4.6 Groundwater Quality Monitoring by Environmental Protection

Executive summary

- The groundwater quality monitoring programme provides valuable background data to assess the status of the Island's groundwater.
- Groundwater in Jersey is a key source of water and an important store of freshwater in the hydrological cycle.
- As well as detecting deterioration or improvement over the long-term, it is also essential to have baseline data so that the impact of pollution incidents can be assessed.
- The flow of groundwater into rivers as seepage through the river bed, known as baseflow, can be essential to the health of wildlife and plants that live in the water. In this way, groundwater sustains about 66% of stream flows in Jersey, and thus sustains terrestrial ecosystems.
- Groundwater is a key indicator under the water framework directive in terms of assessing good status.
- This programme has not been reviewed for 10 years and needs review and updating to reflect current water framework policy.

1. Overview of monitoring programme/project

Groundwater is water below the ground in the saturation zone and it constitutes about 70% of the worlds freshwater. It therefore represents an extremely valuable source of freshwater for drinking and for domestic, agricultural and industrial use. Approximately 10% of Jersey residents rely on private borehole supplies for drinking water and domestic use.

As well as playing a vital part in human activities, groundwater also has a very important role in our environment. It supports rivers, lakes and wetlands, especially through drier months when there is little direct input from rainfall. The flow of groundwater into rivers as seepage through the river bed, known as baseflow, can be essential to the health of wildlife and plants that live in the water. In this way, groundwater sustains about 60% of stream flows in Jersey, and thus sustains terrestrial ecosystems.

Rocks that have sufficient water storage and flows are called aquifers. In Jersey, the bedrock is not particularly conducive to groundwater storage or groundwater flow. Much of the water movement is through fractures in the rock rather than through interconnected pore spaces within the rock and the layer of useful water bearing rock is comparatively shallow. In addition, as the water table is usually only a few metres below ground level (rising to up to 30 m below ground level on high ground) it is highly vulnerable to pollution.

The purpose of the monitoring programme is to collect baseline data about the state of Jersey groundwater in order to determine what the background levels of certain parameters are and to detect long-term trends or short and long term impacts from contamination or pollution incidents.

2. Legislation

EU Directives:
Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances. This is not legally binding in Jersey. The purpose is to prevent the (direct or indirect) discharge of substances in list I and limit the discharge of substances in list II pollutants into groundwater. This directive will be repealed in 2013 under the Water Framework Directive.

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. This is not legally binding in Jersey. The Water Framework Directive has put forward a challenging legislative framework, establishing "good status" environmental objectives for all waters – surface, coastal, transitional, and ground waters – to be achieved by the end of 2015. This modern piece of EU legislation fixes clear objectives but leaves flexibility to Member States on means to achieve them. It is based on milestones such as risk evaluation of anthropogenic pressures and impacts, monitoring programmes, development of river basin management plans (the first one to be published in 2009) and design and operation of programmes of measures. Groundwater is one of the key components of the Water Framework Directive, which focuses on quantitative and chemical status objectives (while the objectives for surface waters concern ecological and chemical status).

DIRECTIVE 2006/118/EC of 12 December 2006 on the protection of groundwater against pollution and deterioration. This is not legally binding in Jersey. The groundwater directive complements the Water Framework Directive. It requires: groundwater quality standards to be established by the end of 2008; pollution trend studies to be carried out by using existing data and data which is mandatory by the Water Framework Directive (referred to as "baseline level" data obtained in 2007-2008); pollution trends to be reversed so that environmental objectives are achieved by 2015 by using the measures set out in the Water Framework Directive; measures to prevent or limit inputs of pollutants into groundwater to be operational so that Water Framework Directive environmental objectives can be achieved by 2015; reviews of technical provisions of the directive to be carried out in 2013 and every six years thereafter; compliance with good chemical status criteria.

Water Pollution (Jersey) Law, 2000

Article 7 of The Water Pollution (Jersey) Law 2000 sets out the requirement to monitor controlled waters. Groundwater is controlled waters.

3. Stakeholders

Stakeholders include Planning and Environment Department, Health Protection, direct groundwater users – domestic and industrial; the general public; local ecosystems – streams, ponds, wetlands and the creatures that are dependant on these.

4. Potential pollution sources and pathways

Many activities on land are potentially a contamination source. These include oil or other hydrocarbon spills to ground, poor chemical storage, construction activities that affect or intercept the water table, leaking septic tanks and tight tanks or soakaways not working effectively, leaks and spills from the main sewerage network, inappropriate slurry or green waste application to land causing contamination or runoff to groundwater, pesticides, fertilisers and other chemicals used in farming.

5. Monitoring undertaken by Environmental Protection

In 1990, The British Geological Survey (BGS) carried out an in depth study of groundwater resources of the Island. As part of this study, 109 samples of groundwater (approximately 1 site per km^2) were collected and analysed in May 1990. Follow up samples of 16 of these sites were taken and analysed in October 1990. Since 1990, monitoring of approximately 50 sites has continued on a six monthly basis. Numbers of sites sampled on each sampling run have varied slightly as sites become unavailable for a variety of reasons and new sites have been incorporated to replace them and to improve coverage in some areas of the Island. However, many of the sites from the original study are still in use and we therefore now have over 20 years of data collected at some locations.

The monitoring is carried out in May and November by Environmental Protection who collect all of the samples.

Field analysis for pH, conductivity temperature and alkalinity are carried out at each site, and samples are taken for further chemical analysis at the Laboratory of the Official Analyst to the States of Jersey. At 13 of the sites, further samples are taken for microbiological analysis and pesticide analysis, the latter of which are sent to a UK laboratory for analysis.

Results are forwarded to participating property owners if requested, to Health Protection and to the Environmental Management and Rural Economy Section. Health Protection are responsible for advising on the suitability for drinking of private water supplies.

This programme is complemented by the groundwater *quantity* monitoring programme - a network of sites at which groundwater levels are measured. An electronic dipper is used to determine the level of the water table at each site, which is a simple method of monitoring year by year gains or losses to the resource. Currently, there are 42 sites on this monitoring round and data for some of the sites goes back to 1993.

6. Analysis and reporting of data

Data is stored on the L drive in excel format and then uploaded onto the WQMIS database. Graphs of results are produced to detect trends. Only Environmental Protection has direct access to the L;/ drive and to WQMIS but anyone can request the data. BGS reports have been uploaded to the old States of Jersey website, but these reports have not been included on the new website.

After each monitoring run results are sent to those property owners that have requested them, and letters are also sent to property owners for information where results are above drinking water limits for pesticide or microbiology and it is a known drinking water source.

7. **Budget, manpower and resources considerations**
   Pesticide analysis costs approximately £10,000 and is carried out by a lab at Eurofins, UK. The other costs are existing staff costs and analysis carried out by the States of Jersey Official Analyst (covered by the Service Level Agreement). Manpower-wise the programme involves two weeks of mornings for one person (five days), plus another four mornings (two days) for a second person to assist with pesticide sampling. One day for bottle and paperwork preparation and packing/sending. Approximately five days per year on organisation, data handling, result sending.

8. **Constraints**
   Pesticide monitoring has been cut back as it is high cost. Pesticide sampling has to be carried out on Monday and Tuesday as samples have to be sent to the UK. Limits on number of parameters analysed for as States of Jersey Analyst is limited by capacity. There has also been no wholesale review and consolidation of the data and no consultancy input for the last 10 years due to resource constraints and other priorities in the section taking precedence.

9. **Further Available Reports/Info on request:**
   Groundwater Sampling Monitoring Protocol (internal guidance document)
   Various British Geological Survey reports up to 2003.

Appendix 1 Borehole Pesticides Protocol as at 19/01/10

January / Feburary - Arrange Funding

Discuss with Managers whether funding is available. An annual budget of approx. £10,000 is required.

April - Decide on Sampling Run

1. Decide on sites to sample by looking at the sample frequency in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Letters & Admin/Adminstration/Pestsites, year-on-year schedule/pesticide numbers.,. Funding is normally available for 16 sites each borehole run in May and November, i.e. 32 sites per year.

2. Not all the boreholes have been sampled for pesticides, only those that are in areas identified as being under particular stress.

3. On each borehole run, essentially the same sites are sampled, but sites are slowly rotated. EP decided to monitor a site for a period of four years if no pesticides are detected before moving on to a new site.

4. Make sure the schedule is kept up-to-date with the Eurofins Sampling Reference Numbers when results come in.

5. Arrange the schedule of sampling and call the property owners required for permission. This is done as part of the borehole run arrangements as a whole. L:/WRS/Monitoring Programmes Groundwater-Quality (Boreholes)/Sites, Info and Arrangements/ Arrangements.

End March/early April and end September/early October - Ordering the bottles

6. Send email to Eurofins asking for quote for sampling at 16 sites. Our usual suites are as follows:

   AHERB – Phenoxyalkanoicacid Herbicides

   OCPST – Organochlorine Pesticides

   P&T – Purge and Trap. EPA 524 Suite

   THM's

   TRIAZ – Triazine Herbicides

   URONS – Phenylurea Herbicides
   Aldicarb and Oxamyl

This should be done approximately six weeks before sampling is due to commence. Eurofins will give quote by email.

7. Make sure the order for payment is raised electronically on JDE and you have an order number for the sampling to give to Eurofins. This can be done in May on two lines in JDE that split the total amount and the second line used for November.

8. Print, sign and date the quote and return by fax on 01962 ******. At the same time send an email to Eurofins to let them know the dates that the sample bottles will be returned to her and to request that all bottles, logs and labels are received two weeks prior to sampling to allow time for checking.

The number of bottles reduced for the November 2009 as THM and VOC are combined into two VOC bottles, but a THM label needs to be affixed to one of the bottles. There should now be 8 bottles in total.

9. Labels should be attached to the bottles carefully. Each type of bottle has its own label. The bar code should be visible (important to ensure this on the smaller bottles). These numbers and site names should be entered on the sheets provided by Eurofins.

May/November - Sampling

10. Sampling days for pesticides are Monday and Tuesday of each week of the borehole sampling run. Each week's samples should be returned to Eurofins by courier. Arrival must be by 4 pm on the Thursday afternoon of each week. Make arrangements with Huelin Renouf Airfreight 1-2 days before shipment date.

11. On site, make a note of the bottle no. (unique 'Sampling Reference Number' (SRN) supplied by Eurofins) on the field sheet. This is vital. Ensure all bottles at each site have the same SRN.

Despatching the bottles

12. Pack the bottles carefully using bubble wrap (more bubble wrap is available from Paperclix at Sandybrook) and send back to Eurofins. Ensure that glass bottles are placed in the crates and not cardboard boxes if insufficient. The maximum weight limit per crate for air transport is 30 kg. If the crates are heavier the shipment will be rejected and will need to be re-packed.

13. Enclose copy of fax with order number with each consignment.

14. Seal the crates and attach address label FAO Eurofins which is found in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Letters & Admin/Bottle Orders and Sending/Big crate address to Eurofins Scientific.

15. On the Monday afternoon of the first week, telephone Huelin Renouf Airfreight couriers (tel. 744477). Raise order in JDE. Confirm the details by fax, i.e. time of collection, collection point, no of crates etc and include order number. Fax for Huelin Renouf can be found in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Letters & Admin/Bottle Orders and Sending/Huelin Renouf fax DATE.

16. Type and sign customs declaration L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Letters & Admin/Bottle Orders and Sending/Customs note DATE 1st week and attach to exterior of crate. Attach courier order to one of the crates in each consignment, making a note on the order that further crates will need to be collected next week. You may need to remind Huelin Renouf to pick up the crates the following week as they have been known to forget. It is best to phone again on the following Tuesday as a reminder.

Certificates

17. The Certificates are now received by email to EP

18. Enter the data into the database. Results should be added to L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Field and Analysis Results/Individual Sites/Pesticide Data.

19. If a new site is being added a Pesticide template can be found in the L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Pesticide Template.

20. Review the data and where appropriate update graphs in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Field and Analysis Results/Individual Sites/Pesticide Data .

21. Ask for a volunteer to check the data.

22. Once the data has been checked copy the most recent results from the L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Field and Analysis Results/Individual Sites/Pesticide Data to L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Pesti and Micro results May 2000 - date Create a new spreadsheet for the latest results and include the latest set of micro biological results. These can be found in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Field and Analysis Results/Individual Sites/Microbiology.

23. Enter Eurofin certificate numbers in L:/WRS/Monitoring Programmes/Groundwater - Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Letters & Admin/Adminstration/Pestsites, year-on-year schedule/pesticide numbers.

24. File the Certificates in latest Groundwater Monitoring Pesticide Data Folder.

25. The Chlorthal Data also needs updating once the results have been checked L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/Pesticide and Micro Results, Info and Arrangements/Chlorthal Information/Chlorthal 1998 - date.

26. Update L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/\Field and Analysis Results/Nitrate Results/Percentage of sites over 50mgll2.xls

Sending out the data

27. For the property owners requiring results, send out a spreadsheet of the last 5 sets of results included on it to enable a comparison of the results.

28. The pesticide spreadsheet should be sent out together with the standard letter, field, chemical and micro data.

29. Environmental Health and Rural Economy get sent a copy of all the pesti/ micro results from the L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/Field and Analysis Results/Combo Results/All data DATE. The All Data needs updating biannually with the All Data results from the Field and Analysis folder, the Pesticide and Micro Results in the Pesticide and Micro Results, Info and Arrangements/Results folder, the Chlorthal information in the Pesticide and Micro Results, Info and Arrangements folder and the Nitrate Results in the Field and Analysis Results/Nitrate Results folder. A copy of the emails sent out to HP and Rural Economy can be found in L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/Site Info and Arrangements/Letters & Admin/Health Protection and L:/WRS/Monitoring Programmes/Groundwater-Quality (Boreholes)/Site Info and Arrangements/Letters & Admin\/Environment Dept\/Env. Management & Rural Economy

Analysing Data

30. Once data has been updated and sent out, the results must be transposed and input into the WQMIS database (water quality database). Decide which areas to sample next and which pesticides/ organics to analyse for.