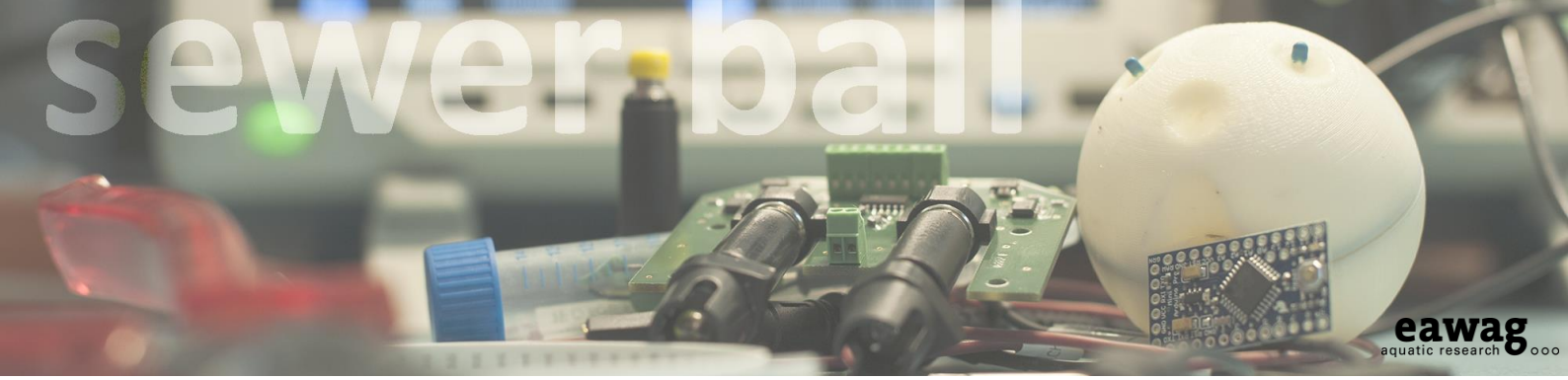

Background. Over the past 15 months, Adrian developed a small, floatable sensor platform – aka ***Sewer Ball*** (see Figure 1A and B and project webpage) – measuring and recording pH, temperature, redox and electrical conductivity. The autonomous system can be deployed upstream and collected downstream in a sewer system (some pre-requisites must be met, see Table 1). Repeated deployment facilitates obtaining the spatio-temporal distribution of these variables in a sewer network (longitudinal profile). This complements point measurements from permanent monitoring stations (where available) or provides information with relatively little effort where no monitoring station is operated.

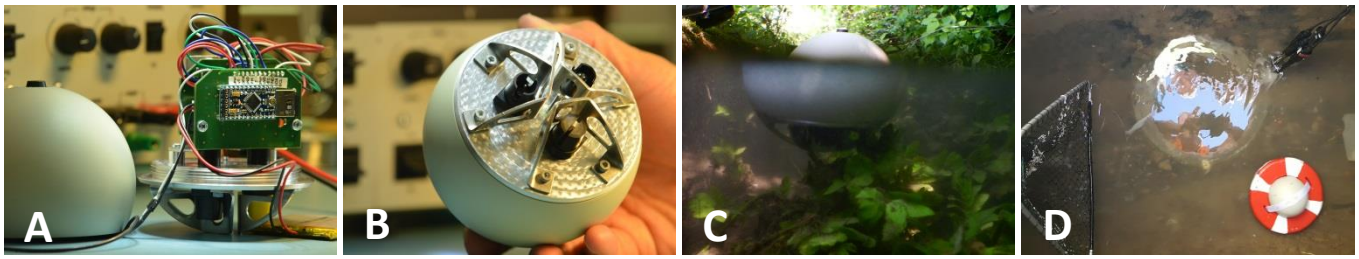

Figure 1. A Inside: Arduino Pro Mini (A/D, storage), real-time clock (time stamp), power supply. **B** Temperature, pH, redox and conductivity probes. **C** In a small creek. **D** In shallow wastewater (life-saver for more buoyancy designed by Adrian's daughter ;-)

Status of the project. After laboratory and field tests in clean water (Figure 1C), we recently deployed our prototype for the first time in a real sewer in wastewater (Figure 1D). Adrian will present this at the Aqua Urbanica in Graz (3.7.2017, 12:05) and at ICUD in Prague (10.-15.9.2017).

Invitation for collaboration. To test the user friendliness of an improved version of the ***Sewer Ball*** and to collect data across Europe, we are looking for interested partners who have access to suitable sewer segments (see criteria in Table 1).

Table 1. Criteria for suitable sewer section.

Required

- A person must be able to physically reach the surface of the wastewater stream to deploy the *Sewer Ball* gently and to collect it (e.g. with a hand net, see Figure 1D).
- Sufficiently large diameter of conduit (the *Sewer Ball's* diameter is currently 106mm)
- **None** of the following should be between the deployment and collection point:
  - pumping station
  - pressurized mains
  - culvert
  - vortex shaft (invert steps, weirs or other free fall secions of <0.3m should be ok if water depth below is >0.5m)
  - obstacles that block the *Sewer Ball*

Ideal

- Residence time in the sewer section between deployment and collection point: 10 minutes or longer
- Lateral confluents (which may change the water quality locally)

Tasks and time frame. In Table 2 we list the tasks that we anticipate you to perform. The time needed for each of these tasks are generous estimates, but obviously they depend on experience and circumstances.

Table 2. Tasks associated with testing the *Sewer Ball*.

Task	*Estimated time [days]*
1) Get familiar with the *Sewer Ball* in the laboratory and calibrate sensors (we provide a manual and calibration solutions)	*1*
2) Identify a suitable sewer section and get permission from the operators to deploy the *Sewer Ball* (maybe perform a test with a dummy buoy, e.g. a tennis ball, to make sure it reaches the expected collection point)	*1*
3) Deploy the *Sewer Ball* in **October/November 2017** to collect approximately 1h of data (either over a long flow distance or repeatedly over a shorter distance (minimum travel time 10 minutes)	*1*
4) Make a photo of you with the *Sewer Ball* and some photos of the *Sewer Ball* in the sewer	
5) Read out data, check plausibility and send it to us along with a short description of your test location, e.g. profile, diameter, slope, flow, velocity, type of wastewater until **1 December 2017** (your contribution will be acknowledged in the paper)	*0.5*
6) Provide feedback on *Sewer Ball* handling and usefulness of data	
7) **December 2017 to February 2018:** Additionally to the points above, if you wish to be considered as a co-author, you will have to i) actively contribute to the drafting of the manuscript – we provide a suggestion for the basic structure, content and discussion – and ii) approve the final version.	*1*

Safety. We trust the staff performing the experiment is familiar with working in sewers. In brief: Never work alone in/at a sewer site! The person performing the experiment must be trained and authorized to enter sewers and adhere to relevant safety guidelines of its institution and requirements by local operators. Eawag is not liable for any injury, sickness, damage or loss (see also attached MTA). Please note: the ***Sewer Ball*** is currently not ATEX certified, but its low-power design (max voltage 5V) make it basically *intrinsic safe*.

Costs. We send you a ***Sewer Ball*** kit along with instructions for free usage until 1 December 2017 (estimated production costs approx. 1'200€). If you do not want to keep the ***Sewer Ball*** after this small cooperation, you merely have to cover the shipment costs to return it to us. If you wish to keep it, you can purchase it for 350€ (or win one, see next section).

Acronym/name. When googling for "*Sewer Ball*", ours is not a top hit, two other types of Sewer Balls come up (see Figure 2). Also WATSENS or WATSEN as acronyms for *(waste)water sensing* seem not suitable. Therefore, you can send us suggestions for acronyms/names until 30 June. The jury consists of the four Eawag ***Sewer Ball*** team members and the winner can keep the *Sewer Ball* at no cost.

Figure 2. A+B Iron ball to clean Paris' sewers [Paris Sewer Museum, source: atlasobscura.com (direct link)]. **C** Rubber water stop [source: Zaoqiang Dacheng Rubber]

Google form. Please fill in this google form to express your interest (5 minutes to fill in) **until 30 June 2017**. If you have any questions, please do not hesitate to contact us.