EXECUTIVE SUMMARY

On the instructions of Elliott Wood Partnership LLP, on behalf of Postcruise Limited, RSK STATS Geoconsult has carried out a Phase 1 and Phase 2 geotechnical, hydrogeological, and geoenvironmental site investigation of 53 Fitzroy Park, located close to Highgate, North West London. The project was commissioned in connection with the proposed redevelopment of 53 Fitzroy Park with a detached property and basement to replace the existing house on site.

Project Findings

Site History	From mid-Victorian times, the site lay within the wider Fitzroy Park and was covered by mixed woodland and heathland. On the earliest map of 1870, the pond to the immediate southwest of the site is shown extending into the extreme southwest section of the site. On the 1894 map, the outline of the pond has changed, and no longer encroaches into the southwestern part of the site (i.e. it has been infilled in the site area). From the mid-1910s, a small structure of unspecified usage was present in the southern area of the site, but this structure had been demolished by the mid-1930s. From the 1950s, there was another small building present close to the footprint of the building noted above. The site remained unchanged until the early 1970s, when the current property was constructed. By the late-1980s, the small structure to the south of the site had been removed. The site attained its current configuration at this time.
Geology, Hydrogeology and Hydrology	The published geological information indicates that the site is underlain by Unit D of the London Clay Formation. The London Clay is a non-aquifer (non-productive strata) and the site does not lie within a groundwater Source Protection Zone (SPZ). Although no such features have been identified or reported from the subject site, springs / seepages / issues are indicated in the wider vicinity. These features are associated with geological boundaries between units of contrasting permeability, namely the junctions between the overlying Bagshot Formation and Claygate Member (which make up the higher ground on Hampstead Heath and Highgate), and the Claygate Member and underlying argillaceous London Clay. The subject site lies within the catchment of a stream formerly known as the Highgate Brook, forming one of the tributaries of the River Fleet, which rises on Hampstead Heath. A series of historical artificial ponds (Highgate Ponds) lie within this stream and serve a variety of leisure and recreational purposes, and are the subject of a number of conservation and management measures under the Corporation of London's Hampstead Heath Management Plan. These ponds lie down-gradient from the site. The subject site lies within a northeast to southwest orientated valley, within which no surface watercourse currently flows. Information provided by the Resident's Association suggests that drainage in this area is diverted through a culvert / buried channel beneath the residential properties in this area.
Contaminative Uses	The historical research has revealed no evidence of contaminative activities having occurred on the site.
Review of Previous Report	An intrusive site investigation was formerly undertaken at the site by GEA, details of which were provided within their report no. J09196/RR/01, dated November 2009. Four boreholes were advanced to depths of 6m below ground level (bgl) across the site. The encountered ground conditions were described as 0.5m to 1.1m thickness of Made Ground overlying the London Clay Formation. The London Clay was described as firm brown fissured silty clay

	becoming a firm to stiff grey silty clay.
RSK Site Investigation Findings	Nine further boreholes were undertaken across the site, to depths between 5m and 15m bgl, with samples taken to determine the geotechnical and material properties of the London Clay and with groundwater monitoring equipment installed. The site investigation confirmed the ground conditions as encountered by GEA and confirm that the site is underlain by the London Clay Formation. Water-bearing reworked ground was encountered in the southwest of the site, confirming the presence of the historical infilled pond in this area. Minor seepages were encountered within the London Clay and rising head tests were undertaken to allow an assessment of recharge and permeability. Values of permeability within the range 1.83 to 1.98 x 10^{-7} m/s were obtained where seepages had been recorded and values of 1.37 x 10^{-8} m/s were obtained for clay where seepages had not been recorded. Both values are consistent with clay modified by the effects of weathering, desiccation and fissuring, which reflects the materials encountered on-site. Any groundwater movement within the London Clay is likely to be through the secondary effect of fissuring. Soakage tests were undertaken to assess the soils beneath the site and revealed that the soils are not suitable for the use of SUDS-type drainage. A ground penetrating radar (GPR) survey revealed no evidence for drainage to the south of the site, adjacent to a pond in the grounds of No.55 Fitzroy Park. To the west of the site signals were detected that were indicative of buried pipes associated with a surface water inspection cover. This cover was lifted and confirmed that two pipes exited the shallow inspection chamber, one heading directly to the pond, the second heading towards the southwest. The inspection also revealed a shallow pipe entering the inspection chamber from the adjacent site of 'The Waterhouse'. However, this pipe was sealed with a pipe bung, which appeared to have been *in situ* for a considerable time. No water was flowing in the pipework at the time of this inspection. Chemical testing of groundwater and pond water within the immediate site vicinity indicate that groundwater is unlikely to make any significant contribution to the adjacent pond, which is more likely to be fed by surface water. No significant ground or groundwater contamination was encountered at the site.

Project Conclusions

Geoenvironmental Conclusions	The findings of the site investigation, conceptual site model and the assessment of potential health and environmental risks from contamination for the proposed development has identified no evidence of significant ground contamination on the site and hence pollutant linkages are deemed not to exist.
Geotechnical Conclusions	The soils encountered during the investigation comprised very high plasticity clays of high volume change potential underlying variable Made Ground at shallow depths. Soils in the vicinity of the proposed development also show evidence of desiccation within the upper few metres. A piled foundation solution has been proposed for the redevelopment. It is understood that the permanent basement structure will be constructed in reinforced concrete with a piled raft to support the vertical load and deal with any tensile forces that might develop as a result of any heave or hydrostatic pressures. Support for the proposed basement excavation will be provided by a temporary contiguous piled wall. Perched water has been encountered in the Made Ground and seepages within the London Clay Formation. Temporary groundwater

	control will be necessary for construction of the basement. Provision should also be made for the build up of hydrostatic pressures behind retaining walls and beneath the basement slab, and waterproofing of the basement structure.
Hydrogeological Conclusions	Perched water appears to be locally present in the Made Ground, overlying the weathered London Clay. It is proposed that the Made Ground would be excavated immediately behind the upstream piled wall to allow the insertion of a geotextile membrane which will allow water to continue to flow but would prevent fines from being washed out. Should water flows be high, which is considered unlikely, then a series of counterfort-type drains could also be incorporated within the porous layer. The void between the temporary piles and the permanent retaining wall will be backfilled with a free-draining material and the temporary piles would be left in place. Groundwater monitoring indicates slow rates of water seepage within the London Clay, compatible with the anticipated low permeability of the encountered materials, and flow within the clay is likely to be fissure-dominated. In view of the proposal to support the basement excavation with a contiguous pile wall, it is considered that temporary groundwater control will be necessary in the form of gravity drainage and pumping from sumps. The short-term disadvantage of temporary groundwater control is outweighed by the long-term advantage of the proposed contiguous piled wall (with spaces between the piles), which will allow the free passage of groundwater, ensuring long-term drainage. This measure should effectively mitigate against damming of flows up-gradient of the basement structure. It is considered that the impact of the proposed development on the local hydrological/hydrogeological regime will be minimal and is considered unlikely to have any significant effect on the water supply to the Highgate Ponds. Any potential disturbances to drainage from the site may be effectively mitigated by the measures outlined above.