HAMMARBY SJOSTAD
Stockholm, Sweden:
A Case Study

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Introduction & Background

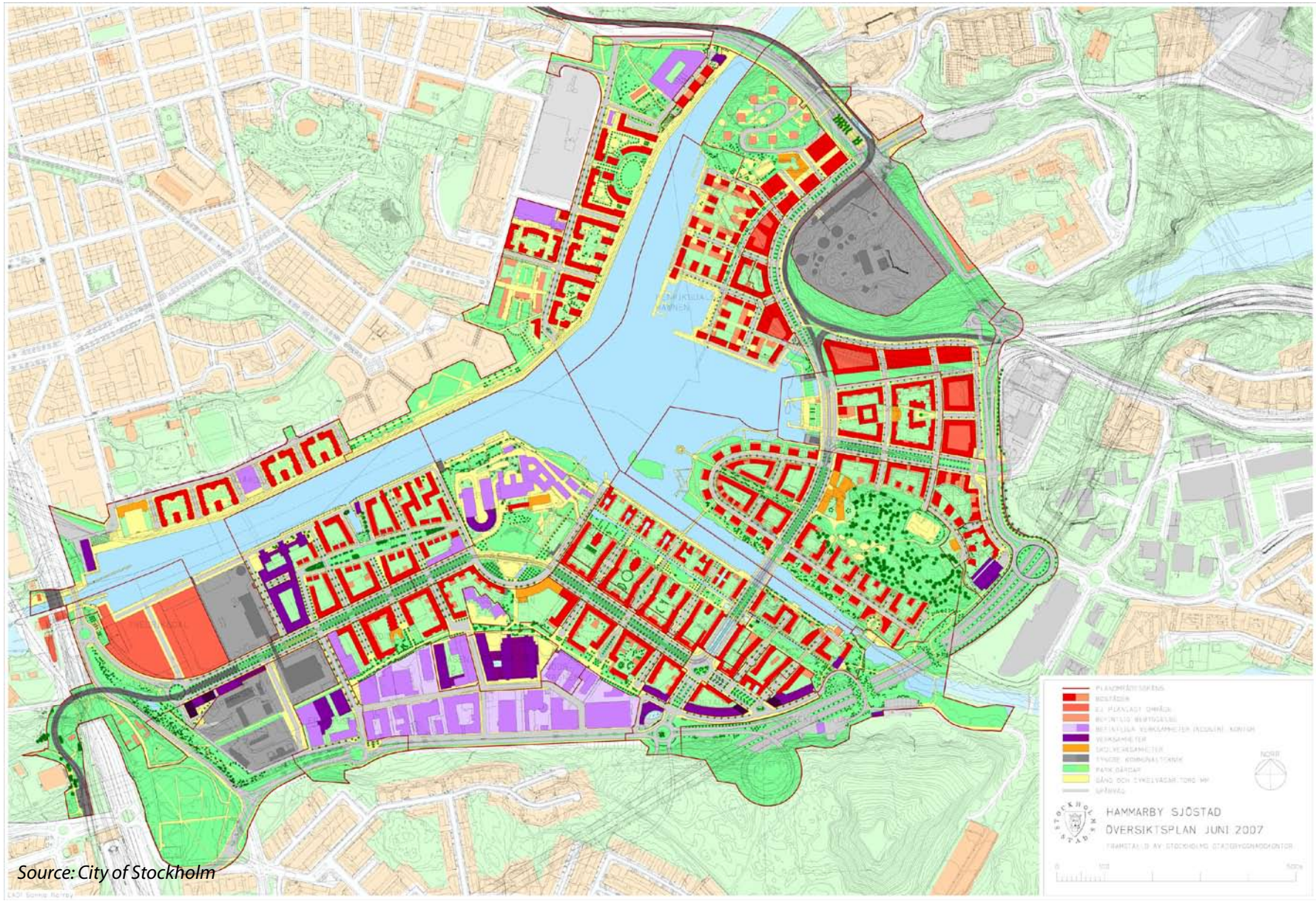
PROJECT SUMMARY

Hammarby Sjostad is a district in Stockholm, Sweden adjacent to the downtown, which is a brownfield site that is being developed as a sustainable neighborhood. Previously an industrial waterfront, planning for the redevelopment of the site began in 1996. The 2004 Olympic bid was incorporated into the site's redevelopment, however after Sweden did not receive the bid, the city shifted its development focus to building a sustainable community that is twice as efficient as a typical one.

2012 is the projected completion of build-out, in which the 200 hectare district will house approximately 20,000 people in 9000 housing units. Hammarby will also provide 200,000 square meters of commercial space providing jobs for 10,000 people (CABE 2007). The district also provides for a wide range of educational, cultural and recreational programs (Dastur 2005).

Early Illustrative Plan

Olympic Plan



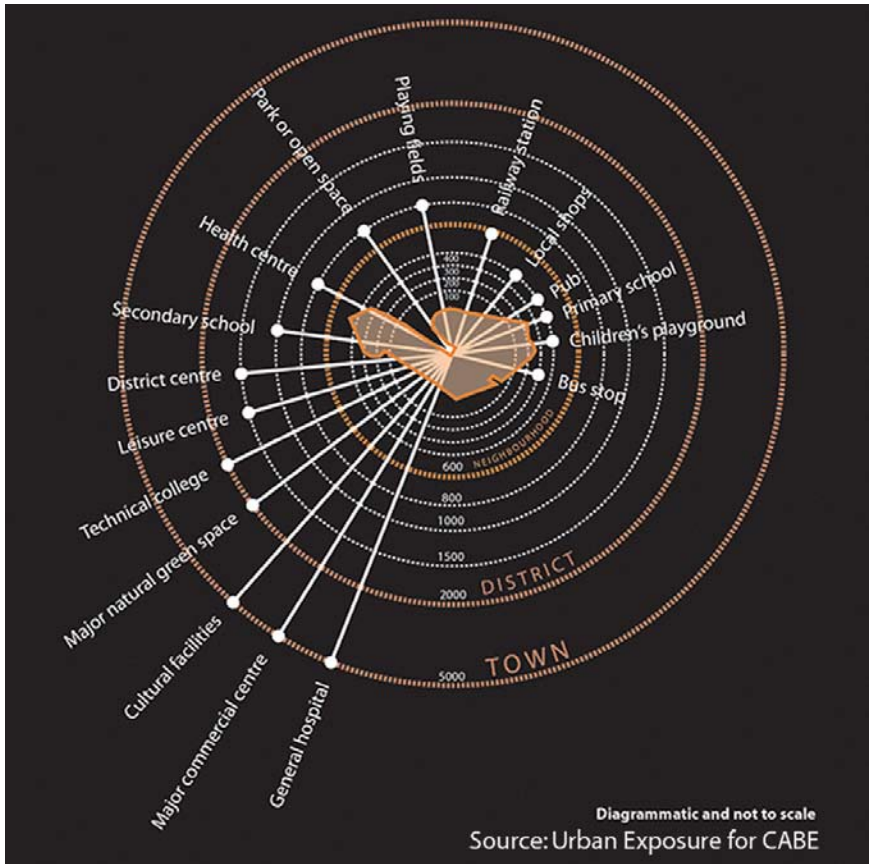
Source: City of Stockholm

Overall Plan

The Hammarby Model, which is the district's attempt at a balanced, "closed-loop urban metabolism", accounts for the unified infrastructure of energy, water and waste. In addition to the Hammarby Model infrastructure, the presence of urban-scaled density, access to multiple modes of transit with an emphasis on reduced car commuting, preservation and restoration of existing natural systems, and progressive construction and housing policies make Hammarby Sjostad an "effective demonstration that ecological and urban go together" by means of comprehensive planning (Beatley 2004:251, 255).

BACKGROUND AND CONTEXT

Sweden has a population of about 9 million people and is a parliamentary democracy. The country is comprised of 21 counties, which are further divided into 289 municipalities. Stockholm is one of these municipalities of Sweden. The government exist at all three institutional levels and cooperation among and between each level of government is common due to the centralized configuration (Dastur 2005).



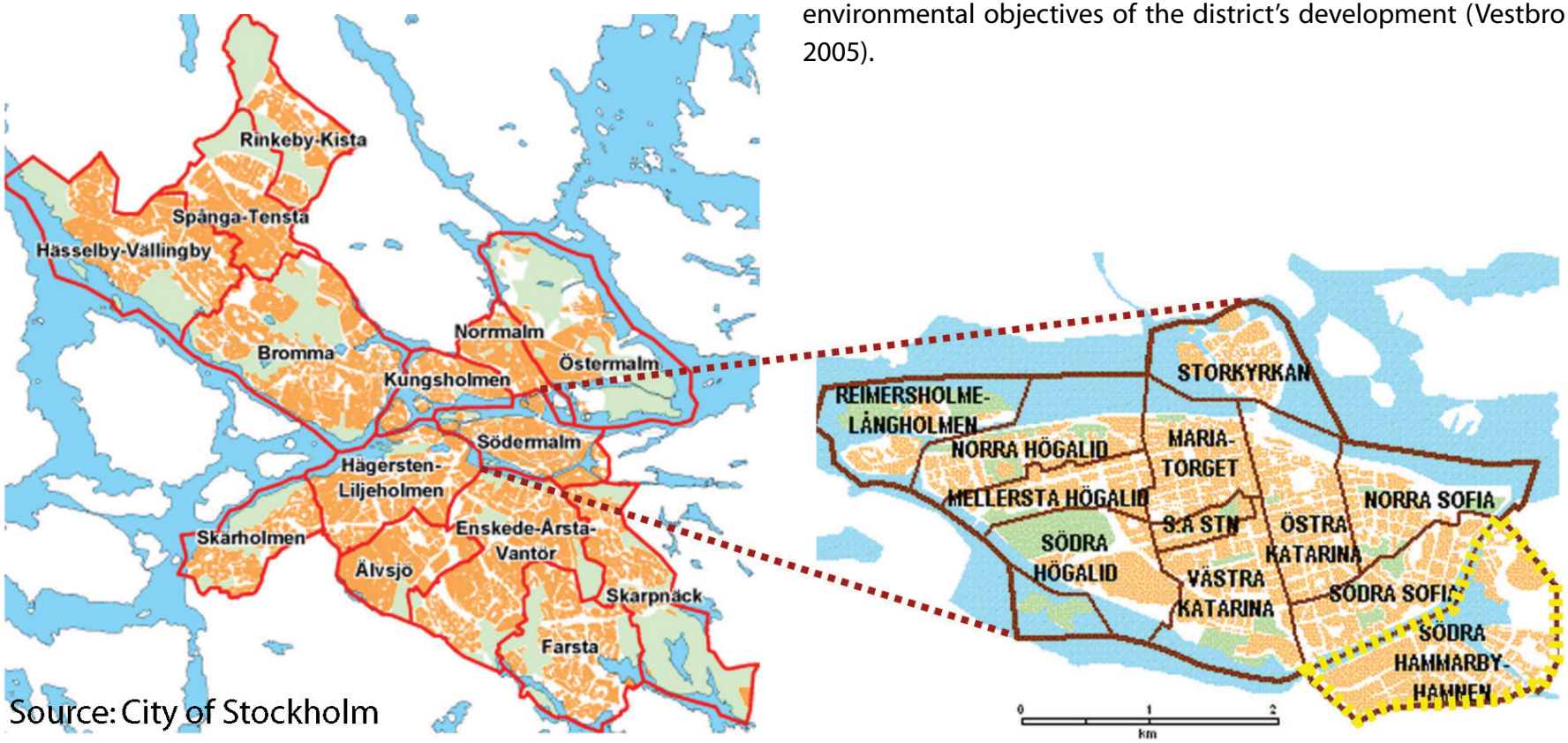
Amenity Distance Wheel

Map of Sweden

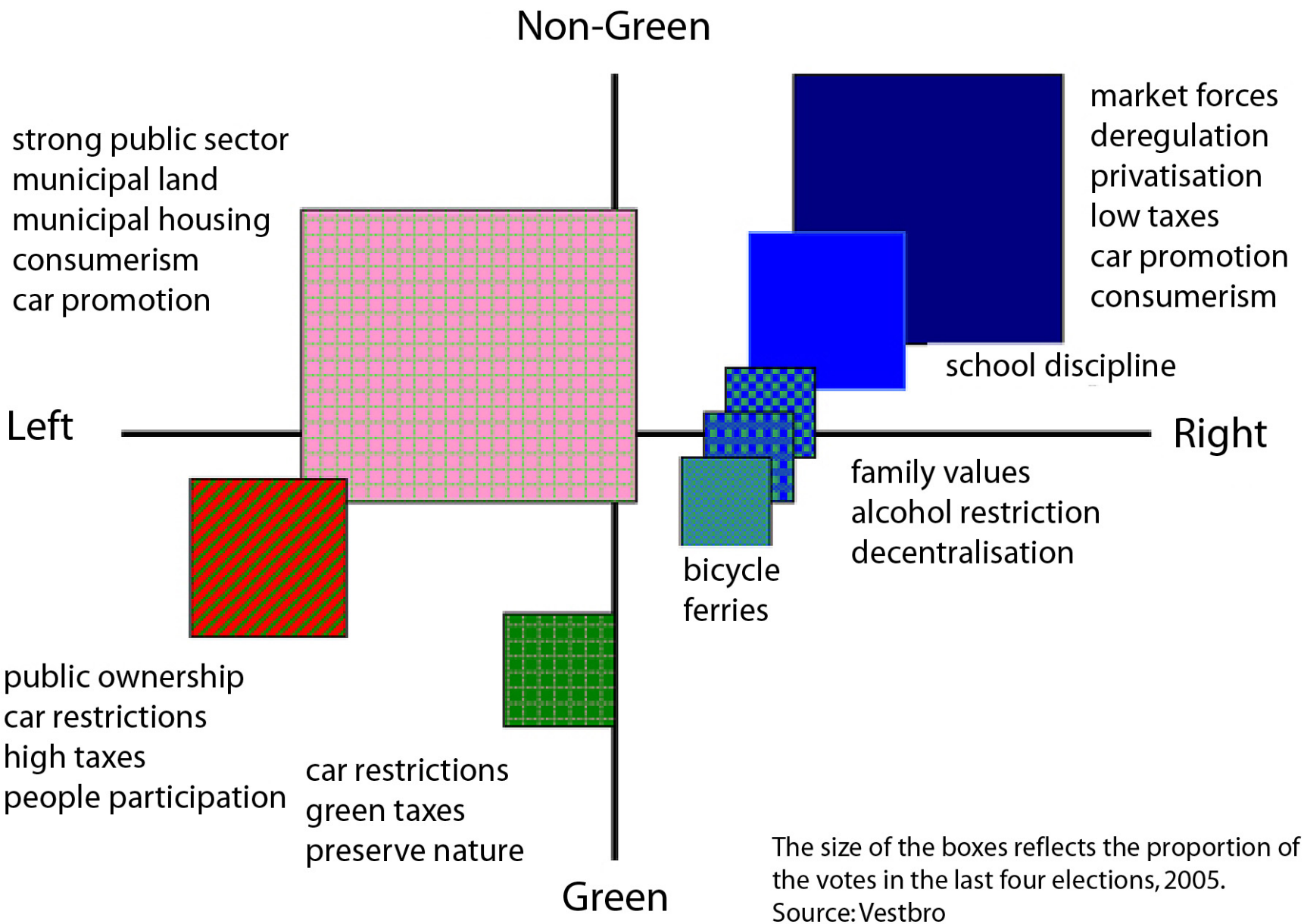
Map of Stockholm

The municipalities are concerned with the local level of governance, including urban planning. "In 1996 the city municipal government further decentralized by establishing 14 district councils," one of which is the Sodermalm district in which Hammarby Sjostad is located (Dastur 2005: 38).

Unlike the two-party system in the US, there are many more political parties in the Swedish government. "The voter distribution between parties makes it necessary to have at least three parties in coalition in order to form a majority" How this has manifested itself in the past 10 years is a shift back and forth between the left and right wings of government with a constant green association tying both parties toward an environmental center (Dastur 2005). In his paper entitled Conflicting Perspectives in the Development of Hammarby Sjöstad, Stockholm, Dick Urban Vestbro, a member of Stockholm City Council from 1994 to 2002 describes how these shifts in coalition majority affected the social equity and environmental objectives of the district's development (Vestbro 2005).

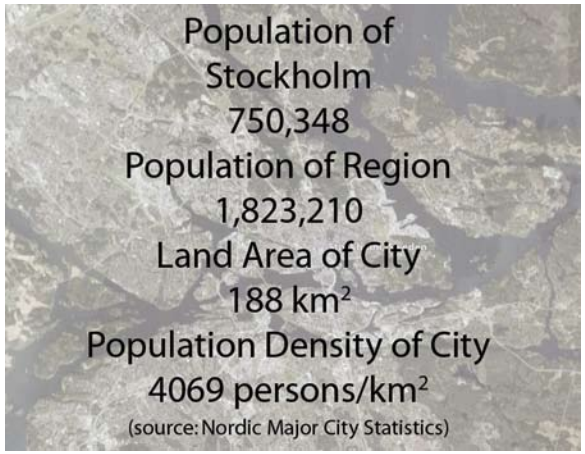


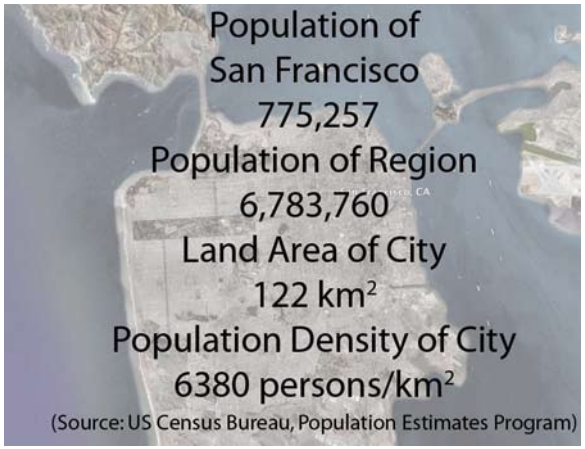
Districts of Stockholm



The size of the boxes reflects the proportion of the votes in the last four elections, 2005.
Source: Vestbro

Party Configuration in Swedish Politics





Population Comparisons

As seen above, the population of the cities of Stockholm and San Francisco are quite similar, while their regional populations are very different. An interesting note is that San Francisco is denser than Stockholm. The density of Hammarby Sjostad is 133 persons per hectare, which is slightly less than Stockholm proper. The decrease in density can be attributed to an increase in public space.

The housing of the site compared to Stockholm and San Francisco can also be noted below.

Stockholm (2004)

Dwelling Units: 407,000
11% Single-family houses
89% Multi-family houses

23% Social Housing
29% Privately Owned
37% Cooperative
(Dastur 2005)

San Francisco (2005)

Dwelling Units: 354,963
16% Single-family houses
75% Multi-family houses
9% Vacant

38% Owner-occupied
62% Renter-occupied
(4.6% Public Housing)
(Bay area census, accessed 21 October 2007)

Hammarby Sjostad (2006)

Dwelling Units: 5171
100% Multi-family Dwellings
21.9% Public Housing
23% Individuals, companies, associations
55.1% Co-operatives
(City of Stockholm)

Dwelling Unit Comparisons

How Housing Works in Sweden

"Most housing in Stockholm falls into one of four categories, two of which are private housing arrangements and two of which are public housing arrangements. 1) The first kind is privately developed, owned and rented-out housing. 2) The second kind is privately developed property sold to a Housing Co-operative whose members are the flat owners. The co-operative as a whole acquires ownership from the developer over a period of 2 years from its formalization, while members of the co-operative purchase the right to buy, occupy, and sell their respective homes or apartments at market price. All purchasers enter the co-operative framework. During the two-year ownership transition period from developer to housing co-operative, the developer is responsible for management and building condition, after which the co-operative assumes responsibility. This method of private ownership is the most widespread private housing mechanism in Stockholm. 3) Public housing is provided for in the following two ways. The city of Stockholm owns land, which is leased (at a token amount) to a municipal housing company. The municipal housing company then proceeds to develop and rent housing to lower middle class and middle class citizens. 4) In addition to rented out public housing, the government also facilitates the formation of semi-public tenant-owned co-operatives for lower middle class and middle class citizens. In such cases the housing company takes on a new responsibility of selling management services to the tenants or the co-operative through a NGO structure. Public housing is available to all members of society, and some very wealthy people often live in public housing" (Dastur, 2005: 40).

"Land ownership is an issue where political parties usually have ideological differences. This is also the case in Stockholm. While the left insists on municipal ownership, the right advocates sale of public land to private developers. When the right coalition won the 1998 elections it started to sell land to private housing and construction companies. A special argument used in connection with the Hammarby Sjöstad development is that land lease contracts may include clauses about environmental issues, while selling land make the implementation of the environmental program more difficult. There is also a clear ideological divide on the issue of which type of tenure to promote.

After 1998 the allocation of land for municipal housing companies was reduced from 40 to 18 percent, while the percentage of condominiums increased to 82 per cent. Because of changes in the real estate market it proved difficult for a while, however, to sell advertised condominiums, and therefore planned condominiums were converted into rental. The policy of the red/green majority is to allocate 50 per cent of land to companies with rental tenure as an instrument to make new housing accessible to people, who cannot raise big loans. In practice phases 4 and 5 have got almost 100 per cent rental accommodation" (Vestbro 2005: 6).

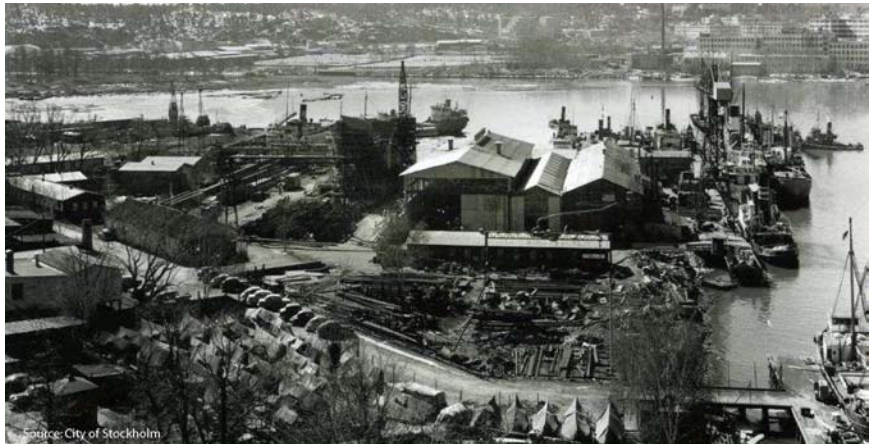
History of the Hammarby Sjostad Site

Hammarby Sjostad is located in the south-central inner city of Stockholm. It is situated along the lake (Sjo) Hammarby, and its name literally means 'Hammarby Waterfront Town.' Hammarby is the name of the old manor, which was located on the site until 1945 (Dastur 2005).

Historical Hammarby Sjostad Aerial

Current Hammarby Sjostad Aerial

Pre-Industrial Use



Industrial Use

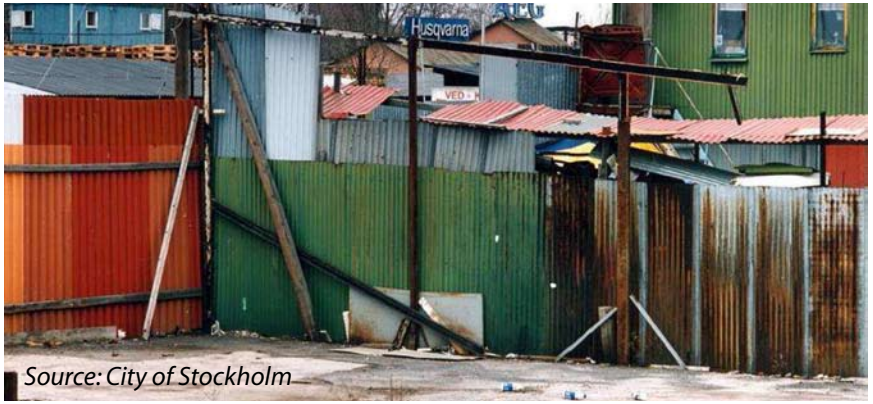
Sickla Canal Construction

Initially an agricultural region, industrialization and the associated urbanization spread to the area in the late 19th century due to its proximity to the central city (Dastur 2005). The city planning office in Stockholm was instituted in 1636, which helped control the rage of industrialization in the Swedish landscape.

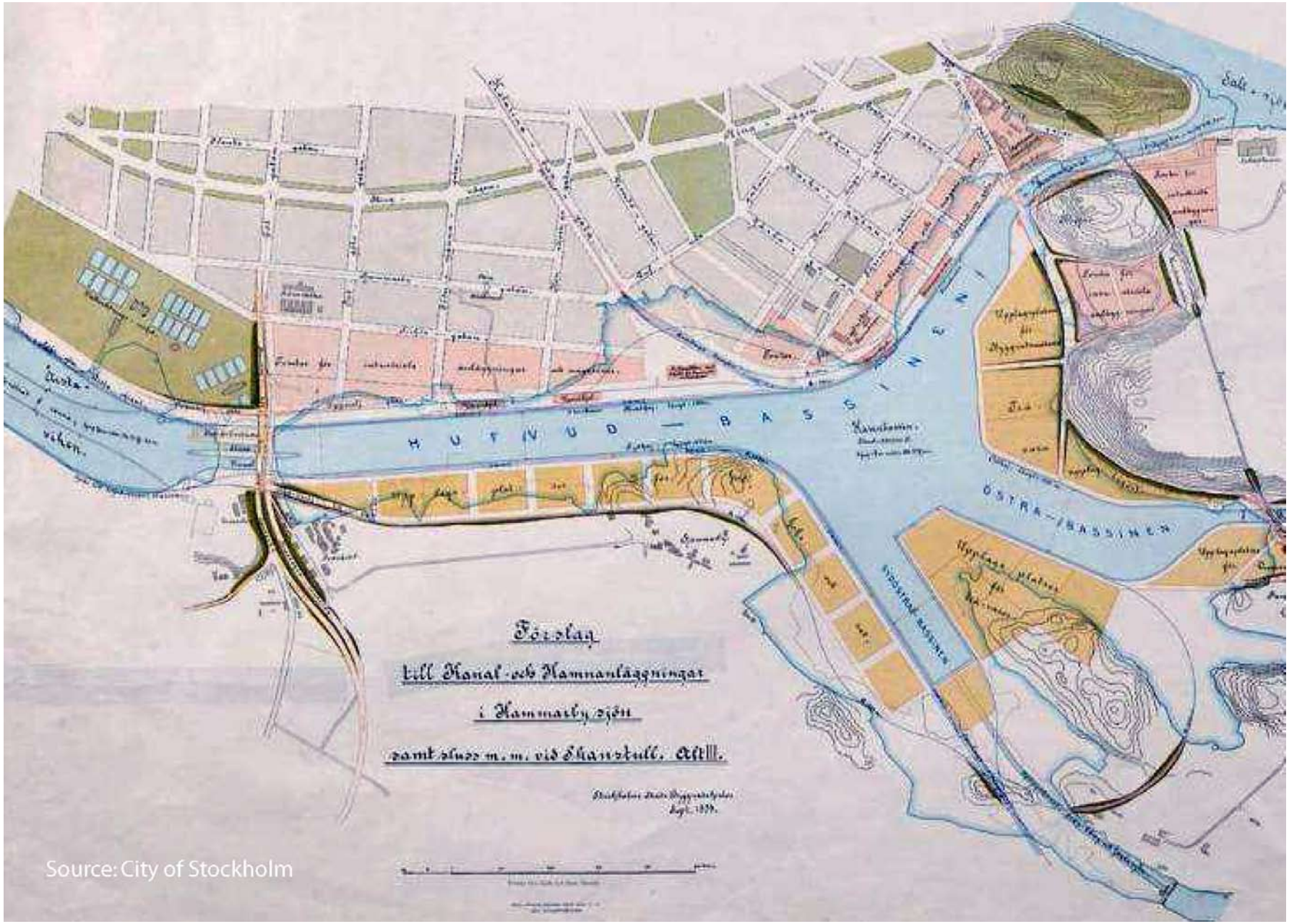
After the transition from national to municipal planning in 1904, Stockholm commenced a land-buying program, where, in the first three decades, "the city territory grew from thirteen to forty-four square miles" (Dastur 2005:52). Portions of Hammarby Sjostad were purchased in 1917.

A canal was then built in the early 20th century to connect the lake to the Baltic Sea, facilitating industrial development in the area. Rail lines were also built to booster heavy industry such as the General Motors automotive factory and the Luma bulb factory (Vestbro 2005).

Over the years, light industry also located in this area, "activities of a type for which the City always has great difficulty planning" (Dastur 2005:60).



Low Land Use



Early Parcel Map with Outline of Historical Water's Edge

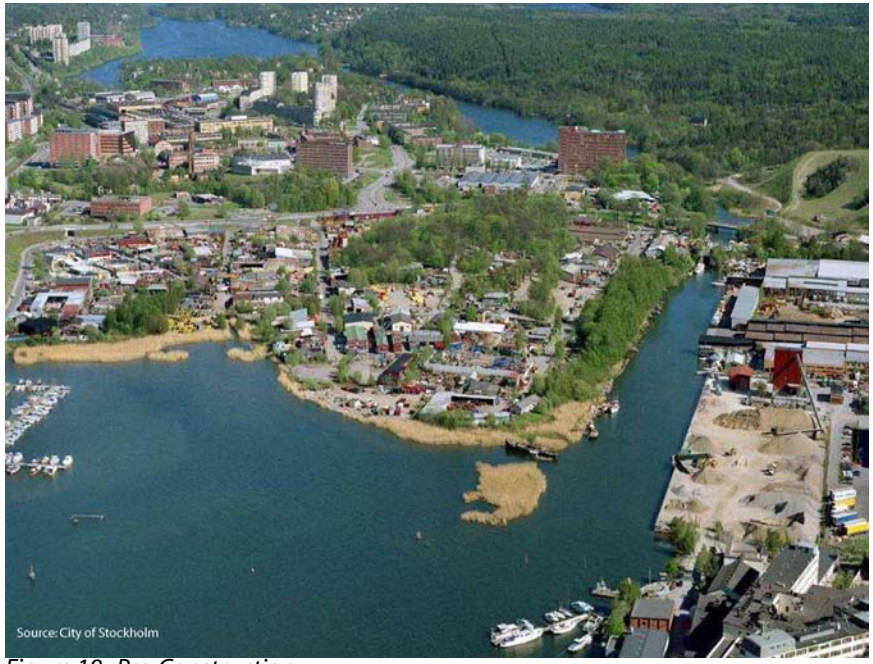


Figure 18. Pre-Construction

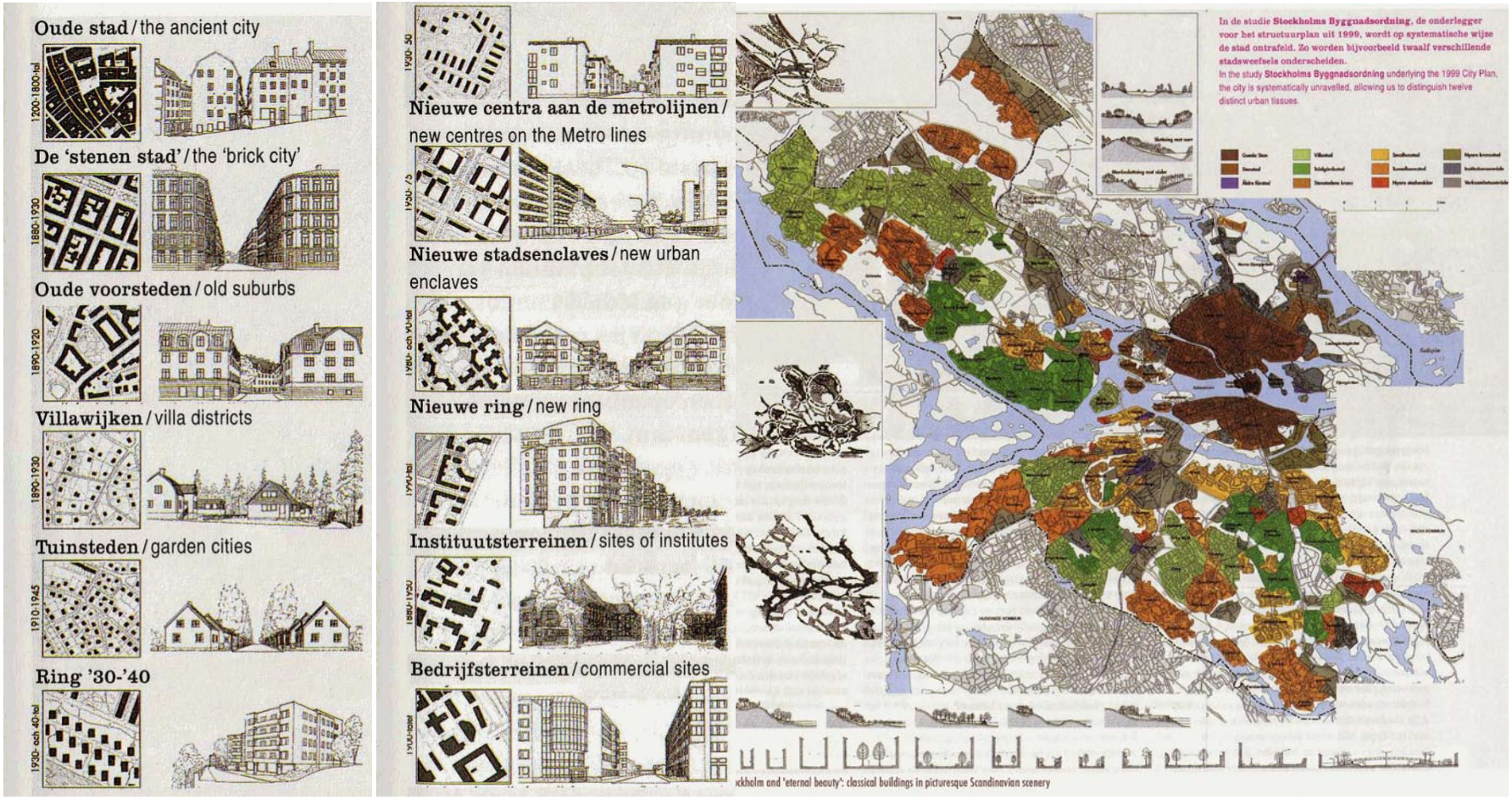
During Construction

"In the early 1990's there was a strong demand for housing in Stockholm, concurrent with the economic boom" which led to the decision to redevelop Hammarby Sjostad as part of the "build inwards" strategy (Dastur 2005:60). "Although Hammarby Sjostad was a well functioning industrial area, it was classified as a site for further investigation by the City of Stockholm. Because of its close proximity to the city center it was regarded as attractive for residential purposes" (Dastur 2005:61). Worth noting is that, "contrary to the situation in other European brownfields very few sites in Hammarby had been abandoned" (Vestbro 2005:2). The result was that the land in private ownership was purchased by the city at prices above market value to expedite the acquisition process. Through the city's forethought in land acquisition, and willingness to pay for the remaining parcels, the city planning department was able to coordinate transportation, landuse and development for Hammarby Sjostad in a very efficient manner.

Urban Morphology of Stockholm which helped guide the development of HS

Although Hammarby Sjöstad is located outside what is traditionally considered to be the perimeter of inner city Stockholm, the design is intentionally urban rather than suburban, and follows standards for Stockholm's inner city (CABE 2007).
"Stockholm has four types of landscape and five types of public waterfront, as well as twelve different types of urban tissue and as many street profiles. Each of these types of tissue follows the earth's folds. The result is a city in which the fire brigade and the 'tree line' (the of height of the trees, 20 to 25 metres) fix the building height and only churches, public buildings and tower blocks are exceptions to this rule." The applications of these built system hierarchies to the existing landscape conditions creates the variations in the city" (Assche, 2000: 45-46).

Tissues of Stockholm's Urban Fabric



Design Approach

Overall Mission Goal

The overall mission goal of Hammarby Stostad is to create an urban district which would be twice as good in terms of reduced environmental impact, and which would use half of the amount of energy used in a typical development (Inghe-Hellström 2005). In achieving its mission goal, the City of Stockholm is setting out to create an international model of sustainable development; "It is the expressed objective of the city that this project serves as a model to other large-scale sustainability projects – and the systems, technologies and processes used in this case are being considered for their contributive value to re-planning and retrofitting other city areas" (Dastur 2005:10). This ambitious environmental goal includes targets for decontaminating brownfield land, provisions for public transit, recycling programs for water and waste, and zero impact energy consumption for its residents.

View of Lake Hammarby

Main Design Theme Idea

The main design theme of the Hammarby Model is based conceptually on the UN's Agenda 21 Human Settlement Objective 7.5. This objective provides a framework for promoting socially and environmentally sustainable developments. The program areas include:

"Providing adequate shelter for all, improving human settlement management, promoting sustainable land-use planning and management, promoting the integrated provision of environmental infrastructure: water, sanitation, drainage and solid-waste management, promoting sustainable energy and transport systems in human settlements, promoting human settlement planning and management in disaster-prone areas, promoting sustainable construction industry activities, and promoting human resource development and capacity-building for human settlement development"(UN 2007).

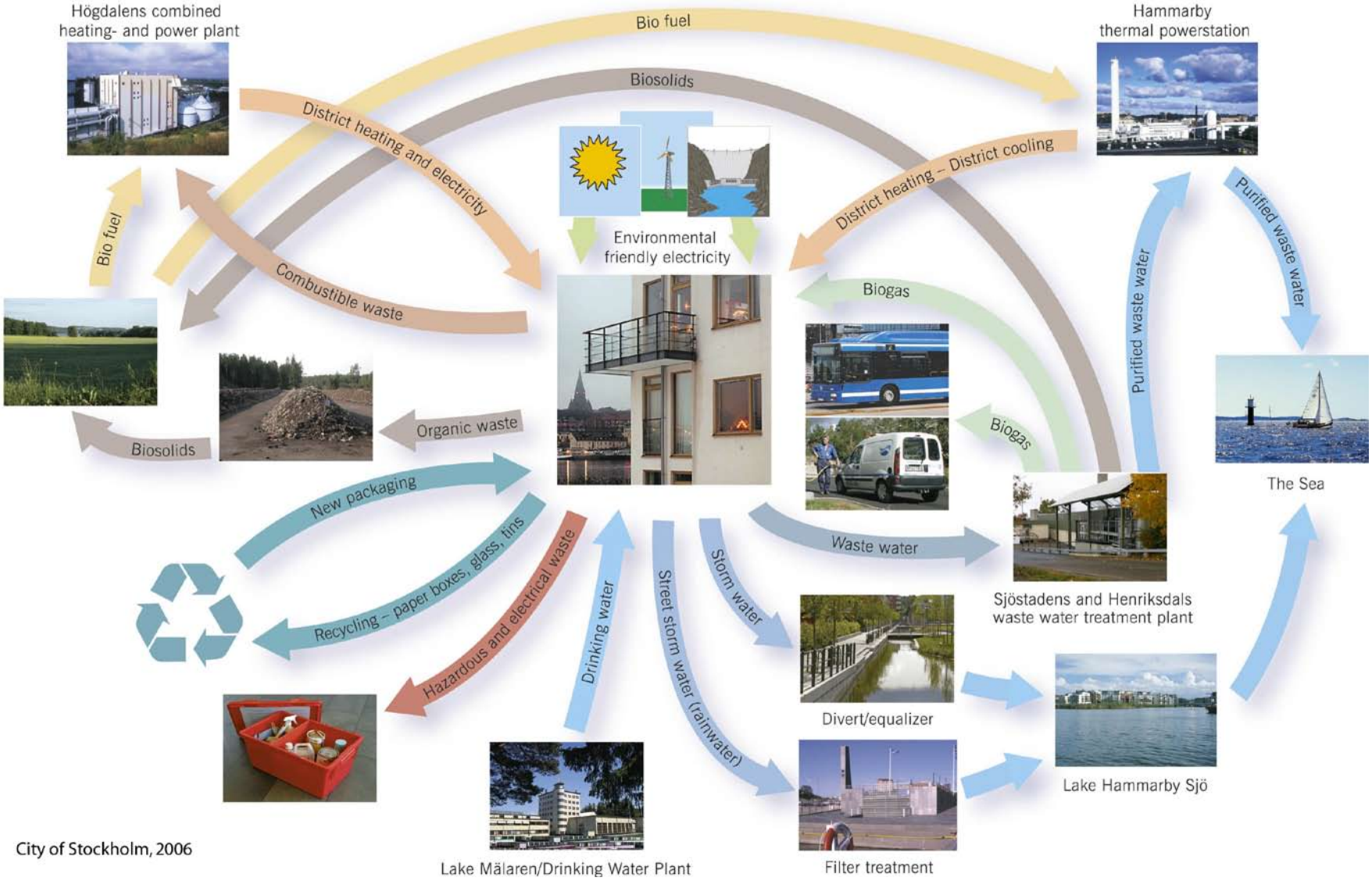
Agenda 21

The Human Settlement Objective 7.5 has been adopted at the Swedish national level, and will later be discussed as one of the basis for the urban design theory in Hammarby Sweden.

Major Plan Moves

The major plan moves of Hammarby Stostad correspond to the project's main design theme ideas, which, as mentioned above, reflect the UN's Agenda 21 Human Settlement Objective 7.5.

For instance, the major plan move of creating the Hammarby Model can be identified with the preceding Human Settlement Objective 7.5's program for "promoting the integrated provision of environmental infrastructure: water, sanitation, drainage and solid-waste management"(UN2007). At its core, the Hammarby Model aims to integrate otherwise disconnected infrastructure systems into a closed-loop. It functions as a "holistic approach to infrastructure service provision and… integrat[es]… otherwise separate systems in order to accomplish the environmental objectives set forth by the local parliament" (Dastur, 2005:68). It is an example of a successful partnership of three municipal utility districts to combine forces for on-site recycling, energy production and conservation, and water and waste management. The municipal districts are Birka Energy, Stockholm Water Company and the City of Stockholm Waste Management Bureau.



Hammarby Model

The Hammarby Model objectives were summarized as 'twice as good' as ordinary developments of that time (Svane 2006). The program includes targets for decontamination, use of brownfield land, provision of public transport options to discourage car use, energy consumption, recycling of water and waste (CABE 2007).

The other principal major plan move is the location and form of Hammarby Stostad development. Its setting is on a historically brownfield site, and its form can be defined as "compact" urbanisim. Conceptually, this move is also rooted in the UN Agenda 21 Human Settlement Objective 7.5. The project accomplishes physical and infrastructural connection to the inner city of Stockholm. In addition, its urban form reflects that of the Stockholm's center in terms of density, block configuration, and street type (Vestbro 2004:5-6). To achieve the preceding concept, it is important to note that there are specific guidelines for each the project's districts.

Infrastructure Buildout

Full Buildout

Philosophic approach

The philosophic, underlying approach to the Hammarby Stostad project is its ambition to achieve both environmental and social sustainability in its development. To achieve sustainable urban development, the players involved recognize that they must build on inter-disciplinary 'cooperation' between the many involved parties. There must be a philosophical acceptance that on a fundamental level, the project is to remain dynamic, and should maintain a high carrying capacity for systemic change in the short and long term (Inghe-Hellström 2004).

Urban Design Theory

Historically, there have been numerous antecedents of sustainable urban design theory prior to the UN's Agenda 21 Human Settlement Objective 7.5. For instance, many common threads can be found in the utopian visions of philosophers including Dante, Sir Thomas More, Kant, Rousseau, William Penn and Woodrow Wilson (Estes 1993:4). In a more current light, world wide environmental and social philosophical movements beginning in the mid 1960s and continuing well into the late 1980s have laid grounds for international environmental concerns. For example, in June of

Urban Design Components

1992, the United Nation Conference on the Environment and Development (UNCED) was held (Estes 1993:4). Following this conference, numerous policy based environmental movements have emerged, one of which is the UN's Agenda 21 Human Settlement Objective 7.5.

As mentioned in the Major Design Theme Ideas section, the nation of Sweden has adapted the UN Agenda 21 Objective 7.5 on a national scale to help guide sustainable development on social, cultural, economic and environmental terms.

As a result, the Swedes have created The Eight Core Strategies for achieving sustainability. They focus on: "the future, limitations on climate change, population and public health, social cohesion, welfare and security, employment, economic growth and competitiveness, and community development" (Sweden Ministry of the Environment 2002).

To realize the Eight Core Strategies, Hammarby Stostad has adapted the urban design theories of New Urbanism, Transit Oriented Development, and Smart Growth into its core.

New Urbanism principals are found in the project's approaches towards achieving sustainability. These strategies are "minimum impact development, eco-friendly technologies, respect for ecology and value of natural systems, energy efficiency, less use of finite fuels, more local production, and increase walking and reduced automobile dependency"(NewUrbanism2007).

Transit Oriented Development (TOD) Theory is applied in the transportation infrastructure dimension of the project. This is an urban design theory which focuses on sustainable urban living as based on a medium density living being connected to public transport systems.

Smart Growth Theory is applied to the project by focusing on concentrating urban growth in city centers by planning and transportation systems to avoid 'urban sprawl.' The theory advocates for compact urban development, TOD, walk ability, and mixed development land use planning (Smart growth Network 2007).

Social Goals

The Swedish Case for Sustainability and Integrated Infrastructure

"Sustainability is usually considered as inter-generational equity. While intra-generational equity is equity as we usually speak about it – within time and across classes, inter-generational equity is equity within class groups and across time. Intra-generational equity asks for redistribution between classes at all times, while inter-generational equity calls for redistribution within a given class through time. This clarifies the issue of sustainability – and makes it easy to ask if sustainability is just planned inter-generational equity within the upper class for the sake of its preservation" (Dastur, 2005:8).

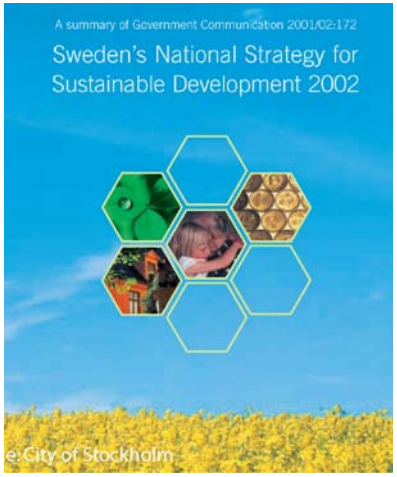
"Since there is nothing inherently redistributive about sustainable development – since it is basically an argument for doing what we do in a cleaner and more efficient way – the extent to which any sustainable development agenda is equitable has almost everything to do with the political, economic and social climate in which it takes place" (Dastur 2005: 34).

"The creation of a more sustainable urban metabolism has the potential to greatly increase short and long term economic efficiency for both government and the private sector. For the complete benefits of such realignments to be realized, capital requires a reconfiguration of the urban infrastructural landscape that can only be achieved with the coordinated effort of government and capital. […] The prospect of sustainable development, then, creates an opportunity for planners concerned with equity to build in more systemic equity and welfare. Doing so, a government interested in providing welfare to its citizens, can use sustainable development to solder welfare provisions into the configuration of urban space and planning practices" (Dastur 2005: 31).

Since it is law that all municipalities "provide basic services of equal standards throughout their jurisdiction," intra-generational equity is inherent in the structure of Swedish society (Dastur 2005: 37). In developing Hammarby Sjostad in a sustainable, or an inter-generationally equitable manner, the city of Stockholm is reconfiguring its urban infrastructural landscape "to build in more systemic equity and welfare" (Dastur 2005: 31). The most symbolic portion of this effort is the Hammarby Model, a "closed-loop urban metabolism" system unifying the infrastructure of energy, water and waste.

The project focuses on the many dimensions of creating a sustainable social sphere: social sustainability, human sustainability, social equity and environmental education.

Swedish Sustainability Strategies



Source: City of Stockholm

Social Sustainability

In terms of social sustainability, the project balances both private and public space for the residents, and ensures priority is placed on social capital. The high density living in Hammarby Stostad promotes a greater sense of community through development of programs and processes that promote social interaction and cultural enrichment.

A specific example of social sustainability in architectural design would be the inclusion of the overhanging balconies from individual apartments. This design element heightens the sense of a common space below the balconies, and encourages more social interaction (Natural Space 2007).

Children at Play

Human Sustainability

The other form of social sustainability in Hammarby is human sustainability. This programmatic element examines the way 'delight' as a commodity affects the feelings of the dwellers of Hammarby Stostad.

Hammarby Sjostad design has clear goals to create living conditions which tune into residents moods. For instance, there are areas of silence for the dwellers to escape from the fast pace of the surrounding city life. These areas, such as the Gunilla Bandolo's bridge sculpture at the Sickla Canal, are examples of designed therapeutic destinations for the residents. Bandolos writes of the bridge installation's settling influencing human moods saying:

"The sculpture is a place that represents nothing other than itself. It sits upright like a pearl, on the sightlines that go through the whole of Sickla Udde and looks towards the neighborhood. Like a house it has both an inside and an outside. The roof is the sky. The inside is introvert. It invites group activity, fellowship in seclusion. From there we can climb up, and with the sculptures highest point as our defense, see out over the neighborhood and the water in every direction. On the outside there are the seating areas on three levels. Like birds that gather on a bird cliff, visitors can find their own resting place and lookout point."

Bridge Sculpture

Social Equity

Although the target goal of Hammarby Stostad is to achieve a desired ratio of 50:50 percent rentals to owner-occupied apartments, it has not been achieved to date.

Instead, social critics point to the fact that Hammarby Stostad is not proactively addressing the existing problems of socio-economic segregation in the city of Stockholm, but is continuing them; Residents are described as belonging to a "homogenous" economic group. It is important to note that the project's aim to avoid social segregation has been obstructed by the increased construction costs and the gradual removal of housing subsidies since the 1980s. For instance, a condominium flat built during the first phase were sold for SEK 8,000 per sqm, while those sold later were costing up to 30,000 per sqm (SEK 2.7 million for a 2-bedroom flat of 90 sqm) (Vestbro 2004:6-7). On average, the resident's incomes are the highest within Hammarby Stostad's city district of Katarina-Sofia. The price of apartments is comparable to those in the inner city, but requires higher monthly management fees.

In terms of Hammarby Stostad rental market, the rents are considered to be relatively high, and the national housing policy does not obligate the developers to provide affordable housing. The project is successful in allocating apartments to be rented, but typically, the corresponding land value of the apartments is comparably inferior. For instance, rental apartments do not have direct views to the water (CABE 2007). On the other hand, Hammarby Stostad is attempting to counteract the social segregation by constructing subsidized student housing, and group homes for the mentally challenged and persons suffering from dementia (Vestbro2004:7).

Environmental Education

Hammarby Stostad has launched extensive efforts into educating and encouraging its residents to make full use of the project's environmental program. The Glass House, built in the center of the district demonstrates this. The Glass House functions space to showcase technical solutions, and to advise locals on environmental issues. Overall, the Glass House center has cost the £2m to build. The costs were underwritten by the City of Stockholm, with approximately one third funded by a Local Investment Program grant. Ongoing revenue funding for the centre (approximately £110,000 a year) is split equally between Stockholm Water, Fortum and the City of Stockholm's land development bureau (CABE 2007).

According to the program coordinator, the Glass House is struggling to establish contact with the residents, and has found its website the most successful way of targeting an audience (CABE 2007).

The lessons learned from the Hammarby Stostad development are impacting the niche of sustainable developments worldwide. The "Intellegence Community Forum" has announced that the project is one of their nominees for their "Smart Communities 2008" award. Among Hammarby Stostad, some of the other cities include Ashland, Oregon, USA, Barceloneta, Puerto Rico, Cape Town, South Africa, Doha (Ad-Dawhah), Qatar, Dublin, Ohio, USA, Dundee, Scotland, Edmonton, Alberta, Canada, Eindhoven, The Netherlands, Fredericton, New Brunswick, Canada, Gangnam-gu District, Seoul, South Korea, Gold Coast City, Australia, and Vancouver, British Columbia, Canada (City of Dublin 2007). This nomination provides a mechanism to advertise and promote global awareness of Hammarby Stostad's programmatic elements.

Also, the program of "Partnership of Sustainable Cities" between the nations of Sweden and Australia is a method of Hammarby Stostad's lessons learned to be shared with other cities.

In addition, the nation of Sweden has developed "Pathways to a Swedish Sustainable City" program which is intended for an international audience. Within this program, they share their sustainable development methods as to enhance the growing, international sustainable cities knowledge base (Ecos 2006).

Source: City of Stockholm

Publicity Material about Hammarby Sjostad

Design Process & Implementation

This section addresses the planning and design process for Hammarby Sjostad, beginning with Sweden's Local Investment Program.

Local Investment Program (LIP)

The Local Investment Program (LIP) was a subsidy offered by the Swedish national government and designed to encourage local governments to adopt new environmentally sustainable technology and knowledge. The national subsidy was aimed at encouraging municipalities to work towards becoming part of an 'ecologically sustainable society,' while at the same time providing jobs. In January 1998, the Swedish parliament voted through the bill on the LIP. It became effective on February 3rd as Enactment 1998:23, colloquially known as the LIP-enactment. The program had a budget of 5.4 billion kronor and was intended to run between 1998 and 2000, though it was extended to 2004.

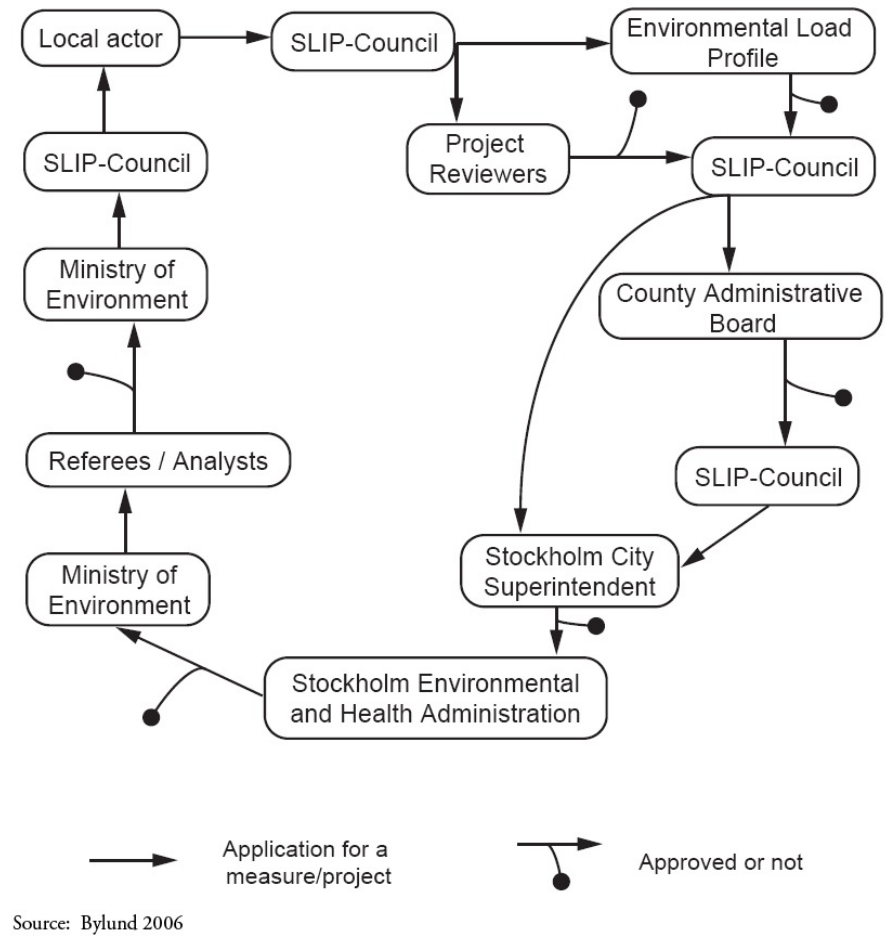
The program stated that municipalities could apply for the subsidy if they employed measures that promoted ecological sustainable development. The measures would be eligible for the subsidy if they:

- Were aimed at reducing the environmental load;
- Increased efficiency in energy and other natural resources
- Promoted the use of renewable raw materials;
- Increased reuse and recycling;
- Helped conserve and strengthen biological diversity and safeguard cultural environmental value;
- Enhanced the cycling of plant nutrients; and
- Improved the indoor environment regarding allergenic substances.

Only municipalities or associated municipalities were eligible to apply for the subsidy, which was anchored at the local government level. The government's program inscribed the municipalities' gate-keeping function because the local actors had to apply to the municipality first so that an initial decision on the merits of the proposal measure could be made. If the measure was seen as feasible, then the municipality would pass the application on to the Ministry of Environment (see Figure 28 for the overall project application process). The government substantiated LIP along the lines that local anchoring is needed for the ecological dimension to be successfully inserted in the further structuring or building of society. This argument comes from Habitat II, the United Nations Conference on Human Settlements in Istambul 1996, which stressed urban policies and local and regional partnerships for future sustainable development. Also, by this time, each of Sweden's 288 municipalities had already started work with the Local Agenda 21, so it was natural that the program would be anchored at the local level. A further reason for delegating a large part of the execution of the subsidy to the local governments was the relatively strong independence and extended powers for decision-making the municipalities had been given during the 20th century (Bylund 2006).

Stockholm Allocation

In 1998, Stockholm applied to the National Government for LIP funds for 16 projects (including Hammarby Sjostad) within three Eco-cycling Districts. As written in the application, the districts are



The route of the applications, from local actor through various instances to be granted a subsidy

to become pilot projects for sustainable development. According to a spokesperson for Stockholm City, the application's core was completely built upon the concept for Hammarby Sjostad (Bylund 2006).

As part of this larger LIP, the National Government set aside 678 million kronor (67 million Euros) for the city, which is about a tenth of the total amount allocated at the national level. Stockholm then allocated about SEK 400 million (42 million Euros) to aid its projects in three Eco-cycle Districts: 200 million kronor for Hammary Sjostad and 200 million kronor to be shared by Skarholmen and Ostbergahojden. The cost (the total investment) is calculated to be 5.7 billion kronor for Hammarby Sjostad and 700 million kronor for the existing areas (Bylund 2006).

The government granted the following amounts to each of the following uses:

- *Technology Procurement* to accelerate the development of new technology and technology on the way towards commercial application – 60 million kronor.
- *Co-operative Procurement* to decrease the costs of environmentally-adapted technology and to broaden the range of interested parties and demand – 15 million kronor.
- *Knowledge Transference* for feedback and knowledge sharing about the new technology and practices – 6 million kronor.
- The *Environmental Load Profile* an evaluation model is used to describe the present situation (ie, base condition) and to judge the consequences of new projects and alternative solutions – 9 million kronor.
- *Development and Demonstration Projects* to test systems and technologies to reach commercial acceptance – 270 million kronor.

- *Incentive for Best Proposition* to stage contests concerning new development and renovation – 5 million kronor.
- *Incentive for Best Building* to stage contests directed exclusively at renovation – 35 million kronor.

As shown above, the majority of the subsidy (67% of 400 million kronor) was earmarked for development and demonstration projects. The remaining 33% was to be used for best building incentives (contests), technology procurement, development of the environmental load profile, and information sharing.

The government adopted a wait-and-see stance towards some of the instruments written into Stockholm's program, as the local actors are primarily defined according to their role as market actors and these instruments might influence market competition (Bylund 2006).

The national government identified several requirements associated with the subsidy. The government's conditions for the Stockholm LIP are summarized below:

- The subsidies constitute a fixed part of the project's sum total and with a maximum amount;
- Disbursements are carried out annually (for 80 percent of the subsidy);
- The remaining 20 percent is distributed after the timeframe for the project has ended, that is, the year 2001;
- The progress of the project is to be accounted for annually;
- Any deviations and changes in the projects that may occur must be reported; and
- Repayment is required for non-realized projects (Bylund 2006).

According to the LIP subsidy, 30 percent of additional costs incurrent by proposals adopting a sustainable plan were to be defrayed by the subsidy. This LIP policy was later revised when competitors complained that the subsidy was too small. The funding was then increased to 30 percent of the entire cost of accepted projects (Dastur 2005).

The Subsidy in Action

The bill had very loose guidlines on how the government or the ministry should appraise measures and general criteria for what the municipalities' programs should result in. The municipalities found the guidance and objectives too vague and directives sometimes contradictory so that the framework was later made more stringent. According to the parliament's auditors, the looseness gave the municipalities the possibility to use innovative thinking and to tailor the program to the specific, local situation. On the other hand, however, it also meant taking greater risks and the possibility that much work would come to nothing when or if rules were changed (Bylund 2006).

Between 1998 and 2000, 23 technology procurements and 13 co-operative procurements were initiated (not all of them directly pertaining to Hammarby Sjostad). A couple of examples include: the use of double-glass facades for GlashusEtt (Glass-house One) in Hammarby Sjostad and fuel-cells and solar cells testing. Out of the 13 participants, five have been invited to hand in prototypes

for testing according to the specifications. Two winners and one special prize have been awarded (Bylund 2006).

Knowledge Transference has included seminars on solar cell-technology, energy efficient windows, environmentally adapted lighting, "A Sustainable Starkholmen", waste management, IT in buildings, and environmentally adapted developments throughout the world (Bylund 2006).

Meanwhile, during this time, the city completed the model structure of the ELP and, in the five rounds of applications until the end of 1999 for the instrument Development and Demonstration Projects, applications concerning support for 292 measures/ projects were handed in. Of these 292 measures/project, 97 are granted for all three Eco-cycling Districts (Bylund 2006).

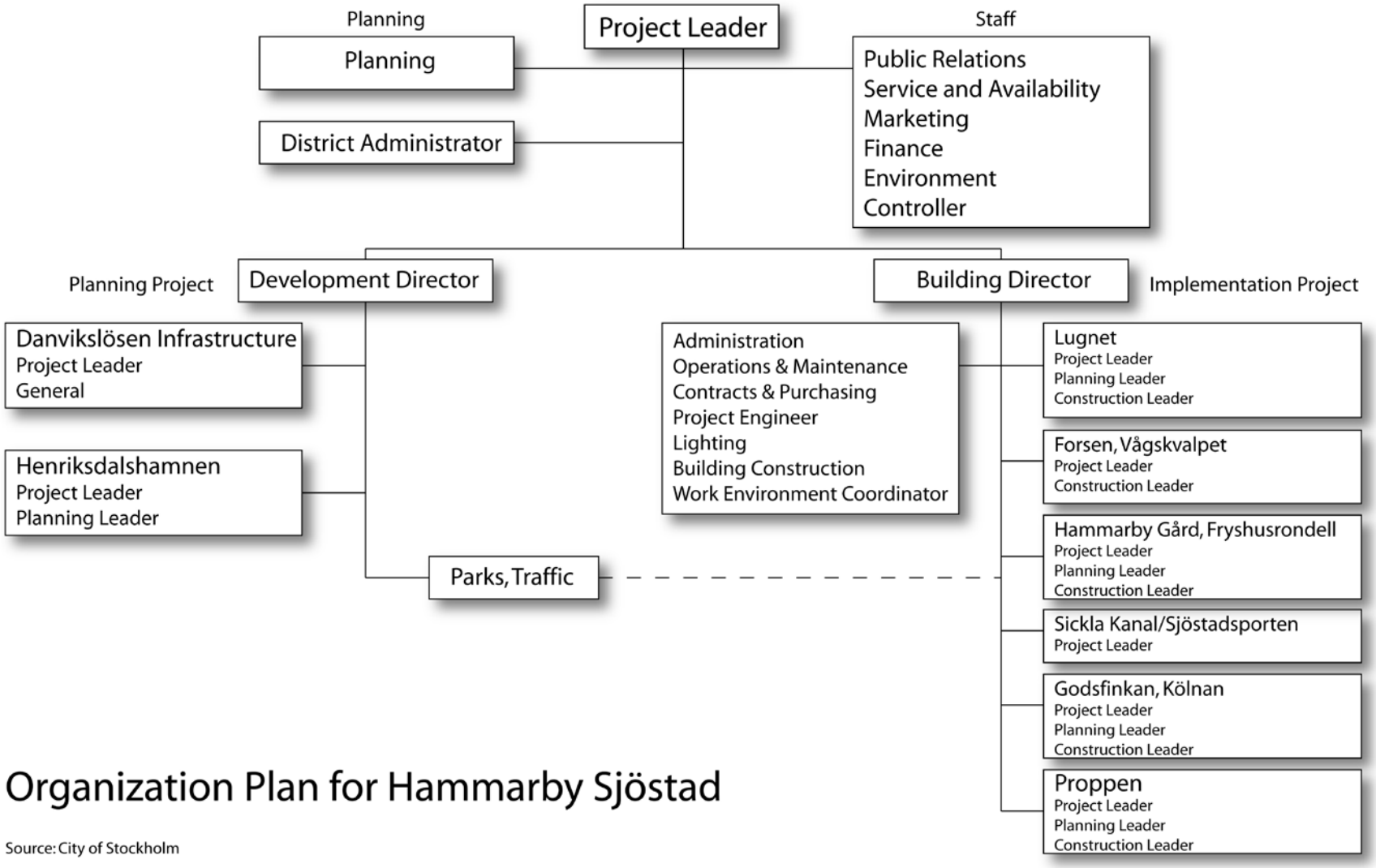
Also during this time, the project team held two competitions: The 'Best Proposition' and the 'Greenhouse for Creative Ideas' competitions. Following each competition, the City works on compiling and disseminating the ideas and experiences gained from the competition. A 'Best Building' competition is in the program phase but open for all developers in Hammarby Sjostad. The prize money is to be disbursed according to how well the measured values of the propositions correspond to the claimed values (Bylund 2006).

Environmental Program

The development program for Hammarby Sjostad is guided by well-defined environmental objectives which were drafted by the City of Stockholm. The environmental program was included in the Stockholm application for the LIP as an appendix (Dastur 2005).

The politicians of Stockholm decided on the objectives in 1996, in agreement between political blocs. The environmental program is integrated into the core of all aspects of the project. Each decision made in the course of implementing the development of Hammarby Sjostad must further the achievement of stated environmental goals. The environmental program thus serves as both a planning tool and a guideline for development of the area (Nattrass 2007). The City's administrators and companies, municipal and private developers, the contractors and consultants are jointly responsible for realizing the objectives. Together, they form the group of actors or stakeholders of the development of Hammarby Sjostad. In their environmental management process, they utilize drawings and written documents, contracts and other tools, also used in ordinary planning, design and construction (Svane 2001).

All contractors involved in the project must agree to work towards these high environmental standards. For example, by 1997, contractors were required to have developed an environmental policy, established a register of environmental effects, and to have developed a rationale for their operations or in some way have begun working either towards registration according to EMAS, certification according to ISO 14000, or the equivalent. Further, contractors must verify that every purchase they make complies with the environmental program (Nattass 2007).



Organization Plan

Hammarby Sjostad Project Team

For the project, the City established a project team, which is an addition to the normal set of stakeholders. When first appointed in 1997, the project team was outside the ordinary organization of departments and companies and was localized near the construction site. The idea was that the team should be 'neutral' in its contracts with the other companies and departments, thus being able to strike a balance (for example, in goal conflicts). One disadvantage was that the main part of the City's estimated investment – SEK 2 billion – would be directed to ordinary way, out of control of the team.

In 1998, the political majority shifted, and as a result, the team became part of the City's Streets and Real Estate Administration. The team also moved its office to the same location as the rest of that administration. In its new position within the Streets and Real Estate Administration, the project team is able to more closely coordinate the public investment. Because the team has been incorporated into the city, they have greater access to and control over public funds and are in a stronger position to leverage and negotiate with private interests. Also, through the board of that administration, the politicians have a more direct influence over the team than before (Johansson 2002).

Led by a project manager and environmental officer, team members include representatives from planning, real estate, traffic, water and sewage, waste, and energy. The project team is responsible for the finance, design and implementation of the area. It is also responsible for soil decontamination and the construction of bridges, utility services, streets and parks within the area (Johansson 2002).

The project team has used and continues to use formal and informal methods to direct planning of the Hammarby Sjostad project. Master plans are drawn up, building permits given and contracts signed, just as in any other large-scale construction project. The stakeholders compete, negotiate and co-operate in the usual manner. However, because the environmental objectives are tough, new methods, tools and solutions are needed in the development process. Two of these tools are: mutual learning concerning the environmental issues and the search for new technical solutions. Organization and the division of responsibilities have also be affected (Johansson 2002).

The project team uses negotiations, competitions (such as from the most environmentally innovative building) and instruments (such as the detail plan and developer agreements) as policy instruments (Svane). A third instrument was used much later in the development process, when one of the contractors through lack of moisture protection caused extensive mold problems in some buildings. Officers of the project team had documented the oncoming mould problems and could use documentation as well as publicity as "whips" to influence not only the offender, but all contractors towards better onsite management (Svane 2005).

The project team used money to entice developers to get involved in the project. Early in the environmental management process, the City's politicians promised SEK 200 million (22 million Euro) to finance the extra costs of environmental measures, systems, materials, etc. In the end, they were not available to the developers,

but instead used for innovations concerning the integrated technical supply systems, the Hammarby Model. Somewhat later, the national government offered the LIP subsidy for investments in environmentally adapted technology (Svane). When the City sells land as part of a development agreement, the price is part of negotiations. In principle, the project teams' officers from the Roads and Real Estate Office could set conditions concerning, for example, environmental objectives and use land price as a policy instrument: the developer gets the land at a lower price if he or she promises to realize a set of environmental objectives. In practice, this was little used on Sickla Udde, one reason being that the City did not own the land (Svane 2005).

Informal means used by the project team to guide the project management process were the ELP, seminars, discussion groups, the dissemination of information on the most cutting edge infrastructure (Dastur 2005). When the Project Tram has little formal power, or as supplement to other policy instruments, information can be used. For example, early in the environmental management process, the future contractors and their architects were invited to seminars, officers from the City's Environmental Office wrote an Environmental Design Guide, and the contractors were asked to prepare a corresponding document. The environmental objectives were rewritten in a more effective form (as "success criteria") by the head of the project team, architects from the Planning Office produced clear visions of the intended plans and designs (Svane 2005).

Environmental Load Profile (ELP)

To follow up the goals for the district, the project team developed an environmental assessment tool called the Environmental Load Profile (ELP). The computerized tool takes account of activities of individuals (e.g. cooking, laundry), buildings (e.g. materials, domestic heating, commercial electricity), unbuilt real estate area (e.g. materials, working machines) and the common area (e.g. materials, personal transports, transports of goods). Aggregated, these activities constitute the environmental load from a whole city district (Forsberg 2003).

As Anna Forsberg describes in her thesis titled "Environmental Assessment of the Urban Environment – Development and First Application of the Environmental Load Profile for Hammarby Sjostad," two concepts are fundamental for the development of the ELP tool: environmental systems analysis (ESA) and life cycle assessment (LCA). The concept of ESA focuses on environmental progress within the society. Since the application of the concept is broad, it does not represent a specific methodology but rather embodies a principle to focus on the interactions between the sub-components of a complex system rather than reducing the system into its sub-components and studying them individually. The basic idea of LCA is to evaluate the total environmental impact of the whole life-cycle of a product, process or activity. The assessment includes evaluation of environmental impacts from generation of raw materials, production, transports, use, reuse, maintenance, recycling and final disposal (that is, from cradle to grave) (Forsberg 2003).

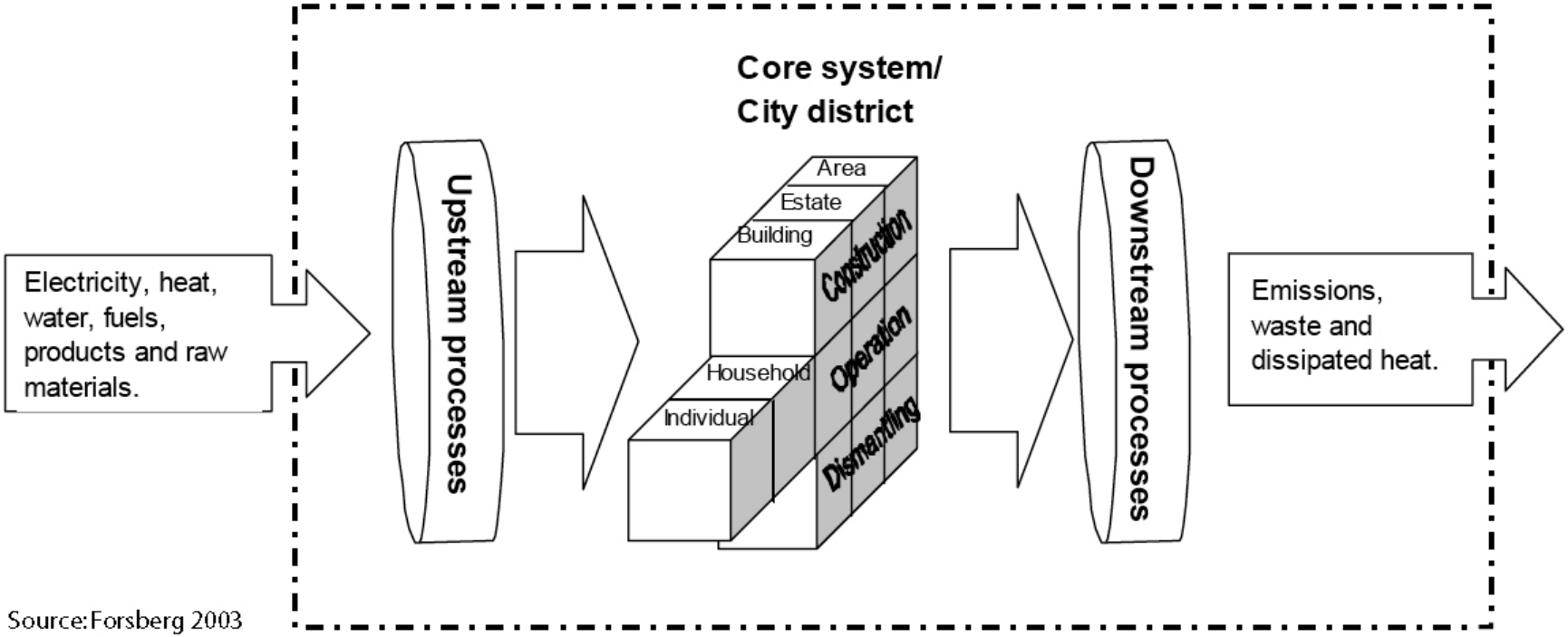
1	2	Σ 1-2	3	Σ3	4	Σ4	5	Σ5	Σ1-5
			Building level Constructiom		**Real estate level Construction**		**District level Construction**		**Total Construction**
			Materials Working Machines Material transports		Materials Working Machines Material transports		Materials Working Machines Material transports		
Individual level	**Household level**		**Building level Operation**		**Real estate level Operation**		**District level Operation**		**Total Operation**
Personal hygiene Laundry Cooking Waste generation	Lighting Other		Domesic Heating Real estate electric. District cooling		Materials Working Machines Material transports Storm water treatm.		Materials Working Machines Material transports Storm water treatm. Personal transports Transport of goods		
			Building level Dismantling		**Real es tate level Dismantling**		**District level Dismantling**		**Total Dismantling**
			Working Machines Material transports Reuse Recycling Energy recovery Landfill		Working Machines Material transports Reuse Recycling Energy recovery Landfill		Working Machines Materia l transports Reuse Recycling Energy recovery Landfill		
Total Individual level	**Total Household level**		**Total Building level**		**Total Real estate level**		**Total District level**		**Total**

Source: Forsberg 2003

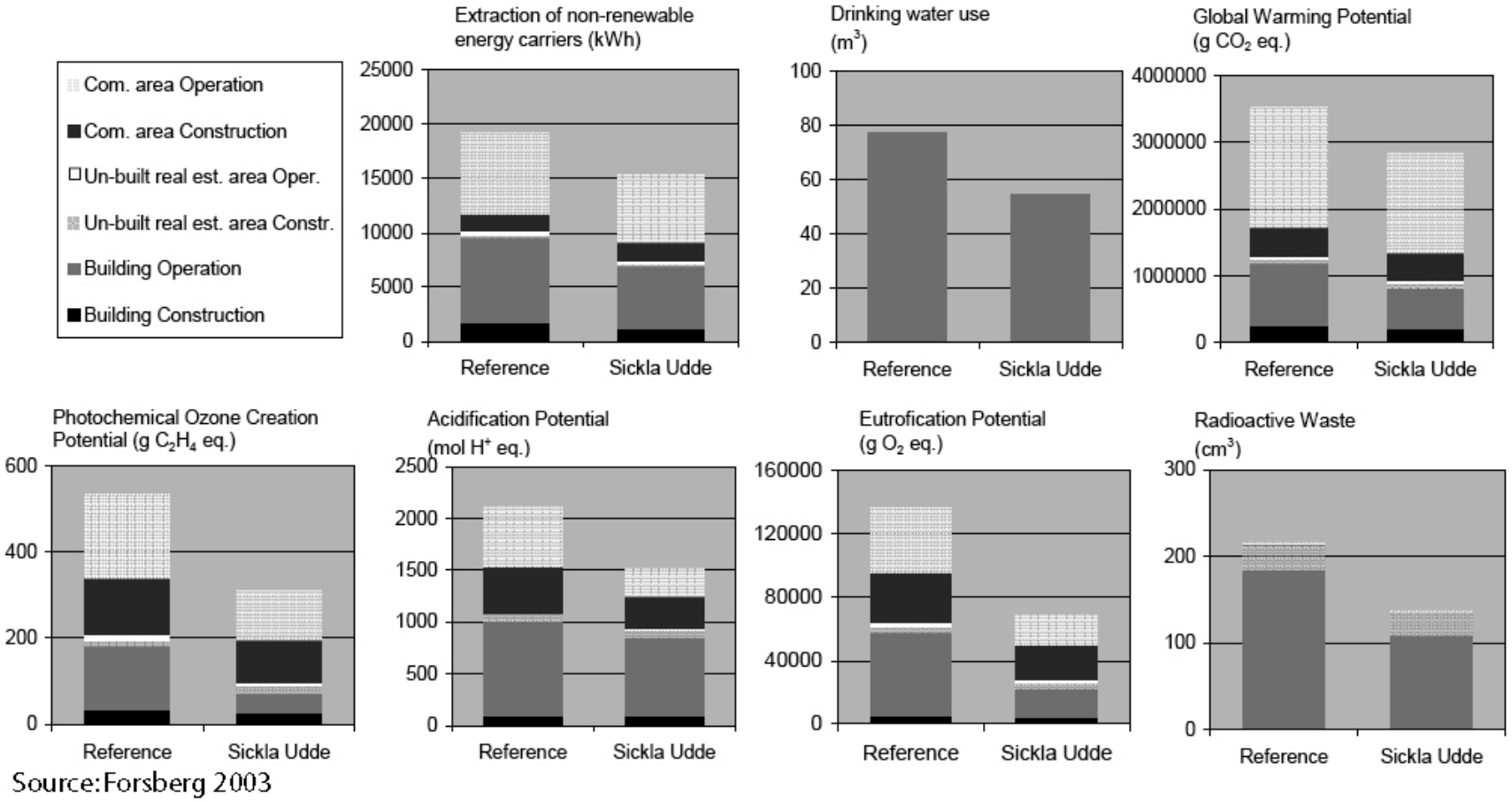
Environmental Load Profile Fundamental Structure Tool

A city-district is a complex system. Defining the system boundaries is crucial while performing a LCA. System boundaries define the limits of the system and the inflow/outflow of process chains in relation to its surroundings. Borderlines can be defined by classifying the system into: core system, upstream processes, and downstream processes. The ELP tool is defined using geographical (physical) system boundaries, temporal system boundaries and functional units. A conceptual model of the system boundaries in the ELP is shown below. The conceptual model illustrates the system boundaries in the ELP. The cubes in the figure illustrate the core system (the district) and the various subparts (the individual level, etc.) including the three life cycle stages: construction, operation and dismantling. The circles symbolize upstream and downstream processes supporting the district. The outer limit (dashed-dotted line) illustrates how far the flows are followed upstream and downstream of the district (Forsberg 2003).

The outcome of the ELP consists of the following environmental impact categories or environmental loads: extraction of non-renewable resources, water use, global warming potential, acidification potential, eutrophication potential, photochemical ozone depletion potential, radioactive waste and use of hazardous compounds. The outcome of the calculation with the ELP tool is presented in bar charts. The charts show two bars, one represents the reference case (ie, base condition) and the second the proposed or actual project (depending on the stage of the



Conceptual Model Boundaries



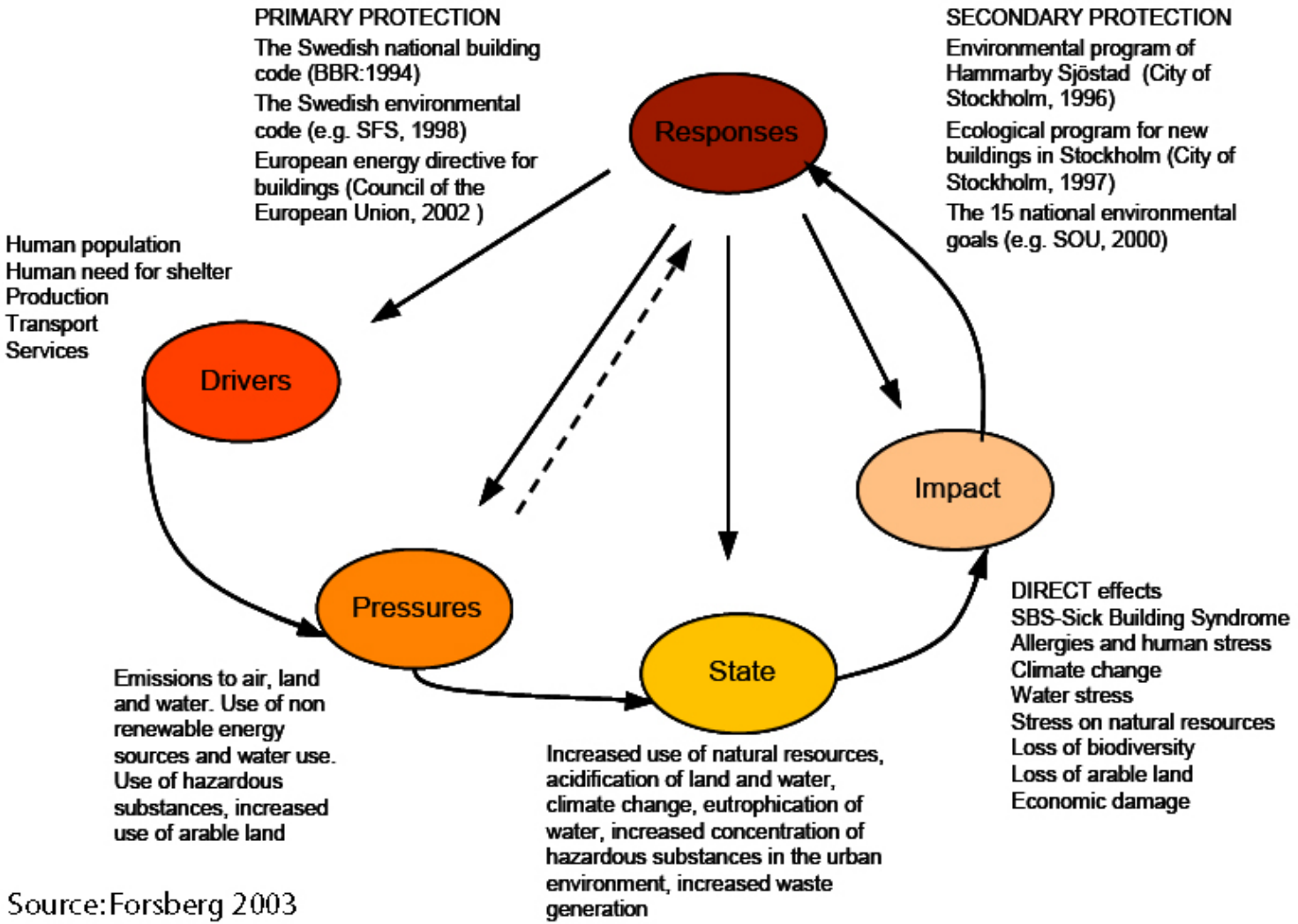
Environmenal Load Profile Results for Sickla Udde

project the ELP is being used for). Results of an ELP analysis are presented per various units (e.g. per m2 inhabitable floor area and year for the whole city district). The ELP results for the Sickla Udde project are shown above. The ELP is presented for the overall environmental load of Sickla Udde distributed on the life cycle stages of construction and operation, buildings, unbuilt real estate area and common area per individual and year (Forsberg 2003).

The approach of using a multidimensional framework with a lifecycle perspective on products and services to calculate the environmental load on buildings is not unique for the ELP. However, the uniqueness of the ELP is the ambition of grasping a whole city district and not just the buildings or properties within it. This is a very ambitious approach, which in practice is almost impossible to account for. Nerveless, buildings, properties and

areas have functionalities that are strongly linked to one another and a comprehensive approach in necessary (Forsberg 2003).

The ELP and other similar assessment tools for the built environment could offer urban planners and developers a short-cut in feedback on the environmental performance of the built environment. The figure below illustrates how the ELP tool fits into the DPSIR model (Forsberg 2003). When developers prepare terms of reference for contractors and local authorities grant building permits, environmental assessment tools can be used



Source: Forsberg 2003

The Environmental Load Profile in the Larger Context

for a quick, preliminary analysis of the expected environmental performance of a project (Forsberg 2003).

The environmental stakes in Hammarby Sjostad are managed by the agreements written with all the developers who work on the project. During each phase, Stockholm City makes development agreements with land owners as well as with developers to secure the flexibility of the environmental program (Bylund 2006). This represents one way by which the city puts demands on developers and directs development.

Once a developer uses the ELP to estimate the load profile for their project, they submit the proposal to the city in order to receive the LIP nationwide subsidy. As seen in the SBC Kobben Block case, the additional cost of adopting a sustainable building model was about 13,000 Euros per flat – representing an additional 5% over construction costs which is incredibly minimal when considering what was achieved (Dastur 2005).

The ELP tool was developed during the design and construction of Sickla Udde, the first sub-district constructed within Hammarby Sjostad. Because Sickla Udde was well into the planning process when the ELP was developed, the tool was not thoroughly administered for that project. It is assumed, that its use will be more integrated in the management process of the later phases of the Hammarby Sjostad development. The tool has also been used to evaluate entries for competitions between the developers, as arranged by the project team (Svane 2005).

Project Design & Implementation

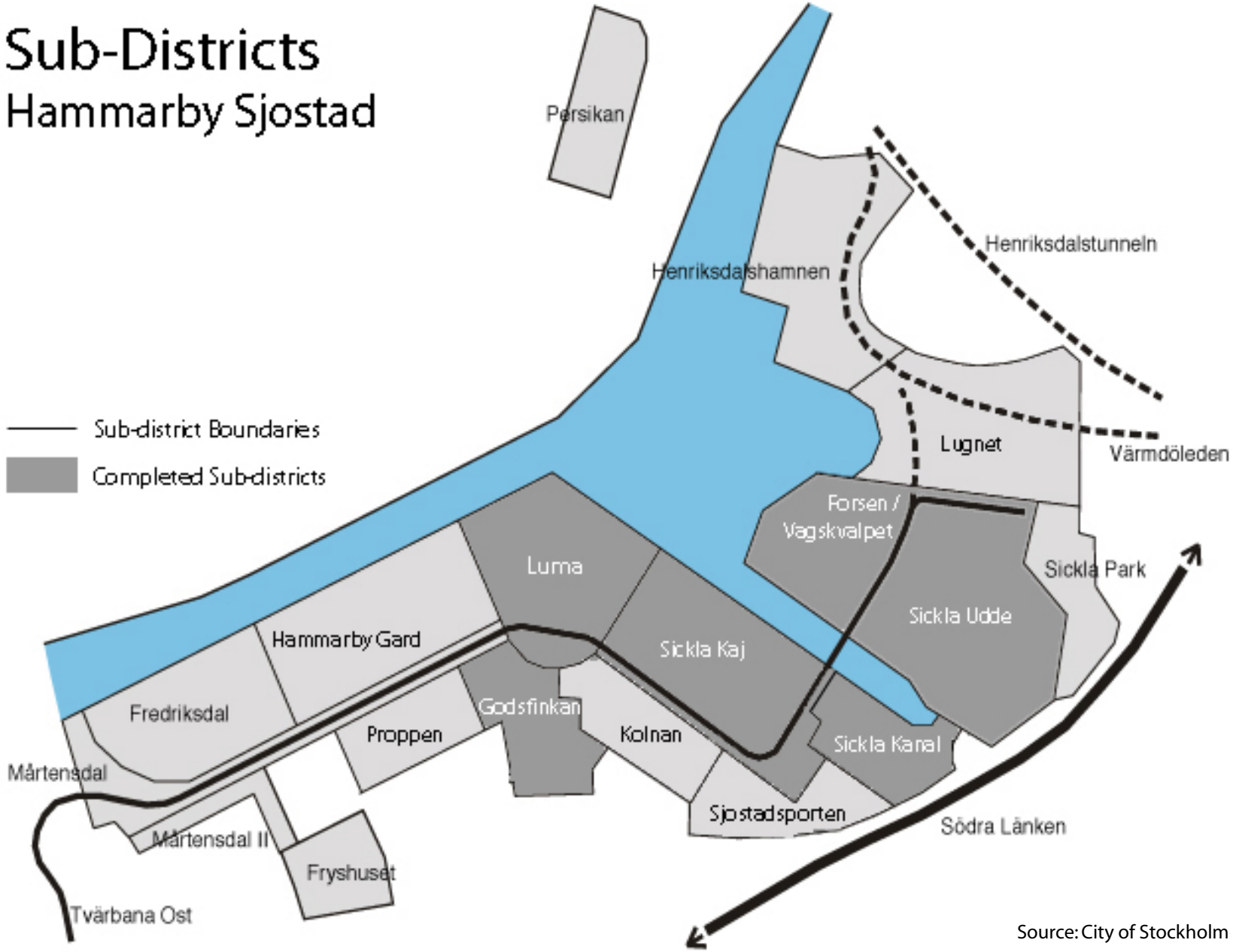
The design process is notable for the extremely high degree of local authority leadership, which permeates every stage from the development of the Masterplan to building on the ground. The implementation and control of the design is facilitated by the fact that the City has acquired the majority of land in Hammarby Sjöstad.

1. Strategic Master Plan

The design process started with the strategic Masterplan, the preparation of which was led by Stockholm's City Planning Bureau. The plan is divided into twelve sub-districts, which are being implemented as a series of development phases, six of which have been developed to date.

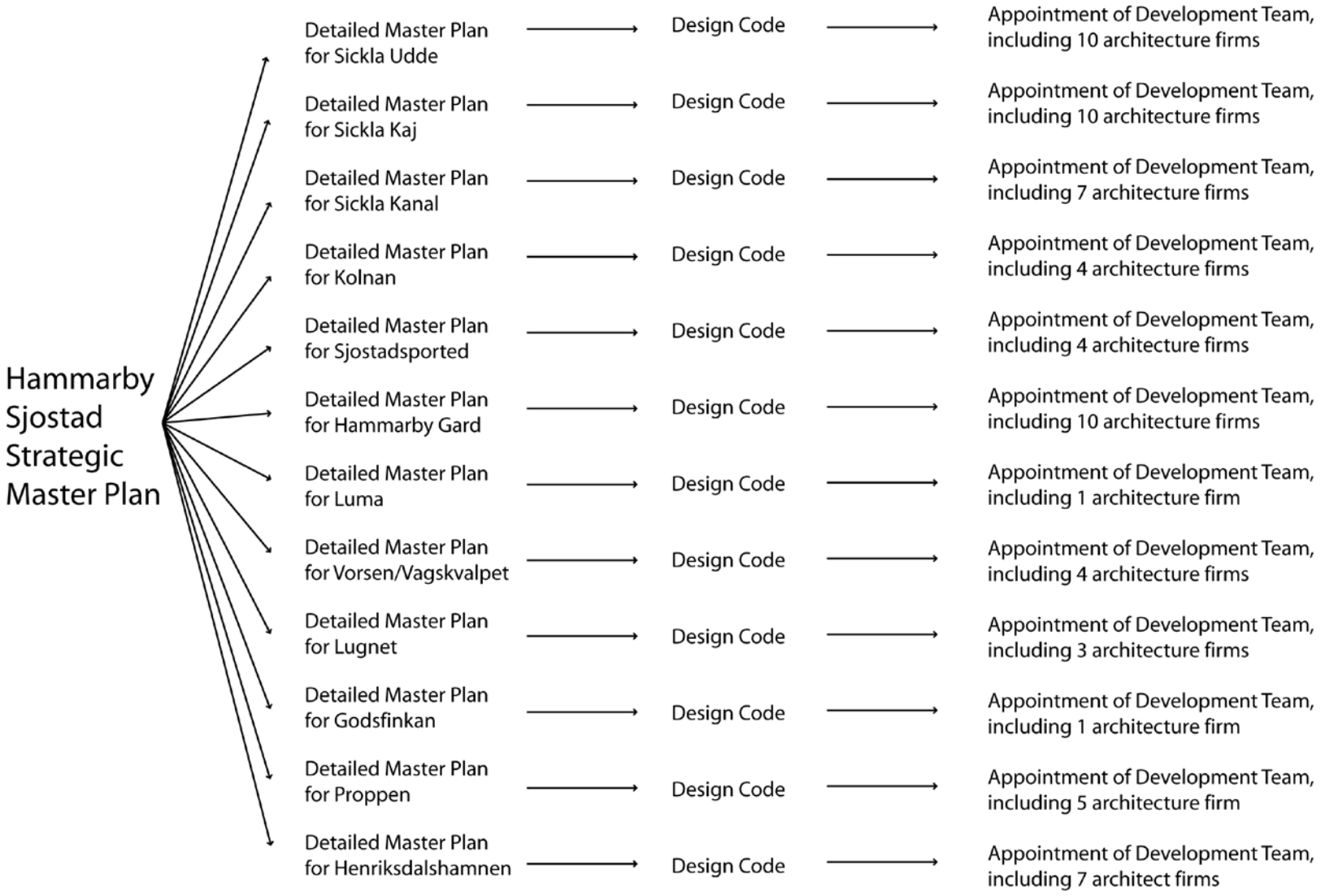
2. Detailed Master Plans

Following completion of the Strategic Plan, the City selectes three to four architects/master planners in the private sector who are appointed to 'test' the strategic Master Plan and draw up more detailed proposals for the sub-district. A design process termed "parallel sketches" has been adopted in the preparation of detailed Master Plan for each sub-district. The chief planner at the City Planning Bureau responsible for Hammarby Sjöstad emphasizes that they try to choose new architects for each sub-district, where possible, and that they encourage young architects and up-and-coming firms to take part. The City evaluates the sketches and assimilates the best features from each to arrive at an agreed upon detailed Master Plan (CABE 2007).



Completed Sub-districts

Hammarby Sjostad Design Process



Source: CABE 2007 and City of Stockholm

Design Tree

3. Design Codes

To complement the detailed plan, the City planning and design team then prepares a design code for each sub-district, in close partnership with the chosen developers and architects for each plot. The design code is taken through the local authority political process and forms an appendix to the development agreement between the City and the developer partner. The aim is to establish a level of quality for the development that both the City and developer agree on (CABE 2007).

The design code is incredibly comprehensive and sets out principles under a number of headings:

- District character, combining traditional inner city (European) built form with modern architecture influenced and inspired by Hammarby Sjöstad's natural environment. Key to this character is the mix of businesses and uses, density, built form (blocks built around inner courtyard or play area), public spaces and relationship to the water.

- Layout, form and structure, including guidelines for each block, key landmark buildings, public spaces and pedestrian routes. The guidelines are not prescriptive with regards to which materials are to be used or the number of storeys, but a descriptive rationale behind the concept for each block or key buildings is set out, which makes clear the principles which should apply, but which also manages to retain significant scope for innovation. Two and three-dimensional illustrations are used to illustrate concepts.

- Architectural style – a five-point program for architectural style is set out as follows:

o Traditional Stockholm innercity character

o Sjöstad local distinctiveness (larger dwellings compared to inner city, greater variation between buildings in terms of height and form, greater emphasis on outdoor spaces, balconies and terraces, flat roofs, greater variation of materials)

o Building form and architectural style to reflect hierarchy of open spaces which buildings relate to (for example taller, more prominent buildings along waterfront and esplanade)

o Scale, order and variation – density guidelines are set out but an emphasis on maintaining quality and variation is also articulated.

o Architectural trends – this section articulates how the modern architecture in Hammarby Sjostad should both draw inspiration from and differ from early "modernist" architecture. Similarities should include preserving the natural environment where possible and using it as inspiration for development, as well as light, views, access to green space, flat roofs, clean lines, light colors. But this should be combined with the density and hierarchy of spaces prevalent in the traditional inner city and the architecture should be place-specific and respond to its local environment. There is also an emphasis on mixed use rather than separation of uses.

- Building types - different building types are identified (for example either long, thin blocks of 12m width or a large "cube" with dimensions of 40x40m). For each building type, the number and

location of stairwells is defined, as are the number of apartments (and apartment sizes) per floor.

- Building design principles – façade materials, location of stairwells, window and balcony arrangement, roof type, and including specific guidelines for each block or key landmark building.

- Building elements – guidelines and dimensions for entrances, balconies, windows and roofing, including dimensions, proportions, colors and materials. Guidelines vary for each block and include sketches and drawings with measurements.

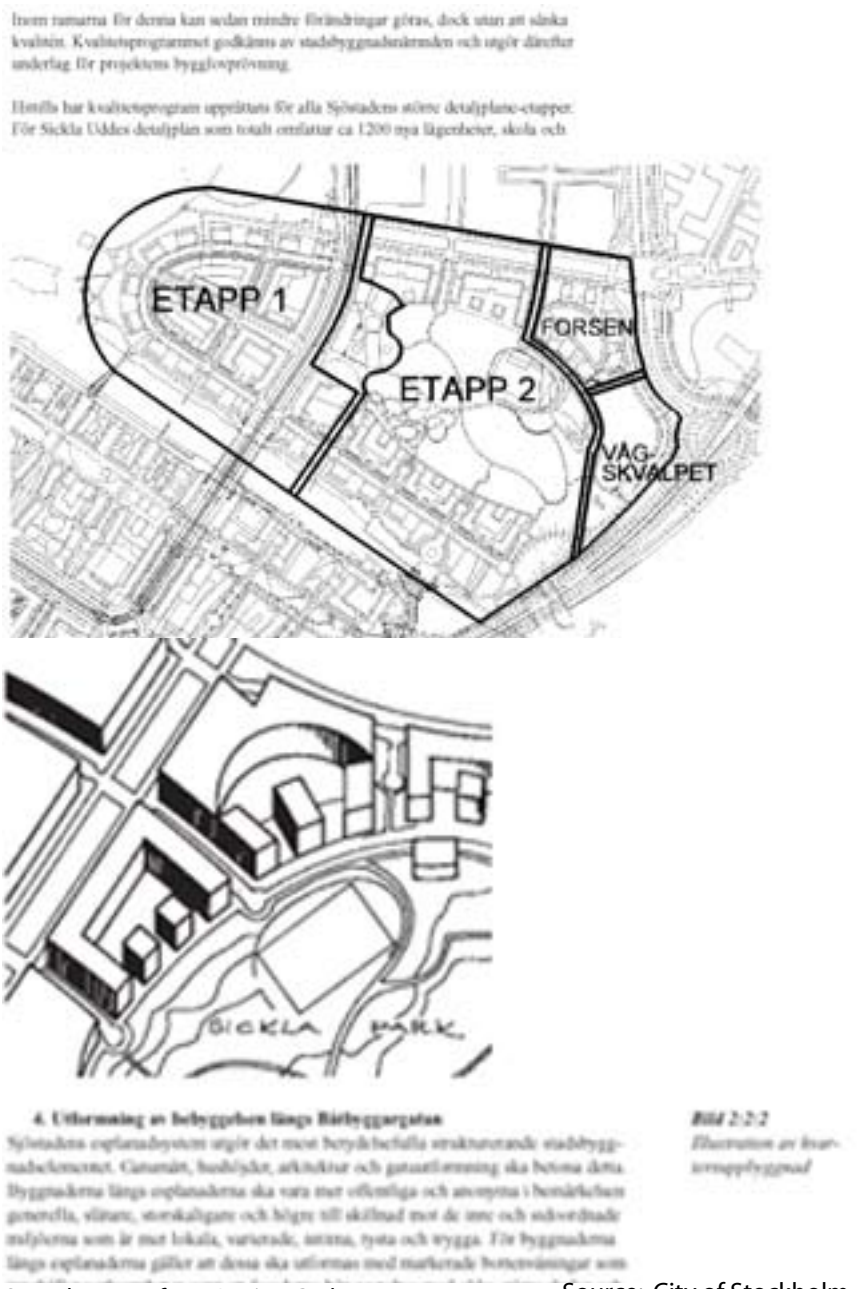
- Apartment standards – layout, daylight, height of rooms, access to outdoor space, sound insulation and accessibility requirements for entrances, balconies, terraces and outdoor space.

- Standards for additional services, including:

o Storage, stating a preference for storage within individual apartments and where this is not possible, to be located within reach of the stairwells and accessible by elevator.

o Laundry, stating a preference for space to be allocated within the bathrooms of apartments for both washing machine and dryer. Alternatively, a laundry room to be provided for each stairwell.

o Garages, specifying height and accessibility for mobility-impaired persons.



Sample pages from Design Code

Source: City of Stockholm

o Refuse collection, specifying a minimum distance of 30m from main apartment entrance to rubbish chute.

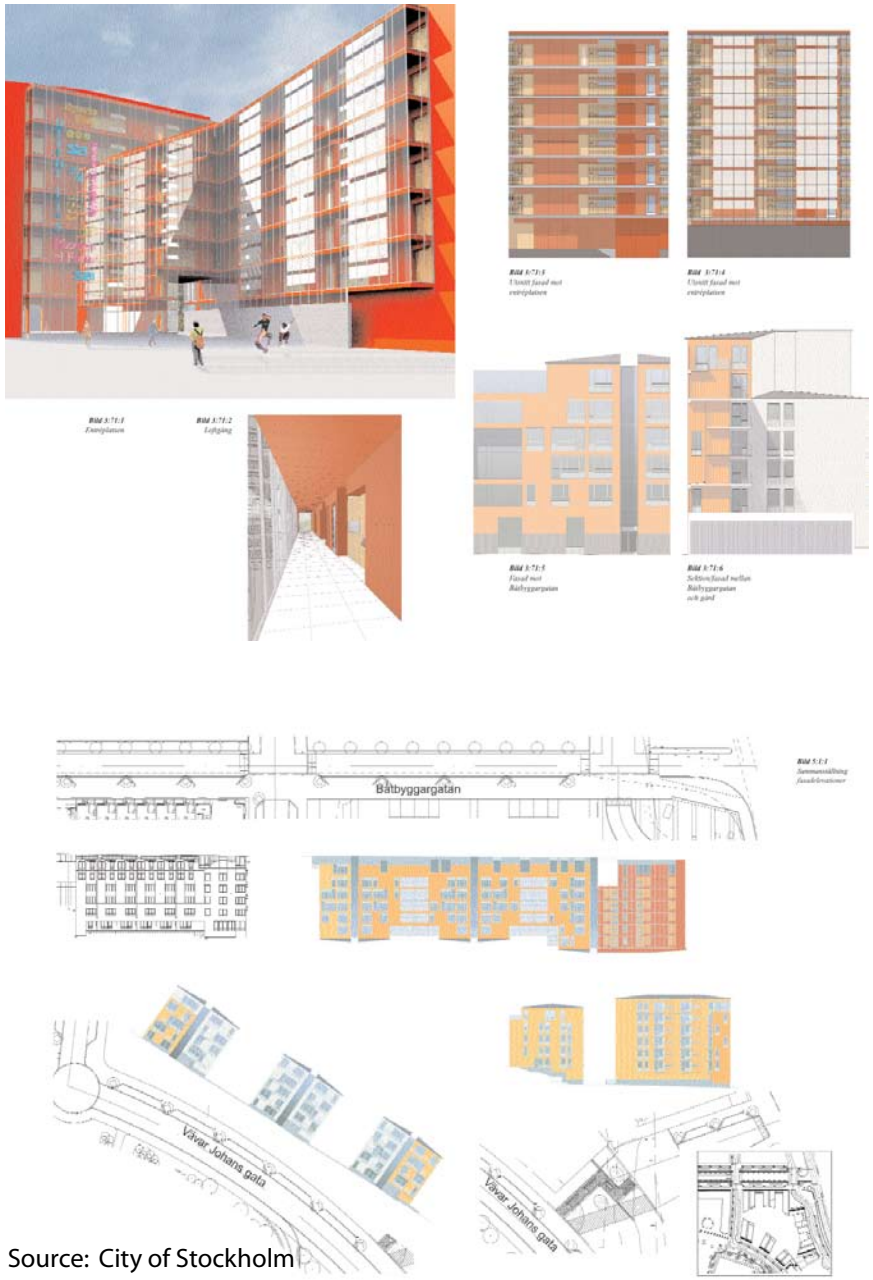
• Building color – Guidelines are given for each block and key landmark buildings, including façades and building details (windows, balconies, entrances, roofing). The rationale behind the choice of color palettes is described.

• Design of courtyards and open spaces – reference is made to defining public and private space, the proportion of green to hard open space (50%), choice of planting, play areas, materials for hard areas and lighting standards.

• Detailed architectural and design principles for each plot, to ensure distinctiveness – at this stage, 3D images of each block are provided together with a detailed description of architectural and urban design form, making reference to links to open space and other blocks. Drawings of typical apartment floorplans are provided, as well as sample designs for open spaces and courtyards.

• Design of public spaces, parks and streets, including landscaping, paving, lighting and street furniture.

• Guidelines for public spaces are provided through a combination of 3D illustrations, 2D plans and descriptive text setting out context and rationale. 2D plans and sections are provided to set standards for street and pavement width, cycle lanes and location of street furniture. Standards for different types of streets are set out, including esplanade, tram stop and local streets. A detailed lighting plan is provided, including street



Source: City of Stockholm

Sample pages from Design Code

lighting, building lighting and lighting as part of street furniture and public art. A prescriptive approach to street furniture is addressed, similar to lighting (CABE 2007).

4. Appointment of Development Teams

Finally, the City invites a consortium of developers and architects to take forward the development of each plot or individual building within the sub-district. Many developers are invited in order to ensure architectural diversity and a fine grain to the development, but all under the umbrella of a unifying code. Each sub-district typically has between four and eleven plots depending on the size and complexity of development. Different teams of developers and architects take forward development on identified blocks. Over 30 different developers have been identified. Key developers are Skanska, Family Housing, Swedish Housing, HSB, SKB and Borätt. Over 30 different architects have been appointed, examples include White Architects, Nyréns Architect Firm, Equator and Erséus. A list of the architecture firms involved with the project to date is provided in the appendix. The project has involved various engineers, surveyors and contractors, which have been appointed by individual development teams (CABE 2007).

The biggest challenges for implementation were considered to be decontamination of land, land reclamation and relocation of a large number of small low-grade industrial businesses such as car breakers and scrap yards, which is an ongoing and expensive process (CABE 2007).

Land Ownership

Land ownership is an issue where political parties usually have ideological differences, as is to case in Stockholm. While the left insists on municipal ownership, the right advocates sale of public land to private developers. When the right coalition won the 1998 elections it started to sell land to private housing and construction companies. A special argument used in connection with the Hammarby Sjostad development is that land lease contracts may include clauses about environmental issues, while selling land make the implementation of the environmental program more difficult (Vestbro 2005).

After 1998, the allocation of land for municipal housing companies was reduced from 40 to 18 percent, while the percentage of condominiums increased to 82 percent. Because of changes in the real estate market, this made it difficult to sell advertised condominiums, and therefore planned condominiums were converted into rental. The policy of the red-green majority is to allocate 50 percent of land to companies with rental tenure as an instrument to make new housing accessible to people who cannot raise big loans. Phases 4 and 5 have almost 100 percent rental accommodation (Vestbro 2005).

The aim to avoid social segregation by having a fair amount of rental housing in Hammarby Sjostad has been obstructed by rapidly raising construction costs and the gradual removal of housing subsidies since the 1980s. The difficulty to acquire a condominium flat is reflected by the fact that apartments built during the first phase were sold for SEK 8,000 per sqm, while those sold later were costing up to 30,000 per sqm (SEK 2.7 million for a

2-bedroom flat of 90 sqm). Social segregation has to some extent been counteracted by the construction of subsidized student housing, and but he integration of several 'group retirements' for mentally disabled persons and persons suffering from dementia. The present red-green coalition is also working on a new experiment with cheap housing (Vestbro 2005).

Additional Funding Mechanisms

The funding body for the Hammarby Sjostad project consists of the City of Stockholm, Stockholm Transport, the National Road Administration and private funding. However, major funding allocations distributed through the City were received from the national government through the LIP.

Sickla Udde: A More Detailed Study

Development of Sickla Udde, the first of Hammarby Sjostad's sub-districts to be developed, was a large undertaking for the city authorities. Development of the sub-district involved many stakeholders in addition to the project team: approximately ten developers, their architects and other consultants, the same number of main contractors and many sub-contractors. The city's project team assumed the role of coordinating environmental manager. The team's officers took this role in relation to colleagues within the city administration, but also towards the developers, consultants, contractors and other stakeholders. Their main task was to implement as many of the environmental objectives as possible (Svane 2005).

The project team consisted of representatives from the city's offices of city planning, roads and real estate, and environment, and also from the companies providing water and energy and handling the waste. Furthermore, the team had a head and a secretariat, and an independent financial advisor. The environmental officer was a key person, through her role in the organization as well as from personal commitment (Svane 2005).

To realize the environmental objectives of Hammarby Sjostad, all stakeholders had to combine efforts. For objectives related to transport for example, waste and energy use, the users and manager of the area also had to contribute. The project team had direct control over only a part of this realization. Therefore, influencing the other stakeholders though indirect, informal means became a main task (Svane 2005).

Numerous stakeholder were involved, but many of them participated only for a shorter period. For example, according to Swedish practice, architects are little involved with a project once the design phase is over. Furthermore, stakeholders worked together in teams, unique for each development contract. Thus, the project team's counterpart in each development was a unique, temporary organization consisting of a developer and his consultants or a contractor with his sub-contractors (Svane 2005).

The process of environmental management was one of 'management by objectives.' Often, this was seen as rather straightforward; compare for example the way such processes are described in the standardized documents on environmental management, the ISO 12000 series. With the Hammarby Sjostad

project, the environmental objectives are at the same time precise and out of the ordinary. Thus they add to an already complex process of decision-making in developing Sickla Udde; new routines had to be found and new knowledge gained and disseminated, to counteract everyday processing techniques (Svane 2005).

Any large-scale development must fulfill many different kinds of objectives, for example technical ones such as durability and energy efficiency, practical ones such as efficient use of space and also economic and aesthetic ones; programming, design and purchase about with potential goal conflicts. When environmental objectives are added, the number of goals increases, and the number of possible conflicts. To realize the environmental objectives, the project team had at its disposal a set of tools, policy instruments, such as detailed plans and procurement programs. Policy instruments were often used in a specific phase of a project: signing a procurement contract comes before construction begins but after the design. These shorter moments of the management process were influenced so as to more or less comply with the environmental objectives (Svane 2005).

The ELP tool was applied in a first case study to answer the question of how far Sickla Udde has reached in achieving the goal or 'twice as good'. The assessment indicates that compared to a reference district based on the technology used in 1990, the environmental performance of Sickla Udde has reached the goal for some environmental load categories and 30 percent for others. Although these findings are preliminary, they indicated a development in the right direction. Measures taken contributing to largest environmental improvements are: a more efficient energy production (improved district heating) and use (e.g. lower U-values in the buildings, energy efficient appliances, heat exchange of ventilation are) and improved sewage treatment. The results also demonstrate that the environmental load from domestic transports can be the same magnitude as from the buildings situated within the city district. Therefore, resources spent to decrease environmental load in the planning process should primarily be devoted to improving domestic transportation systems and on optimizing the operational phase of the buildings (Forsberg 2003).

The environmental program proposes the target 'twice as good', but it is clear that it will not be possible to reach this target during the first phase of construction at Hammarby Sjostad. This is both because of the production costs and the aim to secure good living qualities. But the first phase is seen as important preparation to safeguard the district's ability to achieve these targets when everything is finished (Bylund 2006).

Specific Design Approaches

Hammarby Sjostad Current Day


Source: Alex Linthicum

Architecture responding to water

Source: City of Stockholm

Infrastructure Building

Approaches to Architecture and Site Design

Hammarby Sjöstad adds a new ring to Stockholm's urban growth. It is a modern, semi-open, block-based city, with a combination of a closed and traditional inner city with more modern planning. The inner city street dimensions, block sizes, building heights, density mix are integrated with openness, waterfront views, parks and sunlight (hammarbysjostad.se 2007).

Although Hammarby Sjöstad is located outside what is traditionally considered to be the perimeter of inner city Stockholm, the design is intentionally urban rather than suburban, and follows standards for Stockholm's inner city in terms of street width (18m or 60ft), block sizes (70x100m or 230ftx328ft), density, and land use. The scale of development varies from four to five storey buildings along Sickla canal and 6 to 8 storey buildings along the main corridors (Cabe 2007). Along Hammarbyleden, taller buildings facing the water are built in a classic inner city style that complements the large-scale facilities and large open water areas. Large-scale, multi-functional buildings have been built along the avenue, with small-scale backstreet and courtyard houses built between the dock and Sjöstadsparterren, the new park walkway. The environment along the canals, Sickla Udde and Sickla Kanal is more intimate and small-scale, with natural shorelines, and development gradually downscaled towards these shorelines (hammarbysjostad.se 2007).

Hammarby Sjostad has a vibrant urban center that is contiguous with and integrated into the inner city and the city core due to its extension of the typical Stockholm character (Dastur 2005). This traditional city structure of Stockholm has been adopted

and combined with a new architectural style that responds to its specific waterside context, promotes the best of contemporary sustainability technology and follows modern architectural principles of maximizing light, and views of the water and green spaces (Cabe 2007). Limited building depths, recessed penthouse flats, large balconies and terraces, big windows, flat roofs and light colors on water-facing façades are examples of the different applications of this modernistic architectural program that Hammarby Sjostad promotes (hammarbysjostad.se 2007). Most apartments with balconies provide for overlooking onto the streets, waterfront walkways and open spaces. Many of these apartments also follow a semi-open block form, thus providing open access to the designed courtyards of the residential blocks (Cabe 2007). The city also has an emphasis on durable materials such as glass, wood, steel and stone (hammarbysjostad.se 2007).

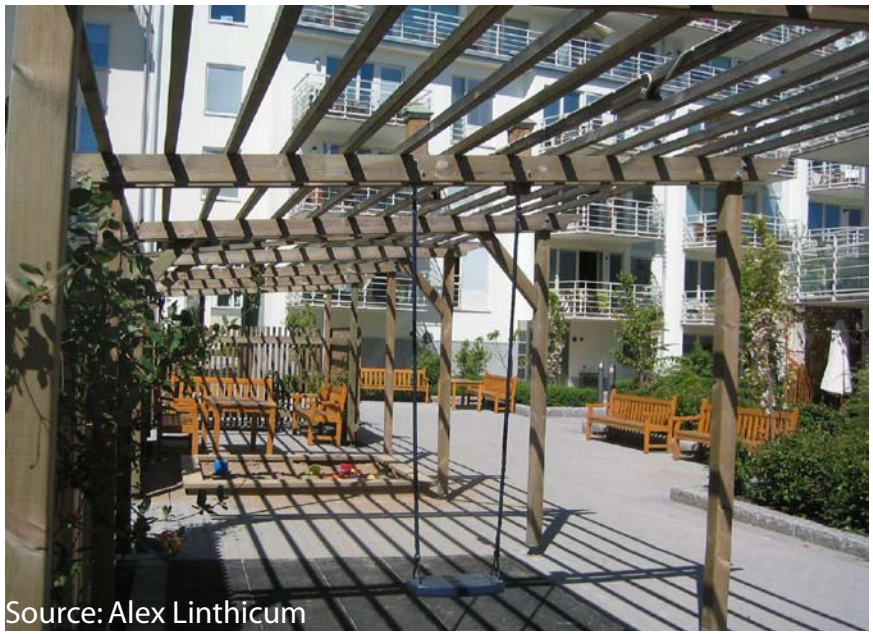
The main spine of this new district is a 37.5m (120ft) wide boulevard and transport corridor, which connects key transport nodes and public focal points, creating a natural focus for activity and commerce. The ground floors of nearly all the buildings along this stretch have been designed as flexible spaces, suitable for retail, leisure or community use. To enable retail use, these buildings have high floor to ceiling heights (Urban Design Compendium 2007). Additional opportunities for commercial uses are also provided through the intermittent placing of two-storey pavilions along the Sickla canal. Businesses that have located in this neighborhood have included fashion, electrical, interior, health and beauty, book and flower shops, cafés, restaurants and bars. General services such as launderettes and key cutters, a co-op supermarket, an art gallery and several real estate agents are also located in this commercial part of the neighborhood (Cabe 2007).

Use of terraces and balconies

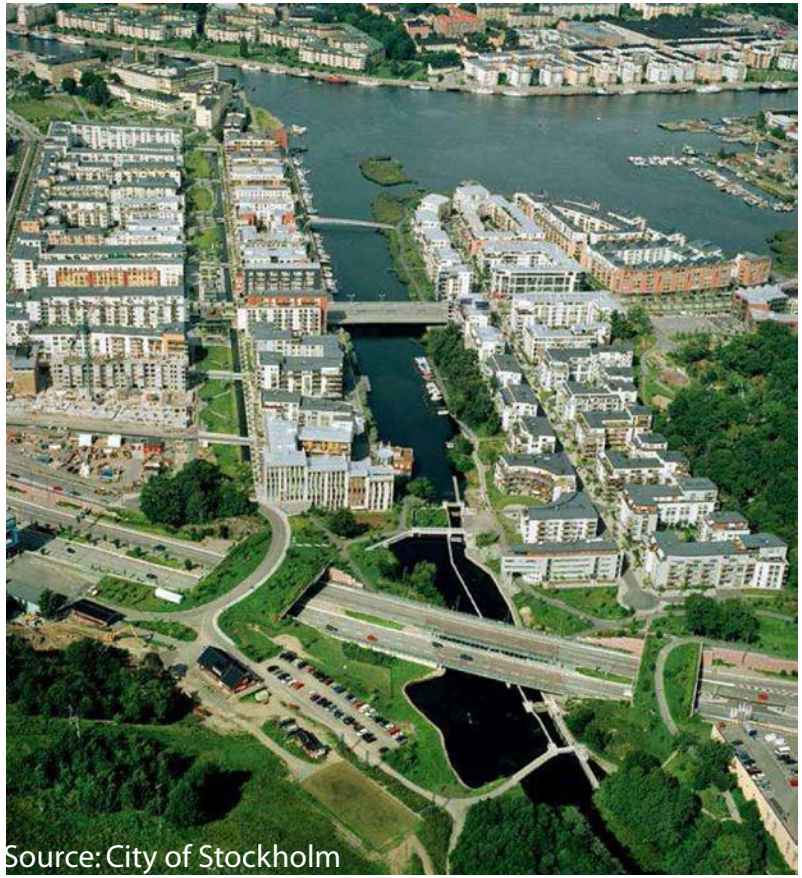
Approaches to Landscape Architecture

A network of varied parks, green spaces and walkways runs through the district to provide a counterbalance to the dense urban landscape. One can notice the amount of green spaces and their connections on the following page. Green surfaces and trees that have been planted help to collect rain water locally instead of having it drain into the sewage system. The vegetation will also filter the pollutants from this stormwater runoff and ensure cleaner air. Even, two wide bridges over the busy Sodra Lanken

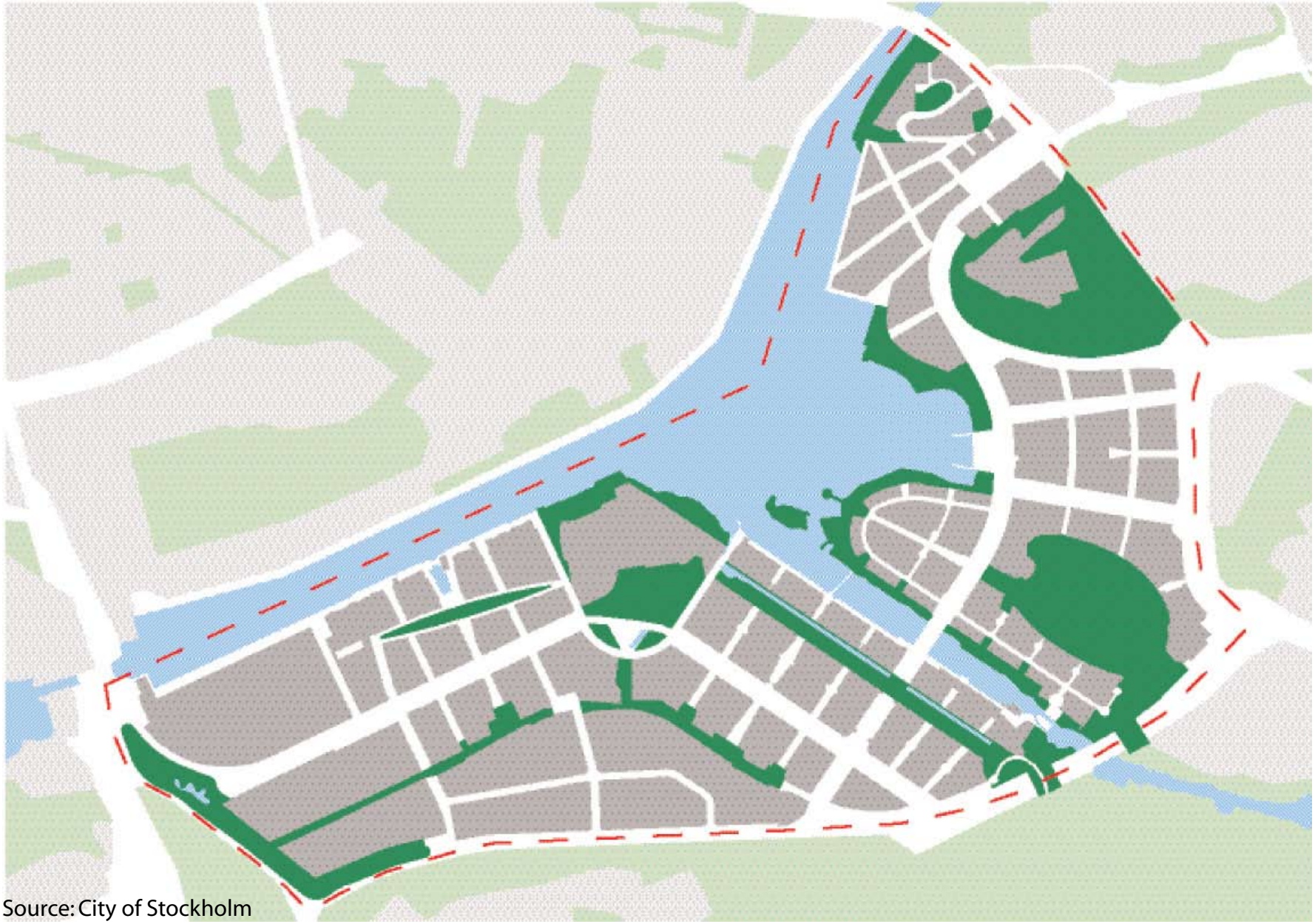
Designed Open Space



Trellis design detail



Ecoducts



Source: City of Stockholm

Green Spaces Network

Walks out to Lake Hammarby

Preservation of natural reeds

road have also been covered with vegetation. These bridges also provide both a link and a shortcut between Hammarby Sjostad and the nature reserve just outside of the city (city of Stockholm 2007).

The natural landscape, where possible, has been preserved and has provided inspiration for the development. The original reeds and rushes remain along the waterfront, where built secluded walkways extend out into the water (Cabe 2007). There is also a carefully preserved oak forest on site (city of Stockholm 2007).

Approaches to the Environment

Energy

The total energy supply for the community that will serve 30,000 people living and working in Hammarby Sjostad will be based only on renewable sources. The electricity content will be based on solar cells, hydropower and bio fuel technology. Solar panels have also been located on roof tops and solar cells cover building facades harnessing the light energy of the sun and transforming it into electrical energy, which is used to heat hot water. The energy from a single solar cell module covering one square meter provides around 100kWh/year, which is equivalent to the household energy used for three square meters of housing (city of Stockholm 2007).

All of the energy for heating will come from combustible waste from the area which will be recycled in the form of heat or from renewable sources. In addition, climate affecting and ozone depletion properties are banned from the heating and cooling processes (Natural Space 2007).


Source: City of Stockholm
Use of solar cells

Source: City of Stockholm
Smart System

Another energy source for the neighborhood is natural gas. Sewage water is cleaned and purified at a large sewage plant just outside the area and the waste is then recycled into natural gas. The waste water from a single household produces sufficient biogas for the household's gas cooker, and most of the biogas is currently used as fuel in eco-friendly cars and buses (city of Stockholm 2007). In addition, heat produced through this purification process is then recycled for use at a district-heating unit. Eventually the district heating will be delivered from a combined power and heating plant based on bio fuel technology (Cabe 2007).

A "smart system" (Ett Klokt Boende), which was developed by Swetab AB, has been implemented in a few of the houses and will help residents understand more about their energy use (Natural Space 2007). Through an email conversation with Erik Freudenthal at the environmental information center in Hammarby Sjostad, it was said that the residents have a display in the kitchen where they can see in real time how much they have used for heating, electricity and water. Residents can then be more aware of their energy uses in order to save energy and even minimize their energy costs. He thought that the "smart system" was too advanced for the tenants though, and hopes in the future, the whole idea with the "smart system" will improve.

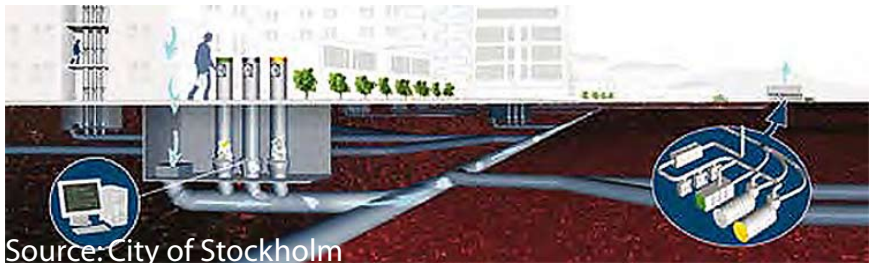
Waste

The plan proposes to accomplish an overall waste reduction of 20%, in comparison to the average of all the new inner-city projects, whose statistics are already significantly low. By the same relative measure there is a proposed 50% reduction in hazardous waste materials, and 60% of nutrients from waste are proposed to be recovered and used in farmland. In order to help achieve

these goals, biodegradable waste is composted nearby and each apartment block has recycling facilities implemented (Cabe 2007). And, to reduce hazardous waste, it is either recycled or incinerated (hammarbysjostad.se 2007).

To further enhance the traditional ways of recycling and reuse, the district has opened (in 2003) its own pilot sewage treatment center, named Sjostadsverket. The wastewater treatment plant is testing new technologies for recycling waste. Four new processes for purifying waste water are currently being assessed at the plant. The unit currently recycles nutrients from sewage for use on agricultural land, while methane recovered from this sewage is to be used as biogas to fuel not only homes, but also cars and buses (Dastur 2005). Once their evaluations are completed, a new waste water treatment plant may be constructed for handling the waste water from the entire city of Hammarby Sjöstad (city of Stockholm 2007).

To sort solid waste and refuse, Hammarby Sjostad uses a vacuum system. The heaviest and bulkiest waste portions are sorted and collected via an underground waste collection system. The waste is sucked down through pipes into a blocked-based recycling room, one portion at a time. The containers are then collected from the room by refuse collection trucks. This one-stop collection helps reduce the amount of vehicle traffic in the area. (city of Stockholm 2007). On collection days, the waste disposal vehicles suck the contents of the chambers out in a clean airtight process (Natural Space 2007).


Source: City of Stockholm

Systems Diagram


Source: City of Stockholm

Pilot Sewage Treatment Plan


Source: City of Stockholm

Waste Vacuum Systems


Source: City of Stockholm

Waste Vacuum Systems

Water

To reduce the amount of runoff entering the drainage system of Hammarby Sjostad, surface water is cleaned locally. The rain water from surrounding houses and gardens is led by an open drain system that drains out to the attractive channel. The water then runs into a series of basins, known as an equalizer, where the water is purified and filtered through sand filters or in the artificially established wetlands of the area. After this purification process, the water then travels out into the Lake Hammarby Sjo, re-energizing the water lake levels.

Roof gardens also serve to reduce roof run-off during storm events, by allowing the water to be absorbed through the plants which will eventually lead to transpiration. The roof rain water that would otherwise drain into the sewers is now absorbed by the roof top plants. The roof gardens use stonecrop or sedum plants, which not only serve a purpose to absorb the rain water, but also serve as an attractive detail for the residents (city of Stockholm 2007).

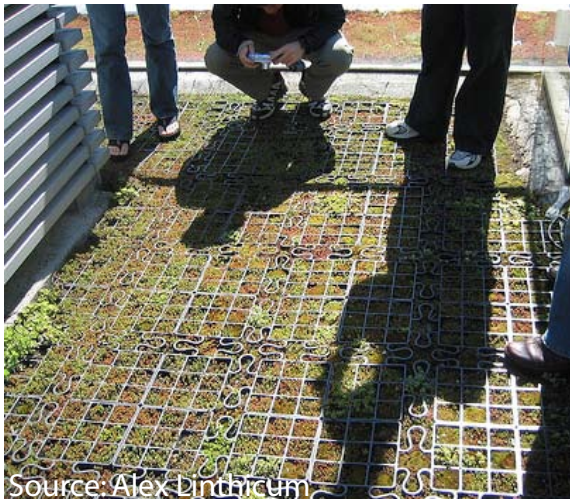
Materials Selection

To be truly environmentally friendly, sustainable, ecological-friendly products have been used throughout the project. Environmental considerations apply to all materials used, including both the visible materials on the façades and ground as well as the materials used inside the buildings, such as the building's shell, the installations and the equipment (city of Stockholm 2007).

The large scale of development in Hammarby Sjostad called for significant materials, construction and procurement policies. Due to this, strict frameworks for the use of materials and restrictions on chemical properties of materials were drawn up. The selection process for suppliers and contractors was also critical for this process. For example, products would need to demonstrate that any material or product used could be recycled at the end of its effective life (Natural Space 2007).

Source: City of Stockholm

Stormwater Channel



Source: Alex Lindhcum

Plant Material on Green Roofs

Source: City of Stockholm

Green Roof

Tram

Transportation Corridor

Approaches to Transportation

Hammarby Sjostad has a diverse system of transportation to serve its residents. The light rail link (Tvarbanan) infrastructure has been developed with four stops in the heart of Hammarby, which connects directly to the underground network of Stockholm. There are also plans to extend the tram further eastwards to connect directly to one of Stockholm's main transport hubs (Cabe 2007).

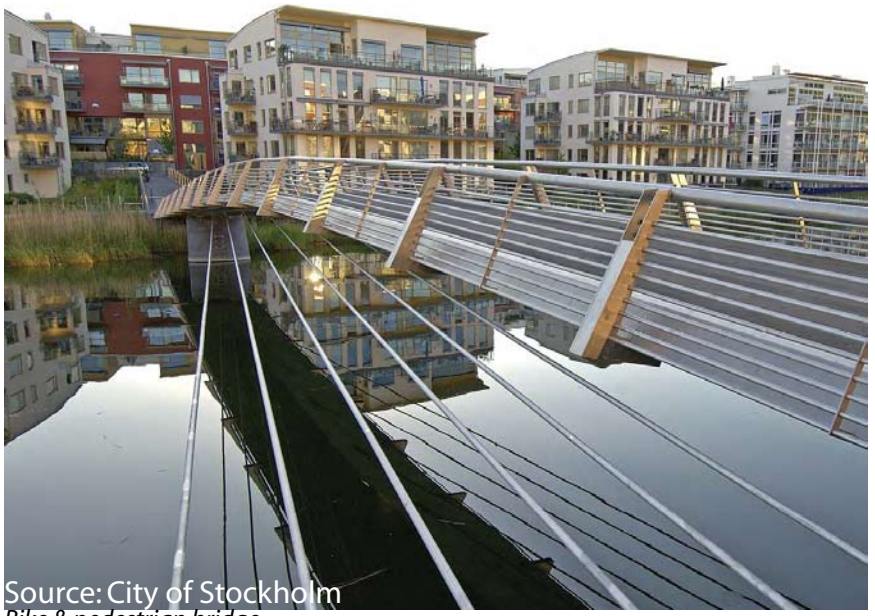
Three new bus routes have been introduced and there is one night bus that serves the area (Cabe 2007). The highly efficient bus service is driven by biogas, and the stopping points are computerized and inform the users with an electronic time table, which fine tunes revised times according to the traffic conditions (hammarbysjostad.se 2007).

There is a Ferrylink system, that takes five minutes to cross the lake, Hammarby Sjo. The ferry traffics Hammarby Sjö throughout the year, every 10-15 minutes, from early in the morning until midnight. During the summer season, a ferry will also run from Hammarby Sjöstad to Nybroviken in Stockholm's city center. Hammarby Sjostad is also served with numerous boat services which start right in the very heart of the city centre. A new service, The Sea Bus (Sjobussen), is also been planned to be introduced to run small biogas driven boats to and from Nybroviken (hammarbysjostad.se 2007).

There has also been an emphasis to reduce the use of one's private automobile. A car pool system is in operation and these cars run on biogas (hammarbysjostad.se 2007). There are also provisions

for cycling with a safe network of cycle lanes, walking, and a short-term rental car sharing system. A new cycle and pedestrian bridge has been introduced to complete the new networks into the Sodermalm area of Stockholm. And, all of the apartments have been well provided with bicycle space.

If cars are to be used, the new highway, Södra Länken, has been designed in line with the City's environmental requirements, and has accordingly been lowered and bridged by two ecoducts to Hammarby backen and the large Nacka nature reserve (hammarbysjostad.se 2007). The ecoducts serve as green bridges linking the two areas.


Source: City of Stockholm
Bike & pedestrian bridge


Source: Alex Linthicum
Ferry departure


Source: City of Stockholm
Boat Docks


Source: City of Stockholm
Ferry as Public Transportation


Source: Alex Linthicum

Bridge sculpture


Source: Alex Linthicum

Public realm

Approaches to Public Realm

Hammarby Sjostad has provided its residents with the necessary institutional spaces. The area has provided for preschool and elementary school facilities. There is also a retirement home on the banks of Sickla Kanal, and health care facilities are provided in the area. There is also a boat-based vaccination facility permanently moored. Commercial services are gradually expanding and the area now has a reasonably wide commercial and retail offering, in addition to the usual convenience goods outlets (hammarbysjostad.se 2007).

Hammarby Sjostad has many amenities for their residents, inviting people into the public realm. There are around 100 mooring places for small boats along the Sickla Kaj canal. Sjöstadshallen, a sports hall to the north-east of Sickla Udde's oak-forested hill, was opened in October 2005. There are jogging tracks that cross the two ecoducts over the Södra Länken highway leading directly over to the Nacka nature reserve. There is a library at Sickla Kaj and a new culture and theatre centre is being built in Lugnet. And, during the summer, Sicklasjön lake is used for swimming, while in the winter, Hammarbybacken's slalom slopes are used for skiing (hammarbysjostad.se 2007).

Also, educational courses and cultural activities, mainly for children and youth can be found at the Kulturama and Fryshuset. The Sofia parish is represented in the chapel, Sjöstadskapellet. The old Dieselverkstaden factory building, which houses theatrical venues, a library, concert venues and cultural workshops, is also close by in the Sickla area (hammarbysjostad.se 2007).

Art in Public Realm

Bespoke Church

Art in Public Realm

Approaches to Education

GlashusEtt is Sjöstaden's environmental information center which disseminates knowledge via study trips, exhibitions and demonstrations of the building's new environmental technology, including fuel cells and the building's double-glazed façade. GlashusEtt often hosts overseas visitors as part of its cooperation with the City of Stockholm and Swedish Trade Council (city of Stockholm) to educate and inform visitors. GlashusEtt was made possible through the Stockholm Water Company, Fortum and the Stockholm Real Estate Administration Office (hammarbysjostad.se 2007).

The residents' involvement plays an essential role to the environmental work at Hammarby Sjostad. GlashusEtt provides

tips and advice for residents on how to use the technology and conserve resources. The Environmental Information Centre is staffed by personnel who answer questions and help guide people into the environmental world (hammarbysjostad.se 2007). Also for residents to view is an exhibition hall that holds displays of the latest environmental technology. The technology is explained simply and pedagogically, so that visitors can easily understand the technicalities (hammarbysjostad.se 2007).

There are also exhibits which are directly for school children. The exhibits would focus on a specific topic such as conservative ways: not using the toilet as a waste paper basket. Lectures about the whole environmental program which Hammarby Sjöstad is built upon are also given to school children. Fortum, the Finnish Energy Company, also conducts Energy talks where teenagers, 16-17 years old, learn about energy use and how they can save energy with very little effort (Freudenthal 2007).

During the planning of GlashusEtt, a long list of eco-friendly adaptations was laid down. The aim was to achieve a pleasant indoor climate with low energy consumption. Double-glazed facades, linked to an advanced control system, cuts the energy consumption to 50 % of what an equivalent building with glass facades would produce. The double-glazed facades reduce the need for artificial light and the energy requirement for heating, cooling and ventilation. Low-energy lighting has also been installed in the entire building and an advanced control system adjusts lighting and ventilation in line with the current activities, the amount of daylight, and air quality (hammarbysjostad.se 2007).

Heating in GlashusEtt is primarily provided by a heat pump that takes energy from the pumping station's heat and the waste heat generated by the main power installation. The building has a fuel cell, which is an advanced energy converter. This is the first fuel cell in Stockholm to be installed in a commercial building. The fuel cell runs on hydrogen gas, where hydrogen and oxygen are fed to the fuel cell. Then electons are released in the fuel cell, generating electricity and heat, while water is the waste product (hammarbysjostad.se 2007). A solar panel plant has also been installed on the roof to supply the fuel cell with energy by breaking water down into hydrogen in an electrolyzer. Surplus power produced during summer will also boost the building's power supply (hammarbysjostad.se 2007).

Source: City of Stockholm *GlasHusEtt Environmental Center*

Conclusion

Analysis

What can we take away from this case study for use in planning in the United States?

The Hammarby Sjostad project is noted as one of the best examples of implemented sustainable urbanism in the world (Beatley 2000). The overall concept of an integrated, closed-loop system, such as the Hammarby Model where infrastructure for water, waste & energy is integrated into one system, could have many positive repercussions.

We found that the level of detail and control expressed in the master plan through the design codes created a consistent urbanism through the integration of architecture, landscape, and water. Nonetheless, it is debatable if this level of control is good or bad. The project team used a number of formal and informal tools to encourage developers to carry out the city's environmental program. For example, the use of leasehold agreements, where absolute ownership is always retained by the city, proves to be a very effective tool in the city's ability to retain the power to negotiate and plan more effectively with successive lessees (Dastur, 2005). Unfortunately, a number of the planning practices employed in Sweden cannot be directly modeled in America because of the demonstrated state-supported social equity in Sweden and the lack thereof in the United States.

This demonstration of intra-generational sustainable goals does come with some words of warning. "If the institutional arrangements and capacity exist for a mutually beneficial self-reinforcing and self-perpetuating dynamic between social welfare and sustainability, then urban planning should positively engage sustainable development" (Dastur 2005). Planning for ecological sustainability that compromises social sustainability is not desirable, as this is a form of inter-generational equity. As Dastur writes, "attempting to embrace sustainability in the wrong environment, urban planners will naively support sustainability agendas that don't really contribute to sustainability, and they will mostly end up reinforcing the power of global capital" (Dastur 2005).

Sustainable development has consequences not directly connected to ecology. "…it becomes clear why sustainable development is considered acceptable to the left party in Stockholm. The city of Stockholm's service organization employs 50,000 people and in the year 2002, had revenues of SEK 38 billion. The abundance and relevance of government agencies and state-owned companies creates a governing and institutional framework whereby the state itself provides, owns and recovers direct revenues, from a significant portion of the 'systems and processes' of sustainability. The state directly stands to benefit from the consequences of such preemptive action – assuming it is convinced in the potential of wealth generation' through the savings and efficiencies generated by sustainable development" (Dastur 2005).

"In conditions where the institutional capacity of government is rendered irrelevant by increased privatization of the public realm – this marriage of left and green gets divorced. This is because - no longer is it the state that stands to benefit from sustainability, and no longer does the state itself provide an institutional capacity for sustainability to be achieved in the first place" (Dastur 2005:

89). In the US, publicly-owned municipal utilities and federally funded infrastructure projects provide similar opportunities for sustainable planning in which the government can directly benefit and profit, creating a situation similar to the Swedish model.

Shifting politics played a significant role in the development of the project and the end product. Because the project is guided and developed by the political party in power, changes in the political party resulted in changes to the project goals (specifically in regards to the amount of social housing provided and the enforcement of the environmental program – 'required' versus 'recommended'). Recommendations that are negotiated into a development contract are mutable in a much shorter timeframe than regulations instituted in city policies. Therefore if the ideals behind the development project are to weather shifting political parties, the important terms stand a much better chance of survival if they are adopted as public policy.

What kind of place was created?

In our research of the project, we came across a variety of opinions regarding what kind of a place Hammarby Sjostad is becoming. Dastur writes that Hammarby is "a vibrant center that is contiguous with and integrated into the inner city core" and that "the characteristics of the plan give the area a pleasant human-scale feeling of a good waterfront development" (Dastur 2005). Dastur also states "it is impossible to tell the difference between pubic and private housing, something I had intended to try to notice. Most of the housing looks great, and is built with large balconies, big windows and small interconnecting parks" (Dastur 2005). Other critiques state that "the invisibility of the environmental program is refreshing" and that "the individual contributions of each of the architectural practices have given the homogeneous developments some degree of individualism and variety" (Natural Space Magazine 2004). "In effect the first phase of a well-structured mini city has been created which allows the full range of human and social feelings to thrive" (Natural Space Magazine 2004).

In the course of this case study, we corresponded with a student residing in Hammarby Sjostad who stated that he likes living there "very much". Our questions and his thoughts on the projects are given below:

Question: Do you like living there?
Response: Very much. The apartment is brand new and I like the idea that no one has lived there before me. It´s close to the water, shopping malls, training facilities and nature at the same time. No need for a car. The only downside is the price, I'm renting the apartment (54 square meters) and paying around 1,000 dollars a month for it.

Question: What do you think about the place?
Response: Close to the city center but still has the quietness of the suburb. In the summer you can take the ferry directly to the city center. Before I moved there, I´d heard about shoddy building (right word?). They were building so fast that they didn't have time to do it correctly. I've not experienced any trouble with my apartment though.

The project has been criticized as "a near replica of much of what the existing Stockholm city fabric has to offer" by incorporating

the scale, color and texture of the city such that many of the local architects and media view the project as a lost opportunity to create a more dynamic architecture (Natural Space Magazine 2004). According to Dick Vestbro, a member of Stockholm City Council 1994-2002, this 'extension of the city' was intentional and meant to strengthen the connection between the project and its urban surroundings.

Our opinion, based on review of photos of the project, is that it has created beautiful spaces with successful integration of architecture, landscape, and water.

What is the fit between intentions and results?

During its planning phase, the City of Stockholm decided to make the Hammarby Sjostad redevelopment project a leading showcase of urban sustainability and, by many accounts, they have succeeded. Though the project is not complete, it has been described as "one of the best examples of implemented sustainable urbanism in the world" (Beatley 2000). To name a few accomplishments, energy is produced in a renewable fuel-fired district heating plant in the project area. In the sewage plant, wastewater is treated, the heat recovered for heating houses and the silt is converted to biogas. Surface water is treated locally to avoid overloading the sewage works. Combustible waste is recycled as head and food waste is composted into soil (Dastur 2005).

Though the ecological achievements are impressive, the City has faced challenges in achieving its sustainability goals for the project. Some difficulties came as the result of shifting political powers. When the blue coalition took over in 1998, it decided to convert the program from being binding to a status of recommendation, which weakened the municipal control. One of the major revisions of the program concerned the parking space standards. Before the change in political parties, the standards had been 0.5 parking spaces per household in the inner city stone town, while the level outside this area was 1.0 per household. The red-green majority set the car parking standards for Hammarby Sjostad at a level of 0.25 per apartment (0.4 if guest and workspace parking is included) in 1996, stating that residents would be able to use the rapid tramway, a special program for car sharing and have easy access to good local services. When the right coalition won the elections in 1998, one of its first decisions was to raise the parking norm to 0.7 (Vestbro 2005).

Other challenges came about when attempting to balance desirable design amenities (such as the inclusion of large north-facing windows to accommodate views and the provision of larger than standard apartment sizes) with sustainability goals (such as energy savings). Despite compromises in the environmental program, initial estimates show that the project is on the right track. Compared to a reference district based on the technology used in 1990, the environmental performance if Sickla Udde has reached the goad 'twice as good' for some environmental load categories and 30 percent for others (Forsen 2003). It is expected that the sub-districts constructed after Sickla Udde will demonstrate a higher environmental performance, however, we were unable to find information regarding how these districts are performing.

A further objective of the plan is that future property owners of the properties would continue the ecocycle process by their use of efficient appliances, and their adherence to ecocycle benefits

habits and lifestyle choices, such as waste disposal, etc. It was assumed that by providing Hammarby Sjostad with the best facilities for energy savings, waste separation, pubic transport and an environmental information center, the residents' behavior would adapt to less consumerist lifestyles. However, not to any fault of the project proponents, this has not necessarily been the case. People moved to Hammarby Sjostad not because of its environmental qualities, but because they wanted a house in an attractive area, close to the city center and with access to green spaces. An interview study in 2001 showed that inhabitants appreciate the environmental profile of Hammarby Sjostad, but they are not prepared to make sacrifices in their comforts to achieve environmental goals (Vestbro 2005). Though some of the residents may not, at present, appreciate the sustainable systems in place, we feel this does not diminish the project's overall achievement.

Integration of human design and environment

Strengths

We feel that the strengths of the project center on its achievement of sustainable practices, the well-integrated planning process that guided the project and on its physical design. Hammarby Sjostad breaks new ground for a sustainable urban development that is twice as efficient. The strength of the Hammarby Model is its holistic approach to infrastructure service provision and its integration of otherwise separate systems in order to accomplish the environmental objectives set by the local parliament (Dastur 2005). The model combines urban utilities for the purposes of efficiency, innovation, and ecological betterment.

However, regardless of the innovation of the environmental program, the project would not have come as far as it did without coordination across and between agencies at all levels of government or without public/private cooperation. Municipal control and restructuring brought about the project's integration of infrastructure as envisioned by the Hammarby Model and ensured that the developer teams retained their commitment to the environmental program throughout project design and construction. As Dastur writes, "the use of leasehold agreements, where absolute ownership is always retained by the city, proves to be a very effective tool in the city's ability to retain the power to negotiate and plan more effectively with successive lessees"(Dastur 2005:82). Further, "the abundance and relevance of government agencies and state-owned companies creates a governing and institutional framework whereby the state itself provides, owns and recovers direct revenues, from a significant portion of the 'systems and processes' of sustainability, thus enabling implementation and construction of sustainable communities" (Dastur 2005).

For us, two major strengths of the plan are the choice of a site in close proximity to the city center and that it is a brown field (not green field) development. We feel these are key sustainable development considerations that the project illustrates well. Overall, the project design capitalizes on the site's proximity to the Hammarby Sjo waterfront and surrounding natural areas by orientating the buildings toward views and providing public access to the waterfront. We feel that the environmental program has been successfully integrated into the design (such as with waterways that retain and treat stormwater) and in ways that allow for human contact. The density of the development enables preservation of the surrounding natural areas and "a vibrant center" (Dastur 2005).


Source: City of Stockholm

Architecture oriented toward water

Weaknesses

Our main criticisms of the project are that it is deficient in regards to intra-generational equity and that the design is largely homogeneous (though this later criticism is well supported by historic city morphology). The project is guided and developed by the political party in power, causing shifts in goals each time the party in power changes. Due to these political shifts, the housing/social equity of the project has been compromised. The right-green coalition came to power early in the project design and construction phases (1998 – 2002) and set the housing stock to 18 percent public and 82 percent private-ownership (Dastur 2005). When the left-green coalition came back to power (2002 – 2006), the land allocated for municipal housing was reset at 30 percent public, 20 percent private-rental and 50 percent private-ownership (Dastur 2005).

"As long as sustainability generates enough of a return to equity and welfare concerns, and as long as the government provides the adequate institutional capacity for successful sustainability, the agendas of the left and green reinforce each other. This generally takes place in circumstances where there is a strong governmental role in planning and a political climate favoring equity" (Dastur 2005:87). Sweden, a socialist democracy that relies mainly on centralized planning can create an appropriate climate for intra-generational sustainability, but this is a questionable practice for the US, where we live in a climate of decentralization and privatization.

"In conditions where the institutional capacity of government is rendered irrelevant by increased privatization of the public realm

– this marriage of left and green gets divorced. This is because - no longer is it the state that stands to benefit from sustainability, and no longer does the state itself provide an institutional capacity for sustainability to be achieved in the first place" (Dastur 2005:88). The reclamation of infrastructure and utilities by public agencies is a venue in which the US could begin to address sustainable, intra-generational equity.

Our second criticism relates to the overall urban design and the degree of control exercised by the planning team. As Dastur writes, the development process "encourages homogenous building form, according to local Swedish architects" (Dastur 2005). As noted in the introduction, the morphology of Stockholm is one of consistency. As Hammarby Sjostad was seen as an expansion of the central urban area, the city planners decided to use the language of the historic morphology. The local architects lamented this decision as a missed opportunity to explore new forms. Ultimately it comes down to a question of whether the district should be part of a larger context or a focal point.


Source: Alex Linthicum

Homogeneous Architecture

One final criticism concerns the Environmental Load Profile calculations. Because different people worked on the calculations, this led to inconsistencies, potentially leading to false levels of success.

Missed opportunities

A couple of missed opportunities that we have identified are Sickla Udde's lowered ecological performance and the limited availability of information in English. As discussed earlier, Sickla Udde, the first sub-district constructed, did not fully incorporate the environmental program because it was already well under way before the environmental program was developed. Though the project did achieve ecological performance gains relative to similar projects constructed at that time, as the first project constructed, it could have gone further to meet the sustainability goals.

The limited availability of information in English has made it challenging to learn about the innovations of the project. In general, we would have liked to learn more about how the systems that feed into the Hammarby Model work in practice. However, the limited availability of information may simply be a consequence of studying such a recently constructed project. The available information enabled us to learn a good deal about the project. Hopefully, more information will become available in time.

Overall though, the community created has brought environmental design to a higher level, and we hope that this level will continue as other projects take this more sustainable way.

Appendix

List of Architects by Sub-District for the Hammarby Sjostad Project

	Sub-District	Summary	Product	Architect
1.	Sickla Udde	1,200 apartments	Skanska	Brunnberg & Forshed Architect Firm
			JM	Nyrens Architect Firm
			Svenska Bostader	Erseus, Frannin g & Sjogren Architect Firm
			Family housing	White Architect Firm
			SISAB / School	Arksam Architect Firm
			Skanska	Hedborg Gyllhammar Architect Firm
			JM	AWL Architect Firm
			Svenska Bostader	Stenberg and Lindberg Architect Firm
			HSB	Modern Line Architect Firm
2.	Sickla Kaj	1,000 apartments	NCC	Nyrens Architect Firm
			SBC	CAN Architect Firm
			Seniorgarden	Arkitekturkompaniet
			HSB	Ersues Frannin g & Sjogren Architect Firm
			PEAB	Equator Architect Firm
			PEAB	Arksam Architect Firm
			NCC	White Architect Firm
			JM	Arkitekturko mlaniet
			HSB	Brunnberg& Forshed Architect Firm
			Stockho lmshem	Nyrens Architect Firm
		Environmenta l Info Center, Stockho lm Water, Fortum, Department of Sanitation		Tengbo m Architects
3.	Sickla Kanal	250 apartments	Katarinastiftelsen	FFNS Architect Firm
			Reinhold Gustafsson	AQ Architect Firm
			Einar Mattsson	AQ Architect Firm
			Besqab	FFNS Architect Firm
			Lennart Ericsson	Johansso n & Linnman Architect Firm
			Riksbgge n, Folkhem	Jan Fidjeland Architect Firm
		Sofia parish, Veidek ke		Reflex Architects
4.	Kolnan	Approx. 650 residen tial units, studen t housing and a school	Family housing	FFNS Architect Firm
			HEF AB	Lindberg & Stenberg Architect Firm
			SKB	AWL Architect Firm
			SISAB	school
			SSSB, studen t housing	Murma n Architect Firm
5.	Sjostadsporten	Area with 215 apartmen ts, 11 0 studen t housing and other facilities	Real Estate and Traffic Adminsitration	Land allocation not completed
			Svenska Bostader	Nyrens Architect Firm
			Skanska	Erseus Architect Firm
			Riksbyggen, Wihlborgs	Lund & Valen tin Architect Firm
			Statoil	Berg Architect Firm

* Sub-district numbers correspond to the map following this table.

List of Architects by Sub-District for the Hammarby Sjostad Project (Cont.)

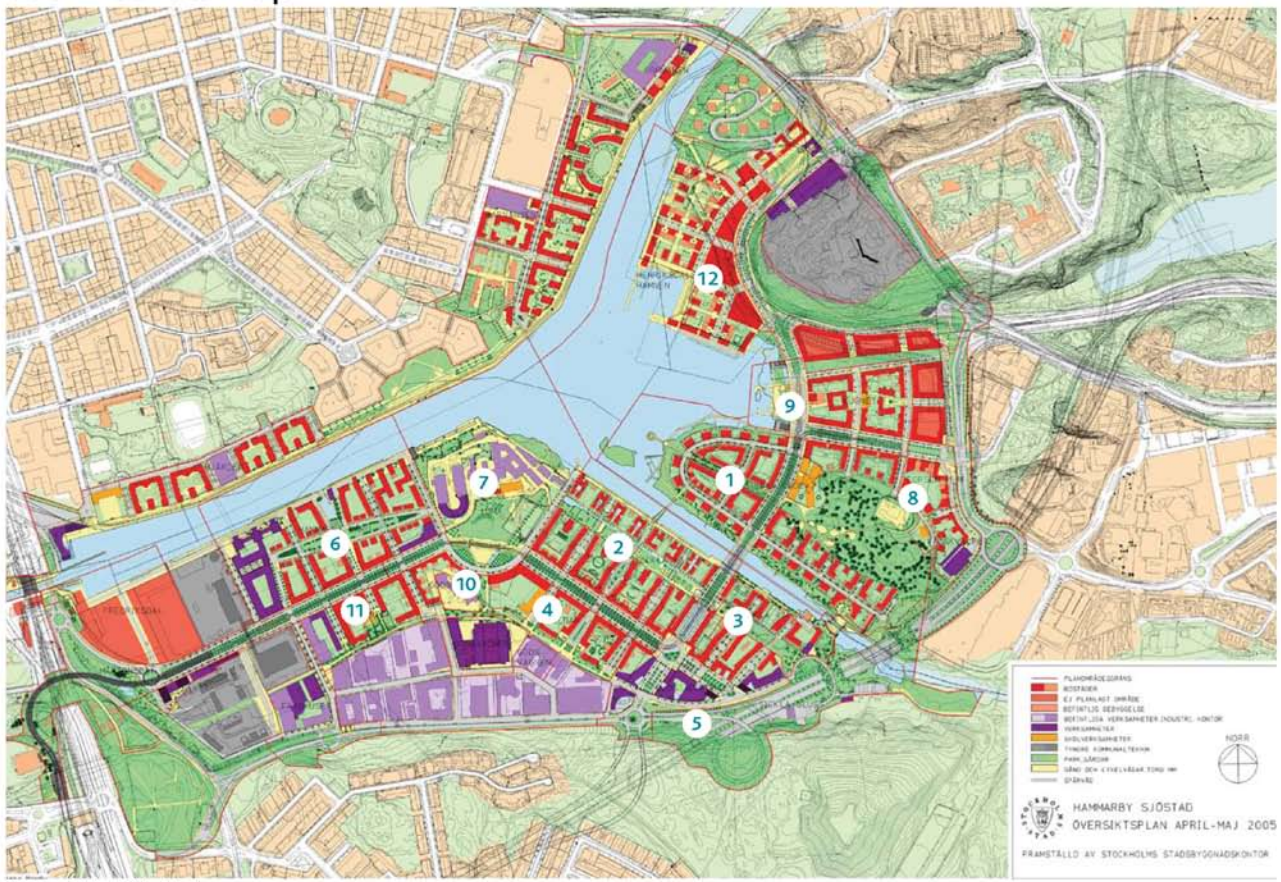
	Sub-District	Summary	Product	Architect
6.	Hamma rby Gard	Plans for 1000 apartmen ts, new offices and businesses	Riksbyggen PEAB Riksbyggen Byggnad sfirman Erik Wallin Stockho lmshem PA EB, HSB, Folkhem Bygg Ve sta Bo Fabe ge	Michelse n Architect Firm Equator Architect Firm Te ngbo m Architect Firm Michelse n Architects Michelse n Architects AIX Architect Firm, Brunnb erg & Forshed Architect Firm Whi te Architect Firm Whi te Architect Firm, Lund & Valentin Architect Firm
7.	Luma	The Luma factory from 192 6-30 has been transpormed into mod ern busines s facilities. A new town park has been built. New car park structu re with 300 parkin g spaces	Malartornet	FFNS Architect Firm
8.	Forsen / Vagsk valpet	220 residen tial units, 13 5 studen t hou sing units, and a sport hall	Svens ka Bos tader Wallenstam BoTrygg Sjos tadsha llen	Johansso n & Linnman Architect Firm Arkitekth uset Jonko ping AIX Architects Brunnb erg & Forshed Architects
9.	Lug net	Plans for 650 apartmen ts and a cultural facility	Wallenstam Stockho lmshem Riksbyggen , KOD Boratt	Frannin g & Sjogren Architect Firm Whi te Architect Firm Erseu s Architect Firm Erseu s Architect Firm
10.	God sfinkan	--	Bygg Ve sta Bo	Whi te Architects
11.	Propp en	500 apartmen ts and a preschool	Family hou sing Boratt HSB Primula Einar Mattsson	Rosenberg Architect Firm AW Ar chitect Firm Rits Architect Firm TEArk Thelaus Architect Firm

List of Architects by Sub-District for the Hammarby Sjostad Project (Cont.)

	Sub-District	Summary	Product	Architect
12.	Henriks-dalshamnen	--	Botrygg	FFNS o Sweco Architecs
			Jarntorget Bostader	White Architects
			Bygg Vesta Bo	White Architects
			Skanska PDR	Aix Architect Firm
			JM	AWL Architect Firm
			Wallenstam	Frenning & Sjogren Architect Firm
			Familjebostader	Erseus Architect Firm
			Svenska Bostader	White Architect Firm
			Boratt	Erseus Architect Firm
			Seniorgarden	Nyrens Architect Firm

Source: City of Stockholm

Sub-Districts Map



Source: City of Stockholm

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