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CBM Prospectivity Report

IGas/GDFS/INEOS 13 Licences Assessment

1 EXECUTIVE SUMMARY

Objectives
Coal Bed Methane (CBM) prospectivity has been analysed across the 13 IGas/GDF Suez/INEOS Joint Venture licences in both the North West and the East Midlands of the United Kingdom. The goal of the prospectivity analysis was to evaluate all available data, both public and confidentially held, on the Pennine Coal Measures and determine whether CBM could be economically recovered across the acreage.

Methodology
This report is subdivided into two areas to reflect geography and geologically separate areas. The North West licences are EXL273, PEDL147, PEDL185, PEDL186, PEDL187, PEDL188 and PEDL189. The East Midlands licences are PEDL146, EXL288, PEDL012, PEDL200, PEDL207 and PEDL210.

A technical assessment of prospectivity was made across the East Midlands and North West acreage, using the following information:

- Regional geology
- Previous exploration in the area
- CBM exploration across Scotland, Wales and other European countries including Poland and Germany
- Actual CBM production data (water and gas) from Airth (PEDL133), Doe Green (PEDL145) and Broadmeadows (PEDL159)

As a result, potential target (Primary) coal seams were identified across both the North West and East Midlands areas based on thickness and lateral distribution. Other coal seams were identified over the areas but were not considered as target coal seams due to low thickness and/or lateral discontinuity.

Development restrictions were applied to the seams to produce coal seam net thickness prospective areas. These restrictions included:

- on seam thickness greater than 1m
- abandoned coal mine workings
- residential areas
- surface designations; and
- groundwater source protection zones.

Results
1. Composite coal seam net thickness maps were produced to identify any potential net thickness 'sweet spots'
2. Coal seam (Primary and Secondary) depth and gas content were mapped to display the trends and values across the licence areas.
3. Resource estimations were made on each licence block following the application of the development restrictions.

Analyses
Analysis for each area revealed the following:

North West
1. Eight coal seams were identified as primary prospective coal seams.
2. Seven coal seams were identified as secondary prospective coal seams.
3. Net thickness varies from <1m to 3m for the primary coal seams and from <1m to 2.5m for the secondary coal seams
4. Coal seam depths vary from 200m to >1500m across licence areas.
5. Development restrictions significantly reduce the seam volumes and/or reduce the ability to access primary seams.
6. Composite coal seam net thicknesses (primary coal seams) vary from 1m to 9m.
7. Coal seam gas content varies from 5m^3/t to 12m^3/t with an average of 8m^3/t.

8. Coal seam gas saturation varies from 50% to 75% with an average of 55%.

The estimates of Gas in Place and Contingent Gas Resources for the North West licences were:

Licence	GIP BCF (Low)	GIP BCF (Mid)	GIP BCF (High)	Prospective Area (Km^2)	GIP BCF Per Km^2 (Mid)	Gas Resources BCF* (Mid)
PEDL185	14	18	24	15	1.2	7
PEDL186	70	88	121	52	1.7	35
PEDL187	48	61	83	37	1.6	24
PEDL188	79	99	137	51	1.9	40
PEDL189	111	139	191	71	2.0	56
PEDL147	134	168	232	75	2.2	67
EXL273	3	10	17	5	2.0	4
TOTAL	**459**	**583**	**805**	**306**	**1.9**	**233**

Estimates of CBM GIP and Contingent Resources in the North West licence areas

* Mid RF assumed to be 40%, based on analogue CBM fields globally, assuming a similar development plan and coal properties.

East Midlands

1. Five coal seams were identified as primary prospective coal seams.
2. Three coal seams were identified as secondary prospective coal seams.
3. Net thickness varies from <1m to 4.5 m for the primary coal seams and from <1m to 1.2m for the secondary coal seams.
4. Coal seam depths vary from 200 mBGL to >1400 mBGL m across licence areas.
5. Development restrictions significantly reduce the seam volumes and/or reduces ability to access primary seams.
6. Composite coal seam net thicknesses (primary coal seams) vary from 1m to 11.5m.
7. Coal seam gas content varies from $1m^3/t$ x to $12m^3/t$ with an average of $6.5m^3/t$.
8. Coal seam gas saturation varies from 20% to 90% with an average of 50%.

The estimates of Gas in Place and Contingent Gas Resources for the East Midlands licences were:

Licence	GIP BCF (Low)	GIP BCF (Mid)	GIP BCF (High)	Prospective Area (Km^2)	GIP BCF Per Km^2 (Mid)	Gas Resources BCF* (Mid)
PEDL146	141	303	487	267	1.1	121
EXL288	12	18	24	14	1.3	7
PEDL012	4	6	8	8	0.8	2
PEDL200	41	59	79	56	1.0	24
PEDL207	13	17	22	25	0.7	7
PEDL210	27	36	46	65	0.6	14
TOTAL	**237**	**439**	**667**	**435**	**1.0**	**175**

Estimates of CBM GIP and Contingent Resources in the East Midlands licence areas

* Mid RF assumed to be 40%, based on analogue CBM fields globally, assuming a similar development plan and coal properties

Conclusions

Technical

In the North West licences, the Gas in Place (mid case) was estimated at 583 bcf, with more than half in PEDL189 and PEDL147. The prospective acreage equates to c. 300 km^2. Applying a 40% recovery factor gives contingent gas resources of 233 bcf. PEDL185, PEDL187 and EXL273 can immediately be discounted on grounds that there is insufficient scale (compared to the marginal 2P volume of 40 bcf at Airth) to warrant further development. For all the North West licences reviewed, key technical metrics were less than those identified at Airth in PEDL133.

In the East Midlands, the Gas in Place (mid case) was estimated at 439 bcf, with almost 70% in PEDL146 (a reflection more on licence area than the resource density). The prospective acreage equates to c. 435 km^2. Applying a 40% recovery factor gives contingent gas resources of 175 bcf. Only PEDL146 has recoverable gas in place of sufficient scale to even consider for development – all other licences fall below the 40 bcf 2P resource that was identified in Airth as a minimum. For all licences, including PEDL146, key technical metrics were less than those identified at Airth in PEDL133.

Commercial Viability

Based on the work undertaken, CBM prospectivity was evaluated to be low in both the East Midlands and the North West licence areas reviewed. CBM exploration and development is currently not commercially viable in these licences based on technical analysis, sub economic flow rates from CBM wells tested to date, development constraints, capital costs, expected timeline and forecast gas prices.

2 Introduction

This report was intended to give a description of what is known about the Coal Bed Methane characteristics of the Pennine Coal Measures Group over 13 onshore licences spread across two separate areas, the North West and East Midlands of England. CBM characteristics were compiled and development restrictions were applied to assess the prospectivity of each area for a commercially viable CBM project. These characteristics were benchmarked against other UK and Australian CBM projects for comparison.

When the work for this report commenced, the 13 licences being assessed for CBM prospectivity were held by a Joint Venture between IGas Energy plc (75%) and GDF Suez (25%) spanning 1,359 km^2 (Figure 1 and Figure 6). On 10 March 2015, IGas Energy plc announced that it had signed a Farm out and Purchase Agreement for INEOS to acquire a 50% interest in IGas' licences PEDL147, 184, 189, and 190, and a 60% interest in IGas' licences PEDL145, 193 and EXL 273. In addition, INEOS was granted an option to acquire 20% in PEDL 012 and 200. As a result INEOS became a partner in 5 of the 13 licences reviewed in this report: North West licences EXL273, PEDL147 and PEDL189 and East Midlands licences PEDL012 and PEDL200. In Scotland, INEOS acquired IGas' entire working interest in the acreage held under PEDL 133 in the Midland Basin and assumed operatorship. PEDL133 includes the planned Airth CBM development project. PEDL145 is not one of the 13 licences reviewed in this report but it includes the pilot CBM development at Doe Green, which is currently the only CBM production site in the United Kingdom.

This report assessed the North West and East Midlands areas separately as the Pennine Coal Measures formed in sub-basins either side of the Peak District. Furthermore the North West and East Midlands areas were divided into two sub areas, Warrington/Cheshire and York/Gainsborough respectively.

All available well data (oil & gas, coal and water wells) and analyses were acquired, tabled into a comprehensive database and used for this report to give the most accurate and up to date summary of the CBM prospectivity over the 13 licences.

CBM characteristics used to analyse prospectivity were net seam thickness (individual and composite), seam depth, gas content/quality and gas saturation. Each of these characteristics are summarised in individual sections of this report. Surface and subsurface development restrictions were applied to the coal seams to assess the CBM prospectivity of the 13 licences.

Gas in place (GIP) estimates were produced for each area after the development restrictions were applied to assess the commercial prospectivity of the 13 licences.

3 North West

3.1 Licence Summary and Location

The North West IGas/GDFS JV area consists of 7 licence blocks covering 717 km^2. The JV area is located on the England/Wales border, with the bulk of the licences spanning from Chester, through Wrexham and down to Oswestry. EXL273 is located to the north of the main licence cluster between Liverpool and Warrington (Figure 1). PEDL185 consists of 2 non-contiguous 100 km^2 licence blocks.

The following table is a summary of the licences:

Licence No	Licencing Round	Licence Area (km^2)
PEDL185	13th	200
PEDL186	13th	100
PEDL187	13th	80
PEDL188	13th	100
PEDL189	13th	100
PEDL147	Out of Round (2005)	89
EXL273	10th	48

Table 1 Summary of North West IGas/GDFS JV Licences

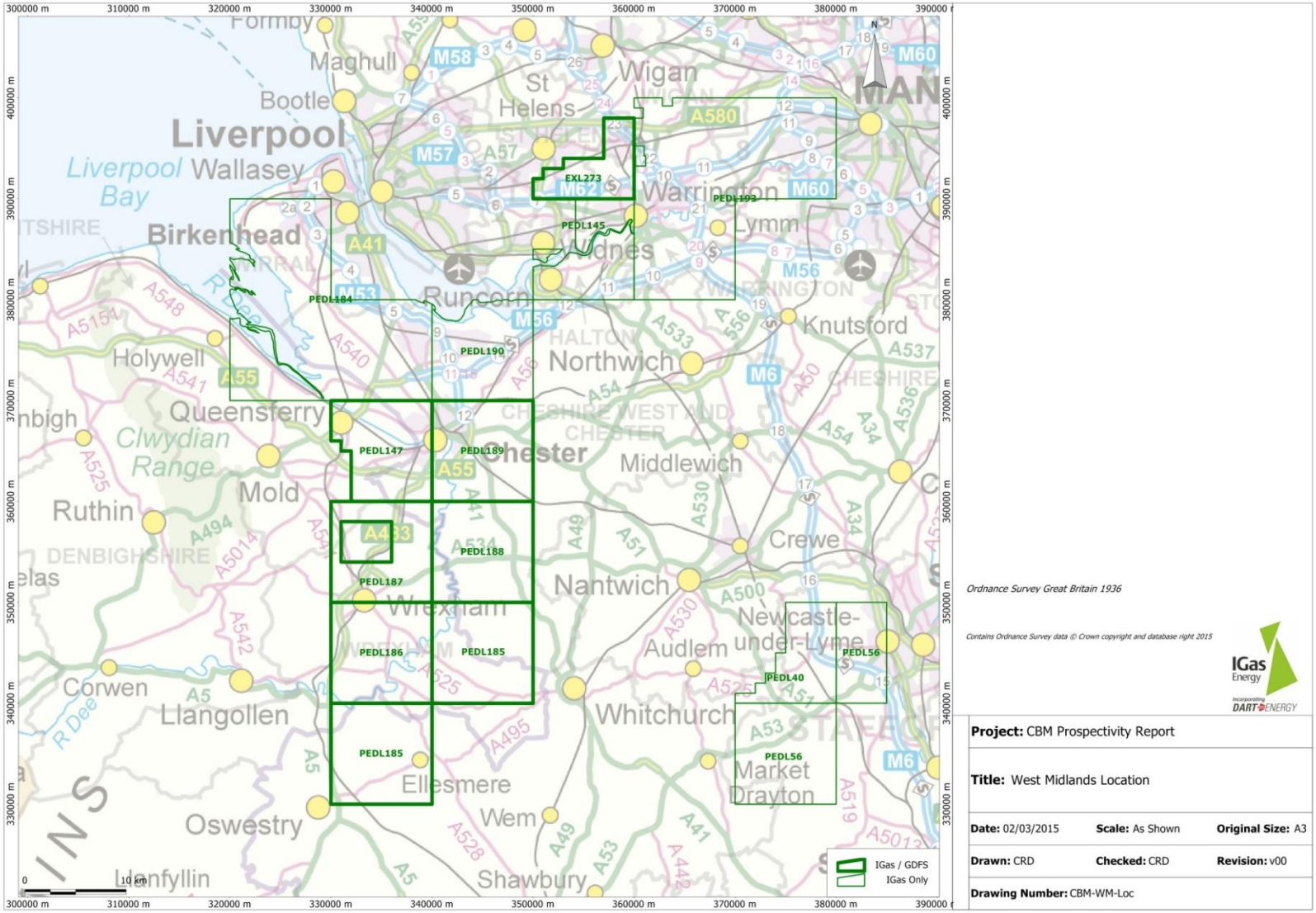


Figure 1 Location of North West IGas/GDFS JV Licences

3.2 Regional Exploration History

The North West area is a mature area for coal exploration, however, there are only a small number of conventional and unconventional hydrocarbon exploration wells that have been completed in the area, compared to other onshore areas in the United Kingdom.

The North West area was the subject of a CBM and Abandoned Mine Methane (AMM) drilling programme by Evergreen Resources Inc. during the late 1990s and early 2000s: four exploration wells south of Wrexham in 2000-2003 (Bersham 1+2 and Erbistock 2+3); five exploration and appraisal wells in the Chester area during 1992-2003 (Sealand 1-5); one exploration well just east of Ellesmere Port in 1994 (Kemira 1); three wells east of Liverpool during 2000-2003 (Cornton 1-3); and three wells west of Warrington in 2002 (Sutton Manor 1+2 and Four Oak 1). No significant data were ever released by Evergreen concerning this programme.

Pre-mine Methane Drainage Wells and Abandoned Mine Methane projects are known in collieries in South Lancashire (e.g. Parkside Colliery) and North Wales (e.g. Point of Ayr and Llay Collieries).

From 2006 to 2012, Nexen and IGas drilled four CBM wells near Evergreen's Four Oak 1 CBM well near Warrington (Doe Green 1-4). These wells were drilled using horizontal drilling technology and the Doe Green pilot CBM site continues to produce gas and generate electricity. There are currently three production wells, each of which is testing a separate seam, that demonstrate that gas is flowing from the seams.

Composite Energy (now Dart Energy (Europe) Limited) drilled the Castletown 1 CBM exploration well on PEDL188 in 2009 and this well cored the entire coal-bearing Carboniferous sequence and collected coal samples for desorption and adsorption analysis. Net coal of 11m with individual seams up to 2.3m thick were recorded.

In 2010, IGas drilled the Ince Marshes 1 well on PEDL190 which is located immediately to the north of PEDL189. This exploration well encountered approximately 10m of net coal over a number of seams.

The Lesters Lane 1 CBM exploration well was drilled on PEDL147 in 2011 by Greenpark Energy. However, at this location the entire coal bearing sequence was faulted out by a low hade fault and the well drilled directly into Lower Carboniferous shales.

In 2014, Dart Energy drilled the Churton 1 CBM exploration well on PEDL188, which is located directly south of PEDL189. This exploration well encountered approximately 8m of net coal over 12 seams up to 1.5m thick.

3.3 Regional Geology

The Cheshire Basin contains what is, for the UK onshore area, an exceptionally thick Permo-Triassic red bed and evaporite sequence overlying coal-bearing Upper Carboniferous and older rock. The term "Cheshire Basin" does not strictly apply to the Carboniferous sequence which is logically part of the Pennine Basin and extends beyond the northern boundary of the Mesozoic basin into Lancashire and Staffordshire. As in the East Midlands – Humberside area, the base of the Permian and Mesozoic sequence is a surface of major unconformity with the underlying Upper Carboniferous but dips more vigorously (9.5° in places) to the east and south-east to depths in excess of 3,650m.

Structurally, the Cheshire Basin is more complex than the contemporary East Midlands Basin, the Humberside Basin, during both the Carboniferous and deposition of Permo-Triassic cover. Little is known about the detail of Carboniferous basin development because, in key deep parts of the basin, seismic does not image effectively through the thick Permian and Mesozoic sequence. Early Carboniferous basin development was probably extensional, most likely controlled in the south at least by reactivation of underlying basement structures with Welsh Caledonian trend (north-east) throwing down to the north-west.

Coal cyclic sequences dominated Westphalian A+B deposition. Numerous thick coals are known at outcrop in the Oswestry, Denbighshire/Wrexham, Flintshire/Deeside and South Lancashire Coalfields and deep drilling has proven their existence beneath Permo-Triassic cover at least 15km down-dip of the base Permo-Triassic unconformity outcrop. There is a general thinning of the Upper Carboniferous from north to south, although numerous seams are present in all exposed coalfields on the periphery of the Cheshire Basin. The thinning relates to southerly onlap against the London Brabant Platform which formed the Carboniferous basin's southern margin. Whilst relatively barren in comparison, the overlying Westphalian C/D sequence does contain a number of moderately thick coals, especially at the Westphalian C/D boundary (basal Coed Yr Allt Beds and topmost Ruabon Marl).

A highly compressional stress regime developed at the end of the Carboniferous during the Variscan Orogeny in South Wales and Southern England. This is marked by large scale thrust faulting and nappe emplacement., In the Cheshire area the effects of this were limited to uplift and reversal of existing Carboniferous normal faults (i.e. basin inversion). Continued uplift into the early Permian led to the peneplanation of Upper Carboniferous strata (mainly Westphalian C+D); especially in the vicinity of major reverse faults (e.g. the Bala and Wem Faults). Despite considerable denudation, Permian and Triassic sediments were laid down on a predominantly Westphalian C+D surface. Permo-Triassic deposition took place in a north-south rift system which also involved extensional reactivation of the older northeast trending Caledonian basement faults. Extensional subsidence and associated north-south trending normal faulting probably continued through the Mesozoic (Triassic, Jurassic and Cretaceous) into the earliest Cenozoic, when basin inversion uplift once again resulted in erosion and removal of much Mesozoic basin fill.

The Cheshire Permo-Triassic sequence is contiguous with that in the Irish Sea, as evidenced by a narrow but thick remnant of Triassic sediment across the Wirral peninsula and south-west Lancashire. The Triassic sedimentation was almost certainly controlled by movement on the Croxteth Fault where the basin fill is most thickly preserved. The base Permo-Triassic erosion surface outcrops along the line of the Dee Estuary where Westphalian coals have been mined at outcrop in the south of the Wirral (Neston Colliery) and along the North Wales coast. However, the deeper geology of the central part of the central Wirral peninsula is largely unknown and unexplored by deep drilling. Magnetics and gravity surveying indicate the presence of a small high (or ‘saddle’) at Ellesmere which appears to have a Caledonian trend continuing south-west into north central Wales and north-east towards Wigan.

Thermal modelling by the Geological Survey suggests that, although Carboniferous rocks have undergone two phases of burial (Carboniferous and Mesozoic/Cenozoic), maximum depths and temperatures were attained during the early Cenozoic. Immediately prior to later Cenozoic uplift, the Upper Carboniferous within the main part of the Cheshire Basin was buried to depths in excess of 6,000m in the east and 1,500m in the west and north.

The most numerous and thickest coals occur in the Westphalian B and topmost Westphalian A sequence. The most consistently thick seams include the Two Yard, Main, Fireclay Group and Nant. Several other seams thicken locally to more than 1m but their lateral distribution is minimal.

3.5 General Stratigraphy

Quaternary - Unconsolidated Deposits

In the Cheshire/Wrexham project area the composition and thickness of superficial deposits vary significantly. Typically superficial deposits are between 30m and 70m thick and comprised of varying amount of clayey glacial till and unconsolidated sands. The sands may form shallow aquifers locally.

Chester Pebble Beds Formation and Kinnerton Sandstone Formation (eastern areas only)

Unconformably overlying the Carboniferous Upper Coal Measures across much of the eastern part of the project area are the Triassic Chester Pebble Beds and the Kinnerton Sandstone. The Chester Pebble Beds Formation comprises sandstones with some conglomerates and siltstones of early Triassic age. It ranges from less than 90m to over 220m in thickness. The Kinnerton Sandstone Formation is a sequence dominated by early Triassic aeolian sandstones which ranges from 0m to over 150m thickness.

Both units are nationally significant aquifers and water is routinely abstracted for public and industrial water supplies. Porosities up to 30% have been reported near surface and abstraction wells commonly produce 20-30l/s. The Triassic aquifers must be cased off and cemented before coring the coal measures.

Warwickshire Group (Upper Coal Measures)

The Carboniferous Upper Coal Measures of the Cheshire area are formed from three formations which constitute the Warwickshire Group. These are the Etruria, Halesowen and Salop Formations.

Salop Formation

The Salop Formation is formed from interbedded red and red-brown mudstones and sandstones with beds of pebbly sandstones and conglomerates composed of recycled Carboniferous and possibly Devonian lithic material. The sandstones are mostly sublitharenitic. The clasts within the conglomerates are generally formed from limestone and chert. Thin Spirobis limestones and calcrete and rare thin coals can be found in the lower part of the formation. The formation is characterised by the presence of caliche.

Halesowen Formation

The Halesowen Formation predominantly formed from grey-green micaceous sandstone and mudstone. Thin coals, Spirorbis and pedogenic limestones and local intraformational conglomerates are also present. Non-marine bivalve fauna and plant debris may also be visible in this formation.

Etruria Formation

The Etruria Formation comprises red, purple, brown, green and grey mudstones with subordinate lenticular sandstones and conglomerates. There are common pedogenic horizons but coal seams are rare.

Pennine Middle Coal Measures Formation

The Pennine Middle Coal Measures Formation comprises repeated cycles of sandstones, siltstones, mudstones, seatearths and coals. In the lower section there are at least seven cycles marked by thin coals or seatearths with, in places, shelly ironstone layers. The middle section contains cycles with the thickest coals in the formation; however there are extensive and wide splits in most of the coals and large variations in inter-coal thickness. The upper section contains several marine bands and Estheria bands. There are several locally thick sandstones with erosive bases.

Pennine Lower Coal Measures Formation

Pennine Lower Coal Measures Formation comprises three sequences containing repeated cycles of sandstones, siltstones, mudstones, seatearths and coals. The lowest sequence contains up to eleven well defined cycles most of which have a marine band at the base. A few have locally thick sandstones and several have a thin coal or seatearth at the top. The middle sequence has about thirteen cycles but they are poorly defined. It is dominated by sandstone with a few thin coals. The highest sequence contains up to twenty five cycles most with a coal at the top, several of which are quite thick. There are no marine bands in this sequence and the sandstones it contains are generally thin.

3.6 Coal Seam Stratigraphy

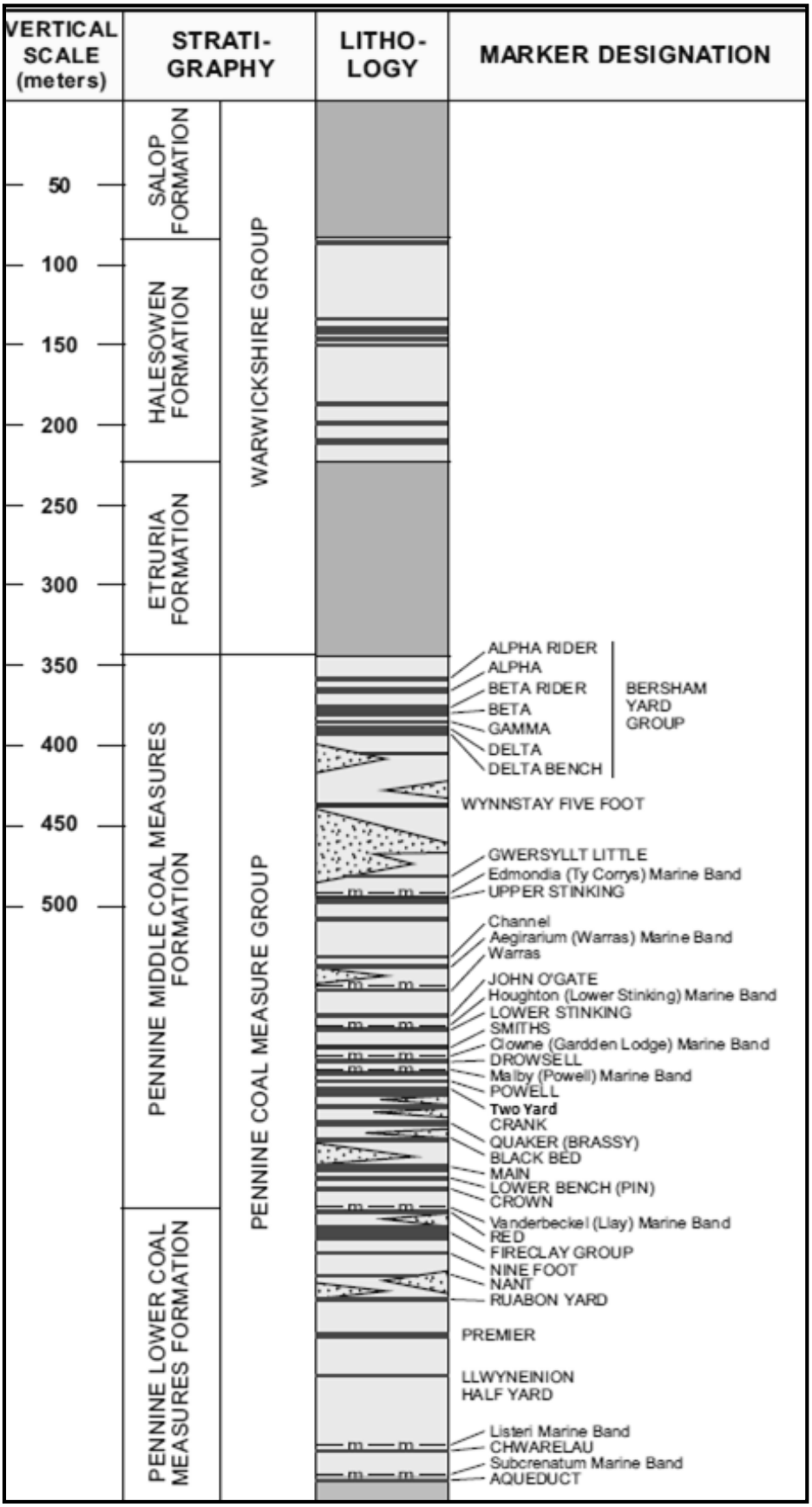


Figure 2 North West - Cheshire Coal Stratigraphy

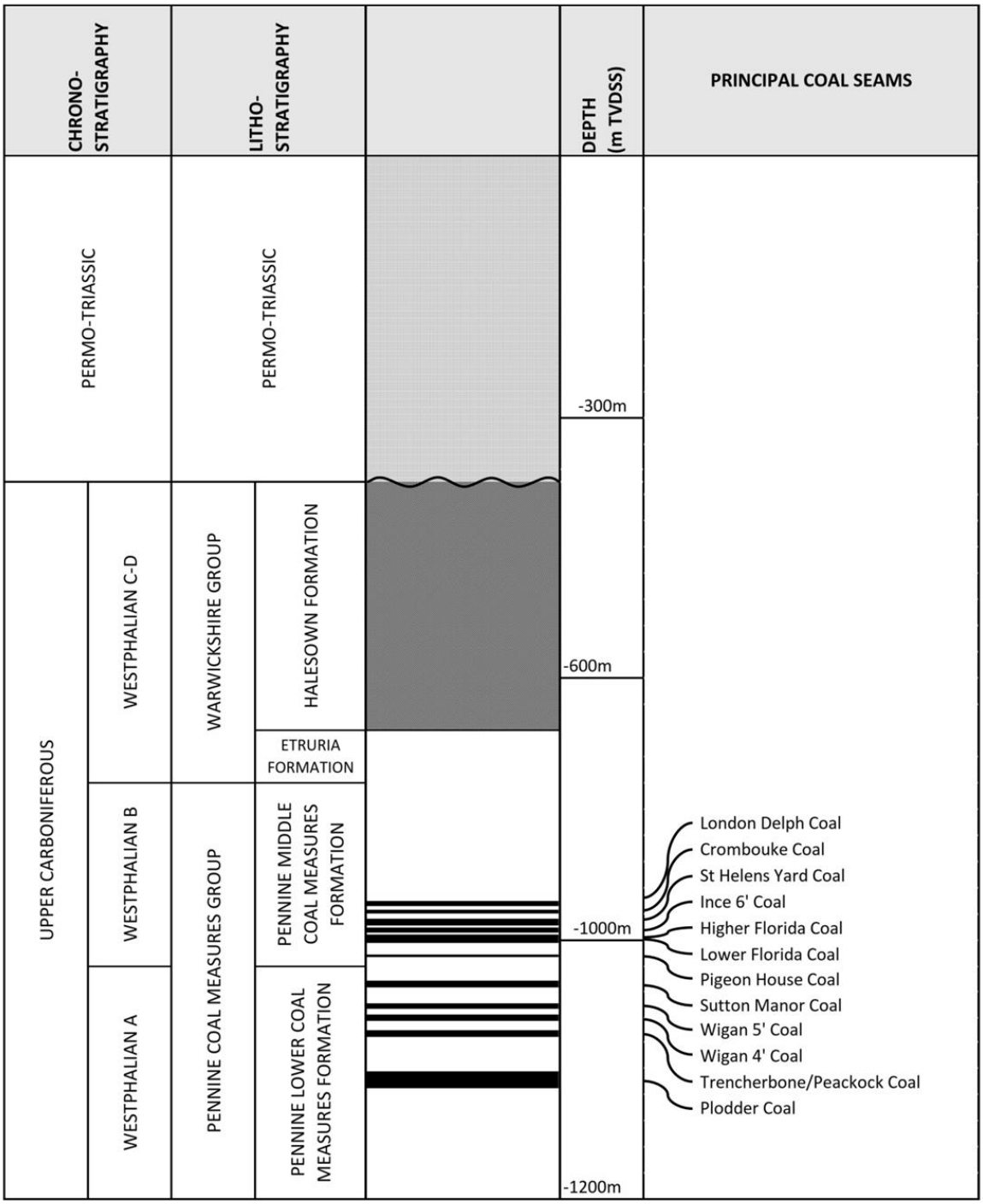


Figure 3 North West - Warrington Coal Stratigraphy

3.7 Coal Seam Net Thickness

Four primary coal seams have been identified over the North West- Cheshire area, the Two Yard, Main, Fireclay Group and Nant (APPENDIX C). These four seams were identified as primary due to their good lateral extent and moderate thicknesses. In the North West-Warrington Area four primary coal seams have been identified, The Crombouke, Lower Florida, Wigan Four Feet and Trencherbone (APPENDIX C). As the Warrington area is small and seams are laterally continuous across this area, the primary seams were identified using moderate thicknesses only. Development restrictions (outlined in APPENDIX Q) have been applied in the prospectivity analysis of these coal seams.

Net coal seam thickness varies for the primary coal seams from less than one metre to up to three metres. For the purpose of this report the North West area was subdivided into two smaller areas, Cheshire (PEDL147, PEDL185, PEDL186, PEDL187, PEDL188 and PEDL189) and Warrington (EXL273). Average primary coal seam thickness is approximately one and a half metres throughout the Cheshire and Warrington areas. Methodology for determining net coal seam thickness is detailed in APPENDIX R.

Secondary coal seams have been identified over the North West - Cheshire area, the Upper Stinking, Lower Stinking, Powell, Brassy and Lower Yard. These five seams where identified as secondary due to their smaller lateral extents where they exhibit moderate thicknesses (APPENDIX D). Two secondary coal seams have been identified over the North West - Warrington area, the Ince Six Feet and Peacock, these seams exhibiting less thickness than the primary coal seams (APPENDIX D). Development restrictions (outlined in APPENDIX Q) have been applied in the prospectivity analysis of these coal seams.

All Primary and Secondary coal seams are presented in APPENDIX A and APPENDIX B unclipped to display the variation in lateral extent before development restrictions are applied.

3.8 Composite Coal Seam Net Thickness

A composite of the four primary coal seams (net thickness – clipped with development restrictions) was compiled to identify any potential thickness sweet spots across the North West, both the Cheshire and Warrington areas. Composite coal seam thickness varies from one metre (development restriction minimum coal seam net thickness value) to approximately nine metres in Cheshire area (Figure 4) and six metres in the Warrington area (Figure 5). Small areas with the upper limit of composite coal seam net thickness exist in PEDL147, PEDL188 and PEDL186 in the Cheshire area. The small area sizes and lack of lateral continuity between these identified areas minimizes any prospectivity for a CBM development. The Warrington area is also small thus minimizing any prospectivity for a CBM development.

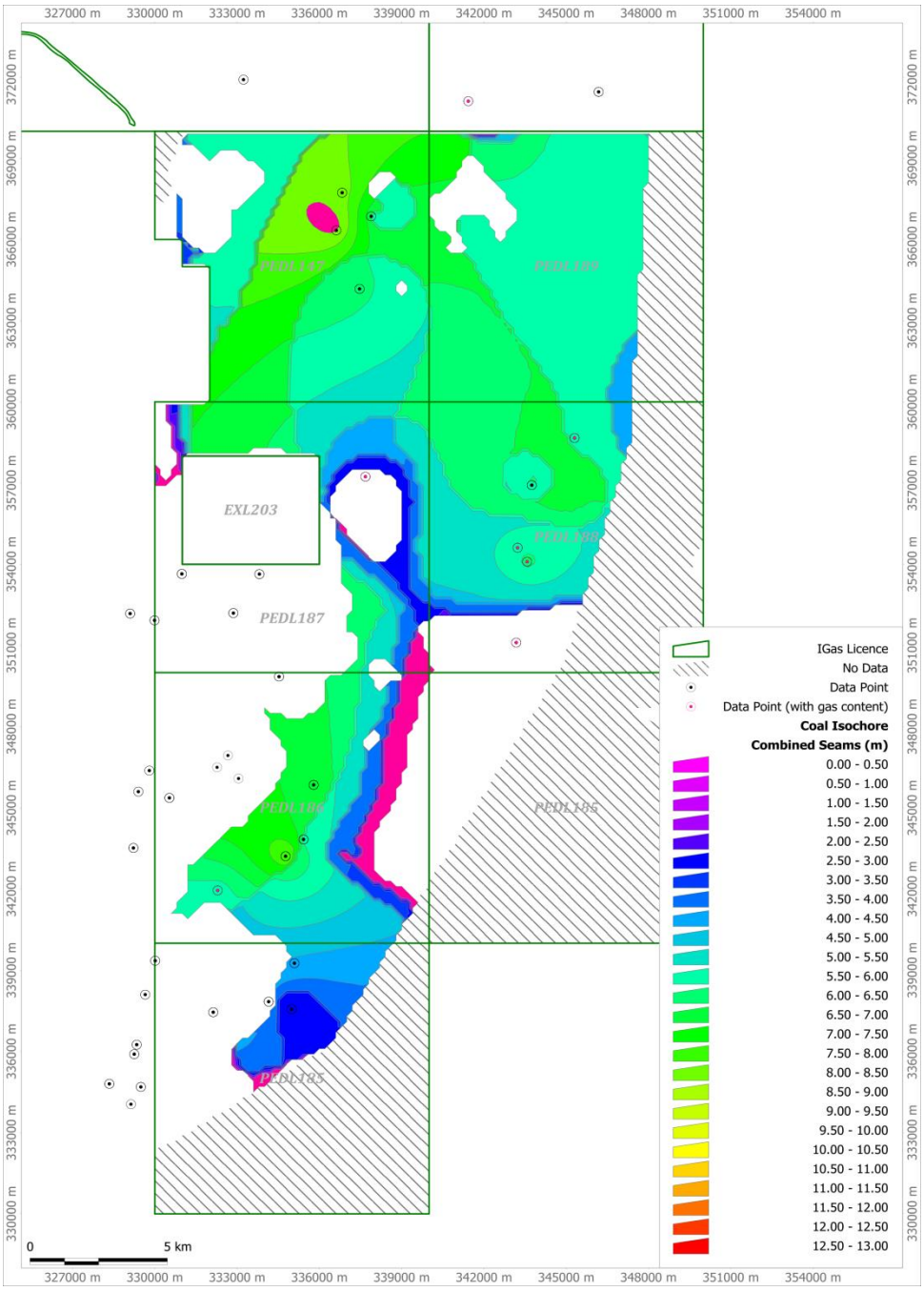


Figure 4 North West Composite Coal Seam (Cheshire) Net Thickness (m) - Primary - Clipped with Development Restrictions

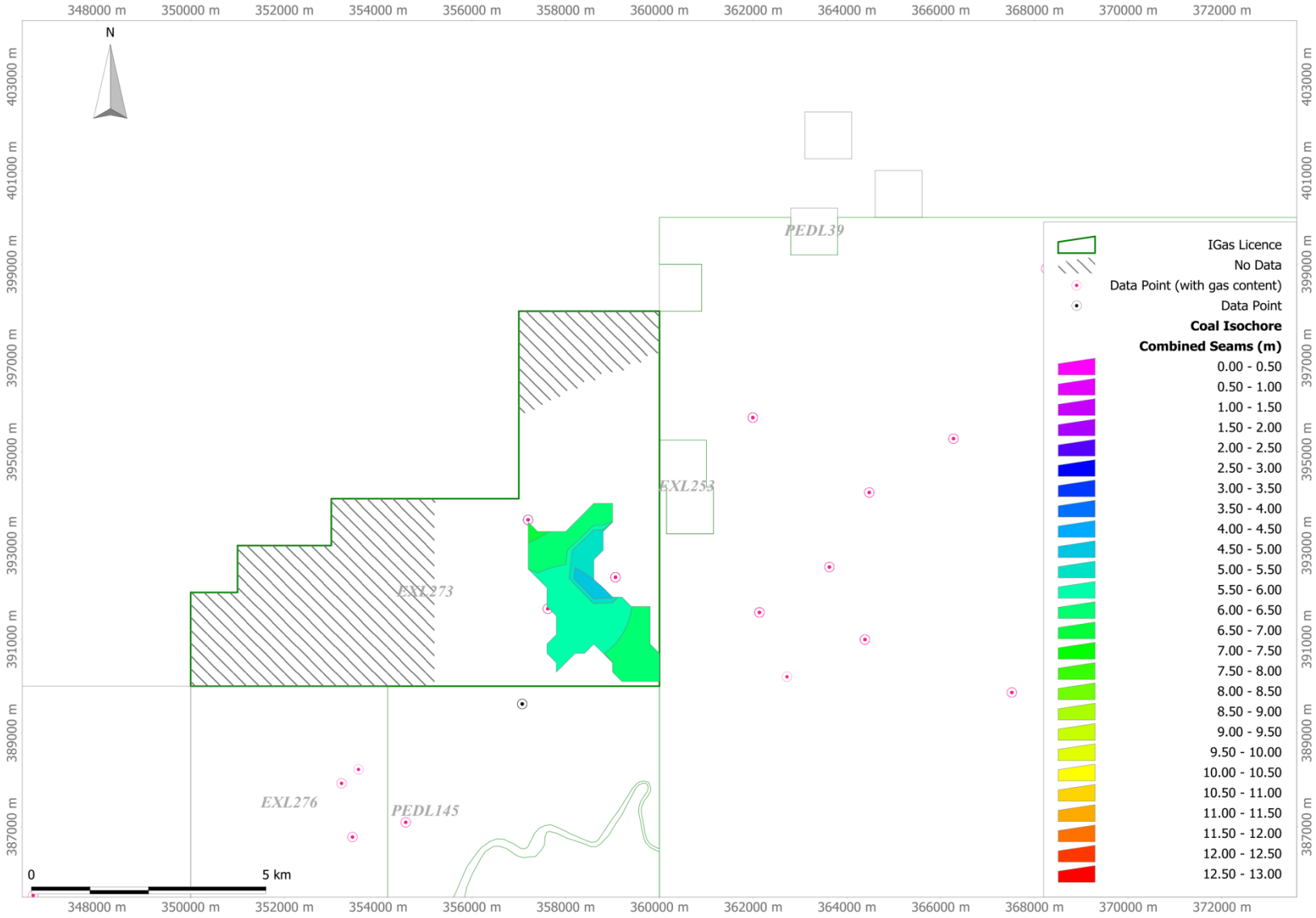


Figure 5 North West Composite Coal Seam (Warrington) Net Thickness (m) - Primary - Clipped with Development Restriction

3.9 Coal Seam Depth

Primary and secondary coal seam depths vary from 200 mBGL on the western extent of the North West – Cheshire area to greater than 1,500 mBGL in the south eastern portion of the North West area (APPENDIX E and APPENDIX F).

Primary and secondary coal seam depths vary from 600 mBGL on the northern extent of the North West – Warrington area to greater than 1,200 mBGL in the southern portion of the North West – Warrington area (APPENDIX E and APPENDIX F).

3.10 Coal Seam Gas Content and Quality

The limited number of National Coal Board (NCB) gas content database records have methane values up to 8.95m^3/t (dry ash free, daf) for exploratory drilling north and south of Chester. Spot values for primary and secondary seams within this district are plotted on plans within APPENDIX G and APPENDIX H. The Castletown 1 well reported gas contents of between 6m^3/t and 10m^3/t with the Main Coal seam reporting an average gas content of 9m^3/t (daf). The Churton 1 well reported gas contents of between 3m^3/t and 6m^3/t (daf) to a maximum depth of 770m, average gas content was 4.5m^3/t (daf). For the purpose of this report coal seams above 300 mBGL are assumed to be degassed due to their proximity to the surface.

There is also a limited number of NCB gas content database records in the Warrington area. Across the licence area the gas content ranges from 5.5m^3/t (daf) to 11.6m^3/t (daf). Spot values for primary and secondary seams within this district are plotted on plans within APPENDIX G and APPENDIX H.

Methane concentrations from historic NCB wells, Castletown 1 and Churton 1 range from 80-90% across the Cheshire area. In the Warrington area methane concentrations from NCB wells vary from 78-92%.

3.11 Coal Seam Gas Saturation and Holding Capacity

The only data relating to coal seam saturation comes from the Castletown 1 and Churton 1 wells drilled on PEDL188 which indicates coal carrying capacities of between 13.5m^3/t to 14.5m^3/t and 17.06m^3/t to 22.27m^3/t respectively, at reservoir pressure. At these carrying capacities the majority of the coals within the Cheshire area would be moderately to highly undersaturated (ie 50-75%). Table 2, below, displays the analysis results for Castletown 1 and Churton 1. No coal seam saturation data is available for the Warrington Area.

Well	Coal Seam	Depth	Reservoir Pressure	Langmuir Pressure	Langmuir volume (daf)	Storage Capacity at reservoir pressure	Total Gas Content (daf)	Total Gas Content In situ	Gas Saturation
		m	Mpa	Mpa	m^3/t	m^3/t	m^3/t	m^3/t	%
Churton 1	Smiths	698.96	6.80	6.75	17.06	5.9	6.4	4.4	75
Churton 1	Drowsell	736.67	7.20	6.90	18.24	8.2	4.5	4.0	48
Churton 1	Hollin	759.38	7.40	10.20	22.27	8.0	6.1	5.2	65
Castletown 1	Cannel	1188.52	13.71	6.35	20.22	13.8	6.8	5.1	49
Castletown 1	Smiths	1212.78	13.99	6.75	20.22	13.7	8.0	7.0	59
Castletown 1	Powell	1226.07	14.14	7.09	20.22	13.48	7.79	7.08	58
Castletown 1	Main	1349.79	15.57	6.75	20.22	14.10	8.89	8.38	63
Castletown 1	Fireclay	1370.25	15.81	6.25	20.22	14.50	8.95	8.07	62
Castletown 1	Chwarelau	1472.23	16.98	7.49	20.22	14.05	8.18	4.98	58

Table 2 North West Isotherm Analysis Results

3.12 Coal Seam Permeability

Currently the only coal permeability data available in the North West area are from the Castletown 1 well where multiple seams were tested using Weatherford's FRT tool. In total, 7 drawdown type tests were completed at depths of between 840m and 1,475 mBGL, however the initial interpretation by Weatherford indicated that the tests did not approximate radial flow and therefore could not be interpreted to give a view on permeability. Additionally Dart/Composite have often found that permeability is not a particularly good variable to predict productivity. This is most likely a function of measurement inaccuracies on the sampled wells. As a consequence permeability is not considered to the best reference point for deliverability of a coal resource across a region.

3.13 Benchmarking

Property	North West – Cheshire	North West – Warrington	Airth FDP (PEDL133)	Canonbie (PEDL159)	Doe Green (PEDL145)	Sydney Basin (Australia)	Gunnedah Basin (Australia)	Clarence Morton Basin (Australia)
Av Depth Range (m)	650 – 1500	600 – 1200	650 -1100	400 - 1000	850 - 1150	100 – 1350 *	0 – 400 *	200 – 650 *
Seam Thickness Range (m)	0.8 – 2.3	0.3 – 3.6	0.8 – 2	0.3 – 3.2	0.6 – 4.5	2 – 5 *	0.5 – 3 *	300m Fm. Rich in lenticular seams (net coal 1.5 – 4.5)*
Number of Seams > 1m thick	4	6	3 to 4	Up to 8	Up to 10	Up to 9 *	Up to 5 *	-
Gas content (daf m^3/t)	5-10	5 – 12	10-12	3.5-12	8-11	5 – 15 *	1 – 14 **	1 – 10 *
Gas Saturation (% in situ)	50-75	-	80-100	95-100	75-100	90 – 95 *	30 – 70**	100 *
Gas Composition (% CH4)	80-90	78 – 92	80-90	83-88	>96	>95 *	≈82 **	≈95 *
Ash Content (AR %)	3-40	1 – 33	1-10	3-65	2-25	6 – 65 **	2 -75 **	30-80 **
Moisture Content (AR %)	<5	-	<5	<5	<5	1 – 5 **	1 – 15 **	1 – 6 **
Average Density (Dry gm/cc^3)	1.42	-	1.36	1.38	1.30	1.51 **	1.56 **	1.47 *
Permeability (mD)	0.01 - 0.1 (assumed from FRT tests)	-	1-3	3-36	<0.1	1-3 **	1-4 **	1-4 **

* Data sourced from Dart Energy Australian acreage well results
** Data sourced from acreage in each basin from DTE NSW geo database

3.14 Gas in Place Estimations

CBM GIP estimates (completed in-house for this report) based on the four identified primary seams and development restrictions are outlined below:

Licence	GIP BCF (Low)	GIP BCF (Mid)	GIP BCF (High)	Prospective Area (Km^2)	GIP BCF Per Km^2 (Mid)	Gas Resources BCF* (Mid)
PEDL185	14	18	24	15	1.2	7
PEDL186	70	88	121	52	1.7	35
PEDL187	48	61	83	37	1.6	24
PEDL188	79	99	137	51	1.9	40
PEDL189	111	139	191	71	2.0	56
PEDL147	134	168	232	75	2.2	67
EXL273	3	10	17	5	2.0	4
TOTAL	**459**	**583**	**805**	**306**	**1.9**	**233**

Estimates of CBM GIP and Contingent Resources in the North West licence areas

* Mid RF assumed to be 40%, based on analogue CBM fields globally, assuming a similar development plan and coal properties.

Estimation parameters used were determined from core data (desorption and proximate analysis) and geomodelling volumes (parameters and individual licence coal volumes in APPENDIX S).

4 East Midlands

4.1 Licence Summary and Location

The East Midlands IGas/GDFS JV area consists of 6 licence blocks covering 642 km^2. The JV area is located between the east coast of England and the Pennines, spanning from York in the north to Lincoln in the south (Figure 6).

The following table is a summary of the licences:

Licence No	Licencing Round	Licence Area (km^2)
PEDL146	Out of Round	276
EXL288	1993	75
PEDL012	1996	33
PEDL200	13th	114
PEDL207	13th	28
PEDL210	13th	116

Table 3 Summary of East Midlands IGas/GDFS JV Licences

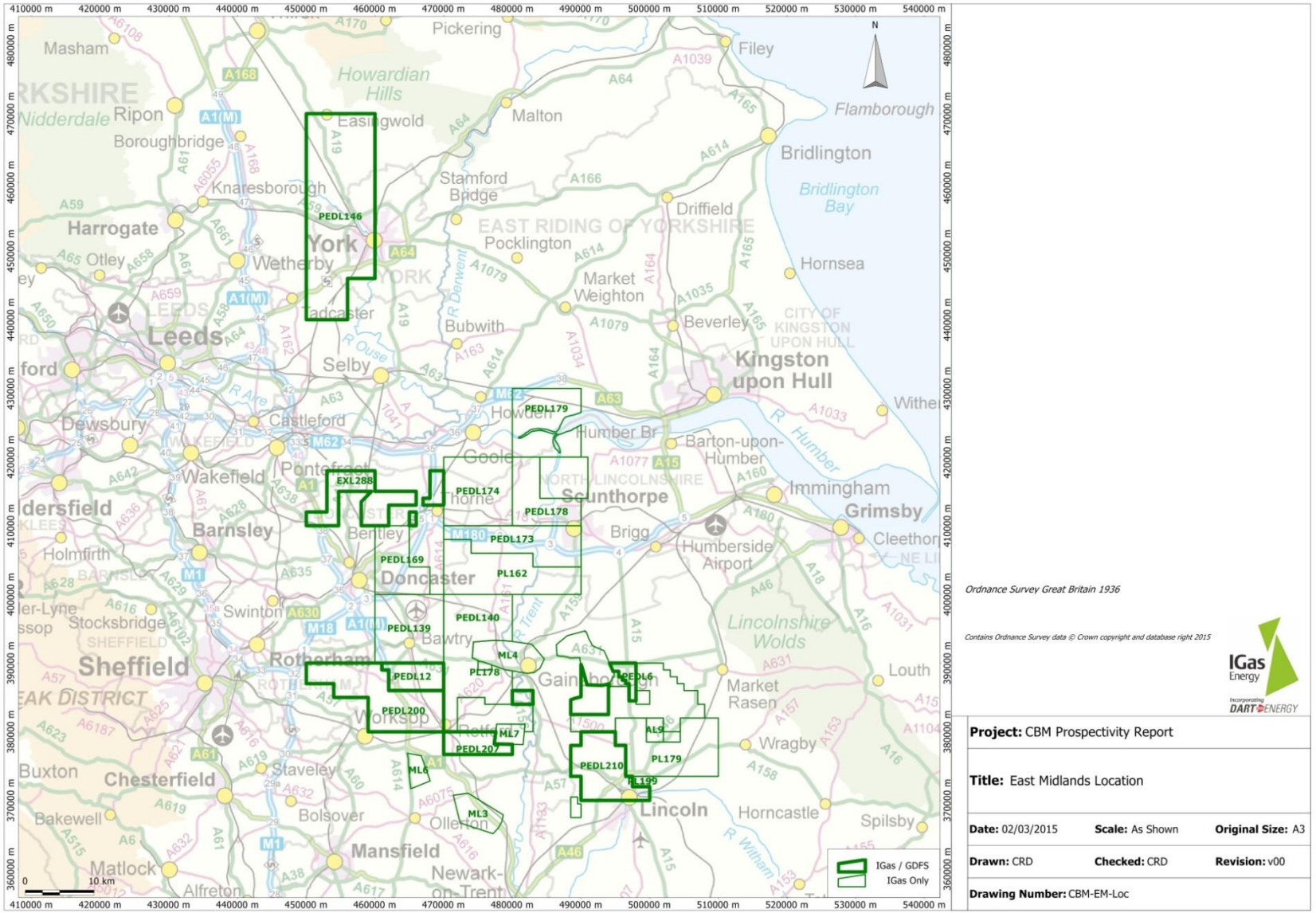


Figure 6 Locations of East Midlands IGas/GDFS JV Licences

4.2 Regional Exploration History

The East Midlands area is a mature hydrocarbon province with a drilling and production history dating back to Kelham 1 drilled in 1920. In addition to the hundreds of hydrocarbon wells drilled in the basin, the western areas where the carboniferous outcrops (or is covered by a relatively thin overburden) have been extensively drilled and mined for coal.

Nexen and Island Gas drilled the first CBM appraisal well in the basin on PEDL092 in 2007. The Mill Farm 1 well, drilled in South Yorkshire in the northern part of basin near Selby, indicated that the Wheatworth Coal, located towards the base of the coal-bearing sequence, was effectively degassed with a gas content of around $1m^3/t$ in this area.

Composite/Dart drilled six CBM exploration wells along a north-south trend across their acreage in 2009. These wells provided continuous core from just below the Permo-Triassic unconformity to near the base of the Westphalian. All coals >0.3m thick were collected for desorption and adsorption analysis. Net coal for the entire Westphalian sequence from all six wells ranged from 12m to 21m with individual coals up to 2 metres thick. Greenpark recovered cored coal from four exploration wells with similar total net coal to the Composite/Dart wells.

4.3 Regional Geology

The East Midlands area overlies Upper Carboniferous (Westphalian A-C) coal resource which extends westwards from considerable depths beneath the North Sea to outcrop east of the Pennines. At outcrop onshore, it forms the historically important coalfields of Nottinghamshire, Derbyshire and South Yorkshire. The Upper Carboniferous of the East Midlands is also a mature hydrocarbon-bearing province with oil and gas accumulations proved within delta sandstones of the coal-bearing Westphalian A-C sequence (and deeper).

The East Midlands area is overlain by Permian, Triassic, Jurassic and Upper Cretaceous strata which dip gently eastwards into the offshore area. The base of this younger sequence is a surface of major unconformity with the underlying Upper Carboniferous and also dips gently towards east and east-north-east. During this extended hiatus between Upper Carboniferous coastal plain deltaic deposition and renewal of sedimentation in the Permian desert and Zechstein Sea, the Hercynian Orogeny resulted in gentle folding, extensive faulting, uplift and prolonged erosion of the coal-bearing Westphalian strata. Many of the major faults affecting the Westphalian appear to be reactivated Lower Carboniferous growth faults with associated rollover folds. A subcrop map at the base Permian suggests that the youngest Carboniferous strata (Westphalian C-D) are best preserved beneath the unconformity in the area east of Sheffield. To the north and south of this, the topmost Westphalian is progressively eroded and over large part of the coal basin (e.g. beneath the upper Humber Estuary), it is likely that much Westphalian C-D may be absent by erosion.

After initial deposition and burial during the Upper Carboniferous when the coals likely achieved their bituminous rank, and subsequent Hercynian uplift and denudation resulting in probable seam degassing, the Westphalian sequence was reburied to its maximum depth during Mesozoic (deposition of Triassic, Jurassic and Cretaceous sediments). The main phase of hydrocarbon generation and migration occurred at this time. This entire sequence was sealed by Permian and younger sediments, estimated to be up to 1,800m thick, and then tilted to the east during the Tertiary.

Structurally, the Upper Carboniferous sequence is divided into northern and southern areas by a faulted anticline known as the Askern-Spital Structure. North of this structure, dip is generally easterly with cross faulting aligned to the north-east and less commonly to the south-east. The Finningley Syncline is the dominant feature south of the Askern-Spital Structure and its formation may be related to the Lower Carboniferous Gainsborough Trough which underlies it. Faulting to the south of the Askern-Spital Structure is similar to that in the north and is dominated by a north-easterly trend.

Variations within the Westphalian succession are poorly known in the application areas. Westphalian A+B thickness is estimated to be in excess of 900m in the south-west between Sheffield and Doncaster and decreases northwards to just over 670m, north of the River Ouse. An eastward thinning to less than 500m is also likely. These variations are attributable to basin subsidence during deposition. Where it is preserved between Lincoln and the Humber, the Westphalian C+D sequence may attain 500m.

The most numerous and thickest coals occur in the Westphalian B and topmost Westphalian A sequence. The most consistently thick seams include the Barnsley Coal Complex, the Flockton Coal Complex, the Parkgate Coal Complex and the Beeston Coal Complex. Several other seams thicken locally to more than 1m but their distributions are not reliably charted. Net coal thicknesses determined largely from oil and gas exploration wells, ranges from 10m to 20m. There may be a decrease of cumulative coal thickness northwards from the Humber Estuary, and again over the Askern-Spital Structure.

4.4 General Stratigraphy

Quaternary

Unconsolidated deposits of fine to medium grained, quartzose sand with occasional mud and organic plant debris.

Jurassic - Lower Lias Group

The Lower Lias Group is composed primarily of limestone with minor colour variation from medium grey to light brownish grey with low argillaceous component. The limestone is often soft, micromicaceous and microcarbonaceous with rare to abundant pyrite. Minor evaporite is present, observed as white fibrous, elongated crystals. The formation is increasingly muddy to base, with dark grey mudstone becoming more abundant.

Mercia Mudstone Group

Predominantly reddish brown and bluish grey mudstones with some thin siltstones in a sequence 150m thick. Locally very dolomitic with common evaporite layers and infrequent thin quartzose sandstones. It has a gradational base into the Sherwood Sandstone below.

Sherwood Sandstone Group

This group is dominated by reddish brown, fine to medium grained, quartzose sandstones. Occasional thin lenses and beds of more silty material are also present, increasing in abundance with depth. Discrete gypsum and anhydrite lenses and layers are common throughout.

Zechstein Group

The Zechstein Group is composed of repeating cycles of carbonates, evaporites and clastics. The carbonate sequences are predominantly comprised of light grey to white, finely crystalline limestone, with some mudstones and siltstones and occasional evaporites infilling voids. Clastic sequences are primarily composed of reddish brown and greenish grey silty mudstones and occasional siltstone, with sandstones becoming more dominant towards the base. Evaporites, composed mainly of anhydrite and gypsum with minor halite, are also present in the mudstones and are most common in the upper part of the Group.
The base of the group lies unconformably over the Coal Measures Group.

Pennine Coal Measures Group

The Coal Measures are generally composed of repeating cycles of mudstone, siltstone and sandstone with coal seams throughout. The upper part of the formation, below the Permo-Triassic unconformity, exhibits red staining which decreases with depth. The mudstones and siltstones are often closely related with gradational margins and range from light grey to dark grey and black. The mudstones are often carbonaceous and grading into coal. Below the coals the mudstones and siltstones often form seatearths and are rooty with disturbed bedding. Occasional bands of marine fauna including shell fragments are present. Non-marine fauna are also present in some bands. Plant fragments are common throughout the group.

Sandstones are common, often forming thick units up to 20m thick, particularly in the lower parts of the formation. They are predominantly quartzose, though silty, micaceous and occasionally carbonaceous laminae are common demonstrating both planar and cross lamination. Grain size varies within units, with majority fine to medium grained; occasional coarse grained bands are common. Sandstone units often possess sharp, erosional contacts.

Coal seams vary in thickness considerably, from traces to over 2m. The thicker seams are generally found in the mid to lower part of the sequence. Argillaceous bands are common within seams

4.5 Coal Seam Stratigraphy

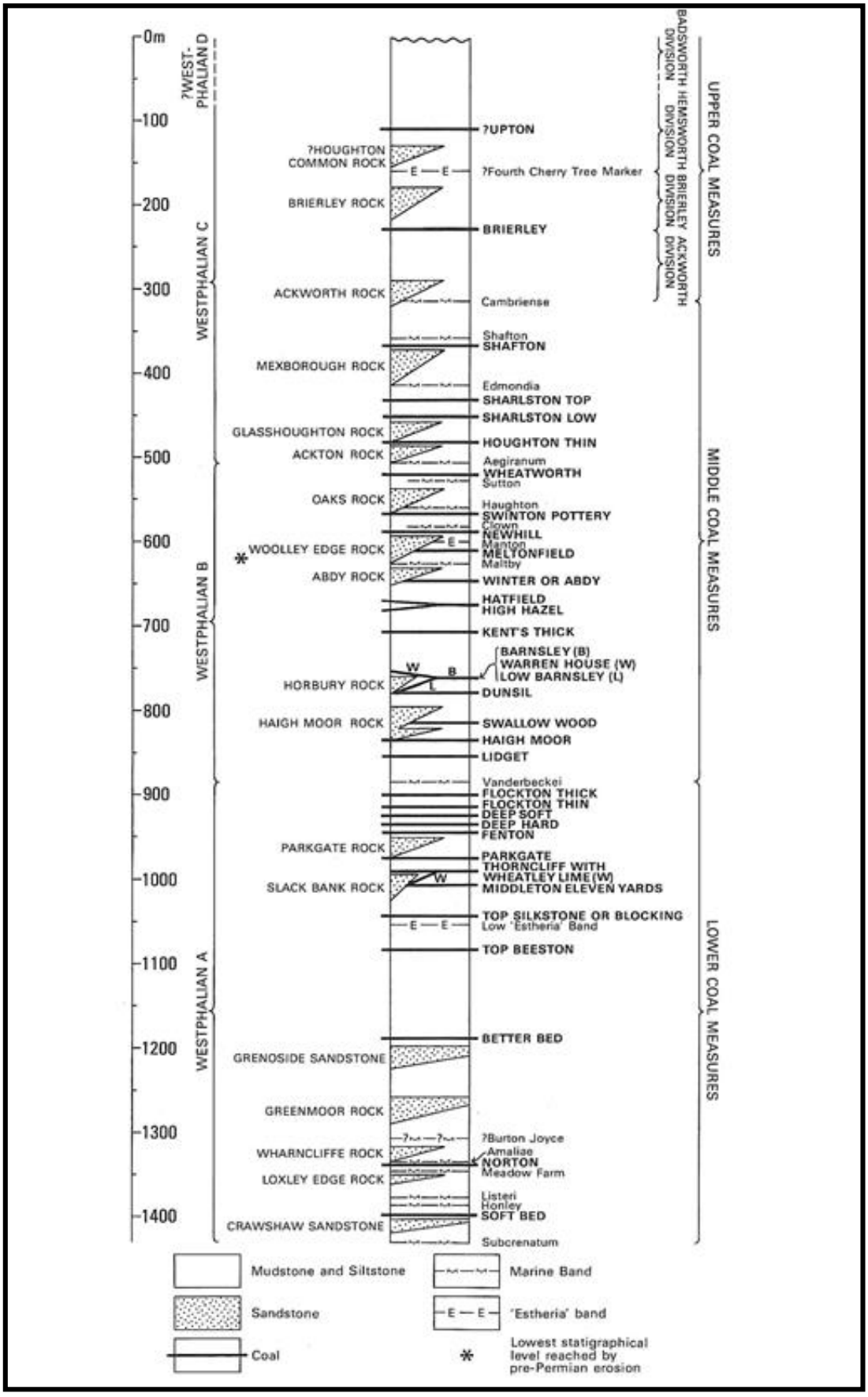


Figure 7 East Midlands Coal Stratigraphy

4.6 Coal Seam Net Thickness

Five Primary coal seams have been identified over the East Midlands area, the Barnsley, Flockton, Parkgate, Silkstone and Top Beeston (APPENDIX K). These five seams were identified as primary due to their good lateral extent and moderate thicknesses. Development restrictions (outlined in APPENDIX Q) have been applied in the prospectivity analysis of these coal seam packages.

Net coal seam thickness varies for the primary coal seams from less than 1 metre to up to 4 metres. For the purpose of this report the East Midlands area was subdivided into two smaller areas, York (PEDL146) and Gainsborough (EXL288, PEDL012, PEDL200, PEDL207 and PEDL210). Average primary coal seam thickness is approximately 2 metres throughout York area and approximately 1.25 metres throughout the Gainsborough area. Methodology for determining net coal seam thickness is detailed in APPENDIX R.

Secondary coal seams have been identified over the East Midlands area, the Newhill, Two Foot and Joan. These three seams where identified as secondary due to their good lateral extents but reduced thicknesses compared with the primary seams (APPENDIX L). Development restrictions (outlined in APPENDIX Q) have been applied in the prospectivity analysis of these coal seams.

All Primary coal packages and secondary coal seams are also presented in APPENDIX I and APPENDIX J unclipped to display the variation in lateral extent before development restrictions are applied.

4.7 Composite Coal Seam Net Thickness

A composite of the five primary coal seams (net thickness – clipped with development restrictions) was compiled to identify any potential thickness sweet spots across the two East Midlands areas, York and Gainsborough. Composite coal seam thickness varies from one metre (development restriction minimum coal seam net thickness value) to approximately 11.5 metres in the York area. In the Gainsborough area, composite coal seam (net thickness – clipped with development restrictions) varies from one metre (development restriction minimum coal seam net thickness value) to approximately 5 metres.

In the York area the favourable composite thickness occurs over a large percentage of the mapped area. Composite thickness and lateral continuity are conducive with a moderate to large scale CBM development. In the Gainsborough area, the low composite thickness and lack of lateral continuity between these identified areas minimizes any prospectivity for a CBM development.

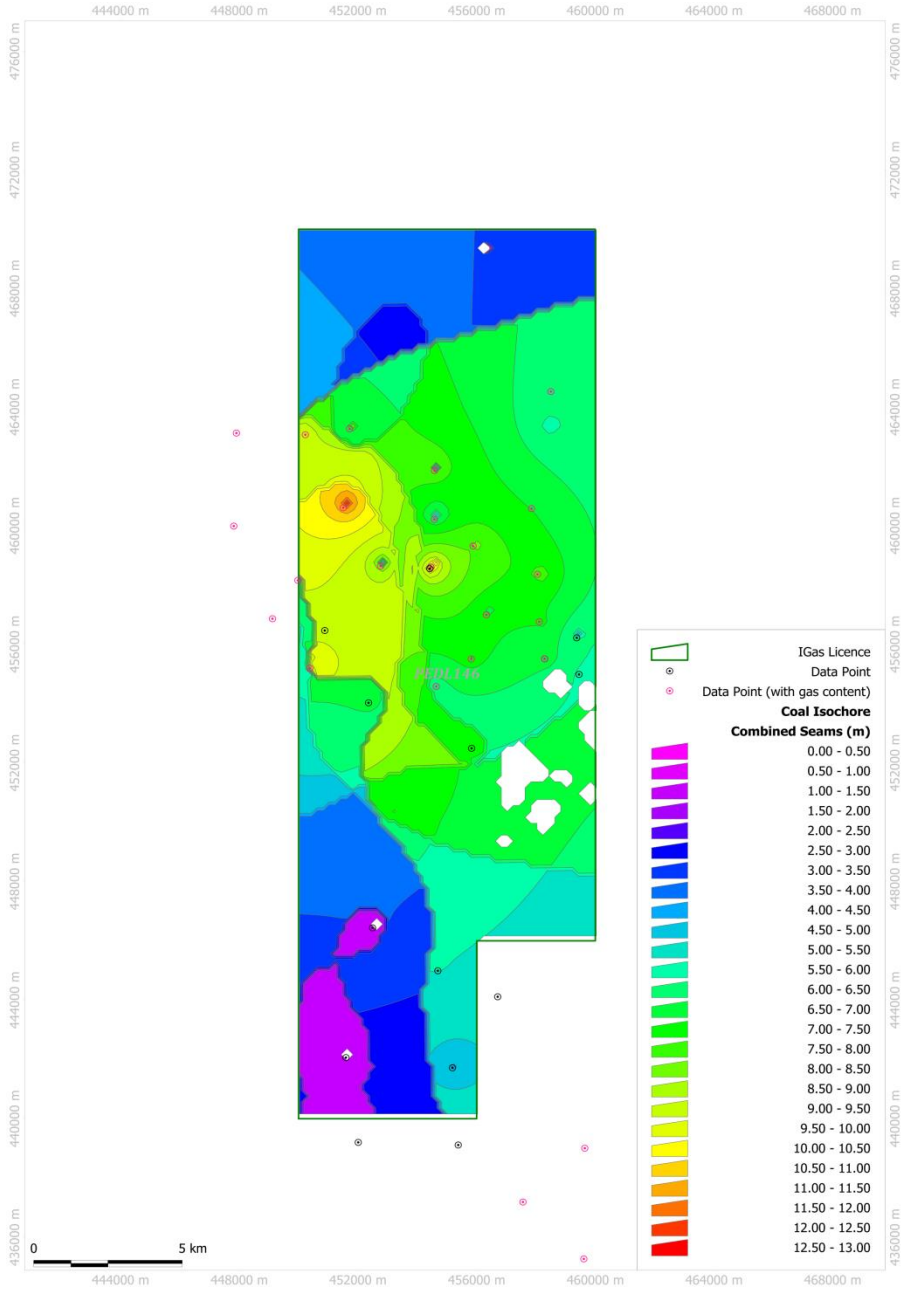


Figure 8 East Midlands Composite Coal Seam (York) Net Thickness (m) - Primary - Clipped with Development Restrictions

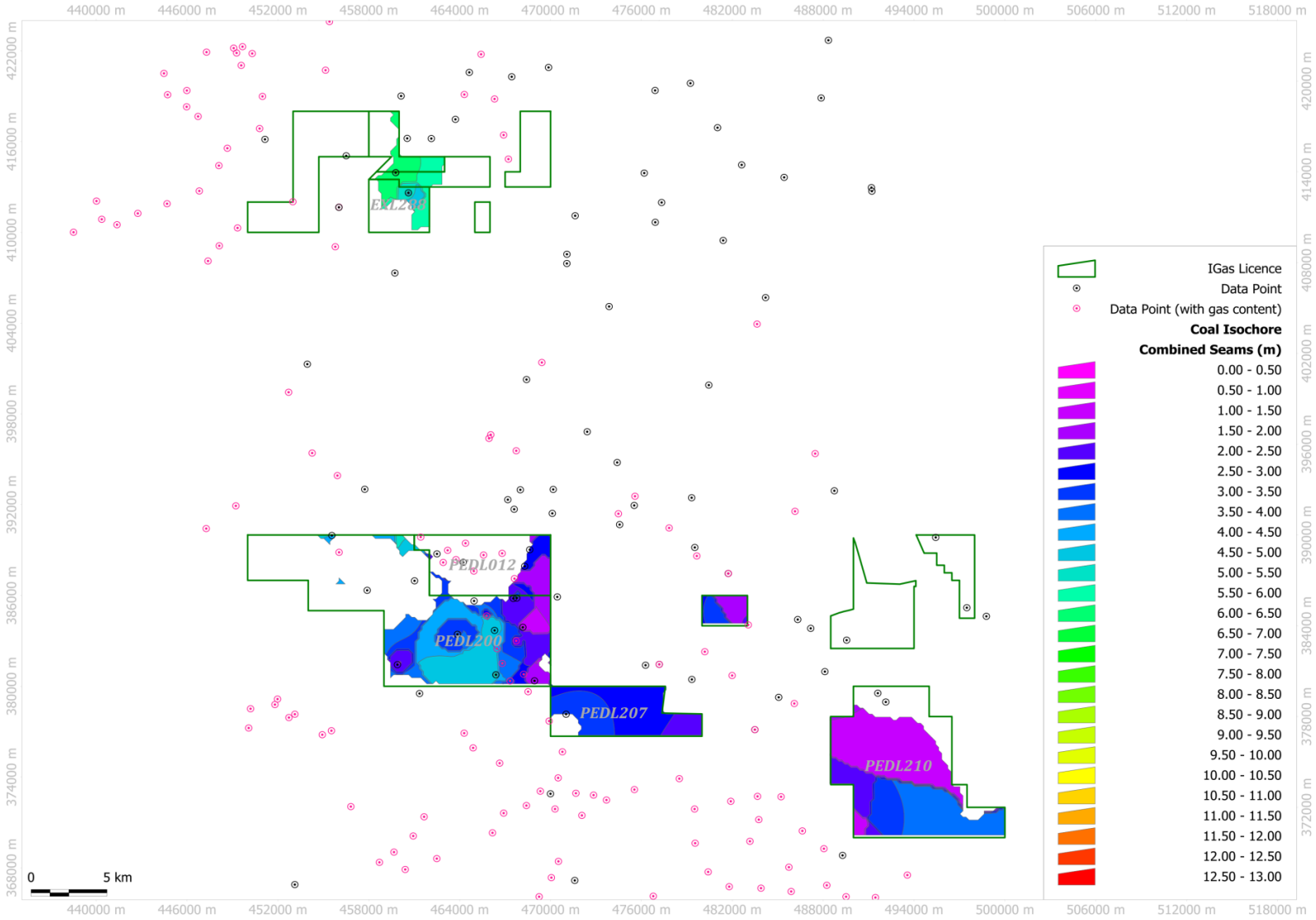


Figure 9 East Midlands Composite Coal Seam (Gainsborough) Net Thickness (m) - Primary - Clipped with Development Restrictions

4.8 Coal Seam Depth

Primary and secondary coal seam depths vary from 100 mBGL (subcrop) in the centre of the York East Midlands area to greater than 1,100 mBGL in the eastern edge of the York East Midlands area. In the Gainsborough East Midlands area primary and secondary coal seam depths vary from 400 mBGL in the north west to greater than 1,400 mBGL in the south east. Plans displaying depth variation are displayed in APPENDIX M and APPENDIX N.

4.9 Coal Seam Gas Content and Quality

Published methane depth gradients based on NCB data suggest a reasonably linear correlation with depth below the Hercynian unconformity of between 0.4 and 0.6m^3/t per 100m. Data from the NCB Gleadthorpe borehole near Welbeck provides some of the most reliable gas content data from below the unconformity indicating a gradient of 0.58m^3/t per 100m, ranging from 4.03m^3/t (daf) to 6.05m^3/t (daf) at TD, a vertical distance of 775m. Plans displaying gas content trends for primary and secondary coals within York and Gainsborough areas are displayed in APPENDIX O and APPENDIX P.

The gas content of the coals sampled from the wells drilled by Composite Energy reached a maximum of 9.6m^3/t (daf). The Barnsley Coal gas content ranged from 4.0 m^3/t (daf) to 7.6m^3/t (daf) with an average of 5.8m^3/t (daf). Greenpark Energy wells Wiggington 1 and Wood Farm 1 had average measured gas content for the sampled coals of 5.1m^3/t (daf) and 3.2m^3/t (daf) respectively. For the purpose of this report coal seams above 300 mBGL are assumed to be degassed due to their proximity to the surface.

Methane concentrations from historic NCB, Composite, Greenpark and Dart wells range from 90-97%.

4.10 Coal Seam Gas Saturation and Holding Capacity

The recent CBM exploration wells drilled by Composite /Greenpark have resulted in a relatively good lateral and vertical spread of isotherm and carrying capacity data. The carrying capacity of the sampled coals ranges from 8.1 to 16.3m^3/t at reservoir pressure, with an average of 12m^3/t. The calculated values indicate an average gas saturation level of 51%, which suggests that the majority of the coals in the East Midlands project are highly undersaturated with respect to their measured carrying capacity. Table 4 below displays the analysis results for Wigginton 1, Wood Farm 1, Lound 1 and Broxholme 1.

Well	Coal Seam	Depth	Reservoir Pressure	Langmuir Pressure	Langmuir volume (daf)	Storage Capacity at reservoir pressure	Total Gas Content (daf)	Total Gas Content In situ	Gas Saturation
		m	Mpa	Mpa	m^3/t	m^3/t	m^3/t	m^3/t	%
Wigginton 1	Barnsley	1033.68	10.26	3.50	14.53	9.28	-	-	-
Wigginton 1	Barnsley	1034.52	10.24	4.57	16.33	10.28	6.13	5.65	59.62
Wigginton 1	Barnsley	1036.13	10.25	4.22	12.46	5.58	5.12	3.27	91.67
Wigginton 1	Flockton	1177.45	11.66	3.44	12.72	8.84	-	-	-
Wigginton 1	Flockton	1177.85	11.64	3.94	14.56	10.35	6.06	5.84	58.53
Wigginton 1	Flockton	1182.43	11.69	4.74	12.58	7.65	5.63	4.96	73.60
Wigginton 1	Middleton Little/Main	1198.61	11.92	3.85	12.51	8.09	6.53	6.19	80.76
Wigginton 1	Middleton Little/Main	1198.61	11.84	4.97	13.29	8.54	6.53	6.19	76.42
Wigginton 1	Middleton Little/Main	1204.22	11.90	6.30	9.59	5.97	5.20	3.34	87.06
Wigginton 1	Wheatley	1214.88	12.00	3.84	12.47	7.98	5.57	4.99	69.76
Wood Farm 1	Stanley Main Kilnhurst	538.25	5.38	3.54	14.26	7.26	1.74	1.47	24.02
Wood Farm 1	Kent's Thick	592.19	5.92	3.33	14.73	7.43	2.90	2.08	39.07
Wood Farm 1	Barnsley	619.98	6.19	4.12	13.16	7.02	2.97	2.03	42.28
Wood Farm 1	Upper Swallow Wood	656.74	6.54	3.30	13.71	7.74	4.03	3.42	52.07
Wood Farm 1	Lower Swallow Wood	664.15	6.61	3.70	15.55	9.04	3.38	3.02	37.34
Wood Farm 1	Joan	777.42	7.72	3.51	14.22	8.48	3.90	3.38	45.96
Lound 1	Abdy	727.81	7.10	5.27	14.92	6.80	4.48	3.53	65.88
Lound 1	Abdy	727.81	7.20	5.27	14.92	6.20	-	3.51	0.00
Lound 1	Main Smut	808.37	7.90	11.17	25.59	8.60	8.55	6.96	99.42
Lound 1	Main Smut	808.37	8.00	11.17	25.59	9.20	-	7.27	0.00
Lound 1	Dunsil	826.00	8.10	11.99	28.43	9.60	9.30	7.75	96.88
Lound 1	Dunsil	826.00	8.10	11.99	28.43	7.00	-	6.89	0.00
Broxholme 1	Abdy	1181.19	11.57	8.54	15.74	9.06	2.79	1.96	30.75
Broxholme 1	Dunsil	1294.22	12.68	8.80	21.78	12.86	3.99	3.34	31.01
Broxholme 1	3rd Waterloo	1333.05	13.06	9.60	21.78	12.54	4.55	3.84	36.30
Broxholme 1	3rd Waterloo	1333.42	13.07	9.48	21.78	12.63	5.08	4.26	40.21
Broxholme 1	Low Waterloo	1366.28	13.38	7.95	20.22	12.69	4.67	3.74	36.79
Broxholme 1	Low Waterloo	1366.67	13.39	5.30	16.65	11.92	4.13	3.59	34.66
Broxholme 1	Low Waterloo	1367.52	13.40	9.96	28.32	16.25	4.71	3.14	28.98
Broxholme 1	2nd Ell	1409.23	13.80	8.66	17.70	10.87	5.47	4.55	50.28
Broxholme 1	Deep Soft	1460.94	14.31	7.85	20.22	13.05	5.87	5.27	44.95
Broxholme 1	Deep Soft	1460.54	14.31	7.76	17.70	11.47	5.58	5.04	48.65
Broxholme 1	Silkstone	1565.58	15.33	7.47	18.89	12.69	6.33	5.72	49.93

Table 4 East Midlands Isotherm Analysis Results

4.11 Coal Seam Permeability

Currently the only coal permeability data available in the East Midlands area are from the CEL wells: Althorpe 1, Swinefleet 1 and Melbourne 1. Multiple seams were tested at each well using Weatherford's FRT tool. However, the initial interpretation provided by Weatherford, indicated that the majority of the tests did not approximate radial flow during the drawdown period and therefore could not be interpreted to give a view on permeability. Of the few tests that were successful, subsequent analysis of the data indicates that the permeability of the coal seams is less than 0.5mD.

Many technical assessments appear to place great emphasis on permeability data. Over the last ten years, as Composite/Dart/IGas have drilled more than 30 CBM exploration and production wells, the conclusion has been that while permeability is an interesting metric, the measured permeabilities do not correlate well with actual well rates. This experience suggests that either the impact of permeability (or more often in the UK impermeability) is overstated, or that there are significant measurement issues. It appears that both statements are true. For the purpose of this report coal seams below 1,200 mBGL are assumed to have insufficient permeability to be prospective for commercial CBM production (also see permeability comments in the North West section on permeability).

4.12 Benchmarking

Property	East Midlands (Gainsborough)	East Midlands (York)	Airth FDP (PEDL133)	Canonbie (PEDL159)	Doe Green (PEDL145)	Sydney Basin (Australia)	Gunnedah Basin (Australia)	Clarence Morton Basin (Australia)
Depth (m)	700 – 1600	500-1200	650 -1100	400 - 1000	850 - 1150	100 – 1350 *	0 – 400 *	200 – 650 *
Seam Thickness (m)	1.3 – 2.2	0.8-2	0.8 – 2	0.3 – 3.2	0.6 – 4.5	2 – 5 *	0.5 – 3 *	300m Fm. Rich in lenticular seams (net coal 1.5 – 4.5)*
Number of Seams > 1m thick	9	3-4	3 to 4	Up to 8	Up to 10	Up to 9 *	Up to 5 *	-
Gas content (daf m3/t)	0.5-11.7	1-6	10-12	3.5-12	8-11	5 – 15 *	1 – 14 **	1 – 10 *
Gas Saturation (% in situ)	10-90 (av 50)	20-44	80-100	95-100	75-100	90 – 95 *	30 – 70**	100 *
Gas Composition (% CH4)	90-97	90-95	80-90	83-88	>96	>95 *	≈82 **	≈95 *
Ash Content (AR %)	2-40	2-10	1-10	3-65	2-25	6 – 65 **	2 -75 **	30-80 **
Moisture Content (AR %)	<5	<5	<5	<5	<5	1 – 5 **	1 – 15 **	1 – 6 **
Average Density (Dry gm/cc)	1.38	1.32	1.36	1.38	1.30	1.51 **	1.56 **	1.47 *
Permeability (mD)	<0.5	<0.5	1-3	3-36	<0.1	1-3 **	1-4 **	1-4 **

* Data sourced from Dart Energy Australian acreage well results
** Data sourced from acreage in each basin from DTE NSW geo database

4.13 Gas in Place Estimations

CBM GIP estimates (completed in house for this report) based on the identified potential target (primary) seams and development restrictions are outlined below:

Licence	GIP BCF (Low)	GIP BCF (Mid)	GIP BCF (High)	Prospective Area (Km^2)	GIP BCF Per Km^2 (Mid)	Gas Resources BCF* (Mid)
PEDL146	141	303	487	267	1.1	121
EXL288	12	18	24	14	1.3	7
PEDL012	4	6	8	8	0.8	2
PEDL200	41	59	79	56	1.0	24
PEDL207	13	17	22	25	0.7	7
PEDL210	27	36	46	65	0.6	14
TOTAL	**237**	**439**	**667**	**435**	**1.0**	**175**

Estimates of CBM GIP and Contingent Resources in the East Midlands licence areas

* Mid RF assumed to be 40%, based on analogue CBM fields globally, assuming a similar development plan and coal properties

Estimation Parameters used were determined from core data (desorption and proximate analysis) and geo-modelling volumes (parameters and individual licence coal volumes in APPENDIX S).

5 CBM Prospectivity Analysis – Primary Coal Seams

The parameters considered for assessing CBM prospectivity used in this report are listed below:

- **Coal seam volumes** (consideration given to lateral extent and net thickness after development restrictions area applied).
- **Coal seam depth range 300 – 1,200 mBGL.** Above 300 mBGL coal seams have been found to be degassed due to connectivity with the surface outcrop and/or low confining pressure has allowed the escape of gas generated during coalification. Below 1,200 mBGL permeability is assumed to be too low. All coal seams outside of this range have been discounted
- **Coal seam gas content and quality.** Gas content and quality become more critical with reduced coal seam volumes. Minimum gas content for commercial production deemed to be $10m^3/t$.
- **Coal seam gas saturation.** Low saturations reduce the pressure at which the gas is stored and absorbed within the coal seams. CBM production is driven by a pressure differential created when dewatering the production well (lowering the hydrostatic pressure), with low saturations dewatering must continue longer and significantly larger amounts of water will be produced. This excess water production has a direct offset to the economic viability of a well.
- **Coal seam permeability**. Permeability is required to allow sufficient transport paths through the coal seam to any production wells. Minimum permeability for commercial production deemed to be 1mD.

North West – Cheshire

- *Coal seam Volumes*: Individual coal seams exhibit moderate volumes however these areas are small in comparison with total area and not laterally continuous.
- *Coal seam Depth*: Coal seams within area mostly occur at the specified depth range. On the western and eastern extent of the Cheshire area the coal seams occur above and below (respectively) the specified depth range.
- *Coal seam gas content and quality*: Coal seam gas content prospectivity is deemed to be low. Average gas content is well below $10m^3/t$. Coal seam gas quality is good, exhibiting 80-90% methane concentrations.
- *Coal seam gas saturation*: Coal seams are moderately undersaturated (ie 50-75%). This is up to a factor of two times undersaturated compared with the Airth CBM development.
- *Coal Seam permeability*: Insufficient permeability data is available to accurately analyse the area. Formation testing in one well in the area failed to give results due to the very low permeability of the coal seams.

Prospectivity Analysis Rating: The Cheshire area is deemed to have low prospectivity due to insufficient coal volumes and lower than commercially viable coal seam gas contents.

North West – Warrington

- *Coal seam Volume*: Individual coal seams exhibit moderate volumes however the total area is insufficient to develop a commercial CBM project.
- Coal seam Depth: Coal seam depths occur in the specified range. No coal seams are discounted due to depth.
- *Coal seam gas content and quality*: Coal seam gas content prospectivity is moderate to high. Two of the four seams identified had gas contents above $10m^3/t$. Coal seam gas quality is good exhibiting 78-92% methane concentrations.
- *Coal seam gas saturation*: No coal seam saturation data is available for this area.
- *Coal Seam permeability*: No coal seam permeability data is available for this area.

Prospectivity Analysis Rating: The Warrington area is deemed to have no prospectivity due to the insufficient coal volumes (minimal total area)

East Midlands – York

- *Coal seam volume*: Individual coal seams exhibit moderate to high volumes. The upper seam sub-crops to the Permian unconformity to the west extent of the area slightly reducing the total volume for this seam.
- *Coal seam depth*: Coal seam depths mostly occur in the specified range. Only the upper coal seam is discounted in part due to depth.
- *Coal seam gas content and quality*: Coal seam gas content prospectivity is deemed as very low. Average gas content is well below $10m^3/t$. Coal seam gas quality is excellent exhibiting 90-95% methane concentrations.
- *Coal seam gas saturation*: Coal seams highly undersaturated (ie 20-44%). This is up to a factor of five times more undersaturated compared with the Airth CBM development.
- *Coal seam permeability*: Coal seam permeability is deemed to be low, less than 0.5mD.

Prospectivity Analysis Rating: The York area is deemed to have very low prospectivity due to lower than commercially viable coal seam gas contents.

East Midlands – Gainsborough

- *Coal seam volume*: Individual coal seams exhibit low to moderate volumes however these areas are very small in comparison with total area and not laterally continuous.
- *Coal seam depth*: Coal seams mostly occur in the specified range. All coal seams have been discounted on the south eastern corner of the area due to occurring deeper than the specified range.
- *Coal seam gas content and quality*: Coal seam gas content prospectivity is deemed as low. Average gas content is well below $10m^3/t$. Coal seam gas quality is excellent exhibiting 90-97% methane concentrations.
- *Coal seam gas saturation*: Coal seams moderately undersaturated (ie average 50%). This is up to a factor of two times undersaturated compared with the Airth CBM development.
- *Coal Seam permeability*: Coal seam permeability is deemed to be low, less than 0.5mD.

Prospectivity Analysis Rating: The Gainsborough area is deemed to have low prospectivity due to insufficient coal volumes and lower than commercially viable coal seam gas contents.

6 Conclusions

Conclusions

Technical

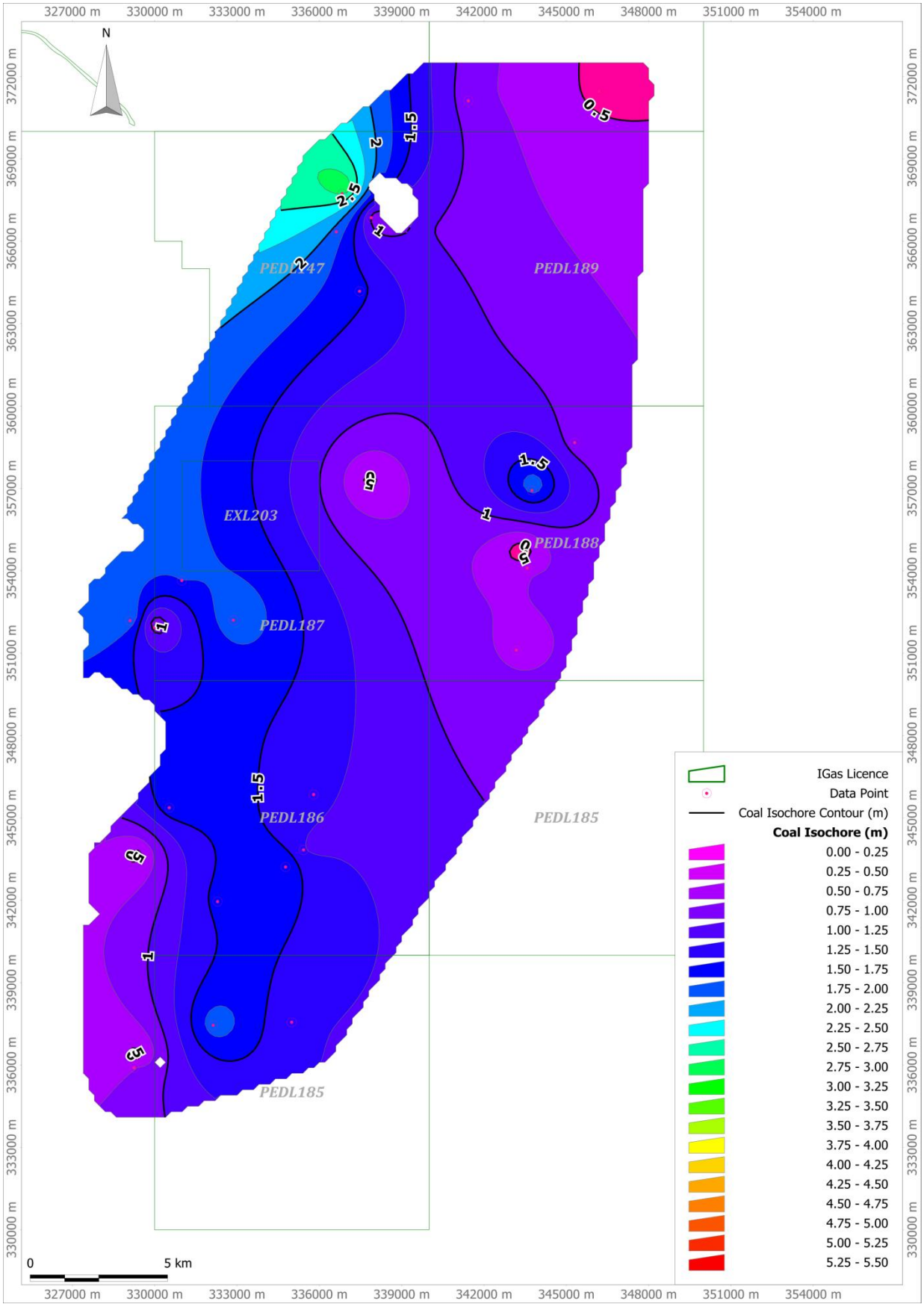
In the North West licences, the Gas in Place (mid case) was estimated at 583 bcf, with more than half in PEDL189 and PEDL147. The prospective acreage equates to c. 300 km^2. Applying a 40% recovery factor gives contingent gas resources of 233 bcf. PEDL185, PEDL187 and EXL273 can immediately be discounted on grounds that there is insufficient scale (compared to the marginal 2P volume of 40 bcf at Airth) to warrant further development. For all the North West licences reviewed, key technical metrics were less than those identified at Airth in PEDL133.

In the East Midlands, the Gas in Place (mid case) was estimated at 439 bcf, with almost 70% in PEDL146 (a reflection more on licence area than the resource density). The prospective acreage equates to c. 435 km^2. Applying a 40% recovery factor gives contingent gas resources of 175 bcf. Only PEDL146 has recoverable gas in place of sufficient scale to even consider for development – all other licences fall below the 40 bcf 2P resource that was identified in Airth as a minimum. For all licences, including PEDL146, key technical metrics were less than those identified at Airth in PEDL133.

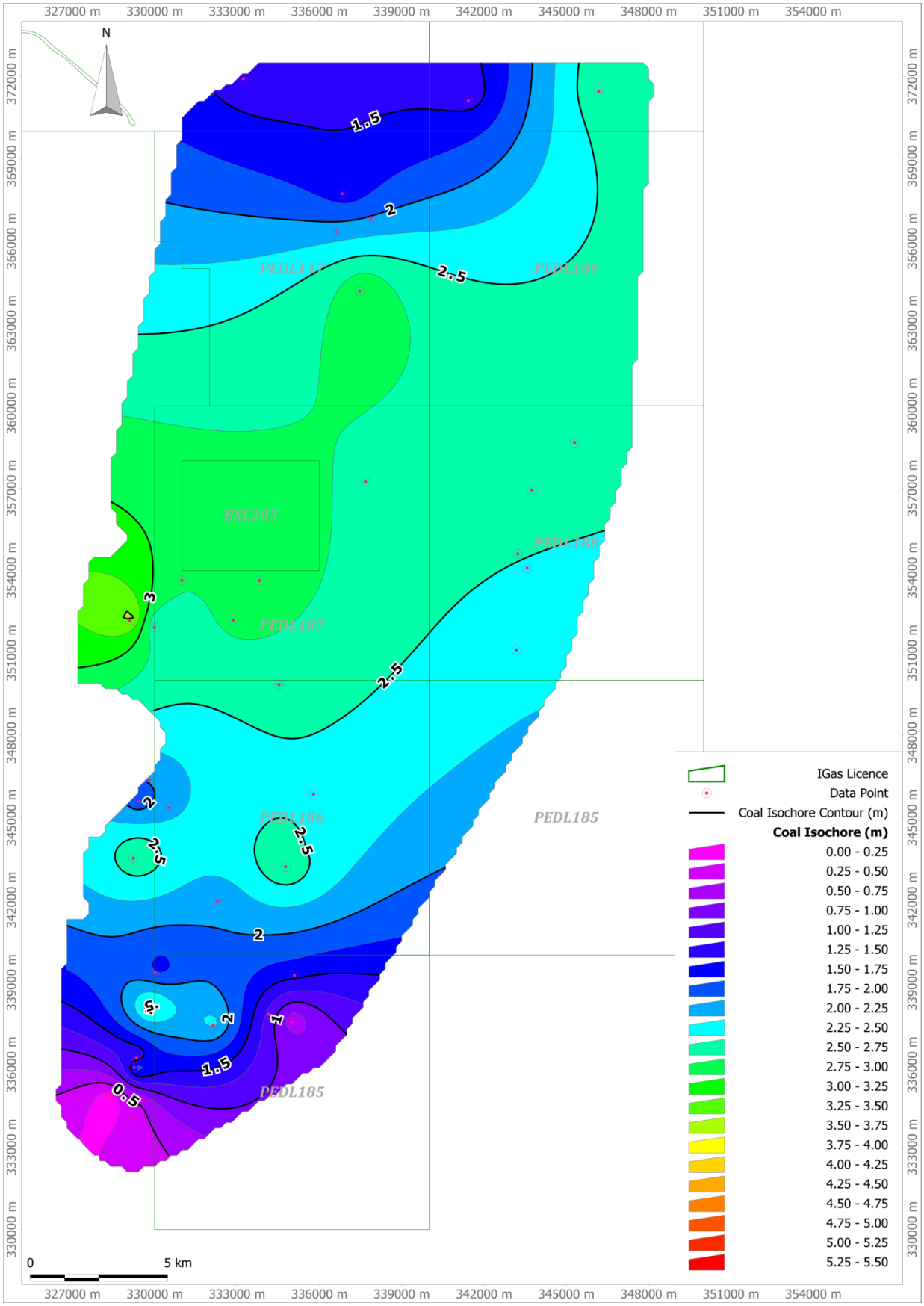
Commercial Viability

Based on the work undertaken, CBM prospectivity was evaluated to be low in both the East Midlands and the North West licence areas reviewed. CBM exploration and development is currently not commercially viable in these licences based on technical analysis, sub economic flow rates from CBM wells tested to date, development constraints, capital costs, expected timeline and forecast gas prices.

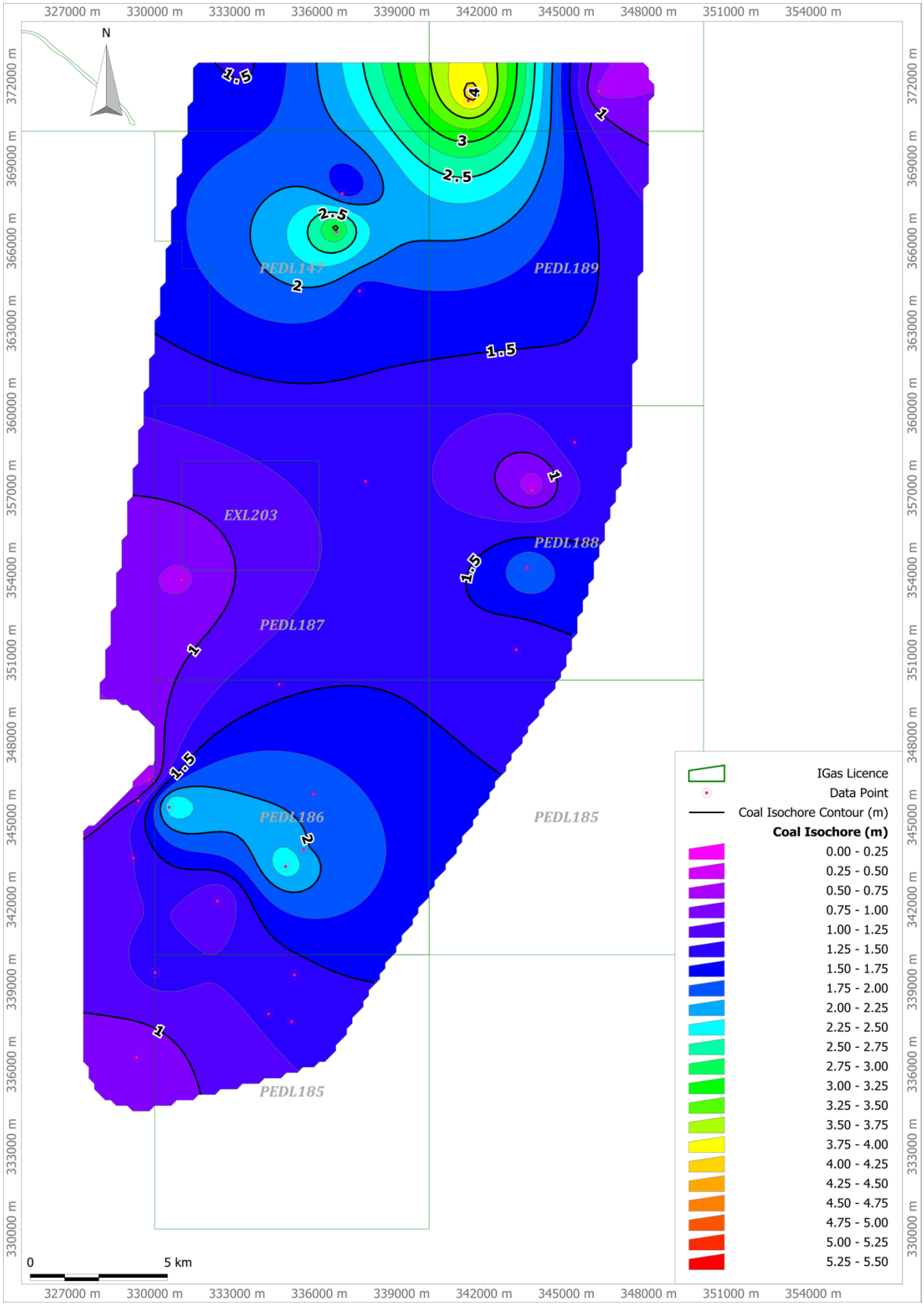
APPENDIX A. North West Coal Seam Net Thickness – Primary - Unclipped



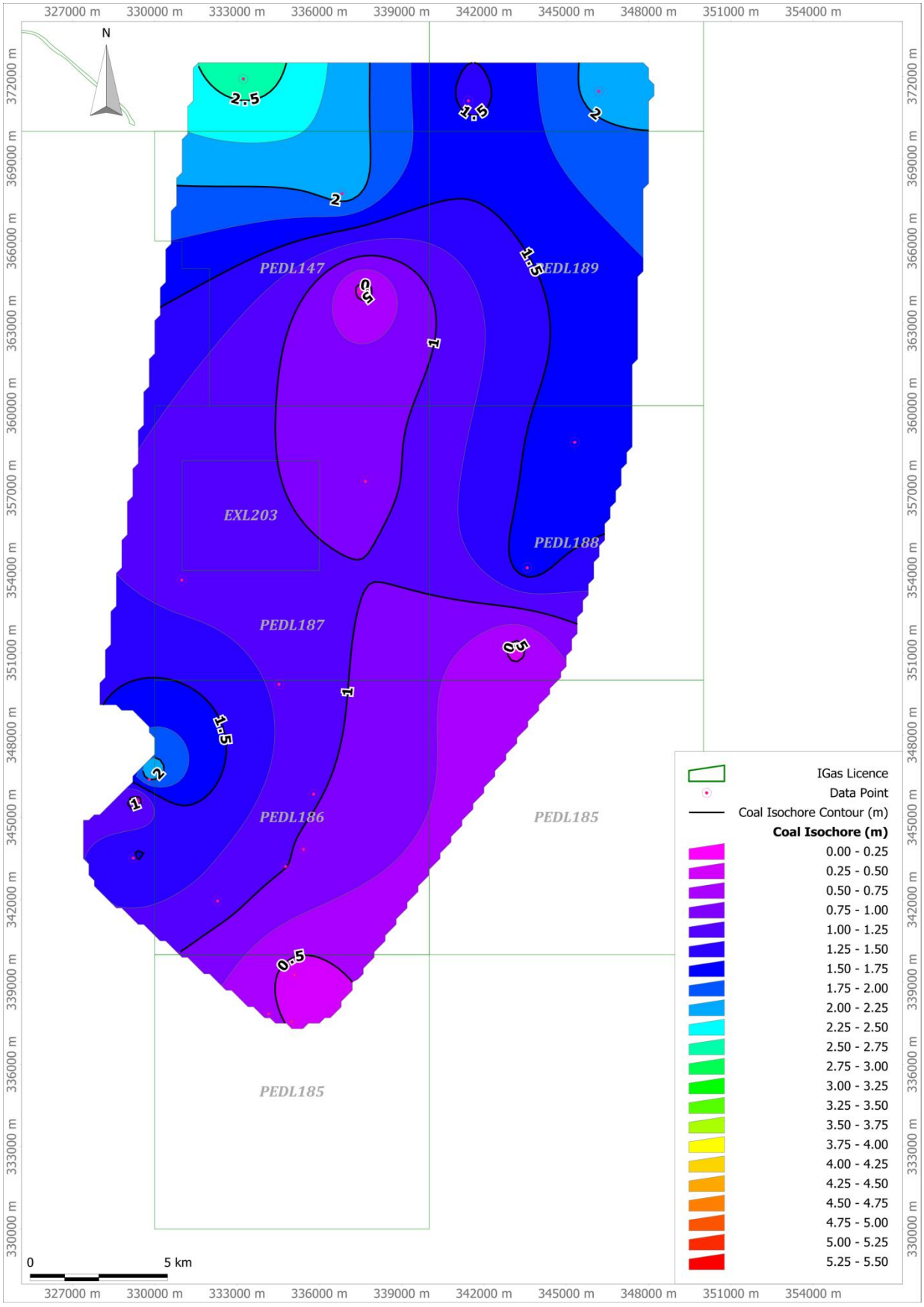
Two Yard Net Seam Thickness (m) – Unclipped



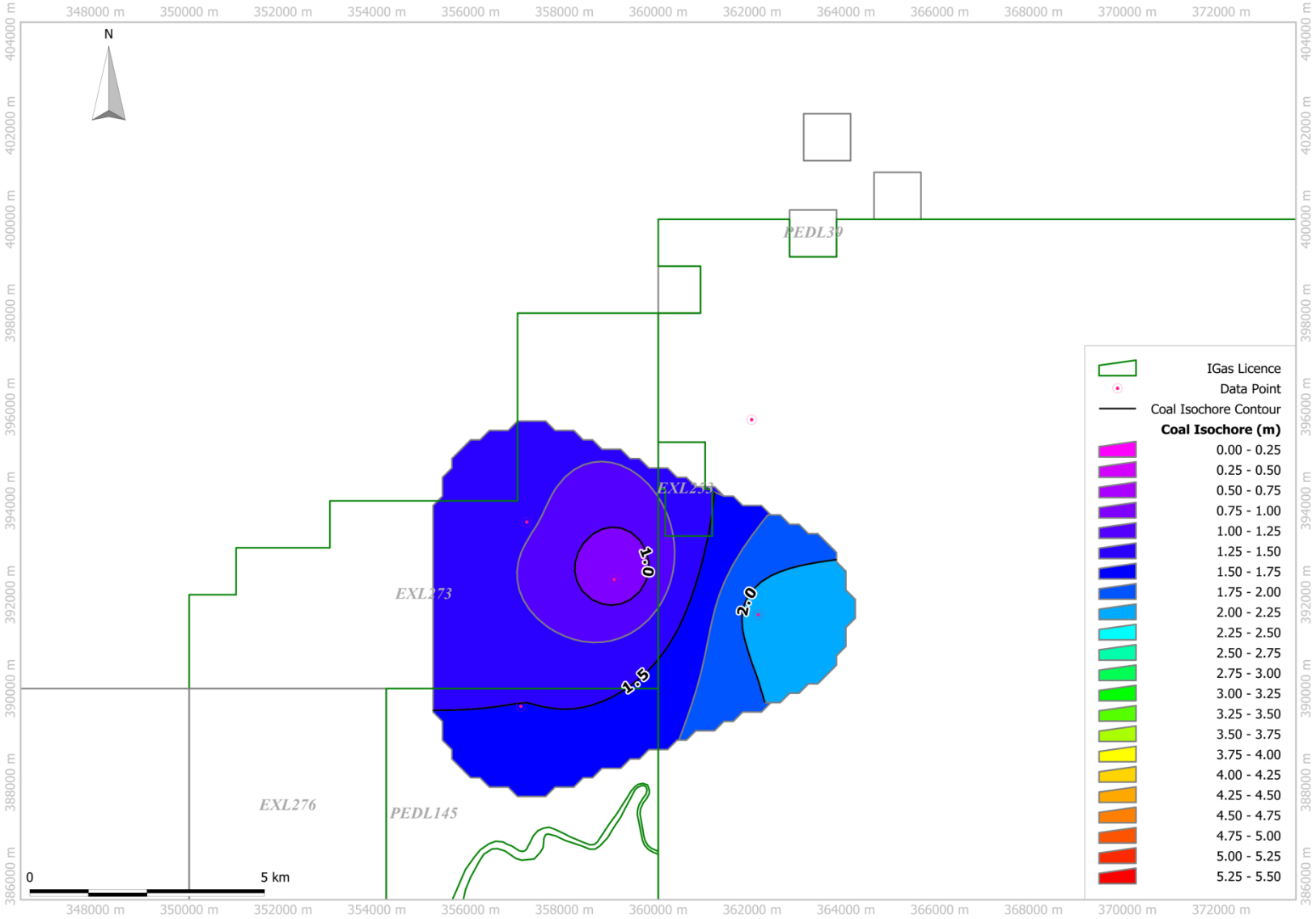
Main Seam Thickness (m) – Unclipped



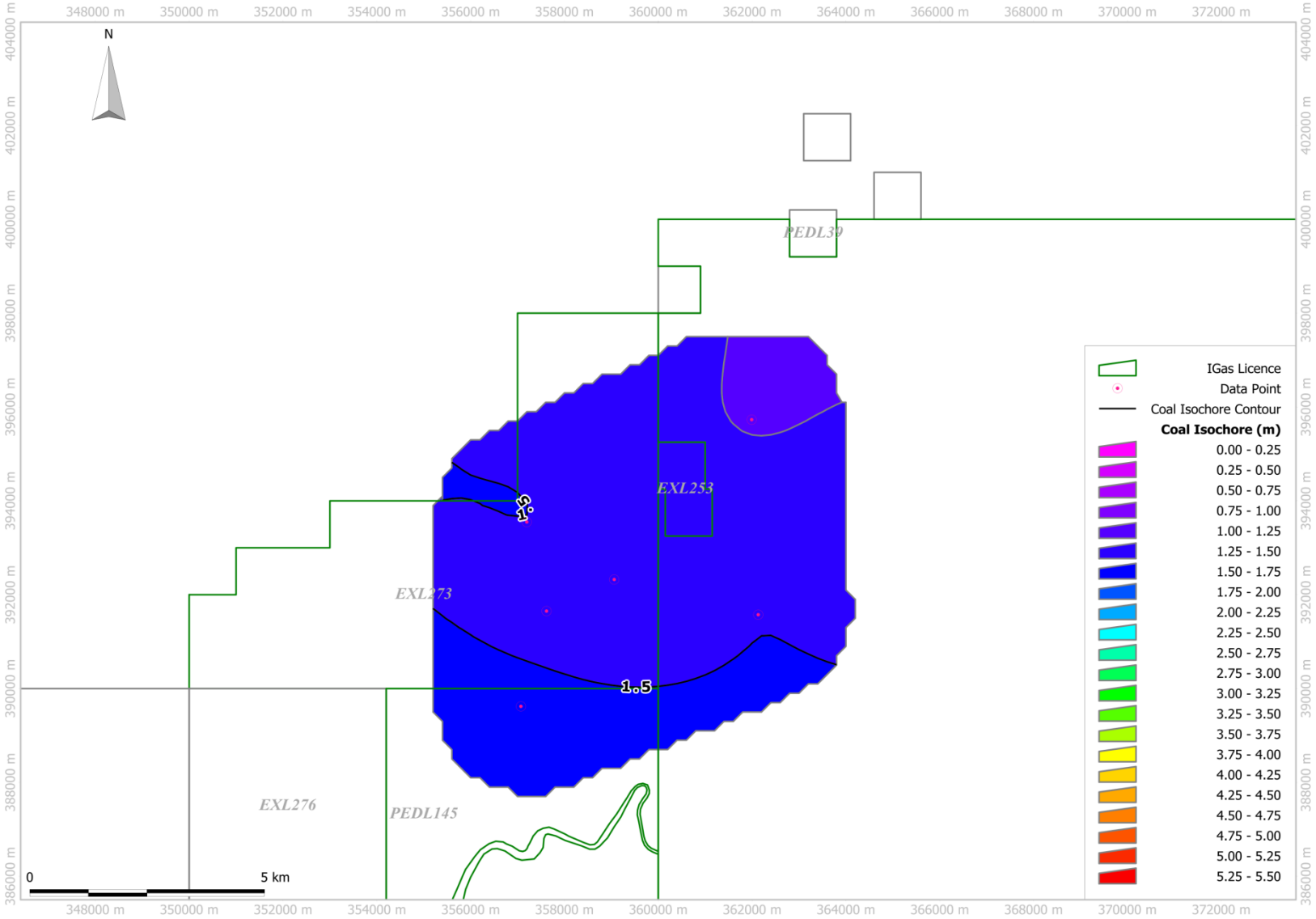
Fireclay Group Seam Thickness (m) – Unclipped



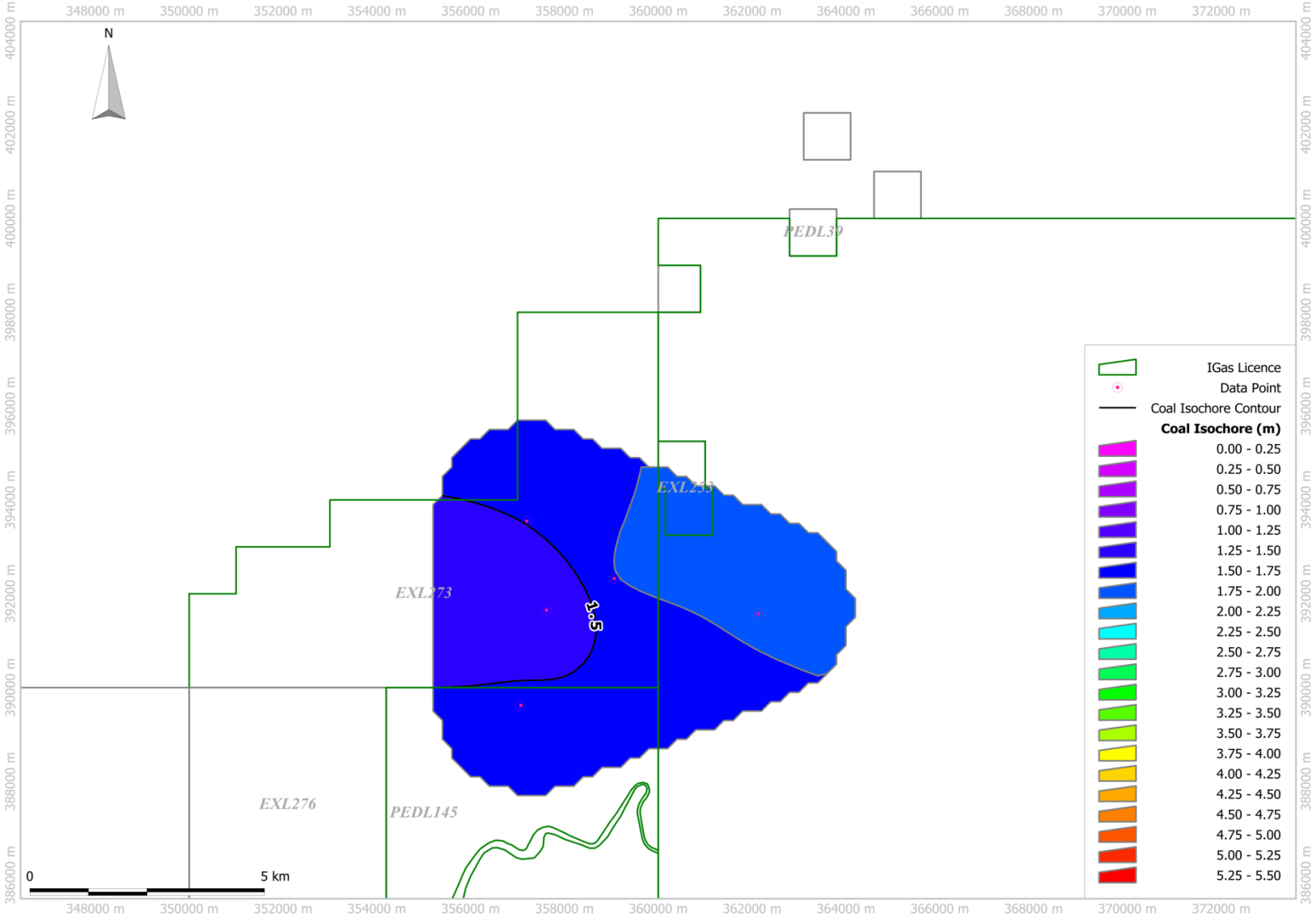
Nant Seam Thickness (m) – Unclipped



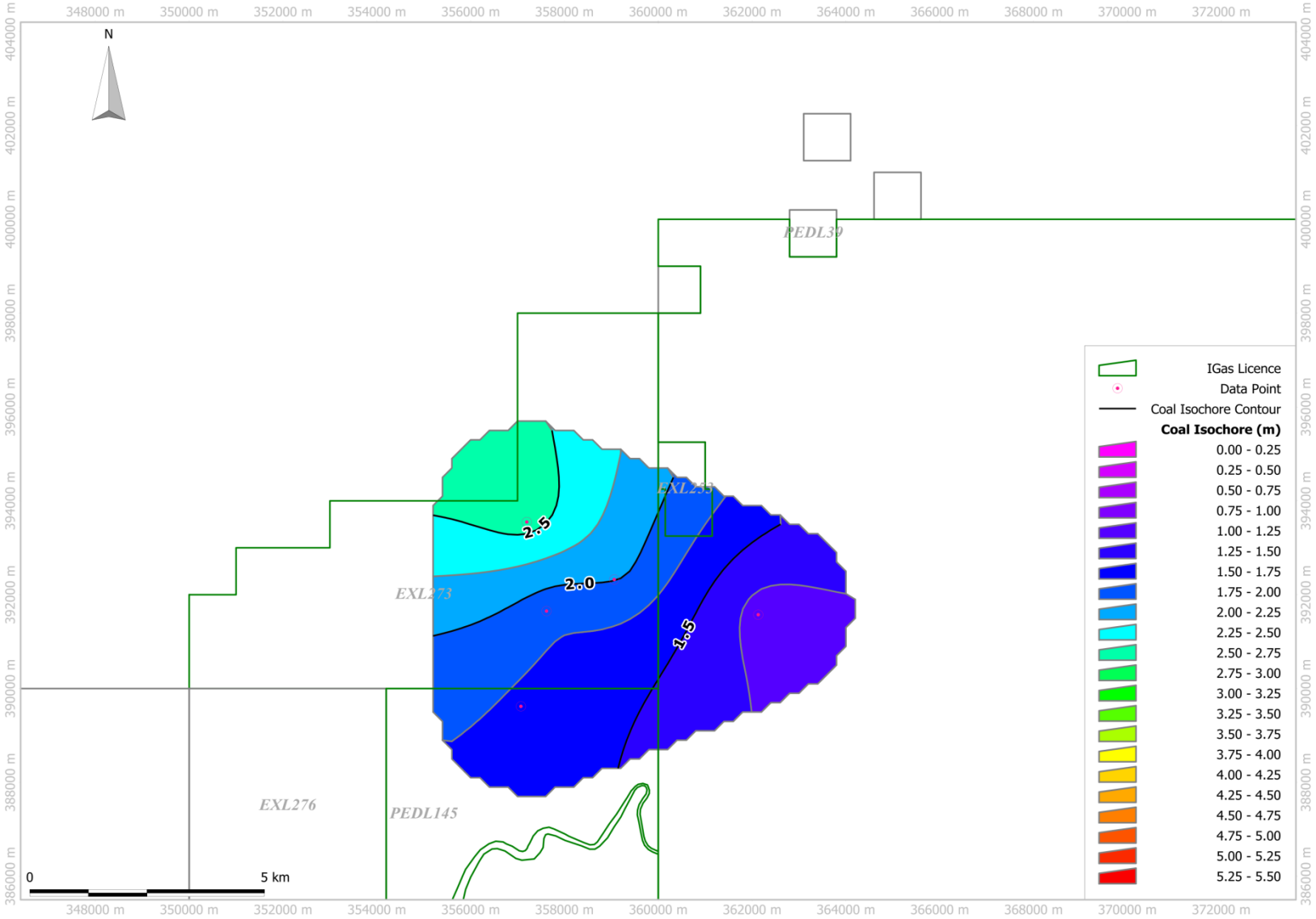
Crombouke Seam Thickness (m) – Unclipped



Lower Florida Seam Thickness (m) – Unclipped

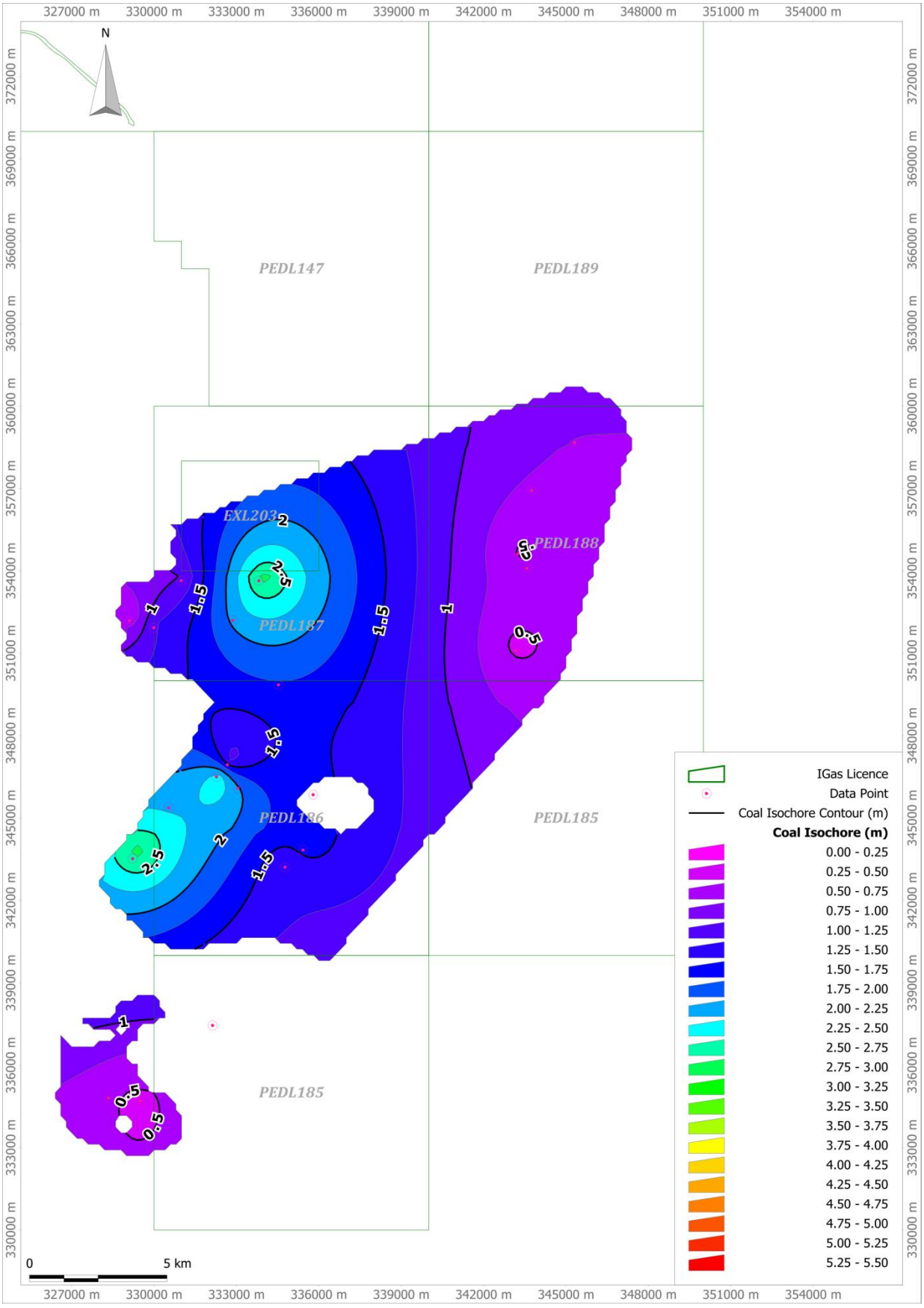


Wigan Four Feet Seam Thickness (m) – Unclipped

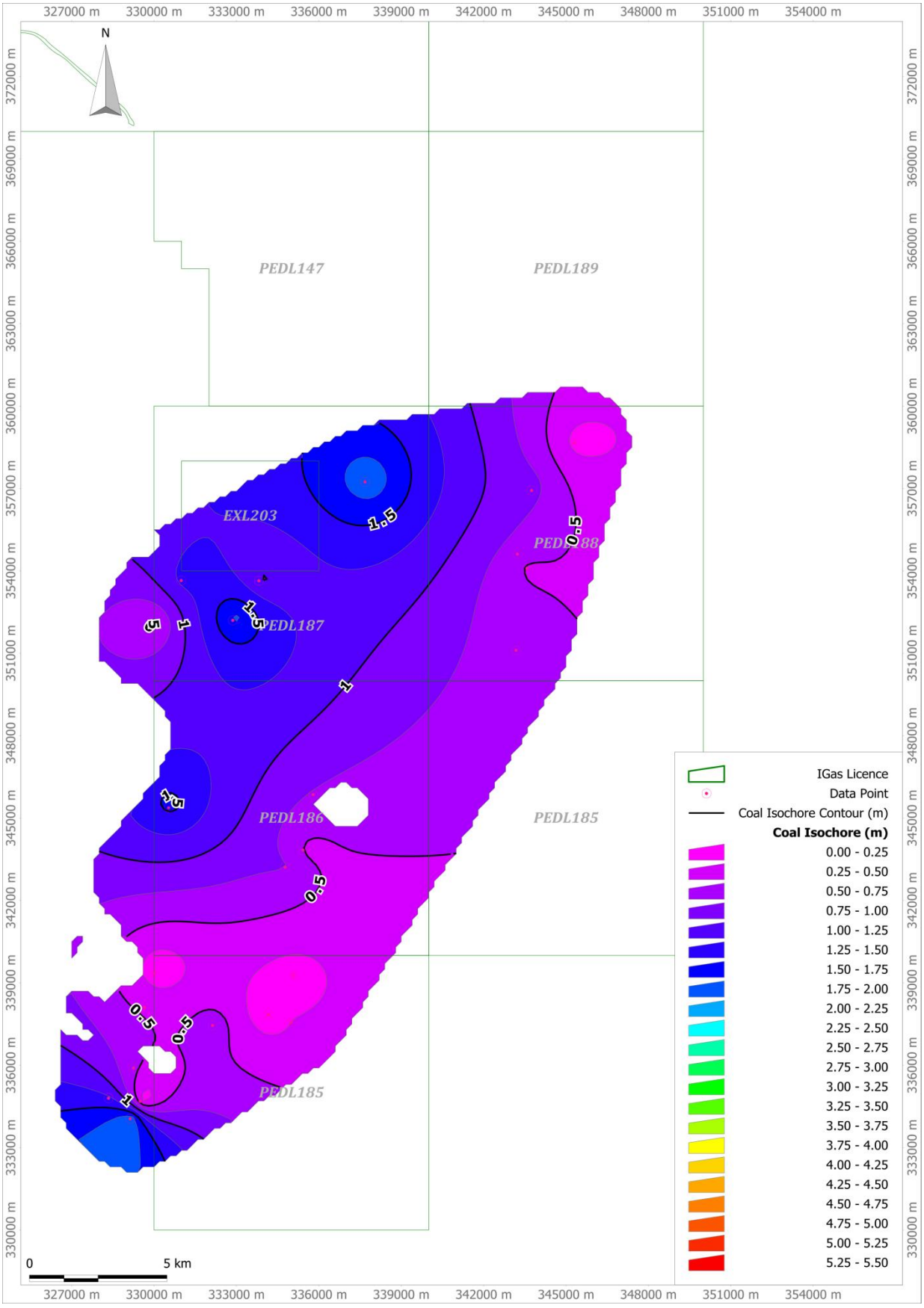


Trencherbone Seam Thickness (m) – Unclipped

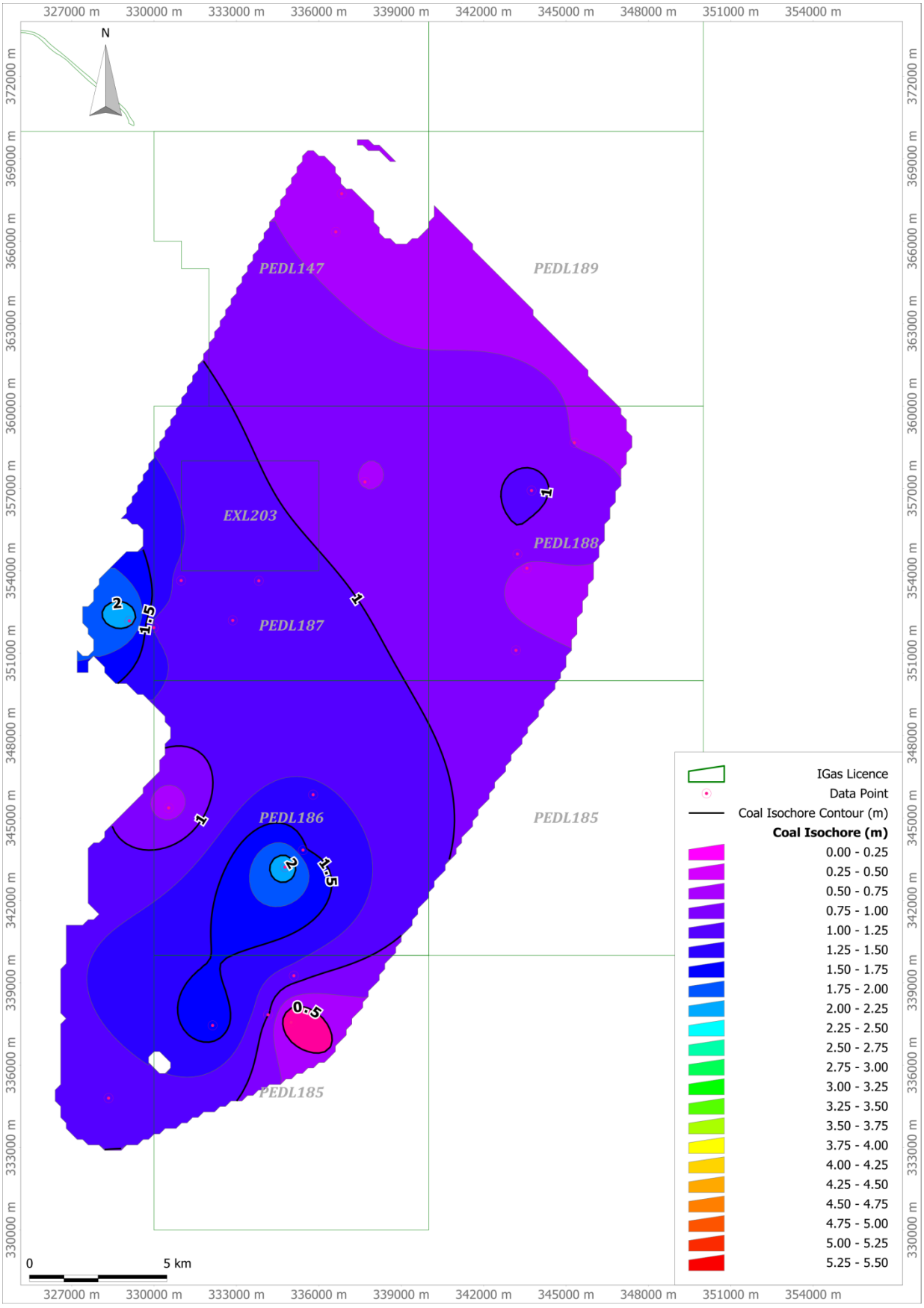
APPENDIX B. North West Coal Seam Net Thickness – Secondary – Unclipped



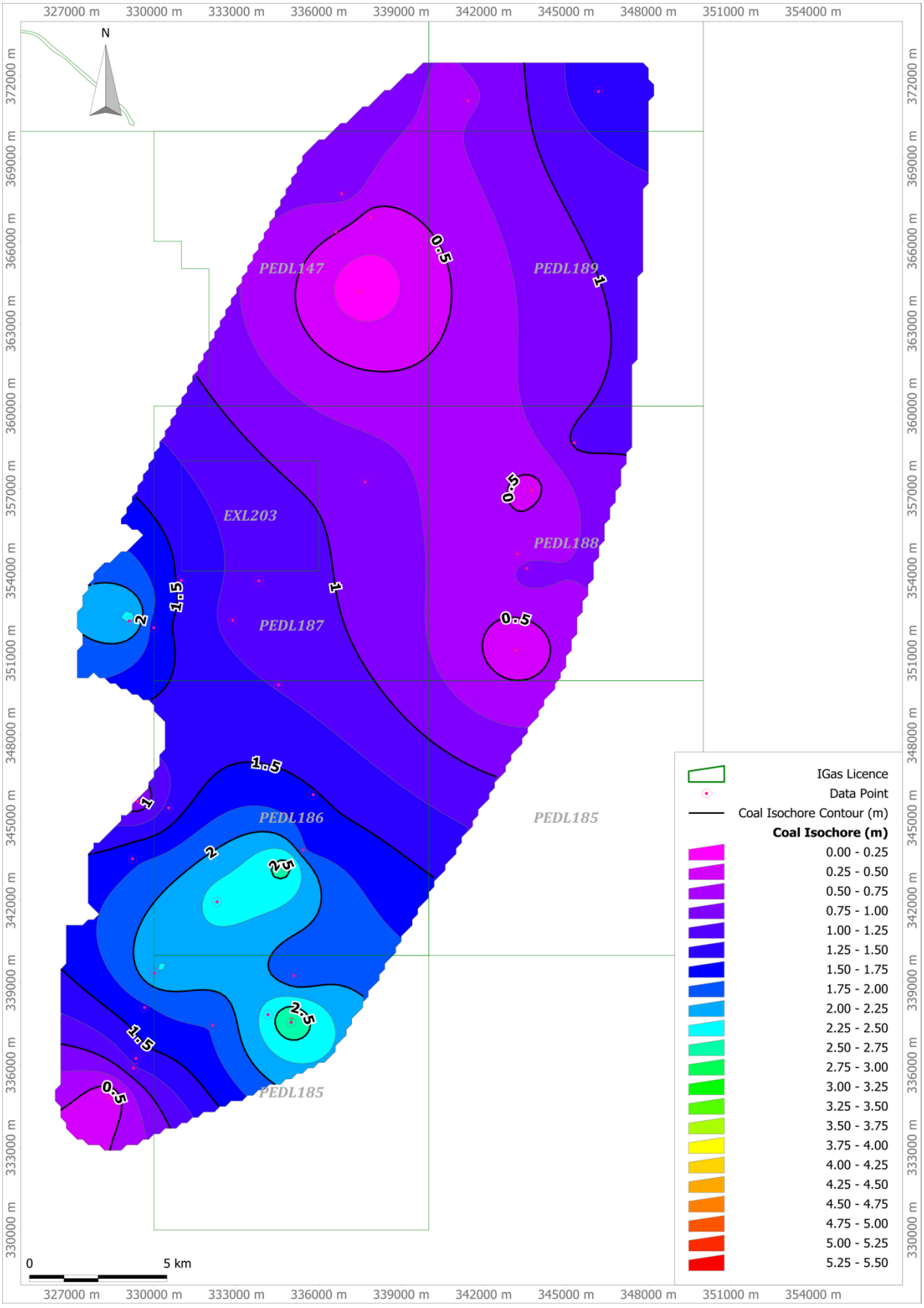
Upper Stinking Seam Thickness (m) – Unclipped



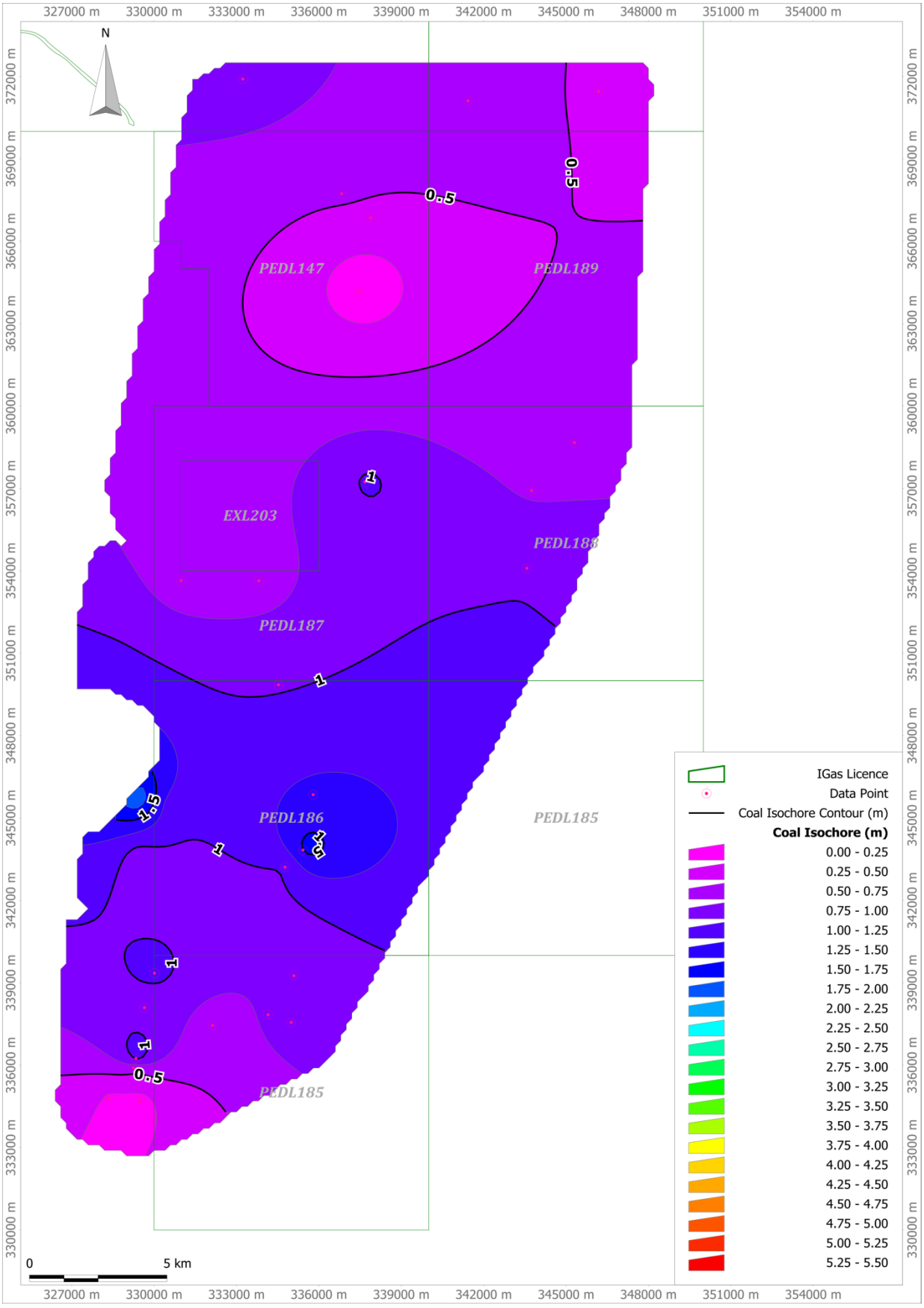
Lower Stinking Seam Thickness (m) – Unclipped



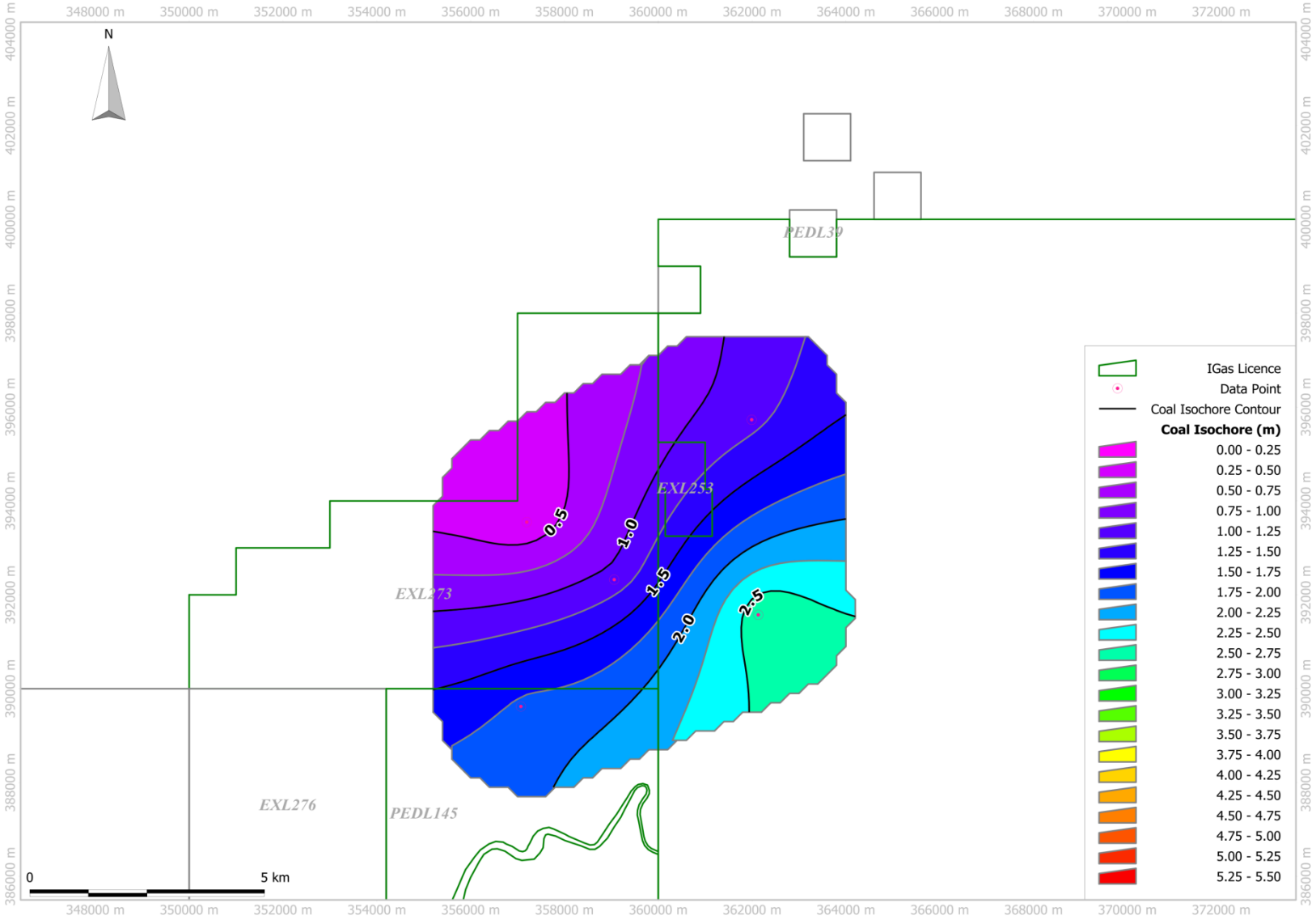
Powell Seam Thickness (m) – Unclipped



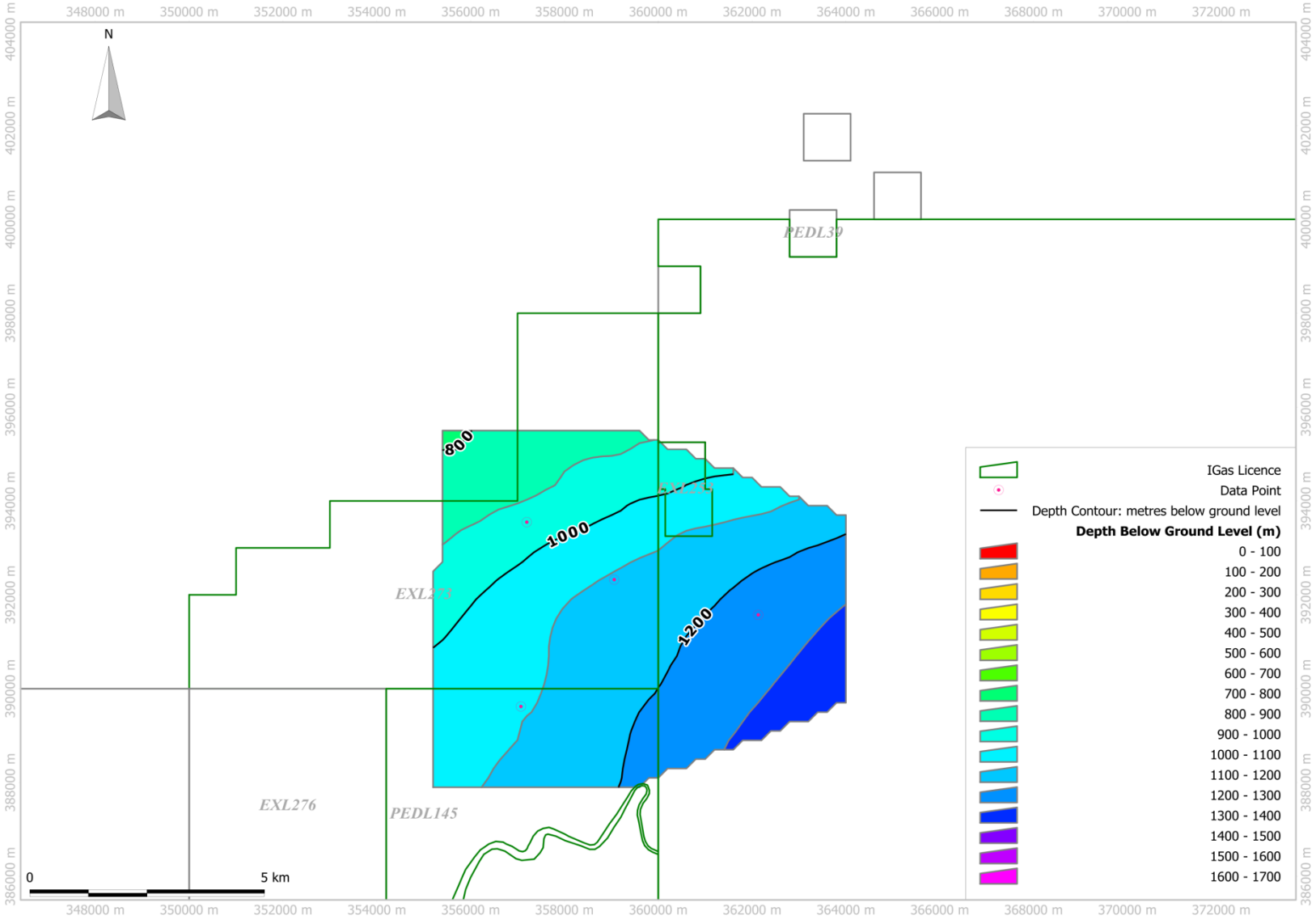
Brassy Seam Thickness (m) – Unclipped



Lower Yard Seam Thickness (m) – Unclipped

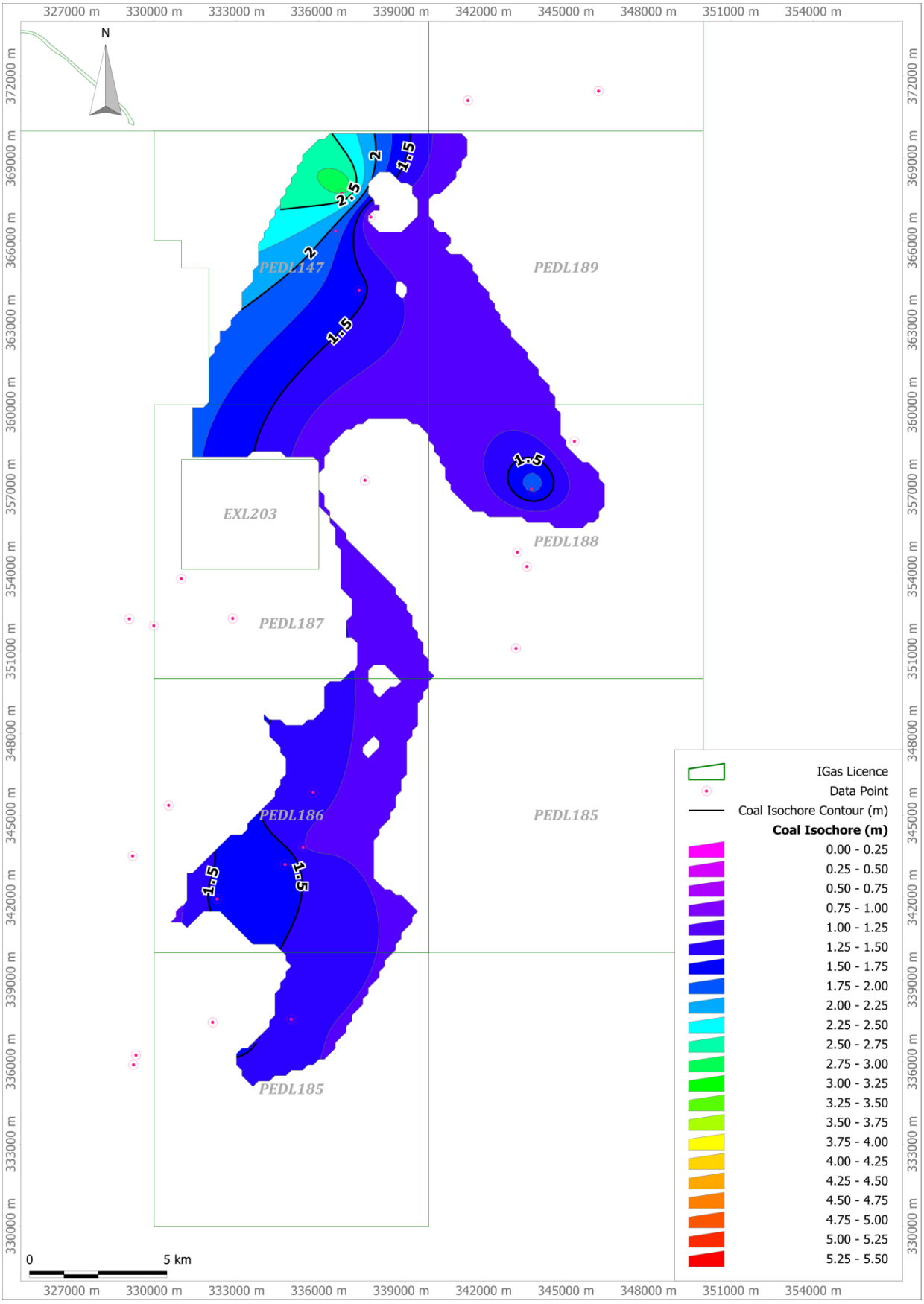


Ince Six Feet Seam Thickness (m) – Unclipped

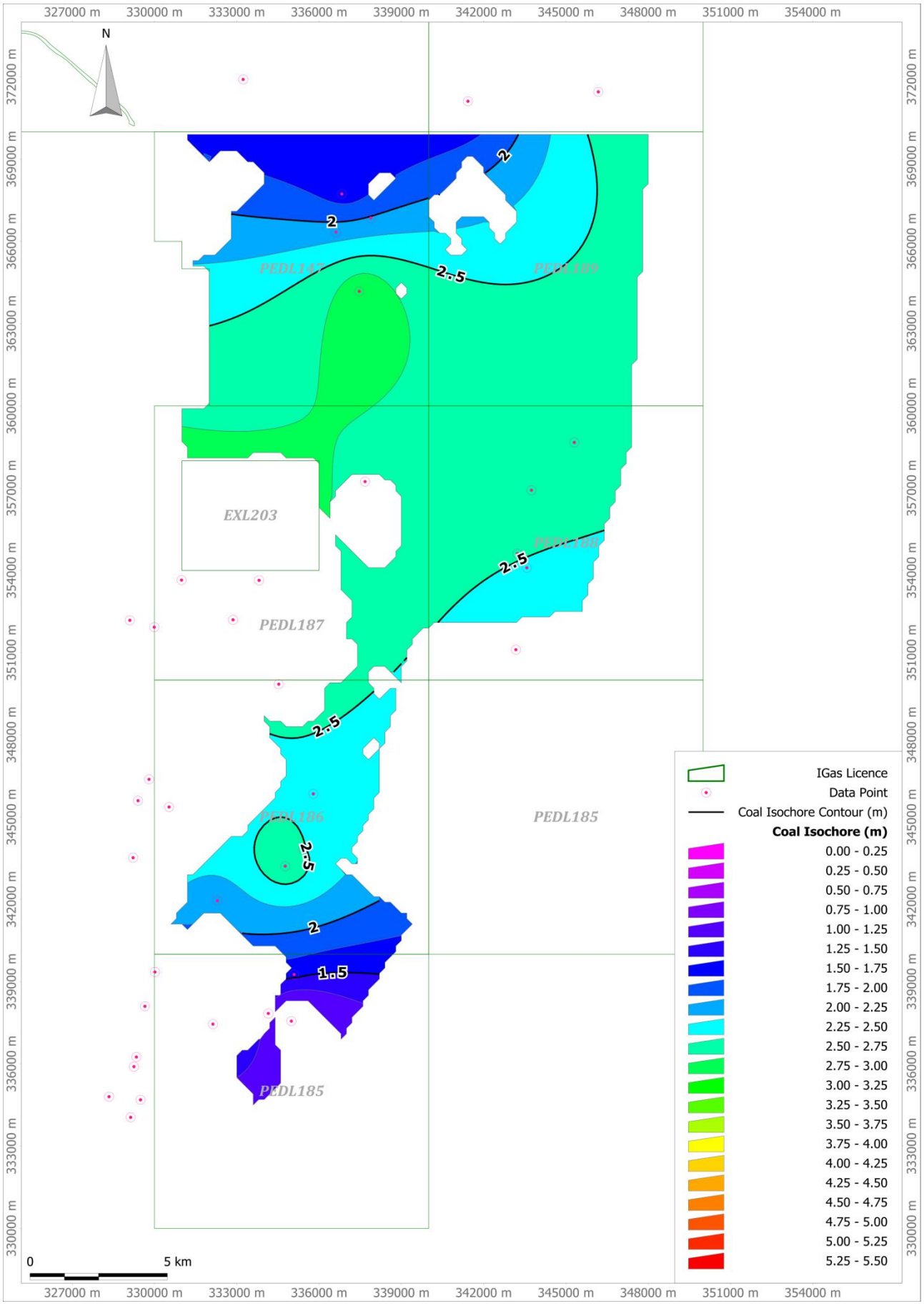


Peacock Seam Thickness (m) – Unclipped

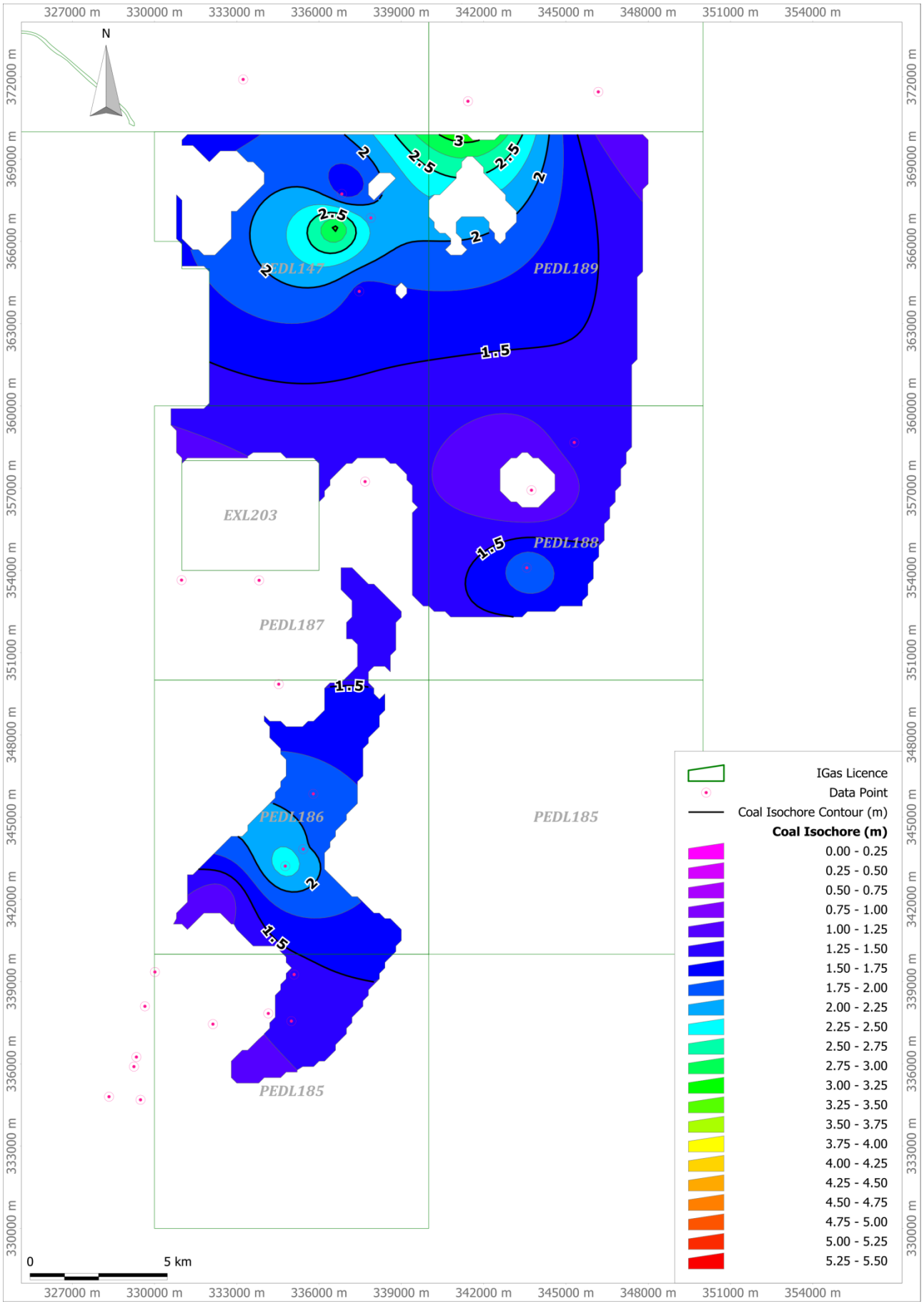
APPENDIX C. North West Coal Seam Net Thickness – Primary – Clipped



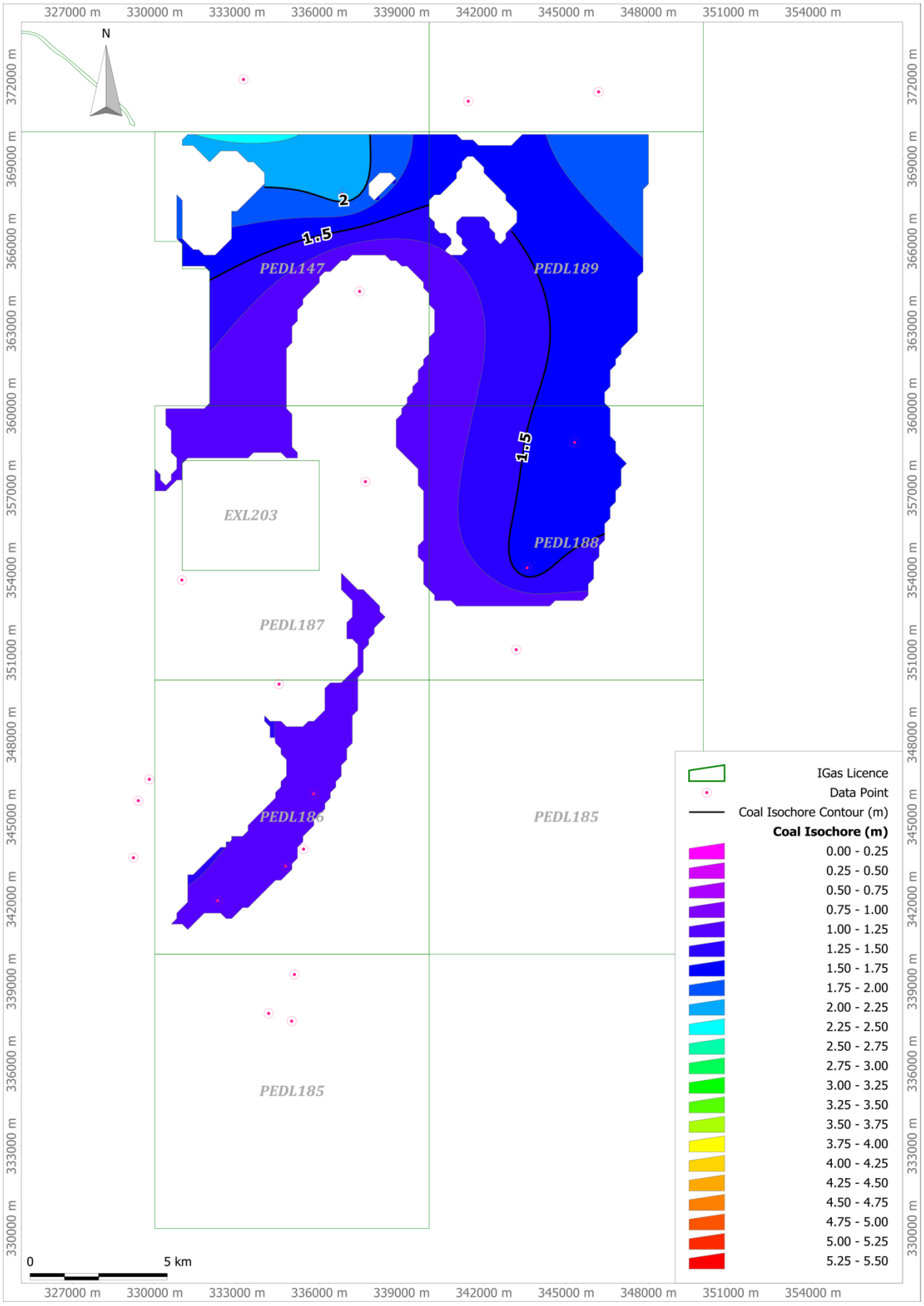
Two Yard Seam Net Thickness (m) - Clipped with Development Restrictions



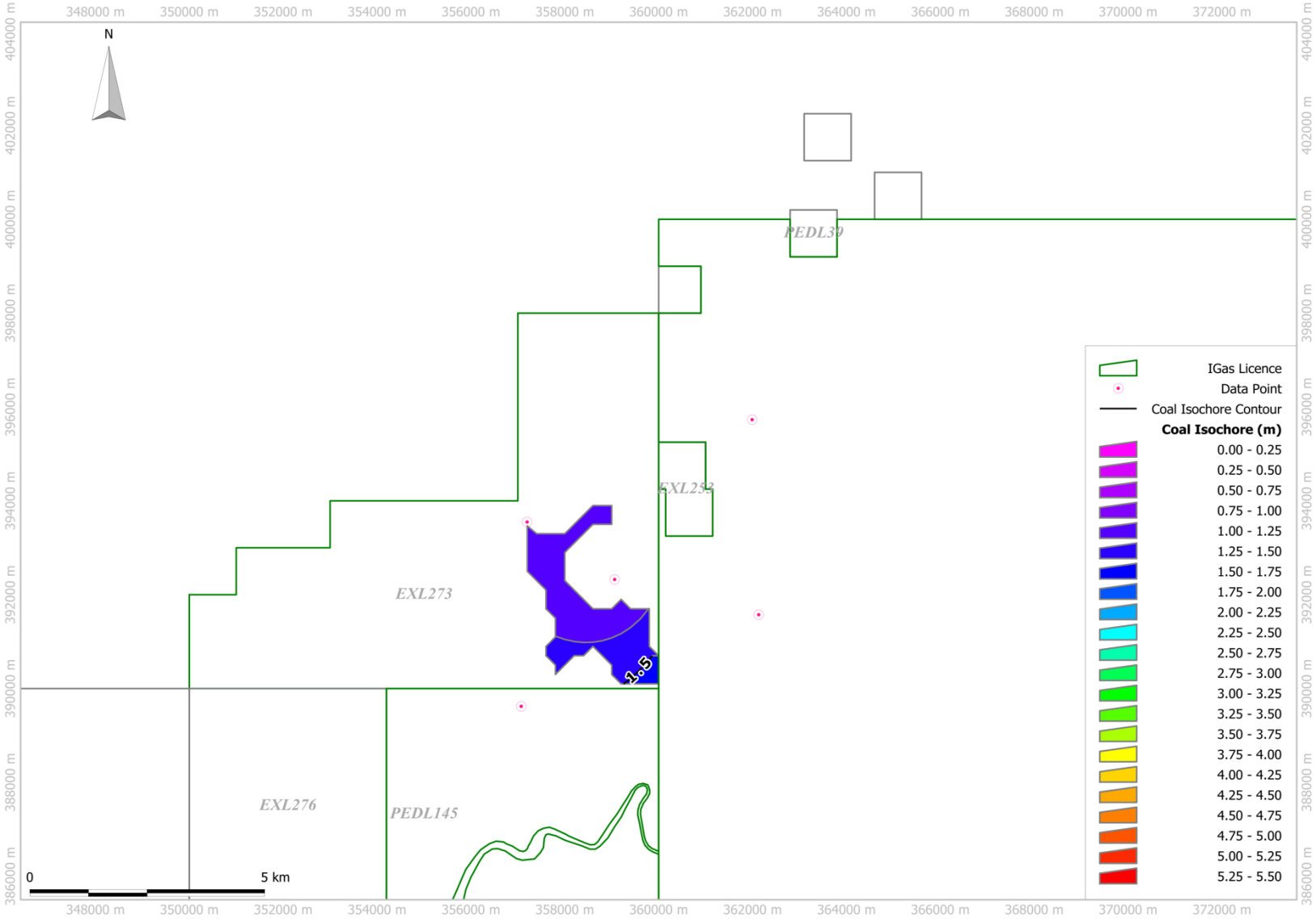
Main Seam Net Thickness (m) - Clipped with Development Restrictions



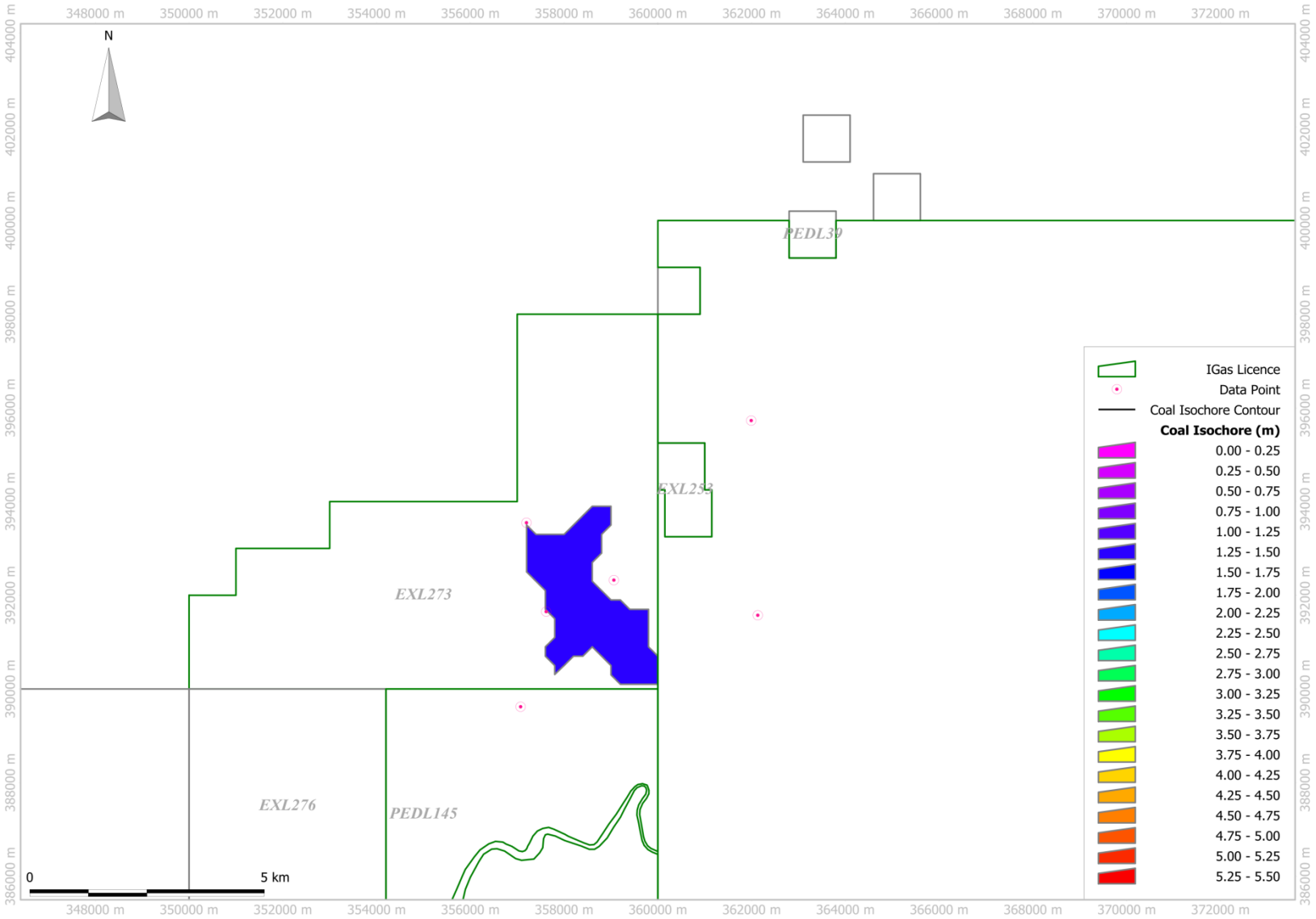
Fireclay Group Seam Net Thickness (m) - Clipped with Development Restrictions



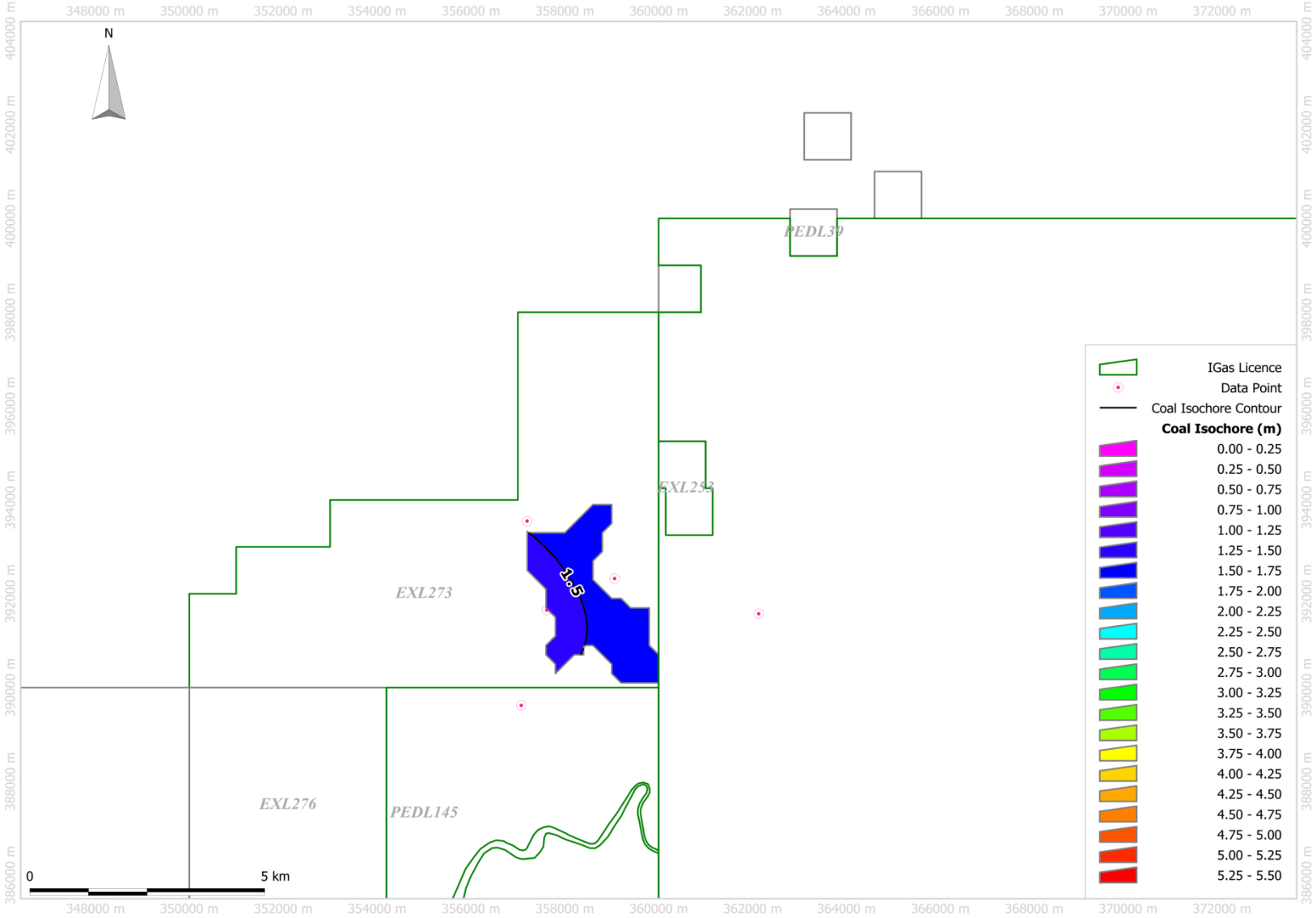
Nant Seam Net Thickness (m) - Clipped with Development Restrictions



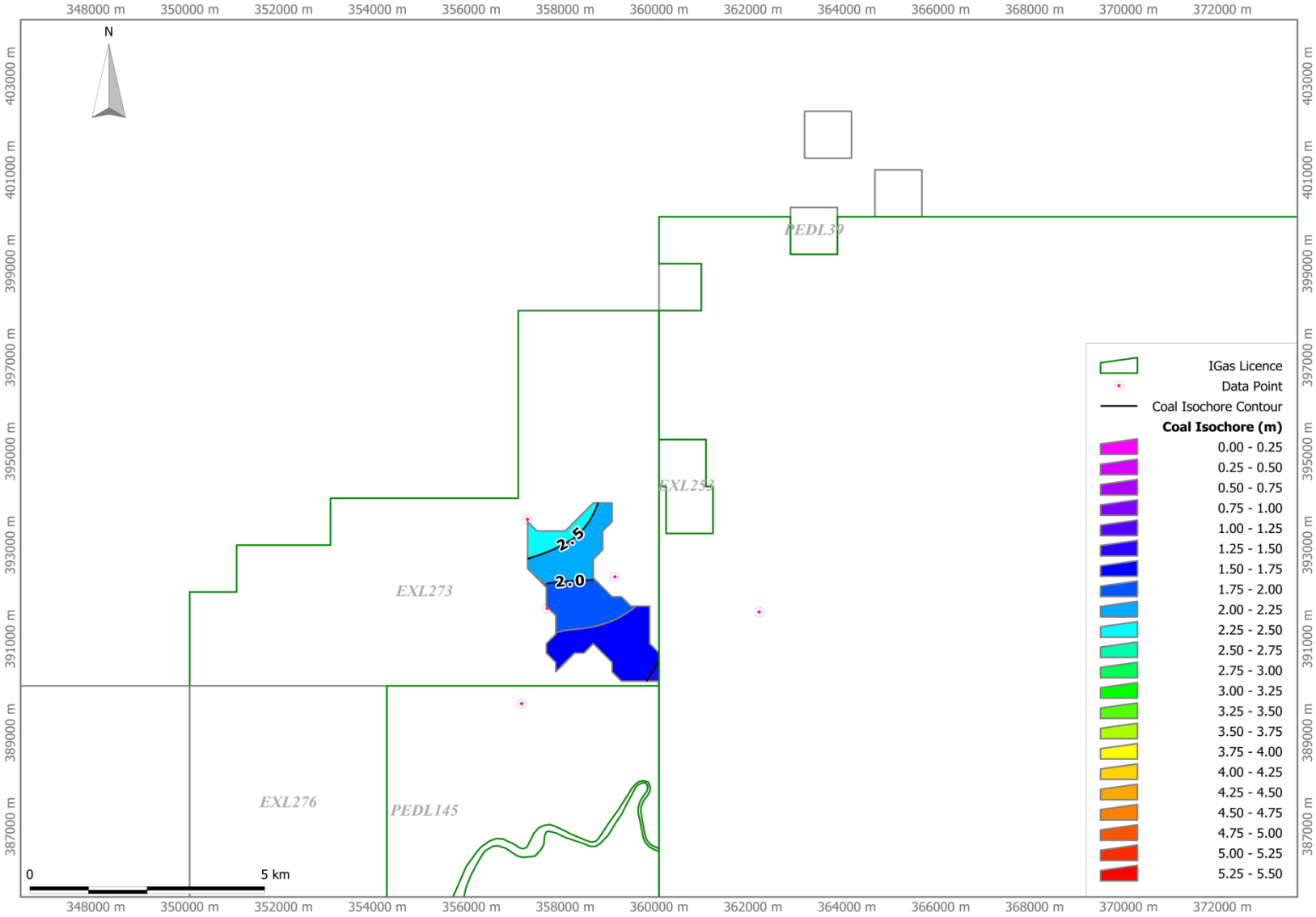
Crombouke Seam Net Thickness (m) - Clipped with Development Restrictions



Lower Florida Seam Net Thickness (m) - Clipped with Development Restrictions

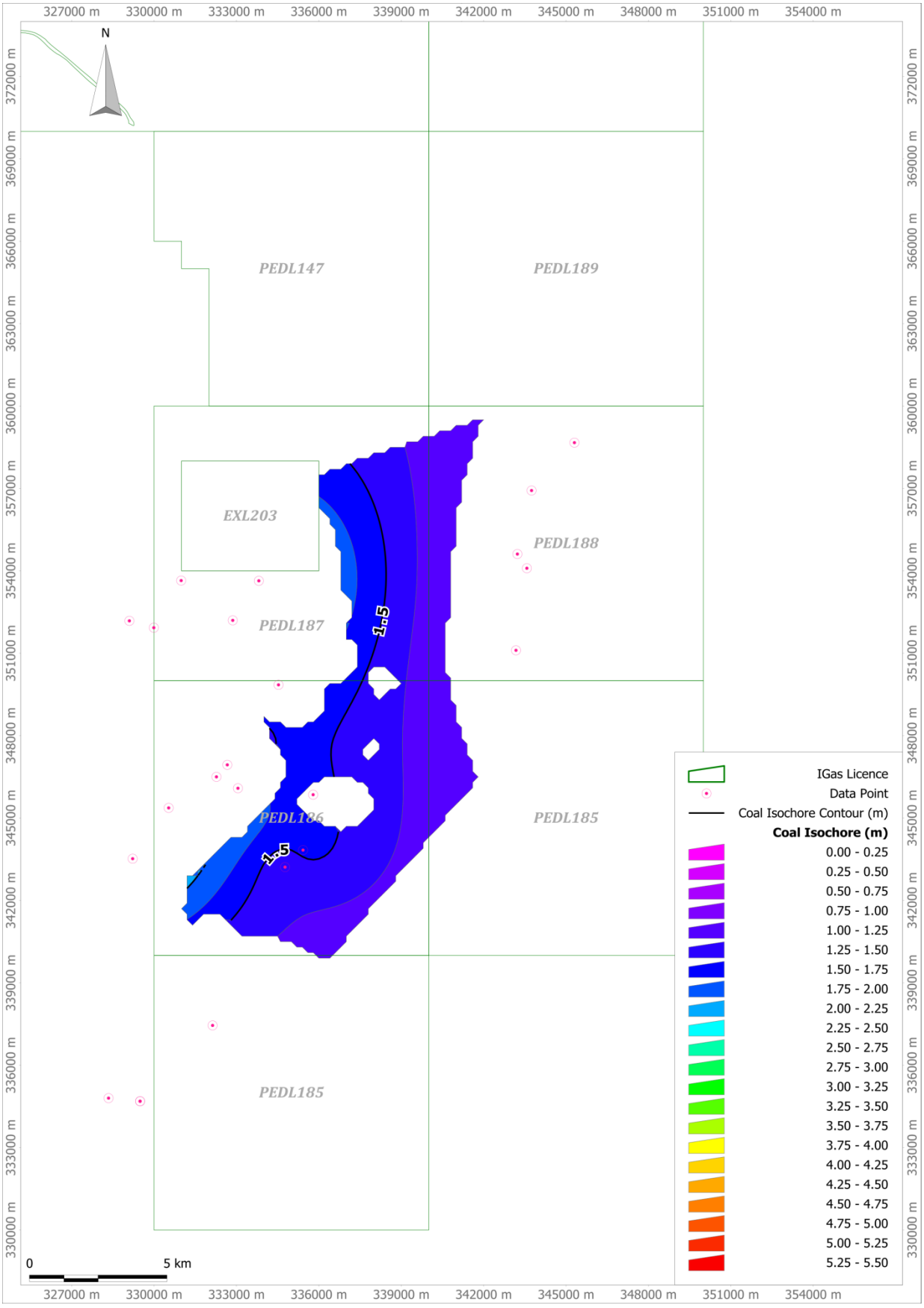


Wigan Four feet Seam Net Thickness (m) - Clipped with Development Restrictions

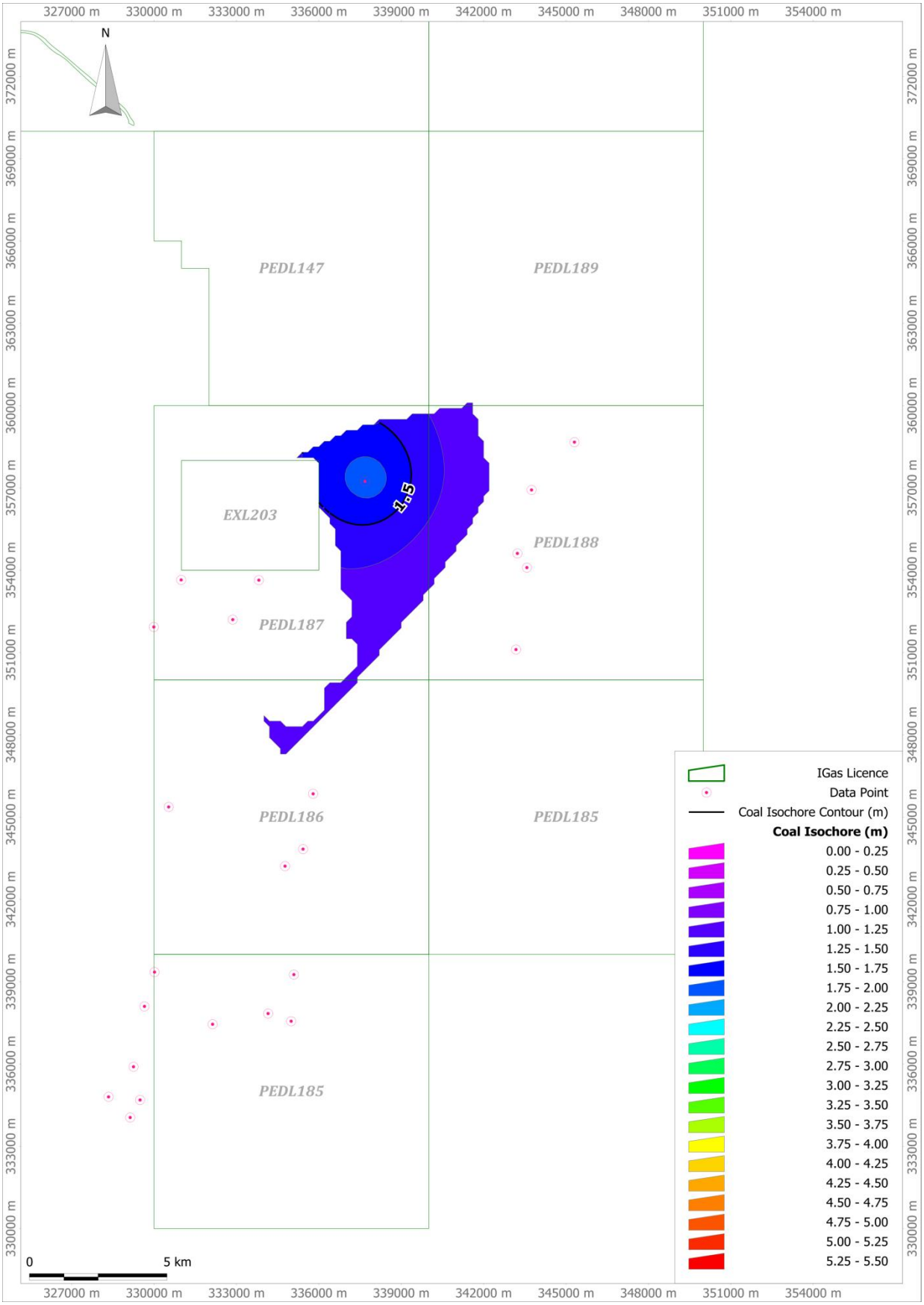


Trenchebone Seam Net Thickness (m) - Clipped with Development Restrictions

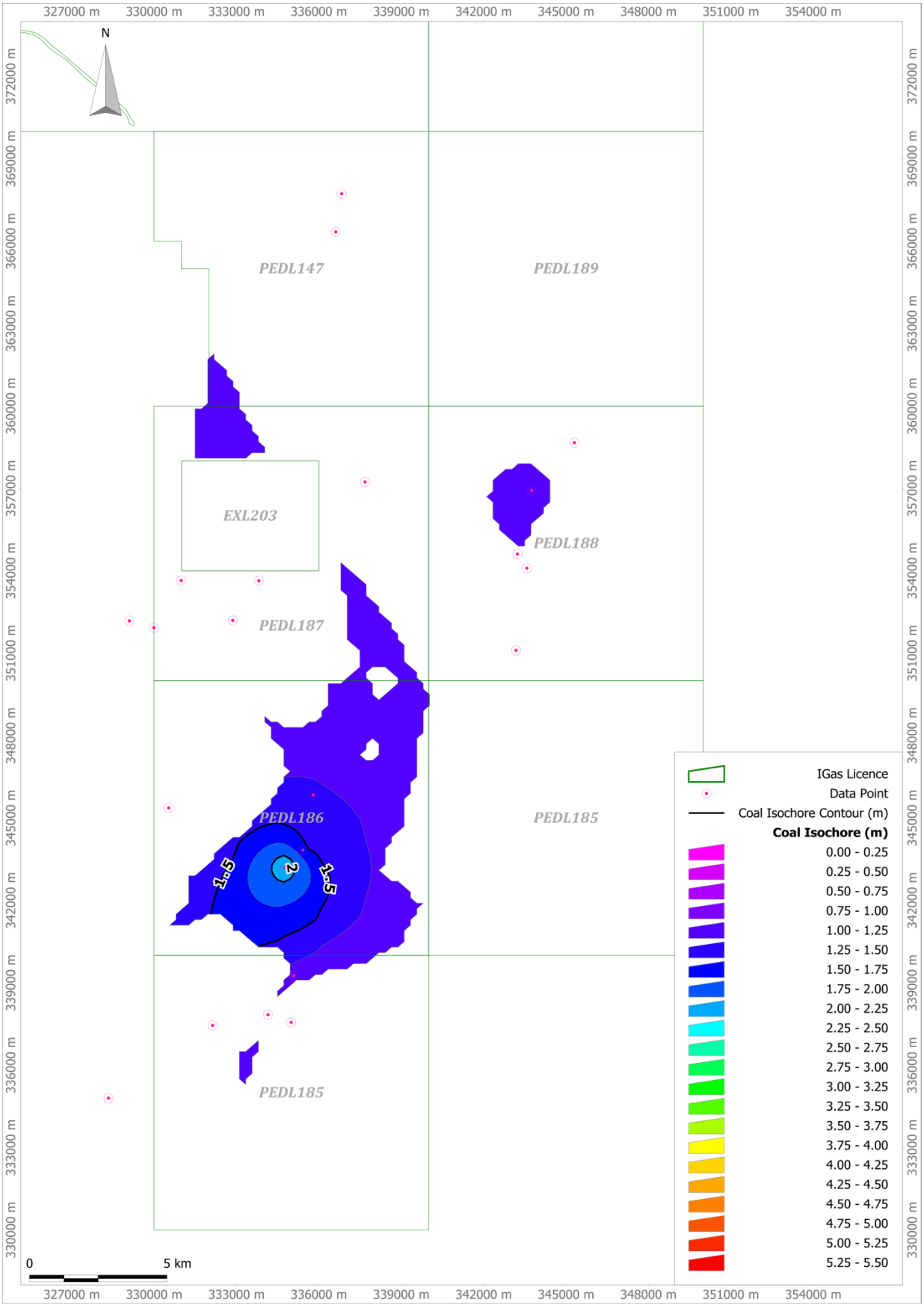
APPENDIX D. North West Coal Seam Net Thickness – Secondary – Clipped



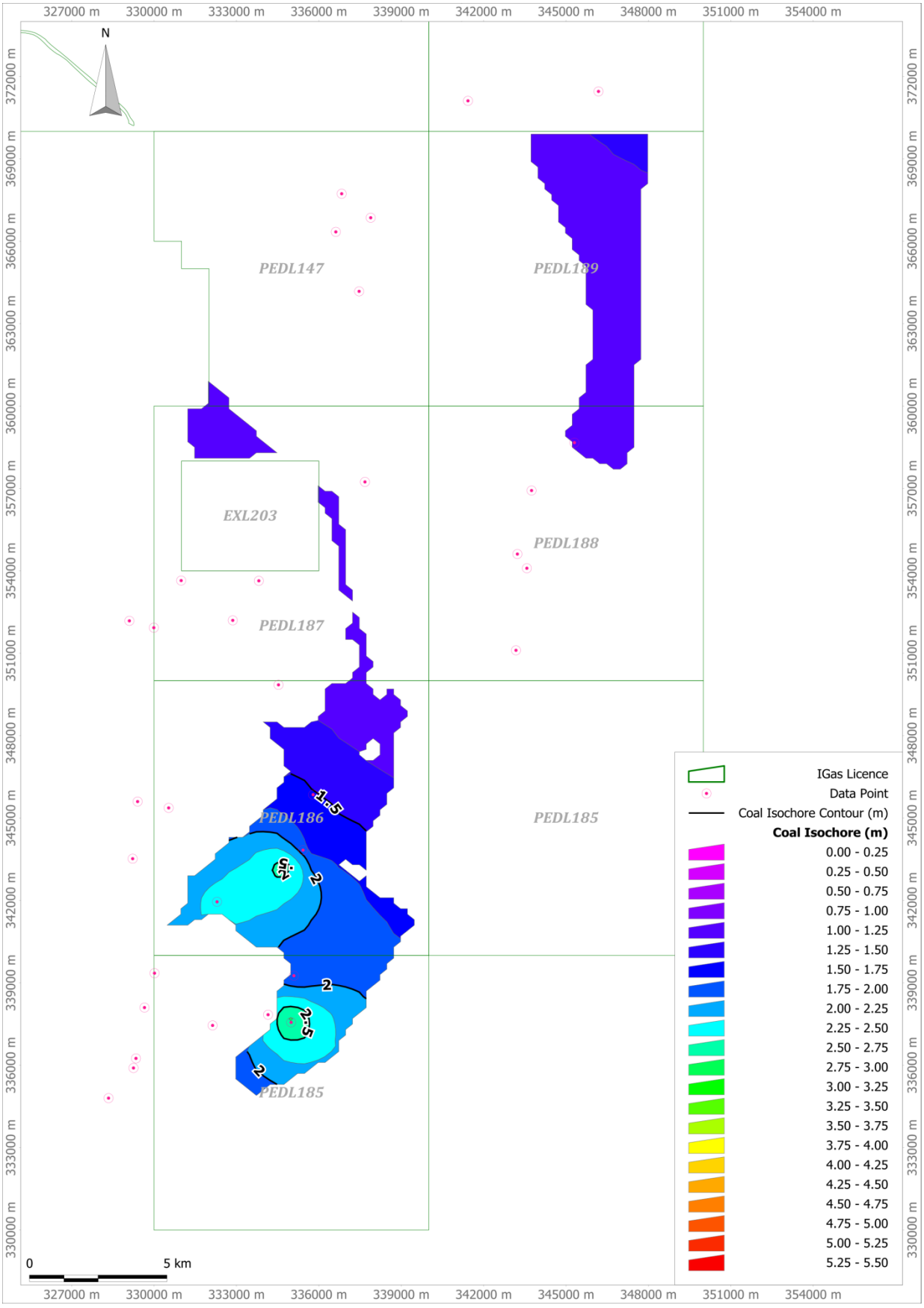
Upper Stinking Seam Net Thickness (m) - Clipped with Development Restrictions



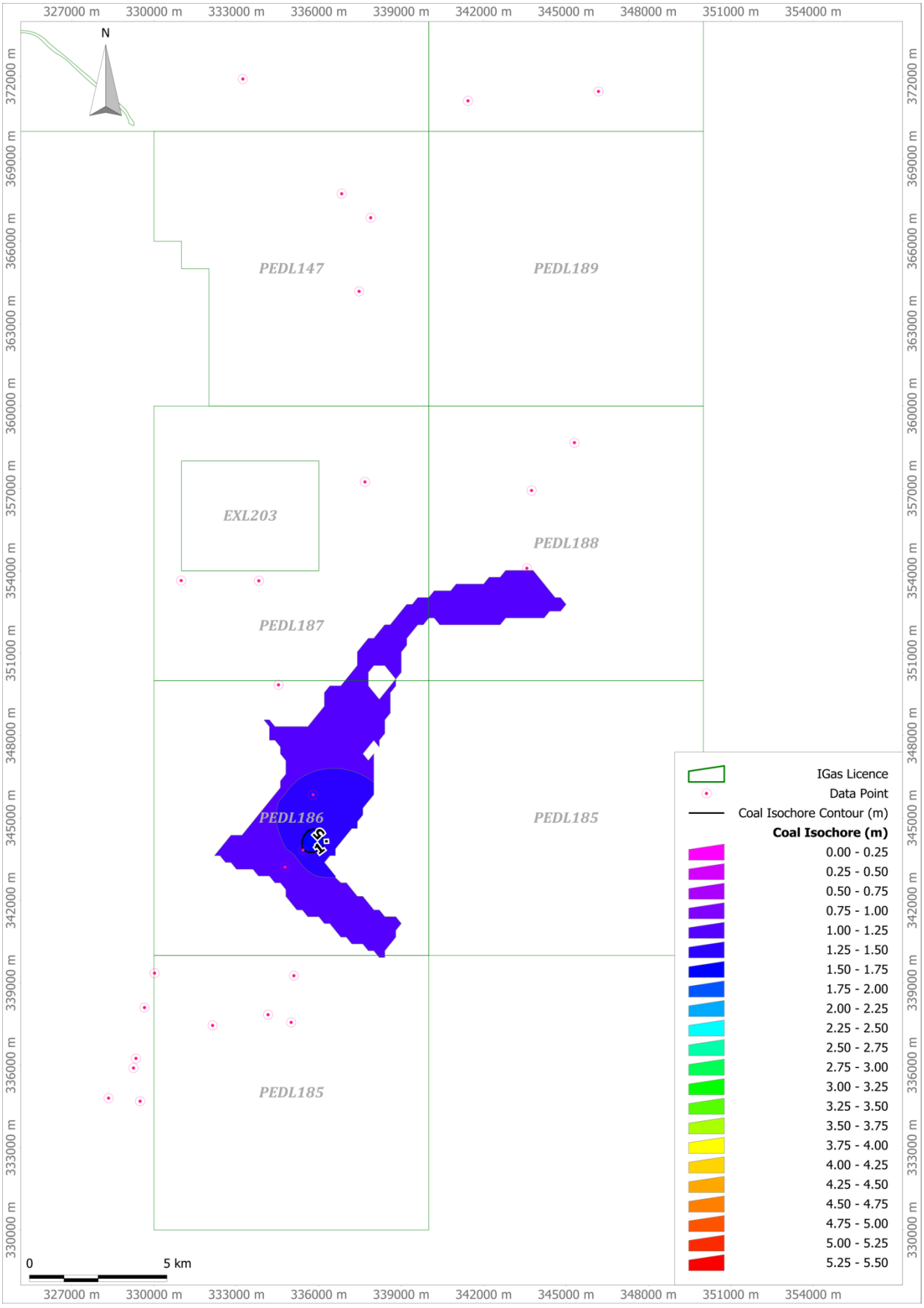
Lower Stinking Seam Net Thickness (m) - Clipped with Development Restrictions



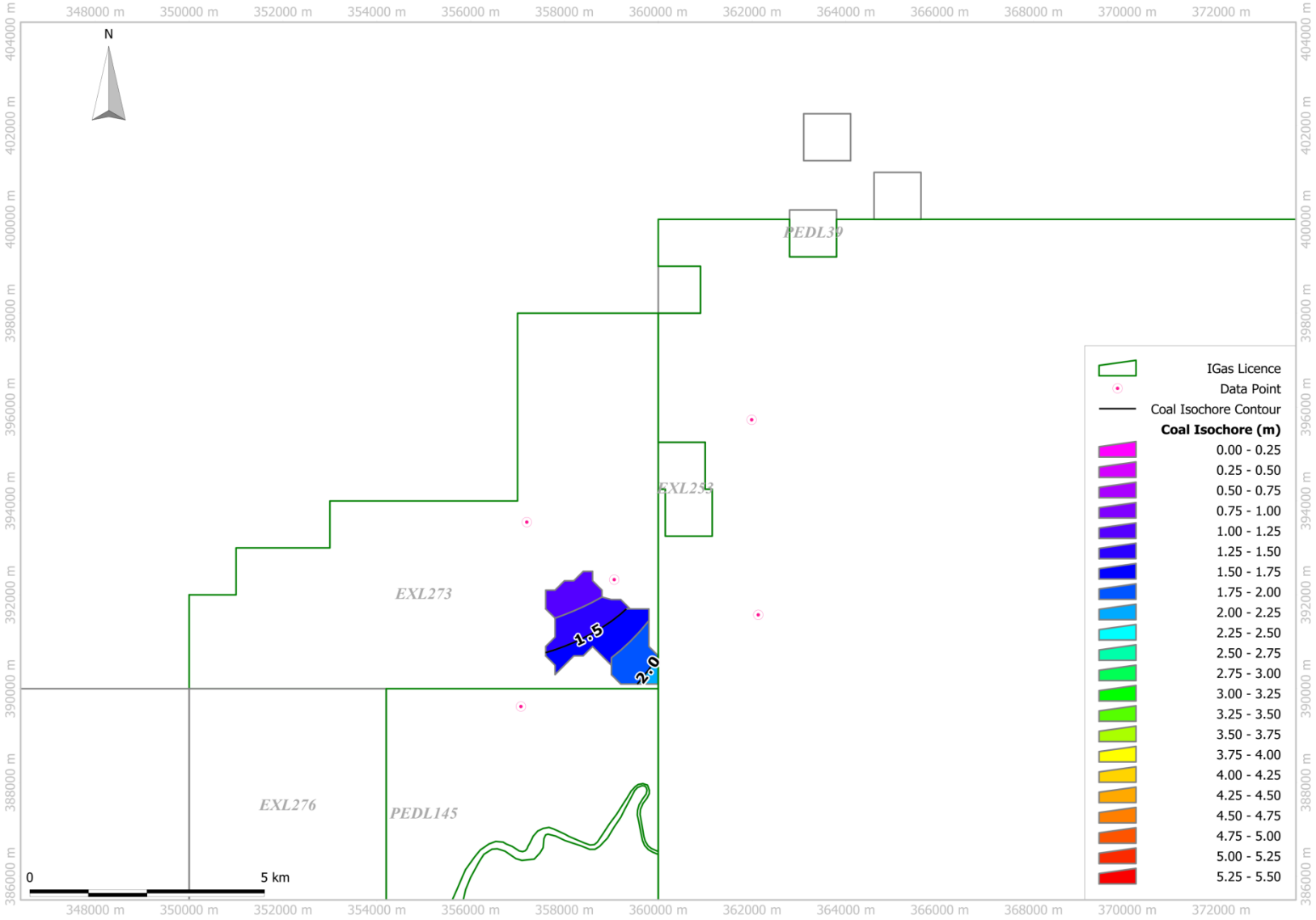
Powell Seam Net Thickness (m) - Clipped with Development Restrictions



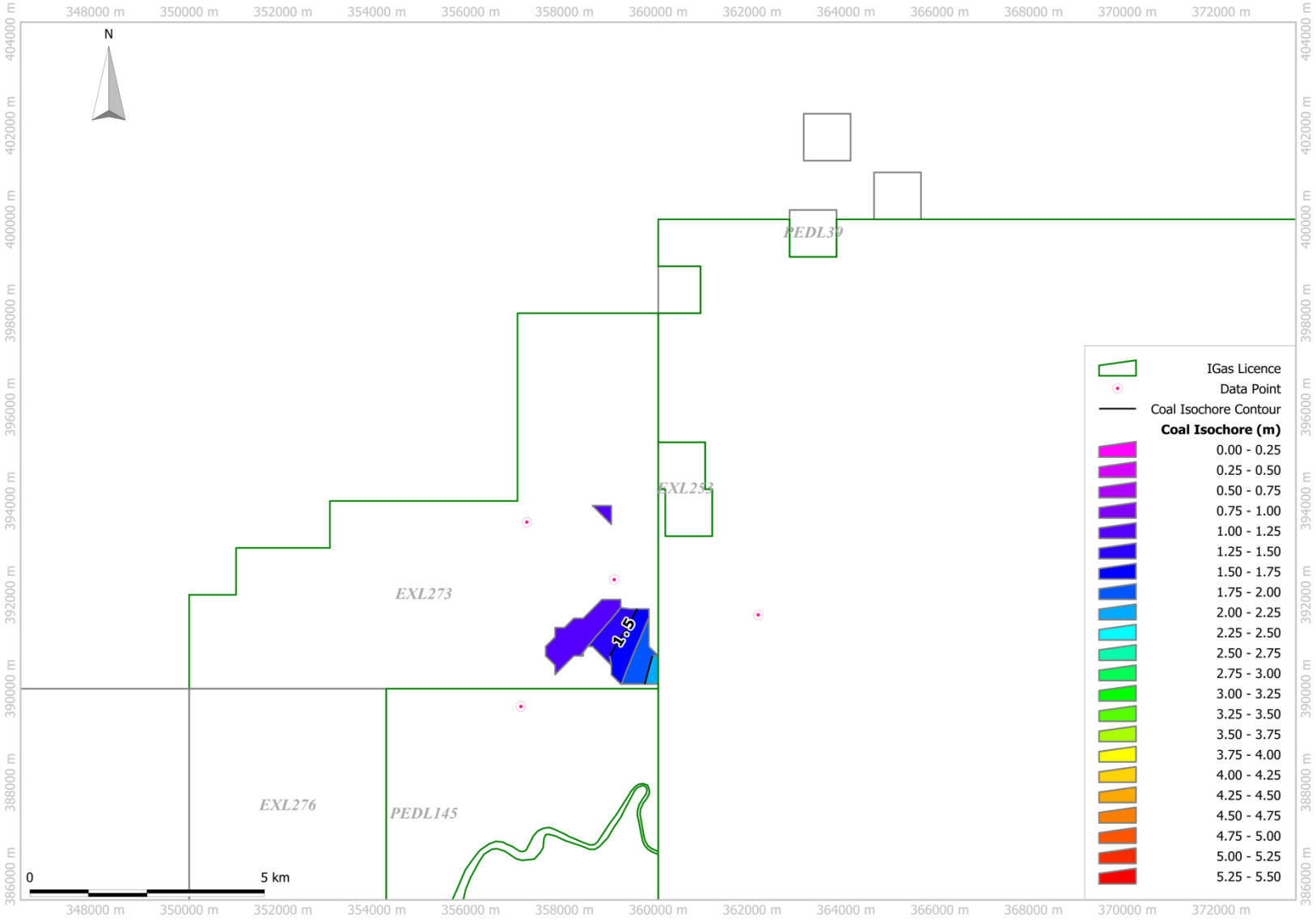
Brassy Seam Net Thickness (m) - Clipped with Development Restrictions



Lower Yard Seam Net Thickness (m) - Clipped with Development Restrictions

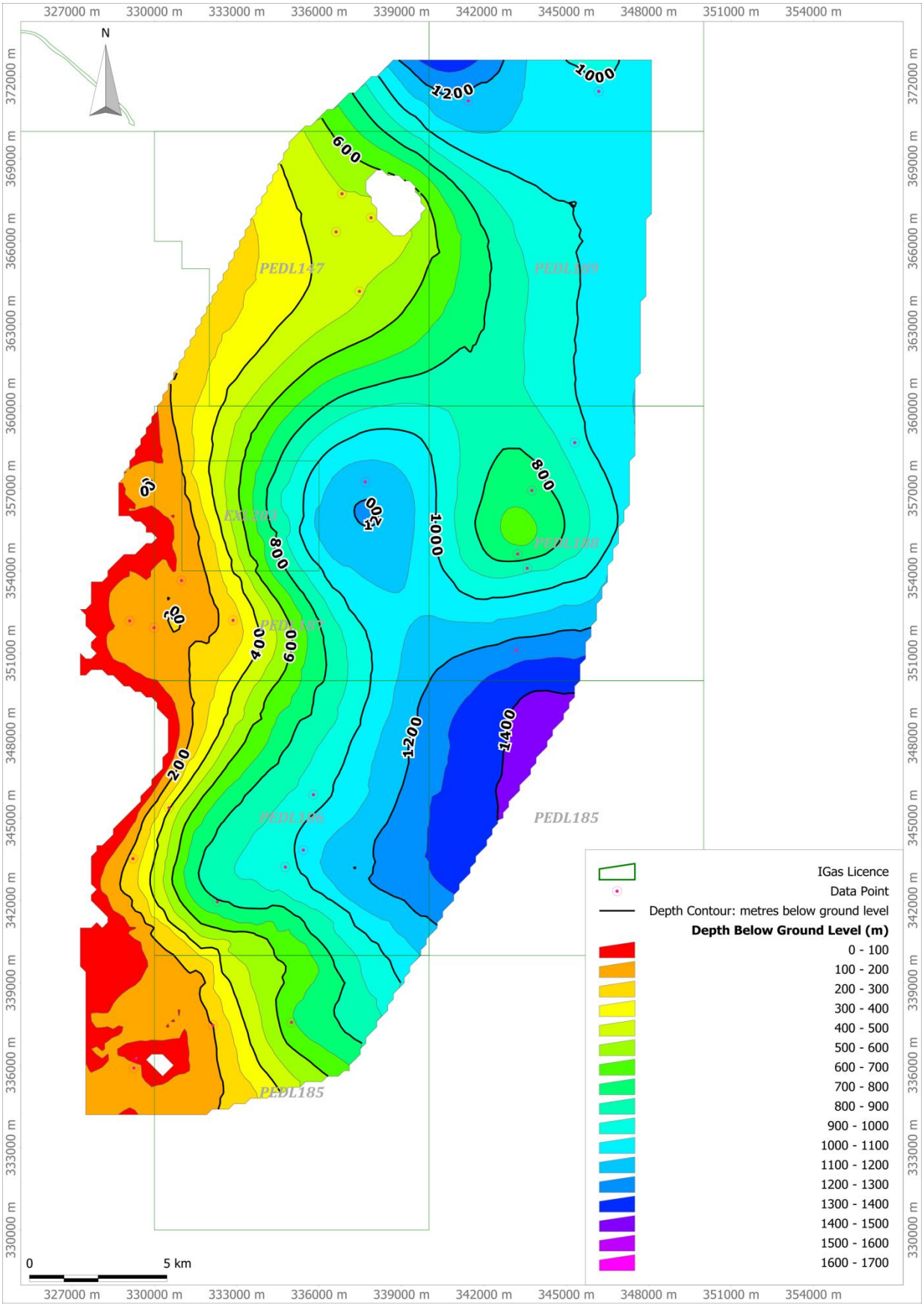


Ince Six Feet Seam Net Thickness (m) - Clipped with Development Restrictions

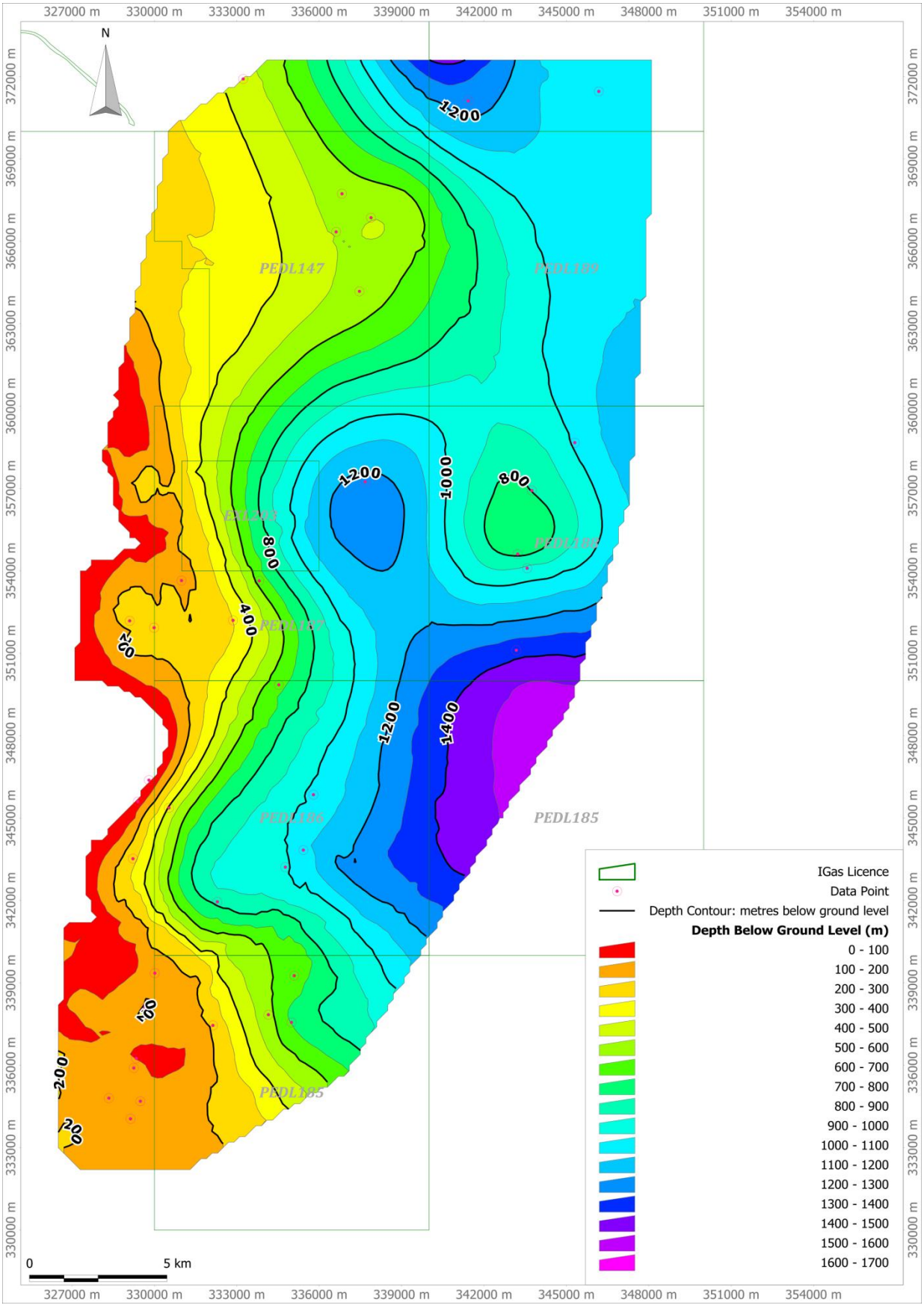


Peacock Seam Net Thickness (m) - Clipped with Development Restrictions

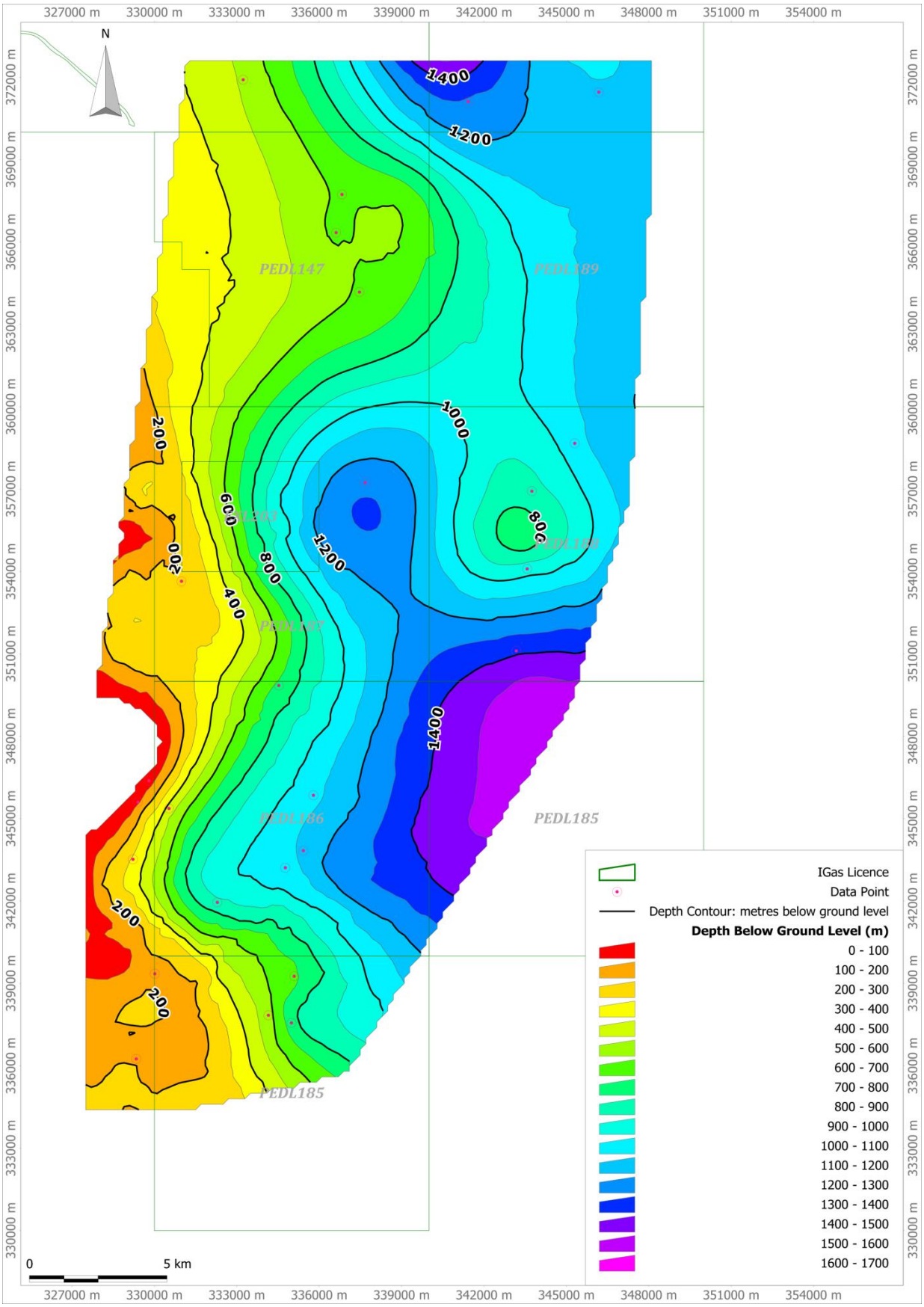
APPENDIX E. North West Seam Depth – Primary



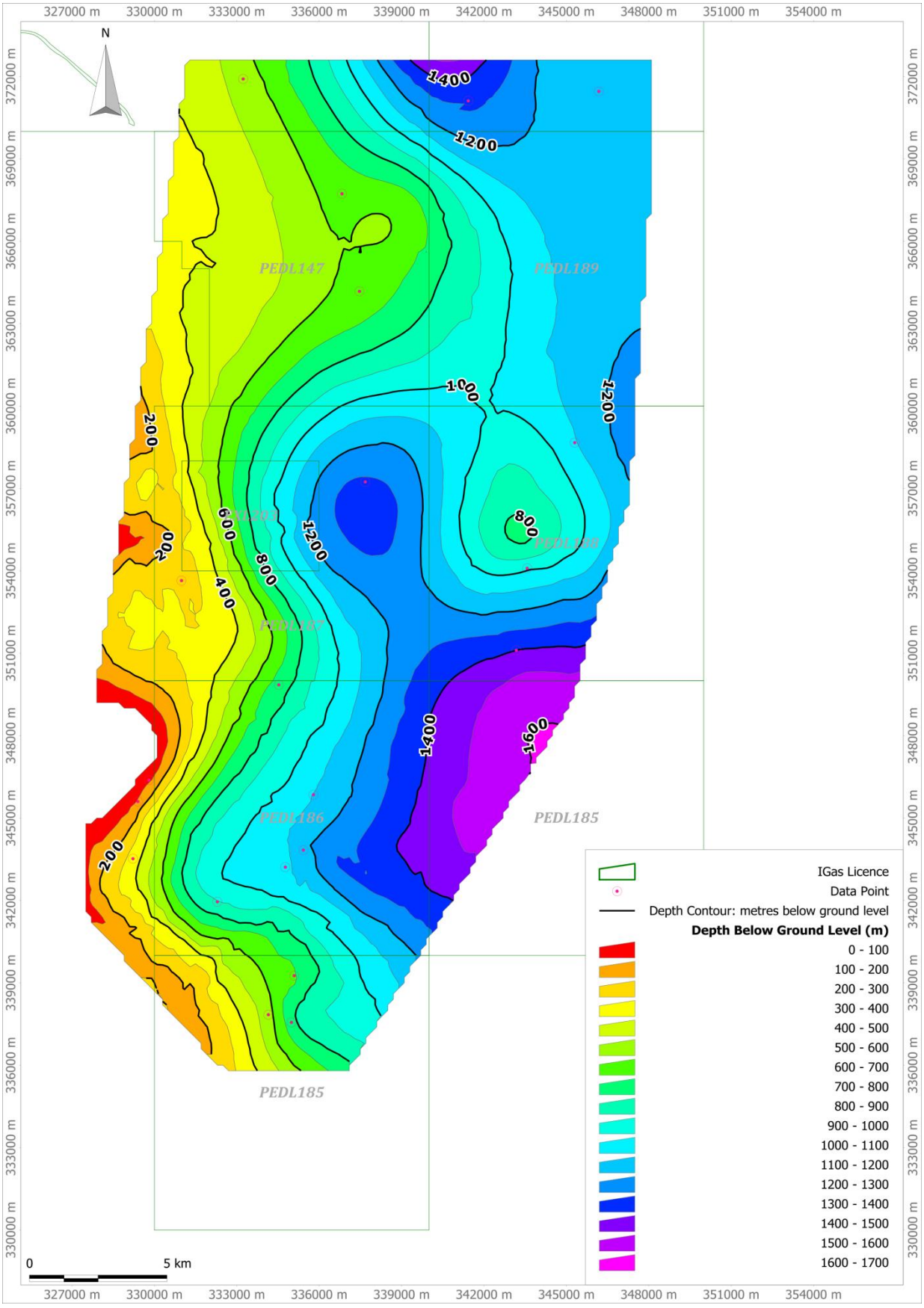
Two Yard Seam Depth (mBGL)



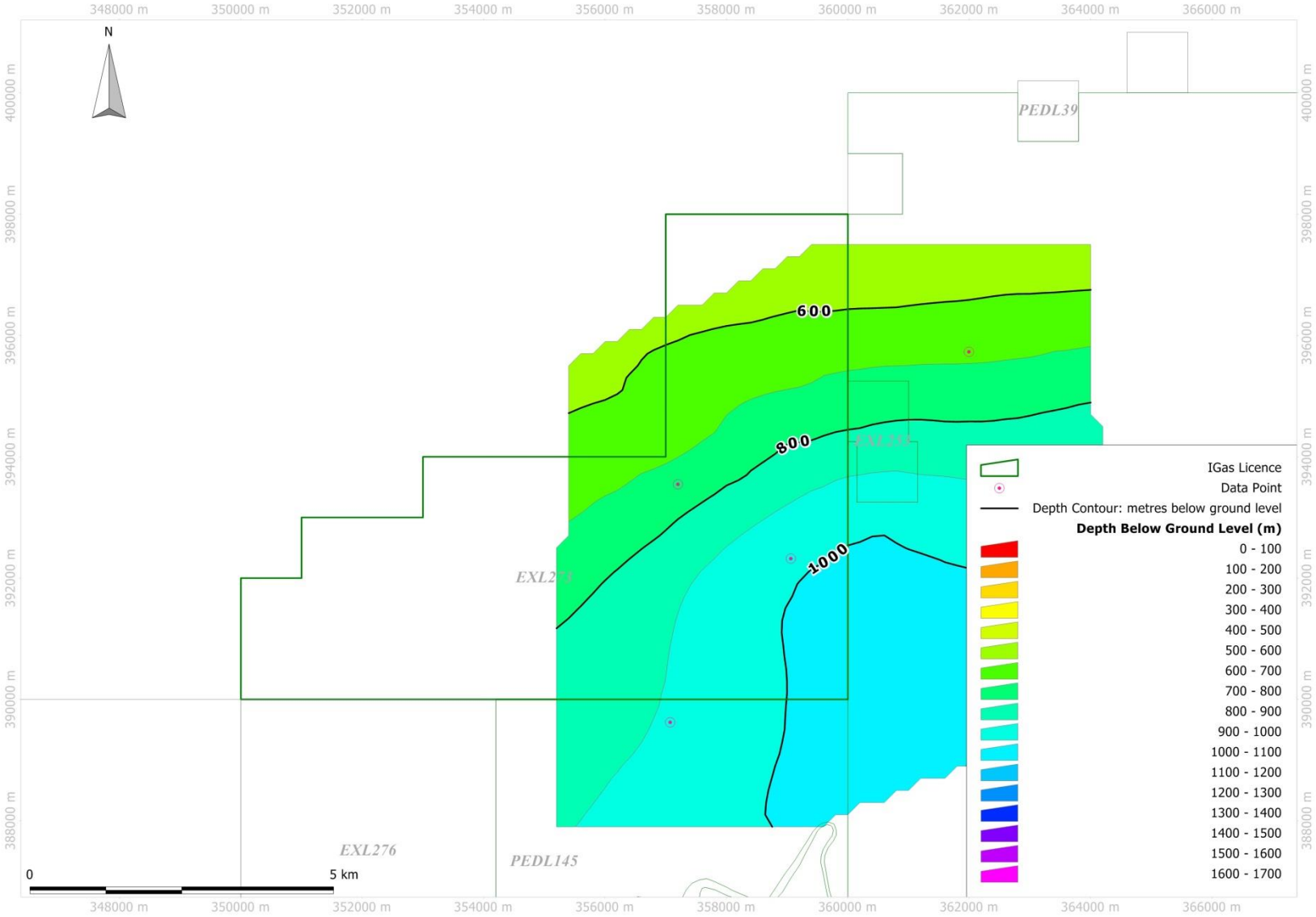
Main Seam Depth (mBGL)



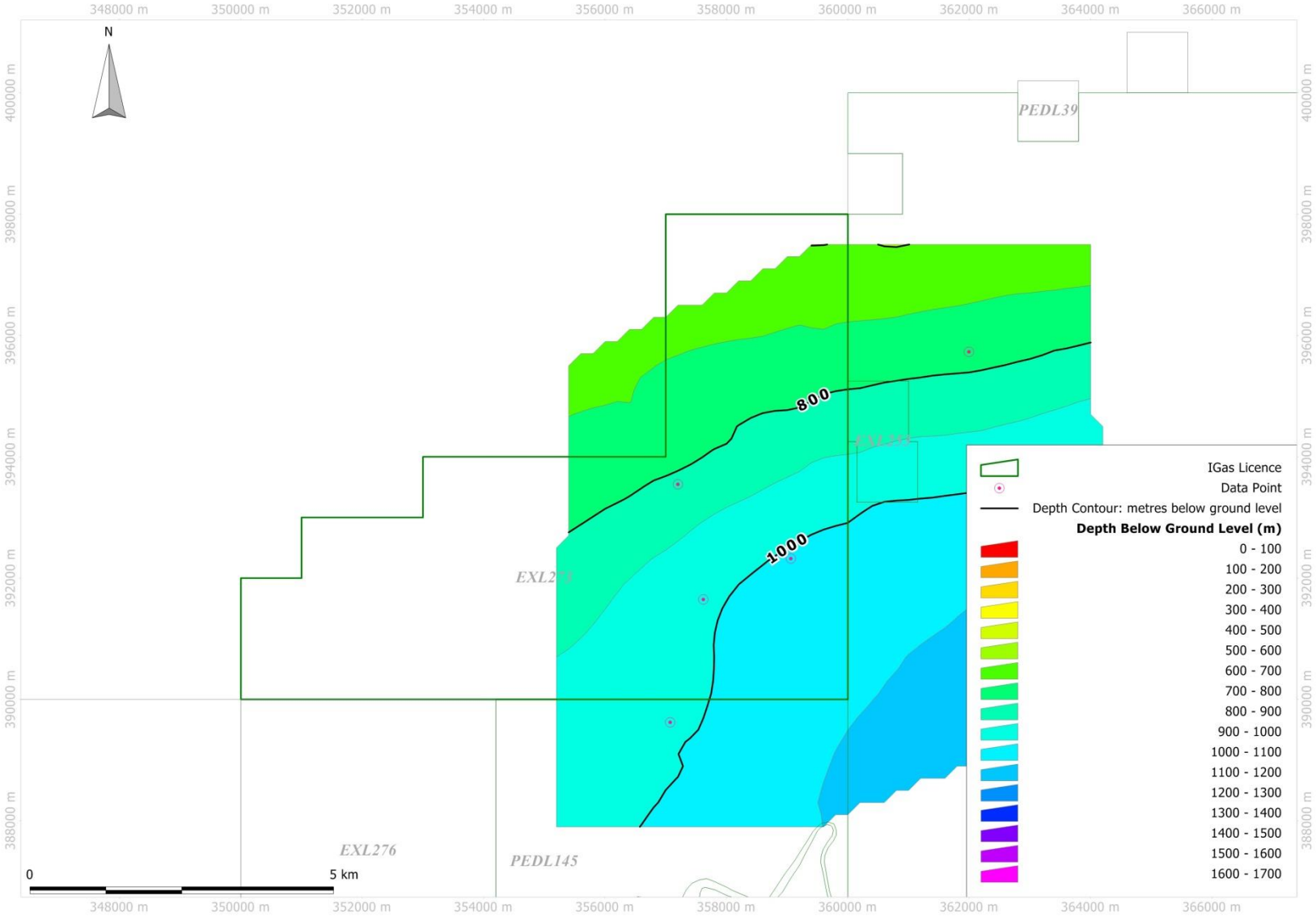
Fireclay Group Seam Depth (mBGL)



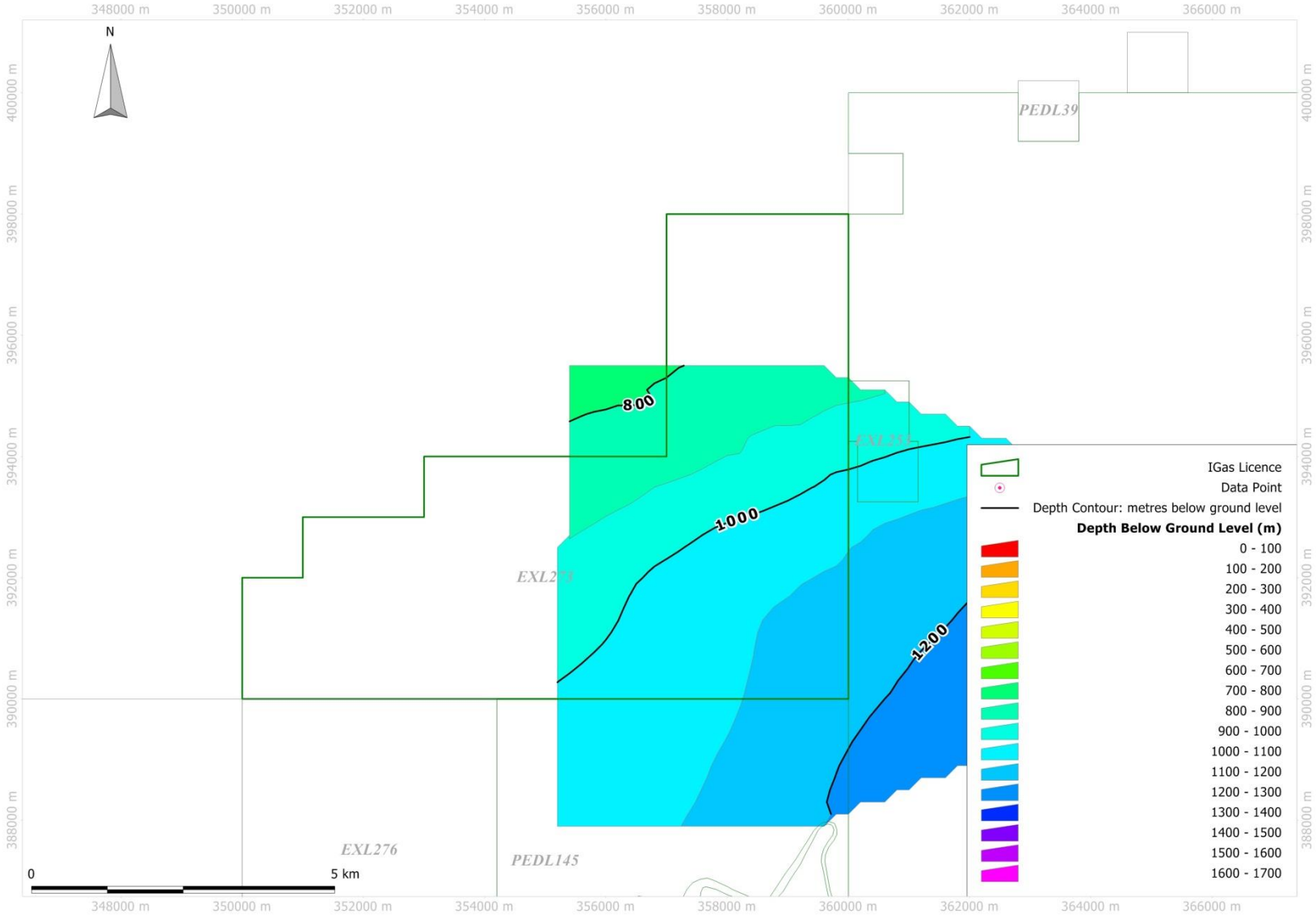
Nant Seam Depth (mBGL)



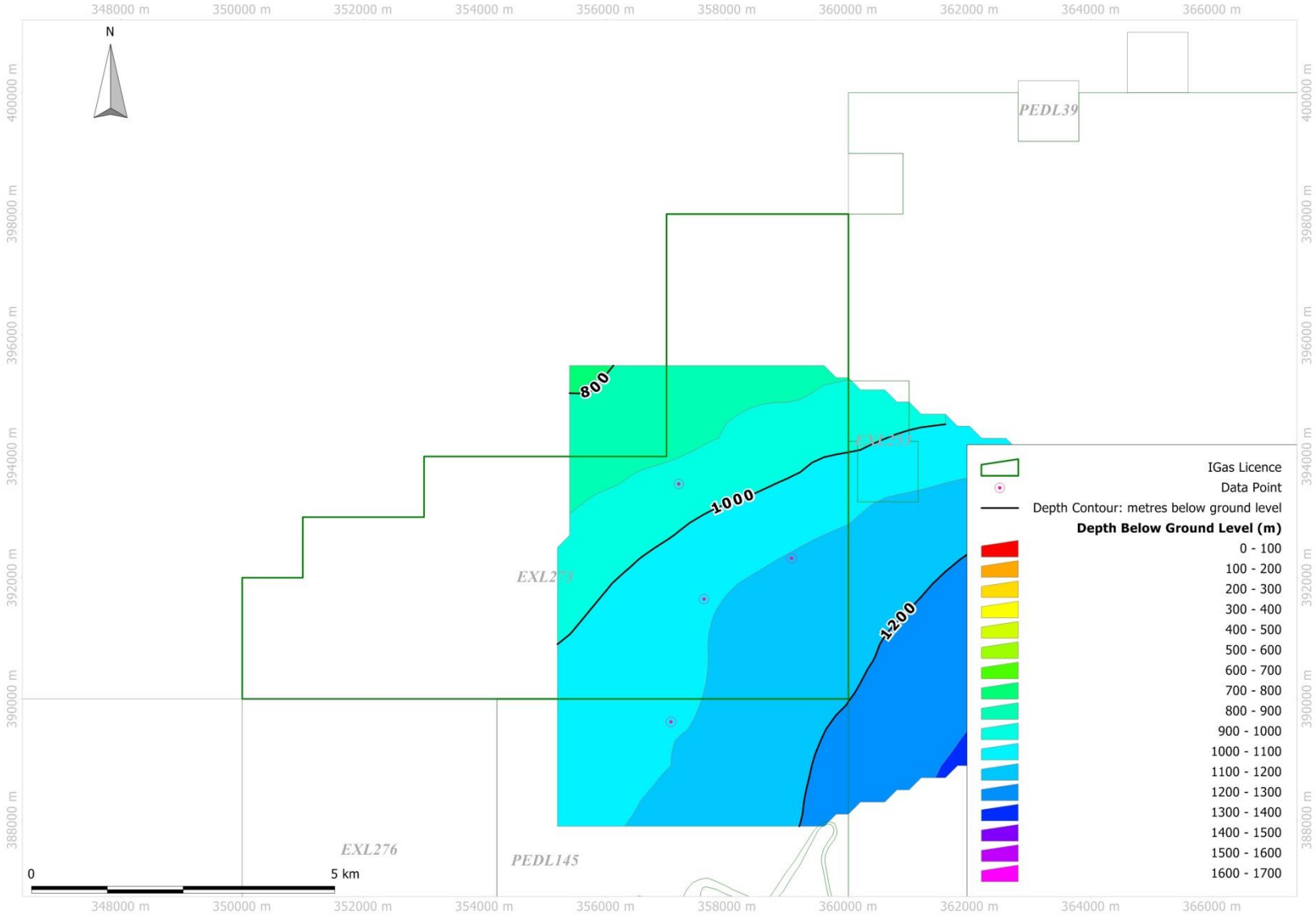
Crombouke Seam Depth (mBGL)



Lower Florida Seam Depth (mBGL)

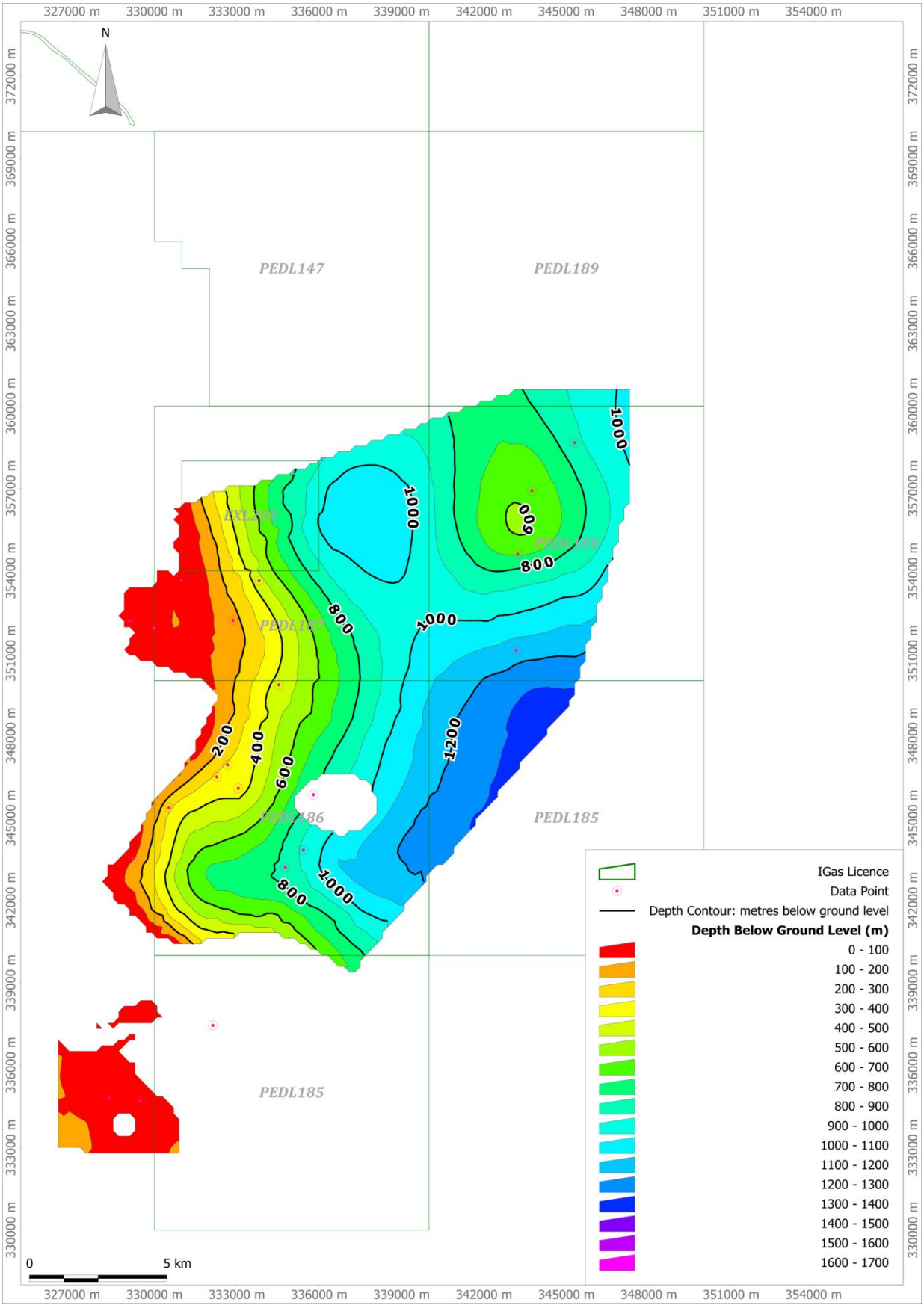


Wigan Four Feet Seam Depth (mBGL)

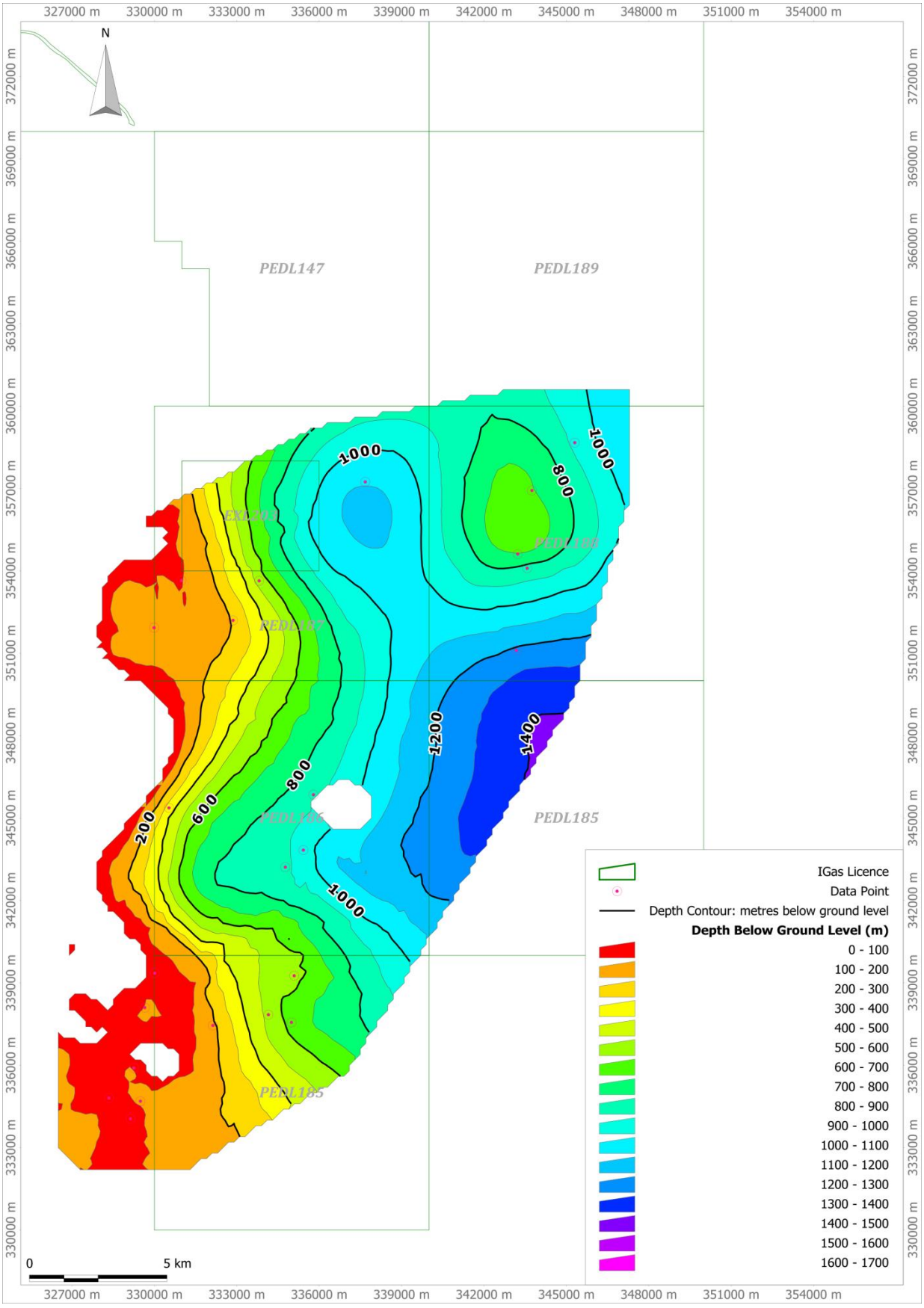


Trencherbone Seam Depth (mBGL)

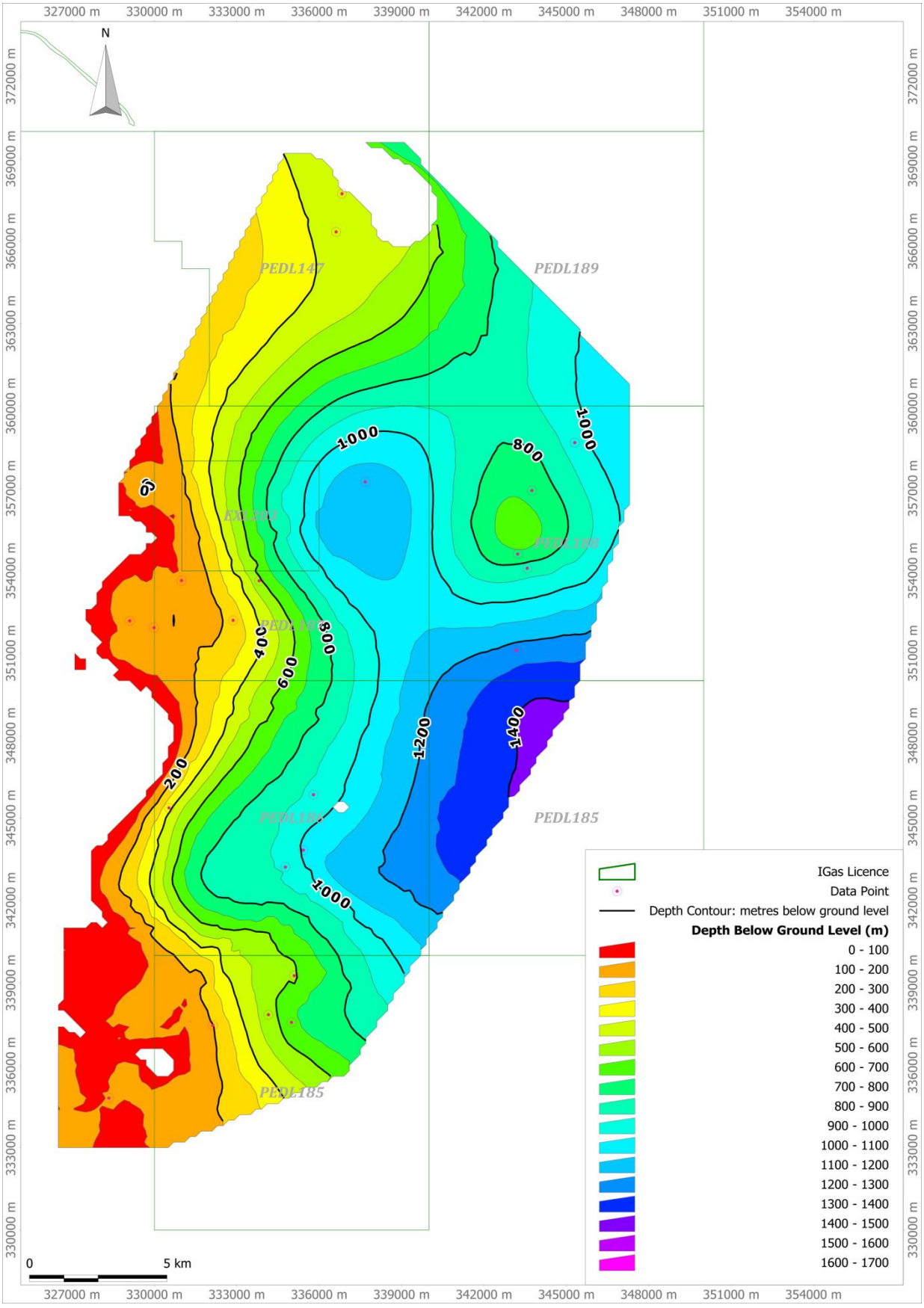
APPENDIX F. North West Seam Depth – Secondary



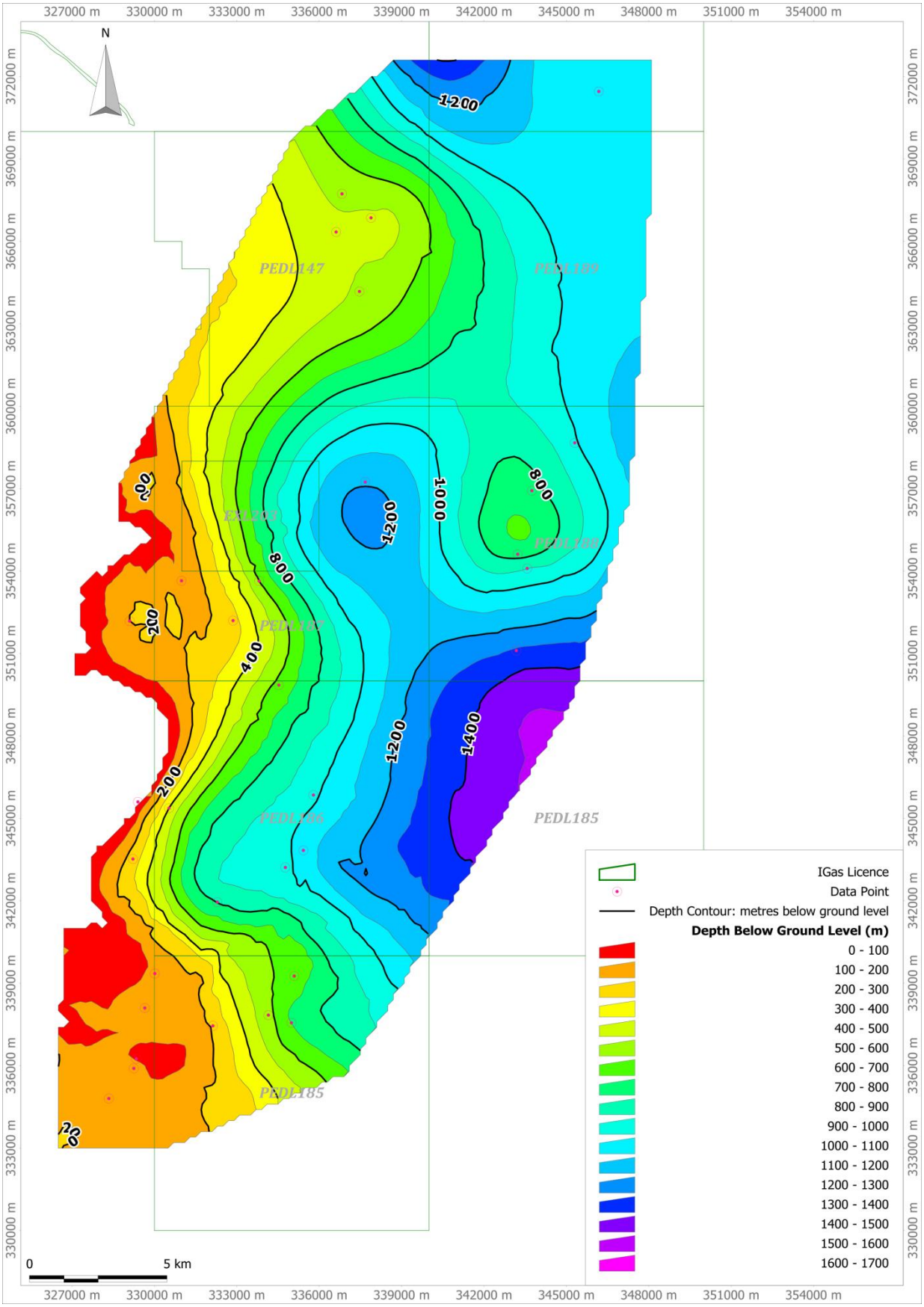
Upper Stinking Seam Depth (mBGL)



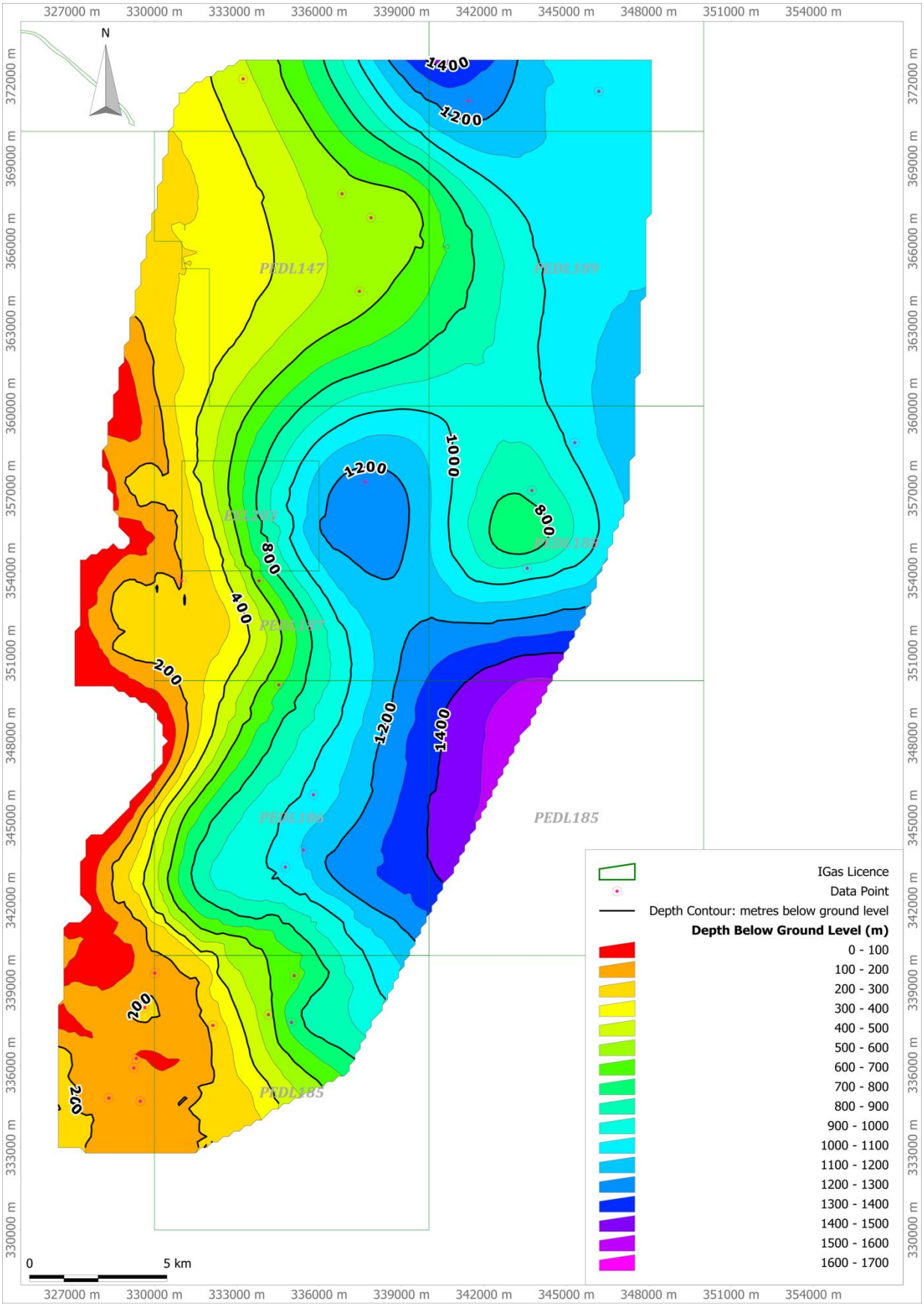
Lower Stinking Seam Depth (mBGL)



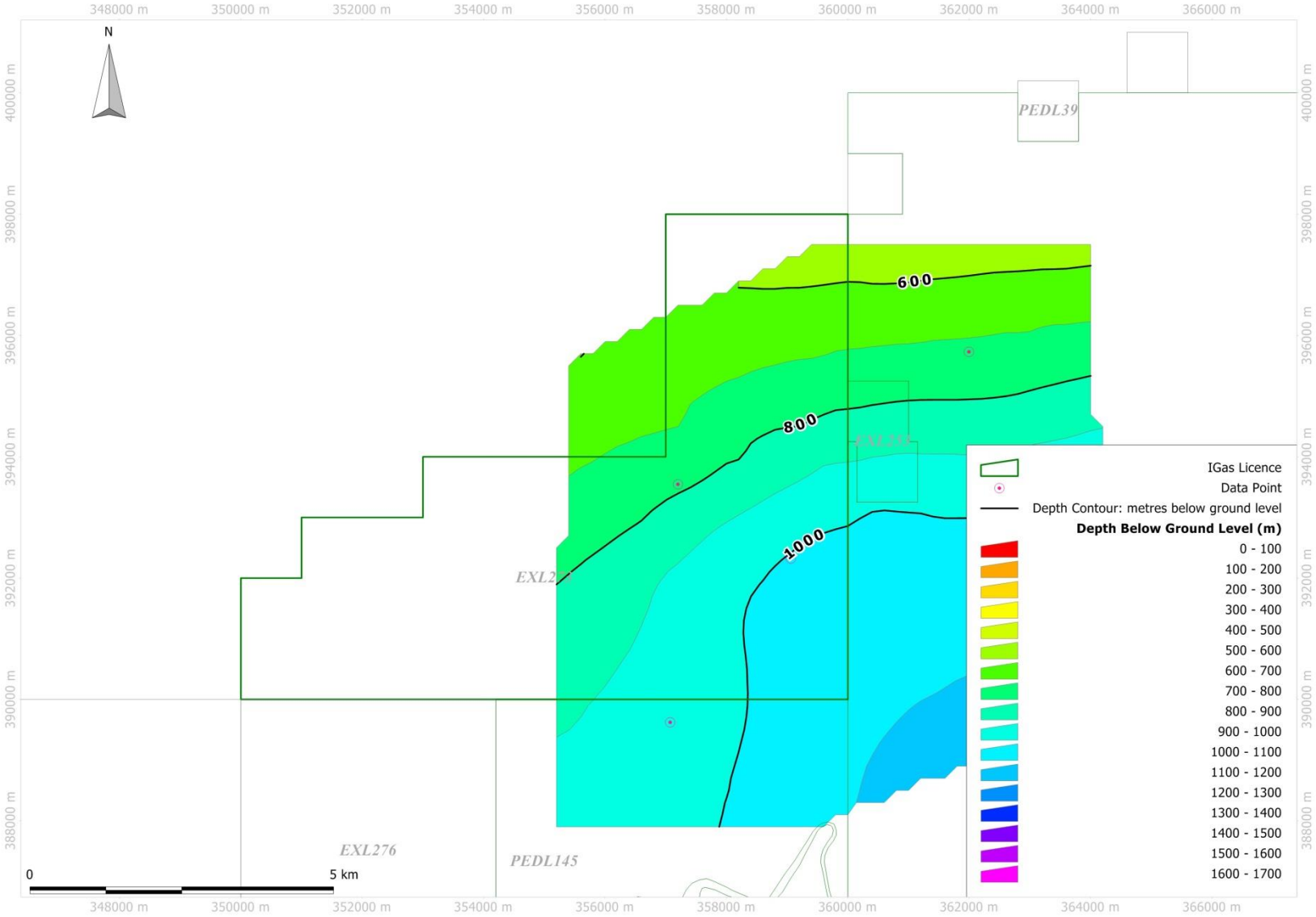
Powell Seam Depth (mBGL)



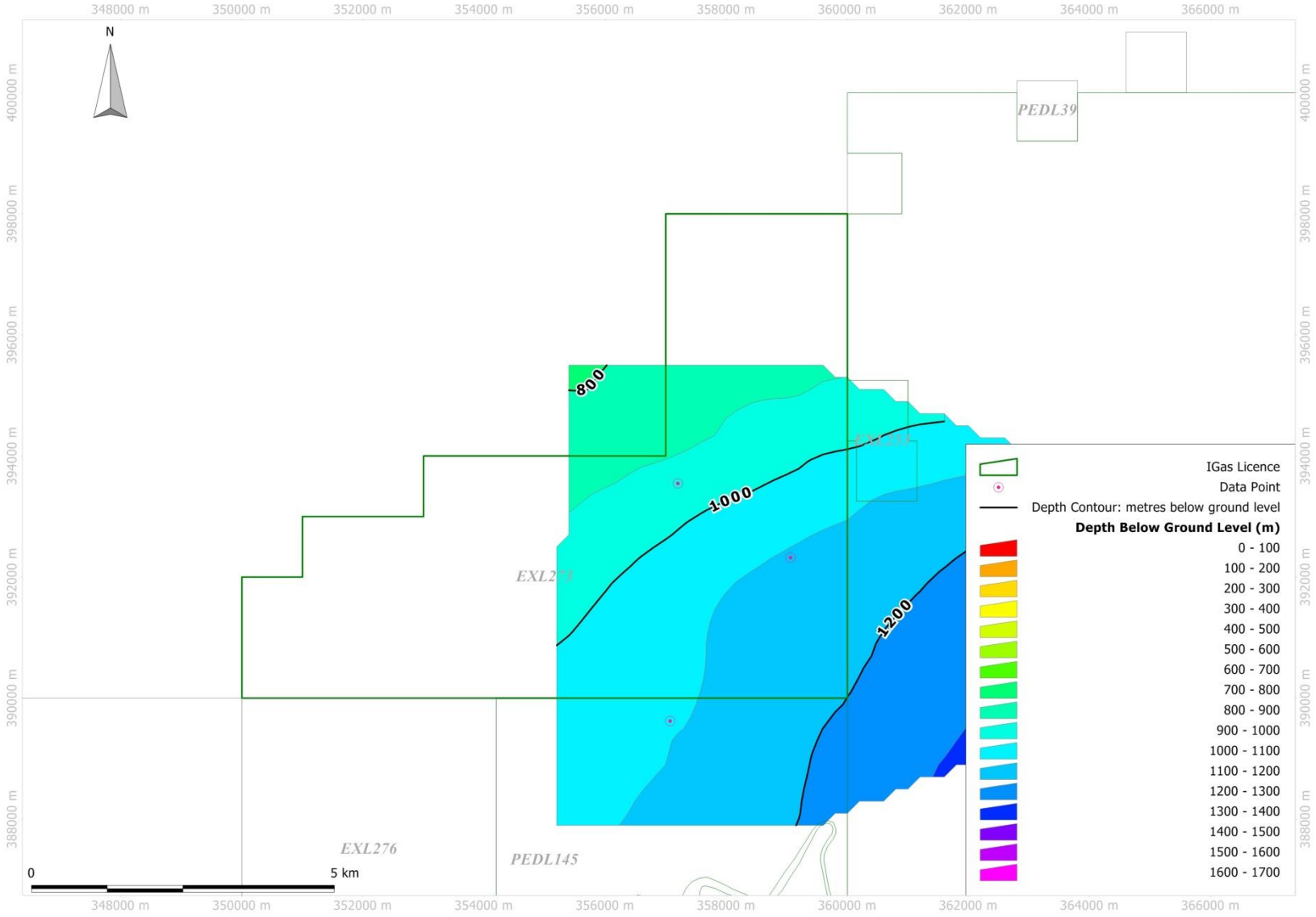
Brassy Seam Depth (mBGL)



Lower Yard Seam Depth (mBGL)

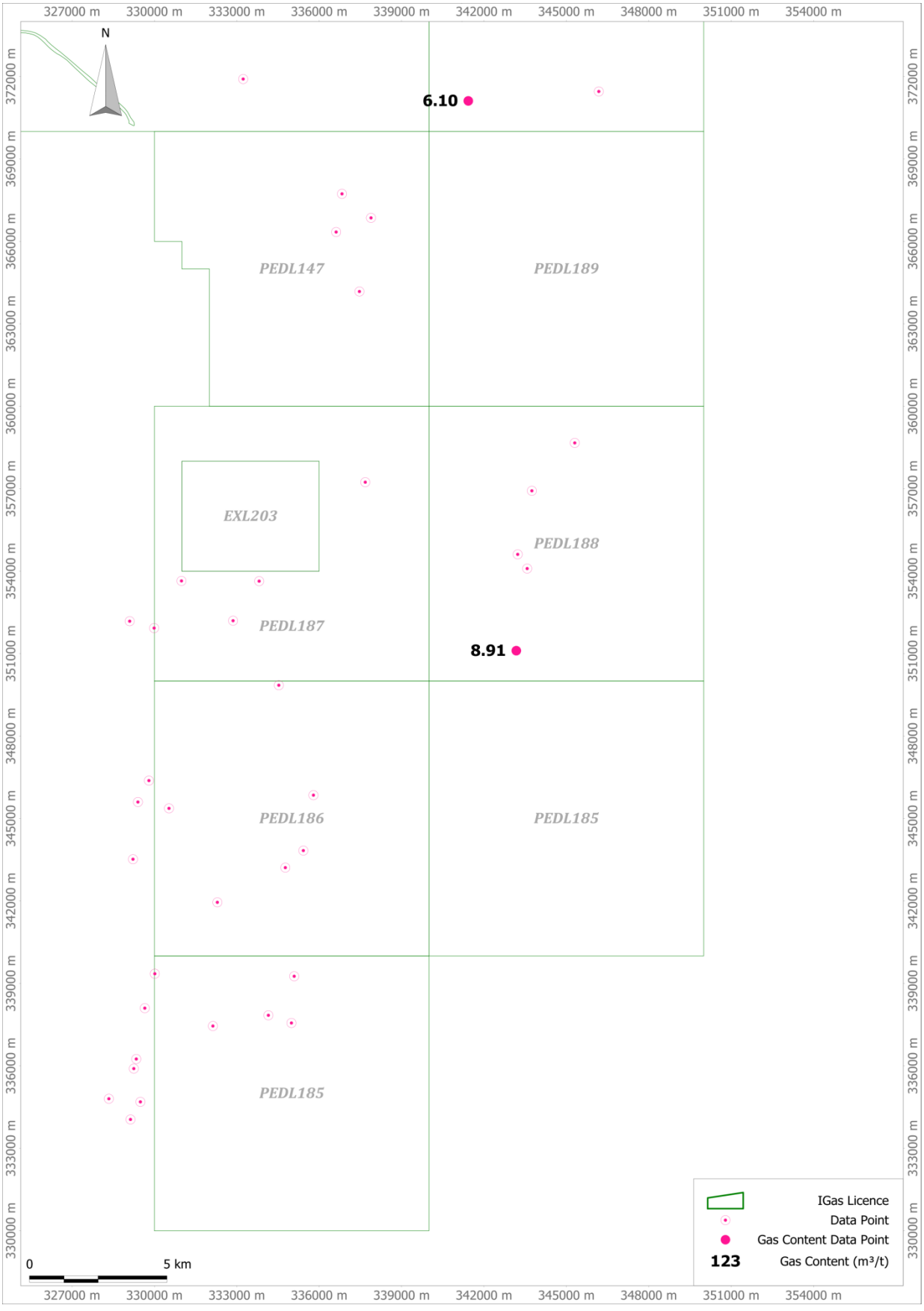


Ince Six Feet Seam Depth (mBGL)

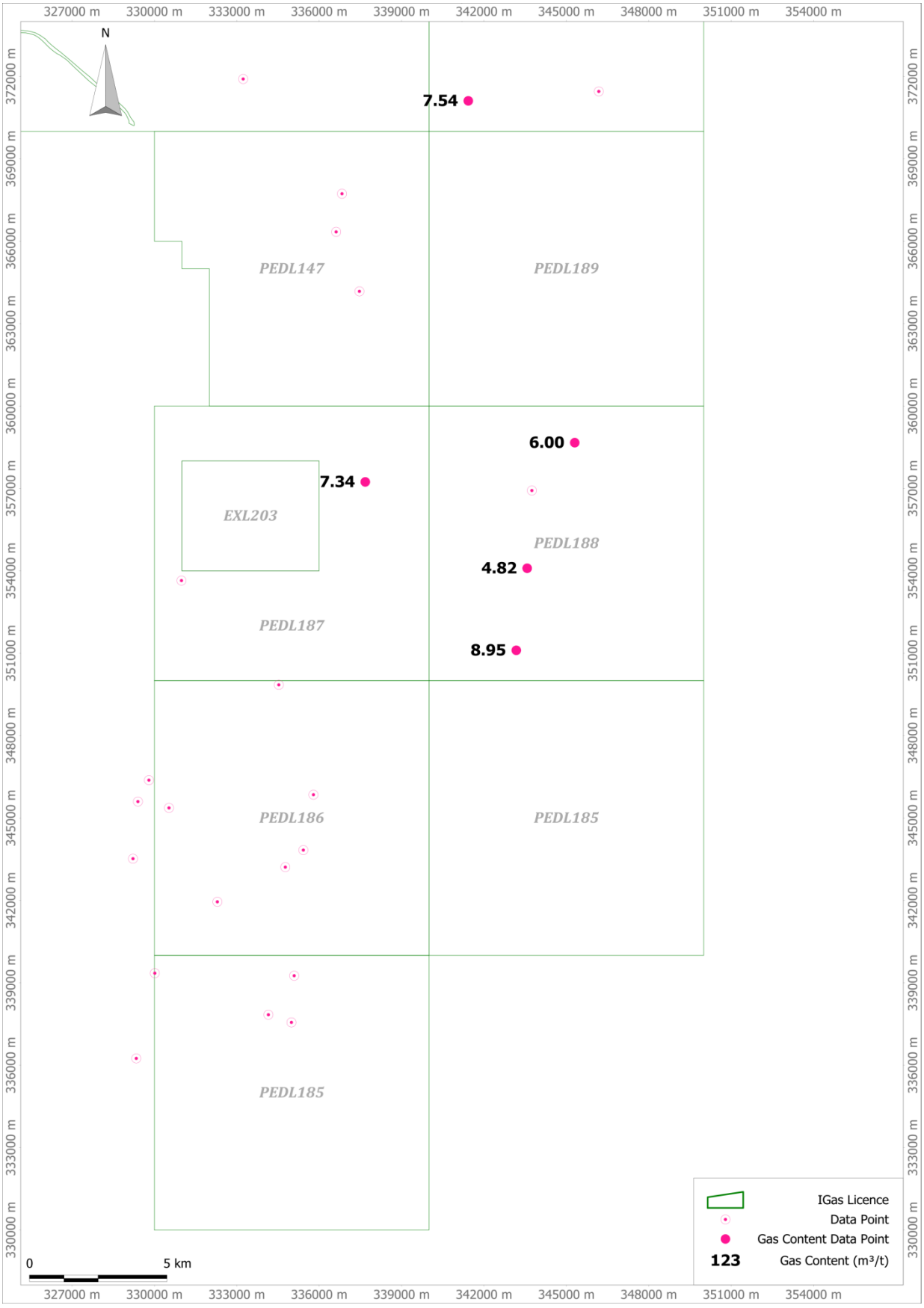


Peacock Seam Depth (mBGL)

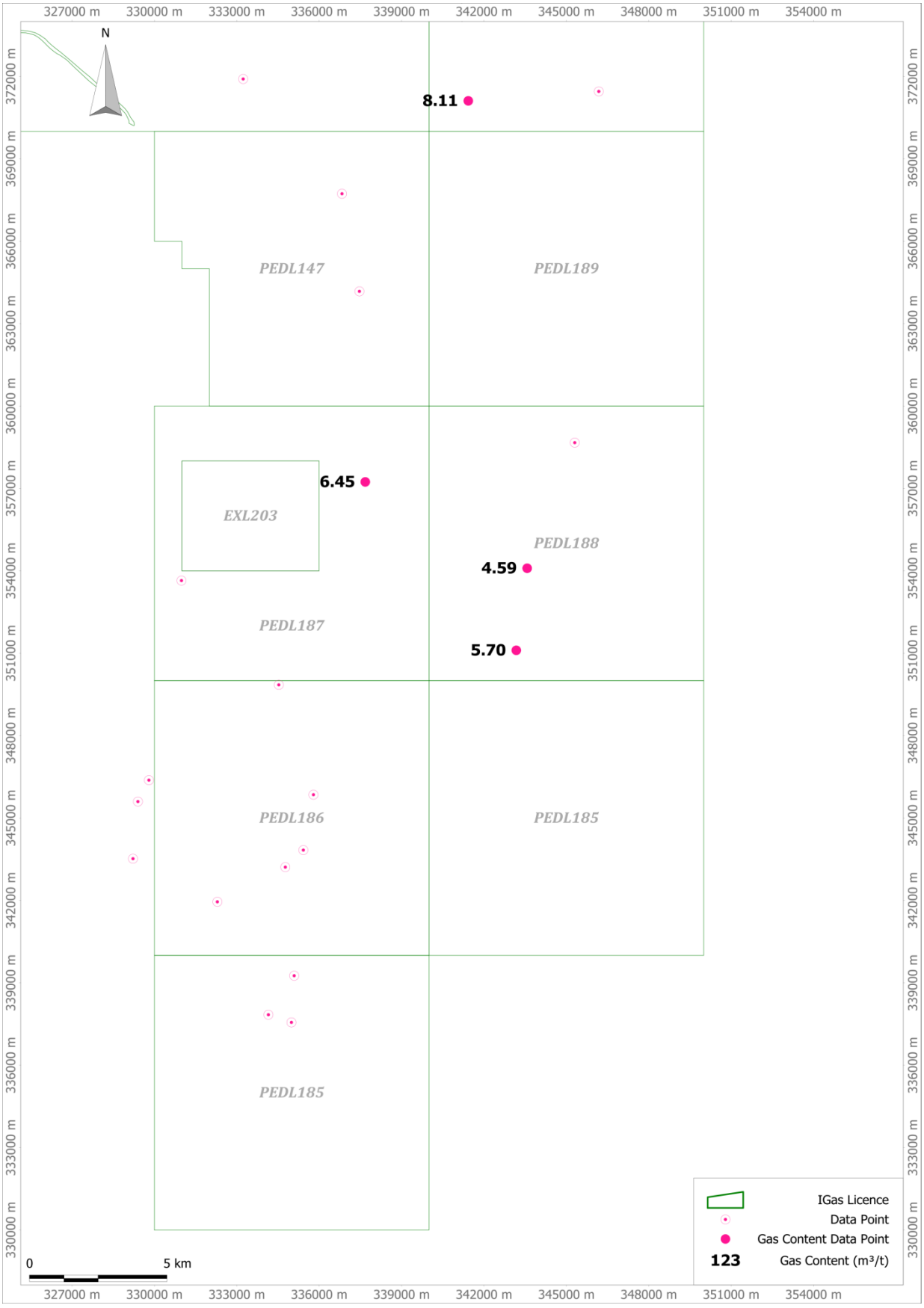
APPENDIX G. North West Seam Gas Content – Primary



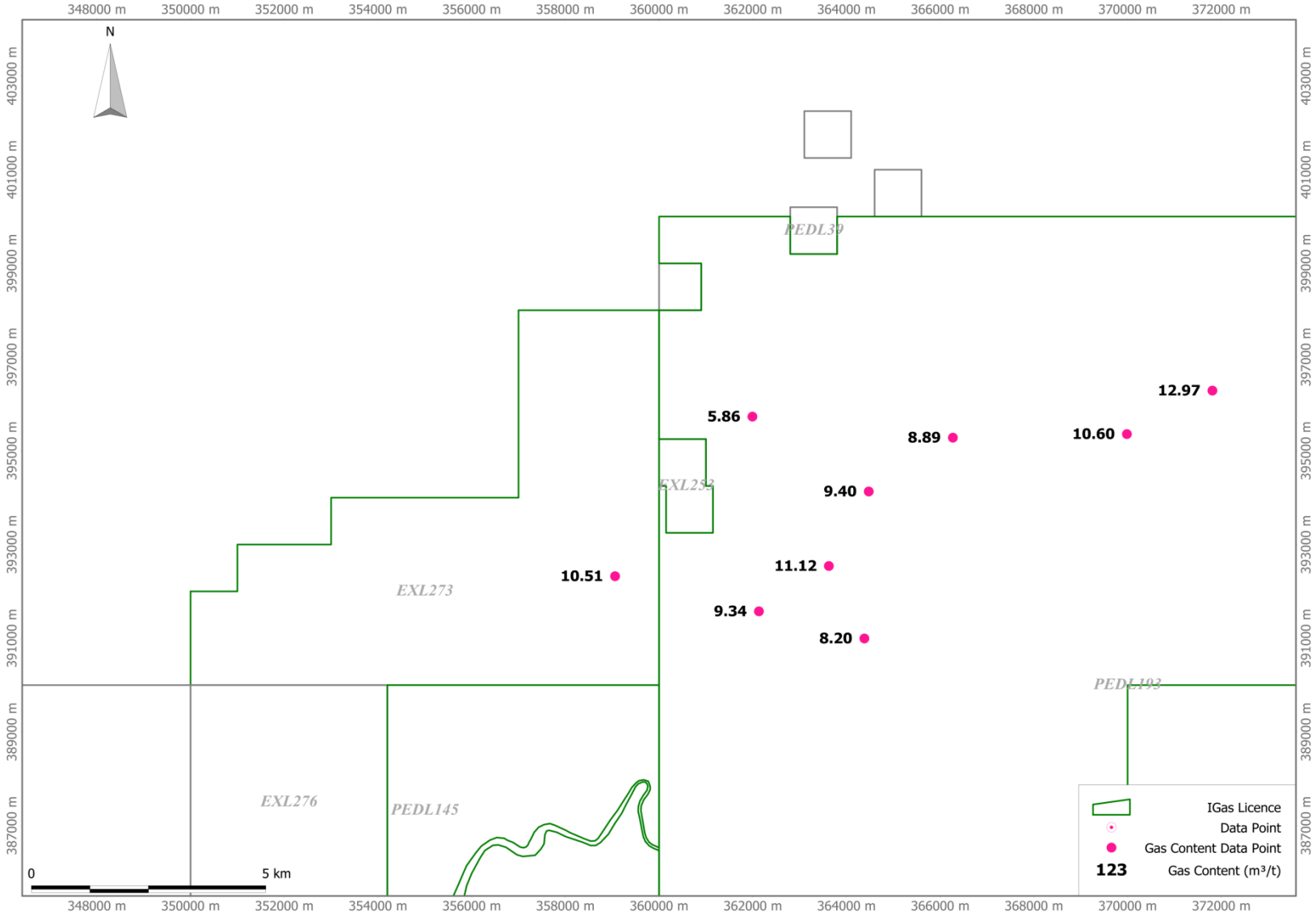
Main Seam Gas Content (m^3/t)



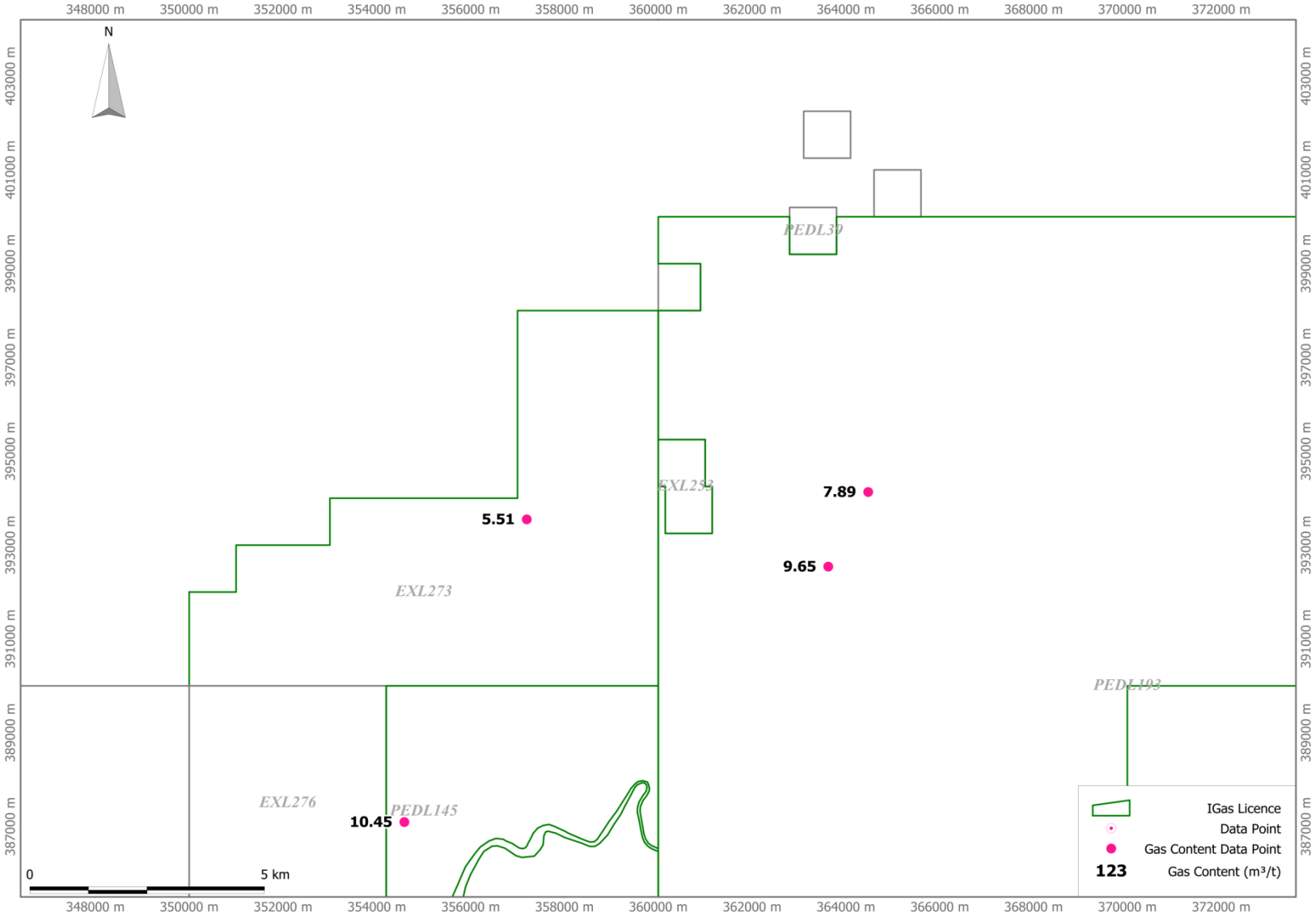
Fireclay Group Seam Gas Content (m^3/t)



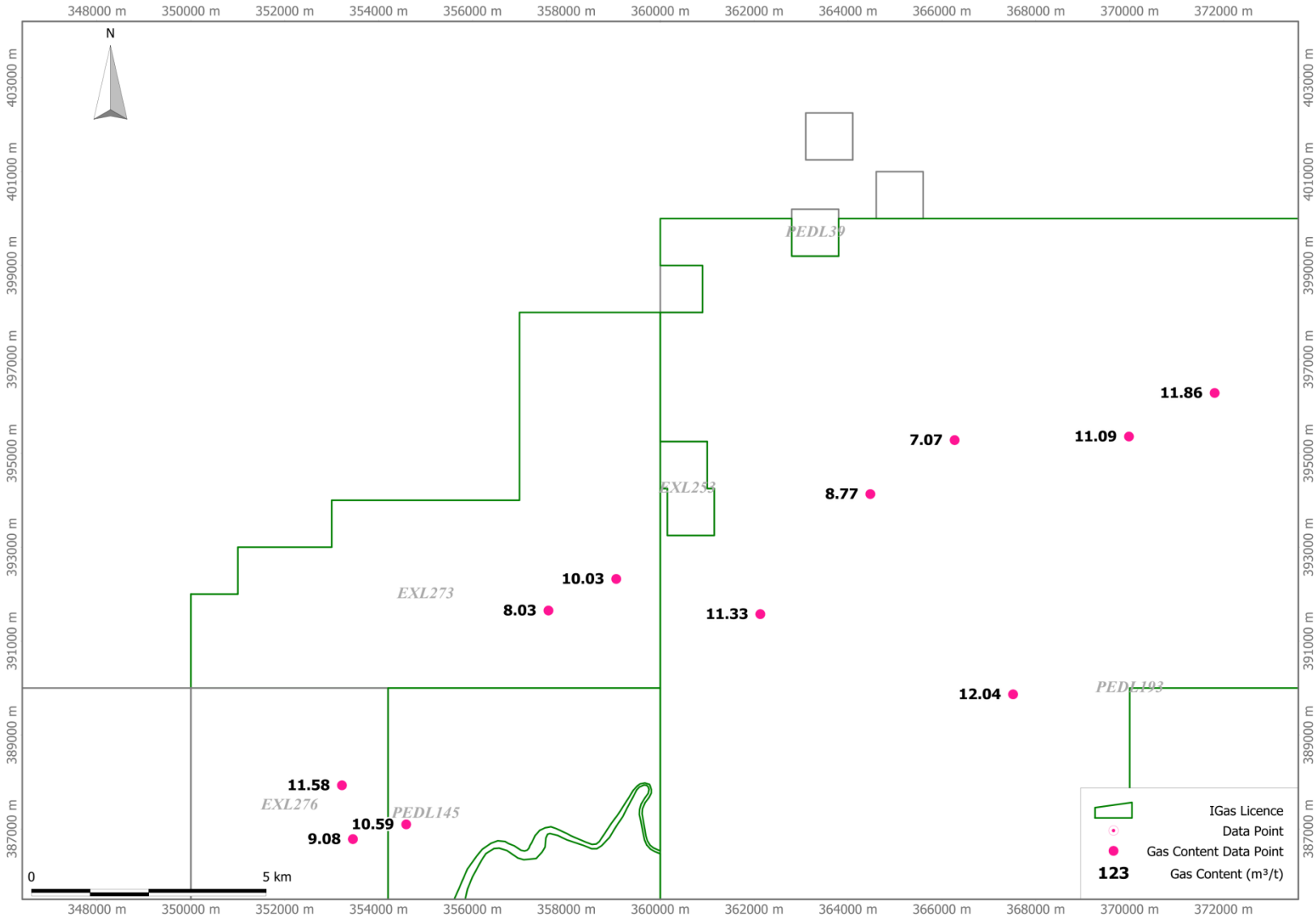
Nant Seam Gas Content (m^3/t)



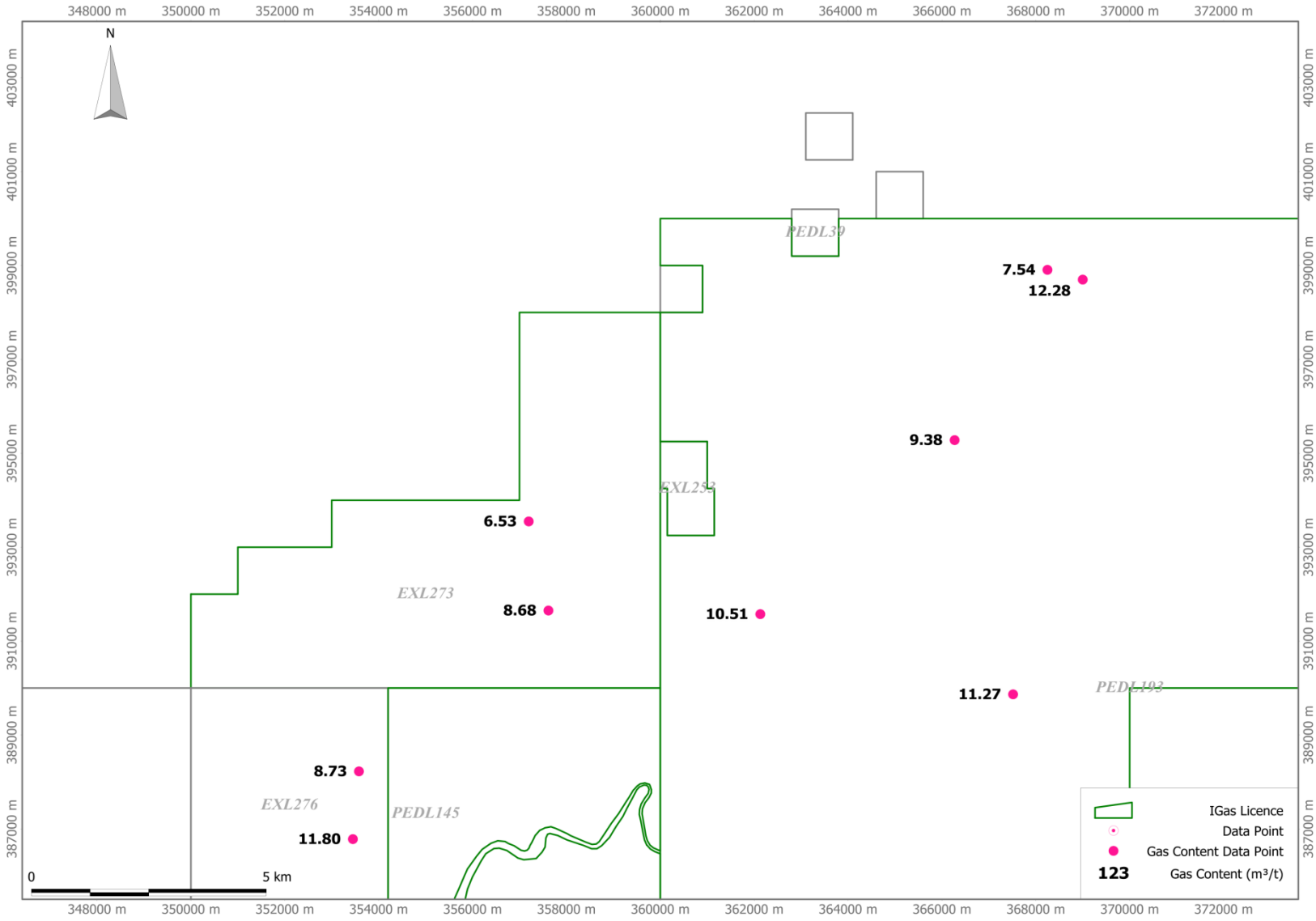
Crombouke Seam Gas Content (m^3/t)



Lower Florida Seam Gas Content (m^3/t)

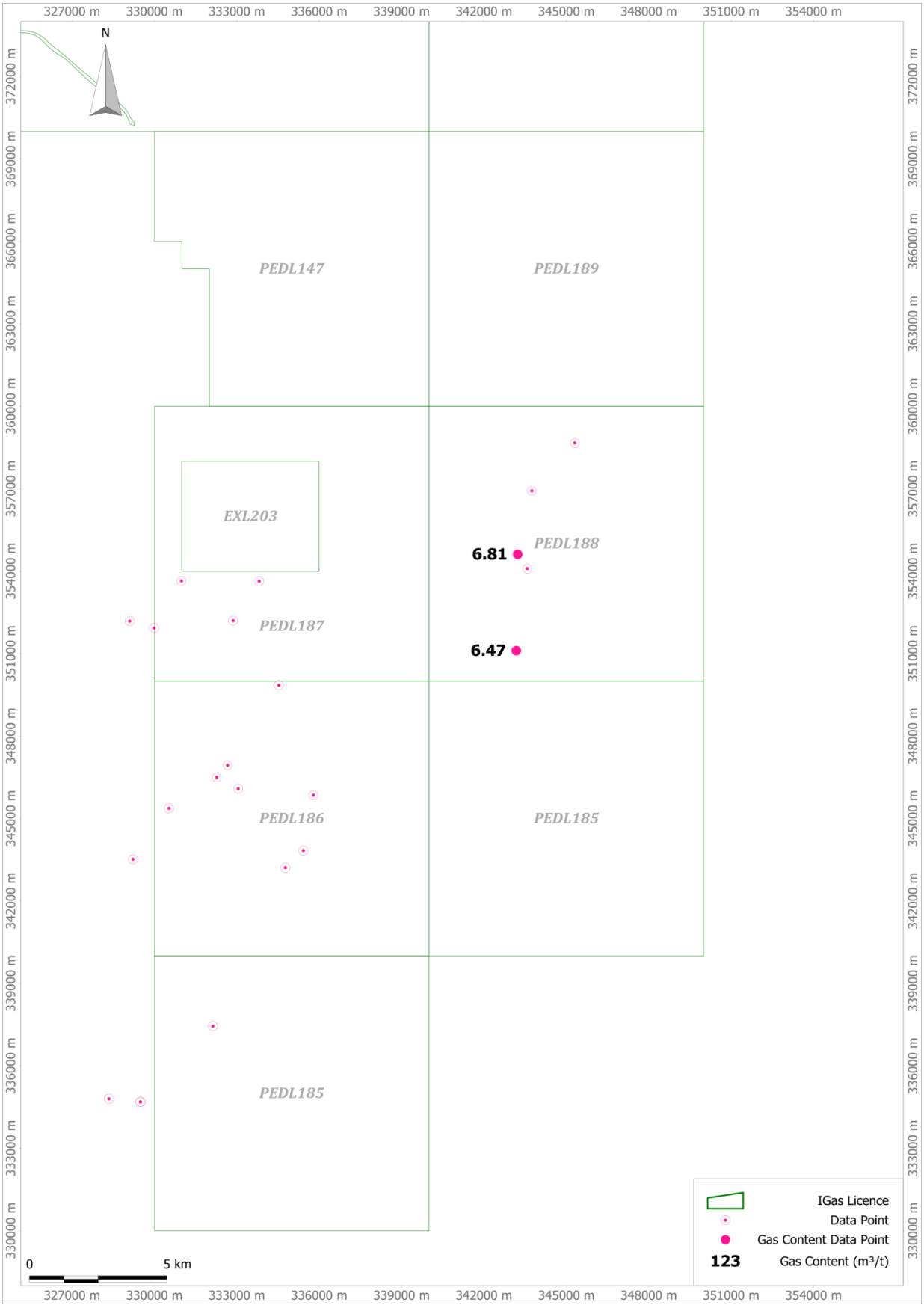


Wigan Four Feet Seam Gas Content (m³/t)

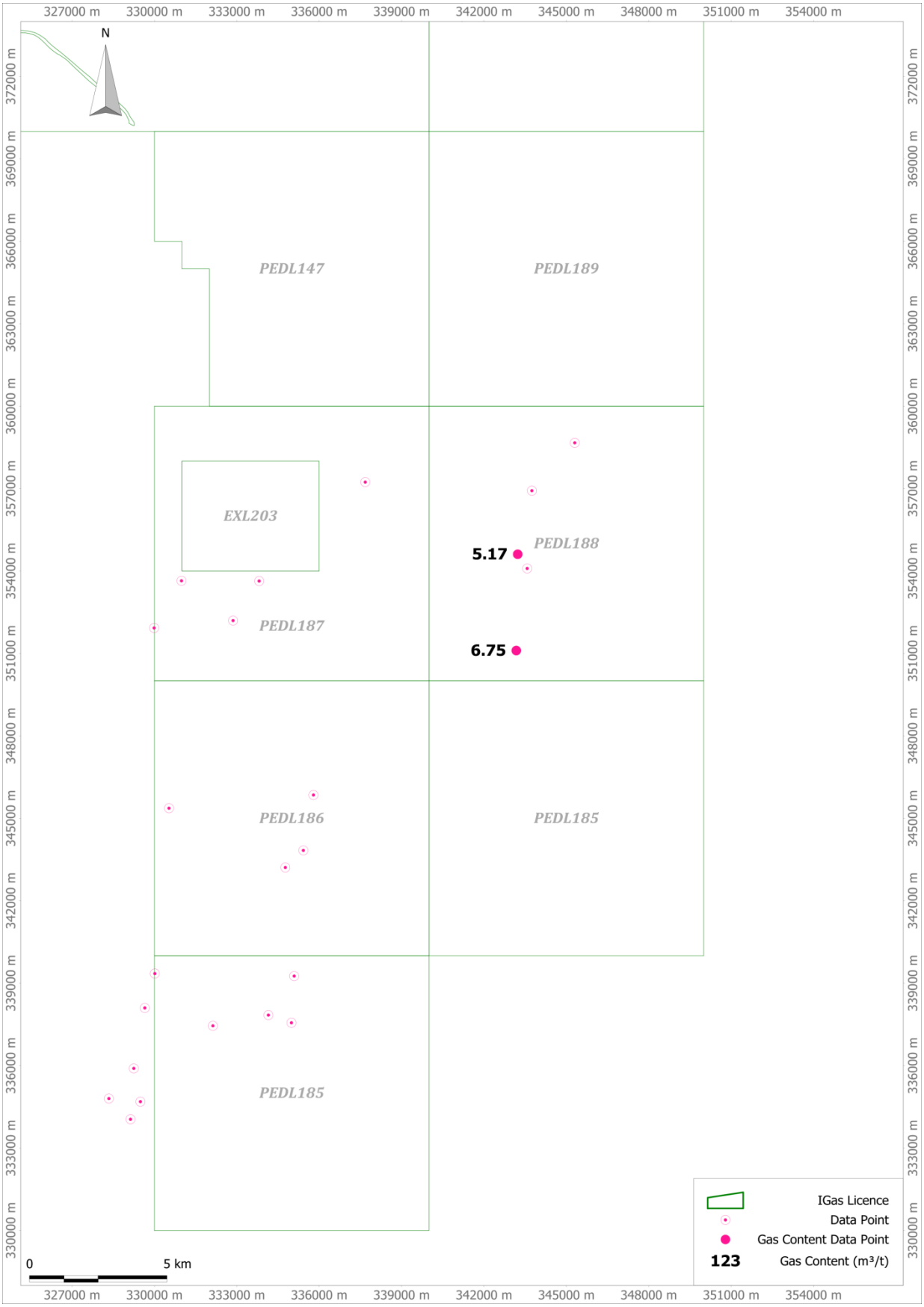


Trencherbone Seam Gas Content (m^3/t)

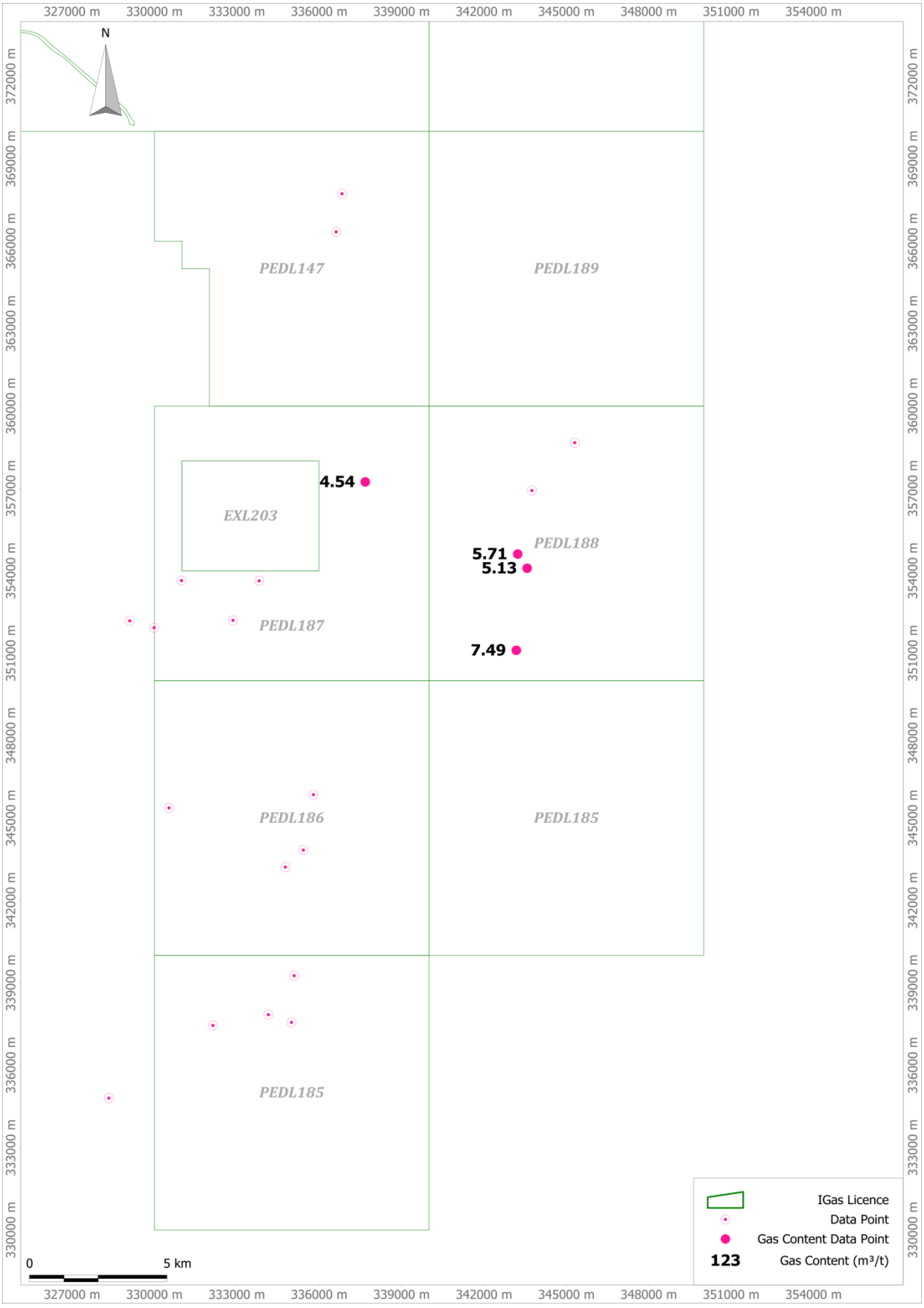
APPENDIX H. North West Seam Gas Content – Secondary



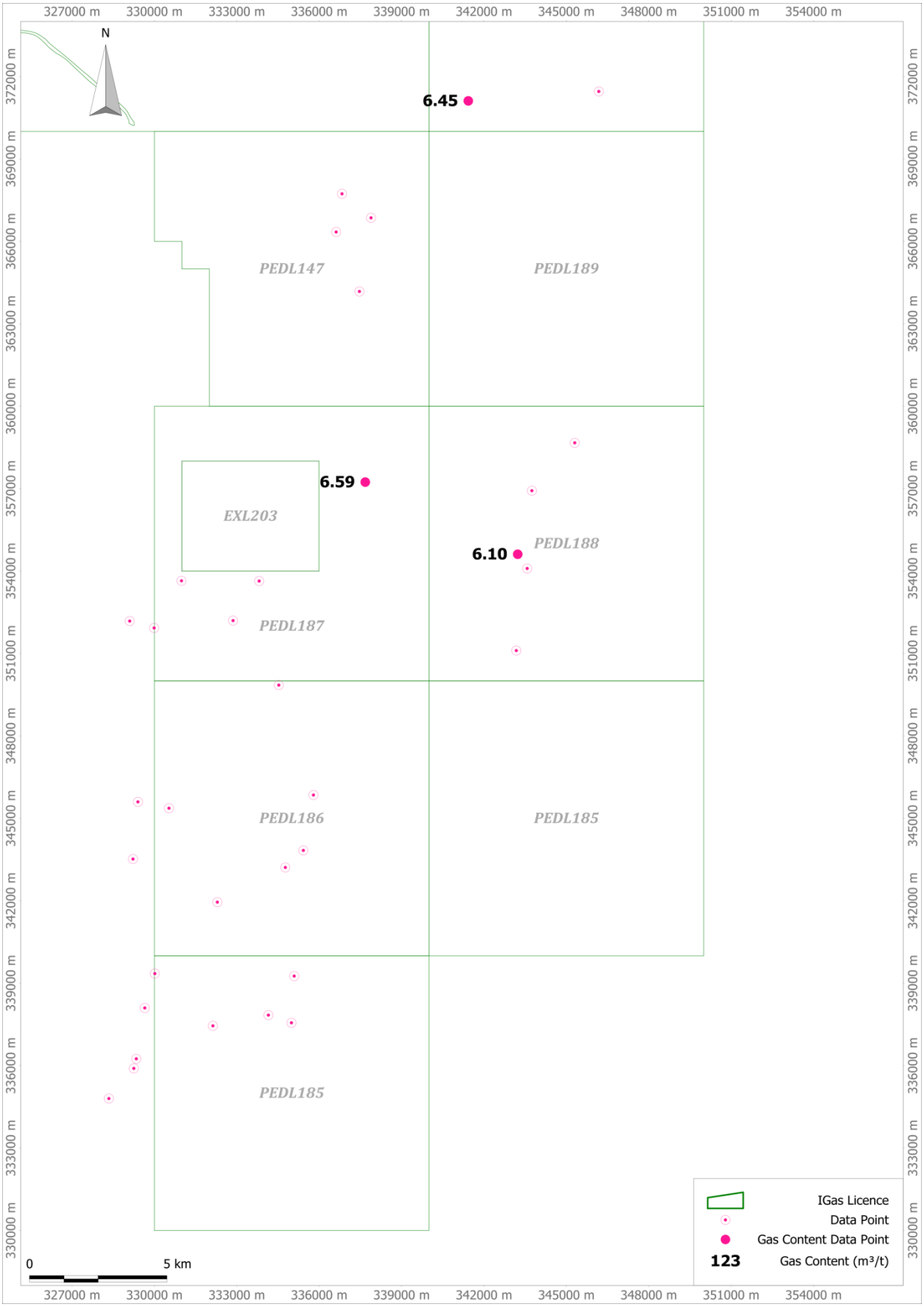
Upper Stinking Gas Content (m^3/t)



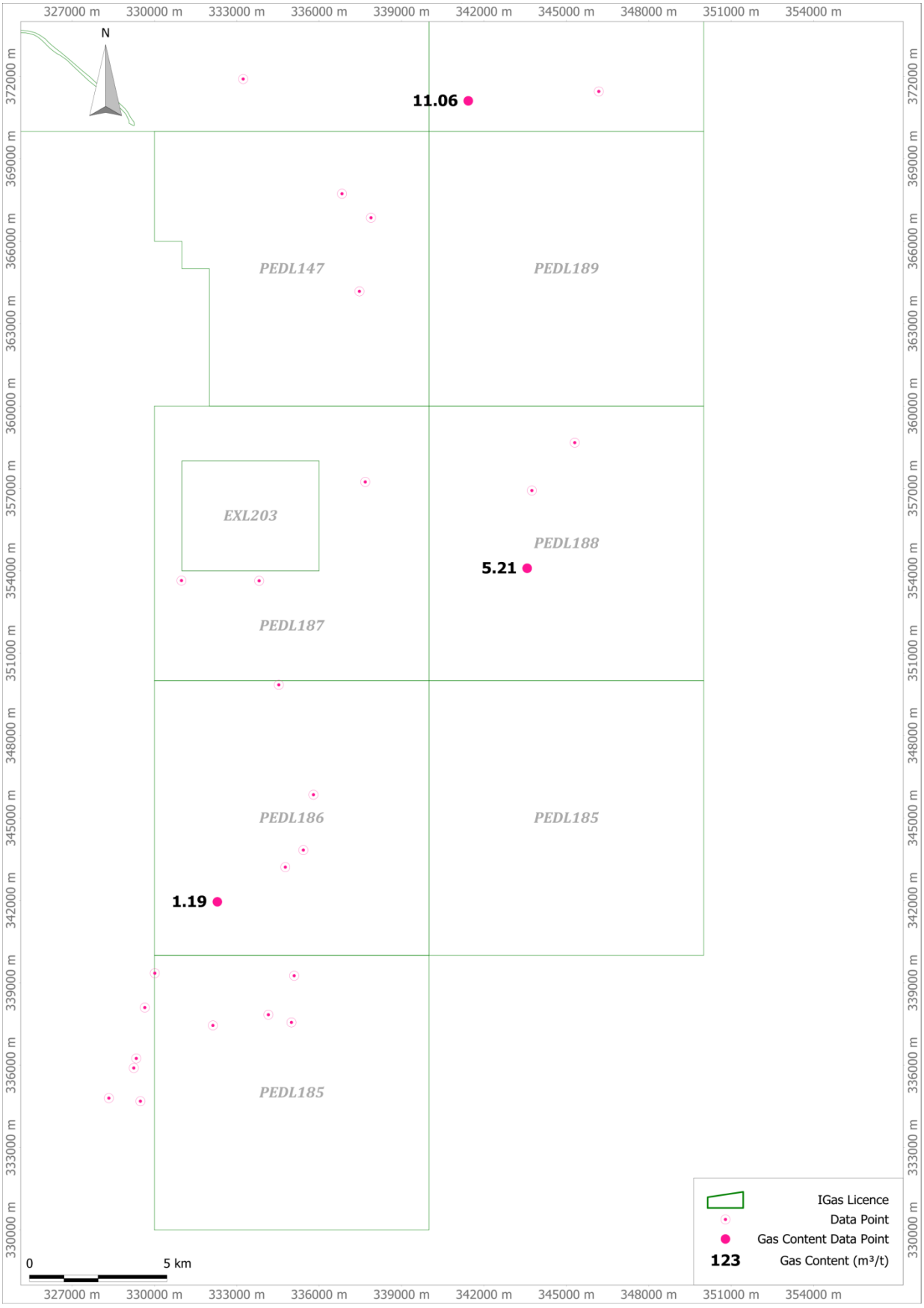
Lower Stinking Gas Content (m³/t)



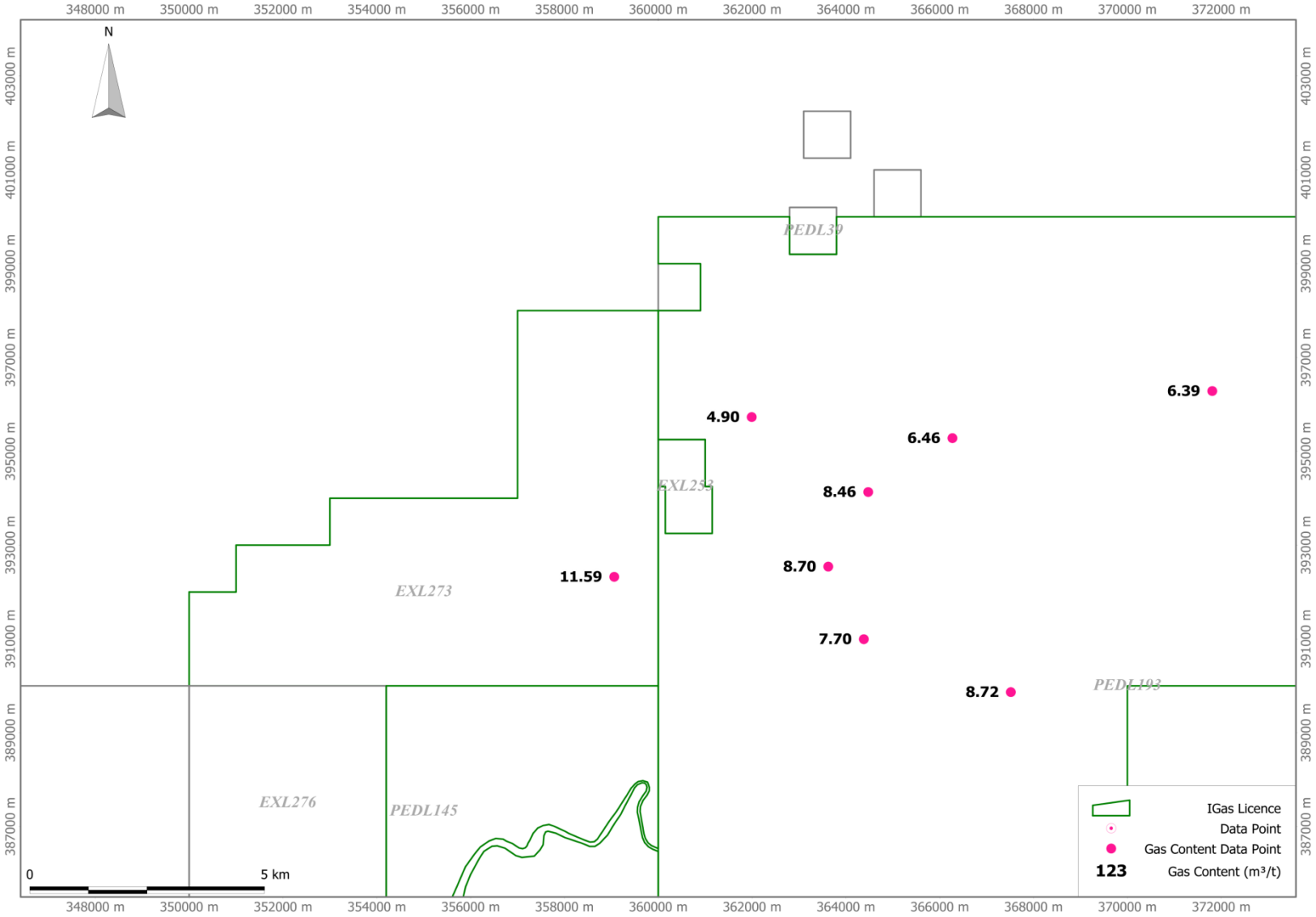
Powell Gas Content (m³/t)



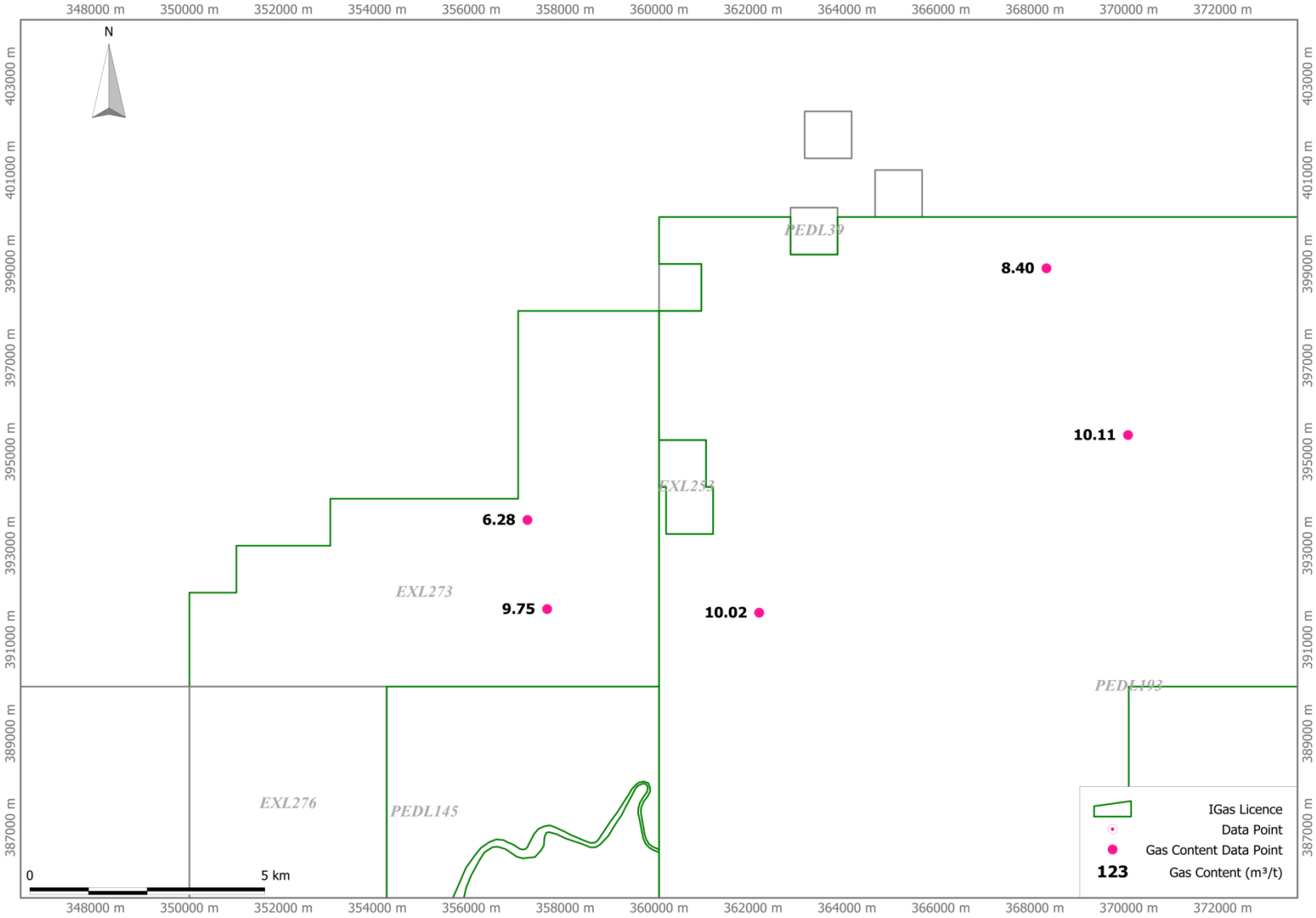
Brassy Gas Content (m^3/t)



Lower Yard Gas Content (m^3/t)

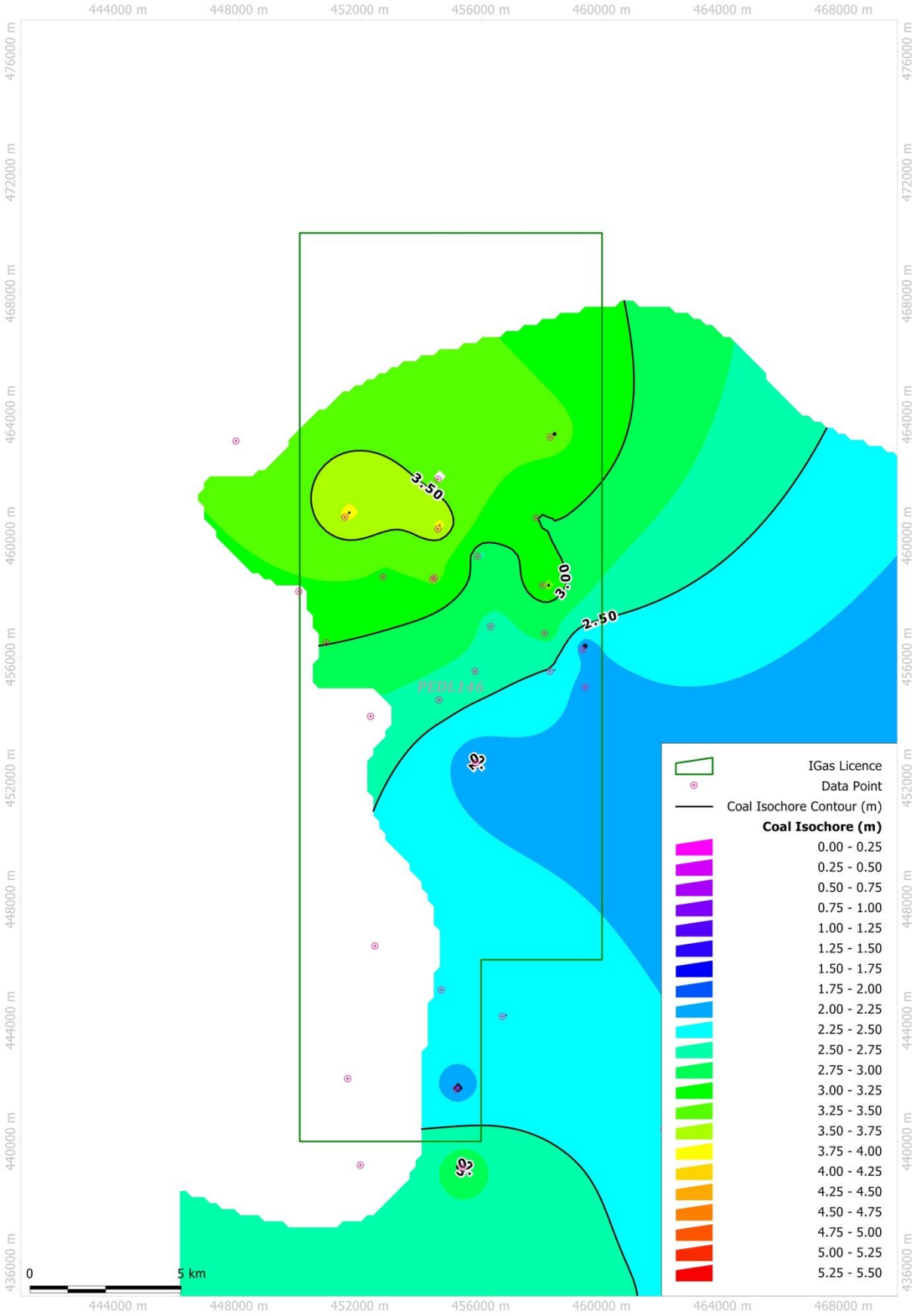


Ince Six Feet Seam Gas Content (m^3/t)

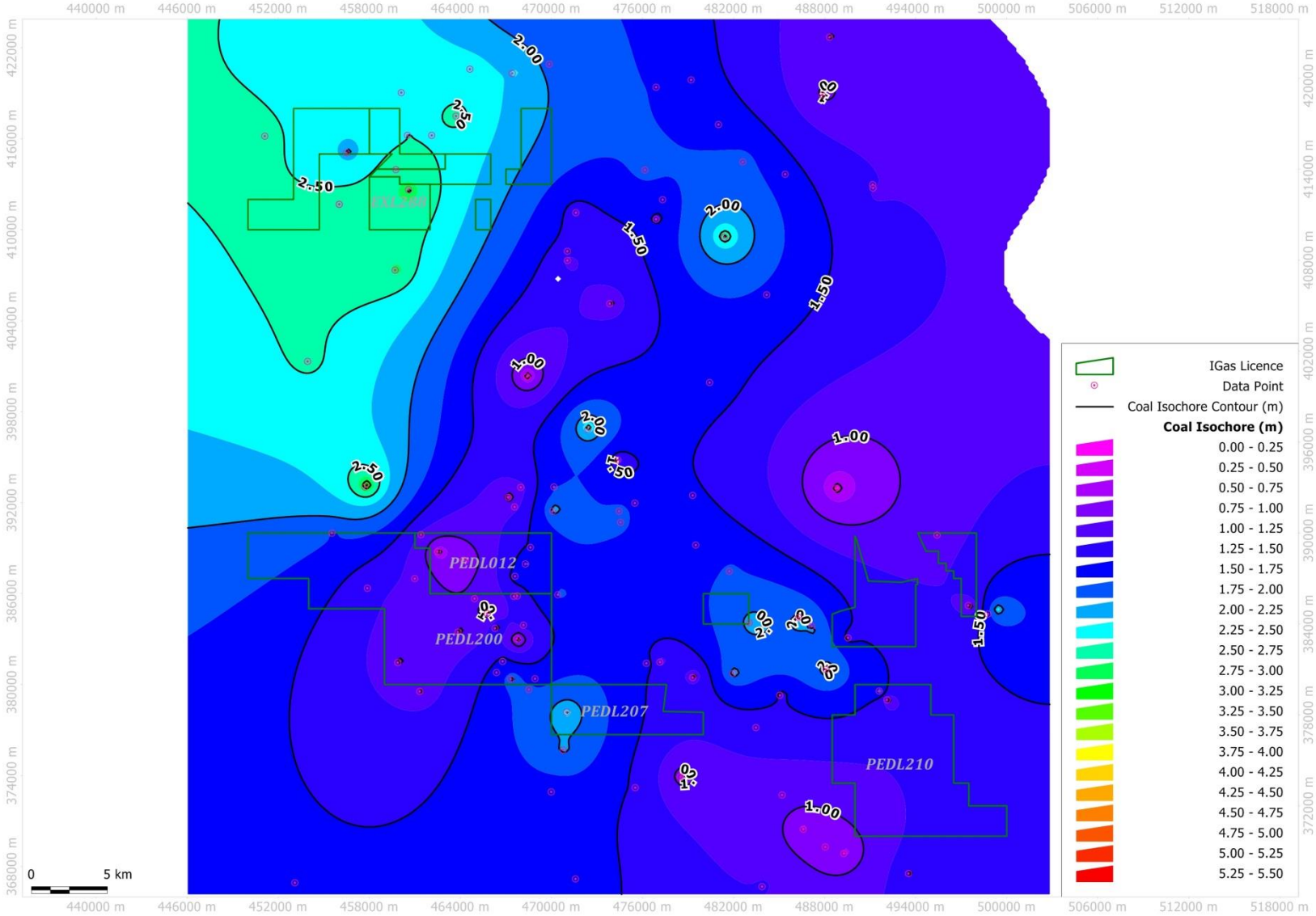


Nant Seam Gas Content (m^3/t)

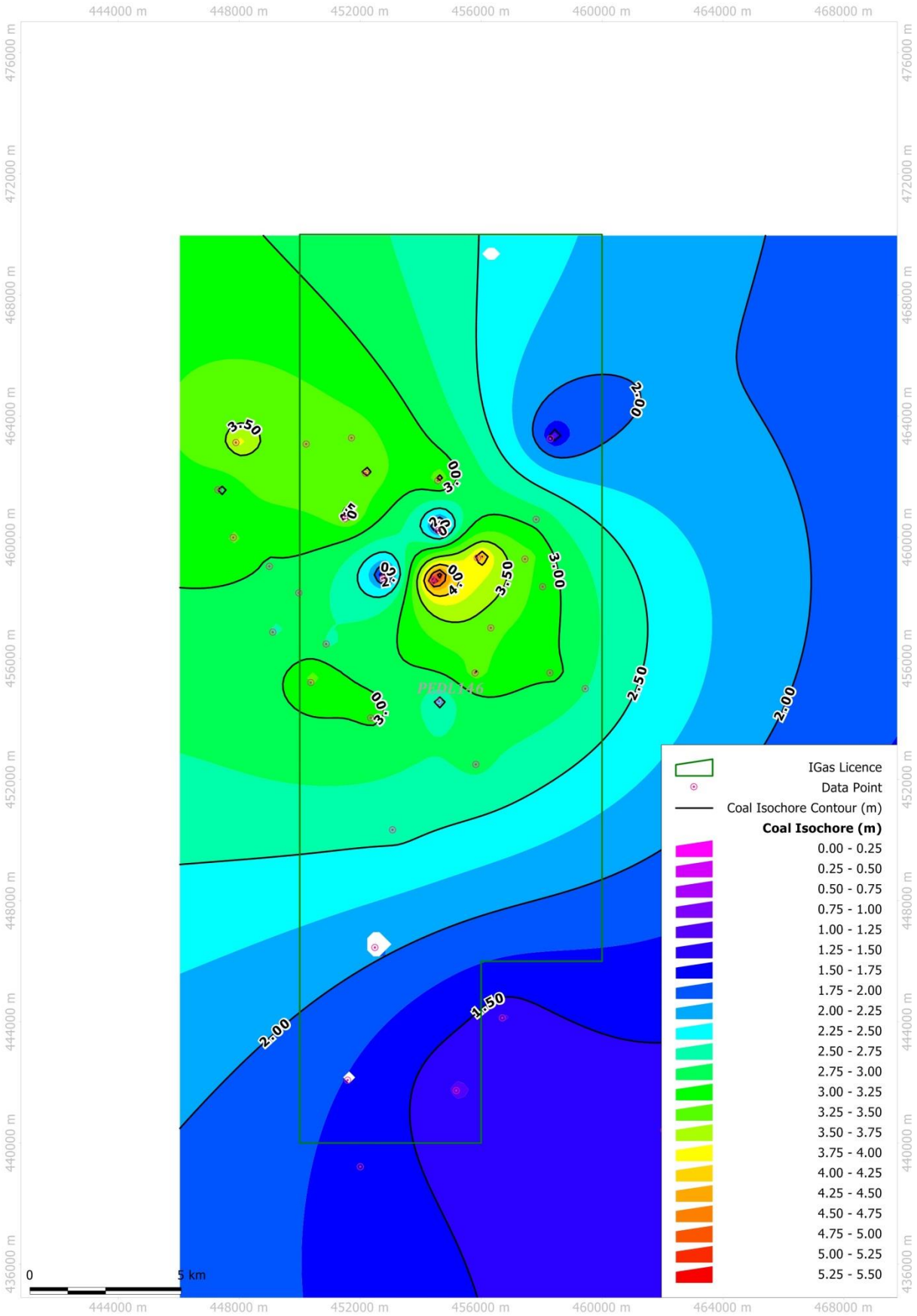
APPENDIX I. East Midlands Coal Seam Net Thickness – Primary – Unclipped



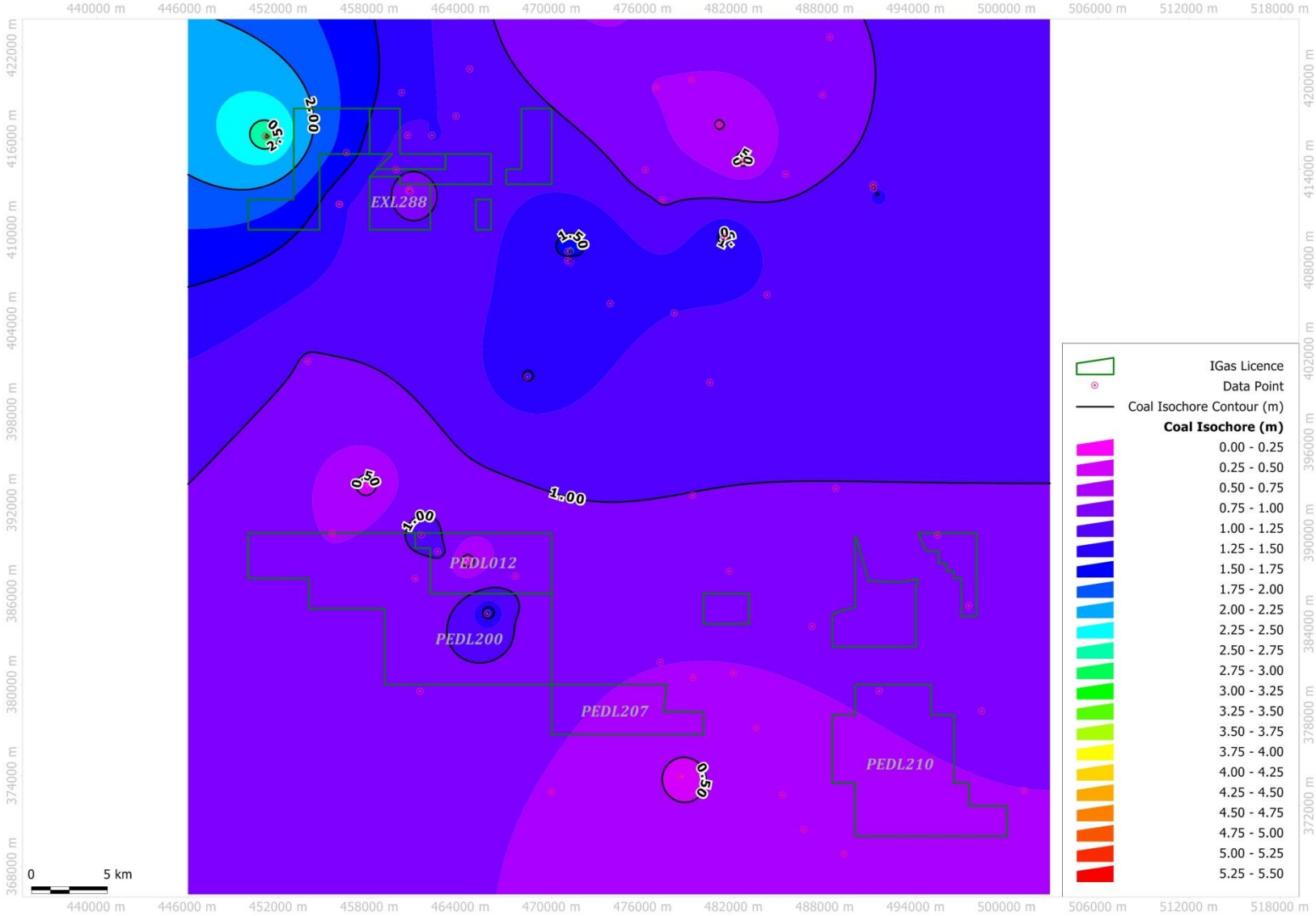
Barnsley Seam (York) Net Thickness (m) – Unclipped



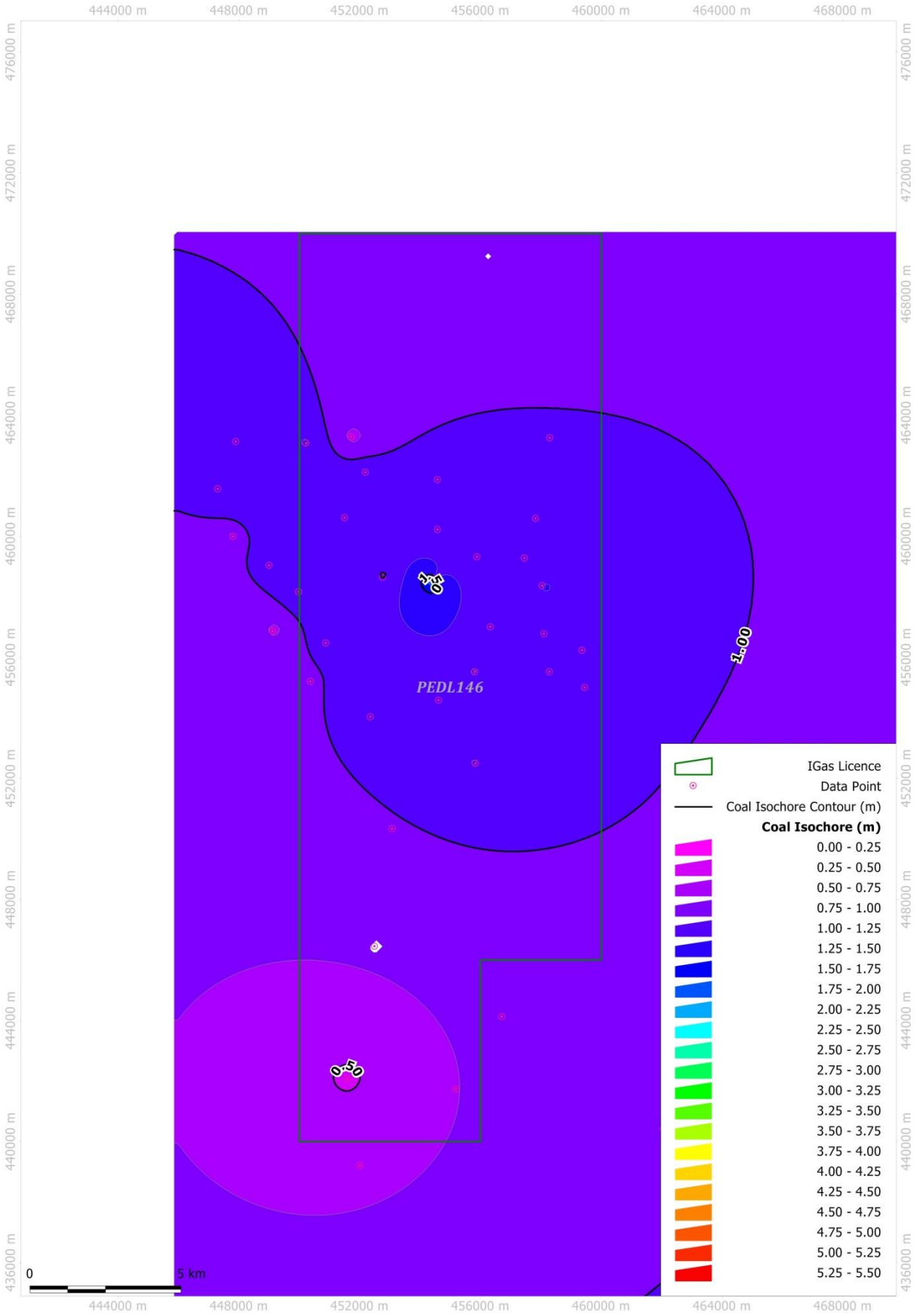
Barnsley Seam (Gainsborough) Net Thickness (m) – Unclipped



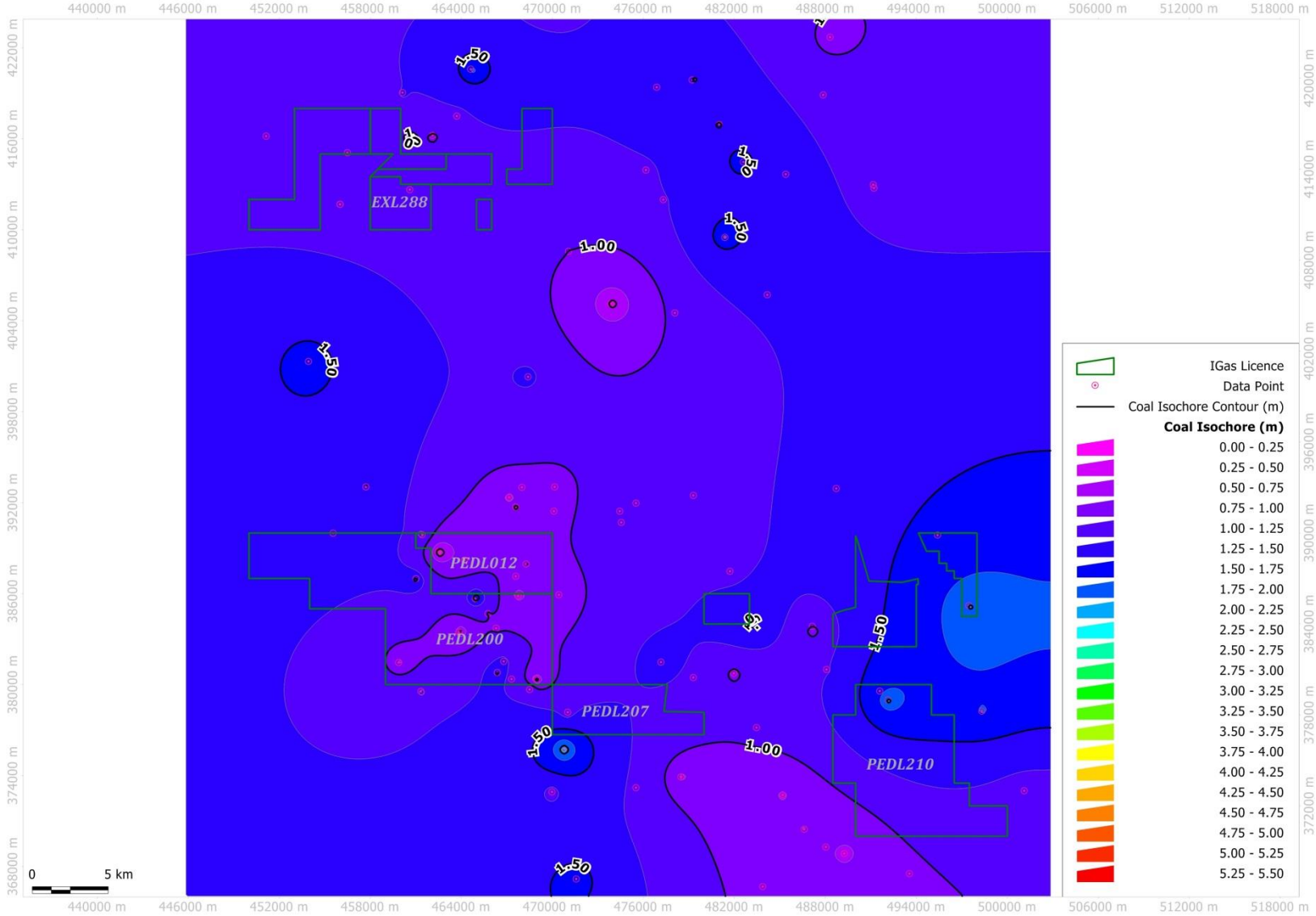
Flockton Seam (York) Net Thickness (m) – Unclipped



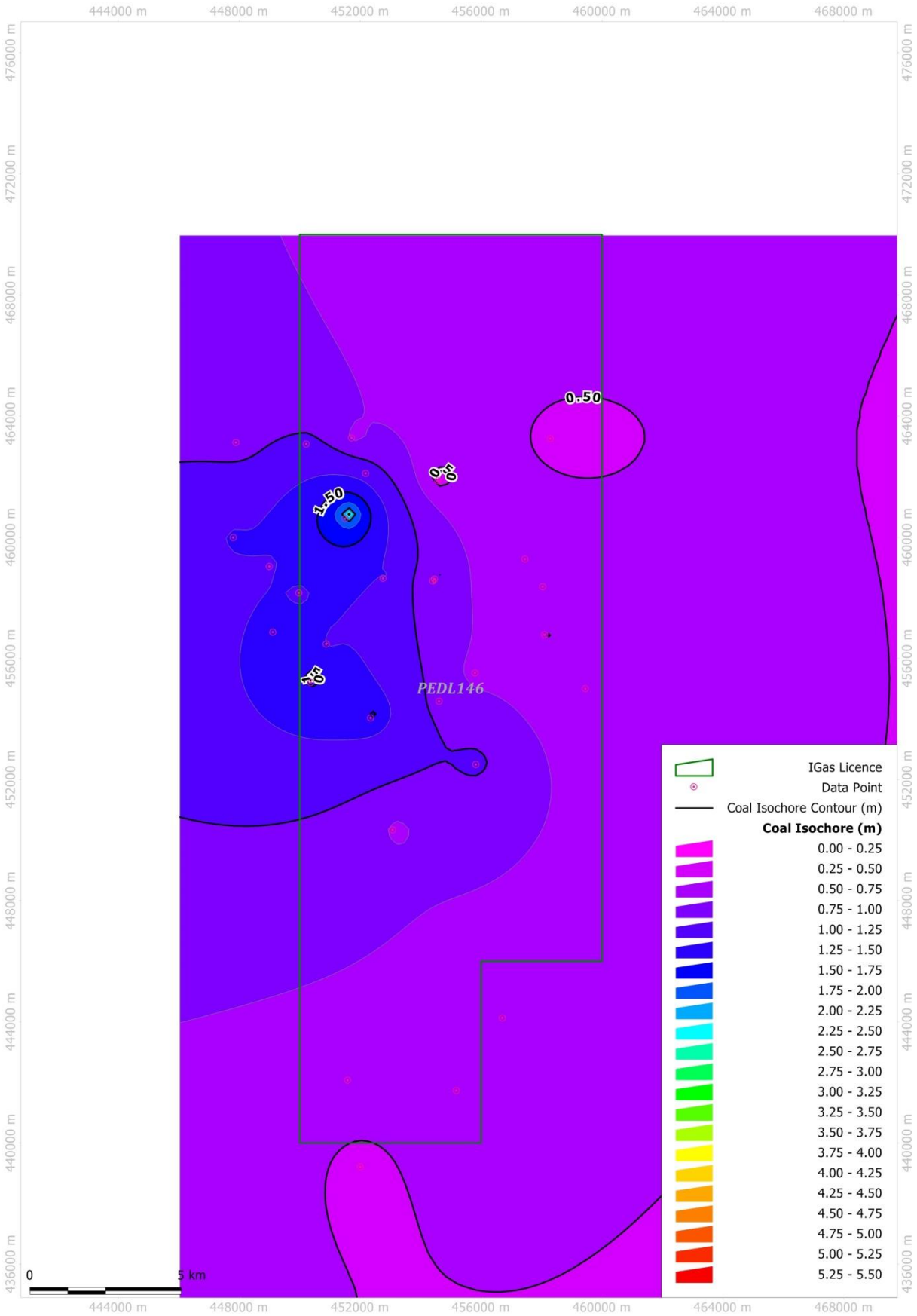
Flockton Seam (Gainsborough) Net Thickness (m) – Unclipped



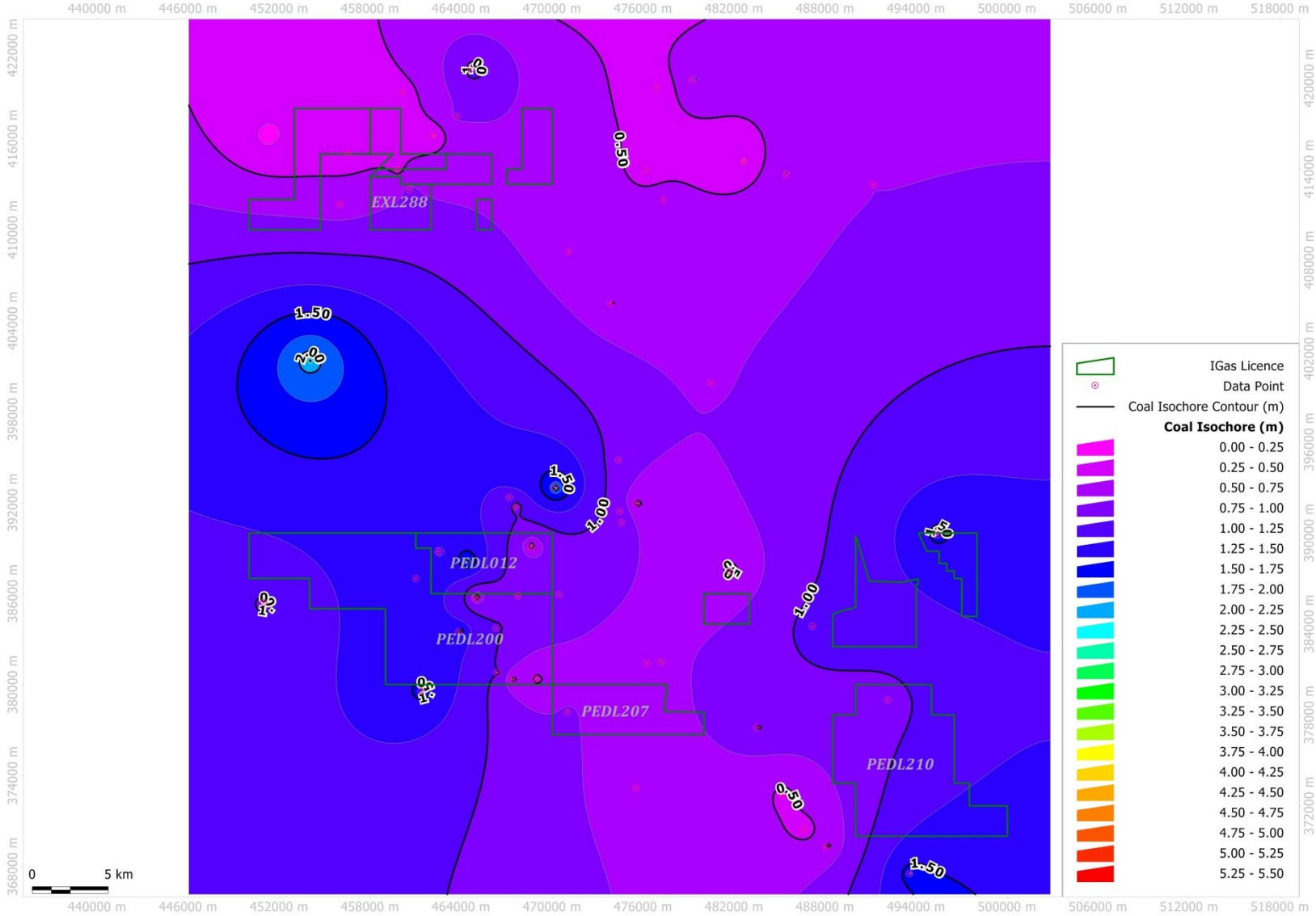
Parkgate Seam (York) Net Thickness (m) – Unclipped



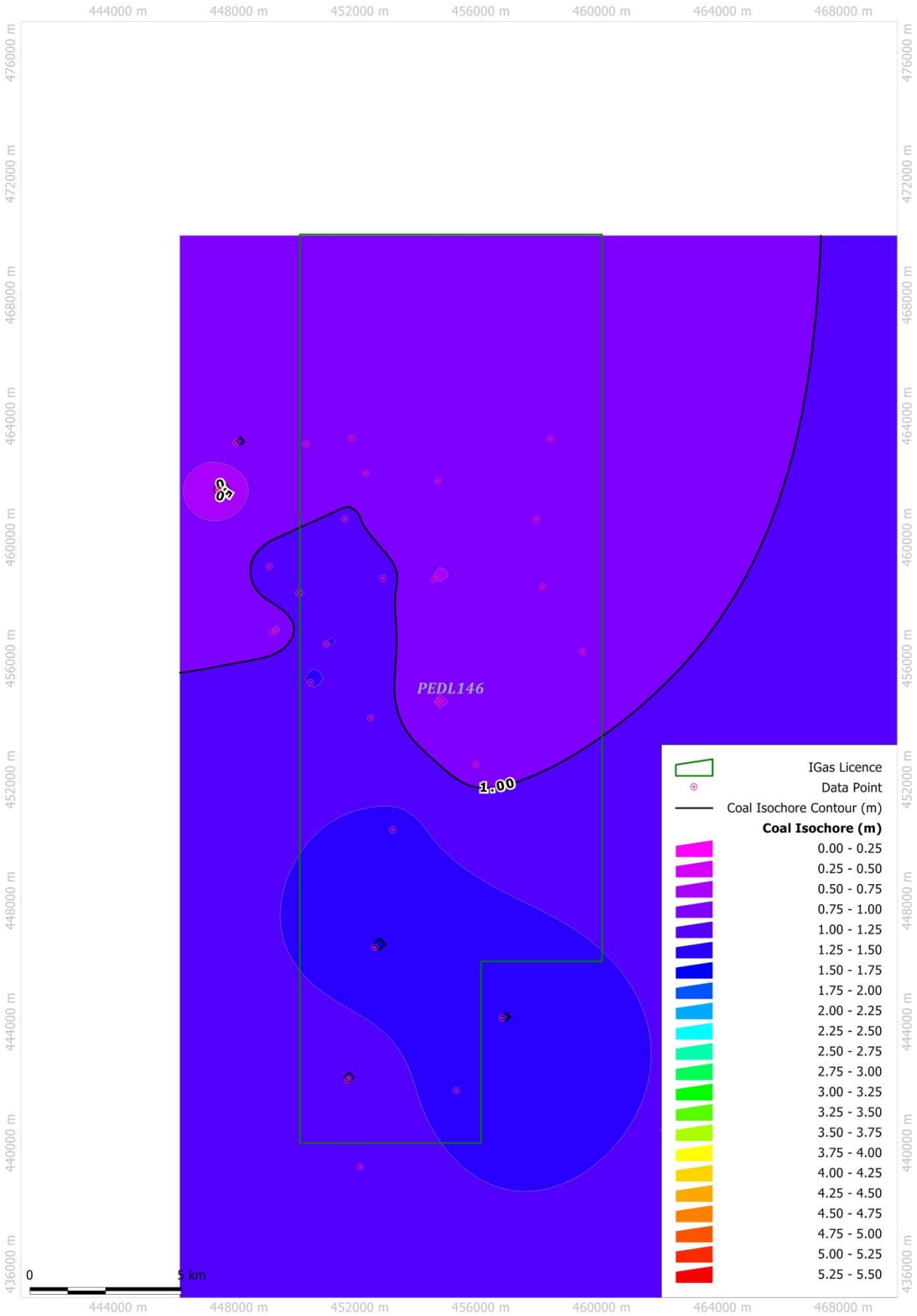
Parkgate Seam (Gainsborough) Net Thickness (m) – Unclipped



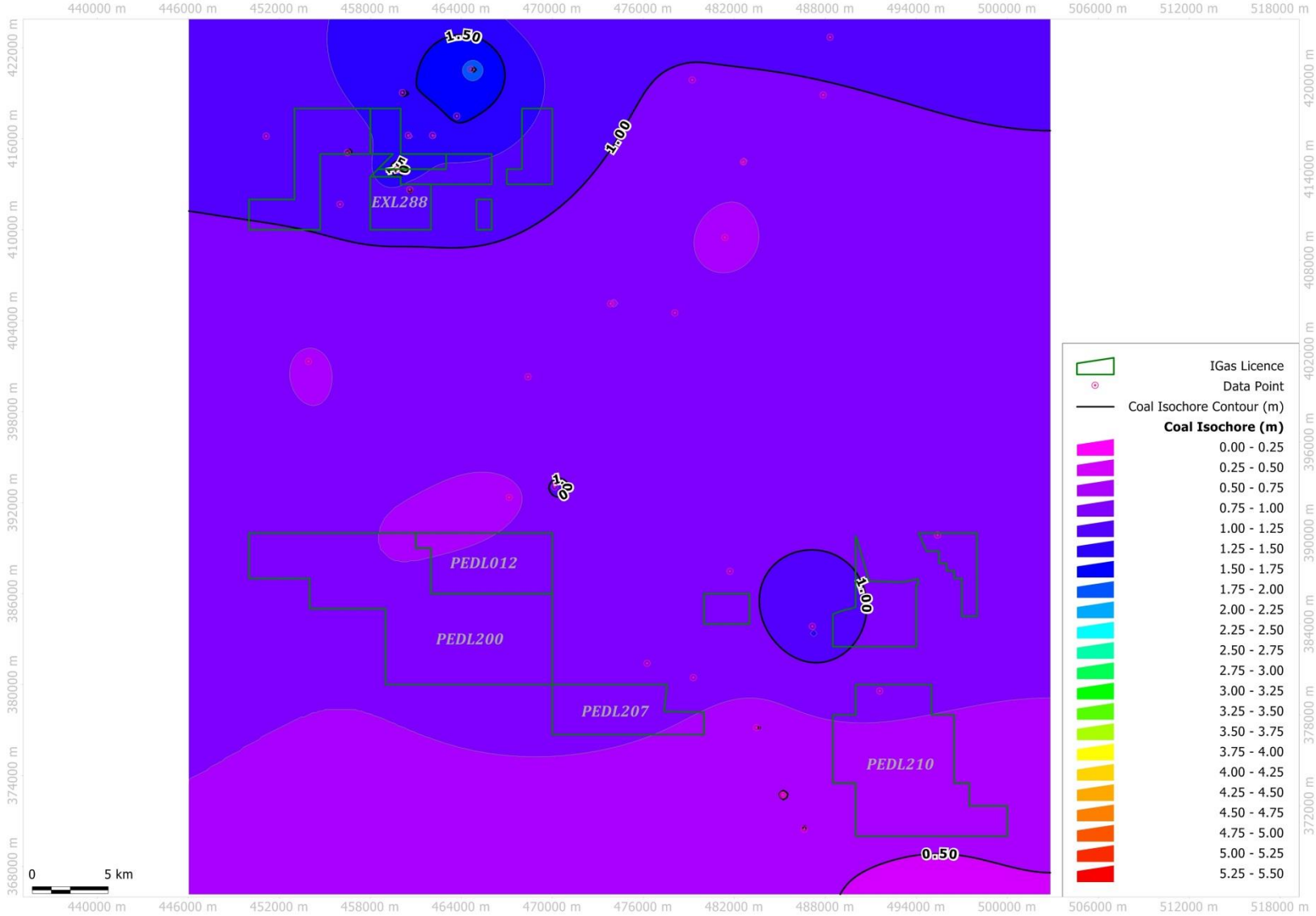
Silkstone Seam (York) Net Thickness (m) – Unclipped



Silkstone Seam (Gainsborough) Net Thickness (m) – Unclipped

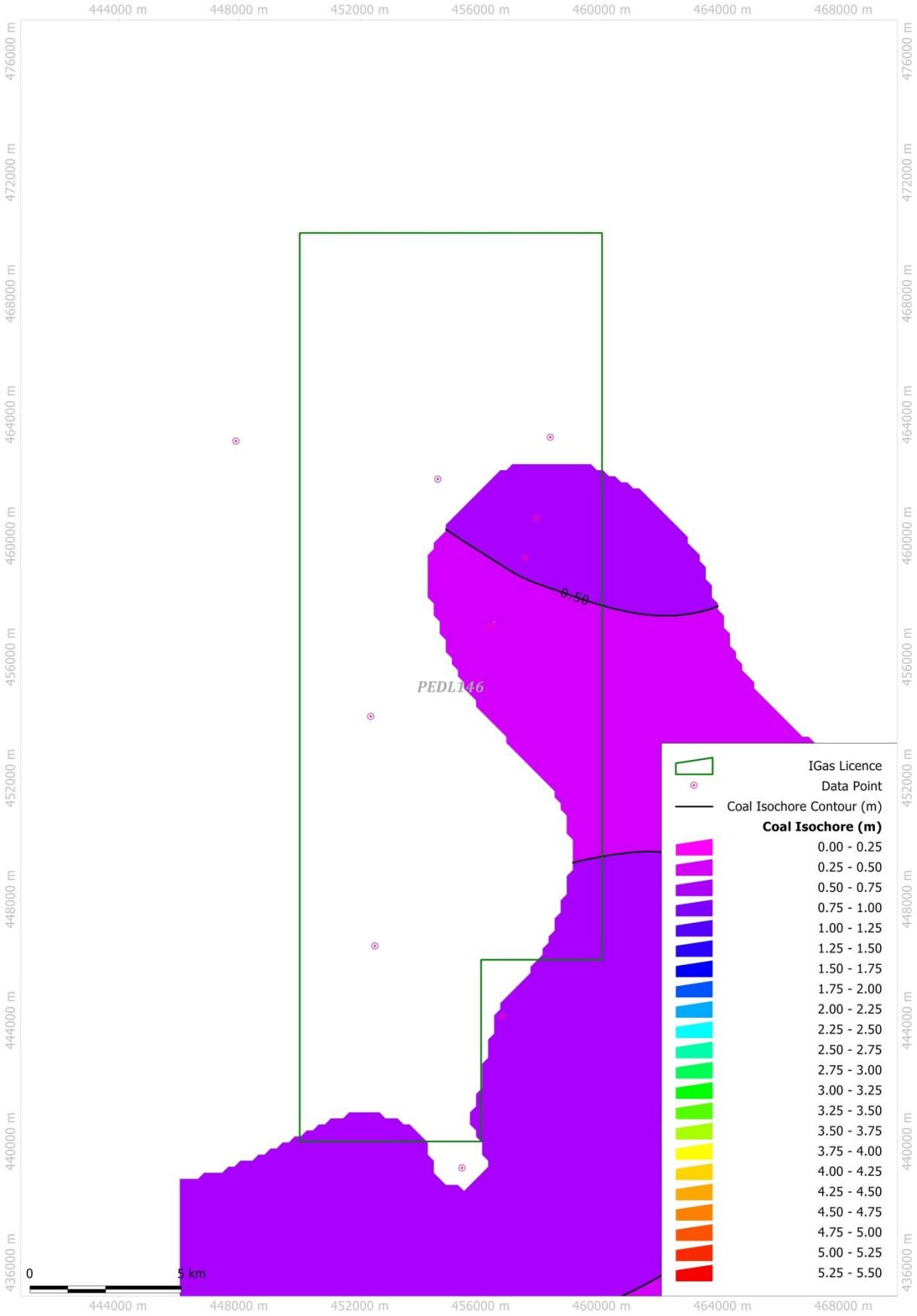


Top Beeston Seam (York) Net Thickness (m) – Unclipped

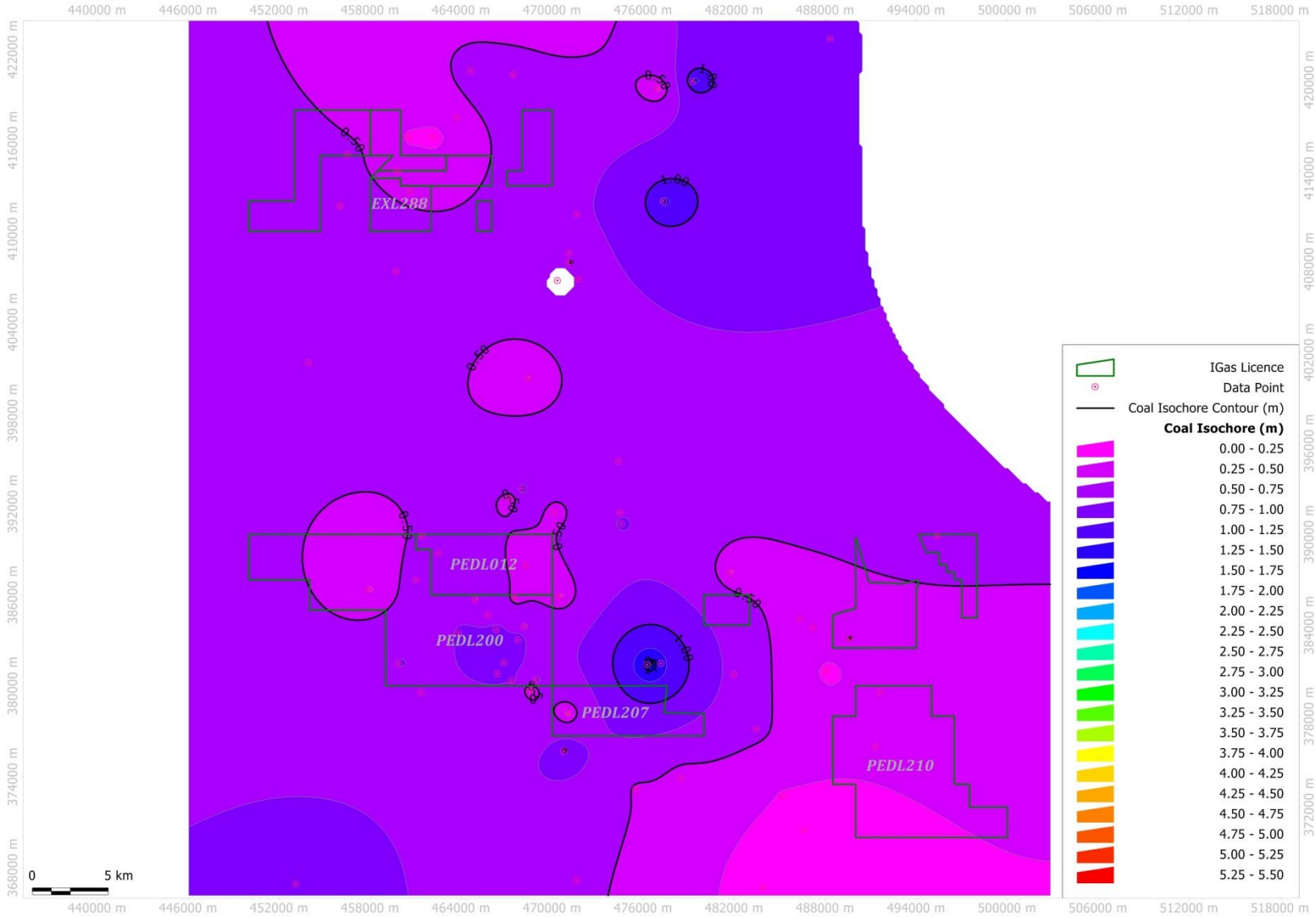


Top Beeston Seam (Gainsborough) Net Thickness (m) – Unclipped

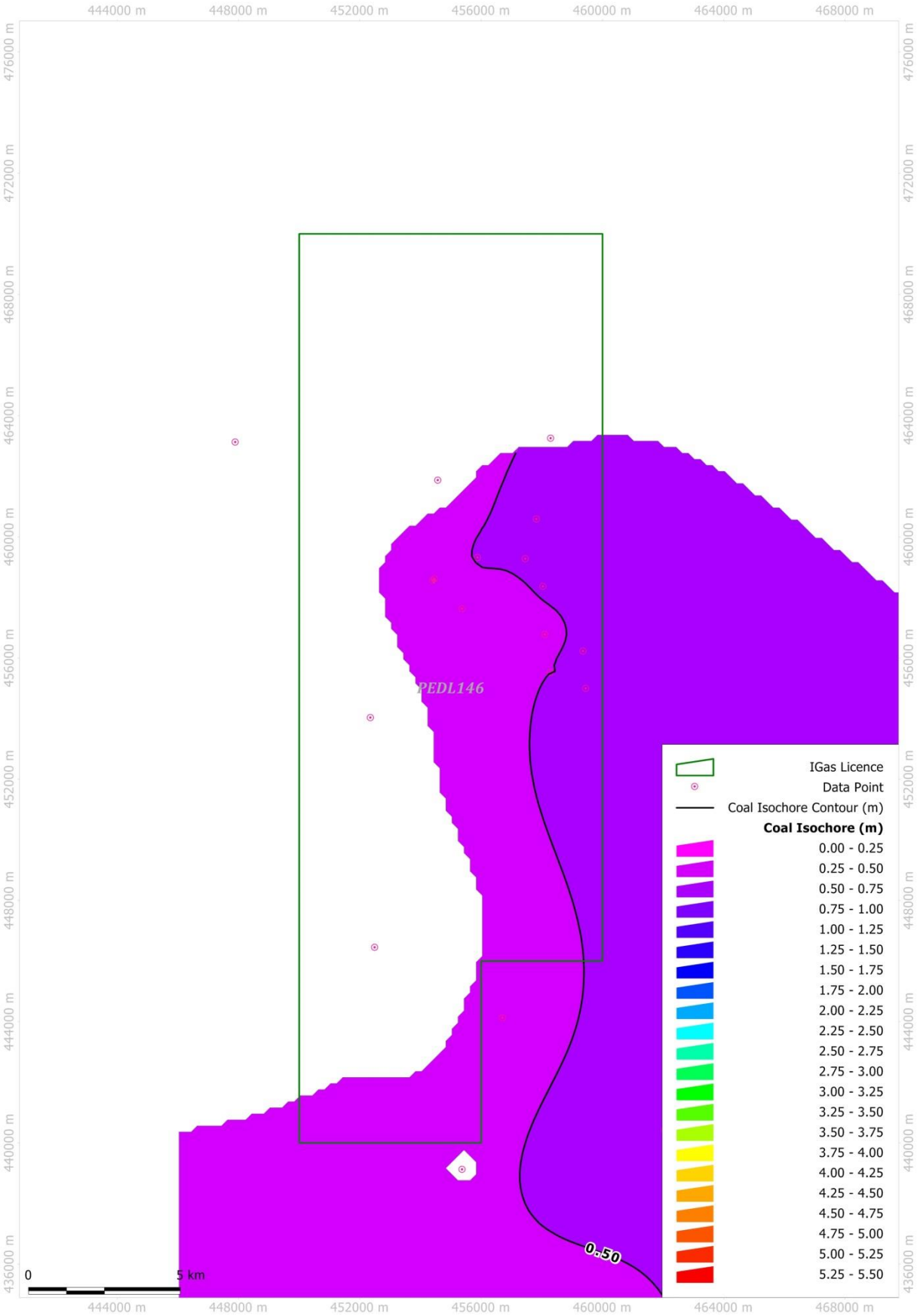
APPENDIX J. East Midlands Coal Seam Net Thickness – Secondary – Unclipped



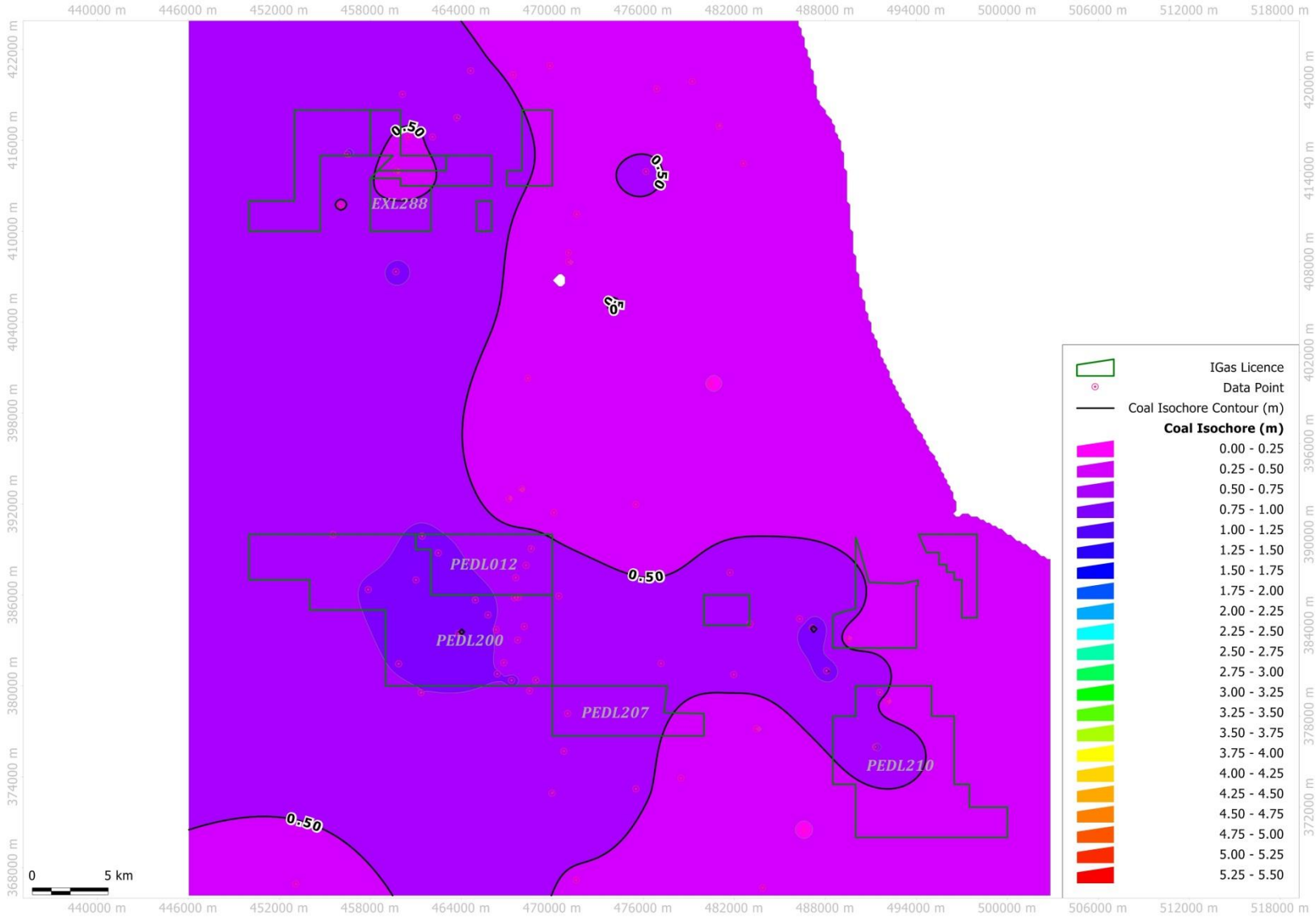
Newhill Seam (York) Net Thickness (m) – Unclipped



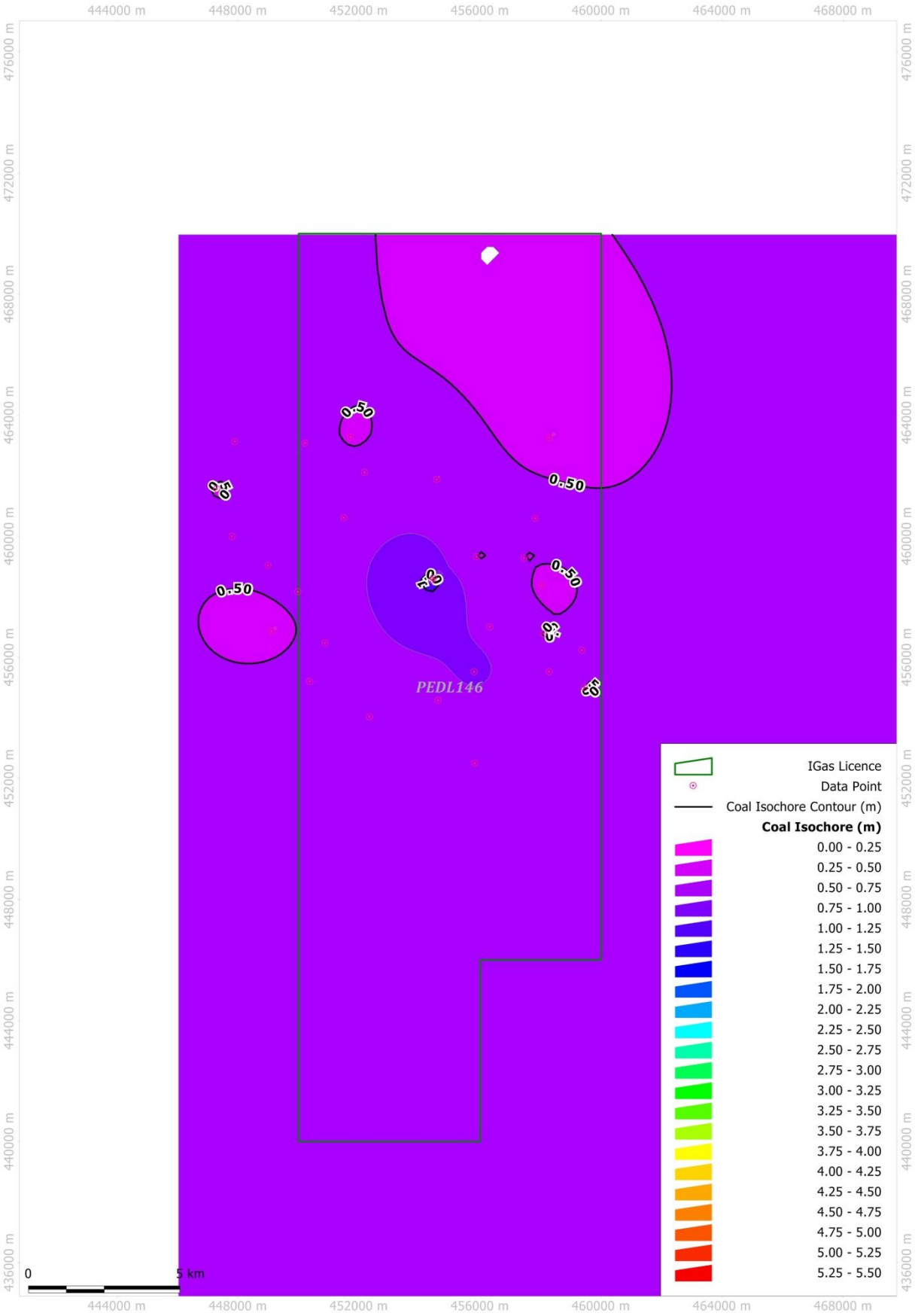
Newhill Seam (Gainsborough) Net Thickness (m) – Unclipped



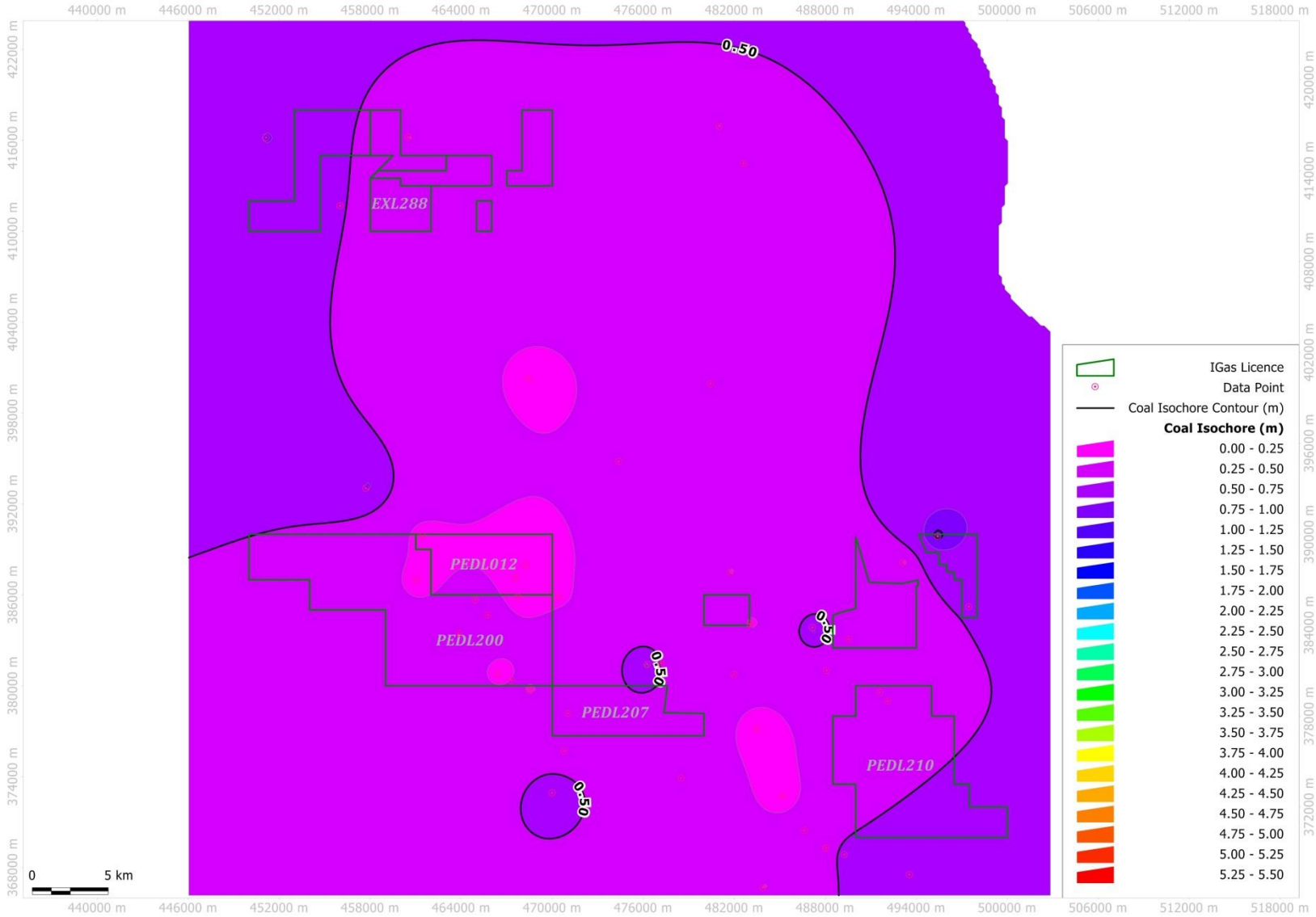
Two Foot Seam (York) Net Thickness (m) – Unclipped



Two Foot Seam (Gainsborough) Net Thickness (m) – Unclipped

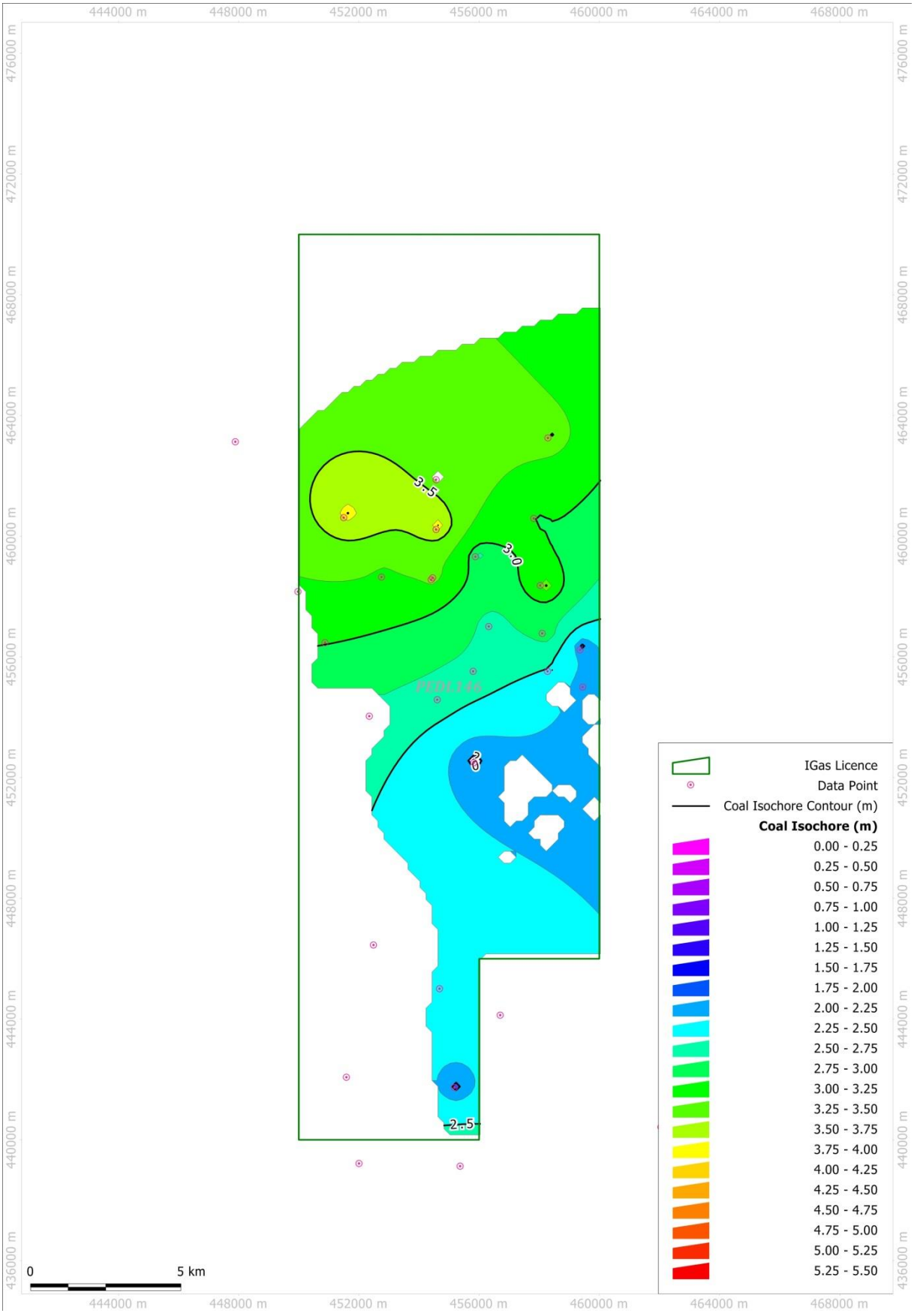


Joan Seam (York) Net Thickness (m) – Unclipped

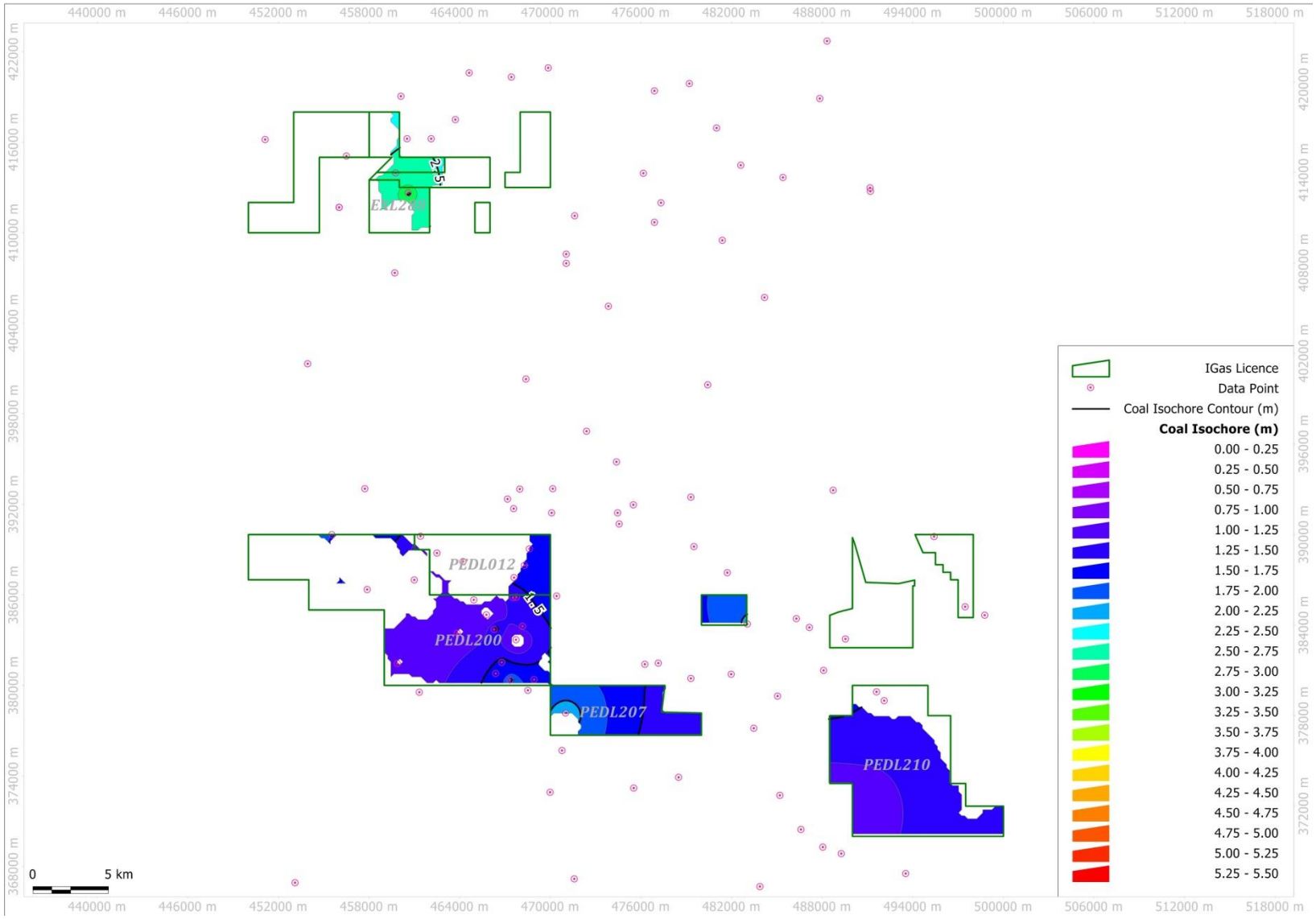


Joan Seam (Gainsborough) Net Thickness (m) – Unclipped

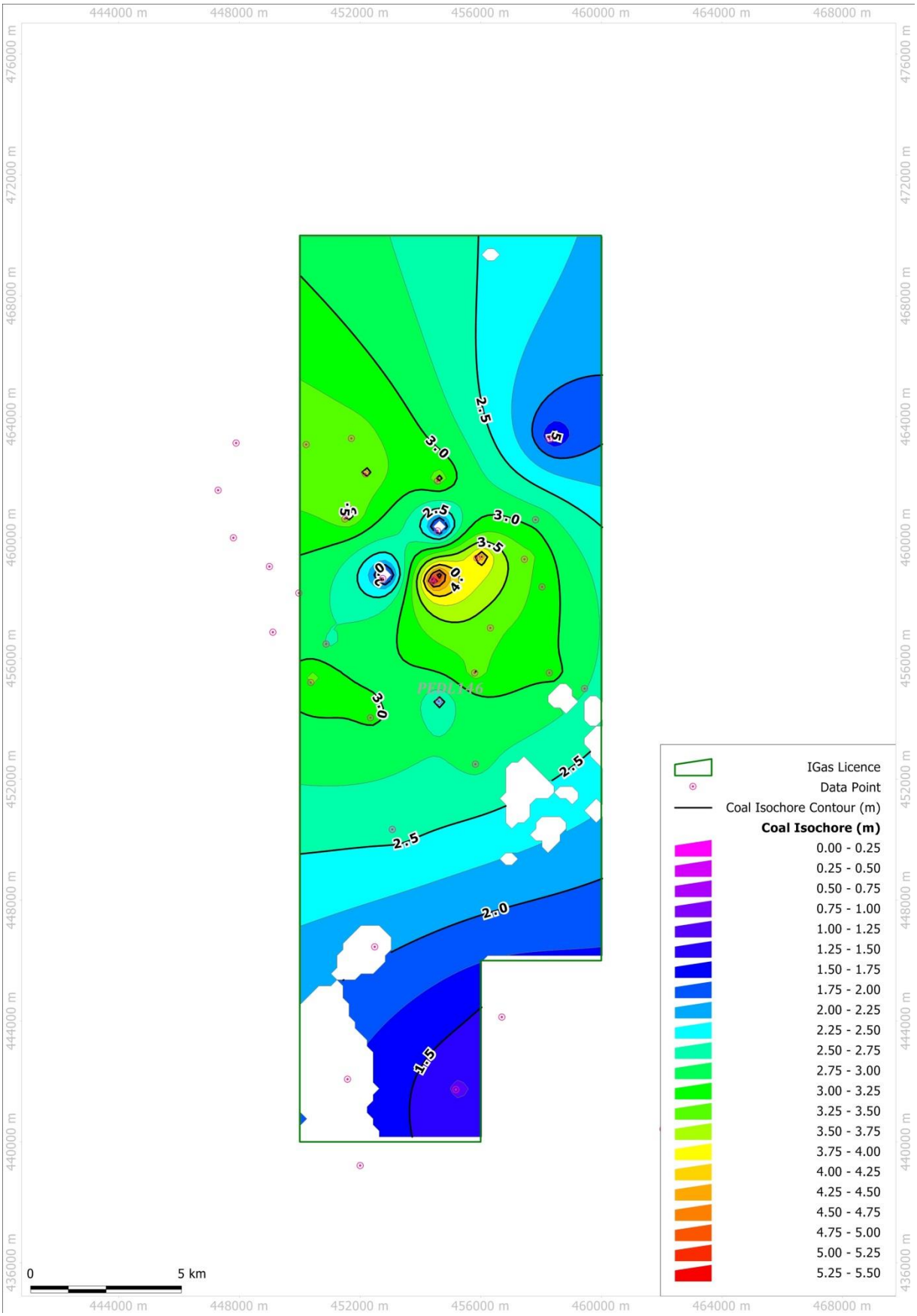
APPENDIX K. East Midlands Coal Seam Net Thickness – Primary – Clipped



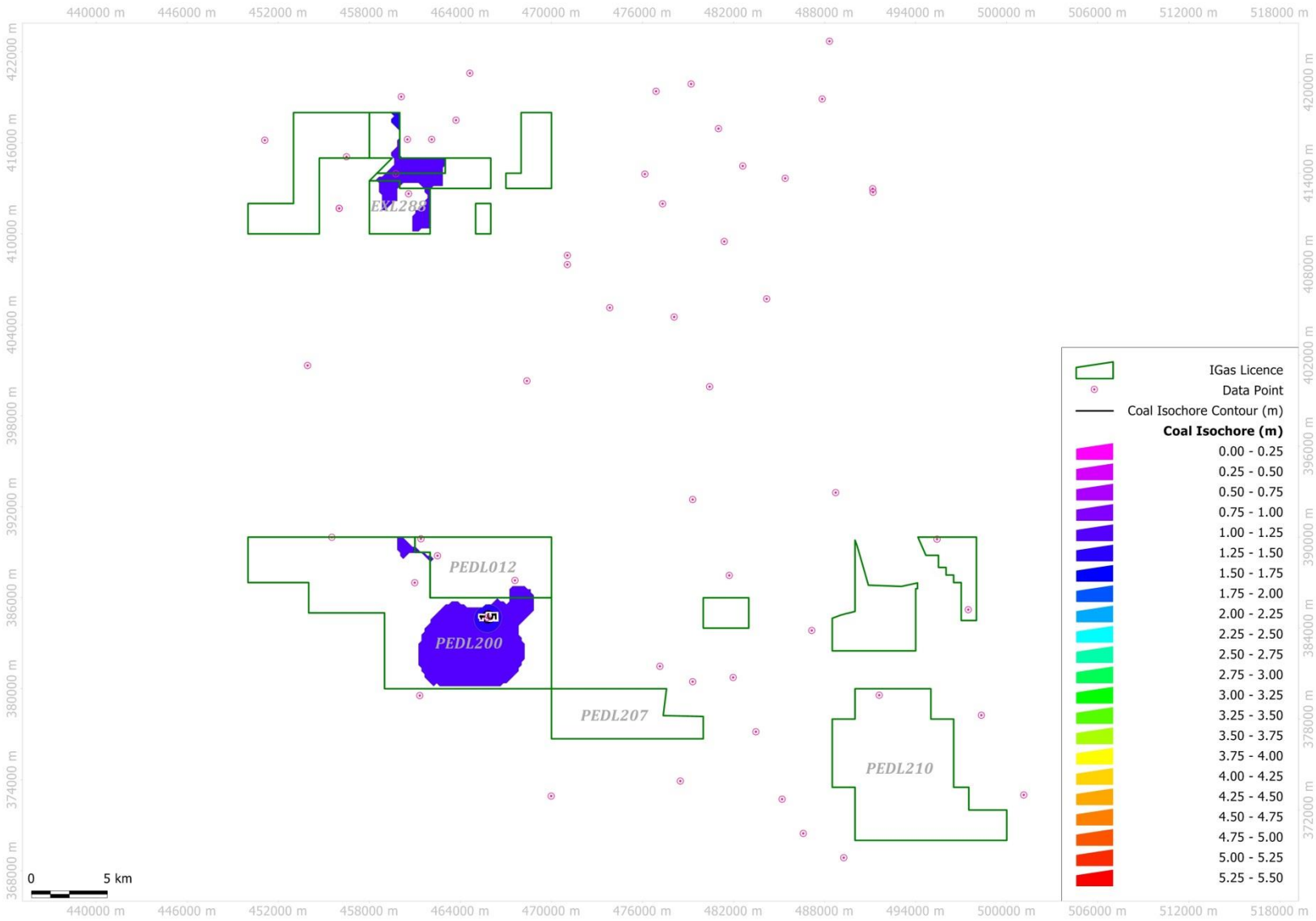
Barnsley Seam (York) Net Thickness (m) - Clipped with Development Restrictions



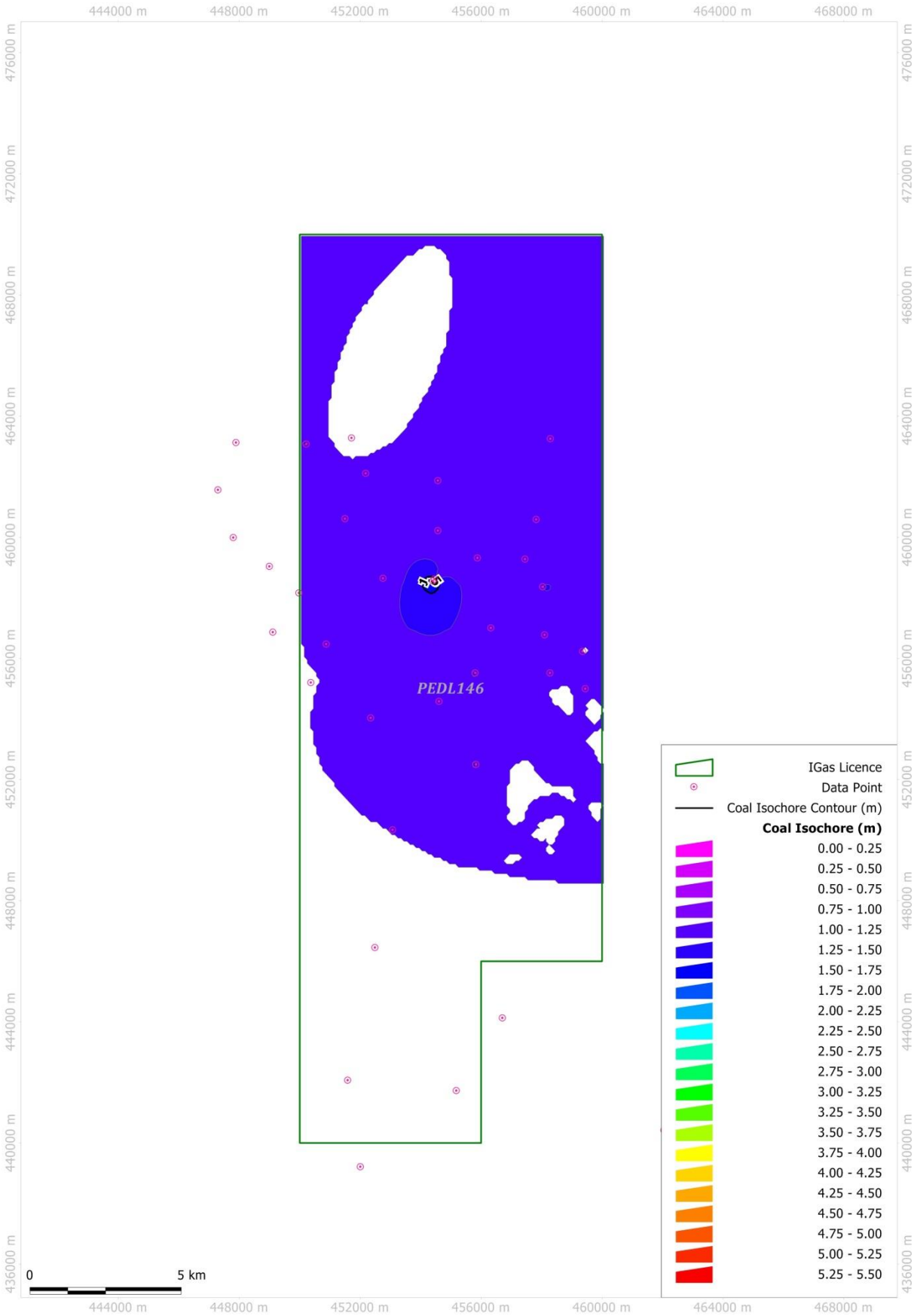
Barnsley Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions



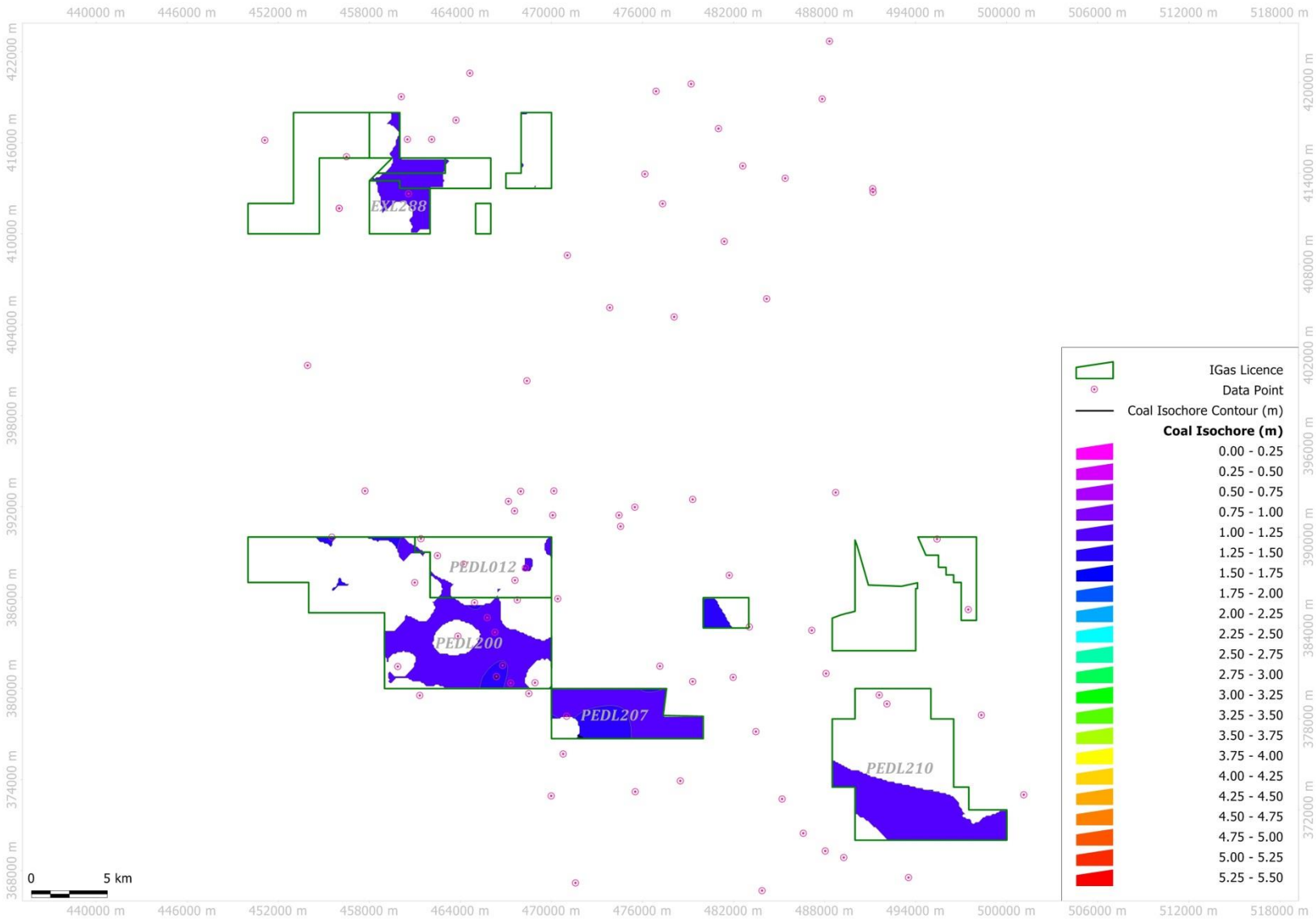
Flockton Seam (York) Net Thickness (m) - Clipped with Development Restrictions



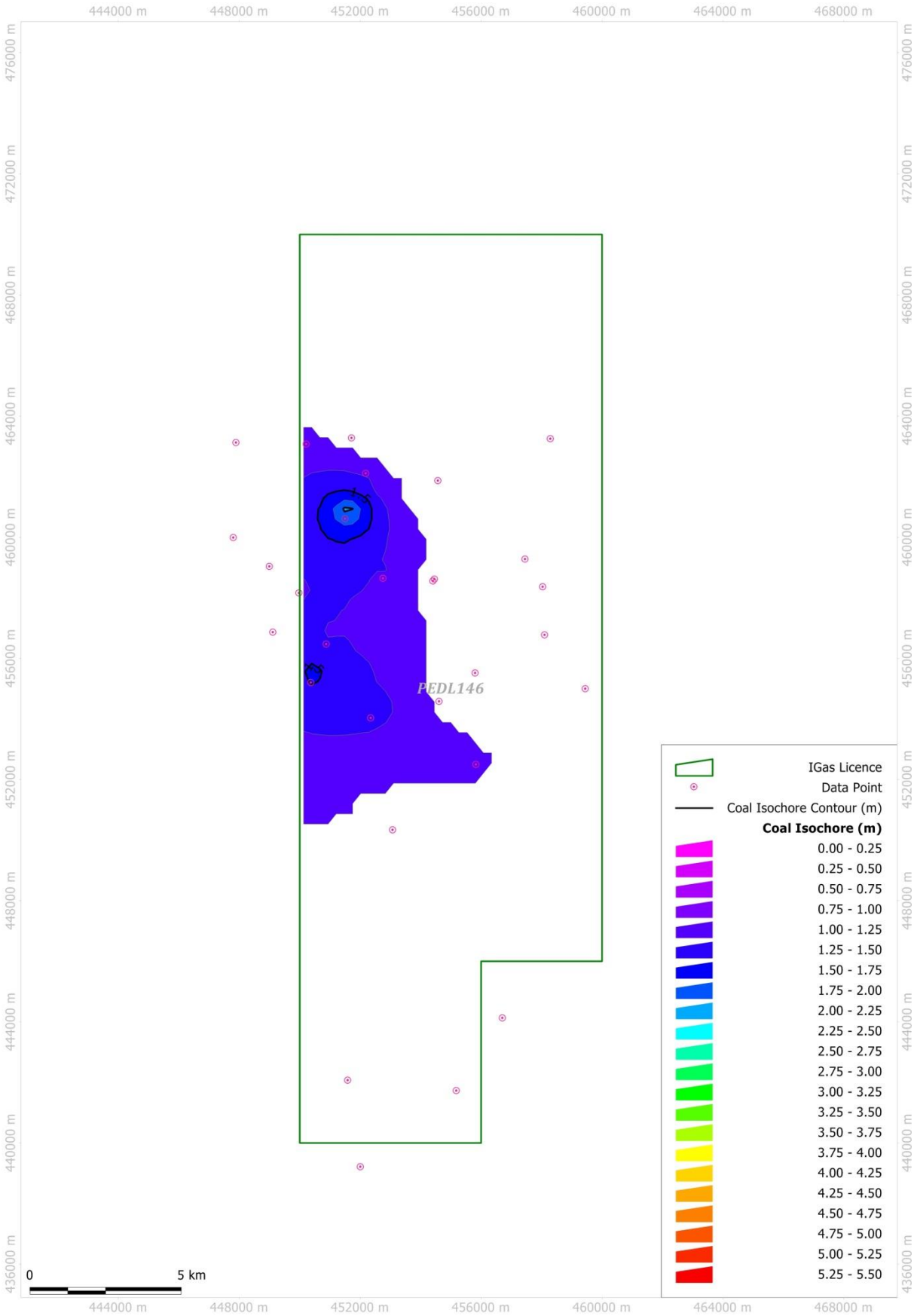
Flockton Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions



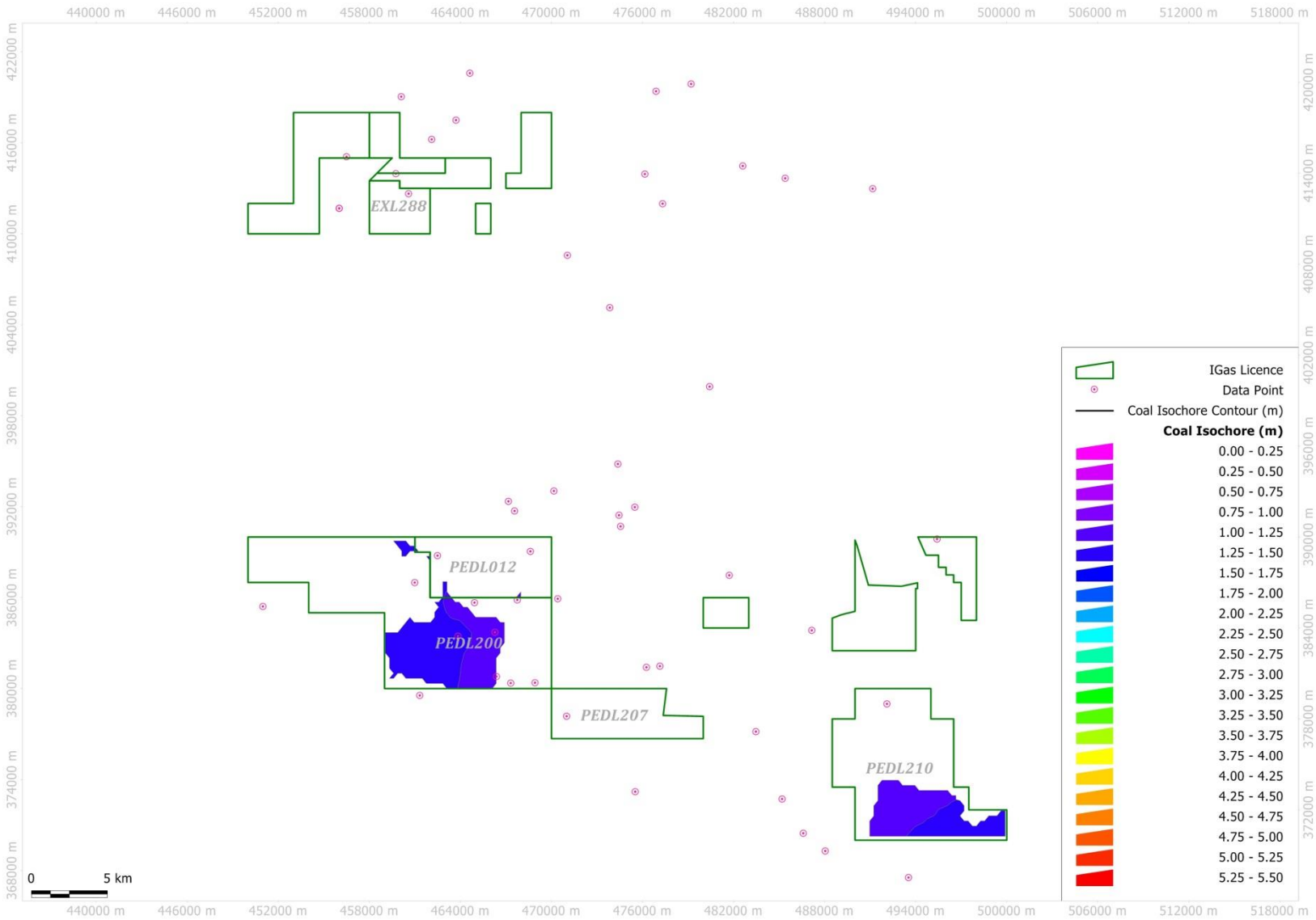
Parkgate Seam (York) Net Thickness (m) - Clipped with Development Restrictions



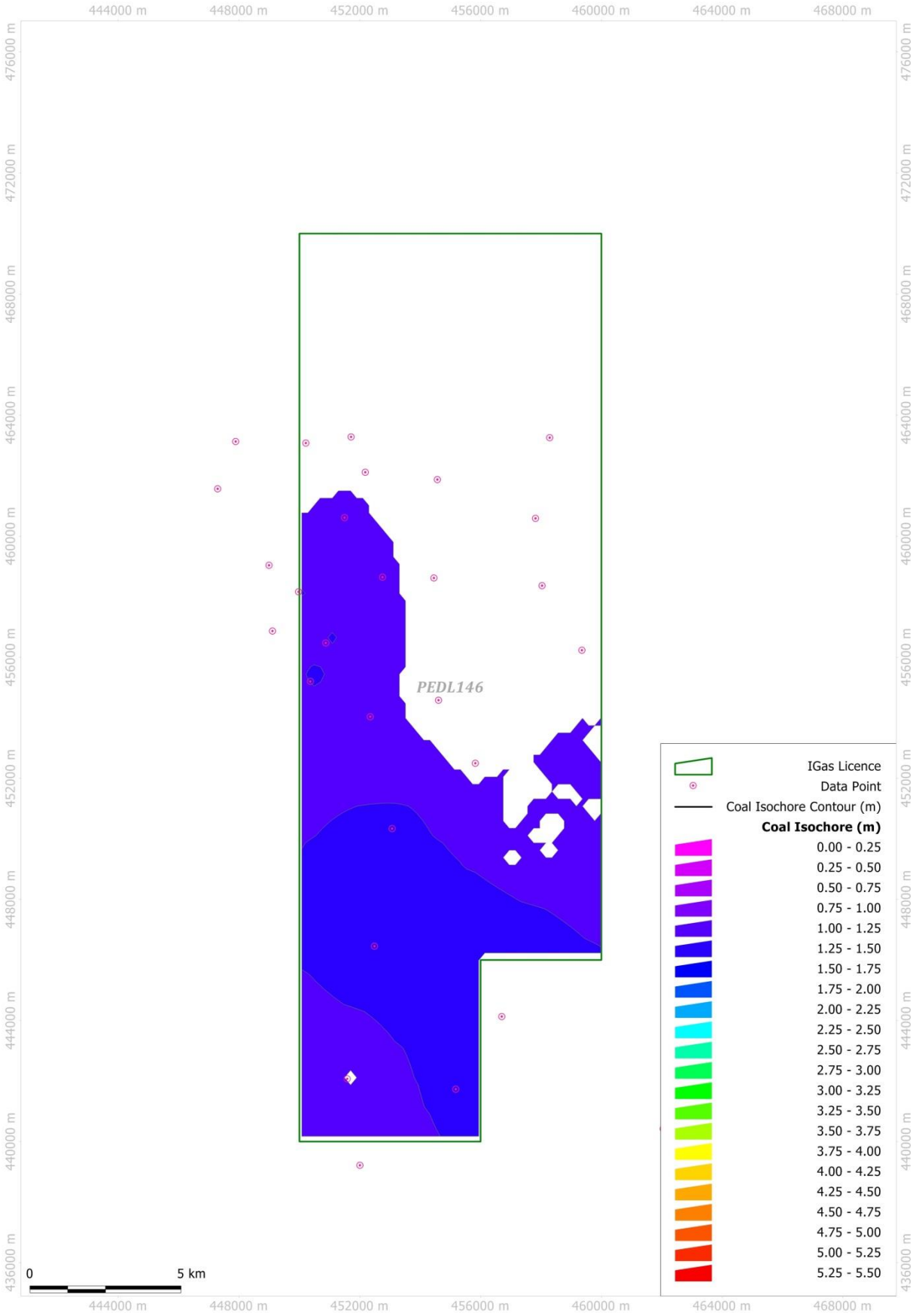
Parkgate Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions



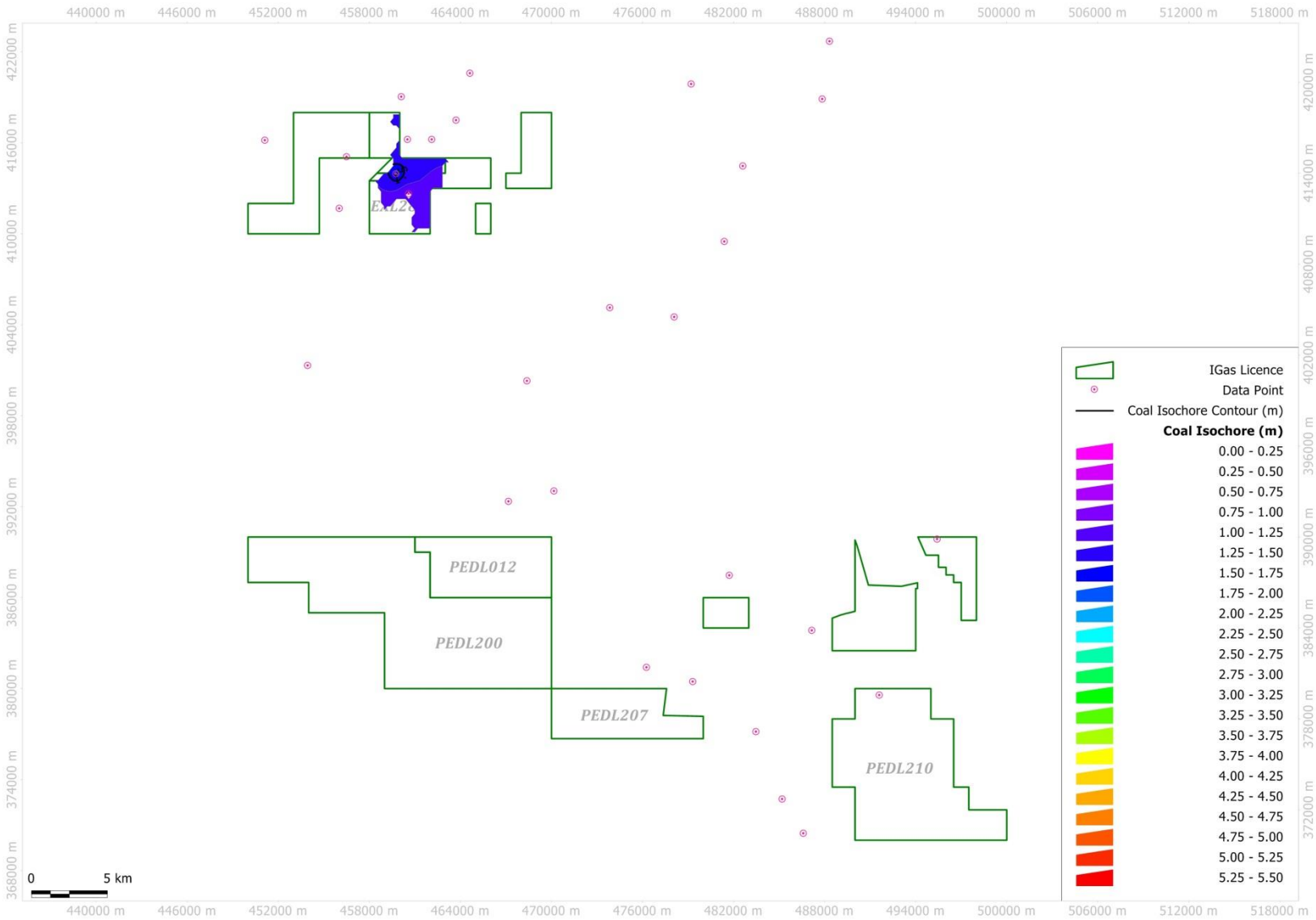
Silkstone Seam (York) Net Thickness (m) - Clipped with Development Restrictions



Silkstone Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions

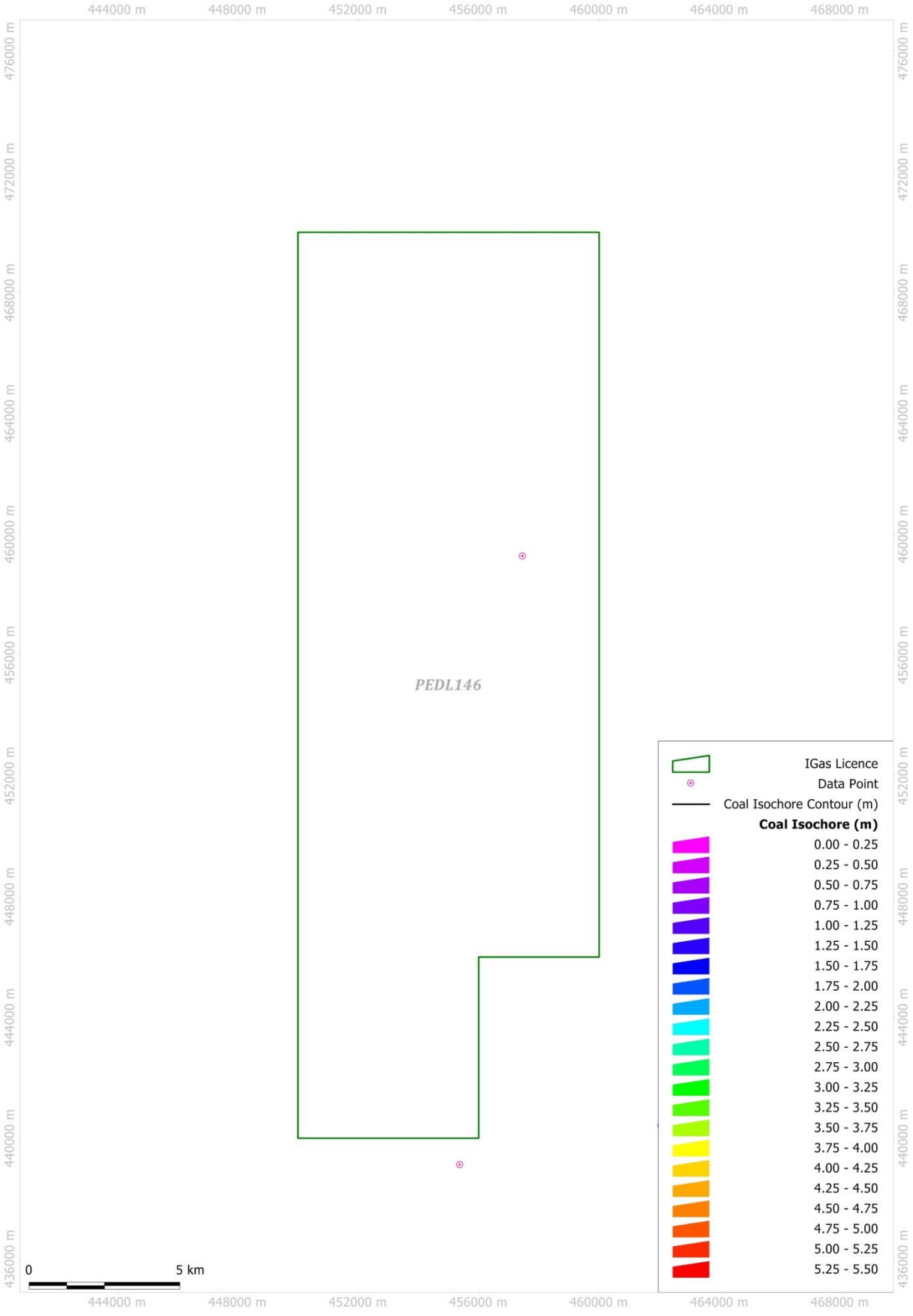


Top Beeston Seam (York) Net Thickness (m) - Clipped with Development Restrictions

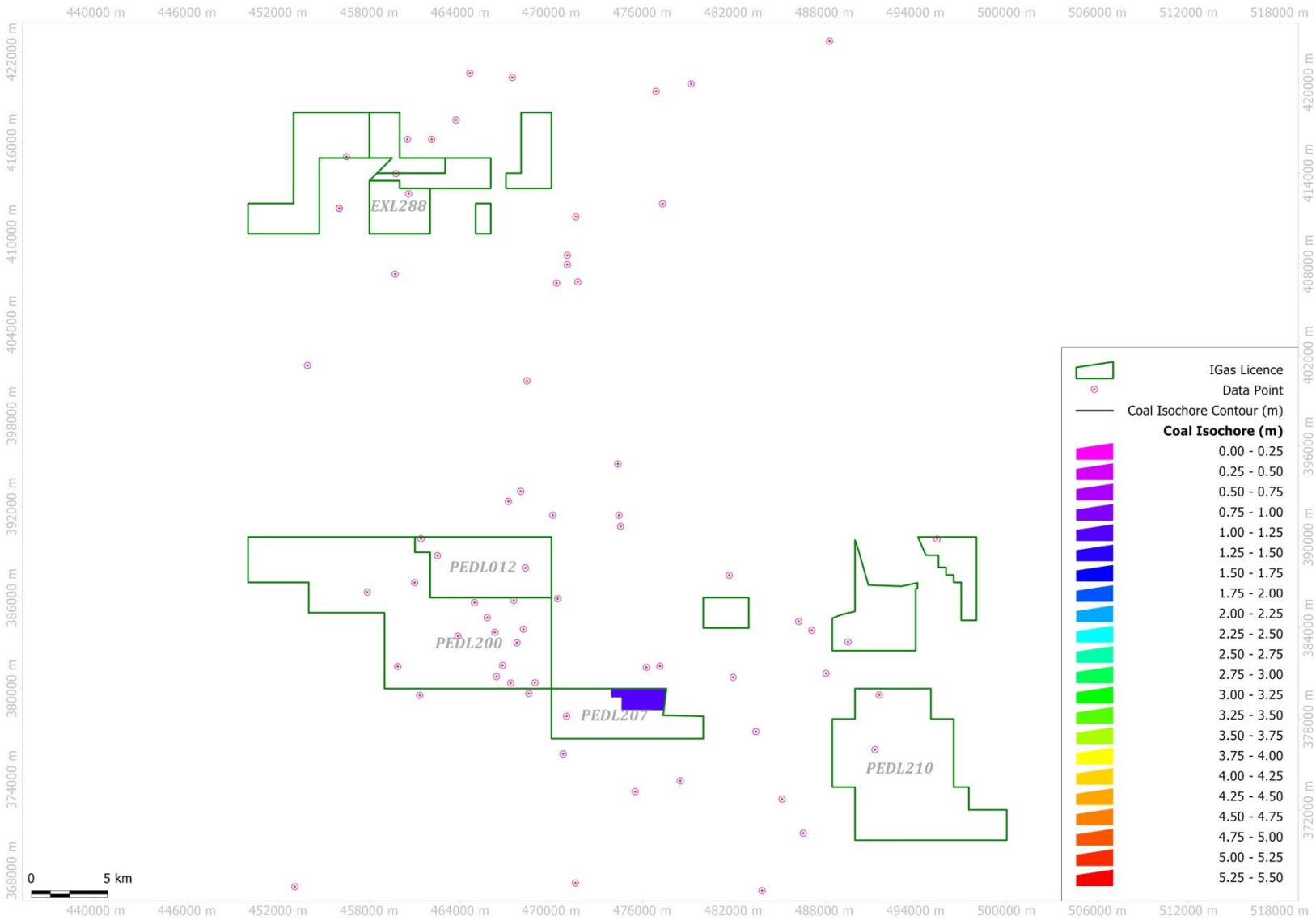


Top Beeston Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions

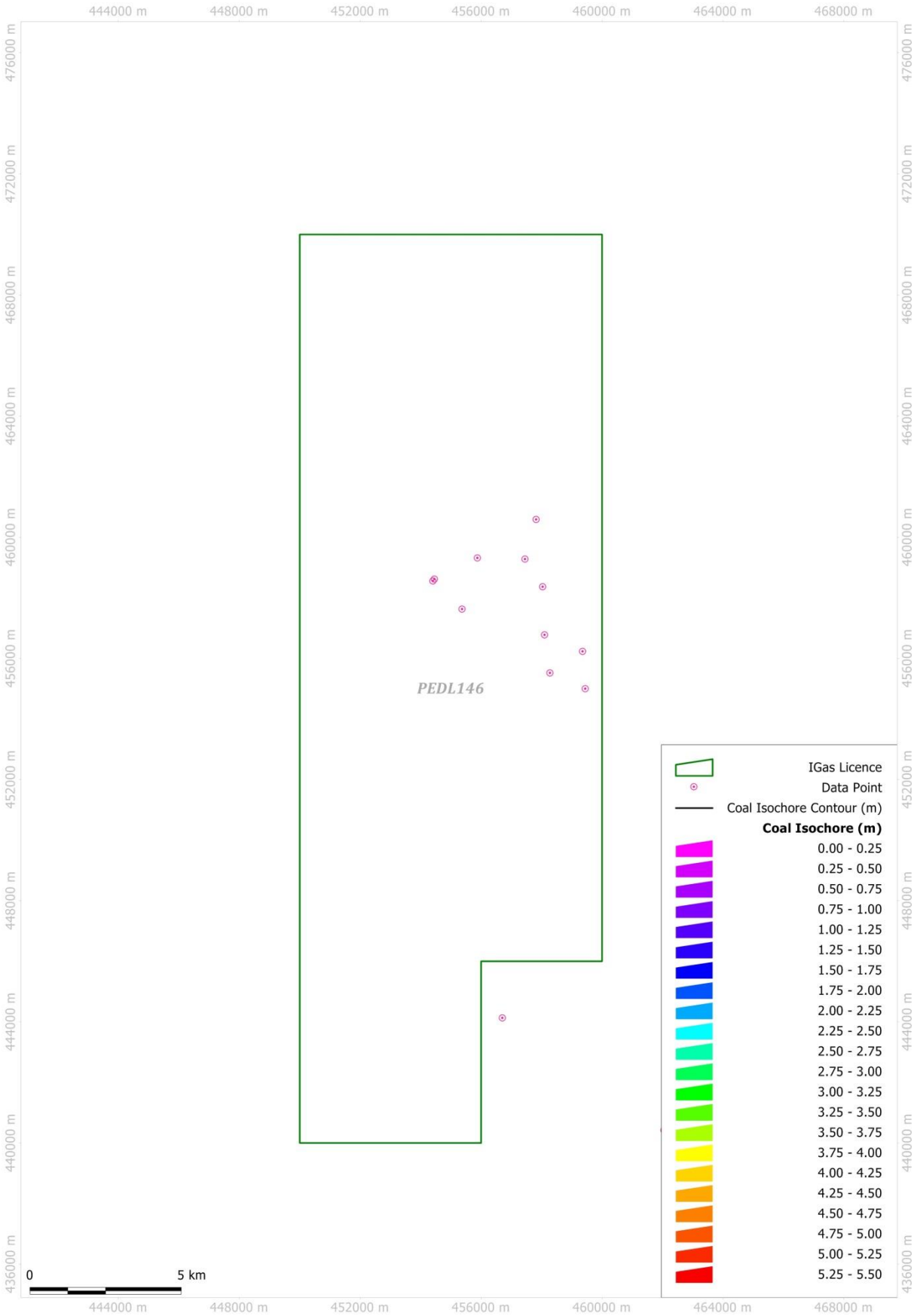
APPENDIX L. East Midlands Coal Seam Net Thickness – Secondary – Clipped



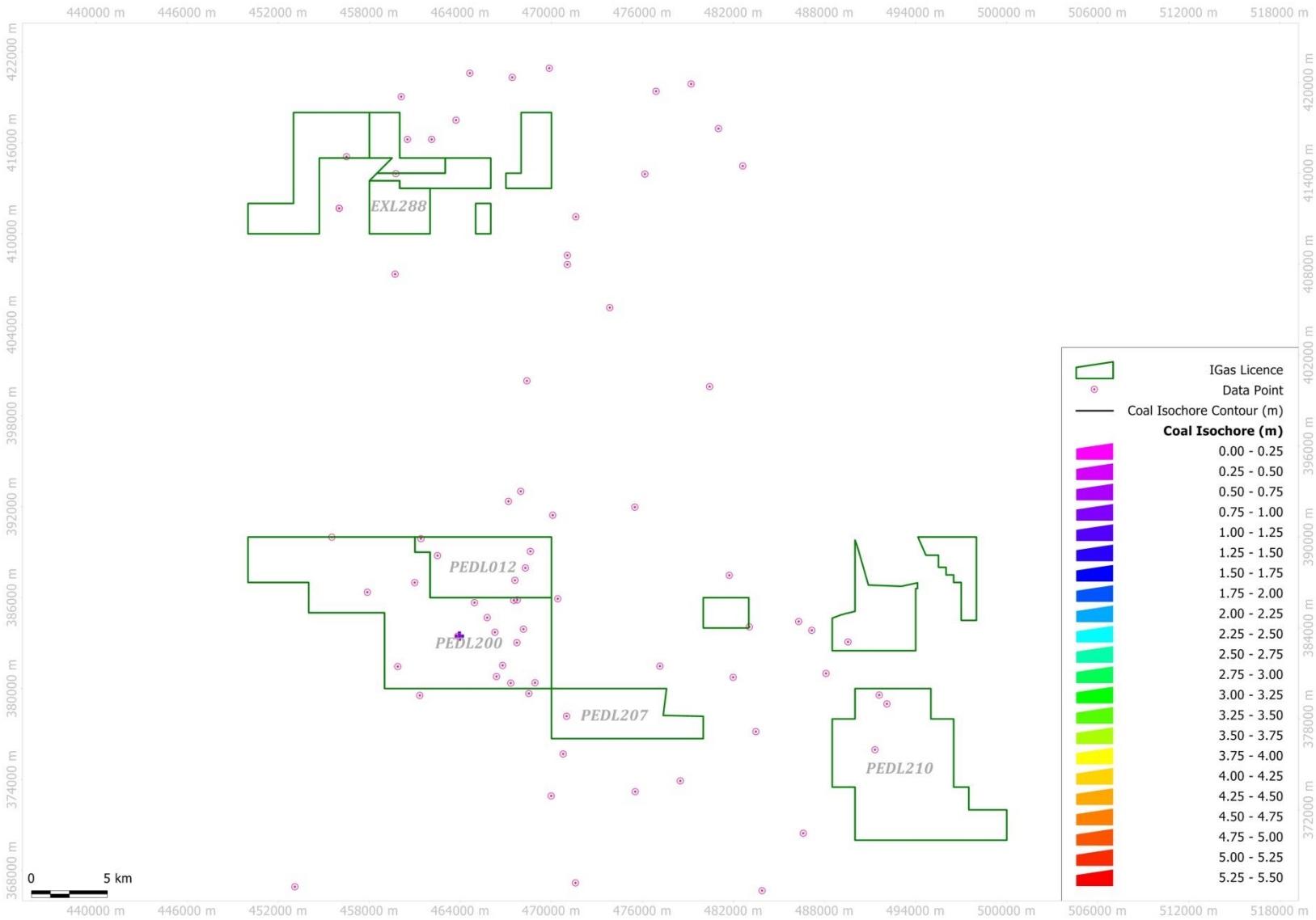
Newhill Seam (York) Net Thickness (m) - Clipped with Development Restrictions



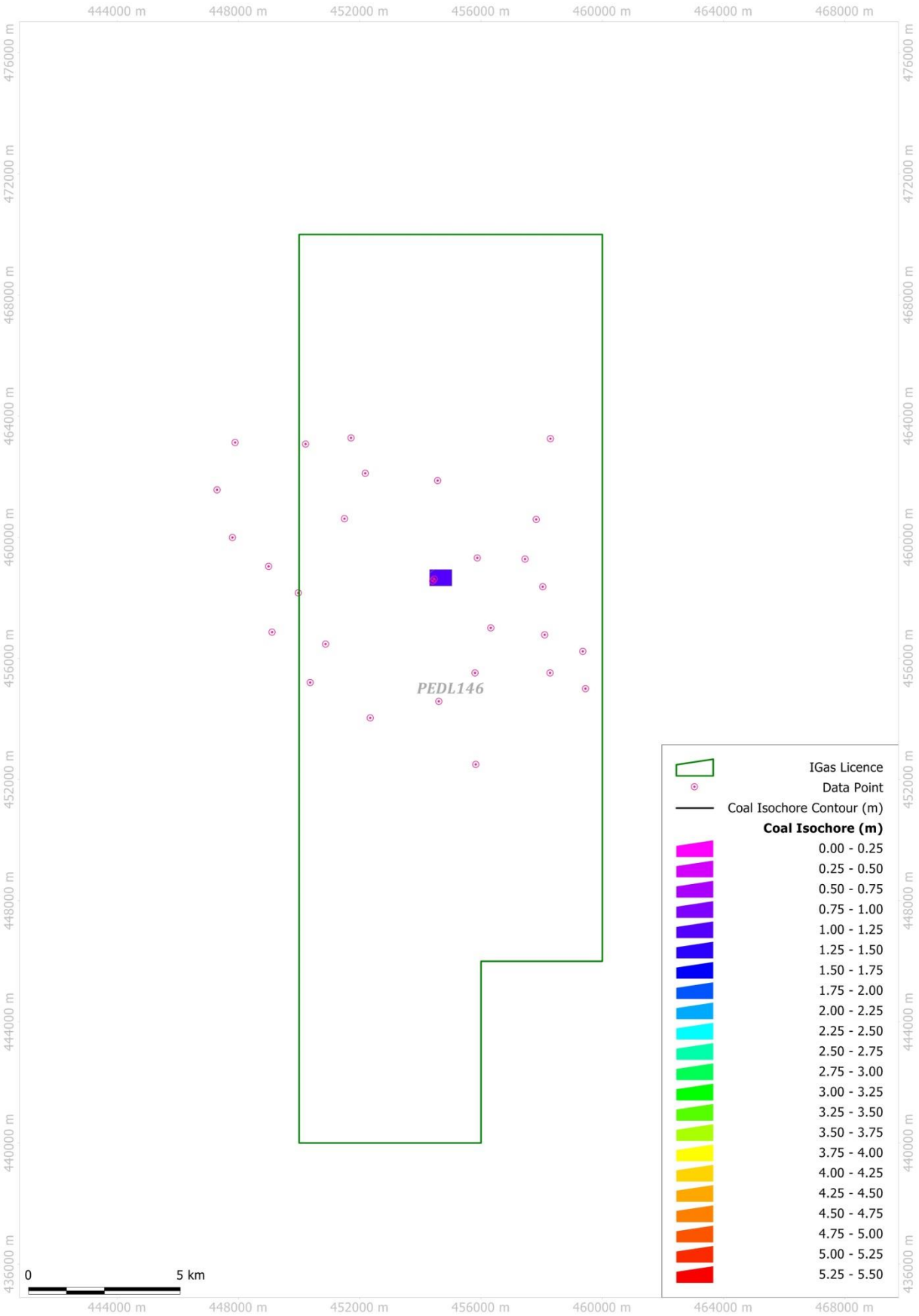
Newhill Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions



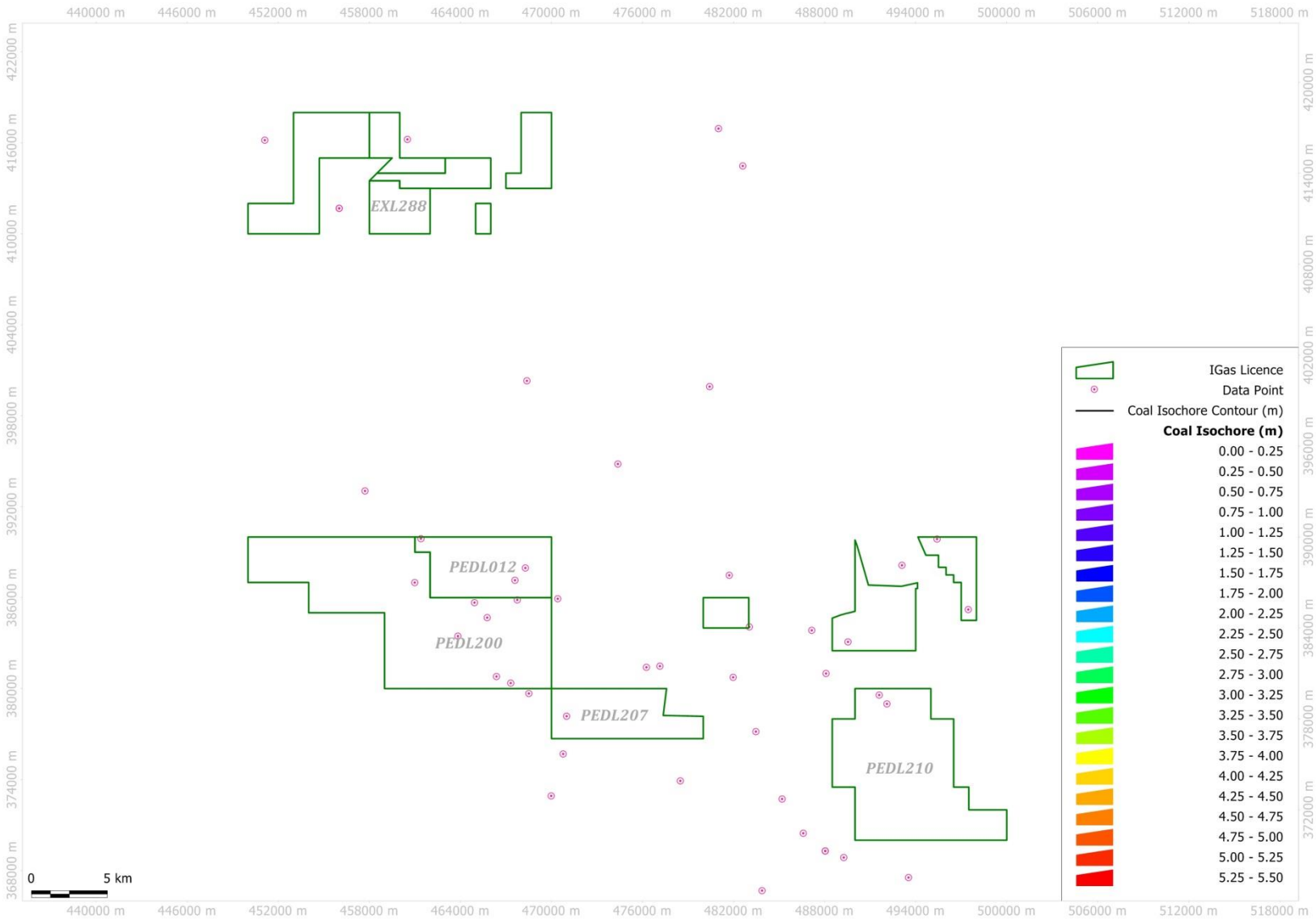
Two Foot Seam (York) Net Thickness (m) - Clipped with Development Restrictions



Two Foot Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions

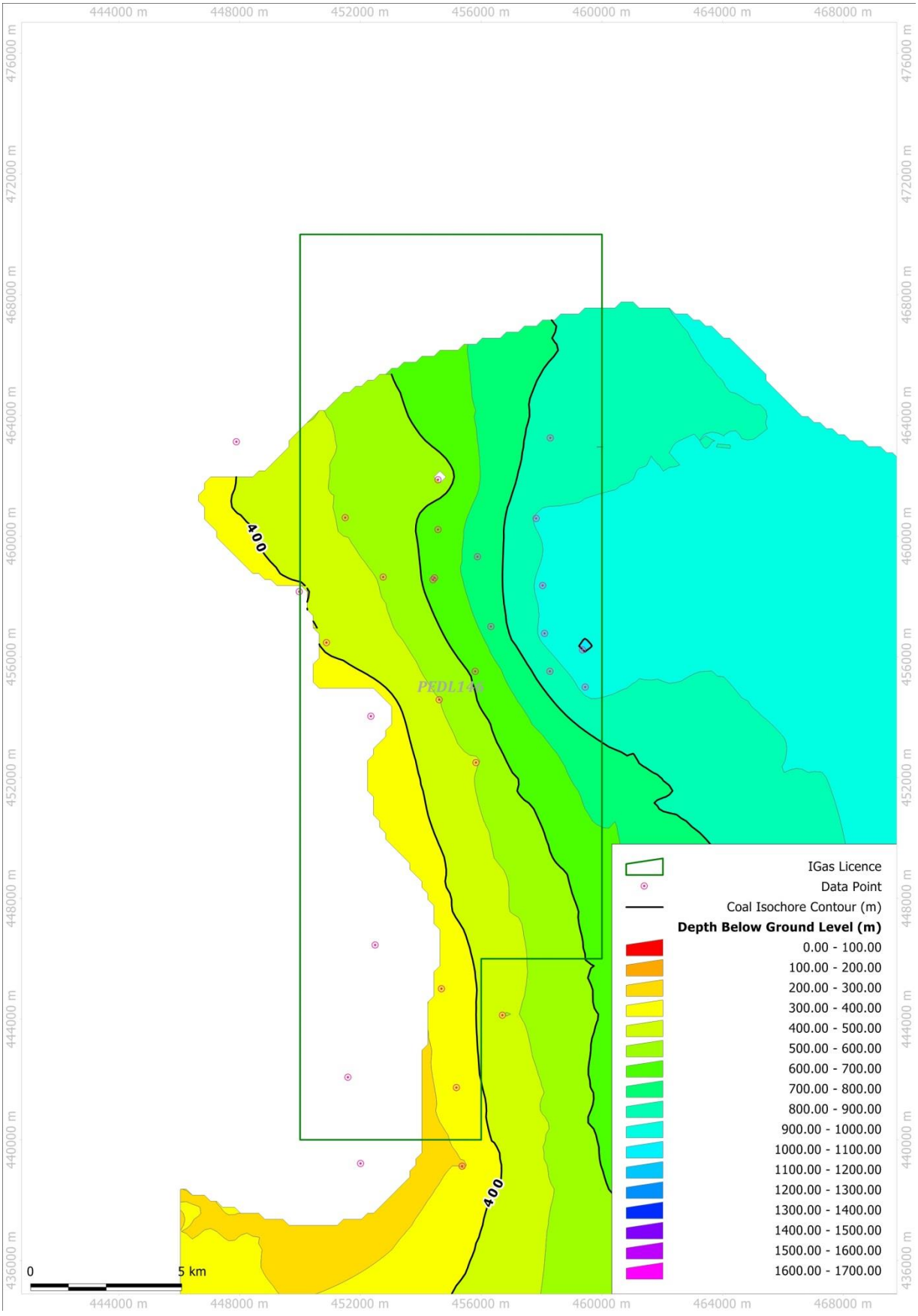


Joan Seam (York) Net Thickness (m) - Clipped with Development Restrictions

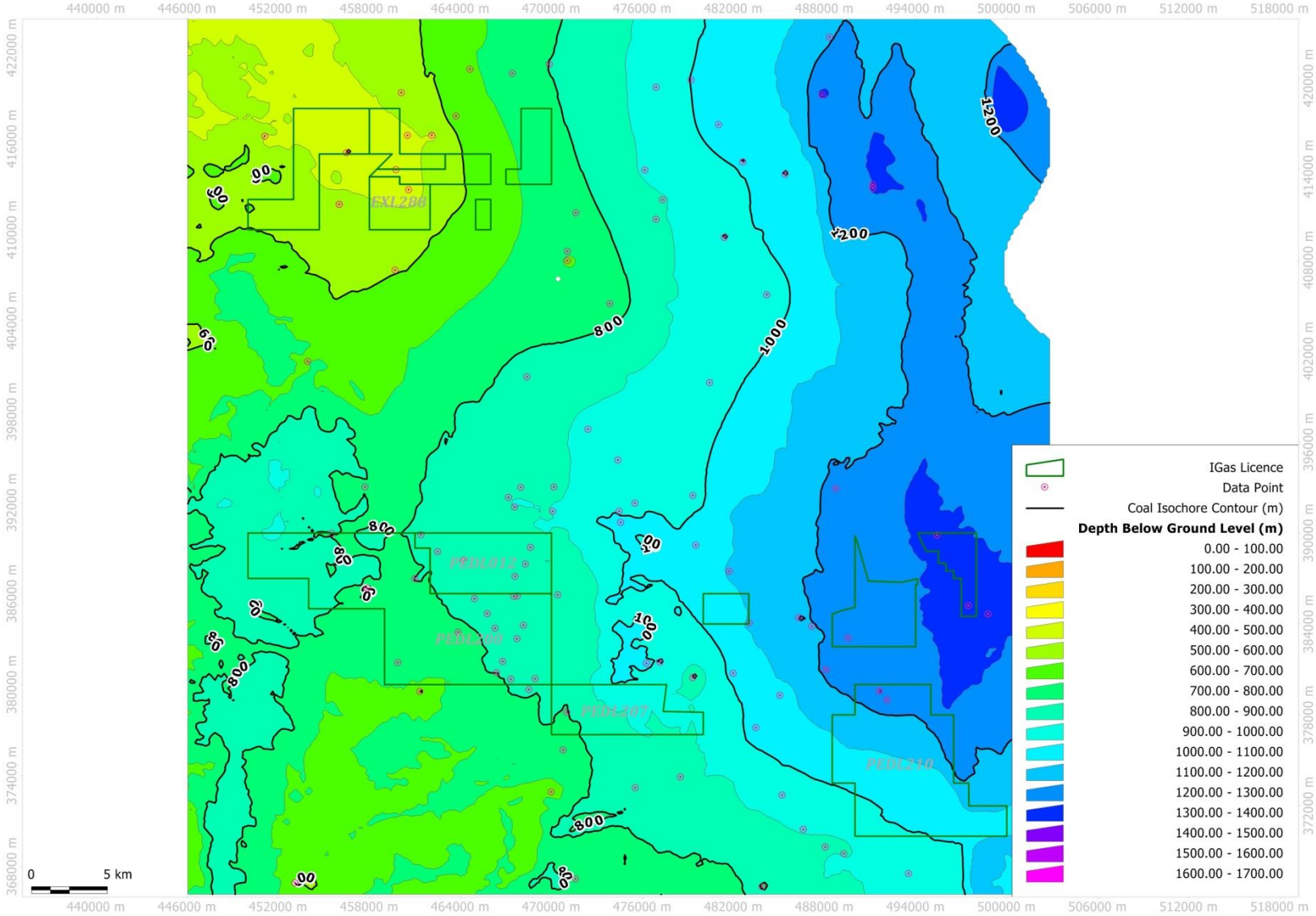


Joan Seam (Gainsborough) Net Thickness (m) - Clipped with Development Restrictions

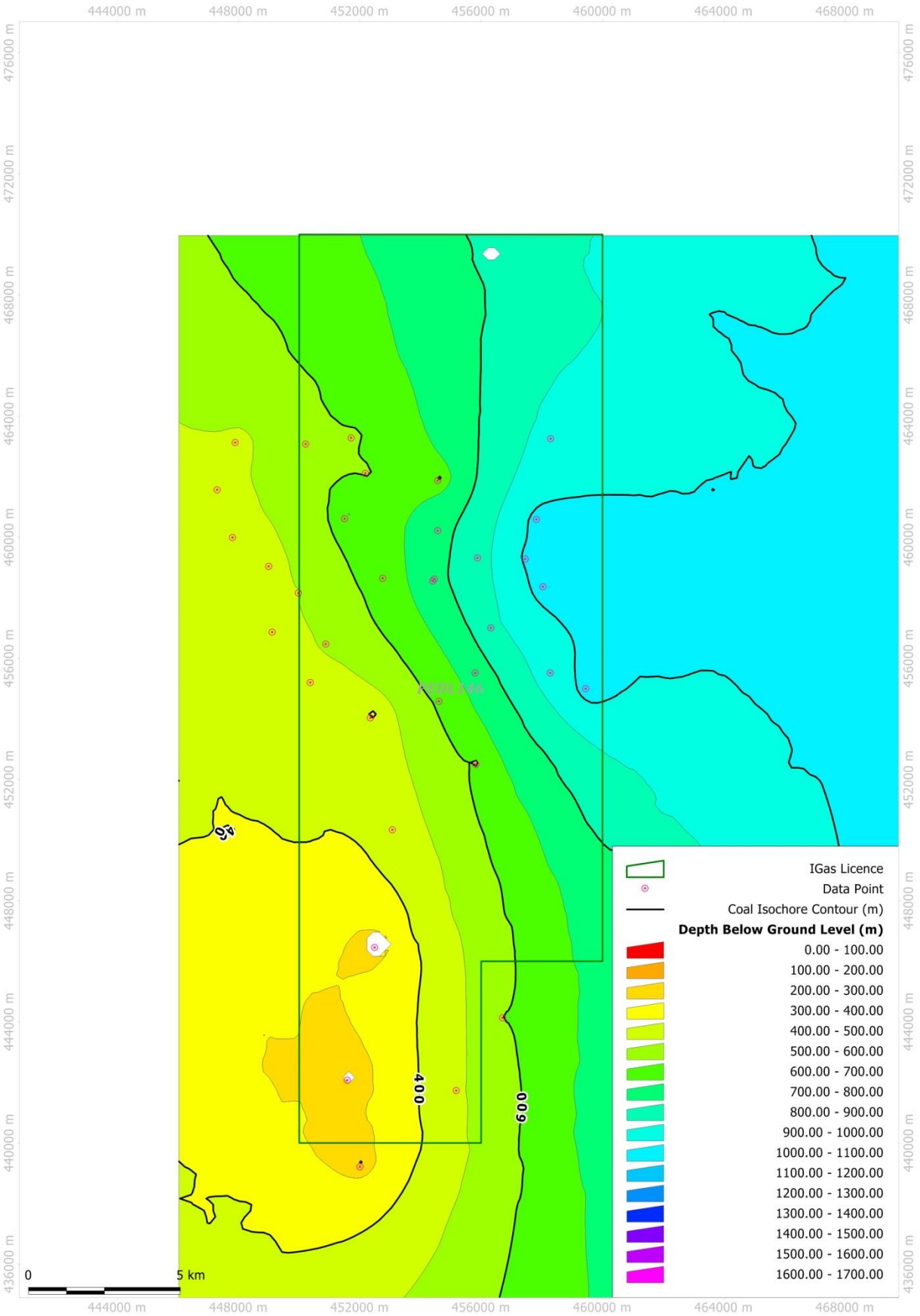
APPENDIX M. East Midlands Seam Depth – Primary



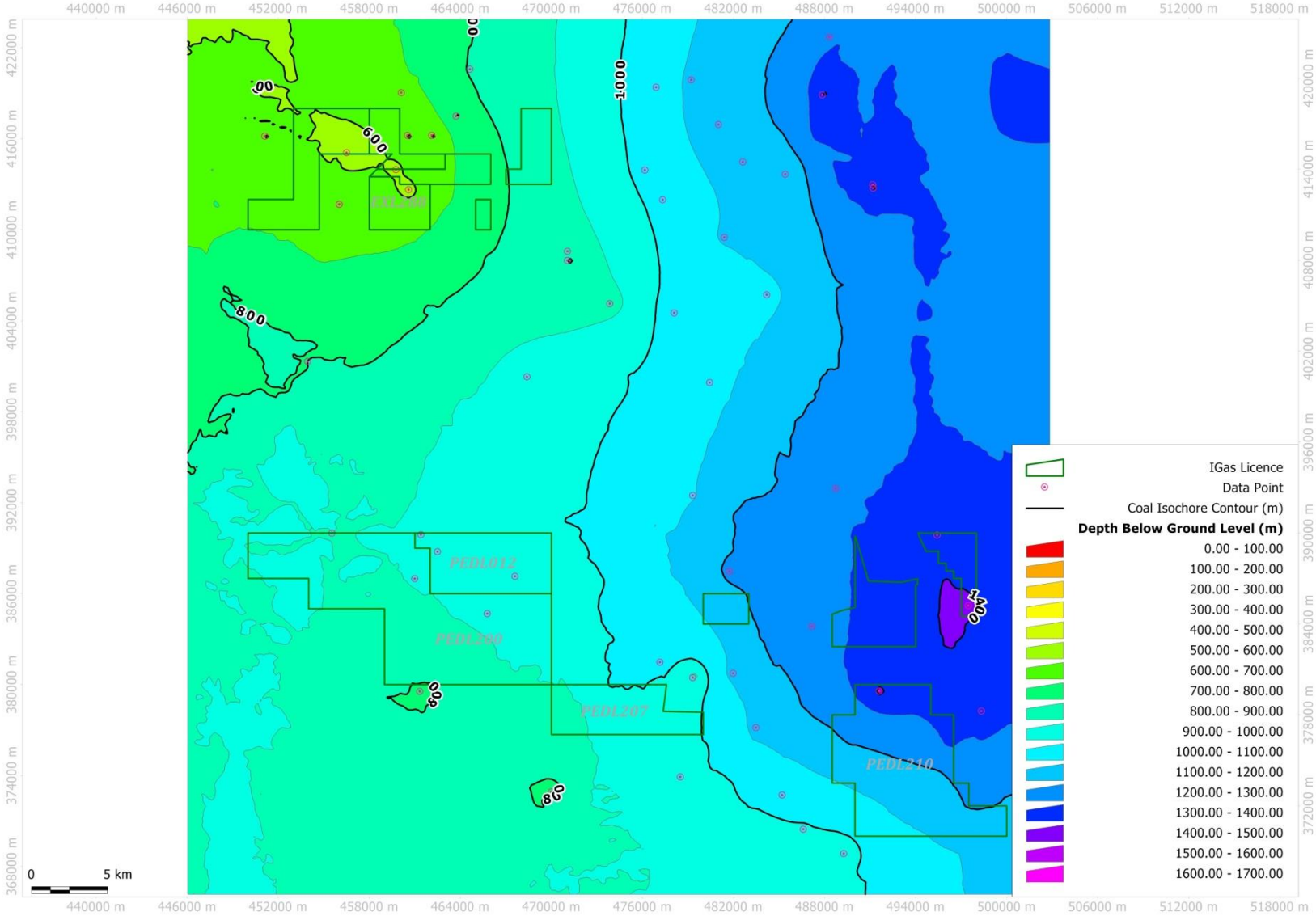
Barnsley Seam (York) Depth (mBGL)



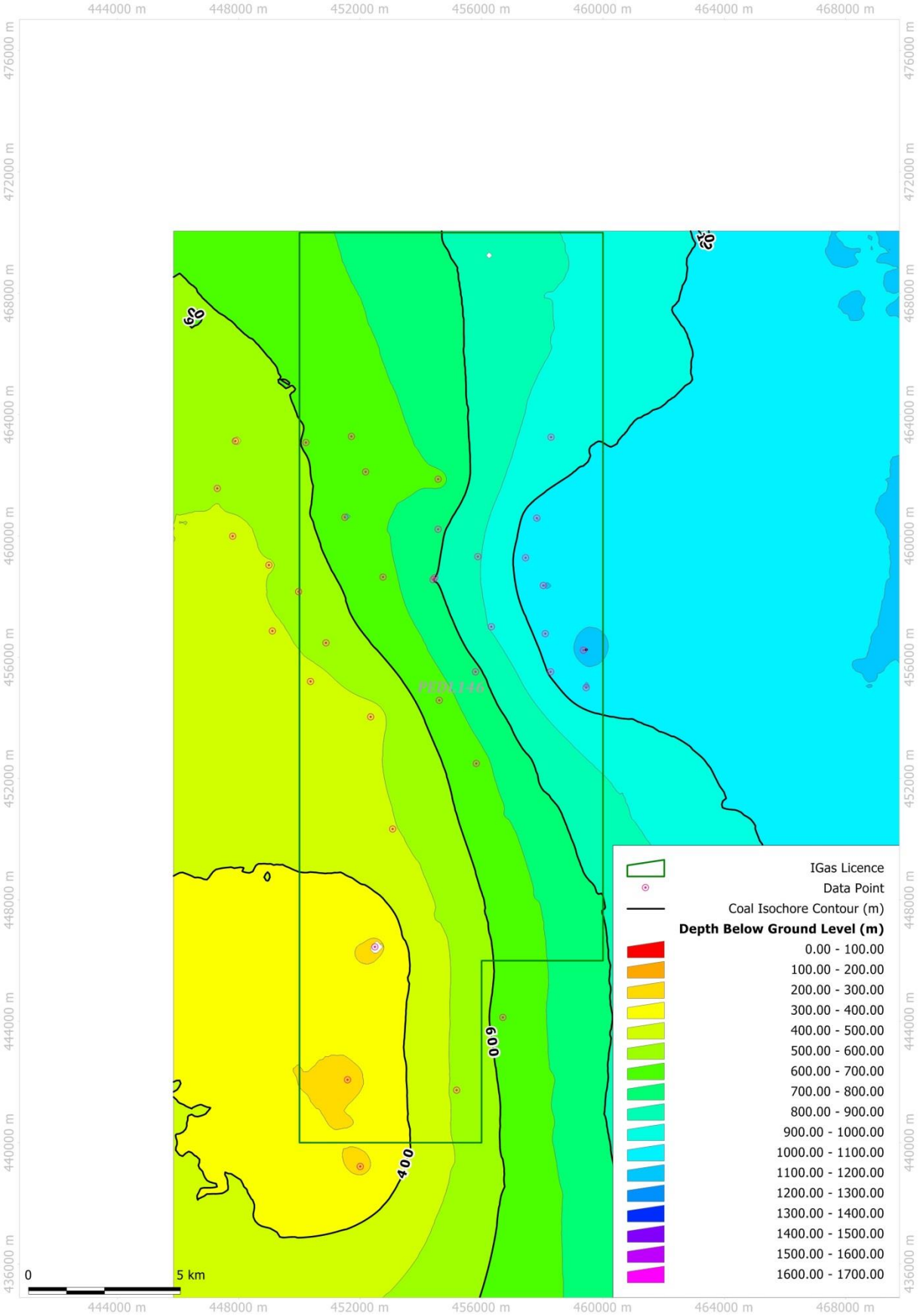
Barnsley Seam (Gainsborough) Depth (mBGL)



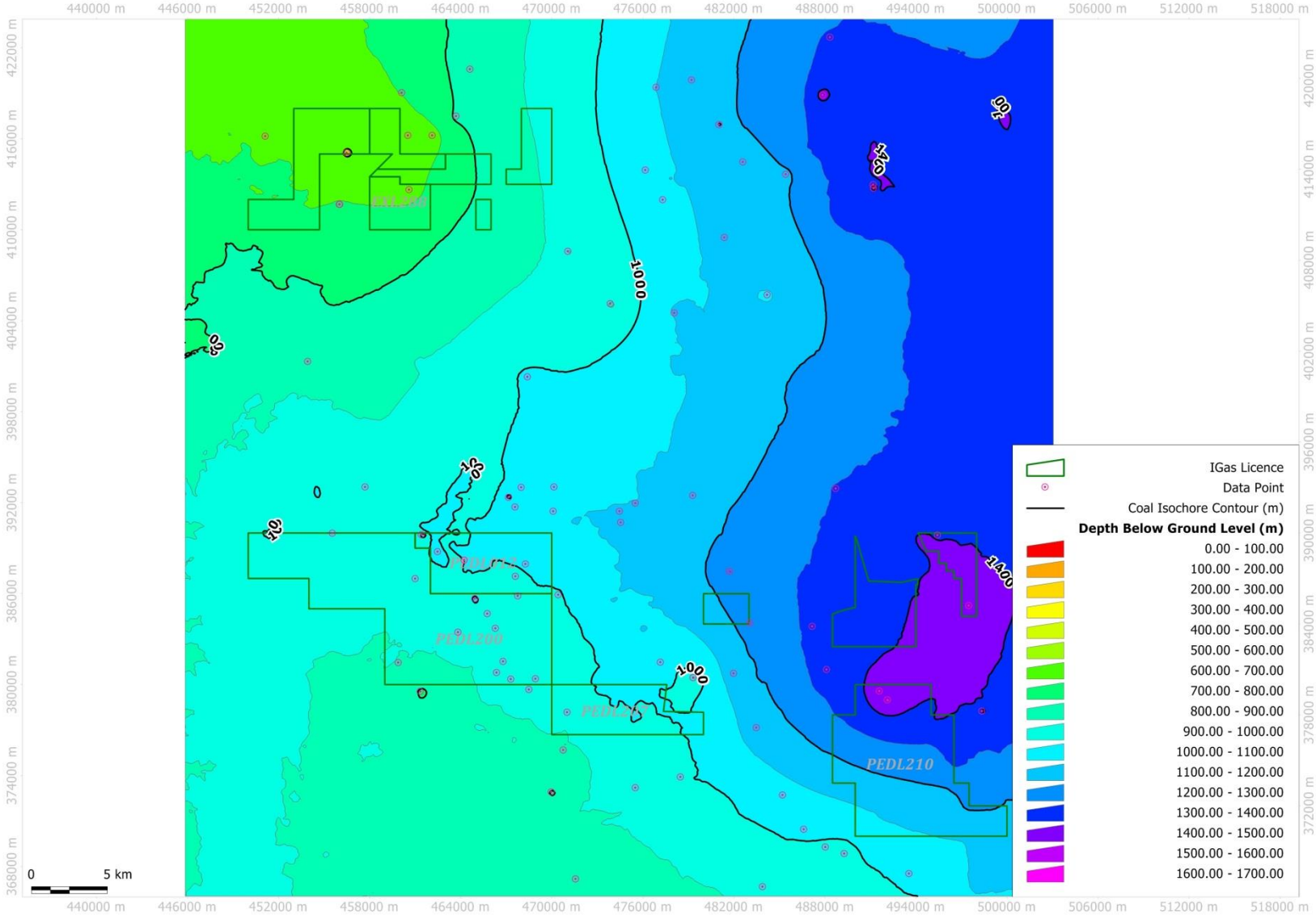
Flockton Seam (York) Depth (mBGL)



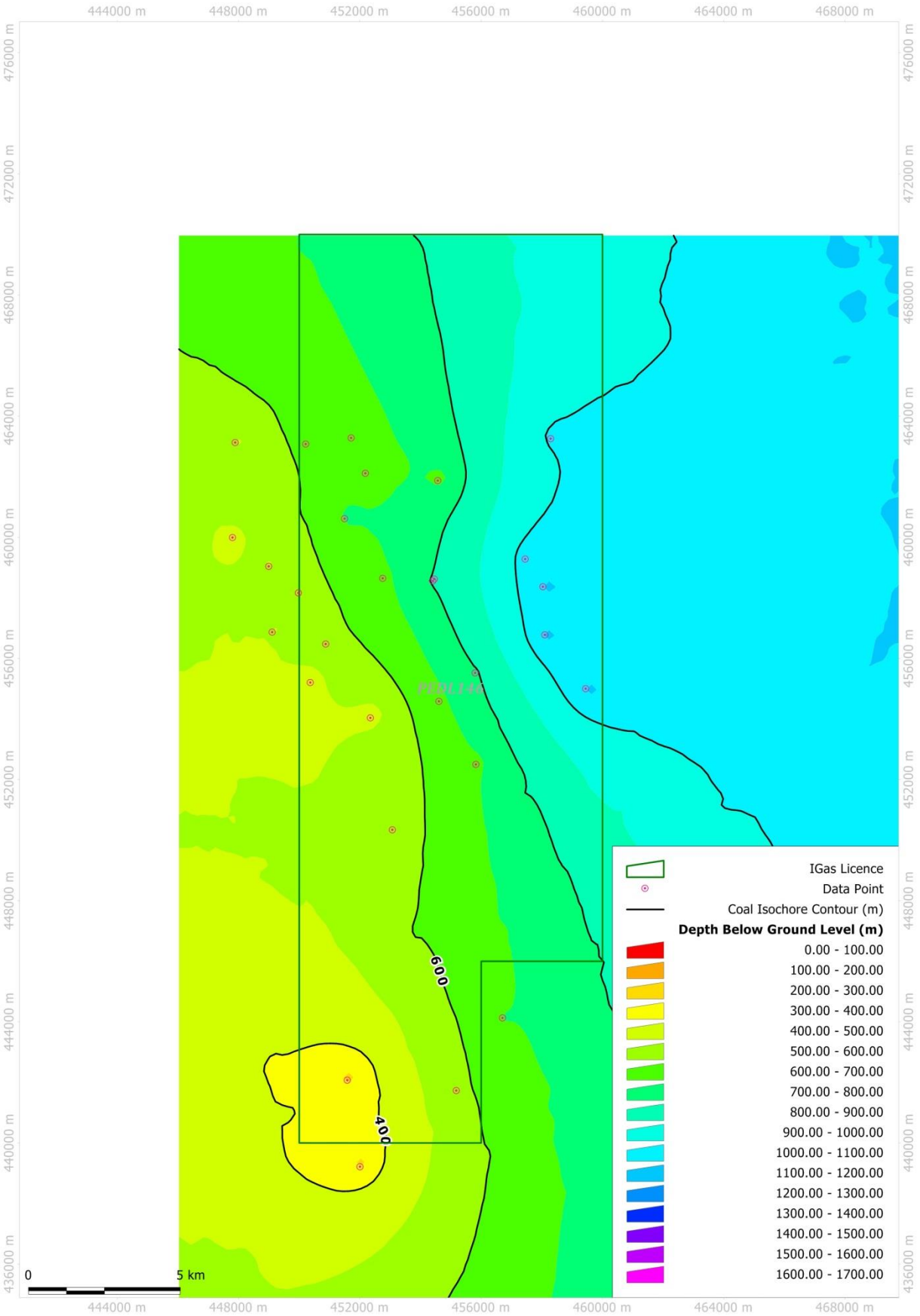
Flockton Seam (Gainsborough) Depth (mBGL)



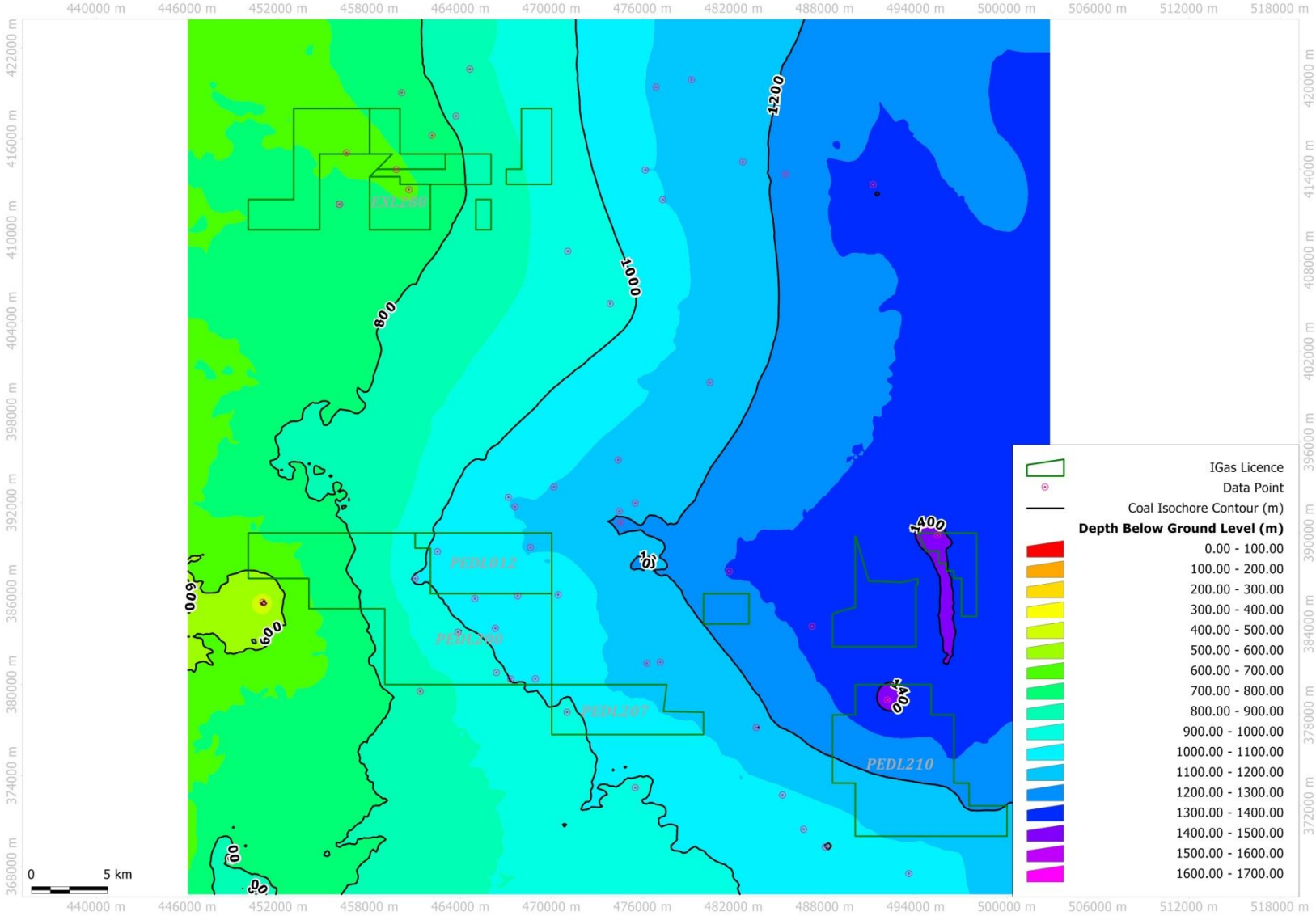
Parkgate Seam (York) Depth (mBGL)



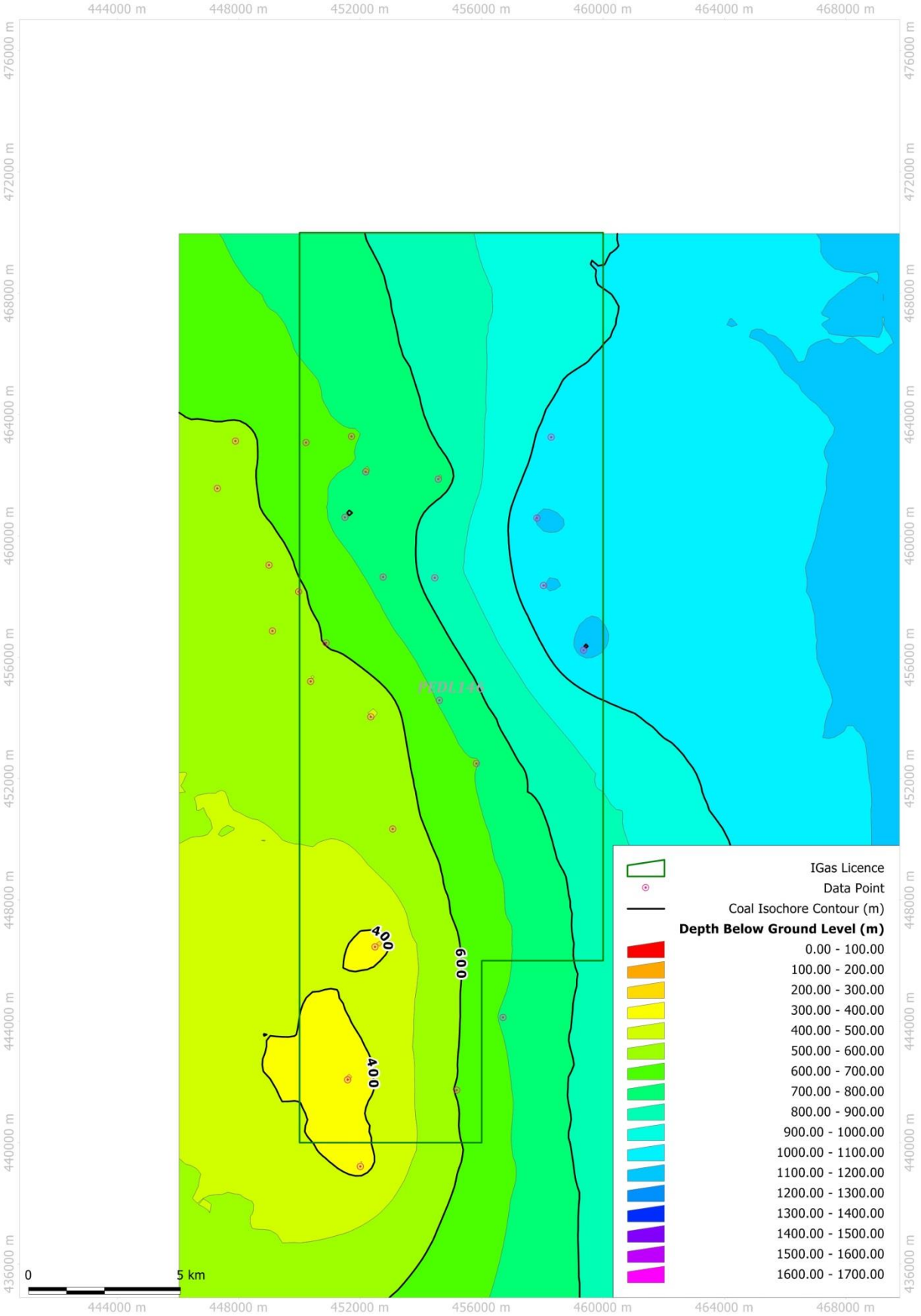
Parkgate Seam (Gainsborough) Depth (mBGL)



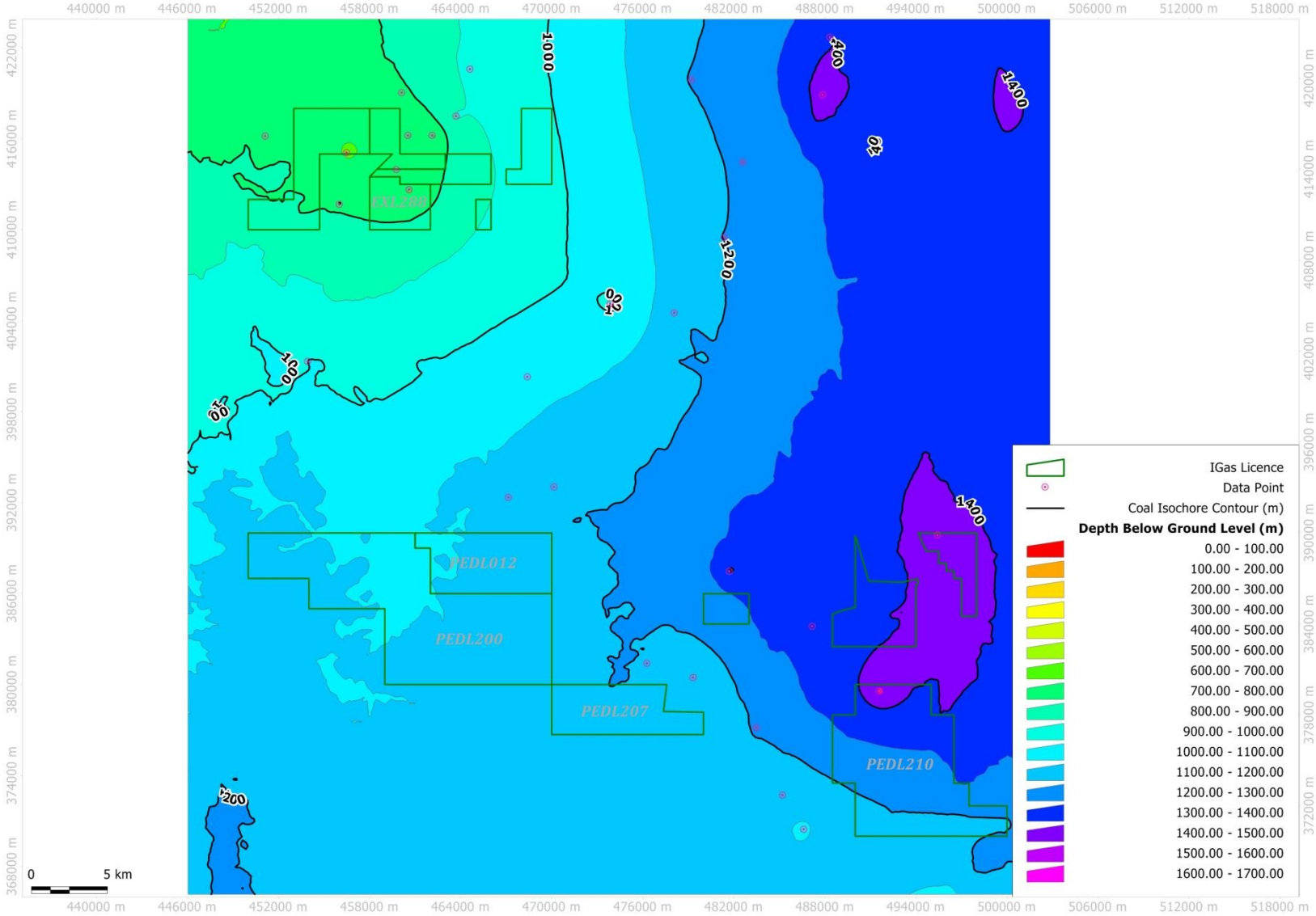
Silkstone Seam (York) Depth (mBGL)



Silkstone Seam (Gainsborough) Depth (mBGL)

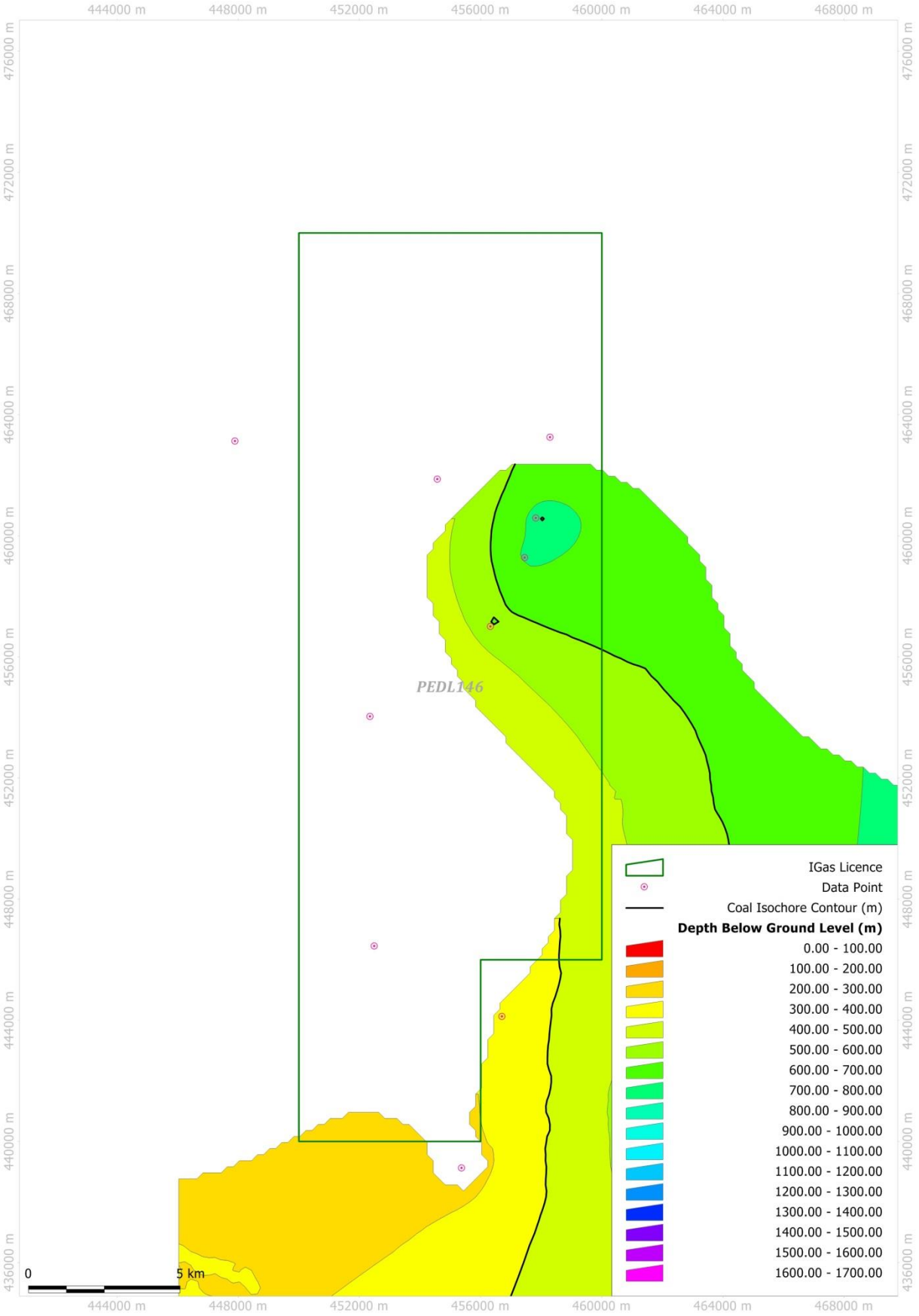


Top Beeston Seam (York) Depth (mBGL)

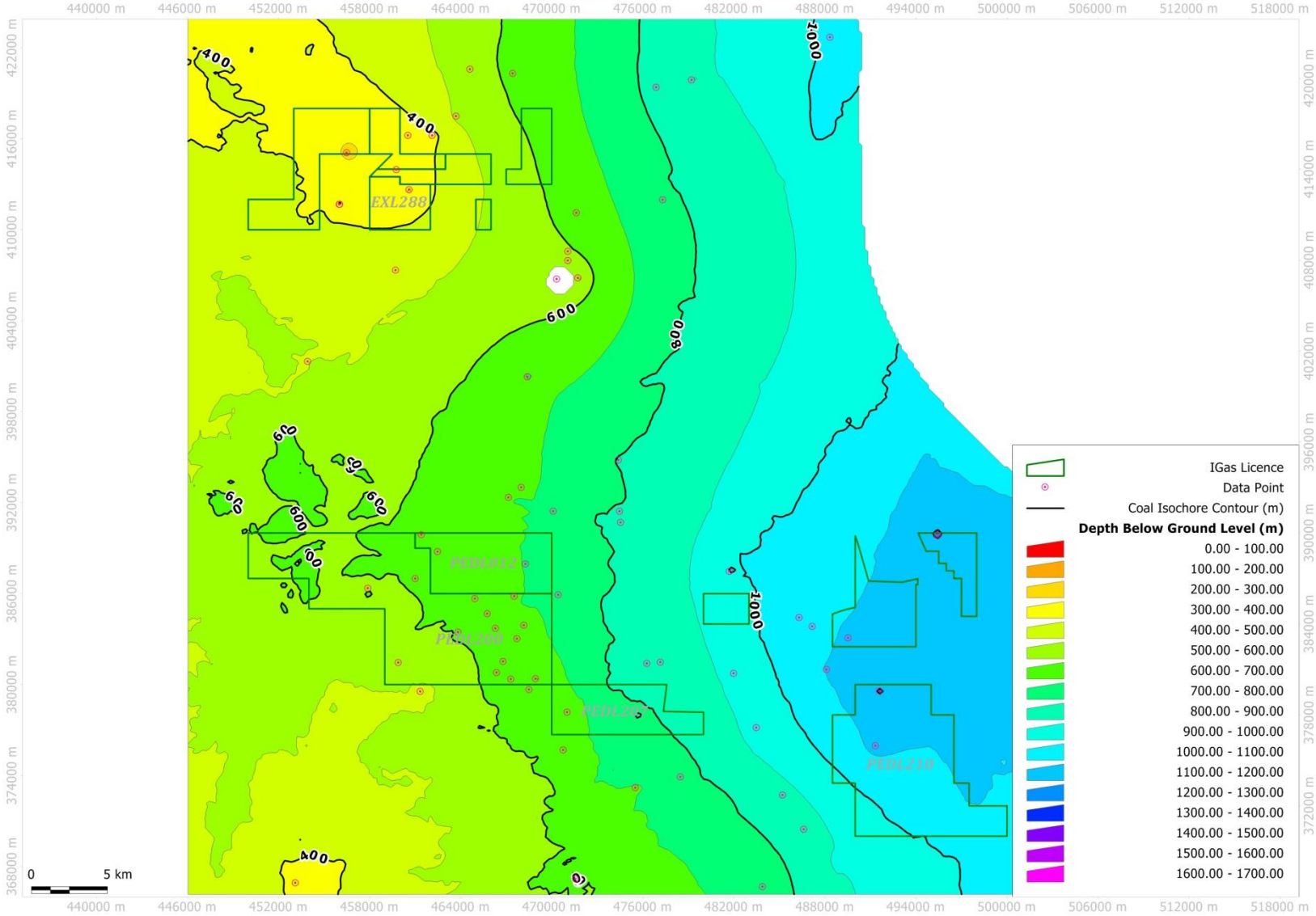


Top Beeston Seam (Gainsborough) Depth (mBGL)

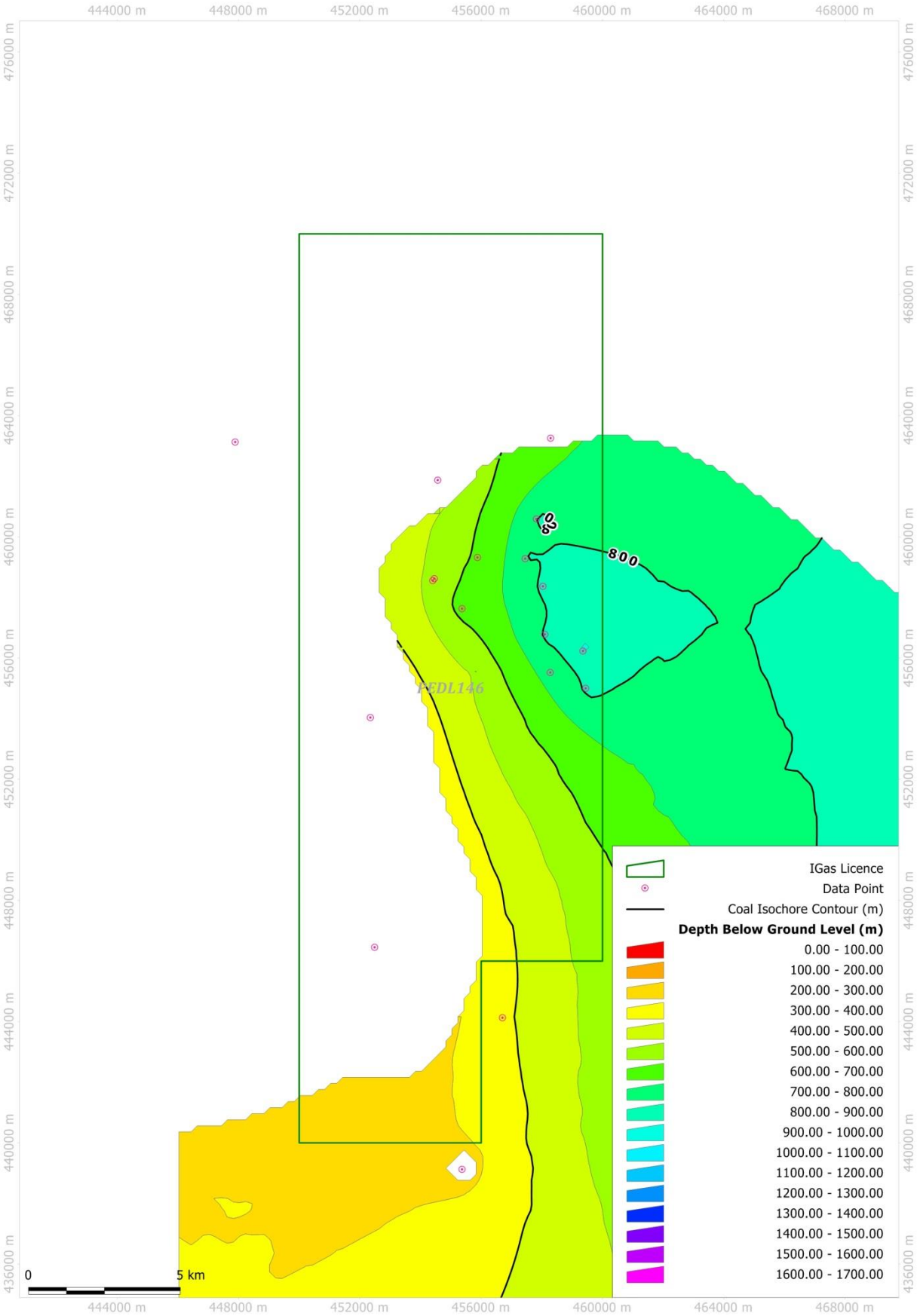
APPENDIX N. East Midlands Seam Depth – Secondary



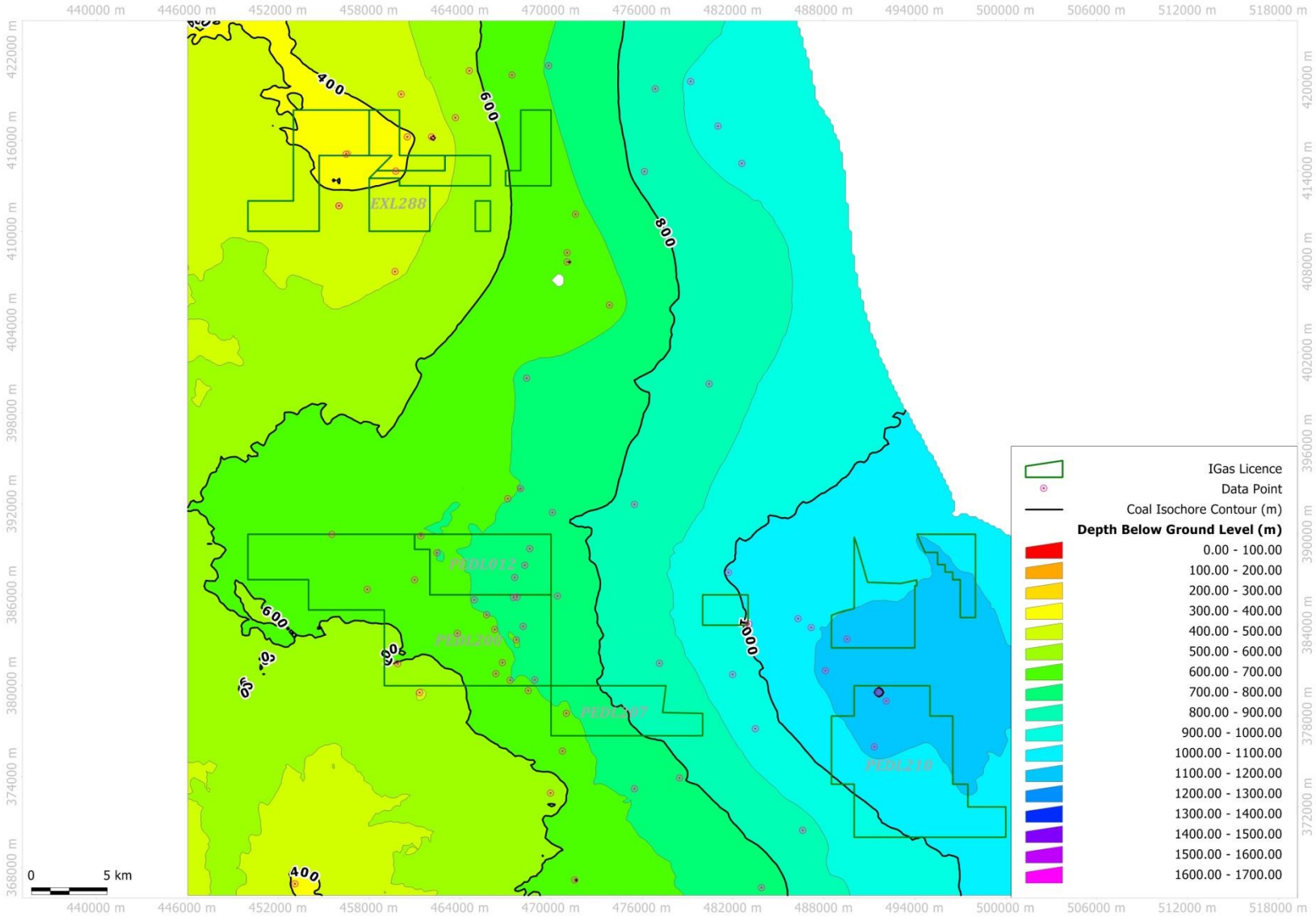
Newhill Seam (York) Depth (mBGL)



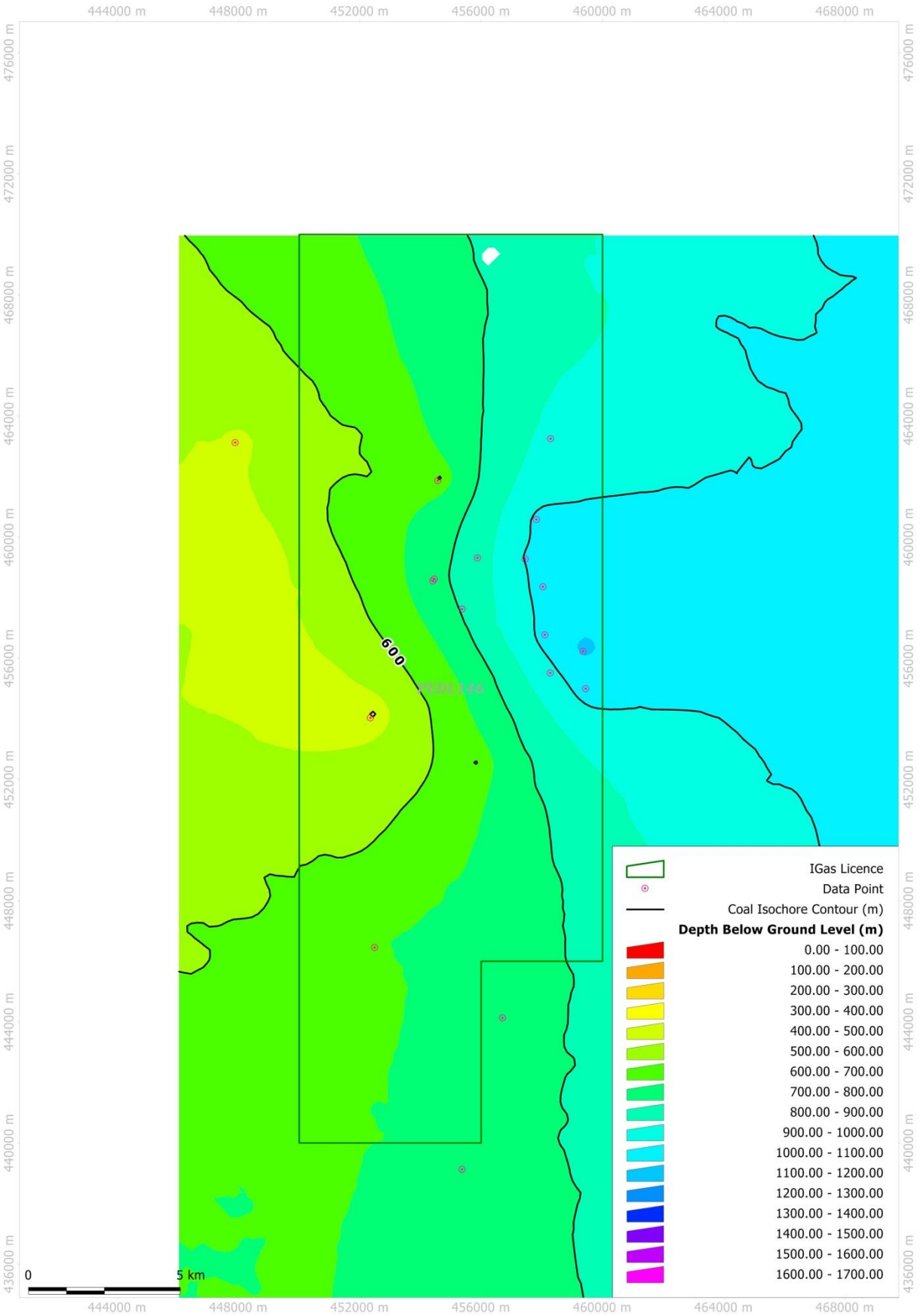
Newhill Seam (Gainsborough) Depth (mBGL)



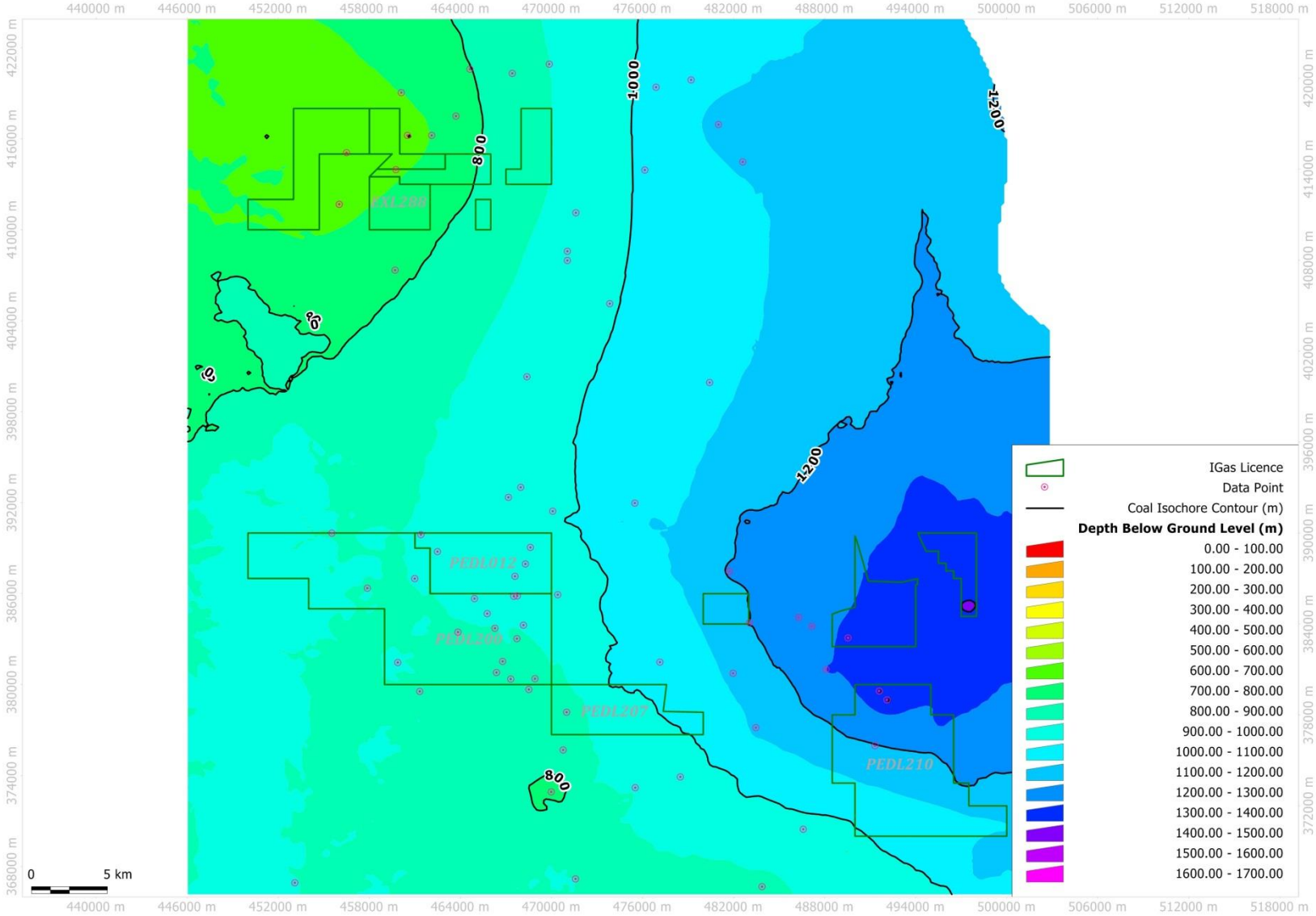
Two Foot Seam (York) Depth (mBGL)



Two Foot Seam (Gainsborough) Depth (mBGL)

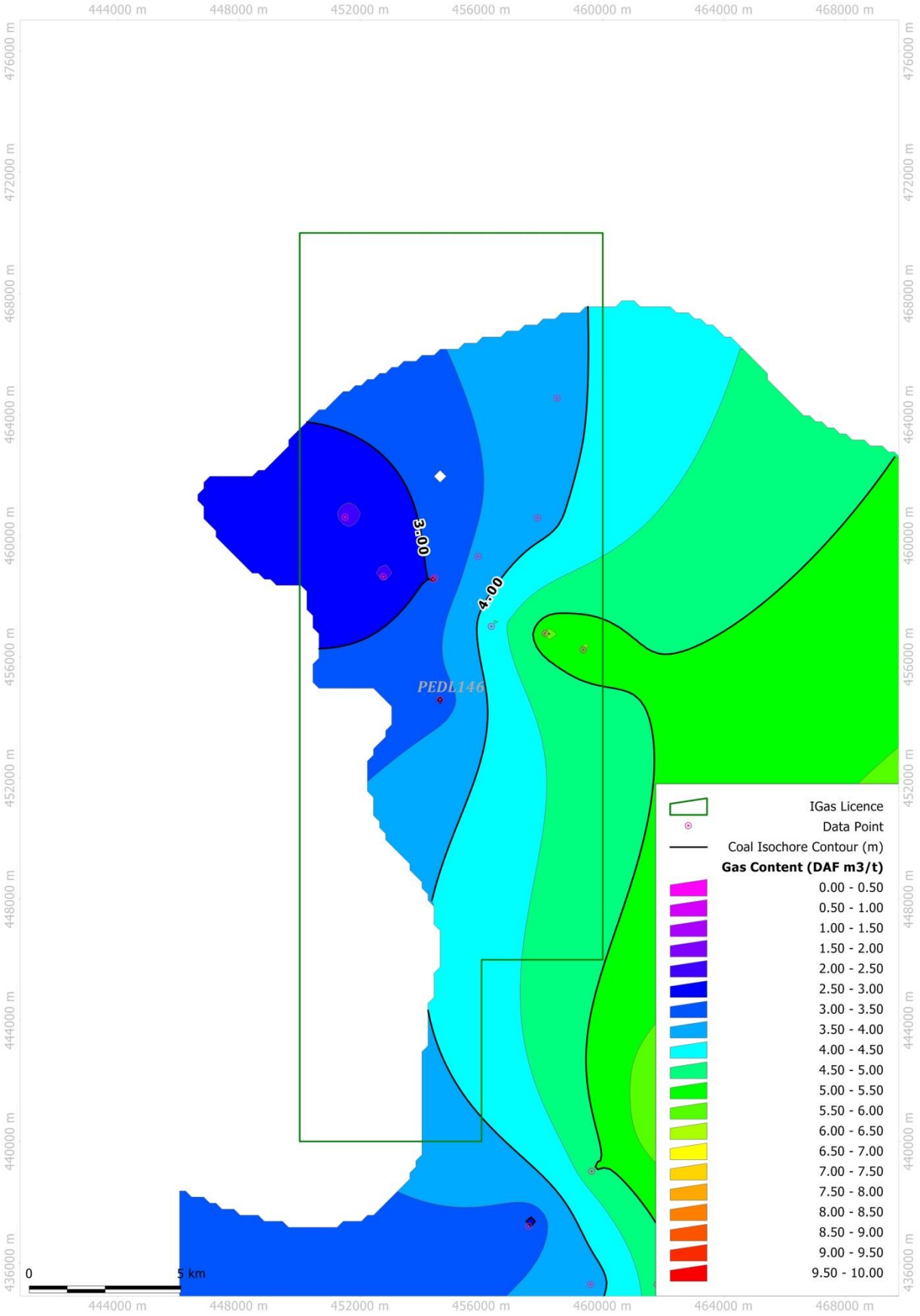


Joan Seam (York) Depth (mBGL)

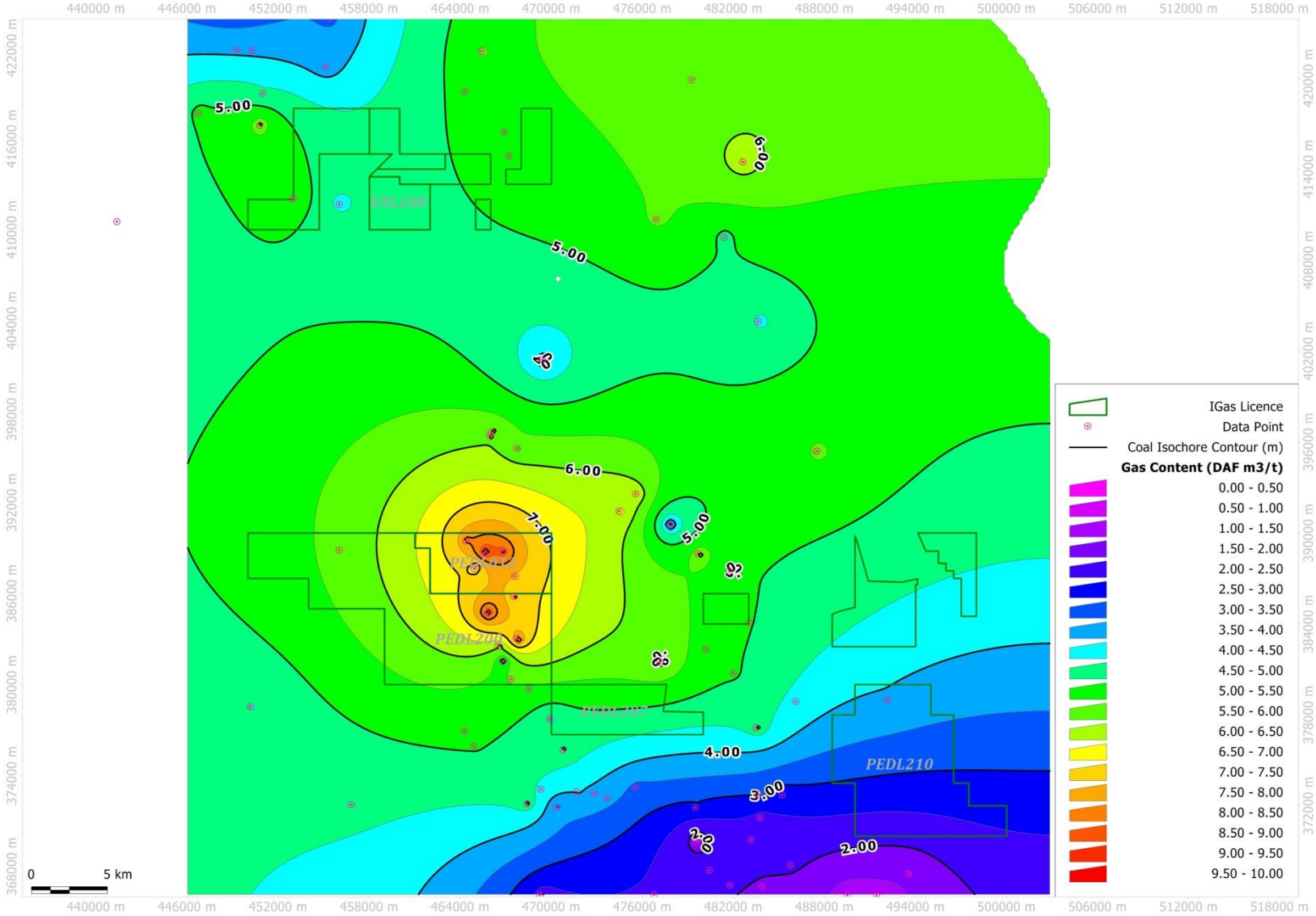


Joan Seam (Gainsborough) Depth (mBGL)

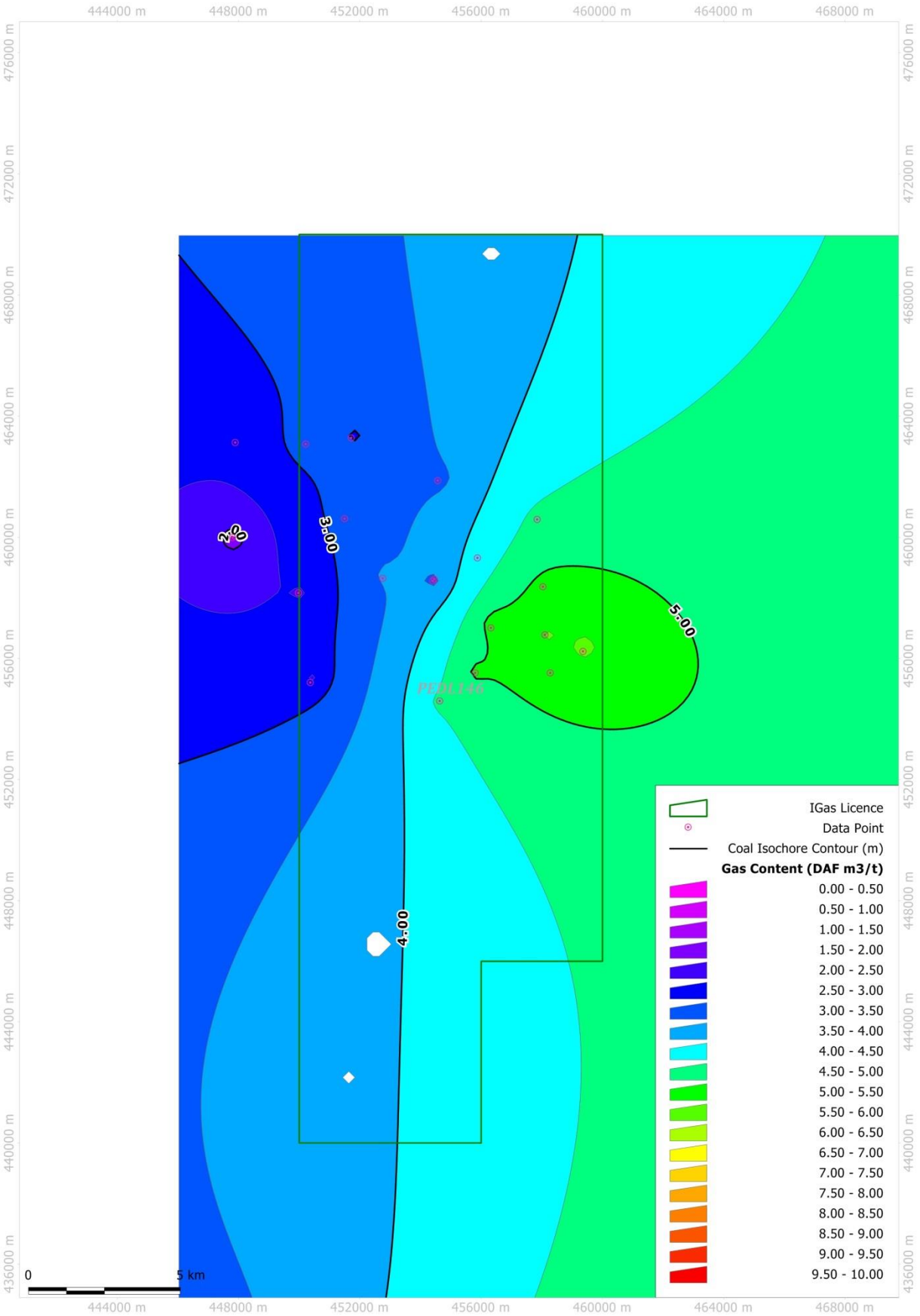
APPENDIX O. East Midlands Seam Gas Content – Primary



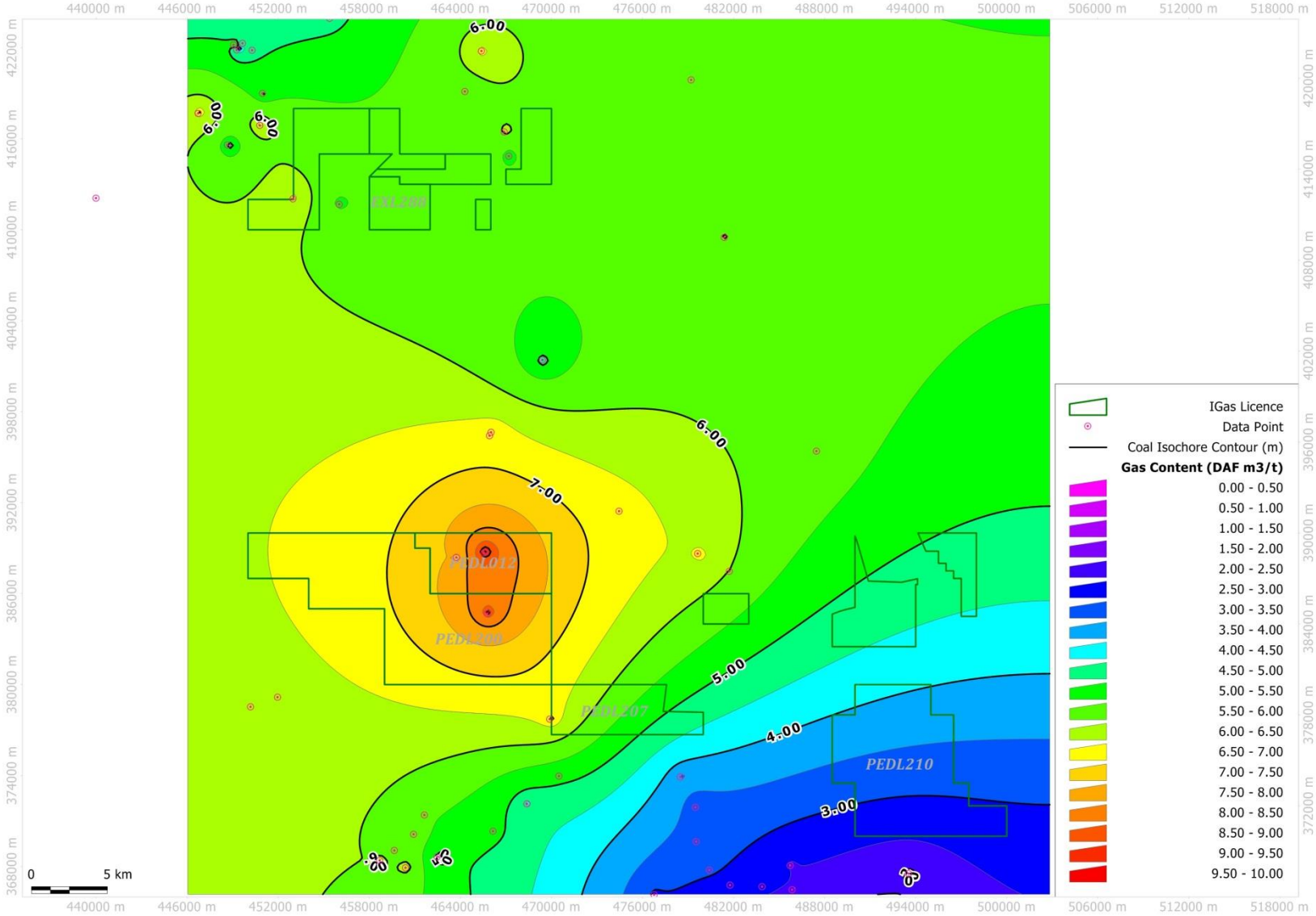
Barnsley Seam (York) Gas Content (m^3/t)



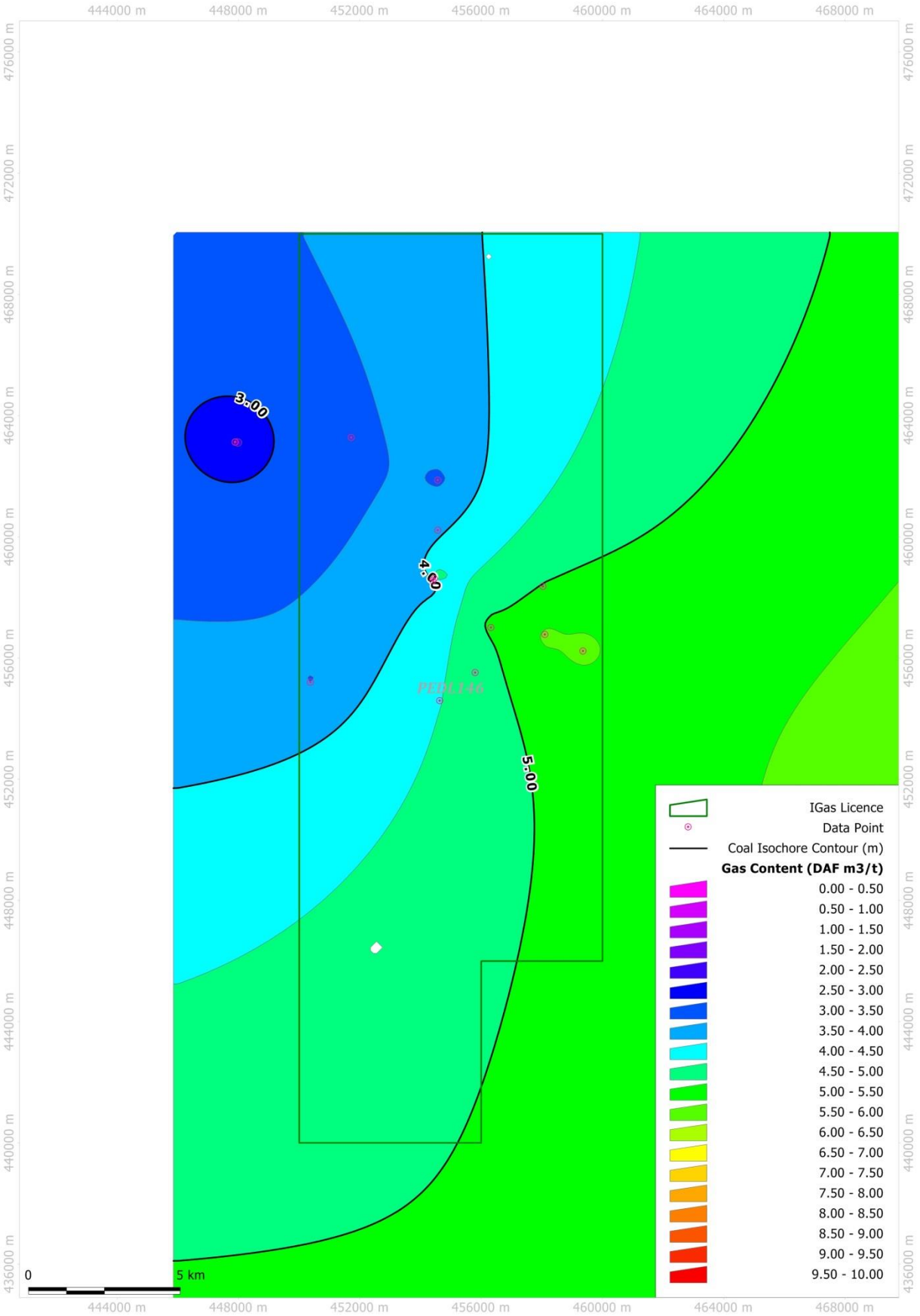
Barnsley Seam (Gainsborough) Gas Content (m^3/t)



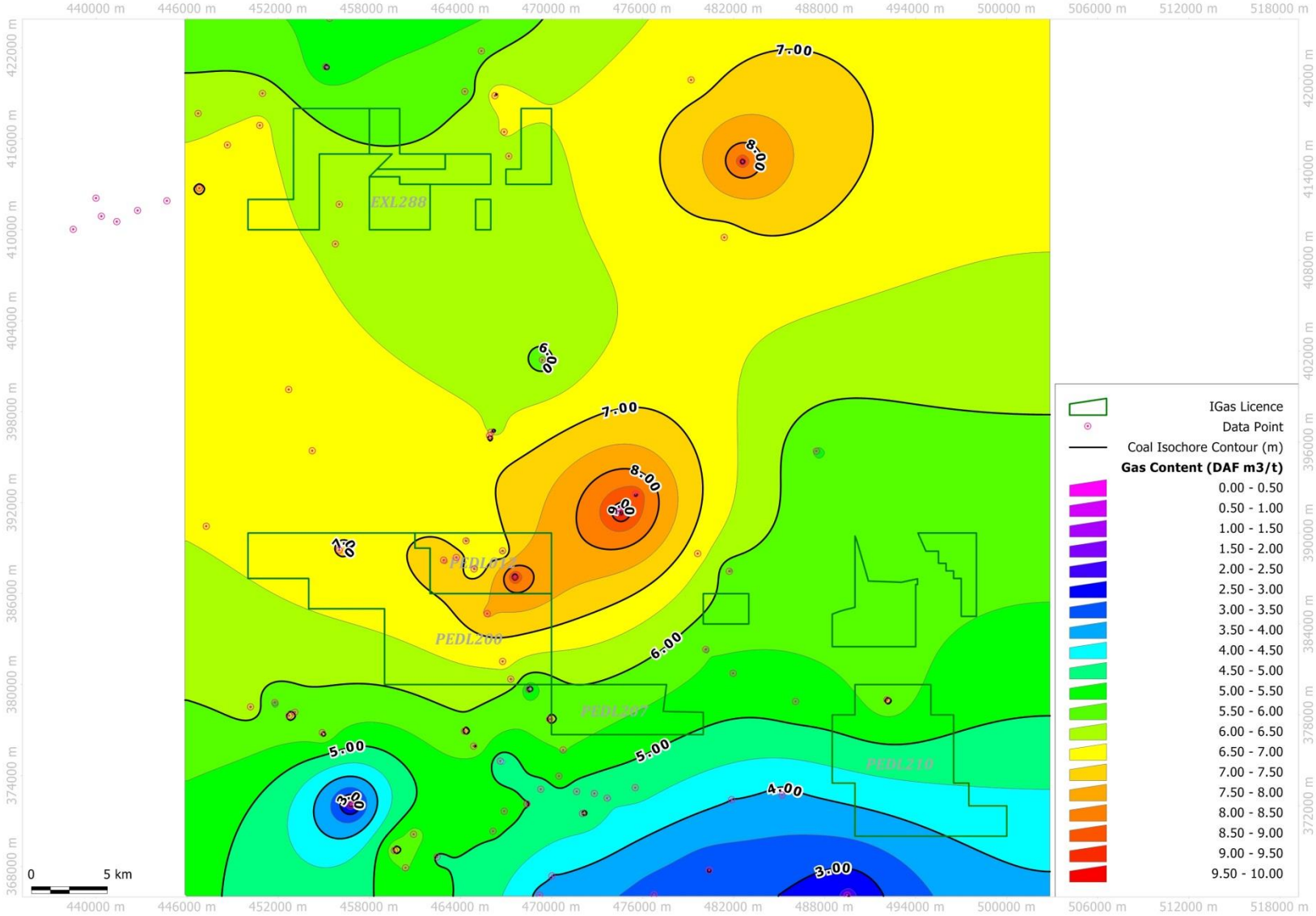
Flockton Seam (York) Gas Content (m^3/t)



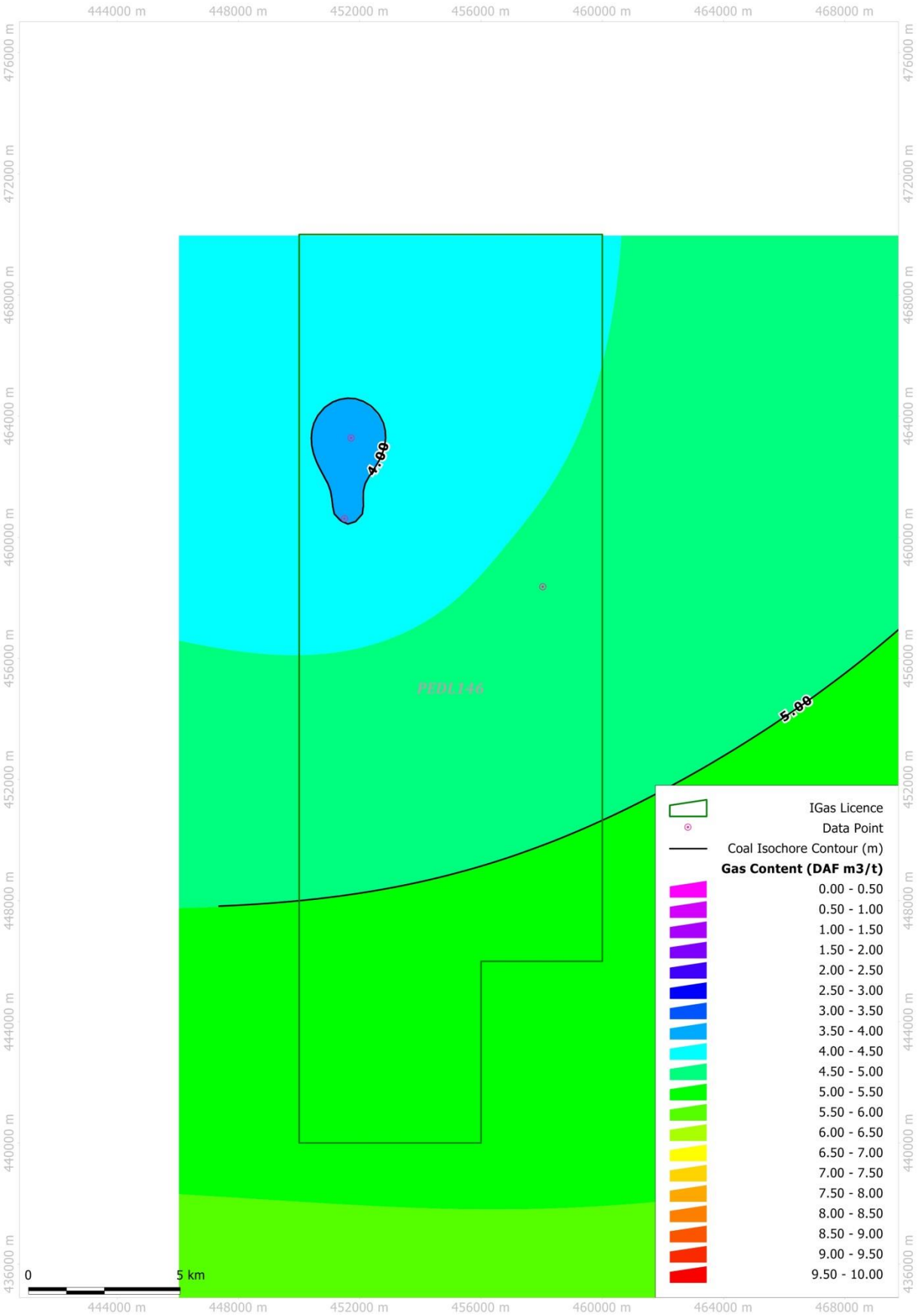
Flockton Seam (Gainsborough) Gas Content (m^3/t)



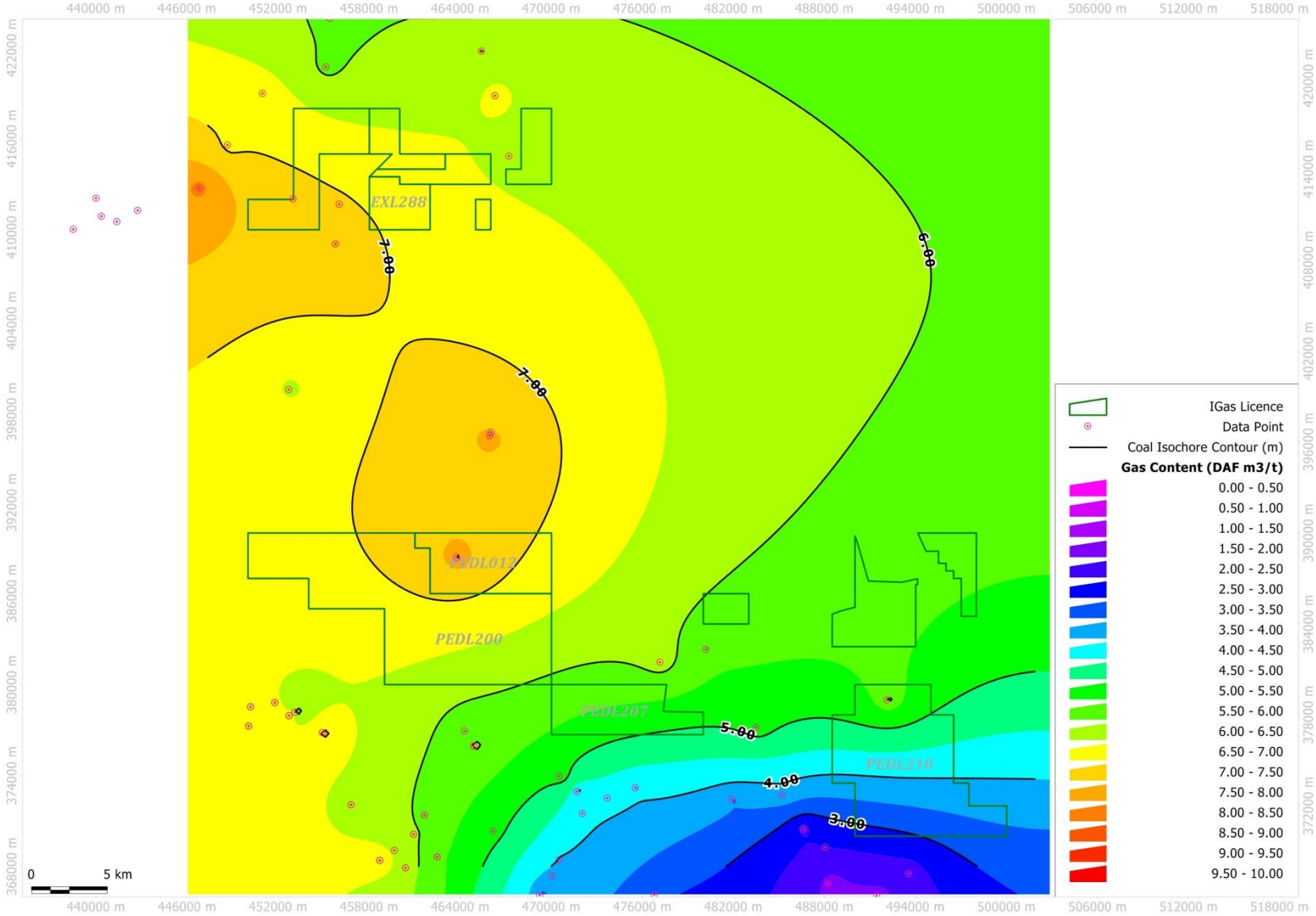
Parkgate Seam (York) Gas Content (m^3/t)



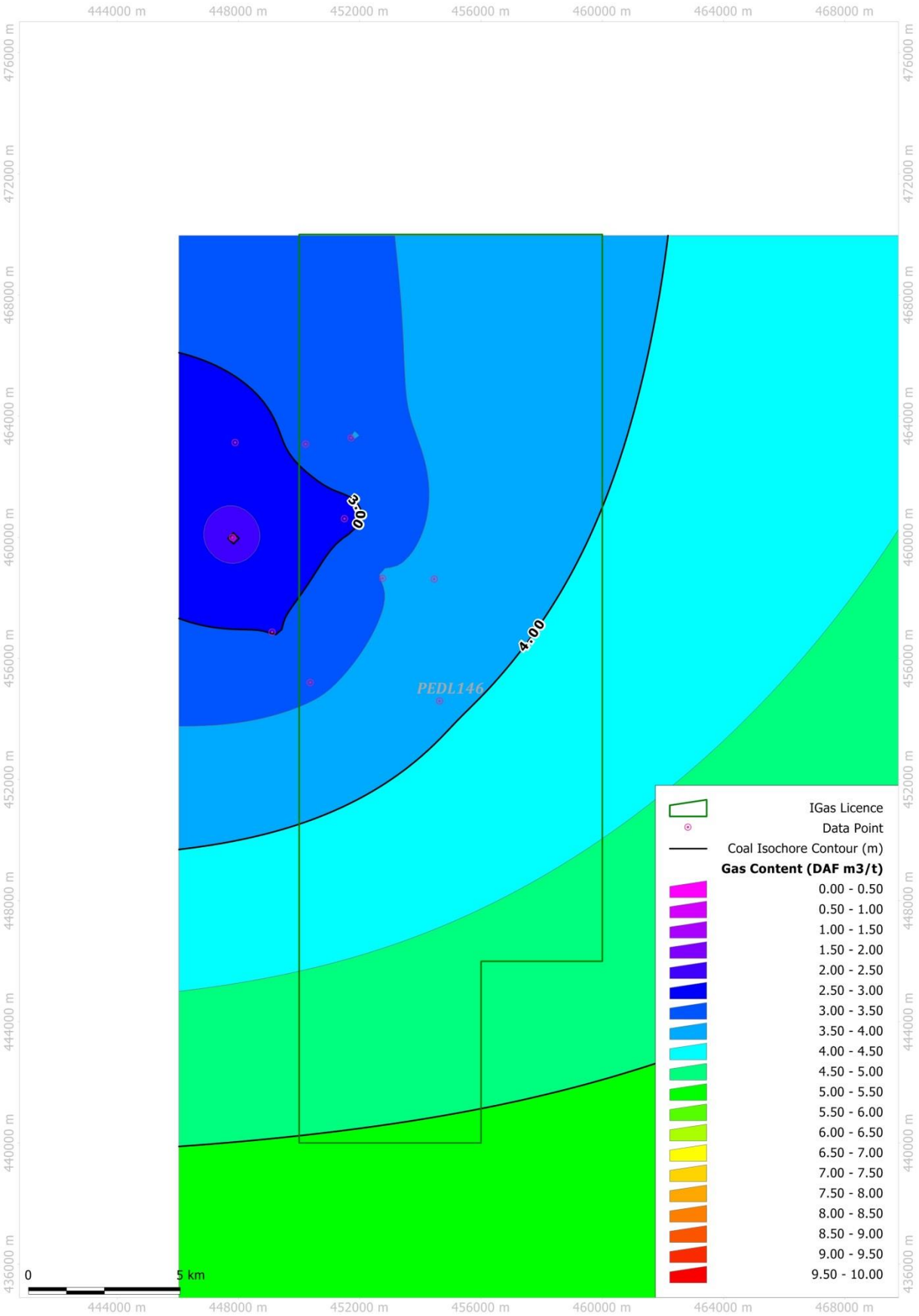
Parkgate Seam (Gainsborough) Gas Content (m^3/t)



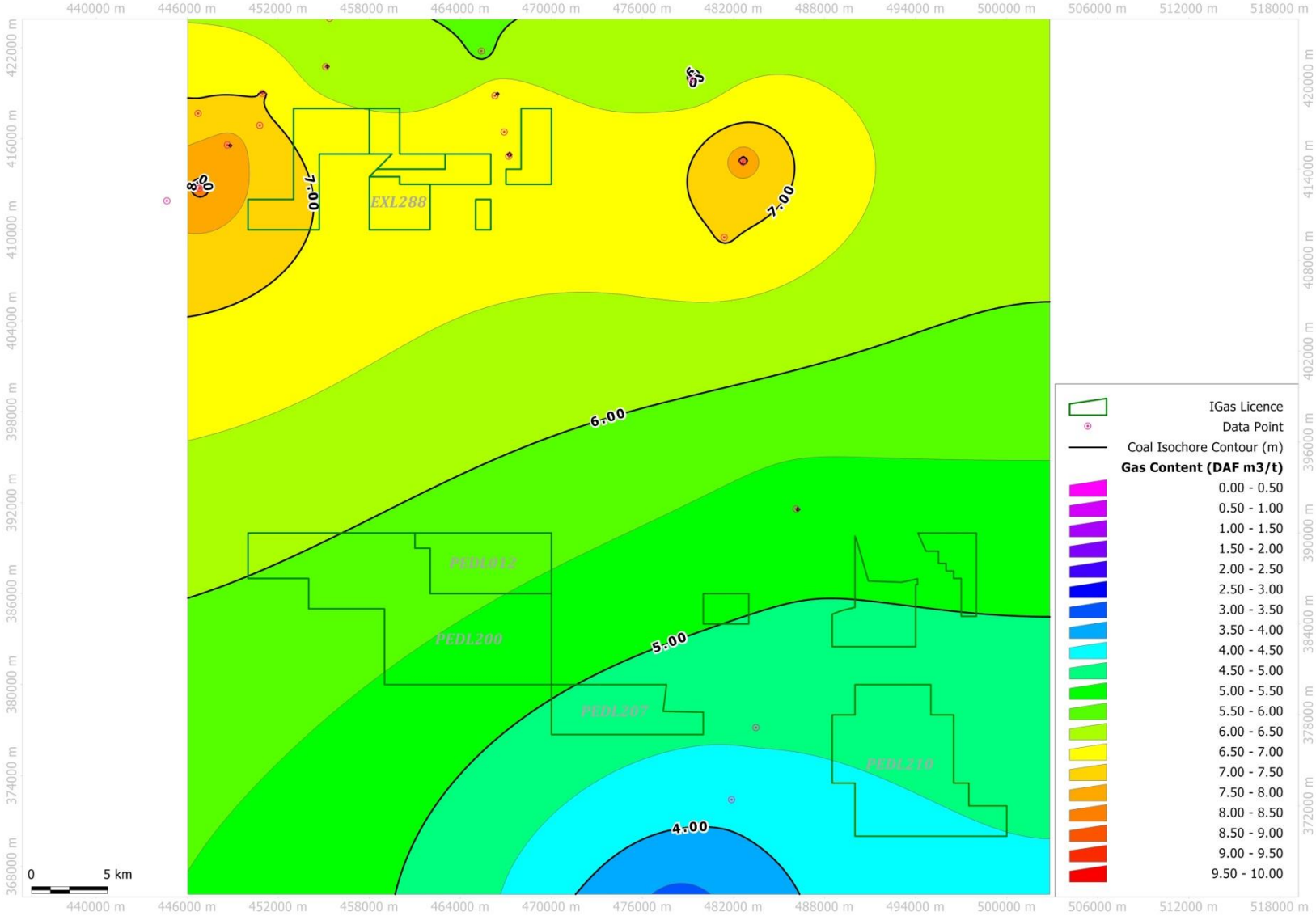
Silkstone Seam (York) Gas Content (m^3/t)



Silkstone Seam (Gainsborough) Gas Content (m^3/t)

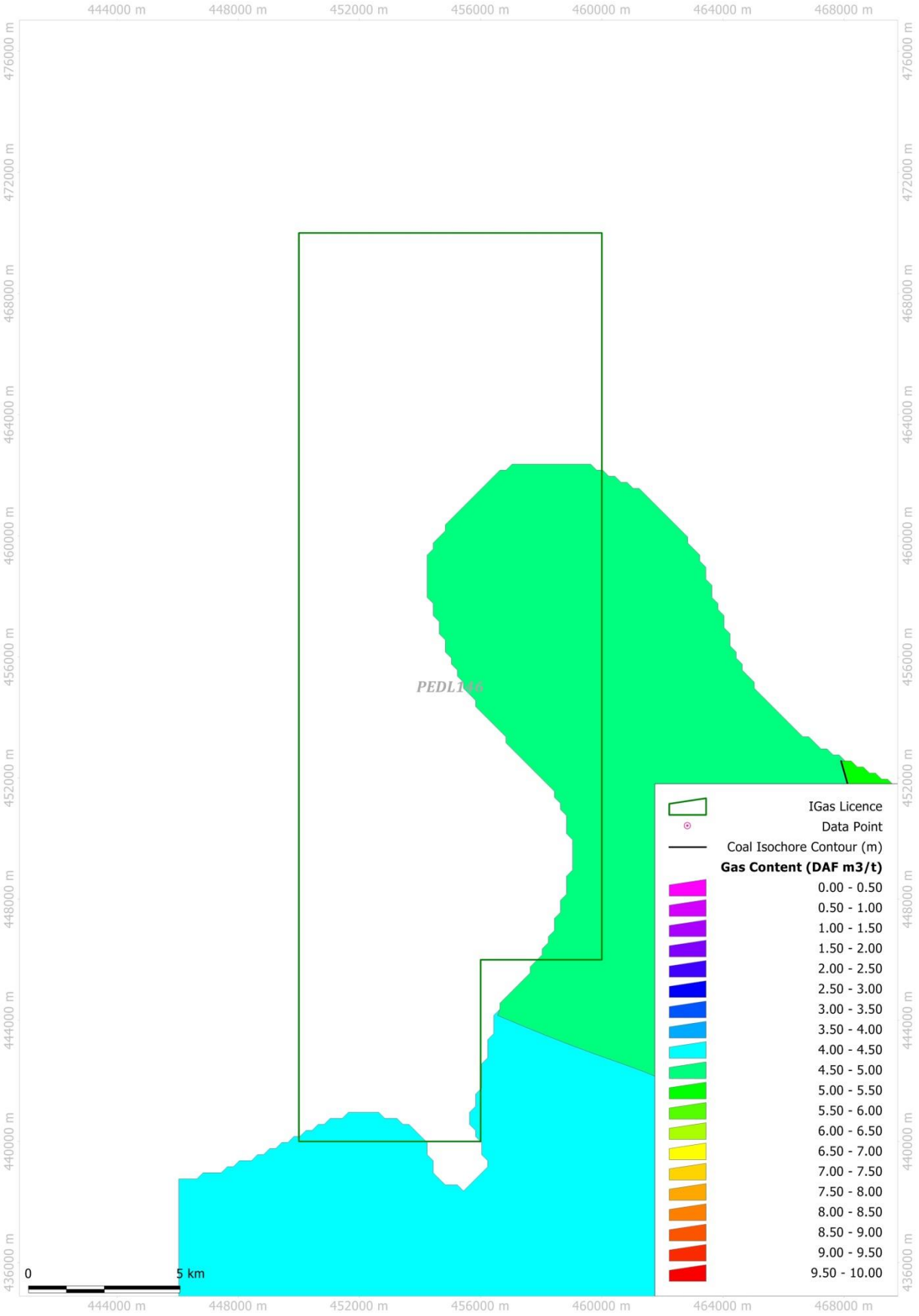


Top Beeston Seam (York) Gas Content (m^3/t)

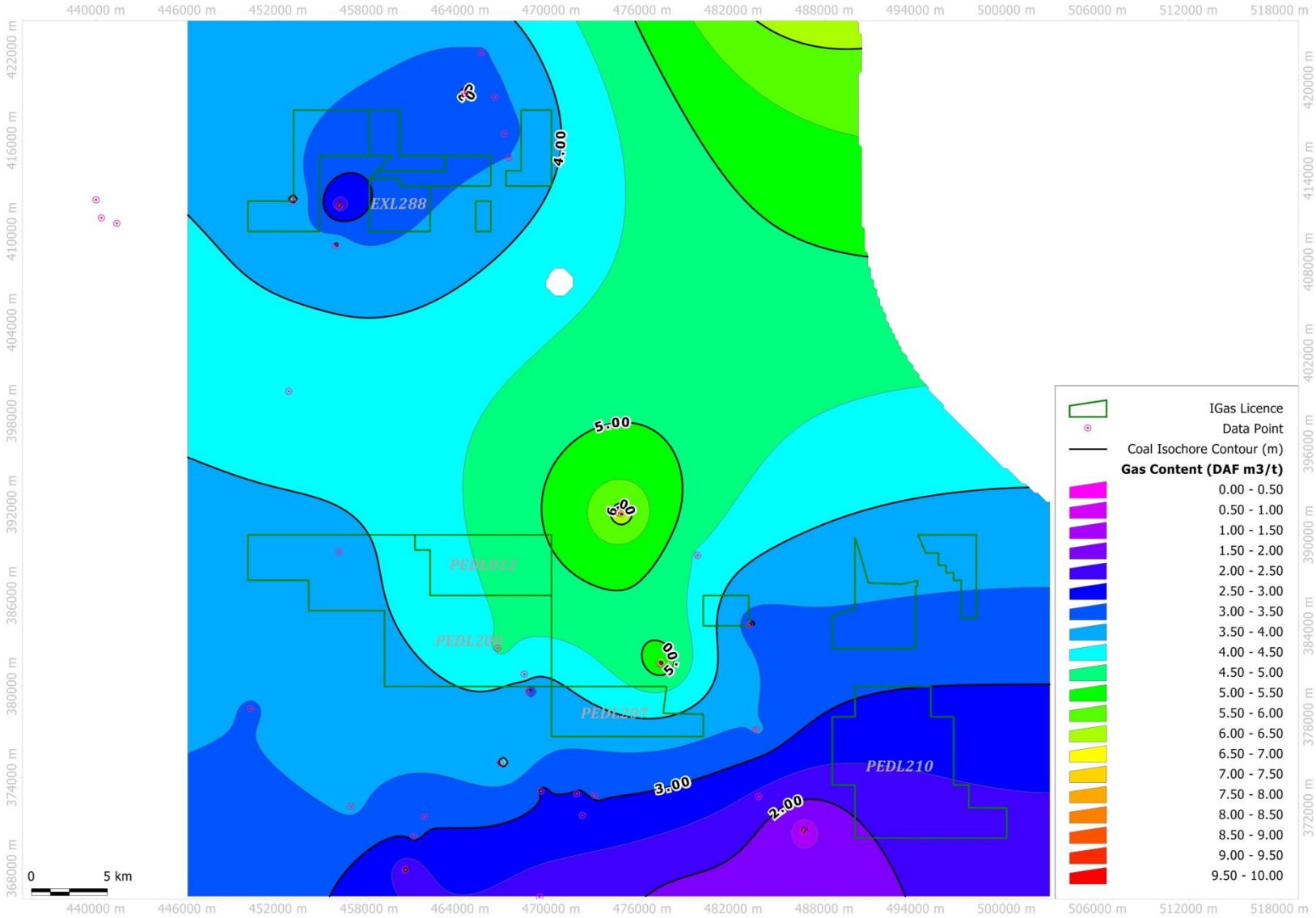


Top Beeston Seam (Gainsborough) Gas Content (m^3/t)

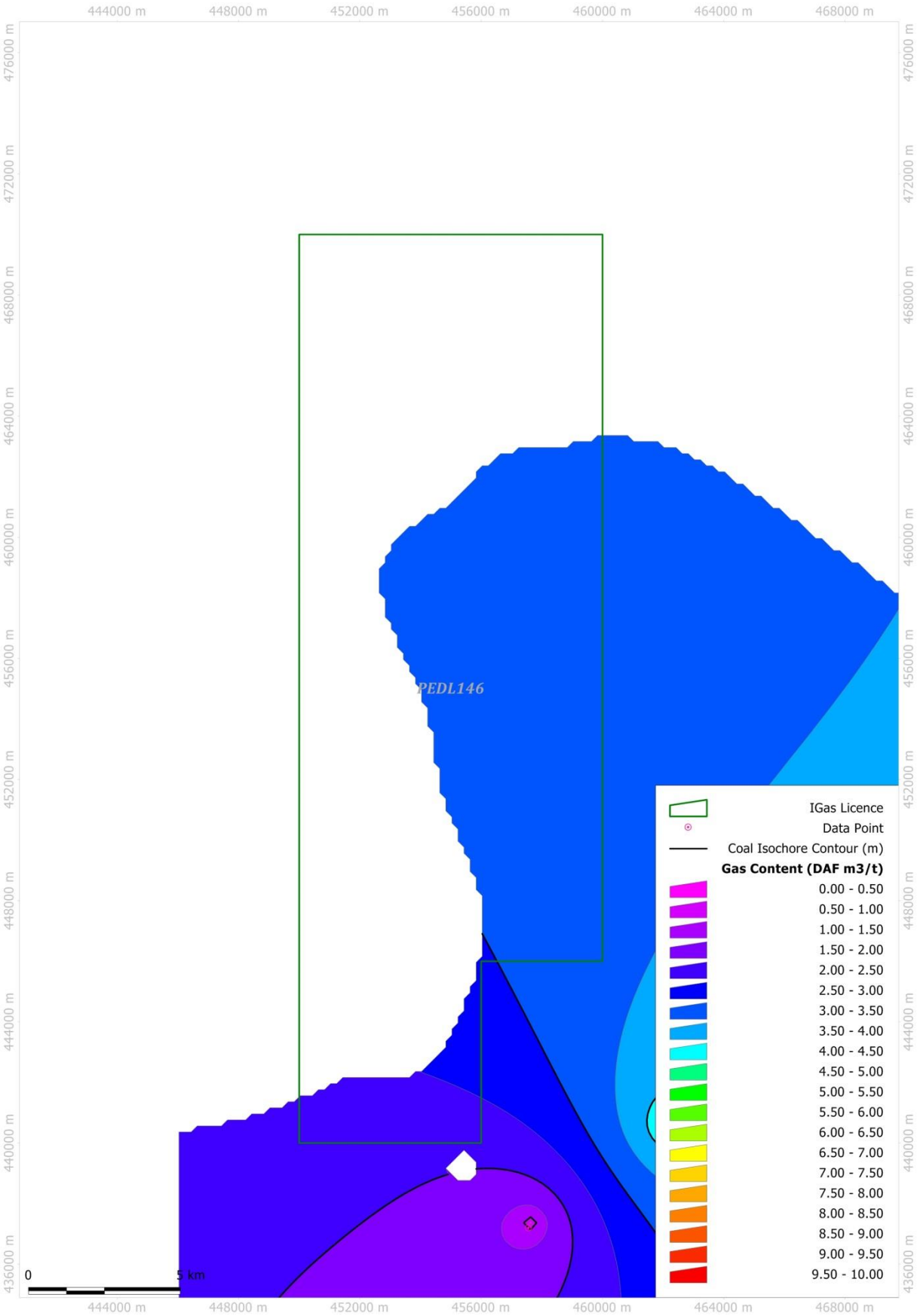
APPENDIX P. East Midlands Seam Gas Content – Secondary



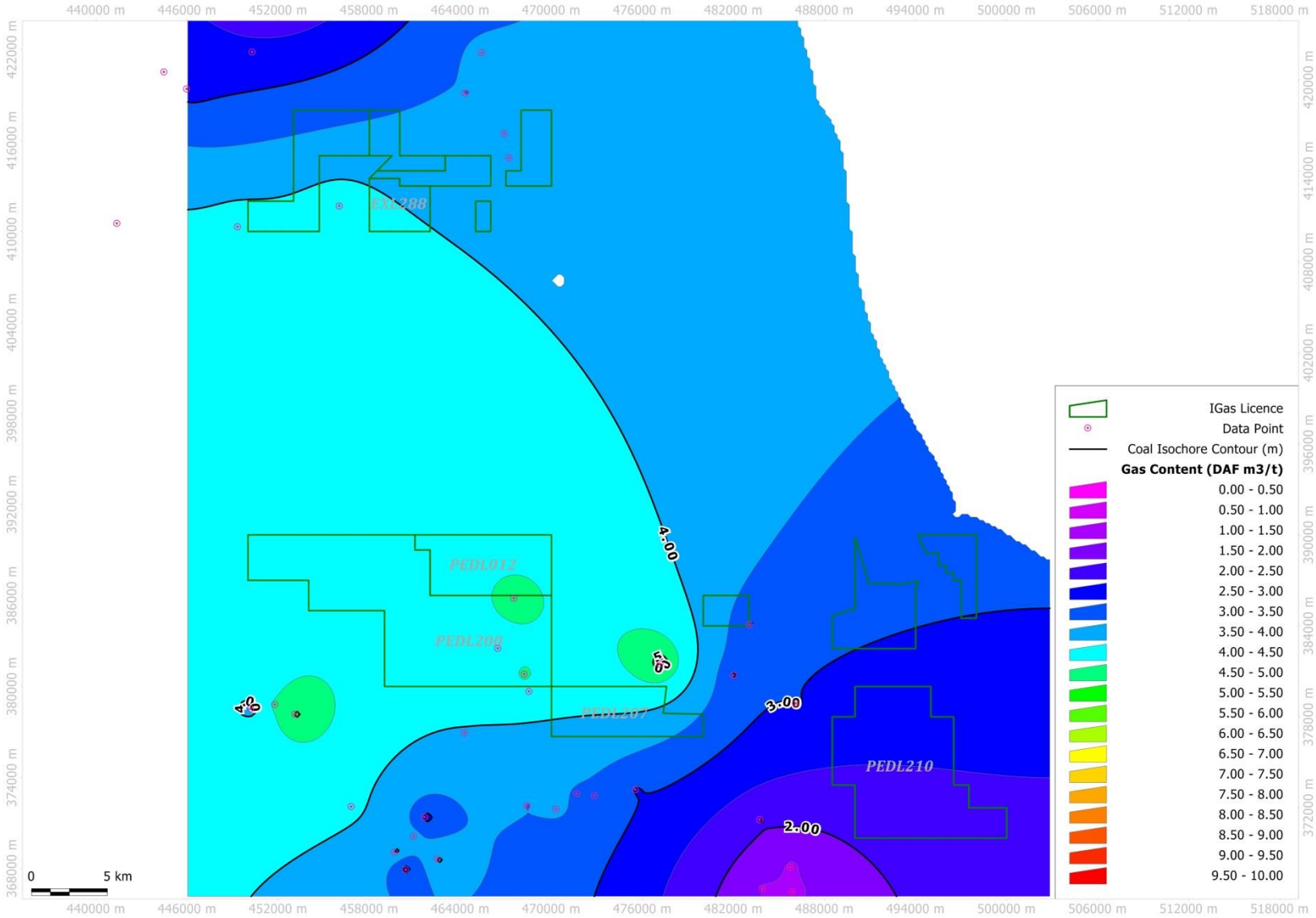
Newhill Seam (York) Gas Content (m^3/t)



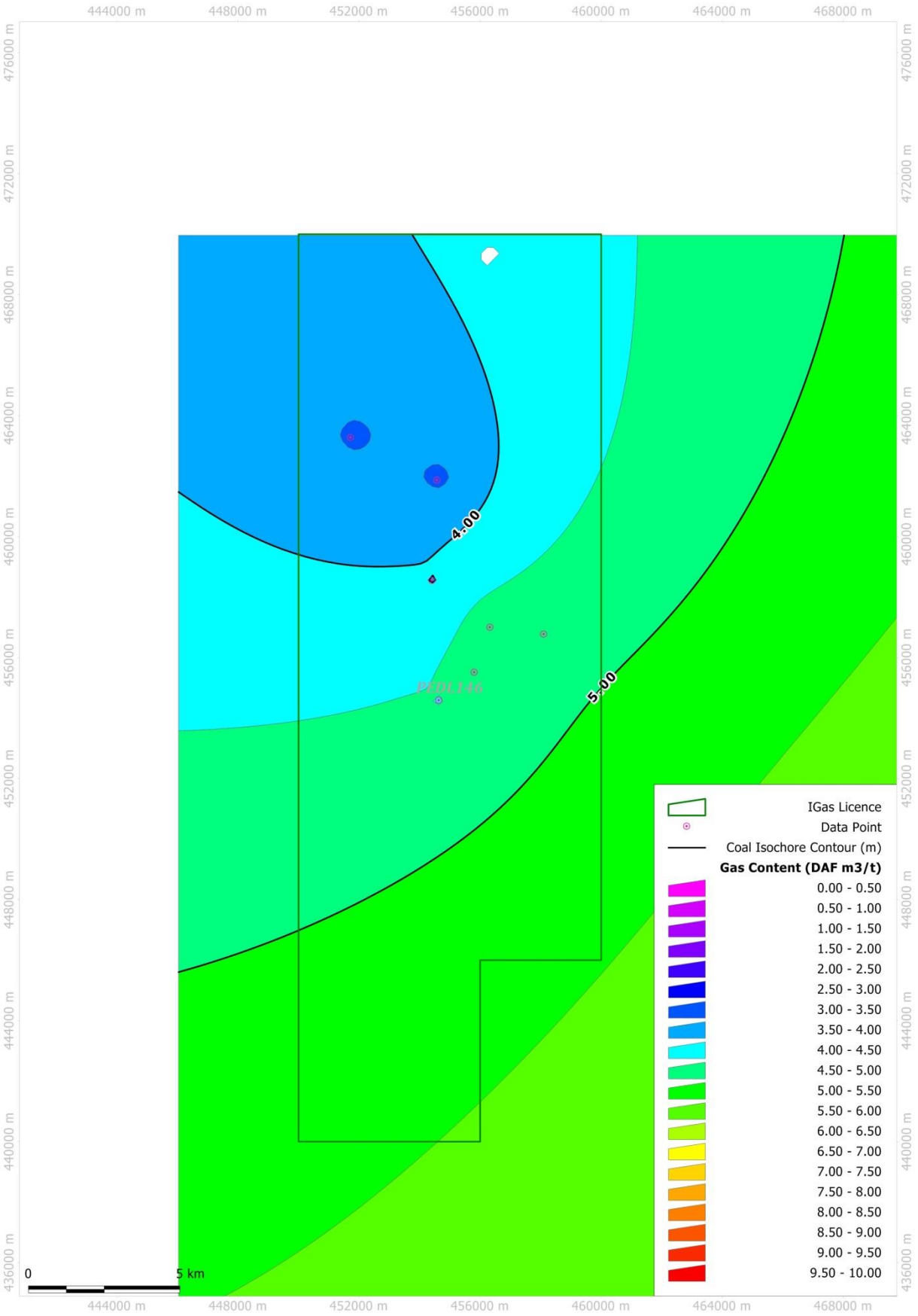
Newhill Seam (Gainsborough) Gas Content (m^3/t)



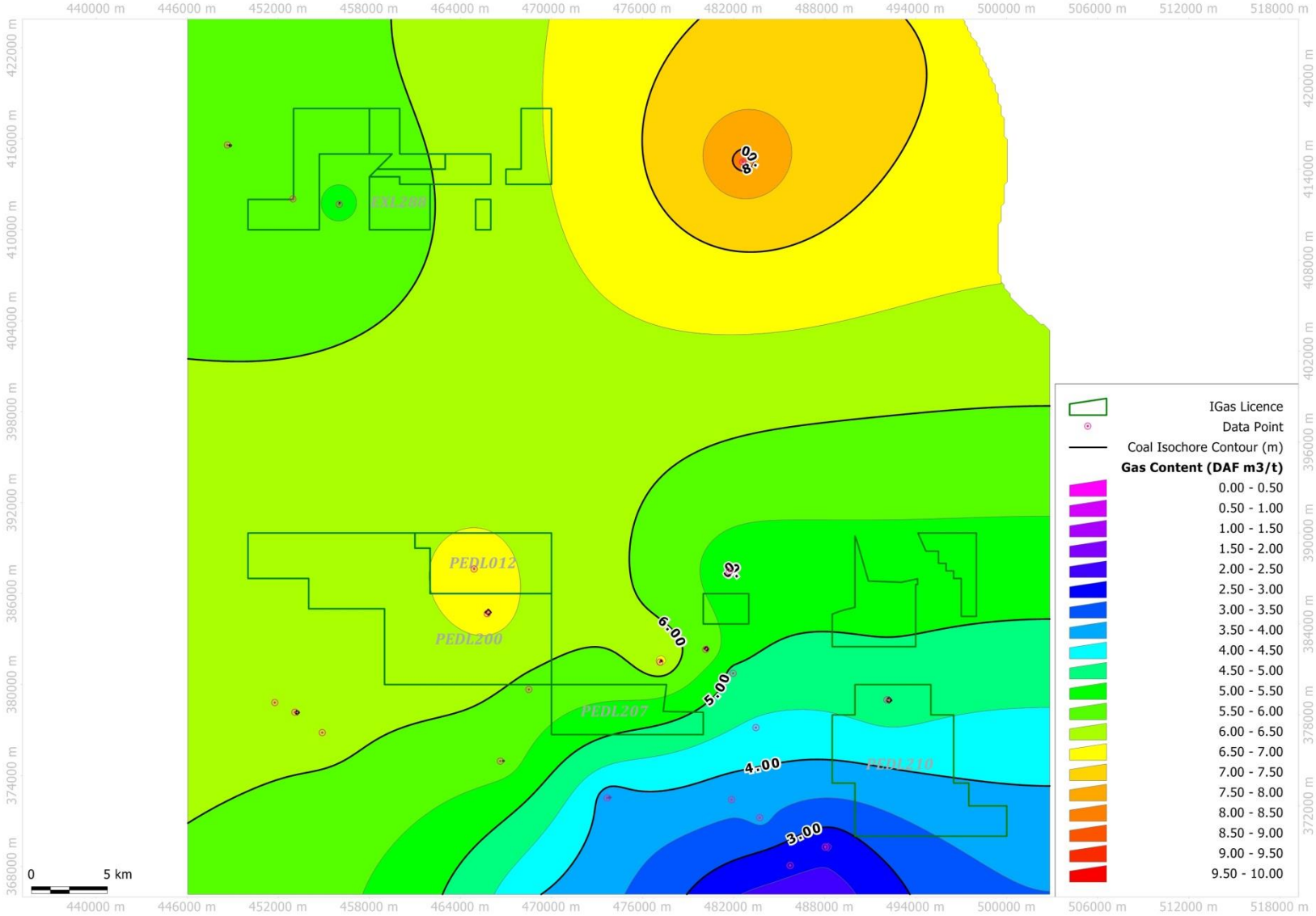
Two Foot Seam (York) Gas Content (m^3/t)



Two Foot Seam (Gainsborough) Gas Content (m^3/t)



Joan Seam (York) Gas Content (m^3/t)



Joan Seam (Gainsborough) Gas Content (m^3/t)

APPENDIX Q. Development Restrictions

Development Restrictions taken into account in the CBM Prospectivity Report are shown in the tables below. These restrictions have been used in the prospectivity analysis of the primary and secondary coal seams (volumes/extents) identified in this report.

All areas where coal seam net thickness is less than 1m were discounted due to insufficient coal volumes and classified as a development restriction. Similarly, areas where coal seam depths are shallower than 300m and deeper than 1200m were discounted and classified as a development restriction. Historic drilling results have shown a degassed zone above 300 mBGL and it is assumed coal seams would have insufficient permeability below 1200 mBGL to produce a commercial flow of gas.

Unclipped Coal Seam thickness maps show the lateral variation of thickness across the licence areas and the subsequent reduction of coal volume is shown in the clipped with development restrictions coal seam net thickness maps (APPENDIX A to APPENDIX D, APPENDIX I to APPENDIX L).

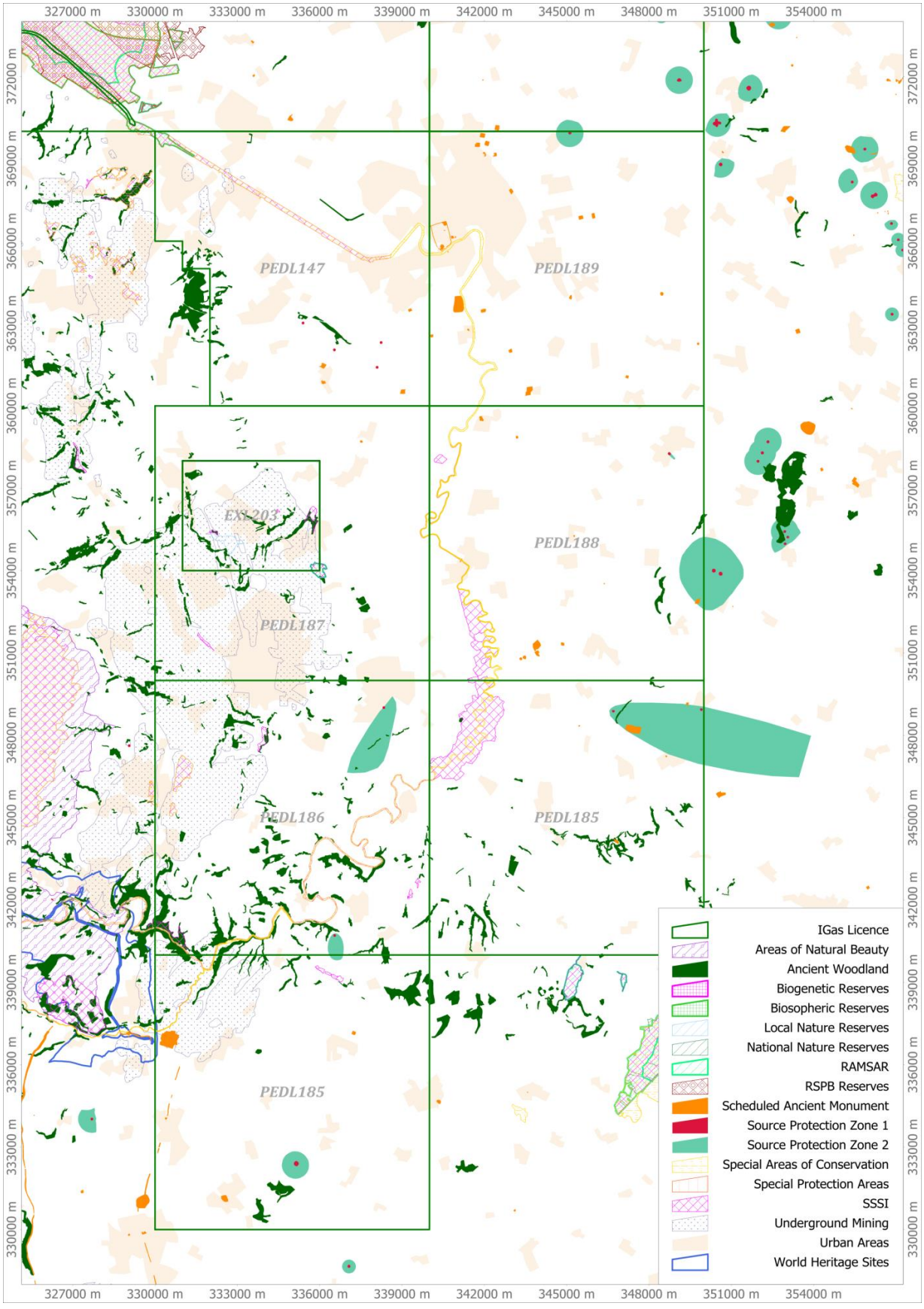
Development Restriction	Exclusion Criteria
Coal Seam Net Thickness	Less than 1m
Coal Seam Depth	Less than 300 mBGL and Greater than 1200 mBGL

Development Restrictions - Coal seam exclusion Criteria

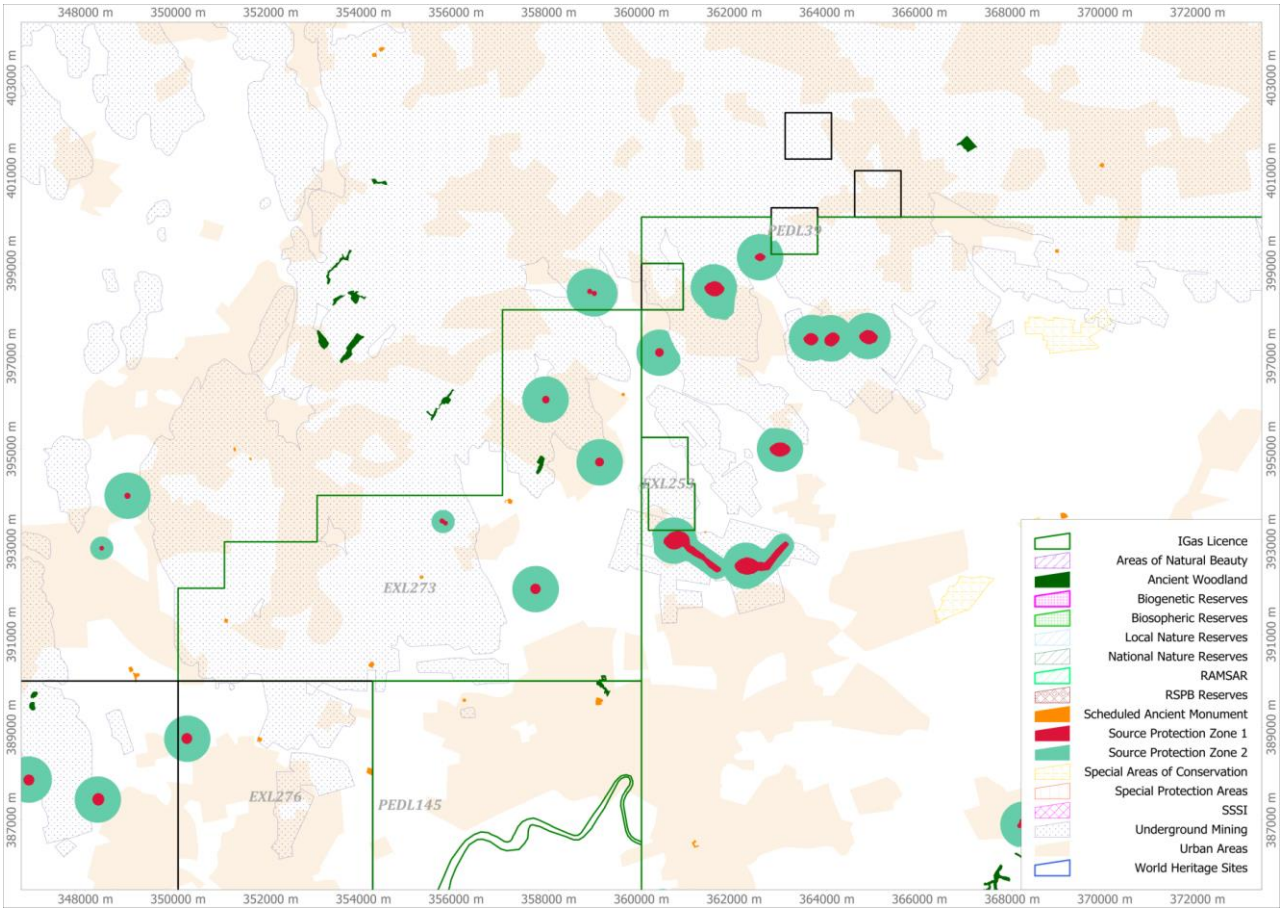
Development Restriction
Areas of Natural Beauty
Ancient Woodland
Biogenetic Reserves
Biosopheric Reserves
Local Nature Reserves
National Nature Reserves
RAMSAR
RSPB Reserves
Scheduled Ancient Monument
Source Protection Zone 1
Source Protection Zone 2
Special Areas of Conservation
Special Protection Areas
SSSI
Underground Coal Mining
Urban Areas
World Heritage Sites

Other categories of development restrictions taken into account

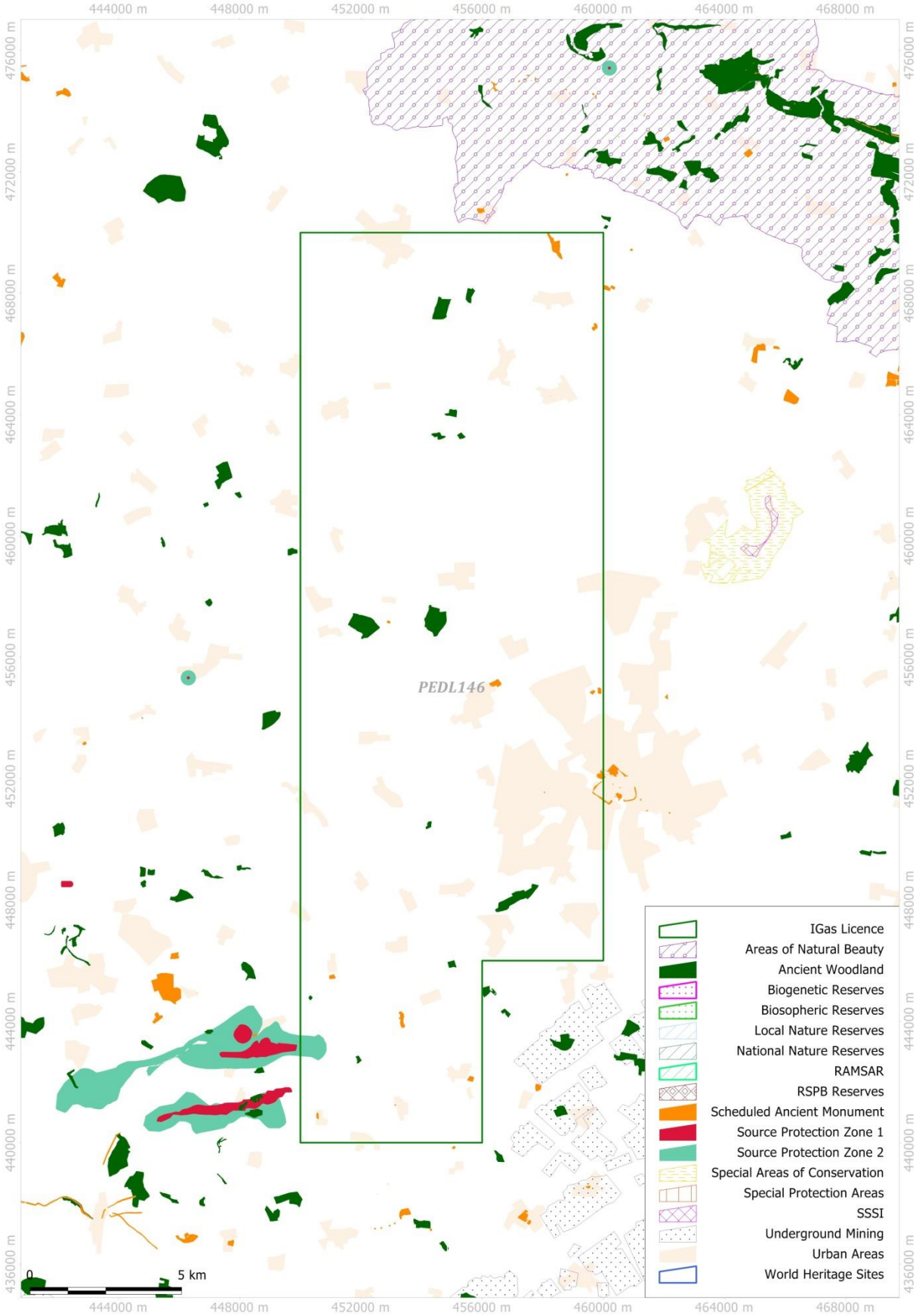
North West - Cheshire



North West (Cheshire) surface designations, source protection zones and urban areas

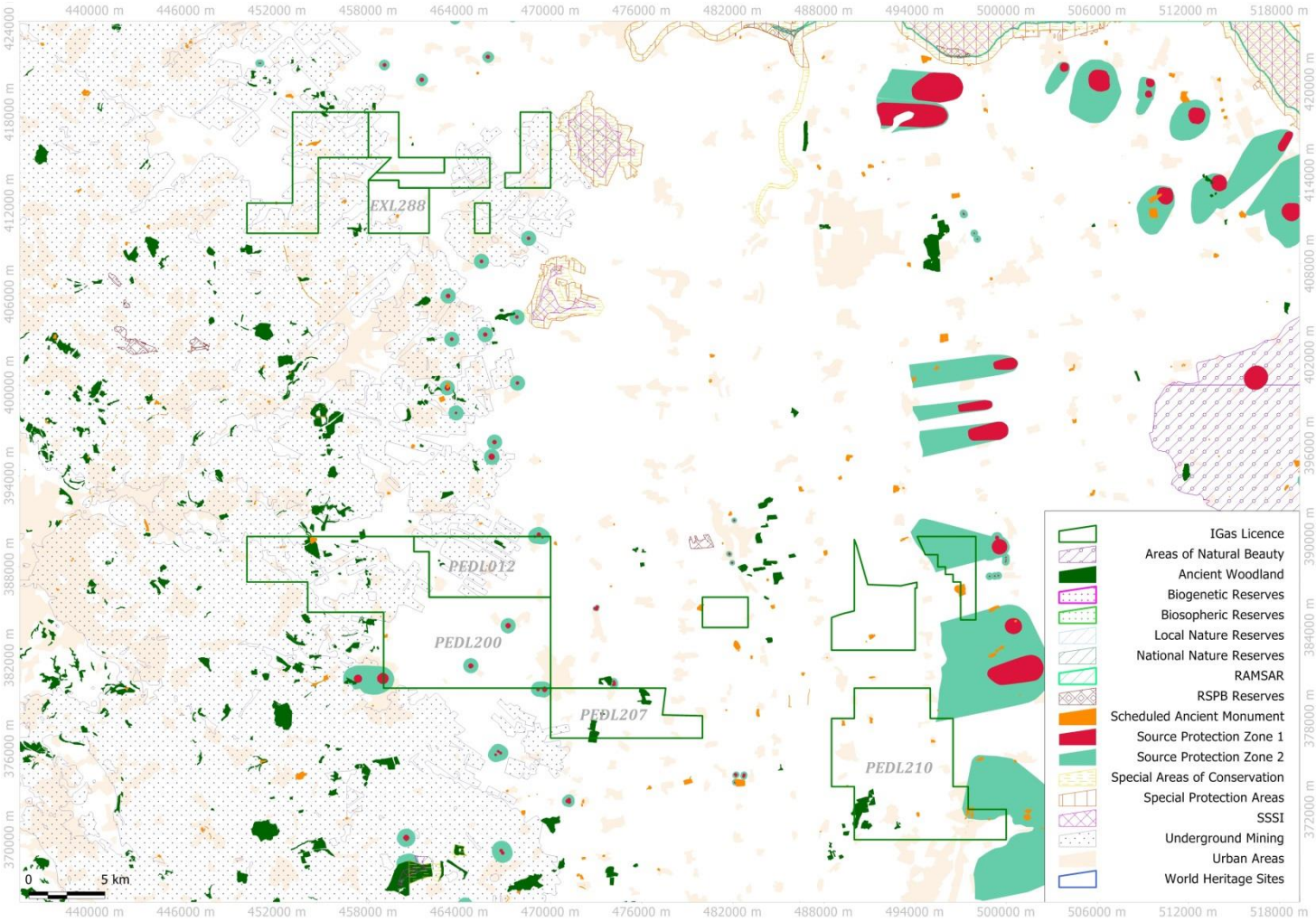


North West (Warrington) surface designations, source protection zones and urban areas



East Midlands (York) surface designations, source protection zones and urban areas

East Midlands - Gainsborough



East Midlands (Gainsborough) surface designations, source protection zones and urban areas

APPENDIX R. Database & Methodology

North West – Database

Thickness and Depth

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation (mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
A5/1 Whitegate	334530	349850	Ground Level	64.54	941.53	Millstone Grit Group
A5/4 Plas Thomas	335090	339260	Rotary Table	64.68	745.07	Pennine Lower Coal Measures Formation
A5/5 Ifton	334150	337840	Rotary Table	109.42	792.44	Millstone Grit Group
A5/5/1 Plas Iolyn	334990	337560	Ground Level	97.22	848.8	Pennine Lower Coal Measures Formation
A5/6 Pen y Lan	332292	341951	Ground Level	108.52	1030.83	Millstone Grit Group
Barton 1	343573	354095	Rotary Table	20.09	1032.07	Pennine Lower Coal Measures Formation
Black Park Colliery 4 Shaft and Bore	330015	339352	Rotary Table	127	290.31	Pennine Lower Coal Measures Formation
Blacon	336830	367730	Ground Level	8.42	856.95	Pennine Lower Coal Measures Formation
Blacon East 1	337887	366856	Rotary Table	9.75	2265.77	Carboniferous Limestone Supergroup
Blacon West 1	336617	366341	Rotary Table	4.27	1339.23	Millstone Grit Group
Boarded Barn	357197	393549	Ground Level	25.2	973.11	Pennine Lower Coal Measures Formation
Brookfield	332270	346500	Ground Level	93.49	376.83	Pennine Middle Coal Measures Formation
Brynkallt Colliery	329650	338100	Rotary Table	119	222.2	Pennine Middle Coal Measures Formation
Castletown 1	343177	351107	Rotary Table	28.04	1519.2	Millstone Grit Group
Churton	345305	358667	Rotary Table	18.37	1160.32	Pennine Lower Coal Measures Formation
Churton 1	343228.18	354612.05	Ground Level	16.78	778.11	Pennine Middle Coal Measures Formation
Cockbank Wood	335791	345850	Rotary Table	54.06	1236.21	Pennine Lower Coal Measures Formation
Collinge	341429	371112	Rotary Table	14.8	1361.76	Pennine Lower Coal Measures Formation
Daywall Colliery 1	329490	334690	Ground Level	115	248.93	Millstone Grit Group
Daywall Colliery 2	328342	334803	Rotary Table	136	211.57	Pennine Lower Coal Measures Formation
Daywall Colliery 3	329130	334050	Ground Level	125	167.61	Pennine Middle Coal Measures Formation
Daywall Colliery Shaft 1	329490	334690	Ground Level	115	99.54	Pennine Middle Coal Measures Formation
Daywall Colliery Shaft 2	329490	334690	Ground Level	115	100.58	Pennine Middle Coal Measures Formation
Dollys Bridge	361991	395730	Ground Level	33.99	765.7	Pennine Middle Coal Measures Formation

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation (mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Eccleston	337465	364176	Ground Level	20.25	739.01	Pennine Lower Coal Measures Formation
Erbistock 1	334767	343213	Rotary Table	63.39	1888.3	Carboniferous Limestone Supergroup
Gertrude Pit	332130	337450	Ground Level	117.85	271.88	Pennine Lower Coal Measures Formation
Gresford Colliery Dennis Shaft	333814	353637	Rotary Table	80.47	689.7	Pennine Middle Coal Measures Formation
Houghton Green	362131	391574	Ground Level	16.75	1310.82	Pennine Lower Coal Measures Formation
Ivy Cottage	357072	389621	Ground Level	18.42	1110.1	Pennine Lower Coal Measures Formation
Jacklegs	357617.7	391651.1	Ground Level	14.4	1102.87	Pennine Lower Coal Measures Formation
Marchweil	335530	348720	Ground Level	39.66	776.03	Pennine Lower Coal Measures Formation
Milton Green 1	343744	356925	Rotary Table	15.97	1588.03	Silurian
Moreton Hall Colliery Shaft	329250	335900	Rotary Table	108	195.06	Pennine Lower Coal Measures Formation
Morley Bridge	346181	371455	Ground Level	17.22	1217.27	Pennine Lower Coal Measures Formation
Overton Bridge	335423	343834	Rotary Table	42.5	1203.09	Pennine Lower Coal Measures Formation
Park Pit 1	329400	345600	Rotary Table	151	165.32	Pennine Lower Coal Measures Formation
Plas Power Colliery	329990	351930	Rotary Table	158	252.64	Pennine Middle Coal Measures Formation
Ponkey Ironworks	329800	346380	Rotary Table	144.48	201.16	Pennine Lower Coal Measures Formation
Preesgwyn	329340	336250	Rotary Table	101	183.96	Pennine Lower Coal Measures Formation
Shotwick	333232.5	371908	Ground Level	26.55	702.19	Pennine Lower Coal Measures Formation
Smithy	332666	346937	Ground Level	92.64	320.65	Pennine Middle Coal Measures Formation
Sontley	333053	346085	Ground Level	79.47	366.68	Pennine Middle Coal Measures Formation
Trevalyn	337678	357238	Rotary Table	15	1353.9	Pennine Lower Coal Measures Formation
Vauxhall Colliery 1 Shaft	330531	345370	Rotary Table	106.68	468.78	Pennine Lower Coal Measures Formation
Vron Colliery 4 Shaft	329100	352180	Rotary Table	216.41	265.77	Pennine Middle Coal Measures Formation
Westminster Colliery 1	330986	353646	Rotary Table	155.45	309.28	Pennine Lower Coal Measures Formation
Winwick Quay	359061	392324	Ground Level	13.3	1186.82	Pennine Lower Coal Measures Formation
Wrexham and Acton Colliery 1 Pit	332864	352198	Rotary Table	89.92	320.94	Pennine Middle Coal Measures Formation
Wynnstay Colliery 2 Shaft	329220	343520	Rotary Table	124.97	379.15	Pennine Lower Coal Measures Formation

North West – Database

Gas Content

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation (mAOD)	Total Depth (m Below Elevation Reference)
A5/6 Pen y Lan	332292	341951	Ground Level	108.52	1030.83
Barrows Green	353218	387928	Rotary Table	28.77	934.22
Barton 1	343573	354095	Rotary Table	20.09	1032.07
Birchwood	364382	390995	Ground Level	13.03	1528
Boarded Barn	357197	393549	Ground Level	25.2	973.11
Brookhouse Farm	364475	394132	Ground Level	33.58	1436.6
Castletown 1	343177	351107	Rotary Table	28.04	1519.2
Cawley Farm	366271	395281	-	-	-
Churton	345305	358667	Rotary Table	18.37	1160.32
Churton 1	343228.18	354612.05	Ground Level	16.78	778.11
Collinge	341429	371112	Rotary Table	14.8	1361.76
Crompton House	368248	398908	Ground Level	19.74	967.2
Cut Nook	371810	396285	Ground Level	26.79	1568
Dans Road	353451	386782	Ground Level	22.89	1144.83
Dollys Bridge	361992	395730	Ground Level	33.99	765.7
Eavesbrow	363624	392542	Ground Level	15.53	1207.45
Four Oak	354587	387096	Ground Level	23.26	1150.28
Houghton Green	362131	391574	Ground Level	16.75	1310.82
Jacklegs	357617	391651	Ground Level	14.4	1102.87
Lovels Hall	347965	384935	Rotary Table	12.8	1095.2
Mossbrook	369000	398700	Ground Level	18.8	1110
Sutton Manor W20S UG80/3	353580	388225	-	-	-
Trevalyn	337678	357238	Rotary Table	15	1353.9
Winwick Quay	359061	392324	Ground Level	13.3	1186.82
Woodside Farm	367516	389866	Rotary Table	23.33	1768.99
Woolden Moss	369985	395357	Rotary Table	26.5	1601

North West – Methodology

1. Well headers and formation top data from records in the IGas database were imported into IHS Kingdom 8.8, checked for accuracy and corrected where appropriate.
2. Formation tops and marker horizons (including coal seams) were correlated using historic and existing IGas interpretations. A new exercise in coal correlation was conducted and significantly improved the data and model. Where multiple names for a single coal seam existed, a suitable name was chosen and all other names aliased to the chosen name.
3. Detailed lithology descriptions were digitised and imported into Kingdom to accurately determine net coal values for each named seam. Any coal bed within a named coal seam, separated from another coal bed by more than 0.30m of non-coal bearing rock was discounted from the net coal value. This method provides a realistic tangible net coal value which can be developed through

modern in-seam directional drilling. No corrections were made to coal thickness for bedding dip or borehole inclination due to limited data for each.

4. Depth data for all named seams were exported from Kingdom and imported to Petrel 2013 for gridding calculations. These calculations were done in Petrel to allow the coal with most data (Main Coal) to be used as a trending surface to stop cross-cutting in areas of low data density. All grids were restricted to a 2000m area around the data.
5. The depth grids were imported back into Kingdom and clipped to subcrop based on a grid of the top Pennine Coal Measures Group erosion surface, which was itself clipped to ground level (Ordnance Survey Terrane 50 dataset).
6. All depth grids were transformed from subsea to a ground level datum.
7. An additional set of depth grids were created and clipped to a depth range of 300 to 1200 mBGL, the depth window currently considered by IGas as economic.
8. Isochore grids were calculated in Kingdom from the net coal data (set to a 2000m area around the data) and clipped to the subcrop grid of each coal.
9. All net coal grids were imported into Manifold GIS software where they were clipped based on all identified development restrictions and the PEDL boundaries.
10. Volumetric calculations were completed on each isochore grid using Kingdom.
11. Final maps showing depth, isochore, gas content and development restrictions were created in Manifold.

East Midlands – Database

Thickness and Depth

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation (mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Aldwark	447904	463099	Ground Level	17.22	543.07	Pennine Coal Measures Group
AlKelly Bushorough 1	488345	422644	Kelly Bush	10.97	1998.9	Dinantian
Althorpe 1	481398	409417	Kelly Bush	6.1	1323.68	Millstone Grit Group
Amcotts 1	485424	413585	Kelly Bush	8.23	1754.04	Carboniferous Limestone
Appleton Roebuck	455185	441692	Ground Level	7.84	626.6	Pennine Coal Measures Group
Arksey Common	459722	407264	Ground Level	5.34	653.37	Pennine Coal Measures Group
Ash Hill	462128	416149	Ground Level	4.9	701.22	Pennine Coal Measures Group
Askern 1	456507	415008	Kelly Bush	7.62	1466.93	Carboniferous Limestone
Askern Lodge	456030	411615	Ground Level	4.65	782.07	Pennine Coal Measures Group
Babworth	468940	380310	Kelly Bush	32.31	1067.05	Pennine Coal Measures Group
Balne Lodge	456026	411602	Ground Level	5.1	807	Pennine Coal Measures Group
Barnby Moor	466304	383643	Kelly Bush	18.12	1018.29	Pennine Coal Measures Group
Barnby Moor Stud	465782	384607	Kelly Bush	17.98	990.86	Pennine Coal Measures Group
Beech Villa	467618	387068	Ground Level	8.2	1013.8	Pennine Coal Measures Group
Beninborough	452764	458613	Ground Level	15.08	433.14	Pennine Coal Measures Group
Bilbrough	452492	446413	Ground Level	28.93	342.78	Pennine Coal Measures Group
Bilby	463851	383384	Kelly Bush	20.2	1020.42	Pennine Coal Measures Group
Black Fen	460344	434445	Ground Level	4.33	616.46	Pennine Coal Measures Group
Blyth	461020	386920	Kelly Bush	13.5	1066.03	Pennine Coal Measures Group
Booth Ferry	473854	425833	Kelly Bush	3.87	1022.55	Pennine Coal Measures Group
Botany Bay	467732	382954	Kelly Bush	4.88	829.67	Pennine Coal Measures Group
Bridge Farm	491610	379495	Kelly Bush	8.51	1421.47	Pennine Coal Measures Group
Brier Hills	471081	408504	Kelly Bush	1.88	926.85	Pennine Coal Measures Group
Brind Common	475200	431294	Kelly Bush	4.64	978.15	Pennine Coal Measures Group
Brocket Wood	456709	444088	Ground Level	9.39	752.64	Pennine Coal Measures Group
Broxholme 1	492136	378913	Kelly Bush	12.19	1671.75	Pennine Coal Measures Group

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation(mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Burton-upon-Stather 1	487868	418829	Kelly Bush	64.16	1857.67	Millstone Grit Group
Butterwick 1	484198	405639	Kelly Bush	2	1700.7	Carboniferous Limestone
Cliffe Common	466451	433623	Ground Level	7.74	879.05	Pennine Coal Measures Group
Clifton Airfield	459450	454960	Ground Level	14.1	1243.4	Pennine Coal Measures Group
Clifton Airfield No2	458293	455484	Ground Level	13.08	1053.57	Pennine Coal Measures Group
Colton Borehole	454693	444965	Ground Level	11.64	366.7	Pennine Coal Measures Group
Cornley	474401	394740	Ground Level	2.8	1200	Pennine Coal Measures Group
Corringham 2	488740	392870	Kelly Bush	20.3	1639.74	Millstone Grit Group
Crosby Warren 1	491219	412672	Kelly Bush	37.19	1853.43	Carboniferous Limestone
Crosby Warren 2	491187	412908	Kelly Bush	40.23	2049.38	Carboniferous Limestone
Cross Hill	460132	418962	Ground Level	6.51	801.01	Pennine Coal Measures Group
Crowle 1	477334	411923	Kelly Bush	5.21	1465.78	Millstone Grit Group
Crowle Common	476186	413868	Ground Level	1.37	1110.2	Pennine Coal Measures Group
Danes	467769	385781	Kelly Bush	12.9	1054.42	Pennine Coal Measures Group
Drax 2	468696	425402	Ground Level	3.94	976.45	Pennine Coal Measures Group
Drax 3	468300	427400	Ground Level	4.1	984.89	Pennine Coal Measures Group
Ealand 1	476914.5	410614.3	Ground Level	1.34	1009.8	Pennine Coal Measures Group
Eastoft No 1	481026	416867	Kelly Bush	4.65	1242.9	Pennine Coal Measures Group
Eaton	471026	378103	Kelly Bush	19.86	997.05	Pennine Coal Measures Group
Escrick Brickworks	462059	440385	Ground Level	6.6	856.6	Pennine Coal Measures Group
Eskholme	463719	417418	Ground Level	5.62	944	Pennine Coal Measures Group
Everton 1	470175.21	392959.58	Kelly Bush	7.31	2079.27	Millstone Grit Group
Fenton	483491	377084	Kelly Bush	7.99	1240.17	Pennine Coal Measures Group
Fenwick Hall	460535	416159	Ground Level	5.68	705.45	Pennine Coal Measures Group
Finningley No 1	468413	400222	Kelly Bush	8.78	1069	Pennine Coal Measures Group
Fir Tree	478304	432915	Kelly Bush	4.55	1060	Pennine Coal Measures Group
Fiskerton	472939	349792	Kelly Bush	16.8	833.8	Pennine Coal Measures Group
Forest Hill	459890	381378	Kelly Bush	56.36	899.12	Pennine Coal Measures Group
Gamston Church	470782	375618	Kelly Bush	28.73	952.93	Pennine Coal Measures Group
Gate Burton	483055	384006	Kelly Bush	17.15	1297.78	Pennine Coal Measures Group

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation(mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Great Morton	468517	379593	Kelly Bush	26.56	986.17	Pennine Coal Measures Group
Gringley No.1	474562	390636	Kelly Bush	76.75	1698.98	Millstone Grit Group
Grove 3	476273	381342	Kelly Bush	64.12	2932.85	Pre-Cambrian
Grove House	471625	411049	Kelly Bush	3.05	783.6	Pennine Coal Measures Group
Haxey	472419	396772	Ground Level	5.49	971.04	Pennine Coal Measures Group
Headstead Bank	481989	380661	Kelly Bush	6.6	1200.16	Pennine Coal Measures Group
Hemingbrough	469700	430734	Ground Level	5.91	1048.17	Pennine Coal Measures Group
Hemswell 1	495433	389788	Kelly Bush	53.07	1668.39	Carboniferous Limestone
Hessay	452357	454001	Ground Level	15.79	474.75	Pennine Coal Measures Group
Hornington Manor	451596	442037	Ground Level	12.17	283.5	Pennine Coal Measures Group
Humble Carr	481732	387405	Kelly Bush	10.35	1398.94	Pennine Coal Measures Group
Hunts Bridge	483895	366608	Kelly Bush	9.97	875.74	Pennine Coal Measures Group
Hykeham Bridge	495394	364946	Ground Level	8.86	1009.44	Pennine Coal Measures Group
Hykeham Station	493560	367473	Kelly Bush	14.38	1056.68	Pennine Coal Measures Group
Ingham 1	497486	385143	Kelly Bush	51.21	1706.49	Millstone Grit Group
Kingshaugh House	475536	373123	Kelly Bush	28.22	966.18	Pennine Coal Measures Group
Kirksmeaton 1	451142	416097	Kelly Bush	37.7	1636	Carboniferous Limestone
Knaith	486321	384362	Kelly Bush	17.8	1274.43	Pennine Coal Measures Group
Knapton	455831	452467	Ground Level	19.76	744.37	Pennine Coal Measures Group
Laxton	471599	367119	Ground Level	78.07	915.62	Pennine Coal Measures Group
Laxton BH	478195	425699	Ground Level	3.19	1150	Pennine Coal Measures Group
Lindholme	471077	407892	Ground Level	4	925.07	Pennine Coal Measures Group
Lound	470445	385857	Kelly Bush	8.56	1065.35	Pennine Coal Measures Group
Lound 1	467540.33	385756.29	Kelly Bush	17.19	850	Pennine Coal Measures Group
Lound Hall	469996	372847	Kelly Bush	23.47	792.39	Pennine Coal Measures Group
Lowfield Farm	489551	383000	Kelly Bush	10.62	1406.01	Millstone Grit Group
Luddington 1	482620	414408	Kelly Bush	4.88	1295.34	Pennine Coal Measures Group
Manton 1	461351	379473	Kelly Bush	34.14	1589.92	Carboniferous Limestone
Mattersey NCB	468625	388976	Kelly Bush	7.51	1146.6	Pennine Coal Measures Group
Mattersey Quarry	468292	387883	Ground Level	7.65	1047.82	Pennine Coal Measures Group

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation(mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Melbourne 1	476308	443085	Kelly Bush	10.36	1482.17	Pennine Coal Measures Group
Moor Monkton B	450883	456440	Ground Level	15.56	647.7	Pennine Coal Measures Group
Moorlands	458051	458337	Ground Level	18.21	1148.24	Pennine Coal Measures Group
Morton 1	479317	392410	Kelly Bush	3.96	1676.32	Millstone Grit Group
Moss	459777	413897	Ground Level	6.02	1098.33	Millstone Grit Group
New Bridge	467436	420233	Ground Level	5.92	813.76	Pennine Coal Measures Group
New Parks	454580	461834	Ground Level	11.27	706.6	Pennine Coal Measures Group
Newsholme	472444	429336	Ground Level	4.46	1066.8	Pennine Coal Measures Group
Normanby 1	487178	383778	Kelly Bush	19.41	2302.96	Dolerite Sill penetrating Namurian
Nornay	462500	388700	Kelly Bush	13.7	1176.17	Pennine Coal Measures Group
Nun Monkton	449975.5	458132	Ground Level	13.71	594.35	Pennine Coal Measures Group
Old London Road	466810	381460	Kelly Bush	34.35	945.44	Pennine Coal Measures Group
Osgodby Surface	464554	433499	Ground Level	9.74	780.77	Pennine Coal Measures Group
Overton	455817	455480	Ground Level	16.94	801.53	Pennine Coal Measures Group
Owston Ferry	480450	399854	Ground Level	4.69	1185	Pennine Coal Measures Group
Pasture Farm	468004	392935	Ground Level	2.93	1083.98	Pennine Coal Measures Group
Quay Lane	476903	419328	Kelly Bush	2.8	1146.2	Pennine Coal Measures Group
Ranby Camp	466390	380710	Kelly Bush	44.62	989.39	Pennine Coal Measures Group
Ranskill 1	464234	388144	Kelly Bush	14.02	1729.35	Millstone Grit Group
Rawcliffe Bridge	469867	420849	Ground Level	6.78	849.92	Pennine Coal Measures Group
Roe Carr	473867	405048	Kelly Bush	3.23	1078.94	Millstone Grit Group
Rosecroft	457835	460549	Ground Level	16.83	1138.78	Pennine Coal Measures Group
Rusholme Grange	469694	426603	Ground Level	4.25	928	Pennine Coal Measures Group
Ryther	455380	439088	Ground Level	7.62	338.63	Pennine Coal Measures Group
Saundby 1	479524	389125	Kelly Bush	8.99	1249	Pennine Coal Measures Group
Scaftworth	467597	391650	Ground Level	18.9	1160.15	Pennine Coal Measures Group
Scaftworth 2	467179	392283	Kelly Bush	13.9	2325.29	Millstone Grit Group
Sheds Farm	477178	381399	Kelly Bush	41.91	1157.36	Pennine Coal Measures Group
Shipton 2	454460	458579	Ground Level	15.82	892.5	Pennine Coal Measures Group
Shipton 3	454574	460188	Ground Level	17.25	562.65	Pennine Coal Measures Group

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation(mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Shipton 4	455881	459288	Ground Level	14.73	919.67	Pennine Coal Measures Group
Shirebrook Colliery No. 2	453114	366844	Ground Level	97.54	496.73	Pennine Coal Measures Group
Skelton	456328	456972	Ground Level	13.31	958.84	Pennine Coal Measures Group
Skelton Moor	458112	456737	Ground Level	13.39	1149.5	Pennine Coal Measures Group
South Duffield	467891	432632	Ground Level	7.43	884.24	Pennine Coal Measures Group
South Leverton 1	479330	380402	Kelly Bush	11.37	1562.02	Carboniferous Limestone
Spaldington 1	479275	432455	Kelly Bush	9.9	1850	Carboniferous Limestone
Stone	455559	389917	Kelly Bush	65.52	985.5	Pennine Coal Measures Group
Stow	488114	380920	Kelly Bush	23.28	1395.57	Pennine Coal Measures Group
Sutton	468171	383849	Kelly Bush	14.94	1082.86	Pennine Coal Measures Group
Swinefleet 1	479235	419802	Kelly Bush	8.23	1349.89	Pennine Coal Measures Group
Swinethorpe	488050	369216	Kelly Bush	18.06	1087.03	Carboniferous Limestone
Tethering Lane	470115	391377	Ground Level	3.87	1157.74	Pennine Coal Measures Group
Thorney	485221	372648	Kelly Bush	12.73	1114.9	Pennine Coal Measures Group
Tickhill 1	457730	392970	Kelly Bush	29	1710.5	Millstone Grit Group
Torksey 4	485065	379222	Kelly Bush	14.39	1845.78	Carboniferous Limestone
Torworth	464950	385590	Ground Level	24.54	1083.66	Pennine Coal Measures Group
Trumfleet 1	460615	412561	Kelly Bush	8.18	1580.01	Carboniferous Limestone
Ulleskelf	452010	439176	Ground Level	8.89	307.03	Pennine Coal Measures Group
Upper Poppleton	454623	454551	Ground Level	16.35	723.03	Pennine Coal Measures Group
Walkeringham 1	475524	391902	Kelly Bush	38.04	1947.58	Pennine Coal Measures Group
Walkers Wood	467326	380302	Kelly Bush	41.38	1025.3	Pennine Coal Measures Group
Wallingwells	457894	386292	Ground Level	32	805	Pennine Coal Measures Group
Warmsworth 1	453939	401239	Kelly Bush	48.02	1605.61	Millstone Grit Group
West Cowick	464635	420522	Ground Level	3.5	959.21	Pennine Coal Measures Group
West Firsby 2	498777	384575	Kelly Bush	42.37	1971.96	Millstone Grit Group
Whimpton Moor	478502	373846	Kelly Bush	14.14	1021.88	Pennine Coal Measures Group
Whisby 1	489281	368775	Kelly Bush	33.15	1045.09	Carboniferous Limestone
Whitewater	461428	389811	Kelly Bush	11.82	1044.24	Pennine Coal Measures Group
Wigginton 1	459372	456193	Ground Level	5	1231	Pennine Coal Measures Group

Well	Easting (m)	Northing (m)	Elevation Reference	Elevation(mAOD)	Total Depth (m Below Elevation Reference)	Formation at TD
Wigsley East	486626	370392	Kelly Bush	8.96	1080.87	Pennine Coal Measures Group
Wood Farm 1	454420	458526	Kelly Bush	3.4	860	Pennine Coal Measures Group
Wooden Beck	474480	391355	Kelly Bush	39.96	1218	Pennine Coal Measures Group
Woodhouse	458302	463223	Ground Level	20.41	1109.26	Pennine Coal Measures Group

East Midlands – Database

Gas Content

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Airedale Sewage Fm3	446712	426991	Ground Level	11.1
Aldwark	447904	463099	Ground Level	17.22
Amos Lane	485104	363367	Kelly Bush	13.8
Askern Lodge	456030	411615	Ground Level	4.65
Aubourn	492566	361919	Kelly Bush	16.8
Austerfield	465937	396332	Kelly Bush	18.6
Babworth School	468221	380746	Kelly Bush	24.1
Bank Hill	461248	347042	Kelly Bush	122.2
Bankwood Farm	466344	351005	Kelly Bush	94.4
Barlow 4	465580	428455	Ground Level	4.55
Barnby Moor Stud	465782	384607	Ground Level	17.87
Bassingham	492080	360598	Kelly Bush	16.6
Bathley Hill Fm	476599	359877	Ground Level	49.94
Beckingham 31D Oil	477829	390414	Kelly Bush	28.7
Beech Villa	467618	387068	Ground Level	8.22
Beevers Bridge	466302	418765	Ground Level	3.6
Beningborough	452764	458613	Ground Level	15.08
Berrill Farm	445971	418247	Ground Level	36.54
Besthorpe Wharf	481043	363576	Kelly Bush	9.6
Bevercotes Village	470296	371840	Ground Level	40.44
Birch Row	461507	362116	Kelly Bush	97.9
Bishop Wd4	456023	433648	Ground Level	7.19
Black Cat	490254	363990	Kelly Bush	23.4
Blaxton Common	469426	401349	Ground Level	1.79
Blooms Gorse	462774	362227	Kelly Bush	66.4
Booty Lane	455142	420666	Ground Level	6.37
Botany Bay	467732	382954	Ground Level	15.67
Boughton Brake	466165	370265	Ground Level	34
Boundary Stone	451972	379105	Kelly Bush	119.1
Boyne Hill	432412	415371	Ground Level	57.53
Breighton Airfield	472929	435257	Ground Level	5.13
Brierley Road	440017	412018	Ground Level	71.5
Broomhill	453973	347469	Ground Level	65.98
Brough	483348	358403	Kelly Bush	17.8
Bryans Close	467734	395514	Kelly Bush	11.6
Budby Carr	460932	370057	Ground Level	54.79
Bullcar	448100	414360	Ground Level	43
Burghwallis	452983	411973	Ground Level	36.6
Caledonian Farm	489513	366043	Kelly Bush	17.3
California Farm	483666	372674	Ground Level	5.87
Carlton Hill	478424	364585	Kelly Bush	28.1

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Carlton No3	466007	424158	Ground Level	5.2
Caunton Lodge	474016	361849	Kelly Bush	44
Cliff Lane	440366	410814	Ground Level	77.95
Clifton Airfield3	458293	455484	Ground Level	14.07
Clint Hill	451505	460580	Ground Level	17.69
Clog Bridge	485889	366388	Kelly Bush	11.3
Commonside	476782	366078	Kelly Bush	38.5
Cotmoor Lane	466148	352346	Ground Level	102.52
Cowick Grange	465413	421718	Ground Level	8.23
Cremorne Wood	462344	363267	Ground Level	82.47
Cromwell Moor	478874	361646	Kelly Bush	12.6
Cut Plantation	460405	367843	Kelly Bush	87.6
Dale Plantn 2	446126	430258	Ground Level	59.99
Dale Plantn 3	446027	430033	Ground Level	50.25
Decoy House	468406	372067	Ground Level	27
Dorket Head	459733	348048	Ground Level	139.82
Doveroyd	449078	422125	Ground Level	45.31
Eagle	488240	366798	Kelly Bush	19
Eakring Village	466977	362671	Kelly Bush	9.6
East Markham	473691	372432	Ground Level	44.66
Eaton Bogs	469904	377652	Kelly Bush	35.3
Emsall Lane	448125	409061	Kelly Bush	71.9
Enfield Farm	485738	367992	Kelly Bush	9.8
Escrick Brickwks	462059	440385	Ground Level	6.6
Fallows Farm	464542	353163	Ground Level	101.17
Fenton	483491	377084	Kelly Bush	11
Firbeck Lane	453117	378103	Kelly Bush	17.4
Firbeck Wood	456037	388804	Ground Level	54.5
Fishpond	450978	418935	Ground Level	13.54
Flaggs Farm	475635	360869	Kelly Bush	28.1
Flash Lane	468644	364663	Ground Level	69
Fox Quarry	448700	426000	Ground Level	16.3
Gallow Hole Dyke	469245	366042	Ground Level	74.85
Gamston Church	470782	375618	Ground Level	27
Gate Burton	483055	384006	Kelly Bush	17.2
Gibraltar Farm	479511	371838	Kelly Bush	1.2
Gleadthorpe	459661	368991	Ground Level	76.32
Gracefield Lane	479547	369579	Kelly Bush	1
Grassthorpe	480406	367681	Kelly Bush	1.6
Gravel Pit Lane	470500	373896	Kelly Bush	23.9
Great Morton	468517	379593	Kelly Bush	26.6
Greavefield Lane 4	447283	421859	Ground Level	50.97
Green Lane	446726	417610	Ground Level	36.9
Greengate Farm	488397	360965	Kelly Bush	18.2
Greenmile Farm	466461	382438	Ground Level	33.1

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Habblesthorpe	480185	382234	Kelly Bush	7.7
Hagg Lane	466248	349284	Ground Level	85.14
Halfway House	488903	363316	Kelly Bush	18
Hamilton Hill	452272	359493	Ground Level	133.41
Harthill South	450190	378465	Kelly Bush	132.1
Headstead Bank	481989	380661	Kelly Bush	6.6
Hemsworth Gate	442745	411203	Ground Level	85.52
High House Fm	464934	387565	Ground Level	19.71
Hillam Quarry	450213	428467	Ground Level	10.48
Holdgate Hill	449575	420985	Ground Level	37.71
Holly Farm	484129	365138	Kelly Bush	1.4
Hooton Pagnell	447382	408054	Kelly Bush	42
Hopyard Lane	477752	358627	Ground Level	12.05
Humble Carr	481743	387405	Kelly Bush	1.4
Hunts Bridge	483895	366608	Kelly Bush	1
Hykeham Station	493560	367473	Kelly Bush	14.4
Inch Lane	446807	412685	Ground Level	47.15
Infield Lane	456813	371999	Ground Level	58.16
Inkersall Grange	461472	360494	Kelly Bush	98.7
Keepers Breck	462304	360035	Kelly Bush	94.3
Kensbury Hall	457561	437165	Ground Level	7.09
Kingshaugh House	475536	373123	Ground Level	26.47
Kirton Wood	470519	368378	Kelly Bush	78
Kitchener Plantn.	461650	371326	Kelly Bush	56.4
Kneesall Green	470890	364716	Kelly Bush	86.6
Lady Galway	466051	396574	Kelly Bush	13.7
Leys Lane No9	449269	421806	Ground Level	44.34
Leys Lane No10	449660	422220	Ground Level	38.8
Lindhurst Colliery	457217	357818	Kelly Bush	125.1
Linton Woods	450228	463044	Ground Level	16.44
Low Farm	464384	389405	Kelly Bush	1.3
Maltby Ug28	455927	393875	Ground Level	92
Manor Fd Hse	459614	435247	Ground Level	5.72
Marsh Lane	479657	388562	Kelly Bush	6.2
Mattersey Hill	466802	388736	Ground Level	6.43
Maun Chapel	469325	373015	Kelly Bush	26.8
Meadowcroft	450379	455167	Ground Level	14.7
Mill Farm	486141	391514	Kelly Bush	23.8
Mill Hill	466844	361719	Ground Level	96.28
Milton Village	471673	372881	Kelly Bush	43.6
Moor End	459645	438980	Ground Level	7.1
Moor House Lane	449333	410240	Kelly Bush	33
Moor Lane	445984	419322	Ground Level	31.06
Moorlands	458051	458337	Ground Level	18.21
Mount Pleasant	476886	361087	Kelly Bush	19.3

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Nearcliff Quarry	452703	399382	Ground Level	33.23
New Lodge No.4	433519	409282	Ground Level	83.18
New Parks	454580	461834	Ground Level	11.27
North Clifton	481902	372348	Kelly Bush	8.1
North Collingham	484172	362553	Kelly Bush	12.9
North Ewster	483635	403887	Ground Level	4.22
Northfield Fm	451821	427616	Ground Level	8.43
Norwell Lodge	475427	362258	Kelly Bush	38.9
Nun Monkton	449976	458132	Ground Level	13.71
Oak House	465577	388624	Kelly Bush	18
Oakham Farm	466904	371568	Kelly Bush	42.4
Old London Road	466810	381460	Ground Level	34.35
Oldbridge Dyke	461978	442352	Ground Level	6.78
Ossington	474893	364638	Kelly Bush	5.9
Overton	455817	455480	Kelly Bush	16.9
Park House	464307	419060	Ground Level	4.68
Park Lidget	476679	363455	Kelly Bush	52.5
Parson Wood	462299	442538	Ground Level	6.55
Peartree	448659	415509	Ground Level	40.85
Pool Lane	449120	456838	Ground Level	14.82
Poole	449661	426964	Ground Level	10.88
Potter Hill	485245	360806	Kelly Bush	23.2
Poulter	464887	375878	Kelly Bush	3.4
Priest Gate	472841	372758	Kelly Bush	72.1
Ramsdale Farm	458848	348930	Kelly Bush	14.9
Ratcliffe Grange	455531	377015	Kelly Bush	56.9
Ravensknowle	444474	420455	Ground Level	57.54
Red Bridge	463704	360420	Kelly Bush	69.7
Redhill Lane	467015	363083	Kelly Bush	76.9
Riccall No.3	461807	435246	Ground Level	7.42
Rock Abbey	487473	395328	Kelly Bush	23.9
Roe Hill	463757	388323	Kelly Bush	13.8
Rosecroft	457850	460552	Ground Level	16.83
Rufford Hills	465302	365503	Kelly Bush	68.3
Rusholme Grange	469694	426603	Ground Level	4.25
Ryton	462912	388133	Ground Level	21.8
S Kirby Ug 31	444677	411841	Ground Level	41.15
Sandfield	467224	436354	Ground Level	8.44
Sandy Lane	467457	362611	Kelly Bush	61.1
Sandygate Lane	444714	419045	Ground Level	74.26
Serlby Park	463206	388936	Kelly Bush	13.6
Seymour Grove	462488	368561	Ground Level	64.09
Shacklefield	447816	459962	Ground Level	13
Sharps Hill	464297	376850	Kelly Bush	39.1
Sheds Farm	477178	381399	Kelly Bush	41.9

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Shelt Hill	464159	348050	Kelly Bush	37.3
Shipton No.5	455881	459288	Kelly Bush	17.9
Shipton No3	454464	458579	Ground Level	15.82
Shipton No4	454574	460188	Kelly Bush	23.8
Sidcop Road	438502	409955	Ground Level	67.67
Silverwood Ug32	449220	391874	Ground Level	0
Skelton	456328	456972	Ground Level	13.31
Skelton Moor	458112	456737	Kelly Bush	16.5
Smiths Bridge	475575	392510	Kelly Bush	17.3
Sod Wall	458700	368314	Kelly Bush	6.3
South Collingham	483231	360773	Kelly Bush	13
South Hills	472068	371417	Kelly Bush	6.3
South Muskham	479348	357810	Kelly Bush	13.2
Spalford	483165	369706	Kelly Bush	9
Spitfire Hill	466638	374869	Ground Level	41.04
Springfield Fm	450067	377193	Kelly Bush	141.8
Stapleford	489587	358166	Kelly Bush	15.3
Stapleford Moor	486904	357584	Kelly Bush	18.8
Stow Park	486094	378810	Kelly Bush	1.3
Stubbs Lane No3	450299	421769	Ground Level	38.91
Swinderby No3	487425	362962	Ground Level	15.42
Swinethorpe	488050	369216	Kelly Bush	18.1
The Birks	454927	376749	Ground Level	65.39
Thorney	485221	372648	Kelly Bush	12.7
Thorpe On The Hill	491452	365990	Kelly Bush	15.9
Tilt Hills	455785	408997	Kelly Bush	4.7
Tollerton	451720	463244	Ground Level	21.19
Treeton Ug38	447263	390372	Ground Level	0
Trow Bridge	481937	360105	Kelly Bush	11.2
Tug Bridge	469290	362346	Kelly Bush	54.3
Tunman Wood	487923	364937	Kelly Bush	15.8
Two Gates	441375	410454	Kelly Bush	78.3
Upper Poppleton	454638	454553	Ground Level	16.53
Vicarage Lane	478335	359830	Kelly Bush	14.2
Walkers Wood	467326	380302	Kelly Bush	41.4
Weecar	481797	366706	Kelly Bush	9.1
Weeland Road	455402	423881	Kelly Bush	17.8
Went Edge Road	450788	416810	Ground Level	48.35
West Kneesall	469984	364110	Kelly Bush	65.8
West Pk Fm	449800	428275	Ground Level	10
West View	482800	363363	Kelly Bush	15.9
Westwood Fm	470055	367304	Ground Level	98.85
Wheatholme	483750	371138	Kelly Bush	9
Wheatley Fm	484151	360044	Kelly Bush	17.1
Whimpton Moor	478502	373846	Kelly Bush	14.1

Well	Easting (m)	Northing (m)	Elevation reference	Elevation (mAOD)
Whitewater	461428	389811	Ground Level	11.82
Whitwell Wood No2	452723	377882	Kelly Bush	116.1
Whitwell Wood No3	451800	378741	Ground Level	122.99
Wigsley East	486626	370392	Kelly Bush	9
Wood Lane	467217	414791	Ground Level	3.21
Wooden Beck	474480	391355	Kelly Bush	4
Woodhouse	458500	464500	Ground Level	20
Wormley Hill	466901	416383	Ground Level	3.72
Yorks Main Ug 32	454257	395364	Ground Level	91.44

East Midlands – Methodology

1. Well headers and formation top data from records in the IGas database were imported into IHS Kingdom 8.8, checked for accuracy and corrected where appropriate.
2. Formation tops and marker horizons (including coal seams) were correlated using historic and existing IGas interpretations.
3. A depth map of the Permo-Triassic unconformity referenced to subsea was generated in Kingdom to eliminate areas in which the coal is not present as a result of the unconformity but would inevitably be produced due to the nature of the gridding process.
4. Key target seams were identified and catalogued into packages to identify and attempt to quantify potential target seams on a regional scale. In the East Midlands, many of the target seams exhibit a complex distribution across the region. The complexity is due to a combination of differing naming conventions and seam splits and thinning. Despite this, the coals are well documented and a system was put in place for the purposes of this CBM prospectivity analysis. This in itself is not considered to be infallible and measures were taken to identify areas where the influence of a large split or incorrectly named seams may affect the results. These target seams are the Barnsley, Flockton, Parkgate, Silkstone and Top Beeston Coals. In addition to these, the Newhill, Two Foot and Joan Coals were also included as though these may not be particularly prospective, a comprehensive dataset was available for these seams and they are all known to be present across the region.
5. Detailed lithology descriptions were digitised and imported into Kingdom to accurately determine net coal values for each named seam. Any coal bed within a named coal seam, separated from another coal bed by more than 0.30m of non-coal bearing rock was discounted from the net coal value. This method provides a realistic tangible net coal value which can be developed through modern in-seam directional drilling. No corrections were made to coal thickness for bedding dip or borehole inclination due to limited data for each. The regional dip in the East Midlands is relatively low (typically <2°) and is not expected to be significantly different to the true stratigraphic thickness.
6. Depth grids referenced to subsea were generated to the tops of the coal packages and individual seams.
7. All depth grids were corrected to Ground Level using the Ordnance Survey Terrane 50 dataset and cross checked with the well data.
8. Seam isochore maps were produced in Kingdom for the packages. The purpose of this map is to identify areas where the packaging may not be applied correctly or to identify areas where the seam splits significantly for geological reasons and thus indicate where the net coal calculations may be compromised. A good example of this is observed to the north of EXL288 where the Horbury Rocks splits the Upper and Lower Barnsley Coal.

9. An additional set of depth grids were created and clipped to a depth range of 300 to 1200mBGL, the depth window currently considered by IGas as economic.
10. Isochore grids were calculated in Kingdom from the net coal data (set to a 2000m area around the data) and clipped to the subcrop grid of each coal.
11. All net coal grids were imported into Manifold GIS software where they were clipped based on all identified development restrictions and the PEDL boundaries.
12. Volumetric calculations were completed on each isochore grid using Kingdom.
13. Gas content maps were generated in Kingdom using the NCB Creedy dataset. The dataset is from dry, ash-free desorption measurements taken during NCB exploration. Seam names were normalised to account for regional variation and averages across the seam used where more than one measurement was taken within a seam. The dataset was also filtered for samples which were identified to be poorly measured, primarily due to sampling time which was often hours and would thus show a misrepresentative measurement. The results from Composite Energy, Greenpark Energy and Dart Energy CBM exploration wells are also included in the dataset.
14. Final maps showing depth, isochore, gas content and development restrictions were created in Manifold.

APPENDIX S. Resource Estimation Parameters

Volumetric Calculation Methodology

GIP = Area x Thickness x Density x Gas Content

Coal Volumes

Licence	Primary Seams Coal Volumes (m^3)
PEDL185	51106300
PEDL186	253243700
PEDL187	174969400
PEDL188	286926600
PEDL189	401514900
PEDL147	486675400
EXL273	29465800
PEDL146	1531290900
EXL288	64444500
PEDL012	15026418
PEDL200	149496341
PEDL207	70282300
PEDL210	146058400
TOTAL	**3631035159**

North West - Cheshire

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	6	7	9

North West - Warrington

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	2	7	11

East Midlands – PEDL146

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	2	4	6

East Midlands – EXL288

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	4	5.5	7

East Midlands – PEDL200 & PEDL012

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	6	8	10

East Midlands – PEDL207 & PED210

Parameter	Low	Best	High
Density of Coal (g/cc)	1.30	1.40	1.50
Average Gas Content (cc/g)	4	5	6