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Project Exodus - Thorpe Park Resort

Flood Risk Assessment

Merlin Attractions Operations Ltd

March 2022

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This document has 32 pages including the cover.

Document history

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Client signoff

Client	Merlin Attractions Operations Ltd
Project	Project Exodus - Thorpe Park Resort
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Glossary of terms

Term	Description
AEP	Annual Exceedance Probability
BGS	British Geological Survey
F&B	Food and beverage
Flood Zone 1	Area with a low probability of flooding from either rivers or the sea (< 1 in 1,000 annual chance of flooding).
Flood Zone 2	Area with a medium probability of flooding from either rivers (1 in 100 – 1 in 1,000 annual chance of flooding) or the sea (1 in 200 – 1 in 1000 annual chance of flooding).
Flood Zone 3	Area with a high probability of flooding from either rivers (> 1 in 100 annual chance of flooding) or the sea (> 1 in 200 annual chance of flooding).
FRA	Flood Risk Assessment
Ha	Hectare
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
mAOD	metres Above Ordnance Datum
NPPF	National Planning Policy Framework
RAMSAR	A wetland site designated to be of international importance under the Ramsar Convention
SFRA	Strategic Flood Risk Assessment
SPA	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
RoFSW	Risk of Flooding from Surface Water

Executive summary

Site Address	THORPE PARK Resort, Staines Road, Chertsey, Surrey, KT16 8PN		
Grid Ref	TQ 03520 68050	Size	1.86 ha
Current Use	Theme Park	Proposed use	Theme Park

Flood Zone	3
Vulnerability class	Less vulnerable
Is it compatible?	Within Flood Zone 1, 2 and 3a.
Application of the Sequential test.	Not applicable. There are no lower risk locations where this development could be built due to the development needing to be within the existing theme park which is all within the flood zone.
Exception test?	Not required

Overview Statement

The main flood risk to the site is fluvial, the site is within Flood Zone 3 and the land within the site boundary is first at risk in a 3.3% (1 in 30) AEP.

Other baseline flood risk:

- There is no tidal risk due to being situated upstream of the tidal boundary
- The site area has a very low risk of surface water flooding.
- Thorpe park Resort is a standalone site with its own sewer system, that has three pumped outfalls into the Thames Water network. It is therefore considered that the risk of flooding from sewers is a low risk.
- The site is at risk in both a dry day and wet day reservoir breach scenario, however assumed to be residual risk due to management of reservoir by law (Reservoirs Act, 1975).
- High groundwater levels are linked to high water levels in the River Thames and therefore classed as fluvial.
- There are no other known sources of flood risk that pose a flood risk to the site, or that would be impacted as a result of the proposed development.

The design of the proposed development is considered to be in line with the principles of NPPF, to be at an acceptable level of flood risk and will not result in any increased flood risk to people or property due to the following measures:

- The control room, ride maintenance building and rollercoaster boarding platform finished floor levels (FFLs) are above the design water level of 1% (1 in 100) AEP with 35% climate change allowance. Other buildings (food and beverage unit and photo opportunity) are within the floodplain, and Thorpe Park Resort have accepted this risk, given that buildings would not be in use during a flood event, and resilience measures will be incorporated into the building design.
- Floodplain compensation has been provided for the construction of new buildings, the new rollercoaster and rollercoaster columns, and partial infill of the inlet of the Abbey Lake. The existing floodplain compensation scheme on site at Thorpe Park Resort has sufficient surplus to compensate for the floodplain lost through the proposed development.
- Any new fencing will be open in design and not impede flood flows.
- Thorpe Park Resort have a flood evacuation plan that would see people evacuated prior to the area being flooded, and the site made safe and secure.
- A drainage strategy has been designed in accordance with the SFRA (Runnymede Borough Council, 2018). It is summarised from the drainage strategy that the proposed works will have no adverse impact on surface water runoff, in comparison to the existing arrangement.
- There is no predicted impact of development on sewer flooding or groundwater flooding.

1. Introduction

1.1. Assessment purpose

Merlin Attractions Operations Ltd has commissioned Atkins Ltd to produce a Flood Risk Assessment (FRA) to support the planning application for Project Exodus. This document describes the proposed works, the flood risk at the site and the potential implications of this development in terms of flood risk. This document also identifies relevant planning policies (both national and local) and concludes with recommendations for the design work to ensure that planning policy requirements are met.

1.2. Scope of work

In line with the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) this FRA is required to:

- Define flood risk to the site;
- Determine the impact of the development on flood risk;
- Outline (if required) the proposed mitigation measures; and
- Provide evidence demonstrating that the development is at an acceptable risk of flooding and safe for users over the design lifetime, whilst ensuring the development will not increase flood risk elsewhere.

1.3. Sources of data

To inform this FRA, the following available information has been utilised:

- Environment Agency Light Detecting and Ranging (LiDAR) (Defra, 2022);
- Environment Agency flood risk mapping including Flood Zones, Surface Water Extent, Historic Flood Map, Reservoir Flooding (Defra, 2022);
- Environment Agency data request (Products 5, 6 and 7) for the Thames (Hurley to Teddington) 2019, including the Thames Tributaries (Environment Agency, 2022);
- British Geological Survey Viewer (British Geological Survey, 2022)
- Thorpe Park Medium Term Development Plan Flood Risk Assessment (Atkins, 2010)
- Surrey Local Flood Risk Management Strategy 2017-2032 (LFRMS) (Surrey County Council, 2017)
- Runnymede 2030 Strategic Flood Risk Assessment (SFRA) (Runnymede Borough Council, 2018)
- Runnymede 2030 Local Plan (Runnymede Borough Council, 2020)
- Design drawings and information provided by HBL, Smytheman Architectural and Litchfield's; and
- Proposed Drainage Strategy (8931-HBL-00-XX-RP-D-0001)

1.4. Site location

The Project Exodus development is situated on the southeast corner of the Thorpe Park Resort, as shown in Figure 1-1.

Thorpe Park Resort is located to the north of Chertsey and to the south of Staines-upon-Thames, in close proximity to the M25 junction with the M3. Thorpe Park Resort is situated in Runnymede Borough, within Surrey County Council.

The Thorpe Park Resort site boundary covers approximately 109 hectares (ha), which includes the surrounding lakes. The core of the Park includes a number of mechanical rides, water based rides and flumes, shops, restaurants, and ornate garden attractions. The Project Exodus site red line boundary 1.86 ha.

Surrounding the core of the Park are three lakes which were former gravel pits:

- Manor Lake (to the north-west);
- Fleet Lake (to the north-east); and
- Abbey Lake (to the south-west).

The lakes are fed by a small stream; the Mead Lake Ditch, to the north of the site, but lake levels are primarily dominated by groundwater levels that vary with levels of the River Thames. A fourth lake, St. Ann's Lake is situated to the southwest of the site and is fed by The Moat.

As well as Mead Lake Ditch and the Moat, the site is located approximately 1.1km southwest of the River Thames, 0.5km northeast of the Chertsey Bourne and 0.5km west of the Abbey River, all which are Environment Agency main rivers.

The location of the Park on a former gravel extraction site means that the site has a naturally permeable sub-surface material. The bedrock geology is comprised of Thames Group clay, but this is overlain with significant deposits of Alluvium and River Terrace deposits (British Geological Survey, 2022) . These superficial layers are bounded to the north and east by the same deposits underlying the River Thames, and to the northwest by floodplain gravels. The sub-surface aquifer on the site therefore has a strong connectivity with the River Thames.

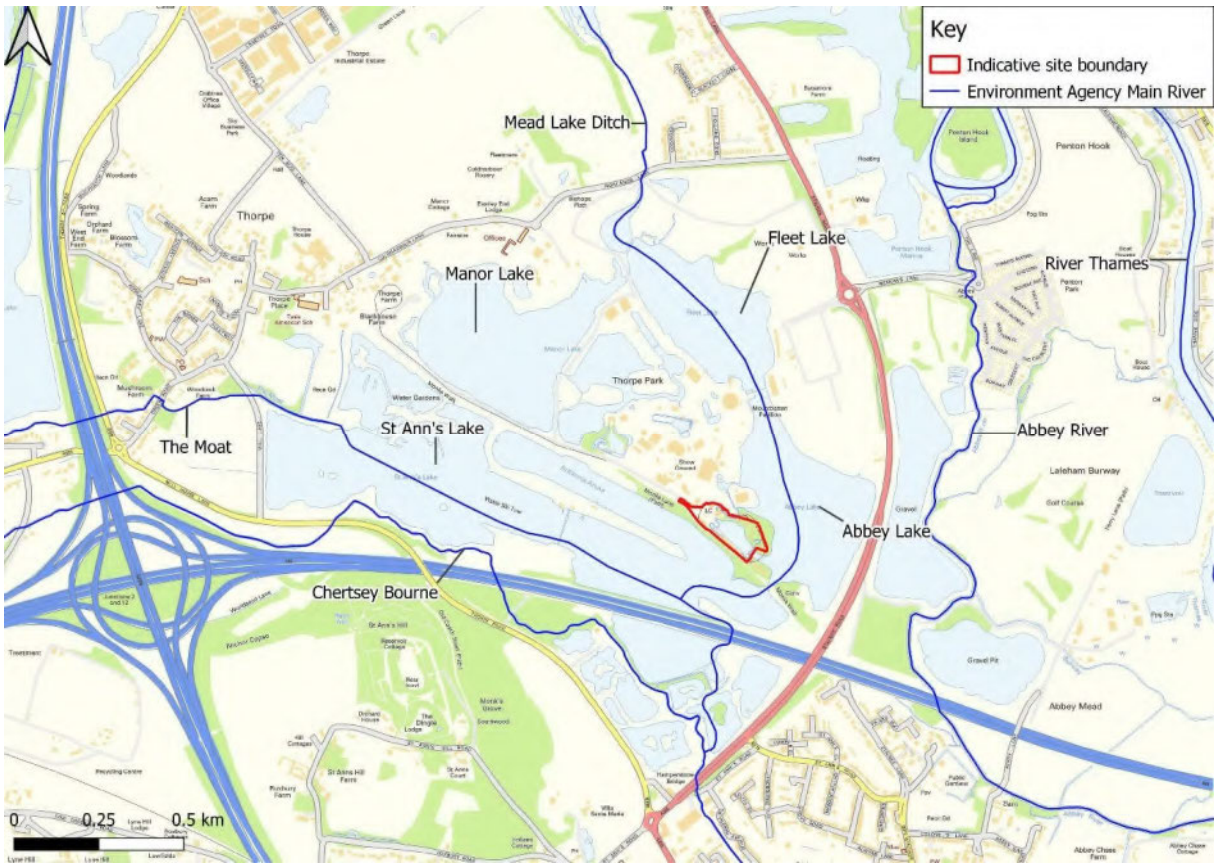

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Figure 1-1 - Site location (Defra, 2022)

1.5. Proposed development

The proposed works involve the development of a new rollercoaster, with associated buildings and structures, ground works infrastructure, infilling of part of the lake inlet and landscaping.

Demolition will be required of some existing structures, (as shown on Figure 1-2 and in Appendix A.1) including the existing Loggers Leap ride, the train station, the Rocky Express ride, the Timber Tug Boat, the Lumber Jump, the Old Town Grill and various huts.

As part of the construction several structures will be developed (as shown on Figure 1-3 and in Appendix A.2) including:

- A new rollercoaster, including track, rollercoaster columns, ride station building, maintenance/control building and queue line. Some of this rollercoaster will be over the existing inlet of the Abbey Lake, and some columns will be positioned within the lake inlet;

- A photo kiosk adjacent to an existing retail / food and beverage (F&B) unit; and
- Queue F&B unit.

In order to construct the new rollercoaster, partial infill of the inlet to the Abbey Lake will be required. This infill will be reduced once the rollercoaster is operational, as follows:

- During construction: A working platform of 13.00 mAOD will be required and this will result in 7,730m^3 of fill. This platform will be at a level of ~0.5m above the average lake water level of 12.5 mAOD. This is shown in Figure 1-4 and in Appendix A.3.
- During operation: Part of the working platform will be reduced to a level of 12.20 mAOD (below the existing water level). Approximately 1,755m^3 of cut from the construction platform will be required to achieve this level. The rest will be kept at a level of 13.00 mAOD. As part of the cut, the section going across the entrance to the Abbey Lake inlet will be reduced to 12.2 mAOD. As the normal lake level is 12.50 mAOD this maintains hydraulic connectivity with the Abbey Lake. This is shown in Appendix A.4.

Figure 1-2 - Proposed demolition (TP24-SA-XX-XX-DR-A-0103)

Figure 1-3 - Proposed development (TP24-SA-XX-XX-DR-A-0104)

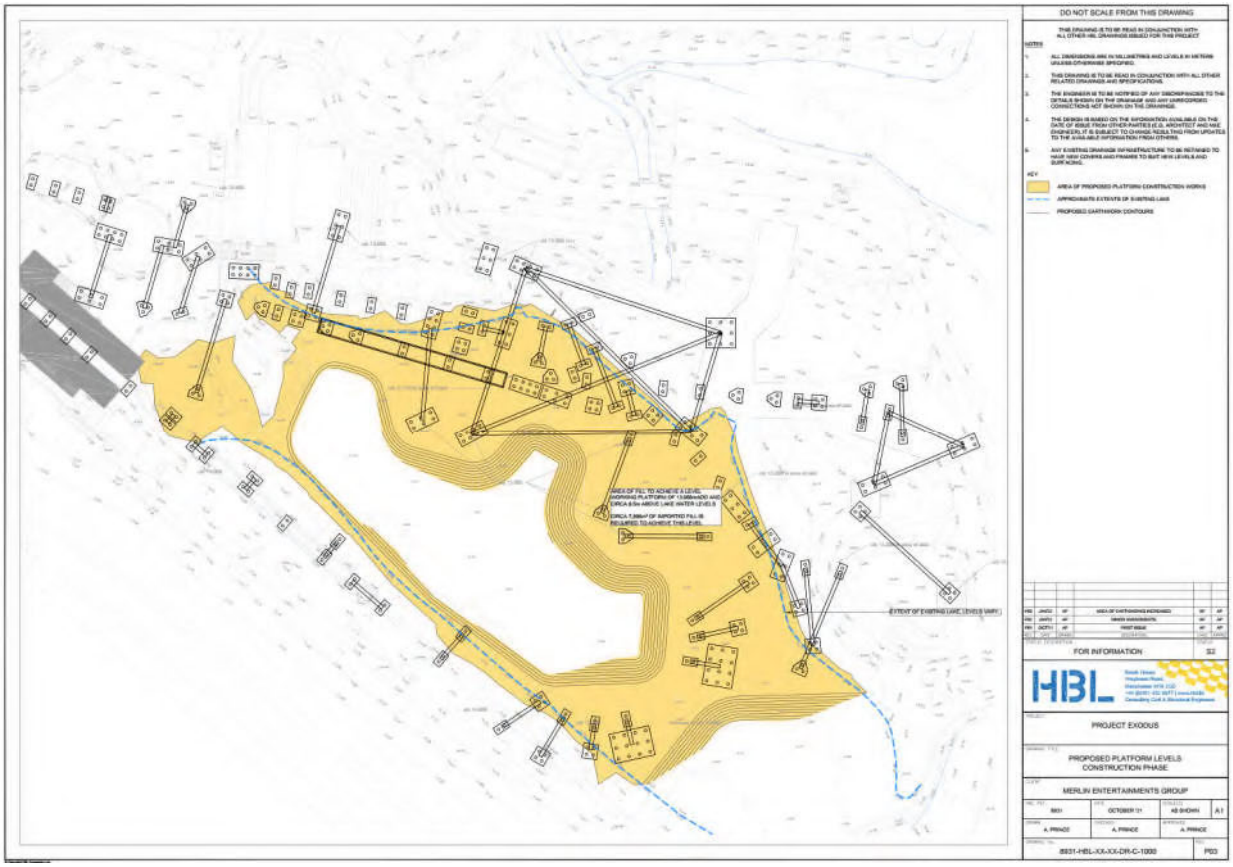

Figure 1-4 - Proposed platform levels – construction phase (8931-HBL-XX-XX-DR-C-1000)

1.6. Previous studies

Regular re-development of the theme park is required in order to maintain its competitiveness within the market and attract visitors. As such, planning permission has been regularly sought for new rides / attractions over a period of many years. The location of the site in an Environment Agency Flood Zone (see subsequent sections) means that these planning applications have included FRAs as well as extensive engagement with both the Environment Agency and Runnymede Borough Council. Key principles including those relating to design flood levels and acceptance of risk, floodplain compensation and the definition of functional floodplain have been previously agreed for this site and are referenced in this FRA.

1.7. Consultation

A pre-application enquiry form was made to the Environment Agency on 06/01/2022 to seek a pre-application meeting to discuss this development. It is however understood that the Environment Agency are currently very busy and at the time of writing a meeting and formal pre-application response from the Environment Agency has not been secured. The project team continues to seek to engage with the Environment Agency to inform the application, and initial conversations are being undertaken to arrange this.

2. Planning policy

2.1. National Planning Policy

The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) is the overarching document in relation to development and flood risk and sets out the Government's policy on development relating to flood risk. The aim of the NPPF is to ensure that development is not at an unacceptable risk of flooding. Where development is unavoidable in areas at risk from flooding, the NPPF ensures that the development is safe without increasing flood risk elsewhere and where possible reducing flood risk overall.

In accordance with the NPPF, a site-specific FRA should be provided for all development in Flood Zones 2 and 3 (the definitions of Flood Zones are provided in Section 3.2). In the first instance, the location of the site within Flood Zones is identified through the use of the Environment Agency flood maps.

A site-specific FRA is also required for development in Flood Zone 1 (low fluvial risk), where:

- Proposals involve sites of 1 hectare or more;
- Land which has been identified as having critical drainage problems. This is identified through reviewing flood risk documents, including the Strategic Flood Risk Assessment (SFRA), the Surface Water Management Plan (SWMP) and the Local Flood Risk Management Strategy (LFRMS);
- Land identified in a SFRA as being at increased flood risk in the future; or
- Land that may be subject to other sources of flooding (as determined through the sources listed in bullet 2, informed by the client or local knowledge of the area), where its development would introduce a more vulnerable use.

The proposed development site is located in Flood Zone 3 and therefore requires a site-specific FRA.

2.2. Flood Zone definition

The NPPF outlines four Flood Zone classifications of which three have been used by the Environment Agency in the creation of their Flood Map. Table 3-1 in Section 3, provides definitions of each Flood Zone. These Flood Zones are used in determining the appropriateness of the proposed development uses when considering flood risk through the application of the Sequential Test. They represent both fluvial and tidal flooding without flood defences in place. The proposed development is located within Flood Zone 3, with a high probability of flooding.

2.3. Flood risk vulnerability classification

The NPPF classifies development type in terms of vulnerability to the impact of flooding. The vulnerability types range from water-compatible to essential infrastructure. More vulnerable development, for example residential, would be unsuitable for construction in areas at risk from flooding, however water-compatible development such as water-based recreation might be considered acceptable (if the development does not increase flood risk elsewhere). The definitions for vulnerability type and Flood Zone compatibility, is available on the gov.uk website.

The proposed development is classified as 'Less Vulnerable' which infers the development is appropriate in Flood Zones 1 and 2 and 3a. It is not permitted in Flood Zone 3b. The rollercoaster columns can be deemed as 'Water Compatible' and therefore appropriate for development within all flood zones.

2.4. Sequential Test

The purpose of the Sequential Test is to promote development within areas at lowest flood risk. Therefore, areas for development in Flood Zone 1 should be sought in the first instance. If there are no practicable areas for the development in Flood Zone 1, then areas in Flood Zone 2 should be sought, and so on. As the majority of Thorpe Park Resort is situated in Flood Zone 2 and 3, there are no alternative sites with a lower risk of flooding that are better suited for the proposed rollercoaster. It is also fundamental that the new rollercoaster is situated within the Thorpe Park Resort due to the development type and being intrinsically linked to the theme park.

2.5. Exception Test

A passed Exception Test is required when there is a need to demonstrate wider benefits that outweigh flood risk, and that the development will be safe from flooding without increasing risk elsewhere.

An exception test is not required for 'Less Vulnerable' or 'Water Compatible' development.

2.6. Permitting requirements

Although this assessment only refers to flood risk, it is acknowledged that a Flood Risk Activity Permit (FRAP) will be required for this development prior to construction due to the proximity to a main river.

The FRAP is likely to require supporting documents in the form of a Water Framework Directive assessment and consideration of the potential impacts on water quality and groundwater, due to the proximity of the statutory environmental designations (SPA, RAMSAR and SSSI) in St Ann's Lake. The acceptability of the scheme based on water quality will be controlled via this process.

2.7. Local planning policy

2.7.1. Local Flood Risk Management Strategy (LFRMS)

Surrey County Council worked in partnership with Surrey Flood Risk Partnership Board to produce the LFRMS (2017-2032) (Surrey County Council, 2017). This is a Risk Management Authorities partnership. The vision of the Strategy is 'to make Surrey more resilient to flooding on a long-term basis through a co-ordinated approach with residents and partners'. Within this Strategy, relevant objectives include: Objective 5 Resilience and Objective 6 Planning.

2.7.2. Strategic Flood Risk Assessment (SFRA)

The Runnymede 2030 SFRA (Runnymede Borough Council, 2018) assesses the flood risk in Runnymede from various sources. It also outlines flood risk management and mitigation within the borough. The guidance provides an overview of the specific actions for producing an accurate FRA as well as surface water drainage requirements.

The SFRA outlines that the functional floodplain (Flood Zone 3b) is defined by the 5% (1 in 20) AEP. Thorpe Park Resort is included in the mapped area of the Flood Zone 3b provided within the SFRA. The SFRA however wasn't based on the most recent 5% (1 in 20) AEP outlines from the River Thames model.

2.7.3. Local Plan

The Runnymede 2030 Local Plan (Runnymede Borough Council, 2020) outlines the Council's approach to understanding and managing flood risk and climate change, and how this supports wider development targets. Policies of note within the Local Plan are: Policy EE12 Blue Infrastructure; and Policy EE13 Managing Flood Risk.

3. Assessment of baseline flood risk

As outlined within the NPPF (Ministry of Housing, Communities and Local Government, 2021), flood risk from all sources must be addressed within the FRA to ensure that potential flood risk has been considered during the development design and proposed works. Therefore, this section outlines all the potential sources of flood risk to the site and the implications these risks have on the development. It is also necessary to outline any records of previous flooding events as these may identify areas vulnerable to flooding.

3.1. Historical flooding

The identification of past flood events can often indicate areas that are vulnerable to flooding and thus areas that have the potential to flood in the future.

The Historic Flood Map (Defra, 2022) shows areas of land that have been previously subject to flooding in England from river, sea, and groundwater sources. The map does show evidence of previous flooding at Thorpe Park Resort although no date information is given.

The SFRA (Runnymede Borough Council, 2018) outlines that there is a long record of flooding within Runnymede Borough. It outlined that Thorpe Park Resort experiences flooding. However, anecdotal information from Thorpe Park Resort outlines that although lake levels do rise (e.g. January and February 2014) and surrounding areas are flooded, the main Thorpe Park Resort island has not historically flooded.

3.2. Flooding from rivers and the sea

Flooding from rivers (fluvial flooding) occurs following exceedance of the flow capacity of river channels, leading to overtopping of the riverbanks and inundation of the surrounding land.

Inundation by high tides, storm surges and waves along coastal regions is described as coastal flooding. The propagation of high tides and storm surges up estuarine channels can lead to overtopping of the riverbanks and inundation of the surrounding land. This is referred to as tidal flooding.

The Environment Agency publish mapping showing fluvial and tidal Flood Zones. Table 3-1 provides a description of the fluvial and tidal zones and their annual chances of risk.

Table 3-1 - Flood Zones

Flood Zone	Definition
Zone 1 Low Probability	Land having less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3.)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map.)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map.)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRA areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map.)

As discussed in Section 1.4, the development site is located within an inlet of the Abbey Lake, which is fed by the Environment Agency main river, the Mead Lake Ditch. It is also in close proximity to other Environment Agency main rivers: the River Thames; the Chertsey Bourne; the Abbey River; and The Moat.

3.2.1. Tidal risk

The site is located over 20km upstream of the tidal boundary of the River Thames at Teddington and away from the tidal risk zone. It is therefore not at risk of tidal flooding and this source of flood risk is not considered further in this FRA.

3.2.2. Fluvial risk

The majority of the site is located in Flood Zone 3 and has greater than a 1% (1 in 100) Annual Exceedance Probability (AEP) risk of flooding (Figure 3-1). There is a small section within the red line boundary in Flood Zone 2, which has between a 1% (1 in 100) AEP and 0.1% (1 in 1000) AEP risk of flooding.

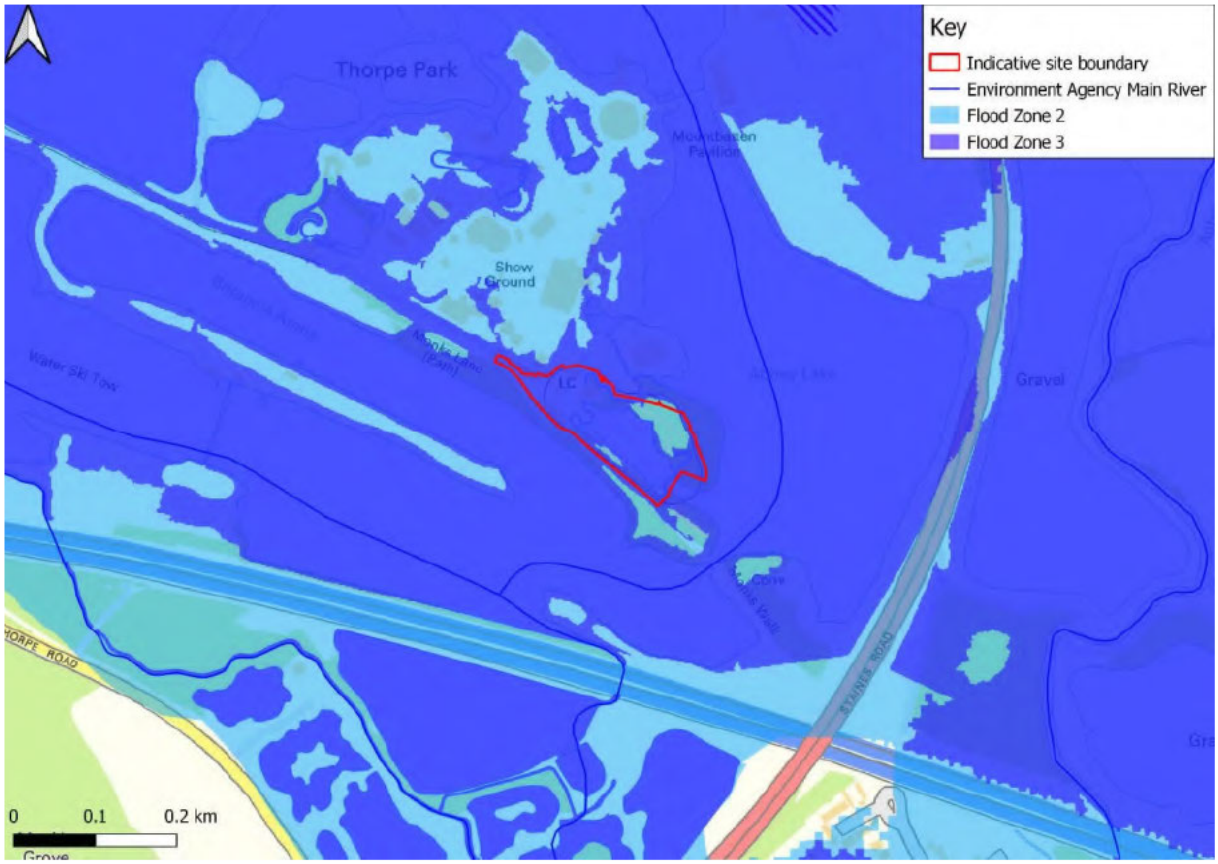

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Figure 3-1 - Environment Agency Flood Zones (Defra, 2022)

The Environment Agency flood risk mapping does not take into account climate change, and it is necessary to determine flood risk to a site over the lifetime of a proposed development including climate change. Furthermore, given that the site is within an area identified as being at risk of flooding, flood levels must be used to inform the development design.

To identify the flood levels, the hydraulic model from the River Thames and its tributaries was requested from the Environment Agency. The lakes surrounding Thorpe Park Resort were modelled and their levels for differing AEPs are outlined in Table 3-2. The site sits within Abbey Lake and therefore these levels are provided. However, all lake levels were checked, and were the same as the Abbey Lake. The modelled water levels were the same from both the River Thames model and the Thames tributaries (including the Chertsey Bourne) model.

The modelled flood outlines from the River Thames model are shown in Figure 3-2. Four AEPs are shown: the 50% shows the location of the lakes; the 3.3% is the AEP in which the land within the site boundary first floods; the 1% shows a greater flood extent; and the 1% + CC shows the maximum flood extent.

Table 3-2 - Modelled Lake flood levels (mAOD) (Environment Agency, 2022).

Lake	Annual Exceedance Probability (AEP)										
	50%	20%	10%	5%	3.3%	2%	1.3%	1%	0.5%	0.1%	1% + 35%CC
Abbey	12.60	12.66	12.77	13.22	13.63	13.80	13.84	13.90	13.96	14.07	14.26

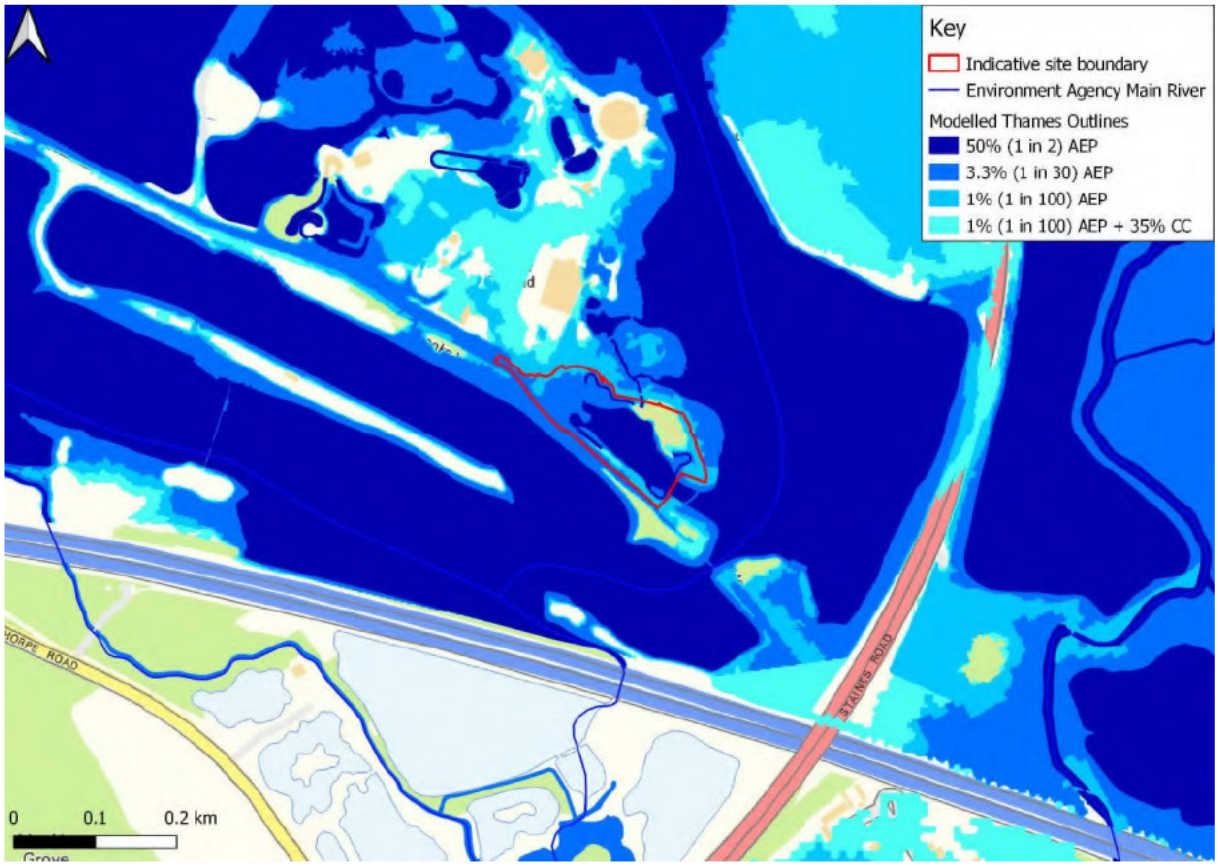

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Figure 3-2 – Modelled flood outlines (Environment Agency, 2022)

The design flood level is defined as the 1% (1 in 100) AEP with climate change allowance. The River Thames at this location is within the Maidenhead to Sunbury Management Catchment, and peak river flow allowances are outlined in Table 3-3. As the development is classed as Less Vulnerable, the central allowance can be used (Environment Agency, 2021). Parts of the construction is assumed to have a design life greater than 50 years and therefore the 2080s epoch should be used.

The design flood level for the development is the 1% (1 in 100) AEP with a 35% Climate Change allowance. As the development sits within Abbey Lake, it has a design flood level of 14.26 mAOD.

Table 3-3 - Change to peak river flow allowances for the Maidenhead and Sunbury Management Catchment compared to a 1981 - 2000 baseline (Environment Agency, 2021)

Maidenhead and Sunbury Management Catchment	Total potential change anticipated for '2020s'	Total potential change anticipated for '2050s'	Total potential change anticipated for '2080s'
Central Estimate	14%	17%	**35%**
Higher Central Estimate	19%	25%	45%
Upper End Estimate	32%	45%	81%

This analysis shows that the site is at risk of fluvial flooding.

3.3. Flooding from surface water

Surface water flooding occurs when rainfall intensities exceed the infiltration capacity and/or drainage capacity such that water collects on the ground surface. Therefore, there is a greater risk of flooding from this source within urbanised areas where there is a higher proportion of impermeable surface.

The Risk of Flooding from Surface Water (RoFSW) Environment Agency mapping identifies the site as being at Very Low Risk (Figure 3-3). This means that the site area has a chance of flooding less than 0.1% AP. There are a couple of areas of Low Risk (0.1% AP), however this is pooling in depressions rather than a surface water flow route through the site. One of the areas of Low Risk occurs in the lake and therefore this can be ignored.

EA climate change guidance (Environment Agency, 2021) recommends consideration of a 20% to 40% increase in peak rainfall intensity when considering the impact of climate change. There is no climate change mapping of surface water flood risk, however, given the lake side location and existing low level of risk, with no defined flow path, the risk is assumed to remain low.

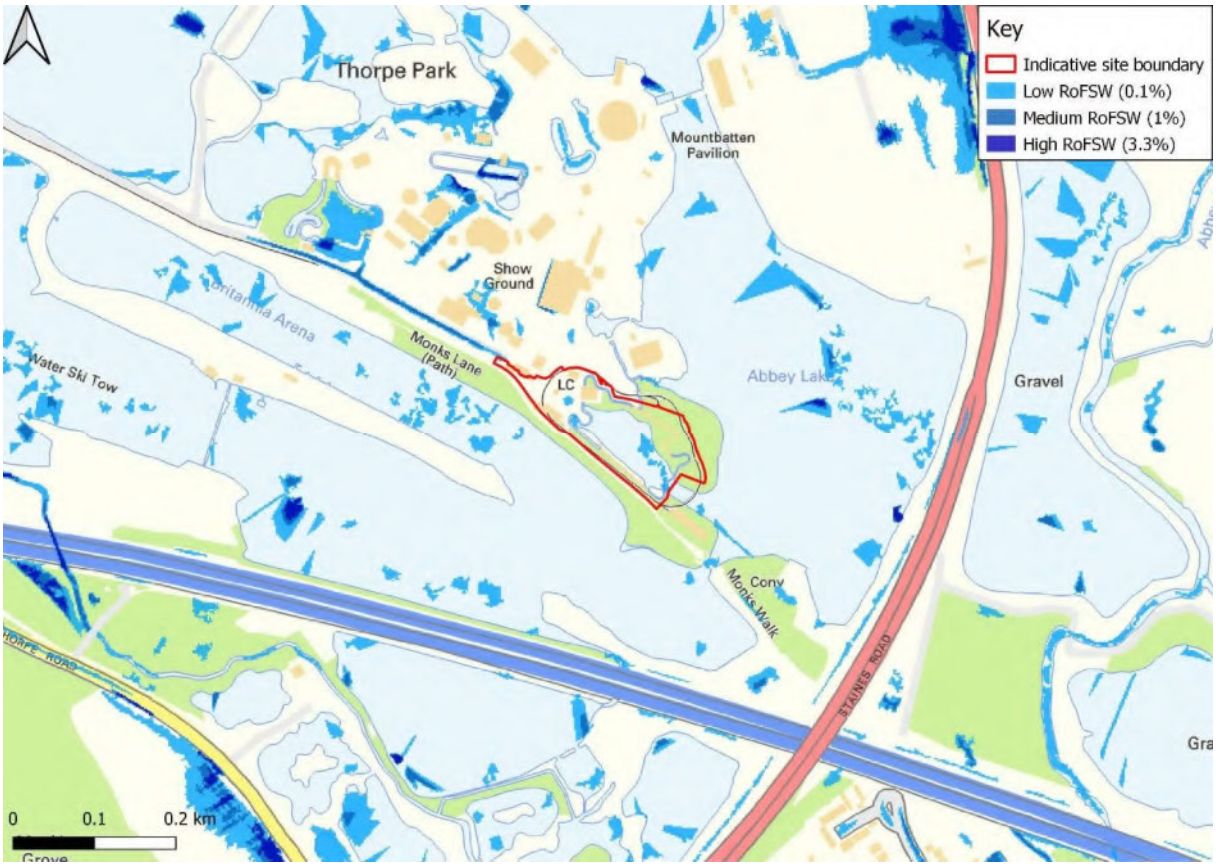

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Figure 3-3 – RoFSW mapping (Defra, 2022)

3.4. Flooding from sewers

Flooding from sewers is caused by a blockage, pipe failure or exceedance of the system capacity.

The SFRA outlines 'During the last 10 years sewer flooding has affected up to 8 properties in the TW20 9 postcode area (external flooding), up to 9 properties in the TW20 8 postcode area (3 internal flooding and 6 external flooding), up to 1 property in the TW18 3 postcode area (external flooding) and up to 9 properties in the KT16 8 postcode area according to Thames Water's DG5 register'.

Thorpe Park Resort is a standalone site with its own sewer system, that has three pumped outfalls into the Thames Water network. Thorpe Park Resort is responsible for the maintenance of this pump and so manage their own risk of sewer flooding and are not at risk from infrastructure failure outside of their own control. It is therefore considered that the risk of flooding from sewers is a low risk.

3.5. Flooding from reservoirs

Flooding from reservoirs is caused when there is a dam failure that allows water to escape from a reservoir.

The Environment Agency provides flood mapping identifying areas that are at risk of inundation following failure and breach of reservoirs. Figure 3-4 displays the extent of flooding during Dry Day and Wet Day event scenarios. The mapping indicates that the site is at risk from flooding from a large number of reservoirs in both

Surrey and Windsor and Maidenhead including, Chertsey Settling, and the reservoirs situated to the north of Staines-upon-Thames. However, strict inspection and maintenance requirements are imposed on the management of reservoirs by law (Reservoirs Act 1975), and hence the probability of this source of flood is considered residual.

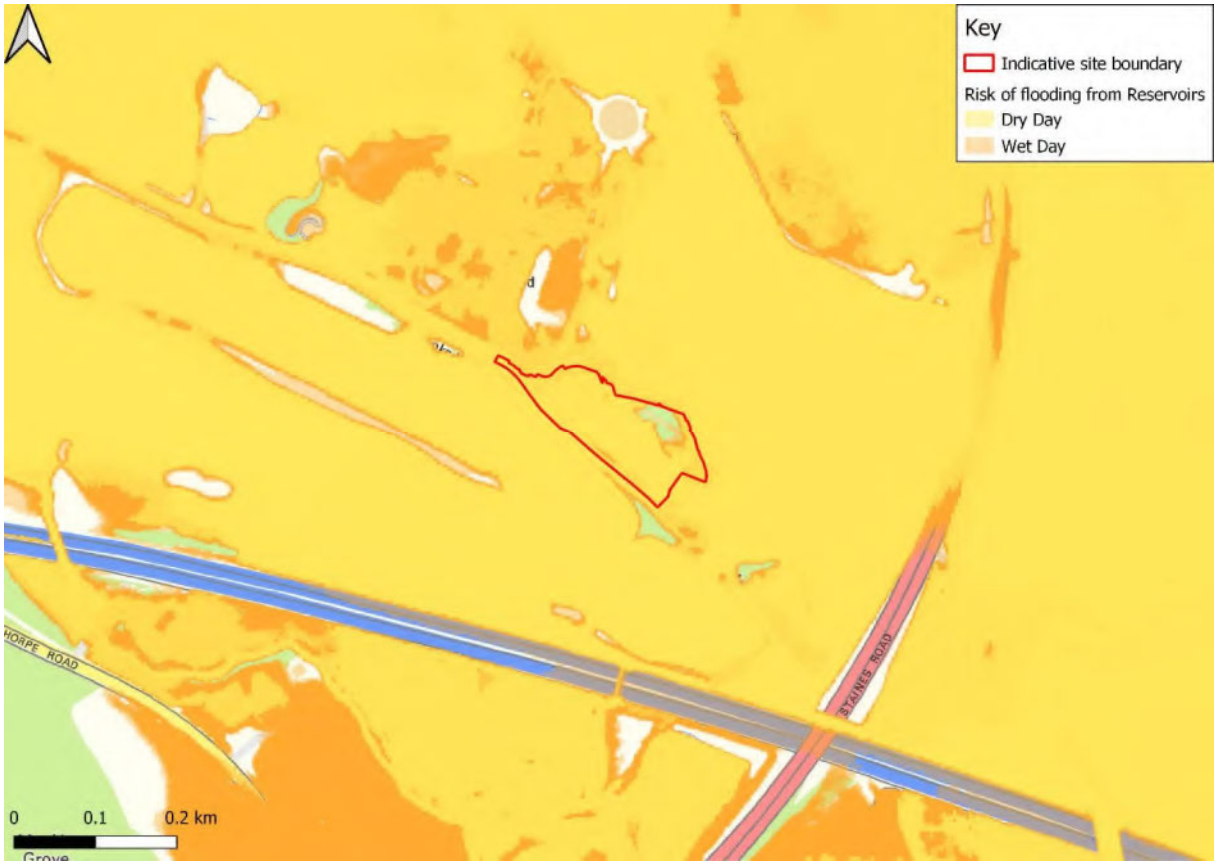

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Figure 3-4 - Maximum extent of reservoir flooding (Defra, 2021)

3.6. Flooding from groundwater

Groundwater flooding normally occurs where the water table meets the ground surface in low lying areas which are underlain by permeable rock known as an aquifer. Groundwater flooding tends to follow long periods of sustained rainfall but can also be caused by local obstructions to groundwater flow (e.g., following the placement of engineering structures or buildings with foundations) or by the rebound of groundwater levels after a decrease in abstraction or dewatering. It is important to recognise that the risk of groundwater flooding is typically highly variable and heavily dependent on local geological, topographical, and weather conditions. Groundwater flooding is hard to predict and challenging to mitigate.

The SFRA outlines that within Runnymede Borough there is some potential for groundwater flooding, however this is greatest in the Egham and Thorpe areas due to the geology and topography which is lower lying and underlain by Thames gravels.

The location of the Park on a former gravel extraction site means that the site has a naturally permeable subsurface material. The bedrock geology is comprised of Thames Group clay, but this is overlain with significant deposits of Alluvium and River Terrace deposits. These superficial layers are bounded to the north and east by the same deposits underlying the River Thames, and to the north-west by floodplain gravels. The subsurface aquifer on the site therefore has a strong connectivity with the River Thames and under normal hydrological conditions, the level of the lakes surrounding Thorpe Park Resort equalises to that of the local groundwater level in the gravel aquifer. It follows that high groundwater levels are most likely to result from high water levels in the River Thames and hence this source of flooding is described as a fluvial, rather than a groundwater one and has been assessed in detail in the section above. In the absence of high water levels in the River Thames, the risk of flooding resulting from high groundwater levels is assessed as being low. This is

because of the location of the site within a wide flat floodplain, which is not conducive to prolonged high groundwater levels

The impact of climate change on groundwater flooding is more uncertain than other sources of flooding owing to the predicted increases in rainfall intensity, but also longer drier spells. However, based on the current low risk to the proposed works it is anticipated that groundwater flood risk will remain fluvially linked, and therefore addressed as fluvial risk over the lifetime of the development. Groundwater flooding is therefore, not considered further in this FRA.

3.7. Other sources of flood risk

There are no other known sources of flood risk that pose a flood risk to the site, or that would be impacted as a result of the proposed development.

4. Scheme impact on flood risk

4.1. Risk of fluvial flooding

4.1.1. Function Floodplain (Flood Zone 3b)

The Runnymede SFRA (Runnymede Borough Council, 2018) defines the functional floodplain (Flood Zone 3b) by the 5% (1 in 20) AEP. Parts of the new development are at risk in the 5% (1 in 20) AEP; however, this is just the lake and the areas where the lake is infilled to 13.00 mAOD. The proposed developments on the existing park site are not at risk within this AEP. The rollercoaster support columns planned to be constructed in the lake / at 13.00 mAOD, are water compatible and will be designed to withstand hydraulic loading.

Extensive discussions about the functional floodplain took place between Runnymede Borough Council, the Environment Agency, and Thorpe Park Resort in 2009 and 2010. Runnymede Borough Council agreed (letter from Jonathan Partington dated 04/11/2010) that while the 5% (1 in 20) flood risk definition of the functional floodplain applied, "a degree of pragmatism ought to be applied when considering new development at Thorpe Park". This is because it is a "major development site", benefits have been provided through provision of floodplain compensation and the existing "flood warning and evacuation procedures are well controlled."

4.1.2. Finished Floor Levels

The analysis in Section 3.2 has demonstrated that the site is at risk of fluvial flooding. A comparison of flood levels with ground levels and the proposed development Finished Floor Level (FFL) across the site enables an analysis of the likely depth of flooding during a range of flood events. This is provided in Table 4-1.

Table 4-1 – Proposed finished floor levels and depth of flooding analysis

Building	FFL (mAOD)	AEP first floods	Depth of flooding in 1% AEP (mm)	Depth of flooding in 1% + 35%CC (mm)
F&B unit	13.75	2% (1 in 50)	150	510
Photo opportunity building	13.83	1.3% (1 in 75)	70	430
Control room	14.34	Not flooded		
Ride maintenance building	15.07	Not flooded		
Rollercoaster boarding platform	17.49	Not flooded		

The photo opportunity building will be at risk of flooding in a 1.3% AEP event. This building is to be constructed adjacent to an existing F&B unit and therefore the floor level has been kept the same. It is proposed that flood resilience measures are included for this unit, including raising plug sockets above the 1% + 35% CC flood level of 14.26 mAOD and using water-resistant coatings up to the same level with a freeboard of 300mm (14.56m AOD). It is planned that the buildings will be constructed with flood resistant concrete blocks. Incorporation of these resilience measures will reduce the impacts of flooding and make drying out and repair of buildings easier should inundation occur, reducing down-time following a flood event.

With a slightly lower proposed FFL, the F&B unit is at risk of flooding in a 2% AEP event. This is a small new unit adjacent to the queue providing pre-packaged food and drinks. The same guidance is recommended here as for the photo opportunity building.

Thorpe Park Resort accept the risk to both of these buildings/units and will manage them in line with the rest of the Resort and their flood management plan. This is considered acceptable due to the nature of the use within the building.

The lower part of many of the rollercoaster columns will be at risk of flooding, including some columns which are located in the lake. The columns will be, by their nature, water compatible and will be constructed to a suitable design that will ensure they can withstand hydraulic loading and therefore will not be adversely affected during a flood event.

The ride maintenance building and rollercoaster boarding platform are not at risk from flooding as they are raised above ground level. The control room, where all control units for the new rollercoaster are located, will be raised to a level of 14.4mAOD which is above the design flood level of 14.26 mAOD.

4.1.3. Partial infill of inlet to Abbey Lake

As outlined in Section 1.5 in order to construct the rollercoaster columns, partial infill of the inlet to the Abbey Lake is required. This is to a level of 13.0 mAOD during construction, and then parts reduced to 12.2 mAOD for operation.

During operation, the normal lake level is 12.5 mAOD and therefore hydraulic connectivity is maintained with the Abbey Lake. However, during construction, the working platform sits 0.5m above the normal lake level and spans the width of the inlet, cutting off this part of the inlet from the Abbey Lake. This is a loss of floodplain and a temporary construction impact (construction period expected to span 16 months). It will reduce hydraulic connectivity up to 13 mAOD, which is between a 10% and 5% AEP. During flood events greater than a 5% AEP, connectivity would be restored. No significant flood risk impacts would be anticipated.

4.1.4. Floodplain compensation

Development located in areas of high risk have the potential to impede rising (and falling) flood waters and reduce flow conveyance during a flood event. This can reduce the area of land where flood water can be stored during high flows and cumulatively can impact on neighbouring sites by increasing flood levels.

The proposed development will result in a change in floodplain storage due to construction occurring in the floodplain, and the partial infilling of an inlet to the Abbey Lake both temporarily during construction, and permanently during operation. This construction includes both “cut” (lowering of existing ground levels at the planted mound and demolition of the existing ride on the site) and “fill” (construction of new buildings and the rollercoaster).

Thorpe Park Resort has an existing floodplain compensation scheme which has evolved over a number of years and includes designated areas (1a, 1b, 2, 4a and 4b; agreed with the Environment Agency and the Council as part of the Medium Term Development Plan (MTDP) FRA (Atkins, 2010)) where land has been excavated to provide areas of flood storage to compensate for development of the Park. These areas are hydraulically connected to the floodplain at Thorpe Park Resort and the scheme has been designed on a level-for-level basis in 100mm increments. With the agreement of the Environment Agency, surplus compensation is available that has been carried forward to mitigate future development at the Park. This surplus compensation is recorded in the compensation table. The current compensation table (prior to Project Exodus) is version 472-9-27AD (December 2017), and the updated version (incorporating Project Exodus) (472-9-27AE) is in Appendix B.

It is proposed that a condition is attached to the planning permission requiring an updated version of the compensation table to be created, reflecting the final cut and fill required for the development, prior to first occupation of the development.

The pre-development surplus area and volume was compared with the development proposals[1] for Project Exodus. This is summarised in Table 4-2. This summarises the operational cut and fill volumes although it should be noted that:

- No cut has been included at this stage of the project, as the extent of cut will be established at the detailed design stage, and therefore this is a worst case scenario. This demonstrates that even with no cut, the existing compensation scheme is sufficient to compensate for the floodplain lost through the proposed development;
- The table shows the current outline design estimates for the operational (permanent) fill volumes. There may be minor changes to this as part of the detailed design and construction. The partial lake infill will be greater within the construction phase between levels of 12.7 to 12.9 mAOD. At 12.7 mAOD there is an additional 57m^2, 12.8 mAOD an additional 17m^2 and 12.9 mAOD an additional 57m^2. Therefore, there is sufficient floodplain compensation in the existing bank to temporarily compensate for this increased lake infill during development construction. However, as noted above, due to a loss of

[1] Data provided by HBL (2022) in drawings 8931-HBL-XX-XX-DR-C-1002 and 8931-HBL-XX-XX-DR-C-1102, and spreadsheet ‘8931 - EXODUS - FILL AREAS - OPERATIONAL PHASE’

hydraulic connectivity with the Abbey Lake, up to a 5% AEP event, more floodplain will be temporarily lost if a flood event lower than this magnitude were to occur during construction.

The existing compensation scheme is sufficient to compensate for the floodplain lost through the proposed development. Project Exodus will therefore not increase fluvial flood risk elsewhere. Following construction completion, surplus compensation will continue to be available to compensate future development for the Park.

Table 4-2 - Floodplain compensation[2]

Level (mAOD)	Pre development*		Development proposal		Post development	
	Existing surplus area (m^2)	Existing surplus volume** (m^3)	Proposed fill area (m^2)	Proposed cut area (m^2)	New surplus area (m^2)	New surplus volume** (m^3)
14.50	14,663	-	404	0	14,259	-
14.40	14,921	1,479	404	0	14,517	1,439
14.30	18,382	1,665	404	0	17,978	1,625
14.20	20,927	1,965	404	0	20,523	1,925
14.10	23,455	2,219	404	0	23,051	2,179
14.00	24,342	2,390	404	0	23,938	2,349
13.90	22,593	2,347	404	0	22,189	2,306
13.80	22,093	2,234	404	0	21,689	2,194
13.70	18,369	2,023	173	0	18,195	1,994
13.60	14,811	1,659	173	0	14,638	1,642
13.50	10,787	1,280	141	0	10,646	1,264
13.40	3,255	702	141	0	3,114	688
13.30	2,816	304	141	0	2,675	289
13.20	4,273	354	141	0	4,132	340
13.10	4,795	453	141	0	4,654	439
13.00	5,635	522	141	0	5,494	507
12.90	5,922	578	3,642	0	2,280	389
12.80	5,830	588	3,507	0	2,323	230
12.70	5,760	580	3,344	0	2,416	237

* The pre-development surplus area and volume includes all development constructed to date. This therefore represents the actual current surplus area and volume at Thorpe Park Resort.

** Volumes are calculated using the "trapezium rule" taking into account the area both at that level and the area at the level above.

4.1.5. Flood flow conveyance

At the consultation meeting on the 7 October 2009, it was agreed with the Environment Agency that the central part of Thorpe Park Resort (the main Island) does not act as a flow conveyance route during flood events. The main flow path through Thorpe Park Resort is from the Mead Lake Ditch, through the Fleet and Abbey Lakes, and downstream under the M3. The Project Exodus site is located on the edge of Abbey Lake. The ground levels are highest in the centre of the island, meaning that fluvial flood water originating from the surrounding lakes gradually inundates land on the edge of the main island and flows around, instead of over the top of, the area. The proposed development which is located on the main island will therefore not act to impede flood flows and will not increase flood levels off site.

[2] Data provided by HBL (2022) in drawings 8931-HBL-XX-XX-DR-C-1002 and 8931-HBL-XX-XX-DR-C-1102, and spreadsheet '8931 - EXODUS - FILL AREAS - OPERATIONAL PHASE'

New fencing is included as part of the development proposals. This will be open in design to allow water to easily pass through. Any debris that collects against the fencing will be removed as part of the general park maintenance.

4.1.6. Flood Evacuation

Thorpe Park Resort has already developed a flood response plan that includes provision for evacuation of the Park to ensure the safety of staff and visitors (Merlin Entertainment Group, 2011). In accordance with the plan, a lake level of 13.5m AOD would trigger a meeting of the Thorpe Park Resort Core Flood Action Team who would determine whether a full evacuation of the Park was required. In the event of continually rising lake levels and / or receipt of an Environment Agency 'flood warning', a decision to evacuate would be made. Power to attractions (including the new rollercoaster) would be turned off and areas made secure.

The flooding response in this part of the River Thames has a long lead time, with flood levels rising slowly over a period of days and with flooding in the upstream part of the catchment providing a good indication of how flood levels will change as an event evolves. Thorpe Park Resort has confirmed that full evacuation (of approximately 15,000 guests) can be undertaken in less than one hour. At a trigger level of 13.5m AOD, the Park would therefore be fully evacuated before the site area becomes inundated. In accordance with existing Park procedures, the area would then be out-of-use and would remain so for the duration of the flood.

4.2. Risk of surface water flooding

Although the proposed development is at a very low risk of surface water flooding, development that changes the ground covering could impact on surface water runoff rates and volumes.

The proposed drainage strategy (8931-HBL-00-XX-RP-D-0001) outlines the following measures:

- The proposed works are largely on existing impermeable surfaces, and there will be an overall decrease in impermeable area compared to the pre-development site. Extensive landscaping is to be implemented as part of the scheme, and the development will utilise permeable paving with surface water being infiltrated at source.
- Surface water run-off from all impermeable areas within the proposed application site will be directed via underground gravity pipe network and will discharge into the surface water body (Abbey Lake).
- Run-off will be limited (as is practically possible) to the greenfield rates for the 1 in 1 year, 1 in 30 year and 1 in 100 year levels as outlined in the SFRA (Runnymede Borough Council, 2018).
- The drainage network will be designed for the 1% (1 in 100) AEP + 40% climate change allowance and 10% urban creep allowance.
- All SuDS on site will be installed with full consideration to long term maintenance. Thorpe Park Resort will be required to implement an active management plan of all SuDS related to the project.

The design of the new fencing means that the development will not act to affect any existing surface water flow routes through the site.

Based on the information above, it is summarised that the proposed works would have no adverse impact on surface water runoff, in comparison to the existing arrangement.

4.3. Risk of sewer flooding

The existing sewer system servicing Thorpe Park Resort conveys foul flows to one of three pumping stations, from where sewage is pumped off site. This sewer system is separate from the surface water system and so does not pose a flood risk during storm events. In addition, there are no nearby developments which are likely to pose a risk to the proposed site in terms of flooding from foul or combined sewers.

The proposed works do not involve any alteration to the sewer network, nor will the development increase discharge to it. Therefore, the proposed works would not impact on the low risk associated with this source of flooding.

5. Conclusions

Table 5-1 below provides a summary of flood risk at the site and any potential impact on flood risk from the proposed development.

Table 5-1 - Summary of flood risk

Flood risk	Baseline risk	Commentary
Fluvial	High	Flood Zone 3. Land within site boundary is first at risk in a 3.3% (1 in 30) AEP with the exception of the lake, where the lake levels rise during all fluvial flood events.
Tidal	None	Upstream of tidal boundary of the River Thames.
Surface Water	Very Low	The site area has a chance of flooding less than 0.1% AEP.
Sewer risk	Low	Thorpe Park Resort is a standalone site with its own sewer system, that has three pumped outfalls into the Thames Water network. It is therefore considered that the risk of flooding from sewers is a low risk.
Reservoir	Residual	At risk in both a dry day and wet day reservoir breach scenario, however assumed to be residual risk due to management of reservoir by law (Reservoirs Act, 1975).
Groundwater	Fluvially dominated	High groundwater levels linked to high water levels in the Thames and therefore classed as fluvial.
Other sources	None	There are no other known sources of flood risk that pose a flood risk to the site, or that would be impacted as a result of the proposed development.

As outlined in the table above, the main risk to the site is fluvial flood risk. Based on the River Thames flood model outputs, the land within the indicative site boundary first floods in a 3.33% (1 in 30) AEP. The design flood level for the Park is the 1% (1 in 100) AEP with a 35% Climate Change allowance, which based on the Abbey Lake is 14.26 mAOD.

The construction includes the new rollercoaster and associated buildings and structures (including rollercoaster support columns, control/maintenance buildings, queue line, rollercoaster boarding platform, new photo opportunity building and a F&B unit), ground works infrastructure, infilling of part of the lake inlet, and landscaping.

There will be both temporary and permanent infill of the inlet of the Abbey Lake at this location. In operation, the hydraulic connectivity to the Abbey Lake will be maintained with the platform at 12.2 mAOD, compared with a normal lake level of 12.5 mAOD. However, during construction, the platform will be raised to 13.0 mAOD, and therefore hydraulic connectivity will be temporarily lost up to the 5% (1 in 20) AEP flood level.

The rollercoaster support columns will be constructed within the floodplain; however, they are deemed as water compatible infrastructure which will be designed to withstand hydraulic loading. The F&B and photo opportunity units are also constructed within the floodplain, with FFL below the design flood level but Thorpe Park Resort have accepted this risk and resilience measures will be incorporated. The control room, ride maintenance building and rollercoaster boarding platform are not at risk of flooding, as they will be raised above the design flood level.

The cut and fill at the site due to the proposed development has been compared with the existing agreed floodplain compensation bank at the Resort. The existing compensation scheme is sufficient to compensate for the floodplain lost through the proposed development. Project Exodus will therefore not increase fluvial flood risk elsewhere. Following construction completion, surplus compensation will continue to be available to compensate future development for the Park.

New fencing is included as part of the development proposals. This will be open in design to allow water to easily pass through. Any debris that collects against the fencing will be removed as part of the general park maintenance.

The proposed development would not put additional people at an unacceptable flood risk. This is owing to the implementation of Thorpe Park Resort's flood evacuation plan that would see people evacuated prior to the area being flooded, and the site made safe and secure.

The drainage network has been designed in accordance with the SFRA (Runnymede Borough Council, 2018) . It is summarised from the drainage strategy that the proposed works will have no adverse impact on surface water runoff, in comparison to the existing arrangement.

There is no predicted impact of the development on sewer flooding or groundwater flooding.

The proposed development is therefore considered to be at an acceptable level of flood risk, will not result in any increased flood risk to people or property and has been design in accordance with principles of NPPF.

6. References

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Runnymede Borough Council, 2020. *Runnymede 2030 Local Plan,* s.l.: s.n.

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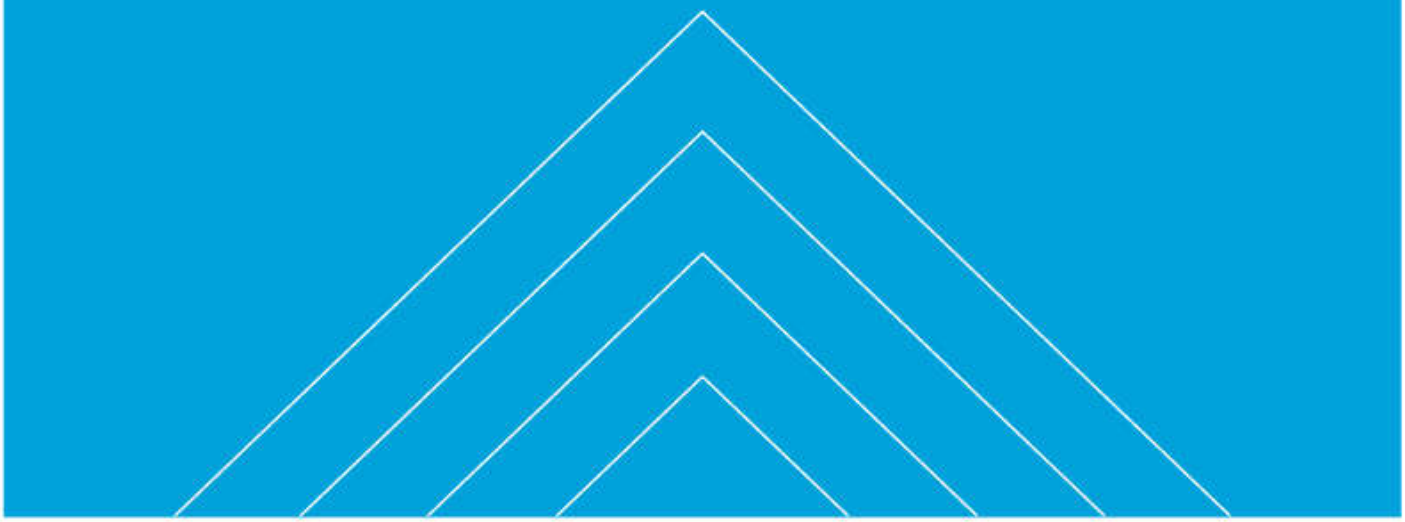
Appendices



Appendix A. Planning Drawings

A.1. Proposed demolition (TP24-SA-XX-XX-DR-A-0103)

1 Demolition
0103 SCALE 1 : 500

Scale 1 : 500

0 5 10 25 50 m

N

BIM 360://TP24 Exodus/TP24-SA-XX-XX-M3-A-0001.rvt

All heights, sizes and dimensions should be checked on site by the contractor before any work is put in hand.

Figured dimensions should be taken in preference to scaling and any errors or omissions reported to the architect at once.

This drawing has been prepared in accordance with the CDM (Construction Design and Management) and all foreseeable design risks to those involved or affected by construction have been avoided wherever possible.

Drawing prepared utilising drawings prepared by:

On Centre Surveys Drawing: 11076BX-1 Land & Utility Survey.dwg extract of 11076BX MASTER LAND SURVEY JUNE 2021.dwg

and

Ian Keen Ltd Drg: 1769-KC-XX-YTREE-TreeConstraintsPlan01Rev0.dwg

Specialist tree protection hoarding in accordance with BS 5873 Fig 2. & to the satisfaction of Ian Keen Ltd - Refer to drawing:1769-KC-XX-YTREE-TreeConstraintsPlan01Rev0.dwg for details and locations of hoarding and root protection areas.

Refer to Drawing Reference 472-105-5 for Landscape Proposals

NB; Information on this drawing is considered to be reliable. Smytheman Architectural take no responsibility for any unknown alterations undertaken during the construction process.

Key:

- Application Boundary
- Ownership Boundary
- Buildings/Structures to be demolished
- Existing Building

Rev	Date	By	Detail
P2	10.02.22	AD	Lichfield's Comments addressed
P1	27.01.22	AD	Prelim Planning Drawings

Drawing status

S3

Client

Merlin Magic Making

Project/Location

Thorpe Park
Staines Road
Chertsey
Surrey
KT16 8PN

Drawing title

Demolition Drawing

Date	Drawn	Checked	Job No.
26.11.21	AD	TM	3198

Scale(s)

As indicated @A1

Drawing number	Revision
TP24-SA-XX-XX-DR-A-0103	P2

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CIAT CHARTERED PRACTICE

A.2. Proposed development (TP24-SA-XX-XX-DR-A-0104)

1 0104 Site Plan as Proposed
SCALE 1 : 500

Scale 1 : 500
0 5 10 25 50 m

N

BIM 360://TP24 Exodus/TP24-SA-XX-XX-M3-A-0001.rvt

All heights, sizes and dimensions should be checked on site by the contractor before any work is put in hand.

Figured dimensions should be taken in preference to scaling and any errors or omissions reported to the architect at once.

This drawing has been prepared in accordance with the CDM (Construction Design and Management) and all foreseeable design risks to those involved or affected by construction have been avoided wherever possible.

Drawing prepared utilising drawings prepared by:

On Centre Surveys Drawing: 11076BX-1 Land & Utility Survey.dwg extract of 11076BX MASTER LAND SURVEY JUNE 2021.dwg

and

Ian Keen Ltd Drg: 1769-KC-XX-YTREE-TreeConstraintsPlan01Rev0.dwg

Specialist tree protection hoarding in accordance with BS 5873 Fig 2. & to the satisfaction of Ian Keen Ltd - Refer to drawing:1769-KC-XX-YTREE-TreeConstraintsPlan01Rev0.dwg for details and locations of hoarding and root protection areas.

Refer to Drawing Reference 472-105-5 for Landscape Proposals

NB; Information on this drawing is considered to be reliable. Smytheman Architectural take no responsibility for any unknown alterations undertaken during the construction process.

Key:

- Application Boundary
- Ownership Boundary
- Water
- Existing Building
- Proposed Building
- Proposed Surfacing

"F&B" - Food and Beverage offering

Rev	Date	By	Detail
P2	10.02.22	AD	Lichfield's Comments addressed
P1	27.01.22	AD	Prelim Planning Drawings

Drawing status

S3

Client

Merlin Magic Making

Project/Location

Thorpe Park
Staines Road
Chertsey
Surrey
KT16 8PN

Drawing title

Site/Block Plan as Proposed

Date	Drawn	Checked	Job No.
26.11.21	AD	TM	3198

Scale(s)

As indicated @A1

Drawing number	Revision
TP24-SA-XX-XX-DR-A-0104	P2

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CIAT CHARTERED PRACTICE

A.3. Proposed platform levels – construction phase (8931-HBL-XX-XX-DR-C-1000)

DO NOT SCALE FROM THIS DRAWING

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER HBL DRAWINGS ISSUED FOR THIS PROJECT

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METERS UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATIONS.
3. THE ENGINEER IS TO BE NOTIFIED OF ANY DISCREPANCIES TO THE DETAILS SHOWN ON THE DRAINAGE AND ANY UNRECORDED CONNECTIONS NOT SHOWN ON THE DRAWINGS.
4. THE DESIGN IS BASED ON THE INFORMATION AVAILABLE ON THE DATE OF ISSUE FROM OTHER PARTIES (E.G. ARCHITECT AND M&E ENGINEER). IT IS SUBJECT TO CHANGE RESULTING FROM UPDATES TO THE AVAILABLE INFORMATION FROM OTHERS.
5. ANY EXISTING DRAINAGE INFRASTRUCTURE TO BE RETAINED TO HAVE NEW COVERS AND FRAMES TO SUIT NEW LEVELS AND SURFACING.

KEY

- AREA OF PROPOSED PLATFORM CONSTRUCTION WORKS
- APPROXIMATE EXTENTS OF EXISTING LAKE
- PROPOSED EARTHWORK CONTOURS

u/s 13.500

u/s 13.500

u/s 13.500

u/s 13.000 in

u/s 12.375 in area of troph

15.0 in area of slab

u/s 14.000

u/s 13.000

u/s 13.000 in area of slab

u/s 14.000 in area of slab

u/s 16.

u/s 14.000

u/s 13.

removed to u/s 11.000

AREA OF FILL TO ACHIEVE A LEVEL WORKING PLATFORM OF 13.000mAOD AND CIRCA 0.5m ABOVE LAKE WATER LEVELS

CIRCA 7,898m³ OF IMPORTED FILL IS REQUIRED TO ACHIEVE THIS LEVEL

EXTENT OF EXISTING LAKE, LEVELS VARY.

REV.	DATE	DRAWN	DESCRIPTION	CHKD	APPRD
P03	JAN'22	AP	AREA OF EARTHWORKS INCREASED	AP	AP
P02	JAN'22	AP	MINOR AMENDMENTS	AP	AP
P01	OCT'21	AP	FIRST ISSUE	AP	AP

STATUS DESCRIPTION: FOR INFORMATION

STATUS: S2

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Consulting Civil & Structural Engineers

PROJECT: PROJECT EXODUS

DRAWING TITLE: PROPOSED PLATFORM LEVELS CONSTRUCTION PHASE

CLIENT: MERLIN ENTERTAINMENTS GROUP

HBL REF.	DATE	SCALE(S)	
8931	OCTOBER '21	AS SHOWN	A1

DRAWN	CHECKED	APPROVED
A. PRINCE	A. PRINCE	A. PRINCE

DRAWING No.: 8931-HBL-XX-XX-DR-C-1000

REV.: P03

A.4. Proposed platform levels – operational phase (8931-HBL-XX-XX-DR-C-1100)

DO NOT SCALE FROM THIS DRAWING

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER HBL DRAWINGS ISSUED FOR THIS PROJECT

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METERS UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND SPECIFICATIONS.
3. THE ENGINEER IS TO BE NOTIFIED OF ANY DISCREPANCIES TO THE DETAILS SHOWN ON THE DRAINAGE AND ANY UNRECORDED CONNECTIONS NOT SHOWN ON THE DRAWINGS.
4. THE DESIGN IS BASED ON THE INFORMATION AVAILABLE ON THE DATE OF ISSUE FROM OTHER PARTIES (E.G. ARCHITECT AND M&E ENGINEER). IT IS SUBJECT TO CHANGE RESULTING FROM UPDATES TO THE AVAILABLE INFORMATION FROM OTHERS.
5. ANY EXISTING DRAINAGE INFRASTRUCTURE TO BE RETAINED TO HAVE NEW COVERS AND FRAMES TO SUIT NEW LEVELS AND SURFACING.

KEY

- AREA OF PROPOSED PLATFORM CONSTRUCTION WORKS
- APPROXIMATE EXTENTS OF EXISTING LAKE
- PROPOSED EARTHWORK CONTOURS

LEVEL PLATFORM CREATED TO ALLOW FOR CONSTRUCTION TO BE REDUCED FROM 13.000mAOD TO 12.200mAOD

CIRCA 1,755m³ OF CUT FROM CONSTRUCTION PLATFORM IS REQUIRED TO ACHIEVE THIS LEVEL

EXTENT OF EXISTING LAKE, LEVELS VARY.

REV.	DATE	DRAWN	DESCRIPTION	CHKD	APPRD
P01	JAN'22	AP	FIRST ISSUE	AP	AP

STATUS DESCRIPTION: FOR INFORMATION

STATUS: S2

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PROJECT: PROJECT EXODUS

DRAWING TITLE: PROPOSED PLATFORM LEVELS OPERATIONAL PHASE

CLIENT: MERLIN ENTERTAINMENTS GROUP

HBL REF.	DATE	SCALE(S)	
8931	JANUARY' 22	AS SHOWN	A1

DRAWN	CHECKED	APPROVED
[redacted]	[redacted]	[redacted]

DRAWING No.: 8931-HBL-XX-XX-DR-C-1100

REV.: P01

Appendix B. Floodplain Compensation Table

472-9-27AB_1 /Thorpe Park Compensation Land Programme rev AE 02.02.2022

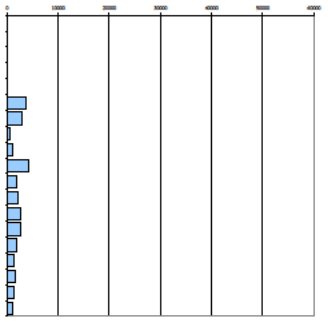
With Cut areas 1,2 & 3 as original consent, suplus of Area 3 removed, plus 1A, area F moved to F', No Fill areas D & J, others ACTUALS or as DESIGNED

Includes, updates for Area C, Top up for Area A, fill associated with 2012 Rollercoaster, 2011 actual cut for Area 1A, 2011 cut and fill for the Marquee approach path, 2011 Detonator Kiosk fill, as built (actual) fill for Area E, 2013 Crash Pad development on Area E, Mexican Cantina and pizza restaurant extension, dodgems attraction, the 2016 attraction and the DBGT Extension This version updated to include cut and fill associated with the 2017 pizza restaurant extension works

Compensation History to 10.2.03 (from WSA AK2511 (rev 10)

Area F'Actuals

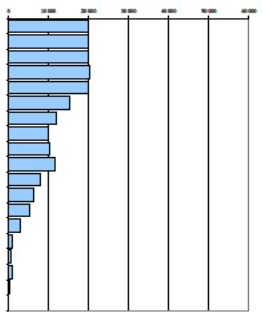
Level	Fill Tidal	Cut/Fill Colossus	Fill Storage	Fill			Cut/Fill	Cut					Yr 2000 Compensation Area			
m AoD	Wave		Building	A320 bund			Nemesis Inferno	Mound	Total used				FCA Existing	FCA Proposed	Comp'n offered (FCA Proposed-FCA Existing)	Surplus (Comp'n Offered-Total Used)
RDC ref	99/1049	00/0707	99/8879				01/0418	03/0060								
	Areas above level indicated in square metres															sqm
14.50	Not recorded														included in Cut 4a shown in following table	0
14.40	Not recorded															0
14.30	Not recorded															0
14.20	Not recorded															0
14.10	Not recorded															0
14.00	-2,886	-578	-300	-937			-164	180	-4,685				363	8,687	8,324	3,639
13.90	-3,355	-1,026	-300	-1,029			-109	540	-5,279				297	8,552	8,255	2,976
13.80	-3,936	-2,440	-300	-1,114			215	0	-7,575				237	8,420	8,183	608
13.70	-4,124	-1,771	-300	-1,017			183	0	-7,029				181	8,284	8,103	1,074
13.60	-3,164	-418	-300	-150			120	0	-3,912				133	8,150	8,017	4,105
13.50	-5,010	-532	-300	-50			-212	0	-6,104				89	8,014	7,925	1,821
13.40	-5,083	153	-300	0			-432	0	-5,662				46	7,874	7,828	2,166
13.30	-4 982	314	-300	0			0	0	-4,968				28	7 727	7,699	2,731
13.20	-4,935	291	-300	0			0	0	-4,944				18	7,577	7,559	2,615
13.10	-5,650	304	-300	0			0	0	-5,646				9	7,423	7,414	1,768
13.00	-5,775	0	-300	0			0	0	-6,075				0	7,363	7,363	1,288
12.90	Not recorded														1,694	1,694
12.80	Not recorded														1,260	1,260
12.70	Not recorded														976	976



Actual areas achieved although not recorded at the time as these levels not required by EA

Recent changes and Proposed Phases I & II

Level	Surplus	Rotary Ride	Icon Coaster	Phase I 4a	Colossus W'shop	Marquee	F Fish		Rotary Ride	Icon Coaster	Phase I Area B &G			Colossus W'shop	Marquee	F Fish	New
m AoD	c/f	Cut	Cut	Cut	Cut	Cut	Cut		Fill	Fill	Fill			Fill	Fill	Fill	Surplus
RDC ref																	
	Areas above level indicated in square metres								sqm		sqm			sqm			sqm
14.50	0		5,356	14,637			368			-588							19,773
14.40	0		*5 323*	14,655			*428*			-588							19,818
14.30	0		*5 290*	14,674			488			-588							19,864
14.20	0	645	5,257	14,695			*465*		-130	-588							20,344
14.10	0	*534*	*5 185*	14 711			*442*		*-138*	-588					-129		20,017
14.00	**3,639**	423	5 114	7 056	89	384	418		-146	-1 110				-166	-412		**15,289**
13.90	**2,976**	0	2,437	*7 072*		570	*412*		*-139*	-831				-46	-436		**12,015**
13.80	**608**	0	2,141	*7 088*		685	*407*		*-132*	-509					-389		**9,899**
13.70	**1,074**	0	1,858	*8 004*		107	401		-125	-495					-107	-492	**10,225**
13.60	**4,105**	0	320	*8 020*		*92*			0	-481					*-79*	*-521*	**11,456**
13.50	**1,821**	0	164	7,136		76			0	-467	-278				-53	-550	**7,849**
13.40	**2,166**	0		*7 397*		52			0	-453	-2,290					*-581*	**6,291**
13.30	**2,731**	0		*7 658*		30			0	-439	-4,185					*-612*	**5,183**
13.20	**2,615**	0		7 921		8			0	-412	-6 655					-643	**2,834**
13.10	**1,768**	0		8,688					0	-452	-8,432					*-623*	**949**
13.00	**1,288**	0		10,290					0	-435	-10,051					-603	**489**
12.90	**1,694**	0		*10 493*					0	-418	*-10 362*					*-601*	**806**
12.80	**1,260**	0		*10 696*					0	-401	*-10 673*					*-598*	**284**
12.70	**976**	0		10,898			271		0	-564	-10,985					-595	**1**
						Balancing fig see below										-12,144	

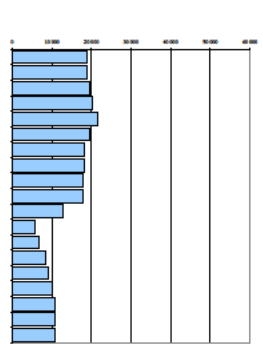


Proposed Phase III

Used comp as permitted. Surplus removed

ACTUAL

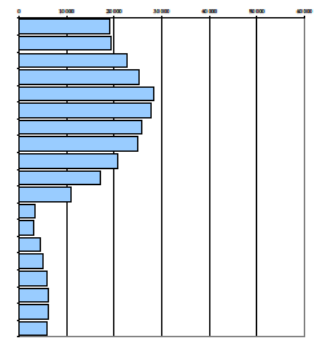
Level	Surplus	area 1 Cut	area 2 Cut		area 3 Cut				Area A Fill	Area C Fill		Area F Fill		472/58sk/2 100% of H Fill	Area J Fill		New Surplus
m AoD	c/f																
RDC ref																	
	Areas above level indicated in square metres								sqm	sqm		sqm			sqm		sqm
14.50	19,773	428			0				-378					-925	0		18,898
14.40	19,818	616			0				-408	-174				-925	0		18,927
14.30	19,864	1,287			0				-440	-220				-925	0		19,566
14.20	20,344	2,654			0				-473	-1369				-925	0		20,231
14.10	20,017	4,352	736		0				-508	-2018		-18		-925	0		21,636
14.00	**15,289**	5 470	2987		0				-544	-2596		-33		-925	0		**19,648**
13.90	**12,015**	6,279	4660		0				-582	-3106		-54		-925	0		**18,287**
13.80	**9,899**	6,940	6618		0				-637	-3600		-86		-925	0		**18,209**
13.70	**10,225**	7,620	7006		0				-771	-4160		-131		-1,814	0		**17,975**
13.60	**11,456**	8 213	7323		0				-1285	-5311		-277		-2 332	0		**17,787**
13.50	**7,849**	8,729	7604		0				-2070	-5439		-1,186		-2,775	0		**12,712**
13.40	**6,291**	9,073	7865		0				-3846	-8870		-1,657		-3,061	0		**5,795**
13.30	**5,183**	9,397	8007		*2 763*				-4664	-8918		-1,897		-3,288	0		**6,583**
13.20	**2,834**	9 765	8115		8 076				-5122	-8964		-2 114		-4 108	0		**8,482**
13.10	**949**	9,953	8224		*10 610*				-5351	-9015		-2,114		-4,108	0		**9,148**
13.00	**489**	9,804	8311		12,259				-5439	-9064		-2,114		-4,108	0		**10,138**
12.90	**806**	9,639	8204		*12 841*				*-5510*	-9131		-2,114		-4,108	0		**10,627**
12.80	**284**	9,409	8049		*13 992*				*-5582*	-9199		-2,114		-4,108	0		**10,731**
12.70	**1**	8,967	6148		17,134		-271		-5654	-9266		-2,114		-4,108	0		**10,837**
		& 250sqm ! Could win another 1700 sqm here					Balancing fig see above			Area C actual as built areas by 2012						-21,142	



Proposed Phase IV

ACTUAL

Level	Surplus	area 1a Cut		Marquee Path Cut					To Finish Area A Fill	Area D Fill	ACTUAL Area E Fill			2011 Water Ride Fill	2011 Marquee Path Fill	2011 Detonator Kiosk Fill	New Surplus
m AoD	c/f																
RDC ref																	
Areas above level indicated in squ m				sqm					sqm	sqm	sqm			sqm	sqm	sqm	sqm
14.50	18,898	343												-112			19,129
14.40	18,927	570												-112			19,388
14.30	**19,566**	3,326		178					0					-112	-100	-16	**22,842**
14.20	**20,231**	5,167		172					0					-56	-123	-16	**25,375**
14.10	**21,636**	6,834		158					0	0	0			-18	-187		**28,423**
14.00	**19,648**	8,501		152					-265	0	0			0	-204		**27,832**
13.90	**18,287**	8,400		159					-740	0	0			0	-237		**25,869**
13.80	**18,209**	8,296		166					-1448	0	0			0	-272		**24,951**
13.70	**17,975**	8,192		179					-2664	0	-2608			0	-209		**20,865**
13.60	**17,787**	8,088		192					-3427	0	-5215			0	-156		**17,269**
13.50	**12,712**	7,984		203					-4330	0	-5432			0	-112		**11,025**
13.40	**5,795**	7,891		214					-4778	0	-5585			0	-46		**3,491**
13.30	**6,583**	7,799							-5258	0	-5919			0	-30		**3,175**
13.20	**8,482**	7,707							-5792	0	-5920			0			**4,477**
13.10	**9,148**	7,615							-5792	0	-5979			0			**4,992**
13.00	**10,138**	7,523							-5792	0	-6030			0			**5,839**
12.90	**10,627**	7,409							-5792	0	-6112			0			**6,132**
12.80	**10,731**	7,296							-5792	0	-6188			0			**6,047**
12.70	**10,837**	7,183							-5792	0	-6245			0			**5,983**
											Area E actual as built areas					-12,037	

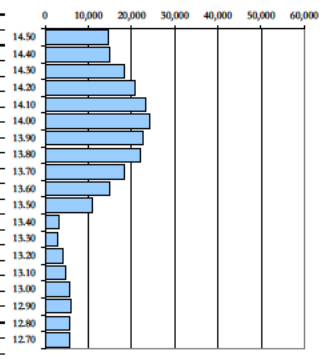


Area 1A actual as built areas 2011

Surplus after creation of Comp Area 1a

Proposed Phase V MTDP (2010-2016) **Actual Phase V MTDP (2010 - 2016)** **Actual Development under MTDP3** **Crash Pad**

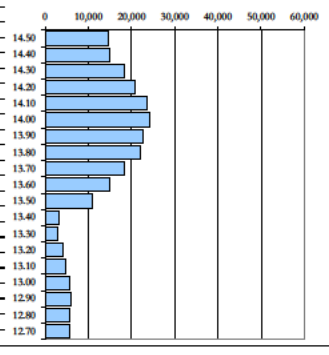
Level	Surplus	Indicative MTDP3 Develop-ment	Indicative Surplus Following MTDP3	Dodgems Cut	2016 Attraction Cut	DBGT Extension Cut	2012 Coaster Fill	Area A Top Up for 2012 Coaster Fill	Mexican Cantina Extension Fill	Dodgems Fill	Pizza Restaurant Extension Fill	2016 Attraction Fill	Containment Attraction Fill	DBGT Extension Fill	Remaining Approved Fill MTDP	2013 Crash Pad Fill	Indicative Surplus Following MTDP3 & Crash Pad	Actual New Surplus
m AoD	c/f																	
RDC ref																		
			sqm	sqm	sqm		sqm	sqm	sqm	sqm	sqm	sqm	sqm	sqm	sqm		sqm	sqm
14.50	19,129	-5,000	14,129		698	0	-1,333		-71	-12	-180	-1,197	-69	0	-2,836	-2,298	11,831	14,667
14.40	19,388	-5,000	14,385		690	0	-1,331		-71	-12	-180	-1,193	-69	0	-2,833	-2,298	12,087	14,920
14.30	**22,842**	-5,648	17,194		677	0	-1,329		-71	-12	-180	-1,185	-66	0	-3,482	-2,298	14,896	**18,378**
14.20	**25,375**	-5,648	19,727		594	0	-1,325		-71	-12	-180	-1,161	-10	0	-3,483	-2,298	17,429	**20,912**
14.10	**28,423**	-5,648	22,775	1	28		-1,315		-71	-371	-180	-776		0	-2,964	-2,298	20,477	**23,441**
14.00	**27,832**	-5 648	22 184	2			-593		-71	-371	-180				-4 435	-2 298	19 886	**24,321**
13.90	**25,869**	-5,648	20,221	4			-421		-21	-358	-180				-4,671	-2,298	17,923	**22,594**
13.80	**24,951**	-5,648	19,303	6			-337			-229					-5,088	-2,298	17,005	**22,093**
13.70	**20,865**	-5,648	15,217	8			-253			-37					-5,366	-2,214	13,003	**18,369**
13.60	**17,269**	-3 648	13 621				-244								-3 404	-2 214	11 407	**14,811**
13.50	**11,025**	-3,148	7,877				-238								-2,910		7,877	**10,787**
13.40	**3,491**	-2,048	1,443				-185	-51							-1,812		1,443	**3,255**
13.30	**3,175**	-2,048	1,127				-175	-184							-1,689		1,127	**2,816**
13.20	**4,477**	-2 048	2 429				-13	-191							-1 844		2 429	**4,273**
13.10	**4,992**	-2,048	2,944					-197							-1,851		2,944	**4,795**
13.00	**5,839**	-2,048	3,791					-204							-1,844		3,791	**5,635**
12.90	**6,132**	-2,048	4,084					-210							-1,838		4,084	**5,922**
12.80	**6,047**	-2,048	3,999					-217							-1,831		3,999	**5,830**
12.70	**5,983**	-1 548	4 435					-223							-1 325		4 435	**5,760**



Phase VI (from 2017) **Actual Phase VI (from 2017)**

Actual Development CUT | Actual Development FILL

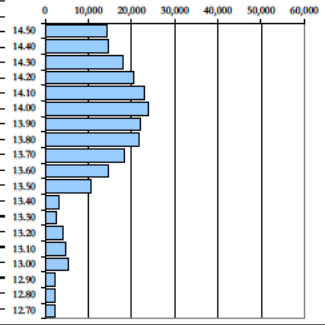
Level	Surplus	Pizza restaurant extension 2017 Cut	Pizza restaurant extension 2017 Fill	Actual New Surplus
m AoD	c/f			
RDC ref				
		sqm	sqm	sqm
14.50	14,667	1.4	-5.25	14,663
14.40	**14,920**	5.4	-5.25	**14,921**
14.30	**18,378**	9.4	-5.25	**18,382**
14.20	**20,912**	16.4	-1.48	**20,927**
14.10	**23,441**	16.0	-1.48	**23,455**
14.00	**24,321**	22.8	-1.48	**24,342**
13.90	**22,594**		-1.48	**22,593**
13.80	**22,093**			**22,093**
13.70	**18,369**			**18,369**
13.60	**14,811**			**14,811**
13.50	**10,787**			**10,787**
13.40	**3,255**			**3,255**
13.30	**2,816**			**2,816**
13.20	**4,273**			**4,273**
13.10	**4,795**			**4,795**
13.00	**5,635**			**5,635**
12.90	**5,922**			**5,922**
12.80	**5,830**			**5,830**
12.70	**5,760**			**5,760**



Phase VII (from 2022) **Planned Phase VII (from 2022)**

Planned Development CUT | Planned Development FILL

Level	Surplus	Project Exodus 2022 Cut	Project Exodus 2022 Fill	Actual New Surplus
m AoD	c/f			
RDC ref				
		sqm	sqm	sqm
14.50	14,663		-404.00	14,259
14.40	**14,921**		-404.00	**14,517**
14.30	**18,382**		-404.00	**17,978**
14.20	**20,927**		-404.00	**20,523**
14.10	**23,455**		-404.00	**23,051**
14.00	**24,342**		-404.00	**23,938**
13.90	**22,593**		-404.00	**22,189**
13.80	**22,093**		-404.00	**21,689**
13.70	**18,369**		-173.40	**18,195**
13.60	**14,811**		-173.40	**14,638**
13.50	**10,787**		-141.40	**10,646**
13.40	**3,255**		-141.40	**3,114**
13.30	**2,816**		-141.40	**2,675**
13.20	**4,273**		-141.40	**4,132**
13.10	**4,795**		-141.40	**4,654**
13.00	**5,635**		-141.40	**5,494**
12.90	**5,922**		-3642.29	**2,280**
12.80	**5,830**		-3506.87	**2,323**
12.70	**5,760**		-3343.76	**2,416**



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