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Development Constraints and Opportunities Summary Report

Strategic Land Planning Trust

Land at Lower Feltham Road, Feltham

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Executive Summary

Development is being considered on a 120-acre site in Lower Feltham in the London Borough of Hounslow. Whilst currently green belt land, the owners consider that there is future potential to develop part of the site for housing and /or commercial purposes, with other parts of the site given over to a public access scheme. The site was subject to sand and gravel extraction in the past, and has been partially infilled with waste. There are currently four significant ponds on the site.

In order to consider options for the development planning of the site, Mott MacDonald have previously undertaken a Phase I Geo-Environmental Assessment (Ref. 1), an Extended Phase I Ecological Assessment (Ref. 2) and a Topographic Survey (Ref. 3). Following these works, it was recommended that a Phase II geo-environmental investigation and risk assessment and geotechnical investigation of the site was undertaken (Ref. 4) to investigate any constraints on future development based upon in-ground issues.

Based upon the works undertaken to date, a number of potential ground-related development constraints have been identified at the site. These constraints relate to topographic, ecological, contamination and geotechnical features.

It is concluded that the topographic constraints are minimal. Ecological constraints are fairly evenly spread, as are contamination and geotechnical constraints. This suggests that any proposed development layout could be determined by other matters, such as transportation and access. In addition, if the issues identified are addressed in a suitable and timely manner, these constraints are likely to be manageable within the context of a mixed development scheme. The key constraints identified are summarised on Figure 1.

However, the site also presents some significant ecological opportunities in the northern and eastern parts of the site, and this may be an important consideration when discussions commence with the Local Authority about possible re-designation of the site for development.

Discussions on the possible future development of the site are likely to invite detailed regulatory scrutiny of the ground and groundwater contaminations issues. In order to satisfy regulatory requirements for contamination-related information, significant additional expenditure may be required on investigations, and there may be a considerable lead-in time to obtain the necessary data.

One key issue that may arise in discussions with the regulators is the significance or otherwise of possible impacts to groundwater around the site that may already be happening as a result of the presence of the infilling on the site. It may therefore be prudent to make a quantitative assessment of these potential impacts, prior to opening negotiations with the regulators.

Regarding abnormal development costs, the greatest costs are likely to be in the combination of contamination remediation / mitigation works and foundation works. Ecological mitigation costs, whilst potentially significant, are likely to be of a lower order.

It should be recognised that, as no specific development proposals have been tabled, the scope of the ground investigations undertaken to date is consistent with an "Exploratory Investigation" as defined in BS 10175:2001 (Ref. 5). This acknowledges that further, more detailed investigations will be required once specific development proposals have been formulated.

The principal recommendations ensuing from these investigations are as follows:

1. When planning the possible development of the site, consideration should be given to the in-ground constraints that are likely to be present. These include ecological, contamination and geotechnical constraints. Whilst these constraints may not favour any particular area of the site, the potential ecological opportunities afforded by the presence of the existing ponds in the north and east should be recognised, and this may lead to the south and west of the site being preferred for development.
2. In building up a budget for the development, an allowance should be made for abnormal in-ground costs, particularly with respect to contamination remediation/mitigation and additional or unusual ground works, including foundation works.
3. When specific development proposals start to be formulated, further investigations will be required in order to allow more detailed planning and design to proceed. However, all further investigations may be inhibited by the presence of thick vegetation across large areas of the site which limits access. This must be considered in the planning of further investigation works.
4. It should also be noted that obtaining additional information, either for design purposes or for regulatory approval, can take a considerable period of time, as monitoring is often required for a period of at least 12 months. In drawing up a programme for the development of the site, it may therefore be prudent to allow for a two-year lead-in period to obtain the necessary information.
5. Groundwater beneath the site appears to have been impacted by contamination. A site specific quantitative risk assessment should be undertaken without undue delay to examine whether significant contamination effects on groundwater are currently likely to extend beyond the site boundaries. This will help in assessing whether or not there are any significant regulatory issues in respect of contamination with the site in its current condition. It is also likely to be very important to have this information prior to opening negotiations with the regulators if it is decided to proceed with development.

1 Introduction

1.1 Background

The Strategic Land Planning Trust (SLPT) is a Trust holding and administering funds for the promotion of development on behalf of overseas landowners who have an interest in a 120-acre site in Lower Feltham in the London Borough of Hounslow. Whilst currently green belt land, the owners consider that there is future potential to develop part of the site for housing and /or commercial purposes, with other parts of the site given over to a public access scheme. The site was subject to sand and gravel extraction in the past, and has been partially infilled with waste. There are currently four significant ponds on the site, one of which is used by an angling club.

In order to consider options for the development planning of the site, Mott MacDonald have previously undertaken a Phase I Geo-Environmental Assessment (Ref. 1), an Extended Phase I Ecological Assessment (Ref. 2) and a Topographic Survey (Ref. 3) for the site, on behalf of the Trust. Following these works, it was recommended to undertake a Phase II Geo-Environmental Risk Assessment and geotechnical investigation of the site to investigate any constraints on future development based upon in-ground issues. The Phase II works were completed in September 2007 (Ref. 4). The information obtained from all of these studies will now be used to prepare a Development Constraints and Opportunities Summary Report for the site.

Mott MacDonald has been commissioned by the Trust's retained planning consultants DLP Planning Ltd to undertake these studies on behalf of the owners. The brief for the study was put forward in Mott MacDonald letter MEW/JHP/RPA/TB, dated 14th December 2006, and formal instruction for the work was received in DLP Planning Ltd's letter of 20th December 2006.

1.2 Objectives

The objectives of this report are to briefly summarise the actual in-ground development constraints that have been brought to light and any potential opportunities that arise in the light of the conditions at the site, and to make recommendations for future works.

1.3 Scope of Work

The scope of work includes:

- A very brief summary assessment of the Mott MacDonald Phase I Geo-Environmental Assessment (Ref. 1), the Extended Phase I Ecological Assessment (Ref. 2), the Topographic Survey (Ref. 3) and the Phase II Geo-Environmental Risk Assessment (Ref. 4);
- A discussion of the development constraints and opportunities that arise at the site; and
- The drawing up of conclusions for the site, and recommendations on future works required.

This report relates only to constraints and opportunities arising out of the ground conditions, ecology and topography at the site, and does not include any information or discussion on other aspects which may constrain development, such as transport or access requirements. Nevertheless, it is considered that information contained within the report may inform other aspects involved in development indirectly.

Any information presented within the report which indicates the site, or parts of it, are suitable for development does not imply or guarantee that a successful planning application can be achieved in relation to these aspects, as this is outside the control of Mott MacDonald.

1.4 Limitations

This document has been prepared for the titled project or named part thereof and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority of Mott MacDonald being obtained. Mott MacDonald accepts no responsibility or liability for the consequences of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm his agreement to indemnify Mott MacDonald for all loss or damage resulting there from. Mott MacDonald accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned.

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To the extent that this document is based on information obtained in ground investigations, persons using or relying on it should recognise that any such investigation can examine only a fraction of the subsurface conditions. In any ground investigation there remains a risk that pockets or “hot-spots” of contamination or other hazards may not be identified, because investigations are necessarily based on sampling at localised points. Certain indicators or evidence of hazardous substances or conditions may have been outside the portion of the subsurface investigated or monitored, and thus may not have been identified or their full significance appreciated.

2 Topographic Constraints

A topographic survey of the site was undertaken by Tower Surveys (commissioned by Mott MacDonald) between 25 September 2006 and 6 October 2006. The works undertaken included:

- Establishing Survey Control over the site using both GPS and Total Station;
- Levelling to Ordnance Survey Benchmarks to confirm height;
- Obtaining Spot Levels over the site in all areas that were accessible;
- Traversing and locating all boundaries that were accessible;
- Locating all features on site that were accessible including buildings, vegetation, banks, ponds, tracks, concrete, manholes, inspection covers and retaining walls.

The data was processed and the output displayed in the form of a Digital Terrain Model (DTM) and drawn in AutoCAD 2006 (Ref. 3). Due to the very overgrown nature of the site, it was not possible to survey the ground surface over the complete area.

The survey revealed no major undulations in general ground levels across the site, with the exception of the presence of the lakes and a number of mounds at various locations around the site.

It is considered that the lakes and mounds will potentially present access restrictions but not present any other significant constraints to development of the site. Minor earth works to remove or re-grade the mounds, and infilling or bridging works for the ponds could remove this potential constraint.

3 Ecological Constraints

3.1 Ecological Survey

A Phase 1 assessment was undertaken in August 2006 using a combination of desk-based studies and site-based ecological assessments in compliance with the *Handbook for Phase 1 Habitat Survey: a Technique for Environmental Audit* (JNCC, 1993) and the Institute of Ecology and Environmental Management's (IEEM) *Guidelines on Ecological Impact Assessments*. The Extended Phase 1 Ecological Assessment included:

- Assessments on the ecological and conservation importance of the site and the surrounding adjacent area by searching available publications, reports and online databases. Information regarding local and national species and habitat action plan and areas of protected status was obtained from Nature on the Map, National Biodiversity Gateway, UKBAP, MAGIC and JNCC websites.
- A Phase 1 habitat survey to identify and map the broad habitat types. Each habitat type was target noted to identify the key plant species as appropriate.
- Records on protected and notable species and designated areas near to the site were obtained from the local biological records centre; Greenspace for Greater London.
- Rapid assessment for the presence of protected and nationally rare species.

The conservation importance of habitats and species found in the survey was evaluated in accordance with the Department of Transport Biodiversity Impact Assessment Guidance (WebTAG). All supplementary information on the conservation and ecological importance of species, habitats and protected areas is provided in the appendices of the Phase 1 Ecological Survey report (Ref. 2).

3.2 Main findings

The previous ecological surveys and assessments have identified a number of ecological constraints on the site, which can be summarised thus:

- There are no statutory protected sites within the survey area or within 2 km of the site.
- The study site itself has been designated as a Site of Importance for Nature Conservation (SINC) by the local authority. The designation is of high, regional conservation importance and will be an important consideration for Hounslow Borough Council when contemplating the future allocation of the land for development.
- The survey site consists primarily of dense scrub habitat, with some broadleaf woodland strips and isolated areas of poor semi-improved grassland and tall ruderals. The site also contains four sizeable ponds of at least 100 m in breadth, three semi-improved neutral grassland paddocks and is bounded by hedgerows on two sides.
- The site is locally important for breeding bird species.
- The site contains suitable habitat for breeding birds, reptiles and great crested newts.
- Badger field signs were detected over much of the site indicating that the area is used by badgers and suggesting that a sett could be present on site.
- Japanese Knotweed *Fallopia japonica* is scattered over much of the site.

3.3 Key ecological constraints

No significant overall ecological constraints were identified that could block or significantly restrict the development of the site. However, ecological mitigation would be required to minimise the ecological impacts and ensure compliance with UK and EU nature conservation legislation. The ecological constraints which need to be addressed are:

- Japanese knotweed removal. It is an offence to spread Japanese knotweed under the Wildlife & Countryside Act 1981 and methods for correct handling and disposal must be devised to prevent them from spreading to unaffected areas. It is highly recommend that Japanese knotweed is removed from the working area of the site.
- There is potential for the development to have a negative impact on birds, badgers, and reptiles. Further surveys need to be undertaken to confirm the presence and location of these species, including great crested newts in the lagoons (albeit a low probability that this protected species is present).
- The potential constraint of working within and therefore directly impacting upon the non-statutory designated site needs to be discussed with Hounslow Borough Council. It is not known at this stage whether the Council might be sympathetic to the idea of re-designating the site for development.

3.4 Potential opportunities

It is possible that the development would have a significant negative impact on the local and regional biodiversity. However, the site itself is largely in unfavourable condition owing to the abundance of Japanese knotweed on the site. Development would therefore present an opportunity to enhance the ecological value and conservation importance of the site by:

- Removing Japanese knotweed from the site;
- Creating new habitats in those areas not to be developed, such as the creation of new ponds and areas of reedbeds;
- Enhancing the existing habitats through the control of scrub, planting native trees species, installing bird and bat boxes, creating reptile hibernacula, installing an artificial badger sett, and;
- Areas of the site could also be developed for environmental education purposes, with the involvement of local schools and London Wildlife Trust.

Following more detailed protected species surveys and undertaking the appropriate mitigation and enhancement measures, the ecological condition and value of the site could be significantly enhanced.

3.5 Requirements for Further Work

If plans for possible re-development of the site are progressed, further work will need to be done in terms of obtaining greater detail of the species actually present and the areas affected by certain species. This will best be done when the areas specified for development have been established, so that more detailed, targeted surveys can be undertaken. In addition, a judgement will have to be made as to when is the most appropriate moment to commence negotiations with Hounslow Borough Council on the future of the site.

4 Contamination Constraints

The following assessment is based upon the Mott MacDonald Phase I Geo-Environmental Assessment (Ref. 1), and the Phase II Geo-Environmental Risk Assessment (Ref. 4).

4.1 Geo-Environmental works

A Phase 1 Geo-Environmental Risk Assessment was undertaken in November 2006 which comprised a review of readily available environmental records and historic maps and a site reconnaissance visit. The information gathered was interpreted to build up a qualitative assessment of the environmental risk in respect of soil and groundwater contamination. A conceptual model was developed which identified potentially active sources, pathways and receptors. Where an active pollutant linkage was identified, the risk was evaluated on the basis of the available information. An overall risk category for the site was then determined based upon these linkages. The overall level of contamination risk for the site was classified as high, mostly due to the quantity of waste, of unknown composition, beneath the site.

Based upon the findings of the Phase 1 Geo-Environmental Risk Assessment, the primary purposes of the Phase 2 studies were to confirm the conceptual site model developed in Phase 1, to investigate the nature of the waste at the site, including its thickness, composition, distribution, contamination status and so on, and thereby to refine and update the preliminary risk assessment undertaken in Phase 1. This Phase 2 risk assessment was then used to inform a discussion of the actual development constraints with respect to land condition at the site.

The Phase II ground investigation of the site was carried out by Norwest Holst during the period of 10th April 2007 to 20th April 2007. It has provided a considerable amount of information on the sub-surface conditions, including the ground stratigraphy, the geotechnical ground conditions, ground contamination, and the level and quality of groundwater. However, access difficulties encountered during the site works mean that some large areas of the site remain to be investigated, and thus whilst the findings summarised in this report may be representative of the areas examined, other conditions may exist at the site which have yet to be assessed.

In view of the fact that no specific site development proposals were tabled at this stage, the scope of investigation undertaken was consistent with an "Exploratory Investigation" as defined in BS 10175:2001 (Ref. 5). This acknowledges that further, more detailed investigations will be required once specific development proposals have been formulated.

The contamination constraints are discussed, below.

4.2 Contamination constraints – soils

Hydrocarbon, inorganics and, locally, asbestos contamination in soils are considered to be a risk to human health and water resource receptors in certain areas and, if unmitigated, will present some significant development constraints at the site. An important finding from the investigations so far is that there is no clearly defined pattern of impacts.

Local ground remediation is likely to be required if commercial end uses are envisaged and, based upon risks to human health receptors, is almost certainly required for residential end uses. Further detailed investigation to quantify and delineate impacts is likely to be required, in order that a suitable remediation strategy can be developed. Site specific risk assessment work may demonstrate that certain areas of the site will not require much remediation and this may therefore have a significant influence on the most economic areas to develop. However, in view of the very "patchy" pattern of contamination found to date, it is not possible at this stage to state which areas these may be. The most promising candidate is perhaps the industrial / transport area to the east of Pond A.

The proposed uses of the site and the locations of different land uses will strongly influence the amount of remediation works required.

4.3 Contamination constraints – groundwater

Groundwater beneath the site is impacted by hydrocarbon and VOC contaminants and this is likely to present a moderate risk to water resource receptors. Whilst soil remediation at the site would be likely to improve groundwater quality, it is considered that this is unlikely to be necessary because contamination levels are not excessively high and the contaminants present are not especially mobile. Site specific quantitative risk assessment work would provide some confirmation of this view, and demonstrate whether significant effects are currently likely to extend beyond the site boundaries. However, further groundwater quality monitoring would be required to confirm this with greater certainty.

A potential risk is that if development of the site occurs, details of the groundwater quality may enter the public domain and are likely to come under the scrutiny of regulators such as the Environment Agency. Dependant on the regulator's approach, it is likely that the site owners will be asked either to demonstrate (by means of a site specific risk assessment) that the impacts observed in groundwater do not present a significant risk to controlled waters, or to undertake groundwater remediation. If this is not undertaken and the regulators are of the opinion that this site does not comply with the Groundwater Regulations (1998) (Ref. 6) and other legislation, the consequences could be serious.

Groundwater contamination should not significantly influence or constrain any proposed development, except insofar as if groundwater remediation is necessary, the necessary works will need to be accommodated within the proposed site boundary and development layout. In addition, if some soil remediation is required to improve groundwater quality, this is very difficult to achieve once a site has been developed. Conversely, development itself may present an opportunity to improve groundwater quality by breaking or at least inhibiting certain pollutant linkages, through development activities such as capping the site.

4.4 Contamination constraints – ground gas

Ground gases may also constitute a high risk to human receptors in the completed development if suitable mitigation measures are not implemented. Carbon dioxide has been measured in all boreholes across the site at levels which could potentially present a risk to human health receptors. In addition, methane has been detected at unacceptable concentrations in boreholes BH04, BH05 and BH06. Soil remediation (for example, by removal to landfill) would reduce this risk in some areas, but would be expensive and may be unacceptable to the regulators. However, other mitigation measures are likely

to be more acceptable and possibly more economic, such as the provision of gas-impermeable membranes or gas venting barriers. Thus the risks are considered to be significant but manageable.

It should be noted that there does appear to be a correlation between those areas generating the greatest concentrations of methane, and the deepest areas of fill. Both occur in Boreholes BH4, BH5 and BH6, in the central part of the site. Thus it can be anticipated that gas mitigation measures are likely to be at their most onerous in this central area, and at their least onerous around the periphery of the site.

5 Geotechnical Constraints

Geotechnical investigations have been undertaken in both the Phase I and Phase II works. The Phase II ground investigation was designed to provide data for the contamination assessment but also to assess potential geotechnical constraints at the site.

The potential geotechnical hazards identified at the site are few, and are discussed below.

It is considered likely that there may be further ground movements associated with settlement of the made ground. Areas of the made ground may not have undergone compaction and could be highly susceptible to further consolidation when loaded. In addition, the presence of ground gases on the site indicates that some degradable materials are present. Rapid changes in made ground thickness are also likely to be present, and may cause differential movements in engineering structures. Therefore it is likely that some degree of settlement due to degradation of the made ground is likely still to be occurring, albeit probably at a very slow rate.

In order to mitigate against this poor ground, the use of deep foundations such as piles is likely to be required for any significant structures. Much of the site is underlain by fill that is over 4m thick, so piled foundations will probably be required in almost all areas of the site. The few exceptions to this may include the eastern part of the site to the north east of Pond A. For external works or road construction, ground improvement, such as the installation of stone columns, may be required.

The made ground contains variable materials and includes construction rubble that could obstruct foundation construction. There may be additional materials not discovered as part of the ground investigation, which could also obstruct ground works. Notable obstructions, believed to be related to the presence of buried concrete beams, were encountered during the intrusive investigation in the southern corner of the site. Such obstructions may prevent or seriously inhibit the use of deep piled foundations. However, their removal and disposal would be expensive.

It is considered likely that there may be groundwater ingress and/or instability in temporary excavations. Provision could be made for localised pumping using sumps, although their effectiveness will depend on the permeability of the soil and how quickly the water flows into the excavation. Disposal of the pumped water could also be problematic. Excavation within a cofferdam construction may be an alternative, but this would be expensive. In addition, structures close to the ponds would be subject to groundwater ingress and potential ground instability.

The above hazards and their associated mitigation measures will lead to abnormal costs in the ground-related development works. However, it is considered that with additional data from further site investigation for the detailed design phase, engineering solutions can be developed to minimise these abnormal costs.

6 Discussion

As discussed in the previous chapters, there are a number of ground-related constraints on development at the site relating to topographic issues, ecological issues, contamination issues and geotechnical issues. In order to progress plans for development of the site, the conflicting pressures created by these and other constraints will need to be balanced to achieve a workable solution.

Topography

The topographic constraints are not considered to be significant and although the ponds and mounds may present some access issues, minor earthworks to remove or re-grade the mounds could be undertaken along with infilling or bridging works over the ponds. Therefore, these issues are not considered an overall constraint on potential development.

Ecology

No significant overall ecological constraints were identified that could block or significantly restrict the development of the site. However, ecological mitigation would be required to minimise the ecological impacts and ensure compliance with UK and EU nature conservation legislation. The ecological constraints which need to be addressed include the fact that the site has been designated as a Site of Importance for Nature Conservation by the local authority. Although not a statutory designation, it will be an important consideration for Hounslow Borough Council when contemplating the future allocation of the land for development.

In addition, Japanese knotweed is present in small stands spread across most areas of the site. This has implications for its control and/or removal. There is also the potential for the development to have a negative impact on birds, badgers, and reptiles. Further surveys need to be undertaken to confirm the presence and location of these species.

However, all of these constraints are considered to be reasonably evenly spread across the site, and it therefore follows that, in this regard, no one part of the site should be preferred for development over another.

However, development may also carry with it certain ecological opportunities, including the potential to enhance existing habitats, to create new habitats, and to develop an environmental education resource at the site. The greatest potential for taking advantage of these opportunities lies in the north and east of the site, around the existing ponds. This would suggest that development for residential or other purposes may be best placed in other areas of the site.

Contamination

Constraints relating to contamination issues at the site have been assessed by considering the soils, groundwater and ground gas phases separately. Based on current UK guidance and the information obtained to date, residential development (with gardens) on approximately 60% of the site would present unacceptable risks to human health receptors if no mitigation is undertaken. One difficulty is that soil contamination is very patchy, with a series of hot-spots in most areas. This means that no area can be taken as particularly favourable with respect to residential development, and mitigation measures are likely to be required where ever such development occurs.

There are not considered to be any significant risks to human health receptors from groundwater impacts at the site. However, contamination in the groundwater presents a moderate risk to groundwater resources locally, and this brings with it the risk of regulatory intervention, particularly when development proceeds. Further risk assessment and/or monitoring work would be required to assess whether or not these effects could extend outside the site either now or in the future. Consideration should therefore be given to making a more quantitative assessment of possible off-site groundwater impacts from the current site, in order that this information is known before negotiations start with the Local Authority and others.

One possible solution to mitigate risks posed by soil contamination is to cut pathways to human health receptors by capping significant areas, or possibly the whole site, with a clay capping layer. This would break direct contact pathways and inhalation pathways of volatile contaminants. The decrease in infiltration would also prevent downward leaching of contaminants and potentially reduce the risks to groundwater.

Ground gases will potentially present an unacceptable risk to human health receptors, most notably in the centre of the site where high concentrations of methane have been detected. Soil remediation would be likely to reduce this risk in some areas, but would be expensive. However, other mitigation measures are likely to be more economic, such as the provision of gas-impermeable membranes and/or gas venting barriers. The extent of mitigation will depend on the proposed end-use and type of structures proposed. The risk associated with ground gases is therefore considered to be significant but manageable.

Overall, the level of contamination is not considered to be extreme, and it is considered that it should be possible to develop at least parts of the site without excessive expenditure on remediation. If the risks identified are addressed in a suitable and timely manner, these constraints are likely to be manageable within the context of a mixed end-use development scheme.

Geotechnical

Geotechnical constraints include the variable composition of, and the presence of locally degradable materials within, the made ground. Areas of the made ground may therefore be subject to ongoing settlement, and could be highly susceptible to further consolidation when loaded, leading to significant and uneven settlements during development. Rapid changes in made ground thickness are also likely to be present, and may cause differential movements in engineering structures.

In order to mitigate against this poor ground, the use of deep foundations such as piles is likely to be required for any significant structures. Much of the site is underlain by fill that is over 4m thick, so piled foundations will probably be required in almost all areas of the site. The few exceptions to this may include the eastern part of the site to the north east of Pond A. For external works or road construction, ground improvement, such as the installation of stone columns, may be required.

However, the made ground also contains various construction materials that could obstruct foundation construction. There may be additional materials not discovered as part of the ground investigation, which could also obstruct ground works. Notable obstructions, possibly related to the presence of discarded concrete beams, were encountered during the ground investigation in the south of the site. These would prevent the use of deep foundations in this area, unless the obstructions are first removed.

Therefore, in general, significant ground works are likely to be required for any buildings constructed on the site. The cost of providing deep foundations may be somewhat higher than for a 'normal' site, in that ground movements, rapid changes in ground conditions and obstructions are all likely to be present. However, these constraints are fairly evenly spread over the site, so no one area should be preferred over another, with the exception of the eastern part of the site, north east of Pond A, which may not have been subject to past excavation and infilling.

7 Conclusions

Based upon the works undertaken by Mott MacDonald to date, a number of potential ground-related development constraints have been identified at the site. These constraints relate to topographic, ecological, contamination and geotechnical features. However, if the issues identified are addressed in a suitable and timely manner, these constraints are likely to be manageable within the context of a mixed development scheme.

It is concluded that the topographic constraints are minimal. Ecological constraints are fairly evenly spread, as are contamination and geotechnical constraints. This suggests that any proposed development layout could be determined by other matters, such as transportation and access. The key constraints identified are summarised on Figure 1.

However, the ecological opportunities presented by the northern and eastern parts of the site may be significant, and this may be an important consideration when discussions commence with the Local Authority about possible re-designation of the site for development.

Another consideration is that discussions on the possible future development of the site are likely to invite detailed regulatory scrutiny of the ground and groundwater contaminations issues. In order to satisfy regulatory requirements for contamination-related information, significant additional expenditure may be required on investigations, and there may be a considerable lead-in time to obtain the necessary data. For example, recent CIRIA guidance (Ref. 7) suggests that a period of 12 to 24 months of ground gas monitoring might be required to obtain sufficient data, and a similar period can be envisaged for groundwater monitoring.

One key issue that may arise in discussions with the regulators is the significance or otherwise of possible impacts to groundwater around the site that may already be happening as a result of the presence of the infilling on the site. It may therefore be prudent to make a quantitative assessment of these potential impacts, prior to opening negotiations with the regulators.

Regarding abnormal development costs, the greatest costs are likely to be in the combination of contamination remediation / mitigation works and foundation works. Ecological mitigation costs, whilst potentially significant, are likely to be of a lower order.

It should be recognised that, as no specific development proposals have been tabled, the scope of the ground investigations undertaken to date is consistent with an "Exploratory Investigation" as defined in BS 10175:2001 (Ref. 5). This acknowledges that further, more detailed investigations will be required once specific development proposals have been formulated.

8 Recommendations

The principal recommendations ensuing from these investigations are as follows:

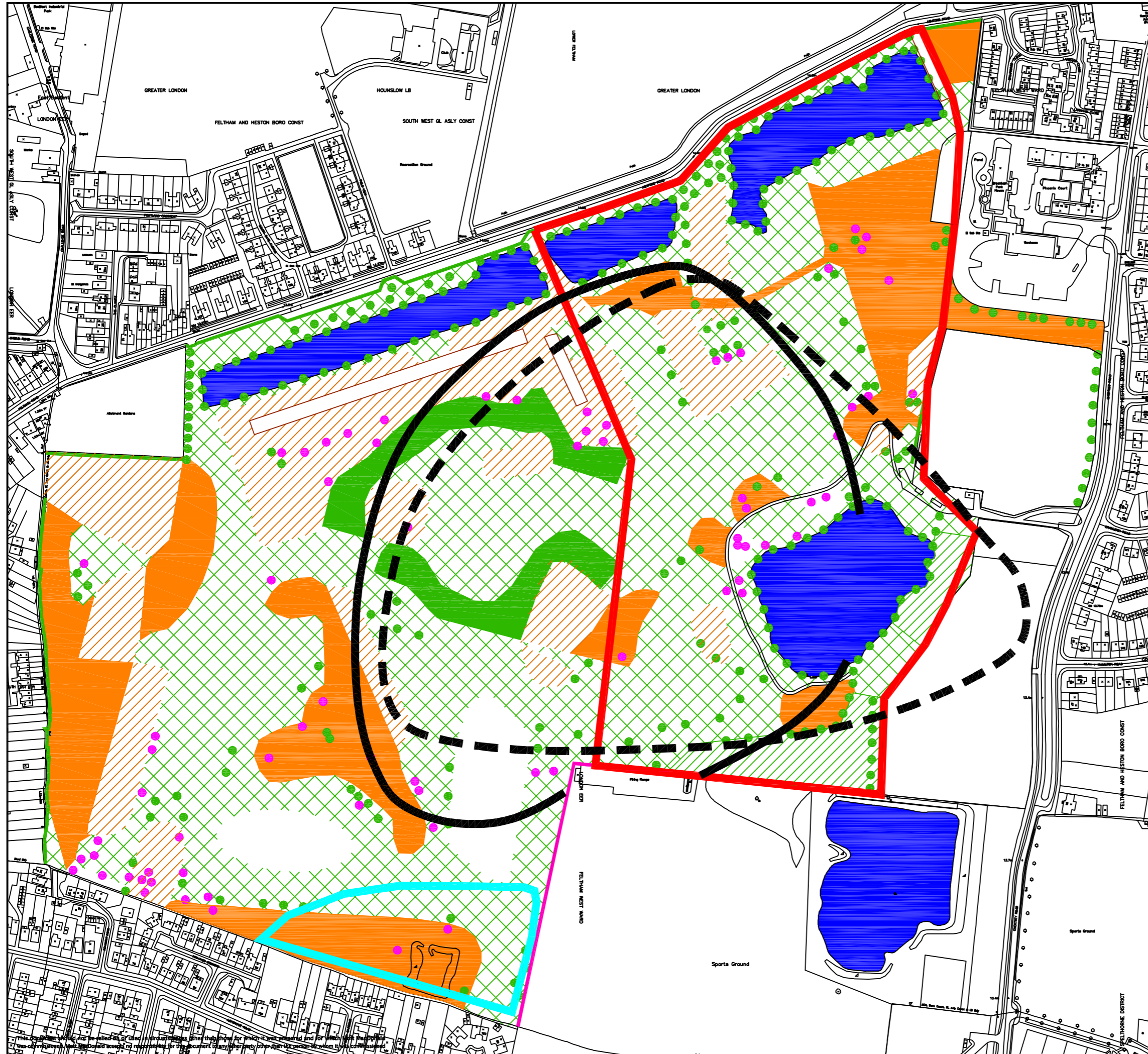
1. When planning the possible development of the site, consideration should be given to the in-ground constraints that are likely to be present. These include ecological, contamination and geotechnical constraints. Whilst these constraints may not favour any particular area of the site, the potential ecological opportunities afforded by the presence of the existing ponds in the north and east should be recognised, and this may lead to the south and west of the site being preferred for development.
2. In building up a budget for the development, an allowance should be made for abnormal in-ground costs, particularly with respect to contamination remediation/mitigation and additional or unusual ground works, including foundation works.
3. When specific development proposals start to be formulated, further investigations will be required in order to allow more detailed planning and design to proceed. Such investigations should include further boreholes and trial pits to cover areas of the site not yet investigated, further laboratory testing, and further groundwater and ground gas monitoring. Non-intrusive methods of investigation, such as geophysical techniques, should also be considered as these can be used to obtain further information on the presence of subsurface obstructions and contamination profiles. However, all further investigations may be inhibited by the presence of thick vegetation across large areas of the site which limits access. This must be considered in the planning of further investigation works.
4. It should also be noted that obtaining additional information, either for design purposes or for regulatory approval, can take a considerable period of time, as monitoring is often required for a period of at least 12 months. In drawing up a programme for the development of the site, it may therefore be prudent to allow for a two-year lead-in period to obtain the necessary information.
5. Groundwater beneath the site appears to have been impacted by contamination within the soils on the site. Therefore, a site specific quantitative risk assessment should be undertaken without undue delay to examine whether significant contamination effects on groundwater are currently likely to extend beyond the site boundaries. This will help in assessing whether or not there are currently any significant regulatory issues in respect of contamination. It is also likely to be very important to have this information prior to opening negotiations with the regulators if it is decided to proceed with development.

9 References






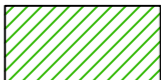



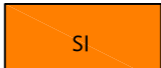
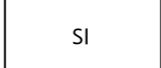



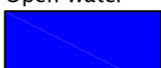
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10 Figures

Figure 1 – Summary of Development Constraints at the site



LEGEND

-  Area With Most Significant Ground Gas Issues
-  Area With At Least 5m Depth Of Infilling
-  Area With Known Buried Concrete Obstructions
-  Area With Greatest Ecological Enhancement Potential
- Woodland**
-  Broad leaved semi natural woodland
-  Broad leaved plantation
- Scrub**
-  Dense/continuous
- Parkland/scattered trees**
-  Broad leaved Trees
-  Japanese Knotweed
- Grassland & Marsh**
-  Neutral grassland semi improved
-  Poor semi improved grassland
- Tall Herb & Fern**
-  Tall Ruderal
- Boundaries**
-  Wall
-  Hedge (Intact Hedge Species - Poor)
- Open Water**
-  Standing Water



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Title
**LAND AT LOWER FELTHAM ROAD
SUMMARY OF DEVELOPMENT CONSTRAINTS**

Date	Drawn	Checked	Approved	Status
20/12/08	CJE	FB	MAJ	Final
Drawing No			Scale	Rev
228898/06 Figure 1			NTS	P1