PROTECTING NATURAL WATER SOURCES USING SPACE DATA TO ANALYSE AGRICULTURAL LAND USE

Case Study: Portsmouth Water

THE PROBLEM

Portsmouth Water approached Rezatec following a long-term observation of increased nitrate pollution and concern of potential contamination of raw water sources with FIOs, such as from manure heaps, in groundwater (85% of Portsmouth Water's supply is groundwater via boreholes or springs). Understanding these to be most likely a direct result of agricultural activity, the company wanted to analyse the overland flow of these pollutants and try to predict where they might be entering the groundwater.

By understanding the potential sources of pollution, and using this knowledge to put mitigation measures in place as part of a proactive catchment management campaign, Portsmouth Water's main aims were to:

+ Improve water quality
+ Reduce the costs of water treatment
+ Support legislative compliance
+ Understand the dynamics between land use & water quality
+ Reduce the risk of future nitrate pollution

THE SOLUTION

> "Portsmouth Water has observed a long-term rise in nitrate levels in groundwater within its supply area. A key contributor to this increase has been due to the high use of – and leaching of – nitrate fertiliser, particularly in past decades, with further contribution from intensive livestock farming. The presence of many karst features prompted the company to also consider the potential risk of FIOs in raw water supplies, derived from both livestock farming and the increasing number of equestrian activities."
>
> Alastair Stewart, Project Manager, Portsmouth Water

Having previously conducted detailed modelling of nitrate pollution in its catchment, Portsmouth Water came to Rezatec to add more layers of detail, including the identification of further karstic features. To understand the pollution in more depth, Rezatec performed sophisticated data analysis on a variety of remotely-sensed images and datasets.

Using pioneering Earth Observation (EO) data processing techniques and unique proprietary geospatial technologies, Rezatec analysed agricultural land use and modelled the natural hydrology in the key water Source Protection Zones (SPZs). We provided Portsmouth Water with landscape intelligence tailored to their objectives, predicting the likely overland flow of nitrates from agriculture and other sources.

From this analysis, they were able to see potential connections between nitrate spikes and a diverse mix of potential sources, which were found to include certain crop types, livestock, the use of fertilisers, and dung heaps. The data also gave them an understanding of the likely ways in which this pollution was reaching the groundwater, typically via karstic features (such as swallow/sink holes), and chalk pits.

Rezatec delivered its powerful commercial insights in the form of map-based data layers that can be used by Portsmouth Water to assist and direct conservation efforts, reduce risk and meet other business objectives. Specifically, Rezatec applied the following data products:

+ An agricultural land-use map to identify and predict point and diffuse sources of nitrate and FIO pollution, including specific crop types

+ Hydrological attributes to extract probable overland flow patterns of nitrates and FIOs, allowing the prediction of groundwater contamination points

+ Estimated amount and timing of point-source and diffuse pollutants entering sinks

+ Rainfall run-off modelling, showing the risk of overland flow production and subsequent nitrate contamination to chalk pits, sink or swallow holes.

KEY BENEFITS AND OUTCOMES

"One of the most useful outputs of Rezatec's work was that using their feature detection techniques, including the incorporation of Lidar data, they were able to discover a significantly greater number of possible swallow holes and chalk pits that weren't already formally identified."
Portsmouth Water

These tools have brought many important benefits to Portsmouth Water's catchment managers, including the ability to:

+ Identify previously unknown hotspots of agricultural pollution

+ Establish the flow of point and diffuse pollution

+ Promote mitigating activities to farmers and other land users

+ Assess whether geological and anthropogenic features are contributing to groundwater nitrate levels

+ Direct ground resources and help reduce nitrate levels and FIO threats.

Using the data to see where the highest levels of risk are, Portsmouth Water has the information necessary to inform catchment management decisions. This allows them to be strategic about where to put in place cost-effective mitigation practices for reducing nitrate pollution, such as enhanced soil testing and management , or encouraging farmers to plant trees and cover crops.

Crucially, Rezatec's map-based portal provided visually striking analytics to enable catchment managers to work more effectively with farmers, equestrian businesses and other local land users. The risk map is easily understood by non-experts, putting Portsmouth Water in a stronger position to explain the problems and work together with landowners to find solutions.

The data has also helped inform the company's business plan and catchment management programme for the years ahead, providing valuable data to justify spending to Portsmouth Water's Board. In this context, being able to provide detailed information about the risks is particularly useful, as it is typically decades before it is possible to see the benefit of mitigation efforts.

WHAT'S NEXT?

> "We really enjoy working with Rezatec, and have been impressed with the company's ability to adapt and match our requirements. It's a really good product and we're looking to work further with them to follow crop rotations and monitor changes over three years. The more accurate we can become with our targeting, the more cost-effective we can be. Rezatec's approach really helps us get this right, and we're happily promoting it to water companies and others to encourage catchment management approaches."
> Portsmouth Water

Following the success of the first phase of this project, Portsmouth Water intends to continue working with Rezatec to follow the patterns of crop rotation and the changing risk levels this system entails.

Charting nitrate variations produced by different fields in a typical three-year farming cycle, some crops are more nitrate-hungry than others, Rezatec's sophisticated algorithms will be able to deliver even more detail on the risks.

That means greater cost-effectiveness and better long-term outcomes both for Portsmouth Water, farmers and for the environment.

If you would like to learn more about Rezatec, please visit our website www.rezatec.com. Alternatively contact us on 01865 817500 or info@rezatec.com to book a demo of our geospatial intelligence platform.

> "We were very pleased to support Portsmouth Water's drive towards a more efficient water management strategy across their catchments. The ability to improve and protect water sources using space data can deliver considerable savings when it comes to treatment downstream, and of course help to meet ever-tightening regulations."
> Philip Briscoe, Chief Operating Officer, Rezatec