

## *Long-term Groundwater Monitoring at LLWR*

*Dr John Shevelan*

10<sup>th</sup> July 2013

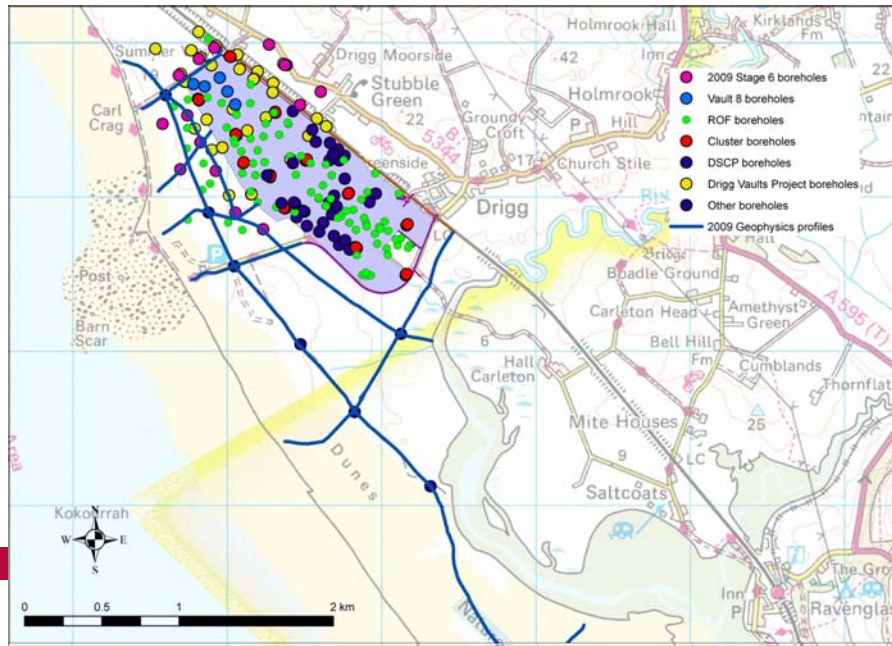
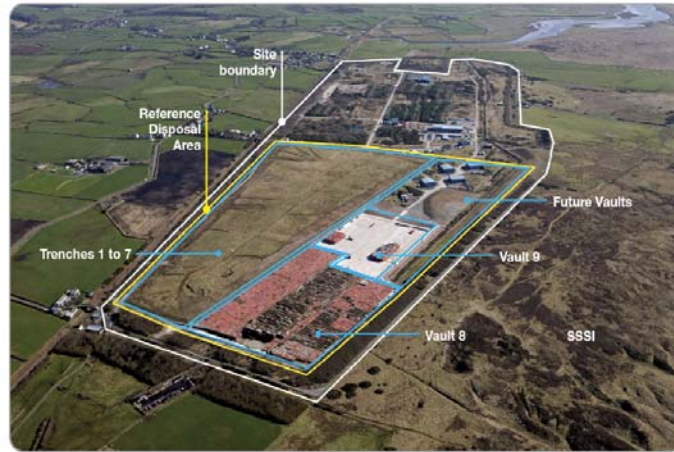


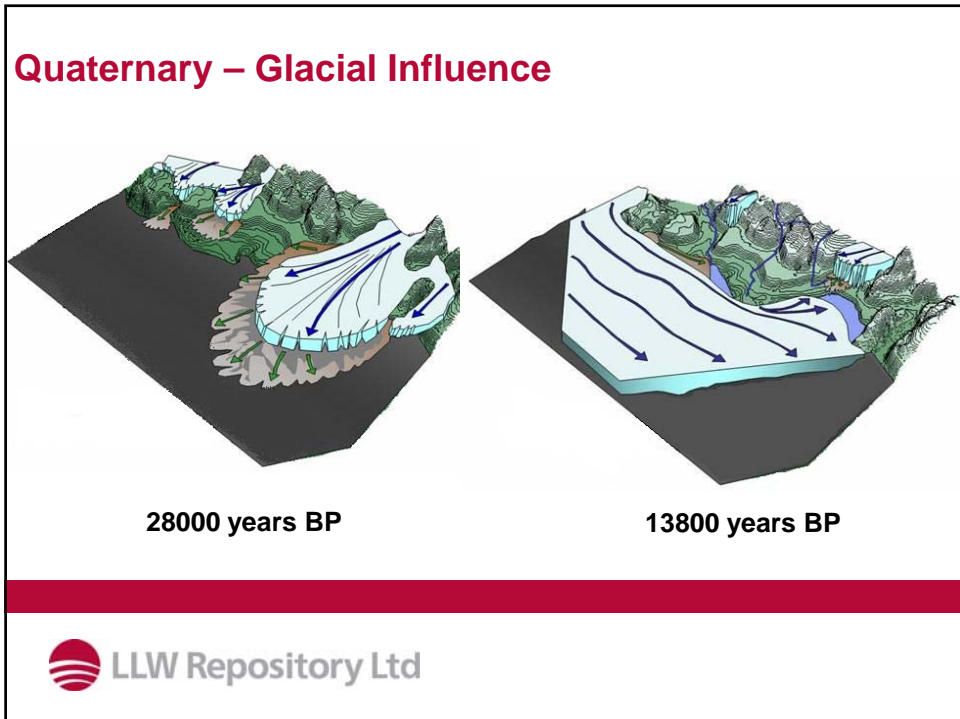
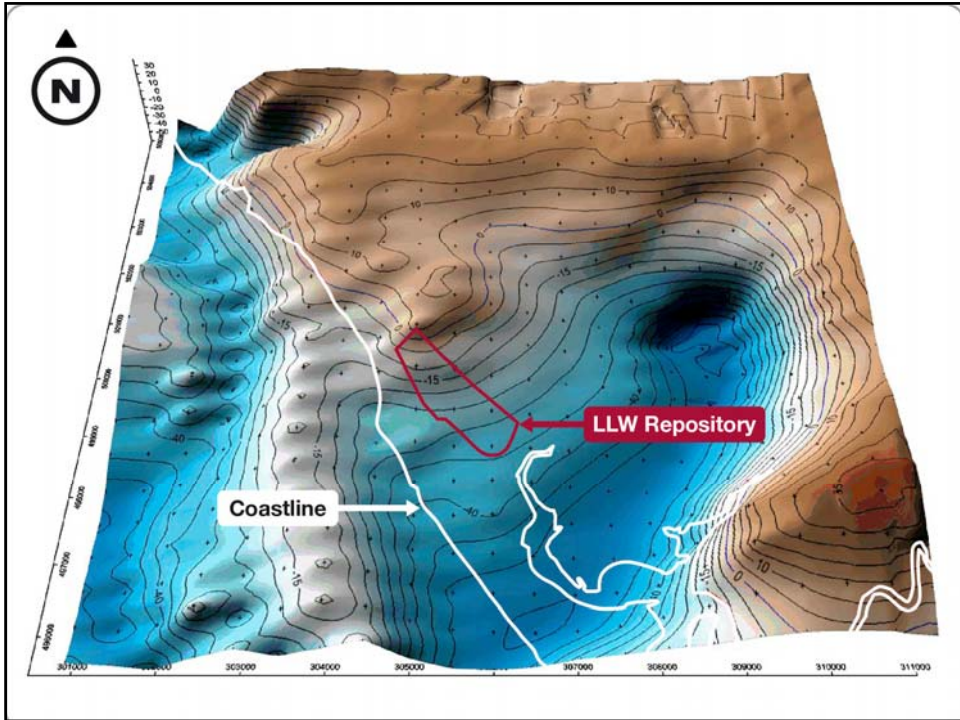
### **Introduction**

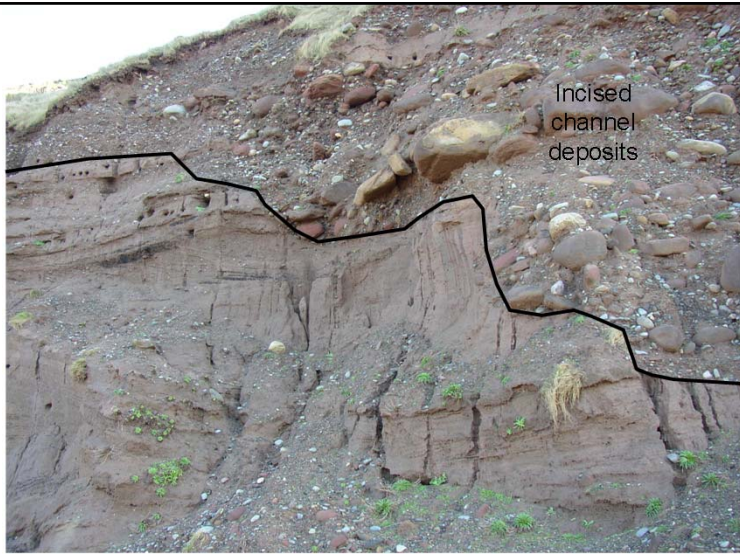
- Site setting / background
- Site investigation data
- Site conceptual model
- Current groundwater monitoring programme
- Data management
- Future programme / challenges



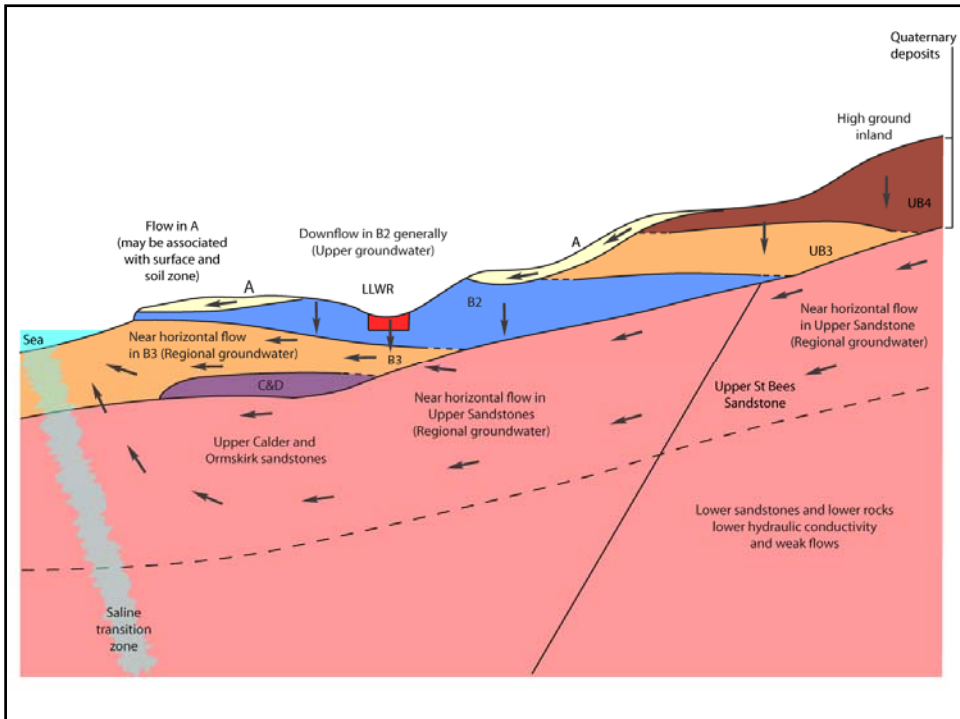
## LLWR Site







 LLW Repository Ltd



## Current Monitoring Programme

### Requirement R14: Monitoring

*“In support of the environmental safety case, the developer/operator of a disposal facility for solid radioactive waste should carry out a programme to monitor for changes caused by construction, operation and closure of the facility.”*

*Guidance on Requirements for Authorisation (GRA)*

Site closure – 2130

Period of Authorisation - 2230



## Environmental Monitoring Objectives

- To confirm that the repository system is not giving rise to unacceptable environmental hazards by direct measurement of the impacts to ensure compliance with the relevant environmental standards
- To provide data to refine models of site evolution
- To reassure stakeholders that the system is safe and evolving in a manner consistent with the conceptual models
- To provide an understanding of baseline conditions before construction or other works are carried out at the site



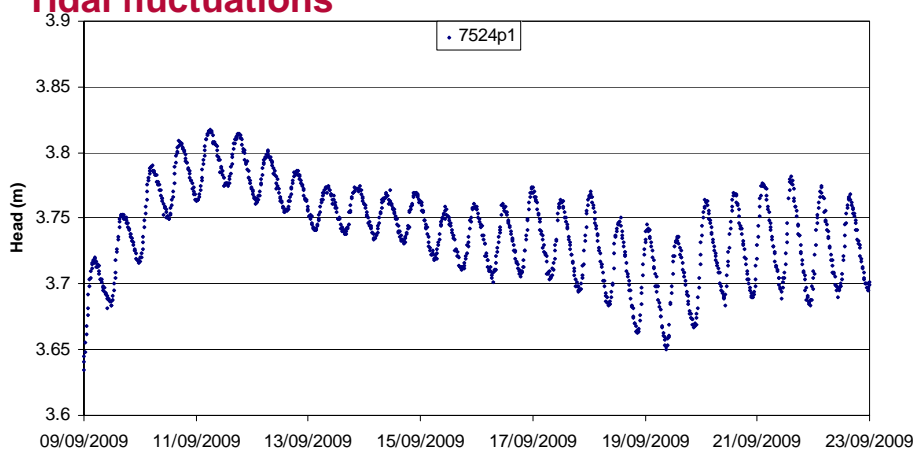


## Groundwater Level Monitoring

- Automatic logging at 100 locations monitored at hourly intervals
- Environment Agency borehole network used to supply regional data
- Move to automatic logging at 34 locations at hourly intervals and quarterly downloads
- Quarterly dips of all other locations plus regional data set
- High frequency data used to support transient groundwater monitoring and to investigate tidal influence on Regional groundwater



## Tidal fluctuations



## Groundwater Quality Monitoring

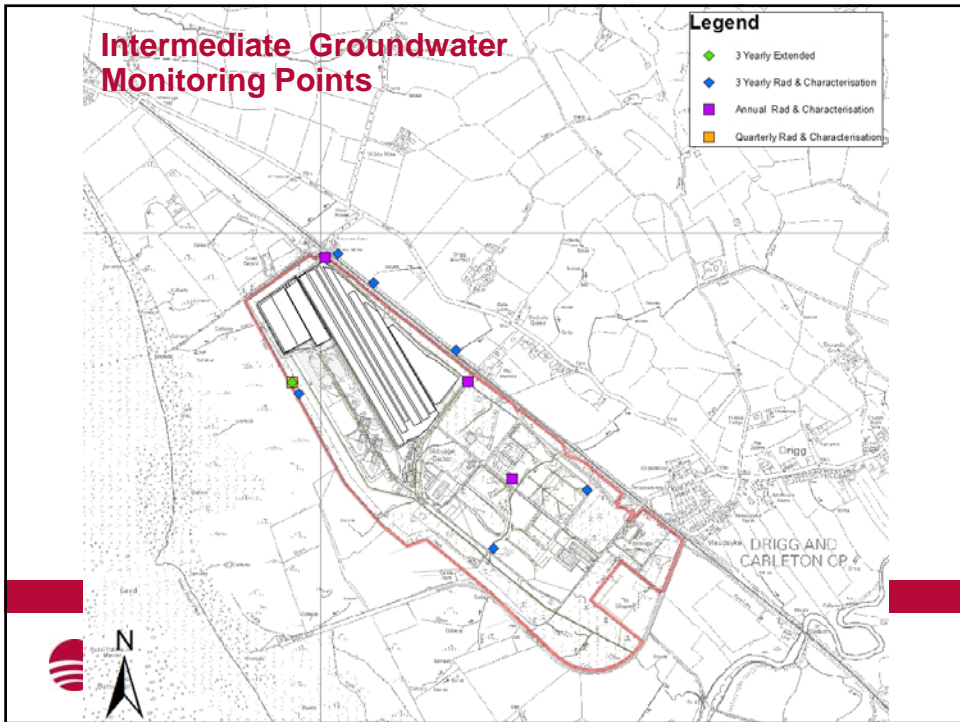
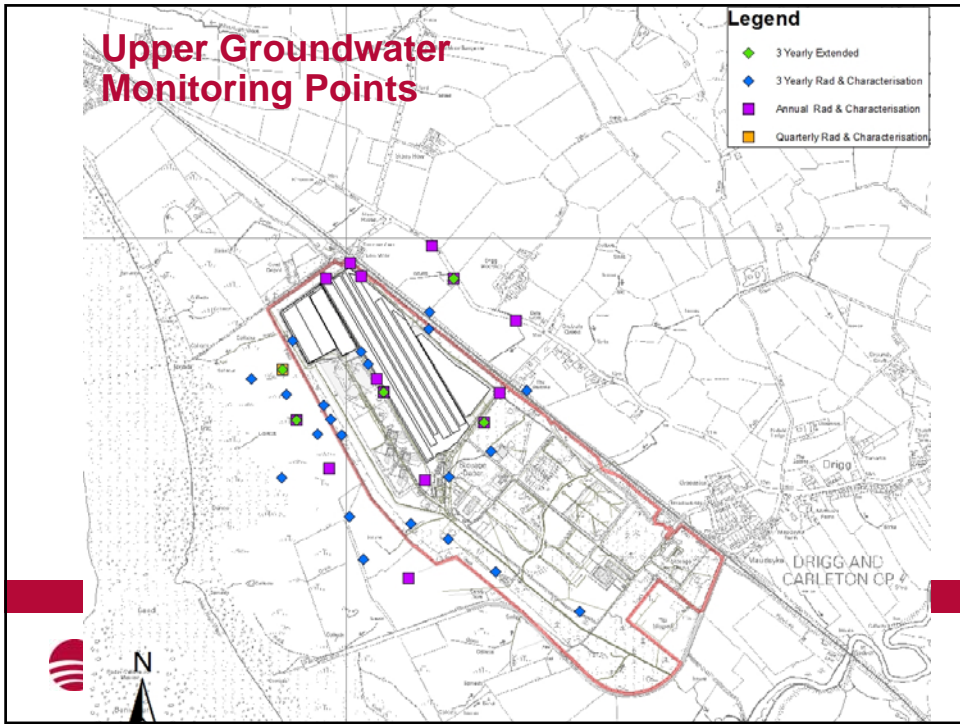
- Quarterly radiological monitoring combined with field measurements for groundwater level, conductivity, pH, temperature, dissolved oxygen and redox potential are considered sufficient to act as indicators of changes in groundwater conditions or increased releases and prompt further investigation as required
- The number of monitoring points is considered to be sufficient to provide good coverage across the site, including both up-gradient and down-gradient boreholes, and monitor long-term trends



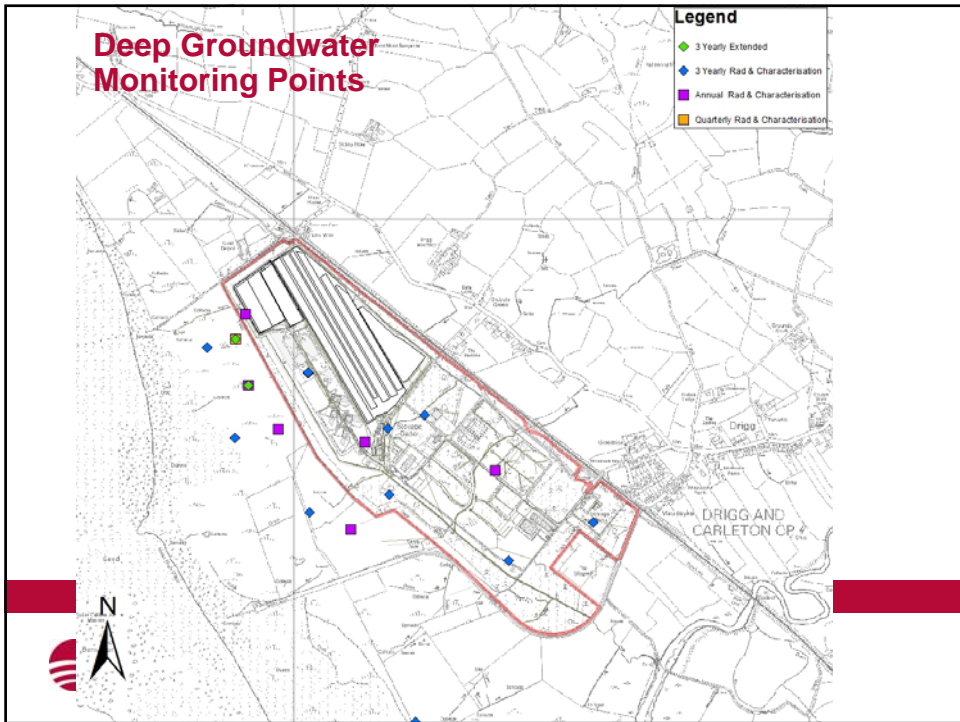
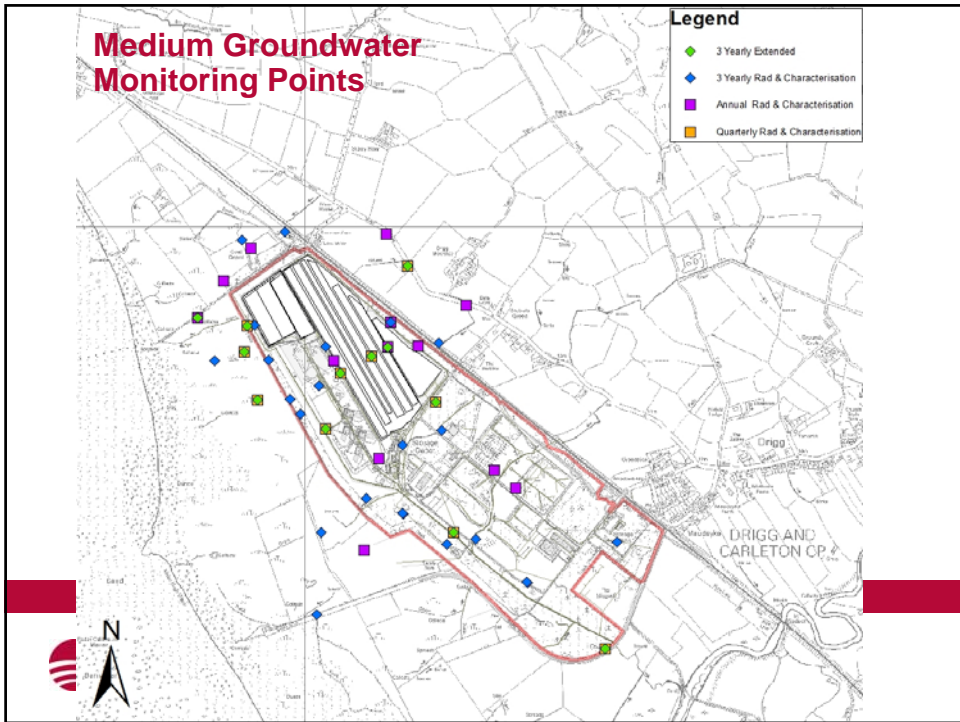
## Groundwater Quality Monitoring

- The frequency of non-radiological monitoring in leachate and surface water was reduced to be proportionate to the risk posed by the site
- 65 locations on a three yearly cycle
- Currently completing first 3-year cycle









## Data Management

- Radiological data for leachate from 1978
- Groundwater radiological data from 1986
- Intermittent non-radiological data
  
- Monitor Pro (MP5) database used for all monitoring data.
- Monitoring programme collects three million data points every year
- Long-term costs of data management and transition between software programmes



## Knowledge Management

- Ensuring staff know why data are being collected
- Ensuring the reasoning behind changes to the programme are recorded and accord with the long-term objectives
- Capturing important information about monitoring operations / procedures



## Future Programme / Challenges

- Flexible environmental monitoring programme
- Infrastructure maintenance
  - Early identification of problems
    - Repair
    - Re-development
  - Replacement / loss of boreholes due to site development
  - Access agreements
- Long-term changes
  - Sea-level rise
  - Climatic variation – increased rainfall
- Technology
  - Detection levels
  - Remote sensing



More information available  
at  
[www.llwrsite.com](http://www.llwrsite.com)



22/05/2012 22