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Introduction

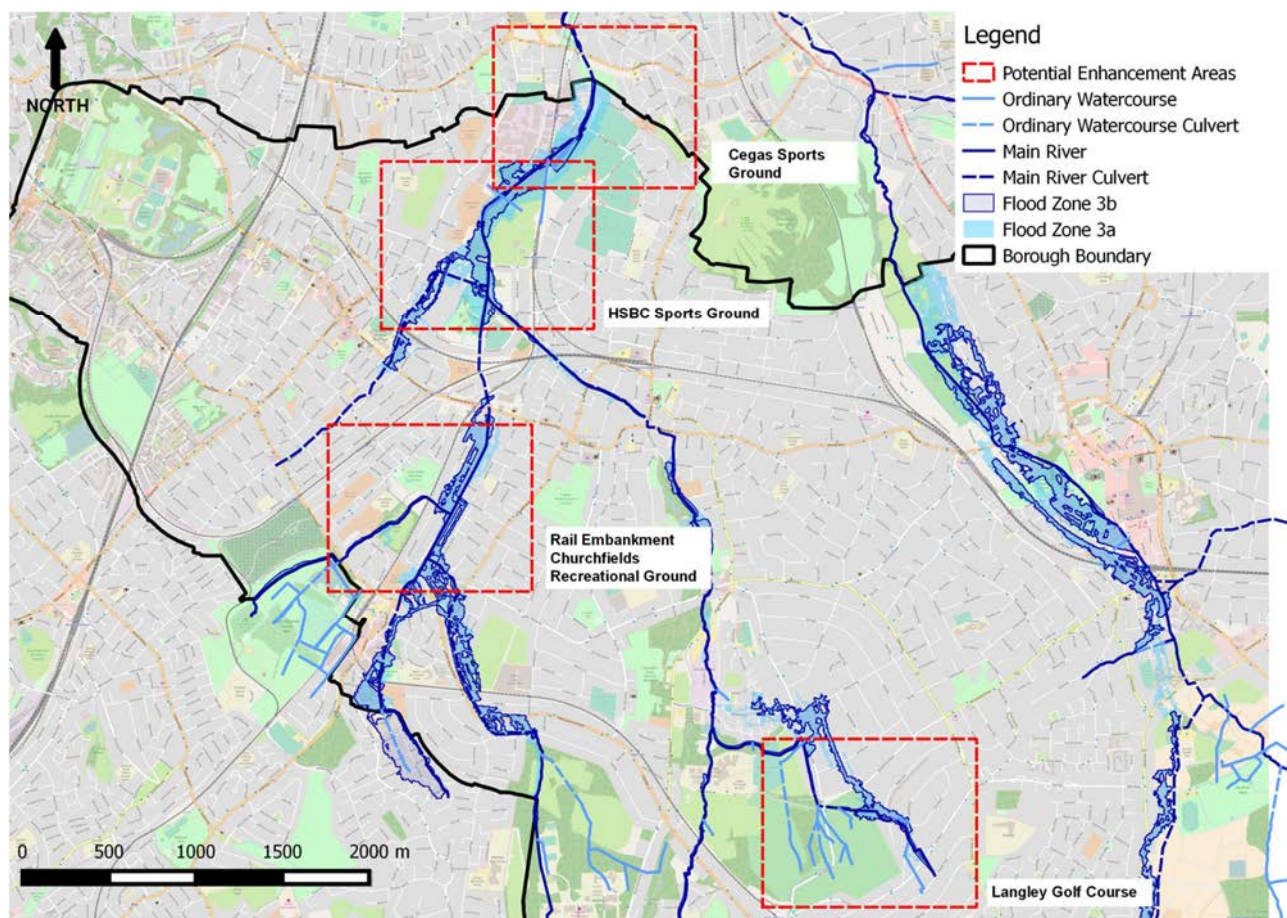
This appendix provides a high level assessment of some potential options within the London Borough of Bromley (LBB) to increase the effectiveness of the 'functional floodplain' (Flood Zone 3b). The two main river systems within the Borough, the River Ravensbourne and River Cray, become heavily urbanised in the downstream London Boroughs of Lewisham and Bexley. Within LBB, however, they have a slightly more rural setting with parks and open space of one or both banks in many places. These open spaces, where the rivers can freely flood, play a vital role in the prevention of flooding of the downstream urban areas. The options identified herein look to improve the functionality of these areas or identify additional other parts of the Borough which, with minimal adaptation of the river channel, could become part of the functional floodplain.

Four locations within the Borough, shown in Figure 1, have been identified as potentially suitable for further investigation. It is envisaged that these potential floodplain enhancement options could be included within future modelling and flood alleviation optioneering studies by the Environment Agency (EA). It is worth noting that these locations were the result of a filtering process which took into account their suitability from a topographic and land use perspective.

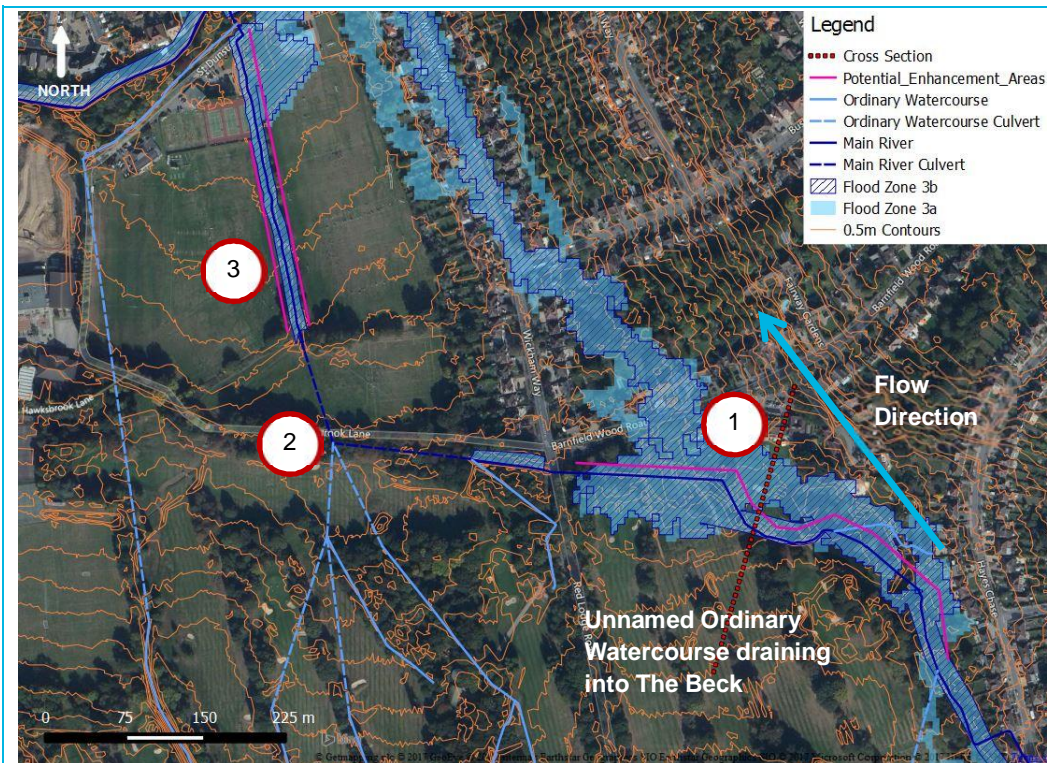
A brief summary of each location including an overview of the topography and river setting, current flood zone designation, flood levels and the surrounding land use is provided in this document. An indication of the potential floodplain enhancement options have been provided along with their limitation and recommended next steps.

It should be noted that identification and assessment of these potential locations has been undertaken through a high-level desk-based review of EA datasets. Further investigation of the options would be required through hydraulic modelling, site investigations, surveys, stakeholder engagement, etc.

Figure 1 Potential locations for floodplain enhancement



Langley Golf Course



Location: Hawksbrook Lane, Beckenham, BR3 3SR

NGR: 538271,167276

Land-Use: Left bank – Golf course and cricket club,
Right bank – residential

Current Flood Mechanism:

- The culvert beneath Hawksbrook Lane at location (2) controls the flow rate into the open channel in Langley Park. The open channel in Langley Park at location (3) is currently not shown as likely to flood which suggest that during extreme events flows back up into the small unnamed watercourse on the east.
- During extreme events, flood water from this unnamed Ordinary Watercourse is predicted to spill over the right bank of the channel at location (1) and flow overland, remote from the river channel, through a residential area before joining The Beck approximately 500 m downstream.

Possible Option:

- Increase the ground level on the right bank of the Ordinary Watercourse along Hawksbrook Lane at location (1) to reduce likelihood of overtopping.
- Increase the culvert size beneath Hawksbrook Lane, location (2) to increase flow rate into Langley Park.
- Lower ground levels in Langley Park at location (3) to promote the flooding of land within the park.
- Provide earth bunds around Langley Park to impound the potential flood water and prevent flooding of highways and properties.

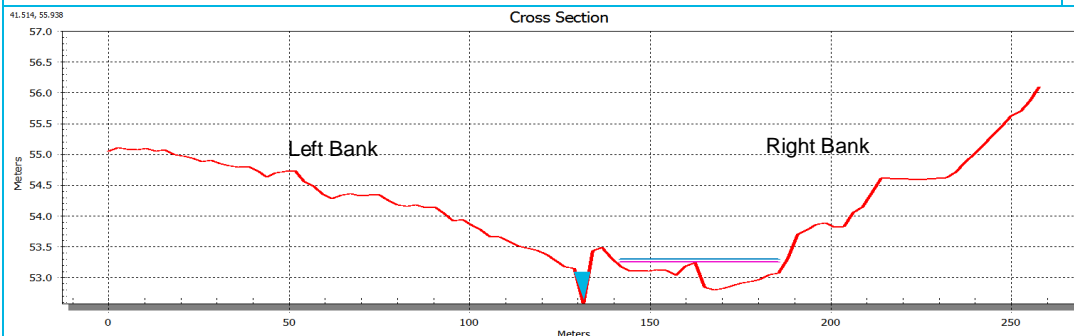
Limitations:

- Topography in Langley Golf Course slopes steeply from the left bank of the channel, limiting the available space for storage if the right bank is raised.
- Scheme would require hard engineering to raise the right bank and to install a protection bund in Park Langley.

Next Steps:

- Hydraulic modelling would be required to determine the necessary changes in culvert dimensions, right bank levels and storage arrangements in Langley Park.

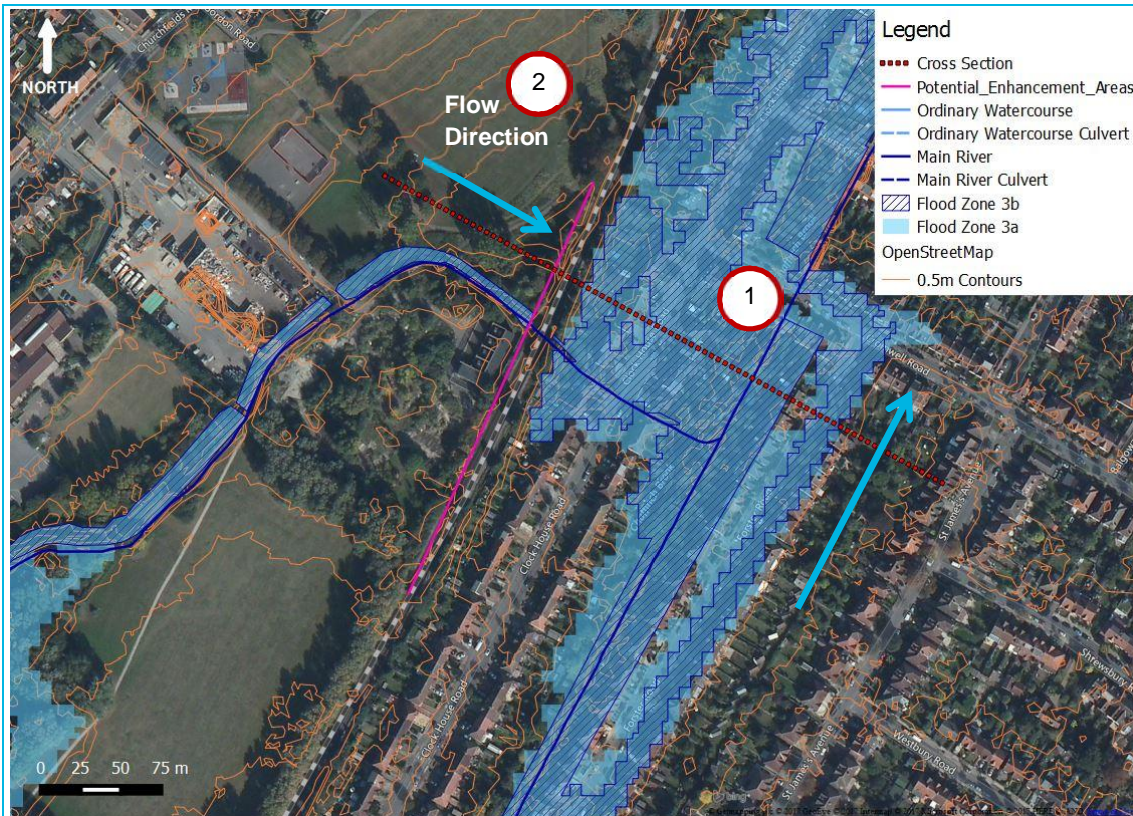
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Legend:

- Ground Elevation (mAOD)
- 1 in 100 Year Flood Level (mAOD)
- 1 in 20 Year Flood Level (mAOD)
- River / Watercourse Channel

Rail Embankment Churchfields Recreational Ground



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Location: Clock House Road, Beckenham, BR3 4JY
 NGR: 536164,168964

Land-Use: West of rail embankment there is a recycling unit adjacent to Churchfields Recreational Ground
 East of rail embankment is residential

Current Flood Mechanism:

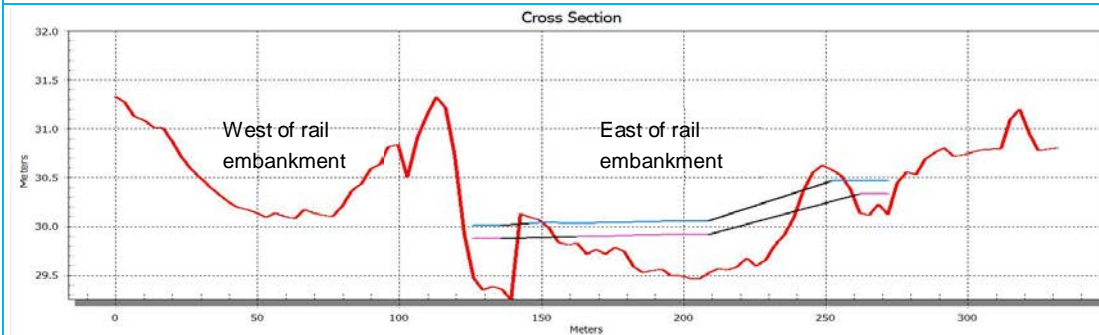
- There is a risk of flooding of residential properties on the eastern side of the rail embankment from the Chaffinch Brook at location (1).
- There is a culvert beneath the rail embankment from the Ordinary Watercourse on the western side which contributes to the flooding.

Possible Option:

- Restriction of flow through the culvert beneath the railway would reduce the volume and flow rate entering the eastern side thus reducing the risk of flooding.
- This would result in backing up of flood water against the railway embankment on the western side. This flood water could be stored in Churchfields recreation ground (location (2)) through ground lowering and provision of earth bunds.

Limitations:

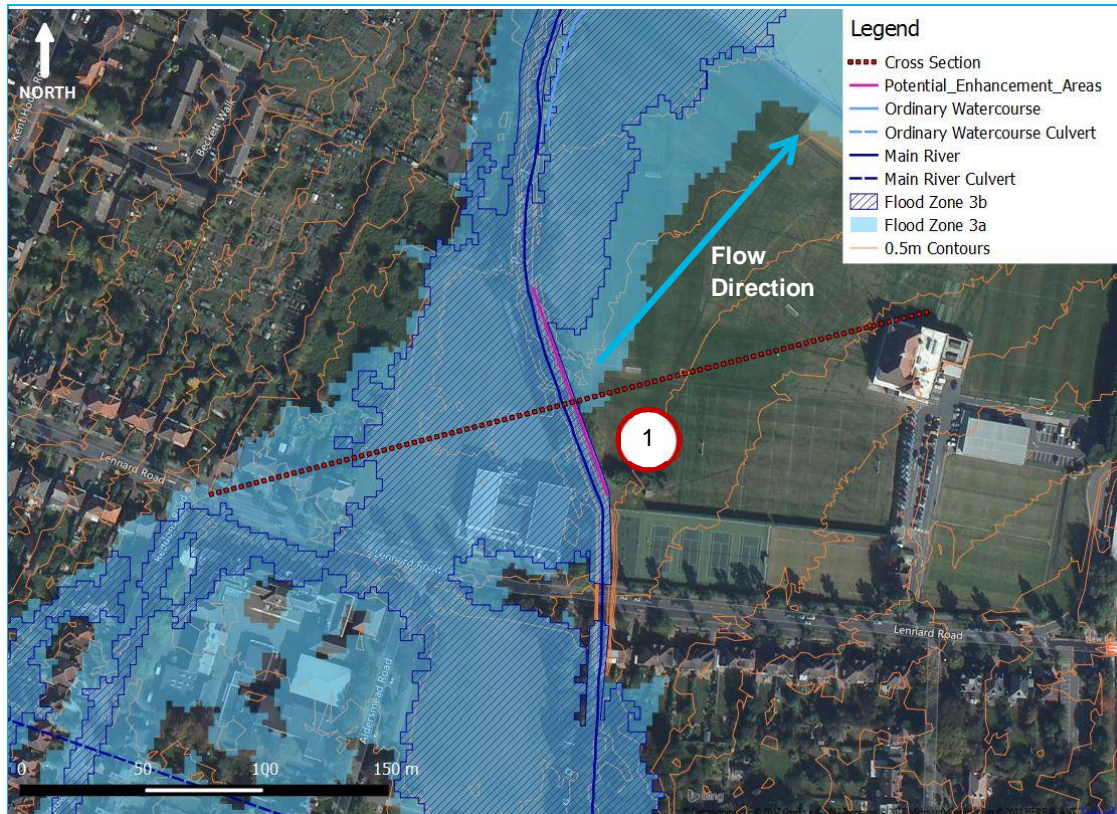
- This will only reduce the volume and flow rate of water passing through the rail embankment culvert and may have a limited impact on the risk of flooding on the eastern side due to the dominant flow along the Chaffinch Brook.
- Churchfields recreation ground has reasonably steep topography, limiting the potential for storage.
- **Next Steps:** In order to fully understand the impact of adapting the culvert structure and flooding Churchfields recreational ground, hydraulic modelling is required.



Legend:

- Ground Elevation (mAOD)
- 1 in 100 Year Flood Level (mAOD)
- 1 in 20 Year Flood Level (mAOD)
- River / Watercourse Channel

HSBC Sports Ground



Location: Lennard Road, Beckenham, BR3 1QN
 NGR: 536439,170426

Land-Use: Left bank: Harris Academy Bromley Athletic Ground
 Right bank: HSBC Group Sports Ground

Current Flood Mechanism:

- Flooding is currently predicted to occur along both banks of the Pool River. However, areas of low ground along the right hand floodplain at location (1) are protected from flooding by high ground along the bank of the river channel.

Possible Option:

- Lowering of the right hand bank at location (1) could encourage water to flow onto the sports ground on the right floodplain rather than the residential areas upstream and on the left floodplain.

Limitations:

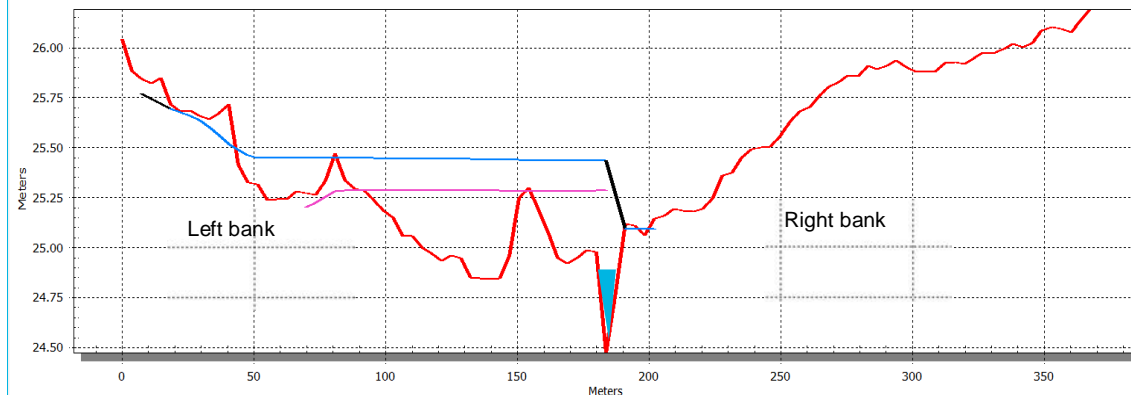
- The ground level on the right floodplain may need to be lowered to encourage flooding in these areas; this would result in large excavations.

Next Steps:

- In order to fully understand the impact of removing the high ground along the right bank, hydraulic modelling should be undertaken to assess the impact on flood level to the neighbouring properties.

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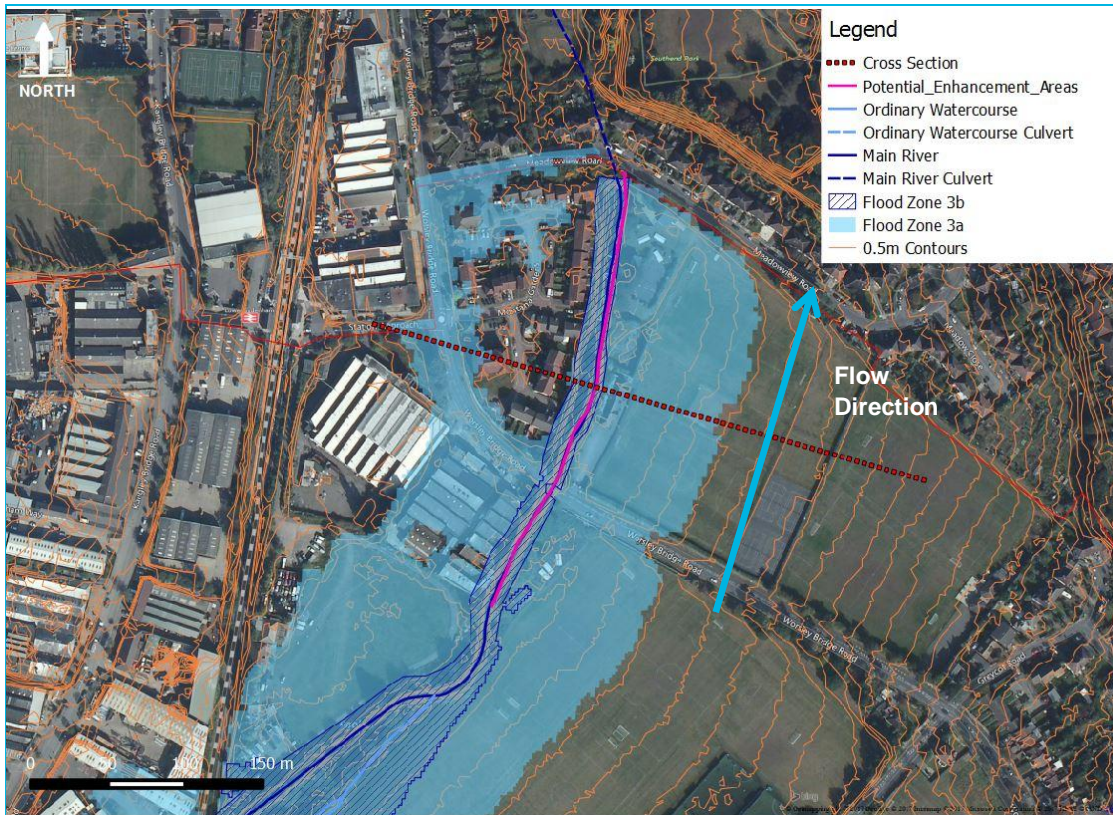
Cross Section



Legend:

- Ground Elevation (mAOD)
- 1 in 100 Year Flood Level (mAOD)
- 1 in 20 Year Flood Level (mAOD)
- ▨ River / Watercourse Channel

Cegas Sports Ground



Location: Worsley Bridge Road, Beckenham, BR3 1RL
 NGR: 537060,171229

Land-Use: Left bank: residential
 Right bank: sports ground

Current Flood Mechanism:

- Flooding is currently predicted to occur along both banks of the Pool River during the 1 in 100 year event; however, is largely constrained to the immediate river channel during the 1 in 20 year event. There is a small earth mound along the right hand bank which prevents the 1 in 20 year event spilling onto the sports ground.

Possible Option:

- Removal of the earth mound on the right river bank could allow flood water to inundate the adjacent sports field and reduce flood depths in the neighbouring developed areas and downstream.
- This could be combined with profiling of land on the eastern bank to extend the functional floodplain further into the sports ground.

Limitations:

- Right bank floodplain slopes relatively steeply up from the watercourse, limiting the available space for storage.
- Any alteration to the ground levels and flood extent would be dependent on agreement with the sports ground land owners.

Next Steps:

- Hydraulic modelling is required to determine the achievable benefits of removing the earth mound on the eastern bank.
- Following modelling, discussion would be needed with the land owners.

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