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East Midlands Coal Mining Seismicity

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HAZARDS PROGRAMME

COMMERCIAL REPORT CR/18/115

East Midlands Coal Mining Seismicity

R. Lockett

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British Geological Survey offices

**Environmental Science Centre, Keyworth, Nottingham
NG12 5GG**

Tel 0115 936 3100

BGS Central Enquiries Desk

Tel 0115 936 3143

email enquiries@bgs.ac.uk

BGS Sales

Tel 0115 936 3241

email sales@bgs.ac.uk

**The Lyell Centre, Research Avenue South, Edinburgh
EH14 4AP**

Tel 0131 667 1000

email scotsales@bgs.ac.uk

Natural History Museum, Cromwell Road, London SW7 5BD

Tel 020 7589 4090

Tel 020 7942 5344/45 email bgs-london@bgs.ac.uk

**Cardiff University, Main Building, Park Place, Cardiff
CF10 3AT**

Tel 029 2167 4280

**Maclean Building, Crowmarsh Gifford, Wallingford
OX10 8BB**

Tel 01491 838800

**Geological Survey of Northern Ireland, Department of
Enterprise, Trade & Investment, Dundonald House, Upper
Newtownards Road, Ballymiscaw, Belfast, BT4 3SB**

Tel 01232 666595

www.bgs.ac.uk/gsni/

**Natural Environment Research Council, Polaris House,
North Star Avenue, Swindon SN2 1EU**

Tel 01793 411500

Fax 01793 411501

www.nerc.ac.uk

**UK Research and Innovation, Polaris House, Swindon
SN2 1FL**

Tel 01793 444000

www.ukri.org

Website www.bgs.ac.uk

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Foreword

This report is the published product of a study by the British Geological Survey (BGS) for the Oil and Gas Authority. It is a review of instrumental seismicity in the East Midlands and its relationship with coal mining.

Acknowledgements

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Summary

The relationship between collieries and seismicity is well documented. Earthquakes are an expected side effect of deep longwall mining. This study looks in detail at the seismicity of a region of England where mining has been very widespread over many decades. The size of mining earthquakes is considered and the associated ground motion presented. Ground motions of the largest events are such that they can be locally felt but are not damaging. Seismicity is looked at in the context of the mines closing and it is shown that seismicity near a given mine only lasts a matter of months after it has shut.

1 Mining Seismicity

Small to moderate earthquakes have been felt within British coalfields for over a century, for example, the Stafford earthquake of 1916 (Davison, 1919). In the 1970s and 1980s, the BGS gradually installed the national seismograph network across the UK and the earthquakes recorded were entered into the BGS earthquake database. It was noted that a disproportionate number of these earthquakes were in mining areas (Redmayne, 1988). Temporary networks of sensors were deployed to study some of these earthquakes in more detail (e.g. Redmayne et al, 1998, Westbrook et al, 1980). This showed that these events were related to ongoing mining activity and were distinct from the natural seismic activity of the UK. It became standard practice for analysts at the BGS to mark shallow earthquakes near to coal mines as “coalfield events” so that they could be distinguished from natural seismicity for hazard or other studies. In the 1980s and 1990s, such events accounted for approximately 25% of all the earthquakes recorded in the UK (Browitt et al, 1985). This proportion reduced steeply throughout the 2000s as mining activity declined. The most recent earthquake to be labelled as a coalfield event was in 2016.

In the East Midlands, there have been two well-documented episodes of increased mining-induced seismicity. Between July 1989 and August 1990 over 130 earthquakes were reported to the Thoresby Park estate office, near to the Thorseby Colliery in Nottinghamshire. British Coal commissioned the University of Liverpool to determine whether the earthquakes were caused by mining activity (Bishop et al., 1994). The resulting temporary network operated between August 1990 and August 1991 and located 192 earthquakes with magnitudes up to 2.5ML. The researchers concluded that the earthquakes ‘appear to have been caused by longwall mining in the surrounding collieries’ (Bishop et al., 1994). 34 of the original earthquakes are in the BGS database and several of those recorded by the temporary network were big enough to be also detected by the national network. Between December 2013 and January 2014, the national network detected a series of over 40 earthquakes near to the village of New Ollerton, Nottinghamshire, again within 2km of the Thorseby Colliery. Many of these were felt and in February 2014, the BGS installed a temporary network around the mine. The network remained until October and a further 300 earthquakes with magnitudes between 0.1ML and 2.1ML were recorded (Verdon et al., 2018).

2 Seismicity

2.1 DATA

The Coal Authority maintains a database of coal mining reporting areas (Coal Authority, 2004). Of the national reporting areas, it was decided that two covered the area of interest for this report. These are NOTTS, 199 and NOTTS, 30. The extent of the corresponding regions can be seen in Fig. 1. This area covers the coalfields of Nottinghamshire, Yorkshire and Derbyshire.

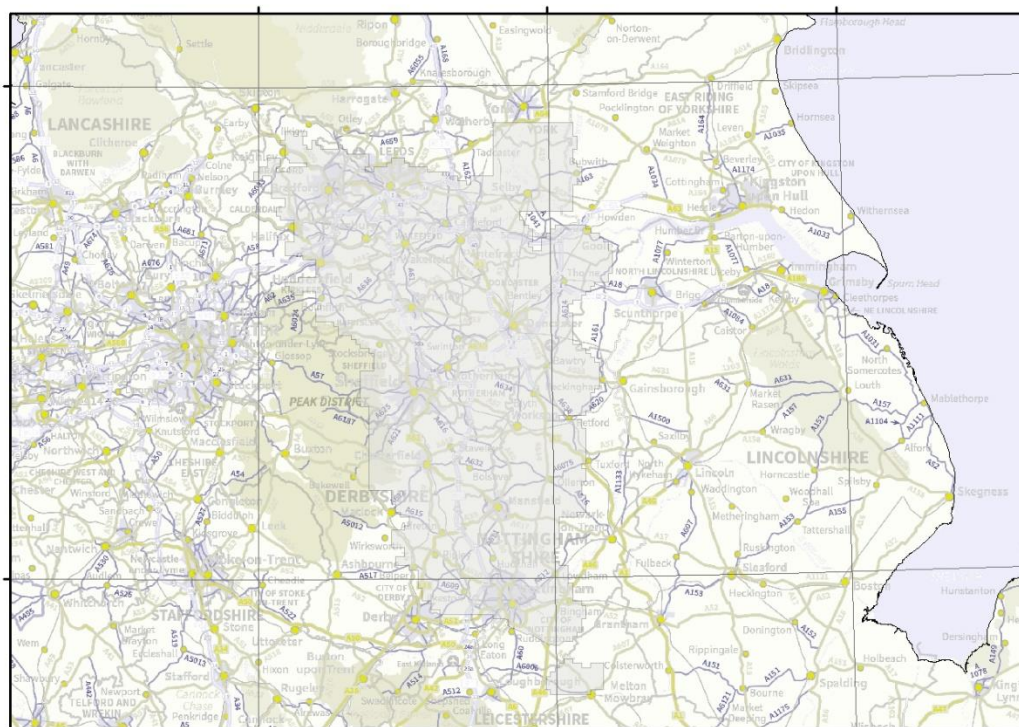


Figure 1: The extent of Coal Authority reporting areas 199 (the large shaded area) and 30 (the small shaded area to the South).

The BGS earthquake database was queried for events within the polygons defined by the Coal Authority – that is in the region known to have been mined for coal. 802 earthquakes were found between 1970 and 2018, with a magnitude range of 0.1ML to 2.1ML (Appendix 1). The earthquakes were chosen purely geographically, rather than by using the ‘coalfield’ label, so that the total seismicity of the area can be investigated. The label is subjective and decided upon by the analyst at the time, and may not be completely reliable. Of the earthquakes selected, 684 are labelled as coalfield events in the database but from now on all earthquakes will be considered together without reference to that label.

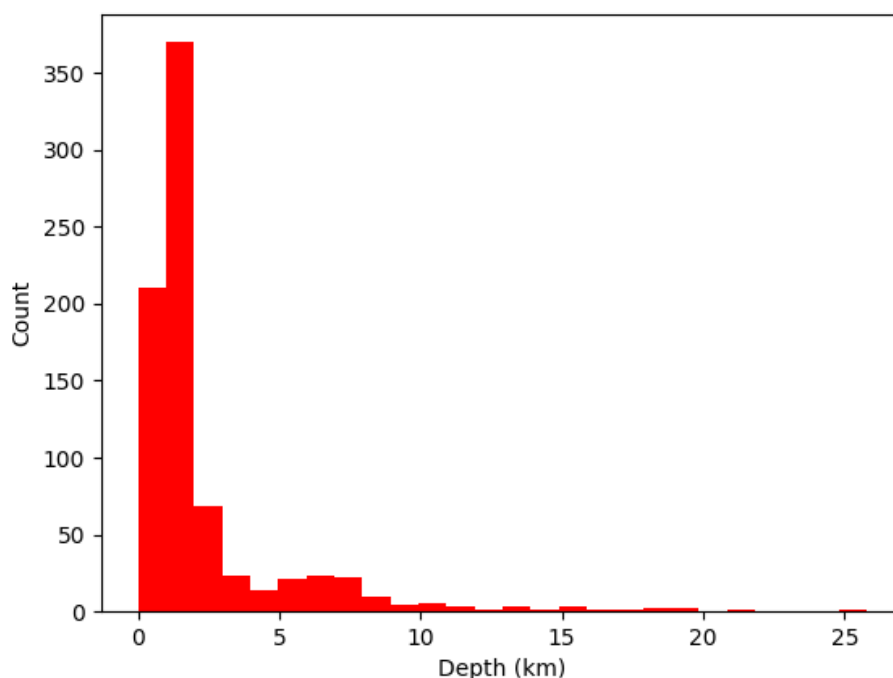


Figure 2 Depth of the 802 earthquakes in the area of interest.

Fig. 2 shows the depths of the 802 earthquakes. As can be seen, the vast majority are less than 3 km deep. In general, the standard error in the depth determined by the location inversion is several kilometres. As the deepest mine in the area was a little less than 1 km deep, it was decided that earthquakes deeper than 10 km were very unlikely to be mining induced and these were removed from the dataset. This excluded 22, well-detected earthquakes with magnitudes ranging from 0.7 ML to 3.2 ML. The 780 remaining earthquakes are shown in Fig. 4. Fig. 3 shows their magnitude distribution. Using the seismicity rate calculated for the whole UK, you would expect approximately 24 earthquakes with magnitude between 2 ML and 3 ML in an area this size in 48 years, 240 between 1 ML and 2 ML and 2200 between 0 ML and 1 ML. The magnitude of completeness for the National Network (the magnitude above which the network was guaranteed to detect an earthquake) varies from 3.0 ML in the 1970s to 2.0 ML in more recent decades. Many earthquakes smaller than this will not have been detected (although some were – detections continue below the magnitude of completeness). This explains why most earthquakes have a magnitude of between 1.4ML and 1.8ML as detection is trading off against incidence. 93% of the earthquakes have a magnitude of less than 2.0 ML. For the 1970s, most earthquakes in the database do not have a depth recorded, these were included as shallow earthquakes as it is not possible to say that they are deep. The largest earthquakes in Fig 3 fit into this depthless category and were probably deep, like all other earthquakes in the dataset this large. The largest earthquake in this region definitely at a depth suggesting that it might be mining induced is 2.6ML.

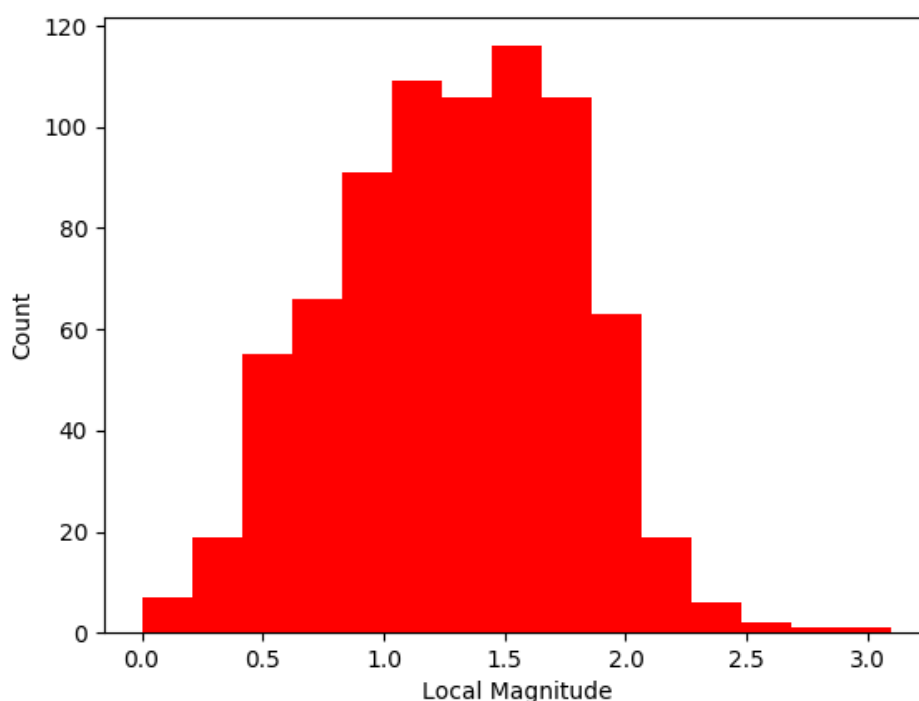


Figure 3 Magnitude distribution of the 780 earthquakes less than 10 km deep.

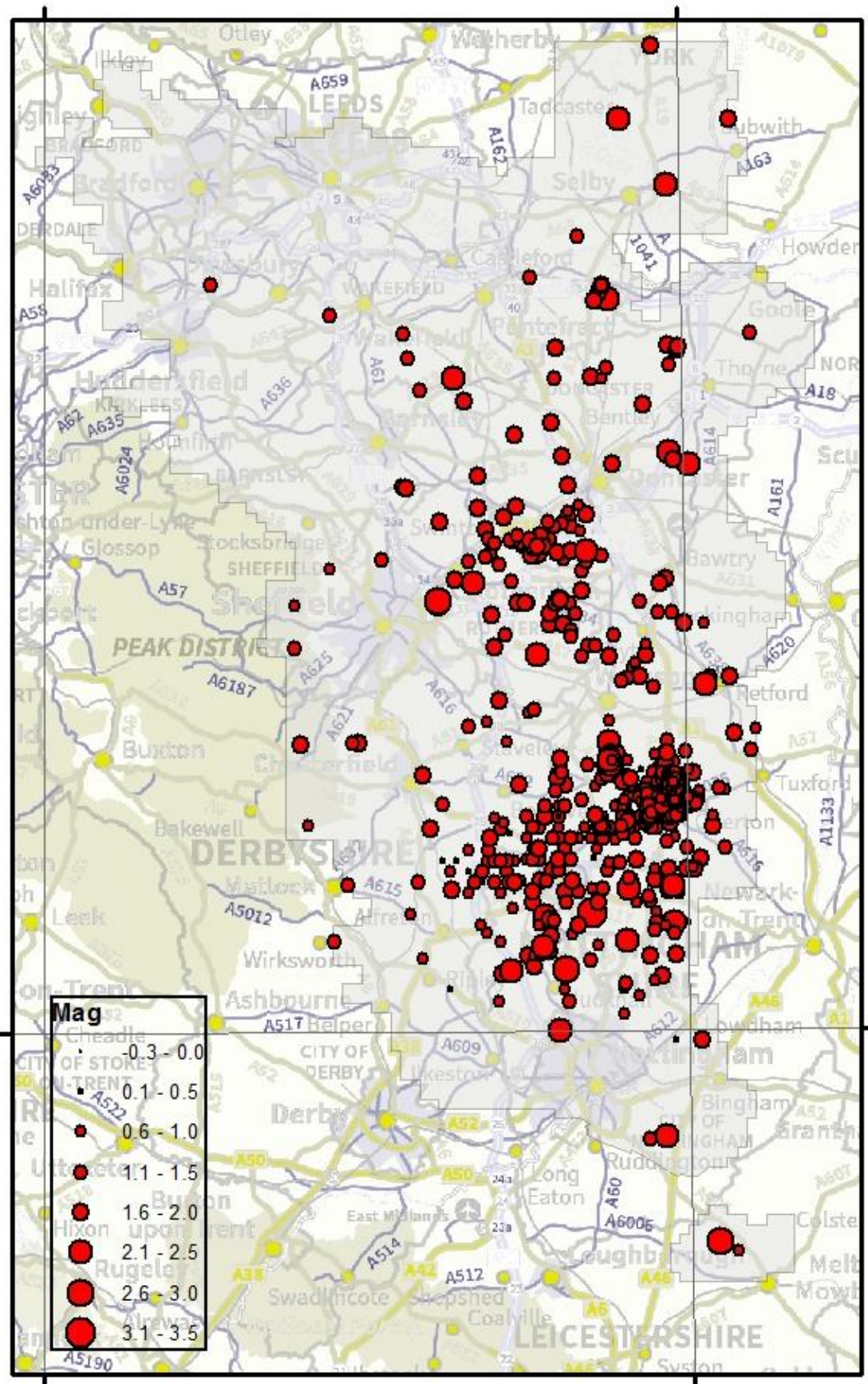


Figure 4 Location of earthquakes within the reporting area less than 10 km deep.

2.2 GROUND MOTIONS

To allow comparison with British standards for vibration, a study was made of the maximum ground motion caused by mining earthquakes. It was decided to use the earthquakes recorded by the New Ollerton network at Thorseby Colliery for this. Most other earthquakes in the database were not recorded at distances of less than 10 km, meaning that only very small ground motions were measured. In early 2014, the BGS installed seven seismic stations within 5 km of the mine. This network recorded 305 earthquakes clearly linked to ongoing longwall mining at 850m depth. As the mining moving up and down two mining panels about 3 km long, the point of earthquake generation changed. This meant that earthquakes were recorded at each station at a range of distances. The magnitudes of the earthquakes ranged from 0.1ML to 2.1ML.

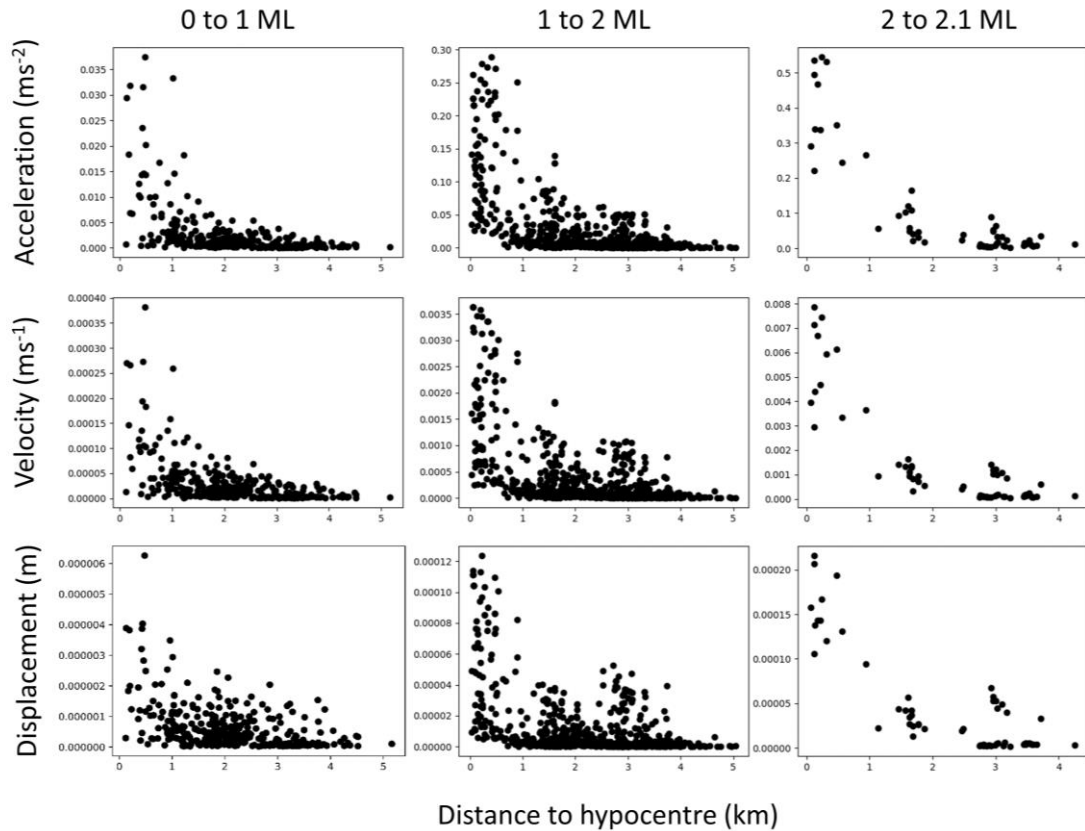


Figure 5 Zero-to-peak ground motion from 305 earthquakes recorded at the seven stations of the local New Ollerton network. Individual stations plot at a range of distances as the earthquakes move.

Fig. 5 shows the maximum ground motions recorded at each station for each earthquake. This demonstrates the large variability that is typically observed in ground motion caused by earthquakes. At a given distance from an earthquake of a given magnitude, the maximum velocity measured typically varies between values a factor of 10 different. The reasons for this include site effects, as at each distance there are observations from different stations, and the focal mechanisms of the earthquakes, as well as large uncertainty in magnitude assignment. The largest peak particle velocity (PPV) recorded was of about 8mm/s at a distance of less than 1 km from an earthquake of magnitude 2.0 ML. The British standard for “maximum satisfactory magnitudes of vibration with respect to human response” is 2 mm/s at night in residential properties for three blasts per day (BSi, 2008). There were days when this was exceeded at the nearest station to the mine (that is, there were more than three earthquakes large enough to exceed 2 mm/s) but there are no residences this close. The threshold value for “cosmetic damage to residential buildings” in the British standard on transient vibration (BSi, 1993) is 15 mm/s. Only mine buildings are close

enough to have experienced such vibration. Many claims for damage to buildings in the area were accepted by the mine at Thorseby, but these were due to subsidence rather than earthquakes.

2.3 TIME PROGRESSION

The region under consideration in this report covers the coalfields of Derbyshire, Nottinghamshire and Yorkshire. Across these coalfields, 143 mines were working in 1970 and none remains today (Northern Mine Research Society, 2018). The decline in mine numbers is shown in Fig. 6 alongside the number of earthquakes each year. The comparison with earthquake numbers is not trivial, as the number of earthquakes recorded depends largely on the network present at the time. Coverage in this area improved greatly from the late 1980s onwards. The rise in earthquake numbers in the late 1980s and early 1990s shows when earthquakes started being reliably detected, rather than a change in activity. The largest numbers of earthquakes in 2014/2015 correspond to the well-documented activity at Thorseby mine (Verdon et al., 2018). For these years, the number of earthquakes detected is greatly increased by the presence of a local network detecting very small earthquakes. Once this spike has been discounted, the number of earthquakes does follow the same general trend as the number of mines working. Figure 7 shows the geographical distribution of the earthquakes for various time windows. It is worth noting that the positions of older events are less well known and would probably cluster more tightly if location errors were smaller. The notable clusters are around Thorseby Colliery, near Ollerton, in 2012 to 2018 and around Maltby Colliery, near Rotherham, in 2006 to 2012.

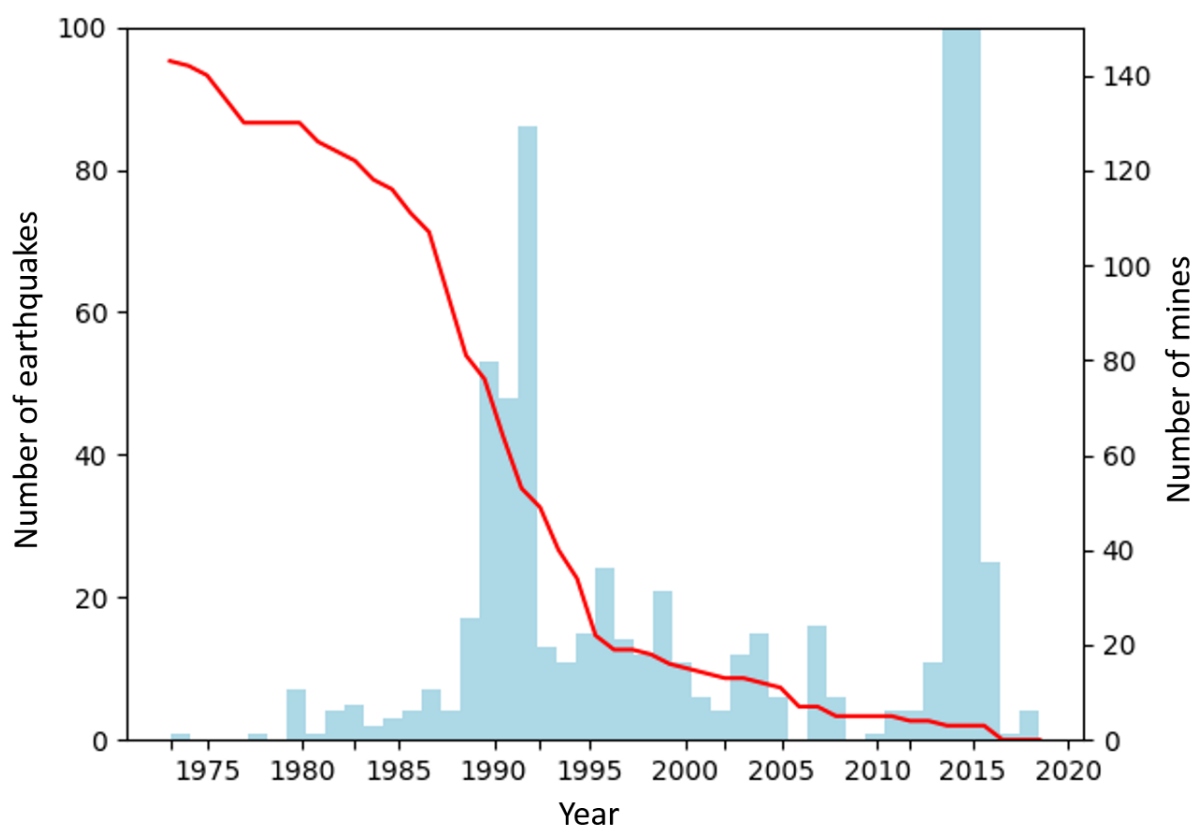


Figure 6 Number of earthquakes in each year. The bars for 2014 and 2015, while the temporary network was installed at New Ollerton, are clipped so that the other bars can be seen more clearly. The actual values are 201 and 120. The red line shows the number of mines open in each year.

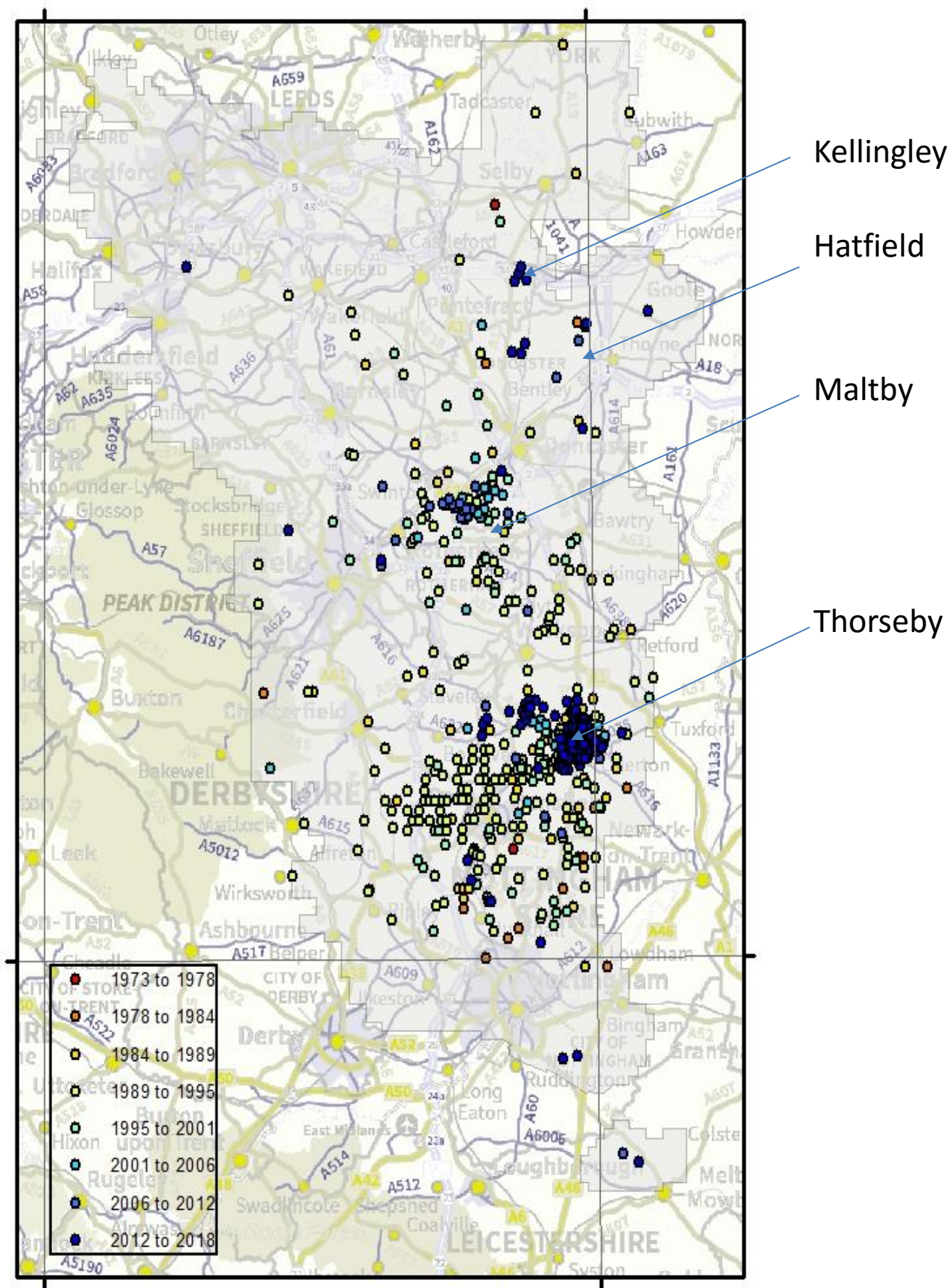


Figure 7 Earthquakes colour coded by year. The surface locations of the four last mines to close are labelled.

In 2015, the collieries closed at Hatfield, Thorseby and Kellingley. These were the last deep coal mines in the UK and the last coal mines in this region. There are five earthquakes in the dataset later than 2015. These are scattered and none are within 10 km (a typical uncertainty in location) of any of the three final mines. Five earthquakes over three years in an area this size is consistent with average rates for natural seismicity in the UK. Similarly, looking at the earthquakes between 2012 (when Maltby Colliery closed) and 2015, if all earthquakes within 10 km of one of the three working mines are discounted, then there are eight scattered earthquakes in four years. It would appear that mining earthquakes are, at least in this region, limited to the time the mines are working and to the close environs of the colliery.

2.4 CONCLUSIONS

In the case of Thorseby Colliery, near New Ollerton we have a very detailed knowledge of how the seismicity relates to mining. The vast majority of earthquakes recorded while the temporary network was in place occurred within 300m of the active coalface (Verdon et al., 2018). As the position of this active face was moving at a rate of 100m each day it is clear that there is a very tight temporal correlation too. There was no clear correlation between the volume of coal being extracted and the number of earthquakes, however. Although all earthquakes were caused by mining, not all activity caused earthquakes. This observation is borne out by the fact that much of the known longwall mining in this area did not cause recorded earthquakes. It has been pointed out (Bischoff et al., 2010) that mine layouts are typically complex and unique with active panels rarely in untouched rock, but at varying distances from old mine workings in a prestressed area. Although coal mining can certainly cause earthquakes, it does not always do so.

For the region studied here there is no evidence that any mining induced earthquakes were recorded more than a few months after the mine in question closed. This can be seen for the last few mines to close, but before 2012, there are too many mines too close together to categorically state that a closed mine is no longer causing seismicity. The last earthquake in the database within 10 km of Thorseby occurred in November 2015 after the mine closed in July. The last earthquake near Kellingley Colliery in Yorkshire was recorded in April 2015 a few months before the mine closed in December. Hatfield Colliery closed in June 2015 and the last earthquake was in July. Work stopped in July 2012 at Maltby Colliery (although it did not officially close until December). The last earthquake nearby was in July.

The size of mining induced earthquakes globally seems to be generally less than 3.5 ML (Sen et al., 2013). The largest earthquake in the database here is 3.1 ML. Earthquakes this size do not cause serious damage, and even superficial damage will be limited to property close to the colliery. The vast majority of earthquakes in this region are less than 2.6 ML, meaning that they would have caused no damage, even very close to the mine. Ground vibration will, however, have exceeded British standards for nuisance and events this large have been frequent at some mines for certain periods of their operation.

References

- British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at <https://envirolib.apps.nerc.ac.uk/olibcgi>.
- Bischoff, M., Cete, A., Fritschen, R. and Meier, T., 2010. Coal mining induced seismicity in the Ruhr area, Germany, *Pure appl. Geophys.*, **167**, 63–75.
- Bishop, I., Styles, P. and Allen, M. 1994. Mining Induced Seismicity in the Nottinghamshire Coalfield. *Quarterly Journal of Engineering Geology*, **26** (4), 253-279.
- British Standards Institute. 1993. Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration. BS 7385-2:1993.
- British Standards Institute. 2008. Guide to evaluation of human exposure to vibration in buildings Part 2: Blast-induced vibration. BS 6472-2:2008.
- British Standards Institute. 2014. Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. BS 5228-2:2009+A1:2014.
- Browitt, C.W.A., Turbitt, T. and Morgan, S. 1985. Investigation of British earthquakes using the national monitoring network of the British Geological Survey. *Earthquake Engineering in Britain*, Thomas Telford, London, 33-47.
- Coal Authority, 2014. Coal_Mining_Reporting_Area_Metadata_v4. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/361758. Downloaded 10/2018.
- Davison, C. 1919. The Stafford earthquakes of January 14-15, 1916 and the relations between twin earthquakes of the Midland counties. *Geological Magazine*, Decade VI, 6, 302-312.
- Northern Mine Research Society. 2018. <https://www.nmrs.org.uk/mines-map/coal-mining-in-the-british-isles>. Accessed October 2018.
- Redmayne, D.W. 1988. Mining-induced seismicity in UK coalfields identified on the BGS National Seismograph Network. *Engineering Geology Of Underground Movements*, Geological Society Engineering Geology Special Publication, **5**, 405-413.
- Redmayne, D.W., Richards, J.A. and Wild, P.W. 1998. Mining-induced earthquakes monitored during pit closure in the Midlothian Coalfield. *Quarterly Journal of Engineering Geology*, **31**, 21-36.
- Sen, A.T., Cesca, S., Bischoff, M., Meier, T. & Dahm, T., 2013. Automated full moment tensor inversion of coal mining-induced seismicity, *Geophys. J. Int.*, **195**, 1267–1281.
- Verdon, J.P., Kendall, J.M., Butcher, A., Luckett, R. and Baptie, B.J. 2018. Seismicity induced by longwall coal mining at the Thoresby Colliery, Nottinghamshire, U.K. *Geophysical Journal International*, **212**, 942-954.
- Westbrook, G.K., Kusznir, N.J., Browitt, C.W.A. and Holdsworth, B.K. 1980. Seismicity induced by coal mining in Stoke-on-Trent (U.K.), *Engineering Geology*, **16**, 225-241.

Appendix 1 Earthquake List

Earthquakes in the BGS database for the Coal Authority reporting areas NOTTS, 199 and NOTTS, 30. An “F” in the 5th column means that the depth was fixed by the analyst before location.

date and time	lat	lon	depth	ML
26/01/1973 05:07	53.11	-1.15	5.0	3.1
10/02/1978 00:13	53.76	-1.17		2.9
07/10/1979 04:51	53.05	-1.24		2.2
07/10/1979 05:26	53.05	-1.24		2.5
07/10/1979 05:37	53.05	-1.24		1.9
07/10/1979 06:44	53.05	-1.24		2.4
07/10/1979 08:12	53.05	-1.24		3.1
07/10/1979 08:14	53.05	-1.24		1.9
09/10/1979 10:10	53.05	-1.24		3.0
22/11/1980 03:45	53.17	-1.19		1.8
02/06/1981 11:02	53.03	-1.14		2.7
22/08/1981 21:25	53.02	-1.16		1.4
01/10/1981 02:34	53.60	-1.19		1.8
02/02/1982 21:09	53.10	-1.03	5.0	1.8
03/03/1982 16:49	53.10	-1.02	9.3	2.2
13/03/1982 05:58	53.07	-1.06	5.0	1.7
02/04/1982 20:40	53.15	-1.00	5.0	1.7
14/05/1982 02:10	53.17	-0.94	5.0	1.4
02/07/1982 03:38	53.64	-1.02	0.5	1.9
16/03/1983 04:21	52.99	-0.98	5.0	1.7
23/12/1983 03:06	53.27	-1.60	0.5	2.0
22/03/1984 12:09	53.30	-0.95	25.8	3.2
30/05/1984 02:53	52.94	-1.13	15.0	3.1
04/06/1984 14:16	53.79	-0.90	10.4	3.0
23/08/1984 09:09	53.00	-1.20	6.5	2.2
18/09/1985 14:51	53.79	-1.02	1.4	2.4
26/09/1985 18:15	53.14	-1.03	7.5	1.1
16/10/1985 02:55	53.49	-1.26	0.7	1.9
07/01/1986 19:33	53.16	-0.98	7.6	2.0
18/04/1986 11:22	53.21	-1.10	2.7	1.7
03/06/1986 19:54	53.60	-1.41	2.0	1.4
17/06/1986 11:08	53.14	-1.05	7.7	1.6
10/07/1986 19:22	53.19	-0.96	8.4	1.6
28/09/1986 18:18	53.54	-1.02	5.0	2.1
11/11/1986 02:04	53.09	-1.02	6.0	1.2
03/02/1987 23:10	53.27	-1.51	3.0	1.8
15/05/1987 20:22	53.48	-1.28	0.6	2.0
05/08/1987 23:15	53.38	-1.00	0.4	2.0
05/08/1987 23:15	53.27	-1.12	0.2	2.3
26/08/1987 17:20	53.14	-1.09	0.1	1.9
20/05/1988 01:38	53.52	-1.32	3.5	1.8
22/06/1988 03:35	53.92	-1.04	6.7	1.7
29/07/1988 17:41	53.64	-1.74	15.3	1.8
18/08/1988 20:36	53.18	-1.02	2.6	0.8
01/10/1988 02:39	53.23	-1.26	0.2	2.0
12/10/1988 00:45	53.43	-1.16	1.4	1.3
14/10/1988 16:46	53.42	-1.33	1.9	2.2
27/10/1988 02:33	52.99	-1.02	0.4	0.4
29/10/1988 01:45	53.14	-1.26	5.1	0.6
01/11/1988 00:16	53.07	-1.25	2.9	1.8
23/11/1988 20:28	53.23	-1.27	21.3	1.8
08/12/1988 05:57	53.23	-1.19	0.5	1.9
17/12/1988 15:35	53.51	-1.18	3.7	1.6
22/12/1988 17:36	53.06	-1.24	4.2	1.6
11/01/1989 02:51	53.33	-0.93	1.0	1.8

20/01/1989	15:47	53.24	-1.41	0.2	1.6
26/01/1989	03:53	53.05	-1.04	0.1	1.9
13/04/1989	20:08	53.40	-1.26	0.3	1.6
31/05/1989	18:59	53.12	-1.08	0.1	0.7
16/06/1989	22:10	53.16	-1.36	0.2	0.5
14/07/1989	22:25	53.07	-1.24	2.3	0.6
20/07/1989	01:05	53.12	-1.14	0.4	1.6
22/07/1989	00:25	53.15	-1.03	0.5	1.7
27/07/1989	00:07	53.29	-1.31	4.9	0.7
28/07/1989	23:12	53.18	-1.15	0.9	0.8
01/08/1989	02:35	53.20	-1.10	1.7	0.8
05/08/1989	04:19	53.19	-1.08	1.0	0.9
10/08/1989	19:35	53.18	-1.15	2.6	1.0
12/08/1989	13:58	53.17	-1.14	0.9	0.9
15/08/1989	20:37	53.16	-1.18	2.7	1.0
22/08/1989	01:20	53.19	-1.09	1.0	1.2
25/08/1989	13:19	53.38	-1.21	0.4	1.8
26/08/1989	14:56	53.22	-1.03	2.3	1.1
29/08/1989	22:49	53.07	-1.23	2.6	0.9
02/09/1989	07:51	53.22	-1.03	9.3	0.8
06/09/1989	22:39	53.22	-0.98	0.0	1.0
09/09/1989	02:16	53.24	-1.02	3.4	1.3
12/09/1989	01:02	53.22	-1.04	1.5	1.0
12/09/1989	23:21	53.23	-1.02	2.8	1.0
13/09/1989	22:29	53.22	-1.03	2.9	1.2
17/09/1989	10:15	53.23	-1.03	1.8	1.0
20/09/1989	17:53	53.24	-1.08	18.9	1.2
22/09/1989	19:38	53.20	-1.09	1.4	1.1
24/09/1989	17:43	53.24	-1.09	17.9	1.1
02/10/1989	23:36	53.23	-1.03	2.0	1.2
08/10/1989	01:17	53.25	-1.04	7.6	0.8
20/10/1989	03:25	53.25	-1.02	7.6	1.3
21/10/1989	14:43	53.24	-1.05	5.9	1.2
03/11/1989	19:13	53.21	-1.11	3.4	1.0
10/11/1989	03:17	53.26	-1.00	3.8	1.1
20/11/1989	20:35	53.22	-1.09	3.9	1.3
25/11/1989	15:41	53.23	-1.06	3.5	1.1
01/12/1989	04:15	53.22	-1.08	4.5	1.1
07/12/1989	00:31	53.22	-1.09	7.0	0.9
09/12/1989	18:20	53.23	-1.04	2.5	1.1
16/12/1989	04:54	53.20	-1.10	0.7	1.2
03/01/1990	05:05	53.21	-1.10	2.7	1.0
07/01/1990	01:28	53.22	-1.05	3.4	1.1
15/01/1990	23:49	53.19	-1.09	0.6	1.2
19/01/1990	02:53	53.21	-1.06	3.1	1.2
01/02/1990	04:12	53.19	-1.16	4.7	1.0
03/02/1990	15:01	53.20	-1.10	1.9	1.1
08/02/1990	01:53	53.52	-1.16	17.9	3.0
08/02/1990	15:16	53.39	-1.04	0.3	1.3
12/02/1990	09:33	53.49	-1.15	12.7	2.4
16/02/1990	18:33	53.19	-1.12	1.0	1.1
17/02/1990	21:31	53.20	-1.13	0.8	1.0
20/02/1990	19:21	53.20	-1.03	1.0	1.1
24/02/1990	03:15	53.18	-1.25	0.7	1.0
02/03/1990	05:20	53.19	-1.14	2.0	1.0
03/04/1990	23:18	53.18	-1.13	1.2	1.2
27/09/1990	03:55	53.42	-1.27	2.8	1.4
28/09/1990	14:47	53.18	-1.08	2.1	1.4
03/10/1990	11:15	53.24	-0.99	0.2	1.7
04/10/1990	04:33	53.12	-1.24	0.1	1.7
06/10/1990	11:28	53.18	-1.08	2.5	1.2
07/10/1990	16:33	53.20	-0.96	3.8	1.0
07/10/1990	16:43	53.09	-1.18	0.7	0.6
08/10/1990	17:47	53.39	-1.30	1.7	1.3
16/10/1990	04:17	53.08	-1.14	8.1	0.6

17/10/1990	10:34	53.11	-1.43	7.6	0.8
27/10/1990	03:36	53.17	-1.00	1.7	1.5
01/11/1990	07:46	53.59	-1.34	1.0	1.8
03/11/1990	03:11	53.15	-0.99	0.5	1.7
12/11/1990	01:53	53.11	-1.05	2.5	0.6
22/11/1990	01:20	53.10	-1.05	2.8	1.4
11/12/1990	10:05	53.61	-1.20	2.4	1.5
15/12/1990	03:09	53.40	-1.18	0.9	1.2
16/12/1990	20:33	53.13	-1.03	0.5	1.7
20/12/1990	14:34	53.39	-1.21	0.5	1.7
05/01/1991	00:23	53.19	-1.13	0.4	1.6
08/01/1991	01:39	53.39	-1.17	3.9	1.4
15/01/1991	14:32	53.31	-1.29	5.2	1.6
16/01/1991	03:08	53.37	-1.28	0.5	1.4
18/01/1991	15:03	53.36	-1.61	7.7	1.2
23/01/1991	03:42	53.67	-1.55	0.4	1.5
24/01/1991	14:10	53.14	-1.23	0.1	1.6
28/01/1991	10:58	53.13	-1.24	1.8	1.6
28/01/1991	23:35	53.16	-1.23	4.2	1.0
30/01/1991	03:00	53.63	-1.43	0.5	1.5
31/01/1991	06:42	53.48	-1.18	0.2	1.6
01/02/1991	11:57	53.13	-1.19	1.9	1.6
05/02/1991	07:29	53.15	-1.28	2.8	1.2
05/02/1991	11:37	53.15	-1.21	0.5	1.6
05/02/1991	23:48	53.40	-1.24	2.0	0.8
07/02/1991	22:18	53.04	-1.10	1.0	0.7
08/02/1991	06:28	53.12	-1.19	1.0	1.3
09/02/1991	08:24	53.13	-1.17	0.3	1.3
13/02/1991	04:20	53.15	-1.05	0.5	0.7
14/02/1991	16:20	53.16	-1.23	2.9	1.2
15/02/1991	13:13	53.16	-1.24	4.4	1.0
21/02/1991	04:41	53.15	-1.20	0.1	1.2
21/02/1991	18:38	53.19	-1.23	0.4	1.5
01/03/1991	14:33	53.14	-1.18	0.2	1.6
02/03/1991	11:30	53.20	-1.22	5.0	1.6
02/03/1991	21:05	53.16	-1.28	4.2	1.1
15/03/1991	23:32	53.10	-1.00	1.0	0.5
23/03/1991	00:46	53.53	-1.11	0.2	2.0
20/04/1991	03:32	53.16	-1.38	0.2	0.4
22/04/1991	20:57	53.22	-1.02	1.0	0.7
25/04/1991	23:32	53.28	-0.89	0.2	0.6
08/05/1991	04:42	53.47	-1.31	0.2	1.6
15/05/1991	17:30	53.46	-1.21	0.5	1.4
18/05/1991	18:50	53.13	-1.27	3.2	0.0
20/05/1991	03:25	53.20	-1.25	8.4	1.3
22/05/1991	00:05	53.17	-1.23	2.7	1.1
22/05/1991	04:05	53.14	-1.22	1.6	1.5
22/05/1991	17:53	53.16	-1.31	1.0	1.2
25/05/1991	05:38	53.14	-1.33	0.2	1.3
28/05/1991	17:50	53.14	-1.28	3.9	1.2
31/05/1991	05:29	53.20	-1.20	2.5	1.1
04/06/1991	00:27	53.18	-1.20	1.0	1.3
05/06/1991	01:53	53.27	-1.28	1.4	1.0
06/06/1991	00:15	53.16	-1.27	0.2	0.9
06/06/1991	06:29	53.14	-1.42	0.4	1.3
06/06/1991	23:24	53.16	-1.30	0.5	1.2
07/06/1991	19:56	53.17	-1.24	10.0	0.6
07/06/1991	23:18	53.14	-1.32	2.6	0.4
12/06/1991	08:35	53.16	-1.20	0.5	1.0
12/06/1991	17:39	53.13	-1.34	0.3	0.8
13/06/1991	04:40	53.11	-1.22	2.7	0.5
14/06/1991	00:34	53.16	-1.23	2.7	1.4
17/06/1991	02:28	53.16	-1.25	3.9	0.7
17/06/1991	21:42	53.21	-1.19	0.5	1.2
18/06/1991	23:57	53.19	-1.20	0.5	0.6

20/06/1991	01:08	53.20	-1.20	0.4	1.3
20/06/1991	15:22	53.15	-1.37	0.6	0.7
21/06/1991	02:46	53.21	-1.20	0.2	0.8
21/06/1991	06:02	53.19	-1.09	1.0	1.2
21/06/1991	22:56	53.21	-1.19	2.5	1.2
29/07/1991	03:11	53.40	-1.61	8.6	0.9
01/08/1991	01:20	53.18	-1.17	0.1	1.0
07/08/1991	13:26	53.85	-0.92	0.8	1.9
04/09/1991	18:08	53.38	-1.19	1.1	1.8
11/09/1991	00:48	53.14	-1.27	0.4	1.6
12/09/1991	01:44	53.16	-1.24	0.2	1.5
12/09/1991	07:42	53.17	-1.23	0.2	1.8
12/09/1991	20:03	53.19	-1.29	1.4	1.3
12/09/1991	22:06	53.17	-1.31	0.3	1.1
17/09/1991	01:31	53.17	-1.19	1.7	1.4
18/09/1991	03:29	53.16	-1.20	2.5	1.9
18/09/1991	22:25	53.11	-1.22	2.8	1.4
25/09/1991	02:49	53.15	-1.32	1.3	1.4
26/09/1991	05:15	53.14	-1.30	7.8	1.1
26/09/1991	23:41	53.16	-1.18	7.1	1.4
27/09/1991	20:56	53.18	-1.21	5.3	1.5
02/10/1991	04:34	53.40	-1.20	2.5	1.7
03/10/1991	01:13	53.17	-1.34	0.1	1.0
08/10/1991	01:55	53.21	-1.22	0.2	1.1
09/10/1991	02:03	53.16	-1.28	7.6	1.2
09/10/1991	23:20	53.18	-1.18	0.5	1.3
10/10/1991	01:32	53.20	-1.20	1.0	0.5
11/10/1991	03:53	53.20	-1.30	0.5	1.0
11/10/1991	19:56	53.39	-1.02	3.4	1.3
12/10/1991	00:07	53.16	-1.29	5.6	1.2
14/10/1991	01:40	53.37	-1.11	5.6	1.3
15/10/1991	04:01	53.15	-1.34	0.2	0.4
15/10/1991	05:27	53.27	-1.52	0.1	1.4
16/10/1991	23:56	53.13	-1.29	0.3	0.6
18/10/1991	02:35	53.19	-1.24	0.1	1.2
22/10/1991	01:29	53.36	-1.15	1.0	1.2
24/10/1991	03:00	53.34	-1.08	0.4	1.4
26/10/1991	00:27	53.35	-1.06	2.0	1.6
28/10/1991	19:38	53.29	-1.12	0.5	0.9
31/10/1991	03:42	53.40	-1.07	3.1	1.3
12/11/1991	04:19	53.04	-1.37	0.2	0.1
13/11/1991	01:30	53.38	-0.97	3.0	0.9
15/11/1991	06:29	53.51	-1.44	2.6	1.1
19/11/1991	00:01	53.27	-1.03	0.5	1.1
19/11/1991	03:54	53.20	-1.07	0.5	1.1
21/11/1991	02:55	53.36	-1.06	1.0	0.9
22/11/1991	19:28	53.36	-1.14	2.3	1.5
22/11/1991	22:03	53.07	-1.41	0.7	0.1
25/11/1991	18:10	53.33	-1.07	1.0	1.6
30/11/1991	03:26	53.14	-1.04	0.5	0.3
30/11/1991	03:58	53.16	-1.08	0.2	1.7
01/12/1991	16:04	53.33	-1.09	0.2	1.3
01/12/1991	16:04	53.33	-1.10	0.4	1.3
03/12/1991	04:19	53.35	-1.16	1.0	1.4
04/12/1991	03:30	53.32	-1.05	0.2	1.2
07/12/1991	05:24	53.33	-0.96	0.5	1.1
30/01/1992	14:33	53.14	-1.53	0.5	1.2
28/02/1992	00:50	53.33	-1.18	11.6	2.0
27/03/1992	20:54	53.18	-1.31	9.4	1.6
07/04/1992	13:59	53.23	-1.43	19.1	1.5
10/04/1992	10:31	53.13	-1.37	0.2	1.6
19/05/1992	02:12	53.28	-0.93	0.5	2.0
19/05/1992	22:44	53.22	-1.16	2.6	1.5
17/06/1992	04:30	53.30	-1.25	6.9	1.0
02/07/1992	22:16	53.21	-1.38	8.0	1.2

25/09/1992	05:26	53.39	-1.30	0.2	2.0
05/11/1992	22:17	53.03	-1.19	5.0	1.2
11/11/1992	06:31	53.29	-1.34	0.5	1.5
20/11/1992	07:37	53.46	-1.22	0.1	1.8
31/01/1993	18:39	53.20	-1.04	0.5	1.0
05/02/1993	03:44	53.22	-0.99	0.4	1.2
15/03/1993	14:23	53.08	-1.10	0.3	2.3
22/06/1993	05:38	53.19	-1.40	0.3	1.6
06/09/1993	02:47	53.07	-1.02	0.3	2.0
22/09/1993	01:00	53.12	-1.06	1.0	1.3
20/10/1993	02:33	53.44	-1.23	0.2	1.5
11/11/1993	17:52	53.32	-0.97	0.0	2.2
31/12/1993	01:45	53.07	-1.41	0.1	0.6
11/01/1994	11:58	53.18	-1.21	1.0	1.2
17/01/1994	03:47	53.16	-1.15	1.8	0.4
20/01/1994	12:29	53.20	-1.14	0.6	1.4
15/03/1994	02:56	53.18	-1.03	1.0	1.1
05/04/1994	07:10	53.09	-1.21	6.3	1.7
19/04/1994	21:52	53.13	-1.13	0.4	1.2
27/05/1994	00:32	53.09	-1.55	0.3	1.5
26/06/1994	16:40	53.53	-0.99	6.8	2.2
11/07/1994	21:36	53.30	-1.24	3.9	1.5
28/07/1994	04:33	53.19	-1.28	0.1	0.2
15/10/1994	00:16	53.45	-1.30	0.3	1.2
28/10/1994	04:58	53.46	-1.31	5.6	1.4
29/10/1994	00:49	53.11	-1.21	8.4	1.2
25/11/1994	17:10	53.11	-1.22	1.0	2.1
26/11/1994	03:29	53.11	-1.22	2.6	1.7
27/11/1994	20:04	53.10	-1.21	1.5	1.1
01/12/1994	23:54	53.22	-0.94	2.9	0.6
05/12/1994	22:05	53.85	-1.09	0.0	2.2
07/02/1995	01:50	53.34	-1.08	0.2	0.8
24/02/1995	19:10	53.13	-1.01	1.0	0.6
21/04/1995	00:37	53.70	-1.24	0.3	1.3
21/04/1995	21:22	53.44	-1.31	0.3	1.1
25/04/1995	21:26	53.04	-1.10	0.4	1.3
10/05/1995	04:03	53.44	-1.29	0.0	1.5
13/05/1995	23:20	53.24	-1.00	2.0	0.8
25/05/1995	18:58	53.49	-1.32	1.0	1.6
30/06/1995	03:28	53.15	-1.13	1.6	1.3
14/07/1995	08:57	53.09	-1.05	0.3	1.5
16/07/1995	10:53	53.10	-1.17	0.8	1.7
18/07/1995	05:05	53.16	-1.11	4.8	1.1
18/07/1995	15:58	53.08	-1.29	1.0	1.0
19/07/1995	04:22	53.13	-1.15	0.5	0.7
11/10/1995	01:34	53.42	-1.33	1.0	F 1.9
11/10/1995	18:19	53.05	-1.29	6.5	1.9
11/10/1995	18:20	53.06	-1.28	6.8	2.4
11/10/1995	20:53	53.51	-1.43	0.4	1.9
11/10/1995	21:23	53.41	-1.16	1.0	2.0
22/10/1995	20:35	53.40	-1.20	0.5	1.7
01/11/1995	00:55	53.85	-1.09	0.5	2.1
12/12/1995	04:43	53.65	-1.44	6.3	1.2
18/01/1996	18:08	53.36	-1.30	1.0	1.8
08/03/1996	03:58	53.20	-1.09	1.0	1.7
11/04/1996	00:24	53.19	-1.13	0.1	1.3
12/04/1996	23:52	53.23	-1.08	2.3	1.1
21/04/1996	02:27	53.61	-1.36	4.2	2.3
23/04/1996	16:19	53.08	-1.22	1.8	1.9
21/05/1996	04:12	53.15	-0.99	0.3	0.9
24/07/1996	01:09	53.20	-1.03	0.8	1.9
02/09/1996	23:35	53.10	-1.04	2.3	0.7
10/09/1996	21:47	53.22	-1.03	2.5	1.0
04/10/1996	03:17	53.24	-1.02	1.0	F 2.0
18/10/1996	21:09	53.13	-1.02	2.0	2.1

25/10/1996	04:32	53.74	-1.16	7.2		1.4
26/01/1997	07:17	53.20	-1.29	5.6		0.8
06/02/1997	00:36	53.40	-1.05	1.0	F	1.6
07/02/1997	21:37	53.42	-1.03	3.6		1.6
10/02/1997	23:09	53.19	-1.53	13.4		2.9
23/03/1997	05:56	53.42	-1.04	2.7		2.0
27/04/1997	15:20	53.57	-1.20	0.9		1.7
02/07/1997	06:48	53.03	-1.30	0.5		0.7
12/08/1997	03:05	53.06	-1.08	1.0	F	1.1
22/08/1997	19:31	53.06	-1.20	2.2		1.0
15/10/1997	22:21	53.20	-1.07	1.0	F	1.7
29/10/1997	15:20	53.03	-1.08	2.9		0.9
21/11/1997	01:27	53.21	-0.99	0.5		0.8
28/11/1997	02:39	53.23	-1.09	1.0		0.9
26/01/1998	01:14	53.04	-1.19	1.0		0.9
17/02/1998	14:26	53.48	-1.15	0.1		2.0
22/03/1998	23:57	53.37	-1.18	1.6		1.1
23/03/1998	05:01	53.37	-1.18	2.4		1.1
01/05/1998	06:22	53.05	-1.05	1.1		0.9
05/05/1998	17:21	53.56	-1.26	0.5		1.9
22/05/1998	00:58	53.24	-1.12	2.9		1.6
01/06/1998	23:02	53.49	-1.18	0.8		1.0
17/06/1998	23:28	53.44	-1.19	1.0		1.5
22/06/1998	16:28	53.44	-1.13	1.0		1.5
25/06/1998	02:47	53.45	-1.20	2.1		1.9
25/06/1998	20:02	53.40	-1.19	0.3		1.6
24/07/1998	00:57	53.45	-1.18	0.5		1.8
26/08/1998	18:59	53.23	-1.14	2.4		1.0
01/10/1998	18:45	53.12	-1.27	0.0		1.0
06/10/1998	02:16	53.22	-1.04	1.0	F	1.8
09/10/1998	02:07	53.22	-1.03	1.0	F	0.6
13/10/1998	05:21	53.05	-1.07	1.0	F	0.7
03/11/1998	03:47	53.10	-1.32	0.2		0.7
10/11/1998	12:38	53.09	-1.31	0.3		0.8
12/01/1999	05:41	53.10	-1.32	0.3		0.6
19/01/1999	00:23	53.26	-0.90	1.9		1.2
27/01/1999	22:40	53.13	-1.19	1.0	F	0.8
11/02/1999	01:09	53.22	-1.10	0.5		0.8
17/03/1999	20:30	53.06	-1.19	2.9		0.7
11/05/1999	07:21	53.13	-1.09	2.9		2.1
11/05/1999	21:49	53.13	-1.19	1.0	F	0.7
27/05/1999	04:13	53.18	-1.11	0.2		0.8
30/05/1999	02:31	53.40	-1.44	1.0	F	1.0
11/06/1999	01:44	53.18	-1.10	0.1		1.3
30/06/1999	00:56	53.44	-1.34	1.0		1.3
23/07/1999	00:47	53.23	-1.09	1.3		1.0
24/12/1999	17:17	53.07	-1.15	1.6		1.3
15/03/2000	04:34	53.20	-1.04	1.0		0.9
11/04/2000	18:23	53.18	-1.01	1.0	F	1.1
03/05/2000	18:20	53.22	-1.07	1.0	F	1.3
26/06/2000	20:49	53.43	-1.25	1.0	F	1.4
05/07/2000	23:09	53.44	-1.15	0.5		1.5
18/07/2000	14:51	53.13	-1.28	1.0	F	0.8
04/08/2000	10:52	53.54	-1.19	1.9		1.9
18/09/2000	20:20	53.44	-1.47	0.5		1.5
31/05/2001	18:19	53.40	-1.25	0.0		1.6
10/12/2001	04:05	53.24	-1.12	0.3		1.8
06/01/2002	17:14	53.23	-1.04	1.0		1.6
23/01/2002	01:05	53.23	-1.06	2.1		1.3
08/07/2002	05:55	53.00	-1.08	14.3		1.7
12/07/2002	22:39	53.64	-1.20	1.6		1.7
22/08/2002	03:20	53.24	-1.11	3.7		1.4
08/10/2002	02:08	53.47	-1.18	0.2		1.2
10/10/2002	21:59	53.47	-1.16	1.7		1.0
13/10/2002	07:27	53.51	-1.19	11.5		1.5

13/10/2002	10:03	53.44	-1.20	1.0	F	1.5
14/10/2002	01:59	53.45	-1.20	1.0	F	1.3
17/12/2002	11:49	53.15	-1.14	0.0	F	1.2
19/02/2003	22:34	53.16	-1.12	0.8		1.0
01/03/2003	00:07	53.24	-1.10	2.9		1.0
27/03/2003	22:54	53.21	-1.07	0.7		0.9
19/08/2003	19:46	53.48	-1.01	13.2		3.1
30/10/2003	00:05	53.21	-1.49	13.1		1.1
21/11/2003	20:57	53.23	-1.10	4.2		1.7
02/12/2003	03:23	53.47	-1.19	0.2		1.1
02/12/2003	23:18	53.47	-1.20	0.2		1.2
05/12/2003	03:49	53.46	-1.24	1.0	F	1.5
06/12/2003	04:45	53.45	-1.23	1.0	F	1.2
07/12/2003	00:15	53.51	-1.21	1.0	F	1.1
07/12/2003	11:56	53.46	-1.19	1.0	F	1.1
07/12/2003	19:56	53.47	-1.19	1.0	F	1.0
08/12/2003	03:26	53.45	-1.22	1.0	F	1.1
08/12/2003	05:45	53.45	-1.21	1.0	F	1.3
08/12/2003	18:30	53.43	-1.32	1.0	F	1.4
14/12/2003	19:42	53.24	-1.09	1.3		1.8
28/02/2004	03:51	53.19	-1.59	8.7		1.0
19/07/2004	17:13	53.22	-0.98	2.6		0.6
20/07/2004	16:54	53.23	-0.99	1.0	F	0.7
30/11/2004	04:31	53.35	-1.23	2.5		2.2
20/12/2004	19:11	53.23	-1.23	1.0	F	2.3
19/01/2005	22:41	53.57	-1.21	15.0		2.8
21/02/2005	20:22	53.58	-1.21	10.7		1.9
07/03/2007	05:36	53.45	-1.23	2.5		1.8
08/03/2007	02:31	53.46	-1.25	1.0		1.8
09/03/2007	16:00	53.45	-1.24	1.0		1.9
14/03/2007	16:54	53.46	-1.25	1.3		2.0
17/03/2007	01:56	53.45	-1.22	2.4		1.9
19/03/2007	05:31	53.48	-1.38	1.6		1.8
20/03/2007	13:03	53.40	-1.38	1.6		1.6
21/03/2007	09:26	53.45	-1.23	1.7		1.7
22/03/2007	02:05	53.46	-1.27	3.8		1.5
23/03/2007	01:37	53.46	-1.24	2.5		1.7
27/03/2007	15:37	53.48	-1.21	1.9		1.3
29/03/2007	22:59	53.45	-1.23	2.7		1.6
04/04/2007	01:08	53.46	-1.27	2.3		1.3
05/04/2007	13:09	53.46	-1.30	4.0		1.4
12/04/2007	23:22	53.46	-1.26	0.2		1.4
19/04/2007	10:18	53.42	-1.36	5.7		1.7
15/07/2007	14:10	53.13	-1.06	2.3		1.3
15/07/2007	14:30	53.14	-1.09	2.9		1.1
17/09/2007	15:39	52.89	-1.13	10.5		1.9
11/03/2008	03:22	53.20	-1.14	4.4		1.6
15/03/2008	22:47	53.22	-0.94	17.5		0.9
21/04/2010	06:08	53.26	-1.20	1.1		1.7
30/06/2010	00:35	53.58	-1.06	2.5		2.0
07/09/2010	23:21	53.45	-1.15	1.1		2.2
15/10/2010	05:49	53.26	-1.04	6.1		1.7
25/10/2010	04:12	53.64	-1.01	1.4		1.8
19/10/2011	02:32	53.20	-0.99	1.3	F	1.6
04/11/2011	23:40	53.20	-1.01	1.1		1.6
13/04/2012	04:51	53.69	-1.13	3.3		1.5
23/05/2012	23:45	53.62	-1.02	1.7		1.4
05/07/2012	22:28	53.19	-1.07	2.0		1.3
15/07/2012	08:52	53.35	-1.12	1.1		1.7
09/08/2012	21:51	53.19	-1.06	1.2		1.4
08/10/2012	09:28	53.22	-1.05	1.1		1.6
18/11/2012	16:33	53.22	-0.98	1.2		1.4
12/01/2013	03:59	53.20	-1.02	1.1		1.4
14/01/2013	10:09	53.19	-1.03	1.1		1.8
13/02/2013	10:37	53.20	-1.02	1.2		1.5

19/02/2013	03:52	53.68	-1.11	1.3	2.1
27/02/2013	23:57	52.90	-1.04	7.9	2.5
28/02/2013	00:52	52.90	-1.06	8.5	1.3
16/06/2013	22:58	53.22	-1.06	1.2	1.2
26/06/2013	03:51	53.53	-1.01	1.1	1.9
26/09/2013	06:21	53.64	-1.00	1.1	1.7
10/12/2013	07:57	53.21	-1.01	1.1	1.4
10/12/2013	19:12	53.21	-1.02	1.1	0.9
12/12/2013	03:01	53.21	-1.04	1.2	1.5
12/12/2013	20:06	53.21	-1.06	1.1	1.6
13/12/2013	21:24	53.21	-1.04	1.2	1.2
16/12/2013	02:31	53.21	-1.04	1.1	1.7
17/12/2013	15:06	53.22	-1.04	1.2	1.5
18/12/2013	16:35	53.21	-1.05	1.2	1.2
19/12/2013	10:27	53.22	-1.02	1.2	1.3
20/12/2013	21:23	53.20	-1.03	1.2	1.4
22/12/2013	10:19	53.21	-1.01	1.1	1.1
28/12/2013	23:45	53.19	-1.05	1.2	1.5
30/12/2013	00:20	53.22	-1.01	1.0	1.2
31/12/2013	21:53	53.22	-1.00	1.1	0.9
03/01/2014	19:47	53.19	-1.06	0.4	1.1
04/01/2014	15:09	53.21	-1.03	1.1	1.4
04/01/2014	23:32	53.20	-1.06	0.8	1.0
06/01/2014	01:47	53.19	-1.05	1.1	1.3
07/01/2014	13:49	53.22	-1.01	0.7	1.3
08/01/2014	03:48	53.22	-1.00	1.2	1.3
09/01/2014	23:33	53.21	-1.02	0.9	1.4
11/01/2014	23:46	53.20	-1.05	1.7	1.5
13/01/2014	00:13	53.21	-1.03	1.3	1.5
13/01/2014	14:34	53.21	-1.05	1.0	1.5
14/01/2014	04:11	53.20	-1.05	1.1	1.5
16/01/2014	01:57	53.21	-1.05	1.1	1.5
17/01/2014	02:19	53.19	-1.07	0.3	1.4
19/01/2014	05:22	53.20	-1.06	0.1	1.6
20/01/2014	17:16	53.19	-1.10	1.0	1.5
21/01/2014	02:05	53.20	-1.06	0.1	1.4
21/01/2014	12:21	53.20	-1.05	0.1	1.3
22/01/2014	03:49	53.20	-1.05	1.1	1.5
23/01/2014	03:01	53.21	-1.06	1.5	1.5
24/01/2014	03:58	53.21	-1.01	0.1	1.6
26/01/2014	03:50	53.20	-1.03	0.2	1.7
26/01/2014	14:34	53.20	-1.05	1.5	1.0
28/01/2014	03:06	53.21	-1.02	1.2	1.5
28/01/2014	17:00	53.20	-1.02	0.9	1.2
30/01/2014	10:04	53.20	-1.06	0.1	1.6
31/01/2014	10:10	53.21	-1.03	0.4	1.5
31/01/2014	21:36	53.20	-1.05	1.4	1.3
02/02/2014	11:49	53.23	-0.95	1.0	1.4
03/02/2014	10:30	53.20	-1.02	1.0	1.4
05/02/2014	02:00	53.20	-1.02	1.0	1.3
05/02/2014	18:20	53.22	-1.01	1.1	1.3
06/02/2014	03:59	53.22	-1.01	1.3	1.8
06/02/2014	20:55	53.22	-1.01	1.3	1.6
07/02/2014	04:06	53.22	-1.01	1.5	1.9
07/02/2014	15:14	53.22	-1.01	1.4	1.8
07/02/2014	15:20	53.22	-1.02	1.4	1.3
07/02/2014	22:01	53.22	-1.01	1.3	1.6
08/02/2014	06:52	53.22	-1.01	1.5	1.5
08/02/2014	08:35	53.23	-1.02	0.1	0.7
08/02/2014	14:14	53.22	-1.02	1.0	1.5
09/02/2014	03:48	53.22	-1.01	1.3	1.5
09/02/2014	05:33	53.22	-1.01	1.6	1.9
09/02/2014	13:56	53.22	-1.01	1.3	1.8
09/02/2014	20:30	53.23	-1.01	0.8	0.7
09/02/2014	22:46	53.22	-1.01	1.5	1.5

10/02/2014	03:09	53.22	-1.02	1.1	0.7
10/02/2014	08:30	53.22	-1.01	1.3	1.6
10/02/2014	12:36	53.22	-1.01	0.8	1.3
10/02/2014	12:47	53.22	-1.00	1.5	1.8
10/02/2014	12:56	53.21	-1.03	1.0	0.2
10/02/2014	17:54	53.22	-1.02	1.1	1.6
10/02/2014	19:08	53.22	-1.00	0.1	-0.3
10/02/2014	19:08	53.21	-1.01	1.3	0.3
11/02/2014	01:59	53.22	-1.02	1.2	1.7
11/02/2014	08:52	53.23	-1.01	0.8	1.0
12/02/2014	02:35	53.23	-1.01	1.2	1.8
12/02/2014	02:39	53.22	-1.01	1.2	0.9
12/02/2014	03:33	53.23	-1.02	0.2	0.5
12/02/2014	13:20	53.22	-1.01	1.5	1.7
12/02/2014	14:15	53.22	-1.01	1.2	1.7
12/02/2014	16:45	53.23	-1.02	0.2	1.2
12/02/2014	16:59	53.23	-1.02	0.7	1.1
12/02/2014	21:03	53.22	-1.02	1.2	1.7
13/02/2014	03:26	53.22	-1.02	1.1	0.9
13/02/2014	16:01	53.22	-1.01	1.5	2.0
14/02/2014	14:07	53.22	-1.01	1.2	1.9
15/02/2014	02:25	53.23	-1.01	0.2	0.7
15/02/2014	02:48	53.22	-1.01	1.2	1.8
17/02/2014	17:52	53.22	-1.01	1.6	2.0
18/02/2014	13:56	53.22	-1.02	1.1	1.8
18/02/2014	17:23	53.22	-1.02	1.0	0.5
19/02/2014	17:22	53.22	-1.02	1.3	1.8
20/02/2014	16:21	53.22	-1.01	1.3	1.6
20/02/2014	23:13	53.22	-1.01	1.3	1.6
22/02/2014	03:44	53.22	-1.01	1.4	1.7
23/02/2014	02:22	53.22	-1.01	1.4	1.8
23/02/2014	08:48	53.22	-1.01	1.3	0.8
23/02/2014	09:36	53.23	-1.01	1.0	0.8
23/02/2014	18:35	53.22	-1.01	1.6	1.1
24/02/2014	00:24	53.22	-1.01	1.2	1.8
24/02/2014	10:05	53.22	-1.01	1.0	1.6
24/02/2014	10:38	53.23	-1.01	1.0	1.4
24/02/2014	23:19	53.22	-1.01	1.4	1.6
25/02/2014	01:42	53.22	-1.00	1.4	0.5
25/02/2014	03:19	53.22	-1.01	0.9	0.6
25/02/2014	18:39	53.22	-1.01	1.0	1.7
25/02/2014	19:36	53.22	-1.01	1.0	1.0
26/02/2014	14:35	53.22	-1.02	1.4	1.5
26/02/2014	18:24	53.22	-1.01	1.5	1.8
27/02/2014	04:32	53.22	-1.00	1.3	0.8
27/02/2014	16:36	53.22	-1.01	1.6	1.5
28/02/2014	01:58	53.23	-1.01	1.3	2.0
28/02/2014	02:39	53.22	-1.01	1.4	0.8
28/02/2014	21:32	53.22	-1.01	1.6	1.7
02/03/2014	09:39	53.21	-1.01	1.0	F 1.5
03/03/2014	17:50	53.21	-1.04	1.0	1.6
04/03/2014	14:08	53.22	-1.01	1.5	1.9
05/03/2014	01:18	53.22	-1.01	1.2	1.8
05/03/2014	15:56	53.22	-1.01	1.3	1.7
05/03/2014	20:56	53.22	-1.01	1.1	1.4
06/03/2014	01:36	53.22	-1.00	0.7	0.5
06/03/2014	06:08	53.22	-1.01	1.4	1.7
07/03/2014	05:13	53.22	-1.01	1.4	1.7
08/03/2014	04:08	53.22	-1.01	1.3	1.8
10/03/2014	02:21	53.23	-1.01	0.9	2.0
10/03/2014	23:15	53.22	-1.01	1.5	0.7
11/03/2014	03:04	53.22	-1.01	0.7	0.5
11/03/2014	11:37	53.22	-1.01	0.9	2.1
12/03/2014	04:44	53.22	-1.01	1.0	1.9
13/03/2014	10:19	53.22	-1.01	1.1	0.9

13/03/2014	12:39	53.22	-1.01	1.1	2.0
14/03/2014	00:32	53.22	-1.01	1.1	1.8
14/03/2014	03:48	53.22	-1.01	0.8	1.3
14/03/2014	21:23	53.22	-1.01	1.0	1.9
16/03/2014	12:18	53.22	-1.01	1.0	2.0
17/03/2014	02:58	53.22	-1.01	1.1	1.9
19/03/2014	02:21	53.23	-1.01	0.4	0.8
19/03/2014	19:34	53.22	-1.01	1.1	2.1
20/03/2014	02:28	53.22	-1.01	1.6	1.3
20/03/2014	11:32	53.22	-1.01	1.4	1.9
20/03/2014	18:29	53.22	-1.01	1.5	0.8
20/03/2014	19:52	53.22	-1.00	1.0	1.1
21/03/2014	07:55	53.70	-1.74	8.7	1.1
21/03/2014	13:45	53.22	-1.01	1.2	2.0
21/03/2014	15:50	53.22	-1.01	0.8	1.1
23/03/2014	11:46	53.22	-1.01	1.2	2.0
23/03/2014	20:10	53.22	-1.01	1.2	1.2
23/03/2014	21:25	53.22	-1.01	1.3	1.8
25/03/2014	04:23	53.22	-1.01	1.4	2.0
25/03/2014	23:14	53.22	-1.01	0.9	1.8
26/03/2014	11:36	53.22	-1.01	1.1	1.7
26/03/2014	12:45	53.22	-1.01	0.8	1.9
27/03/2014	03:48	53.22	-1.01	0.8	1.8
30/03/2014	13:29	53.22	-1.01	1.1	1.9
30/03/2014	17:54	53.22	-1.01	1.4	1.7
30/03/2014	20:57	53.22	-1.01	0.9	1.6
31/03/2014	12:22	53.22	-1.01	1.1	1.8
02/04/2014	03:31	53.22	-1.01	1.2	1.8
03/04/2014	03:52	53.22	-1.00	1.3	0.7
03/04/2014	13:48	53.22	-1.01	1.0	1.8
03/04/2014	15:24	53.21	-1.01	1.0	1.1
03/04/2014	17:11	53.22	-1.01	1.5	1.8
04/04/2014	08:06	53.22	-1.01	1.1	1.7
04/04/2014	12:51	53.22	-1.00	1.1	0.8
06/04/2014	00:53	53.22	-1.01	1.2	1.9
06/04/2014	10:25	53.22	-1.01	1.2	1.8
06/04/2014	18:20	53.22	-1.01	1.3	0.8
06/04/2014	18:47	53.22	-1.01	0.8	1.0
07/04/2014	02:52	53.22	-1.02	0.7	0.3
07/04/2014	07:30	53.22	-1.01	1.2	1.3
07/04/2014	20:05	53.22	-1.00	1.5	1.9
08/04/2014	18:19	53.22	-1.00	1.7	1.8
10/04/2014	06:53	53.22	-1.00	1.5	2.0
10/04/2014	18:11	53.22	-1.00	1.4	1.7
10/04/2014	18:43	53.22	-1.01	1.1	1.1
11/04/2014	13:38	53.22	-1.00	1.5	1.4
11/04/2014	19:17	53.22	-1.01	1.0	0.8
13/04/2014	05:48	53.22	-1.01	0.9	1.7
13/04/2014	12:58	53.22	-1.01	1.2	0.7
13/04/2014	20:58	53.22	-1.01	1.1	1.5
13/04/2014	23:38	53.22	-1.01	1.2	1.3
15/04/2014	11:35	53.22	-1.01	1.0	1.6
16/04/2014	00:24	53.22	-1.01	1.1	1.5
16/04/2014	16:37	53.22	-1.00	1.3	1.4
17/04/2014	17:50	53.22	-1.00	1.6	1.7
18/04/2014	00:58	53.22	-1.01	1.2	1.8
18/04/2014	04:53	53.22	-1.01	1.2	1.5
19/04/2014	00:26	53.22	-1.02	1.1	1.3
19/04/2014	19:57	53.22	-1.00	1.7	1.8
22/04/2014	16:57	53.22	-1.01	1.1	1.1
25/04/2014	19:04	53.22	-1.01	1.1	0.9
29/04/2014	01:21	53.22	-1.00	1.7	1.5
30/04/2014	23:53	53.21	-1.01	1.4	0.6
01/05/2014	00:50	53.22	-1.01	0.7	0.5
02/05/2014	01:26	53.22	-1.00	0.6	0.6

02/05/2014	05:30	53.22	-1.00	1.3	1.2
02/05/2014	16:00	53.22	-1.01	0.8	0.6
02/05/2014	20:41	53.21	-1.00	1.3	0.6
09/05/2014	15:14	53.22	-1.02	1.6	1.5
11/05/2014	21:25	53.21	-1.00	1.0	0.5
13/05/2014	23:57	53.21	-1.00	1.0	1.1
14/05/2014	02:46	53.21	-0.99	1.7	1.7
15/05/2014	15:04	53.21	-0.99	1.3	1.5
26/05/2014	12:40	53.22	-1.00	0.8	0.6
09/06/2014	08:20	53.21	-1.03	1.3	1.2
18/06/2014	08:44	53.40	-1.38	4.6	2.8
20/06/2014	14:51	53.23	-1.05	1.4	1.0
23/06/2014	17:35	53.25	-1.04	1.0	1.0
24/06/2014	02:25	53.24	-1.03	1.2	0.8
24/06/2014	02:33	53.24	-1.04	1.3	0.7
24/06/2014	02:38	53.24	-1.03	1.2	2.0
24/06/2014	02:41	53.24	-1.03	1.5	1.0
24/06/2014	13:03	53.24	-1.04	1.1	0.9
24/06/2014	13:27	53.24	-1.02	0.2	0.6
24/06/2014	19:57	53.24	-1.03	1.2	1.0
26/06/2014	13:12	53.23	-1.04	1.4	1.0
26/06/2014	22:45	53.24	-1.03	1.2	1.0
26/06/2014	23:10	53.24	-1.03	0.9	0.8
28/06/2014	02:52	53.25	-1.03	1.2	1.7
29/06/2014	10:55	53.26	-1.05	1.3	0.8
29/06/2014	20:53	53.24	-1.03	1.6	0.9
29/06/2014	21:14	53.25	-1.04	1.4	0.6
29/06/2014	21:39	53.24	-1.07	1.6	0.5
12/07/2014	17:02	53.25	-1.04	1.4	1.4
17/07/2014	01:41	53.25	-1.03	1.6	1.9
17/07/2014	01:45	53.24	-1.03	1.6	0.3
17/07/2014	14:49	53.26	-1.03	1.1	1.9
17/07/2014	20:47	53.24	-1.02	1.4	1.4
18/07/2014	03:17	53.24	-1.02	1.0	1.7
18/07/2014	03:34	53.24	-1.02	1.4	0.4
18/07/2014	04:50	53.24	-1.02	1.2	0.4
21/07/2014	09:27	53.25	-1.09	1.0	0.9
21/07/2014	09:31	53.24	-1.01	1.0	1.1
22/07/2014	03:24	53.24	-1.02	1.4	1.0
22/07/2014	03:25	53.24	-1.04	1.6	1.1
22/07/2014	04:03	53.24	-1.02	1.1	0.9
22/07/2014	15:38	53.24	-1.02	1.4	1.8
22/07/2014	20:02	53.24	-1.02	1.0	1.3
23/07/2014	02:41	53.24	-1.03	1.5	0.6
23/07/2014	02:51	53.24	-1.02	1.0	0.8
23/07/2014	02:54	53.24	-1.02	0.1	0.6
23/07/2014	02:55	53.24	-1.02	1.6	1.5
23/07/2014	02:58	53.24	-1.03	1.6	0.4
23/07/2014	03:01	53.24	-1.02	1.5	0.7
24/07/2014	14:45	53.24	-1.02	1.5	1.6
28/07/2014	22:40	53.24	-1.02	1.2	0.7
30/07/2014	01:53	53.23	-1.03	1.6	0.3
30/07/2014	01:55	53.24	-1.02	1.4	0.9
30/07/2014	01:57	53.24	-1.02	1.7	0.5
30/07/2014	18:22	53.24	-1.02	1.0	1.6
30/07/2014	23:27	53.24	-1.02	1.0	0.4
10/08/2014	19:25	53.24	-1.02	0.4	1.3
10/08/2014	20:09	53.24	-1.02	0.3	0.5
10/08/2014	20:14	53.24	-1.02	1.0	0.6
12/08/2014	23:32	53.24	-1.03	1.7	0.8
13/08/2014	02:13	53.24	-1.02	0.9	1.0
13/08/2014	15:37	53.24	-1.02	1.4	1.8
13/08/2014	15:39	53.24	-1.02	1.4	1.7
14/08/2014	01:00	53.24	-1.02	0.1	1.0
14/08/2014	01:05	53.62	-1.12	1.1	1.4

14/08/2014	01:13	53.61	-1.14	1.1	1.7
14/08/2014	01:27	53.24	-1.02	0.4	1.3
18/08/2014	11:18	53.24	-1.03	1.0	1.5
19/08/2014	13:10	53.24	-1.02	1.4	0.4
19/08/2014	22:16	53.61	-1.12	1.2	0.8
21/08/2014	01:17	53.24	-1.02	1.7	1.5
22/08/2014	01:53	53.24	-1.02	1.3	0.9
24/08/2014	02:47	53.24	-1.02	1.7	0.5
24/08/2014	23:28	53.24	-1.02	1.3	1.7
26/08/2014	19:35	53.24	-1.02	1.7	0.5
27/08/2014	15:29	53.24	-1.02	1.4	0.6
27/08/2014	16:25	53.24	-1.03	1.3	0.8
29/08/2014	13:11	53.24	-1.02	1.7	1.7
29/08/2014	16:14	53.24	-1.02	1.1	1.7
29/08/2014	16:49	53.24	-1.02	1.4	1.6
30/08/2014	21:28	53.23	-1.02	1.0	0.4
31/08/2014	22:41	53.24	-1.03	0.9	0.1
01/09/2014	01:08	53.24	-1.02	1.3	0.8
01/09/2014	14:16	53.24	-1.02	1.4	1.1
01/09/2014	15:30	53.24	-1.02	1.7	1.5
01/09/2014	16:41	53.24	-1.02	1.3	1.0
01/09/2014	17:11	53.23	-1.03	1.6	0.5
02/09/2014	01:35	53.24	-1.02	1.4	0.5
02/09/2014	04:20	53.24	-1.02	1.5	0.6
02/09/2014	16:28	53.24	-1.02	1.6	0.7
02/09/2014	20:31	53.24	-1.02	1.6	1.5
02/09/2014	20:41	53.24	-1.02	0.6	0.8
02/09/2014	20:46	53.24	-1.02	0.7	0.6
02/09/2014	21:21	53.24	-1.02	1.2	0.4
04/09/2014	06:22	53.24	-1.02	0.3	1.1
04/09/2014	09:36	53.23	-1.03	1.3	0.8
06/09/2014	00:03	53.23	-1.02	1.3	0.2
07/09/2014	20:28	53.24	-1.02	1.4	0.6
09/09/2014	15:33	53.24	-1.02	1.0	0.6
10/09/2014	13:28	53.22	-1.02	1.3	0.6
10/09/2014	13:30	53.22	-1.02	1.3	1.0
10/09/2014	14:18	53.21	-1.02	1.4	1.4
10/09/2014	16:58	53.24	-1.02	1.4	1.6
10/09/2014	18:46	53.22	-1.02	1.5	1.0
11/09/2014	22:31	53.69	-1.13	1.0	1.9
12/09/2014	04:17	53.23	-1.03	1.4	0.9
12/09/2014	19:34	53.24	-1.02	1.3	0.5
02/10/2014	19:54	53.24	-1.02	0.5	0.9
04/10/2014	00:15	53.24	-1.02	1.1	1.1
05/10/2014	11:12	53.23	-1.02	0.4	1.6
05/10/2014	12:55	53.23	-1.02	1.2	0.4
07/10/2014	21:05	53.23	-1.02	1.0	1.1
10/10/2014	02:44	53.23	-1.02	0.2	1.2
12/10/2014	22:57	53.23	-1.02	0.7	0.6
12/10/2014	23:01	53.23	-1.02	1.4	0.5
17/10/2014	21:03	53.23	-1.02	1.1	1.3
20/10/2014	21:43	53.23	-1.02	1.1	1.3
21/10/2014	21:30	53.23	-1.01	1.0	0.6
21/10/2014	22:50	53.23	-1.02	0.8	1.4
23/10/2014	15:14	53.23	-1.02	1.0	0.9
23/10/2014	20:41	53.23	-1.02	0.1	0.9
24/10/2014	05:20	53.23	-1.02	0.3	1.0
24/10/2014	17:27	53.22	-1.04	1.4	1.0
28/10/2014	19:16	53.06	-1.19	7.1	2.6
29/10/2014	16:38	53.24	-1.02	0.2	1.4
30/10/2014	05:44	53.23	-1.02	1.0	0.6
06/12/2014	11:05	53.68	-1.14	1.1	1.9
09/12/2014	07:31	53.08	-1.23	2.4	2.1
27/03/2015	11:58	53.70	-1.12	0.9	1.9
09/04/2015	23:48	53.70	-1.12	0.8	1.2

16/06/2015 16:02	53.56	-1.66	11.8	1.8
19/11/2015 09:24	53.24	-1.20	7.3	1.8
19/11/2015 10:31	53.24	-1.20	7.5	1.7
20/11/2015 01:21	53.24	-1.13	6.3	1.4
20/11/2015 01:29	53.25	-1.13	6.4	1.2
20/11/2015 21:48	53.24	-1.12	7.5	1.7
21/11/2015 00:55	53.25	-1.12	6.7	1.8
21/11/2015 02:14	53.22	-1.20	6.4	1.2
21/11/2015 20:48	53.25	-1.13	6.9	1.2
25/11/2015 13:20	53.25	-1.15	5.8	1.5
25/11/2015 15:00	53.26	-1.11	7.5	1.1
25/11/2015 20:27	53.25	-1.12	7.7	1.4
25/11/2015 20:30	53.26	-1.12	6.8	1.9
25/11/2015 21:53	53.26	-1.12	6.6	1.5
25/11/2015 22:38	53.26	-1.12	7.1	1.6
26/11/2015 02:10	53.25	-1.12	6.9	2.1
26/11/2015 04:02	53.24	-1.19	7.0	1.1
26/11/2015 16:00	53.25	-1.12	6.3	1.2
26/11/2015 17:09	53.25	-1.12	5.3	1.5
26/11/2015 21:09	53.26	-1.12	6.2	1.0
27/11/2015 02:05	53.25	-1.12	5.4	0.8
27/11/2015 11:42	53.25	-1.12	7.4	2.2
29/11/2015 04:08	53.25	-1.12	6.1	0.8
28/12/2015 20:59	53.20	-1.53	16.2	1.1
09/06/2016 02:56	53.10	-1.23	2.5	1.0
22/01/2017 22:33	53.70	-1.92	4.4	1.0
16/05/2017 04:30	53.83	-1.27	6.0	1.9
17/06/2017 06:09	53.02	-1.10	9.6	1.0
13/09/2017 01:16	53.65	-0.89	8.0	1.3
18/02/2018 04:56	53.22	-1.55	10.2	0.7
05/06/2018 02:15	53.49	-1.16	6.8	0.7
28/06/2018 21:33	53.43	-1.55	2.4	0.9

Appendix 2 Mine List

List of coal mines open in the region of interest between 1970 and present. This list was taken from the Northern Mine Research Society website (<https://www.nmrs.org.uk/>).

Colliery	Location	Opened	Closed
Thoresby	Edwinstowe	1925	2015
Hatfield Main	Stainforth	1911	2015
Kellingley	Knottingley	1958	2015
Maltby (Main)	Maltby	1907	2012
Welbeck	Meden Vale	1912	2010
Harworth	Bircotes	1924	2006
Rossington Main	Rossington	1912	2006
Gascoigne Wood Drift	South Milford	1977	2004
Riccall	Riccall	1978	2004
Stillingfleet	Stillingfleet	1978	2004
Wistow	Wistow	1976	2004
Clipstone	Mansfield	1915	2003
Prince of Wales	Pontefract	1869	2002
Annesley	Annesley	1865	2000
Calverton	Calverton	1938	1999
Whitemoor	Barlby	1980	1998

Bilsthorpe	Bilsthorpe	1925	1997
North Selby	Escrick	1979	1997
Markham Main	Armthorpe	1916	1996
Ollerton	Ollerton	1923	1994
Kiveton Park	Kiveton Park	1866	1994
Silverwood	Thrybergh	1899	1994
Bevercotes	Bevercotes	1952	1993
Manton	Manton	1900	1993
Rufford	Rainworth	1911	1993
Shirebrook	Shirebrook	1896	1993
Bolsover	Bolsover	1890	1993
Markham	Duckmanton	1881	1993
Bolsover	Bolsover	1890	1993
Markham	Duckmanton	1881	1993
Shirebrook	Shirebrook	1896	1993
Bentley	Bentley	1905	1993
Frickley	South Elmsall	1902	1993
Sharlston	Sharlston	1858	1993
Sherwood	Mansfield	1902	1992
Cotgrave	Cotgrave	1955	1992
Silverhill	Sutton-in-Ashfield	1875	1992
Allerton Bywater	Allerton Bywater	1854	1992
Grimethorpe	Grimethorpe	1894	1992
Houghton Main	Little Houghton	1873	1992
Creswell	Creswell	1895	1991
Gedling	Gedling	1900	1991
Creswell	Creswell	1895	1991
Askern (Main)	Askern	1911	1991
Barnsley Main	Stairfoot	1985	1991
Dearne Valley	Little Houghton	1900	1991
Denby Grange	Netherton	1854	1991
Dinnington (Main)	Dinnington	1901	1991
Thurcroft (Main)	Thurcroft	1909	1991
Shireoaks	Shireoaks	1854	1990
Shireoaks, No.3	Shireoaks	1924	1990
Brodsworth Main	Woodlands	1905	1990
Treeton	Treeton	1878	1990
Warsop	Shirebrook	1893	1989
Blidworth	Blidworth	1924	1989
High Moor	Killamarsh	1957	1989
Renishaw Park	Eckington	1859	1989
Sutton	Sutton-in-Ashfield	1874	1989
High Moor	Killamarsh	1957	1989
Renishaw Park	Eckington	1859	1989
Barnborough Main	Barnburgh	1911	1989
Barnburgh	Barnburgh	1911	1989
Darfield Main	Darfield	1858	1989
Royston Drift	Royston	1975	1989
Mansfield	Mansfield	1904	1988
Linby	Linby	1875	1988
Arkwright	Arkwright Town	1899	1988
Arkwright	Arkwright Town	1899	1988
Bentinck	Kirkby-in-Ashfield	1895	1988
Cadley Hill	Swadlincote	1869	1988
Ferry Moor Riddings	South Kirkby	1973	1988
Kirkby Riddings	South Kirkby	1987	1988
Manvers Main	Wath upon Dearne	1868	1988

Park Mill	Clayton West	1877	1988
South Kirkby	South Kirkby	1876	1988
Wath Main	Wath upon Dearne	1873	1988
Newstead	Newstead	1874	1987
Nostell	Nostell	1854	1987
Redbrook	Barugh	1982	1987
Wheldale	Castleford	1863	1987
Woolley	Darton	1854	1987
Whitwell	Whitwell	1890	1986
Babbington	Cinderhill	1842	1986
Hucknall	Hucknall	1854	1986
Ireland	Staveley	1875	1986
Ireland	Staveley	1875	1986
Whitwell	Whitwell	1890	1986
Cadeby Main	Cadeby	1889	1986
Glasshoughton	Glass Houghton	1863	1986
Hickleton Main	Thurnscoe	1892	1986
Kilnhurst	Kilnhurst	1861	1986
Kinsley Drift	Fitzwilliam	1978	1986
Ledston Luck	Kippax	1909	1986
Thrybergh Hall	Kilnhurst	1854	1986
Ackton Hall	Featherstone	1877	1985
Barrow	Worsbrough Bridge	1873	1985
Brookhouse	Beighton	1929	1985
Bullcliffe Wood	Bretton West	1948	1985
Caphouse	Overton	1828	1985
Cortonwood	Brampton	1873	1985
Denby Grange, Caphouse	Overton	1828	1985
Dodworth	Dodworth	1855	1985
Emley Moor	Emley	1948	1985
Fryston	Fryston	1873	1985
North Gawber	Mapplewell	1854	1985
Savile	Mickleton	1873	1985
Yorkshire Main	Edlington	1908	1985
Pleasley	Pleasley Hill	1871	1984
Westthorpe	Sheffield	1923	1984
Pleasley	Pleasley Hill	1871	1984
Westthorpe	Sheffield	1923	1984
Steetley	Steetley	1873	1983
Elsecar	Elsecar	1905	1983
Newmarket	Stanley	1835	1983
Newmarket Silkstone	Stanley	1835	1983
Rothwell	Rothwell	1950	1983
New Hucknall	Sutton-in-Ashfield	1876	1982
Park Hill	Stanley	1883	1982
Lofthouse	Outwood	1873	1981
Manor	Wakefield	1861	1981
Newmillerdam	Newmillerdam	1929	1981
Orgreave	Handsworth	1851	1981
Teversal	Sutton-in-Ashfield		1980
Peckfield	Micklefield	1888	1980
Rockingham	Hoyland	1873	1979
Walton	Walton	1873	1979
Langwith	Mansfield		1978
Langwith	Mansfield	1876	1978
New Stubbin	Rawmarsh	1913	1978
Wentworth Silkstone	Stainborough	1911	1978
Glapwell	Glapwell	1885	1974

Oxcroft	Clowne	1900	1974
Glapwell	Glapwell	1885	1974
Oxcroft	Clowne	1900	1974
Barley Hall	Thorpe Hesley	1886	1974
Ferry Moor	Grimethorpe	1915	1973
Gomersal	Gomersal	1913	1973
Riddings Drift	South Kirkby	1969	1973
Shuttle Eye	Grange Moor	1856	1973
St John's	Normanton	1870	1973
Smithy Wood	Ecclesfield	1902	1972
Thornhill	Thornhill	1948	1972
Combs	Thornhill	1856	1971