

**London Borough of Enfield  
(Meridian Water Strategic  
Infrastructure Works)  
Compulsory Purchase Order 2020  
Proof of Evidence - Joe Nunan**

PINS Ref: PCU/CPOP/Q5300/3258664

Issue | 26 March 2021

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Job number 256240-00

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# 1 Qualifications and Experience

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## 1.1 Joe Nunan

1.1.1 My name is Joe Nunan. I am a Chartered Civil Engineer with a degree B.Eng (Hons) in Civil Engineering.

1.1.2 I am an Associate Director within Arup's Infrastructure Group based in London and responsible for leading a range of engineering projects in support of new developments.

1.1.3 I have worked as a civil engineer for 30 years and have been a Member of the Institution of Civil Engineers for twenty-three years. I have wide experience in leading the design of complex civil engineering infrastructure for major urban developments and the associated interfaces and discussions with affected statutory and other bodies. My work includes involvement through the whole design process from site assessments to construction and handover.

1.1.4 I led the civil engineering team developing the proposals for the consented Meridian Water Strategic Infrastructure Works ('SIW') as well as the 'Meridian Water Phase Two' planning application, which related to the development of Zones 4 and 5 and a part of Zone 2 (as shown on the plan at Core Document 7) for up to 284,600 sqm (GEA) of residential led mixed use development ('Phase Two'). The SIW design included developing the flood mitigation, drainage, earthworks/remediation, utility and roads/bridges strategies including identifying associated land requirements to implement these strategies.

## 2 Scope of Evidence

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- 2.1.1 My evidence, presented on behalf of the London Borough of Enfield ('Council') has been prepared to summarise the engineering aspects of the SIW and consequential requirement for land identified within the London Borough of Enfield (Meridian Water Strategic Infrastructure Works) Compulsory Purchase Order 2020 ('the Order'). The land included within the Order is referred to as the Order Land which is shown on the plan at Core Document 2 to the Statement of Case (the 'Order Map').
- 2.1.2 The Council has made the Order pursuant to sections 226(1)(a) of the Town and Country Planning Act 1990 ('the 1990 Act') and section 13 of the Local Government (Miscellaneous Provisions) Act 1976 ('the 1976 Act'). The Council is the local planning authority and local highway authority for the Order Land.
- 2.1.3 If confirmed by the Secretary of State, the Order will enable the Council to acquire the Order Land including certain rights over land compulsorily, in order to undertake the SIW, which are described in greater detail below, in connection with the housing-led regeneration of the area known as Meridian Water. The development of Meridian Water is also referred to in the Statement of Case and this evidence as the Scheme. The nature of the Scheme is described in greater detail in the evidence of Mr George.
- 2.1.4 I am familiar with the Order Land and wider Meridian Water area, having been part of the Council Design Team since 2015. I have visited Meridian Water on numerous occasions during the development of the SIW and Phase Two proposals.
- 2.1.5 In the remainder of this evidence, I detail how the site constraints have influenced the engineering solutions at Meridian Water and some alternative solutions were considered. I also address those aspects of the remaining objections that are relevant to my area of expertise.
- 2.1.6 My evidence is structured such that I describe the SIW works including options considered and the relationship between the elements in Section 3. Section 4 considers the objections raised to the Order and responds to those aspects concerning the engineering design of the SIW. Section 5 contains my conclusions and I have included figures within my evidence at a larger scale in the Appendix.

- 2.1.7 My evidence demonstrates that the land included within the Order is necessary to deliver the Scheme, that alternatives were considered where practical and the extent of any land take has been minimised.
- 2.1.8 I confirm the opinions expressed are my true and professional opinions.

## 3 Engineering Overview of SIW

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3.1.1 This section considers the background to Meridian Water, the constraints which affect it and how the engineering approaches which comprise the SIW have been developed to address the constraints. The site is currently affected by flooding, contamination, poor access and inadequate utility provision as described in the following sections of my proof. In the remainder of this section I set out the development of the engineering approaches to each of these development constraints, by reference to the following headings:

- Flooding;
- Naturalisation of Pymmes Brook;
- Surface Water Drainage;
- Earthworks, Contamination and Remediation;
- Roads and Bridges; and
- Utility Services.

## 3.2 Flooding

3.2.1 In this section I set out how flooding affects the existing development site, what the proposed mitigation strategy is and what land is required to implement this strategy.

3.2.2 The site is crossed by a number of water courses including the Pymmes Brook, the Salmons Brook and the River Lee Navigation Canal ('the Canal'), whilst the eastern boundary is formed by the River Lee. These are shown in Figure 1 below:

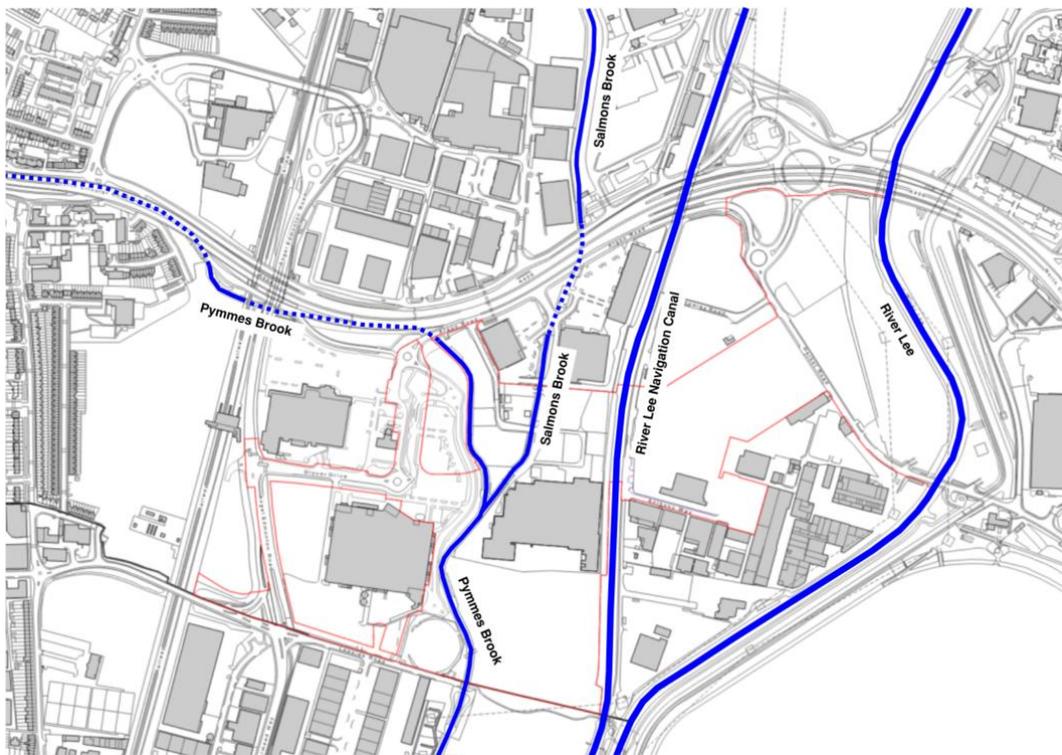


Figure 1 - Watercourses at Meridian Water

3.2.3 The Environment Agency ('EA') flood mapping for the area shows that extensive flooding occurs as a result of overtopping from the Canal onto sites on both sides and overtopping from the River Lee into the areas on the east side of the site. Large parts of the site are located within Flood Zone 2 or Flood Zone 3. Flood Zones are identified by the EA have the following definitions:

- Flood Zone 2 – land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year;
- Flood Zone 3 – land assessed as having a 1 in 100 or greater probability of river flooding in any year.

The extent of the flooding is indicated by the blue shading in Figure 2.

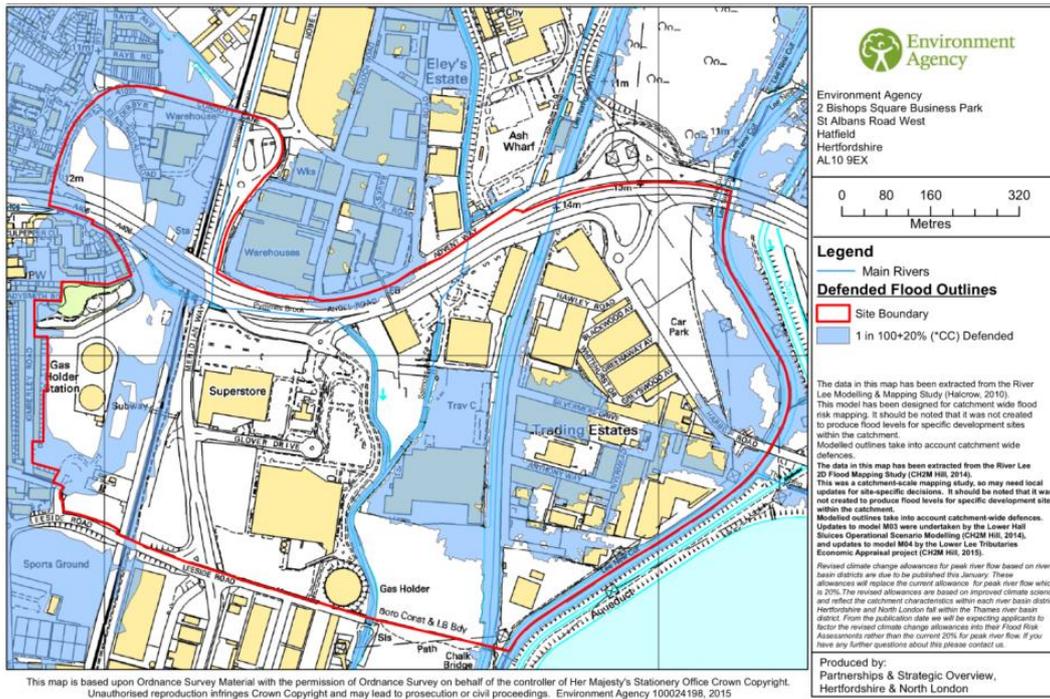


Figure 2 - Flood Mapping for Meridian Water (2012)

3.2.4 The above EA flood mapping is not current for the area, in that it shows a 20% allowance for climate change rather than the 35% allowance which should now be used. Therefore the EA required that updated flood mapping was prepared to establish the current baseline. Arup undertook this hydraulic modelling to update the flood mapping for the 35% climate change allowance. This provides a revised baseline and shows where flooding is currently expected, shown in Figure 3.

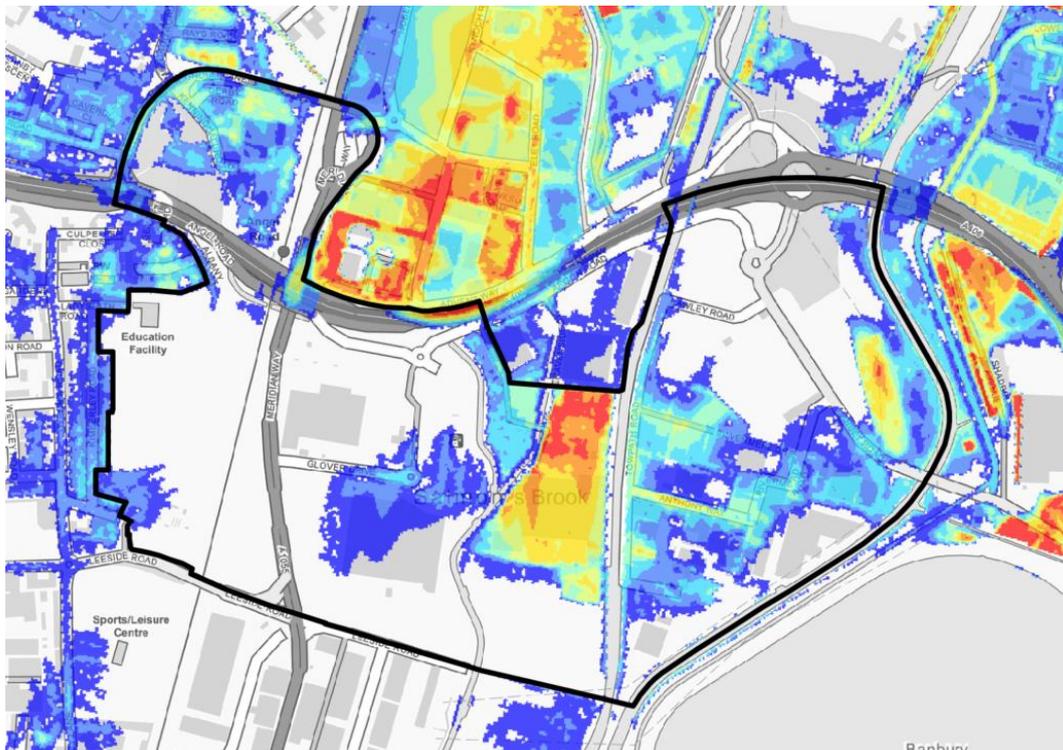


Figure 3 - Update Flood Mapping (with 35% Climate Change allowance)

3.2.5 The new modelling showed that the areas at risk of flooding were more extensive with the higher climate change allowance. Flooding from the Canal still extends across the area between the Canal and the brooks, but it also affects the land on the east bank of the Canal and there is some extension of the flooding into the land to the east of Harbet Road. In addition flooding may also occur from the Salmons Brook north of the A406; this flooding results in overland flow into the area of the site between the Pymmes Brook and Salmons Brook. Flooding from the River Lee also extends further into the land to the east of Harbet Road.

3.2.6 The flooding extent covers much of the area identified for development within the development plan, specifically within the

ELAAP. In order to bring forward development in the areas proposed in the ELAAP, these areas need to be protected from flooding.

Approaches to flood protection include flood barriers or defences or raising ground levels. They all require that the flooding is displaced and therefore a flood mitigation strategy is required. The mitigation strategy needs to demonstrate that the mitigation proposals will not adversely impact upon areas upstream or downstream of the development.

3.2.7 There are two aspects to the flood mitigation strategy. The first is mitigation of the flooding emanating from the canal, which is described below in paragraphs 3.2.8 to 3.2.23 . The second is mitigation of the flooding emanating from the Salmons Brook, which is described in paragraphs 3.2.24 to 3.2.26.

### **Flood mitigation for the Canal flooding**

3.2.8 The flood mitigation measures need to be close to the location of the flooding to be effective and three locations were identified with the Council Lead Local Flood Authority ('LLFA') including:

- Upstream at Lee Valley Golf Course;
- Downstream on Tottenham Marshes;
- On site within the land east of Harbet Road.

The locations are shown in the Figure 4 below.

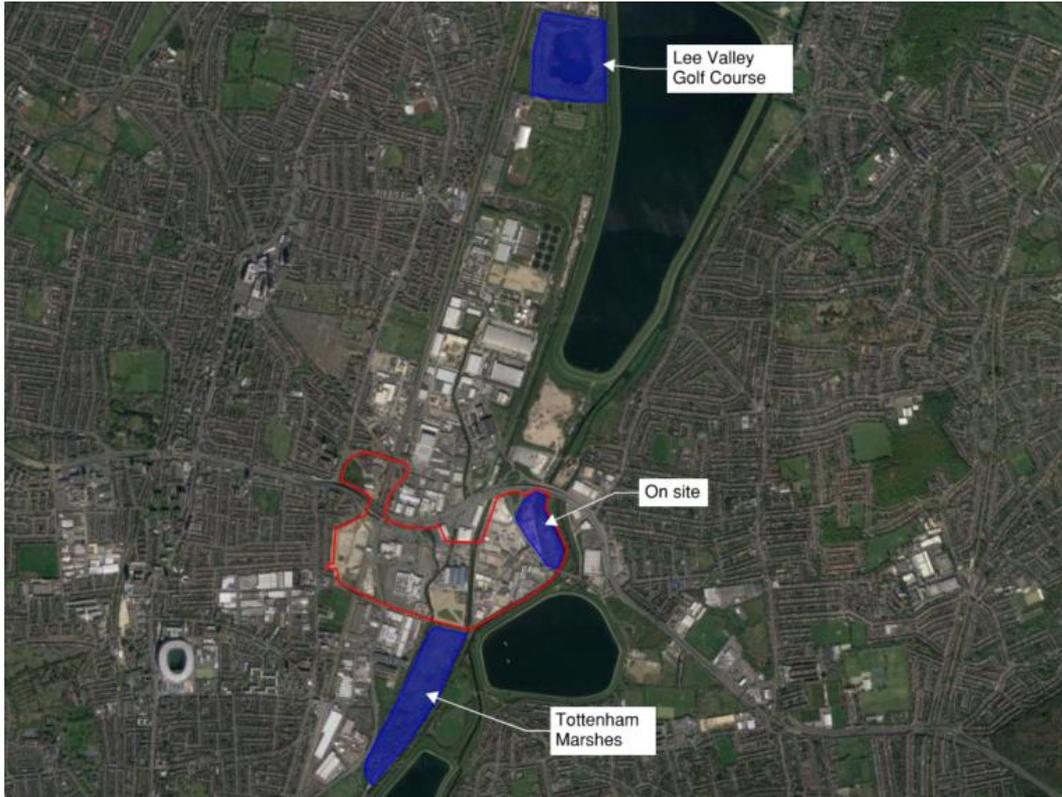


Figure 4 - Possible Flood Compensation areas

3.2.9 The land at the golf course was considered because it is open space adjacent to the water courses and modification of the levels would be possible. The land is upstream of the development which makes linking the flood compensation hydraulically between the sites technically difficult. The land is not owned by the Council.

3.2.10 The land at Tottenham Marshes was considered because it is open space which is currently directly affected by flooding. The land is within the borough of Haringey rather than Enfield.

3.2.11 The land east of Harbet Road was considered because it is green space, parts of which are currently subject to flooding and it is located within the Scheme boundary (as described in the evidence of Peter George), and the site is currently unused. The land is partly within the ownership of the Council.

3.2.12 The preferred location for the flood mitigation was identified as the land east of Harbet Road because:

- it is most proximate to the land which it is intended to protect from flooding (which is optimal),

- it is already partially affected by flooding, so the effect of the increased flooding to site is minimal; and,
- the path for flood water from the Canal to the land is already within Council control.

- 3.2.13 When planning to mitigate the impact of flooding, it is necessary to provide an equivalent flood storage volume and to demonstrate there are no significant impacts through hydraulic modelling. The flood mitigation strategy needs to be agreed with the EA.
- 3.2.14 At Meridian Water the principal of the flood mitigation strategy is to raise the ground levels within the development areas and to displace the flood water to new flood compensation basins formed within the land to the east of Harbet Road. The aim is to use material excavated when forming the flood compensation basins to raise the ground levels in the development areas. The flood compensation basins which are utilised infrequently for flooding will then also provide open space/park as part of the development. The flood compensation basins use land within Plots 127, 128, 129, 130, 131, 132, 133, 134, 136 and 137, for the reasons explained below.
- 3.2.15 The land east of Harbet Road includes assets owned by National Grid Electricity Transmission and Thames Water Utilities Limited ('TWUL'). These include a pylon and buried pipes and a tunnel. The flood compensation is being provided through basins in order to minimise any impacts on those assets. The layout of the basins in relation to the assets is shown in Figure 5, they have been split east-west to maintain a spine at existing levels over the TWUL pipes, and they have been split north-south to provide an access corridor from Harbet Road to the pylon and TWUL assets. This results in four basins:

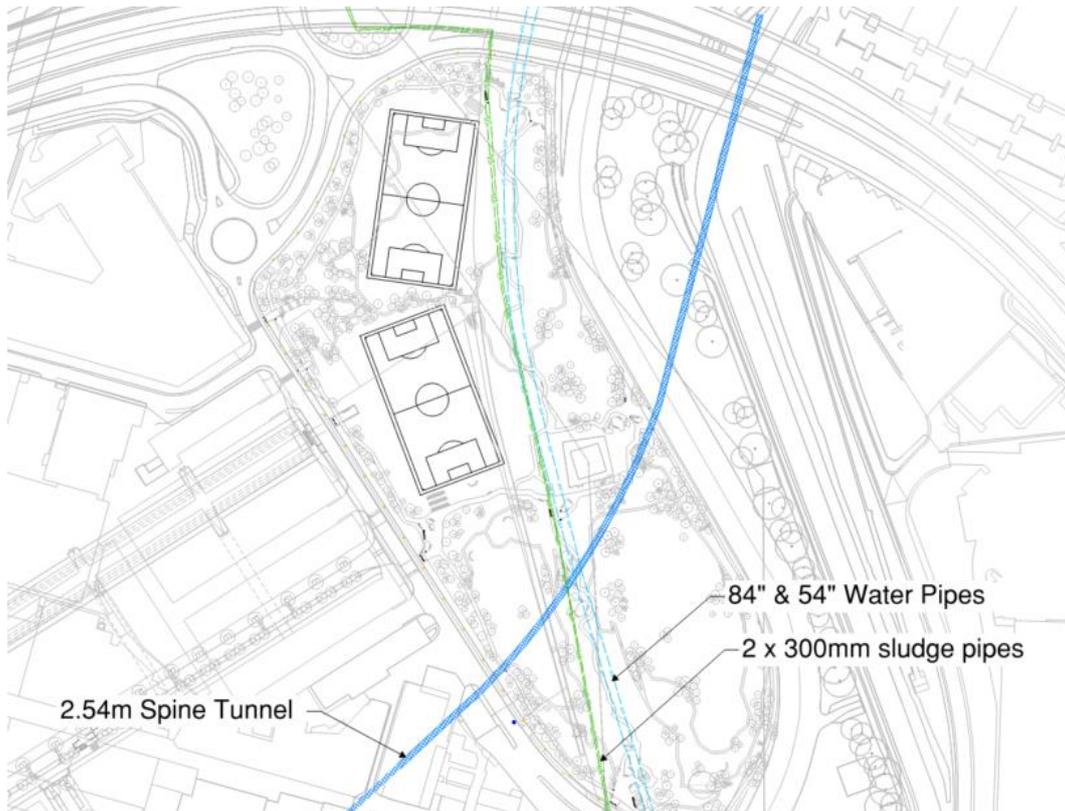


Figure 5 - Proposed Flood Compensation Basins and TWUL Assets

3.2.16 Using hydraulic modelling software it was demonstrated that the flood mitigation strategy using the compensation basins would be effective, but in order to reflect the existing flood regime as closely as possible and ensure no detrimental impacts five additional measures have been identified. These measures and their purpose are described below and shown in Figure 6:

- A conveyance channel between Towpath Road and Edmonton Marshes, including a new culvert under Harbet Road;
- A flood barrier along Towpath Road between Anthony Way and the Arriva bus depot;
- A berm (an artificial ridge or embankment) on the east side of Harbet Road;
- Raised levels on the spine between the compensation basins; and
- Outlets from the compensation basins to the River Lee.

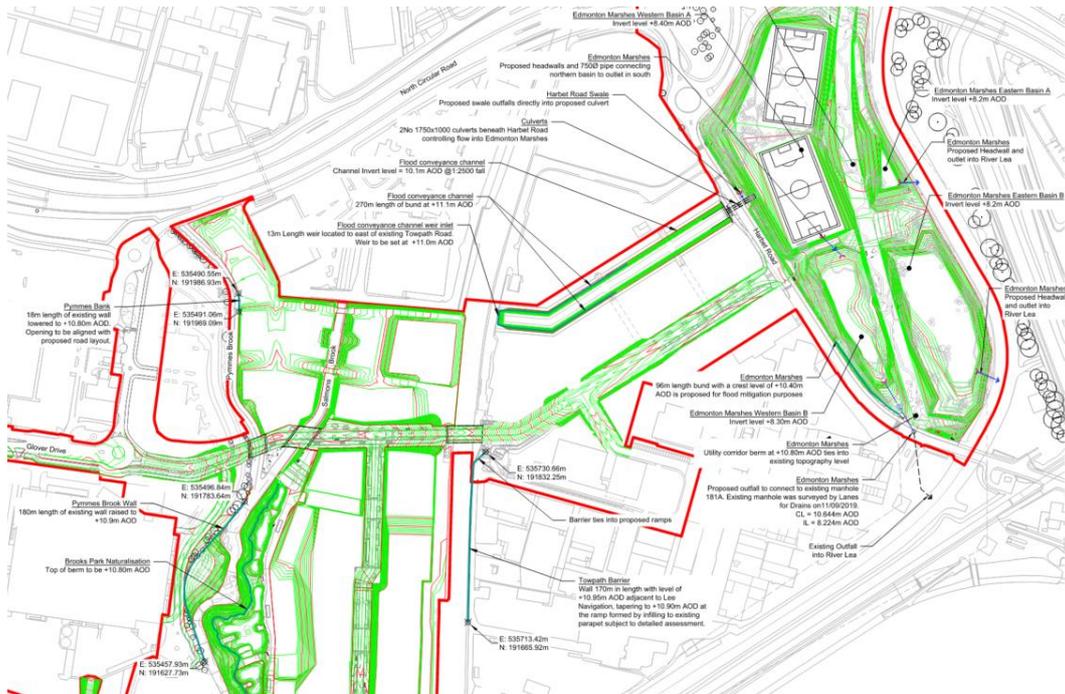


Figure 6 - Proposed Flood Mitigation Measures

### Flood conveyance channel.

#### 3.2.17

With the existing levels and flooding regime, water overtops the east bank of the Canal and floods the land to the east of the Canal. When the levels are raised in the development area to the west of the Canal the displaced flood water flows across the land on the east side of the Canal to the compensation basins, but in an uncontrolled way increasing flooding of these existing uses. To mitigate this detrimental impact it is necessary to provide a flood conveyance channel to the north of the site so that flood water can reach the compensation basins more easily, reducing the risk of the flooding on the existing uses. The channel will be 11.5m wide and will connect via a culvert under Harbet Road to the compensation basins.

#### 3.2.18

For the flood conveyance channel to operate as designed, it is important that the flow into the western end of the channel is not impeded. This flow will be across the Canal towpath and Towpath Road affecting Plots 106 and 107. The flood conveyance channel will be within Plots 107 and 116. The culvert under Harbet Road will be within Plot 125 and 126.

## **Towpath Road Flood Barrier**

3.2.19 The hydraulic modelling showed that the conveyance channel will reduce the detrimental effects on the east bank due to flooding, however there would still be a small increase in flood level. In order to mitigate this increase a flood barrier is proposed along Towpath Road, between the Central Spine Road and the entrance to the Arriva bus depot, approximately 170m. The barrier will only need to be approximately 500mm above existing ground level. Since there is an existing vehicle parapet along this section of Towpath Road it is proposed that the flood barrier is integrated with the vehicle parapet. The installation of the flood barrier will affect Plots 107, 109, 112, 113 and 114.

## **Harbet Road Berm**

3.2.20 The hydraulic modelling showed that when the flood water had filled the compensation basins, it could flow back (from the compensation basins west) across Harbet Road into the industrial area. This is an existing flow path across Plots 136 and 137 with flooding from the River Lee already causing some flooding. However flooding was exacerbated by the compensation proposals. To mitigate this impact it is proposed to raise levels on the east side of Harbet Road by forming a berm. The berm will contain the flooding in the compensation basin and additionally will mitigate existing flooding of the industrial area. The berm will be integrated into the landscaping to prevent unauthorised vehicle access to the park area. To operate effectively, the southern section of the berm will need to be located within Plot 136 with the remainder in Plot 137 to prevent the flow path described above.

## **Raised Levels on the spine**

3.2.21 There is existing flooding to the land east of Harbet Road. The flooding originates from the River Lee to the east. When the flood compensation basins were initially included in the hydraulic modelling they had limited effect in mitigating flood impacts downstream. It was identified that this was due to the basins being filled early in the flood cycle with flood water from the existing flood relief channel. When the maximum flood level in the Canal reached the site, the compensation basins were already filled and did not provide any benefit. This is resolved by raising ground levels on the

spine through compensation area. The two basins east of the spine provide the compensation for the flooding from the River Lee, but the raised levels on the spine prevent this flood water flowing further west. The two basins west of the spine are then available to receive flood flows from the maximum flood level in the Canal. The raised levels are consequently required to be contained within Plot 133.

### **Outlets from the Compensation Basins**

3.2.22 The compensation basins need to drain down so that they are available for use in a subsequent storm event. It is not practical to rely on them emptying through infiltration because this would be slow and the volume may not be available when required. Therefore physical outlets from the basins are required. For the two basins east of the spine it is proposed that new outfalls are formed through the existing structure into the River Lee. These outlets are located in Plot 135.

3.2.23 The two basins west of the spine cannot drain directly to the River Lee because it is not possible to form a connection past the pipes within the spine. It is therefore proposed that these two basins will drain to an existing manhole and sewer in Harbet Road which is connected to the River Lee. The outfall and connection from the basins will be located within Plot 136.

### **Flood mitigation in respect of Salmons Brook flooding**

3.2.24 The revised flood modelling showed that increased flooding from the Salmons Brook north of the A406 would occur when including the new climate change allowances. This flooding extends overland south across the A406 and into the area of the development in Zone 5 between the Pymmes and Salmons Brooks. It is effectively contained in this area by the existing walls to these brooks.

3.2.25 To mitigate this flooding it is proposed to lower a section of the wall to the Pymmes Brook to allow the floodwater to continue its flow south back into the watercourses. The confluence of the Pymmes and Salmons is approximately 150m to the south of the proposed section of lowered wall. Effectively the floodwater will be returned to the same watercourse it came from.

3.2.26 The proposal to naturalise the Pymmes Brook described in Section 3.3 includes widening the brook corridor and creating parkland at this

lower level. This also creates flood compensation volume within the brooks. The hydraulic modelling showed that by allowing the floodwater to re-enter the Pymmes Brook and providing the flood compensation in the park the extent of flooding in Zone 5 and north of the A406 would be reduced. The areas where flood depths are reduced are shaded blue in Figure 7.

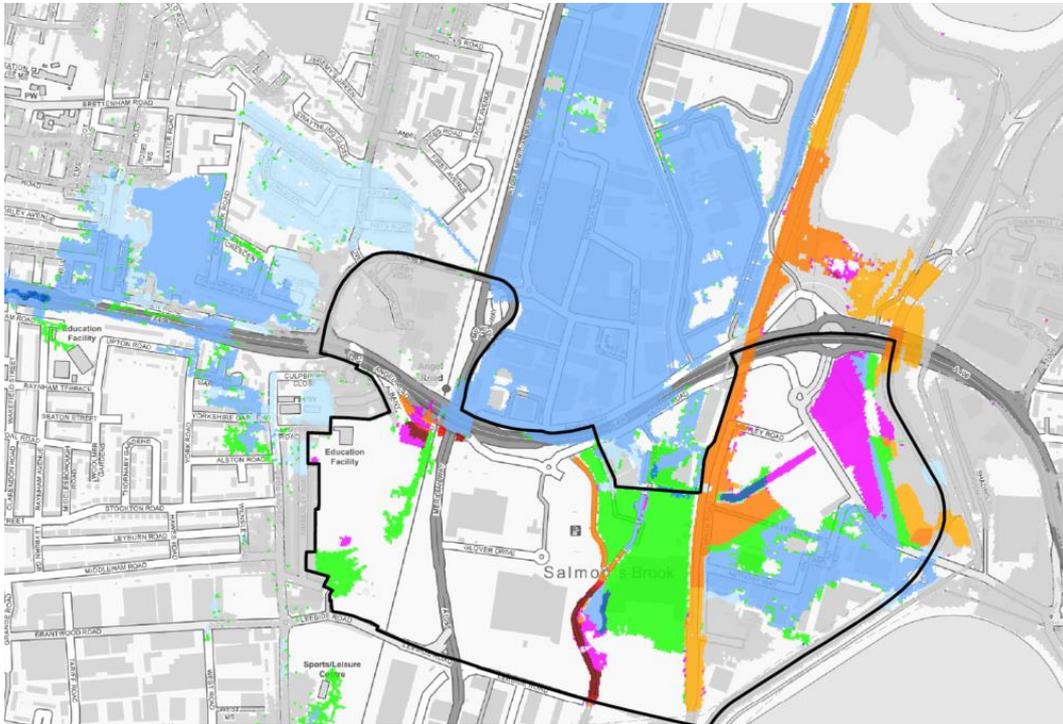


Figure 7 - Salmons Brook flooding mitigation

### **Flood mitigation summary**

3.2.27 When the above flood mitigation measures are considered together in the hydraulic model it was shown that the flooding within the proposed residential development areas can be mitigated without detrimental impacts offsite. This scheme was agreed with the LLFA and the EA and the above elements are all delivered through the consented SIW. The Phase Two Planning Application relies on these works being undertaken in advance of development to address the existing flooding issues.

## **3.3 Naturalisation of Pymmes Brook**

3.3.1 In this section I describe the proposals for the Pymmes Brook, how these fit within the SIW and why access and land rights are required to complete these works.

3.3.2 The Pymmes Brook was channelised in response to the Lee Conservancy Catchment Board Act 1938, with the proposals developed in the late 1950s. The channels incorporate a concrete base typically 30ft (9.14m) wide and side walls which are typically 12ft (3.66m) high (measured from the base of the channel). Along the majority of the reach through Meridian Water, both the eastern and the western banks are comprised of reinforced concrete walls. Through the southern reach of the Pymmes Brook, near the site of a former National Grid gas holder, the banks are comprised of sheet piles with concrete capping. These walls act as flood defences, preventing flooding arising from the Brook. In addition, the eastern wall also prevents overland flooding, arising from the Canal, from entering the Pymmes Brook.

3.3.3 In response to the Thames River Basin Management Plan and the Water Framework Directive objectives it is proposed to naturalise as much of the Pymmes Brook through the site as possible. This improves biodiversity, reduces flood risk and improves the public space delivery of as part of the SIW. The section of Pymmes Brook considered for naturalisation in the SIW is shaded blue in Figure 8 below:

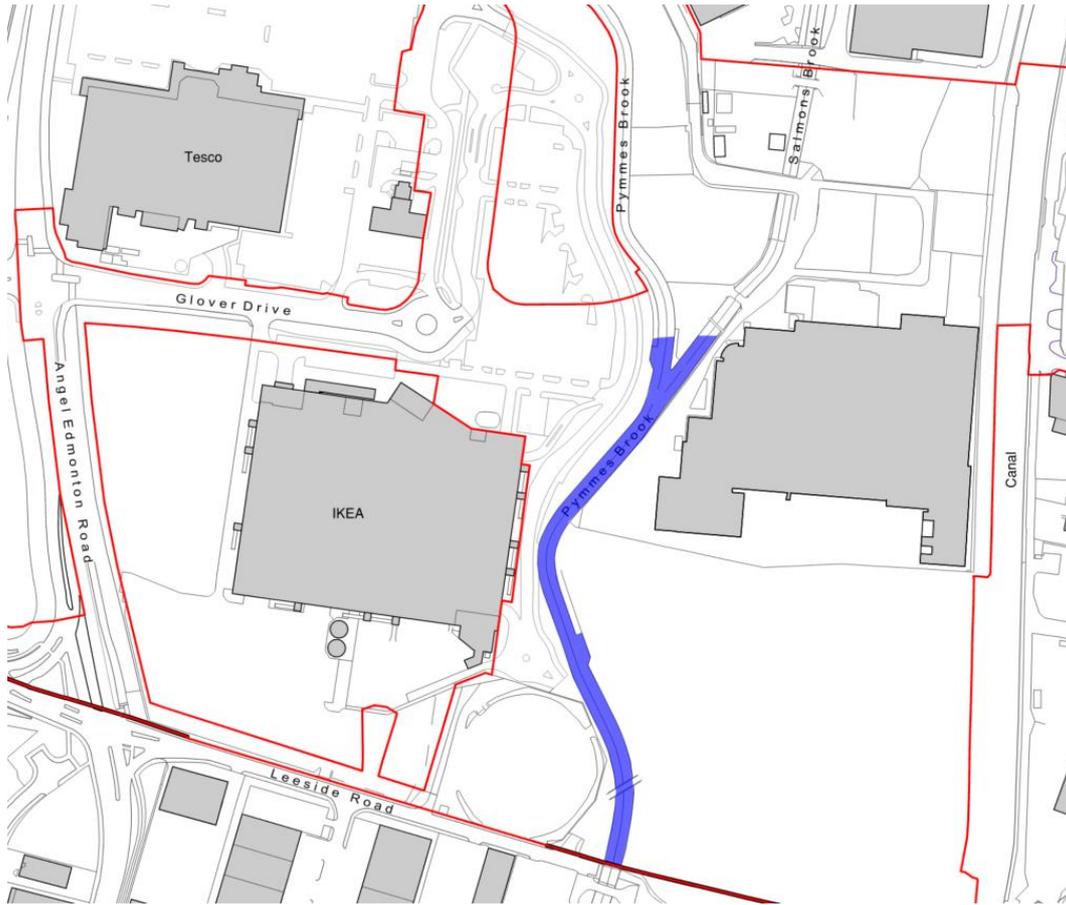


Figure 8 - Extent of naturalisation proposed for Pymmes Brook

3.3.4 Naturalisation of the Pymmes Brook north of the above extent is not proposed because it could not be delivered within the area of development and would require more land from IKEA. Naturalisation of the Salmons Brook north of the above extent is not proposed because it could not be delivered without taking an extent of land of within the development which was excessive in respect of the benefits of naturalisation.

3.3.5 Naturalisation can take a range of forms and include varying degrees of removal of the existing structure. Consultation was undertaken with the EA in November 2018 and February 2019, to present and agree options for naturalisation; the options discussed in the second meeting are shown in Figure 9 and explained further below.

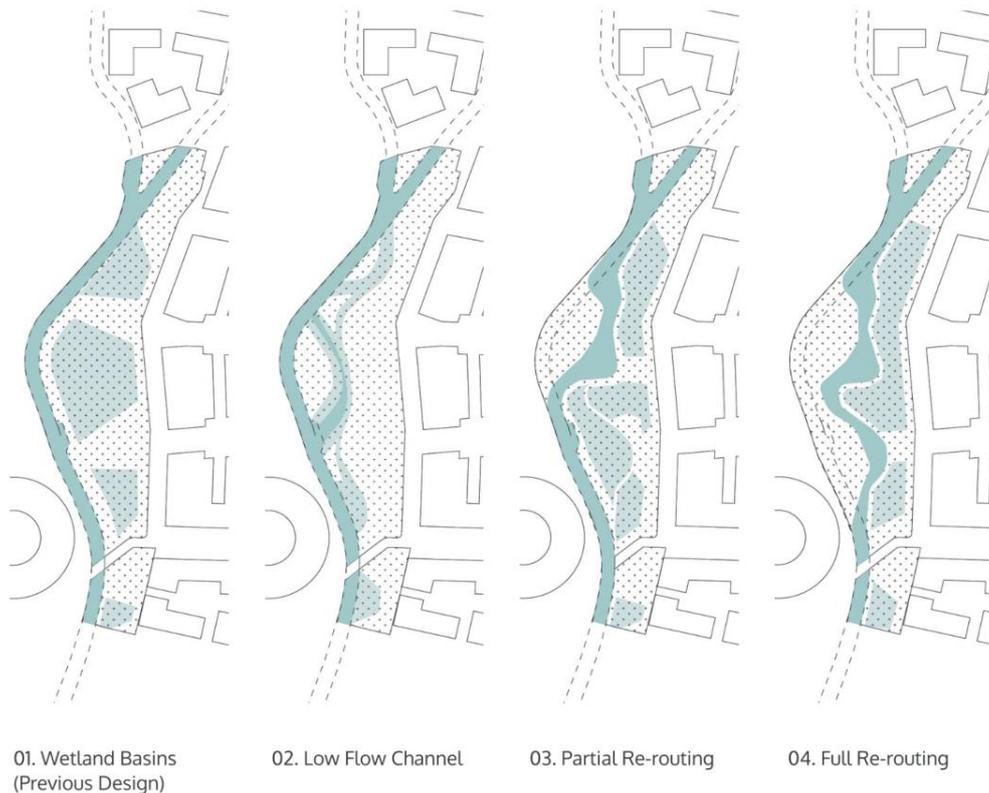


Figure 9 - Pymmes Brook Naturalisation Options (Feb 2019)

3.3.6 Naturalisation balances a number of risks and opportunities including ground conditions, fluvial capacity, cost, constructability and development space. The options shown in Figure 9 included varying degrees of removal of the existing structures:

- Option 1 – Wetland Basins – this retained the existing channel base, but removed most of the east wall. The aim was to minimise

the risk of creating pathways between the brook and the underlying ground which includes pollutants;

- Option 2 – Low Flow Channel – this retained much of the existing channel base for low flow conditions and created alternative channels which would be activated if water levels rise;
- Option 3 – Partial re-routing – this included removal of a central portion of the existing channel and realigned the brook east into the park area. In this case a new bed to the channel would be formed and this would have to comprise a liner, which could be clay or manmade, to prevent the creation of a pathway between the brook and the underlying contamination;
- Option 4 – Full re-routing would include the full removal of the channel and re-routing of the brook east into the park area. This option would also require a channel as Option 3.

3.3.7 The naturalisation and associated landscaping also allows the opportunity to incorporate attenuation areas into the scheme to provide mitigation for both flooding and surface water run-off.

3.3.8 In the discussions with the EA it was agreed that Option 3 Partial Re-routing would optimise benefits whilst also accommodating an appropriate area for development. This preferred option retains sections of the existing channel adjacent to IKEA, although in the central section this is largely incorporated into a new embankment area. The construction work for Option 3 is all located within the existing watercourse and Plots 72 and 78. Option 3 is the proposal included in the SIW and the consented planning application.

3.3.9 As part of the development of the Scheme, hydraulic modelling was undertaken of the Pymmes Brook to determine what effects the naturalisation would have on capacity and flood levels. The flood modelling identified that for the extreme events there were some small increases in the flood water level due to the naturalisation.

3.3.10 One of the effects of the modelled increase in flood water level would be that the retained section of wall on the west side of the Pymmes would be overtopped and flooding could be caused in the IKEA site.

3.3.11 In order to mitigate the risk of flooding to IKEA two measures were considered. These options were either:

- A berm;
- Raising the existing brook wall;

- 3.3.12 The berm option would be provided on the IKEA side of the brook wall and by setting the height of the berm above the maximum flood level, it would prevent flood water extending further into the IKEA site.
- 3.3.13 The existing brook wall is not sufficiently high to prevent flood water extending into the IKEA Store; by increasing its height above the maximum flood water level it would prevent any flooding into the IKEA.
- 3.3.14 The berm option would require more land to construct the slope to the embankment. It would also need to interface with pump station equipment IKEA operate which is located between the access road and the existing brook wall. The wall option would be an extension of the existing wall and would therefore not require any additional land. The wall option is considered to have the least impact on IKEA. If IKEA bring forward development and want to provide connectivity to the brook they will be able to modify the wall and site levels to maintain the protection against flooding. Both options require access onto the IKEA Store to construct.
- 3.3.15 The wall option was considered to be preferable because it minimises the land take required on the IKEA Store and the requirement is only temporary rights to construct and inspect/maintain the all. As such that is the solution which has been included in the SIW and Plot 73 is included in the Order to enable the construction of the wall.
- 3.3.16 The hydraulic modelling and flood mitigation strategy described above was included in the Flood Risk Assessment which was approved as part of the SIW Planning Permission.
- 3.3.17 This section has described the background to the naturalisation proposals, the options considered and has detailed the associated works and land required to undertake the naturalisation.

## 3.4 Surface Water Drainage

- 3.4.1 In this section I describe the principles of the surface water drainage strategy, how it has been developed, where the principal outfall points are and what rights are required for these.

- 3.4.2 The strategy for surface water drainage discharge for the Scheme had to be agreed with the LLFA and with input from the EA. For new development sites within London the drainage hierarchy is set out in the London Plan. The expectation is that discharge from developments is minimised through infiltration and attenuation and any discharge to sewers should be minimised. Generally surface water run-off from a development should be controlled back to the equivalent that would run off from the development site if it was still ‘greenfield’; this is known as the greenfield runoff rate (‘GRR’). When determining run-off from a development it is normal to consider rainfall for different rainfall events up to and including the 1 in 100 year event with a climate change allowance to determine the volume of attenuation required.
- 3.4.3 Areas within Meridian Water are subject to historical contamination and the area also has underlying aquifers. The EA guidance is therefore to avoid using infiltration drainage systems. This means that all run off from the site should be attenuated and discharged to either the water courses or as a last resort to sewers.
- 3.4.4 Through discussion with the LLFA it was agreed that providing rainwater attenuation on the site up to the 1 in 100 year event would not be appropriate at this location. This is because the site is close to the low end of the watercourse catchments. If such attenuation is provided, it will result in a delayed discharge from the site, but this would actually mean discharge from the site to the watercourse would be likely to coincide with the peak flows arriving from upstream in the watercourse.
- 3.4.5 The drainage strategy that has been developed and agreed with the LLFA includes a series of elements:
- building plot attenuation;
  - permeable paving, planters and swales along road corridors;
  - attenuation within the parks;
  - discharge to the adjacent watercourse. The main discharge points are to the Pymmes Brook and the River Lee.

These are described further below:

### **Building Plot attenuation**

- 3.4.6 It was agreed with the LLFA that each building plot within the development will attenuate water up to the 1 in 2 year event (this is the amount of rainfall that would be experienced in an event that may on average occur once every two years). When rainfall greater than this occurs it is discharged from the plot into the drainage system.

### **Permeable Paving , Planters and Swales**

- 3.4.7 Within the road corridors a series of permeable parking bays, raingardens and tree planters, all with liners to prevent infiltration, collect, attenuate and convey run-off to collector pipes within the road.

### **Attenuation within park**

- 3.4.8 In the two main parks adjacent to the naturalisation of the Pymmes Brook and within the flood compensation basins, there are attenuation areas as described in Section 3.3. These are storage volumes sized so that they can contain run-off for a rainfall event up to the equivalent of a 1 in 10 year event.

### **Outfalls to the watercourse**

- 3.4.9 The attenuation basins will be linked to the watercourses (Pymmes Brook and the River Lee) with outfall points as indicated in the drainage diagram below. These include flow control devices to control the rate of run-off and ensure the system operates as designed
- 3.4.10 The system described above is illustrated in Figure 10:

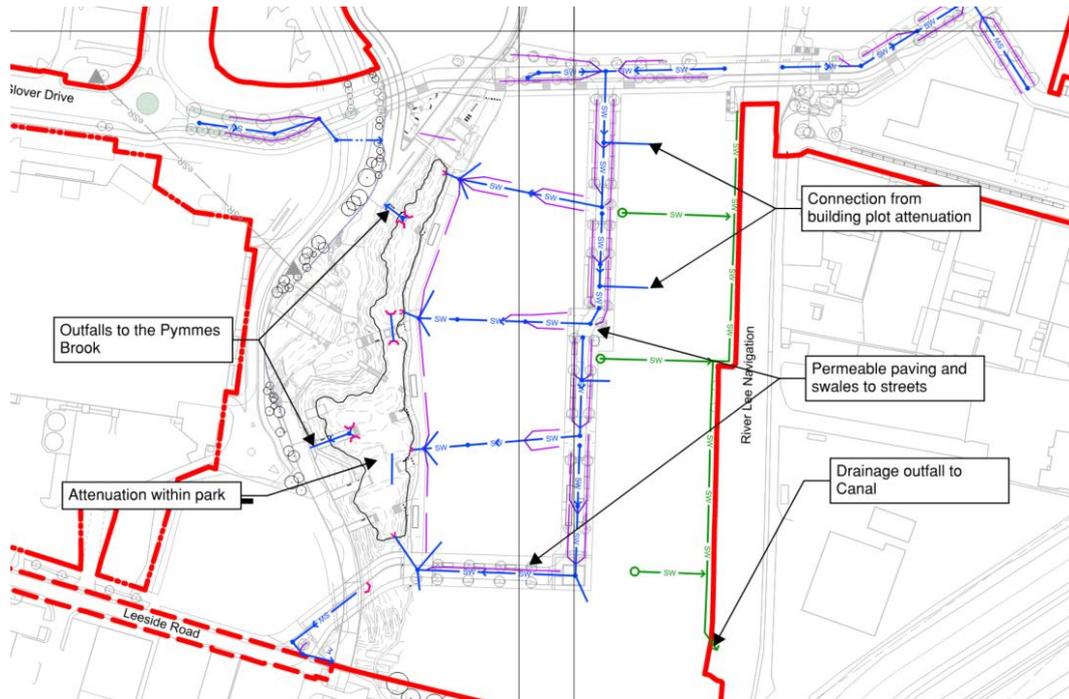


Figure 10 - Proposed Surface Water drainage strategy

- 3.4.11 There are some local areas of the site where the proposed levels mean it would only be possible to connect to the drainage system described above by pumping. This is an inefficient and unsustainable approach that would only be used as a last resort. The areas affected are parts of the site immediately to the west of the Canal. It is proposed that these areas will discharge surface water run-off directly into the Canal.
- 3.4.12 Discharging surface water to a watercourse is a recognised approach which is set out in the drainage hierarchy within the London Plan, and which the CRT typically accommodate. In this regard the CRT requirements are set out in Section 3 of the organisation's Code of Practice for Works Affecting the Canal & River Trust – Part 2 Detailed Information (an extract from which is provided in my Appendix B). The requirements include conditions on the water quality, volume and velocity of the discharge. During the detailed design stage of the development these criteria and the supporting documentation will be developed such that an application to the CRT for a 'Surface Water Discharge Licence' can be made. Because this is a recognised process, where agreement is not normally unreasonably withheld, no specific rights have been sought in terms of the requirement to discharge surface water to the Canal as none are considered to be necessary.
- 3.4.13 The drainage strategy has been agreed with the LLFA and is included in the SIW planning permission.

## 3.5 Earthworks, Contamination & Remediation

- 3.5.1 In this section I describe the earthworks required to deliver the SIW and the associated issues of contamination and remediation. The earthworks are a key element in delivering the site level strategy.
- 3.5.2 In the flooding, naturalisation and drainage sections I outlined two areas where extensive excavation is anticipated within the SIW, namely to form the flood compensation basins and to complete the naturalisation of the Pymmes Brook. In both these locations excavation is required to a depth of several metres. In the flooding section I described how site levels would be raised to lift proposed development areas above the flood level. It is proposed that the material excavated will be used where site levels will be raised.

- 3.5.3 Further as described in the section on roads and bridges certain minimum road levels are required to achieve clearances to the water courses below. The site levels have been developed with consideration of the flood mitigation strategy, the remediation, site drainage and the need to provide new crossings over the watercourses.
- 3.5.4 The site levels strategy is to raise levels within the Phase Two development area such that they are above flood level, achieve a connection to the bridge links over the brooks and the Canal and generally achieve gradients that are considered to be accessible, i.e. less than a slope of 1 in 21. The proposed levels within Phase Two also need to slope down to the naturalised Pymmes Brook to create the park and attenuation basins.
- 3.5.5 To the east of the Canal the Central Spine Road will be constructed on a retained earth embankment to minimise the landtake required. A temporary access route to the Arriva Depot will also be required and this will connect to the raised section of the Central Spine Road via a low ramped section.
- 3.5.6 The proposed areas of excavation and placement of fill are shown in Figure 11. The orange/red colours indicate areas of excavation and the greens indicate areas where levels will be raised by placing fill.



Figure 11 - Earthworks - Excavation and placement of fill

- 3.5.7** The site has been subject to a range of historical uses, which have resulted in varying degrees of contamination across it. The Council has been undertaking site investigation work to understand the extent and nature of the contamination. Once this is established it will inform the remediation strategy. There are a variety of remediation options which can include separation of materials to remove contaminants, exposing material to air to allow hydrocarbons to evaporate, removing from site for specialist treatment etc. These activities are most effective when done on a larger scale, which allows more space to undertake them and a greater variety of techniques to be used and enables an efficiency of scale to be achieved.
- 3.5.8** The earthworks for different elements of the SIW and Phase Two overlap e.g the road embankments extend into development plots, parks require slopes into development plots. For these reasons all of the bulk earthworks and remediation required for the development are included in the SIW.
- 3.5.9** These works extend across numerous Plots including those identified for the flood compensation excavation, Plot 101 adjacent to the Canal owned by CRT and plots 72 and 78 owned by the Council but with a number of occupiers.
- 3.5.10** Overall the proposed remediation will take land which is currently underused brownfield and contaminated and ensure that it is suitable for development purposes.
- 3.5.11** In this section I have set out the extent of the earthworks and remediation, how these relate to other aspects of the SIW and Phase Two and how they link to the land requirements.

## **3.6 Roads and Bridges**

- 3.6.1** The ELAAP and the transport evidence of Mr Savage sets out the requirements and justification for the new roads.
- 3.6.2** The road geometry has been developed following appropriate guidance (Manual for Streets and DMRB (Core Documents 27 and 28)) and reviewed with the Council Highways team.

3.6.3 The bridge levels were determined based on the clearance requirements below each bridge as discussed with either the EA or CRT. The bridges over the Pymmes and Salmons Brooks will provide a minimum of 600mm above the maximum flood level. The bridge over the Canal provides a minimum clearance of 2.7m over the Towpath, and a greater clearance than the bridges immediately upstream at the Argon Road provide to the Towpath.

3.6.4 The road alignments were then developed using the above constraints and working with the masterplanning team to inform site levels. The clearance over the Canal defines the Phase Two public realm interfaces and associated site levels in the area of the bridge and therefore influence the earthworks described previously.

3.6.5 The widths of roads and consequently of the bridges were developed by the masterplanning team based on a number of considerations including:

- providing segregated cycleways;
- incorporating tree planting;
- incorporating on street parking and servicing;
- separation between building facades;
- vehicle swept paths to test clearances; and,
- providing adequate space for utility services.

3.6.6 A Stage 1 Road Safety Audit was undertaken in 2019 and designer responses were subsequently prepared and issued. This did not require any significant changes to the scheme submitted for planning and incorporated in the approved SIW.

3.6.7 There are four new road bridges over watercourses, at each of these locations rights are required to construct, inspect, maintain and operate the bridges. The rights include a 5m zone either side of the bridge to allow access to the sides of the bridge for those purposes. These include:

- Pymmes Brook North – Plots 33, 34 and 41;
- Salmons Brook – Plots 56, 57, 60, 61 and 63;
- Pymmes Brook South – Plots 79, 81, 82, 84 and 88;
- Canal – Plots 102, 104 and 105.

- 3.6.8** It is proposed to retain an existing road bridge over the Salmons Brook. This will provide an internal access road in the Phase Two development. Rights are required to inspect, maintain and operate the bridge. This requires rights over Plots 51, 52 and 54.
- 3.6.9** There is an existing steel truss bridge over the Pymmes Brook. It is proposed to reuse this bridge as a footbridge over the Pymmes Brook to the south of the Central Spine Road. This will improve access routes through the public realm. Rights are required to Plots 43, 65, 67, 68 and 69 for the purpose of providing this access.
- 3.6.10** The Central Spine Road results in severance of the IKEA Store's current access arrangements and severance from some of the car parking. As described by Mr Savage alternative access points have been proposed. These include both car park and service yard accesses. These alternative accesses are located off Glover Drive, A1055, Leaside Road and the new Central Spine Road. These accesses are included in the proposed SIW. In order to construct these accesses rights are required over Plots 73, 74, 95, 96, 97 and 100.
- 3.6.11** Where the Central Spine Road crosses Towpath Road, it achieves the minimum headroom clearance required for the Canal towpath (2.7m). This means there is not standard highway clearance to the road, which currently provides access to the Arriva bus depot and industrial units. As described in Mr Savage's evidence an alternative access road is therefore proposed, connecting from the Central Spine Road to Anthony Way. In order to make this access suitable for buses accessing the depot and vehicles accessing the industrial units it is proposed to widen Anthony Way and the connecting roads and form new junctions. This includes re-providing parking along Anthony Way by constructing a new retaining wall adjacent to Anthony Way. In order to construct this access road, rights over Plots 119 and 120 are required. In addition Plots 115, 118, 121, 122, 123 and 124 which are owned by the Council but have a number of occupiers are also required to carry out the widening works described in this section.

## **3.7 Utility Services**

- 3.7.1** This section describes the requirement for new utility services to support the proposed development and how the proposed layout of these has been developed.

- 3.7.2 The proposed earthworks, roads and bridges described above result in extensive change to the existing utility distribution networks across the development area. Existing utilities are either within areas that are being excavated and remediated or existing access roads that are being removed or altered. In both cases the existing utilities will not be in appropriate locations to serve the proposed development.
- 3.7.3 The existing utilities are also relatively old and while they have capacity to support the existing site uses, this will not be sufficient capacity to serve the proposed development. New utility services are therefore required to support the development.
- 3.7.4 Utility services are generally installed within the road and footway. Guidance on the positioning of the utilities is provided both through Street Works UK guidance (Core Document 26) and specific guidance from statutory undertakers. These show the typical distribution of utilities across the road corridor.
- 3.7.5 A coordinated layout of services including the proposed service water drainage was developed based on the Street Works UK guidance to confirm the proposed road corridor widths were adequate.
- 3.7.6 The utility layouts are coordinated with the proposed bridge layouts to ensure there is suitable space within the bridge construction to accommodate utilities. This is one of the requirements in the bridge design and influences the overall bridge deck thickness and therefore also has a minor impact on the site levels.
- 3.7.7 The proposed utility routes follow the road corridors and have provision for connection to proposed building plots to support these when they are constructed.
- 3.7.8 Utility service connect back to the statutory undertaker's wider networks at the same locations that the roads connect back, i.e. at Leaside Road, Glover Drive and Harbet Road.
- 3.7.9 Where existing utility services were identified as being impacted by the Scheme and requiring diversion, quotes were obtained from the relevant statutory undertaker for these diversions. These quotes inform project costs and due to their period of validity will need to be renewed prior to the works being undertaken (as is typical in developments of this scale and duration). Where land owned or

occupied by the statutory undertaker has been affected by the proposals these Plots are included in the Order. The affected Plots are Plot 39, 92, 93, 94 and 110.

## 4 Response to Objections

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4.1.1 In this section I consider each of the objectors and the issues that they have set out in their objection, so far as relevant to my area of expertise. I will respond as appropriate, explaining what alternatives were considered (if relevant), why land or rights are required and how the impact has been mitigated.

### 4.2 Tesco Stores Ltd (Tesco)

4.2.1 Tesco have stated that their store would be adversely impacted in various ways including effects on Plots 1, 6, 7, 8, 12, 14 and 18. The proposed works and the effect of the works on Tesco and the identified plots are considered below.

4.2.2 The proposed works which affect the store comprise two elements:

- Road and junction improvements to Glover Drive including new traffic islands, pedestrian crossing, bus stops and access to IKEA car parking;
- A new north-south link road between Argon Way and Glover Drive ('North South Link Road'). As part of the overall transport improvements associated with the Scheme it is proposed to formalise the existing north-south connection which can currently be made using the Tesco and IKEA car park and access roads.

4.2.3 The requirement for the above transport improvements are described in the evidence of Mike Savage.

4.2.4 **Issue:** The impact on the internal roads and accessways including the right to alter the route of pedestrian and vehicular access ways. The affected Plots are numbered 6, 7 & 12 and shown in Figure 12 below:

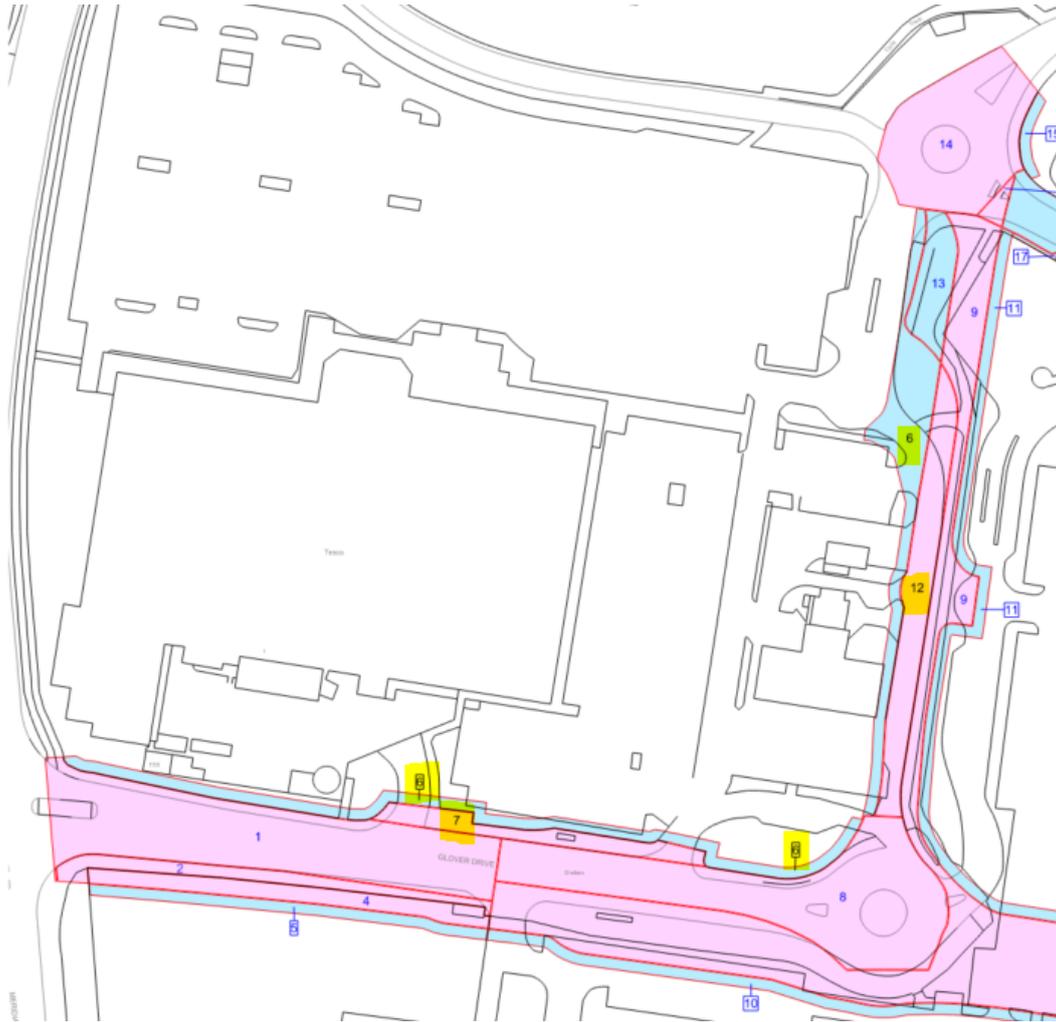


Figure 12 - Tesco Store - affected plots

**4.2.5 Response – Plot 7:** The proposed works to Glover Drive include forming a new access to the IKEA Store car parks to the south, enhanced bus stop provision and improved footways and a new pedestrian crossing arrangement immediately east of the access to the Tesco Store service yard (see Figure 13 below). These works will require minor modification of the kerb line on the north side of Glover Drive between the Tesco Store service yard entry/exit and the Tesco Store car park/petrol filling station entry. These two existing access locations will not be moved as part of the works.

**4.2.6** Where construction work is undertaken within the highway corridor it is known as streetworks. Streetworks are normally subject to Traffic Management Orders setting out notice periods, restrictions and durations for the works. When the streetworks are being carried out, temporary traffic control arrangements are usually required to minimise disruption to traffic. The requirements for temporary traffic

control are set out in the ‘Traffic Signs Manual – Chapter 8 (‘TSM’) (Core Document 25).

4.2.7 The works on Glover Drive would be carried out as normal streetworks using typical traffic control measures as outlined in the TSM. Some limited disruption to traffic is likely to occur during these works. Details of the duration of the works and the traffic control measures will be developed by the contractor during the detailed design and implementation stage. However these works would be phased to minimise disruption. This is likely to mean that the works to the southern kerb line which widens Glover Drive would be undertaken first over a period of approximately six to eight weeks. Then the new traffic island would be constructed, which could be done with two way traffic maintained, over approximately two weeks. The final part of the works would be the buildout on the north kerb line, this is likely to require traffic control measures with single way working. This stage is likely to take only 3 to 5 days to complete.

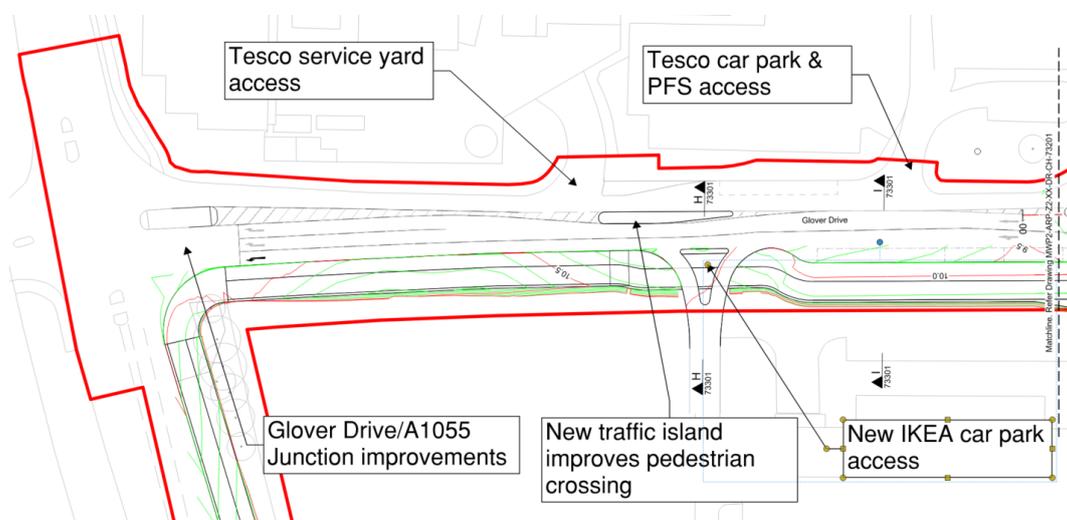


Figure 13 - Glover Drive - proposed works

4.2.8 **Response – Plot 12:** the majority of Plot 12 currently provides a southbound exit from the Tesco car park area, north east of the store, to the Glover Drive roundabout south east of the store. The proposed works include converting this southbound exit road so that it forms the new 2-way link between Glover Drive and Argon Way. This section of road will be extended to the existing Argon Road roundabout through the northern part of Plot 12 and Plot 9. The construction works will involve extending the existing road north, resurfacing and modifying road markings. These works would be carried out as

normal highway works using typical traffic control measures as outlined in the TSM and will take approximately eight to ten weeks.

- 4.2.9 The egress from the fuel tank filling area currently directs tankers to the south and the Glover Drive roundabout. Because the road is converted to 2-way traffic, this egress will be too close to the junction to allow right turn egress and tankers will need to turn to the north towards Argon Way. This is a minor change and tankers will still access appropriate roads on the wider highway network. This is not considered to adversely affect Tesco in any way.
- 4.2.10 **Response – Plot 6:** this is the strip of land immediately to the north of Plot 7. Rights are required for this area to allow the construction works within Plot 7 to be undertaken safely. Plot 6 will be used for temporary barriers to protect the public from the works, for temporary pedestrian routes around the works and for access to Plot 7 to minimise disruption to Glover Drive.
- 4.2.11 **Issue:** That the acquisition of Plot 14 and the seeking of rights over Plot 18 could affect the ability of traffic to reach the Tesco Store from the North Circular Road (A406) via the Cooks Ferry and Harbet Road roundabouts
- 4.2.12 **Response:** The Order does not affect the land at Cooks Ferry and Harbet Road roundabouts.
- 4.2.13 As noted in the Tesco objection at 2.5.5 and in Table 2 of the Schedule to the Order, Tesco currently enjoy a right of entry relating to services for Plot 14. The plot is identified within the Order to enable the Council to make minor modifications to the kerb and levels to construct the junction with the proposed access road between Glover Drive and Argon Road. The construction works would be carried out as normal highway works using typical traffic control measures as outlined in the TSM. Details of the duration of the works and the traffic control measures will be developed by the contractor. However, the roundabout has two lane entry from Argon Way and two lane exit into the Tesco Store car park. This is likely to be narrowed to a single lane during works, but continuous traffic could be maintained during the streetworks in this area during the period of working, which is likely to be only 2 to 3 weeks. Subsequently this roundabout will become adopted highway.

4.2.14 As noted in the Tesco objection at 2.5.4 and in Table 2 of the Schedule to the Order, Tesco currently enjoy a right of access to Plot 18. The Council are seeking rights for access over this land Plot in order to access the proposed construction site for the Pymmes Brook bridge and Central Spine Road. The Council do not propose to undertake any construction work on this Plot and will not reconstruct a new vehicular access and egress as noted in the objection at 5.1.1. The proposed rights sought by the Council will not therefore affect Tesco's existing rights.

4.2.15 **Issue:** That the acquisition of Plot 1 and Plot 8 could affect the ability of traffic to reach the Tesco Extra store from the Angel Edmonton Road (A1055):

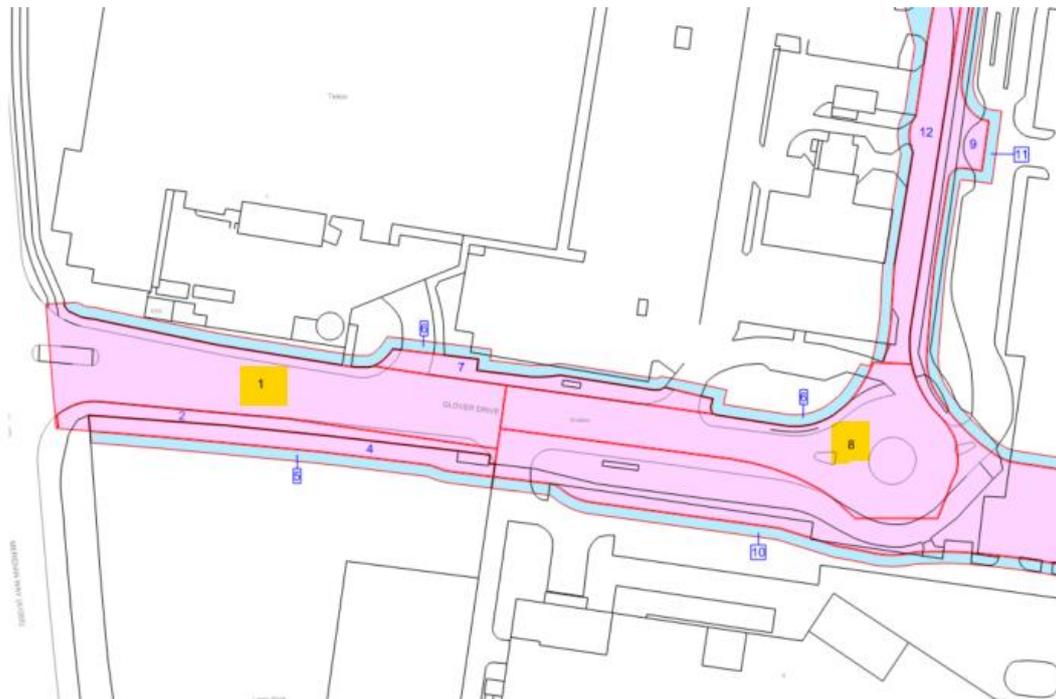


Figure 14 - Glover Drive - proposed works

4.2.16 **Response – Plots 1 and 8** are required to undertake streetworks to Glover Drive, the junction with the A1055, including constructing a traffic island, the new pedestrian crossing, modifying the roundabout layout, new bus stops and for surfacing works. The proposed works would be carried out as normal streetworks using typical traffic control measures as outlined in the TSM. As described above in Section 4.2.7 the streetworks would be sequenced to minimise disruption to traffic, e.g. widening the road which can be carried out with a partial closure whilst maintaining two traffic flow would be carried out first. Streetworks at the junction of Glover Drive and the

A1055 will require temporary traffic signals; these works may last for three to four weeks. However access from the A1055 (Angel Edmonton Road) would be maintained throughout the works.

- 4.2.17 The Plots would be retained as adopted highway on completion of the works so not changing the status of access to the Tesco Store.

### 4.3 **IKEA Properties Ltd (IKEA)**

- 4.3.1 The IKEA objection notes that the Council has failed to demonstrate what alternatives (if any) have been considered and identifies the improvements to the Pymmes Brook and the associated rights to deliver these improvements as being excessive.

- 4.3.2 In his evidence Mike Savage sets out the alternatives considered with regard to the alignment of the Central Spine Road and access to the store and associated parking. I summarise below the alternatives considered with regards to the Pymmes Brook.

#### **Pymmes Brook Alternatives**

- 4.3.3 The proposed works to the Pymmes Brooks comprises naturalisation and flood protection works. Although IKEA make a general statement that alternatives have not been considered, Section 3.3 of my evidence show that alternatives were considered for the extent and nature of the Pymmes Brook improvements and that these were discussed and agreed with the EA.

- 4.3.4 The naturalisation proposals are all carried out to the east side of the existing Pymmes Brook and do not impact on IKEA. As noted in section 3.3 of my evidence the hydraulic modelling has shown an increase in flood risk to the IKEA site as a result of the naturalisation. To mitigate this it is proposed to extend the existing brook wall to prevent flooding in IKEA land. In order to modify the wall and to construct the areas of naturalisation between the wall and realigned Pymmes Brook access will be required from the west side of the brook on the IKEA land. In order to allow this construction to be carried out Plot 73 has been identified along with appropriate rights. The construction methodology and detailed access requirements will be developed by the Contractor. However the proposed work is limited in nature and the area to carry out work would largely be contained within the footway and landscaping east of the existing service

yard/undercroft parking access road. In the existing configuration the footway does not lead anywhere and it is possible to walk on the other side of the road. Therefore the impact on the store and its operations will be limited.

## 4.4 Hastingwood Securities

4.4.1 The Hastingwood objection states that the land is not essential to the SIW. The land in question is the A&A Skips site east of Harbet Road, which is identified as Plot 136 in the Schedule to the Order.

4.4.2 Plot 136 is within the land required as part of the flood mitigation strategy. As set out in section 3.2, in order to bring forward the Meridian Water development it is necessary to undertake flood mitigation. This is due to the existing condition whereby floodwater from the Canal and the River Lee causes extensive flooding across the development site. The available EA flood mapping (Product 4 information) does not reflect the current climate change allowances. Therefore Arup undertook hydraulic modelling using the EA models for the rivers and brooks in the area to prepare mapping which includes the current allowance of 35% for climate change. The extent of flooding is shown in the overlay of the plot boundary on the 1 in 100yr + 35%CC flood map in Figure 3.

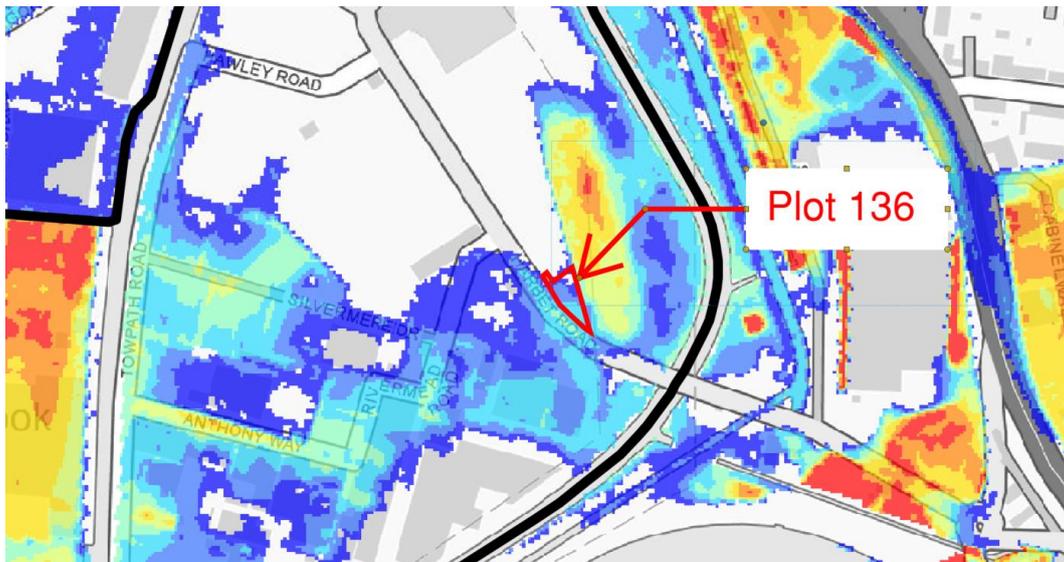


Figure 15 - Plot 136 overlaid on flood mapping

4.4.3 The flood mitigation strategy approved in the SIW Planning Permission is to provide flood compensation on the land east of Harbet Road by reducing ground levels within the land. The proposed

flood mitigation measures including lowered ground levels are shown in MWP2-ARP-XX-XX-DR-CF-80307. An extract from this drawing is shown at Figure 16 and the drawing is included in Appendix A. Plot 136 is part of the land required to implement this strategy.

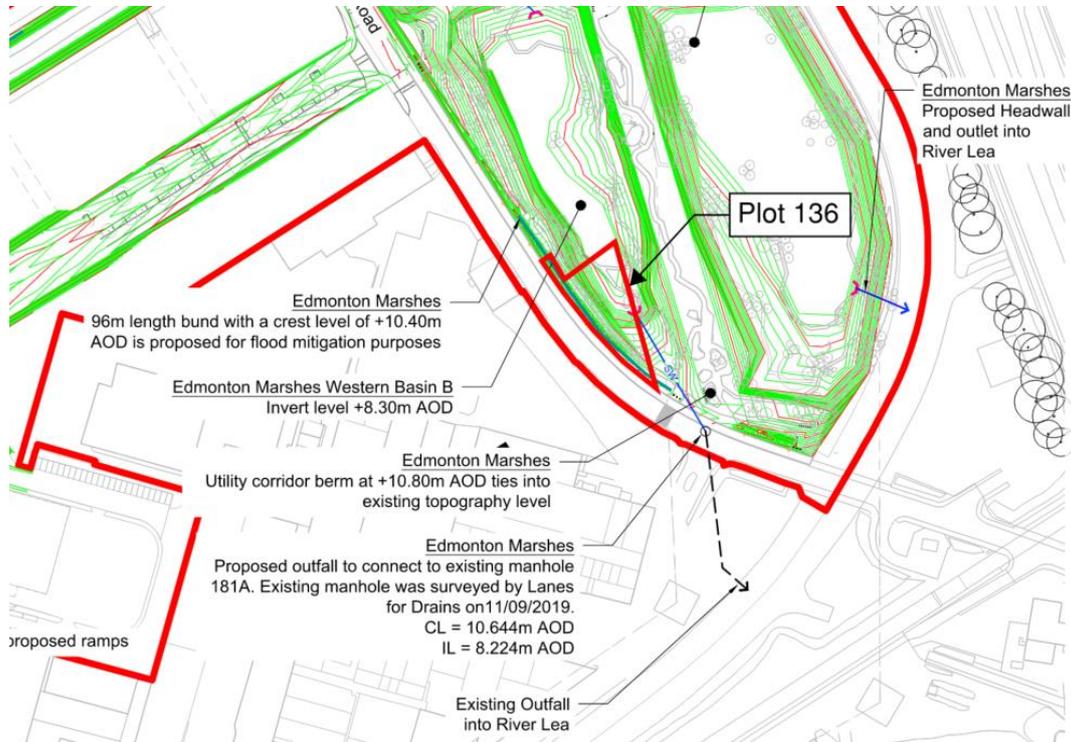


Figure 16 - Hastlingwood overlay with SIW (refer to Fig 06 in Appendix A)

4.4.4 The flood waters attenuated within the lowered areas described need to drain out to the River Lee after any flood event has passed. This will be achieved by connecting to an existing surface water sewer within Harbet Road, which in turn outfalls to the River Lee. This connection is shown in Figure 16. The headwall and pipe connection from the lowered area are positioned within Plot 136.

4.4.5 Plot 136 is essential to the implementation of the SIW because it is used both for part of the flood compensation volume and to provide a drainage route from the compensation areas to the River Lee.

## 4.5 National Grid Electricity Transmission (NGET)

4.5.1 The NGET objection letter identifies that in respect of the existing NGET infrastructure, NGET will require appropriate protection for

retained apparatus including compliance with relevant standards for works proposed within close proximity of its apparatus.

4.5.2 NGET note that where the Promoter intends to acquire land, extinguish rights, or interfere with any of NGET's apparatus, they will require appropriate protection and further discussion on the impact upon its apparatus and rights.

4.5.3 NGET make specific comments regarding the nature of works close to their infrastructure which should be considered including:

- The overhead lines are protected by Deeds of Easement, which provide full right of access to retain maintain, repair and inspect.
- Not to erect any building or structure or plant, or allow to grow any plant within 5.3m of the conductors (the overhead lines).
- Not to raise the level of the ground so as to make the distance between ground level and the lowest conductor (overhead line) at any point of the span less than 7.6m.
- The construction methodology should follow relevant guidance; and,
- That any landscaping scheme needs to use species that reduce the risk of growth to a height which compromises statutory safety clearances.

4.5.4 The NGET assets within the development area are Pylons 038 (forming part of the ZBD Route) and the associated 275kV high voltage overhead line. The Plots affected by the overhead lines and pylon are 131, 133 and 137. They are all within the area of Edmonton Marshes that is proposed to form the flood compensation basins.

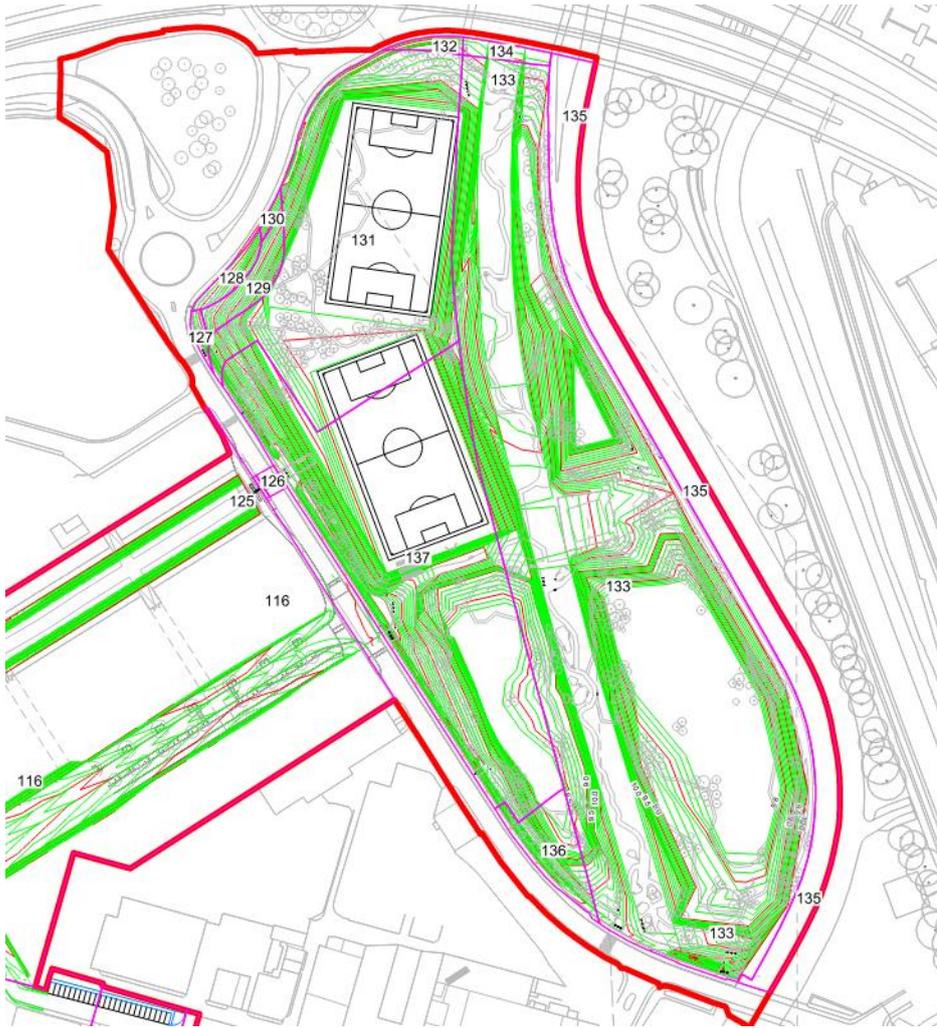


Figure 17 - Edmonton Marshes Contours

4.5.5 There is also a pylon located within Plot 133. NGET have provided a ‘pillars of support’ diagram showing the area around the tower where ground levels should not be adjusted to ensure the tower foundations are not affected.

4.5.6 During the development of the SIW, the sag curves for the overhead lines were received from NGET. The curves show the normal and maximum sag positions of the overhead lines when in use. They also indicate the clearances required to the maximum sag position.

4.5.7 The proposed works on the land to the east of Harbet Road consist of earthworks, regrading and resurfacing to allow flood volume storage and create an area of landscaping forming a new public open space to be known as Edmonton Marshes. No foundations, piling or buildings are proposed within the safety clearances of the overhead lines. The proposed contours for the park area are shown in Figure 17.

4.5.8 Figure 18 below shows the proposed change in ground levels from existing:

- Areas shaded red or yellow are proposed to be lowered or remain as existing levels below the overhead line, hence statutory electrical safety clearances are maintained;
- Areas shaded green require local raising of ground level by between 0.5m and 0.8m, to ensure the proposed flood mitigation measures operate as designed. Within these areas this increase in ground level would reduce the existing clearance from ground level to the ‘Safety clearance zone of 7.6m’, from the existing minimum clearance of approx. 13.8m shown to approx. 13.0m. These clearances are based on the sag curve diagrams provided by NGET.



Figure 18 - Edmonton Marshes - Level Changes (refer to Figure 11 in Appendix A)

4.5.9 The existing ground levels around the pylon will be maintained over the area illustrated in the ‘Pillar of Support’ diagram. This is illustrated in the diagram in Figure 19 where the area of unchanged ground level is shown hatched.

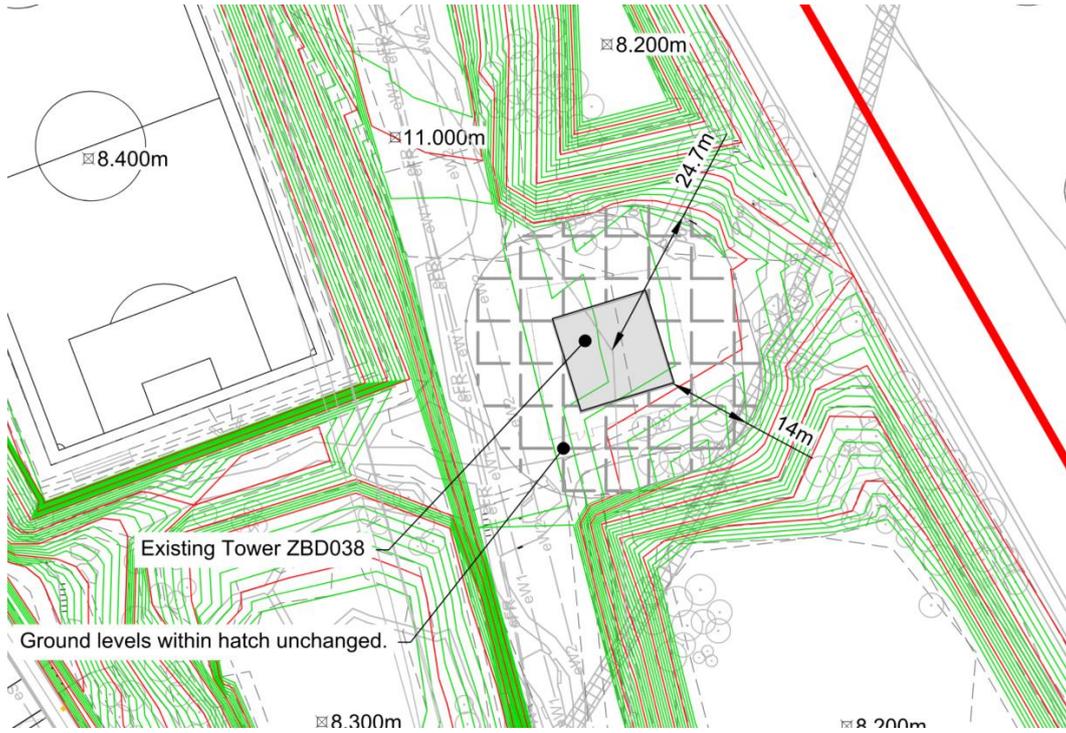


Figure 19 - Pillar of Support area

- 4.5.10 Access to the pylon for the maintenance is maintained along the spine of the park, where ground levels will remain as existing.
- 4.5.11 The SIW works contractor will be responsible for developing the construction methodology for the earthworks in the vicinity of the OHL. The methodology will comply with requirements for working near overhead lines EN43-8 and HSE’s guidance note 6 “Avoidance of Danger from Overhead Lines” and NGET’s Technical Guidance Note 287 ‘Third-party guidance for working near National Grid Electricity Transmission equipment.
- 4.5.12 The proposed SIW have taken into account NGET’s infrastructure and make provision for access to retain, maintain, repair and inspect the assets. The works do not change levels such that they encroach within any safety clearance zones and existing ground levels will be retained within the ‘pillar of support’ area identified by NGET. The planting scheme will be developed to reflect the requirement for avoiding plant which compromises the statutory safety clearances. The construction approaches will adopt best practice and guidance to ensure no encroachment within the clearance zones. Considering these points the proposed SIW will not detrimentally affect the NGET infrastructure.

## 4.6 Canal and River Trust (CRT)

- 4.6.1 In their objection CRT identify three points that I now respond to.
- 4.6.2 CRT state that the Council has failed to demonstrate that it requires the CRT’s interests as specified in the order. The Plots within the order which CRT have an interest in are: 101, 102, 104, 105, 106, 109, 112 and 113. These interests are:
- Land on the offside bank (west side of the Canal) – 101;
  - Areas of the Canal – 102, 104 & 105;
  - Sections of the Towpath – 106, 109 & 112
  - Part of Towpath Road – 113.

4.6.3 CRT note that no specific rights to discharge flood water and surface water to the Canal have been sought and they note that this is not consistent with the approach to other watercourses which are included within the Order.

4.6.4 CRT also seek clarification as to what modelling has been undertaken in respect of anticipated water levels and in particular what impacts upon the Canal have been identified. They identify that this particularly important given that one purported justification for the Order is to facilitate construction of a flood restraint barrier.

### **Requirement for the CRT's interests**

4.6.5 The land and rights identified within the Order for the plots described above are required for 3 main uses within the SIW:

- Remediation of land west of the Canal;
- Construction of a road bridge; and,
- Flood mitigation measures.

4.6.6 **Plot 101** is required as part of the SIW for two purposes:

- Construction of the western bridge abutment of the Central Spine Road – the western bridge abutment will be partially located within Plot 101 and therefore part of the Plot is required for this structure;
- Remediation and earthworks to form the development platform for the Phase Two works – the land to the west of the Canal has previously had a variety of industrial uses and is susceptible to flooding. In order to allow residential development on this land it is likely that some remediation of the existing ground will be required and the site ground level needs to be raised to above flood level. Plot 101 forms the edge of these works and is therefore required.

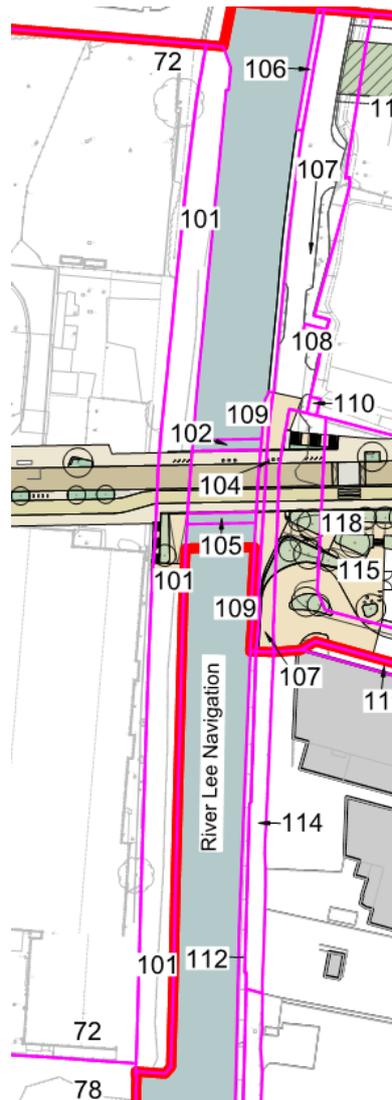


Figure 20 - Plot 101 on left bank of Canal

**4.6.7 Plots 102 and 105** - rights over these Plots are required to allow access to the airspace either side of the new Canal road bridge as shown in Figure 21. Access to these two plots is required during the construction period and to facilitate future inspection and maintenance of the bridge. It is likely that in either of these scenarios temporary structures extending beyond the bridge footprint (Plot 104) would be required.

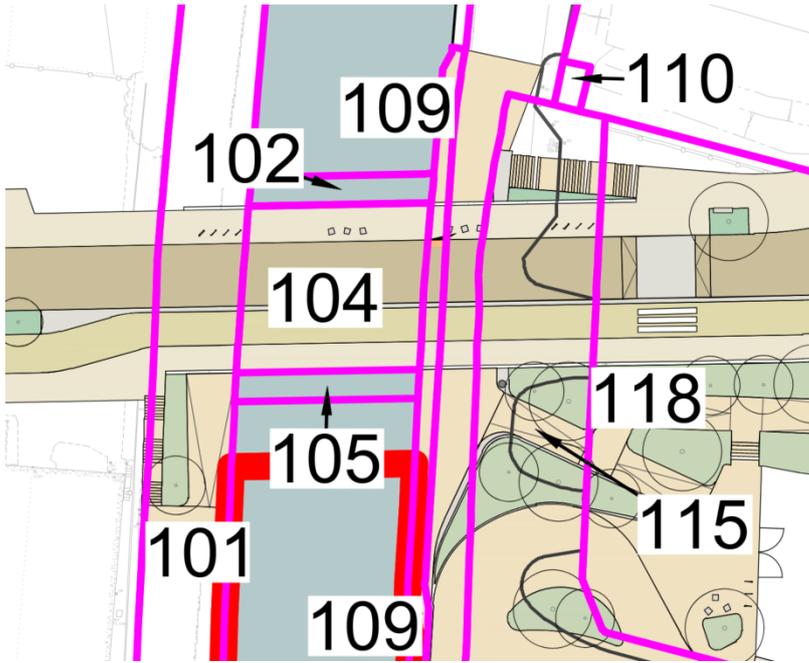


Figure 21 - River Lee Navigation Canal - Road Crossing

- 4.6.8 Plot 104** – rights over this Plot are required for the proposed Canal road bridge to be constructed in the airspace above the Canal. Plot 104 will contain the footprint area of the proposed new bridge over the Canal. The bridge is located with a minimum vertical clearance of 2.7m to the towpath, which is in line with CRT requirements and will ensure it does not obstruct use of the Canal.
- 4.6.9 Plot 106** is required to safeguard the route for flood flows from the Canal to the proposed flood compensation areas. As noted in Section 3.2 a flood conveyance channel ('FCC') is proposed for this route. The FCC starts on the east side of Towpath Road. During significant flood events, water levels in the Canal will rise and flow over Towpath Road and into the FCC. Flow into the FCC is controlled by a weir entry located to the east of Towpath Road; the weir level is set +11.0mOD. No level changes are proposed to the Towpath or adjacent Towpath Road and to ensure flood flow is not impeded in this location, the existing levels to the towpath are required to be maintained as existing. The Council need to acquire plot 106 to ensure there are no level changes, barriers or structures installed on this plot which could affect the flood mitigation proposals, as they cannot impose such a requirement or restriction compulsorily.
- 4.6.10 Plot 109** is required for rights to a section of the towpath to undertake improvements to the public realm and to install a flood barrier.
- 4.6.11** This section of towpath is within an early phase of the development (incorporating the relocation of the Building BloQs). The Council propose to undertake enhancements to the public realm between the Building BloQs workshop and the Canal, including under the new road bridge. The works will comprise installing new surfacing across this area to create a unified finish. The Council require rights to Plot 109 in order to undertake these improvements. These finishes will not change the existing ground levels or access arrangements.
- 4.6.12** A flood barrier is required along Towpath Road as set out in Section 3.2. The council also require rights to the plot to install and maintain the flood barrier. The flood barrier will be constructed within the same zone as the existing vehicle restraint barrier between Towpath road and the Towpath. It will not affect public use or CRT use of the Canal.

4.6.13 **Plot 112** is required for rights to install and maintain a flood barrier. The barrier will extend from Plot 109 through 112. The requirement for this barrier is set out in Section 3.2. As noted above the flood barrier will not affect public use or CRT use of the Canal.

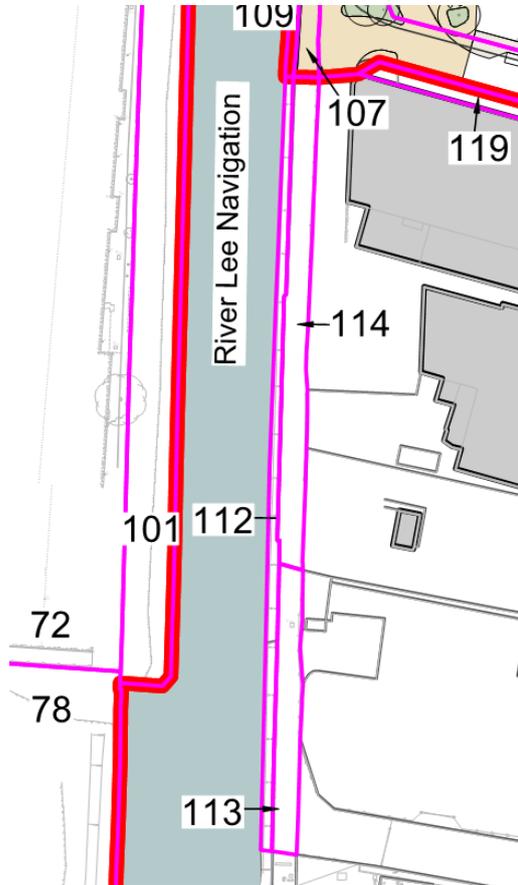


Figure 22 - Plot 112 - Extent of Towpath Road flood barrier

- 4.6.14 The engineering works described above to construct the bridge, flood mitigation measures and to improve the quality and condition of the Towpath surfaces will not affect the use of the Canal or Towpath on completion of the SIW. CRT's ability to carry on its undertaking will be unaffected by the completed SIW.
- 4.6.15 Whilst the SIW are being constructed there will be temporary disruption, e.g a restriction or potentially stoppage of the Canal will be required when the bridge beams are being lifted into place. The requirements and notice periods for restrictions and stoppages is set out in Code of Practice for Works Affecting the Canal & River Trust: Part 1 General Information. In developing the detailed construction methodology the Contractor will consider the notice periods and obtain the necessary consents set out in the Code.

#### **Rights to discharge surface water**

- 4.6.16 The strategy for surface water drainage is set out in Section 3.4. It is expected that as part of the SIW or Phase Two works some surface water will be discharged to the Canal. However as noted in Section 3.4 and in the objection CRT's 'Code of Practice for Works Affecting the Canal & River Trust' sets out the approach and requirements to discharge surface water run-off to the Canal. This is a recognised approach so no specific additional rights with regard to drainage were considered necessary and accordingly these have not been requested in the Order.
- 4.6.17 The existing flood mechanism and the strategy for flood mitigation is set out in Section 3.2. Currently flooding emanates from the Canal into the adjacent areas. In the mitigation strategy flood water is re-directed to the flood compensation basins from where it discharges to the River Lee. Flood water from the site is not discharged to the Canal therefore no rights have been sought in this regard within the Order.

#### **Hydraulic Modelling and water levels**

- 4.6.18 As described in Section 3.2 the existing EA flood mapping is not current for the site. Arup agreed a scope for with the EA for developing a new baseline and post-development fluvial hydraulic model for use in the Meridian Water project. This set out the

requirements for the models to be used, how they would be combined, what proving would be undertaken and what design events should be considered. The scope also set out how the post development model would be developed.

- 4.6.19 The updated baseline model was used to prepare flooding mapping using the current climate change allowances. The proposed development site levels including the flood compensation measures were included in the modelling to demonstrate that the mitigation strategy would be effective.
- 4.6.20 The modelling allowed flood levels along the Canal to be determined for both the updated baseline and the mitigation scenario for all of the design events. The modelling showed that for the 1 in 100yr +35% CC the maximum water level within the Canal would be increased by 43mm compared to the baseline levels. This occurs locally adjacent to the overflow into the flood conveyance channel and reduces upstream and downstream. This increase is not a significant detrimental impact.
- 4.6.21 The baseline and post development hydraulic modelling has been submitted to and agreed with EA and was incorporated in the FRA submitted as part of the SIW and Phase Two Planning Applications.

## 4.7 Lee Valley Regional Park Authority (LVRPA)

- 4.7.1 LVRPA's objection states that the inclusion of its land is unnecessary, excessive and disproportionate. The land which the LVRPA has interest in is:
- 128 and 131 – owner/reputed owner and occupier
  - 127, 129, 130, 132 and 134 – occupier

4.7.2 The land all falls within the area east of Harbet Road which will form part of the new Edmonton Marshes. The land is within the areas where the flood mitigation basins are proposed; see Figure 23. Section 3.2 sets out the flooding issues and associated mitigation measures which were considered and why the area in Edmonton Marshes including these land Plots are required. Consequently, all the land identified is required and its inclusion in the Order is neither excessive nor disproportionate.



Figure 23 - LVRPA land Plots with flood mitigation scheme (refer to Fig 17 in Appendix A)

## 4.8 Thames Water Utilities Ltd (TWUL)

4.8.1 TWUL's objection states that insufficient information is available. They also note the presence of their assets on the site which could be affected by the proposed SIW works.

4.8.2 TWUL are identified as owner of three land Plots 133, 134 & 135 located to the east of Harbet Road. They also have an asset protection interest in land above their spine tunnel which affects plots 133 & 137.

4.8.3 From consultation and the information provided by TWUL, the following operational assets were identified within plots 133 and 134:

- 2 x 305mm ID sludge rising mains
- 84" Conduit to Coppermills Stream
- 54" Raw water
- 2540mm Lee Valley Spine Tunnel

4.8.4 As described in section 3.2 the flood mitigation strategy needs the land between Harbet Road and the River Lee to provide the flood compensation for development.

4.8.5 In light of the TWUL asset records, the flood mitigation strategy was modified to retain a central north-south spine of existing ground levels over the rising mains, the 84” and 54” pipes. This spine is approximately 15m wide with maximum slopes of 1 in 3 into the adjacent lowered areas. The spine can be seen in the contour plan for the park; the zone highlighted yellow in Figure 24 is an area where ground levels are largely maintained as existing to avoid impact on the TWUL assets.



Figure 24 - Edmonton Marshes - retained ground level over TWUL assets (refer to Fig 17 in Appendix A)

4.8.6 The TWUL spine tunnel is at a depth of approximately 8m below ground level. In order to provide the flood mitigation within the land

east of Harbet Road it is necessary to lower ground levels. In the area over the spine tunnel, it is proposed that ground levels will be lowered by approximately 2m to 8.3mOD.



Figure 25 - Depths of cut and fill in Edmonton Marshes

4.8.7 Lowering ground levels over a tunnel structure may affect its structural stability. During the detailed design of the SIW the effects of the ground level changes on the tunnel will be assessed. The Contractor's designer will undertake the detailed assessment of the impact of the current proposals on the TWUL assets. The designer will review the assessment criteria and scopes set out above and agree a site specific approach for Meridian Water with TWUL. There is no reason why a suitable engineering approach cannot be developed that will address any TWUL concerns. In this regard, I note that as set out in the evidence of Mr Bodley, an agreement has been reached with

TWUL which sets out an approach relating to restrictions and reservations around their assets.

## 5 Conclusions

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- 5.1.1 My evidence covers the engineering issues related to the proposed development.
- 5.1.2 I have summarised the scheme and the engineering background to the different aspects of the SIW. In doing so I have demonstrated why the land identified within the Order is required to build out the SIW.