



**KINGSNORTH PROJECT**  
**UNITS 5 & 6**

**REVIEW OF WORKS UNDERTAKEN AND PROPOSALS FOR**  
**ARCHAEOLOGICAL WORK AND MITIGATION PRIOR TO**  
**CONSTRUCTION**

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REVIEW OF WORKS UNDERTAKEN AND PROPOSALS FOR  
ARCHAEOLOGICAL WORK AND MITIGATION PRIOR TO CONSTRUCTION

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		Name	Doug Waters	Adrian Smith	Adrian Smith
		Signature			
		Filename			
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			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
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## 1. Introduction


E.ON submitted an application under Section 36 of the Electricity Act 1989 in December 2006 to replace its existing 2000MW coal fired plant at Kingsnorth with two 800MW supercritical coal fired generating units. Section 3.10 of the Environmental Statement to accompany the application identified that a pre-determination archaeological evaluation be undertaken to determine the archaeological impact of the proposed development and scope for mitigation. This report details works undertaken in summer 2007 to provide this information.

Following a geophysics survey of the site in May 2007 by GSB Prospection Ltd. (an experienced contractor in this type of work), which identified areas of potential archaeological interest, a two phase field investigation was undertaken in June/July 2007. These investigations included a phase of electrical sectioning undertaken by TerraDat in June 2007 followed by the drilling of 4 boreholes under the supervision of Dr. Martin Bates of University of Wales (Lampeter) in early July.

The objectives of the field investigations were:

- 1.1 To understand more fully the nature of the deeper sequences preserved within the vicinity of the proposed development and in particular their history of formation and consequently any archaeological relevance. This has built on local knowledge of the site stratigraphy obtained through a number of prior investigations within the Beluncle Farm/Kingsnorth area. The archaeological significance of this data is that it provides information on the development of the land/river transition over time. It should be preserved by record prior to development progressing to enhance the wider archaeological understanding of the area over time.
- 1.2 To determine any areas of more recent archaeological interest. Section 3.10 of the Environmental Statement detailed finds in the surrounding developments. It can therefore be hypothesised that likely recent archaeological interest will be in localised form particularly around Damhead Creek and the north eastern corner of the site; its significance is likely to be such that preservation through record will be required.
- 1.3 To map proposed development over the areas of archaeological interest to inform recommended mitigating actions that should be undertaken by E.ON prior to the development commencing.

These investigations have made it possible to assess the likely significant effects of the development on archaeological interest and to identify the mitigation measures applicable.


		
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## 2. Details and Findings of Field Investigations

The field investigations were split into two phases. Phase 1 consisted of electrical sectioning undertaken by TerraDat in June 2007 followed by phase 2 drilling works of 4 boreholes under the supervision of Dr. Martin Bates in early July (Appendix 1).

Evidence obtained from the field investigations indicates that:

- 2.1** The electrical sectioning work revealed a three layer model for the subsurface consisting of a thin layer (c. 8-10m thick) of relatively low conductivity overlying c. 20m of conductive material and a basal unit of relatively low conductivity material. These layers are considered to reflect the distribution of the superficial sediments (i.e. the unconsolidated sediments dating to the recent past, last 2 million years, the objective of this study) corresponding to the upper layer of low conductivity layer above London Clay (bedrock).
- 2.2** The output of the electrical sectioning provided sufficient information to inform the drilling of four boreholes. The boreholes have two purposes; firstly to confirm the interpretations from the electrical sectioning; and secondly to give core samples that can be taken to the laboratory for analysis and added to the database of such information for wider archaeological information purposes. Whilst the findings are not of specific relevance to this development, they add to wider archaeological understanding of the area and can only be captured prior to construction commencing particularly in areas of significant groundwork. Four boreholes were drilled along transect lines 2, 5 and 6.
- 2.3** Boreholes 1 (TQ 81029 72626) and 2 (TQ 81030 72563) was drilled along transect line 2. Borehole 1 was drilled to a depth of 8.7m where hard, dense London Clay was encountered. The unconsolidated sediments overlying the London Clay in Borehole 1 consisted of recent alluvium (sediments deposited by river or estuarine processes) (ground level to 1.65m) over Pleistocene (a time period broadly corresponding to the ice age but including both warm and cold periods) gravel (1.65-c.2.4m), bedded silts with potential mollusc fragments (c.2.4-5.45m) and gravel (4.45-8.6m). Borehole 2 was drilled to a depth of 8.4m where London Clay was encountered. Borehole 2 consisted of fine grained silts and sands throughout its depth. It was not possible to determine from these results where the exact top of the Pleistocene sequence lies. Whilst this is not significant from the perspective of the effect of the proposed development it is of interest for broader archaeological understanding of the area and further opportunities to gather information relating to this would be useful in this respect.


		
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- 2.4 Borehole 3 (TQ 81179 72616) was drilled on transect line 5. Recent alluvium was present to a depth of 0.8m. This overlay a mixture of sands, gravels and silts to a depth of 9.3m. London Clay was encountered at 9.3m depth.
- 2.5 Borehole 4 (TQ 81322 72616) consisted of recent alluvium to a depth of c. 1.60m. The alluvium consisted of dark grey sands and silts with significant quantities of charcoal, red fragments of possible brick/tile/ceramic and occasional burnt flint at a depth of c. 0.7m. Below the recent alluvium gravels, bedded sands and silts and a basal gravel occurred between 1.60 and 7.6m depth. London Clay was present at 7.6m.
- 2.6 The field investigation indicated that the deep Pleistocene channel located previously at the Damhead Creek Power Station to the north continues south into part of the area of the proposed units 5 and 6. However, the sequences recorded in borehole 1 are significantly different to those recorded at the Damhead Creek site and may record a different part of the channel history. Whilst this finding is not of specific significance to the development, it is of broader archaeological interest and any pre-construction borehole data should be made available to further supplement the broader understanding of the area.

### 3. Significance of findings

#### 3.1 For the deeper archaeological sequence:

The field evidence indicates that the 3 layer model obtained from the geophysical survey is correct and that a body of Pleistocene sands and gravels lies across much of the site. This is overlain by a thin body of recent alluvium. A good sequence of undisturbed (U4) samples was obtained from Borehole 1 that appeared to contain faunal remains (possibly molluscs). The potential presence of Molluscan remains indicates the strong possibility that foraminifera and ostracoda will also be present. These findings suggest that palaeoenvironmental reconstructions will be possible. The presence of Molluscan remains also indicates a potential for dating the sediments using Amino Acid Geochronology on *Bithynia tentaculata* opercula. The presence of sand in many of the deposits indicates that direct dating using Optically Stimulated Luminescence dating will be possible. Palaeoenvironmental and dating work will now be undertaken and the results made available in due course. These results are not required to inform determination of the Section 36 consent but are of broader archaeological interest. The analysis conducted here and the results of the laboratory analysis represent mitigation for the deeper sequences in this area namely to provide a record of the development of the land/river transition over time prior to the development commencing. It would be of broader archaeological benefit for records relating to pre-construction boreholes to be made available to further inform this understanding.

		
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### 3.2 For more recent archaeological interest

On the basis of the field evidence the thickness of the Holocene alluvium resting on the Pleistocene sediments across the area of the site investigated varies but never exceeds about 1.6m. The discovery of charcoal, possible ceramic material and burnt flint in borehole 4 suggests that at least in some areas human activity (date unknown but probably post 7000 yrs B.P.) are to be anticipated within the site area particularly around Damhead Creek as hypothesised. Similar materials were found to the north of this area during the construction of Damhead Creek Power Station. Whilst disturbance occurred in many areas of the proposed development during the construction of the existing power station in the 1960s and therefore such deposits may well have been disturbed, preserve these features by record prior to the development proceeding. A series of trial trenches will be required certainly in the area of Damhead Creek and areas adjacent to borehole 4. As trial trenches are required during pre-construction ground investigations across the whole development site it is recommended that these also be monitored for archaeological interest.


### 4. Previous Activity on the Site

It is worth noting that there was significant disturbance to a number of areas of the proposed development during the construction of the existing units in the 1960s as shown in Appendices 3 and 4. It can be seen that significant disturbance occurred in the area of the proposed cooling water corridor (yellow) including cable tunnelling (Appendix 5) and deep excavation on the river for the cooling water intake and pump house. It can also be seen that Damhead Creek was channelled into a man-made structure for cooling water discharge involving significant excavation in that area and there was some disturbance to the proposed area of the new units and the laydown area.

A road way previously passed in a north easterly direction along the edge of Damhead Creek through to the Kingsnorth Business Park as shown in Appendix 6.

### 5. Proposed Mitigation

On the basis of the proposed development work details and the archaeological work detailed here the site has been divided into 4 separate areas for consideration and mitigation strategies proposed. These are summarised in table 1 and detailed below:

		
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## 5.1 Main area of new generating units

## 5.2 Laydown area

## 5.3 Cooling water corridor

## 5.4 Earth bund area (east and west)


It is not clear at the present time the exact scale and precise distribution of development impact in these individual areas (for example pile density and depths) although previous experience can provide a broad outline and sufficient information for the likely effects to Be assessed. E.ON anticipates specific details of the proposed development in these areas to become more defined during the pre-construction phase of the project as tenders are returned from suppliers. The proposed mitigation strategy assumes worse case impact into consideration in light of the current uncertainties.

E.ON intends to undertake detailed Ground Investigations (GI) during the pre-construction phase of the project (late in 2007) to inform the detailed design works. This will entail 74 boreholes at 57 locations and 74 trial trenches/pits. A draft map of these locations is included in Appendix 2 which also identifies the development areas outlined above. Whilst sufficient information has already been gathered to determine the likely significant effects of the development on archaeological interest, these GI works provide an ideal opportunity to supplement the broader archaeological information of the area and to begin the process of mitigation for any more recent archaeological interest.

## 5.1 Main Area of New Generating Units

### 5.1.1 Issue

This area will experience the major disturbance through piling, foundation raft construction and service trenching. Recent archaeological potential has previously been demonstrated adjacent to the immediate area by the Archaeology South East works at the Damhead Creek site to the north as well as the circumstantial evidence from borehole 4. Previous activity (see above) may have impacted on the archaeological record in this area whilst construction of Damhead Creek itself is also likely to have resulted in a localised impact on buried remains. Whilst such archaeological potential is not a reason to prevent the development from proceeding it will be necessary to monitor and record any findings as the works progress. The thin cover of Holocene sediments suggests any archaeology dating to the Holocene is likely to lie within a zone prone to impact by soil stripping, shallow service trenches, foundation raft construction etc. The areas of deeper archaeological interest (Pleistocene deposits) have largely been mitigated already by the drilling of the 4 boreholes although additional information will contribute to greater understanding of the broader areas past.

		
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### 5.1.2 Mitigation proposed

Monitoring of the GI test pits will be the first opportunity to capture the nature and distribution of any recent intact archaeological remains, which will most likely be similar in nature to those found at borehole 4 and during construction of Damhead Creek Power Station. Finds of this type will be preserved by record. Depending upon the findings and potentially practical issues with access to the trial pits these observations may be insufficient to adequately record the archaeological interest in their own right. Therefore a further phase of archaeological work may be required for specific archaeological purposes prior to main construction activities commencing. The exact scope of these works will depend on the archaeological findings of the GI trial pits and the final design and layout of the proposed development, but could entail:

- ◇ Purposive archaeological trial trenching in areas of major construction impact, preserving by record any finds of archaeological interest.
- ◇ This may usefully be supplemented, in advance of archaeological trial trenching, by an electro magnetic (EM) survey of the site area in order to track major, near surface, palaeochannels (foci of human activity may well relate to the distribution of these palaeochannels).

For the deeper archaeological interest an evaluation of the GI report for the deeper Pleistocene deposits will be undertaken as part of obtaining further information relating to these deeper sequences. An additional borehole may be required to sample deeper sequences should the GI boreholes provide information warranting further investigation.


## 5.2 Laydown Area

### 5.2.1 Issue

This area is likely to suffer minimal impact during construction. GI will occur in the area as above to characterise this ground that will bear substantial loads during construction and may be covered with hardstanding in certain areas. This GI work presents an opportunity to supplement the broader archaeological information of the area. Local evidence suggests that similar sequences to those at Damhead Creek Power Station (both of Pleistocene and Holocene date) and in the area of new generating units are likely to be encountered.

### 5.2.2 Mitigation

Given the low significance of the archaeological impact of the proposed development in this area a minimal archaeological response is recommended. Monitoring of GI works would provide a first order view of the deeper sequences and more recent archaeological interest as for the area of the main units. The findings of this

		
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monitoring may identify works of archaeological interest that could usefully be undertaken before construction commences to contribute to the broader archaeological understanding of the area. The exact scope of these works will depend on the archaeological mitigation arising from the GI works, but could entail:

- ◇ Extension of the EM survey proposed for the main area (could usefully provide information on the distribution of any abandoned creeks)
- ◇ Two further boreholes may usefully be undertaken within the area if the GI and EM work yields information worthy of further investigation for archaeological benefit.

### 5.3 Cooling Water Corridor

#### 5.3.1 Issue


Excavation of the trench for the cooling water corridor will be a large civil engineering undertaking, however significant disturbance of this corridor previously occurred during the construction of the present power station (see above). It is therefore very unlikely that significant areas of archaeological interest remain intact on this area. Whilst there is the possibility for localised areas of recent archaeological interest that were not impacted during previous activity, the development activities in this area are not deemed significant. Deeper archaeological interest may be more intact and there is the opportunity to supplement the broader archaeological information of the area.

#### 5.3.2 Mitigation

The GI results will determine the exact route of the cooling water corridor and the trial pits may yield information on any pockets of recent archaeological interest not impacted by the previous activities in the area. As for other areas, the GI boreholes offer an opportunity to supplement broader deeper archaeological information.

The results of this GI work may determine further archaeological works to be undertaken for archaeological benefit in the area that would usefully be undertaken before construction commences. However, given the likely thickness of the sequences of archaeological interest (thickening towards the river), access for conventional archaeological response is likely to be difficult. The following may be required to some degree:

- ◇ Should the GI boreholes provide information warranting further investigation then purposive geoarchaeological boreholes may be required
- ◇ Watching brief allowing access to the construction trench is the most likely successful response to any localised recent archaeological interest if areas of undisturbed ground are discovered.

		
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## 5.4 Earth bund area (east and west)

### 5.4.1 Issue

GI works in this area are to check the integrity of the flood defences that will be required to last for lifetime of the proposed development. Additional construction activity associated with these defences will be focused in increasing integrity and possibly height/width of bunds rather than impact through excavation. Therefore the archaeological impact of works in this area is broadly insignificant. At a worst case significant supplementing of the flood defences will increase loading on the ground and may impact sub-surface archaeological interest although this was likely disturbed in construction of the original flood defence to some degree. The GI works will offer an opportunity to supplement the broader archaeological information of the area. These works are therefore unlikely to have a significant effect on archaeological interest.

### 5.4.2 Mitigation

The GI will determine the exact scope of works in the area but a worst case (significant reinforcement of flood defence) the impact will be limited to insignificant, given the previous activities on the site. Therefore no direct mitigation is required although there will be a watching brief for any works. More importantly, as for the other areas of the site the provision of borehole data arising from the GI will supplement existing broader archaeological information and understanding of the area.

## 6. Conclusion

The Environmental Summary for the proposed development identified further work to determine the archaeological impact of the development and to propose a mitigation strategy for these works. This report details this additional work and the mitigation strategy for the development.

An archaeological field study of the proposed Kingsnorth 5&6 development area has been undertaken by Dr Martin Bates of University of Wales (Lampeter). This has concluded the following:

- ◇ Some of the site for the proposed development has had significant previous disturbance that may have impacted upon the integrity of any archaeological interest present. This is particularly relevant to more recent archaeological interest.
- ◇ The field work was able to provide useful information to characterise the deeper archaeological interest of the area. This information must be preserved

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by record pre-construction in areas of significant ground disturbance to add to the archaeological record.

- ◇ The field work has achieved this by providing the information on deeper archaeology prior to the development commencing through the undertaking of 4 boreholes targeted following geophysics, electrical sectioning and knowledge of findings in the surrounding area.
- ◇ It would be beneficial to have access to borehole data through the pre-construction phase to further supplement this data. E.ON has undertaken to provide this data. This will help to supplement the broader archaeological information of the area in particular the land/river transition.
- ◇ For more recent archaeological impact the development has potential interest in a number of areas which have been identified in the field study, particularly in the area around Damhead Creek. Based upon finds in adjacent areas the significance of any archaeological interest is such that it is best preserved by record.
- ◇ A mitigation plan has been developed starting with archaeological watching brief on the pre-construction ground investigation trial pits. The site has been divided into four areas of impact and mitigation strategies have been proposed for each based upon a worst case assessment of construction impact and archaeological potential (see table 1).

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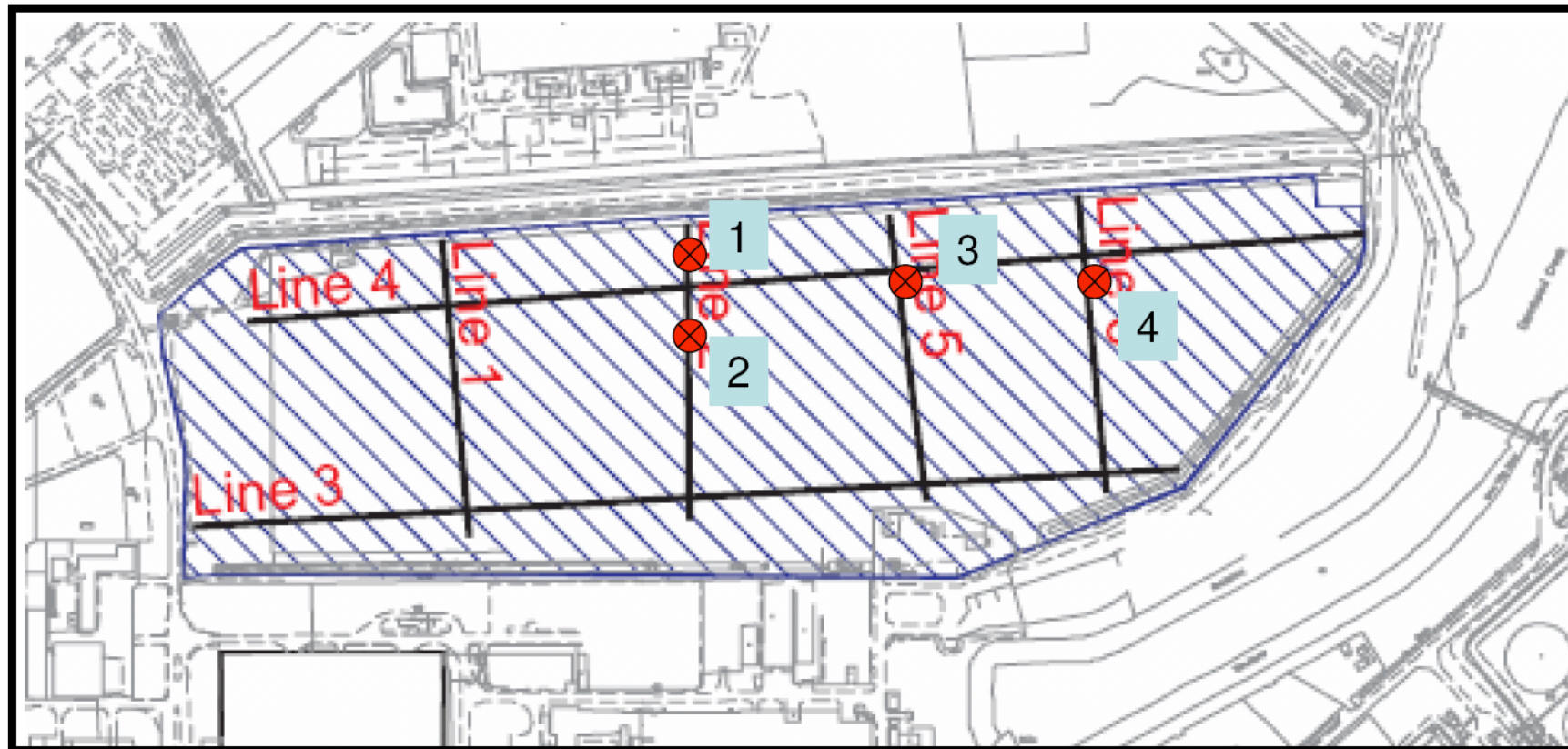
**Tables**

**1. Proposed archaeological mitigation programme**

Phase of works	Pre-Construction	Pre-Construction/ Post GI					Construction
Area	Monitoring GI	Potential EM survey	Review of GI	Further Trial trenching	Purposive boreholes	Excavation	Watching brief
Main area of new generating units	Yes	Yes	Yes	Yes	Possibly 1 additional	Possible depending on findings	Yes
Laydown area	Yes	Yes	Yes	Possible depending GI results	Possibly 2 additional	Possible depending on findings	Yes
Cooling Water Corridor	Yes	No	Yes	Unlikely	Possible depending on findings	Unlikely	Yes
Bunds (east and west)	Yes	No	Yes	Possible depending GI results	Unlikely	Unlikely	Yes

**Appendices**

**1. Geoarchaeological site investigation works showing geophysical transects (1-6) and borehole locations (1-4)**

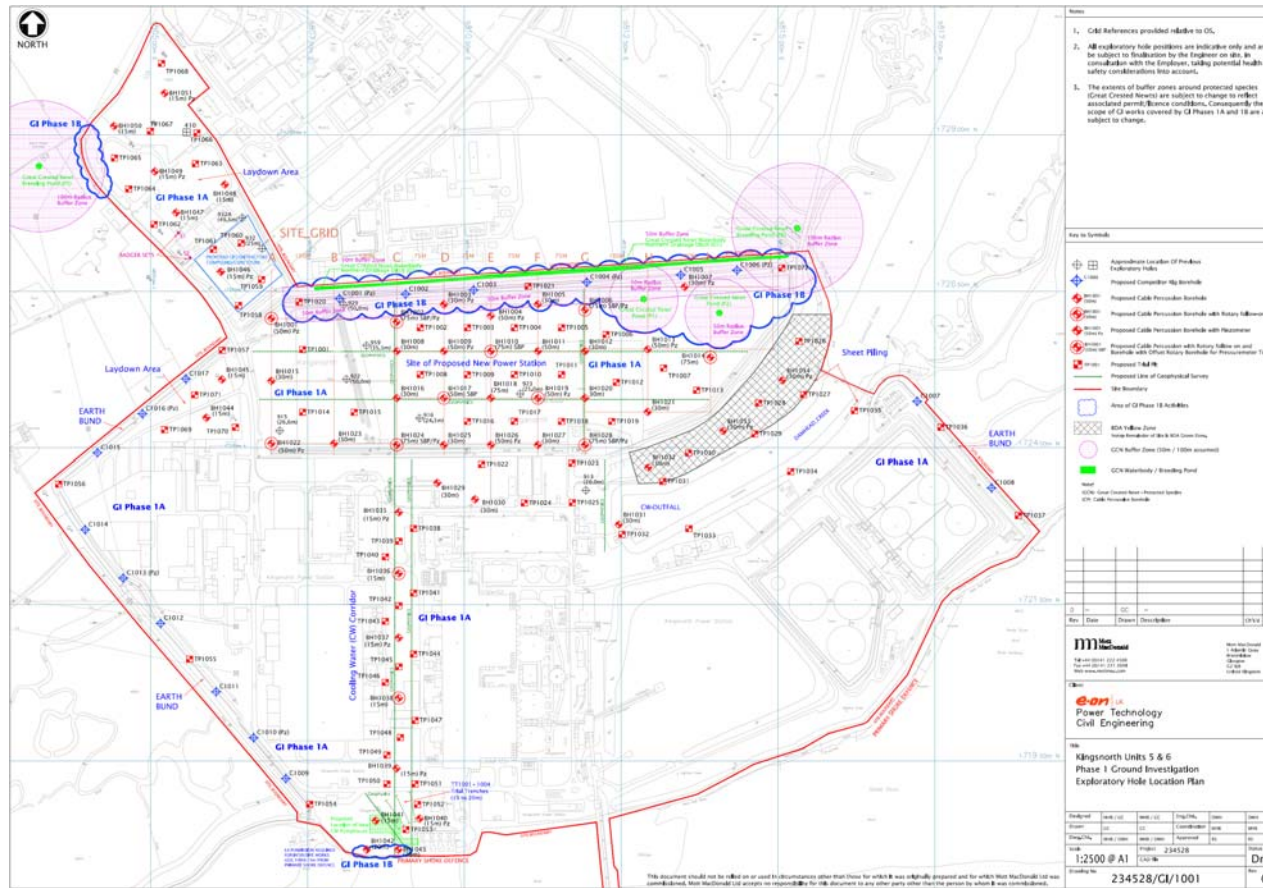


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**2. Locations for boreholes and trial pits for GI works**



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**3. Aerial Photo - Kingsnorth Power Station, Main Station area looking East**



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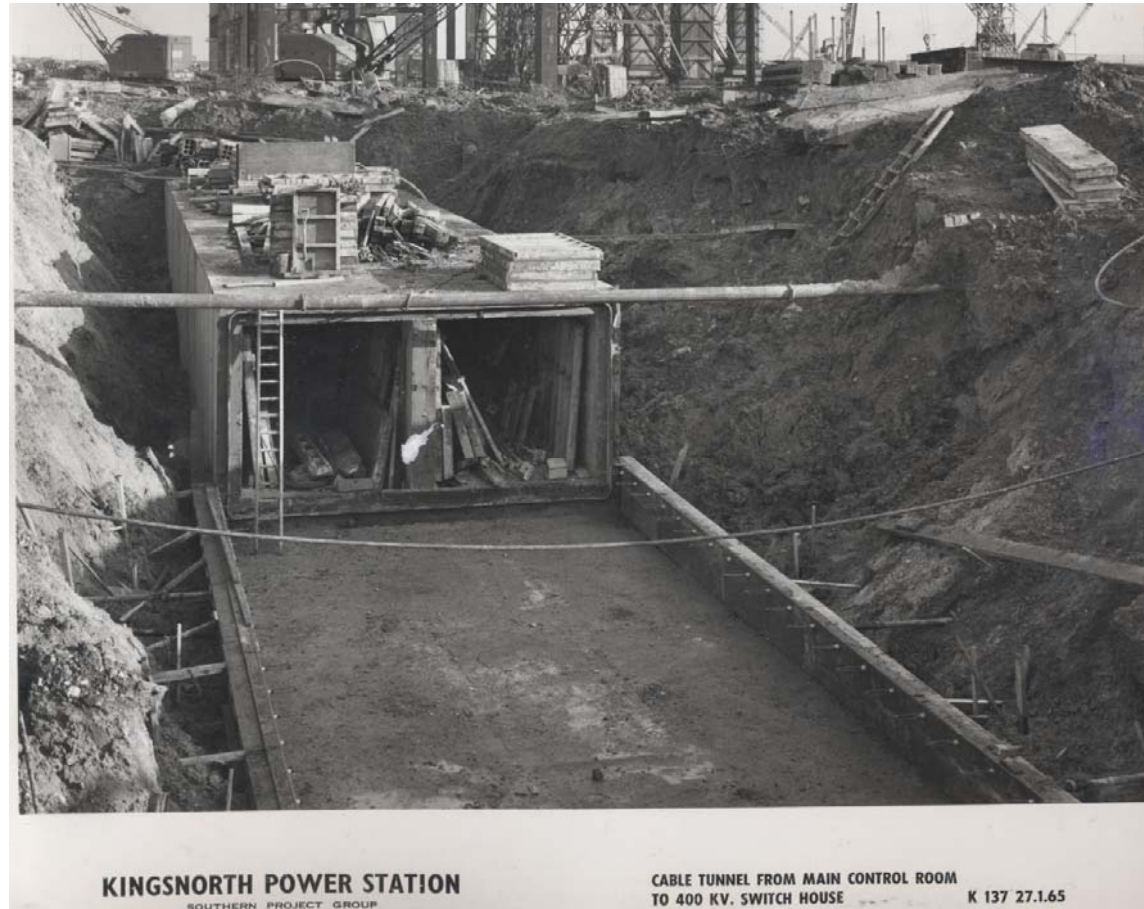
**4. Aerial Photo - Kingsnorth Power Station, view of station looking approx. North**



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**5. Photo - Kingsnorth Power Station, cable tunnel from main control room**



**6. Aerial Photo - Kingsnorth Power Station**

