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Geotechnical Review

Consideration of Ground Conditions and Subsidence Hazard to Old Stocks Court, Upper Basildon, Berkshire

Project Ref: 34285/3501 | Rev: GRR001/Rev 02 | Date: September 2015

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Document Control Sheet

Project Name: **Geotechnical Review Report**

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Report Title: **Consideration of Ground Conditions and Subsidence Hazard to Old Stocks Court, Upper Basildon, Berkshire**

Doc Ref: **GRR001/Rev02**

Date: **September 2015**

	Name	Position	Signature	Date
Prepared by:	Dr Clive Edmonds	Partner	CNE	23 Sept 2015
For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
01	July 2015	Final draft	CNE	CNE	CNE
02	Sept 2015	Final incorporating comments	CNE	CNE	CNE

Contents

Figures

1 Instructions Received

1.1.1 I was instructed by West Berkshire District Council, in a note received 27 March 2015 by post to act as a geotechnical expert to provide advice in relation to the ground conditions and subsidence problems that have occurred at Old Stocks Court, Upper Basildon, Berkshire.

1.1.2 I was requested to provide professional advice to address a series of questions and other matters in relation to the information provided to me by the Council as follows:

Q1 What is the likelihood of further sinkholes developing on the Site (area hatched red on Plan A)?
Q2 What is the likelihood of sinkholes developing on the area hatched in black on Plan B?
Q3 What is the likelihood of sinkholes developing on Tenaplas Drive, shaded blue on Plan A?
Q4 In the event that you consider that further sinkholes may develop in the areas identified, please advise, if possible, as to likely timescales for those problems to materialise.
Q5 In the event that you consider that further sinkholes may develop in the areas identified, please indicate, if possible, as to the likely severity of the sinkholes.
Q6 Would further investigations assist the above assessment and if so, to what extent?
Q7 Are there any other issues which in your opinion may be relevant for consideration by this Council?

1.1.3 Source documents provided include:

Source A: Report on a Ground Investigation at Tenaplas Plastics Factory, Tenaplas Drive, Upper Basildon, Berkshire for John Newton & Partners, prepared by Geo-Environmental Services Ltd, Ref GE552, dated January 1999;

Source B: Site Investigation Report, Tenaplas Drive, Upper Basildon, Berkshire for Suntex Safety Glass Industries Ltd, prepared by LBH Wembley, Ref LBH1478, dated November 1997 (forms Appendix E of Source A);

Source C: Geotechnical and Environmental Audit Phase 2 at Former Tenaplas Plastics Factory, Tenaplas Drive, Upper Basildon, Berkshire for Clancy Developments Ltd, prepared by John Newton & Partners, Ref S8814/JN/RF/Audit2, dated May 1999;

Source D: Letter to Earth Solutions from John Newton & Partners dated 10th June 1999;

Source E: Results of a ground conductivity and resistivity geophysical survey carried out for Clancy Developments Ltd by Earth Solutions, dated July 1999;

Source F: Letter to Clancy Developments Ltd from John Newton & Partners dated 6th August 1999 concerning Plot 24;

Source G: Fax to Clancy Developments Ltd from John Newton & Partners dated 19th November 1999 concerning Plots 6 & 7;

Source H: Revised Design Calculations for Continuous Flight Auger Piling to New housing, Tenaplas Drive, Upper Basildon, Nr Reading for Clancy Developments Ltd, prepared by Colets Piling Limited, Ref S8611, dated 22nd June 1999;

Source I: CFA Pile installation & Operators daily records prepared by Bachy Soletanche dated 18th October to 6th December 1999;

Source J: Certificates of completion issued by West Berkshire District Council building control to Clancy Developments Ltd for Plots 1 to 23, variously dated May 2001 to September 2003

2 Qualifications and Experience

2.1.1 My name is Clive Edmonds and I am a Partner at Peter Brett Associates LLP (PBA) based in the Reading office. I graduated in 1977 from Nottingham University with a BSc (hons) degree in Geology after which I worked for Soil Mechanics Ltd (a site investigation contractor) based at Bracknell, Berkshire until 1980. During 1980 to 1981 I studied at Imperial College, London where I gained an MSc in Engineering Geology and was awarded a DIC for my dissertation as well. My dissertation topic was a study of the engineering characteristics and challenges of construction upon rocks prone to dissolution and subsidence, including field study of construction problems for the M4 Motorway in South Wales where it crossed limestone strata. After returning briefly to Soil Mechanics Ltd I decided to pursue a PhD to study the engineering geology and geomorphology of subsidence problems upon the Chalk outcrop in England. This lead to the development of new methods for modelling and predicting subsidence behaviour on the Chalk caused by naturally formed solution features and man-made mining cavities. The PhD was awarded in 1987 by Royal Holloway & Bedford College, London University. I returned to commercial practice in late 1985 as an engineering geologist with Applied Geology Ltd based at Leamington Spa in Warwickshire. I continued to develop my skills for recording, investigating and providing remedial solutions for subsidence problems, particularly upon Chalk, writing and publishing many technical papers on the subject. Following my collection of natural cavity and mining cavity data for the Chalk in England I was appointed to develop national databases for Great Britain, published in 1993, following government research funding. In 1997 I joined PBA becoming a Partner in 2006. Since this time the databases consist of a Natural Cavities Database containing >35,000 records and a Mining Cavities Database containing >16,000 records. The databases are operated commercially by PBA, being regularly updated and are also available through other vendors. Over many years of professional practice (Fellow of the Geological Society 1978, Chartered Geologist 1994, European Geologist 2002 and Chartered Scientist 2004) I have been involved with investigating and stabilising large numbers of land instability problems (1,000+) associated with unstable slopes, natural cavities and mining cavities. I have become a leading UK authority on such matters, and apart from regularly publishing technical papers and articles, I have been interviewed by television and radio, newspapers and magazines (including website blogs and podcasts). I also regularly give talks to companies, learned societies, universities and other groups. Consequently I have a wide ranging knowledge of geohazards and land instability that is relevant to considering the ground conditions and subsidence hazard at Old Stocks Court, Upper Basildon, Berkshire.

3 The area of interest and background to events

3.1 Location

3.1.1 Old Stocks Court is a mix of 25 detached and semi-detached residential properties built during the period of 1999 to 2000 by Clancy Developments Ltd upon the site of a former factory operated by Tenaplas Ltd, located at the end of an un-adopted road named Tenaplas Drive at Upper Basildon, Berkshire (see Site Location Plan Figure 1). The development is centred at approximate NGR SU 585 764.

3.1.2 The development comprises open areas of ground and private roads that are maintained by an owners' management company together with privately owned plots containing the houses, gardens and attached garages.

3.2 Summary of Recent Events

3.2.1 The development has continued to mature with time since construction and no particular problems were known until a collapse appeared suddenly in the driveway of Number 5 in February 2014. The hole measured about 3m diameter and 2.5m deep. In March 2014 PBA arranged for the hole to be infilled with foamed concrete (32m^3) on behalf of the owners of Number 5 to provide temporary stability while plans were made to carry out ground investigations to determine the cause of ground movement.

3.2.2 During April 2014 PBA coordinated a dynamic probe investigation of the ground conditions surrounding the collapse position. A number of the probes stopped prematurely upon shallow level obstructions in the made ground present, but some achieved penetration depths up to 16.9m bgl. It was evident from the limited probing data that the ground in places was weak, disturbed and voided to depths up to 16m or so before the ground strength improved. Overall, although the results were limited, experienced interpretation showed that the ground was most likely impacted by the collapse of old chalk mine workings.

3.2.3 The owners of Number 5 next commissioned PBA to advise on suitable remedial ground stabilisation measures to stabilise the driveway and then to tender and oversee the works carried out by Forkers Ltd. This work was started in early November 2014. The rotary drilled boreholes overcame the ground penetration problems suffered by the probes and so drilling parameters were measured to provide feedback on the ground conditions as the work took place. Generally the contractor worked from the northern end towards the southern end of the driveway, always working within the confines of the driveway. The drilling results confirmed the presence of weak, collapsing ground with underlying old chalk mine workings having a general floor level of about 16m bgl.

3.2.4 During the course of the works a second new collapse occurred on 5 December 2014 closer to the house where the driveway entered into the front garden. As the collapse progressively developed and enlarged it became about 9m in diameter and was up to 5m or so deep. The driveway stabilisation works were temporarily stopped while works to infill the collapse took place (18 December 2014) and a temporary diversion of the foul sewer was carried out by Thames Water since their sewer was endangered as it passed through the collapse zone.

3.2.5 The second collapse was infilled with foamed concrete to provide temporary stability and once set the remainder of the works to stabilise the driveway was completed (January 2015). At this time the house insurer commenced paying for the works associated with the second collapse in order to treat the ground sufficiently to reinstate the utility services. After infilling PBA set out a grid pattern of ground treatment holes centred on the collapse location that the contractor Forkers Ltd then undertook starting in January 2015. Analysis of the drilling parameters showed that the typical floor level of the mined ground was around 15m to 17m bgl. On completion of the agreed treatment area the total grout takes amounted to 338m³ of material injected into the ground in addition to the 62m³ of foamed concrete previously used to infill the collapse. The ground treatment works were completed by the end of March 2015.

3.2.6 Currently the owners of Number 5 are awaiting the final repairs and reinstatement of the foul sewer by Thames Water before surface reinstatement work can be completed.

4 Assessment of risks and related advice

4.1 Terminology

4.1.1 The term “sinkhole” refers to a surface depression produced by ground subsidence over a naturally formed feature usually developed as a result of dissolution of a soluble rock. Such rocks can include limestone, chalk, gypsum and salt. At Old Stocks Court the underlying geological sequence comprises Palaeogene age Lambeth Group deposits (sands and clays) underlain by Chalk Group strata (soluble rock). However, the ground subsidence problems being addressed in this report are not caused by dissolution of the chalk, but are caused by historical man-made mine workings in the chalk.

4.1.2 The link between chalk mining and brick making during the late 1700s to the early 1900s is well established and researched (Edmonds et al 1990, Lord et al 2002). The brick makers dug clays from surface pits and sunk a shaft down into the chalk below in order to mine it. Once brought to the surface the mined chalk was mixed with the clay and ground in a pugmill in the proportion of 3 parts clay (75%) to 1 part chalk (25%). The ground clay/chalk mixture was then used to form a slab which was cut into dimensioned raw blocks prior to being placed into a kiln for firing to produce the bricks.

4.1.3 As can be appreciated from the above the collapses affecting Number 5 Old Stocks Court are man-made due to the past mining rather than natural in origin. Therefore the correct term used for such collapses is “crown hole”. Consequently this term will be used in this report.

4.2 Historical analysis

4.2.1 In order to assess the likelihood of further crown holes as per the questions 1 to 3 as listed in Section 1 it is first necessary to consider the areas that are most likely to contain historical chalk mine workings.

4.2.2 This assessment is based on study of old maps that show the location of the brickworks dating back to the early 1800s and onwards in time. The earliest map available, the Land Enclosure Map of 1809, does not show any details for the Old Stocks Court area. The Records Office informed PBA that the local area was enclosed before the 1809 map was produced. This information was probably shown in Estate Papers but was not transferred onto the 1809 map and the Records Office does not have a copy of the information.

4.2.3 The next historical map is the Tithe Map dating from 1839 (see Figure 2). This shows some useful details of the area of interest. The Basildon Brick Works was active at this time (Land Plot 44: The Kiln Ground), the land being worked by Richard Smith and used for brick making. It is interesting to note that the position of the kiln and four probable drying sheds (hacks) are shown towards the southern edge of the land plot at this time. Another plot (Land Plot 43: Clay Pits) wraps around the south side of The Kiln Ground. Richard Smith appears to own and live on “Plot 48: House, Garden, Orchard” to the north east of the brick works, adjacent to Withy Copse (Land Plot 49).

4.2.4 The first edition OS Map dates from 1878 (see Figure 3) and the Basildon Brick Works are again shown. An area of clay pits is clearly shown, the southern and western portion of which appear to be overgrown and no longer in use. A “kiln” is marked within the area central to the clay pits that are open and active, together with four long, narrow buildings, presumed to be drying sheds (hacks). Another rectangular building is also shown to the north east side of the kiln, close to a track. The kiln and the sheds are located further north than the positions of the same structures shown on the 1839 map which are no longer shown. The plot of land containing the brick works is marked “Kiln Ground” on the map and two circular land enclosures within the woods are shown similarly to the 1839 map.

4.2.5 The second edition OS Map dates from 1899 (see Figure 4) which indicates that the clay pits have been extended northwards. The northern edge of the pits now runs irregularly in an east to west direction and has partially removed the western circular land enclosure feature in the woods. The old clay pits south and west of the kiln shown on the 1878 map are now shown to be overgrown and disused. The kiln dating from the 1878 map and other buildings remain largely the same as before. A second kiln is now shown to be present north of the 1878 kiln and an additional building west of the sheds as well. The rectangular building north east of the 1878 kiln is no longer shown.

4.2.6 The third edition OS map dates from 1912 (see Figure 5). The map shows the same two kilns as depicted on the 1899 map, but by this time the area of clay pits has greatly expanded to both the north and west of the former areas worked, the edge of the worked out area now lying close to the footpath crossing the northern part of the Kiln Ground wooded land.

4.2.7 After this time it is understood from Source B that the brick works continued to operate until about 1939. After the WW2 period Meldrum Tenaplas Extrusions Ltd purchased the site and set up a factory on the former brick works land. The map of 1960 shows a series of factory buildings which has become a large rectangular building by the 1973 map edition (see Figure 6). Source A report information shows that the factory continued to operate until at least November 1998 when a walkover survey of the premises was done.

4.2.8 Source D suggests that the site demolition and clearance took place in June 1999 and construction of the new housing took place from October 1999 onwards (Source H).

4.2.9 A summary of the spatial distribution of the quarrying extents and locations of kilns through time is show in Figure 7.

4.3 Discovery of voids

4.3.1 The ground investigation report (Source A) records that a void was encountered in the chalk by a borehole (BH 5) at the eastern edge of the factory site. The chalk roof of the void was present at a depth of about 10.5m bgl. The chalk floor of the void was at about 13.7m depth bgl with around 800mm of very loose silty sand with chalk fragments and bricks fill present overlying the floor level. The void was correctly identified as being man-made, possibly a bellpit or pillar-and-stall mine. An alternative explanation offered was that the void might be associated with the former brick kiln if set into the ground. Further investigation of the extent of the void was recommended and stabilisation in due course.

4.3.2 The presence of voids associated with the former usage of the site as a brick works and the need to carry out further investigations is acknowledged in Source C. The need to further investigate their presence and to stabilise them is mentioned as well.

4.3.3 A letter (Source D) suggests that voids are most likely to be found near BH5 affecting Plots 1, 2 and 22, 23 and caution was also expressed regarding possible voids below Plots 3 to 9.Site clearance had found an old brick kiln on the northern boundary of Plots 5 to 8 which was removed. Earth Solutions was asked to advise on the best survey methods to investigate the potential for voids.

4.3.4 The survey results (Source E) reveal that ground conductivity and resistivity geophysical surveys were carried out. A linear anomaly is centred on BH5 suggesting how the void might extend outwards from the borehole location towards Plot 1 (Number 3 Old Stocks Court). A zone of elevated resistivity also apparently underlies Plots 5 to 7 (Numbers 7 to 9 Old Stocks Court).

4.3.5 A letter (Source F) sets out how during piling operations at Plot 24 (Number 2 Old Stocks Court) a series of 8 piles all failed due to encountered voids beneath the building extending to the south east. Trial bores using the auger rig found that the floor level of the void was about 14.5m bgl beneath the centre of the building and the roof level was at about 11m to 12m bgl. Elsewhere the trial bores located the void floor level to lie between 15m and 16.4m depth bgl. The engineer confirmed that it was agreed with the developer to fill the voids encountered with foamed concrete. The piles were then to be re-constructed onto the foamed concrete and socketed into the concrete by 1m below the void roof level so that the pile load was distributed down onto the void floor level.

4.3.6 Finally a fax (Source G) confirms that voids were found below Plots 6 & 7 (Numbers 8 & 9 Old Stocks Court) and that further investigation and void filling was to take place. Pile records (Source I) confirm the piling installation problems on 8th to 10th November 1999 and the trial boring done on 23rd November 1999. The plots were re-piled on 3rd December 1999 but even after void filling further concrete slumping in pile bores occurred in two piles (18 & 14).

4.3.7 A piling daily record (24th November 1999) refers to the ground giving way under the rig on the position of Pile 27 at Plots 20 – 21(Numbers 23 & 26 Old Stocks Court).

4.3.8 A summary of the spatial distribution of voids found during the investigation phase and pile installation phase is presented in Figure 7, together with the area where ground collapses and investigation/treatment of collapsing voids has taken place at Number 5 Old Stocks Court.

4.4 Potential for future collapses

4.4.1 As discussed previously the collapses that occurred in 2014 were the result of ground subsidence over old failing chalk mine workings associated with the historical usage of the area for brick making. Research has shown that brick making has taken place from at least 1839 onwards and probably for some years before that. As clay was removed by excavation at the surface, chalk was being mined at depth. From studying the layout of many brick works developed on the Lambeth Group deposits it appears that the entry shaft to the mine is frequently positioned in close proximity to the kiln, thereby limiting the need to transport the mined chalk any significant distance to where it was required to be broken up and mixed with clay in a pug mill or wash mill close to the kiln.

4.4.2 As Figure 7 shows, there have been 3 kiln positions noted at the Basildon Brick Works, the first from the 1839 map, the second from the 1878 map and a third one from the 1899 map edition. This situation indicates a number of scenarios: (a) a new chalk mine entry shaft was dug close to each kiln position in turn leading to the excavation of 3 small scale mines, or (b) the original mine was extended towards the new kiln position and a new shaft dug to connect with it at the new kiln position (i.e. 1 larger mine). Other variations are also possible, but in order to visualise the potential footprint that the mining options would occupy a series of 50m diameter circles have been drawn centred on each of the kilns in turn. From reviewing large

numbers of chalk mine records across SE England it is known that most mines do not exceed a dimension of 50m from the shaft position to the outer extremity of the mine.

4.4.3 It is notable that there is a good fit between the possible mine extents shown on Figure 7 and the occurrence of voids and collapse problems recorded at the Old Stocks Court development.

4.4.4 In answer to Q1 (Section 1 of this report) it is considered feasible that future crown hole collapses could occur within the eastern portion of the red hatched area on Plan A as illustrated by reference to Figure 7. The properties (houses and gardens) at risk of potential ground collapse (crown hole) include Numbers 2 to 9 and 22 to 26. In addition the access road from its junction with Tenaplas Drive, through the archway and the eastern portion of the road within the open land inside the quadrangle is also at risk of crown hole collapse, as would be any of the adjacent open land owned by the management company.

4.4.5 In answer to Q2 (Section 1 of this report) it is considered feasible that future crown hole collapse could occur to the south and east of the Old Stocks Court development overlapping the area which is hatched in black on Plan B as illustrated by reference to Figure 7.

4.4.6 In answer to Q3 (Section 1 of this report) it is considered feasible that future crown hole collapse could occur possibly at the junction of the Old Stocks Court access road with the western end of Tenaplas Drive which is shaded blue on Plan A as illustrated by reference to Figure 7.

4.5 Timescales for future collapses

4.5.1 In Section 1 of this report Q4 asks for advice concerning likely timescales when crown holes might occur assuming it is considered that there is a continued risk of this happening as confirmed above.

4.5.2 From studies I have made and reports that I have prepared in connection with a variety of major ground collapses, mostly crown holes, it is evident that there has been an increase in the number of collapses generally since 2000. From reviewing rainfall records in parts of southern England it appears that the mean average annual rainfall has increased since 2000 as compared with the long term average of the previous 30 years. In particular the volume of rainfall and its intensity during storm events has increased noticeably. This was especially evident during the months of December 2013 to February 2014 when rainfall was more than twice the long term average for the period and a record number of ground collapses occurred in February 2014.

4.5.3 In parallel with the changing pattern and effects of rainfall the historical chalk mines are getting older year-on-year. The old chalk mines below the Old Stocks Court area probably range in age from at least 185 years to 115 years. As a general observation, once mines approach an age of 150 years or so it seems that they are more prone to collapse because the chalk walls and roof of the mine exhibit a time dependent stress softening effect that results in the onset of breakdown as the ability of the chalk to support and span over open void space reduces.

4.5.4 The precise timing of the next crown hole collapse is almost impossible to predict – it could happen any time, though more likely during wetter periods of the year. Water leaks from services (water mains, sewers, drains) can also play a role in triggering collapses if the leakage of water causes inundation of ground over an open void.

4.6 Severity of future collapses

4.6.1 In Section 1 of this report Q5 asks for advice concerning likely severity when crown holes might occur assuming it is considered that there is a continued risk of this happening as confirmed above.

4.6.2 When old chalk mines collapse the severity depends upon whether it is caused by breakdown of a tunnel roof or the shaft. Mine tunnels are commonly 3m to 5m high and wide and when collapse occurs it is often the case that the ground drops vertically and also moves laterally at the base into the connected open tunnel void space around the collapse position. The extent of lateral movement into the connecting void space depends upon the presence of water to aid the process. In many cases old chalk mine entry shafts are perhaps 1.5m to 2.5m diameter and sometimes they contain a conical heap of spoil at the base, thrown back into the shaft when the mine is abandoned, and sometimes not. Collapses over shafts often result from the backfills dropping in level and the washing through of spoil into connecting void space at the base when the capping gives way. Some shafts are brick lined and so the surface crown hole will be limited in size to the shaft diameter, but may be deep, 5m to 10m or more. The ground movements over unstable tunnels tend to produce larger diameter collapses (3m to 10m or more) that are shallower, say 3m to 6m. Other variations are also possible so the above is provided for guidance purposes only.

4.6.3 From reviewing the background data for the development and the information derived from the investigations and treatment at Number 5 Old Stocks Court it appears that the mine floor level varies from about 13m to 17m bgl approximately. This provides a guide as to the depth of ground that has been impacted by the past mining activities.

4.7 Further investigations

4.7.1 In Section 1 of this report Q6 asks whether further investigations would assist with the assessment of areas at risk which are now indicated on Figure 7.

4.7.2 Assessment of the background information available from the investigation and development phase of the housing at Old Stocks Court shows that although there was early recognition of the presence of possible chalk mine working voids, other than a limited geophysical survey, little was done to locate and map the mine workings. During the piling phase voids were treated by infilling only at the positions they were encountered. Some additional probing using the pile auger was done but this was at best a very crude way to attempt to find mine workings.

4.7.3 At Number 5 Old Stocks Court a review of the investigation and ground treatment holes indicated a mine tunnel running at an oblique angle along the driveway axis passing beneath the management company land. The narrow linear corridor of investigation and treatment limited the interpretation possible and so there may be intersections with other tunnels as well. As a wider rectangular grid area was treated around the second collapse it was possible to detect tunnels radiating outwards in all directions from the treatment area. These tunnels lie in close proximity to the kiln position shown on the 1878 map edition.

4.7.4 There is a range of evidence suggesting that extensive mine workings are present below the development as indicated by the areas shown on Figure 7. There are a variety of ways to investigate and map the mine workings and in order to fully risk assess the situation it would be best if further investigation was carried out.

4.7.5 The most positive proof of the presence of mine workings would be obtained by carrying out rotary drilling on a grid pattern across the area, but this would be very expensive for the size of area indicated in Figure 7. Dynamic probing on a grid pattern offers another cheaper technique to detect and locate mine workings but as was experienced at Number 5 there are hard obstructions in the made ground below the development platform that prevent the probes achieving the ground penetration wanted. Therefore the benefits of dynamic probing are limited.

4.7.6 Another option would be to carry out a geophysical survey (probably a combination of microgravity and resistivity surveys) to be able to penetrate sufficiently into the ground and cover the entire area at more reasonable cost and with least inconvenience to residents. Such a survey approach would not produce a detailed mine plan, but should be capable of determining broad areas where the ground is disturbed by mining and where voids are in the process of upward migration – this approach has been used before on other mining projects. Once the area of disturbance due to mining is better defined then it would be necessary to carry out intrusive investigations to assess the risks in more detail.

4.8 Other issues for consideration

4.8.1 In Section 1 of this report Q7 asks whether there are any other issues which may be relevant for consideration by West Berkshire District Council. A number of relevant issues are raised below.

4.8.2 It is clear from this review that there is a historical chalk mining instability problem affecting the eastern portion of the Old Stocks Court development at the very least. Though, at the time of writing, I am unaware that any of the houses has been affected by subsidence including 5 Old Stocks Court. A major obstacle to moving forward positively to address the evident risks is that the property insurers will normally only provide funds to deal with subsidence problems once the problem is manifest and has caused structural damage or damage to services. Insurers are usually only reactive to subsidence and not proactive to fund preventative work even if the prospect of subsidence damage in due course is highly likely.

4.8.3 Up until a few years ago it was possible for local authorities to apply for grant aid funding from the Homes & Communities Agency (HCA) to pay for ground investigation and related land stabilisation works under the Land Stabilisation Programme originally started by English Partnerships. This was to cover costs where non-coal mining instability problems blighted areas and prevented normal market conditions and development investment to operate normally. This funding stream is no longer available. However, it may still be possible for the elected Member of Parliament to talk to the Minister responsible for the HCA to find out whether there is a source of public funds available.

4.8.4 In the circumstances I imagine that the property owners will want to explore the legal options to consider whether the original property developer and its advisers have been negligent in any way and can be held to account for the present situation. It may be that legal action, in due course, will result in obtaining funds to carry out the ground investigation and stabilisation works that are likely to be necessary to mitigate the risks identified in this report.

4.8.5 Looking over the “Background” section of the instructing document provided to me the timeline of events as known to the Council is set out therein. It is interesting to note that under Item 4 the Building Regulation application for Plots 1-23 (Numbers 3 to 26 now – there is no Number 13) was initially rejected (8th October 1999 submission) before being re-submitted in April 2000 and approved in August 2000. By April 2000 the developer knew there were problems with the ground conditions yet did not advise the Council and detail what mitigation measures had been taken.

4.8.6 The results of the DoE national studies to look at land instability due to non-coal mining cavities were published in 1990/91and for natural cavities in 1993. The studies demonstrate that Berkshire is a county where there are land instability problems due to both natural cavities in the chalk as well as chalk mines. The results of such studies demonstrate the need to consider land instability when undertaking land development. The developer and their advisers have initially recognised the mining problem, but have not fully engaged with it or properly mitigated it thereafter. If the Council had followed up on its request to obtain the piling records (Item 8 of the document provided to me by the Council) the problems of mining voids being encountered during piling would have been evident, however, in retrospect it seems that the developer has not kept the Council informed.

5 References

5.1 Published works

5.1.1 The list of published works referred to in the report is as follows:

- CN Edmonds, CP Green & IE Higginbottom (1990) “Review of underground mines in the English chalk: form, origin, distribution and engineering significance”, Chalk: Proceedings of the International Chalk Symposium, Brighton Polytechnic, 4-7 September 1989, Thomas Telford

- JA Lord, CRI Clayton & RN Mortimore (2002) “Engineering in chalk”, CIRIA Publication C574, London

FIGURES

Offices throughout the UK and continental Europe.

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Client

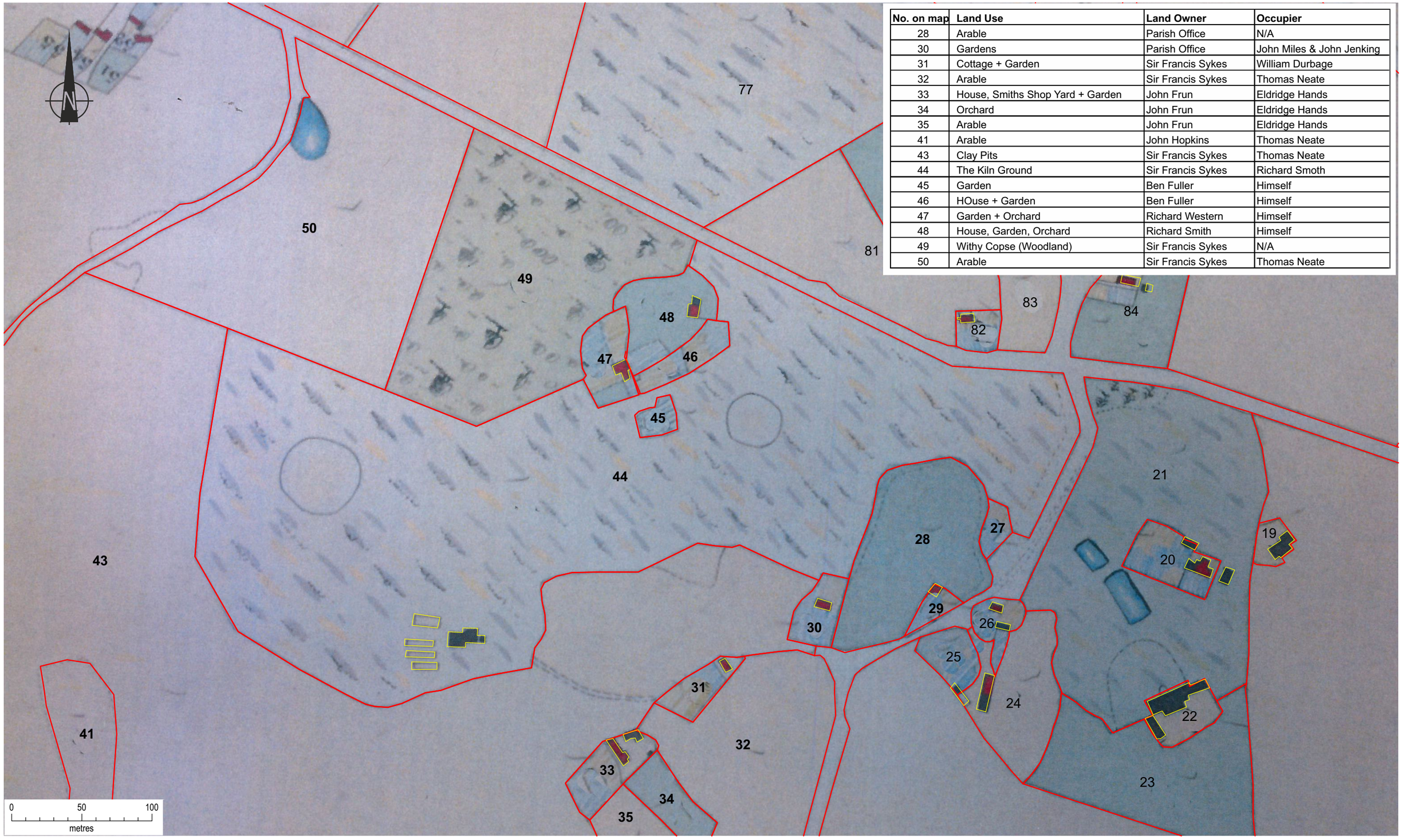
West Berkshire District Council

OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

SITE LOCATION PLAN

Date	15.07.2015
A4 Scale	1:25 000
Drawn by	davco
Checked by	CNE
Revision	0

FIGURE 1



No. on map	Land Use	Land Owner	Occupier
28	Arable	Parish Office	N/A
30	Gardens	Parish Office	John Miles & John Jenking
31	Cottage + Garden	Sir Francis Sykes	William Durbage
32	Arable	Sir Francis Sykes	Thomas Neate
33	House, Smiths Shop Yard + Garden	John Frun	Eldridge Hands
34	Orchard	John Frun	Eldridge Hands
35	Arable	John Frun	Eldridge Hands
41	Arable	John Hopkins	Thomas Neate
43	Clay Pits	Sir Francis Sykes	Thomas Neate
44	The Kiln Ground	Sir Francis Sykes	Richard Smoth
45	Garden	Ben Fuller	Himself
46	HOuse + Garden	Ben Fuller	Himself
47	Garden + Orchard	Richard Western	Himself
48	House, Garden, Orchard	Richard Smith	Himself
49	Withy Copse (Woodland)	Sir Francis Sykes	N/A
50	Arable	Sir Francis Sykes	Thomas Neate

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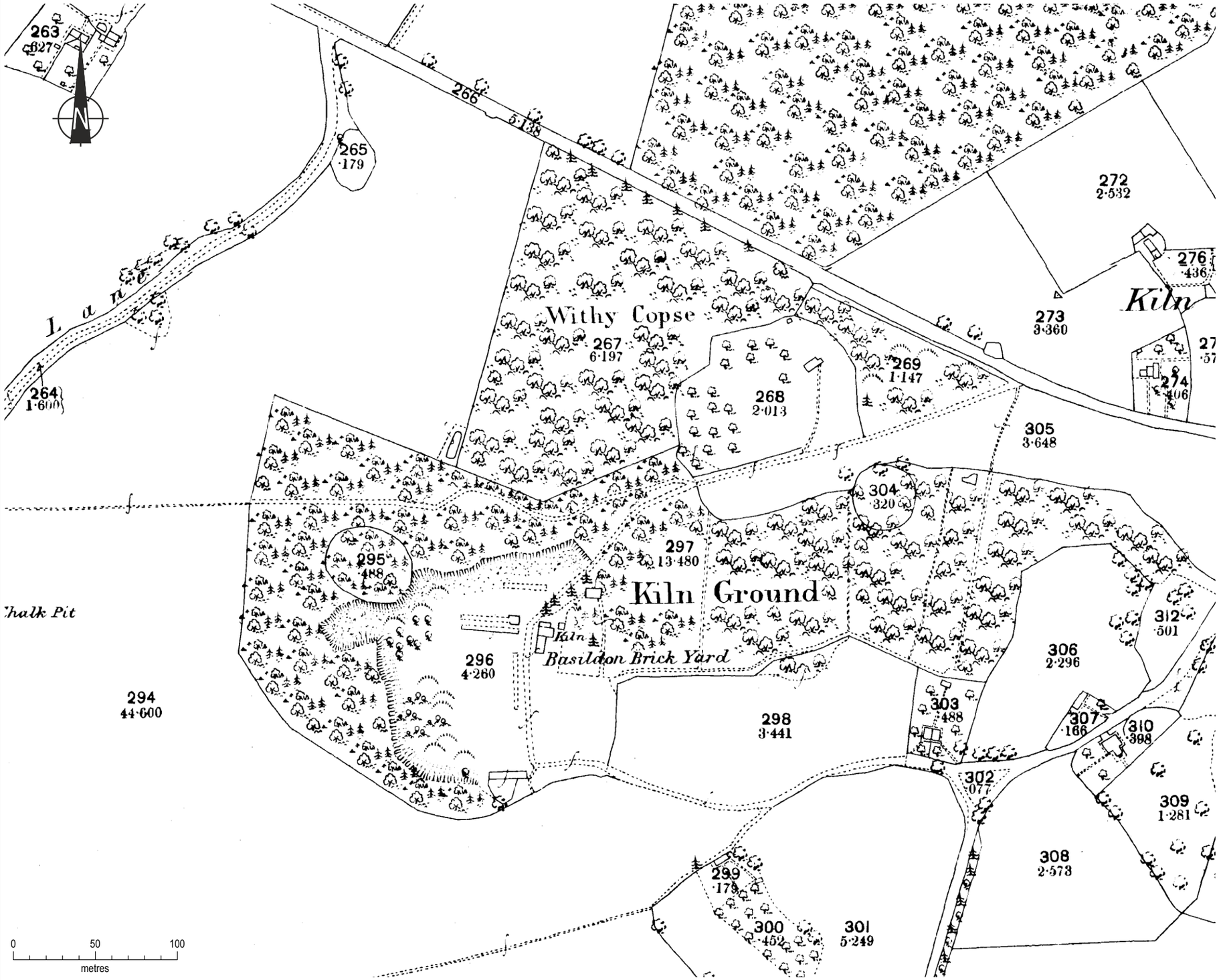
West Berkshire District Council

OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

1839 TITHE MAP EXTRACT

Date	15.07.2015
A3 Scale	1:2500
Drawn by	davco
Checked by	CNE
Revision	0

FIGURE 2



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West Berkshire District Council

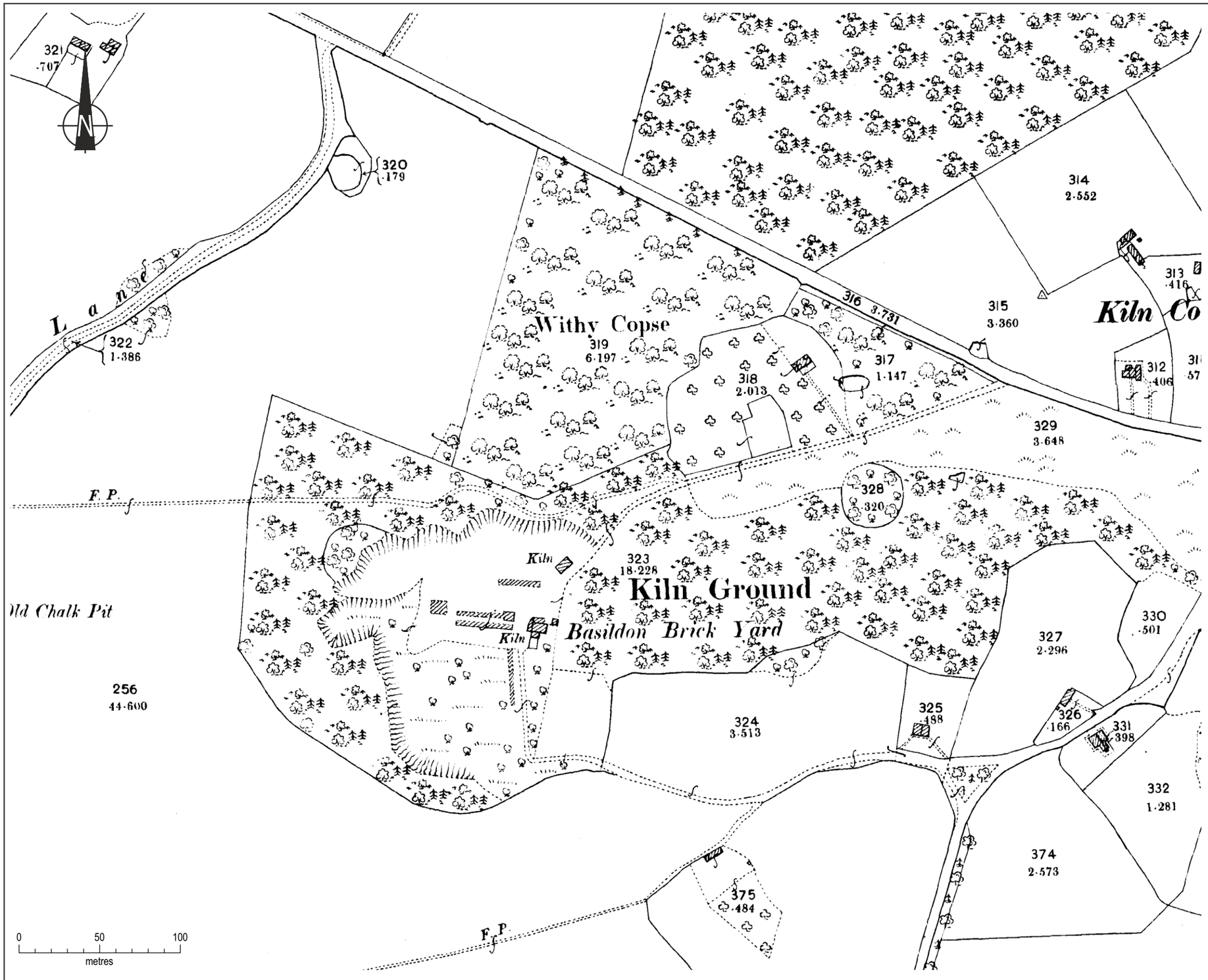
OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

1878 OS MAP EXTRACT

Date	15.07.2015
A3 Scale	1:2500
Drawn by	davco
Checked by	CNE
Revision	0

FIGURE 3

J:\34285 Old Stocks Court, Upper Basildon\03 Figures&Dwgs\Corel



Client	West Berkshire District Council

OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

1899 OS MAP EXTRACT

Date	15.07.2015
A3 Scale	1:2500
Drawn by	davco
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Revision	0

FIGURE 4

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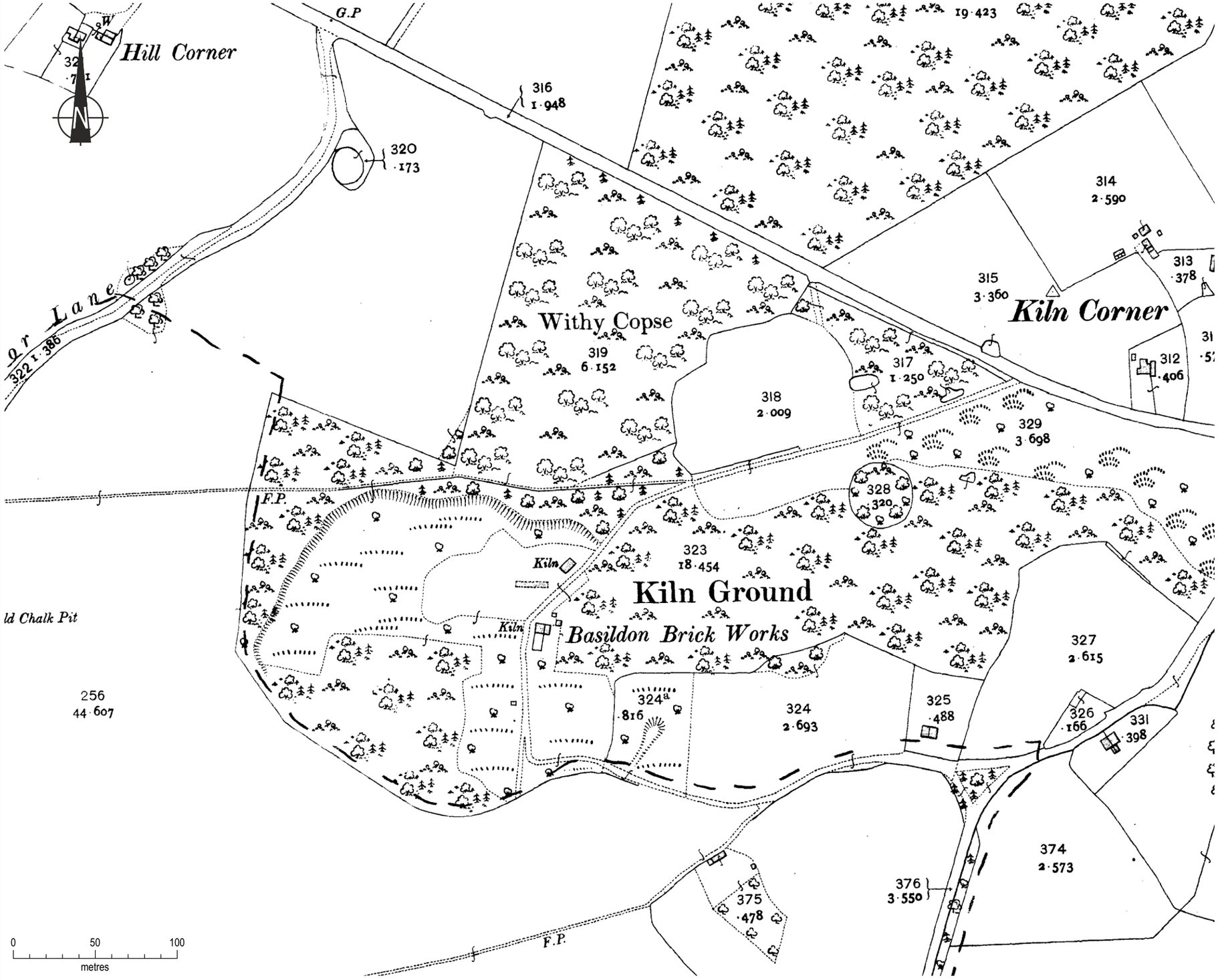

Client	West Berkshire District Council

OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

1912 OS MAP EXTRACT

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FIGURE 5

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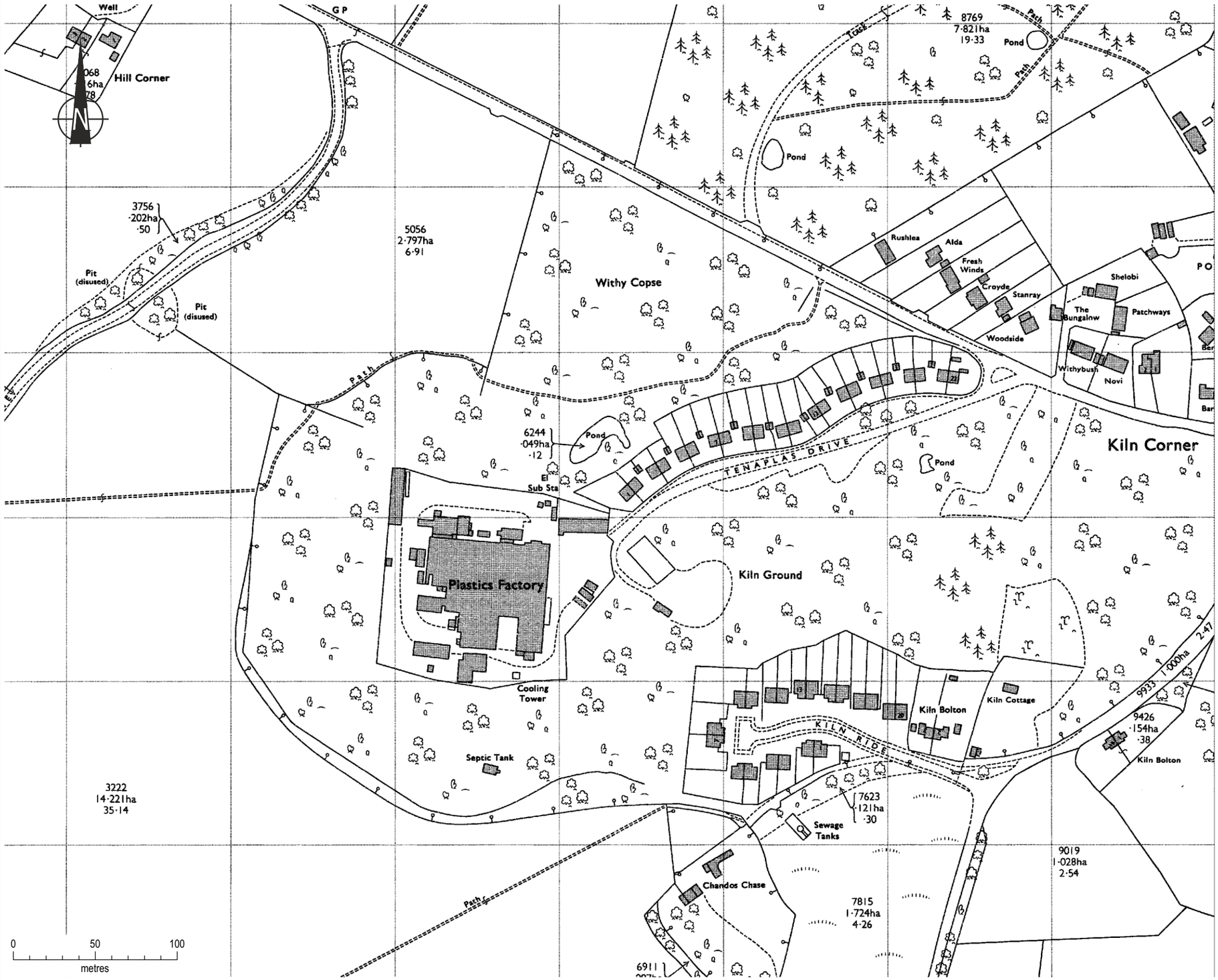

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OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

1973 OS MAP EXTRACT

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A3 Scale	1:2500
Drawn by	davco
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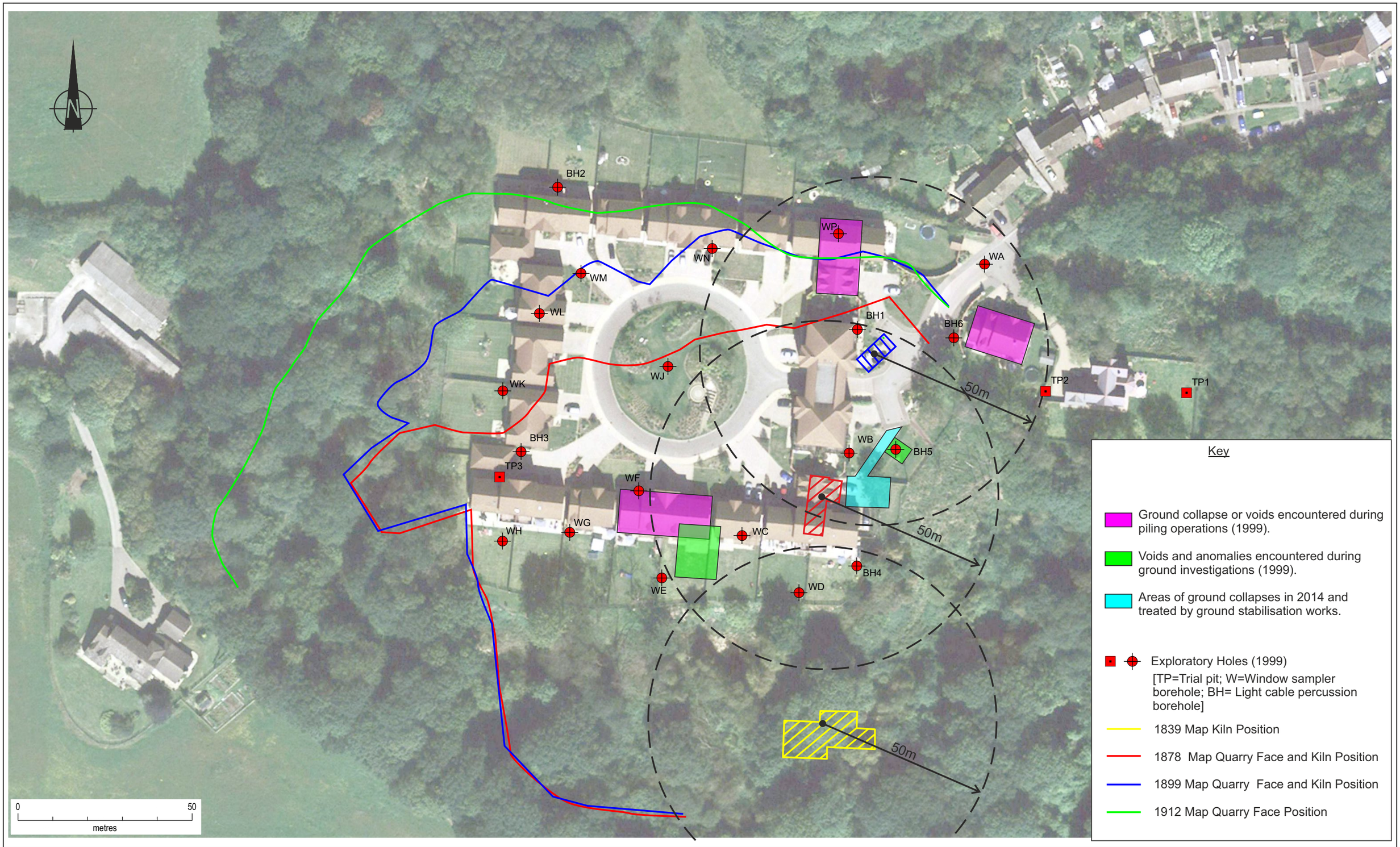
Revision	0

FIGURE 6

J:\34285 Old Stocks Court, Upper Basildon\03 Figures&Dwgs\Corel



Key

- Ground collapse or voids encountered during piling operations (1999).
- Voids and anomalies encountered during ground investigations (1999).
- Areas of ground collapses in 2014 and treated by ground stabilisation works.
- Exploratory Holes (1999) [TP=Trial pit; W=Window sampler borehole; BH= Light cable percussion borehole]
- 1839 Map Kiln Position
- 1878 Map Quarry Face and Kiln Position
- 1899 Map Quarry Face and Kiln Position
- 1912 Map Quarry Face Position

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OLD STOCKS COURT, UPPER BASILDON, BERKSHIRE

ASSESSMENT OF POSSIBLE EXTENT OF OLD CHALK MINE WORKINGS

Date	15.07.2015
A3 Scale	1:1000
Drawn by	davco
Checked by	CNE
Revision	0

FIGURE 7