Appendix 2). Millers and property owners at Tannefors protested after the waterworks had been erected, and, considering von Schwerin’s actions in Norrköping, it is maybe reasonable to interpret these conflicts over property rights as clashes of interests and the questioning of the legitimacy of the projects.

New and untried technologies usually generate conflict, which was very obvious in the introduction of the pipe-bound technology gas lighting in, for

⁵ Stenlås 1998 p. 232-235. Stenlås builds his argument on the anthropology classic *The Gift*, whose argument can be extended to include even modern societies (Mauss 1950 p. 8-18, 39-46). Cf., Horgby 2000 p. 514-518 on bourgeois identity and informal relations in Norrköping.

instance, London and Norrköping. There was fear of explosions and fires.⁶ The reason why the introduction of water supply and sewerage did not lead to any greater conflicts may also have to do with the fact that these technologies were not exactly new in their basic construction. Roman aqueducts were especially familiar, and the textile industry also utilized internal pipe networks. Therefore there was presumably less scepticism to water and sewerage as technologies than to gas.⁷ Furthermore, the representatives of water technology, the water engineers, were citizens who enjoyed great respect, partly due to the status of their profession and their membership in the Royal Corps of Engineers and partly because of other prestigious roles they had in Swedish society. The gas engineering profession did not enjoy this level of prestige.⁸ The local newspaper *Norrköpings Tidningar* also helped spread comprehensive information about water systems, so as to convince decision makers and the public, while *Östgöta Correspondenten* hardly mentioned it.

The border between the public and the private spheres was often blurred in matters of political and economic interests, at least from our present-day viewpoint. In Linköping it did not seem to matter whether water supply and sewage management was financed and carried out by the public or the private sector, or a mix of these, for the City Council and the Water Company had roughly the same social composition. Therefore there is no record during the first two decades that anyone ever saw this as a conflict of interests. The important thing was that the aristocratic and bourgeois elite had the power over these services. In Norrköping, the bourgeois, industrial elite had a utility indirectly beneficial to industry sponsored partly by public means. At the same time, they also contributed and took financial risks themselves. What made the mix of public and private possible were different official and unofficial actor-networks in the two cities, but also the voting system, which was graduated according to income. The city and the bourgeois public sphere were thus made up of a small group of private, but more or less united, interests.⁹

These first actor-networks were mainly economic, because of the financial magnitude of introducing water and sewerage technologies. One can perhaps argue that public health and humanitarianism were part of the networks. In Linköping, public health motives were indeed enlisted after the 1866 cholera epidemic. In Norrköping the sanitary arguments came late in the discussion, but several other non-economic arguments were also enrolled. However, the

⁶ Kaijser 1986 p. 42-46, 116-137.

⁷ According to Goubert, the influence of the Romans was particularly strong in southern Europe, although F. W. Leijonancker testifies to their effect also on the Nordic countries. However, it is important to note that the engineers of the 19th century were also confident that they could surpass the Romans (Goubert 1988 p. 116-118; Leijonancker 1853 p. 3-4).

⁸ Nilsson 1997 p. 641-645; Smedberg 1937 p. 291-358.

⁹ Gunn 1999 p. 12-15; Åberg 1998 p. 13-31.

leverage of the actor-networks was definitely economic. This also becomes obvious if we look at their composition. No public health representative was involved in the first phase of the water discussion in either city, which is also true of excreta management, a non-issue during the period prior to 1880. The initial influence of public health in these cities must be questioned, especially the link between a poor water supply and cholera, for it was at best shaky. The arguments were used, but they were then probably related to general cleanliness and improved sanitation. Important public health institutions such as hospitals received water and sewerage in both cities just after construction of the systems had been completed in 1874-76, but their presence was never used as an argument in the discussion about introduction.

The Local Actor-Networks after 1880

Water Supply and Sewerage

The Norrköping Waterworks Board and Linköping Water Company together with the Financial Department administered the new water and sewer systems. In the years after 1880 there continued to be bigger or smaller technological improvement projects, but the actor-networks were not always distinguishable, for a number of reasons. First of all, several of the projects were too small to cause any political concern at all. Secondly, in Norrköping, where the organization was municipal, there was a growing institutionalization of the water and sewerage services through the Waterworks Board and later the Financial Department. When the water and wastewater services were increasingly incorporated into municipal administration, conflicts lessened and hence the need to enlist actor-networks. Yet there were conflicts involving actor-networks even towards the end of the period and after 1910, for example, in the question of invalidating von Leesen's donation. But these were larger issues that went far beyond the confines of the Financial Department.

In Linköping, on the other hand, the Water Company's separate administration resulted in it minding its own "water business," at least until the 1890s. There was very likely a growing institutionalization in the company, perhaps to the extent that it mismanaged its primary material assets: the waterworks and the distribution network. The important thing became the dividends per share. However, municipalization was not seen as a solution in Linköping to begin with, for the city was unused to having the administrative and technical responsibility for a water system. This led to a political crisis, but the city rode out the storm. Sewerage was an unwanted child to begin with, but, when it finally came under the city again in 1895, substantial improvement was begun, although this scheme took many years to complete.

Around 1900 and after, pressure from the fire-insurance companies was a driving force behind improvements of the water system, particularly in Norrköping, and thereby also the sewerage. Great economic loss in terms of higher insurance fees was imminent should the city have failed to comply with the demands. It is likely that this was also the case in Linköping, especially due to the poor state of the water supply both in the city and its suburbs.

At first, one would have expected the Norrköping free distribution of water to be more advantageous to people than the Linköping water fees. However, in the long run the opposite was true. In 1887 only around 45 percent of the buildings in Norrköping had indoor water and sewer pipes, and connection of all buildings was not achieved until the end of the century. In Linköping the percentage of buildings connected to the systems was 92 for both water and sewerage in 1887. The interpretation of this unexpected outcome is that the Linköping building owners were charged for the total number of rooms of the tenants utilizing the water, whether the dwellings were connected or there was merely a tap in the yard. The additional cost for indoor fittings was small as plumbing work was not very expensive, and consequently should not have significantly affected the rents. There was thus a strong economic incentive for the installation of indoor fittings.¹⁰

Hence there was a more just distribution of water and sewerage services in Linköping than in Norrköping. The free water in Norrköping generally made building owners reluctant to pay anything extra. But many poor home owners could not afford to install water and sewer pipes in their houses, which shows in retrospect that Swartz' enlistment of the less prosperous building owners on the grounds that water would be free was dubious. This inequality affected mainly artisan and working class women, who were the ones who carried out the daily fetching of water. In Linköping, on the other hand, a majority of the women of all classes could take advantage of the new technologies in their homes. In both cities water for street cleaning and fire fighting was free of charge.

After 1880 the local political arena was complicated by several factors that affected the development of the water and wastewater systems. First of all, suburbs were growing rapidly close to the cities, as a result of industrialization and urbanization. The cities were uncertain regarding how to handle this new situation, and the outcome was not in any way given. Economic actor-networks in both cities wanted to protect the town itself, its economy and technological systems, and on legal grounds they could claim that the people

¹⁰ "Helsovårdsnämnderna", *Bidrag till Sveriges officiella statistik. K/ Helso- och sjukvården I. Medicinalstyrelsens årsberättelse för 1887*, Stockholm 1889, p. 2; Norrköping Miljö & Energi Technical Archives, No. 3623, "The Water Supply and Sewerage of Norrköping in 1896", B. L. Hellström 1897-03-31.

in the suburbs were really part of a private, rural domain, not the public, urban planned area. A public health and humanitarian actor-network, often headed by physicians, was interested in helping the people in the suburbs, on the other hand. If we view Linköping and Norrköping narrowly as the cities within the planned areas, water and sewerage were rather evenly distributed across the respective cities. But if we expand the concept of the city to include all those who lived just outside its gates, knocking on the door, initially there was segregation.

Two actor-networks in particular were identified for Norrköping: an economic network around the Waterworks Board, with P. U. Boëthius, J. A. Andersson, and Christian Eberstein as the main figures, and a public health network, primarily represented by C. W. Engelbrecht, Axel Swartling, and Ivar Lyttkens. The largely economic actor-network for water and sewerage, which revolved around and resulted in the Waterworks Board prior to 1880, was transformed into a partly new set of actors with the focus on questions of spatial extension after 1880. Hence questions of technology and organization were being institutionalized in the years after the establishment of the systems, whereas questions of geography began arousing conflict.

The Waterworks Board was the center of an actor-network which generally wanted to extend the water and sewer systems as much as possible, at least within the city. The southern suburb received water and sewerage only a couple of years after the systems had been introduced, for this was a suitable direction for the city's expansion, and it was also financially viable. The inhabitants were reliable taxpayers, and construction costs could be amortized. In the 1883 case of the northeastern district, this actor-network also promoted an extension. The actor-network enrolled power resources by its links to the Waterworks Board, the administrative unit of the water and sewerage. It also enlisted economic advantages of an extension.

Yet it would be wrong to assume that this network always promoted expansion. From the 1880s to the 1900s the conflicts between Norrköping and the northern suburb present strong empirical arguments against the assumptions of technological determinism. There was resistance to the continuous extension and development of technology, and it was the entrepreneurs themselves – the actor-network of the Waterworks Board – that put on the brakes. The city's technological systems and economic interests were to be prioritized; technological development may have been pursued, but only for the urban dwellers.

This becomes particularly evident in the 1886 case when this actor-network stood in contrast to the public health network. Health and humanitarian aspects were dominant rather than strictly technological and economic ones. Eventually, and by the slimmest majority, the water pipe was extended in

1887, thanks to the public health network and the fact that it had enrolled humanitarian arguments. It was also convincing to suggest piped water to the suburb as a sanitary protection for the city. It is interesting that this actor-network had far more adherents in the City Council when it came to extending water and sewerage within the city than outside it, even in the case of a peripheral and marshy working class site such as Beckershof. Apparently, pollution came particularly from workers outside the city. A majority of City Council members in Norrköping seemed to view themselves as the owners of the city, and anything outside the “town walls” was foreign, although a policy of openness was victorious in 1886.

The northern suburb was primarily considered a problem, a pathological growth on the urban body. The city consciously sent off “filthy” workers and poor to the northern suburb, and at the same time wanted to protect itself from being polluted by them. The suburb partly identified itself with the image of a “growth,” “sewer,” or poor area, possibly rhetorically so that the city would show compassion and extend a helping hand. The metaphor of the growth implies two things. First of all, the northern suburb was somehow linked to, and its fate would affect, the city, especially since so many of its inhabitants worked there. The council was divided as to whether the city should look to its own interests first or not. The extension of water would overload the city waterworks, was expensive, and could generate even more serious sanitary problems both in the suburb and the city, according to the Waterworks Board network in 1886. The public health network, in contrast, thought that helping the suburb would also benefit the city, that is, extending the public sphere would be in the interest of the whole city. Secondly, the pathological growth eventually had to be removed so that the disease and dirt would not spread to the city. So whether water supply was extended or not, the object was to make a future separation between the city and the northern suburb smoother.

The tough attitude towards the northern suburb did not change in the early 20th century, but the ambiguous feelings remained. Incorporation suddenly seemed very likely, probably because of increased pressure from the state and the prospect of economic viability. Although some of the old actors were replaced, council discussions still often took place in the clash between a more technical-economic actor-network and a more humanitarian one (cf., the 1902 case of fire-protection), something which did not change just because an incorporation was imminent. The northern suburb became a part of the city of Norrköping in 1916, but it was not until 1927 that the eastern part Fredriksdal was incorporated in the city plan.¹¹

¹¹ Kvarnström, Malmsten, and Nilsson 2000 p. 31.

Within the planned city area of Linköping the water supply was not extended more than in certain streets to begin with. The sewers required quite substantial expansion, since they were so few and short from the beginning. Political conflicts over these extensions were few, because the Water Company was responsible for the building and financing of water, but also because the coverage of water and sewerage was satisfactory after 1890 (see above). What caused complaints among residents was instead the quality of the sewerage: there were frequent ruptures and overflowing street drains. Generally there seemed to be a consensus on trying to keep the municipal expenditure low and to favor less expensive sewer solutions.

To begin with there was the same unwillingness to help the suburbs in Linköping as in Norrköping, particularly Ladugårdsbacke outside the city's jurisdiction, and the arguments were very similar. Hence the distinction between the public and private domains seemed to prevail, even in Linköping, although it was not as clear. There was an actor-network that was protective of the economic interests of the city, personified by Fredrik Carlsson of the Drafting Committee. An actor-network that promoted public health and humanitarian interests existed as well, but it was more easily distinguishable, more powerful, and more durable than in Norrköping. The city physician Oscar Segerdahl was the "spider in the web," and the network also exerted considerable influence in excreta removal and the question of keeping the city clean. Thanks to this actor-network there were some sanitary improvements through water and wastewater systems, notably in the suburbs. The Water Company was also a central actor, and its interests lay primarily in the success of its business and in satisfying the shareholders, of whom the city was one of the most important.

The situation in Linköping was complicated by the existence of the Water Company, whose economic interests sometimes helped the public health network in achieving its goals. The company wanted to extend water wherever it was profitable, but, in the case of Ladugårdsbacke in 1881, neither the company's wish nor the power of the influential Linköping brewer L. T. Brogren helped. At this point in time the public health actor-network had not yet formed, and the bottom line of the sanitation debate in Ladugårdsbacke was more economy than public health. The suburb was not connected to the water system until 1921, despite the fact that Linköping incorporated the entire St. Lars rural commune in 1911. Contrary to Norrköping, Linköping saw incorporation as good business, but yet neglected this suburb.

In 1887, the Board of Health and two of its members, Segerdahl and Stånggren, promoted the extension of water supply and sewerage to Stolplyckan. Presumably both the potential threat of an epidemic from Stolplyckan from the creek Kåringbäcken, and the possibility of financial

profit through the company, prompted a majority of City Council members to approve of the extension of sewerage, on condition that the inhabitants arranged for piped water themselves, that is, through the Water Company. This idea came from two shareholders, Stånggren and Axel Lindeberg. The interests of the public health network and the company consequently fused to prevail over the economic actor-network, but it was a close shave.

In the question of expanding the urban Public Health Act to suburbs at the end of the 1880s, the conflict between the two actor-networks was brought to a head. The Board of Health, Segerdahl, and H. Petri wanted to include all suburbs, even outside the city's jurisdiction, while Fredrik Carlsson and Pehr Orre favored an exclusion of them all. The result was a compromise between the two: suburbs within the city limit, and within a 500-meter radius from the planned area were included.

It is possible to interpret the above cases as a development in which the public health network gradually enlisted more and more power resources, so as to prevail over the economic actor-network of the Drafting Committee. In 1892 and 1893, it could enroll the contaminated creek Kåringbäcken and the Hamburg cholera epidemic, which proved to be powerful enough allies for sanitary improvements, and there was a smooth translation. Apart from Oscar Segerdahl, the most central figures in the public health network were the provincial physicians Hjalmar Suber and Henning Nordenström. If we look at excreta removal, this interpretation is further confirmed. The increased pressure from the state to implement the Public Health Act after 1885 was maybe the most significant power resource, and we can distinguish a public health network even on the national level. After 1880 the major water and sewer extensions in Linköping were to the suburbs within the city's jurisdiction. This is also obvious in Richert's large sewerage plan, which was both for the city itself and its suburbs.

The shanty towns Ladugårdsbacke and the northern suburb outside the city boundaries were to be kept at a distance. They were by no means uncommon phenomena, and existed in many other Swedish and European cities at the time. Such built-up areas were the results of industrialization and the immigration to cities of manpower from the surrounding countryside and from afar. Surprisingly little has been written about the extension of services to shanty towns in Swedish urban and architectural history. Most often it is the attractive middle-class suburb *à la* the southern suburb and the garden city ideal which has attracted attention, perhaps prompted by Lewis Mumford's historical research of *suburbia* – the natural and healthy place to which the

bourgeoisie could escape from the sometimes destructive urban environment.¹² The shanty town Årstadal south of Stockholm, for instance, exhibited many similarities to Ladugårdsbacke and the northern suburb – land speculation, marshy topography, little or no building regulation, working class residents, closeness to the railroad, typhoid epidemics, etcetera, prevailed.¹³

Norrköping and Linköping may have been influenced by prevalent city planning and incorporation ideologies and existing cases in other Swedish and European cities. At the same time incorporation legislation and praxis varied greatly from country to country, and urban growth from city to city.¹⁴ So although there were similarities, particularly with other Swedish cities, I believe that the local social and economic structures, degree of industrialization, (social) topography, sanitation, as well as prevailing actor-networks were more decisive than the input of ideas from the outside. It was the interests of each city that were prioritized, although there were different ways of regarding and reaching this goal. Regardless of city planning ideology, bourgeois, and in Linköping even aristocratic, identity was to be protected and workers were to be kept at arm's length. This bourgeois ideology the city fathers of Norrköping had in common with their equals all over Europe. Linköping was influenced by this ideology as well, but not to the same extent. Linköping had very few workers, and the landed gentry also presumably had a more positive attitude to the surrounding countryside.¹⁵

Norrköping and Linköping represented two different types of cities. Norrköping's industry was situated in the city center. Every morning workers came to the factories from their dwellings nearby or from the northern suburb outside the city. This was also the reason why it was not attractive to incorporate the northern suburb; at least in the first decades, it was inhabited mostly by poor people, who were a poor tax base. Later on more and more factories were started in, or moved out to, the suburb, which caused it to be considered more eligible for incorporation after 1910. Linköping, on the other hand, had most of its industry located in the countryside. Therefore it was attractive to incorporate St. Lars rural commune in 1911, both to develop the city's industrial activity and to get a good tax base.

¹² Mumford 1961 p. 482-487. Cf. Johansson 1987 p. 234-237. A recent Swedish example of this emphasis on the middle-class suburb with reference to Mumford is Legné 2002.

¹³ Johansson 1987 p. 237-245. The division of the suburbs into richer and poorer such as between the northern and southern suburb was also becoming a problem around 1900 in Stockholm, Berlin, and many other large European cities (Larsson 1913 p. 16-17).

¹⁴ Hohenberg and Lees 1995 p. 301-315; Larsson 1913 p. V-XXXIX, 5-18.

¹⁵ Hohenberg and Lees 1995 p. 295-297.

Management of Excreta

The state began to put pressure on the cities to comply with the Public Health Act after 1880, which really was the starting point for the public health actor-networks. In Norrköping, the conflicts revolved around three major issues, which involved different actor-networks. First of all, when the management of excreta was taken up in Norrköping in the early 1880s, it was the question of the *sewered cesspits* that triggered debate. As did an almost unanimous European and Swedish medical community, the physician-writer in *Norrköpings Tidningar* condemned the cesspits as unsanitary.¹⁶ However, some powerful citizens and the building owners defended them. J. G. Swartz vindicated them from a scientific point of view, with reference to German and Italian examples. He was a building owner and also had farming interests, as well as the possible urge to make a name for himself in this question. C. A. R. Lothigius was chairman of the Board of Health and supposedly had public health interests in the solution of this issue. Both of them certainly realized the unlawful character of the pits, but claimed that collection was much more important than storage. This opinion was shared by the association of building owners, for a majority of its members apparently had cesspits and did not want the further expense of rebuilding them and emptying them more often.¹⁷

When the question of the cesspits was taken up by the City Council, the discussion became quite confusing. Building owners such as Christian Eberstein, Gustaf Wahren, and Lothigius enlisted the decreased morbidity and mortality in Norrköping in recent years, and they argued that the cesspits were sanitary as long as they were managed well. Eberstein and Lothigius even claimed that medical expertise favored cesspits. P. U. Boëthius, Ivar Steffenburg, Ivar Lyttkens, and others referred to medical science (Rydhammar even enlisted bacteriology) as an argument against the cesspits. We should not draw the conclusion that these were two actor-networks that opposed one another, however, for Lothigius, Steffenburg, John Philipson, Fredrik Blombergh, and many others were really uncertain as to whether the cesspits were lawful. Although it is clear that many council members were building owners and would save money on the *status quo*, they also wanted to see what the national authorities had to say about the pits from a sanitary and legal point of view.

As it turned out, those who promoted the cesspits failed in the end, for the law clearly forbade cesspits and medical expertise condemned them, whether they were sewerred or not. The central inspection of 1885 was important in

¹⁶ Wawrinsky 1887 p. 5-6.

¹⁷ Henry Nygård observes opposition from house owners against introducing new systems of excreta collection also in Finnish cities at the time (Nygård 2000 p. 159).

alerting the National Board of Health to the situation in the cities, for Norrköping, Linköping, and many other cities still kept the cesspits at the time.¹⁸ It was not primarily the discharge of fecal matter through the sewers that was considered problematic with the pits, but instead the fact that they were leaky and contaminated the soil and groundwater. Finally, they were forbidden in Norrköping in 1893, for the legal power resources of the state could not be counteracted once they had been mobilized.

Secondly, after the sewer cesspits had been prohibited, the debate mainly came to concern whether the collection of excreta should be *a municipal matter or remain in private hands*. If the building owners could loosely be designated an actor-network in the question of the cesspits, in this question they were divided into the well-off and the less prosperous. Some supported one network or the other without maybe themselves being property owners at all.

Basically, the actor-network of wealthier building owners, which included Eberstein, Lothigius, Lyttkens, and Carl Swartz, were of the opinion that the sanitary conditions of Norrköping were very poor, and that therefore there needed to be a municipal Department of Sanitation to centralize excreta collection. To stress their point they enlisted the high morbidity statistics in the city. Apart from better hygiene, for them sanitation improvement seems also to have been to get rid of polluted elements in the urban environment and to protect bourgeois class identity. The actor-network of less prosperous building owners consisted of the physicians C. O. Björck and C. W. Engelbrecht, as well as Arvid Palmgren, Daniel Engelke, and John Philipson. They wanted decentralized collection, which would be cheaper for the city and the building owners, who could carry out the collection themselves if they wanted to. The poor sanitary conditions were toned down by enrolling morbidity and mortality rates, and here the physicians played a major part. Belief in the objectivity of medical science and statistics was obviously great, which reflected the high overall status of science.¹⁹

The interests of the latter actor-network were largely confirmed by sanitary investigations up to the end of the period, which shows that those who supported this network prevailed. In practice, many of the well off supported this actor-network, for all building owners gained financially on the decentralized collection alternative. The continued postponement of the matter had the same effect. Despite further efforts by sanitary investigations after

¹⁸ Report by Robert Schultz and Klas Linroth to the National Board of Health in December 1885, in *Hygiea* 1886 p. 174-182. The report actually gave some support to the argument of Swartz, Lothigius, and Stånggren that what was failing was primarily the collection, not the storage.

¹⁹ Cf. Höjer 2001 p. 252-254.

1910, collection continued to be built on the decentralized principles into the 1920s, and sanitary regulations were not established until 1957.

The real problem with excreta collection in Norrköping was very shrewdly pointed out by the physician-writer in *Norrköpings Tidningar* in 1884: there were no central figures who wanted to impose themselves as passage points, to speak in analytical categories. The reason the water and sewerage project had been successful was that there had been men like Erik Swartz and Jacob von Leesen who could enroll power resources such as knowledge, time, connections, and finances for their implementation. Very few people were interested in excreta, and excreta were less attractive than both water and wastewater for a commercial project. Water was commercially viable, but waste was not.

It was primarily farmers and agronomists who had a commercial interest in waste, but there were many difficulties to overcome. Much land was needed and these products could not be used all the year round. In addition, collection itself was expensive. Another problem was that most nutrients had already gone down the drain with the urine, and inappropriate waste, such as glass and metal, was also mixed with the manure, especially after 1900. Ultimately, even for these agricultural visionaries, this was an economic question. Of all such initiatives in late-19th century Norrköping, only one or two projects succeeded, but they were small and on the whole insignificant for sanitation. Carl Nissen's plan for waste separation and swine feeding was early by Swedish and even international standards. The separation of urine and excrement was promoted in the 1860s by the German chemist Alexander Müller, in order to postpone decomposition and facilitate transport, as when the Swedish dry closet Marino was used. Generally, separation and swine feeding were introduced in Sweden in the early 20th century, with Eskilstuna as the main model, but nothing came of this idea in Norrköping.²⁰

Thirdly, parallel to this development, the *water closet* was gradually accepted by all actors, including medical expertise and both these actor-networks, but excluding the first sanitary committee. It was therefore both in theory and practice more and more separated from the dry collection and became integrated into the sewer system. The Board of Health had been positive to water closets all along, but in the early 1900s it became an active promoter of them, so much that they were seen as the major way of collecting excreta (but not other waste). As manufacturer and promoter of water closets, Arvid Palmgren can also be said to have been a central actor in both local and national WC development. His factory manufactured and supplied water closets and cesspools to Norrköping, Stockholm, and all of Sweden, and Norrköping was seen as a model city regarding WC's. Motala ström, with its

²⁰ Mårald 2000 p. 149-181; Melosi 2000 p. 175-204.

rapid and abundant flow of water, debouching into the immense sea, was enrolled as the primary ally by Palmgren and all the other promoters of water closets. The national actor-networks of sanitary engineers and physicians were crucial, and some of their members operated temporarily in Norrköping, primarily Henrik Holmberg, Klas Linroth, and Johan Gustaf Richert.²¹

A major objection on the part of the first sanitary committee was a system of WC's, that is, a general introduction, which would result in the need for interceptors and thereby increased taxation. This would primarily be a burden for the less wealthy building owners and workers, who could not afford water closets. But this latter group never protested against the WC's, probably because an official introduction on a grand scale was never realized, and the sewer system therefore did not require expansion. The feared WC boom did come about, but only when the public had already accepted this convenience, although the social inequalities in their distribution that the sanitary committee warned for did arise and continued even after 1910. The "new" sanitary committee and the Board of Health helped promote the WC's around the turn of the century, and so did A. W. Cronander and Henning Nordenström. Their respective investigations confirmed the view that excreta were diluted in the enormous masses of river water.

The river was once again enlisted as a guarantor of local development and health, just as J. G. Swartz had earlier enrolled it as a key actant in Norrköping's industrial development. It was thus implied that the river would carry away, dilute, and eventually purify the city's waste. To some extent the river did serve this function, but not quite enough, as Nordenström's report shows. However, river pollution was only a minor issue before 1900 in Sweden, contrary to the situation in France and Great Britain. The main reason was that Sweden had many large waterways, was not so highly industrialized and urbanized, and WC's had not generally been used. Norrköping was both heavily industrialized and a major promoter of water closets. The lack of recognition of river pollution there was mainly due to the economic interests of industry, which wanted to continue discharging waste into the river.

In Linköping there was also a great conflict concerning the question of keeping the city clean, but the actor-networks were clearer. Basically, public health interests opposed the economic interests of the building owners, that is, receptacles versus sewered cesspits. The city physician Oscar Segerdahl, the central figure in the public health network, elaborated also the issues of geographical extension, and tried to impose a general introduction of receptacles only. He was opposed by most of the magistrates and some

²¹ Jakobsson 1999 p. 130; Lundgren 1974 p. 95.

members of the Board of Health, as well as the County Governor Robert De la Gardie, who all constituted an actor-network supporting the cesspits. The latter was indeed surprising as he was the representative of the state and rejected a request from Norrköping to keep the pits. It was probably such an injustice that prompted a certain jealousy and anger on the part of Norrköping residents towards Linköping but also the fact that the County Governor was placed there.²²

Segerdahl's actor-network grew as his colleagues Boman and Nordenström, as well as a few members of the Board of Health, were enlisted. He could also enroll the legal power of the Swedish Government, which had definitely condemned the cesspits in late 1885. But the actor-network protecting the interests of the building owners was evidently strong, and the sanitary regulations of 1889 became a compromise. Fixed, tight boxes above ground were to be allowed, and it was feared that the obscure wording of the regulations would legitimate the keeping of cesspits. But partly due to the 1892 cholera epidemic on the Continent, it was relatively easy for Henning Nordenström to continue Segerdahl's work and almost eradicate the pits in the 1890s.

The position of the physicians was stronger in Linköping than in Norrköping, possibly because the sanitary conditions were worse in the former, but also because they did not share the building owners' interests to the same degree as in Norrköping. Segerdahl, Suber, and Nordenström were deeply engaged in the work of improving public health in Linköping. It is particularly noteworthy that, while he served as first provincial physician, Nordenström was more critical of the sanitary conditions in his home town than in Norrköping. Water closets were allowed in Linköping but not actively promoted, due to the strong position of the physicians. Certainly, at the time the medical profession was spreading the gospel of the water closets, but mostly in cities situated on a sufficiently large and fast-running watercourse. Elias Heyman and others warned of the contamination of smaller waterways.

At the turn of the century, in theory and practice the Linköping sewers fulfilled not only the draining of storm- and groundwater, but also the Chadwickian vision of, in Hamlin's words, "spiriting away wastes."²³ Cesspits with connections to the sewers, in practice, were allowed for from the beginning. The by-passing of the cesspools for household and WC wastewater underlined this, although this was a combined system that flushed everything into the river. In early 20th-century Sweden combined sewerage without

²² Andersson 2000 p. 298-299. The competition between the cities remains to this day. "Never trust a Linköping dweller", a Norrköping City Council member supposedly told a younger colleague in the late 20th century. Today cooperation seems to be the prevailing attitude, however (Andersson 2000 p. 298; Nilsson 1999 p. 87).

²³ Hamlin 1992 p. 706.

cesspools, the end-of-pipe solution, became increasingly prevalent in wastewater and excreta management, especially in cities close to large waterways. Linköping lay on a small and sensitive river, and the Board of Health and other actors tried unsuccessfully to have people use septic tanks.²⁴

Dry collection was still dominant in Linköping. The establishment of a municipal Department of Sanitation in 1909 and the transition to compulsory, regular collection in 1911 marked the first step away from the by and large decentralized excreta management that had been prevalent in Linköping ever since 1889 and even earlier. (This method was still used in Norrköping at the end of the period.) Prior to the early 1900s, the building owners had opposed centralized collection, but had to make concessions to a public health network, which had other members this time. The sorting of the waste into liquid and dry waste, and, in turn, dry waste into categories was a result of Sweden's new industrialization and adaptation to new kinds of waste. Both national and international examples were followed, such as the swine feeding farm, mainly inspired by Germany and the USA. The sorting of filth and waste was also a cultural categorization, based on the Douglasian maxim of "matter out of place" as the potentially dangerous and threatening.²⁵ What was dangerous or innocuous was in this sense both founded upon the material world and culturally constructed.

Both state and city physicians were concerned about the poor sanitary conditions in the Linköping and Norrköping suburbs. The solution to this was generally considered technical, that is, an extension of water and/or sewerage was preferred. Only rarely was excreta management in the suburbs mentioned, and invariably it was seen as rudimentary and dangerous for the city. In Norrköping it is not surprising that the northern suburb was left behind in this regard, given the attitude to it and the poor state of excreta collection in the city itself. In Linköping, on the other hand, the city's suburbs were included in the implementation of the sanitary regulations of 1889, since they were by then included under the Public Health Act. In the early 1900s, the new city physician Carl Schoug also paid attention to sanitation in the suburbs.

It is a bit tricky to say who was right regarding the status of the urban environment in Linköping and Norrköping at the turn of the century, since there were so many different appraisals. Nordenström worked diligently to improve different aspects of sanitation in both the urban and rural environment of Östergötland, first in Linköping during the 1880s, and then in the whole county in the 1890s. It is therefore somewhat surprising to read in his annual reports that he was fairly satisfied with the conditions in Norrköping.

²⁴ Lundgren 1974 p. 94-99.

²⁵ Douglas 1966 p. 2-6, 30-41.

köping and Linköping just before he was to leave his position. However, in relation to the state authorities he probably wanted to paint a rather positive picture of his own district, particularly as the reports were printed, whereas he was often more critical in the reports that he sent directly to the Linköping Board of Health. He seems to have been more personally involved in the solution of sanitation issues in his home town, Linköping, than in Norrköping. The physicians C. O. Björck and C. W. Engelbrecht also toned down the allegedly poor sanitary conditions in Norrköping at the time, while persons who did not have expert medical knowledge, such as Carl Swartz, thought that the conditions were in fact very poor.

The varying testimonies and appraisals of the sanitary conditions in Linköping and Norrköping at the time, and the consequent lack of really reliable information about this, present a problem which is not easily circumvented. The municipal and state employed physicians of the time were evidently part of actor-networks and had to weigh their words when confronting other more or less powerful actors and actor-networks, hence their sometimes contradictory statements. Hans Nilsson, who has studied this problem with a broad historical-demographic approach, concludes that the sanitary situation in Linköping became much better between the 1860s and the end of the century, and that the central inspections by the first provincial physician were crucial in achieving this.²⁶ While generalizing is problematical, it is at least conceivable that the urban environment in Norrköping was also better around 1900 than in the 1860s. Water supply and sewerage must then also have contributed to this general sanitary and environmental improvement.

Norrköping and Linköping in a National and International Context

The rapid spread of modern water and sewer systems in European cities after 1850 has often been cited as a “water mania” in the literature.²⁷ The European and Swedish water supply, sewerage, and excreta development needs to be re-interpreted in the light of the two case cities and the theoretical framework.

First of all, by that time modern water and wastewater technologies were available, and they were primarily of British origin. These technologies were by no means uniform in the sense that there was, for instance, only one kind of sewer design. What made them appropriate in the industrialized and

²⁶ Nilsson 1994 p. 133.

²⁷ Goubert 1988 p. 118; Reid 1991 p. 27.

urbanized cities of Europe was instead their ideological uses. The ideology of Edwin Chadwick and the British public health movement, secondly, offered a specific context for the diffusion of modern water supply and sewerage technologies. They were needed to clean up the growing cities: improve sanitary conditions, fight disease (mainly cholera), boost morality, and prevent revolution. Britain was the great public health and engineering model at the time, and influences were transferred mostly by the Swedish actors (and actor-networks) themselves.²⁸ The development of modern industry and improved fire protection – Nordic cities had a large share of wooden buildings – were also major driving forces.²⁹

Thirdly, newly-established modern financial institutions such as commercial banks often supplied the necessary capital. But there were also other ways in which cities could at least partly finance these technologies: taxation, fees, and private donations. Fourthly, these systems were mostly introduced where there was a power base for local government and independence.³⁰ In Sweden, the Communal Law of 1862 gave cities autonomy, with responsibility for services and the right to levy taxes and to borrow money.³¹

On the whole these prerequisites made possible the introduction of large, technological water and wastewater systems in Swedish cities. From the 1860s to the mid-1880s there were a few civil engineers of the Royal Corps of Engineers who almost completely dominated the Swedish field of water and

²⁸ The Swedish Public Health Act of 1874 is a perfect example of this great British and Chadwickian influence, although it is remarkable that the core of the Victorian public health ideology – sewerage, WC's, and piped water – was largely ignored in this piece of legislation. It was instead the Swedish engineers that were instrumental in the technology transfer (Drangert, Nelson, and Nilsson 2002; Hamlin 1998 p. 2-15; Nelson and Rogers 1994 p. 21-26). France and Germany were also sources of inspiration for Sweden, but not to the same extent as Britain (Hietala 1987 p. 190; Leijonanker 1853). In the south of Sweden, in areas which belonged to Denmark until the 17th century and are more strongly influenced by Denmark to this day, Danish engineers initially played a significant role. They were also inspired by the British, as were Norwegian and Finnish engineers (Katko 1997 p. 21; Lindegaard 2001; Nygård 2000 p. 118-123). The transfer of British water technology also affected France, Germany, the United States, and most other Western countries deeply. This hegemony continued at least throughout the 1870s, and great influence was exerted even into the 20th century (Guillermé 1988 p. 107-110; Melosi 1988 p. 213-222).

²⁹ Hietala 1987 p. 189.

³⁰ There were, of course, exceptions, notably the model country itself. Hamlin argues that the decentralized local government of England and Wales in the early 19th century was actually modernized and centralized by dealing with public health, dung, and similar matters (Hamlin 1998 p. 5).

³¹ Urban autonomy in late 19th century Sweden has often been overrated. The autonomy decreased with the urban laws and other legislation towards the turn of the century 1900, and continued to do so throughout the 20th century (Bokholm 1995 p. 315-316). Nevertheless, the importance of the relative autonomy achieved in 1862 for large infrastructure projects must not be underestimated.

sewerage engineering, initially F. W. Leijonancker and later also J. G. Richert and Abraham Blix. In the 1870s and 1880s, Richert overshadowed the others particularly in the field of sewerage (see Appendix 1). Leijonancker had been on study tours of waterworks in 1852 (Belgium, France, Germany, and Britain) and 1857 (Germany and Britain), and of engineering structures in general elsewhere in Europe and Russia during the 1860s. In 1869 he also visited the opening of the Suez Canal in Egypt. Richert in 1856 studied railroads in the same quartet of countries as Leijonancker above, as well as water and sewerage in Great Britain in the 1860s, and Blix also went on study tours in the 1860s and 1870s.³² These engineers were central figures in actor-networks with nodes in continental, British, and Swedish cities, and the introduction of water and wastewater systems in Sweden would have been much more complicated without them.

In the early 1870s, Richert's actor-network was growing, and he came to exert a decisive influence on the water and wastewater development, especially in Norrköping, but also in Linköping. The work he completed with the Göteborg water supply and sewerage and his subsequent fame were a result of successful network-building, in Great Britain, in Sweden, and in Göteborg. His power resources increased as he enlisted into his actor-network exceptional scientific and engineering knowledge, suppliers, foremen, cast-iron pipes, filters, political and economic means, etcetera, which further facilitated the stabilization and durability of the network. On some occasions Richert's network challenged that of Leijonancker, and it proved the strongest in Göteborg, Norrköping, and Uppsala. Why Richert managed to drive Leijonancker – who was the great water pioneer and also very respected as a member of parliament and various prestigious societies – out of competition is difficult to say. But it seems that Leijonancker's scientific prestige was tarnished by the position he took in the debate in Göteborg.³³ In the early 1870s cities therefore found Richert a reliable and skilled expert, and he was more than willing to help. For him it was financially profitable, he gained in prestige provided he did a good job, and the water engineering profession thereby became further established.

Blix was not as famous but was certainly highly skilled. His actor-network of contractors and entrepreneurs in Great Britain and Göteborg was much the same as that of Richert, but was also part of a larger common network for the diffusion of British engineering and manufacturing technology to Sweden

³² Grill and Lager-Kromnow 1979 p. 454-456; Wetterberg and Axelsson 1995 p. 55-60; Smedberg 1937 p. 321-323. In the 1850s to 1880s, in average around 10 percent of the members of the Corps did international study tours each year, most of which went to European countries (Smedberg 1937 p. 291-305).

³³ Drangert, Nelson, and Nilsson 2002 p. 179; Smedberg 1937 p. 354-358.

around the mid-19th century, in which Göteborg was something of a Swedish center and Norrköping a major recipient.³⁴ This was not technology transfer as was the case in Norway, where British entrepreneurs built the textile industry. Norrköping played a very active role in promoting study tours, importing skilled engineers, workers, and machinery.³⁵ Whether Blix looked to Norrköping and Richert or just utilized the existing network is hard to say, but it seems obvious that building one's own actor-network meant being enrolled in other important networks as well.³⁶

This international network led to a technological uniformity, since technical solutions and components often were taken from Great Britain, but the Swedish engineers also left their own marks on the systems they designed.³⁷ The water and sewer systems in Norrköping and Linköping thus became very similar, especially as Richert designed the sewerage in both cities. His combined system of self-cleaning glazed earthenware pipes was clearly inspired by British models, although he had also developed the construction further. The waterworks of the two cities both had slow sand filters, and cast iron was the dominant pipe material. These were typical features of Swedish waterworks at the time, but also testify to the influence of British water technology. The pumps were turbine-driven, a Swedish way of utilizing the power of waterfalls in close proximity to cities.³⁸

Leijonancker and Richert influenced Swedish cities also in the way they motivated these technologies. Leijonancker's 1853 book on water supply, which was largely inspired by Chadwick's ideas, was particularly widespread. In Norrköping, the local newspaper also helped disseminate these ideas. Often some or all of Leijonancker's arguments were used by local actors, but it is likely that their enlistment mainly served rhetorical purposes, in order to convince decision makers, economic contributors, and the general public. The arguments that became the most decisive in each city were the ones that were related to real or perceived urban problems, which was evident both in Norrköping and Linköping.

³⁴ Gooch 1991 p. 89-92. See also Jörberg 1991 p. 188-189.

³⁵ Bruland 1991 p. 266-267; Nyberg 2000 p. 615-619.

³⁶ NSA, Norrköping Waterworks Board Archives, AI:1, minutes 1875-03-30 §5; Dagersten and Staaf 1976 p. 12-13.

³⁷ Isgård 1998 p. 28-34.

³⁸ Isgård 1998 p. 28-34; Melosi 2000 p. 85-86. According to Bill Luckin, there was little agreement on the role or effectiveness of slow sand filters in London in the mid-19th century. Some water companies filtered their water and some did not (Luckin 1986 p. 35-40). An innovation that facilitated the extension of pipe networks citywide was the dynamite, by the Swedish chemist and engineer Alfred Nobel, founder of the Nobel Prizes. The dynamite, patented in 1867, made the powerful but extremely volatile explosive nitroglycerin much safer to handle (Encyclopaedia Britannica Online, <http://search.eb.com/>, keywords "dynamite", "Alfred Nobel", access date 2002-09-24).

From a Swedish perspective, Norrköping and Linköping were quite early in introducing modern water supply and sewerage (see Appendix 1). The case of Norrköping seems to confirm the view that cities where textile industry dominated were especially early due to their large need for water. On the other hand, industries often arranged their own water supply by placing their facilities close to watercourses, which was certainly the case in Norrköping. Such actions may reduce the incentives for a public supply, but in Norrköping a public supply for the residents facilitated continued discharge of industrial effluent in the river. The development in Sweden was almost simultaneous to the one in Germany, but German textile cities, on the whole, did not develop public water systems earlier than other cities, possibly because the residents could continue to use unpolluted wells. On the contrary, textile and metal industry cities were generally later (1870s and 1880s) than for example commercial and administrative cities (1850s and 1860s).³⁹

Comparisons between cities in different countries may be misleading, however. A big survey of several European countries would be necessary to be able to say anything about what kind of cities first introduced water and sewerage. The only thing that is certain is that the bigger cities generally built water and sewer systems before the smaller. The above development suggests that the diffusion of ideas and technology was decisive, for there was a boom of these urban technologies in the mid- to late-19th century in Europe, but that the exact point in history in which this took place and under what conditions were contingent upon the local context and power structures.

We can at least conclude that Norrköping was somewhat uncommon in the sense that there were many industries with their own water supply, but that the factory owners still contributed substantially to a centralized, municipally owned supply. Linköping was also unique in Sweden and Scandinavia in managing these systems by means of a joint-stock company, which was more common in Great Britain. There the private water industry fell into disrepute in the mid-19th century, resulting in either improved private water distribution or municipal takeovers towards the end of the century.⁴⁰ The municipal takeover in Linköping should be seen partly against this background, but the national uniqueness of the Water Company also led to much conflict regarding how to evaluate its 30 years in operation. Many decision makers and engineers involved seemed to agree that the company had been a commercial success, but that the technical system had been less well-maintained.

By the 1880s a shift seems to have taken place and German water science and technology became a major source of input for Swedish professionals and

³⁹ Hietala 1987 p. 195-200.

⁴⁰ Hassan 1998 p. 16-22.

city authorities, at the same time that introduction of water and sewerage occurred in German cities. This shift is also confirmed if we look at public health and medicine, economics, and several other sciences at the time. Germany traditionally exerted a strong cultural and scientific influence upon Sweden, and representatives of the Royal Corps of Engineers studied there early on. After 1900, the USA joined Germany as precursor and model country for Sweden regarding many sciences.⁴¹

By the turn of the century 1900, water engineering had become institutionalized in Sweden through the formation of associations, the establishment of its own academic discipline, and the establishment of water engineering consulting companies. The Swedish Association of Engineers (*Svenska teknologföreningen*) and of municipal engineers (SKTF) were actor-networks that promoted contacts between water engineers on different levels. On the local level, skilled, educated city engineers – in this study the chief engineer Wilgott Carling in Norrköping and the city engineer J. B. Carlson in Linköping – also began to assert themselves. They often had the last words when the plans of the more well-known national engineers, notably Johan Gustaf Richert, were to be implemented in the extensions and improvements of existing water and sewer systems. These local engineers enlisted their superior knowledge of the local environment and conditions, something that was difficult for an external consultant to contradict. Richert and VBB were very busy from 1900 onward and often did not have time to obtain detailed information on the spot.

Johan Gustaf Richert's father J. G. had been involved in the construction and building of the water supply and sewerage in many Swedish cities, but he was aware that it was controversial in his home town Göteborg and therefore tried to keep a low profile. The solution was to be officially hired as an "advisory engineer," as in Norrköping. Carling's predecessor B. L. Hellström was an unusually early skilled local engineer, and he was given extensive authority, but in practice J. G. still exerted much more influence on the local level than Johan Gustaf later did. Consequently, at the same time that engineers on different levels became more closely connected through the associations, there was also a widening gap between local and national level, public and private, in the early 20th century.

By this time, it had become more accepted for engineers not to remain in public service, but to go private and become consulting engineers or work in industry. This was in line with the new status and self-image of the engineering profession as utterly central in the modernization and industrialization of Swedish society. But this also led to a conflict between the old disinterested,

⁴¹ Linnér and Lohm 1999 p. 315; Smedberg 1937 p. 302, 321-330; Sundin 1981 p. 24-29.

public engineering ideal and a new private-industrial ideal. In this sense father and son Richert can be said to have epitomized these two ideals, as J. G. had been employed both by the city of Göteborg and, like so many civil engineers of his time, the Royal Corps of Engineers, while Johan Gustaf was a founder of the private consulting branch. On the other hand, J. G.'s advisory engineering was indeed often private in nature, and Johan Gustaf moved freely between these ideals in his roles as consultant, professor, and active expert involved in different public studies.

The institutionalization of water technology basically meant that it was now an accepted scientific and social practice – a heterogeneous network. No water and sewerage engineer or any other actors at all, questioned the systems themselves. They had become self-evident, a black box. Piped water and sewers were established systems, economically, technically, and socially, although technical design was continually debated. This had wide-ranging implications for society and nature, which was clear particularly in the question of water pollution. Solutions were almost only thought of in connection with the existing systems, from water closets to sewage treatment.

Swedish professionals began to acquire knowledge of the European debate about sanitation and excreta collection about the same time as modern water supply and sewerage were being discussed for the first time, that is, around the late 1850s and 1860s, and to begin with the foremost source of inspiration was Great Britain.⁴² Although part of the same over-all problem – to clean up European cities and make them physically, socially, and morally healthy places – the discussions concerning water supply and sewerage, on the one hand, and collection of excreta, on the other, were initially often separated in Sweden. It was not until after the National Public Health Act of 1874 had been in force for a few years, and the difficulties of implementing it had become clear, that the two debates merged. But in cities such as Norrköping and Linköping, where water pipes and sewers were introduced very early, this part of the question was seen as already solved, and attention was directed towards excreta collection, where sewerage was an integral part.⁴³

The examples Norrköping and Linköping both testify to the strong influence of variants of the miasmatic theory of disease in Sweden until the turn of the century 1900. The theory affected the way in which water quality was conceived, together with the prevalent methods of chemical analysis. Chemical water analyses were carried out in both cities before the introduction of water supply and sewerage, the water intakes were placed quite far upstream, and slow sand filters were used, mainly to reduce the amount of organic material.

⁴² Wetterberg and Axelsson 1995 p. 55-60.

⁴³ See for instance NSA, Norrköping City Council Archives, supplement No. 34 1886.

There was a general notion of what kind of water was good. It had to be clear from organic matter, not too hard, and taste and smell good (cf., J. G. Richert and the British discussion). In Linköping, the wells were ruled out, but not because well water was generally considered of poor quality. Wells and springs were traditionally the most common water supply in places far from streams, and spas abounded in Östergötland County (for example, at Medevi and Söderköping).⁴⁴ However, well water was regarded as quantitatively insufficient. Yet professionals were aware that contaminated soil could affect the groundwater, and many wells in Linköping were in fact poor. The maxim that “running water purifies itself” was generally cherished, and was conclusive in the choice of water source in both cities in the 1870s.

From the point of view of miasmatic etiology, flowing water was thus not considered problematic. It was putrefying organic material that was the cause of disease, whether poisonous odors that emanated from it filled the air, permeated the soil, or made water stagnant. In the words of Alain Corbin: “Any stagnant water was a threat. It was movement which purified. Currents expelled, crushed, dissolved the organic remains that lodged in the interstices of water particles.”⁴⁵ This was why in the 1860s August Almén could condemn the Norrköping river water because of the large organic content and still consider it “rather usable.”⁴⁶ The river would purify itself of the organic contaminants anyway. However, one of the drawbacks of the chemical analysis was that it did not make a distinction between different kinds of organic matter, and in this case it was probably humus that he had detected.⁴⁷ This limitation was recognized as early as the 1850s by the followers of Justus von Liebig and his zymotic theory, which did not become influential in Sweden until later, but even they were as unable as others to distinguish one type of organic matter from another.⁴⁸

With the advent of bacteriology in Sweden in the 1890s, the parameters important for evaluating water switched from being chemical to being also

⁴⁴ Bergmark 1985 p. 193-199, 205-227.

⁴⁵ Corbin 1986 (1982) p. 32.

⁴⁶ Almén 1868 p. 102.

⁴⁷ Kuylenstierna 1908 p. 250; Drangert, Nelson, and Nilsson 2002 p. 177. Organic material in water was a problem for the British early on in the 19th century due to their general introduction of water closets and the consequent flushing of fecal matter into rivers, but also because of industrial discharge. In Sweden, organic matter was mostly the same as humus, but it was not distinguished from other, more dangerous organic compounds until the breakthrough of bacteriology.

⁴⁸ Hamlin 1990 p. 129-140. Liebig suggested that it was the process of decomposition itself that produced disease, not some poisonous substance emanating from the putrefying matter, as propagated by Chadwick and Thomas Southwood Smith (“traditional” miasmatic theory). By suggesting a process instead of a poison, Liebig undermined the chemical analysis, but nothing came instead until the introduction of the biological analysis.

biological. What became important in the bacteriological paradigm was the origin of matter. Much well water that had previously been condemned on chemical grounds as being too hard or containing ammonia, could instead be commended. Pathogens were believed to be killed off as the water penetrated through the soil down to the groundwater. Previously ammonia had invariably been taken as a sign that the water had been contaminated by animal organic matter,⁴⁹ but now it was recognized that it could also have a vegetable origin, which was not considered dangerous. The biological processes of the sand filters were also understood, which made them essential in killing infectious bacteria, not only in reducing organic material and making the water clear.⁵⁰

The miasmatic and bacteriological paradigms also generated different views of pollution. Seen through Douglasian spectacles pollution is a category that disturbs or threatens the existing social order, and actor-network theory may assist in explaining how pollution came about, or was constructed. In theory there was little worry that fecal matter would pollute or spread disease through waterways in the early to mid-19th century, for streams were seen as sewers that purified themselves. (See the quote by Corbin above.) It was contaminated air and soil that were thought to breed epidemics such as cholera, and effective city cleaning, that is, successful water, sewage, and excreta management, would solve this problem. But from the mid-19th century increasing loads of industrial and urban waste alerted medical experts and decision makers on the Continent and particularly in Britain to the fact that waterways could not accommodate unlimited filth.⁵¹ So even though pollution is a relative construct, determined by the human actors, there was a material limit where matter went from being “in place” to “out of place,” presumably when watercourses either stank disgustingly enough or when the health of people alongside streams – bourgeois or upper class men – was seriously impaired. The actant waste so radically changed in character and quantity that another actant, water, went from being interpreted by different actor-networks as clean to polluted.

⁴⁹ When applied to rivers the British chemist Edward Frankland attributed ammonia to “previous sewage contamination” (Hamlin 1990 p. 159-161).

⁵⁰ Almquist and Richert 1898 p. 32-34; Corbin 1986 (1982) p. 32-33; Hamlin 1990 p. 159-161; Hansen 1903; Melosi 2000 p. 137-146; VAV, Documents of SKTF, 1908, supplement No. 8, “Resultaten af de försök i stor skala, som vid Christianstads vattenverk under Nov. – Dec. 1907 anställdes för att medels ozon förbättra och rena vattenledningsvatten,” Alarik Lagergréen. The sand filters testified to the fact that all bacteria were not “evil,” since the pathogens actually were killed by other “beneficial” bacteria in the filters. However, the new hygienism from Pasteur onward became obsessed with sterilizing pathogens and eradicating disease, which tended to conceal the full implications of bacteriology. To agricultural science, for example, the “beneficial” bacteria fixed nitrogen and were overall essential components of fertile soil (Latour 1988 p. 43-58; Mårald 2002 p. 81; Schmidt and Kristensen 1986).

⁵¹ Heyman 1877 p. 78-90; Wawrinsky 1887 p. 1-3.

With bacteriology came a scientific basis for microbiological pollution: cholera and other epidemics spread via water due to germs. On the other hand, bacteriology also reinforced the significance of quickly removing potentially pathogenic rotting matter, and, as physicians were primarily concerned about the health of the city population, WC's were increasingly promoted to flush out waste from the city. Urban waste was thus considered so dangerous to keep in the city that it justified a swift evacuation and thereby pollution of water and neighboring suburbs and communes downstream. Johan Gustaf Richert defended this by pointing out that, unless the sewage was pathogenic, it was otherwise innocuous. There was a little criticism against dumping waste in waterways before 1900, related to scattered industrial activities in the south of Sweden, but industrial and hygienic interests invariably got the upper hand.⁵²

There were exceptions, such as Ivar Lyttkens in Norrköping, who was a very consistent critic of any kind of contamination in the city and the river in the 1890s. His concern for preserving the river was unusual and courageous at this time, particularly bearing in mind that he acted against mighty industrial interests. It is possible that he promoted the fisheries, for nationally there was a growing anxiety among fishermen that pollutants would kill the fish, but he also seemed to want to protect the river for its own sake. On the national level, however, other concerns gained a hearing, primarily those of engineers and physicians. Richert said in 1897 that "dirt does less harm in the water than in the dwelling, and the health of fish is less important than that of human beings."⁵³

The notion that running water purifies itself was so strong that it outlived the miasmatic paradigm, certainly because there was some truth to it, particularly when small amounts of filth were discharged in large streams,⁵⁴ but also because strong industrial and scientific interests promoted it. By the early 1900s, the self-purifying phenomenon had been translated to fit the bacteriological paradigm. Pathogens and organic matter in water were believed to be neutralized if they were exposed enough to the sun and the air. As regards the air, the rationale was that the greater the flow of a river, the more oxygen could be absorbed in the water and the more microbiological

⁵² Lundgren 1974 p. 32-45; Löwgren, Hillmo, and Lohm 1989 p. 162; Wawrinsky 1887 p. 2-8.

⁵³ *Förhandlingarna vid Nordiska teknikermötet i Stockholm den 15-19 juni 1897* 1898 p. 233.

⁵⁴ The concept of self-purification is still central to present-day water and environmental engineers when evaluating pollution loads in rivers. See, for example, Podar et al. 1985 and Ragas and Leuven 1999. The notion that degradation of organic matter can only take place under aerobic conditions is today being questioned, however. See, for instance, Bastviken 2002 p. 40-41.

processes of breaking down organic compounds and pathogens would be facilitated.⁵⁵

From the onset of the discussions, most Swedish physicians and engineers had regarded water closets as superior to all other constructions for evacuating excreta, both from a hygienic and an economic point of view. The interests of agriculture, for example, were seen as secondary to medical and economic interests. Many professionals, such as Elias Heyman, were aware that WC's could contaminate lakes and rivers and hence suggested caution in their application, but on the whole they never questioned water closets.. Those who opposed WC's were generally not experts. Some were worried about river pollution, such as the first sanitary committee of Norrköping, but it was mainly the expected increase in water consumption, loss of nutrients, and sometimes competition with municipal poudrette manufacturing that propelled their opposition. Often they complained about the limited powers of the Public Health Act, and the unprofessional composition of the boards of health.⁵⁶ There was also criticism due to technical problems; malfunctioning WC's could be a real nuisance. The economic burden that would be generated by a general introduction of water closets for rebuilding the sewers also caused opposition, especially from workers and the poor. The question of WC's became a question of class.

The hygienic argument was difficult for lay people to contradict. After 1900 the traditional and scientific use of excreta in agriculture, which had previously been so important for the material flow between town and country, was therefore losing its central role, especially with the contemporaneous advent of artificial fertilizer.⁵⁷ The ideal of reuse of nutrients survived in the dry collection, although it was slowly being weakened there as well. But, as the younger Richert argued, most of the nutrients had long since been flushed out of the city with the urine (from, for example, kitchen sinks and cesspits). Richert also assumed that the sewer pipes in the streets did not need much rebuilding to accommodate excreta, except for maybe interceptors, which his company VBB was only happy to design and build. The self-purification argument was used to brush aside the fear of river pollution, and it evidently was effective.

In the early 20th century water pollution became a topic of heated discussion in Sweden. Several cases of chemical-industrial water pollution were debated in the Swedish parliament, and it was particularly sugar and sulfite pulp mills in the countryside, where the Public Health Act was less demanding than in cities,

⁵⁵ VAV, Documents of SKTF, 1908, supplement No. 8, Alarik Lagergréen; Carlson 1912 p. 88-90.

⁵⁶ Heyman 1877 p. 61-80; Sondén 1889 p. 55-58; Lundgren 1974 p. 44-45, 50-54.

⁵⁷ Mårald 1998 p. 206-209.

that attracted attention. The Swedish Minister of Finance Carl Swartz in 1907 called in an already existing parliamentary committee, the so-called *dikningslagskommittén*, to investigate possible ways of protecting public health without compromising industrial development, which led to a legislative proposal in 1915 that mainly protected industrial and economic interests.⁵⁸

In the cities environmental conditions had become serious, and in several cases sewage treatment was discussed. WC's, however, were increasingly accepted, occasionally in connection with intercepting sewers and rarely with treatment. Large-scale treatment was preferred to private septic tanks or cesspools. Some cities changed water supply to groundwater to be able to further install WC's. Swedish physicians and engineers made several study tours to Germany, Great Britain, and Denmark in the first years of the 20th century to gain knowledge of sewage purification methods, the most preferred of which was biological filters in combination with a large septic tank. The anaerobic processes of decomposition worked very well in this system, whereas in the yard tanks such processes failed, because the excreta were not pulverized enough and therefore caused stoppage.⁵⁹ Large-scale treatment was preferred to private septic tanks or cesspools. New methods in water treatment were ozonization and chlorination, and the latter became dominant, but only after the 1910s.⁶⁰

Sewage irrigation, that is, the application of wastewater to farmland for its purification, was highly esteemed at this time, but it did not become generally implemented in Sweden. The reasons for this were manifold. First of all, compared to the Continent and Britain, Sweden generally had small cities with few water closets, few industries, and large waterways, which caused the actors to rely on self-purification processes. Secondly, Sweden was probably considered too cold for sewage irrigation. Thirdly, the experience gained from Europe suggested caution, for very vast agrarian fields were required in or in close proximity to cities, and the enterprises were seldom financially sustainable.⁶¹

The essential, structural idea of pollution did not change in any fundamental way in the transition from the miasmatic to the bacteriological paradigm. Environmental pollution was "matter out of place" in either paradigm, but it was explained and constructed differently. Medical and engineering practices did not change as much as one would think, at least not as regards water and sewerage (see above). Bacteriology often confirmed what was already practiced. We can also see this consistency on a social level. Bourgeois

⁵⁸ Lundgren 1974 p. 57-91, 152-154.

⁵⁹ Lundgren 1974 p. 91-114; Olsson 2001. Cf. also, for instance, Christenson 1909 and Andersson 1908 p. 272-279.

⁶⁰ Isgård 1998 p. 38-41.

⁶¹ Heyman 1877 p. 61-104; Lundgren 1974 p. 100-104, 145-151; Wawrinsky 1887 p. 1-48.

ideology and identity survived into the 20th century, and in their world view cleanliness and fragrant smells were a sign of inner moral strength, while dirt and odors symbolized morally “filthy” and “dangerous” people.⁶² Waste and dirt were associated with immorality, radical political ideas, poverty, disease, and ultimately death, and through the water closet, dirt and pollution could be removed via invisible, subterranean pipes.⁶³ Although the relationship was not as clear as professionals in this late 19th-century milieu liked to think, falling mortality rates ultimately seemed to confirm that a pipe-bound city was a healthy city.

Summary

The introduction of modern, pipe-bound water and sewer systems in Norrköping and Linköping, both of which had unsuccessful water projects prior to 1860, was eventually carried out by actor-networks linked to the ruling elite in the 1870s. Central figures of the networks were persons otherwise very powerful in the respective cities. These networks were mainly economic, that is, economy was a predominant factor when the systems were introduced, particularly in the case of water. For example, the local actors were encouraged by the prospect of lowered fire-insurance fees in both cities and decreased costs for poor relief, especially in Linköping, after an introduction of piped water. In Norrköping, piped water was a patriarchal concern for the workers, but was also indirectly to boost local industrial development. Dumping industrial sewage in the river Motala ström was inexpensive waste management that could continue after providing the residents with piped water. The Linköping Water Company was expected to be a profitable business venture.

Public health and environment were enlisted as well, but here the two cities differed. In Linköping the poor sanitary conditions were attributed to deficient sanitation, drainage, and cleanliness, which could be improved through piped water, for example, for flushing the streets. Norrköping’s history of devastating fires made fire protection improved by pressurized piped water crucial. Sewerage came late in the discussion, which implies that, at least in the Norrköping case, the influence of cholera on the introduction of these systems has been exaggerated. Finally, what triggered the initial construction of water and sewer systems in the two cities at this particular time in history was a com-

⁶² See, for example, the quotes by Blix in Chapter Two and Carl Swartz in Chapter Five. Douglas 1966 p. 1-6, 36-41, 139-140; Ekenstam 1993 p. 68-74; Frykman and Löfgren 1987 (1979) p. 157-166, 221-272.

⁶³ Douglas 1966 p. 36-41; Laporte 2000 (1978) p. 76-95, 118-121; Schmidt and Kristensen 1986 p. 11-49; Bauman 1992 p. 129-160; Prendergast 1992 p. 74-101; Åhrén Snickare 2002.

bination of economic viability, urgent environmental problems, as well as civic pride and the influx of engineering ideas from Great Britain, primarily through J. G. Richert and Abraham Blix. The complexity of this matter thus speaks against the assumptions underlying economic, environmental, or technological determinism.

In the years after the initial construction of water and sewerage, technical and organizational issues were increasingly institutionalized, at least for the inner cities. Ironically, the extension of water and sewerage became more socially equal for the Linköping residents, who paid a water fee, than for the inhabitants of Norrköping, whose water was free of charge. Geographical issues came into focus as suburbs emerged and began asking for public services. Economic actor-networks were protective of the city's own economy, and wanted to exclude the suburbs if the extension jeopardized the technological systems. Public health and humanitarian networks feared epidemics such as cholera in the suburbs due to the poor sanitary conditions there, and generally wanted to extend a helping hand, for the good of the city itself. The Linköping organization of water through a private company sometimes led to a situation where its economic interests were fused with those of the public health network, when expansion to the suburbs was profitable.

Public health and sanitary issues gained ground after 1880, when a general Swedish discussion ensued and the state put more pressure behind the Public Health Act of 1874. In Linköping this led to the forming of a well-defined public health network, active in the issues of spatial extension but fully developed and successful in the discussion of excreta collection. Nonetheless, it was more difficult to get rid of the cesspits with sewer connections there, partly because the County Governor was not as eager to condemn them in Linköping as in Norrköping. In both cities building owners resisted the introduction of receptacles to replace the cesspits. In Norrköping some prominent factory owners were more eager to improve the sanitary conditions than the physicians. The physicians and the public health network remained weak as they relied too heavily on the decreased mortality rates after the introduction of water and sewerage. The Linköping physicians worked hard to improve the environment, on the other hand. In Norrköping almost every actor was in favor of water closets, due to the great quantity and flow of the river water, and it seems that the unresolved discussions about excreta collection facilitated the spread of WC's. The use of WC's in Linköping was not widespread, mainly for fear of polluting River Stångån. The dry collection was therefore more developed than in Norrköping.

Despite the differences between Norrköping and Linköping in terms of topography, social composition, and economic structures, the evolution of water supply and sewerage was on the whole fairly similar, except for the

initial extension within the cities. The existence of uniform scientific, technological, ideological, and cultural influences and of legislation at the national level, coupled with suburban growth, contributed to this development. There was more variation in excreta collection, because of the differences that did exist between the cities. Poor sanitary conditions, a river sensitive to pollution, and a strong public health network caused Linköping to introduce sanitary regulations much earlier than Norrköping and in Linköping WC's were not as common.

List of Abbreviations

FTVD	<i>Förslag till vattenledning och dränering i Linköping</i>
HRFOW	<i>Handlingar rörande frågan om vattenledning i Norrköping med anledning af brukspatronen och riddaren J. von Leesens donation</i>
KRA	<i>Krigsarkivet</i>
LiSA	<i>Linköpings stadsarkiv (Linköping City Archives)</i>
NSA	<i>Norrköpings stadsarkiv (Norrköping City Archives)</i>
NT	<i>Norrköpings Tidningar</i>
RA	<i>Riksarkivet (Swedish National Archives)</i>
SKTF	<i>Svenska kommunaltekniska föreningen</i>
VaLa	<i>Vadstena landsarkiv</i>
VAV	<i>Svenskt Vatten (Swedish Water & Wastewater Association)</i>
VBB	<i>Vattenbyggnadsbyrån</i>
ÖC	<i>Östgöta Correspondenten</i>

APPENDIX 1

Table 1: Construction of the first modern Swedish waterworks, 1860 to 1890.

City	Years of Construction	Constructing Engineer	Chief Executive Engineer	Water source ¹	Water fee/year ²
Stockholm	1858-61	F. W. Leijonancker ³	F. W. Leijonancker	S	2 kr/room
Karlskrona	1861-64	F. W. Leijonancker	Abraham Blix	S	—
Jönköping	1864-65	F. W. Leijonancker	K. O. G. Appelberg	S	2 kr/room
Malmö	1861-66	English & Hanssen ⁴	English & Hanssen	S	⁵
Göteborg	1867-71	J. G. Richert ⁶	J. G. Richert	S	—
Landskrona	1869-74	O. Poulsen ⁷	O. Poulsen?	G	—
Lund	1872-74	Abraham Blix ⁸	Abraham Blix	S	—
Norrköping	1872-75	J. G. Richert	B. L. Hellström	S	—
Linköping	1874-76	Abraham Blix	Abraham Blix	S	3 kr/room
Uppsala	1874-75	J. G. Richert	Zacharias Larsson	G	—
Gävle	1874-76	F. W. Leijonancker	J. G. Nyström	S	—
Skövde ⁹	1875	C. Bergensträhle	C. Bergensträhle	G	1 kr/room
Sundsvall	1878-79	J. G. Richert	Lars Berg	S	—
Borås	1881	J. G. Richert	J. G. Richert?	S	—
Vänersborg	1882	J. G. Richert	J. G. Richert	S	—
Härnösand	1882-83	J. G. Richert	A. O. Alrutz	S	—
Helsingborg	1883	J. G. Richert	J. G. Richert	G	1 kr/room
Halmstad	1885-86	Blix & J. G. Stähle	Blix & J. G. Stähle?	S	—
Örebro	1885-86	?	?	G	2 kr/room
Västerås	1887-88	A. O. Alrutz	F. V. Hansen	G	2 kr/room
Växjö	1887	J. G. Richert	?	S	—
Eskilstuna	1887	O. Appelberg	?	S	3 kr/room
Karlstad	1888-89	O. Appelberg	H. Widmark	S	2 kr/room
Mariestad ¹⁰	1889-90	A. O. Alrutz ¹¹	T. O. Nordenstrahl	S	?

Source: Compiled from Bjur 1988 p. 37-61; Drangert, Nelson, and Nilsson 2002; Hansen 1903; Hansen 1904 p. 413-457; Isgård 1998 p. 11-36; Lindman 1911 p. 410-413; KRA-215, H215, Väg- och vattenbyggnadskåren 1851-1960, Chefsexpeditionen, serie D, anställningshandlingar, avlidna 1851-1968, R, vol. 26, Josef Gabriel Richert; "Helsovårdsnämnder-

¹ Surface water (S) and/or groundwater (G).

² This water fee is for household consumption, that is, industrial use is not included. Most information was compiled by F. V. Hansen in 1903. Although there may be some exception, it is very likely that these fees were the same as the ones introduced from the beginning in each city.

³ Leijonancker's plan was scrutinized by Thomas Hawksley, the renowned English water engineer.

⁴ This was a Danish firm, located in Copenhagen.

⁵ 0.80-2 kr per 1,000 kr taxed income.

⁶ Richert's plan was scrutinized by A. Colding, who was a professor from Copenhagen, and engineer Pihl from Christiania (Oslo), Norway.

⁷ Poulsen was a "water inspector" from Copenhagen.

⁸ Blix's plan was scrutinized by F. W. Leijonancker.

⁹ This was really the modernizing of an existing older water supply.

¹⁰ The reservoir was here placed in the town's church tower, since it was the highest point.

¹¹ Alrutz' plan was scrutinized by F. V. Hansen.

na”, Bidrag till Sveriges officiella statistik. K/ Helso- och sjukvården I. Medicinalstyrelsens årsberättelse för 1887, *Stockholm 1889*, p. 2.

Table 2: Construction of the first modern Swedish sewer systems, 1860 to 1890

City	Years of Construction	Constructing Engineer	Chief Executive Engineer	Sewer Design ¹²	Material ¹³
Stockholm	1866-ca. 1900	F. W. Leijonancker ¹⁴	Otto Fröman	C	B/E
Göteborg	1868-88	J. G. Richert	J. G. Richert	C	E/B
Norrköping	1872-74	J. G. Richert	B. L. Hellström	C	E/B
Linköping	1874-75	J. G. Richert	Abraham Blix	C	E/B
Uppsala	1874-75	J. G. Richert	Zacharias Larsson	C	E
Sundsvall	1878-79	J. G. Richert	Lars Berg	C	E/B
Borås	1881	J. G. Richert	J. G. Richert?	C	E/Ce
Härnösand	1883	Lars Berg	?	C	?
Örebro	1885-88	?	?	S	E?
Jönköping	1885-86 ¹⁵	?	?	C	E
Västerås	1887-88	A. O. Alrutz	F. V. Hansen	C	E
Karlstad	1888-89	O. Appelberg?	H. Widmark	S	?
Mariestad	1889-90	A. O. Alrutz ¹⁶	T. O. Nordenstrahl	C	?
Lund	1890	Christian Ambt ¹⁷	?	C	E/C

Source: Compiled from Bjur 1988 p. 37-79; Drangert, Nelson, and Nilsson 2002; Hansen 1904 p. 413-457; Isgård 1998 p. 11-36; Lindman 1911 p. 224, 410-413; Olsson 2001; Fröman 1912; Gullberg and Améen 1971 p. 147-155; Förslag till kloakledning i Lund afgifvet 1886 af dertill utsedde komiterade 1886; KRA-215, H215, Väg- och vattenbyggnadskåren 1851-1960, *Chefsexpeditionen, serie D, anställningshandlingar, avlidna 1851-1968, R, vol. 26, Josef Gabriel Richert; "Helsovårdsnämnderna"*, Bidrag till Sveriges officiella statistik. K/ Helso- och sjukvården I. Medicinalstyrelsens årsberättelse för 1887, *Stockholm 1889*, p. 2.

¹² Combined (C), separate (S), or duplicate (D).

¹³ Circular glazed earthenware pipes (E) and egg-shaped brick sewers (B) were the most common. Towards the turn of the century 1900 concrete became more and more common (C), and cement was also used in some places (Ce). The first letter for a given city denotes the most common material. For instance "E/B" means that glazed earthenware pipes dominated, but that there were also some brick sewers.

¹⁴ Leijonancker's plan was scrutinized by Thomas Hawksley, but was never formally accepted by the Stockholm City Council. Yet this plan was largely followed in the building of sewerage in the years to come.

¹⁵ The low eastern part of the city was only partly sewered to begin with, however.

¹⁶ Alrutz' plan was scrutinized by F. V. Hansen.

¹⁷ Ambt was an engineer from Copenhagen.

APPENDIX 2

In this appendix an attempt will be made to render the various monetary figures in this dissertation relevant. The different figures of anything from annual water fees for households to the large municipal investments in water systems do not say very much to present-day readers unless they can be compared with one another. Below are presented a few tables with figures of salaries, rents, and prices for ordinary people, as well as figures of municipal revenue and expenditure, so that such comparisons can be made. It is important to point out that these figures could not be found both for Linköping and Norrköping, but that they should be roughly comparable. That is, the working or lower class wages in Norrköping should about equal the ones in Linköping, and we should be able to tell whether a particular water fee would be very cumbersome or bearable for a poor family. Figures of municipal expenditure should also reveal roughly how heavy a financial burden a large infrastructure project was.

Table 1. Annual salary and rent of selected Norrköping workers in 1894.

<i>Type of Factory</i>	<i>Type of Work</i>	<i>Sex/Civil Status</i>	<i>Year of Employment</i>	<i>Annual Salary, Kronor</i>	<i>Special Benefits¹, Kronor</i>	<i>Total Salary, Kronor</i>	<i>Annual Housing Rent, Kr</i>
Large Woolen	Dyeing	Male/Married	1860	600	124	724	150
"	Spinning	Male/Married	1882	565	182	747	125
"	Weaving ²	Male/Married	1866	1,350	195	1,545	— ³
"	Weaving	Female/Single	1876	467	0	467	15 ⁴
Cotton	Spinning	Female/Married	1872	466	46	512	60
Cotton	Weaving	Female/Single	1889	505	0	505	52 ⁵
Cotton	Bleaching	Male/Married	1888	560	138	698	170
Lesser Woolen	Weaving	Male/Married	1880	733	0	733	175

All those in the table who were married had families of between zero and three children to support (some also had children who made their own living). The male spinner and bleacher had wives who could help support their families as well. Apart from the exceptions they all lived in apartments and paid rent to a landlord (Source: Compiled from Key-Åberg 1896 p. 36-81).

¹ This could be housing allowances, perquisites, or sickness benefits from the factory.

² Master weaver.

³ Housing paid for by the factory.

⁴ Roomer in relative's house.

⁵ Roomer in relative's house.

Table 2. List of prices for selected every-day groceries in Norrköping, November and December 1895.

<i>Item</i>	<i>Amount</i>	<i>Price, Kronor</i>
Bread	1 loaf	0.25
Wheat flour	1 kilo	0.22
Milk	1 liter	0.04
Sugar	1 kilo	0.64
Pork	1 kilo	1.16
Meat	1 kilo	2.50
Potatoes	1 liter	0.05
Fish (herring)	1 kilo	0.35
Coffee	1 kilo	2.10
Cheese	1 kilo	1.25
Rice	1 kilo	0.15
Barley grain	1 kilo	0.10

This table was drawn up to give a rough idea of how prices on groceries were related to each other and to the income and rent of a family in Norrköping (and, hopefully, more generally in Sweden) in the late 19th century. The groceries taken up in the table were by no means the only ones that (working class) people ate or drank. Other food was also bought, traded, or grown in the garden plot (Source: Compiled from Key-Åberg 1896 p. 102-103).

Table 3. The largest municipal revenues related to the total revenues of Linköping in 1870, 1890, and 1910.

	<i>1870, Kronor</i>	<i>1870, %</i>	<i>1890, Kronor</i>	<i>1890, %</i>	<i>1910, Kronor</i>	<i>1910, %</i>
Tenancy & interest	10,000	12	12,000	7	62,300	11
Liquor tax and profit	17,500	21	36,000	20	106,000	19
Harbor tax	7,000	9	3,000	2	—	—
Gasworks profit	—	—	—	—	26,000	5
Waterworks surplus	—	—	—	—	14,000	2
Municipal rates	49,469	60	106,000	61	303,000	55
Total largest revenues	83,969	102	157,000	90	511,300	92
Total revenues	82,176	100	175,000	100	555,000	100

Source: Compiled from Hagård 1978 p. 261.

Table 4. The largest municipal items of expenditure related to the total expenditure of Linköping in 1870, 1890, and 1910.

	1870, Kronor	1870, %	1890, Kronor	1890, %	1910, Kronor	1910, %
Wages	27,940	34	42,240	22	72,150	13
Interest and amortization	24,650	30	15,360	8	155,400	28
Poor relief	18,080	22	40,320	21	77,700	14
Streets	820	1	28,800	15	16,650	3
Health care	410	<1	3,840	2	5,550	1
Fire defense	—	—	—	—	49,950	9
Total largest expenditure	71,900	88	130,560	68	377,400	68
Total expenditure	82,176	100	192,000	100	555,000	100

Source: Compiled from Hagård 1978 p. 260.

APPENDIX 3

Table 1. The 20 largest shareholders in the Linköping Water Company in late 1874, that is, those in possession of more than 10 shares each, together with those who were, or were just to become, members of the City Council.

Shareholder	Title, Business, etc.	Number of Shares	Member of Council
City of Linköping		400	X
Linköpings Sparbank	Savings bank	200	X
Ljungstedska Frisk.	School	100	X
Östgöta Hypotek	Credit institution	100	X
Wilhelmina Sundberg	Mrs.	60	
Robert De la Gardie	County Governor	50	
C. P. Burén	Factory owner	50	
Hampus Mörner	Ex-County Governor	50	
Gustaf Lagerfelt	Baron	50	
G. R. Westman	Bank director	50	1875-1886
N. Palmquist	Baron	40	
Adolf Wallenberg	Civil servant	25	
Jon Asklund	Factory owner	20	1863-1878
K. G. Bodin	Bank clerk	20	1863-1875
J. Friedleiffer	Clerk	20	
Johanna Lindeberg	Widow	20	
Fredrik Stånggren	Mayor	20	
L. Westman	Estate owner	20	
A. F. Wigander	Pharmacist	20	1870-1884
L. P. Larsson	Brewer	15	
M. Hydén	Merchant	10	1863-1874
L. A. Åman	Physician	10	1863-1886
C. A. J. Wallin	City physician	10	1867-1881
C. M. Lagerfeldt	Baron, Officer	10	1875-1890
Adolf Stånggren	Managing Director	10	1863-1886
P. Sjöbring	Cathedral dean	10	1869-1876
F. W. Österberg	Merchant	10	1863-1886
Edvard Johanson	Merchant	10	1875-1878
C. Jacobson	Merchant	5	1875-1878
A. G. Örn	Officer	5	1869-1894
Claes Livijn	Judge	5	1874-1885
E. G. Munck	Ph.D., teacher	5	1863-1874
S. Pettersson	Goldsmith	5	1863-1884
Philip Svanfeldt	Factory owner	5	1874-1891
C. J. Sandin	Merchant	5	1863-1877
A. F. Olson	Jurist	5	1863-1876
F. Nordenankar	Officer	5	1865-1874
August Friedleiffer	Factory owner	5	1863-1884
Åke E. Hvitfeldt	Physician	3	1863-1874
L. T. Brogren	Brewer	3	1863-1884
C. L. Anjou	Principal	3	1874-1889

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C. A. G. Ahnström	Officer	2	1875-1904
D. G. Bergquist	Tailor	2	1863-1874
C. J. Neuman	Carpenter	1	1863-1877

Source: LiSA, Linköping Water Company Archives, AI:1, minutes of the shareholders' meeting 1874-09-26; Lundberg and Nordström 1962 p. 178-189.

Table 2. *Profit of the Linköping Water Company and dividend on the A- and B-series shares, 1876-1907.*

Year	Profit, Kronor	Dividend A-shares, %	Dividend B-shares, %
1876	5,771		
1880	12,557	6	
1885	27,906	7	5
1890	27,212	8	5
1895	25,925	6	5
1900	33,311	8	5
1905	41,228	8	5
1907	30,843	4	

Source: Dagersten and Staaf 1976.

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