

Guide for the installation of surface hydrology monitoring equipment – channel flow water level

Doka watershed, Gedaref, Sudan



Water level assessment through infrared camera

General idea is to install the camera with a good view to either the inlet or the outlet of the culvert to see 1) when there is runoff at all (event vs. no-event; critical rainfall-runoff assessment), 2) the water level over time-intervals during the event, and 3) if there is a disturbance. For (3) I would prefer to install the camera at the inlet of the culvert (to see potential clogging e.g.) (Figure 1), but therefore someone has to look at the inlet watermarks again and check if there is severe backwater at the inlet which considerably manipulates the entrance water level. I think a good indicator can be if there is a strong > 10-20 cm watermark drop through hydraulic jump turbulence in the first meter if the inlet at the sidewall, or the water keeps more or less a steady slope gradient towards the outlet (which seems to be the case). If there is no strong turbulence – the inlet is the best place.

In general, the camera does more or less the same as the installed pressure transducer, but it provides more accurate data, as the pressure transducer can have a shift and is also sensitive to sedimentation, water flow pressure and turbulence. Also, the pressure transducer has certain installation height (appr. 10cm above ground), where we miss some events and we don't assess entire discharge. In addition, the camera gives good idea about happenings – e.g. clogging with a shrub or else.

We had very good experience with the hunter-camera in Ethiopia (Figure 2), where we constructed defined weirs – but I think the culvert is as good. Therefore, it would be good to make water level paintings in e.g. 5cm marks (best to take something fluorescent material – or very bright (light orange or black-white) or to directly fix a metal water level somewhere in good sight at the culvert wall.



Fig.1: Inlet of the culvert: Best place to observe with the camera and to place water levelmarks (in red) – probably at different places (front of the wall and inside) to investigate and clean out local water turbulence /hydraulic jump distortion.

Please start the water level marks from the concrete ground (not the sedimentation) of the culvert. One example from Ethiopia is shown in below.



Fig.2: Camera data from Ethiopian watershed (day and night).

The Camera itself is whether a black light or infrared flash camera (without visible light – no danger for the cars on the street), so it shows the area at day and night. The flash – please read the camera specifications in the manual - has usually a distance of min. 5 to appr. max 20 meters. So you have to install the camera in less distance than max. flash distance (manual), but in a way that it shows the entire culvert well. It will be around 5-10m distance. The camera can be fixed on a tree or on a metal pipe well grounded at a safe place in front or slightly at the side of the culvert. Certainly try and read out images when installing to find the best place. The camera as a time interval which can be set (min and max time interval according to camera specifications (manual)). The camera saves the images on SD card – we may need to buy two or better three large storage SD cards (min. 32GB). It depends in the size of a single image, which can be usually also to some extent adjusted in the camera (image quality). If the images have around 500kB, with a 2min record interval the SD card can store 89 days, with 5min. 222 days, with

10 min interval the SD card can store 444 days. However, if the images have 4MB, a 2min interval allows 11 days of storage only! (5min hold 28 days and 10 min hold 56 days). I would recommend either 2 or 5 min interval readings and to change the card every week – or maximum each two weeks. Set a formatted card in and take the read out card with you into the office. Also, you may need an external hard disc to save the several 32 GB SD card readings. Please be sure to set the real time in the camera and that the images save the exact time – can be for sure chosen in the camera settings.

The analysis of the data is somehow tedious – has to be done manually, but the quality is excellent and also the results are good to demonstrate and to publish from the site. Also, if you sample the runoff sediments (with bottles) you can put a sticker or else on the culvert concrete after each sample taken (or think about another do-able method), so the 2-5min interval pictures will show when a sample was taken (at least within which time interval) and we may get a very consistent runoff/sediment concentration data-set.

Please let us know if you are unsure with positioning of the camera or the settings.

Please check the images during installation for the best place and read out the images after first day to see the night performance.

Check the time settings if they are correct.

Read out frequently.