

# London 2012 Olympic Park

## Follow-on Project (Stage 2) Consolidated Validation Report – Planning Delivery Zone 2

**October 2012**

**Notice**

This document and its contents have been prepared and are intended solely for the Olympic Delivery Authority (ODA)'s information and use in relation to summarising the ODA Follow-on Project remediation and validation works within Planning Delivery Zone 2 on the London 2012 Olympic Park site.

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## PART III

# 1. Introduction

## 1.1 Scope

The aim of this Stage 2 Consolidated Validation Report (CVR) is to provide a high level summary of the approved Follow-on Project (FoP) remediation related documentation pertaining to Planning Delivery Zone 2 (PDZ2) of the London 2012 Olympic Park, London. These remediation works were completed as part of the Olympic Delivery Authority (ODA) redevelopment of the Olympic Park. This FoP (Stage 2) CVR provides a summary of the ODA FoP earthworks, which have been completed following on from creation of the site platform by the Enabling Works project. The Enabling Works validation scope has been reported separately within the Enabling Works (Stage 1) CVR (Ref. 1). The Enabling Works (Stage 1) and FoP (Stage 2) CVRs form the complete consolidated validation report for ODA works within each PDZ.

This FoP (Stage 2) CVR is produced on the basis that the individual FoP remediation and validation reports have previously been approved by the Local Planning Authority (Olympic Delivery Authority Planning Decisions Team (PDT)). Therefore, this report does not reproduce or re-evaluate any of the detailed testing, results, or assessments that have been previously reported and are contained therein. This document provides a summary of existing FoP validation information: no new information is presented herein.

This document has been prepared to discharge the ODA's obligation under Condition OD.0.36 ('Protection and Validation of Remediation') of the 2007 Olympic, Paralympic and Legacy Transformation Planning Applications: Facilities and Their Legacy Transformation Planning Application (Ref. 2) as well as a number of related Slot-In validation Planning Conditions, as outlined in Section 1.3 below.

## 1.2 Report Objectives

As the focus of the CVRs is to discharge the relevant Planning Conditions associated with validation reporting on the Olympic Park, the CVRs are to be issued in stages to provide clarity and ensure progressive regulatory approval is achieved. The staged process is set out below and shall discharge the planning obligations as follows:

- **Stage 1** – *submitted separately via the Enabling Works CVR* - comprises Part I (Background) and Part II (Implementation of Design – Site Preparation (Enabling Works)). Part I sets out the completed remediation works within the context of the preceding remedial design. Part II discusses the implementation and validation works completed by the Enabling Works Team. The objective of this CVR (Stage 1) is to fully discharge the ODA's obligations under Condition SP.0.35 of the Olympic, Paralympic and Legacy Transformation Planning Applications: Site Preparation Planning Application (Ref. 3).
- **Stage 2** – *this document* - comprises Part III (Implementation of Design – Olympic Development (Follow-on Projects)). Part III presents the ODA completed construction and remediation works

as required to facilitate the development aspects of the works i.e. infrastructure, venues and landscaping. This CVR is submitted to discharge the ODA's obligation under Condition OD.0.36 of the Olympic, Paralympic and Legacy Transformation Planning Applications: Facilities and Their Legacy Transformation Planning Application (Ref. 2) and subsequent applicable Slot-In Planning Conditions for Permissions relating to construction variations.

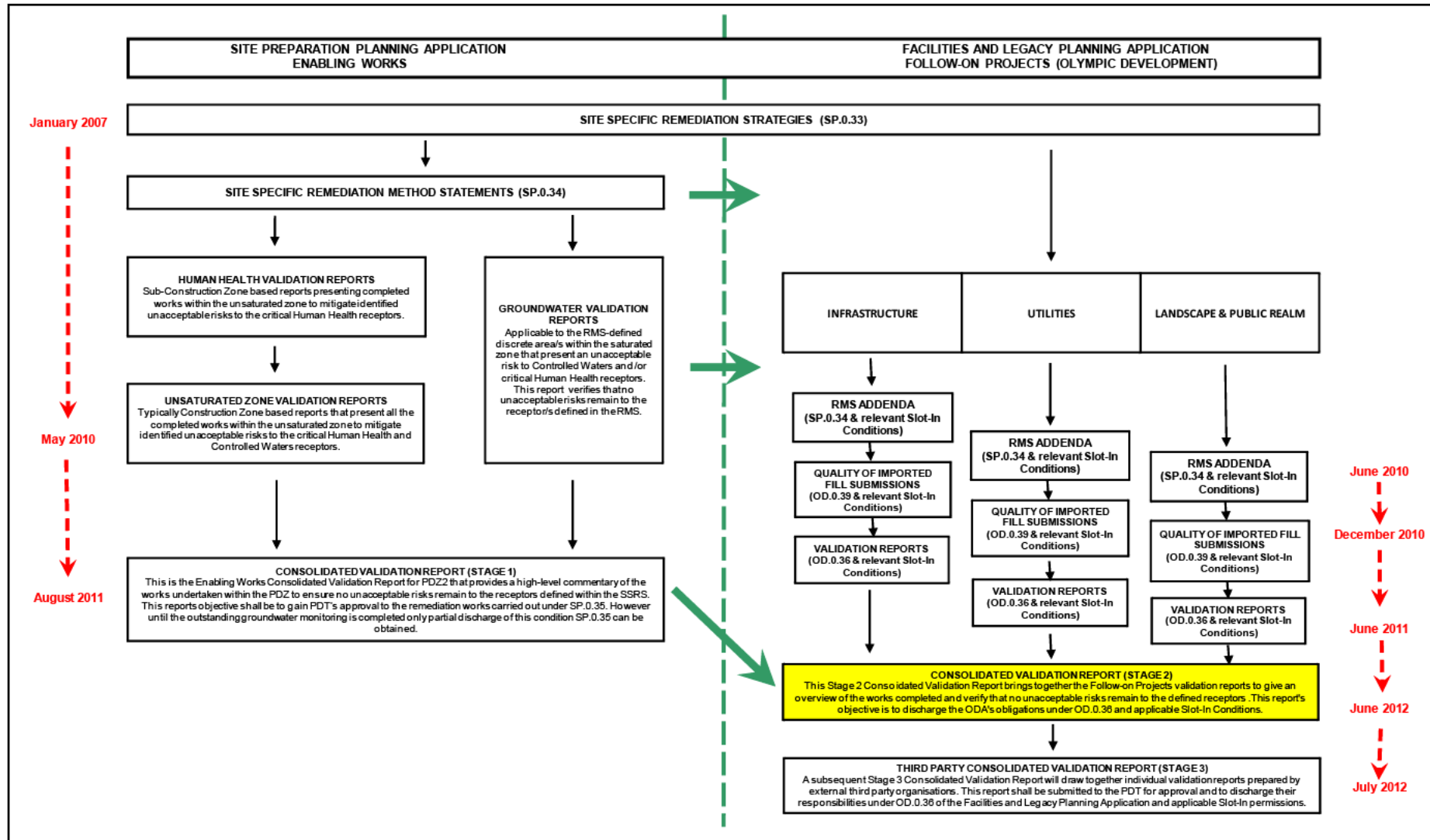
- **Stage 3** - may be required in instances where the Human Health Separation Layer (HHSL) and other overlay / completion works will be carried out by external third party organisations, most notably the London Organising Committee of the Olympic and Paralympic Games (LOCOG). In such circumstances, it will be the responsibility of these third parties to prepare, submit and obtain PDT approval of their works by way of separate validation reports. As a consequence of these separate validation reports, another CVR (Stage 3) will require submittal under Condition OD.0.36 of the Olympic, Paralympic and Legacy Transformation Planning Applications: Facilities and Legacy Transformation Planning Application (Ref. 2). If such a Stage 3 CVR is required this will be prepared and submitted by a third party organisation.

Based on the works completed within PDZ2, a Stage 3 CVR will be required to collate the LOCOG showcase sponsor and Games Overlay scope. This will be submitted separately from this ODA FoP Stage 2 CVR.

This Stage 2 CVR also provides a summary of the Enabling Works residual actions which have been closed out by the FoPs and those which remain to be addressed. Together with the Enabling Works (Stage 1) CVR and the Stage 3 CVR this report is intended to inform future developers / owners / operators at the site, including the London Legacy Development Corporation (LLDC), of the remediation and validation works completed. In addition, these reports will look to highlight any residual actions / issues which need to be considered as part of future development.

Future stages of CVR production will likely be required to capture post-Games Transformation and Legacy re-development works. The PDZ2 validation reporting sequence presenting the three stages of the Consolidated Validation Reporting process is presented in Table 1.1 below.

**Table 1.1: PDZ2 Validation Reporting Structure**



\* Please refer to Appendix B for a summary of each report and the development of the remedial design, implementation and validation

## 1.3 Relevant Planning Conditions

The reporting boundary for this PDZ2 (Stage 2) CVR is presented on the attached Figure 1.

This document is submitted to PDT for discharge of the Planning Condition OD.0.36 of the 2007 Olympic, Paralympic and Legacy Transformation Planning Applications: Facilities and Their Legacy Transformation Planning Application (No. 11/90313/VARODA) (Ref. 2), which states:

*'Validation of the Remediation Works for the purposes of human health protection must be provided within two months of completion of the Final Build Layer within any Construction Zone. When all works for the protection of human health are completed within each Planning Delivery Zone, a consolidated validation report, drawing together the Construction Zone validations, shall be submitted to the Local Planning Authority. This shall include topographic mapping of the final finished ground levels'.*

In addition, this document seeks to discharge the equivalent Planning Condition from a number of subsequent Slot-In Planning Applications relating to specific variations in the construction of certain infrastructure, buildings and landscaping from those set out in the original 2007 Application. These Conditions have similar wording to OD.0.36 above and are written so as to dovetail with this Condition. These Validation Slot-In Conditions are listed below, with Table 2.3 providing further details:

- Infrastructure (Bridge F06) – 08/90319/FULODA (FOD.28)
- Infrastructure (Loop Road) – 08/90194/FULODA (LOD.22)
- Infrastructure (Outer Perimeter Fence (OPF) – 08/90151/FULODA (Condition 26 & 27)
- Infrastructure (OPF River Sections) – 10/90298/FULODA (Condition 21)
- Infrastructure (OPF between Head Houses) – 09/90135/FULODA (Condition 22)
- Infrastructure (Underpass U03 / U07) – 09/90387/FUMODA (UOD.21)
- Landscape and Public Realm (LPR) (South Central Parklands) – 11/90317/VARODA (PPR.39 & PPR.40)
- Utilities (Deep Foul Sewer) – 08/90060/FULODA (Condition 21)
- Utilities (Transformers and ring main) – 09/90212/FULODA (Condition 20)
- Utilities (Utilities Corridor) – 08/90377/FULODA (Condition 16)
- Utilities (Multi-zonal below ground Utilities) – 12/90021/FULODA (Condition 12)

## 1.4 Site Location

PDZ2 is an 11.5 hectare triangular parcel of land located in the southern section of the Olympic Park (the South Park). It lies in an approximately north west to south east orientation and is wholly surrounded by the current Olympic Park Development with PDZ1 to the east and north, PDZs 3 & 4 to the west and PDZ8 to the south. The zone is delineated by City Mill River, which forms the western boundary, the River Lea adjacent to the northern boundary, the Waterworks



River forming the eastern boundary and the southern part of the site being bounded by railway lines. For construction purposes the site was split into two Construction Zones (CZs); CZ2a, which forms the larger area in the northern and western sections and CZ2b located in the eastern section. The internal boundary that divided CZ2a and CZ2b was a notional boundary that was not physically present on-site.

The site layout and location are presented on Figure 1.

For a summary of the wider site context / background of PDZ2, including the history, geology, hydrogeology, hydrology and site investigations completed, please refer to the Enabling Works (Stage 1) CVR (Ref. 1).

## 1.5 Olympic and Legacy End Use

The Olympic and Legacy end uses for PDZ2, as defined by the Designers, are as follows:

**Olympic Mode** (see Figure 2): The majority of PDZ2 will encompass a Concourse Area with soft and hard landscaping along the City Mill River and Waterworks River, whilst a spectator seating area will be present in the south eastern section of the site and the ArcelorMittal Orbit observation tower will be present in the western section of the site.

**Legacy Mode** (see Figure 3): The majority of PDZ2 will comprise interspersed areas of soft landscaping and hard standing with an area to the south east being designated for mixed residential use and the ArcelorMittal Orbit remaining in the western section of the site.

The Legacy design within PDZ2 includes for hard / soft landscape open space areas, including the Olympic Gardens, in the northern section, and mixed residential development, in accordance with the Legacy Communities Scheme (LCS) (Planning Application 11/90621/OUTODA) in the southern section. The LCS application in PDZ2, to the south of Orbit, includes for predominantly residential use with some retail, leisure and community uses. Non-residential uses are to be integrated within the ground floors of mixed-use buildings on the northern end of the development, opposite the Orbit structure.

## 1.6 Outstanding / Excluded Works

At the time of writing this report, all remediation validation reports for PDZ2 were PDT approved. However, certain third party / non ODA works have been completed in PDZ2 which are not summarised herein. These include the temporary back of house, Showcase Sponsor and Common Domain overlay works, to facilitate running the Olympic Games, which have been completed by LOCOG. As discussed in Section 1.2 above it will be the responsibility of these third parties to prepare, submit and obtain PDT approval of their works by way of separate validation reports, which will be summarised within a separate Stage 3 CVR.

## 1.7 Report Limitations

This CVR is based on information received from FoPs, which is assumed to be accurate and complete.

This CVR does not present new information or re-evaluate any of the data previously assessed within the approved documents summarised herein. Neither does this document present

information from third parties working within the Planning Boundary, but whose works are outside of ODA's control or scope. Where appropriate, these works will be detailed within separate validation reports and summarised within a Stage 3 CVR.

This CVR should be read in light of the legislation, statutory requirements and/or industry good practice applicable at the time of the works being undertaken. Any subsequent changes in this legislation, guidance or design may necessitate the findings to be reassessed in the light of these circumstances.

## 2. Basis of Remedial Design and FoP Amendments

### 2.1 Background

The FoP works comprised construction of the principal infrastructure, including services / utilities, roads, bridges and support structures, the key permanent and temporary venues and the hard and soft landscaping for the London 2012 Games. This infrastructure was built on a platform constructed by the Enabling Works project whose remit comprised site clearance, demolition, earthworks and remediation works. The objective of the earthworks is to ensure the site has been remediated to a standard protective of both human health and controlled waters receptors as defined by the Olympic and Legacy Masterplans.

The remedial strategy for the Park was set out in a series of increasingly focused documents which commenced with a Global Remediation Strategy (GRS) (Ref. 4). The GRS was further developed by the Site Specific Remediation Strategies (SSRSs), which were informed by site investigation works completed in accordance with the Intrusive Investigation Method Statement (IIMS) (Ref. 5). The design documentation was further refined in a series of SSRS Addenda, to ensure the remedial works were reflective of the encountered ground conditions. These documents are all discussed in further detail within the Enabling Works (Stage 1) CVR (Ref. 1).

Within the SSRS and SSRS Addenda, a Conceptual Site Model (CSM) was developed for PDZ2, presenting potential sources, pathways and receptors. Individual contaminant concentrations protective of either controlled waters or human health, termed Site Specific Assessment Criteria (SSAC), were derived through the SSRS risk assessment process.

The PDZ2 CSM identified several human health critical receptors associated with the Olympic Park and Legacy end uses. In the context of the FoP works these human health receptors comprised adult athletes, workers, officials and visitors of all ages during the Olympic phase, and residents, workers / office staff and visitors in the Legacy phase. The key sources and pathways to these receptors included dermal contact / ingestion / inhalation of placed soils, especially within soft landscape areas and in residential garden space (likely communal) in the southern mixed residential development platform.

The two key controlled waters receptors were considered to be the City Mills River to the west of the site and the Waterworks River to the east (and to a lesser extent the River Lea to the north of the site). In addition perched water, a potential contamination source, was identified across the site above the Alluvium with shallow groundwater present within the River Terrace Deposits (RTD) and deeper groundwater in the Lambeth Group, the Thanet Sands Formation and the Upper Chalk. In the context of the site, the groundwater within the RTD and Lambeth Group are not considered to be sensitive receptors on the basis that they have little resource potential and rather constitute potential pathways for contamination migration. The Thanet Sands Minor Aquifer is in continuity with the Upper Chalk Major Aquifer which is considered the more sensitive receptor. The Upper Chalk is provided protection by a substantial thickness of low permeability soil in the upper overlying Lambeth Group which acts as an aquitard to downward contaminant migration. On this basis, the Upper Chalk Major Aquifer is not considered to be a sensitive receptor within PDZ2.

Following on from this, the Enabling Works Tier 1 Contractor (Nuttall) issued a series of Remediation Method Statements (RMSs), which detailed how the design would be implemented and subsequently validated to achieve planning discharge.

The risk assessment process identified significant risks to both human health and controlled waters receptors across PDZ2 that required excavation, treatment and / or further investigation / delineation. As a result of this remediation work limited residual actions were transferred to the FoPs and these are outlined further in Tables 3.1 and 4.1. All Enabling Works validation reports are summarised within the Enabling Works (Stage 1) CVR (Ref. 1) and the process is presented graphically within the flow chart in Table 1.1.

Changes to the Olympic and Legacy end use that have impacted the remediation aspects of the project were detailed and subsequently agreed with the PDT in the SSRS and RMS documents, with the principal design change within PDZ2 being the construction of the ArcelorMittal Orbit observation tower in the western section of the site. This structure is a relatively recent addition, with Planning Permission granted in June 2010 (Application No. 10/90250/FULODA) and is a permanent structure which will be operational through Games and Legacy.

## 2.2 FoP Design

Guidance to assist the FoPs with their remedial works and production of planning related documents was produced by the PDT (Ref. 6). This document provided a framework for the FoPs to follow when considering their remedial requirements, set out the anticipated contents of remedial planning submissions and included templates / tools to support the completion of these documents.

At completion of the Enabling Works phase of the programme all identified remedial hotspots within PDZ2 had been addressed through appropriate removal or risk assessment such that the FoPs were not required to complete hotspot remediation. A number of residual remedial issues were, however, identified by Enabling Works which required consideration / action by the FoPs and / or future parties working on the site as detailed in the Enabling Works (Stage 1) CVR (Ref. 1) and further discussed in Section 3.2 and Table 3.1.

In broad terms the FoP remedial design comprised completion of the remedial cover system, placement of compliant fill materials and validation of localised excavations to facilitate construction e.g. service corridors and foundation excavations. The remedial cover system comprised Human Health Separation Layer (HHSL) and Marker Layer, demarcating the 'clean' soil of the HHSL (see Sections 3.3 and 3.4) from the underlying general fill and / or *in-situ* soils. Further, where projects encountered *in-situ* soils there was a requirement for the FoPs to further assess what remediation and validation would be required to ensure the areas were suitable for Legacy use.

A summary of the design for the FoP works, comprising infrastructure, landscaping, utilities and venues, is provided within Table 1.2.

**Table 2.1 – Summary of FoP Design within PDZ2**

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Infrastructure (Lagan)	Bridge F06	'Z' shaped bridge connecting north of PDZ2 with south of PDZ4	Northern and southern abutments	General fill and rubber surface in the 'bowl area' between abutments, and extended bridge deck supported by scaffolding	<ul style="list-style-type: none"> <li>Continuous flight auger (CFA) piling</li> <li>Installation of vibro concrete columns (VCCs)</li> <li>Placement of reinforced earthworks, load transfer platform and general fill</li> <li>Construction of gabion baskets containing recycled crushed concrete to retain fill within 'bowl area'</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Bridge abutments: 450 to 600 mm below Final Finished Level (FFL) with no Marker Layer or HHSL (subsequently completed by LPR South)</li> <li>'Bowl area': temporary Marker Layer placed at a depth of 600 mm, with FFL (including permanent Marker Layer and HHSL) to be completed during Legacy / Transformation</li> </ul>
Infrastructure (Balfour Beatty)	Bridge F08	Connecting north of PDZ2 with eastern side of PDZ3	N/A	All areas	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Placement of reinforced earthworks, load transfer platform and general fill</li> </ul>	Complete: <ul style="list-style-type: none"> <li>Final elevation approximately 5.7 to 11.0 m AOD</li> <li>Bridge deck: FFL with no Marker Layer</li> </ul> To be completed by others: <ul style="list-style-type: none"> <li>Surrounding area: 400 to 500 mm below FFL with Marker Layer and partial HHSL (completed by LPR South)</li> </ul>

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Infrastructure (Nuttall SBH)	Bridge F09	Connecting north of PDZ1 and PDZ2	Northern section	Southern section	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Placement of fill materials</li> <li>Construction of gabion baskets containing recycled crushed concrete</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>All areas to FFL (completed by LPR South)</li> </ul>
Infrastructure (Balfour Beatty)	Bridge F10B	Connecting centre of PDZ1 and PDZ2	Northern section	Southern section	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Installation of steel tubular columns</li> <li>Installation of reinforced concrete abutment wall, infills and edge beams</li> <li>Placement of reinforced earthworks</li> <li>Cladding of reinforced earthworks and abutment wall with gabion baskets containing recycled crushed concrete</li> <li>Construction of road surface on bridge approach</li> </ul>	Complete: <ul style="list-style-type: none"> <li>Final elevation approximately 4.5 to 10.8 m AOD</li> <li>Bridge approach: FFL incorporating Marker Layer and HHSL</li> </ul> To be completed by others: <ul style="list-style-type: none"> <li>Surrounding area: 450 to 600 mm below FFL with no Marker Layer or HHSL (completed by LPR South)</li> </ul>
Infrastructure (Balfour Beatty)	Bridge F11	Connecting centre of PDZ2 and PDZ3	Northern section	Southern section	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Installation of VCCs</li> <li>Placement of reinforced earthworks</li> <li>Cladding of reinforced earthworks with gabion baskets containing recycled crushed concrete</li> </ul>	Complete: <ul style="list-style-type: none"> <li>Final elevation approximately 4.8 to 10.9 m AOD</li> <li>Bridge deck: FFL with no Marker Layer</li> </ul> To be completed by others: <ul style="list-style-type: none"> <li>Surrounding area: 400 to 500 mm below FFL with Marker Layer and partial HHSL (completed by LPR South)</li> </ul>

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Infrastructure (Balfour Beatty)	Bridge H04	Connecting centre of PDZ2 and PDZ3	Southern section	Northern section	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Installation of VCCs</li> <li>Placement of reinforced earthworks</li> <li>Cladding of reinforced earthworks with gabion baskets containing recycled crushed concrete</li> </ul>	<p>Complete:</p> <ul style="list-style-type: none"> <li>Final elevation approximately 5.6 to 11.3 m AOD</li> <li>Bridge deck: FFL with no Marker Layer</li> </ul> <p>To be completed by others:</p> <ul style="list-style-type: none"> <li>Surrounding area: 400 to 500 mm below FFL with Marker Layer and partial HHSL (completed by LPR South)</li> </ul>
Infrastructure (Nuttall SBH)	Bridge H05	Connecting south of PDZ1 and PDZ2	All areas	N/A	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Placement of fill materials</li> <li>Construction of gabion baskets containing recycled crushed concrete</li> </ul>	<p>To be completed by others:</p> <ul style="list-style-type: none"> <li>Landscaping areas: 500 mm below FFL with Marker Layer and partial HHSL (completed by LPR South)</li> <li>Approach ramp and area north of abutment: no Marker Layer or HHSL (completed by LPR South)</li> </ul>
Infrastructure (Nuttall SBH)	Bridge H06	Connecting south of PDZ2 and PDZ3	All areas	N/A	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Installation of VCCs</li> <li>Construction of retaining walls and placement of general fill</li> <li>Construction of gabion baskets containing recycled crushed concrete</li> </ul>	<p>To be completed by others:</p> <ul style="list-style-type: none"> <li>All areas to FFL (completed by LPR South)</li> </ul>

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Infrastructure (Nuttall SBH)	Bridge H07	Connecting south of PDZ1 and PDZ2	All areas	N/A	<ul style="list-style-type: none"> <li>CFA piling</li> <li>Installation of VCCs</li> <li>Construction of load transfer platform and retaining walls</li> <li>Construction of gabion baskets containing recycled crushed concrete</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>All areas to FFL (completed by LPR South)</li> </ul>
Infrastructure (Nuttall SBH)	Loop Road	Road connecting Bridges H06 and H07 in the south of PDZ2	All areas	N/A	<ul style="list-style-type: none"> <li>Installation of surface water drainage</li> <li>Construction of road surface</li> </ul>	Complete: <ul style="list-style-type: none"> <li>Final elevation approximately 9.0 to 10.6 m AOD</li> <li>Loop road: FFL with Marker Layer and HHSL</li> </ul> To be completed by others: <ul style="list-style-type: none"> <li>Road verges: below FFL (completed by Nuttall SBH)</li> </ul>
Infrastructure (Nuttall SBH)	Outer Perimeter Security Fence (and addendum)	Fence line around the perimeter of the Olympic Park (along the southern boundary of PDZ2)	N/A	All areas	<ul style="list-style-type: none"> <li>Installation of fence posts including augering and backfill with concrete</li> <li>Placement of 300 mm layer of gravel between and around the fence posts</li> </ul>	For completion post Games: <ul style="list-style-type: none"> <li>Marker Layer and / or HHSL to be placed (to be completed in Transformation / Legacy)</li> </ul>
Infrastructure (Nuttall SBH)	Surface Water Drainage Outfall S02-01	Outfall draining into the Waterworks River in the south east of PDZ2	All areas	N/A	<ul style="list-style-type: none"> <li>Construction of sheet-piled cofferdam</li> <li>Excavation of soils within cofferdam</li> <li>Construction of outfall within cofferdam and two manholes behind the outfall</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>All areas: no Marker Layer or HHSL (completed by LPR South)</li> </ul>



Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Infrastructure (Nuttall SBH)	Underpasses U03 and U07	Two underpasses passing beneath the railway line in the south east and south of PDZ2 respectively	All areas	N/A	<ul style="list-style-type: none"> <li>Excavation of pre-placed fill and dredging of City Mill River (U07)</li> <li>Removal of aspects of existing underpass structures</li> <li>Renovation of existing concrete piles</li> <li>Installation of new underpass structures</li> <li>Placement of fill material within river bed and behind concrete structures (U07)</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Final elevation 4.2 to 5.2 m AOD</li> <li>No Marker Layer or HHSL (completed by LPR South)</li> </ul>
Infrastructure (Barhale)	Under Track Crossing 5	Construction of a launch pit, reception pit and installation of 3 tunnels	All areas	N/A	<ul style="list-style-type: none"> <li>Sheet piling</li> <li>Excavation of reception pit</li> <li>Micro-tunnelling</li> <li>Chamber construction</li> <li>Backfilling</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Completion of HHSL (completed by Nuttall SBH)</li> <li>Hardstanding (completed by Nuttall SBH)</li> </ul>
Infrastructure (Nuttall SBH)	Soft landscaping and road verges	Earthworks comprising soft landscaping and Loop Road verges to FFL	All areas	N/A	<ul style="list-style-type: none"> <li>Re-profiling of the existing surface</li> <li>Backfilling behind bridge abutments and between retaining walls</li> <li>Installation of Marker Layer</li> <li>Placement of Limestone gravel and Topsoil/Asphalt</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Road verges to FFL (completed by Nuttall SBH)</li> </ul>

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
LPR South (Skanska)	Soft Landscaping	Eight soft landscaping areas: SL2-1 to SL2-4 in the west of PDZ2 and SL2-5 to SL2-8 in the east	All areas	N/A	<ul style="list-style-type: none"> <li>Placement of subsoil and topsoil</li> <li>Construction of gardens, footpaths and riverside towpaths</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>completion of soft landscape FFL in SL2-4 and SL2-8 pending integration with other FOP scope;</li> <li>completion of planting and seeding (including the re-seeding season prior to the Games); and</li> <li>completion of dressing at FFL, including placement of mulch</li> </ul> (All completed by LPR South)
LPR South (Skanska)	Hard Landscaping	Hard landscaping and services (including drainage, irrigation systems, lighting, public announcement and closed circuit television) across PDZ2	Various (including P3A, P6A and F5 pavement design types)	Various (including P2B and P3B pavement design types)	<ul style="list-style-type: none"> <li>Placement of fill and tarmac surface</li> <li>Excavation of trenches</li> <li>Installation of services</li> <li>Trench backfill</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Completion of hard landscape works within pavement type F5 areas at Bridges H04 and H05;</li> <li>Completion of P2B hard landscape areas at U03 (P2B pavement type south of Bridge H05 and west of the Logistics road);</li> <li>Completion of sub-base within P0A pavement design type area (back of house southern part of PDZ2);</li> <li>Completion of hard landscape and services near Bridge F06.</li> </ul> (All completed by LPR South)

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Utilities (Barhale)	Deep Foul Sewer	Primary Shaft P13 and Secondary Shaft S11 in the south west of PDZ2	All areas	N/A	<ul style="list-style-type: none"> <li>Installation of two boreholes</li> <li>Sinking shafts via caisson method</li> <li>Excavation of tunnel linking shafts</li> <li>Placement of fill material around shafts</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Ground surrounding shafts: 300 mm below FFL with Marker Layer and partial HHSL (completed by LPR South)</li> </ul>
Utilities (Cofely)	District Heating and Cooling Network (DHC)	Pipe work located along the centre of PDZ2, with a branch leading onto Bridge F09	Partial	Partial	<ul style="list-style-type: none"> <li>Trench excavation</li> <li>Installation of heating and cooling pipes</li> <li>Trench backfill</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Partial Marker Layer and HHSL (completed by LPR South)</li> </ul>
Utilities (McNicholas)	Multi Utilities	Utilities located along the loop road and along the centre of PDZ2, with branches leading onto Bridges F09 and H05 (including potable and non-potable water, electrical and telecommunications networks, and intermediate pressure gas)	All areas	N/A	<ul style="list-style-type: none"> <li>Trench excavation</li> <li>Installation of utilities</li> <li>Trench backfill</li> </ul>	To be completed by others: <ul style="list-style-type: none"> <li>Partial Marker Layer and HHSL (completed by LPR South)</li> </ul>
Utilities (Volker)	LOCOG Connectables	Excavation and installation of temporary utilities within sections in PDZ 2	N/A	All areas	<ul style="list-style-type: none"> <li>Excavation of battered trench</li> <li>Installation of potable and foul water connections</li> <li>Reinstatement of surface</li> </ul>	<ul style="list-style-type: none"> <li>Works were carried out in areas where FFL had been attained.</li> <li>Marker Layer was breached and reinstated</li> </ul>

Project / Contractor	Task	Description	Permanent	Temporary	Scope of Key Earthworks	Final Surface / Works to be Completed
Utilities (Murphys / UKPN)	Electrical installations	Installation of electricity cables in pre-installed ducts. The works were carried out as part of the LVU (Lea Valley Utilities) Concession works. LVU is the trading name of UK Power Networks Independent Network Operator (IDNO) on the Olympic Park	All areas	N/A	<ul style="list-style-type: none"> <li>Limited excavations at joint, substation &amp; link box locations for the low voltage and high voltage electricity supply.</li> </ul>	Complete: <ul style="list-style-type: none"> <li>Reinstatement to within 150 mm of the FFL (completed by LPR South and Nuttall SBH)</li> </ul>
Venues (Sir Robert McAlpine)	ArcelorMittal Orbit	Construction of the ArcelorMittal Orbit viewing tower.	All areas	N/A	<ul style="list-style-type: none"> <li>Excavation for foundations</li> <li>Placement of piling mat</li> <li>Installation of gas membrane</li> <li>Excavation, stockpiling and reuse of below Marker Layer material</li> </ul>	<ul style="list-style-type: none"> <li>All works were completed to FFL</li> <li>The hard standing acts as both Marker Layer and HHSL within the works footprint with previously installed Marker Layer / HHSL redundant.</li> </ul>

## 2.2.1 Addenda to the Enabling Works Remediation Method Statements

A number of addenda to the established Enabling Works South Park RMSs were completed and approved for works undertaken by the FoPs in PDZ2 (Refs. 7, 8, 9, 10, 11 and 12). These RMS addenda established the FoPs methodologies for undertaking their earthworks so as to complete the remedial strategy, whilst protecting / maintaining the existing Enabling Works remediation and detailing validation of their works. These documents were submitted to PDT to discharge the Planning Condition covering provision of RMS (SP.0.34) in addition to seeking discharge of related Slot-In Planning Conditions. The relevant FoP RMS addenda and Applications for PDZ2 are summarised in Table 2.2 below.

**Table 2.2 – RMS Addenda relevant to PDZ2**

Project / Contractor	Document Title and Reference	Planning Application and Status	Rationale
Venues (Sir Robert McAlpine)	The ArcelorMittal Orbit Full Planning Application: RMS (submitted alongside the ArcelorMittal Orbit Planning Statement, June 2010)	10/90250/FULODA: Approved	To address the scope of works for construction of the ArcelorMittal Orbit a variation from the Enabling Works RMS was proposed. This included omitting Marker Layer and reducing the human health separation layer under permanent hard standing within the Orbit planning boundary (see Section 2.2.2 below).
Infrastructure (Nuttall SBH)	Olympic Park Lot 2 (PDZ1, PDZ2, PDZ3, PDZ4, PDZ8) and Lot 5 (PDZ5 & PDZ6) RMS Addendum – Structures, Bridges and Highways (7040-SBH-SPK-W-REP-0027 & 7080-SBH-NPK-W-REP-0017)	08/90151/FULODA (Condition 25): Approved (10/90514/AODODA) 08/90194/FULODA (LOD.21): Approved (10/90579/AODODA) 10/90298/FULODA (Condition 20): Approved (10/90343/AODODA)	SBH Lot 2 works covered temporary and permanent bridges, the loop road and security fence. In their RMS a variations was proposed to reduce the thickness of the HHSL / shallow placement of Marker Layer under the permanent loop road (see Section 2.2.2 below).
LPR (Skanska)	Olympic Park Planning Delivery Zones 1, 2, 4 & 8: RMS Addendum – LPR South (7170-LPR-SPK-L-RMS-0001)	08/90311/FULODA (PPR.38): Approved (09/90031/AODODA, 10/90363/AODODA, 11/90022/AODODA, 11/90079/AODODA, 11/90084/AODODA, 10/90357/FULODA (WTOD.15): Submitted	To address LPR South works on the soft landscaping and main concourse (hard landscaping) variations were proposed to the standard remediation design. These included reducing the thickness of the HHSL / shallow placement of Marker Layer under the permanent

Project / Contractor	Document Title and Reference	Planning Application and Status	Rationale
			concourse (see Section 2.2.2 below) and omission of sub-grade validation testing on linear drainage trenches. This RMS document also discharged a number of pre-validation Slot-In Planning Conditions (refer to Section 2.2.6).
Infrastructure (Lagan)	Central Park Bridge F06. Addendum to: MST-ENL-CK-02a-OLP-SP1-E-0055 Rev.3 & MST- ENL-CK-04-OLP-XXX-E-0048 Ground Contamination Remediation Method Statements Construction Zones 2a and 4 (7075-SBH-F06-W-ADD-0001)	08/90319/FULODA (FOD.26): Approved (10/90491/AODODA, 11/90127/AODODA)	To address SBH Lot 6 works on Central Bridge F06 a variation was included reducing the thickness of the HHSL / shallow placement of Marker Layer under permanent hard standing (see Section 2.2.2 below). Further variations post Games were also identified including the removal of temporary fill in the eastern 'bowl' and subsequent completion of the remedial cover system as party of Legacy works.
Utilities (McNicholas)	Design Note for McNicholas Works in the Olympic Park, Planning Delivery Zones 1, 2, 3, 4, 5, 6, 7 and 8 (8526-UNN-ECW-U-MST-0070, 8514-UNN-UCW-U-MST-0001)	08/90377/FULODA (Condition 15): Approved (10/90523/AODODA) 09/90212/FULODA (Condition 19): Approved (11/90331/AODODA)	To address the multi-utilities scope of works. Variations included placement of Marker Layer and reduced HHSL by subsequent FoPs overlying the utilities works where permanent hard standing was to be installed. No sub-grade validation testing for the utility linear corridors was proposed.

Note: Refer to Appendix B for a summary of the key elements of the various RMS addenda.

## 2.2.2 Hard standing as a Substitute to the Separation Layer

Under a site wide RMS addendum completed by the Enabling Works remedial designers a framework was established for reducing the thickness of the HHSL under suitably robust hard standing (Ref. 13). The basic premise behind this design change was that hard standing would act as a suitable barrier to certain pollution pathways (namely ingestion, dermal contact and dust inhalation) and reduce the requirement for a full-thickness HHSL.

The framework document required individual projects to provide information of where this approach was being adopted and provide details with regards to the extent of the area and the transition from reduced to full-thickness separation.

For PDZ2 an RMS addendum to reduce the thickness of the HHSL was submitted by the LPR project for the areas of permanent concourse within the central section of PDZ2 including an area under and around the footprint of the ArcelorMittal Orbit. This submission (Ref. 14) was approved by PDT and then subsequently expanded and amended by the project (Ref. 15) to account for raising the Marker Layer immediately beneath the hard standing. In addition the approved Infrastructure RMS for Nuttall works adopted a similar approach for reducing the thickness of HHSL beneath the permanent PDZ2 loop road pavement (refer to the RMSs within Table 2.2 above).

### 2.2.3 Quality of Imported Fill Submissions

Under the 2007 Planning Permissions (OD.0.39 and SP.0.37) and a number of the subsequent Slot-In Permissions, a requirement existed for projects which intended to import unbound fill materials from off-Park to confirm suitability of the material for use on the project in advance of importation to demonstrate the material did not constitute a waste. A framework document, setting out the information required to satisfy the discharge of these 'Quality of Imported Fill' Planning Conditions was established by the Enabling Works Team and subsequently adopted by the FoPs (Ref. 16). Planning applications, in accordance with the framework, were submitted by a number of the FoPs and those applications submitted in relation to Slot-In conditions are summarised in Table 2.3, below.

A large proportion of the materials imported were supplied through the ODA's aggregate supplies concessionaire, Aggregate Industries, who worked alongside CLM Logistics to develop a further framework to encourage use of Waste Recycled Action Programme (WRAP) compliant recycled aggregates (Refs. 17 and 18).

### 2.2.4 Gabion Material

A site wide framework (Ref. 19) was approved by the PDT (Decision Notice: 10/90330/AODODA), which addressed the use of site derived gabion material in the FFL and established that no chemical testing of the material for human health or controlled waters verification purposes was required to be undertaken. This framework was based on the principle that the nature and placement of gabion material mitigates pathways to human health receptors. Regarding potential risks to controlled water receptors, the Environment Agency agreed that visual inspection of the material during hand placement was sufficient to ensure no fines or visual signs of contamination or deleterious material were apparent.

### 2.2.5 SSAC Amendments

Following derivation of the original SSAC for HHSL and general backfill materials for the individual zones / sub-zones across the Park, as provided in the remedial designer's SSRS documents, a number of amendments were subsequently discussed and agreed in consultation with PDT. These Olympic Park wide SSAC amendments included the following key documents:

- Site Wide RMS Addendum (Asbestos in the Sub-grade & General Fill). MST-ENL-CE-ZZZ-OLP-SP1-E-0159 Rev 05 (08/90083/AODODA, 08/90181/AODODA, 08/90216/AODODA, 08/90217/AODODA, 08/90218/AODODA, 08/90219/AODODA, 08/90220/AODODA, 08/90221/AODODA, 08/90222/AODODA 08/90223/AODODA, 08/90281/AODODA and 08/90326/AODODA). This document details the sampling strategy to be utilised when an asbestos value of >0.1% w/w is encountered within the HHSL or General Fill.

- Site Wide SSRS Addendum (Justification of deviation from the GRS in the derivation of SSAC). MEM-ATK-CM-ZZZ-OLP-ZZZ-0004 Rev 2 (09/90233/AODODA). This memorandum documents the changes Atkins applied in the derivation of SSAC from the methodology or data sources presented in the GRS along with justification for the changes.
- Proposed changes to the Human Health SSAC values for Lead, General Metals, and Polycyclic Aromatic Hydrocarbons (PAHs) in the Separation Layer, and to the SSAC values for General Fill. REP-ATK-CM-ZZZ-OLP-ZZZ-E-0004 (08/90265/AODODA). Revised SSAC were calculated for lead using the Provisional Tolerable Weekly Intake method for the Soft Landscaping Legacy end use, for general metals using a single Soil Ingestion Rate, and for PAHs assessing the potential contribution from each of the vapour inhalation pathways based on the Henry's Law Constant.
- Errata to Document entitled 'Proposed changes to the Human Health SSAC values for Lead, General Metals, and polycyclic aromatic hydrocarbons (PAHs) in the Separation Layer, and to the SSAC values for General Fill'. REP-ATK-CM-ZZZ-OLP-ZZZ-E-0004 (08/90265/AODODA). Atkins recalculated the inhalation Tolerable Daily Intake for lead; but the inhalation pathway was still not considered to be significant. The dermal pathway for lead was also calculated, resulting in a new SSAC for areas of soft landscaping not associated with commercial buildings. In addition, Atkins further justified the use of a fraction of organic carbon (FOC) of 0.01.

## 2.2.6 Pre-validation Remediation Slot-In Conditions

A number of the FoP works were subject to Slot-In Planning Permissions, which generally related to structural design changes rather than changes to remediation, and retained the key remediation Conditions from the 2007 Permissions as follows:

- Landscape and Planting Details (OD.0.28) – FoPs required to submit details of the means by which installed remediation measures would be safeguarded during landscaping works.
- Foundation Details (OD.0.26) – FoPs required to demonstrate the means by which existing remediation measures would be safeguarded during foundation construction works, along with any measures to prevent ingress of gaseous contaminants into that building or the contamination of controlled waters.
- IIMS, SSRS, RMS (SP.0.32, SP.0.33 and SP.0.34) – FoPs required to consider the suitability of the prevailing IIMS, SSRSs and RMSs for the area of their works and to provide details of any changes to these strategies or demonstrate how these strategies still applied.
- Quality of Imported Fill (OD.0.39) – FoPs required to confirm suitability of imported material for use on the project (see Section 2.2.3 above).

Table 2.2 above provides details of the RMS Slot-In Conditions discharged by the FoPs in PDZ2 and a summary of the discharge of the remaining remediation Slot-In Conditions is provided in Table 2.3 below.



**Table 2.3 – ODA Remediation Slot-In Conditions relevant to PDZ2**

Slot-in Application and Responsible Party	Pre-validation Slot-In Conditions							Validation
	Landscape Details	Foundation Details	IIMS	SSRS	RMS	Grouped IIMS, SSRS, RMS	Quality of Imported Fill	
Infrastructure: Bridge F06 08/90319/FULODA (Lagan)	N/A	N/A	FOD.24 Approved: 11/90127/AODODA	FOD.25 Approved: 11/90127/AODODA	FOD.26 Approved: 10/90491/AODODA 11/90127/AODODA	N/A	FOD.31 Approved: 11/90127/AODODA	FOD.28 Approved: 11/90127/AODODA
Infrastructure: Loop Road 08/90194/FULODA (Nuttall)	N/A	LOD.39 (N/A)	LOD.18 (discharged under LOD.21)	LOD.19 (discharged under LOD.21)	LOD.20 (discharged under LOD.21)	LOD.21 Approved: 10/90579/AODODA	LOD.24 Approved: 10/90579/AODODA	LOD.22 Approved: 10/90394/AODODA
Infrastructure: OPF 08/90151/FULODA (Nuttall)	N/A	N/A	Condition 23 Approved: 10/90514/AODODA	Condition 24 Approved: 10/90514/AODODA	Condition 25 Approved: 10/90514/AODODA	N/A	Condition 28 (N/A)	Condition 26 Approved: 10/90514/AODODA
Infrastructure: OPF River Sections 10/90298/FULODA (Nuttall)	N/A	N/A	Condition 17 (discharged under Condition 20)	Condition 18 (discharged under Condition 20)	Condition 19 (discharged under Condition 20)	Condition 20 Approved: 10/90514/AODODA	Condition 23 Approved: 10/90343/AODODA	Condition 21 Approved: 10/90514/AODODA
Infrastructure: OPF between Headhouses 09/90135/FULODA (Nuttall)	N/A	N/A	Condition 18 (discharged under Condition 20)	Condition 19 (discharged under Condition 20)	Condition 20 (discharged under Condition 20)	Condition 21 Approved: 10/90343/AODODA via SP.0.34	Condition 24 Approved: 10/90343/AODODA via OD.0.39	Condition 22 Approved: 12/90215/AODODA
Infrastructure: Underpasses U03 & U07 09/90387/FUMODA (Nuttall)	N/A	N/A	None	None	None	None	UOD.24 Approved: 10/90579/AODODA	UOD.21 Approved: 12/90043/AODODA
LPR: South Central Parklands 08/90311/FULODA 11/90317/VARODA (Skanska)	PPR.20	PPR.25 (N/A)	PPR.36 Approved: 11/90079/AODODA	PPR.37 Approved: 09/90014/AODODA 11/90079/AODODA	PPR.38 Approved: 09/90031/AODODA 10/90363/AODODA 11/90022/AODODA 11/90079/AODODA	N/A	PPR.43 Approved: 11/90351/AODODA	PPR.39 & PPR.40 Approved: 11/90659/AODODA
LPR: Wind turbines on lighting masts 10/90357/FULODA (Skanska)	N/A	WTOD.15 Approved: 11/90084/AODODA 11/90123/AODODA	N/A	N/A	N/A	WTOD.15 Approved: 11/90084/AODODA	WTOD.23 Approved: 11/90353/AODODA	None

Slot-in Application and Responsible Party	Pre-validation Slot-In Conditions							Validation
	Landscape Details	Foundation Details	IIMS	SSRS	RMS	Grouped IIMS, SSRS, RMS	Quality of Imported Fill	
Utilities: Deep Foul Sewer 08/90060/FULODA (Barhale)	N/A	N/A	Condition 17 (discharged under Condition 20)	Condition 18 (discharged under Condition 20)	Condition 19 (discharged under Condition 20)	Condition 20 Approved: 10/90137/AODODA	Condition 23 Approved: 10/90137/AODODA	Condition 21 Approved: 10/90137/AODODA
Utilities: Transformers and ring main 09/90212/FULODA (McNicholas)	N/A	N/A	None	None	None	Condition 19 Approved: 10/90523/AODODA	Condition 22 Approved: 11/90004/AODODA	Condition 20 Approved: 11/90331/AODODA
Utilities: Utilities Corridor 08/90377/FULODA (McNicholas)	N/A	Condition 19 (N/A)	Condition 12 (discharged under Condition 15)	Condition 13 (discharged under Condition 15)	Condition 14 (discharged under Condition 15)	Condition 15 Approved: 10/90523/AODODA	Condition 18 Approved: 11/90004/AODODA 11/90015/AODODA	Condition 16 Approved: 11/90198/AODODA
Utilities: Multi-zonal below ground Utilities 12/90021/FULODA (Logistics)	N/A	N/A	None	None	None	None	Condition 14 <i>Pending approval</i>	Condition 12 <i>Pending approval</i>

## 3. Implementation of Design – Follow-on Projects

### 3.1 Summary of Works Completed

PDZ2 forms the section of the site which links the Stadium island in PDZ3 and the Aquatics Centre in PDZ1 during Games time (Figure 2). During Legacy PDZ2 will comprise a predominantly hard landscaping area in the central section with soft landscaping to the east and west (refer to Figure 3). In addition the ArcelorMittal Orbit is located in the western central section of PDZ2 which remains in Legacy to provide a viewing platform across eastern London.

The following sections summarise the key construction earthworks completed by the FoPs within PDZ2 and further details from each FoP validation report are provided within Appendix B, including which Enabling Works residual actions were addressed (see also Section 3.2 below). Details of the FoP works, including sub-grade excavations, extent and the elevation of Marker Layer and HHSL and the final topography are included in Figures 5 to 8, respectively.

#### 3.1.1 Infrastructure

##### 3.1.1.1 Loop Road

The Loop Road was constructed by Nuttall along the south eastern edge of PDZ2 and includes the spectator drop off area which lies adjacent and parallel to the north of the road (Refs. 9 and 20). Bridge H06 is located at the western extent of the road and Bridge H07 is located at the eastern extent of the road. Surface water drainage was installed beneath the road and the Marker Layer was installed beneath the sub-base, with the tarmac hard cover providing an effective substitute for HHSL in terms of addressing the risks to site occupiers from dermal contact and indigestion. The Loop Road was completed to FFL, but the road verges were terminated below FFL and completed as part of a subsequent package of works by the Infrastructure Project (see Sections 3.3 and 3.4, and Figures 6 and 7). A typical section of the loop road works can be seen in Figure 11.

##### 3.1.1.2 Bridges – F06, F08, F09, F10A/B, F11, H04, H05, H06, H07

A total of nine new bridge structures were constructed within PDZ2 to provide the connections required during Games time and Legacy. Bridges F09, H05, H06 and H07 were constructed by Nuttall (Refs. 9, 21, 22, 23 and 24); Bridges F08, F10B, F11 and H04 were constructed by Balfour Beatty (Refs. 25 and 26); and Bridge F06 was constructed by Lagan (Refs. 10 and 27). Bridges F06, F09, F10B, F11 and H04 include a temporary element, which will be used during Games mode and then removed during the Legacy transformation to leave a smaller permanent structure. Bridge F08 is an entirely temporary structure which will be removed post Games (see Table 2.1 above). Construction of the bridge abutments comprised: excavation to create piling / crane platforms, CFA piling, installation of VCCs, construction of retaining walls and reinforced earthworks, ground re-profiling, and backfilling. Certain areas of the bridge abutments were completed to FFL, including Marker Layer and HHSL; however the remaining areas were terminated below FFL (see Sections 3.3 and 3.4, and Figures 6 and 7). No Marker Layer or HHSL were installed during

construction of Bridge F06, in variation to the Lagan RMS and as agreed with the PDT through validation approval 11/90111/AODODA. These elements were to be completed by LPR for the permanent section of the bridge and by future FoPs during Legacy transformation of the temporary section of the bridge.

### 3.1.1.3 Drainage and outfalls

Nuttall constructed surface water drainage beneath the Loop Road. The drainage connects to Outfall S02-01 which drains into the Waterworks River in the south eastern corner of PDZ2, just to the north of Bridge H07 (Ref. 28). The outfall was constructed within a sheet-piled cofferdam which ties into the concrete river wall. Soils within the cofferdam were excavated to the top of the RTD; however, this has been demonstrated not to represent a new contamination pathway into groundwater because the cofferdam remains *in-situ* around the outfall and the mass concrete placed within the structure provides an impermeable replacement to the removed Alluvium. Two manholes were constructed to access the drainage pipe behind the outfall. No Marker Layer or HHSL was placed during construction of the outfall and none of the site was completed to FFL (see Sections 3.3 and 3.4, and Figures 6 and 7) as a part of this work package. These areas were subsequently completed by LPR South.

### 3.1.1.4 Olympic Park Perimeter Fence Line

Nuttall constructed a fence around the perimeter of the Olympic Park as part of the SBH Lot 2 contract (Ref. 29). The Olympic Park Perimeter Fence (OPF) is approximately 4.8 m high, with fence posts installed at 25.7 m intervals. Localised augering was required and the fence posts were secured with concrete. Placement of fill material was limited to a 300 mm thick layer of imported granite gravel between and around the fence posts. Marker Layer and HHSL were not required to be placed along the OPF due to the limited extent of excavations and the established easements and boundary agreements. The OPF will be removed during Legacy transformation, and any necessary remediation (including placement of Marker Layer and HHSL) and validation will be completed at this point by subsequent Transformation Contractors (refer to Table 4.1).

### 3.1.1.5 Addendum Olympic Park Perimeter Fence Line

The OPF comprises a “358 mesh” system manufactured by Zaun Ltd to meet the Olympic Perimeter Fence Specification (Ref. 30). The fence extends approximately 4.8 m above ground level and was typically installed at the existing ground level handed over by Enabling Works. No Marker Layer or human health separation layer was placed by Enabling Works along the path of the OPF as these areas were unremediated due to third party stand-off areas and exclusion zones. The installation of the OPF line required localised auguring of the existing ground at a diameter of 600 – 700mm to an approximate depth of 900 mm. The fence posts were installed into these localised excavations and backfilled with concrete at 25.7 m intervals. As above, completion of the remedial scope in these areas will be required once the OPF is removed as part of Legacy / Transformation.

### 3.1.1.6 Underpasses U03 and U07

The U03 Underpass passes beneath Bridge H07 and the National Rail Great Eastern Line in the south east of PDZ2, and the U07 Underpass passes beneath Bridge H06 and the National Rail Great Eastern Line in the south of PDZ2 (Ref. 31). At U03 the works involved removal of existing underpass decking and modifications to the existing concrete piles, with

no removal or placement of fill material. At U07 the works involved replacement and expansion of the existing underpass, and dredging of river sediment and replacement with geotechnically compliant material. Since the works involved the construction of bridge decks suspended over rivers, there was no requirement to install Marker Layer or HHSL. A typical section of U07 can be seen in Figure 11.

### **3.1.1.7 Soft Landscaping and Road Verges**

This work included earthworks comprising soft landscaping between the Loop Road and Olympic Park Perimeter Fence, known as 'White Areas' 32 and 33, to bring to FFL and earthworks in sections of the Loop Road verges to FFL. Nuttall (Ref. 32) undertook minor shaping and re-profiling works of the existing surface before installing a Marker Layer and placing up to a 450 mm thick layer of Type 1 Limestone gravel (imported from Yeoman Aggregates) and an overlying 150 mm thick layer of Class 5B/2 (topsoil). Within the Loop Road verges, Class 6N, 6P2 and 6I fill materials (imported from Yeoman Aggregates) were placed behind bridge abutments and between retaining walls in order to construct the approach ramps. Nuttall SBH recorded two minor controlled waters exceedances for copper and zinc within the Class 5B/2 topsoil placed in White Area 32 and 33 but subsequently discounted any associated controlled waters risk due to the small volume placed, conservatism within the assessment model and the fact that the soil total results were not elevated. The report concluded that no unacceptable risk remained and no further action was required.

For the H06 and H07 approach ramp verges Nuttall placed an approximate 800 mm thick layer of Type 1 Limestone gravel (imported from Yeoman Aggregates) over the Class 6N, 6P2 and 6I materials followed by a 180 mm thick layer of asphalt. A Marker Layer was installed by Nuttall SBH between the Type 1 and the asphalt.

### **3.1.1.8 Under Track Crossing 5**

Under Track Crossing (UTX) 5 works were completed by Balfour Beatty (Ref. 33). Metal sheet piles were driven to create the reception pit for the under track crossing in the southern section of PDZ2. On completion of the piling operations, the pre-driven sheeted pit was excavated to the required depth and arisings removed to the Soil Hospital in accordance with the Soil Hospital protocol. Once the required depth was reached, a concrete slab was poured, sealing the bottom of the excavation against the pre-driven sheet piles. The purpose of the reception pit was to receive the guided auger boring machine used for the construction of concrete pipe micro-tunnels under the railway network. Telecommunication and heating and cooling services have since been installed by others through the micro-tunnels prior to backfill.

## **3.1.2 Landscape and Public Realm**

### **3.1.2.1 Soft landscaping**

The LPR soft landscaping comprised works within four areas along the west of PDZ2 and four areas along the east of PDZ2 (known as the London 2012 Gardens) (Refs. 12 and 34). The four areas within the East garden are titled Asia, Southern Hemisphere, North America and Europe. Works comprised excavation of some general fill from below the EWFL and placement of soft landscaping materials. The Marker Layer was placed at a depth of 800 mm below Final Finished Level (FFL) in soft landscape areas and 370 mm below FFL in footpath areas under a PDT approved variation to the HHSL thickness (see

Section 2.2.2). All areas were finished to FFL. A typical section of the soft landscaping works can be seen in Figure 11.

### **3.1.2.2 Hard landscaping (main concourse)**

The works carried out by Skanska (Ref. 35) in PDZ2, comprised construction of hard landscaping (main concourse) and services (including drainage, irrigation systems, lighting and Closed Circuit Television (CCTV) in the ArcelorMittal Orbit (Orbit) area of Planning Delivery Zone (PDZ) 2, within Construction Zone (CZ) 2a. The permanent main concourse (P3A and F5 design type hard landscape) areas are features to be used both during Olympic Games and Legacy. The temporary main concourse (P3b, P6A and P2B design type hard landscape) areas are temporary features to be used as hard landscape areas during the Olympic Games only. The northern and central sections of the main concourse will generally be retained as hard landscape areas in Legacy; insular sections of the temporary concourse will be removed in Legacy and transformed into soft landscape areas with additional tree planting. The Legacy end use for the southern third of the temporary main concourse area is as a future development platform. A typical section of the hard landscaping works can be seen in Figure 11.

### **3.1.2.3 Main concourse addendum**

LPR hard landscaping addendum works comprised construction of pavements (temporary and permanent), and installation of services including drainage, irrigation, lighting, public announcement and closed circuit television (Refs. 12 and 36) in the Arcelor MittalOrbit area and southern section of PDZ2. Works involved placement of fill and tarmac surfaces, trench excavation, installation of services and trench backfill. All areas were finished to FFL and included placement of Marker Layer and full thickness HHSL. Within the footprint of the Orbit, subsequent works by Sir Robert McAlpine, in accordance with their established Orbit RMS, made the Skanska LPR South Marker Layer and HHSL redundant (see Section 3.1.4 below). The permanent hard standing placed by the Orbit project was deemed to provide a suitable substitute.

A single exceedance of the residential human health SSAC was recorded for lead in sample PDZ2/THL/W/15 within the placed HHSL in the southern section of PDZ2. This was subsequently removed by the project and the remaining materials suitable validated.

## **3.1.3 Utilities**

### **3.1.3.1 Deep foul sewer**

A new gravity driven deep foul sewer was constructed by Barhale throughout the Olympic Park, consisting of primary and secondary shafts and linking tunnels, gravitating towards a new pumping station constructed within CZ3b. The system discharges into the Thames Water Northern Outfall Sewer located within the Greenway and has been designed to operate in a variety of conditions including dry weather, and Olympic and Legacy modes. Primary Foul Drainage Shaft P13 and Secondary Foul Drainage Shaft S11 were constructed within PDZ2 (Ref. 37). The works included construction of a tunnel linking the shafts and drilling of two boreholes in order to gather groundwater elevation data to assist construction. Marker Layer and 500 mm HHSL was placed around the shafts, with the HHSL being terminated 300 mm below FFL for completion by LPR South (see Sections 3.3 and 3.4, and Figures 6 and 7).

### 3.1.3.2 District Heating and Cooling Network

The District Heating and Cooling Network (DHC) (Ref. 38) runs along the centre of PDZ2 in an approximately north-south alignment, with a branch leading onto Bridge F09 in the north. Cofely are the Principal Contractor for the DHC; however McNicholas were instructed to construct the civil earthworks components (excavation and backfilling only) of the DHC on behalf of Cofely in March 2010, and completed the section from Bridge H05 northwards (Ref. 39). The earthworks associated with the DHC were completed below FFL for completion by others, predominantly LPR South.

### 3.1.3.3 Multi-utilities

McNicholas installed the following utilities throughout PDZ2: potable water, non-potable water, intermediate pressure gas, electricity, telecommunications, surface water and duct crossings, electrical junction boxes and communication boxes (Refs. 11 and 39). The utilities were installed along the Loop Road and in a north-south alignment along the centre of PDZ2, with branches crossing Bridges F09 and H05. A service corridor lined with Marker Layer and filled with HHSL was constructed within PDZ2 during Enabling Works, and the utilities were partially installed within this corridor. The works comprised trench excavation, utility installation and backfill, and McNicholas placed Marker Layer and HHSL where necessary. However, none of the site was completed to FFL and in many cases this Marker Layer was superseded by Marker Layer placed by subsequent FoPs (see Sections 3.3 and 3.4, and Figures 6 and 7). The works included two variations to the McNicholas RMS: use of ex-situ data to validate Soil Hospital material, and use of pre-existing Enabling Works validation data and site investigation data to validate as dug materials from *in-situ* soils. In the latter instance this issue was recorded as a residual action requiring consideration by future land owners and developers when undertaking maintenance of the multi utilities corridor in PDZ2 (for further details refer to Item 11 in Table 4.1 below).

### 3.1.3.4 LOCOG readily connectibles

Works undertaken by Volker to install the LOCOG required underground utilities associated within PDZ 2 were reported in the Site Wide Validation Report for the LOCOG Readily Connectibles and LV Blakey Panels. Potable water excavations were carried out at various locations Park-wide. The excavations comprised a standard stepped trench battered down to a typical depth of 1.2 m bgl. In instances where Marker Layer was breached, this was reinstated to a typical overlapping detail at all locations. Works were not completed to FFL by Volker but were subsequently completed by LPR and the LOCOG Common Domain contractor (ISG). The works to complete to FFL by ISG are not captured herein but form part of the Stage 3 CVR reporting.

### 3.1.3.5 Lea Valley Utilities (LVU)

J Murphy and Sons Ltd (Murphys) on behalf of Lea Valley Utilities (LVU) completed the electrical network which included site-wide excavations at joint, substation & link boxes to install cabling (Ref. 40). These excavations were limited in extent and depth to an average of 2 m in length x 1 m width x 0.5 m deep to facilitate installation through existing validated materials. No LVU excavations extended beneath the Enabling sub-grade. In locations where the Marker Layer was penetrated both the excavated material above and below the Marker Layer was removed from site and disposed to a suitably licensed landfill.

The LVU works consisted of the installation 11,000v High Voltage network & a 415v Low Voltage network throughout the Olympic Park. This was installed in a provided duct system, installed by others. The High Voltage network was also constructed with purpose made Salmore pits, again constructed by others, at any location where cables left the main “spine” or where joints were located. This was different to the LV network, where joints and routes away from the spine were direct buried before re-entering the duct system. The LV network installation consisted of limited excavations, completed by Murphys, over the pre-installed third party duct banks to enable the installation of LV cables and connection to street furniture through its entirety at pre-determined locations.

### 3.1.4 Orbit

The ArcelorMittal Orbit consists of a continuous looping lattice of tubular steel standing 115m tall within the western section of PDZ2 close to Bridge H04 and will provide a viewing platform across the Park and east London (Ref. 7). Ground works for the structure began in November 2010 and comprised placement of a piling mat and installation of CFA piles in accordance with an approved method statement. The approved RMS for the project detailed that the proposed hard landscaping beneath and around the structure would act as a suitable substitute to the full HHSL and Marker Layer. This approach rendered the existing Marker Layer and HHSL, as previously installed by Skanska LPR South, redundant within the footprint of the structure. Ground gas protection within the enclosed spaces on site (the pavilion which is located directly below the structure and plant room compound) was installed as part of construction and subsequently validated.

## 3.2 Residual Actions from Enabling Works

Table 3.1 below presents the residual actions identified at the end of the Enabling Works stage of the project, as summarised within the Enabling Works (Stage 1) CVR for PDZ2 (Ref. 1) and summarises the works undertaken by the FoPs to address these actions, where relevant.



**Table 3.1 – Residual Remedial Actions from Enabling Works for PDZ2**

No	Title	Description	Responsibility	Action completed by FoP
1	Completion of shallow groundwater monitoring and assessment works associated with the Southern Plume	The Enabling Works Team is responsible for implementing and reporting upon the groundwater monitoring strategy associated with the 'Southern Plume'. This monitoring is scheduled for initial review towards the end of 2011. These results will be reported separately for approval by the PDT. An addendum to the PDZ2 Stage 1 CVR report incorporating this information shall be produced by Enabling Works.	Enabling Works	NA
2	Completion of groundwater monitoring for the Southern Plume	Southern Plume groundwater monitoring across the southern part of the Olympic Park shall continue for a period of approximately 12 months as soon as reasonably practicable post Games. The groundwater monitoring results and any associated additional remedial actions required by the Regulator/PDT approval to fully discharge condition 35 will be defined	Enabling Works (novated to the London Legacy Development Corporation)	N/A
3	Decommissioning of groundwater monitoring boreholes	Decommissioning of all boreholes at the site, with the exception of those identified for further monitoring associated with Item 1 above and those requiring monitoring by others (currently WSP Environmental under the direction of CLM) associated with the Global Groundwater Monitoring Strategy (GGMS). The GGMS boreholes to be retained are shown on drawings 2DD-ENL-CE-02a-OLP-SP1-E-0074 and 2DD-ENL-CE-02b-OLP-SP1-E-0075. Those responsible for these boreholes shall ensure appropriate decommissioning.	Enabling Works	NA
4	Potential removal of sub-grade with asbestos concentrations >0.1 w/w (wet-weight)	Asbestos concentrations in the sub-grade have been identified at >0.1% w/w. Confirmation has now been received from the OPLC that no further works are required in this respect as the pathway to human health receptors has been intercepted by the overlying general fill and / or HHSL.	N/A (this action was closed by Enabling Works, refer to the Stage 1 CVR)	NA

No	Title	Description	Responsibility	Action completed by FoP
5	Placement of Marker Layer and HHSL	FoPs are required to provide survey plans within two months of completion of the entire HHSL to demonstrate to the PDT an acceptable thickness of HHSL (minimum 600 mm thickness). These survey plans should also identify any areas where the Marker Layer is not laid. Reference should be to Figures 6, 7, 8 & 9 within the PDZ2 Stage 1 CVR, for the survey of HHSL, EWFL, extent of Marker Layer placed during Enabling Works and non-remediated areas.	FoPs	Details of the extent of Marker Layer and HHSL are presented in Figures 6 and 7.
6	Suitable infrastructure design	Structures should be designed recognising the chemical and other characteristics of the stratum in which they are founded. Sections in contact with potentially contaminated materials may need to be resistant to chemical attack, particularly by sulphates.	FoPs / future land owners and developers	FoP structures have been designed and constructed to take account of known ground conditions. This includes infrastructure, landscaping, utilities and venues. Example specification extracts, for a selection of projects, have been reproduced within Appendix E to demonstrate that this issue has been considered at design and construction stages.
7	Suitable methods to protect contamination pathways	Consideration of design and construction methods (for example, choice of suitable pile design and construction methods) to avoid creation of contamination pathways to lower aquifers.	FoPs / future land owners and developers	As detailed within Section 3.9 below, environmental risk assessments were produced by all FoPs carrying out piling works.  Section 3.9 also describes measures taken to ensure pathways were not created where FoP works involved penetration and / or removal of the Alluvium.  For assessment of risks associated with penetration and / or removal of the Alluvium within PDZ2 please refer to the Atkins Alluvium Technical Note (Ref. 41).

No	Title	Description	Responsibility	Action completed by FoP
8	Ground gas / vapour assessment	Assessment of soil gas and soil vapour hazard and appropriate design and construction.	FoPs / future land owners and developers	As detailed within Section 3.8 and Appendix B, a ground gas risk assessment was produced for the ArcelorMittal Orbit, due to the potential migration pathway to indoor air.  No other enclosed structures requiring ground gas / vapour assessment have been constructed by FoPs within PDZ2.
9	Protection of monitoring installations and facilities	Undertaking measures required to protect monitoring and groundwater remediation installations and facilities. Any damage to such installations or facilities is to be reported to the PTP Team (see Appendix D) as soon as practicable so that remedial works / decommissioning (as appropriate) can be undertaken.	FoPs / future land owners and developers	FoPs followed these guidelines during their works and ensured that access to monitoring locations and facilities was maintained. Further information is provided within the FoP validation reports, summarised within Appendix B.
10	Completion of unremediated areas	Should the areas retained be subject to alteration, then the FoP shall complete the full scope of necessary remediation works.	FoPs	As detailed within Section 3.10, LPR completed remediation within the following retained areas: TPB1, TPB2, TPB3 and TPB4 (See Figure 9 for location of these areas: details to be confirmed and the Retained Areas Risk Assessment Report (RARAR) Addendum (Ref. 42)).
11	Final validation report	The FoP shall produce and gain approval of final validation report on completion of construction to complete above remediation requirements, primarily the provision of the full HHSL.	FoPs	All FoP validation reports for PDZ2 are summarised within this Stage 2 CVR (in Section 3 and Appendix B).

No	Title	Description	Responsibility	Action completed by FoP
12	Excavation of soils at the Site	<p>The PTP Protocol (Appendix D) must be implemented for all below ground works. A review of available data relating to the condition of the soils at the Site should be undertaken prior to any excavation and appropriate precautions must be undertaken.</p> <p>The validation reports prepared by Enabling Works base their assessments on long-term risks to the end-user assuming the Legacy end use stated in the SSRS and do not consider risks to construction or maintenance workers. Any risks to workers can be safely mitigated through use of appropriate PPE and suitable engineering precautions. Reference should also be made to the Health &amp; Safety File.</p>	FoPs / future land owners and developers	<p>FoP compliance with the PTP Protocol is detailed within Section 3.6 below and within the individual validation reports summarised in Appendix B.</p> <p>As detailed within Section 3.16, FoP works incorporated appropriate health and safety measures for workers involved in the excavation of soils.</p>
13	Restrictions to remediation	<p>Restrictions to remediation exist in defined areas of PDZ2 as shown on Figure 9 within the PDZ2 Stage 1 CVR. If these areas are developed in the future, an assessment will be required to determine if remediation is required. In the meantime, any construction adjacent to the areas should consider available evidence from samples taken at the limits of the remediation works.</p>	FoPs / future land owners and developers	Please refer to Item 9 above.
14	Risk assessments	<p>In addition to risk assessments outlined above regarding excavation of soils at the Site, appropriate risk assessments would need to be undertaken with respect to unexploded ordnance (UXO), pathogens, asbestos, radiation and ground gas / vapours when undertaking excavations and / or construction activities at the Site.</p>	FoPs / future land owners and developers	<p>Sections 3.13, 3.14 and 3.16 describe the risk assessments undertaken by FoPs in relation to excavation of soils in PDZ2.</p> <p>For ground gas risk assessment, please refer to Item 7 above.</p>
15	Soil vapour	<p>Future land owners should be cognisant of the below ground concentrations of contaminants, particularly with respect to vapours in the vicinity of borehole NBHCZ2a-810 (e.g. creation of a migration pathway from piling). Should development be proposed over this area then a reassessment of the risks may be required.</p>	FoPs / future land owners and developers	<p>Borehole NBHCZ2a-810 was decommissioned prior to LPR constructing the main concourse (hard landscaping) over this location. This location is within the south western corner of PDZ2, on the edge of the Legacy development platform. Consideration will need to be given to future re-development in this area. Refer to Table 4.1.</p>

No	Title	Description	Responsibility	Action completed by FoP
16	Future land use	The areas designated for different land uses shall not be amended without reassessment of the soil conditions. The Site shall not be used for growing edible crops or for private gardens.	Future land owners and developers	N/A
17	Changes in final level	Any reduction of FFL will require a reassessment of the underlying soil and potentially additional investigation or remediation. The design levels used for the Enabling Works remediation assume that a minimum 600 mm thickness HHSL will be provided.	FoPs / future land owners and developers	Instances where FoPs have used permanent hard standing as a substitute to the HHSL are detailed within Section 2.2.2.  Further detail on the HHSL and FFL is provided within Section 3.1, Section 3.3 and Appendix B.

Note: Where residual actions require further consideration and / or need to be addressed as part of the next stages of the project (including Transformation / Legacy works) these have been taken forward and included in Table 4.1.

### 3.3 Human Health Separation Layer

The HHSL forms the upper section of the cover system across PDZ2 and is compliant with above Marker Layer SSAC, based on the known Legacy use and SSRS assumptions. Whilst the minimum thickness of the HHSL is 600 mm, this varies in accordance with the ground build up and agreed variations (see Sections 2.2.1 and 2.2.2 above).

Within PDZ2 the thickness of HHSL placed by the ODA Enabling and FoP contractors varies from 121 mm (in areas where hardstanding has been used as a substitute to HHSL) to 800 mm and includes the areas of the main concourse, loop road, footprint of the Orbit planning application and wider permanent pathways, where, in accordance with approved RMS addenda (see Table 2.1 above), permanent concourse acts as a substitute to the HHSL. In areas of soft landscaping, except for a small section between the loop road and southern boundary fence, a minimum of 600 mm thickness HHSL has been placed by the FoPs. The majority of the soft landscaping, comprising the London 2012 gardens, in the eastern and western sections of PDZ2, has a thickness of 800mm HHSL. The small area of soft landscaping, known as 'white area', adjacent to the loop road in the south eastern section which has less than the full 600mm HHSL is located behind the road crash barriers, is not readily accessible by the public and has been assessed separately as part of the update to the Retained Areas Risk Assessment report (see Section 3.10). Should the land-use within this area change in future the full remedial scope may need to be implemented (refer to items 2.10 and 2.13 of Table 4.1).

Figures 6 and 7 show the location of Marker Layer and location and thickness of separation layer placed by the FoPs, while Figure 7 also shows the locations within PDZ2 where hardstanding has been used as a substitute to HHSL. Figure 9 shows the 'retained' or unremediated areas within PDZ2 and those subject to FoP works.

A total of approximately 42,600 m<sup>3</sup> HHSL material has been placed as part of the FoP works in PDZ2, with 8,600 m<sup>3</sup> supplied by the Soil Hospital and 34,000 m<sup>3</sup> imported from outside the Olympic Park. The principal material types imported from off-Park comprised sub- and topsoil placed within the soft landscape areas, road verges, white areas etc, virgin Type 1 / 2, Class 6A, 6C, 6N and 6I material used for road construction and as engineered fill for structures, virgin and recycled gravels and sands for pipe bedding / utility surrounds and engineered light-weight fill again for structures. Re-used, site derived materials principally comprised fill from the Westfield development and the Power Line Underground (PLUG) works across the site, which was used as sub-base beneath hard standing and as sub-soil.

The HHSL material placed in PDZ2 has been validated *in-situ*, where required, by the FoPs on a testing frequency of at least one sample per 200 m<sup>3</sup> of placed material or an agreed variation to this frequency. Variations to this baseline frequency were recorded by the Balfour Beatty SBH project, where HHSL sampling and testing was undertaken on an average frequency of one per 300 m<sup>3</sup>.

One exceedance of the residential human health SSAC for lead was recorded within HHSL material placed by LPR South (Skanska) in the southern section of PDZ2, beneath the main concourse. This material was subsequently removed by LPR and the area re-validated to demonstrate compliance. In addition, two minor exceedances of the controlled waters SSAC, for copper and zinc, were recorded within topsoil placed in the extreme south of PDZ2 (in White Areas 32 and 33) but were subsequently demonstrated not to present an unacceptable risk. No exceedances of the applicable SSAC, as defined in the SSRS, have

been identified which require further works to be addressed by the Legacy users in PDZ2. As such no Figure 10, 'Exceedances requiring Action in Legacy Transformation', has been prepared for PDZ2.

## 3.4 Marker Layer

The Marker Layer, a brightly coloured (orange) terram or netlon geogrid forms an integral part of the Park's cover system and provides a visual demarcation between the HHSL (see Section 3.3) and underlying general fill or *in-situ* soils. For planning and remediation design purposes, no special health and safety precautionary measures or controls are required for those undertaking works within material above the Marker Layer. Material below the Marker Layer should be considered potentially contaminated and requires further health and safety consideration.

Variations in the placement of the Marker Layer have been agreed for a number of projects within PDZ2, as follows:

- LPR permanent concourse / hard standing areas - Marker Layer has been raised to the underside of the final surfacing (Marker Layer depth is approximately 121 mm below FFL). This includes the footprint / area of the ArcelorMittal Orbit where the hard pavement construction (also permanent) acts as both the HHSL and Marker Layer.
- The eastern bowl for Central Park Bridge F06 - a white membrane or Marker Layer substitute has been placed beneath temporary fill within the 'bowl' which is to be excavated post Games. The area is to be re-profiled and an orange Marker Layer replaced as part of transformation works.
- Multi-utilities corridors – certain of the utility corridor works have omitted Marker Layer or placed this at a shallower depth than the default 600 mm below FFL. Following subsequent FoP works, namely LPR, several sections of this omitted Marker Layer have been replaced.

The above variations have all been approved by PDT through either an RMS addendum or validation submission. Refer to Appendix B and Table 2.1 above for further details of these agreed variations and see Figure 6 for the extent of Marker Layer placement.

## 3.5 General Fill

General backfill was placed beneath the HHSL and Marker Layer during FoP deeper excavations in PDZ2 including as part of drainage installation, foundation works for bridge abutments and structures and to raise site elevations in accordance with the Legacy design e.g. beneath permanent hard standing.

A total of approximately 70,000 m<sup>3</sup> of general fill was placed during the FoP works, with approximately 45,500 m<sup>3</sup> supplied by the Soil Hospital and approximately 24,500 m<sup>3</sup> imported from outside the Olympic Park. Imported general fill principally comprised recycled (Waste Recycling Action Programme, WRAP compliant) demolition rubble, rail ballast and glass and recycled sand for pipe bedding / utility surrounds. Chemical testing of this placed material was generally undertaken on a frequency of one sample per 1,000 m<sup>3</sup> or agreed variation. In certain instances agreed in retrospect; however, *in situ* testing of Soil Hospital supplied general fill was not undertaken and works were validated through assessment of *ex situ* stockpile test data provided by Soil Hospital. Within PDZ2, this approach was adopted by the multi-utilities contractor McNicholas and Balfour Beatty's SBH

team where Soil Hospital data, based on an *ex-situ* sampling frequency of 1 per 500 m<sup>3</sup>, was utilised to demonstrate compliance. Assessment of these data has established that the FoP placed general fill material does not present an unacceptable risk to identified SSRS receptors.

In addition, certain projects re-used as-dug, existing, unremediated ground excavated from beneath the sub-grade and did not undertake validation of the replaced material. These projects included McNicholas multi-utilities and Skanska LPR South with a total estimated volume of as-dug re-used material of approximately 2,000 m<sup>3</sup> in PDZ2. Where this approach was adopted the projects sought retrospective PDT approval via presentation of either pre-construction site investigation data or adjacent Enabling sub-grade data to demonstrate compliance. See residual item 2.4 in Table 4.1 for details of actions / mitigation required for future maintenance workers in relation to the McNicholas multi-utilities corridors in PDZ2.

## 3.6 Safeguarding Remediation

On completion of the Enabling Works remediation, processes were put in place by the ODA to ensure the protection of the integrity of these works. The processes were collectively known as the 'Permit to Proceed' (PTP) system.

This system ensured the protection of remediation works and the maintenance of environmental protection measures during FoP excavation works. The PTP system was implemented across the Olympic Park and was fully adhered to by FoPs throughout the duration of the works. The procedure is described in full in the PTP Protocol (Appendix D).

Prior to the commencement of any ground excavation works, all the information required by the PTP team was provided on an ATK-084 'Protection of Remediation Works' *pro forma* completed by the FoPs and submitted to the PTP team for approval. The PTP team informed the FoPs of any remedial aspects they should be aware of during their works. On completion of the ground excavation works FoPs provided as-built details to the PTP team to demonstrate adequate protection of existing remediation works. This process was supported by monthly PTP Audits of the projects by the PTP team, which monitored materials management and protection of remediation works. Any non-compliances identified were informed to the CLM project management team and steps put in place to address the issues.

Slot-In Conditions relating to the safeguarding of remediation during foundation and landscape works are detailed within Table 2.3 above.

## 3.7 Soil Hospital Process

As part of the Olympic Park development, a facility known as the Soil Hospital was established and made available for use throughout the project. The procedure is detailed within the Soil Hospital protocol (Ref. 43). The Soil Hospital was introduced with a view to maximising the re-use of site derived earthworks materials within the Park, in accordance with the ethos of the Construction Code of Practice (Ref. 44). Soil Hospital provided a hub for processing / handling materials generated by ground works within the Park (both Enabling Works and FoPs) and included treatment facilities and related testing of produced materials to maximise re-use across the project.



Prior to any material movements to or from the Soil Hospital, information was provided by the FoP on an ATK-088 'Request from Follow-on Contractor' *pro forma* and submitted to the Soil Hospital team. The Soil Hospital maintained stockpiles of a range of recycled earthworks materials and collected chemical and geotechnical test data on these materials which was supplied to the FoPs for them to confirm acceptability based on the proposed area of placement. When FoPs needed to dispose of material, the Soil Hospital team provided a response detailing the arrangements for disposal of the material within the Park or agreement that the material could be disposed off-site (to landfill).

## 3.8 Gas / Vapour Protection Measures

Gas and vapour protection measures were driven by the design of certain structures / venues across the Olympic Park in the context of the known and established gas regime. Within PDZ2 the only identified structure which required a ground gas / vapour assessment was the ArcelorMittal Orbit. A ground gas risk assessment was presented in the SSRS addendum for the Orbit Structure due to the potential vapour migration pathway to indoor air. The recommendations and subsequently installed and validated measures comprised:

- a proprietary gas membrane to be installed below the slab of the plant room; and
- a monolithic, 1m thick, highly reinforced structural slab underlying the Pavilion designed to make potential gas ingress through the slab unlikely, therefore requiring no further protection measures.

As detailed in of Table 3.1 (Item 14), a residual action was raised in relation to vapours in the vicinity of borehole NBHCZ2a-810, making future land owners aware that reassessment of the risks may be required if development is proposed over this area.

## 3.9 Mitigation Measures for Contamination Migration

Residual Action 6 in Table 3.1 above states that FoPs must adopt suitable design and construction methods to avoid creation of preferential contaminant migration pathways to the lower aquifers.

Environmental risk assessments were produced by the FoPs carrying out piling works and subsequently approved by the regulators (the Environment Agency). These risk assessments are listed in Table 3.2 below.

**Table 3.2 – FoP Piling Environmental Risk Assessments**

Task	Document References
Bridge F06	REP-OAP-CG-ZZZ-FBR-F06-X-0002 (08/90319/FULODA) REP-OAP-CG-ZZZ-FBR-F06-X-0006 (08/90319/FULODA)
Bridge F08	C-108036-RA-817 (08/90332/REMODA)
Bridge F09	7040-SBH-F09-W-REP-006 (09/90131/REMODA)
Bridge F10B	Aquatics Centre Temp Footbridge F10 REP-OAP-CG-ZZZ-FBR-F10-0001 (08/90029/REMODA)
Bridge F11	C-108036-RA-816 REP-OAP-CG-ZZZ-FBR-F11-X-0001 (08/90332/REMODA)
Bridge H04	C-108036-RA-819 REP-OAP-CG-ZZZ-HBR-H04-X-0001 (08/90332/REMODA)
Bridge H05	7040-SBH-H05-W-REP-0004 (08/90309/REMODA & 08/90237/REMODA)
Bridge H06	REP-OAP-CG-ZZZ-HBR-H06-X-0006 (09/90072/REMODA)
Bridge H07	REP-OAP-CG-ZZZ-HBR-H07-X-0002 (08/90072/REMODA & 08/90195/REMODA)

In addition, one of the key SSRS assumptions for PDZ2 was that the cohesive Alluvium underlying the Made Ground across the site provides a barrier to the migration of overlying contamination to the RTD aquifer. Where works compromised or breached the Alluvium the remedial strategy called for consideration of replacement of cohesive fill or a suitable substitute to the Alluvium, for example, an impermeable membrane or other appropriate seal.

Construction of surface water drainage outfall S02-01 involved removal of the Alluvium, and Section 7 of the relevant validation report (Ref. 28) includes a description of the measures taken by Nuttall to ensure a pathway was not created. At the request of PDT a site wide assessment of penetrations of the Alluvium has been produced by the remediation designers, which considers the risks to the underlying RTD and how these have been mitigated. This document (Ref. 45) concludes:

- Alluvium is considered to be present as a continuous layer across the site with perched water present as a continuous body in CZ2b and in discontinuous pockets within CZ2a.
- Following discussions with the Environment Agency the shallow aquifer, comprised of the RTD, is considered to represent a potential source and or pathway of contamination, but not a receptor. The SSAC have been derived assuming the presence of an unsaturated pathway through the Alluvium. Parameters applied to the unsaturated zone are consistent with alluvial material. Therefore, the derived SSAC may not be conservative enough to prevent a significant risk to controlled waters assuming the confining Alluvium is penetrated and no mitigation measures are put in place.

- Only earthworks undertaken for the construction of surface water drainage outfall S02-01 and outfalls related to the installation of drainage in the Main Concourse area have been identified as penetrating the Alluvium. It is also considered that the construction and earthworks for the Primary Foul Drainage Shaft P13 and Secondary Foul Drainage Shaft S11 have penetrated the Alluvium, although this is not specifically highlighted within the relevant validation report.
- Where works have penetrated the Alluvium these works are not considered to present a significant risk to controlled waters, as mitigation measures have been put in place, either through placement of membrane or construction methods, to prevent the creation of a preferential pathway.

Where relevant, information has been submitted to the PDT and the Environment Agency with regards to safeguarding remediation and minimising potential contamination pathways in the context of the applicable foundation design condition(s). Where no such details have been submitted as part of remediation documentation, either the foundations are such that there is considered to be no unacceptable risk in terms of safeguarding remediation / creating potential contaminant pathways or no specific foundations have been proposed / constructed.

## 3.10 Non Remediated Areas

Works by the FoPs within areas defined as 'unremediated' i.e. those not subject to remediation during the Enabling Works phase of the project, within PDZ2, were limited to certain boundary areas of the Zone (retained areas) and instances of excavation beneath Enabling Works sub-grade (*in-situ* soils). These works were undertaken by the SBH Lot 2, utilities and LPR projects and have been reported separately. Refer to Figure 9 for the location of these areas.

A separate, revised and updated assessment of retained areas will be produced at the end of the programme to capture the works completed by the FoPs in these unremediated areas, forming an addendum to the existing Retained Areas Risk Assessment Report (Ref. 46). Where works in these areas have a potential to impact future works these are recorded in Table 4.1.

## 3.11 Sampling and Analytical Testing

In situ sampling and validation chemical testing, where undertaken by the FoPs, was in accordance with recognised UK industry guidance and Park-wide protocols. Analysis of samples was undertaken by UKAS accredited laboratories and soils were analysed using MCERTS accredited methods.

Test suites were designated by the individual FoPs to capture the relevant compounds listed within the zonal SSAC for HHSL and general backfill, as outlined within the SSRS for PDZ2.

## 3.12 Invasive Species

Invasive species treatment during the FoP works in PDZ2 has focussed on control / eradication of Japanese Knotweed identified in along the river banks, in the northern section

and pockets within the southern section of the zone. These works were initially undertaken by specialist contractors on behalf of Enabling Works and latterly managed by the LPR North project. Treatment of these Japanese Knotweed stands is ongoing and will likely extend into transformation and will be captured under separate reporting. All treatment was carried out in accordance with the Invasive Species Protocol (Ref. 47). Reference should be made to the Park Wide Invasive Species Treatment Report (Ref. 48), residual action 2.3 in Table 4.1 below and the invasive species drawing within Appendix E.

### 3.13 Unexploded Ordnance

A Park wide risk assessment of German air-dropped unexploded ordnance (UXO) was conducted by BAE Systems in advance of the project (Ref. 49). The objective of this document was to assess the potential to encounter UXO during the project, to evaluate implications of such an occurrence and to determine whether risk mitigation measures would be necessary. The assessment recommended that there was a moderate probability of German air-dropped UXO being encountered during the Project.

No UXO were recorded during the Enabling Works phase of the project. Based on this and the limited extent of the FoP works undertaken beneath the Enabling Works sub-grade, the risk associated with the FoPs encountering UXO was deemed to be low. No UXO have been encountered during the FoP works in the Zone.

### 3.14 Radiological Material / Unexpected Contamination

No instances of unexpected contamination, in accordance with the applicable Planning Condition definition, were recorded for ODA FoP works in PDZ2.

Details of the works completed during the Enabling Works phase, to assess and address potential radiological materials, are summarised in the Stage 1 CVR (Ref. 1). These works included construction of two temporary holding cells, within PDZ2, for storage of materials classified as 'Exempt'. This material was subsequently removed to licensed off-site facilities and the area subject to a clearance survey which demonstrated concentrations were comparable with background levels.

For the FoP works, the risk associated with encountering radiological materials was considered to be low, based on the extent of the earthworks, in relation to the works completed by Enabling. Based on this no further formal radiological assessment was undertaken by the FoPs for their works in PDZ2. It is further noted that where as-dug materials were re-used as general fill within PDZ2 or general fill was re-used from another zone with a known previous radiological land use, that these materials have been placed beneath a full thickness Human Health Separation Layer or hard standing substitute. The full thickness (minimum 600mm) of HHSL or hard standing substitute has been shown to provide an effective barrier to underlying materials thus breaking potential pathways to future human health receptors. Within PDZ2 the only areas identified as not having full thickness HHSL or an agreed hard standing substitute are the two small 'White Areas' in the south eastern section. These areas have been subject to placement of between 300 and 600mm of imported, virgin HHSL, were not subject to excavation, are currently located behind road crash barriers and are not readily accessible by the general public. Future access and use of these areas will need to be considered in terms of potential pathways to

underlying existing / unremediated ground and, as such, are identified within item 2.10 of Table 4.1 below.

## 3.15 Materials Management and the Waste Recovery Licence

Temporary stockpiling of materials was managed by all FoPs in accordance with the established Park wide guidance and included segregation of different types of material and, where required, sheeting and appropriate bunding of potentially contaminated material to reduce rainwater infiltration / run-off and the release of odours and dust. Stockpiles were located to be clear of waterways and public places where practical and were constructed so as to shed water.

On-site material tracking has been undertaken by the FoPs across the project. All material movements were subject to a ticketing process with a record of the source and destination of the load, its description, the time, date and vehicle identifier and signatures for representatives controlling the loading and unloading. The tickets were collated to provide daily and weekly summaries of materials moved. The information was then entered onto the ODA Smartwaste / M<sup>3</sup>n system to allow material movements and re-use to be reconciled.

A Waste Recovery Licence (Environmental Permit), held by the ODA for its scope of works, has been managed by the CLM Waste Recovery Manager and sets out requirements with regards to managing the recovery of materials from within the Park and limits importation of waste materials. Any variations to the original consent have been discussed and subsequently agreed with the Environment Agency. No breaches of the Waste Recovery permit have been recorded for the FoP works in PDZ2. Completion and approval of this Stage 2 CVR is intended to support surrender of the ODA's obligations under its Olympic Park Environmental Permit.

## 3.16 Health, Safety and Environment

FoP works were completed in accordance with Construction (Design and Management) (CDM) Regulations. Permit to work and permit to dig systems were in operation for the duration of FoP works. Staff wore suitable Personal Protective Equipment (PPE), with gloves, helmets, boots, eye protection and hi-visibility clothing required at all times as a minimum. All details regarding Health and Safety, environmental controls and monitoring are provided within the various FoP construction risk assessments and method statements.

Baseline environmental monitoring across the Olympic Park was undertaken and reported by Enabling Works. General environmental control measures that were in place during FoP works included the following, in accordance with the requirements of the Code of Construction Practice (Ref. 44):

- wheel washes at site entrances / exits;
- wetting of roadways to prevent dust generation;
- sheeting of loads;
- use of hard surfaces for heavily-used haul roads;
- control of vehicle speeds on site;

- readily available spill kits to deal promptly with any spillages;
- monitoring to confirm the absence of protected and invasive species; and
- tool box talks to brief workers on potential environmental issues.

## 3.17 Legacy Transformation Works

A number of structures completed for the Olympic mode within PDZ2 will be subject to works in transformation to facilitate the Legacy development. Final details of these works are not currently known; however it is known that certain bridge structures will be subject to decommissioning and removal of sections of deck and related abutments to reduce capacity for Legacy use. The bridges within PDZ2 which will be subject to these transformation works include F06, F09, F10A/B, F11 and H04. In addition, Bridge F08 is an entirely temporary structure and will be removed during transformation works.

It is noted that residual remedial works / protection of existing remediation, will be a requirement of transformation for these structures in addition to the wider transformation works (refer to Table 4.1 below).

## 4. Conclusions

The PDZ2 FoP Validation Reports conclude that the placed and validated soils do not pose an unacceptable risk to the SSRS defined critical controlled waters and human health receptors. On this basis this FoP (Stage 2) CVR seeks to discharge the ODA's obligations under Condition OD.0.36 of the Facilities and Their Legacy Transformation Planning Application and the Slot-In Validation Planning Conditions referenced in Section 1.3. Aside from the residual actions identified in Table 4.1 below, ODA has completed the SSRS remedial scope within PDZ2 and is not reliant upon works by LOCOG to demonstrate the design has been fully implemented. The final pre-Games site conditions, however, are subject to LOCOG works and details of these can be found in the LOCOG Stage 3 CVR.

Residual remedial actions for completion during future Transformation / Legacy works and / or restrictions to future development within PDZ2 are summarised in Table 4.1 below. The incoming Project Teams should be cognisant of these residual actions together with the underlying assumptions of the SSRS design.

### 4.1 Further Works - Residual List and Issues Affecting Future Development

Table 4.1 below records the works that have been transferred from the ODA Enabling Works and FoPs to LOCOG, the LLDC Transformation team and future Legacy developers. This table collates the residual items identified in the preceding individual FoP reports and those passed on from the Enabling Works team (refer to the report summaries in Appendix B). No areas of PDZ2 are being passed back to their original landowners.

In addition, Table 4.1 records some key aspects for future developers to consider as part of their works. It is further noted that this table does not in any way alleviate the incumbent Project Teams from complying with the full requirements of the remediation documentation, their legal, regulatory and contractual obligations.

### 4.2 Stage 3 Consolidated Validation Reporting

This report summarises the FoP validation works completed by the ODA to create the venues and infrastructure suitable for staging the London 2012 Olympic and Paralympic Games. It is recognised that other, non-ODA, parties have earthworks on the site which follow on from these ODA completed works, most notably LOCOG. These works are not summarised herein and are to be included in a third stage of the CVR programme.

In the context of the works in PDZ2, known third party works, which are not summarised herein comprise the LOCOG overlay construction including Common Domain areas, and Showcase Sponsor structures including a McDonalds and the BMW Pavilion. Removal of this temporary infrastructure, the 'bump-out' phase of the project, may also need to be captured through validation reporting and this will be established with the appropriate parties.

Further works, as a result of post-Games transformation will need to be captured under separate documentation and submitted against the relevant Legacy Transformation Development Planning Conditions (refer to item 2.15 in Table 4.1).

**Table 4.1: Outstanding Works transferred to Future Developers / Land Owners and Restrictions on Future Works in PDZ2**

No.	Title	Site Specific Actions Required	Action By
2.1	Completion of groundwater monitoring for the Southern Plume	Future land owners should note that the Southern Plume groundwater monitoring across the southern part of the Olympic Park shall continue for a period of approximately 12 months as soon as reasonably practicable post Games. The groundwater monitoring results and any associated additional remedial actions required by the Regulator/PDT approval to fully discharge Condition 35 of 07/90011/FUMODA (Olympic, Paralympic and Legacy Transformation Planning Applications: Site Preparation Planning Application) will be defined and auctioned accordingly.	Future land owners / developers – London Legacy Development Corporation (LLDC)
2.2	Soil vapour	Future land owners and developers shall be cognisant of the potential below ground contamination in the vicinity of NBHCZ2a-810 (see PDZ 2 Stage 1 Consolidated Validation Report, REP-ATK-PM-ZZZ-ZZZ-ZZZ-E-0193) as part of the design and construction process. It is recommended that a precautionary approach is taken to future works in this section and any re-development within 20m of borehole location NBHCZ2a-810 should consider the need for additional monitoring and assessment. This would be necessary to evaluate potential risks from vapour inhalation pathways and potential creation of preferential migration pathways to controlled waters from, for example, piling activities and the resultant mitigation measures for the development.	Future land owners and developers / LLDC
2.3	Invasive Species Monitoring and Treatment	Ongoing monitoring of invasive species adjacent to the river bank (refer to the Olympic Park Invasive Species plan in Appendix E which highlights these areas).	Future land owners and developers / LLDC
No.	Title	General Actions Required	Action By
2.4	Excavation of soils at the Site	<p>Future land owners and developers shall take appropriate health and safety measures to protect workers involved in excavation of soils.</p> <p>It is likely that a permitting system similar to PTP shall be implemented within the Olympic Park in post-Games mode.</p> <p>Future land owners / developers should be cognisant of utilities works below Enabling Works sub-grade completed by McNicholas Utilities. In certain areas the project re-used non validated materials around their utilities. As such below Marker Layer soils around utilities should be treated as potentially contaminated / harmful to health. This is highlighted in the applicable Asset Holders health and safety file. Health and safety risks to future workers accessing these utilities should be assessed in advance of undertaking works.</p>	Future land owners and developers / LLDC



No.	Title	General Actions Required	Action By
2.5	Placement of Marker Layer and HSSL	<p>Maintain HSSL and installation of Marker Layer during future works and install where omitted by Enabling / FoPs including the eastern bowl of Bridge F06, Bridges F08, F10B, F06 and underpass U06. (The locations of Bridges and the underpass are shown on Figure 4)</p> <p>Transformation works associated with removal of bridge structures must also include for the reinstatement of a suitable thickness of HSSL and placement of the Marker Layer.</p>	Future land owners and developers / LLDC
2.6	Suitable infrastructure design	<p>Future land owners and developers need to consider ground conditions when designing appropriate infrastructure, such as foundations, utilities, etc. Infrastructure installed beneath the marker layer should assume ground conditions are impacted by chemical contamination and appropriate mitigation measures should be taken (e.g. use of barrier pipes for potable water, sulphate resistant concrete etc)</p>	Future land owners and developers / LLDC
2.7	Suitable methods to protect contamination pathways	<p>In agreement with PDT the remedial designers have completed a Park-wide assessment of risks to controlled waters from removal of Alluvium (Ref. 45).</p> <p>Future land owners and developers need to consider protection of contamination pathways as part of their earthworks design.</p>	Future land owners and developers / LLDC
2.8	Ground gas / vapour assessment	<p>Future land owners and developers need to review requirements for ground gas assessment and potential protection measures as part of the design process.</p>	Future land owners and developers / LLDC
2.9	Decommissioning / Protection of monitoring installations and facilities	<p>Future land owners and developers will be responsible for either decommissioning of any monitoring installations and facilities no longer required for monitoring purposes, or the protection of any retained monitoring installations and facilities, required for ongoing monitoring.</p>	Future land owners and developers / LLDC
2.10	Completion of unremediated areas & Restrictions to remediation	<p>An addendum to the RARAR is being produced by the remedial designers for details of any areas not remediated as part of the ODA works (Ref. 42). Figure 9 shows Retained Areas within PDZ2.</p> <p>Future developers need to consider what additional information is required in these areas. These include certain of the ODA 'white areas' and loop road verges where the full remedial scope has not been implemented.</p>	Future land owners and developers / LLDC

No.	Title	General Actions Required	Action By
2.11	Removal of OPF	An easement associated with the OPF has meant that remediation and placement of Marker Layer and full HHSL has not been completed by ODA. The area of the OPF shall be assessed and corrective actions undertaken to complete the remedial design as part of the Legacy / Transformation phase. The location of the OPF is shown in Figure 4.	Future land owners and developers / LLDC
2.12	Risk Assessments	Future land owners and developers shall complete appropriate risk assessments with respect to piling, UXO, pathogens, asbestos, radiation and ground gas / vapours when undertaking excavations and / or construction activities during their work.	Future land owners and developers / LLDC
2.13	Future land use	Future land owners and developers shall ensure that areas designated for different land uses are not amended without reassessment of the soil conditions and that the Site is not used for growing edible crops or for private gardens. This includes the ODA 'white areas' where the full remedial scope has not been implemented.	Future land owners and developers / LLDC
2.14	Changes in final level	Any works by future land owners and developers involving a reduction of FFL will require a reassessment of the underlying soil and potentially additional investigation or remediation. The design levels used for the ODA remediation assume that a minimum 600 mm thickness HHSL will be provided.	Future land owners and developers / LLDC
2.15	Validation reporting	Future works will need to be captured and recorded through the established validation process including further stages of Consolidated Validation Report production on a zonal basis.  This includes the already established LOCOG Stage 3 CVRs, infrastructure 'bump-out', where necessary and subsequent Transformation and Legacy stages of the project.	LOCOG, LLDC and future land owners and developers

Note: This table incorporates residual actions following completion of the ODA Enabling and Follow-on Project works and represents the status at the end of the Stage 2 consolidated reporting (hence the Residual Action Nos. 2.1 etc). For the status of these residual actions following the LOCOG works please refer to the applicable Stage 3 CVR.

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