Report No. **800/175**

FLOOD RISK ASSESSMENT REPORT

AT

C L A Y L A K E
S P A L D I N G

ON BEHALF OF

A B B E Y P O W E R G E N

NOVEMBER 2011

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1.0 INTRODUCTION

1.1 Abbey Powergen are proposing to redevelop a small part of the Clay Lake industrial site at Spalding for new industrial development. It was considered that a flood risk assessment should be undertaken to assist in viability and planning requirements.

1.2 It is within the general development strategy of the Country for development in areas where there is a risk of flooding to be fully assessed to avoid unnecessary increase in the requirement of flood defence. Under Planning Policy Statement 25 "Development and Flood Risk" (PPS25), consultation should be undertaken with the Environment Agency, Land Drainage Authority and Water Authority and a Flood Risk Assessment Report should be prepared considering the development proposals.

1.3 ARP Associates have been appointed by Abbey Powergen to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with PPS25, to satisfy the requirements of the Planning Authority.

1.4 A Flood Risk Assessment Report was prepared in March 2011 for the whole of the Clay Lake site for Ashley King (Developments) Limited. The initial consultations and walkover survey were carried out between November 2008 and January 2009. However, subsequent consultations were undertaken with the Environment Agency between March and July 2009. Furthermore, as a result of the South Holland Strategic Flood Risk Assessment Report being issued in January 2010, further negotiations were undertaken with the Environment Agency and the South Holland Internal Drainage Board in September 2010, and revised scheme layouts were prepared in March 2011. All the information obtained for the Flood Risk Assessment for the whole site is relevant to this development and has been reproduced for this report with the agreement of Ashley King (Developments) Limited.

1.5 This assessment has been prepared for the sole use and reliance of the Appointee and shall not be relied upon or transferred to any other parties without the written authorisation of ARP Associates. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

2.0 SITE WALKOVER

General

2.1 The site of the Clay Lake Industrial Estate is located to the south of Spalding town centre. The site is basically 'L' shaped and equates to an area of around 24ha. The development site under consideration is located on the northwest corner of the Estate and equates to an area of 0.8ha.

2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is presently unused, apart from an electricity substation, which is located to the western side of the main site area.

Boundaries, Topography and Surrounding Details

2.4 The land is generally level and flat and abuts residential development to the northern and part of the southern boundaries. The Clay Lake Industrial Estate is located to the eastern and part of the southern boundaries. The western boundary abuts Spalding Drove.

2.5 There is a watercourse drain running near to the southern boundary which flows towards Clay Lake (Drain) to the east. Exeter Drain is located to the western side of Spalding Drove with agricultural land beyond, whilst Coronation Channel watercourse and the main Spalding town centre are further to the north.

Drainage

2.6 The site has no obvious positive drainage system, although the presence of land drainage connecting to the watercourse near to the southern boundary cannot be ruled out.

2.7 There are numerous drains and watercourses in the area, some adjacent to the site boundaries and under Riparian ownership, but others, particularly to the south near to the A16 highway, under the responsibility of South Holland Internal Drainage Board. These connect to the main Clay Lake (Drain) to the southeast, adjacent to Clay Lake Bank.

2.8 There was no evidence during the walkover survey that drainage from the development site outfalled to Exeter Drain to the west of Spalding Drove.

2.9 The River Welland is approximately 1.25km to the west of the site, and this flows through the centre of Spalding town centre. The Coronation Channel is a man-made by-pass channel to the River Welland around the eastern side of Spalding to provide flood relief at times of heavy storm.

3.0 ENVIRONMENT AGENCY CONSULTATION

3.1 A consultation was requested from the Environment Agency for the full Clay Lake site and a copy of their response, reference CCN/2008/20499 dated 23rd December 2008, is presented in Appendix B for reference purposes. Further information received on the 13th March 2009 is also presented in Appendix B.

3.2 The Environment Agency Flood Map shows that the area under consideration is at risk of a 0.5% (1 in 200) and a 1% (1 in 100) or greater chance of flood by the sea or river respectively in any one year. The flood map also shows a flood storage area to the west for the River Welland.

3.3 The Environment Agency has also been able to provide fluvial flood levels and this shows that the nearest point to the site ("Welland 13705") has modelled flood levels of 4.37m ODN for a 1 in 100 year storm and 4.38m ODN for a 1in 200 year storm. The Welland catchment model, prepared in April 2007, also shows that a 1 in 100 year level with climatic change is 4.68m ODN. The Bank levels at this location are recorded at 5.80m ODN.

3.4 However, the Environment Agency has also confirmed that the natural channel, in conjunction with the upstream flood storage area, provides protection against a flood event for a 0.5% chance of occurring in any one year. The channel and storage area are inspected regularly to ensure that any potential defects are identified to reduce the risk of any failure.

3.5 As the development site is currently brownfield, the Environment Agency are requesting that the discharge rate from the site should be to a betterment of 20% from the current situation.

3.6 Recommendations for considering Sustainable Drainage Systems (SUDS) are recommended in accordance with Planning Policy Statement 21 "Delivering Sustainable Development" (PPS21) and PPS25.

3.7 Recommendation is also made to consider approved Document Part 8 of Building Regulations 2000 for establishing a hierarchy for surface water disposal using a SUDS approach.

3.8 Subsequent consultations with the Environment Agency resulted in a request that details from the South Holland District Council Strategic Flood Risk Assessment should be considered, and that the guidance should be followed from new development Phase II R & D Technical Report FD2321/TR2 in relation to inundation from failure of flood defences.

4.0 WATER AUTHORITY CONSULTATION

4.1 A consultation was requested from Anglian Water Services Ltd, who are the Water Authority for this area, and a copy of their response, reference A760793 dated 14th October 2008, is presented in Appendix C.

4.2 This has confirmed that there are no public sewers in the close proximity of the site which would be suitable for outfall from the proposed development. The nearest sewers are to the north in the residential area of Spalding on the north side of Coronation Channel. Any discharge to this location would require a pumping system.

4.3 There are water mains running in Spalding Drove adjacent to the western boundary, and these will presumably facilitate water supply to the development, if needed.

5.0 LAND DRAINAGE AUTHORITY CONSULTATION

5.1 A consultation was requested for the whole of the Clay Lake site from South Holland Internal Drainage Board, who are the Land Drainage Authority for this area, and a copy of their response, reference GRD-0352.0009-GRD dated 11th November 2008, is presented in Appendix D.

5.2 The Internal Drainage Board are not aware of any flooding in this locality caused by overtopping of the Board's maintained drainage network, although they cannot comment on whether there has been any flooding relating to systems maintained by any other party.

5.3 A plan showing the Board maintained watercourses was provided, and this shows that Exeter Drain to the west and Clay Lake (Drain) to the south, together with its tributary running north south under the A16 forms part of the network A maximum designed water level of +0.85m Ordnance Datum was confirmed to the southeast of the site.

5.4 In respect of surface water disposal, it will be necessary to provide evidence that the discharge after development is no greater than the present rate of discharge from the site to any watercourse. There is a Byelaw which prevents any increase in flow or volume of water into any watercourse, and a detailed investigation to prove this will be required. Furthermore, if possible, it will be necessary to improve the existing situation by reducing surface water discharge to watercourse, and this should be considered in any new drainage system. Detailed calculations will need to be provided for the Board's approval prior to construction on site.

5.5 A 9m wide easement strip shall be provided between any Board maintained watercourse and the development.

5.6 Information relating to the South Holland Internal Drainage Board Strategic Flood Risk Assessment was also received, following further consultations, and a copy is included in Appendix D. This shows the potential for flood risk in relation to bands, and how the area will develop in future years. The flood levels anticipated from the assessment were also provided.

6.0 MATERIAL CONSIDERATION IN RESPECT OF PPS25

Flood Classification

6.1 The consultation with the Environment Agency has identified that the site falls within an area of extreme flood with a 0.5% (1 in 200) or greater chance of flood from the sea, and a 1% (1 in 100) or greater chance of flood from a River. In accordance with Table D1, Annex D of PPS25, the site falls within Zone 3A "High probability". In order to construct development within this zone, it will be necessary to reduce the overall level of flood risk in the area through the layout and form of the development, and appropriate application of Sustainable Drainage techniques. Consideration will also be made to relocate existing development into land zones with a lower probability of flooding and create space for flooding to occur by restoring functional flood plain and flood flow pathways by the use of open space for flood storage.

End Use

6.2 The development proposal is for the installation of diesel generators, switch room, and transformers to generate electricity to supplement the National Grid at peak times. The electricity is generated by diesel power and a fuel storage tank is also required as part of the development. Whilst there are no habitable buildings proposed, an access track will be required from Spalding Drove and the site will be surrounded by a chain-link fence. A plan showing the proposed development is presented in Appendix E.

6.3 When applying Table D2, Annex D of PPS25, the end use does not fall within any specific classification. It is noted that electricity generating power stations and grid and primary substations fall under "essential infrastructure", but the temporary power supply from the proposed end use cannot be considered to be a primary substation. The most appropriate designation would be "non-residential institutions not included in more vulnerable areas or general industry". This would give a "less vulnerable" classification for the proposed end use.

Sequential Test

6.4 Annex D of PPS25 states that the risk based Sequential Test should be applied at all stages of planning with a view to ensuring new development areas are located in the lowest probability of flooding (Zone 1).

6.5 When the site is evaluated in accordance with Table D3, Annex D of PPS25, the development is considered to be appropriate for a Zone 3A flood risk zone and a "less vulnerable" flood risk vulnerability classification. Therefore, the Sequential Test is satisfied, and the Exception Test is not required in this instance.

6.6 If the designated use is considered as "essential infrastructure", the Exception Test would be required. However, the electricity supply is required for the Spalding area and there is no workforce on the site during the day or in the evening, other than for general maintenance. Furthermore, provided appropriate flood mitigation measures are introduced, as detailed in paragraph 6.20, and that all the surrounding area of Spalding, including a power station, falls within Flood Zone 3A, the Exception Test is satisfied. In these circumstances, the Sequential Test can be deemed to comply and the development is suitable for construction at its location.

Flood Sources

6.7 Flooding from Rivers

6.7.1 The River Welland is approximately 1.25km to the west of the site and the Environment Agency consultation identifies that the River is in natural channel and provides protection against a flood event with a 0.5% chance of occurring in anyone year (1 in 200). The channel and storage area are also regularly inspected to ensure that any potential defects are identified at an early stage. There is also an area of flood storage to the west of the site adjacent to the River Welland, which presumably prevents flooding of the Spalding town centre and adjacent areas.

6.7.2 The Coronation Channel, which provides flood relief around the Spalding town centre, is protected by raised embankment defences to a level of 5.8m ODN adjacent to the site, but to a level of 5.14m ODN adjacent to the disused railway bridge further to the north.

6.7.3 The Welland catchment model, dated April 2007, shows that the water depth in the channels can been seen to be around 4.68m A.O.D. for a 1 in 100 year storm, inclusive of climatic change. The nearest point to the site is labelled "Welland 13705", which confirms the level of 4.68m A.O.D. However, it should be realised that these are channel levels and, if there was a breach of defences or overtopping of the channel embankments, then water would be spread over a much wider area and be at a reduced level across the adjacent land.

6.7.4 The South Holland District Council Strategic Flood Risk Assessment Report, prepared by Haskoning UK Ltd dated January 2010, shows that, if defences were breached or overtopped to Coronation Channel, the site would have a residual flood depth of between 0.5m and 1.0m. The flood hazard is low to moderate and there is no danger to occupants at the present time. However, by the year 2115, without any increase of defences, flooding from overtopping of Coronation Channel would result in part of the site being flooded within half an hour of the breach.

6.8 Flooding from Local Watercourses

6.8.1 The consultation with South Holland Internal Drainage Board (IDB) identified the location of watercourses maintained by the Drainage Board and a series of other open and culverted drains which interconnect the land drainage to the main watercourses. This has identified numerous drains either crossing or in very close proximity to the site, but the maximum design water level in the IDB drainage system is confirmed to be 0.85m on Clay Lake Drain to the southeast of the site. Any flooding of the watercourse appears to be to the east of the site beyond the A16 which is raised above the ground on embankment. The flooding will spread

over a significant area of agricultural land, and is unlikely to cause any major flooding on the development site.

6.9 Flooding from Sea

6.9.1 The site is not located near enough to the sea to cause a problem of flooding from this source.

6.10 Flooding from Land

6.10.1 The site is generally flat with levels on boundaries concordant with the adjoining land. Therefore, it is highly unlikely that there would be run-off of water into the site from outside the site boundaries. Flooding from surface water run-off over adjacent land is unlikely, and flooding from this source is considered to low risk.

6.11 Flooding from Groundwater

6.11.1 Whilst there has been no intrusive ground investigation undertaken on the area, the geological map shows that the natural strata will be generally cohesive in nature and the materials will be impermeable. The presence of the rivers and watercourses in the immediate and distant vicinity of the site confirms this assumption that the ground conditions are generally impermeable and, on this basis, the probability of groundwater entering the site is low risk.

6.12 Flooding from Sewer

6.12.1 There are no existing sewers in the vicinity or crossing the site and the proposed development will have no positive drainage system with any surface water run-off from hard paved areas discharging to adjacent land for either infiltration into the ground or evaporation. Therefore, flooding from this source is not appropriate in this instance.

6.13 Flooding from Reservoirs, Canals and Other Artificial Sources

6.13.1 Apart from Coronation Channel, which is identified in Section 6.4.1, there are no other reservoirs, canals or artificial sources which would result in flooding on the site.

Climatic Change

6.14 Annex B of PPS25 indicates that winters will become wetter over the whole of the UK, by as much as 20% by the 2050s. A shift in the seasonable pattern of rainfall is also expected, with summers and autumns becoming much drier than at present. In making an assessment of the impact of climatic change on flooding from land, rivers and sea, Table B.2 indicates that the peak rainfall intensity for developments likely to extend to between 2055 and 2085 is 20% and peak river flow between 2025 and 2115 is also expected to rise by 20%. If development is expected to extend past 2085, then a 30% peak rainfall intensity should be considered.

6.15 The site is basically level with adjacent land at the boundaries and, therefore, any run-off into the site from outside the site boundaries will be insignificant and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climatic change.

6.16 The latest published figures in PPS25 show that for an anticipated life of greater than 50 years for any new development, then the anticipated increase in rainfall will be around 30%. It will be necessary to accommodate a 30% increase in rainfall capacity falling on the site.

6.17 Subject to making allowance for a 30% increase in rainfall, then the requirements of PPS25 in respect of climatic change will be satisfied.

Flood Mitigation

6.18 In accordance with Annex D of PPS25, the ideal situation would be to relocate the proposed development into areas of land with a lower probability of flooding. Alternative sites within Flood Zone 1 are to the east and southeast, where greenfield and agricultural sites are predominant. The planning restrictions of industrial development in these areas, and the inappropriate location away from the prime recipient source renders these areas unsuitable. Furthermore, the whole of the Spalding area would be stifled for new construction if restrictions on flooding were imposed. Therefore, it is considered that there are sufficient reasons for maintaining the site at the proposed location, particularly as this is for industrial development with no on site manpower. However, it will be necessary to take account of the potential sources of flooding through the layout and form of the development and the use of Sustainable Drainage techniques, wherever possible.

Sustainable Drainage

6.19 In order to comply with the requirements of PPS25, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. As the development will have no positive drainage system with surface water run-off to the adjacent unused ground, this will allow water to either percolate into the ground or evaporate and comply with the requirements of Sustainable Drainage.

Failure of Flood Defences

6.20 Consideration needs to be given to the possibility of failure of the flood barriers in the channel to the River Welland or breaching of the flood defences to the Coronation Channel in the event of a catastrophic storm. Whilst overtopping of the defences to Coronation Channel also needs to be considered, this is likely to be low risk as there is 0.79m of "freeboard" between the 1 in 100 year flood level and the top of the embankment at the present time. However, the recent South Holland District Council Strategic Flood Risk Assessment shows that residual flood depth in the event of a failure

of the defences or overtopping would result in water to the depth of between 0.5m and 1.0m in the vicinity of the site. Furthermore, when the site is assessed in accordance with the Guidance for New Development Phase II R & D Technical Report FD2321/TR2, it can be seen that, for a site at 1km from the flood source, a head of 1m above the crest level of the embankment is needed to cause a danger for all people. In this case, the head would need to be 2.12m above the 1 in 100 year flood level before there is danger to the site. This is considered to be a very rare occurrence and, therefore, the risk is considered to be very low. This assessment, in conjunction with the depth of flooding assessment above, shows that the risk from overtopping or a breach of the flood defences is not a danger and only a nominal depth of water will inundate the site. However, there is still the possibility of flooding on the site from a breach. Therefore, it will be necessary to introduce some mitigation measures to the new development to protect the Occupiers. These are as follows:-

6.20.1 All the electricity equipment shall be supported on suitable structures so that the machinery is a minimum of 1m above existing ground level.

6.20.2 The fuel storage tank shall also be supported on an appropriate structure so that the unit is 1m above existing ground level and shall be surrounded by a bunded wall to a height of 1m above existing ground level to prevent the ingress of water onto any leaking contamination which could be washed out onto third party land. The wall will need to be designed to resist the water pressure of up to 1m in height to prevent any collapse.

6.20.3 As the site will be unmanned and will only require access for maintenance, then no other mitigation measures are required.

Drainage

6.21 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

6.22 Proposed Drainage

6.22.1 The existing site is only occupied by an electricity substation, which is be retained as part of the development of the site, whilst the remaining land is unused. As there is no proposal for positive drainage on the site, then there will be no change to the existing situation with water either percolating into the soils or evaporating from puddles on the level side.

6.22.2 As the site will not be manned, there is no requirement for foul drainage on the development site.

Emergency Egress During Times of Flood

6.23 It is a requirement under PPS25 that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.

6.24 As the site will be unoccupied, there is no requirement for emergency egress during times of flood.

7.0 CONCLUSION

7.1 The site falls within Flood Zone 3A in accordance with PPS25, but there are flood defence measures for the River Welland and Coronation Channel in place to protect against a 1 in 200 year fluvial flood. It is deemed that the site falls within a "less vulnerable" flood classification and, in these circumstances, the Sequential Test is satisfied. However, if the site is deemed to fall within "essential infrastructure", there are sufficient exceptions, subject to appropriate flood mitigation measures, which meet the requirements for PPS25 and the Sequential Test is again satisfied. The flood mitigation measures which are required to allow a development at this location are as follows:-

7.1.1 The proposed electrical units are to be raised on structural supports to a height of 1m above existing ground level.

7.1.2 The fuel storage tank is to be raised on appropriate structure to be 1m above existing ground level with an appropriately designed bunded wall to a height of 1m above ground level.

7.1.3 The incoming electricity supplies shall be raised a minimum 1m above ground floor level.

7.2 Climatic change for 30% increase rainfall shall be accommodated.

7.3 Surface water discharge shall run-off to existing ground to either infiltrate into the existing soils or evaporate and comply with the requirements of Sustainable Drainage techniques for PPS25.

7.4 There is no requirement for any foul drainage.

7.5 As the watercourses have defences against flood and there will be no overnight accommodation on site, there are no special measures required for emergency egress during times of flood.

7.6 Subject to compliance with the flood mitigation measures above, the proposed development can satisfy the requirements of Planning Policy Statement 25 'Development and Flood Risk'.