

Case study

#06

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ResilientTogether is a Defra-funded project that aims to build a Smart Catchment to enhance flood resilience. Our Innovation Case Studies showcase new and creative approaches to building a smarter, more resilient catchment.

## Hybrid Satellite-Radio Telemetry Network

Using a Low-Earth Orbit satellite network and local radio telemetry for constant and reliable sharing of river and rain monitoring data



Figure 1. Iridium satellite connectivity

### ResilientTogether

ResilientTogether is creating a Smart Catchment, through innovative technologies and techniques, to reduce flood risk to people and places, enhance the water environment in the Pix Brook catchment and improve community resilience.

The project is achieving this through a close-knit partnership that collaborate to deliver six inter-related work packages. This case study comes from the Flow Monitoring work package, which aims to build an intelligent telemetry network to improve understanding of flows within the catchment and establish near real-time flow monitoring.

### Challenge

Radio Data Networks Ltd (RDN) have installed a telemetry network across the Pix Brook. The fundamental requirement for any monitoring system is constant and reliable communications. Cellular networks, such as 4G and 5G used by mobile phones, are not always reliable due to maintenance, faults and prolonged power failure, the latter of which can occur during storms.

Unlike mobile phones, for which cellular networks were constructed, gauges cannot be moved to gain better signal. Cellular networks are optimised for devices 1.6m above ground level (human head height), whereas river level gauge locations are often low down, at or below bank level further impacting upon signal quality. Furthermore, the signal cannot be guaranteed and can be patchy.

Gauges in the Pix Brook will be used as part of a Smart Catchment to inform operation of local flood assets such as reservoir gates. Where automated, this will require telemetry to directly communicate with other smart features. Cellular based telemetry systems also tend to log data and share it at set intervals rather than being a real-time system. Therefore, it was decided that cellular would not be sufficiently reliable to meet the needs of the project.

### Innovative Solution

The solution taken to address this challenge was to adopt a hybrid communication system, using Low-Earth Orbit satellite network operated by Iridium Communications Inc. and local radio telemetry operating on a secure Ofcom licenced radio channel. River and rain gauges were programmed to report data locally on a 5-minute basis and to broadcast three readings to the network every 15-minutes.

Satellites are cross-linked to provide reliable, low-latency and weather-resilient connections. The radio network links with a local station so there is no dependence on larger networks that can be at risk of cyber attacks, blackouts or service policy changes.

A limitation of this approach is the higher power consumption required to connect with the satellites. This can drain batteries faster than mobile network communications. To manage this, the telemetry systems provide continuous health updates reporting if batteries fail, to minimise disruption.

### Benefits - improved data

Recently, there have been a number of cellular network outages, locally and nationally, and growing reports of General Packet Radio Service (GPRS) becoming too congested. This issue has been observed in some Environment Agency stations, where significant gaps and latency in data has been reported. By using satellite rather than cellular, data loss and latency has been minimal. Gauges can also be located in areas not covered by cellular.

The Iridium network in conjunction with RDN gauges are used by Network Rail and Transport for Wales. Anglian Water and the Environment Agency have also been using Ofcom Licenced Radio Telemetry for over a decade with great success on other flood and flow control projects.