Nottinghamshire County Council

Report to Communities and the Environment Standing Committee

23 April 2012

Agenda Item: 5

REPORT OF COUNTY COUNCILLOR GAIL TURNER

WATER AND GAS EMISSIONS FROM DISUSED MINES DRAFT FINAL REPORT

Purpose of the Report

1. To Present the final report of the Water and Gas Emissions from Disused Mines Study Group.

Information

2. The **Water Resources Act, (1991)** required amendment to encompass the responsibilities of owners of abandoned mines with respect to permitting a discharge. The statutory liability of permitting a discharge of water from an abandoned mine was changed in 1999 but only for mines closed after 31/12/1991 (i.e. Annesley (2000) and Clipstone (2003)). Thoresby and Welbeck remain open and will fall under this amendment should they close.

3. The advent of the **European Water Framework Directive**, currently being transposed into UK law, will have major impact on the minewater issue. The directive is all encompassing and determines water quality requirements for surface and ground water bodies. A programme of improvements is set out for achievement by 2015. A noted requirement is that no degradation of the current status of water courses is allowed, with clear implications for any new minewater discharge.

4. The Environment Agency and the Coal Authority have a Memorandum of Understanding regarding the environmental issues and potential risks posed by minewater seepage upon groundwater and surface water quality. Both organisations have commissioned various studies to identify the mechanisms of

groundwater movement, contaminant transport within the closed coalfields and the consequent environmental risks posed to groundwater/surface water quality and flows in the future.

5. Strategic Flood Risk Assessments have been completed by a number of Local Government Authorities within the County. Some have identified potential risks of flooding from mines and spoil heaps. The general conclusion is, however, conclusion is that if the minewater levels are controlled at depth and with a flow path and hydraulic gradient maintained as planned then flooding due to mine water is not considered likely to be an issue.

6. The contribution of spoil tips to surface water flooding due to increased runoff resulting from the impermeable nature of the shale/colliery spoil may well be a pertinent consideration when newly formed. However, the various colliery spoil tips now in Nottinghamshire County Council ownership have benefited from restoration, and have a developed significant depth of vegetation, allowing infiltration of rainfall and attenuation of runoff by various sustainable urban drainage features as well as a layer of vegetation. The potential flood impact of any spoil tip restoration would have been subject to scrutiny under the development planning regime, whereby any application would have had to identify the risks posed and provide adequate mitigation.

Mine Water Pumping and Monitoring

7. A proactive mine water monitoring programme is in place to provide information to manage the impending (5-10years) rise in groundwater levels. The initial models of the late 1990s have been refined and tuned at the regional level and have identified locations which may give rise to minewater seepage. A listing of the various mine sites associated with the Nottinghamshire Coalfield where monitoring is conducted is presented in Appendix 1.

8. The Coal Authority has identified a National Preventative Programme of pumping and treatment such that potential discharges are to be dealt with in the next 20 years. A reactive programme deals with the 120 or so discharges which are known to be a problem at present. The Coal Authority has gained the agreement/consent of the Environment Agency and has agreed a joint working consensus. Currently there are no discharge sites in Nottinghamshire. Most of the schemes currently in operation are those associated with coalmines long since closed; South Wales, Scotland, and the North East of England.

9. The monitoring of minewater and groundwater levels has allowed the formulation of a map of the probable groundwater flow across the county. It should be noted that the structural controls (i.e. roadways, collapsed zones, goaf etc) of the mined areas may influence minewater flows in unanticipated directions. The stacking (relative depths) of the interconnections between mines is also most important to understand any attempt to model groundwater flows within the mined area. Appendix 2 illustrates the current probable groundwater flows across the Nottinghamshire Coalfield.

10. It is not considered likely, in the near future, that Nottinghamshire will experience the minewater discharge problem that are evinced in the North East, this being due to geology and depth of operation. It is estimated that pumping and treatment of the minewaters may be required in the County at some later date in 5 -10 years time or longer dependant upon the degree of inter-connection between the mines and the pumping rates employed in current schemes.

11. Appendix 3 and 4 illustrate the changes in groundwater levels over time at 5 no. colliery sites i.e. Morton, A-Winning, Woodside, Langton No.7 and Calverton. It is noted that water levels change abruptly with the cessation/recommencement of minewater pumping (see steep gradients within the various graph lines). The graph of the water levels at Woodside (see Appendix 4) are shown with reference to the control levels which are set to protect from water discharge at the surface.

12. Presently there are three near surface pumping stations in the west of the coalfield; Woodside, A Winning and Morton, all outside Nottinghamshire. These are currently in the ownership of UK Coal but will transfer to The Coal Authority and are used/will be used to pump relatively uncontaminated minewaters to maintain the hydrological equilibrium and thereby reducing the loading on the more contaminated minewaters associated with the Calverton pump site. The coal field dips down west to east and these three locations are in the west. It is expected that the three pumping stations mentioned will be maintained “in perpetuity”.

13. A deep pumping station is proposed for Calverton using the shaft, this location lying to the east is at greater depth, and will act as a sump to pump the minewaters across the southern Nottingham coalfield.

14. Appendix 5 indicates the location of the pumping stations and the potential quantities of minewaters involved. Whilst there is every indication that the pro-active plan will address the minewater rebound issue, there is no Plan B, however it is the considered opinion of both the EA and the Coal Authority that the Calverton scheme, as proposed will provide sufficient time for alternative solutions to be put in place.

15. The mine waters at Calverton are likely to be high in Iron which can be treated, precipitated and entrained in reed bed etc. However the minewaters also have a high saline content due to the source geology. This presents difficulties for disposal as the treatments for the metals contaminants will not remove the saline content. One solution to the saline content will be to pipe the treated minewaters to allow discharge in a part of the River Trent where salinity may not be an issue.

16. Thus between the actions of the Environment Agency and the programme of works from the Coal Authority it is envisaged that the minewaters of the Nottinghamshire coalfield will be controlled in a hydraulically balanced state to allow the programme of treatment to operate effectively and thereby protecting the water quality of the sandstone aquifer and the surface water courses of the region.

17. There exists the potential for realising the energy entrained within the minewaters in the form of heat by the use of ground source heat pumps (GSHP). The exploitation of such potential is underdeveloped in the United Kingdom compared with the situation of Europe.

18. The opportunities offered by the minewater rebound, in the form of source of energy should be explored and maximised. There are currently research projects in the USA where acid minewaters are used in fuel cells to generate electricity.

19. Similarly the opportunities presented by rising minewaters to provide a volume contribution to base flow of at risk streams and rivers during drought conditions should also be investigated and encouraged.

Mine Gas and Monitoring

20. Mine Gas derived from the coal seams will accumulate within the void space of the mine and will migrate via pressure gradients and diffusion through fissures, shafts and roadways etc.

21. Mine water in the Nottinghamshire coalfield has been monitored over an extensive period and has been seen to rise when no controlled pumping of minewater is undertaken. This phenomenon may cause pressure gradients within the mine void and initiate movement of mine gas to the surface.

22. Mine Gas and Mine Water monitoring programmes are carried out by The Coal Authority. Nottinghamshire County Council does not monitor any mine gas / mine water sites. Nottinghamshire County Council monitor closed landfill sites in their possession through various landfill monitoring programmes.

23. In the Nottinghamshire Coalfield, mine gas monitoring is carried out via boreholes and Vent Stacks on a continuous basis and/or spot measurements. On average, locations are monitored on a quarterly programme of visits. 50% of locations are monitored on a monthly basis. Reports are generated for internal use (Coal Authority) and the database extends back to the inception of the Coal Authority in 1994. In certain locations data extends back beyond this date.

24. In cases of close proximity of landfills, to former colliery sites, has resulted in the potential for gas generation and leachate discharge which may not originate from geological sources. This then places a burden of responsibility on the landowner rather than Environment Agency to quantify and assess risk, and act as appropriate.

25. No monitoring is undertaken of coal bed gas extraction processes, there have only been a couple of planning applications for exploratory boreholes to assess the potential of this energy source. There are no current operational schemes for coal seam gas extraction.

26. Similarly there have been no planning applications for hydraulic fracturing or “fracking “of coal shales and it is understood that there is a moratorium on such operations at present. “Fracking” a process where the underlying rock strata is fractured by artificial means to facilitate the extraction of methane. Should these circumstances change it is expected that any monitoring requirement of such activities would be exercised by the planning process.

Summary

27. A programme of ground water/minewater monitoring is carried out to inform and validate a 3 – dimensional computer model of the Nottinghamshire coalfield. This model and the supportive monitoring does not indicate that minewater rebound will cause surface flooding if a controlled programme of pumping is carried out.

28. Currently there are no sites in Nottinghamshire where minewater seepage/discharge is occurring.

29. The pumping of the minewater at key locations in the west of the coalfield is underway. A similar project to pump minewater at a location in the east of the coalfield is also well advanced. The minewater pumping programme has controlled minewater levels and will continue to control minewater levels to prevent localised breakout of minewaters.

30. In summary, the responsibility for monitoring Coal Seam derived gases (methane, carbon dioxide etc); ground waters within the former mine workings and mine waters discharging from former colliery/mines lies with The Coal Authority.

31. The Environment Agency also has various responsibilities with regard to groundwater protection and may also monitor ground waters and surface waters in the areas impacted by mine workings.

32. Nottinghamshire County Council as a landowner have a duty to ensure that landfill sites and restored colliery sites as with any site in their ownership do not cause pollution of ground waters and other water courses, or allow offsite migration of contaminants e.g. landfill gas.

33. As part of the management strategy to fulfil our ownership responsibilities of County Council owned sites, a programme of monitoring of landfill sites is undertaken on a routine basis across the county at various sites. District Councils may also carry out similar landfill gas monitoring programmes.

34. The Environment Agency may also monitor the ground waters, leachate discharges and landfill gases associated with operating and closed landfill sites as part of the waste licensing arrangements or in connection with the protection of groundwater resources.

35. Nottinghamshire County Council as part of its duties and responsibilities under the Tip Inspection Regulations (Mines and Quarries Act 1969) conduct regular inspections of the spoil tips associated with the former colliery sites with particular focus upon the stability and soundness of the tip structures.

36. As a landowner Nottinghamshire County Council would also have liability for any water discharge from a former colliery spoil tip in their ownership. No regular programme of water quality monitoring is undertaken, however the issues of surface water runoff and minewater seepage from these sites would be assessed on a site by site basis in concert with the routine tip inspection.

The following table summarises the key areas of responsibility

TABLE 1 AGENCY RESPONSIBILITIES

	AGENCY RESPONSIBILITY			
ACTIVITY	***Environment Agency***	***The Coal Authority***	***Nottinghamshire County Council***	***District Councils***
Mine Water Monitoring		x		
Mine Gas Monitoring		x		
Groundwater levels	x	x		
Groundwater Quality	x	x		
Surface Water Quality	x			
All Mineral Spoil Tip sites in Nottinghamshire; Inspections		x	x	
Spoil Tip Seepage	x	x	x	
Nottinghamshire County Council owned site:Landfill Gas	x		x	x

Recommendations:

Members are requested to:

1) Consider and comment on the information provided

2) Consider the efficacy of the minewater control programme and the results of such thus far.

3) Consider preparation of a response to, and be committed to the wider stakeholder discussions which will precede the development of a control strategy for the inevitable minewater rebound and any rise in groundwater levels.

4) Consider what contingency planning issues are raised should a “Plan B” be required in the event that minewater breakout is realised.

5) The monitoring of the prevailing groundwater and minewater levels is fundamental to informing and validating the groundwater model of minewater rebound. The County should consider how best it can assist the Coal Authority/Environment Agency monitoring programme by making borehole sites available within the property holding of the Green Estate(Colliery Yards, Spoil Tips etc which have been restored). The long term impact of a monitoring borehole is minimal with only a small 30cm flush borehole cover visible at the surface.

6) Consider a request to the Coal Authority to receive and Annual Report of Minewater levels across the county. This report could also include commentary as to whether minewater levels in any of the monitoring boreholes/ shafts approach or exceed the various Long Term Control Minewater Levels. This way the council could engage more readily and responsively with any minewater control strategy which is developed.

7) Consider the dissemination of the potential impacts of the minewater rebound to relevant County/District Council departments which have responsibility for the council portfolio of property, and in particular the use of Sustainable Urban Drainage Systems in areas likely to be affected by minewater rebound.

8) Consider the recommendation that the successor committee undertake an annual review of liabilities and responsibilities which may fall to the County with regard to regulatory changes in mine and former mine developments and minewater

9) Consider an evaluation of current and future commercial opportunities for harvesting energy from mines and minewater. The potential offered by minewater rebound and the application of ground source heat pumps should be considered at the earliest opportunity.

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Chair of the Water and Gas Emissions from Disused Mine Study Group

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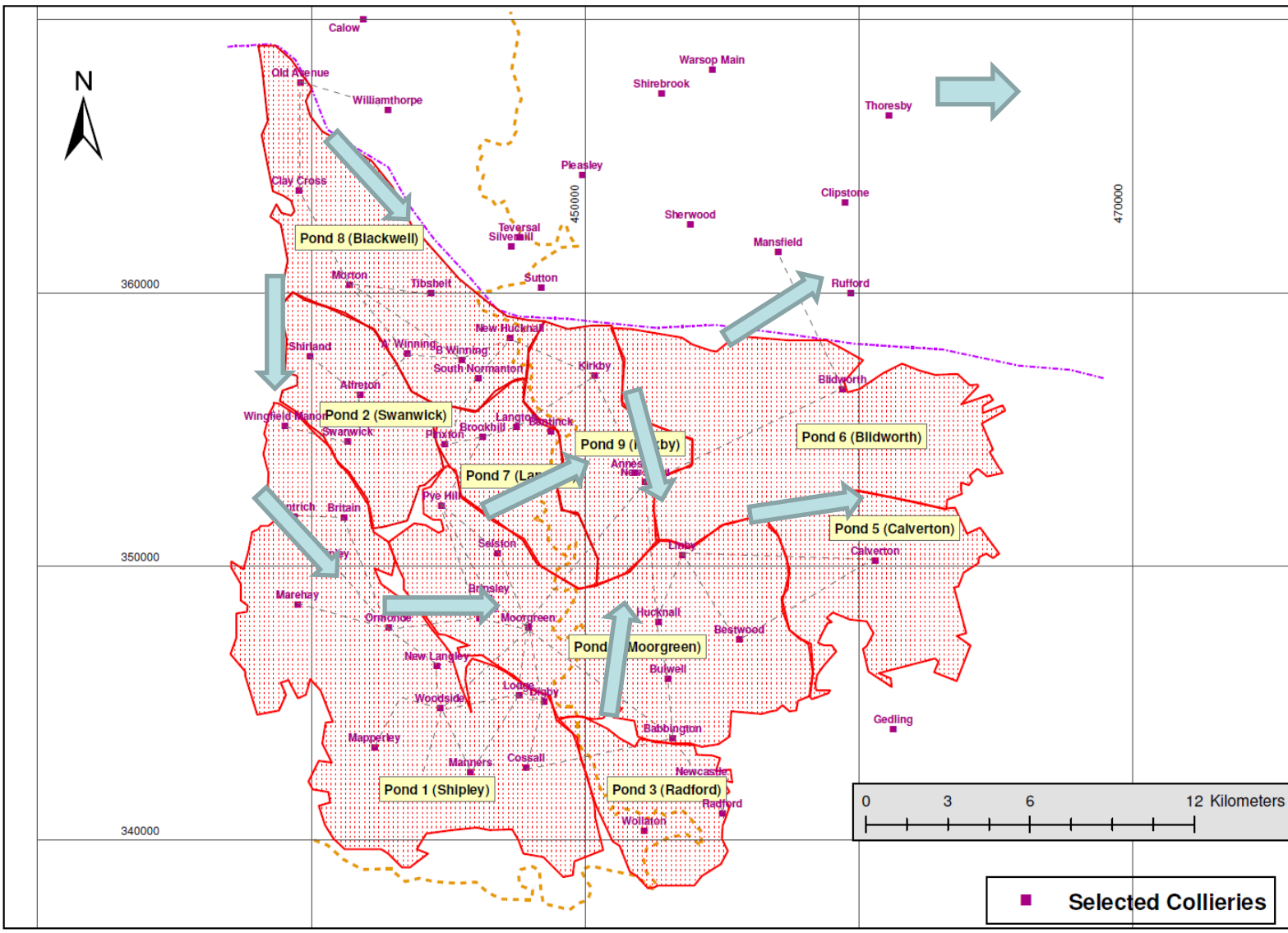
Background Papers Nil

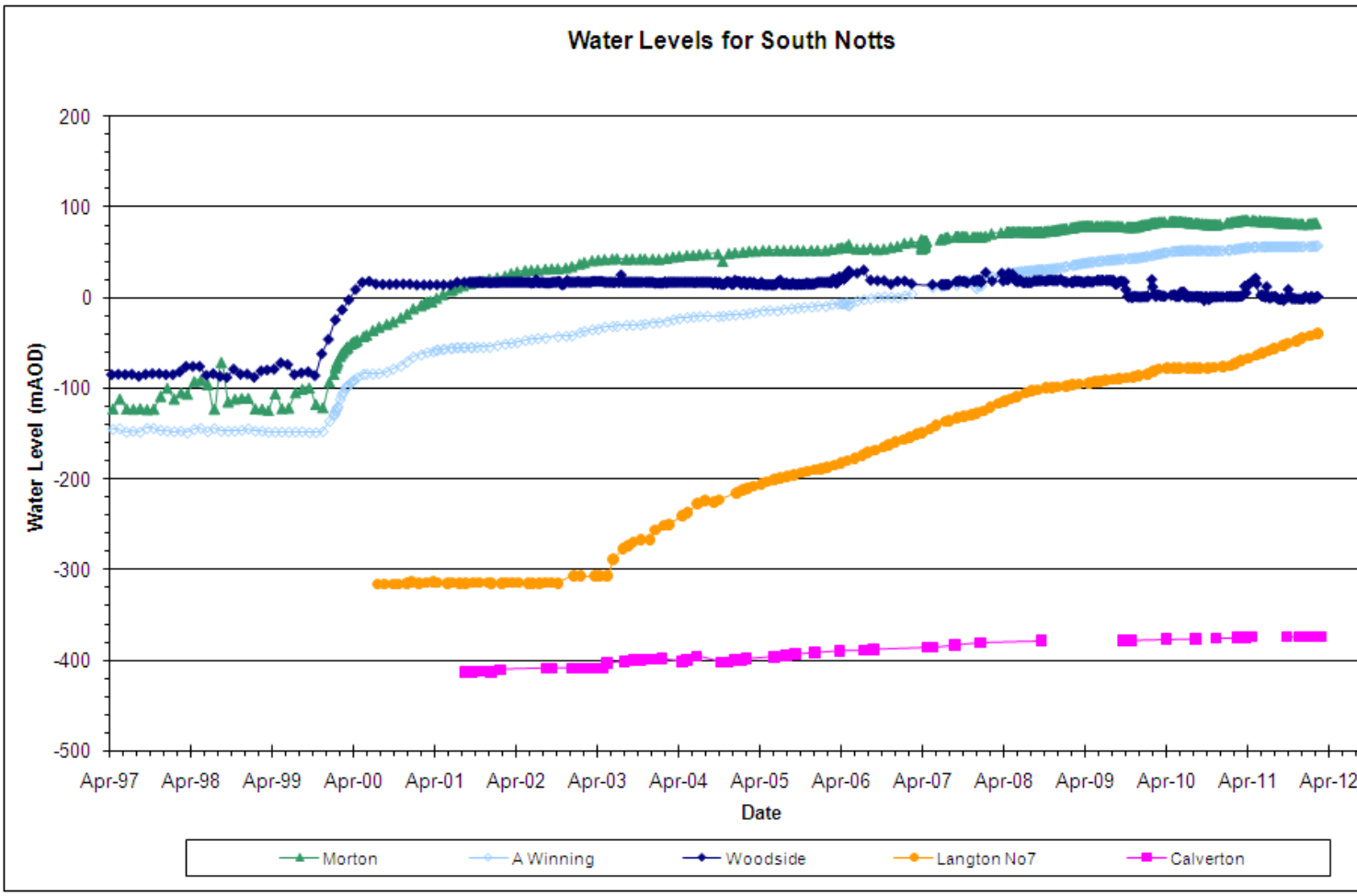
Electoral Division(s) and Member(s) Affected All

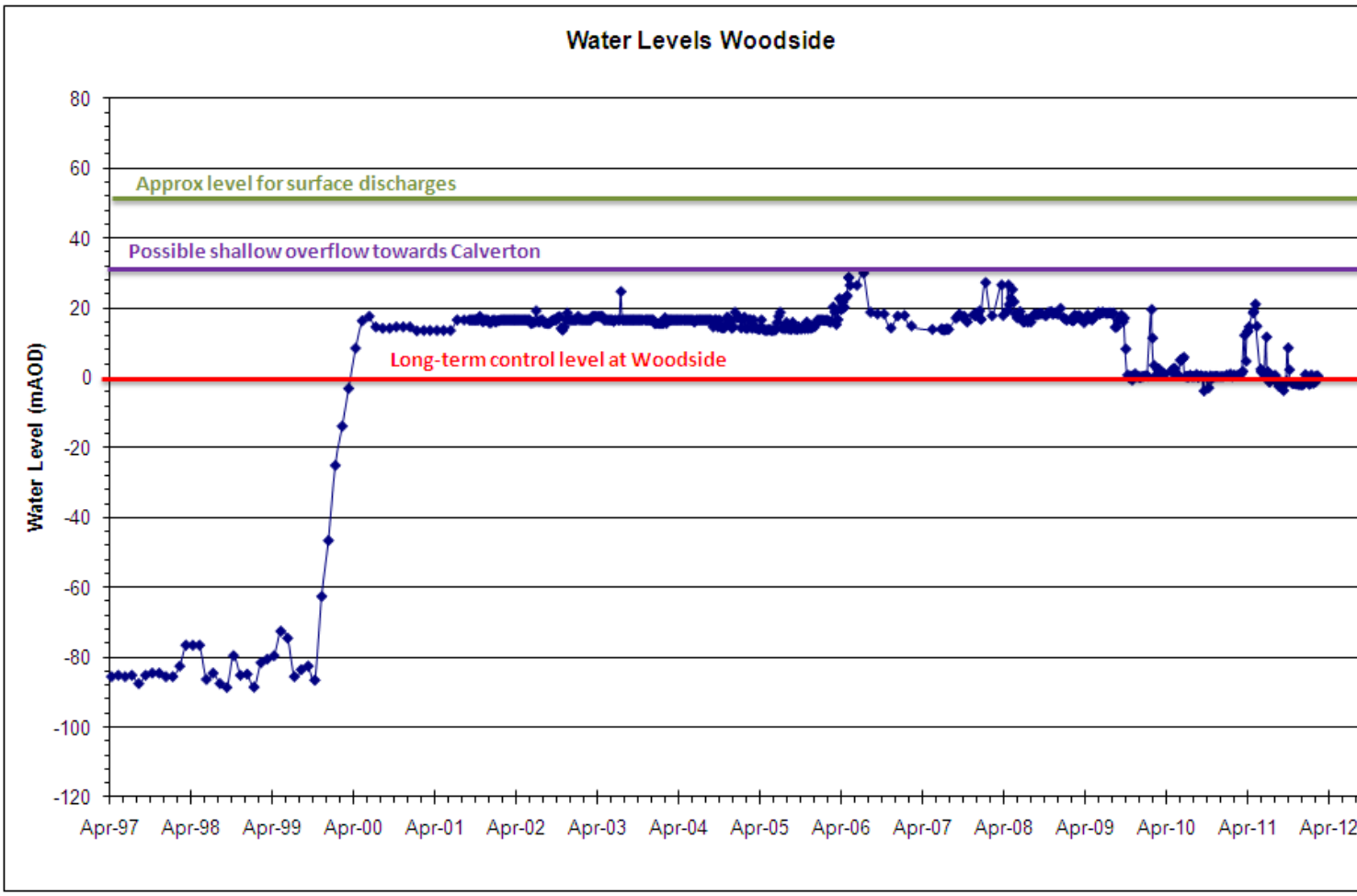
Appendix 1 Minewater and Mine Gas Monitoring Sites

Site	County	Purpose	Data from
Kirkby Drift BH	Nottinghamshire	Gas Venting	1995
A Winning Shaft	Derbyshire	Water Level / Future Pumping	1996
Avenue Shaft	Derbyshire	Water Level	1996
Clay Cross Shaft	Derbyshire	Water Level	1996
Morton Shaft	Derbyshire	Water Level	1996
Woodside Shaft	Derbyshire	Water Level / Pumping	1999
Calverton Shaft	Nottinghamshire	Water Level / Gas Extraction	2000
Langton Shaft	Derbyshire	Water Level / Gas Venting	2000
Denby Hall BH	Derbyshire	Water Level	2001
Oakwood Grange BH	Derbyshire	Water Level	2001
Ormonde BHs	Derbyshire	Water Level / Gas Venting	2001
Stanley BH	Derbyshire	Water Level	2001
Radford BHs	Nottinghamshire	Water Level	2007
Babbington BH	Nottinghamshire	Water Level	2010
Moorgreen BH	Nottinghamshire	Water Level	2010
Newstead BH	Nottinghamshire	Water Level / Gas Monitoring	2010
Lodge BH	Nottinghamshire	Water Level	2011
Pinxton BH	Derbyshire	Water Level	2011
Linby BH	Nottinghamshire	Water Level or Gas	2012



Appendix 2 Probable Minewater flow across Nottinghamshire Coalfield; Western Exposed Outcrop to Eastern Deep Concealed Mines


Water Levels for South Notts
200
100
0
-100
-200
-300
-400
-500
Water Level (mAOD)
Apr-97
Apr-98
Apr-99
Apr-00
Apr-01
Apr-02
Apr-03
Apr-04
Apr-05
Apr-06
Apr-07
Apr-08
Apr-09
Apr-10
Apr-11
Apr-12
Date
Morton
A Winning
Woodside
Langton No7
Calverton


Water Levels Woodside
Water Level (mAOD)
80
60
40
20
0
-20
-40
-60
-80
-100
-120
Approx level for surface discharges
Possible shallow overflow towards Calverton
Long-term control level at Woodside
Apr-97
Apr-98
Apr-99
Apr-00
Apr-01
Apr-02
Apr-03
Apr-04
Apr-05
Apr-06
Apr-07
Apr-08
Apr-09
Apr-10
Apr-11
Apr-12

APPENDIX 5 LOCATION OF MINEWATER PUMPING STATIONS