Open Market Consultation: Conceptual Hydraulic Model (Conceptueel Hydraulisch Model)

Please turn your camera off and mute your microphone throughout the event, unless the hosts asks you to speak.

We’ve prepared this presentation in English, but discussions/questions might be in Dutch. If you do not understand Dutch please mention this in the chat, this will remind us to keep the discussions in English, and we’ll translate to English for you where necessary.

For online voting the tool PlanITPoker is used.

https://www.planitpoker.com/board/#/room/3409cbd592b747beab4e33b793d9dbaa
(link can also be found in the chat)

Please register via the following link with username “<company name>, <first name>”
(for example: Addestino, Jo)

If you are participating as observer, please use username “Observer, <first name>”
(if you do not bring specific technical/product expertise you should probably register as observer)
**Agenda**

12.50 Registration / Logging in

13.00 Introduction: Programme for Innovation Procurement  
  *Veerle Lories, PIO*

13.10 Introduction to the project ‘conceptual Hydraulic Model’  
  *Ronny Van Looveren, Stad Antwerpen*

13.30 Market consultation, use cases and requirements for Workflow  
  *Jo Degraef, Addestino*

15.00 Break

15.15 Market consultation, use cases and requirements for Hydraulic Model  
  *Jo Degraef, Addestino*

17.00 Next Steps
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17.00 Next Steps
WHAT is the Programme for Innovation Procurement?

MISSION  Stimulate public organisations to use procurement as a strategic instrument for innovation

WHY       It doesn’t seem to happen spontaneously!

OUTCOME   Procuring innovation with triple impact
          • Improving performance of public sector
          • Strengthening competitiveness of private enterprises/industry
          • More opportunities to tackle major societal challenges

FOCUS     to develop and validate innovative solutions (new products, services, systems) in response to public needs

HOW       Calls every year
HOW do we work? - Our offer

To public sector organisations:
- Guidance and support throughout the whole procurement process
- Co-financing (50/50)
  - Consultancy to prepare tender: needs and market analysis
  - Final contract

To private enterprises:
- Through market consultations early market involvement in procurement track, to gain insights in public needs, opportunity to co-define possible development tracks
- Easy accessible and enterprise friendly tender procedures with interaction
- More resources for innovation, more possibilities for developing, testing, validating, launching new solutions on the market, ...
70 projects in PIP-portfolio - Interested?

- PIO project portfolio:
  - Search and filter on policy field, topic & status (in preparation, in procurement, in execution….)
  - Project site: Report (needs and market analysis), tender, etc. will be published here!

- Dedicated page for companies (in Dutch)
  - http://innovatieveoverheidsopdrachten.be/node/6446

- Sign up for PIO Newsletter (in Dutch)

- Contact IO-team: pio@vlaanderen.be, piet.desiere.ewi@vlaanderen.be
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17.00 Next Steps
Introduction to the project - initiators

**Need:** tool + implementation

**Input:** Funding, hydraulic and situational knowledge

**Need:** tool

**Input:** hydraulic and situational knowledge
Introduction to the project - context

As a result of climate change and anthropogenic factors (impervious areas, ...)

More frequent droughts

More frequent urban flooding
Introduction to the project – need

We have the **KNOWLEDGE**

We have the **VISION**

We have the first practical **EXPERIENCE**

>>>> it is time to **SCALE UP** our knowledge, vision and experience to the entire city

>>>> we want to bring more water into our city
Introduction to the project – we want to bring more water into our city

**Example 1: Antwerp Left Bank**
Large public area

**Example 2: City center**
Small streets, dense building, ...

>>> HYDRAULIC possibilities depend largely on available SPACE
>>> solution = combination of HYDRAULICS and URBAN LANDSCAPING
Introduction to the project – need – current situation

(1) Execution design not optimal for water
(2) Redo parts of the work – loss of time and effort
Introduction to the project – need – expected situation

>>> more efficient design process
>>> optimal design
Introduction to the project – terminology – building blocks

(Water sensitive) building blocks

- Building blocks: are specific physical elements in the water system
- Waterplan: 61 water sensitive building blocks
- Sewer system: pumps, conduits, ...

14 Regenpark (publiek)
15 Retentievijvers met fluctuerend waterpeil
16 Bioswale (lineair)
17 Open verharding
Introduction to the project – terminology – building blocks

building block type

• Buffering block / infiltration buffering
  • Accent on water retention
  • Buffer empties through infiltration and/or water use and/or throughflow and/or evaporation
  • Examples: rain garden, swale, water roof, ...
• Routing
  • Accent on water routing (reduction and delay of peak flow)
  • Examples: gutters, ...
• Buffering + routing
  • Accent both on retention and routing
  • Examples: urban water channels,
• Change of pervious area
  • No buffer, only infiltration
  • Examples: reduce m² of concrete, roof to garden, ...
• Sewer operation
  • Examples: pumps, valves, ..
• Others
  • ...
Introduction to the project – terminology – water cascade

**Water cascade**

- **A** Private area
- **B** Water transporting local streets
- **C** Water buffering local streets
- **D** Collection streets
- **E** City parks and city squares
- **F** Large blue green infrastructure
- **G** Sewer system (rain water)
- **H** Sewer system (combined water)

Example: case part Borgerhout / Deurne
Introduction to the project – terminology – sewer area and catchment area

Sewer (treatment) area

Catchment area
Introduction to the project – terminology – sewer area and catchment area

Sewer (treatment) area
(= based on sewer system)

Catchment area
(= based on river system and topography)
Sewer treatment area and catchment area largely coincide on level 1

For instance
Sewer treatment areas Brasshaat + Antwerpen Noord = catchment area Schijn-Noord
Introduction to the project – terminology – sewer area level 1 and level 2
Introduction to the project – terminology – catchment area – level 1 and level 2

Catchment area – level 1

Catchment area – level 2
On level 2 sewer area and catchment area do not necessarily coincide
Introduction to the project – terminology – wateropgave

**Wateropgave** (water exercise)

- = amount (m³) of water that has to be stored + amount of impervious area (m²) that has to be transformed in pervious area
- standard
  - Legal = return period of 20 years, actual climate
  - According to Antwerp Waterplan, T20Y2050, return period of 20 years, climate of year 2050
  - Also more intensive rainfalls have to be considered
- Waterplan: standard does not have to be ‘solved’ for each project, but has to be ‘solved’ on the level of a city quarter = level 2 (and thus also on level 1)
- indicative values for storage
  - 25 l/m² for T20 actual climate
  - 54 l/m² for T20 Y2050
A project area =

The area where the project is situated.

Here we want to know the water opgave for the project

For instance: a new larger building development in Berchem
Introduction to the project – terminology

The **project area** is situated in a **sewer area** (level 2).
The sewer area does not completely coincide with the catchment area (level 2).

Based on both you can define the study area (level 2) = city quarter

The study area (level 2) or city quarter is the area in which the project area is situated and where the project has to solve part of the ‘wateropgave’

Part of the total wateropgave is solved in the project area, the other part in the rest of the study area = distribution key / verdeelsleutel
**Introduction to the project – terminology – upstream area**

**Total upstream area** is part of the study area from which water can possibly flow (via the sewer system or via the topography) to the project area.

**The total upstream area** is the part of the study area from which the wateropgave can be solved in the project area.
Introduction to the project – terminology – totale wateropgave

**Total wateropgave** = $T = X + Y + Z$ m³

Total wateropgave = standard = $T20Y2050$

Distribution of total wateropgave $T$ amongst $X$, $Y$ and $Z = \text{distribution key / verdeelsleutel}$
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17.00 Next Steps
Market Consultation process: 5 Steps

1. Scoping session
2. Workshops
3. Market analysis
5. Report

Public Tender

City of Antwerp

A conceptual hydraulic model

Users

60+ Things we want to know and do
Scored on Value

State of the art

Research, Literature, Expert Interviews

Workshop with selected partners

On prioritized use cases: estimate likelihood of success or failure.

i.e. relevance for tender and consequently vendor selection.

A tool that combines a spatial view with a hydrological view

~22 Use Cases.
- Workflow
- Model

Looking for a combination of:
A GIS-workflow tool & (Multiple) Hydraulic Models

© Addestino 2019
a combination of A GIS-workflow tool & Multiple Hydraulic Models

City Databases

Workflow tool
Management of Design Scenarios

optional
Spatial sampler if models are not spatial

Automatic definition of upward/downward drainage area

User-driven Use Cases

Different models
At different levels of detail

Model 1
Model 2
Model 3
Spatial
Model 4

Model Use Cases
“Make a claim on an area land” via a tool: what where and how much?

<table>
<thead>
<tr>
<th>Visie Stadsbreed</th>
<th>Visie Wijk</th>
<th>Studiegebied Verdeelsleutel</th>
<th>Projectgebied Maatvast</th>
<th>Voorontwerp Uitvoering</th>
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</table>

- Niveau van detail
- Wie (rol)
- Gebied in scope

- Waterplan
- Expert Oordeel
- Expert Oordeel
- Tools: Sirio, Aquasensm ICM

- Voorbeeld inhoud

- Groenplan
- Expert (of wijkfiches)
- Expert Oordeel

- Handover
  - Document “een kader”
  - Post-IT “het is geweten”
  - Excel file “digitale flow”
  - “digitale Flow”

© Addestino 2019

Documentation: Post-IT
“Make a claim on area of land” via a tool: what where and how much?

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<tbody>
<tr>
<td>De Grote Lijnen</td>
<td>X m3/ha</td>
<td>Y m3 project Z m3 wijk</td>
<td>Waterbalans uitrekenen</td>
<td>Diameters, waar zit de leiding?</td>
</tr>
<tr>
<td>Districtsbestuur</td>
<td>Ruimtelijk planner wijkinrichting</td>
<td>Project Ingenieur wijkinrichting</td>
<td>Project Ingenieur Ontwerper</td>
<td>Project Ingenieur Ontwerper</td>
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<td>Stadsbestuur</td>
<td></td>
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<tr>
<td>Antwerpen in 5 Sectoren</td>
<td>Wijkniveau 50 sectoren</td>
<td>Uitgebreide Project Zone</td>
<td>Project Zone</td>
<td>Project Zone (detail)</td>
</tr>
</tbody>
</table>

**Niveau van detail**
- Wie (rol)
- gebied in scope
- Ruimte Voor water
- Voorbeeld inhoud
- Voorbeeld inhoud
- Ruimte voor groen
- Handover

**Waterplan**
- Ambitie: T20/2050 Deze cascasde is beschikbaar (A-B-C)
- Mogelijke A-B-C obv van voorkeuren
- Wat is de uitgebreide zone?
- Gronwaterstand Infiltratie capaciteit
- Waterwingebied Voldoende ruimte

**Expert Oordeel**
- Vier Domeinen
  - Probleem zones water
  - Gebruiksgroen
  - Hitte en verkoeling
  - Ecologie
- Bv. Kijk eerst naar privé
- Ruimtelijke Analyse Plijntjes, straten, privé

**Groenplan**
- Document “een kader”
- Post-IT “het is geweten”
- Excel file “digitale flow”
- “digitale Flow”

**Tools:** Sirio, Aquasensm ICM
Focus for the workflow tool

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Methodology: estimating user value and technological risk

![Graph showing user value and technological risk](image-url)
Value for users is captured in use cases

Stakeholders (users)

including

• “Water” Planners
• “Green” Planners
• Management

needs are captured in use cases

AS A [Stakeholder]
I CAN [do / have something]
SO THAT [I can achieve a certain goal]

What are we looking for what do we need, what do we want?

Get a rough simulation of a design for water at different stages of the planning process

Example:

AS A Planner
I CAN simulate a T20/2050
SO THAT I have hard numbers that argue for my design
estimating user value and technological risk

from a user perspective

Value 13

from a technological perspective

Risk
Planning Poker: Estimation technique

‘best practice’ to estimate a.o. value, complexity and required effort supported by estimations and consensus of domain experts.

Scoring:
0  No issues, of the shelf solutions exist.
2-3  A frequent problem, a few special cases might exist but can definitely be solved.
13  Not a standard problem at all. A solution requires important decisions, thorough thinking and specific development. A decent chance at success if provided with sufficient time and resources.
100  Impossible, requires breaking physical laws.
?  No idea, no experience regarding this topic.
Open Market Consultation

Process: For each use case:

• We will read out loud a short description of a key feature (use case) of the project out loud (the description is available in the planITpoker tool as well, no need to write them down)

• Check that everyone understands
  • Slides shared in Teams call show visualizations and explanations in case terminology is not clear

• Clarify if needed, “water planning” experts are available to supply further details if needed

• Individually assess the likelihood that the feature (use case) can not be delivered successfully

  Assessment via Planning Poker:

  • Roundtable discussion why or why not – i.e. what is the rationale behind the assessment
Online Platform: planITpoker

https://www.planitpoker.com/board/#/room/3409cbd592b747beab4e33b793d9dbaa

Scoring:

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17.00 Next Steps
use cases and requirements for Workflow

Workflow tool
Management of Design Scenarios

optional
Spatial sampler if models are not spatial

Automatic definition of upward/downward drainage area

Many different models
At different levels of detail

Model 1
Model 2
Model 3
Spatial Model 4
Model Use Cases

City Databases

User-driven Use Cases
Use Case 0: Existing IT Infrastructure at Digipolis, ArcGIS / ACPaaS platform

**Must** at least Retrieve Data and store results

**Preferred**

ESRI REST Services

ArcGIS access via AD-accounts

Data (to be made) available:

- Waterplan (cascade)
- Greenplan
- Existing WSB
- Flood map
- Groundwater
- Heat & heatstressmaps
- Waterways, drains...

GeoAPI

ACPaaS specific API for spatial queries

Location Picker API

Workflow tool

- Model 1
- Model 2
- Model 3
- Model 4

https://portaal-stadantwerpen.opendata.arcgis.com/
Use Case A1

The tool integrates, imports and exports data to and from the existing tooling and IT landscape so that planners do not need to manually touch-up any of the data.

Example Data to be integrated:
- Waterplan (cascade), Greenplan, Existing WSB, Flood maps, Groundwater depth maps, Heat & heat stress maps, Waterways, drains...

Scoring:
- 0: No issues, of the shelf
- 2-3: A frequent problem, can be solved.
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Use Case A2

As a planner I can draw a “project area” on a map and have the “study area” and the “upstream area” automatically calculated so that I know the total “wateropgave” $T$ and the elements that contribute to it.

- Elements: project area, study area, upstream area (can be determined by e.g. a reverse routing lookup)
- “Wateropgave”: Ideally to 10 à 50 m³ accuracy

**Scoring:**

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Use case A3

As a planner I can mark the location of a water buffer on a map, enter the maximum waterlevel so that the tool will automatically show which area drains above ground towards my buffer on the map
Use Case A4

As a designer I manage a combination of water sensitive building blocks and their locations as a scenario so that they become easy to manage

Note: multiple scenarios for the same area can exist at the same time

Scenario: multiple WSB

• Type, buffers, infiltration, rainwater drainage etc.
• Placement
• Dimensions
Use case A5

As a planner I can see on a map a first indication of the different steps of the water cascade so that I can change them and see where to assign eater sensitive building blocks to.

Waterplan en A-B-C cascade

Kleurcodes voor elke A-B-C
Mogelijkheid om tijdelijk aan te passen (simulatie)
Of permanent op te slagen in database
Use Case A6

As an advisor I can retrieve the remaining amount of water to be buffered for a specific project area so that I can tell the project developers how much buffers (m³) they need to implement and over what area (m²) water needs to be able to infiltrate

Total wateropgave = $T = X + Y + Z$ m³

Total wateropgave = standard = $T_{20Y2050}$

Distribution of total wateropgave $T$ amongst X, Y and Z = distribution key / verdeelsleutel
Use Case A9

As a designer I can enter degrees of freedom for a scenario and have the tool automatically create optimal scenarios
Use Case A11

As a designer I can show the positive impact of a scenario (less flooding, avoided damages) so that I can have hard numbers that are relevent to the city stakeholders (i.e. non-hydraulic numbers)
Use Case A12

As a designer I can visualize the positive impact of a scenario (flood maps, infiltration capacity map) so that I can illustrate the effects and show which scenario is best.
Use Case A13

As a designer I can try the tool early in the development so that the development is agile/iterative and we can give feedback as soon as possible
Use Case A14

As a designer I can estimate the spatial impact of a scenario so that I can judge whether a certain area can still have meaningful other use (e.g. could still be used as a sportsfield)
Use Case A15

As a designer I can use different hydraulic models without reworking the data so that I can transparently switch between different models at different levels of detail and accuracy.
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Use cases and requirements for Hydraulic Model

City Databases

Workflow tool
Management of Design Scenarios

optional Spatial sampler if models are not spatial

Automatic definition of upward/downward drainage area

User-driven Use Cases

Different models
At different levels of detail

Model 1

Model 2

Model 3

Spatial Model 4

Model Use Cases
The hydraulic model can simulate the hydraulic behaviour of all possible water sensitive building blocks (if absolutely required modelled by type is an option) that make up a city drainage and sewage system.

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<td>regentuin</td>
<td>(infiltratie)buffering</td>
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<td>2</td>
<td>reduceren verhardoppervlak (privé)</td>
<td>aanpassing verharding</td>
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<td>ondergrondse waterbergung (privé)</td>
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<td>(infiltratie)buffering + routing</td>
</tr>
<tr>
<td>23</td>
<td>singel</td>
<td>(infiltratie)buffering + routing</td>
</tr>
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<td>(infiltratie)buffering + routing</td>
</tr>
<tr>
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<td>waterspeelplaats</td>
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</tr>
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<td>26</td>
<td>waterplein</td>
<td>(infiltratie)buffering</td>
</tr>
<tr>
<td>27</td>
<td>nieuwe sloot / smalle waterstructuur</td>
<td>(infiltratie)buffering + routing</td>
</tr>
<tr>
<td>28</td>
<td>nieuwe waterverbinding</td>
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</tr>
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<td>29</td>
<td>openmaken van duikers</td>
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</tr>
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<td>toevoegen oppervlakteverharding</td>
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</tr>
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<td>overstroombare kade</td>
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</tr>
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</table>
Use Case: M2

The model can analyze water sensitive building blocks on the level of:

1. A ‘catchment’ (+- 7 in the city of Antwerp)
2. A city quarter (+- 100 in the city of Antwerp)

The lowest geometrical element up to which the model is detailed is a main street, a number of smaller (and similar) streets or a housing block, so no individual houses or conduits. The smallest geometrical element depends also on the model level.

1. For a catchment: a city quarter or part of city quarter.
2. For a city quarter: street, square, park, housing block, ...
Use case M3

The hydraulic model must be able to simulate the hydraulic behaviour of the urban water system

a) Impact on floods for different return periods (f10, f7, f1, T2, T5, T20, T50, T100) and different climate scenarios (current climate, high climate 2030, 2050 and 2100).

b) Infiltration to / replenishment of the subsurface (based on static groundwater maps and known infiltration capacity data)

c) Frequency and duration with which infiltration elements, water buffers, ... contain water and over which are

d) approximate water flows / water volumes in the system (water balance)
Use case M4

The hydraulic model must be able to calculate longer (100-year, 10’ time step) time series. Both upstream (precipitation, evaporation and possible inflow rates) and downstream boundary conditions (river Scheldt levels, dock levels, ...) must be taken into account. Time series for urban water use (household, industrial,...) must also be considered.
Use case M5

The model must allow to be step-wise elaborated from a working, highly simplified model for e.g. a treatment area, sewer area, catchment area, to a more detailed model. The lowest level to which can be detailed is the level of a major street or a building block (so no separate buildings).
Use case M7

The hydraulic model must be accurate enough to make meaningful comparisons between scenarios. The desired level of accuracy depends on the level at which the simulation is run.

For example

- at the highest level (a sewer treatment area) only the impact of inundations at the level of detail of city quarter is required.
- At the level of a city quarter the extent and volume should be calculated at the level of a street or square.
Use case M8

The hydraulic model should be able to simulate a 100-year time series (with a timestep of 10 minutes) for a particular scenario within 5 minutes, without requiring exotic hardware.
Use case M9

The hydraulic model should be a spatial model so that the inputs (elevation model, location of streets etc.) and outputs of the model are spatial as well.
Use Case M10

The hydraulic model should be extendable by 3rd parties so that the City of Antwerp and Aquafin can update it, or have it updated as new insights and needs emerge. E.g. add a new type of green roof.
Use Case M11

The model should be able to cope with missing or incomplete data, e.g. work with meaningful defaults or interpolate values.
Agenda

12.50 Registration / Logging in

13.00 Introduction: Programme for Innovation Procurement  
_Veerle Lories, PIO_

13.10 Introduction to the project ‘Conceptual Hydraulic Model’  
_Ronny Van Looveren, Stad Antwerpen_

13.30 Market consultation, use cases and requirements for Workflow  
_Jo Degraef, Addestino_

15.00 Break

15.15 Market consultation, use cases and requirements for Hydraulic Model  
_Jo Degraef, Addestino_

17.00 Next Steps
Next Steps: Timeline

- **Jun 2021**: Public Tender
- **Sep Q2-2021**: Evaluation
- **Dec Q4-2021**: Selection
- **Dec Q4-2021**: PoC
- **Dec Q4-2022**: Agile Delivery
- **Dec Q4-2022**: Final Deliverable
Thank You