Co-UDlabs

Building Collaborative Urban Drainage research Labs communities

D3.1. 1st Report on training and education activities

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Background: about the Co-UDlabs Project

Co-UDlabs is an EU-funded project aiming to integrate research and innovation activities in the field of Urban Drainage Systems (UDS) to address pressing public health, flood risks and environmental challenges.

Bringing together 17 unique research facilities, Co-UDlabs offers training and free access to a wide range of high-level scientific instruments, smart monitoring technologies and digital water analysis tools for advancing knowledge and innovation in Urban drainage systems.

Co-UDlabs aims to create a urban drainage large-scale facilities network to provide opportunities for monitoring water quality, UDS performance and smart and open data approaches.

The main objective of the project is to provide a transnational multidisciplinary collaborative research infrastructure that will allow stakeholders, academic researchers, and innovators in the urban drainage water sector to come together, share ideas, co-produce project concepts and then benefit from access to top-class research infrastructures to develop, improve and demonstrate those concepts, thereby building a collaborative European Urban Drainage innovation community.

The initiative will facilitate the uptake of innovation in traditional buried pipe systems and newer green-blue infrastructure, with a focus on increasing the understanding of asset deterioration and improving system resilience.

List of acronyms

Acronym / Abbreviation	Meaning / Full text
AaU	University of Aalborg
CA	Consortium Agreement
CITEEC	Center for Technological Innovation in Construction and Civil Engineering
DEL	Deltares
ECTS	European Credit Transfer and Accumulation System
ESR	Early-Stage Researcher
FTIR	Fourier transform infrared spectroscopy
GA	Grant Agreement
IKT	Institute for Underground Infrastructure
INSA	National Institute of Applied Sciences
JRA	Joint Research Activity
LIDAR	Airborne light detection and ranging
RI	Research Infrastructure
SfM	Structure from motion
TA	Transnational Access
UD/UDS	Urban Drainage / Urban Drainage System
UDC	University of A Coruña
USFD	University of Sheffield
WP	Work Package

Executive summary

This document is a deliverable of the Co-UDlabs project, funded under the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 101008626.

The aim of this document is to report on the different types of training and education activities organized by the project partners under WP3 in the first reporting period (M1 -M18), as well as the plan for the next months. Through the organization of these events, WP3's objectives are to:

- Enhance the transfer of knowledge and develop new skills among the project partners and between the research community and the practitioner's community;
- Foster the use of the Co-UDlabs Research Infrastructures via tailored actions targeting their future users;
- Create a pool of high-qualified professionals via adequate training activities targeted to general Urban Drainage community, with a special attention to increase the participation of the industry and the early-stage researchers' community.

1. The Co-UDlabs training programme

In support of its research activities and the establishment of a pan-European Network for Urban Drainage Innovation, Co-UDlabs is organising a series of training activities and initiatives throughout its implementation, as part of WP3. The project's training strategy is based on three main pillars:

- UD early-stage and junior researchers' activities and training events (Task 3.1)
- UD industry professionals and practitioners training activities (Task 3.2)
- Public webinars on specific and emerging monitoring techniques in UD (Task 3.3)

These events will take place in a hybrid, online or physical format, depending on the changing scenario of the COVID-19 pandemic and any other limitations.

Whenever possible, these trainings will be recorded and will be made available online on the Co-UDlabs **YouTube channel** (https://www.youtube.com/channel/UC29gqHMkX1w9QReChDcXniQ) that has been created in April 2022. We expect to produce several topic-based videos of about 3 to 10-minute long, featuring explanations and divulgation of specific techniques and protocols that can be universally relevant to operation and innovation in urban drainage. The Co-UDlabs YouTube channel is curated by the project consortium and it will be regularly updated with videos from the project, allowing the community to access the project content during and after the project completion.

1.1. UD early-stage and junior researchers' activities and training events

Two types of activities are planned within this pillar:

1. Two **internal Co-UDlabs early-stage researcher seminars** targeting PhDs and early-stage researchers from partner institutions of Co-UDlabs, aiming to enhance interaction between academics, sharing ideas and promote common experimental protocols. These seminars have a duration of 2 days and are targeting 20 participants.
2. An **open workshop and a PhD courses** targeting the UD European junior research community.

In the first reporting period, we have organised the following training events for UD junior and early-stage researchers:

- **One open workshop**: The **25th EJSW – European Junior Scientists Workshop on "Monitoring Urban Drainage Systems and Rivers"** was held on 15-21 May 2022, in St-Maurice-en-Valgaudemar, France. This workshop was jointly organised by the Sewer Systems and Processes Working Group of the IWA/IAHR Joint Committee on Urban Drainage and the Co-UDlabs project. It gathered 20 junior-scientist participants from institutions based in 11 countries and even more diverse nationalities. The 25th EJSW included:
    - 20 oral presentations by the junior scientists (20 min presentation + 10 min for questions/answers).
    - 5 short courses (45 min) by senior organisers on i) low-cost monitoring, ii) uncertainty assessment, iii) data validation, iv) application of cameras in discharge monitoring, and v) 3D-printing applied to urban drainage and river monitoring.
    - 1 workshop (1.5 h) on ethics in science and research.

- 4 afternoon hands-on sessions: In total 8 sessions were organized and each participant attended one of them: (i) DIY low-cost water level monitoring, ii) sediment transport monitoring, iii) tracing experiment for discharge measurement, iv) data validation, v) sensor calibration, vi) uncertainty assessment, vii) Large-Scale Particle Image Velocimetry (LSPIV) in river flows, and viii) turbidity -TSS (or COD) correlation.

The EJSW benefitted from favourable weather for outdoor hands-on sessions and was a great opportunity for sharing knowledge and experience, networking and creating links between participants, reinforced by recreational activities. The flyer of the event is available in Annex 2. More information is available on the project website (https://co-udlabs.eu/2022/05/26/25th-ejsw-2022/).

Figure 1. EJSW 2022 in St Maurice en Valgaudemar (photo: F. Clemens-Meyer)

- An **internal Co-UDlabs early-stage researcher seminar** took place on June 27-28, 2022, at the UDC's School of Civil Engineering in A Coruña (Spain). The seminar aimed to enhance interactions between PhD students and junior researchers of the project, sharing ideas while identifying and promoting common experimental protocols and approaches. Organised by UDC, the seminar was an excellent opportunity for attendees to learn about the project's main research lines and agendas and receive feedback, recommendations, and additional insight. The event included cutting-edge work and presentations on sediment accumulation, wastewater turbidity monitoring, infrastructural planning for heavy-rain laboratories, as well as innovative approaches to flooding health risks, performance assessment in UDS, LIDAR and SfM-based techniques for surveying and experimental planning. The agenda of the event is available in Annex 1. More information and a set of presentations given at the Seminar are available online on Co-UDlabs' website (link).

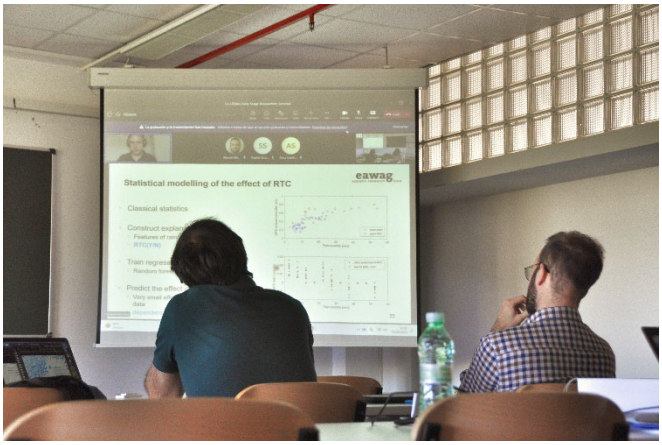

Figure 2. 1st Co-UDlabs internal early-stage researcher seminar (photos: Andrea Ciambra)

The next training events for early-stage and junior researchers are planned to take place in 2023 and 2024, as follows:

- A **PhD course on Sewer Processes will be organized by AaU in Aalborg (Denmark) in 2023**. It will be worth 5 credits in the ECTS system and will be open to PhD students from institutions from all over Europe. The course will focus on sewer process and sewer process modelling in relation to sulphide and methane formation and associated problems in terms of odour sewer corrosion and greenhouse emissions. The objective of the course is to give the students insight and knowledge on the most recent advances of sewer process modelling and applications to real-world use. The course will address the following topics:
    - State-of-the-art of the sewer process modelling
    - Aerobic and anaerobic organic matter transformation
    - Air-water mass transfer of sewer gases
    - Sewer odour and corrosion
    - Mitigation methods
- The **2nd internal Co-UDlabs early-stage researcher seminar** will be held at USFD in 2024.

1.2. UD industry professionals and practitioners training activities

This pillar concerns the organisation of free training activities aimed specifically at urban drainage industry stakeholders, regulators, professionals, and other practitioners.

- The first of these events was organized by IKT on November 3-4, 2021. The free online **Workshop on Urban Drainage Practice and Research Needs** aimed to identify valuable good practices and research for the optimisation of UD assets' performance and improve their resilience to climate change and sustainability. More specifically, the workshop was also designed to introduce Co-UDlabs' three Joint Research Activities and to illustrate their themes with various examples of issues and good practices from urban drainage network owners and researchers. It was, in other words, a very valuable and outstanding opportunity for researchers, utility management, regulators, businesses, and other relevant stakeholders in UD systems to meet, discuss, and share potential pathbreaking ideas for the sustainable future of this field. The workshop was also a great venue to introduce Co-UDlabs' first Trans-National Access (TA) call to the attendees. The

workshop was attended by 59 participants on Day1 and 51 participants on Day2. The agenda of the workshop is available in Annex 3. All presentations are available for download on the project website (https://co-udlabs.eu/2021/11/09/ikt-workshop/).

The next training activities aimed for UD industry professionals are planned to take place with the following schedule:

- **Industrial workshop on flow rate determination of pumping stations and hydraulic structures** (DEL - November 17, 2022). The course targets industrial practitioners who deal with the management and operation of hydraulic infrastructure and drainage pumping stations: employees from water utilities, equipment, pump manufacturers, contractors, engineering and consultancy firms. With a duration of 1 day, the course is limited to 20 participants. Registration for the workshop is open: https://softwaredays.deltares.nl/-/co-udlabs-course-2022.
- **Uncertainty assessment in UD monitoring data** (INSA - 2023). With a duration of 2 days, the course targets practitioners, operators, water utilities and stakeholders engaged in monitoring activities. It will include three main parts:
    - Lectures on uncertainty assessment (0,5 day)
    - Demo with examples in UD of the Matlab/Octave open-source codes developed in the project under WP6 (0.25 day) and guided exercise for the participants, with correction (0.25 day).
    - Training and application by participants who will bring their own cases and data sets (1 day).
- **Applied course on UD metrology** (UDC - 2024). This course targets UD practitioners and water utilities interested in monitoring the main hydraulic and water quality parameters of sewers and drainage networks. The course will be held at CITEEC laboratories, allowing the participants to join STREET and BLOCK TA infrastructures. Limited to 12 participants, the course will take place over 4 days:
    - Day 1 - Measurement of hydraulic variables. Rainfall, flow rates, water depths and velocities will be measured using different technologies (direct measurement, ultrasound, pressure, acoustic velocimetry, etc.).
    - Day 2 - Measurement of pollution parameters. Automatic grab samplers and on-line probes will be used to measure the most relevant variables and methods of analysis.
    - Day 3 - Data collection and management. In this session different technologies to convert signals to data will be presented. Additionally, the course will present how parametrize hydraulic and pollution parameters linked to dry and wet weather flows.
    - Day 4 - Demo Day - Simulation of a field campaign in the infrastructure of CITEEC. A field work will be simulated in the BLOCK model. Measurements of all relevant parameters will be made, online and by grab samples. The analysed events will be parameterized assuming that the control sections are part of a specific urban area.
- **Practice workshop on themes relevant for the improvement of the monitoring and inspection of drainage systems**, which will have an impact on better and more efficient UDS management (IKT - 2024). The aim of this one-day workshop, which will be limited to 20 participants, is to exchange ideas and to define research need regarding the application of practical solutions for the improvement of the monitoring and inspection of drainage systems, which will have an impact on better and more efficient UDS management procedures.

This practice workshop will offer a platform for the exchange of knowledge and experience between industry and public sewer network operators, promoting mutual understanding between scientists, industry and network operators.

1.3. Public webinars on specific and emerging monitoring techniques

Each research institution of the project is planning to organise a webinar for specific and emerging monitoring techniques in UD. The schedule, which has been defined and validated by project partners during the first six months of the project, is available in the table below:

Table 1: List of Co-UDlabs webinars

Webinar title	Date executed or planned	Partner in charge [+ co-organisers]
1 - FTIR Chemical mapping	September 21, 2022	AaU
2 - Acoustic turbidity measurements	Early 2023	EAWAG, UDC
3 - Optical and computer vision techniques for flow and processes	February 2023	DEL, UDC [USFD, INSA]
4 - Routine uncertainty assessment (UA) in urban drainage data	March 2023	INSA, GRAIE
5 - Underground infrastructure monitoring techniques	[Late] 2023	IKT, UoS, DEL
6 - Routine data validation (DV) in urban drainage	May 2024	INSA, GRAIE

More information will be available on the project website (https://co-udlabs.eu/) closer to the date of these events. The recordings of these webinars will be uploaded on the YouTube channel of the project (link) and disseminated on the project social media channels for maximum visibility.

The first webinar, focused **on Fourier transform infrared spectroscopy (FTIR) chemical mapping,** was organized by Aalborg University on September 21, 2022. This free webinar provided introductory knowledge on a widely used analytical technique that combines the chemical information from Fourier Transform Infrared Spectroscopy with the resolving power of microscopy. After introducing basic concepts about Infrared Spectroscopy and how an FTIR spectrometer works, infrared microscopy was briefly explained, including different modes of collecting spectra at the microscopic scale. Finally, µFTIR-chemical mapping technology was introduced, focusing on theoretical and practical details related to this technique. To conclude, the webinar provided a short overview of the main applications of µFTIR-chemical mapping ranging from biomedical science to material science and microplastic analysis on environmental samples, focusing on urban water microplastic monitoring. This public webinar was attended by 18 participants. The agenda of the webinar is available in Annex 4. The webinar has been recorded and the video will be made available shortly on the project You Tube channel.

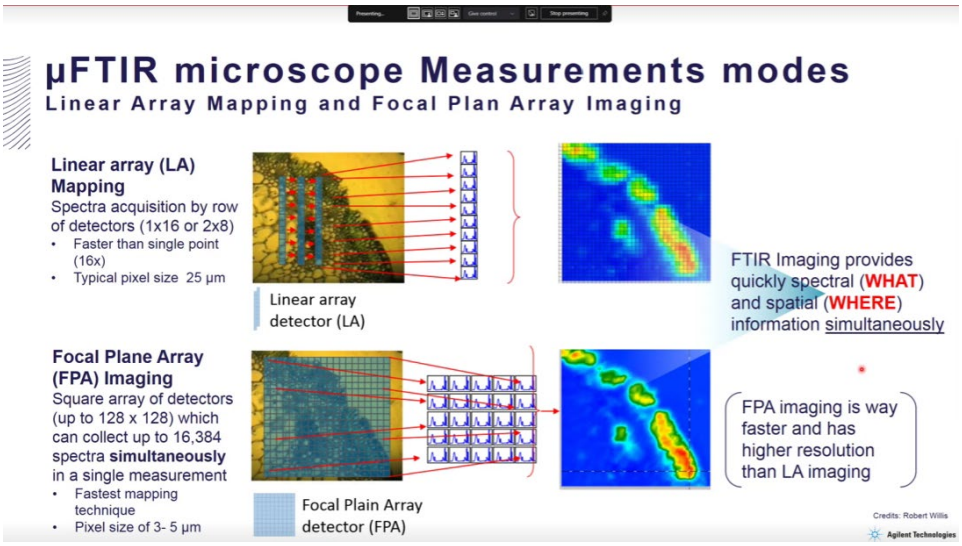

Figure 3. Webinar on FTIR chemical mapping (September 21, 2022)

Conclusion

The training activities organized in the framework of WP3 are progressing as planned. During the first reporting period (M1-M18), Co-UDlabs has organized 4 events including:

- **1 online workshop** on Urban Drainage Practice and Research Needs on November 3-4, 2021
- **1 early-stage research seminars** targeted to PhDs and early-stage researchers from partners of Co-UDlabs
- **1 European Junior Scientist Workshop (EJSW)** on UD monitoring on May 15-21, 2022
- **1 public webinar** on FTIR chemical mapping on September 21, 2022

6 events are planned to be organized during the second reporting period (M19-M36) and 5 events during the last reporting period (M37-M48).

Annex 1. Agenda of the 1st Early-Stage Researchers Seminar (June 27-28, 2022)

DAY 1	Monday, June 27, 2022, 16:00–19:00 (CEST)
16:00–18:00	**Participants' welcome and registration** UDC School of Civil Engineering
19:30	**Icebreaking event: *A Pint of Co-UDlabs*** 'Tapas' route in the city: checkpoint at 'Obelisco' landmark site downtown

DAY 2	Tuesday, June 28, 2022, 09:00–17:00 (CEST)
08:30–09:00	**Participants' welcome and registration** Room 8–Ground floor, UDC School of Civil Engineering
09:00–09:20	**Welcoming remarks and introduction to the Seminar**
09:20–11:00	**Co-UDlabs researchers' portfolio–Early-stage and senior researchers (1)** 20-minute presentation of work performed on urban drainage by Co-UDlabs partners • Manuel Regueiro (UDC) **SedTemp: Approach to sediment accumulation in urban drainage systems based on temperature measurements** • Marcel Goerke (IKT) **Planning and conception of a heavy rain laboratory and its practical use** • Pierre Lechevallier (EAWAG) **Non-contact monitoring of wastewater turbidity and organic pollution with hyperspectral camera**
11:00–11:15	**Coffee break**
11:15–13:30	**Co-UDlabs researchers' portfolio–Early-stage and senior researchers (2)** 20-minute presentation of work performed on urban drainage by Co-UDlabs partners • Jose Anta (UDC) **Permeable pavement clogging laboratory experiments using rainfall simulators** • Sophie Scutt (University of Sheffield) **Evaluating the Public Health Risks of Urban Flooding Events** • Jörg Rieckermann (EAWAG) **Performance assessment of RTC of urban drainage systems based on (uncertain) monitoring data**
13:30–15:00	**Lunch break at ETSICCP Cafeteria**

15:00–16:40	**Co-UDlabs researchers' portfolio–Early-stage and senior researchers (3)** 20-minute presentation of work performed on urban drainage by Co-UDlabs partners • François Clemens (DELTARES) **DELTARES research on Urban Drainage Systems** • João Paulo Leitão (EAWAG) **Flooding and image-based analysis (water level estimation from images)** • Esteban Sañudo Costoya (UDC) **Hydraulic experiments and topographic survey applying LiDAR and SfM techniques at BLOCK facility**
16:40–17:00	**Wrap-up and closing remarks**
20:00	**Social dinner, Restaurante Artabria** Project-wide dinner for all ESRS and GA participants

Annex 2. Flyer of the 25th EJSW – European Junior Scientists Workshop (15-21 May 2022)

EJSW ON 'MONITORING URBAN DRAINAGE SYSTEMS AND RIVERS'

When: 15th May – 21st May 2022

Where: Saint Maurice en Valgaudemar, France

ABSTRACT SUBMISSION

Apply: Extended abstracts should be sent not later than **9th January 2022** to the following e-mail address:

ejsw-2022@sciencesconf.org

Applications require a 1-page motivation letter, an up to 4-pages extended abstract and personal details including name, age, affiliation, position and e-mail address. All submitted abstracts will be evaluated through a scientific review. The organising committee will select the final extended abstracts (max. 24 junior participants) for oral presentations and notify the acceptance by end of January 2022.

PROMOTERS

INSA Institut National des Sciences Appliquées Lyon

Université Lumière Lyon 2

Deltares

NTNU Norwegian University of Science and Technology

ORGANISING COMMITTEE

Jean-Luc BERTRAND-KRAJEWSKI (INSA Lyon)
Francois CLEMENS (Deltares, NTNU)
Mathieu LEPOT (INSA Lyon)
Oldrich NAVRATIL (Univ. Lyon, CNRS UMR 5600)
Antonio MORENO RODENAS (Deltares)

LOCATION & VENUE

Saint Maurice en Valgaudemar is a small typical village in the French Alps, at the entrance of the Séveraisse valley, close to Ecrins National Park.

The workshop venue is the *Val des Sources Hotel* (http://www.levaldessources.com/en/home/), with a meeting room and access to both a small channel and a river (with a flood every evening during that season!) a few minutes away for the practical workshop sessions.

Surrounding landscape and nature offer possibilities for active recreation between workshop sessions. Free-time between working sessions would allow visiting the Séveraisse valley, hiking, cycling, rafting, etc.

St Maurice en Valgaudemar, 1100 m altitude.
(source: https://www.geneanet.org)

First Announcement & Call for Abstracts

25th European
Junior Scientists Workshop

MONITORING URBAN DRAINAGE SYSTEMS AND RIVERS

Hands-on seminar on sensor applications and monitoring techniques

Saint Maurice en Valgaudemar, France
15th – 21st May 2022

Organised by

SS&PWG
Sewer Systems & Processes
Working Group of the IWA – IAHR
Joint Committee on Urban Drainage

and the **Co-UDlabs** H2020 European Project

Co-UDlabs

BACKGROUND AND OBJECTIVES

You are a motivated young scientist, a PhD student or a starting post-doc researcher? You want to present ideas and plans, discuss preliminary results of your own research in an inspiring, open, cooperative and non-competitive environment?

Then, the European Junior Scientists Workshops (EJSWs) provide a perfect opportunity to do so. The idea is not only to listen, neither only to talk and to dominate, but to learn from and help each other in solving scientific problems in a collaborative way.

The 25th EJSW focuses on:

- On-line monitoring of water quality and quantity in waste- and stormwater collection systems, and rivers.
- Links between data validation and model calibration.
- Emerging monitoring concepts and data communication techniques.
- Ethics in researching, publishing, presenting and sharing data.

The Séveraisse river (source: https://cleda.fr).

In a plebiscite manner the 4th edition of this particular workshop offers juniors to i) **present and discuss**, and ii) **hands-on practice** of various measuring principles in a setting that gives more opportunity to learn and to share compared to regular conferences.

CALL FOR EXTENDED ABSTRACTS

Authors are invited to submit an extended abstract accompanied with a 1-page motivation letter not later than **9th January 2022**.

The extended abstract should include title, author(s), affiliation(s), full address (incl. tel. and e-mail) of the corresponding author and 3-5 keywords. The abstract should be between two and four A4-pages including a graphical abstract, illustrations, diagrams, tables and references. Objectives, hypotheses, applied approach, applicability, equipment and methods should be emphasised and (some) results should be presented.

Extended abstracts should be submitted via e-mail, preferably in MS Word format.

For the preparation of the abstracts, authors should use the instructions for authors recommended by Water Science and Technology (a template is available):

http://wst.iwaponline.com/content/instructions-authors-wst

Up to 23 participants will be selected based on submitted abstracts. Evaluation of abstracts will be carried out by the Organising Committee. Authors will be notified of acceptance for oral presentation not later than **31st January 2022**.

FEES

Participants are expected to make all travel arrangements to and from Lyon, France and pay for the trip. The workshop costs will be sponsored. A workshop fee of approx. € 600 (exact amount will be given on the website in January 2022) for all participants will be charged to cover costs for local transportation (Lyon Part Dieu railway station to Saint Maurice en Valgaudemar and return), accommodation and all meals.

PUBLICATION

Selected extended abstracts will be published as workshop proceedings on the workshop website with agreement of the authors.

PROGRAMME

The 25th EJSW will not only offer junior scientists an opportunity to present their research work and to be trained in chairing sessions as usual EJSWs, but will also put forward a unique set of practice sessions lead by the Organising Committee.

Participants during the EJSW 2019 edition in La Bérarde.

Morning sessions will be devoted to junior scientist´s oral presentations and short lectures for afternoon sessions.

Afternoon sessions will include hands-on field workshops on the following topics:

- How to do proper sampling?
- How does a sensor work?
- Why and how to calibrate sensors?
- What induces measurement uncertainty?
- How to assess/interpret this uncertainty?
- How to analyse and validate raw data?
- How to operate a data communication network?
- How to design, to build and to maintain a monitoring station?

WEBSITES

Info and updates will be given at:
25th EJSW website:
https://ejsw-2022.sciencesconf.org

SS&PWG website: http://www.sspwg.org

Co-UDlabs website: https://co-udlabs.eu

Annex 3. Agenda of the Co-UDlabs online practice workshop on urban drainage (November 3-4, 2021)

DAY 1	Wednesday 3rd November 2021, 09.00 – 12.30 (CET) / 08.00 – 11.30 (GMT/UTC)
09:00	**Welcome by workshop moderator** - Dr. Iain Naismith (Co-UDlabs - IKT, Germany)
The Co-UDlabs Project	
09:00 – 09:15	**Why is the European Commission funding the Co-UDlabs Project? Objectives, Ambition, Work programme** Dr. Iain Naismith (Co-UDlabs - IKT, Germany) Dr. Jose Anta Álvarez (Co-UDlabs - Universidade da Coruña, Spain)
09:15 – 09:30	**Co-UDlabs and collaboration - Bringing Science, Industry and Network Operators together** Dipl.-Ing. Thomas Brüggemann (Co-UDlabs - IKT, Germany) Prof. Dr.-Ing. Bert Bosseler (Co-UDlabs - IKT, Germany)
Setting the scene – Storm Bernd – July 2021	
09:30 – 09:45	**Case Study - Heavy rainfall events in Europe in July 2021: consequences and challenges for sewer network operators (experiences of IKT in co-ordinating assistance for affected municipalities)** Mirko Salomon (ComNetAbwasser - IKT, Germany)
Session I - Optimising existing urban drainage asset performance - use of monitoring and sensing to optimise network performance in response to heavy rainfall	
09:45 – 09:55	**Overview of issues concerning monitoring and sensing for asset performance** • **by the leader of the Co-UDlabs Joint Research Activity 1 on Smart Sensing and Monitoring in Urban Drainage** Dr. Jean-Luc Bertrand-krajewski - INSA Lyon (France)
09:55 – 10:30	**Short presentations of examples of good practice in Europe** • **Smart Utilisation of Wastewater Storage capacity in sewers – Centaur Project (UK,France, Portugal)** Dr. Alma Schellart (Co-UDlabs - University of Sheffield, UK) • **Pollution released in Combined Sewer Overflows. Monitoring challenges in traditional infrastructures of Madrid (Spain).** Antonio Lastra (Canal Isabel II, Spain) • **Management of flow measurement data in sewers** Dr. Franz Tscheikner-Gratl (Norwegian University of Science and Technology)
10:30 – 11:00	**Panel discussion on research needs for 'use of monitoring and sensing to optimise performance in response to heavy rainfall'.** • **Virtual White Board open**
11.00 – 11:15	**Coffee break**
Session II - Evaluation of Assets and Deterioration	
11:15 – 11:25	**Overview of the evaluation of assets and deterioration issues** • **by the leader of the Co-UDlabs Joint Research Activity 2 on Evaluation of assets deterioration in Urban Drainage systems** Prof. Simon Tait, (Co-UDlabs, University of Sheffield, UK)

11:25 – 12:00	**Short presentations of examples of good practice** • **Application of cameras for monitoring pumping stations (Netherlands)** Prof. François Clemens (Co-UDlabs - Deltares, Netherlands) • **AI-based Approaches for Short- and Long-term Sewer Asset Management in Berlin (Germany)** Dipl.-Ing. Matthias Riechel (Kompetenzzentrum Wasser Berlin, Germany) • **Numerical Studies about deterioration assets in Arnhem and Den Haag (Netherlands)** Dr. Irene Scheperboer (IKT, Netherlands)
12:00 – 12:30	**Panel discussion on research needs for 'use of monitoring and sensing to optimise performance in response to heavy rainfall'.** • **Virtual White Board open**
12:30 - End of day 1	

DAY 2	**Thursday 4th November 2021, 09.00 – 12.00 (CET) / 08.00 – 11.00 (GMT/UTC)**
09:00	**Welcome by workshop moderator** - Dr. Iain Naismith (Co-UDlabs - IKT, German)
Session III – Improving resilience and sustainability of urban drainage assets	
09:05 – 09:15	**Overview of the issues concerning resilience and sustainability** • **by the leader of the Co-UDlabs Joint Research Activity 3 on Improving resilience and sustainability in urban drainage solutions** Dr. Luís Cea Gómez - Universidade da Coruña (Spain)
09:15 – 10:15	**Short Presentations of good practice in Europe** • **Dealing with London's legacy of combined sewers (UK)** Andrew Hagger (Thames Water Utilities, UK) • **Development of modular technology for handling and treating rainwater as part of Aalborg Utility´s rainwater management (Denmark)** Prof. Jesper Ellerbæk Nielsen (Aalborg University, Denmark) • **Addressing climate change in the City of Almere (Netherlands)** Maria Rus (City of Almere, Netherlands) • **Co-Designing a "Livable Street": Project 'LesSON' and the Future Initiative "Water in the City of Tomorrow" (Germany)** Dr. Daniela Falter (Emschergenossenschaft, Germany) • **Not all SuDS are created equal: Impact of different approaches on combined sewer overflows (Switzerland)** Dr. Joao Paulo Leitao (Co-UDlabs - EAWAG, Switzerland)
10:15 – 11:45	**Panel discussion on research needs for "Improving resilience and sustainability of urban drainage assets"** • **Virtual White Board open**
10:45 – 11:00	**Coffee break**
Reminder of the outcomes from Day 1	
11:00 – 11:15	• **Illustrated summary of the key points from the presentations and discussions from Day 1** – Sessions I and II Dr. Iain Naismith (Co-UDlabs – IKT, Germany)
The way forward	

11:15 – 11:55	• **Panel discussion on the next steps for actioning the workshop's findings through Co-UDlabs** Co-UDlabs Joint Research Activity leaders
11:55 – 12:00	**Concluding remarks**
12:00 - End of day 2	

Annex 4. Agenda of the Webinar on Fourier transform infrared spectroscopy (FTIR) chemical mapping

	Wednesday 21st September 2022, 14.00 – 15:30 (CEST)
PART 1	
14:00 – 14:25	FTIR theory… a quick intro How an FTIR spectrometer work? A few definitions From Marco to µFTIR µFTIR microscopy µFTIR Chemical Mapping… How does it work?
14:25	**5 min break**
PART 2	
14:30 – 15:00	FPA Chemical Imaging Main applications of µFTIR Chemical mapping µFTIR Imaging and urban drainage: analysis of microplastics in urban waters Wrap up
15:00 – 15:30	**Q&A**
15:30 - End of the webinar	