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for Climate Change Adaptation

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Product Validation Report V3

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0.5	2012-11-30	Lars Gidhagen	Co-ordinator approval

Table of Contents

Table of Tables

1. Management Summary

This document D5.3.3 Stockholm Product Validation Report V3 validates the usability of the SUDPLAN product from the Stockholm pilot's point of view. Validation against technical detail requirements is not in the scope of the validation process; this is done as part of the state-of-the-art software development and described in D5.2.3 Stockholm Pilot report V3.

A total of 12 persons worked out the Lime Survey simplified questionnaire. Six persons represented SUDPLAN staff (of which two were urban planners), six modellers, three IT experts and three climate change experts. Six persons had seen presentations and documentation and three had been working with the system. Four persons participated in the SUDPLAN workshop. Five persons were particularly interested in both hydrology and air pollution, three only in flooding of rivers and two focus on storm water flooding and dimensioning of sewage water systems.

The complete results of the Lime Survey questionnaire for the Stockholm pilot is provided in Annex A of this report. A summary is provided in Chapter 4 where the SUDPLAN solution is compared to the state of art. The summary separates aspects related to the graphical user interfaces, the 3D visualisation, the climate scenario information, the Common Services (rainfall, hydrology and air quality) functionality and the overall impression.

In general the SUDPLAN tool is found to yield new and beyond state-of-the-art information, however it is also noted to be complex to operate and that it does not display uncertainties satisfactorily.

Comments and answers provided in the LimeSurvey related to the question of the strengths of SUDPLAN underline – except for many specific functionalities not available in other tools - that it brings together different areas (climate change, hydrology, air pollution, etc) to one system.

Suggested improvements were to provide more climate scenarios, better graphic presentation of results and a possibility to provide modular add-ons so that one can more easily extend the product (open-access to source code throughout).

2. Methodology

The common methodology for all V3 Product Validation Reports is described in detail in D2.1 Product Validation Plan (revised after 1st ATR) document dated June 15, 2011; hereafter only referred to as D2.1 Product Validation Plan. The validation procedure is summarised here below. All technical developing staff members participating in the pilot work have contributed to the validation by filling in a questionnaire.

With the purpose to increase the number of external end-users participating in the validation procedure, the third and final validation of the SUDPLAN project includes a simplified version of the full validation questionnaire. This simplified version contains only questions which can be responded by any interested person that has participated in a seminar and/or demonstration of the SUDPLAN tool. Also the pilot staff members characterized as end-users have used the simplified validation survey.

2.1. Documents involved

D2.1 Validation Plan describes the methodology used to produce the four pilots deliverables D5.3.3 Product Validation Report and the project overall validation of deliverable D2.2.3 Validation and Evaluation Report.

The objective of the D5.3.3 Stockholm Product Validation Report is to validate the usability of the SUDPLAN product from the Stockholm Pilot point of view. It will also constitute input to the D2.2.3 Validation and Evaluation Report, for which the main focus is the potential usability of the SUDPLAN product beyond the project and for an arbitrary city in Europe. This means that the comments given by external end-users will be especially important.

A table of all documents used or referenced in this document is given in Chapter 4 at the end of this document.

2.2. Validation aspects

2.2.1 Fulfilment of the pilot goals

Validating the level of fulfilment of the pilot goals as defined in D5.1.3 Pilot Definition Plan V3 is out of the scope of this document (instead given in D5.2.3 Stockholm Pilot report).

2.2.2 Professional profiles taking part of pilots product validation

The pilot validations are performed in two steps. The first is for WP leaders to assure that all pilot staff members fill in the full validation and to encourage as many external end-users as possible to fill in the simplified LimeSurvey web questionnaire. The second step is to merge all individual answers into this pilot product validation document.

There is a formal SUDPLAN classification, valid for both project staff and external end-users, in which they are defined as:

- Analysts – primary users: End users of SUDPLAN output, e.g. city planners or their technical staff, working directly with the system.

- Analysts – secondary users: End users of SUDPLAN output, e.g. city planners or their technical staff, using SUDPLAN results but without working directly with the system.

- Modellers: Developing, integrating and configuring the different models of the type used in SUDPLAN applications for a city. They are considered secondary end users, as they normally do not work directly with the system.

- System Managers: Installation, maintenance and system administration. They are considered secondary end users, as they normally do not work directly with the system.

The results of the validation LimeSurvey questionnaire should include impressions from all four professional profiles, however one individual can only belong to one professional profile.

2.2.3 Interaction between WP3 and WP4 and usability of the SUDPLAN Product

This deliverable assesses and documents the usability of the main results of WP3 Scenario Management System and WP4 Common Services for the SUDPLAN pilot applications.

The summary and generalization of the pilot validations are compiled as a part of the WP2 work, and reported in D2.2.3 Validation and Evaluation report. That document also draws conclusions on the pilot validations to provide feedback to WP3 and WP4. It is essential for WP3-WP4 to know whether they are on track and where improvement or even changes have to be implemented to allow an ex-project use and exploitation. Furthermore, this document also assesses the independence of the implementation of the SUDPLAN product from the specific pilots and the usability for an arbitrary European city.

2.2.4 Technical requirements of WP3 and WP4

The fulfilment of the technical requirements of WP3 (Scenario Management System) and WP4 (Common Services) is validated by unit- and integration tests done during the product development. This purely technical validation is out of the scope of the present document.

2.3. Rating

SUDPLAN product validation contains questions of the following types:

1. Rating starting with 1 for lowest (not fulfilled at all) to 7 for highest rating (fulfilled beyond expectations, which should be awarded only in exceptional cases and explained in the text), or NA (not applicable). ***Example where 5 persons related to this pilot have filled in the questionnaire:***

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Define scenario:			*2*		*1*	*2*		
Execute scenario					*1*	*3*		*1*

2. Rating from 1 to 7 indicating the comparison with e.g. state of the art solution, with 4=on pair with the state of art, 1=way below state of the art, and 7=way above the state of the art. NA can be used to indicate that the comparison is impossible, useless or beyond the evaluator's knowledge.

   Example where 5 persons related to this pilot have filled in the questionnaire::

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Compared to state of the art solutions					*2*	*2*	*1*	
Compared to SUDPLAN project objectives					*1*	*4*		

3. Yes|No|NA type of questions. ***Example:***

Dynamic workflow composition supported by	**Y**	**N**	**NA**
Pilot application:		5	
SUDPLAN product:	4		1

4. Multiple choice questions used to confirm that specific requirements are met. These type of questions are normally responded by persons involved in SUDPLAN development. Each single question can have only a limited number of answers (with or without NA). For example, in Q 2.2.1 the users are asked to list the SUDPLAN service interfaces and indicate their type (OS = Existing Service Interfaces with open standard specifications, re-used in the SUDPLAN; P = Existing proprietary Services with no open specifications, re-used in the SUDPLAN (if any); (N) New service Interfaces defined in the SUDPLAN (if any):

Service interface	**OS**	**P**	**N**
Dummy 1:			
Dummy 2:			
Dummy 3:			
Dummy 4:			

5. Free text fields are used to collect overall impressions and comments beyond the simple yes/no or rating level, giving the evaluator the opportunity to explain the way a requirement has been fulfilled. In case of partial fulfilment or failure to fulfil the requirement, the description could also explain e.g.:

   - Which part of the requirement was not fulfilled?
   - Why the requirement was dropped/not fulfilled?
   - What are the consequences of not-fulfilling the requirement?
   - Will the requirement be fulfilled later (e.g. "planned for development beyond the project")

3. Validated components and aspects of the pilot product

The following table indicate what components and aspects have been validated during the V3 period, as well as how many individuals that have given their opinion. The Stockholm pilot is, for the V3 validation, only using the simplified version of the online questionnaire (in V2 we used the full version). The complete list of the simplified validation questions is given in Annex A.

The following table gives the number of persons that has participated in the different parts of the V3 validation (the range given reflects that different questions under the different aspects were answered by different number of people).

Components and aspects evaluated in the simplified pilot validation:	**V3**
Graphical User Interfaces	8 – 11
3D Visualisation	2
Climate Scenario information	3 – 8
Common Services: Rainfall	2 – 4
Common Services: Air Quality	2 – 4
Common Services: Hydrology	4
Local models	1
Completeness of functionality	2
Conclusions	10

4. Summary

The participants of the V3 Stockholm pilot validation were urban planners, software developers, experts on air pollution and hydrology and a regional coordinator from a regional water authority. Six participants of the survey had seen documentation and the detailed demonstration of project results achieved in SUDPLAN and 4 persons took part in the Wuppertal workshop.

In this section the characteristics of the validation participants are given, followed by summaries of the most important conclusions concerning each of the validated components and aspects.
The following table summarises the professional profiles of the persons that completed the LimeSurvey simplified questionnaire (Annex A). Persons that have indicated that they do not want to appear with names in the SUDPLAN deliverables, will be indicated as "Anonymous".

1	Lars Örtegren	leo@apertum.se	Apertum IT AB.	Sweden	Manager and software developer
2	Chantal Donnelly	chantal.donnelly@gmail.com	SMHI	Sweden	Senior researcher, research project leader
3	Magnuz Engardt	magnuz.engardt@smhi.se	SMHI	Sweden	Senior researcher, Air Quality
4	Anonymous	-	SMHI	Sweden	researcher
5	Anonymous	-	SMHI	Sweden	researcher
6	Anonymous	-	Stockholm municipality	Sweden	IT expert
7	Anonymous	-	Stockholm municipality	Sweden	GIS expert
8	Joakim Pramsten	joakim.pramsten@stockholmvatten.se	Stockholm Vatten Water and Sewage Network	Sweden	Investigation engineer
9	Lena Strömbäck	lena.stromback@smhi.se	SMHI,	Sweden	Research coordinator
10	Anonymous	-	Stockholm water company	Sweden	Planning sewage networks
11	Jenny Enberg	jenny.enberg@lansstyrelsen.se	Water Framework Directive and Floods Directive for Both-nian Sea Water District Authority	Sweden	Coordinator
12	Christer Johansson	christer@slb.nu	SULVF	Sweden	Senior researcher, Air Quality

The particular interest and profile of the participants filling in the simplified questionnaire have been classified according to the following table (note that one person can be interested in more than one environmental risk):

Type of environmental risk	**Y**	**N**
Urban stormwater flooding during intense rainfall	2	10
Dimensioning of sewage water systems	2	10
Risks of flooding of rivers	3	9
Hydrological conditions	5	7

Air pollution	5	7
Other	Climate change, brief presentation	

SUDPLAN deals with both long term and short term planning. Apparently not all of the questionnaire participants are professionally interested in long term planning where climate change is of importance.

Temporal planning interest	**Y**	**N**	**NA**
Present conditions and short term (<10 years) planning	5	6	
Long term planning (>10 years) planning	7	4	

The professional profiles have been classified according to the following table:

Type of user	**Y**	**N**
SUDPLAN team member	6	6
Urban / regional planner (analysts)	2	10
Modeler	6	6
System manager	0	12
IT expert	3	9
Climate change expert	3	9
Have seen presentations and documentations	6	6
User of the SUDPLAN / model results	2	10
Working with the actual system	3	9
Participated in a SUDPLAN workshop	4	8

4.1. Summary for Graphical User Interfaces

A total of 8 to 11 persons gave input to different issues of this aspect. Very important aspects are to to be able to compare results (7 of 10 persons), and browse through results in time (7 of 11 persons). It is also very important with a task-oriented menu structure (6 of 9 persons), contextual help system (6 of 10 persons) and browsing results in space (6 of 11 persons). Important aspects are to receive alerts when processing finished (8 of 10 persons) and highlighting recently changed data (6 of 7 persons).

The mean rating for all answers to issues related to the ease of use and profiling of the SUDPLAN application is above state of the art, with highest rating for executing scenarios with parameters, but low ratings for visualization of uncertainties. Likewise for the usability of SUDPLAN the mean rating is above state of the art, with high rating for spatial and temporal visualisation and rather low for ease of learning. Comments were that it is a complex system and difficult to remember how to find different functionalities and that uncertainties cannot be visualized well.

4.2. Summary for 3D visualisation

Only 2 persons answered the questions related to 3D/4D visualization, most gave no answer, but those who did judged the capabilities to be above state of the art.

4.3. Summary for Climate scenario information

A total of 3 to 8 persons gave input to different issues related to the climate scenario aspect.

For most people answering the SUDPLAN tool is beyond state of the art in this sense.

The available number of different climate scenarios was, according to 3 persons, considered to be too few to be able to assess uncertainties in results. Description of uncertainties of climate scenarios was found insufficient.

4.4. Summary for Common Services: Rainfall

A total of 2 to 4 persons gave input to different issues related this aspect. Overall the mean rating was almost 6, well beyond state-of the art.

The usability of the SUDPLAN short-term rainfall downscaling was well beyond state of the art for the persons who answered this question. Likewise the functionality and ease of use of the downscaled time series were found to be beyond state of the art and the functionality of the downscaled IDF-curves was also well beyond state of the art.

As regards the scientific soundness and credibility of different aspects of the downscaled continuous rainfall time series and IDF-curves from SUDPLAN all aspects were well beyond state of the art.

4.5. Summary for Common Services: Air Quality

Two to four persons gave input to different issues of the air quality service.

The usability of the SUDPLAN tool as the basis for assessment of the future air pollution was judged to be beyond state of the art by most persons answering the survey.

In the category level of support for following functionality to assess the risk of air pollution, many items were judged to be well beyond state of the art. Also for the usability of SUDPLANs air quality results it was judged to be beyond state of the art.

4.6. Summary for Common Services - Hydrology

In most cases 4 persons gave input to issues of this aspect.

The usability of the SUDPLAN tool as the basis for river flooding assessment applications was beyond or well beyond state of the art by most persons answering. Likewise the usability of SUDPLAN hydrological application was also beyond or well beyond state of the art by most persons answering.

The usability of SUDPLAN hydrological results for assessing changes in river discharge, soil moisture and ground water levels was beyond or well beyond state of the art by most people answering.

4.7. Summary for Local Models

Only one person gave input to this aspect and he/she judged the system to be beyond state of the art.

4.8. Summary for Completeness of functionality

Two persons gave input to this aspect.

As regards the usability of SUDPLAN for the creation of reports, publications and data export with respect to the requirements of planners and system managers it was mostly judged to be beyond state of the art.

A missing functionality was the possibility to implement add-ons (e.g. like in Firefox browser) where developers can add their own modules to enhance SUDPLAN

Suggested improvements were to consider urban heat island effects in air quality modelling and implement higher geographic resolution, include future population density to estimate population weighted concentrations.

4.9. Summary for the Conclusions part of the LimeSurvey

A total of 10 persons gave input to this aspect. Compared with the previous available information, SUDPLAN results were judged to be new by 7 persons, of better quality by 4 and more useful by 7 persons. The other persons could not assess these questions.

Strengths of SUDPLAN output were that it

- makes different climate change scenarios easily available and shows estimated trends based on different scenarios,
- improves the climate change information by adding local data,
- provides graphics interaction with users (i.e. users can enhance the product through their own work),

- brings together different areas (climate change, hydrology, air pollution, etc) to one system and,
- provides the downscaled short-term rainfall and the estimation of seasonal variations in rain patterns.

Suggested improvements were to provide more climate scenarios, better graphics presentation of results, possibility to provide modular add-ons so that one can more easily extend the product (open-access to source code throughout), a functionality to compare maps side by side and improve the user interface.

Short impressions was provided as follows:

- SUDPLAN is a powerful tool for urban planners.
- Provide an impressive collection of results and achievements from a number of different disciplines.
- Easy access of future climate and emission scenarios for long term urban planning.
- Nice user interface and integration with possibilities to easily explore details in results.

5. Conclusion

The following conclusions can be drawn based on the Stockholm product validation V3:

A total of 12 persons worked out the Lime Survey simplified (pilot) questionnaire. Six persons represented SUDPLAN staff. Two were urban planners, six modellers, three IT experts and three climate change experts. Six persons had seen presentations and documentation and three had been working with the system. Four persons participated in the SUDPLAN workshop. Five persons were particularly interested in the hydrology and air pollution, three in risks of flooding of rivers, and two on stormwater flooding and dimensioning of sewage water systems.

In general the SUDPLAN tool is found to yield new and beyond state-of-the-art information, however it is also felt a bit complex to operate and it does not display uncertainty satisfactorily.

Comments and answers provided in the LimeSurvey related to the question of the strengths of SUDPLAN underline – except for its specific functionalities - that it brings together different areas (climate change, hydrology, air pollution, etc) to one system.

Suggested improvements were to provide more climate scenarios, better graphics presentation of results and possibility to provide modular add-ons so that one can more easily extend the product (open-access to source code throughout).

6. References

This is the list of documents and software deliverables that have been be used as input for this document.

Table 1: List of documents and software deliverables that has been referenced or used for this document

Document	Version
D2.1 Validation Plan (revised after 1st ATR)	2011-06-15
D5.1.3 Pilot Definition Plan for Stockholm V3	2012-01-12
D5.3.2 Stockholm Product Validation V2	2012-02-20
D5.2.3 Stockholm Pilot report V3	2012-11-02

7. Glossary

2D	Two-dimensional, typically a field that varies in east-west and north-south direction. The field may also vary in time –this is typical for e.g. air pollution and population density. The former varies from one hour to another while the latter maybe varies from one year to another.
3D	Three-dimensional, typically a field that varies in east-west and north-south direction as well as vertically. The field may also vary in time.
4D	Four-dimensional. Most often 3D field that explicitly also varies in time. It could also be when a certain 3D parameter (e.g. a particular air pollutant) also varies according to another 3D parameter (e.g. temperature). It will then be possible to study the variation of the first 3D parameter as a function of space (x,y,z) and the second parameter.
Airviro	Air quality management system consisting of databases, dispersion models and utilities to facilitate data collection, emission inventories etc, see http://www.Airviro.smhi.se/
Climate scenario	*Climate scenarios* means the resulting climate evolution over time, as simulated by global (GCMs) and regional (RCMs) climate models. Climate scenarios are products of certain emission scenarios that reflect different economic growth and emission mitigation agreements.
Common Services	*Common Services* is the climate downscaling services for rainfall, river flooding and air quality, developed in the SUDPLAN project and accessed through the SUDPLAN platform (Scenario Management System)
Common Services server	*Common Services* models will be executed at a SMHI server, accessible through OGC communication.
Emission scenario	These are of three types, of which the first one is behind the climate scenarios used in all SUDPLAN Common Services. The two remaining emission scenario types are only relevant for air quality downscaling.

- *IPCC emission scenarios*	*IPCC emission scenarios* are estimates of future global greenhouse gas concentrations based on assumptions about global development (economic growth, technical development, mitigation agreements, etc). During the first two years of the SUDPLAN projects, the climates scenarios based on SRES (Special Report on Emission Scenarios) A1B scenario from the 4th assessment have been used. The SRES emission scenarios do not include emissions of the pollutants of interest for air quality. If available the climate scenarios based on the 5th assessment RCP (Representative Concentration Pathways) emissions scenarios will also be used within the SUDPLAN project. They include emissions of air pollutants.
- *European tracer gas emissions (air pollutants)*	*European tracer gas emissions (air pollutants)* thus may or may not be included in IPCC emission scenarios. For creating Pan-European air quality fields under climate scenarios driven by the SRES A1B emission scenario, SUDPLAN uses tracer gas emissions from the more recent RCP emission scenarios. This inconsistency will be solved when climate scenarios based on RCP emission scenarios are available.
- *Local emission scenarios*	*Local emission scenarios* (to the atmosphere) are those of a particular European city. These will to a large extent influence future air quality in the city, but have little influence on global climate, nor do they influence air pollution concentrations in incoming long-range transported air. SUDPLAN will typically need gridded emissions with 1x1 km or finer spatial resolution as input to its urban air quality downscaling model.
Hind cast	A simulation of a historical period. Often done to compare model simulations with data which is available during that period.
Hot spot	Point (or small area) which is very different from its surroundings. In the present context, most often high concentrations of air pollutants, or extreme meteorological conditions.

Information product	Raw data, such as the results of mathematical modelling, and the analysis thereof, will often need to be packaged in such a way as to be accessible to the various stakeholders of an analysis. The medium can be one of a wide variety, such as print, photo, video, slides, or web pages. The term *information product* refers to such an entity.
Mockup	A model of a design used for demonstrating the functionality of a system.
Model	A *model* is a simplified representation of a system, usually intended to facilitate analysis of the system through manipulation of the model. In the SUDPLAN context the term can be used to refer to mathematical models of processes or spatial models of geographical entities.
PM_{10}	'PM10' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM10, EN 12341, with a 50 % efficiency cut-off at 10 μm aerodynamic diameter;
$PM_{2.5}$	'PM2,5' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM2,5, EN 14907, with a 50 % efficiency cut-off at 2,5 μm aerodynamic diameter;
Profile	Within SUDPLAN a *profile* is a set of configuration parameters which are associated with an individual or group, and which are remembered in order to facilitate repeated use of the system.
Regional downscaling	A climate scenario may be downscaled to a higher spatial resolution, typically 25-50 km, by a Regional Climate Model (RCM). The regional downscaling in SUDPLAN will be performed by SMHI's RCM (RCA, see below) and will generate climate scenarios at 44 or 22 km resolution.
Report	A *report* is a particular type of information product which is usually static and might integrate still images, static data representations, mathematical expressions, and narrative to communicate an analytical result to others.

Scenario	A *scenario* is a set of parameters, variables and other conditions which represent a hypothetical situation, and which can be analysed through the use of models in order to produce hypothetical outcomes. In SUDPLAN a scenario is an individual model simulation outcome to be used in urban planning. The model simulation may or may not include Common Services downscaling (with specific input) and may or may not include a local model simulation (with specific input and parameters).
Scenario Management System	*Scenario Management System* is synonymous with SUDPLAN platform
Scenario Management System Framework	The *Scenario Management System Framework* is the main Building Block of the Scenario Management System. It provides the Scenario Management System core functionalities and integration support for the other Building Blocks.
Scenario Management System Building Block	Scenario Management System Framework is composed of three distinct *Building Blocks*: The Scenario Management System Framework, the Model as a Service Building Block and the Advanced Visualisation Building Block.
Street canyon	Volume between high buildings in cities. Due to poor circulation (and high emissions) prone to poor air quality. Street canyons have unexpected circulation patterns, thus dedicated models are needed to study air pollution here.
SUDPLAN application	A *SUDPLAN application* is a decision support system crafted by using the SUDPLAN platform and integrating models, data, sensors, and other services to meet the requirements of the particular application.
SUDPLAN platform	The *SUDPLAN platform* is an ensemble of software components which support the development of SUDPLAN applications.
SUDPLAN system	*SUDPLAN system* is synonymous with SUDPLAN application

Urban downscaling	This refers to further downscaling of the regional climate scenarios for Europe to the urban scale within SUDPLAN. This will be possible for a) *rainfall/precipitation* where the temporal resolution will be 30 minutes or less. The spatial resolution will be that of a precipitation gauge, i.e. representative for a point rather than a certain area. b) *hydrological variables (river runoff, soil moisture etc*) where the temporal resolution is daily and the spatial resolution linked to catchment areas which presently count approximately 35000 and with average size 240 km^2. *c) air quality (PM, NO2/NOx, SO2, O3, CO).* The temporal resolution will be hourly for gridded output fields and the spatial resolution typically 1x1 kilometres.
User	The term *user* refers to people who have a more or less direct involvement with a system. Primary users are directly and frequently involved, while secondary users may interact with the system only occasionally or through an intermediary. Tertiary users may not interact with the system but have a direct interest in the performance of the system.
Web-based	Computer applications are said to be *web-based* if they rely on or take advantage of data and/or services which are accessible via the World Wide Web using the Internet.

8. Acronyms and abbreviations

Acronym	Description
A1B	Emission scenario used for global climate modelling in IPCCs Fourth Assessment Report (AR4)
Airviro	Air quality management system to facilitate data collection, emission inventories etc, see http://www.airviro.smhi.se/
CS	Common Services
AVDB	Airviro Time Series database (used for storage in Common Services)
AR4, AR5	Fourth and Fifth Assessment Report of IPCC
AQ	Air Quality

C API	Application Programming Interface written in C
CMIP5	Coupled Model Intercomparison Project, phase 5 (coordinated model exercise in support to AR5)
CS	Common Services (SUDPLAN functionality)
CTM	Chemistry Transport Model
CTREE	FairCom CTREE database (Index database, core of AVDB)
DBS	Distribution-Based Scaling, a method to bias-correct (i.e. remove systematic errors in) the temperature and precipitation of the RCM output
DoW	SUDPLAN Description of Work
DSS	Decision Support Systems
ECHAM5	GCM developed at Max Planck Institute for Meteorology, DE
ECMWF	The European Centre for Medium-Range Weather Forecasts (also co-ordinating FP7-SPACE project MACC)
EDB	Airviro Emission database
EEA	European Economic Association
E-HYPE	HYdrological Predictions for the Environment (European set-up), hydrological rainfall-runoff model developed and used by SMHI
EM&S	Environmental Modelling and Software
ESA	European Space Agency
ESDI	European Spatial Data Infrastructure
EU	European Union
GCM	Global Climate Model or, equivalently, General Circulation Model. Physically based computer model that simulates the global climate on a 200-300 km resolution. Can be used both to reproduce historical climate and estimate future climate, e.g. in response to changes in greenhouse gas concentrations.
GHG	GreenHouse Gases
GTE	Georeferenced Time-series Editor
GIS	Geographic Information System
HadCM3	GCM developed at Met Office Hadley Centre, UK
HIRLAM	HIgh Resolution Limited Area Model, numerical weather prediction model developed and used operationally by SMHI
ICT	Information and Communication Technologies
ID	Identifier
IDF-curve	Intensity Duration Frequency-curve, a curve (or a table of values) showing the rainfall intensity associated with a certain duration (i.e. time period) and frequency (i.e. probability, generally expressed as a return period). Calculated from short-term rainfall observations and widely used in design of urban drainage systems.
iEMSs	International Environmental Modelling & Software Society
IFIP	International Federation for Information Processing
IPCC	The Intergovernmental Panel on Climate Change, the leading body for the assessment of climate change

IPR	Intellectual Property Rights
ISAM	Indexed Sequential Access Method, a method for indexing data for fast retrieval
ISO	International Standardization Organisation
ISESS	International Symposium on Environmental Software Systems
IST	Information Society Technology
MATCH	Multiple-scale Atmospheric Transport and Chemistry modelling system, a CTM developed and used by SMHI.
MODSIM	International Congress on Modelling and Simulation
OASIS	1) Organization for the Advancement of Structured Information Standards 2) Open Advanced System for Disaster and Emergency Management (FP6 project)
OGC	Open Geospatial Consortium
O&M	Observation and Measurements
ORCHESTRA	Open Architecture and Spatial Data Infrastructure in Europe (FP6 IST-511678)
OSGeo	Open Source Geospatial Foundation
OSIRIS	Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors (FP6 IST-33799)
PMC	Project Management Committee
RC	Rossby Centre, climate research unit at SMHI
RCA	Rossby Centre Atmospheric model, RCM developed by SMHI and used in SUDPLAN
RCM	Regional Climate Model, commonly used to increase the spatial resolution of climate scenarios to 25-50 km in a specific region.
RCP4.5	Radiative Concentration Pathways: A set of four emission scenarios to be used for the AR5 simulations. The scenarios are named according to their radiative forcing at 2100, e.g. 4.5 W/m^2.
RNB	Airviro Field database
SANY	Sensors Anywhere (FP6 IST-033654)
SDI	Spatial Data Infrastructure
SISE	Single Information Space in Europe for the Environment
SISE	Single Information Space in Europe for the Environment
SMHI	Swedish Meteorological and Hydrological Institute
SMS	Scenario Management System
SOA	Service Oriented Architecture
SOS	Sensor Observation Service
SPS	Sensor Planning Service
SWE	Sensor Web Enablement
SUDPLAN	Sustainable Urban Development PLANner for climate change adaptation
SWE	Sensor Web Enablement
Tbd	To be determined

UWEDAT	AIT environmental data management and monitoring system
WCC	World Computer Congress
WCS	Web Coverage Service
WFS	Web Feature Service
WP	Work Package
WPS	Web Processing Service
WMS	Web Map Service

Annex A – Simplified Lime Survey

1.1. A - Personal information

Name	1: Lars Örtegren 2: Chantal Donnelly 3: Magnuz Engardt 4: anonymous 5: anonymous 6: anonymous 7: anonymous 8: Joakim Pramsten 9: Lena Strömbäck 10: anonymous 11: Jenny Enberg 12: Christer Johansson
E-mail address	1: leo@apertum.se 2: chantal.donnelly@gmail.com 3: magnuz.engardt@smhi.se 4: - 5: - 6: - 7: - 8: joakim.pramsten@stockholmvatten.se 9: lena.stromback@smhi.se 10: - 11: jenny.enberg@lansstyrelsen.se 12: christer@slb.nu
Organization affiliation, position and principal responsibilities.	1: Manager and software developer at Apertum IT AB. 2: Senior researcher, research project leader 3: SMHI 601 76 Norrköping SWEDEN 4: SMHI, Sweden, researcher 5: SMHI, Sweden, researcher 6: Stockholm municipality, Environmental and Health administration, ITexpert 7: Stockholm municipality, Environmental and Health administration, GIS expert8: Stockholm Vatten Water and Sewage Network, Investigations 9: SMHI, research coordinator 10: Stockholm Water and Sewage Company, planning sewage network 11: Coordinator, Water Framework Directive and Floods Directive for Bothnian Sea Water District Authority.

	12: SULVF
Where did you learn about SUDPLAN and become familiar with it?	1: Partner of SUDPLAN project 2: via SMHI 3: through participation in the project 4: Through SMHI 5: at SMHI 6: I learned about it in Stockholm but I did not get familiar with it 7: involved in the project 8: Presentation by SMHI 9: By working with the SUDPLAN project 10: At a presentation held at the municipality 11: through SMHI - partner in the project 12: Part of SUDPLAN

Please describe the user's knowledge with respect to the SUDPLAN product (Y= Yes, N = No).

Type of user	Y	N
SUDPLAN team member	6	6
Urban / regional planner (analysts)	2	10
Modeler	6	6
System manager	0	12
IT expert	3	9
Climate change expert	3	9
Have seen presentations and documentations	6	6
User of the SUDPLAN / model results	2	10
Working with the actual system	3	9
I participated in a SUDPLAN workshop	4	8

SUDPLAN team member: You were developing SUDPLAN.

Analysts are those people who will be using the SUDPLAN applications on a regular basis to carry out analyses in order to arrive at an environmental management decision. In some cases they may be the decision makers, and in other cases they may be supporting the decision makers. This category of user would include expert planners and city planners, as defined in the DoW, and are likely to be primary users (i.e. they will use the SUDPLAN applications directly and regularly).

Modelers are those people who develop, integrate, and/or configure mathematical models to be used within SUDPLAN applications. While these users might be expert planners as well, this category is reserved for people performing specific model development tasks; if and when they work as planners, they revert to the Analyst category. Modellers may be seen as secondary users in that they will not generally, in this role, use the SUDPLAN application on a regular basis, and might not use it directly at all.

System Managers are those people who install and maintain SUDPLAN applications and carry out general system administration tasks. This would include the integration of components, such as models, into SUDPLAN applications. While this task might be performed by the same people who developed the models, when they are carrying out the integration into an application they have switched into a role as a System Manager. These users could be considered secondary users. While they will definitely use the SUDPLAN applications directly, it will only be occasionally (in this role).

IT-Experts are people working in the developement or administration of IT systems. If you have some GIS and SOA background please select this also.

Climatic Change experts are people with knowledge in the Climate Change domain. They may or may not act as any of the other roles within SUDPLAN.

Please indicate for what type of environmental risk SUDPLANS has been used (Y= SUDPLAN used, N = SUDPLAN not used, NA= concept not applicable). For other, please indicate what other risk.

Type of environmental risk	Y	N
Urban stormwater flooding during intense rainfall	2	10
Dimensioning of sewage water systems	2	10
Risks of flooding of rivers	3	9
Hydrological conditions	5	7
Air pollution	5	7
Other	Climate change, brief presentation	

Please indicate what is the temporal planning interest (Y= of interest, N = not of interest, NA= not applicable).

Temporal planning interest	Y	N
Present conditions and short term (<10 years) planning	5	7
Long term planning (>10 years) planning	9	12

1.2. B - Graphical user interface

This question group is about the usability and functionality of the graphical user interface.

9 [B_1]: Please indicate the importance of key concepts used in SUDPLAN to assure the GUI ergonomics

Key concepts	*Very important*	*Important*	*Not relevant*	*NA*
Task-Oriented Menu structure	*6*	*3*		*3*
Contextual help system	*6*	*4*		*2*
Alerts when processing finished	*2*	*8*		*2*
Panning/browsing through results (in time)	*7*	*4*		*1*
Panning/browsing through results (in space)	*6*	*5*		*1*
Highlighting recently changed data	*1*	*6*	*1*	*4*
Comparing two result sets	*7*	*3*		*2*

10 [B_2] Please assess the ease of use and profiling of the SUDPLAN application

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Customization of the user interface			*1*	*1*	*1*	*2*		*7*
Define a scenario				*1*	*4*	*1*		*6*
Execute scenario with parameters			*1*		*1*	*3*		*7*
Save results			*1*	*1*	*1*	*1*	*2*	*6*
Share results with others			*1*	*1*			*1*	*9*

Visualize results		*1*	*1*	*1*	*2*	*2*		*5*
Visualize uncertainties		*3*			*2*			*7*
Compare the results of various scenarios				*2*	*3*	*2*		*5*
Export results in different formats					*1*	*2*		*9*

11 [B_3] Please assess the usability of SUDPLAN

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
With various output devices			*2*	*1*	*1*			*8*
Spatial visualization				*2*	*2*	*3*		*5*
Temporal visualization					*2*	*3*		*7*
Spatio-temporal visualization					*2*	*2*		*8*
Contextual help				*1*	*3*			*8*
Ease of learning		*2*	*1*	*2*	*1*	*1*		*5*
Memorability			*1*		*2*			*9*
Geo-referenced data					*3*			*9*
Transparency			*1*		*1*	*3*		*7*
3D data, georeferenced, on a map			*1*	*1*	*1*	*1*		*8*

12 [B_4] Please assess the capabilities of the SUDPLAN 3D/4D visualization framework

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall impression						*2*		*10*
3D GUI interaction						*1*		*11*
Information visualization						*2*		*10*
Presenting of the scenarios						*2*		*10*
Comparing of the scenarios					*1*	*1*		*10*
Analyzing of the scenarios				*1*				*11*

13 [B_5] Please give a short textual explanation on your experience with the capability, usability and ease of use of SUDPLAN GUI, and suggestions for improvement.

2: A little difficult to remember where everything is. The left menu isn't always intuitive
4: Overall fine. Two points to improve: - It is hard to use on a small screen. - It does not visualize uncertainty well.
5: I have not tried it myself so I think it is difficult to judge what is easy and logical and what is not.

1.3. C – Climate Scenario information

Climate scenario information is provided only "as is" for information about existing climate scenarios. This information can also be used for training purposes.

14 [C1_1] Please indicate the usability of the provided climate scenario information.

	1	2	3	4	5	6	7	NA
Available number of different climate scenarios		2	1		3	2		4
Within area of your interest over Europe					2	4	2	4
Available time range						6	2	4
Available scenario documentation				1	2	3		6
Possibility for changing temporal resolution for data export					2	1		9

1.4. C2 – Common Services – Rainfall

The rainfall services provide prediction of

- *rain time series*
- *IDF curves*

15 [C2_1] Please indicate the usability of the SUDPLAN short-term rainfall downscaling.

	1	2	3	4	5	6	7	NA
Overall						2	1	9
Upload of historical/local data to improve the results						3		9
Downscaling						3		9
Visualisation of the results						3		9

16 [C2_2a] Please assess the functionality and ease of use of the SUDPLAN downscaled continuous rainfall time series:.

	1	2	3	4	5	6	7	NA
Upload of historical data			1		2	1		8
Downscaling procedure					1	3		8
Results visualisation and download					1	3		8

17 [C2_2b] Please assess the functionality and ease of use of the SUDPLAN downscaled IDF-curves:

	1	2	3	4	5	6	7	NA
Upload of historical IDF curve					2	1		9
Downscaling procedure						3		9
Results visualisation and download						3		9

18 [C2_3a] Please assess the scientific soundness and credibility of different aspects of the downscaled continuous rainfall time series from SUDPLAN:

	1	2	3	4	5	6	7	NA
Downscaled continuous rainfall time series: General performance						2		10
Downscaled continuous rainfall time series: Long-term (annual, seasonal) volumes						2		10
Downscaled continuous rainfall time series: High and low intensities						2		10
Downscaled IDF-curves: General performance						2		10
Downscaled IDF-curves: Dependency on duration						2		10
Downscaled IDF-curves: Dependency on return period						2		10

19 [C2_3b] Please assess the scientific soundness and credibility of different aspects of the downscaled IDF-curves from SUDPLAN:

	1	2	3	4	5	6	7	NA
General performance						2		10
Dependency on duration						2		10
Dependency on return period						2		10

20 [C2_4] Please give a short textual explanation on your experience with the usability of SUDPLANs results in the rainfall domain, and suggestions for improvement. Please state also which state-of-the art product was used for comparison.

1.5. C3 – Common Services – Air Quality

This includes projections of air pollution influenced by climate change and changees in Europe air pollutant emissions.

21 [C3_1] Please assess the usability of the SUDPLAN tool as the basis for assessment of the future air pollution:

	1	2	3	4	5	6	7	NA
Overall				1	2	1		8
Upload local emission data			1		1			10
Downscaling			1		2	1		

Visualisation of the results			*2*		*1*	*1*		

22 [C3_2] Please indicate the level of support for following functionality to assess the risk of air pollution:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Prediction of long-term air quality and temperature simulations over entire Europe				*1*		*2*		*9*
Trends in air quality			*1*			*2*		*9*
Year-long downscaling air quality simulations			*1*		*1*	*2*		*9*
Impact of local sources, activities and land use on future air quality in particular European cities	*1*				*1*	*1*		*9*
Use of the downscaled air quality grids in local planning scenarios				*1*		*2*		*9*
Use of SUDPLAN air quality results as input to local dispersion models			*1*		*1*	*1*		*9*
Estimate the importance of local sources of pollutants vs. long-range pollution transport for the local air quality					*1*	*1*		*10*

23 [C3_3] Please indicate the usability of SUDPLANs air quality results

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
As information about expected future environmental conditions					*3*	*1*		*8*
Comparing the results of future city development plans					*1*	*2*		*9*
Assess the feasibility of fulfilling national air quality standards and environmental objectives, in a climate change perspective				*1*	*1*	*1*		*9*

24 [C3_4] Please give a short textual explanation on your experience with the usability of SUDPLANs results in the air quality domain, and suggestions for improvement. Please state also which state-of-the art product was used for comparison.

1.6. C4 – Common Services - Hydrology

Questions about prediction of river runoff

25 [C4_1] Please assess the usability of the SUDPLAN tool as the basis for riverflooding assessment applications

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Overall				*1*	*2*	*1*		*8*
Upload of local river discharge time series				*1*	*2*	*2*		*7*
Local calibration			*1*	*1*	*1*	*1*	*1*	*7*
Presentation of the results from local calibration				*2*	*2*	*1*		*7*
Presentation of the results from simulation			*1*	*1*	*2*	*1*		*7*

26 [C4_2] Please assess the usability of SUDPLAN hydrological application

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Preparation and staring a local calibration				*3*	*1*	*1*		*7*
Starting a local climate simulation				*3*	*1*	*1*		*7*
Download and further exploration and use of the results				*2*		*2*		*8*

27 [C4_3] Please indicate the usability of SUDPLAN hyrological results for assessing

	1	*2*	*3*	*4*	*5*	*6*	*7*	*NA*
Changes in river discharge				*1*	*1*	*2*		*8*
Changes in soil moisture				*3*		*1*		*8*
Changes in available ground water levels		*1*		*2*		*1*		*8*

28 [C4_4] Please give a short textual explanation on your experience with the usability of SUDPLANs results in the hydrological domain, and suggestions for improvement. Please state also which state-of-the art product was used for comparison.

1.7. D - Local models

Questions about the usage of local models. Local means the model is typically pre-existing and developed outside SUDPLAN. This model is now integrated to be used from within the SUDPLAN GUI. This models are typically not usable outside the context of this specific city.

29 [D_1] Please assess the ability of SUDPLAN in the field of model integration

	1	2	3	4	5	6	7	NA
Ease of integration of models as a service					1			11
Running models directly from the SUDPLAN GUI					1			11
Specifying parameters for model runs					1			11
Using model results as input for another model (Service chaining)					1			11
Configuration of models					1			11
Model validation					1			11
Model calibration					1			11

1.8. E - Completeness of functionality

30 [E_1] Please assess the usability of SUDPLAN for the creation of reports, publications and data export with respect to the requirements of planners

	1	2	3	4	5	6	7	NA
Creation of information products					1	1		10
Report generation				1	1			10
Coordinate conversion					1			11
Export					2			10
Information/result sharing					1		1	10

31 [E_2] Please assess the usability of SUDPLAN with respect to the requirements of system managers

	1	2	3	4	5	6	7	NA
User management	1			1				10
Security and rights management	1			1				10
Data source integration					1			11
Sensor service integration					1			11
Model integration					1			11

32 [E_3] Please indicate the functionalities you find in SUDPLAN, that are particulary useful

2: visualisation local calibration hydrology
4: Spatiotemporal visualisation Integration of local data with other SUDPLAN models
5: For hydrological modelling: adding your own discharge and calibrate a model for a smaller area.
12: Access of climate and emission scenarios

33 [E_4] Please indicate the functionalities you miss in SUDPLAN, that might be particulary useful

4: - Include add-ons (e.g. like in Firefox browser) where developers can add their own modules to enhance SUDPLAN
12: Time series and spatial visualization of climate scenarios

34 [E_5] Please give a short textual explanation about key advantages of SUDPLAN functionality, usability in the city management scenarios and urban planning, and give suggestions for improvement.

12: Consider urban heat island effects and higher geographic resolution. Include future population density and make population weighted concentrations.

1.9. F - Conclusions

Please, give your final impression on SUDPLAN!

35 [F_1] Compared with the previous available information, SUDPLAN results are:

	Y	N	Can not assess	NA
New	7		3	2
Better quality	4		6	2
More useful	7		3	2

36 [F_2] Would you use the SUDPLAN output as a base for your future city planning? Please choose all that apply and provide a comment

	Y	N	Comments
Yes, I would	3	9	
Yes, it is useful for most cities	2	10	
Yes, to certain extent	5	7	
Yes, but I still miss some information	1	11	4: uncertainties
Maybe for a few specific cases	2	10	
I would recommend to my colleagues in other European cities	2	10	
No, I would not use it at all.	1	11	5: for city planning as I'm no city planner. But for other things maybe.

37 [F_3]: How did you find the graphical presentation of the SUDPLAN results? Choose one of the following answers.

	Not useful	Ordinary	Excellent and contributing to a better understanding
		2	8

Please enter your comments here.

38 [F_4]: What is in your opinion the strength of SUDPLAN output?

1: Making climate change scenarios available. Improving the climate change information by adding local data.
2: Makes recent research methods readily available to planners
4: Graphics, Interaction with users (i.e. users can enhance the product through their own work).
5: Bringing together different areas (climate change, hydrology, air pollution, etc) to one system.
8: Localized estimation on climate change and the abillity to show estimated trends based on different scenarios. The capabillity to downscale short-term rainfall and the estimation of seasonal variations in rain patterns.
10: Easy accessibility to future climate data originating from different estimates.

39 [F_5]: What is in your opinion the weakness of SUDPLAN output? What should be improved?

1: Better user handling.
2: More scenariso required to define uncertainty
3: It's always a weakness with manual uploading of data into the system. I think the graphics (presentation of results) is the weakest point of SUDPLAN.
4: Modular add-ons so that one can more easily etend the product. Open-access to source code throughout.
5: I don't know.
7: NO opinion
8: I do not know.
9: I would like to have functionality to compare maps side by side.
10: No specific weaknesses
12: Not so easy to use without learning. User interface could be improved.

40 [F_6]: Please give a short summary of your impression of the SUDPLAN product:

1: A powerful tool for urban planners.
2: Nice
3: Impressing collection of results and achievments from a number of different disciplines.
4: Good but would be good to link better with other developments going on in this direction
5: Impressive, user interface, integration.
7: NO opinion
8: It seems like a good and usable product.
9: It is an interesting syste. I like the possibility to easily explore details in results.
10: Though interested and impressed I think that most municipal planners has the need for specific reccommendations for the adaptation to a future climate at a specific place and maybe not what will the weather be like in Löddeköpinge year 2063 or the Gdansk forecasts. This is perhaps more useful att a national/europeean level. So (of course, depending on price) I think my organization might not by this product.
12: Easy access of future climate and emission scenarios for long term urban planning.

