SCOREwater

Smart City Observatories implement REsilient Water Management

DELIVERABLE D4.16

INTEGRATION OF EXISTING ICT MODULES IN THE SCOREWATER PLATFORM

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ABBREVIATIONS

Abbreviation	Definition
CKAN	Comprehensive Kerbal Archive Network
ICT	Information and Communications Technology
IoT	Internet of Things
SDG	Sustainable Development Goals
SME	Small and Medium-sized Enterprise

PROJECT ABSTRACT

SCOREwater focuses on enhancing the resilience of cities against climate change and urbanization by enabling a water smart society that fulfils SDGs 3, 6, 11, 12 and 13 and secures future ecosystem services. We introduce digital services to improve management of wastewater, stormwater and flooding events. These services are provided by an adaptive digital platform, developed and verified by relevant stakeholders (communities, municipalities, businesses, and civil society) in iterative collaboration with developers, thus tailoring to stakeholders' needs. Existing technical platforms and services (e.g. FIWARE, CKAN) are extended to the water domain by integrating relevant standards, ontologies and vocabularies, and provide an interoperable open-source platform for smart water management. Emerging digital technologies such as IoT, Artificial Intelligence, and Big Data is used to provide accurate real-time predictions and refined information.

We implement three large-scale, cross-cutting innovation demonstrators and enable transfer and upscale by providing harmonized data and services. We initiate a new domain "sewage sociology" mining biomarkers of community-wide lifestyle habits from sewage. We develop new water monitoring techniques and data-adaptive storm water treatment and apply to water resource protection and legal compliance for construction projects. We enhance resilience against flooding by sensing and hydrological modelling coupled to urban water engineering. We will identify best practices for developing and using the digital services, thus addressing water stakeholders beyond the project partners. The project will also develop technologies to increase public engagement in water management.

Moreover, SCOREwater will deliver an innovation ecosystem driven by the financial savings in both maintenance and operation of water systems that are offered using the SCOREwater digital services, providing new business opportunities for water and ICT SMEs.

EXECUTIVE SUMMARY

The SCOREwater platform is a solution based on existing open source software components, standards and data models. Where possible and applicable FIWARE-components are used.

The SCOREwater platform also facilitates the achievement of business goals for each city, as described in their demonstration projects. This document describes the implementation of the Amersfoort user stories for the SCOREwater-demonstration project, as described in Deliverable 3.1. The implementation for the City of Amersfoort includes connections with existing systems and data sources, like Meet je Stad (measure your city, a citizen science project), Hydronet (commercial solution from Hydrologic) and open data sources from the city of Amersfoort.

1. INTRODUCTION

The SCOREwater platform developed within the frame of WP3 will be implemented in each city. This document describes the implementation for the City of Amersfoort and the connection with existing systems and data sources from the City of Amersfoort. The generic aspects of the implementation of the SCOREwater platform are described in D3.1. This deliverable uses the input from tasks in from WP3, like the architectural guidelines, standards and models.

We will connect existing ICT-systems and data solutions to the SCOREwater Platform (e.g. HydroNET, used by the majority of Dutch water managers). The result of this deliverable will be:

1- An integrated data management platform (SCOREwater platform) to support the demonstration projects that incorporates the existing open data platform

2- A connection from the SCOREwater platform to internal systems and data sources in the City of Amersfoort

3- A connection from the SCOREwater platform to data sources and information products from 3rdparties like HydroNET

4- An integration of sensors and data streams into the SCOREwater platform to support the demonstrations projects. The results of this deliverable provide input for tasks 5.1, 5.3, 6.1, 8.3 and 8.6.

2. USER STORIES

This deliverable refers to Chapter 2 of Deliverable 3.1 for the user stories. In that document generic stories have been described for all cities for uploading, harvesting and managing of data, the data market and underlying models and standards.

In paragraph 3.2.4 of Deliverable 3.1 the data models for the Amersfoort case are described. This document builds upon those descriptions and focuses on progress regarding the sensors and data sources of the demonstration projects.

3. INTERNAL SYSTEMS AND DATA SOURCES FROM AMERSFOORT

The existing Amersfoort Open Data Platform will be integrated in and updated to the SCOREwater platform. New data sources mentioned in this document will be made available in the open data portal.
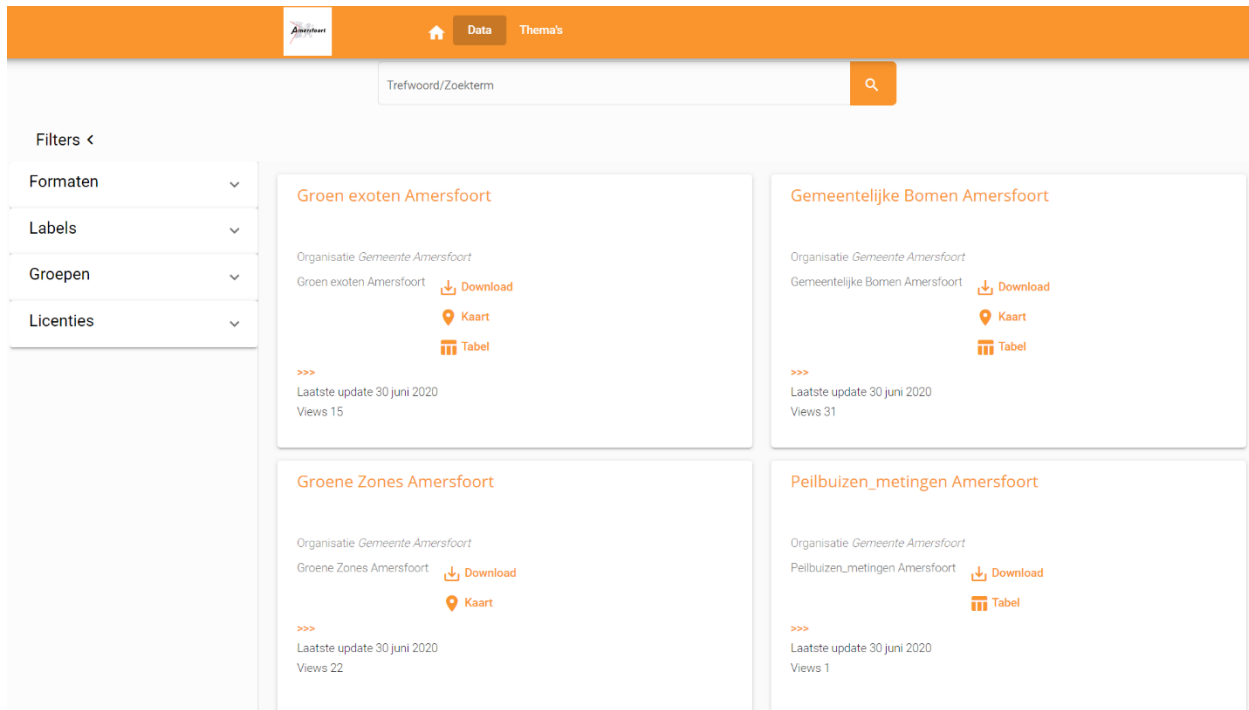
Figure 1 Open Data platform of the City of Amersfoort

The Amersfoort Open Data Platform is based on CKAN (see Figure 2 CKAN-instance for Amersfoort with existing data sources), one of the components of the SCOREwater platform and part of the FIWARE-architecture. Currently the City of Amersfoort has added 42 different datasets to their open data platform.

Currently, most of these datasets are added manually. The SCOREwater platform (CKAN) supports automatic upload/synchronisation of data. With the City of Amersfoort steps are taken to use their existing ETL-tools (Extract, Transform. Load), which makes it possible to upload data directly from their internal source systems. The other option is to use a so-called harvester. CKAN offers functionality to connect to internal (geo)systems and synchronize the data with the SCOREwater platform. Both option (ETL and harvester) will be discussed with Amersfoort.
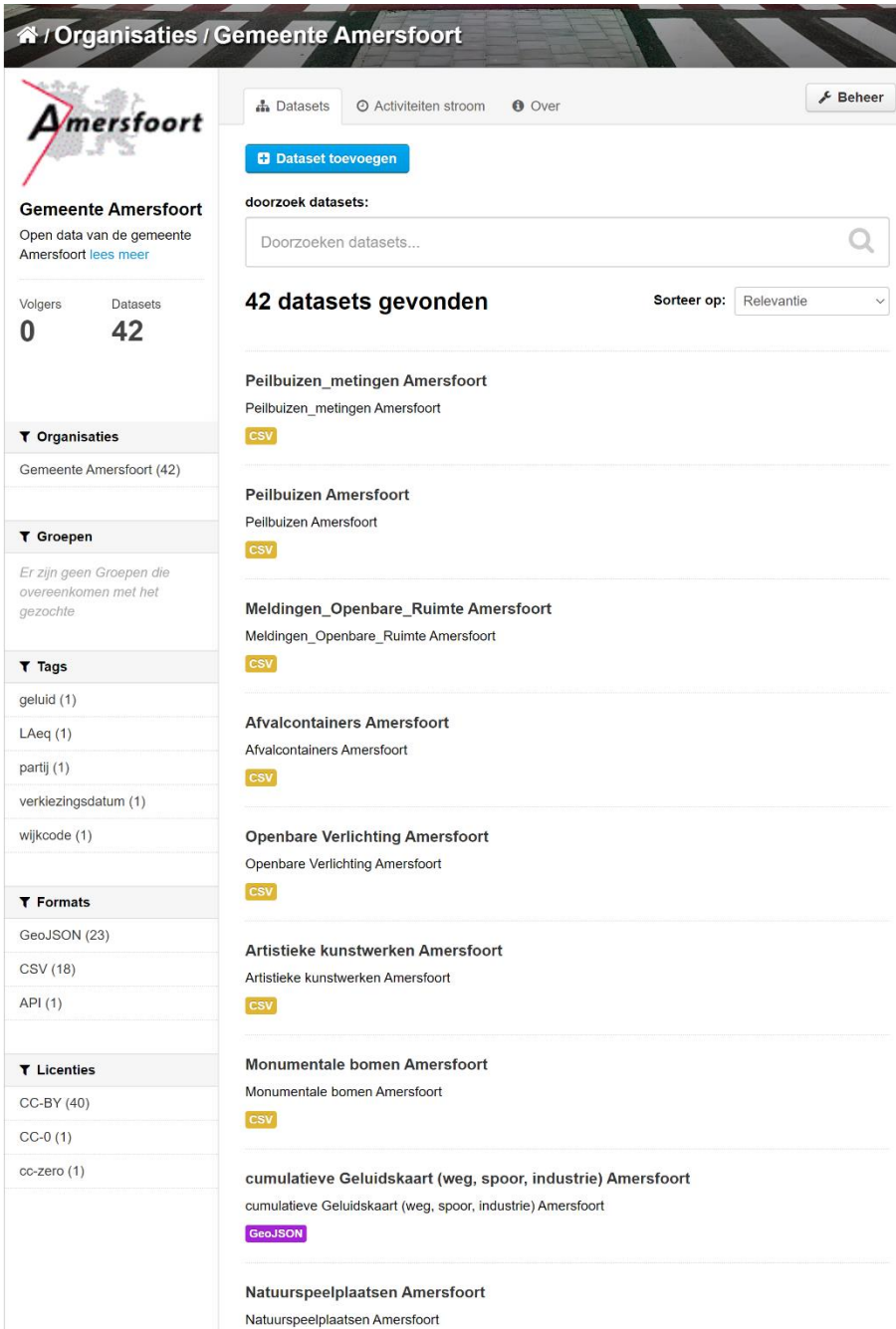
Figure 2 CKAN-instance for Amersfoort with existing data sources

More datasets will be added step by step. Actions have started to add data on the sewerage system, based on the (Dutch) standard Data Dictionary Urban Water (Rioned, 2020).

The City of Amersfoort wants to use their data (and the data of 3rd parties) for the development of a Digital Twin. The SCOREwater platform, with all its different, standardized data sources, is the data provider for this solution.

In addition to the (static) open data sources of the City of Amersfoort, the SCOREwater platform provides sensor data from multiple sources. The available sensor data is described below (and explained in D3.1).

3.1. AIR QUALITY

The City of Amersfoort is one of the participants in a project called Snifferbike. Over 500 mobile sensors on bicycles in the province of Utrecht collect data every 10 seconds about air quality and cycle routes (see Figure 3 The Snifferbike-proces from sensor to dashboard).

Data is made available as open data (see Figure 5 Open data from Snifferbike (CSV and CKAN API)) and will be transformed to be compliant with the FIWARE data model (air quality observed). Currently a standard CKAN-API is available for the Snifferbike data (see Figure 6 Response from CKAN API for Snifferbike data). The next step will be to map the sensor data to the FIWARE-model and discuss some remaining issues with the FIWARE Foundation about the metadata available through the model. Since we focus on collaborating with FIWARE, our goal is to improve this data model. Other possible standards have not been investigated.
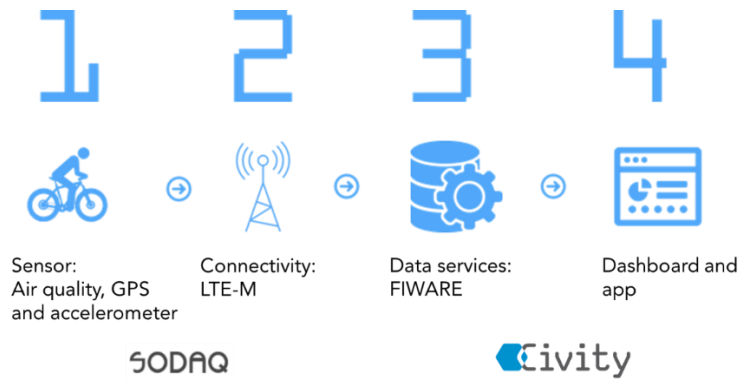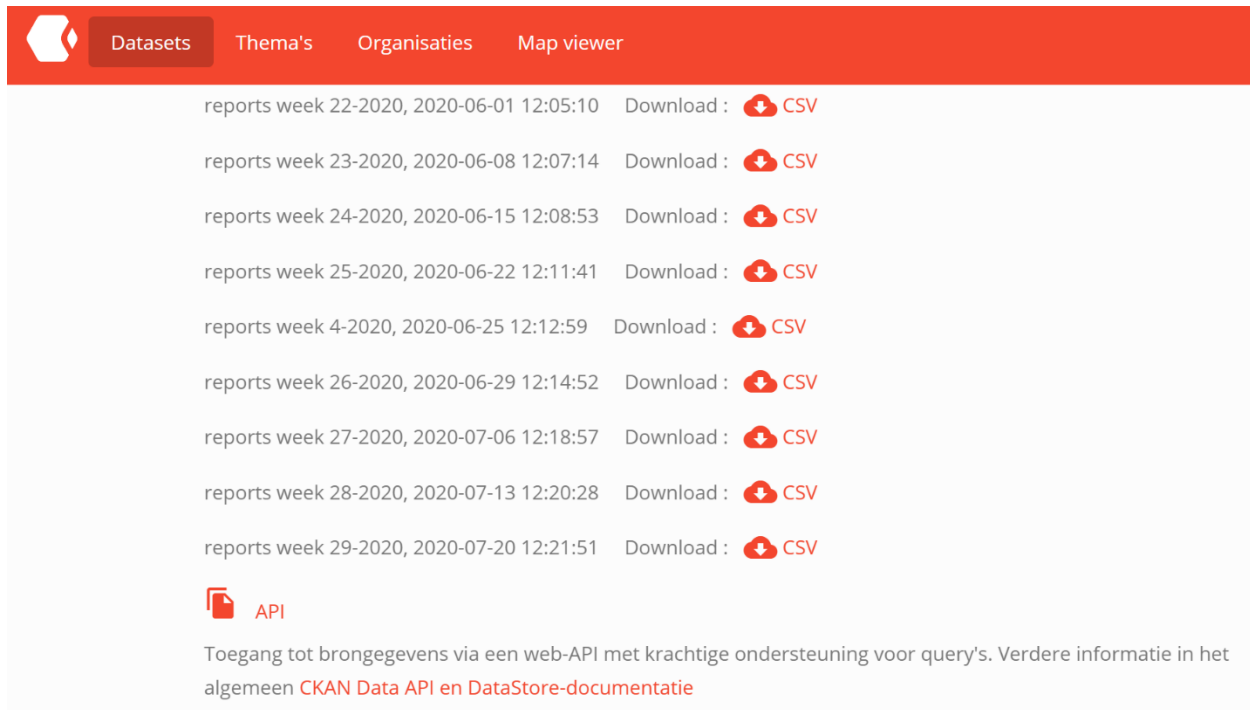

Figure 3 The Snifferbike-proces from sensor to dashboard

Figure 4 The current Snifferbike sensor for measuring air quality and cycle routes

Datasets   Thema's   Organisaties   Map viewer

reports week 22-2020, 2020-06-01 12:05:10   Download : CSV

reports week 23-2020, 2020-06-08 12:07:14   Download : CSV

reports week 24-2020, 2020-06-15 12:08:53   Download : CSV

reports week 25-2020, 2020-06-22 12:11:41   Download : CSV

reports week 4-2020, 2020-06-25 12:12:59   Download : CSV

reports week 26-2020, 2020-06-29 12:14:52   Download : CSV

reports week 27-2020, 2020-07-06 12:18:57   Download : CSV

reports week 28-2020, 2020-07-13 12:20:28   Download : CSV

reports week 29-2020, 2020-07-20 12:21:51   Download : CSV

API

Toegang tot brongegevens via een web-API met krachtige ondersteuning voor query's. Verdere informatie in het algemeen CKAN Data API en DataStore-documentatie

Figure 5 Open data from Snifferbike (CSV and CKAN API)

```
{
    "_id": 487,
    "sensor": "6617042c764c6b9976d01659cc8c5f0c",
    "air_quality_observed_id": 38213262,
    "lon": 5.53092479705810547,
    "lat": 52.0331077575683594,
    "recording_time": "2020-07-19T21:14:20",
    "trip_sequence": 23,
    "humidity": 62,
    "pm10": 4,
    "pm1_0": 3,
    "pm2_5": 3,
    "pressure": 1017,
    "temperature": 20.9000000000000000,
    "voc": 135,
    "voltage": 3.87000000000000000000,
    "error_code": 0,
    "version_major": 1,
    "version_minor": 7,
    "acc_max": 0,
    "no2": 0
},
```

Figure 6 Response from CKAN API for Snifferbike data

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This project is a showcase in the newly founded "Data- en Knowledge Hub Healthy Urban Living", a collaboration between research institutes, government agencies, private sector and citizens. Together with the national Dutch agency for Health and Environment (RIVM) the Snifferbike data collected, is verified and analysed. The goal is to develop an integrated datastore to support research and solution for healthy urban living. The SCOREwater platform is an important contributor to this goal.

Within the SCOREwater platform the FIWARE-model "Air quality observed" (FIWARE, 2020) is used to harmonize the air quality data collected from Snifferbike. A dashboard shows daily results and routes.
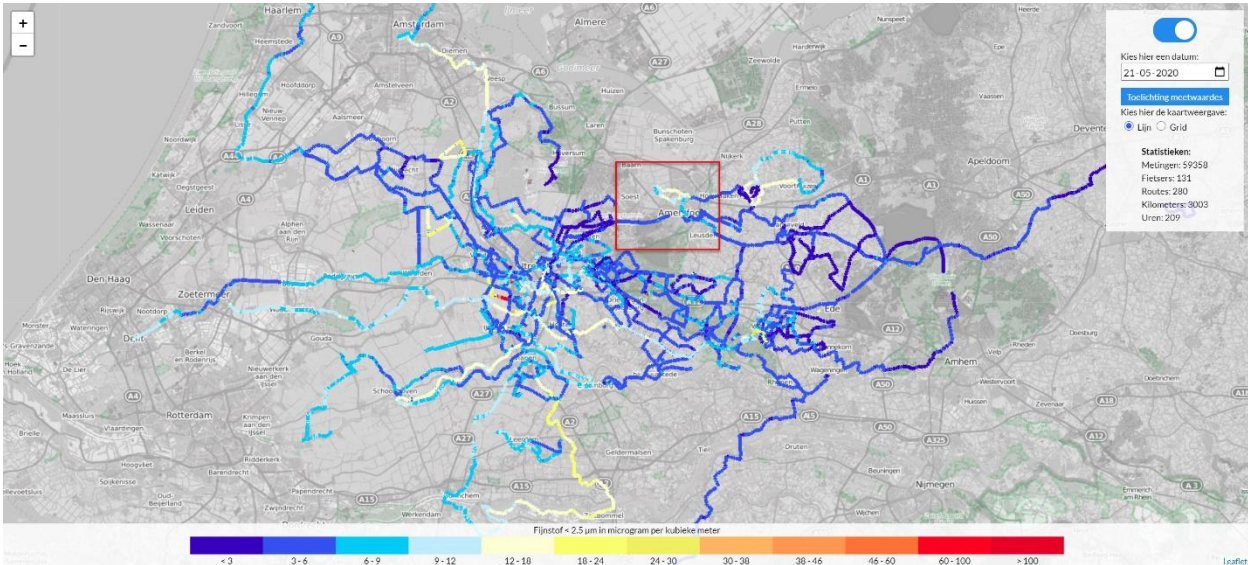
Figure 7 Daily air quality dashboard for Snifferbike (red square is Amersfoort-region)

3.2. WEATHER

The SCOREwater platform in Amersfoort collects data from "Meet je Stad" (measure your city). This citizen science project develops sensors for collecting data about temperature and humidity. All data is available as open data (https://meetjestad.net/data/). Within the SCOREwater platform this data is transformed to fit the FIWARE-data model, stored on the SCOREwater platform and made available with an open API, based on the OpenAPI Specification (OAS, 2020).
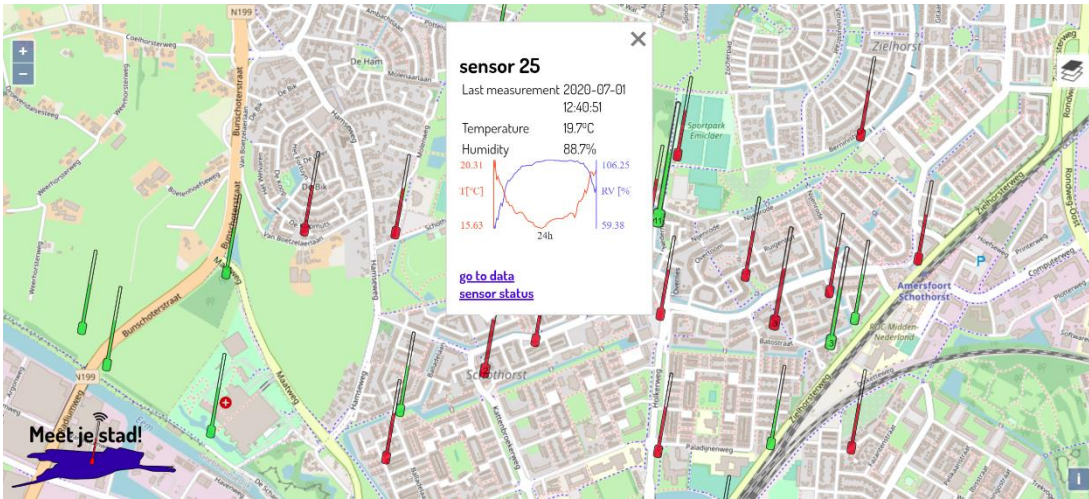
Figure 8 Map from "meet je stad" with sensors and information about temperature and humidity
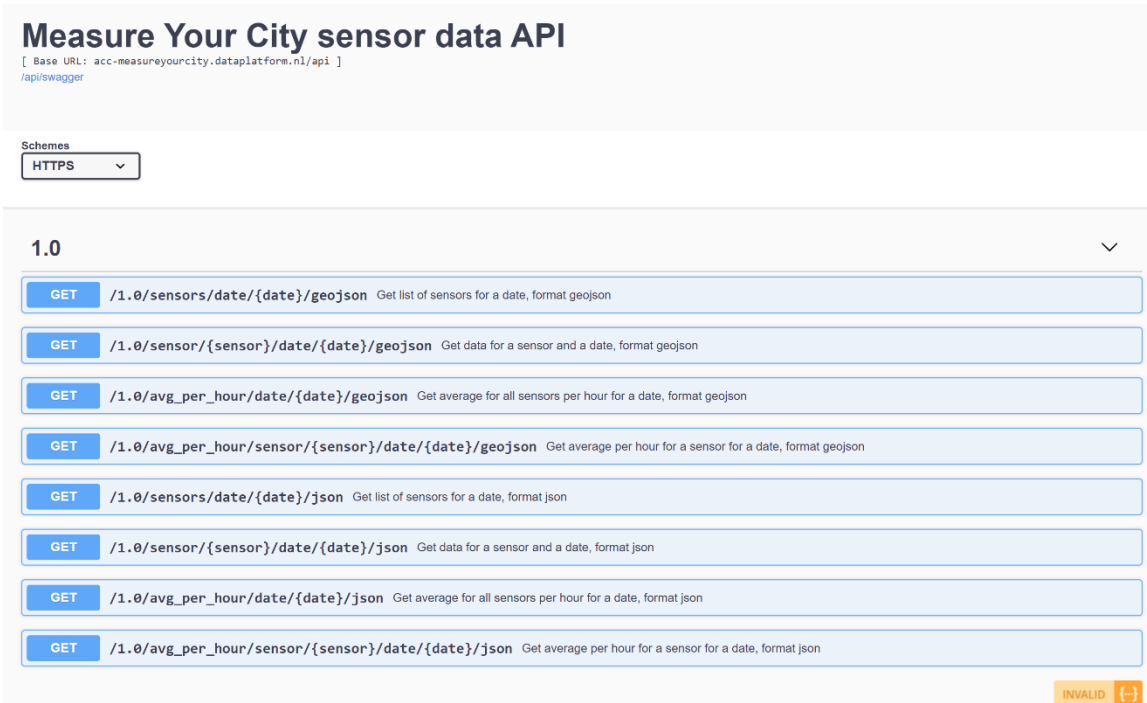
Figure 9 Meet je Stad (Measure your City) open API based on FIWARE data model and OpenAPI-specification

In the case of Measure your City the raw data will be transformed to the Weather Observed FIWARE data model (FIWARE, 2020). Not all attributes are available for a full mapping/processing and more research needs to be done.

3.3. WATER

One of the projects in Amersfoort is about the risk of flooding in the station area. The goal is to send alerts in case of potential flooding, so that preparations can be made to minimize the consequences of the flooding.

No sensor data is available yet due to a delay in acquisition and installation of sensors by the City of Amersfoort.

Data about ground water levels is available on the open data platform of the City of Amersfoort.

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In July a citizen science project has started to measure soil moisture. The first prototype of the sensor is available on Github: https://github.com/meetjestad/mjs_soil_moisture.

All data mentioned above will be available on the SCOREwater platform as soon as possible.

3.3.1. HYDRONET

Hydronet is the platform from Hydrologic, one of the partners in the SCOREwater project. It is a decision support system for water managers, based on data from radars, satellites, ground measurements, databases and other sources. Hydrologic combines and transforms these individual (open and commercial) data sources through smart algorithms into meaningful information.

The Hydronet platform will be connected to the SCOREwater platform and harvest the metadata from Hydronet. Users can find available information in the SCOREwater market place, with all relevant metadata. To use the information/model they are (re)directed to Hydronet for the actual (commercial) information.

3.3.2. SCADA

The waterboard Vallei & Eem in the Amersfoort region recently started the standardisation of their SCADA systems (Scada, 2020) for 16 sewage treatment installations, 87 sewage pumping stations and several connections with approximately 18 different external data sources. The delivery data of this project is 2022, but meetings are ongoing to investigate earlier use of available data sources.

3.4. DIGITAL TWIN

Currently the City of Amersfoort is investigating the use of tools for creating a Digital Twin (like for example Tygron) within the SCOREwater-project. No decisions have been made yet. The data that will be used in this digital twin, will be provided by the SCOREwater platform through open standards/services (API, WFS, etc.)

4. CONCLUSION

This Deliverable is a further specification of D3.1 and describes actions taken to connect data sources from the City of Amersfoort, sensors and 3rd parties to the SCOREwater platform. User stories, platform implementation and connecting data sources are in full progress and an ongoing activity.

5. REFERENCES

FIWARE. (2020). *FIWARE data models*. Retrieved from FIWARE: https://fiware-datamodels.readthedocs.io/en/latest/Weather/WeatherObserved/doc/spec/index.html

OAS. (2020). *Open Api Specification*. Retrieved from Open Api Specification: https://www.openapis.org/

Rioned. (2020). *Gegevenswoordenboek Stedelijk Water*. Retrieved from Gegevenswoordenboek Stedelijk Water: https://www.riool.net/applicaties/gegevenswoordenboek-stedelijk-water

Scada. (2020). *Scada systems*. Retrieved from Scada Systems: http://www.scadasystems.net/

ANNEX 1 – STOCKTAKING

A final Annex of stocktaking was included in all Deliverables of SCOREwater produced after the first half-year of the project. It provides an easy follow-up of how the work leading up to the Deliverable has addressed and contributed to four important project aspects:

1. Strategic Objectives
2. Project KPI
3. Ethical aspects
4. Risk management

STRATEGIC OBJECTIVES

Table 1 lists those strategic objectives of SCOREwater that are relevant for this Deliverable and gives a brief explanation on the specific contribution of this Deliverable.

Table 1. Stocktaking on Deliverable's contribution to reaching the SCOREwater strategic objectives.

Project goal	Contribution by this Deliverable
SO1: Deploy and demonstrate a smart water management approach, which is people-centred, inclusive, interoperable, flexible and safe.	This deliverable provides open data from COA and data from Hydrologic to the SCOREwater platform, based on open (meta)data standards and an integral approach. Participation is stimulated by citizen science projects (Meet je Stad, Snuffelfiets). Different groups from society are involved.
SO2: Harmonize and improve interoperability opportunities in the water sector	The SCOREwater platform complies with FIWARE and SCOREwater participates in (inter)national initiatives aimed at standardisation and interoperability (FIWARE open data models).
SO3: Enable the monetization of water cycle data	This deliverable adds (sensor) data from multiple parties in a market place with options to control API-access and manage business models for monetization of data on the SCOREwater platform
SO4: Demonstrate benefits of smart water management for increased water-system resilience against climate change and urbanization	The (standardised) data streams provided through the SCOREwater platform are an enabler for new solutions and services for water system resilience and climate adaptation and contribute to sustainable urban development.
SO5: Identify and mitigate key barriers to implementation of smart, resilient water management	The provisioning of multiple data streams, from different stakeholders on the SCOREwater platform demand easy to use tools, documentation and examples. The concrete projects already available help others to develop new solutions and services.
SO6: Increase citizen involvement and engagement in the transition to a water-smart, resilient society	This deliverable enables citizens to participate actively in projects (Meet je Stad, Snuffelfiets) and through open data to be involved in the transition to a water-smart, resilient society.

PROJECT KPI

Table 2 lists the project KPI that are relevant for this Deliverable and gives a brief explanation on the specific contribution of this Deliverable.

Table 2. Stocktaking on Deliverable's contribution to SCOREwater project KPI's.

Project KPI	Contribution by this deliverable
KPI2: Number of input data-sources connected and consumed	Sensor data from "Meet je Stad" and the "Snuffelfiets" projects are added to the SCOREwater platform and transformed to the FIWARE data model and OpenAPI specification. The "Meet je stad" en Snuffelfiets provide API are connected, but not yet consumed by other applications
KPI9: Number of Open Data Catalogues in the Data Market	The Open data portal of COA, based on CKAN and integrated in the SCOREwater platform, offers 42 datasets.
KPI21:Cross-domain integration with other Open Data Catalogues	The Open data portal of COA is connected (based on the DCAT-standard) with the national open data portal and the EU open data portal.
KPI10: Standardization barriers identified and mitigation options demonstrated	SCOREwater is participating in the development of open, FIWARE-based data models in collaboration with other EU-projects to increase interoperability and standardisation
KPI12: Technological barriers identified and mitigation options demonstrated	Some connections with sensors, the collection of data and the harmonised API from SCOREwater platform are available. The technical challenges to provide the SCOREwater platform as containerized modules is work in progress, especially where it concerns the Data Market.

ETHICAL ASPECTS

Table 3 lists the project's Ethical aspects and gives a brief explanation on the specific treatment in the work leading up to this Deliverable. Ethical aspects are not relevant for all Deliverables. Table 3 indicates "N/A" for aspects that are irrelevant for this Deliverable.

Table 3. Stocktaking on Deliverable's treatment of Ethical aspects.

Ethical aspect	Treatment in the work on this Deliverable
Justification of ethics data used in project	In compliance with open data policy of COA
Procedures and criteria for identifying research participants	N/A
Informed consent procedures	N/A
Informed consent procedure in case of legal guardians	N/A
Filing of ethics committee's opinions/approval	N/A
Technical and organizational measures taken to safeguard data subjects' rights and freedoms	In accordance with D9.x where applicable
Implemented security measures to prevent unauthorized access to ethics data	In accordance with D9.x where applicable

Describe anonymization techniques	N/A
Interaction with the SCOREwater Ethics Advisor	N/A

RISK MANAGEMENT

Table 4 lists the risks, from the project's risk log, that have been identified as relevant for the work on this Deliverable and gives a brief explanation on the specific treatment in the work leading up to this Deliverable.

Table 4. Stocktaking on Deliverable's treatment of Risks.

Associated risk	Treatment in the work on this Deliverable
Dependency on installation of sensors by COA	Installation of additional sensors is delayed. Technical preparations are made to connect sensors when available