GENERAL INFORMATION

PETUS description of tool in use	
Name of the case	Harbour bathing in Copenhagen
Name of the tool	MIKE and MOUSE
Country	Copenhagen, Denmark
City / region Total area (km2) Population Density (people/km2)	Copenhagen 89 km^2 502.000 5640 people/km^2
Tool user's profile a. Organisation name (municipality, NGO, national or regional department, company, etc.) b. Field of activity c. Detailed contact/feedback (project website, e-mail, address, tel., fax)	a. the Copenhagen Environmental Protection Agency (EPA), which is the environmental department in the Municipality of Copenhagen. b. environmental regulation c. Miljøkontrollen, Kalvebod Brygge 45, Postboks 259, DK-1502 København V. Tlf. 33 66 58 00. Mail: miljoe@mff.kk.dk. Website: http://www.miljoe.kk.dk/?frames=no English presentation of the Copenhagen EPA (leaflet): http://www.miljoe.kk.dk/840D7BF9-97D5-485E-810E-C6AD80AF4B8C
Reviewer, date: Jesper Ole Jensen, 26.11.04	

Short description of the case

The bathing area in the inner harbour of Copenhagen opened in the summer of 2002 and has been one of the main environmental efforts in Copenhagen, since it is very visible and is a tangible environmental result that makes environmental investments and progress understandable to many. Massive investments have been made in the detention basins, to make the harbour water cleaner and give the harbour recreational values. There were no expectations that people would actually swim in the harbour, and no plans for establishing bathing facilities. However, users of the harbour were advocating the allowing of swimming in the harbour, which convinced the Mayor of Environment in Copenhagen of the potential of opening the harbour for bathing. This was made possible by establishing an alarm system, based on simulation tools (MIKE and MOUSE) on water flows in the harbour, warning guests about coming overflows, and being able to predict when the water is clean enough for bathing again.

The first bathing place was established in 2002 (at Islands Brygge), and became a massive success. Due to this, politicians in the city council were soon promising more bathing sites to the citizens. This was however not so easy, as many different conditions had to be taken into account when finding a suitable site. In 2003, another bathing place was opened (Copencabana), and at the moment a third place is being planned.

To which PETUS key-problem is this case study related?
Management and conception of urban water infrastructures (6.2) and sustainable management of water in cities (6.3). There is an overlap to the key problems of green-blue sector.

Sector The case concerns water as a recreational element	Waste	Energy	Water	Transport	Green/blue	Building & Land Use
			X		**(x)**	

Scale of project The project covers bathing facilities in the inner harbour of Copenhagen.	Component	Building	Neighbourhood	City	Region
			(X)	**(X)**	

Status of project Some facilities have been completed, but more are planned. The development of the bathing facilities depends on the progress of establishing detention basins.	Starting up	Ongoing	Finished	Start date	End date (exp.)
		X (building detention basins)	X (two first harbour bath)		

Key words
detention basins, bathing, harbour, storm-water management, tangible environmental results

Project a. Object (building, city park, wind farm, etc.) b. Type of activity (regeneration, renovation, new development, etc.) c. Type of product (plan, scheme, design project, etc.)	a. Bathing facilities. Detention basins b. Recreational use of the harbour c. Storm water management. Warning system.

Tool a. Character (according to WP3final0704.doc) b. Benchmarks (qualitative or quantitative) c. Availability (paid/ free)	a. System simulation tool (MIKE and MOUSE) b. yes c. paid
Decision-making process a. Stage of the tool implementation (preliminary, midterm, etc.) b. Level (political, technical, etc.) c. Public participation	a. The tools were used in the preliminary stages and in operation of the warning system b. political and technical c. public use of the harbour initiated the bathing facilities, and has defined the success of the initiative
Other *(optional, if needed)*	

DETAILED INFORMATION

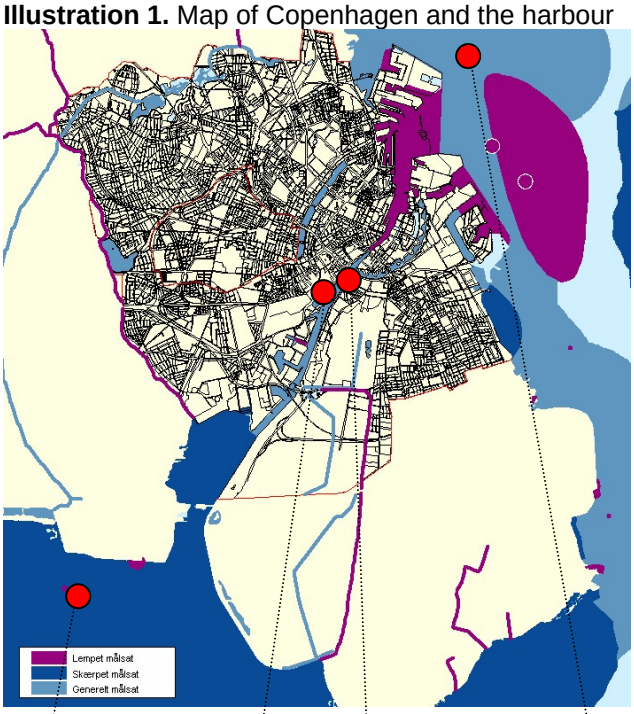
A. Detailed description of project and tool	
1. Description of context (existing strategies, laws, policy, action plans, etc.): EU, national, regional, municipal **Illustration 1.** Map of Copenhagen and the harbour  	The efforts for making the harbour cleaner started in 1989, when it was decided in the City Plan from 1989 to move industry from the inner harbour and turn it into an area for offices and residences. Since industrialisation, large industries as B&W, DS Industries (formerly known as Dansk Soyakagefabrik) and "Sukkerfabrikken" have been located along the harbour. As the regional planning council (Hovedstadsrådet) was abolished in 1990, the responsibility for water area planning in Copenhagen was transferred to the municipality of Copenhagen. As it was expected that the old industrial sites over time would be transferred to residential areas, the Copenhagen EPA (Environmental Protection Agency) suggested in the Water Area Plan from 1992 that the water in the harbour should be turned into bathing water quality before 2004. At this time the possibility of bathing was not considered at all. Calculations were made on how many detention basins would be needed. The main pollution in the harbour was coming from storm-water overflows. The pollution from the industries was strongly declining as they were moving out of the harbour (although some pollution was still left in the harbour). Pollution from the detention basins only occurs in times of extreme rainfall, where rainwater is mixed with wastewater from households and led to the local recipient (the harbour). This occurs app. 20 times per year. In most situations, however, the rainwater is kept in the detention basins, and led to the local sewage treatment plant where it is cleansed. The way to avoid such overflows is simply to increase the capacity of the detentions basins. In spite of heavy investment (expected 1 bill. Dkr., or 140 mill. €) for detention basins, it was broadly accepted by the City Council. According to the Sewage Plan 2000, bathing water quality has to be established in 2009. Although this goal has been reached, detention basins in the rest of the harbour still have to established, due to the political promises made for more bathing sites. The City Council has granted 100 mill. Dkr. (15 mill. €) annually the next couple of years to establish detention basins. However, the basins have to be established along with new buildings at the harbour-front, including the new opera house. Once the opera (or other buildings) are built, it will be impossible to change.
2. Description of project	In the summer of 2001 it became possible to bathe in the inner harbour of Copenhagen. At Islands Brygge a pavilion for public bathing was established by the municipality, and became an instant success with. Thousands of people from Copenhagen and its suburbs were visiting the bath over the summer. It has become one of the (in not *the*) major environmental successes in Copenhagen due to its very visible and tangible character, which makes environmental progress very understandable. The municipality of Copenhagen has used pictures from the harbour bath intensively to promote the image as a green municipality (for

Illustration 2. The first harbour bath at Islands Brygge from 2001 	instance as "the environmental capital of Europe"). It was the massive investments in detention basins along the harbour that enabled bathing. By establishing detention basins along the harbour, the overflows of sewage have been reduced from 1.600.000 to 800.000 m^3 per year. In the Southern Harbour alone, the overflows have been reduced from 600.000 m^3 to 300.000 m^3, in overflows corresponding to a reduction from app. 20 to 7-8 per year. Two to four of the overflows take place in the bathing season. An important detail for making bathing practically possible was the establishment of a warning system that warns the bathers about overflows from the detention basins. The warning system consists of censors measuring how much water runs from the detention basins to the harbour (1 time per second). This is logged and sent to Copenhagen Energy, who collects the data and sends it on to DHI (Danish Hydraulic Company, a private company), who puts the data into the MIKE-model of the Copenhagen harbour. This allows fast estimations on whether an overflow makes the water exceed the limits, and the bathng sites should be closed temporarily (a red flag signalises that the water is temporarily polluted and bathing is prohibited). Before the system was installed, control measures were made from different places in the harbour, to be sure that the model was able to calculate the same values as measured in reality. Copenhagen Energy has the responsibility of establishing detention basins along the harbour.
a. Background (What caused the initiation of the project?; What was the problem? Who initiated the project?); b. Objectives/aims (sustainability statement – what issues of sustainability were attacked); c. Time interval and stages of project realization; d. Financing – amount, sources, institutions involved, partnerships, levels. e. Other sectors involved in the particular project/problem (conflicts and/or links)	a. The idea of a harbour bath occurred because of plans being drawn up to use the harbour for recreational purposes as existing industries were moving out, and the improved water quality due to investments in detention basins, - as opposed to initiation due to a problem. b. The objectives of establishing the detention basins were to improve the sewage treatment in general, and to improve the quality of the local recipients (by limiting overflows). c. The policy of making the harbour cleaner by establishing detention basins started in 1989. The investments in detention basins stated in 1995. The first harbour bath opened in 2001. d. Establishing detention basins (140 mill. €) were financed through taxes e. The project involves benefits for the green-blue sector (using water for recreational purposes)
3. Description of tool a. Character (according to WP3final0704.doc) - calculation tools, process tools, assessment methods, generic tools, simulation tools, guidelines, framework tools, schemes, indicators and monitoring, checklists, case-specific tools; b. Availability of the tool (web-based / paper, paid / free, etc.) c. Based on existing tool or newly elaborated; d. Adaptation of the tool to the local context (are there local experts involved in tool's development?) e. Other tools implemented to support the project development	a. MOUSE and MIKE are System simulation tools. In the planning of the detention basins, the number of overflows per year was calculated with the MOUSE program that simulates the hydraulic systems (pipes and sewers). The tool MIKE was used to make simulations for receiving bodies (harbour, lakes, rivers etc.). *None of these tools claims to be sustainability tools*. They are, however, widely used in water management, and therefore also in issues on sustainable water management. b. the tools are paid computer programs c. The tools are developed in general versions d. The tools are developed as general models, where the users afterwards feeds it with local data e. no
B. Tool implementation	
1. Argumentation for choosing the tool a. What were the reasons for the implementation of the tool? (voluntary or requested by what local, national, etc regulation)	a. Copenhagen EPA was already using the MIKE-model for a number of other purposes, and had adapted the model specific for the Copenhagen harbour. DHI uses a similar MIKE-model, adapted for the Baltic Sea. Using data from this model makes it possible to

b. Who took the initiative for choosing /elaboration the tool? c. What were the criteria for choosing the tool? d. Was there knowledge of other tools and were they considered?	define the border conditions and the currents in Copenhagen harbour. Combining these data with data for volume and bacteria concentrations from the detention basins makes it possible to calculate the concentration of bacteria different places in the harbour. The model calculates the concentration for each 20 meters in the harbour. b. the Copenhagen EPA took the decision of using MIKE and MOUSE. c. The tool was already being used, but for other purposes. d. no
2. Barriers for the tool implementation What were the main problems in the tool implementation? (Regulation, information available, public awareness, lack of clear SD definitions and benchmarks, communication etc.)	There were no barriers for implementing the tool.
C. Influence of the tool on the decision-making process	
1. Description of the decision-making process/ procedures **Illustration 3.** The second harbour bath "Copencabana" from 2003  a. Stages b. Levels (political, technical, etc.) c. Sources of information used during the dmp;	An important precondition for bathing in the harbour is the water quality. The Copenhagen EPA became aware of the possibility of establishing a warning system for overflows after a private company (DHI, Danish Hydraulic Company) presented the system for the EPA. It would be able to warn bathers about coming overflows from the detention basins, and also to calculate when the water would have gained bathing quality again. If the overflows should be completely eliminated, it would be extremely expensive (an even larger number of detention basins should be established) , so this was not an option. At the same time, the Copenhagen EPA gave dispensation for bathing in the harbour at the Culture Week in 2001. An athletic association called the “Big Splash” used the harbour for trampoline jumping in the water. The event was open to the public and more than 1.000 people took part in the two days. Through Copenhagen EPA the group heard about the warning system, opening possibilities for a permanent permit for bathing. Big Splash contacted the mayor, who invited them for a meeting, where also the EPA and Copenhagen Energy (water section) were invited. The leader of “Big Splash” enthusiastically convinced the mayor about the potentials in the harbour. After the meeting, the mayor recommended to the city council that the possibilities for bathing should be seriously investigated, and a harbour bath established if possible. This was decided in the council, after which a municipal group with members from the different departments were appointed to find suitable places for a bathing site. Having located a number of possibilities, meetings with citizens were arranged, to decide on a place. From discussions and a selection procedure based on different criteria, Islands Brygge was chosen as the place for the first bathing place in the harbour. When the harbour bath opened in 2001 it was an instant success, attracting thousands of Copenhageners and people from the suburbs, standing in line to get a bath. Due to the success, and as people were starting to bathe spontaneously in other places in the harbour, politicians soon promised more bathing places in the harbour. There were however certain conditions that had to be respected; the water should be clean, i.e. detention basins should be established, but also it should be a place where the current is not too strong, and a place with a “hinterland” of services for the visitors. In 2003, the second harbour bath, Copencabana, was opened. a. The tools were used in the initial stages, to design the warning system b. Decisions were made on political and technical levels c. The public were notified through information leaflets about the harbour bath. Bathers are informed of the quality of the water through flags; a green flag means that the water quality is ok. A red

d. Who are the decision-makers? e. Who made the final decision for the project implementation? Was it political or technical decision?	flag means overflows, and that bathing is not allowed. d. The main actors have been the Copenhagen EPA, politicians in the city council, DHI (Danish Hydraulic Institute), users of the harbour and Copenhagen Water (from 2002 Copenhagen Energy). The national EPA has been involved in the beginning of the process. e. The main decisions were political
2. Tool in decision-making process a. At what stage was the tool implemented? By whom? (experts, politicians, etc.) b. How did the tool output influence the process (added or skipped levels/stages in the existing decision-making process, etc.)? c. Quantitative goals or benchmarks defined? (If YES, which – and what were they compared to?) d. Was the tool used to support argumentations?	a. The tools were used in the initial stages by experts, but also in the operation of the warning system b. establishing detention basins was based on the output from MOUSE. Using MIKE allows monitoring of overflows through simulations, which enables the warning system, and therefore also bathing. c. Goals defined in relation to the harbour bathing: • Number of overflows per year should be reduced to 5 (from app. 30) by building detention basins along the harbour. This is based on calculations with MOUSE. These goals are defined locally, by comparing to the present situation and to practices in other municipalities • After overflows, the harbour bath can only be opened when e-coli per 100 ml water is less than 500 in 12 hours (the normal limit is 1.000 coli). A coming EU-regulation also operates with a limit on 500 e-coli. Other parameters used are: • Outlet of mercury from overflows (kg of hg per year) has been reduced by app. 80% from 1995-2002, due to the large investments in detention basins that started in 1995. The content of mercury in the harbour water has been compared to limits set by WHO (World Health Organisation), on how much mercury a person can ingest per week without damaging the health, defined as the PTWI index (Provisional Tolerable Weekly Intake). From this, the EPA has calculated that a child of 30 kg could daily drink 7.500 litres of water from the harbour without exceeding the WHO-limit for mercury ingestion (mercury can only be absorbed by drinking the water, not by bathing in it). • Outlet of lead by overflows (kg lead per year) – has been reduced app. 70% from 1995-2002 • Measures of TBT (Tributylin), of which there are no commonly defined limits, only suggestions. From measures and from the suggested limit values, it has been calculated that a child of 30 kg daily could drink 375 litres of water from the harbour without exceeding the limit d. The tool (the warning system, based on system simulations from MOUSE and MIKE) provides information about the water quality. This information is being used to decide when bathing should be cancelled due to overflows, and when the water has regained an acceptable quality.
3. Transparency of decision-making process a. How was the information of the dmp disseminated? - directly (decision makers – public) or indirectly (decision makers - NGO, PR company, etc. - public); sources of dissemination used (mass media, internet, brochure, etc.) b. How was the public involved? c. Was there a public discussion over the project and at what stage of the project development?	a. The decision-making process for allowing bathing and establishing bathing facilities was started by direct contacts between the Copenhagen EPA, users of the harbour and the Copenhagen Mayor of Environment. b. The public was informed by information campaign of the bathing facilities. However, the public (=some users) also initiated the public bathing. c. There was a direct public involvement in the location of the bathing facilities
D. Expert assessment/analysis/comment of the tool effectiveness	
1. Assessment by tool users a. Were there measurable improvements as a result of the tool implementation? If YES, what? If no:	a. The improvements from using the models are the whole basis for being able to establish the bathing in Copenhagen, as it enables a fast, reliable and cheap way to predict the water quality.

why not?	The alternative to this tool would have been to take sample tests of the polluted water after the overflow, take it to the laboratory and analyse it for e-coli. This would take app. 3 days, and would be very expensive. It would also be less precise, as the results from the tests would point to the quality of the water three days ago. Moreover, it would be a very time consuming and more expensive way to examine the water quality. To keep the model calibrated and updated, tests are still done regularly.
b. Were there any spun-off's or unintended consequences?	b. There are a number of spin-offs from improving the water quality to make it possible to bathe. Ever since it has been established, it has become a widely-used symbol for the environmental policy in the municipality, and for the Copenhagen EPA. Pictures of bathing people in the harbour is a more tangible example of environmental improvements, compared to other improvements, for instance concerning CO_2-reductions. The initiative has even given Copenhagen international attention.
c. General view on the tool? Lessons learned?	c. There have been little disagreements between the actors involved on making it possible to bathe in the harbour and investing the money necessary for it. In the beginning of the process there was some arguing with the national EPA, who did not believe it would be possible to turn the water to bathing quality (as described in the Water Area plan from 1992). The question of whether the money spent at the detention basins could have been used in a better way in relation to environmental improvements has not been a big issue. For Copenhagen Water (today Copenhagen Energy) the alternative would have been to use the investments to secure the sewer pipes, i.e. to avoid outlets from them. It is, however estimated that the situation is "under control", i.e. that at the end of the planning period all sewer pipes will be inspected and renovated where necessary (interview, Copenhagen Energy). The main lessons from this case: • The model tools have enabled bathing in the harbour. Using the model is a cheaper, better and faster way to estimate the quality of the water, than test samples • Tangible environmental results can have a high priority which assessment tools might not be able to value, as the benefits achieved goes beyond quantitative environmental measures.
d. Potentials for further use of the tool?	d. As more detention basins are built along the harbour in Copenhagen, more bathing places will probably be established. Besides the two bathing places in the central harbour of Copenhagen (Islands Brygge (2002 and Copencabana 2003), there are plans for establishing bathing places at Svanemøllebugten (2009) and at Kalveboderne (2013). This will, however, partly depend on whether the neighbour municipalities are willing to co-invest in improvements of the Damhusåens sewage treatment plant, a jointly owned plant between Copenhagen and other municipalities. Moreover, fishing in the harbour might also be allowed due to the improved water quality. However, there are some preconditions for establishing the harbour bath in Copenhagen, besides from the industries having moved out of the harbour. One natural precondition is the strong water-current through the harbour, running between Køge bugt and Øresund, which avoids stagnant water. Also, the water in Øresund is very clean, with a sight-depth on up to 16 meters. Another precondition is that the city historically has always had a high standard of its sewer systems, since the first sewage system was established 150 years ago.
e. Will the actors recommend it or use it in other cases - why / why not?	e. Yes. The tools MIKE and MOUSE are well known and quite commonly used in water management.
2. Reviewer's assessment of the tool (usefulness, sustainability relevance, who are the actors	The case shows that these tools – although they do not claim directly to be sustainability tools – can be very important parts in the transformation to urban sustainability.

excluded? etc.) Suggestions and needs for further development of the tool	The case also demonstrates how an unpredicted decision-making process can lead to a highly appreciated tangible environmental result.
E. Additional information on the case study available	
Websites	
References *concerning the case but also the key words or problem* (papers, articles, reports, laws, etc.)	Copenhagen Water Supply (1992). *The water areas of Copenhagen. Partial plan for harbour and coast. Proposal for Water Area Plan.* Copenhagen Energy, Water division (2000). *Sewage Plan 2000*. Copenhagen Energy, Water division (2000). *Water Supply Plan 2001*. Copenhagen Energy (2000). *Annual Report 2000*.
Other sources (Interviews, conferences, discussions, etc.)	Interview with Mrs. Sonja Sørensen, Copenhagen Energy, Water division, d. 13.03.03 Interview with Mr. Tøger Nis Thomsen, Copenhagen EPA, d. 6.5.03 Interview with Mr. Jan Burgdorf Nielsen, Copenhagen EPA d. 1.4.04.
Contact details for further information	Mr. Jan Burgdorf Nielsen, Copenhagen EPA. Tlf. 33 66 58 00