Warwickshire Wildlife Trust
Brandon Marsh Nature Centre
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Warwickshire Wildlife Trust

Invite to tender for delivery of removal and remediation of a rock ramp structure

1. Introduction

1.1 Project Introduction

This document has been prepared by Warwickshire Wildlife Trust and is presented to Contractors interested in providing tender costings and details with respect to delivery of removal and remediation of a rock ramp structure causing an impoundment effect and therefore lack of natural geomorphological processes upstream of aforementioned structure.

Previous work that has been completed in this area includes – Brueton Park Lake and Half moon pool upstream has been de-silted and silt used to create around 500m² soft marginal habitat around hard edging. Brushwood bundles and stakes have been installed alongside retaining toe structures i.e. coir rolls to provide areas for silt to be sculpted.

90t gravel has been installed upstream of Brueton Lake and sculpted. 2 small backwater pools have been excavated. 10 large hinged trees and brash ledges have been installed upstream of Lake. Tree thinning works and coppicing - est. 10cubic metres of trees around pool and lake.

1.2 Site Introduction

The site consists of areas of open publicly accessible amenity space, open water, parkland habitat and riparian corridors owned and managed by Solihull Metropolitan Borough Council. Hardstanding paths run throughout the park and is bordered by St Alphege Junior School, Solihull 6th Form, The river Blythe, residential houses and the Warwick Road.

A site visit can be arranged to view the site before the tender deadline, to arrange please contact William Furniss William.Furniss@wwkt.org.uk 07471033557.

2. INSTRUCTION TO TENDERERS

This section details what Warwickshire Wildlife Trust will require from any Contractor who wishes to tender for the Works as defined.

To ensure an acceptable tender, Warwickshire Wildlife Trust require the tenderer to:

Provide the necessary insurance cover for these Works including Public & Employers Liability (Cover - minimum £5 million). The relevant insurance certificates should accompany the submitted tender

Provide a completed response to the Schedule of Prices / Rates as defined in Document B below

Provide the name of the Contractor's on-site representative.

2.1 Selection:

The process of selection will be by sealed tender, which will be opened and recorded in the presence of Adam Noon (Catchment Coordinator for Tame, Anker and Mease at Environment Agency), Daniel Hunt (Senior/Development Officer – Ecology at Solihull Metropolitan Borough Council), Susan Hartland Smith (Tame Valley Wetlands Manager at Warwickshire Wildlife Trust) and William Furniss (River and Catchment Restoration Assistant at Warwickshire Wildlife Trust).

The quotations will be assessed by relevant staff to assess the technical aspects and the financial basis as described below. Please submit 2 documents A and B as described below.

Document A (quality assessment). The format of this document is left to the discretion of the contractor

To include;

A feasibility study has already been conducted and is included as part of this pack. This includes a Method Statement. It is expected that your submission will cover all required works such as Mobilisation, Delivery, Utility Search, highlighting key issues and risks.

- Appendix 1.1 Brueton Park River Blyther Restoration Method Statement
- Appendix 1.2 Brueton Park River Blythe Restoration Design Drawings
- Appendix 1.3 Brueton Park River Blythe Restoration Report June 2022
- Appendix 1.4 Brueton Park River Blythe Restoration BoQ

The roles and responsibilities of the contractor and the contractor team.

The contractor's head or regional office location.

Logistics – what equipment will be used, will all the work be completed by the contractor or will it require sub-contractors?

Mitigation measures to (i) reduce the risk of delays, and (ii) reduce damage to the environment.

A breakdown of the programme of works – its key stages and an indicative timetable for completing the work (including the length of time the work is expected to take) and the earliest point at which this work could begin.

A statement on the relevance and skills of their organisation to the delivery of this work. To include evidence of previous experience of similar projects and CVs (if appropriate) of the key members of the contractor team.

Health and Safety Policies – to cover all aspects of the works.

Document B (price assessment). The contractor must include a breakdown of all fees and costs, indicating the following in their response to the brief (and whether costs are including or excluding VAT): Section 3 gives a template for costs but contractors are free to detail costs in their own format as long as detail of the following is included.

Mobilisation

Enabling Works

Materials

Equipment/Machinery

Labour/Staff

Total cost (£ excluding VAT).

Total cost (£ including VAT) – final fixed fee to carry out all of the works outlined in this brief.

The submitted documents should be clearly identified as being either Document A or Document B. Document A should not contain any reference to fees or costs as the two elements Document A (quality) and Document B (price) will be assessed independently of each other. See below for the weightings of these two documents.

This contract will be awarded based on the price and the quality criteria indicated below.

The contractor's quality and price submissions will be scored and those scores weighted in the ratio 30:70 (quality: price). The contractor with the highest aggregate score will be considered for the work.

The price assessment (B) will be marked out of 100 points. The lowest price quote will be awarded 100 marks. The other submissions will have one mark deducted for each percentage point by which the cost is above that of the lowest (e.g. a contractor tendering at a total of 20% above the lowest price will receive 80 marks).

The quality assessment (A) will be marked out of 100 points allocated against weighted criteria as described below. The assessment will judge submissions based wholly on the contents of the information provided using a common evaluation method. The highest quality score calculated will be awarded 100 marks. Other quality scores will have one mark deducted for each percentage point by which the total is below that of the highest (e.g. a total of 20% below the best quality score will receive 80 marks).

2.2 Timescales

Please submit your sealed bids by **1.00 pm on Friday 31st January 2025.** via email to william.furniss@wkwt.org.uk. If you consider a hard copy needs to be included please contact the above email address.

The tenders will be scored on **4th February 2025.** Any queries or follow up will be undertaken in that week. We anticipate awarding a contract by **Friday 14th February 2025.**

It is planned that the works should be undertaken **May to September 2025 with final deadline of 30th September.**

Appendix 2 includes a "General Description of the Contractor's Obligations", a "General Description of the Client's Obligations" and additional statements and conditions, which apply to the Works.

It is anticipated that any Contractor tendering for these Works will have recent relevant experience in undertaking the operations necessary to fulfil the Works proposed, and where necessary will provide details of similar activities that have been successfully completed.

Warwickshire Wildlife Trust is not bound to accept the lowest quotation.

3. SPECIFICATIONS PERTAINING TO THE WORKS / SCHEDULE OF PRICES

3.1 Schedule of Prices

Specifications associated with the works are provided in Appendix 1.

The Schedule of Prices should be completed on Table 3.1A.

If the original specifications of the Works change during the detailed design, these changes will be paid for either at the rates agreed above or using a daywork schedule. In order to inform this daywork schedule it is necessary for the Contractor to provide rates for the following:

Labour;

Plant;

Materials:

Temporary works, variations, additions etc. must be agreed in writing with the client's representative prior to implementation by the contractor.

Contractor: _____

Contact Name:_____

Signature: _____

Date: _____

Table 3.1A.

Description of Works	Quantity	Rate	Fees
			£
		GRAND TOTAL	£

Contractor: _____

Contact Name: _____

Signature: _____

Date: _____

3.2 Services

Service searches have not been undertaken. It is expected that these will be included as part of this tender.

3.3 Public Access

The works area is located within a public park and therefore there is public access to the area. The contractor must carry out the works in a manner that ensures that there are no additional risks to the public as a result of the works. However, the public must be able to safely move through the park throughout the duration of the works.

Signage will be put in place prior to works starting to inform regular users of the recreation ground about the works upcoming works. Hazard signs, should, however, be used at all times when machinery is on site and a fenced/segregated work area should be maintained to keep members of the public out of danger.

4. TERMS OF PAYMENT

On completion of the Works the Contractor may make a claim for payment which will be checked by the Client and changed where necessary.

Interim and final payments will be made at the end of the month following receipt of the checked and verified invoice.

The Client will retain 5% of the Total Payment due with respect to the contract for 3 months after completion of the Works. This payment will be made to the Contractor subsequent to the Client's Site Representative verifying the work completed on site at this time.

General Description of the Contractor's Obligations

1. The Contractor must construct and complete the Works, and must provide all the labour, materials, plant and temporary works necessary.

2. The Contractor must be responsible for safety of all site operations, with specific reference to:
    - The safety of all persons entitled to be on site;
    - The care of the Works;
    - Damage to persons and property resulting from the construction process,

    and must take out insurance to cover any claims arising from these areas.

3. The Contractor shall undertake a site visit and inspection of the site prior to preparing the tender. Thus the Contractor is aware of the potential problems and difficulties that will be faced when Works begin.

4. The successful tenderer will be required to submit a Health and Safety Plan and Method Statement for the approval of the Warwickshire Wildlife Trust prior to works starting. This document should detail the order in which the Works will be carried out. The Contractor must specify a date of commencement of Works, and a period of Works. An extension of time for completion of the Works will only be allowed where:

    - Additional work is instructed by Warwickshire Wildlife Trust;
    - There are increased quantities above those shown in the quantities section;
    - There is exceptional adverse weather.

5. The Contractor must detail any additional temporary works that will be undertaken outside of those detailed in the Tender Documentation.

6. All workmanship and materials must conform to the standards specified in the contract.

7. The Contractor must allow Warwickshire Wildlife Trust, the landowner/operator, and statutory organisations access to all parts of the site, at all times.

8. The Contractor shall not at any time store or stockpile on the floodplain area equipment and / or material that will float or contaminate a watercourse in the event of the floodplain being inundated.

9. The Contractor shall take all necessary measures to secure the protection of all Watercourses including water in underground strata against silting erosion and/or pollution of the water so as to affect adversely the quality of appearance thereof or cause injury or death to animal, aquatic or plant life and/or damage to property and land. Such protective measures shall include, but not be limited to, the following:

    (a) All fuel, lubricating oil and/or other liquid chemicals stored on the site shall be located as far as reasonably possible and in any case not less than 50.0 m from any watercourse and such stores shall be sited on impervious bases and surrounded by an effective impervious bund capable of containing the full contents of the store plus 10% and with a sealed drainage system with no discharge to any watercourse land or groundwater. All such stores shall be kept locked or otherwise secured when not in use and all containers therein must bear clear labels giving full descriptions of contents. A stock of absorbent material suitable for use on the contents of the store must be maintained on the site.

    (b) Any leaking and / or empty containers shall be removed from the site.

    (c) The refuelling of machines shall be strictly controlled and confined to a location as far as reasonably possible from any watercourse.

10. Emergency Action: The following actions shall be taken by the Contractor in the event of any breach and / or risk of major pollution to a watercourse or land drainage area or any incident of fish kill:

    (a) Immediately inform the Environment Agency, Warwickshire Wildlife Trust and the Emergency services. For the Environment Agency telephone 03708 506 506.

(b) Secure the area from the approach of traffic and / or general public.

(c) Render every assistance to the Agency and / or Emergency services as shall be requested for the purpose of mitigating damage and / or for the purposes of securing public safety.

(d) With regard to landslope and any apparent flow direction of any potentially polluting material or liquid, construct if possible and as necessary dam bunds with earth board and / or sheet to prevent or restrain such materials from reaching the watercourse and/or flows inundating any adjacent property.

Compliance with the above requirements shall not relieve the Contractor of any of his obligations under the Contract.

11. On completion of the Works, the Contractor must clear the site, leaving it free from obstruction, debris etc. to the satisfaction of Warwickshire Wildlife Trust.

General Description of the Client's Obligations

1. Warwickshire Wildlife Trust will make available to the Contractor all ground investigation information. It is the Contractors responsibility to interpret these data for the purposes of undertaking the Works.

2. Warwickshire Wildlife Trust will provide a part time Site Representative who will administer the contract.

3. Warwickshire Wildlife Trust's Site Representative will 'set out' the position and orientation of the various parts of the Works, using ground markers and temporary benchmarks.

4. Warwickshire Wildlife Trust will ensure access for the Contractor to the site at all times detailed within the 'working period'.

5. Warwickshire Wildlife Trust will pay the Contractor for completed work. Warwickshire Wildlife Trust will pay the amount agreed with respect to the 'Terms of Payment'.

Additional Statements Applicable To These Works

The progress of all or any part of the Works may be suspended on the Warwickshire Wildlife Trust's written order and the Contractor must then protect and secure the suspended section.

If Warwickshire Wildlife Trust at any time believes that the Contractor is not making sufficient progress to complete the Works on time, s/he may write to the Contractor to ask that steps be taken to ensure timely completion.

Warwickshire Wildlife Trust may vary the Works as necessary or desirable. Rates will be paid as 'daywork'.

Excavated surfaces must be finished with a tolerance of +/- 50 mm.

Any reduce level excavation which was not instructed by Warwickshire Wildlife Trust will not be paid for.

It is the Contractor's responsibility to dewater the site if necessary. This activity must be undertaken with respect to the guidance / specifications detailed by the Environment Agency for working within floodplains.

The contractor will comply with all current Health & Safety legislation.

The Contractor will assess the need for Personal Protective Equipment in accordance with current legislation.

Warwickshire Wildlife Trust will, upon a written request by the contractor, grant an extension period for completion for whole or part of the works if the progress of any part of the works is delayed for exceptional adverse weather conditions. The extension period will be determined by the client and will only be granted if the contractor has taken all reasonable steps to avoid or minimise the delay.

The Contract is based on a lump sum quotation, any suspension of works for adverse weather or ground conditions will not be subject to the payment of “standing time”.

Brueton Park River Blythe Restoration - Outline Method Statement

Project name: Brueton Park River Blythe Restoration									
Project location: Brueton Park, Solihull									
Client: Warwickshire Wildlife Trust									
	Initial	Rev1	Rev2	Rev3	Rev4	Rev5	Rev6	Rev7	**Rev8**
Date	21-06-22								
By	SB								
Checked	GH								
Approved	**GH**								

Summary of key works and proposed sequencing

1. Removal of rock ramp and bed regrading/reprofile
2. Creation of riffles
3. Creation of point bars
4. Excavation of apical pools

Pre-construction & construction procedure

Construction of site compounds, lay-down areas, delivery of machinery and any other initial preparatory works to be undertaken in-line with specific site work activity. All works on site will be carried out in accordance with the appropriate British Standards and industry Codes of Practice. A qualified and experienced Geomorphologist must attend the site to advise on construction procedure at certain points during the works, particularly during construction of all features and initial setting out.

Biosecurity measures outlined in the following two documents should be followed by all personnel and machinery on site:

https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/documents/check-clean-dry-england.pdf

http://www.nonnativespecies.org/checkcleandry/

Construction period

The construction period is expected to take ~4-6 weeks, ensuring cost effective delivery and minimal environmental disturbance as a result of the work on site. However, it is possible that adverse weather conditions such as periods of high rainfall (and associated river level rise), will lead to temporary cessation of some construction. Liaison should be undertaken by the client and contractor with the Environment Agency to determine an appropriate time of year for the contractor to deliver the works as some wet working may be required to construct the scheme.

Working in Proximity of Services

A services search has not been conducted for the site at the request of the client. Dynamic Rivers accept no liability with regards to the presence of services and whether these are encountered or impacted on site during the works. The client assumes all liability in this respect. It is strongly recommended the client and/or contractor should undertake a services search prior to the works and undertake additional C.A.T4 / radio-detection scanning before commencing works.
Contractors should be made aware of their location as it is possible that some may be crossed / passed under to undertake the proposed works. The contractor should set up goalposts in the vicinity of overhead lines so that machinery operators are aware of their presence. They should also locate any buried services before excavation begins in liaison with the service provider. Track mats may be required across buried services. Other private services, such as land drains not already mapped, that are not picked up by utilities service searches, could be encountered during the works. This should be monitored and managed by the contractor and client on site.
All services should be considered carefully by the contractor undertaking the works in terms of safe working procedures, access and crossing these utilities. It should be noted that standard services searches do not identify all local land drains. If encountered, these should be managed on site by the contractor and client.
Dynamic Rivers accept no liability of any kind for the presence or location of utilities in the vicinity of the designed features. A full and comprehensive utilities search should be undertaken prior to construction. Design drawings provided remain marked not for construction as per this recommendation.

Public Access during the works

During the construction period, public access to the site should be restricted and fenced off. Impacted footpaths will need to be re-diverted or alternative routes signposted.

The contractor will ensure appropriate signage and fencing off of the construction compound area and work area, and it is the responsibility of the contractor to ensure safe access for the workforce and appropriate restriction of access to the public.

Historic sites within the work zone should be fenced off to ensure no damage is caused by machinery access etc. (where relevant).

Species surveys

No protected or invasive species surveys have been assigned or undertaken as part of the design works.

Timing of vegetation clearance and temporary disturbance to river bed as part of works

Only those areas specifically identified for site clearance (to be marked out by the client and contractor prior to commencement of construction, with supervision from Dynamic Rivers) shall be cleared of existing tree and vegetation cover. Contractor to use tracking mats for river banks when entering and exiting the channels.

Removal, pollarding and pruning of trees and clearance of ground vegetation may be required during the bird nesting season. These works will only be undertaken immediately after the trees and vegetation have been inspected and deemed free of nesting birds and bats by an ecologist.

Nesting bird season and other ecologically sensitive seasons are summarised below:

- Bird nesting - March to August
- Bat roosting - April to September
- Spring salmonid run (migration) – approx. March to May (depending on local run timing)
- Salmon spawning season – 1st October to 15th June
- Crayfish rescue should avoid late May and June when females may be carrying newly hatched young

Note: There may be some changes to the outlined method statement as more knowledge of site conditions are gained in the pre-construction and construction phases of the project to be determined by the contractor.

Note: This outline method statement does not constitute formal construction advice, safe constructability of the proposed design is the responsibility of the contractor.

Activity: Removal of rock ramp and bed regrading/reprofile	Method Statement 1

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, overhead and buried services, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as agreed by the landowner and client. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction. Fence/gate removal and replacement may be required to facilitate / access the works areas, alongside pollarding and vegetation clearance.
- Some working in close proximity to trees required. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.
- Undertake services search and locate services on site prior to excavation commencing. Some may be crossed over/under for access purposes, contractor should ensure appropriate mitigation.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed with the landowner, contractor and the client.
- Silt control measures to be in place downstream and across the floodplain prior to works starting, during works and inspected daily (replace / repair as necessary).
- Wet working approvals may be required from the Environment Agency to undertake the works – recommended that works are undertaken in the dry wherever possible (contractor to consider overpumping).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- Note – following removal and regrading there will likely be a period of time when no flow will enter the Lake, until the riffles have been created. This should be communicated with the landowner.
- The rock ramp to be removed and associated bed grading length should be surveyed in on site prior to removal and regrading commencing using coordinates provided with the design drawings, this should also be undertaken with supervision from Dynamic Rivers.
- Remove the rock ramp along its entire length and regrade the bed locally as demonstrated in the design drawings, ideally in the dry (contractor to consider overpumping). The rock ramp material, including piling, should be removed in its entirety across the full width of the channel (this may result in a greater depth of material removal than that shown in the design drawings as the depth of material may vary along the feature length). The bed should then be regraded to the appropriate slope as shown in the design drawings before riffles are created. The finished bed level following regrading should tie into the downstream bed level.
- Stockpile material temporarily outside of the floodplain. Riddle any excavated gravel material for re-use in riffle and point bar creation. Rock ramp material and sheet piling to be disposed of off site.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Any fencing removed is to be replaced on agreement with the landowner and client.
- Seed exposed / damaged areas of floodplain, excavated areas and top of bank areas (if seeding is proposed) with suitable seed mix at 5g/m^2 spreading rate.

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Check line of works for any trees to be removed, branches to be cut back, vegetation clearance etc. to ensure safe passage for machinery. Where mature trees are encountered during excavation, avoid where possible and adjust line of features if this is possible with agreement with the geomorphologist.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites.
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables where access routes require it.
- Install appropriate fine sediment control measures downstream of works area and across any impacted floodplain e.g. straw bales, fine sediment control mats, silt curtains. These must operate during and after in-channel features are being created, floodplain features are being excavated etc. Machinery access along the bank top or in channel must be controlled to prevent silt/fine sediment-run off from exposed banksides and from disturbed fine sediment.

Control Measures or Modifications

- No smoking in works area.
- No works to be undertaken during the hours of darkness.
- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).
- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.
- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
- Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery.
- As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse and across impacted floodplain areas to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works.
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.
- All personnel working in the river to be confined space trained and contractor to supply appropriate PPE and evacuation procedure.

Activity: Creation of riffles	Method Statement 2

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, overhead and buried services, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as agreed by the landowner and client. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction. Fence/gate removal and replacement may be required to facilitate / access the works areas, alongside pollarding and vegetation clearance.
- Some working in close proximity to trees required. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.
- Undertake services search and locate services on site prior to excavation commencing. Some may be crossed over/under for access purposes, contractor should ensure appropriate mitigation.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed with the landowner, contractor and the client.
- Silt control measures to be in place downstream and across the floodplain during works and inspected daily (replace / repair as necessary).
- Wet working approvals may be required from the Environment Agency to undertake the works – recommended that works are undertaken in the dry wherever possible (contractor to consider overpumping).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- The riffle locations should be surveyed in on site prior to them being created using coordinates provided with the design drawings, this should also be undertaken with supervision from Dynamic Rivers.
- Riffles 4 and 5 are to be over excavated prior to placement of the riffle gravel material as shown in the design drawings. Ensure the riffle material is well mixed prior to placement and the material is well compacted when placed using the back of the digger bucket. Create level variability across the feature surfaces. Slopes can vary on the upstream and downstream faces as demonstrated in the design drawings. Ensure riffle material is graded into bank edges and that placement ensures flow concentration towards the centre of the channel. Work from downstream to upstream when creating the feature sequence and ensure these function alongside created point bars. Ensure upstream and downstream riffle ends tie into the existing river bed. This should be undertaken under the supervision of the onsite geomorphologist/client. Adjustment of levels may be required once all features are placed, and water levels have adjusted. This includes to ensure the continued flow split to the Lake and this should be monitored suitably during creation of the riffle features.
- Geomorphologist/client to review functioning and some level adjustment may be required.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Any fencing removed is to be replaced on agreement with the landowner and client.
- Seed exposed / damaged areas of floodplain, excavated areas and top of bank areas (if seeding is proposed) with suitable seed mix at 5g/m^2 spreading rate.

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Check line of works for any trees to be removed, branches to be cut back, vegetation clearance etc. to ensure safe passage for machinery. Where mature trees are encountered during excavation, avoid where possible and adjust line of features if this is possible with agreement with the geomorphologist.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites.
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables where access routes require it.
- Install appropriate fine sediment control measures downstream of works area and across any impacted floodplain e.g. straw bales, fine sediment control mats, silt curtains. These must operate during and after in-channel features are being created, floodplain features are being

excavated etc. Machinery access along the bank top or in channel must be controlled to prevent silt/fine sediment-run off from exposed banksides and from disturbed fine sediment.
Control Measures or Modifications • No smoking in works area. • No works to be undertaken during the hours of darkness. • Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor). • If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor. • All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser. • Be vigilant for members of public / pets / stock / wild animals entering works area. • Be aware of the risk of Leptospirosis in and around the watercourse. • Ensure bucket is lowered to the ground when machine is not in use. • When visitors are on site, stop work & lower bucket to ground if they enter the works safety area. • If working with a Banksman ensure that they are in a position where you can see them. • Beware of machine blind spots when slewing and turning, especially with regard to tree branches. • Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery. • As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse and across impacted floodplain areas to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works. • All operators to be competent and certificated on the machines they operate. • All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so. • All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter. • All personnel working in the river to be confined space trained and contractor to supply appropriate PPE and evacuation procedure.

Activity: Creation of point bars	Method Statement 3

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, overhead and buried services, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as agreed by the landowner and client. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction. Fence/gate removal and replacement may be required to facilitate / access the works areas, alongside pollarding and vegetation clearance.
- Some working in close proximity to trees required. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.
- Undertake services search and locate services on site prior to excavation commencing. Some may be crossed over/under for access purposes, contractor should ensure appropriate mitigation.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed with the landowner, contractor and the client.
- Silt control measures to be in place downstream and across the floodplain during works and inspected daily (replace / repair as necessary).
- Wet working approvals may be required from the Environment Agency to undertake the works – recommended that works are undertaken in the dry wherever possible (contractor to consider overpumping).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- The point bar locations should be surveyed in on site prior to them being created using coordinates provided with the design drawings, this should also be undertaken with supervision from Dynamic Rivers.
- Ensure the point bar material is well mixed prior to placement and the material is well compacted when placed using the back of the digger bucket. Deepen the channel around the outer bend of the point bar as shown in the design drawings and discussed in Method Statement 4. Create level variability across the feature surfaces. Slopes can vary on the upstream, downstream and side slopes as demonstrated in the design drawings. This should be undertaken under the supervision of the onsite geomorphologist/client. Ensure these function alongside created riffles. Adjustment of levels may be required once all features are placed, and water levels have adjusted.
- Geomorphologist/client to review functioning and some level adjustment may be required.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Any fencing removed is to be replaced on agreement with the landowner and client.
- Seed exposed / damaged areas of floodplain, excavated areas and top of bank areas (if seeding is proposed) with suitable seed mix at 5g/m^2 spreading rate.

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Check line of works for any trees to be removed, branches to be cut back, vegetation clearance etc. to ensure safe passage for machinery. Where mature trees are encountered during excavation, avoid where possible and adjust line of features if this is possible with agreement with the geomorphologist.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites.
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables where access routes require it.
- Install appropriate fine sediment control measures downstream of works area and across any impacted floodplain e.g. straw bales, fine sediment control mats, silt curtains. These must operate during and after in-channel features are being created, floodplain features are being excavated etc. Machinery access along the bank top or in channel must be controlled to prevent silt/fine sediment-run off from exposed banksides and from disturbed fine sediment.

Control Measures or Modifications

- No smoking in works area.
- No works to be undertaken during the hours of darkness.
- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).
- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.
- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
- Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery.
- As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse and across impacted floodplain areas to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works.
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.
- All personnel working in the river to be confined space trained and contractor to supply appropriate PPE and evacuation procedure.

Activity: Excavation of apical pools	Method Statement 4

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, overhead and buried services, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as agreed by the landowner and client. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction. Fence/gate removal and replacement may be required to facilitate / access the works areas, alongside pollarding and vegetation clearance.
- Some working in close proximity to trees required. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.
- Undertake services search and locate services on site prior to excavation commencing. Some may be crossed over/under for access purposes, contractor should ensure appropriate mitigation.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed with the landowner, contractor and the client.
- Silt control measures to be in place downstream and across the floodplain during works and inspected daily (replace / repair as necessary).
- Wet working approvals may be required from the Environment Agency to undertake the works – recommended that works are undertaken in the dry wherever possible (contractor to consider overpumping).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- The apical pools should be surveyed in on site prior to excavation commencing using coordinates provided with the design drawings, this should also be undertaken with supervision from Dynamic Rivers.
- Excavate the apical pool in the main channel, adjacent to created point bar features, following levels / excavation depth and width information provided within the design drawings and under supervision of the geomorphologist. Side slopes for these features can vary within a range as shown in the design drawings. Leave a buffer to the outside of the bend bank edge.
- Stockpile material temporarily outside of the floodplain. Riddle any excavated gravel material for re-use in riffle and point bar creation.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Any fencing removed is to be replaced on agreement with the landowner and client.
- Seed exposed / damaged areas of floodplain, excavated areas and top of bank areas (if seeding is proposed) with suitable seed mix at 5g/m^2 spreading rate.

General Method of Work:

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Control Measures or Modifications

- No smoking in works area.
- No works to be undertaken during the hours of darkness.

- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).
- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.
- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
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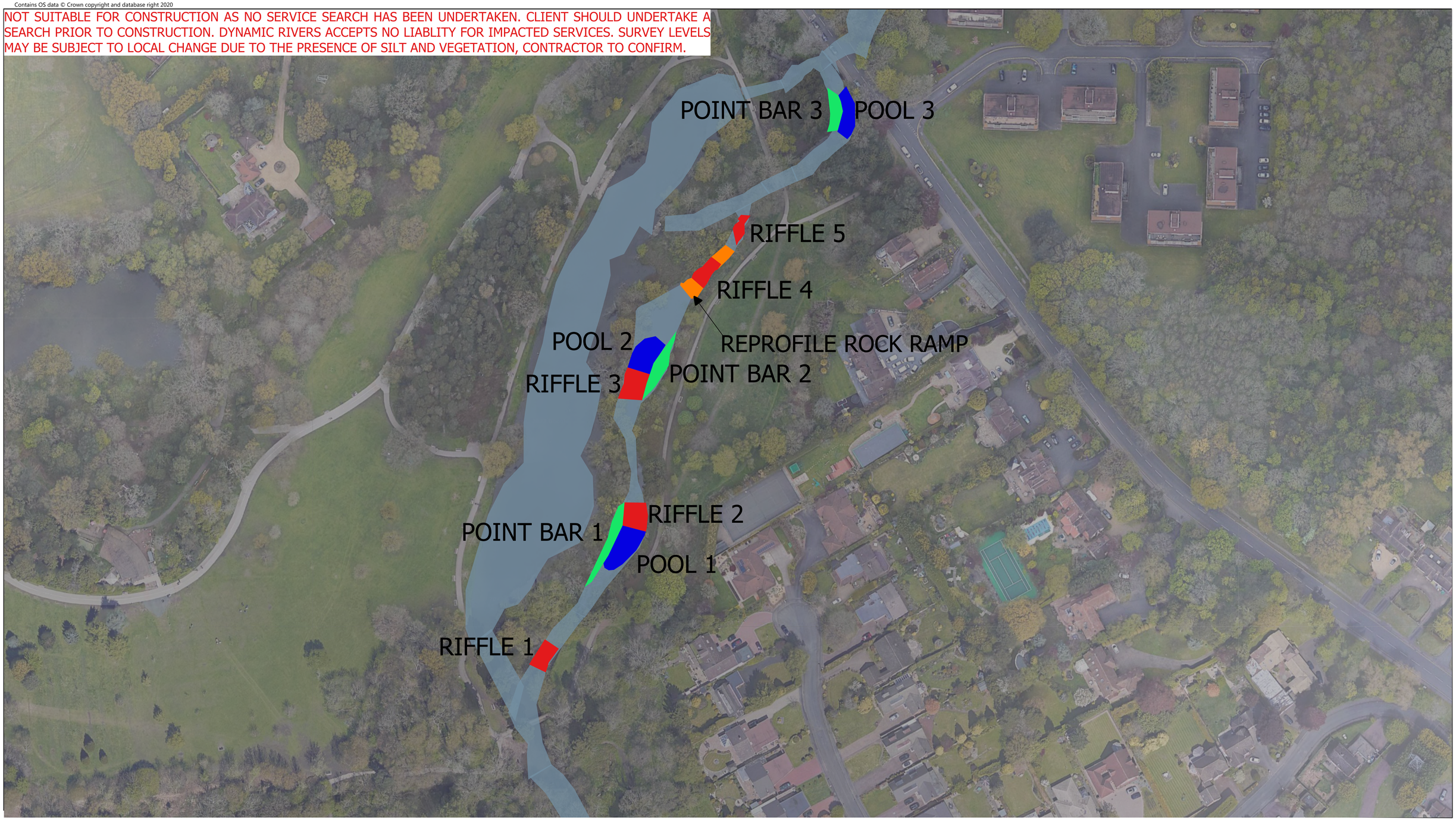
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.
- All personnel working in the river to be confined space trained and contractor to supply appropriate PPE and evacuation procedure.

General mitigation of construction impacts on habitats / species

A site Operational Management plan shall be developed by the contractor with reference to the following elements:

Element	Suggested action	Required
Water quality	Control of silt run-off and potential for machinery pollution source	YES
River crossing	Control of disturbance, contamination, silt release, noise, vibration, debris, flooding	YES
Site waste recycling plan	Re-use on site where possible	YES
Noise and dust	Timing of works; selection of plant	YES
Protected species Protection Plans	Follow species protection plans if applicable.	TBD
Invasive plant species, pests & diseases	Fence giant hogweed, remove other invasives during site preparation where necessary	TBD

NOT SUITABLE FOR CONSTRUCTION AS NO SERVICE SEARCH HAS BEEN UNDERTAKEN. CLIENT SHOULD UNDERTAKE A SEARCH PRIOR TO CONSTRUCTION. DYNAMIC RIVERS ACCEPTS NO LIABLITY FOR IMPACTED SERVICES. SURVEY LEVELS MAY BE SUBJECT TO LOCAL CHANGE DUE TO THE PRESENCE OF SILT AND VEGETATION, CONTRACTOR TO CONFIRM.



Dynamic Rivers (Survey and Design) Ltd

Warwickshire Wildlife Trust

Brueton Park,
Warwick Rd,
Solihull
B91 3HW

REVISION	DATE
1	27/06

LEGEND:

- Pool
- Riffles
- Point Bar
- Reprofile Rock Ramp

NOTES:

ALL LEVELS ARE GIVEN IN m A.O.D (METRES ABOVE ORDNANCE DATUM)

PROPOSED LEVELS MAY VARY +/- 200 mm TO GENERATE BED AND FEATURE VARIATION

CHAINAGE MEASUREMENTS ARE IN METRES ALL ARISINGS TO BE STOCKPILED FOR DISPOSAL OFF SITE OR LOCAL SPREADING OUTSIDE OF THE FLOODPLAIN

REFER TO FEATURE BOUNDARY COORDINATES "DR-2022-0100-Brueton_Park_Coordinates" FOR EXACT INDIVIDUAL FEATURE SHAPES

ALL TEMPORARY WORKS INCLUDING SHORING TO CONTRACTORS DESIGN

DO NOT SCALE FROM THIS DRAWING

ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH BUILDING REGS AND GOOD BUILDING PRACTICE

NOT FOR CONSTRUCTION

PROJECT TITLE:
Brueton Park River Blythe Restoration

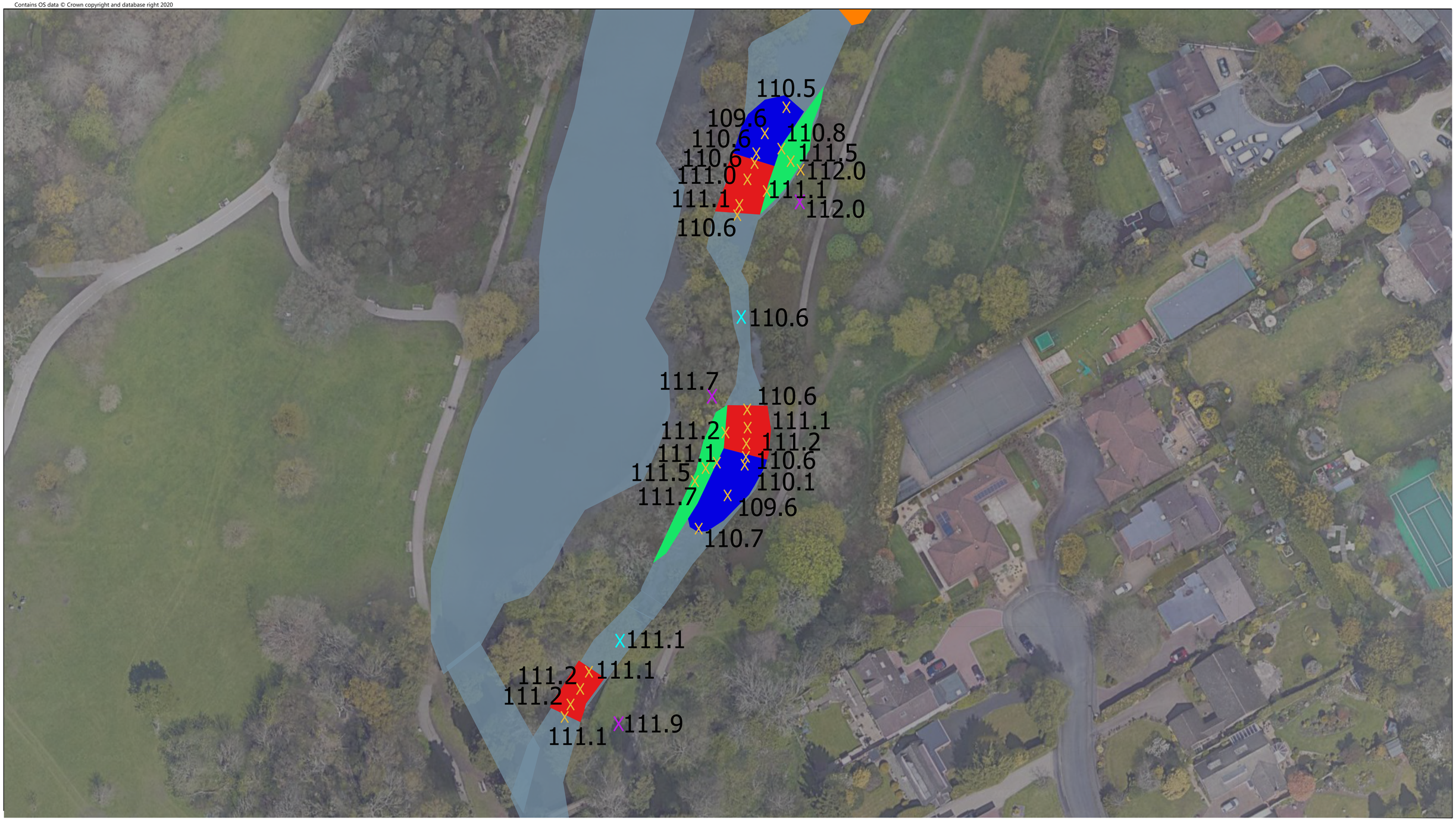
PROJECT NUMBER:
DR-2022-0100

SHEET TITLE:
OVERVIEW MAP

AUTHORS:
Author:RW
Checked:SB
Approved: GH

SCALE:
MAP SCALE :
1 in 1000
AT A1

SHEET:
1



Dynamic Rivers (Survey and Design) Ltd

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B91 3HW

REVISION	DATE
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LEGEND:

- Existing Bed Levels (m AOD)
- Floodplain Levels (m AOD)
- Finished Levels (m AOD)
- Pool
- Riffles
- Point Bar
- Reprofile Rock Ramp

NOTES:

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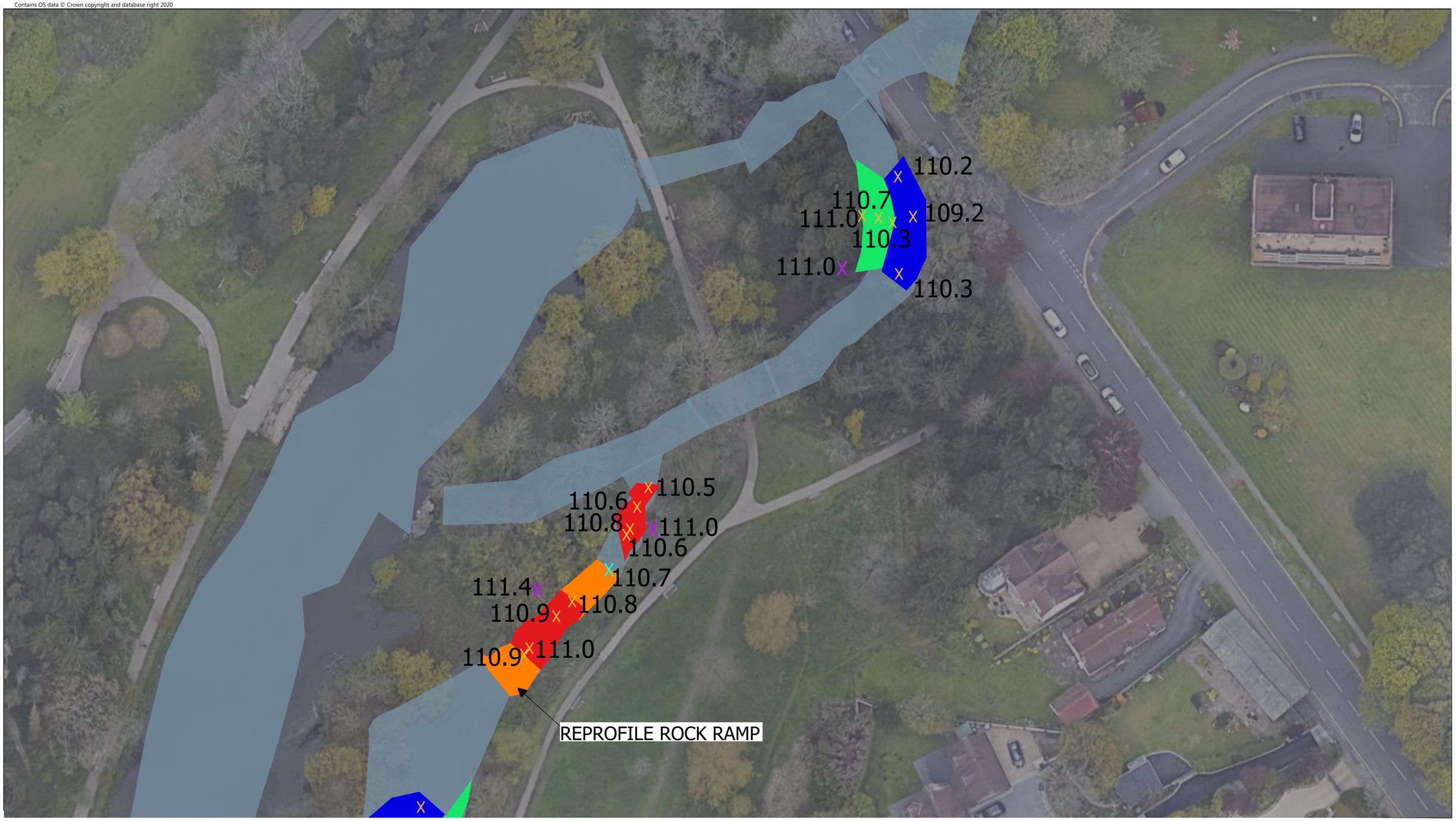
2



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LEGEND:

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- Floodplain Levels (m AOD)
- Finished Levels (m AOD)
- Pool
- Riffles
- Point Bar
- Reprofile Rock Ramp

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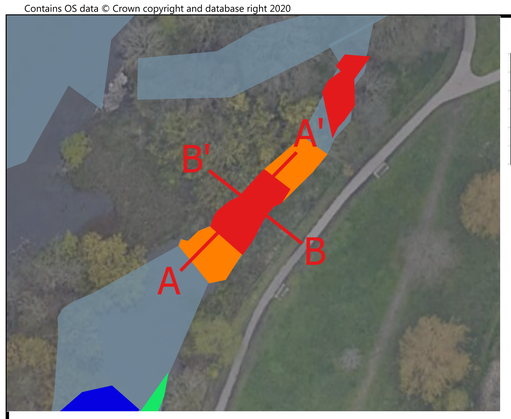
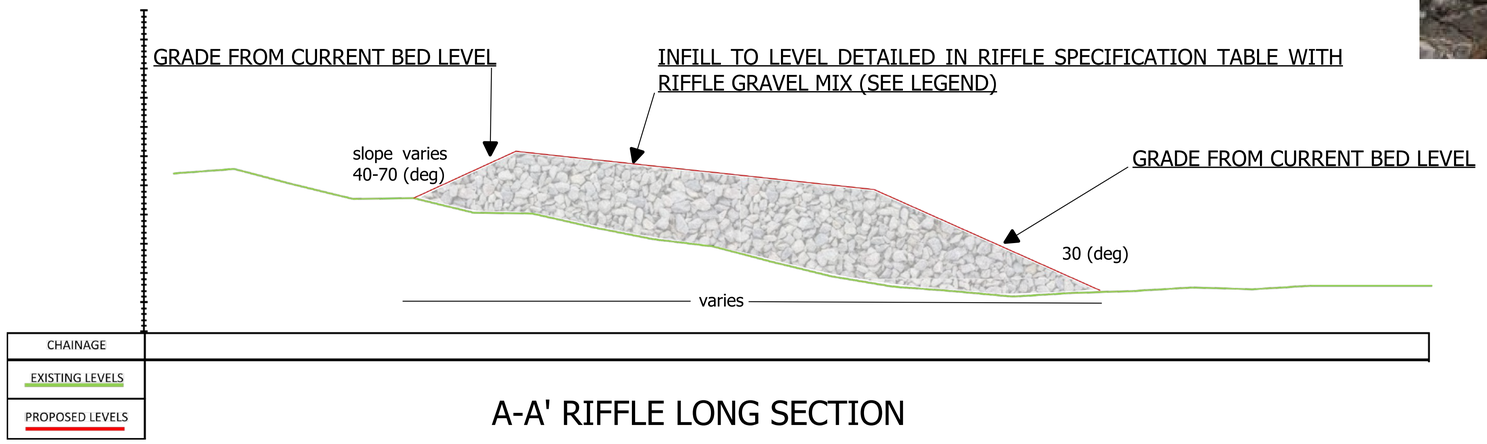
3

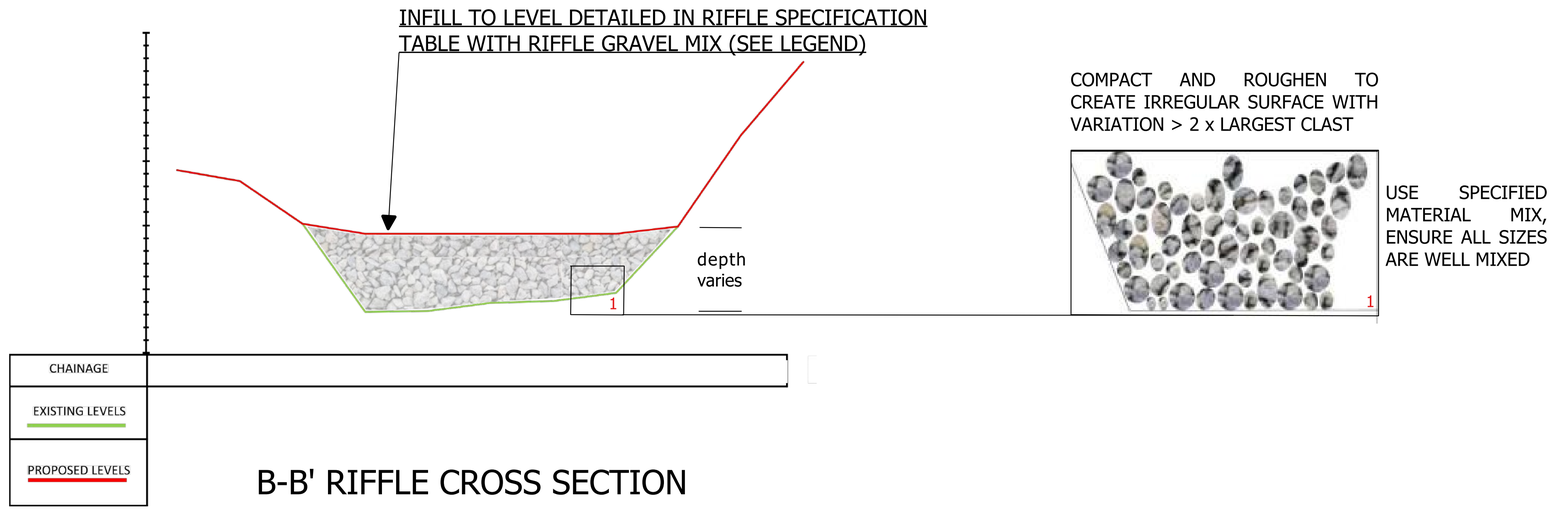


RIFFLE SPECIFICATION TABLE

FEATURE NUMBER	UPSTREAM STARTING COORDINATE (OSGB)	LENGTH OF FEATURE (M)	MAX WIDTH OF FEATURE (M)	MAX UST BASELINE LEVEL (m AOD)	MAX DST BASELINE LEVEL (m AOD)	MAX UST CREST ELEVATION (m AOD)	MAX DST CREST ELEVATION (m AOD)
1	416229.543,278696.402	11.8	FULL CHANNEL WIDTH	111.1	111.1	111.2	111.2
2	416269.341,278754.373	10.7	FULL CHANNEL WIDTH	110.6	110.6	111.2	111.1
3	416266.938,278807.387	12.2	FULL CHANNEL WIDTH	110.6	110.6	111.1	111.0
4	416295.172,278854.994	11.8	FULL CHANNEL WIDTH	110.9	110.8	111.0	110.9
5	416310.415,278871.815	12.3	FULL CHANNEL WIDTH	110.6	110.5	110.8	110.6



A-A' RIFFLE LONG SECTION



B-B' RIFFLE CROSS SECTION

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Warwickshire Wildlife Trust

Brueton Park,
Warwick Rd,
Solihull
B91 3HW

REVISION	DATE
1	27/06

LEGEND:

20% 20-40 mm
50% 40-60 mm
30% 60-100 mm

RECOMMENDED SEDIMENT SIZE FOR RIFFLE FEATURES:

RECOMMENDED SEDIMENT SIZE FOR RIFFLE FEATURES:
·SURFACE ROUGHNESS TO BE 2 X LARGEST CLAST b AXIS
·MIX SHOULD INCLUDE LARGER MATERIAL, GEOMORPHOLOGIST TO ADVISE ON APPROPRIATE PROPORTIONS BASED ON TABLE BELOW
·ENSURE FINAL LOW FLOW LEVEL DOES NOT DROWN OUT UPSTREAM RIFFLE

NOTES:

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RIFFLE SECTIONS

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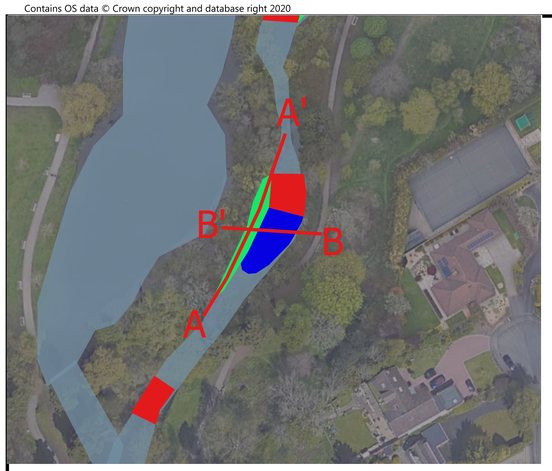
4

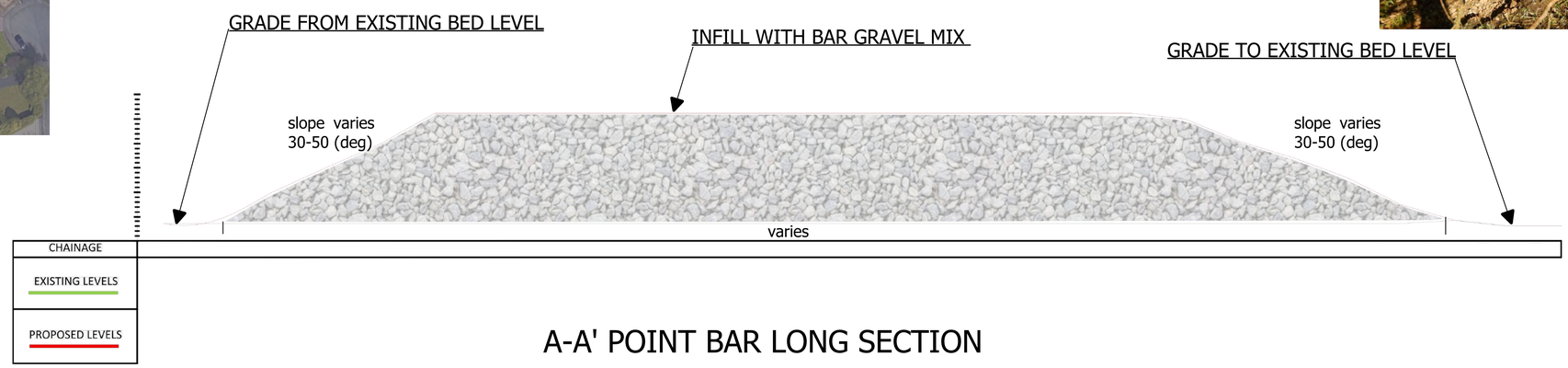


POINT BAR SPECIFICATION TABLE

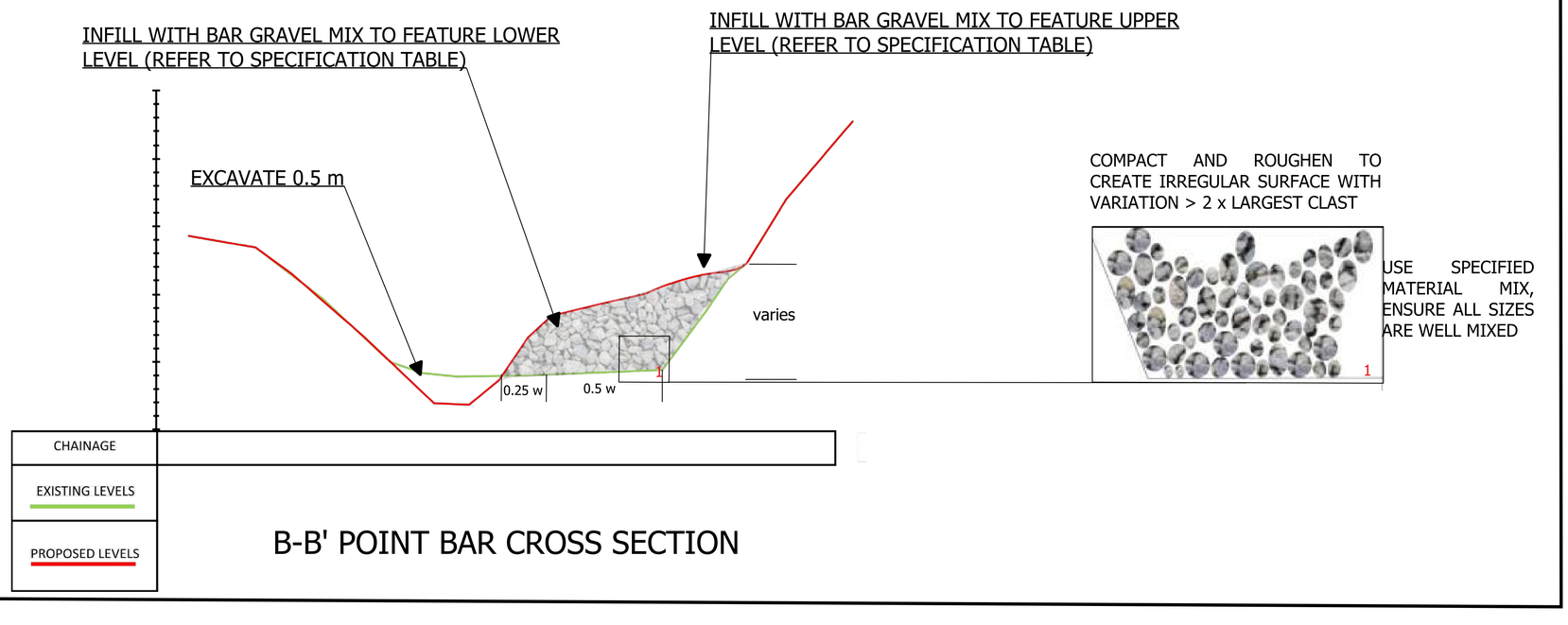
FEATURE NUMBER	UPSTREAM STARTING COORDINATE (OSGB)	LENGTH OF FEATURE (M)	MAX WIDTH OF FEATURE (M)	BASELINE LEVEL (m AOD)	MAX BANK TOP LEVEL (m AOD)	MAX POINT BAR UPPER LEVEL (m AOD)	MAX POINT BAR LOWER LEVEL (m AOD)
1	416249.535,278730.813	38.8	5.1	110.6	111.7	111.5	111.1
2	416272.213,278806.955	31.3	6.4	110.6	112.0	111.5	110.8
3	416349.857,278916.963	16.8	5.7	110.2	111.0	110.7	110.3

POOL SPECIFICATION TABLE

FEATURE NUMBER	UPSTREAM STARTING COORDINATE (OSGB)	LENGTH OF FEATURE (M)	MAX WIDTH OF FEATURE (M)	MAX DEPTH OF FEATURE (m)
1	416257.667,278736.945	19.9	10.3	0.5
2	416270.339,278819.013	15.0	9.8	0.5
3	416354.625,278915.199	18.9	6.2	0.5



A-A' POINT BAR LONG SECTION



B-B' POINT BAR CROSS SECTION

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Warwickshire Wildlife Trust

Brueton Park,
Warwick Rd,
Solihull
B91 3HW

REVISION	DATE
1	27/06

LEGEND:

20% 20-40 mm
50% 40-60 mm
30% 60-100 mm

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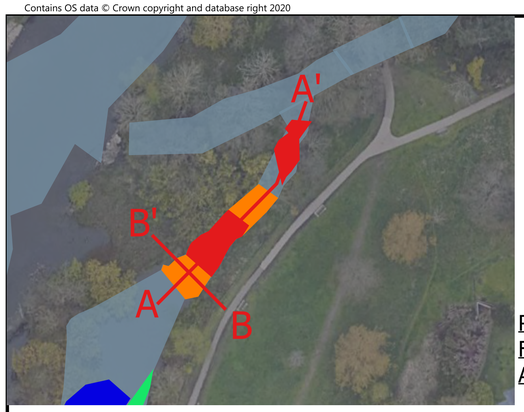
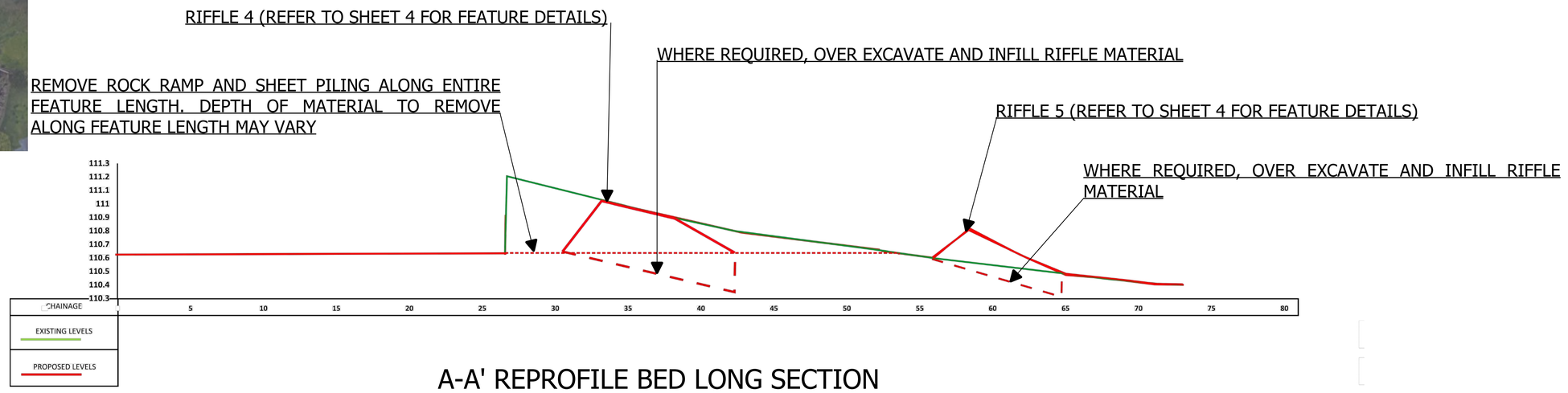
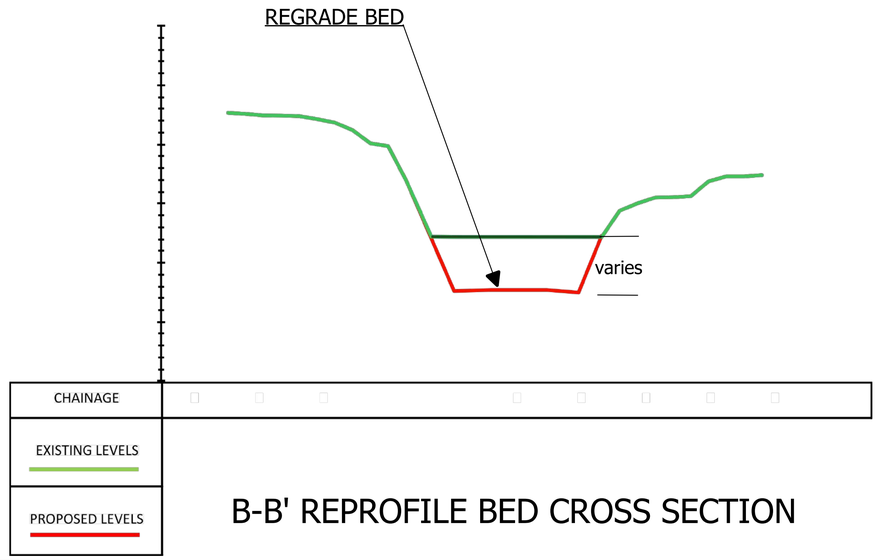
5





A-A' REPROFILE BED LONG SECTION



B-B' REPROFILE BED CROSS SECTION

Dynamic Rivers (Survey and Design) Ltd

Warwickshire Wildlife Trust

Brueton Park,
Warwick Rd,
Solihull
B91 3HW

REVISION	DATE
1	27/06

LEGEND:

NOTES:

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Brueton Park River Blythe Restoration

PROJECT NUMBER:
DR-2022-0100

SHEET TITLE:
REPROFILE BED SECTIONS

AUTHORS:
Author:RW
Checked:SB
Approved: GH

SCALE:
MAP SCALE :
1 in 1000
AT A1

SHEET:
6

Brueton Park River Blythe Restoration – Estimated Bill of Quantities

Project name: Brueton Park River Blythe Restoration									
Project location: Brueton Park, Solihull									
Client: Warwickshire Wildlife Trust									
	Initial	Rev1	Rev2	Rev3	Rev4	Rev5	Rev6	Rev7	**Rev8**
Date	21/06/2022								
By	RW								
Checked	SB								
Approved	**GH**								

Excavation Volumes – ALL WORKS

Volumes of excavation		
Feature	**Excavation volume (m^3)**	**Material type / comments**
Rock ramp removal / regrading	40	Excavated rock ramp material – mixed cobbles, gravels, small boulders – retain any suitable gravels for use in riffle and point bar creation (following riddling). Sheet piling also to be removed *Note – volume given excludes a bulking/expansion factor.*
Pool 1	105	Excavated river bed material – mixed gravels, silts / sands / fines - retain any suitable gravels for use in riffle and point bar creation (following riddling). *Note – volume given excludes a bulking/expansion factor.*
Pool 2	92	Excavated river bed material – mixed gravels, silts / sands / fines - retain any suitable gravels for use in riffle and point bar creation (following riddling).

Volumes of excavation		
Feature	**Excavation volume (m^3)**	**Material type / comments**
		Note – volume given excludes a bulking/expansion factor.
Pool 3	68	Excavated river bed material – mixed gravels, silts / sands / fines - retain any suitable gravels for use in riffle and point bar creation (following riddling). *Note – volume given excludes a bulking/expansion factor.*
Over excavation riffle 4	25	Excavated river bed material – mixed gravels, silts / sands / fines - retain any suitable gravels for use in riffle and point bar creation (following riddling). *Note – volume given excludes a bulking/expansion factor.*
Over excavation riffle 5	30	Excavated river bed material – mixed gravels, silts / sands / fines - retain any suitable gravels for use in riffle and point bar creation (following riddling). *Note – volume given excludes a bulking/expansion factor.*

Infill Volumes – ALL WORKS

Volumes of infill		
Feature	**Infill volume (m^3)**	**Material type / comments**
Riffle 1	30	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Riffle 2	62	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Riffle 3	53	Washed river gravels: 30% 60-100mm 50% 40-60mm

Volumes of infill		
Feature	**Infill volume (m^3)**	**Material type / comments**
		20% 20-40mm
Riffle 4	32	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Riffle 5	30	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Point bar 1	66	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Point bar 2	60	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm
Point bar 3	25	Washed river gravels: 30% 60-100mm 50% 40-60mm 20% 20-40mm

Brueton Park, River Blythe Restoration Design

DRAFT Report

Warwickshire Wildlife Trust

Quality information

Document name	Prepared by	Date	Reviewed by	Approved By
Brueton Park, River Blythe Restoration Design Report DRAFT v1.0	Seb Bentley, George Heritage and Rob Williamson	29th June 2022	George Heritage	George Heritage

Contents

Glossary

Terminology	**Meaning**
2D modelling	Two-dimensional hydraulic modelling
Bed shear stress	Measure of the force exerted by moving water on the river bed
Bedload transport	Process of movement of sediment along the bed of a watercourse
Geomorphology	The study of the physical features of the surface of the earth and associated processes
Hydromorphology	The physical character and water content of water bodies
LIDAR	Light Detection and Ranging Data (provides a topographical surface)
Sediment transport	Process of movement of sediment along a watercourse

1 Introduction and Methodology

1.1 Background and Objectives

Warwickshire Wildlife Trust commissioned Dynamic Rivers to undertake optioneering, hydraulic modelling and detailed design for modifications to the rock ramp on the River Blythe at Brueton Park, Solihull (Figure 1.1).

Weir – purple; rock ramp – red; car park - orange

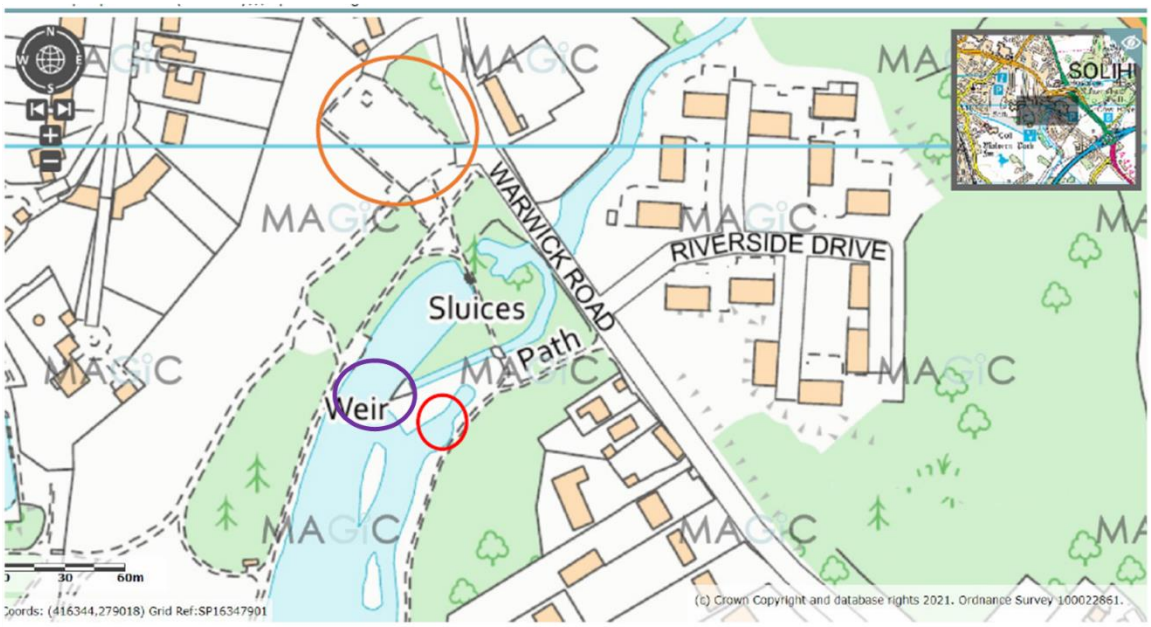

Figure 1.1. Study area of the River Blythe at Brueton Park, Solihull (image supplied by the client).

1.2 Approach

We have gained a detailed understanding of the state, activity and sensitivity of the study watercourse through the study reach, through the review of archival maps and aerial photography illustrating system functioning over both historical and recent time. This was combined with a targeted walkover that helped confirm the desk study, confirming landscape features, identifying sediment sources and sinks, geomorphological units and identifying geomorphological processes linked to the sediment transport and the likely channel change regime. All data were reviewed against the hydraulic modelling outputs.

We have also reviewed potential natural and artificial constraints to the proposed works and the walkover and desk study findings have been used to identify options from a river restoration, ecological habitat creation and geomorphological processes perspective. Options were shared with the client to allow selection of the preferred restoration measures to take forward to detailed hydraulic modelling and production of the detailed design. Service searches have not been undertaken at the request of the client.

We have quantified the geomorphological and flood risk impacts of the preferred restoration option for the rock ramp on the River Blythe at Brueton Park, using a 2D hydraulic model (HEC-RAS, benchmarked by the Environment Agency) for the river, utilising information including Environment Agency LIDAR (flow information was obtained using an AutoRefH approach in the absence of any gauged flow data and existing model data) and supplied hydraulic model information from the client, we have assumed this is acceptable

to the Environment Agency. The 2D modelling approach has been applied across both the river and valley bottom allowing inundation areas to be mapped. Data from the flow modelling across the flow regime in the form of shear stress was used to confirm impacts to the flow and sediment regime, to help size material for proposed restoration features, and to ensure they are appropriate for a naturally functioning watercourse of this type. The model was also used to determine impacts on the flood hydrograph downstream by monitoring the flow at the downstream end of the model and comparing it to the baseline outputs.

2 Data Review and Fluvial Audit

2.1 Desk Study

The headwaters of the River Blythe are just north of Tanworth in Arden, approximately 11km upstream of Brueton Park, flowing in a general northerly direction before heading west once it has flowed through Brueton Park, eventually confluencing with the River Tame at Blyth End. The river presently exhibits a moderately sinuous, single thread nature elsewhere along the watercourse, but is likely to have been historically straightened at Brueton Park (Figure 2.1). The slope on the watercourse is shallow with the LiDAR for the site and reaches upstream and downstream suggesting a value of ~0.001 for the reach (Figure 2.1). The LiDAR also suggests that the river has a moderately wide floodplain through the study site (Figure 2.2), however the left-hand floodplain area is occupied by Brueton Park Lake along the study reach, the right-hand bank is well-used and maintained parkland.

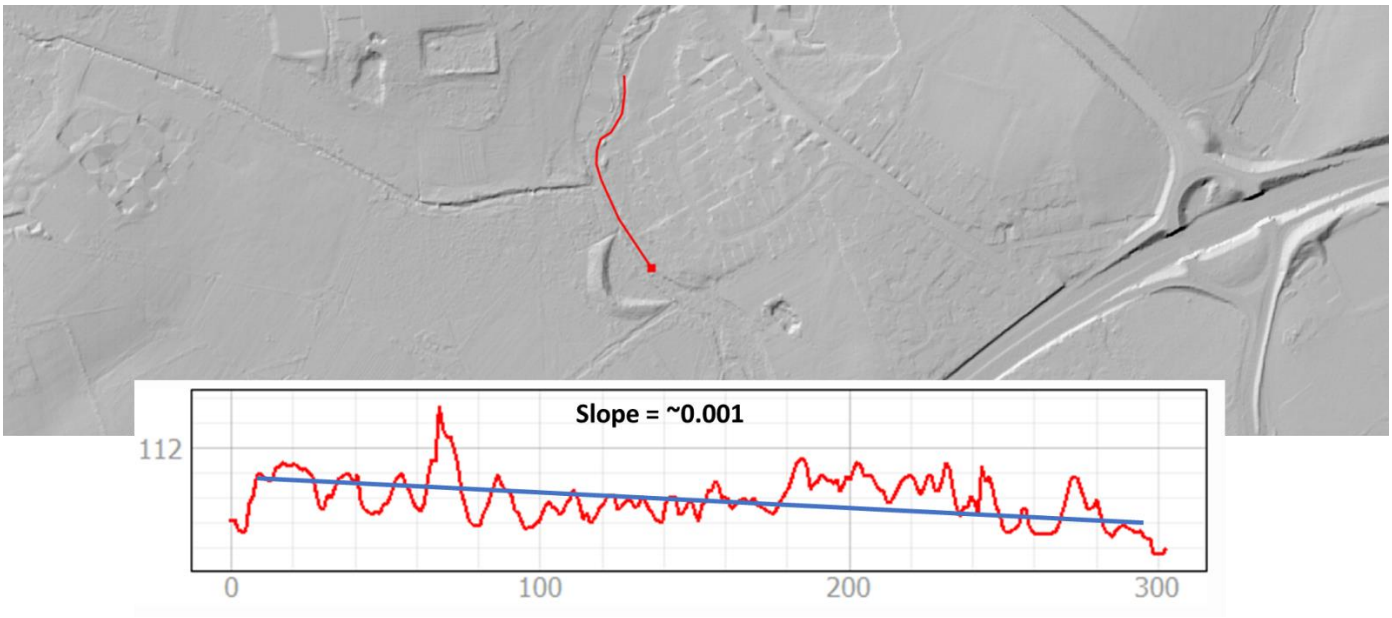

Figure 2.1. Down-valley slope of the River Blythe at Brueton Park.

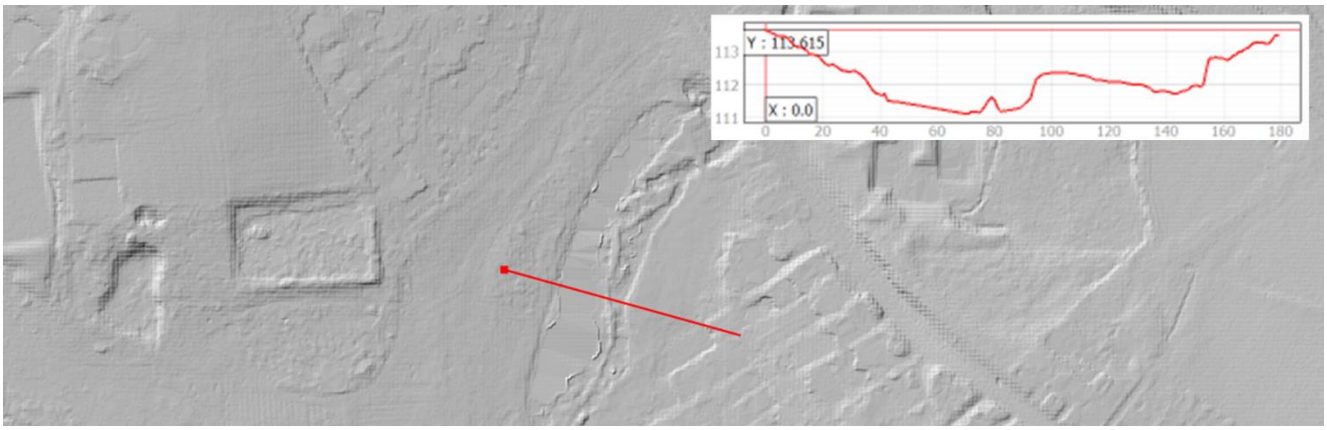

Figure 2.2. Cross-valley slope on the floodplain of the River Blythe at Brueton Park (note poor LiDAR resolution in the main channel and Lake)

A review of the drift geology for the study site suggests that the river has reworked old (110-30ka) fluvio-glacial and glacial deposits to form a moderately wide deposit of river alluvium (Figure 2.3). This is reflected in the general topography with the floodplain bounded by terrace margins as seen in the LiDAR (Figure 2.2). Despite the wide floodplain, recent channel activity has been very low with the Ordnance Survey map of 1887 showing little lateral channel change in the vicinity of the study reach. However, it appears that all flow from the River Blythe was once directed into the Lake (Figure 2.4), with the current main channel being constructed sometime after 1945. This is likely to have been when the rock ramp in question was created, to maintain the flow split into the Lake. The weir on the eastern edge of the lake is marked on the historic map, that is likely to have been replaced/repaired over time. Interestingly, an area upstream of Brueton Parked is labelled as 'liable to floods', suggesting that the river was once better connected to its floodplain.

There is no significant evidence of palaeo channels in the LIDAR (Figure 2.2) suggesting that the floodplain surface has been considerably modified since the channel rationalisation or the channel once flowed through the Lake.

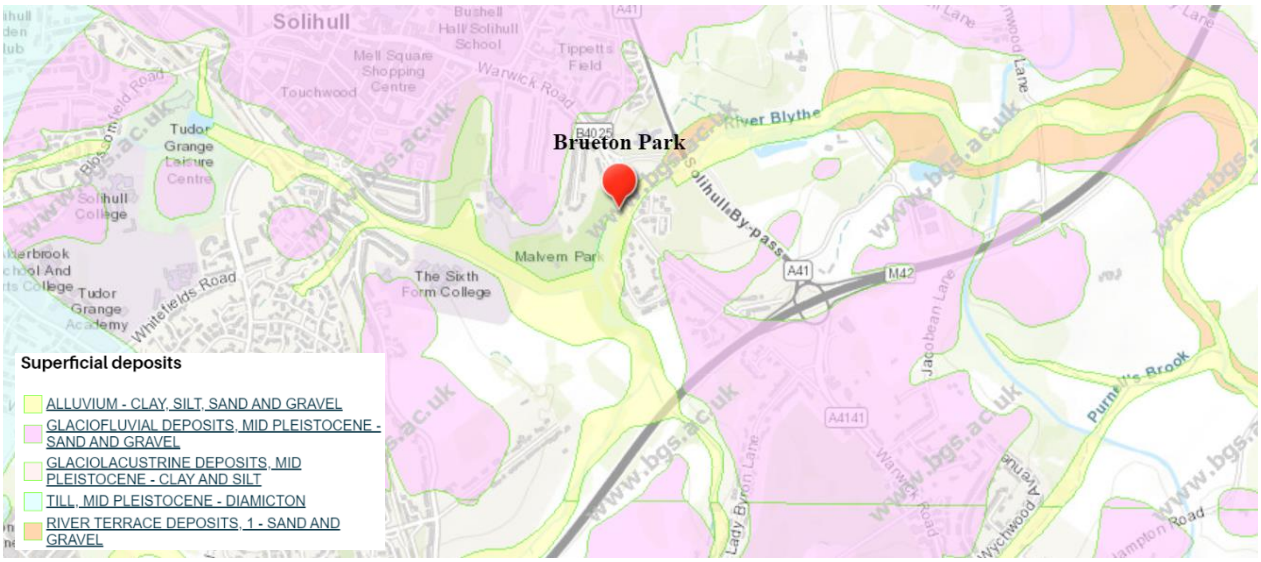

Figure 2.3. Drift geology of the River Blythe through Brueton Park.

Figure 2.4. Current (right) and historic 1887 (left) course of the River Blythe around Brueton Park.

A review of existing topographic information from the supplied hydraulic model provided by the client has been undertaken, the below image (Figure 2.5) shows the functioning of features and levels along the study reach that maintains a flow split into the Lake. This data also reveals that without the influence of the rock ramp, the reach is still low gradient.

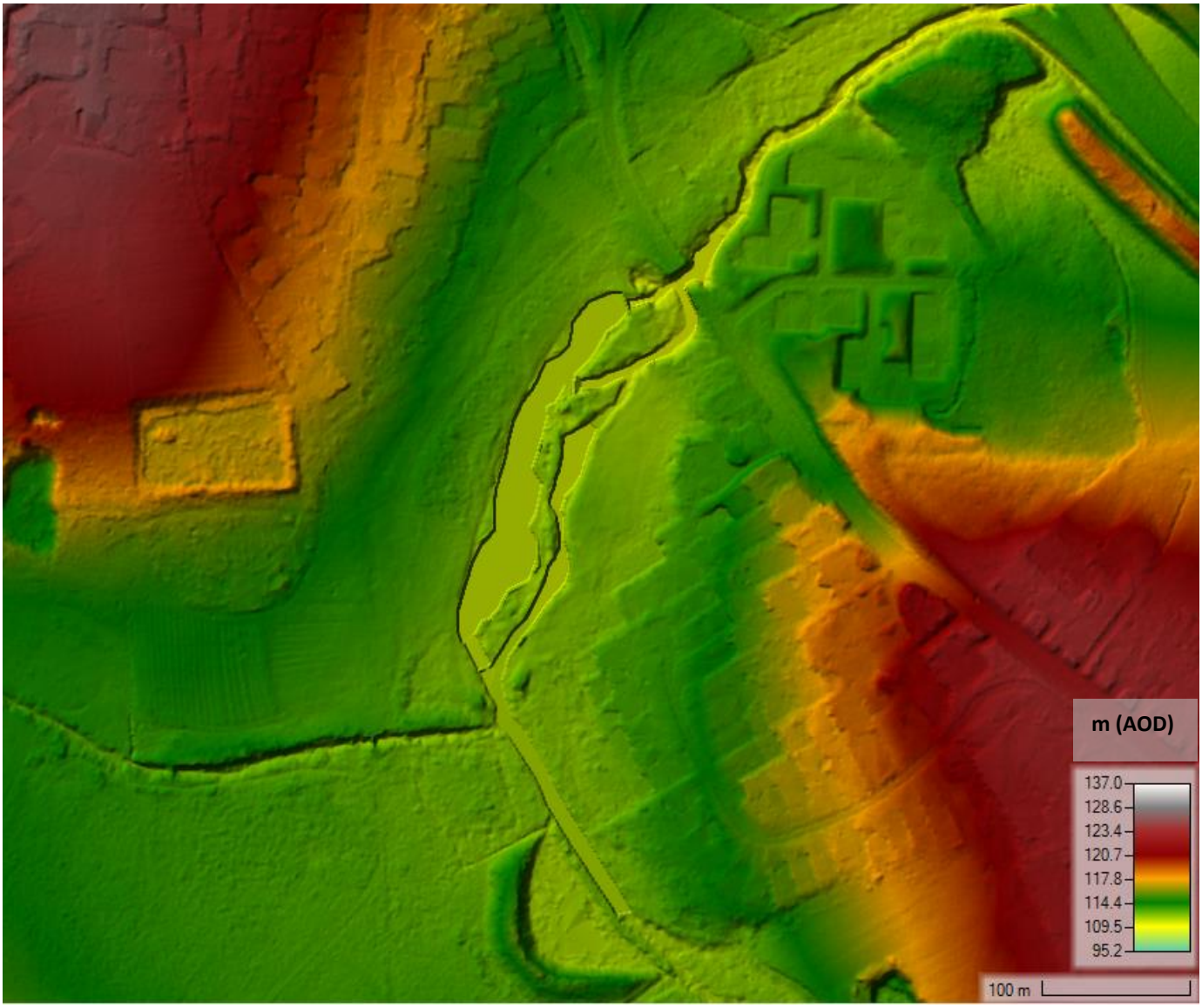

Figure 2.5. Topographic survey data review and levels along Brueton Park reach.

2.2 Field Audit

Field audit has confirmed the majority of the desk-based findings with the river at the study site being low energy and no significant evidence of palaeo features across the wider floodplain area.

The rock ramp (Figure 2.6) itself impounds water to at least the offtake into the Lake over the left-hand bank (facing downstream), and is the control on the water split between the Lake and the main channel of the Blythe through the reach. Water levels in the Lake are then controlled by sluice gates at the downstream end of the feature and a side weir (Figure 2.7) that operates at a slightly higher level that would spill back into the Blythe downstream of the rock ramp, this is in a poor condition. The rock ramp is composed mainly of small boulder/ large cobble sized material that is out of character for the study reach (Figure 2.8). This is becoming flanked over the left-hand side of the feature and exposed sheet piling (Figure 2.8) suggests an overall over-engineered design for the feature that maintains the flow split into the Lake and poor construction is leading to issues across the feature. The rock ramp impounds the channel up to the Lake

offtake structure around ~190m upstream of the feature, controlling the flow split into the Lake where a former sluice type structure moderates the flow into the Lake (Figure 2.9). This creates low energy flow conditions that promote fine sediment deposition within the impounded zone (Figure 2.10). There is a significant small gravel and fine sediment shoal that has accumulated at the offtake to the Lake (Figure 2.9). There is also a small gravel shoal at the confluence with the tributary confluencing with the main channel upstream of the footbridge, suggesting some small gravel inputs to the main River Blythe (Figure 2.11).

Figure 2.6. Rock ramp showing composition along the River Blythe at Brueton Park

Figure 2.7. Side weir structure

Figure 2.8. General composition of rock ramp feature and exposed sheet piling at downstream end of feature

Figure 2.9. Structure moderating flow split into Lake

Figure 2.10. Low energy flow conditions along impounded length upstream of rock ramp

Figure 2.11. View from footbridge looking upstream showing gravel shoal at confluence with tributary

Along the impounded reach, there is evidence of ad hoc bank protection along the left-hand bank between the Lake and the watercourse, this is in varying states of disrepair (Figure 2.12). This island between the Lake and the main channel is generally tree-lined (Figure 2.12).

Along the study reach there is evidence of wood features within the channel, both live and dead, with one such feature extending across part of the rock ramp towards the downstream end of the feature (Figure 2.13).

Figure 2.12. Ad hoc bank protection on the left bank island between the main watercourse and the Lake

Figure 2.13. Live and dead wood feature across rock ramp at downstream end of feature.

The Lake has recently undergone dredging and creation of brash berms along the margins (Figure 2.14). Visually, the controlling structures appear to be in varying states of dis-repair. After flowing over the rock ramp, the watercourse passes under a small footbridge, where there is a small drop in bed level through the structure, and around a shallow meander. Around this meander is typical, poorly developed morphology characteristic of an alluvial channel with a riffle entrance and exit, and poorly developed apical pool. These features could benefit from improvements dependent on impacts to water levels through the footbridge. The watercourse then flows through Warwick Road bridge, which is a triple arch structure that has a concrete invert providing a control on bed levels downstream.

Figure 2.14. Brash berms being created along the Lake margin

2.3 Designations

A review of the Defra Magic site shows that the site is located within the River Blythe Site of Special Scientific Interest (SSSI) Unit 1022295 (Figure 2.15). This is currently in an unfavourable no change condition, due to inappropriate weirs / dams and other structures, invasive freshwater species and freshwater pollution. The proposed works to the river and rock ramp may assist, to a small degree, in recovery of the SSSI unit through replacement of the rock ramp feature with more appropriate morphology for a watercourse of this type.

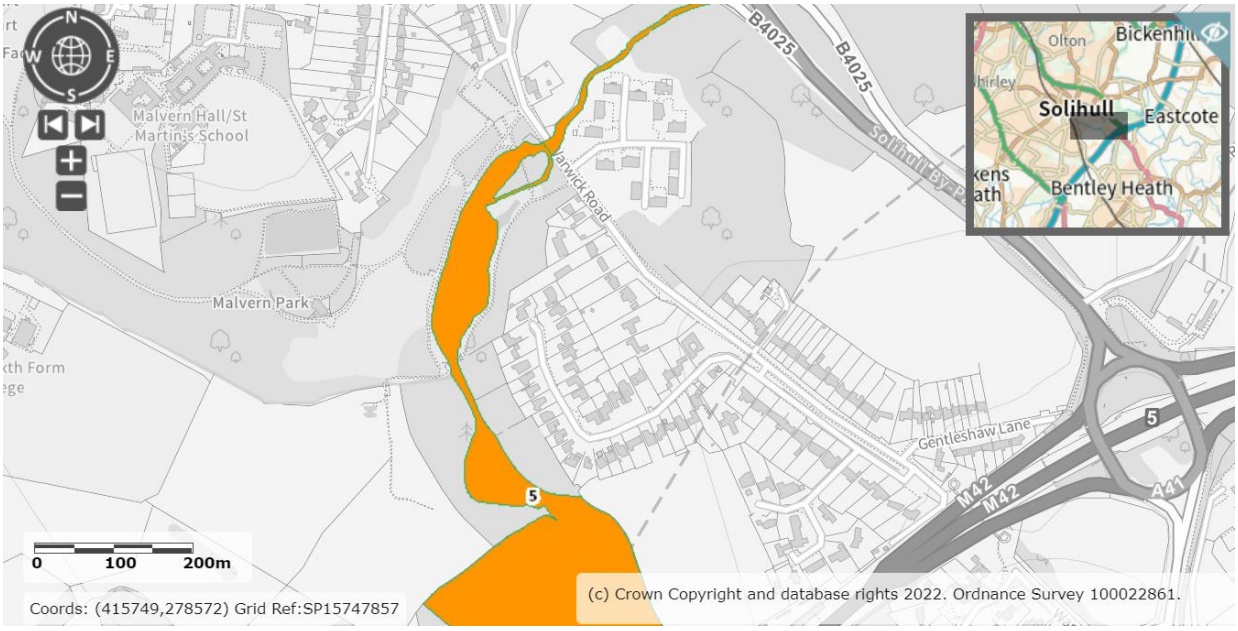

Figure 2.15. Location of River Blythe SSSI along the study reach at Brueton Park, source Defra Magic website

Figure 2.16 below shows the location of Listed Buildings within the vicinity of the River Blythe study reach at Brueton Park. There is one Grade I Listed Building located in relatively close proximity to the Brueton Park reach, 936 Warwick Road. This is unlikely to be directly impacted by the proposed works.

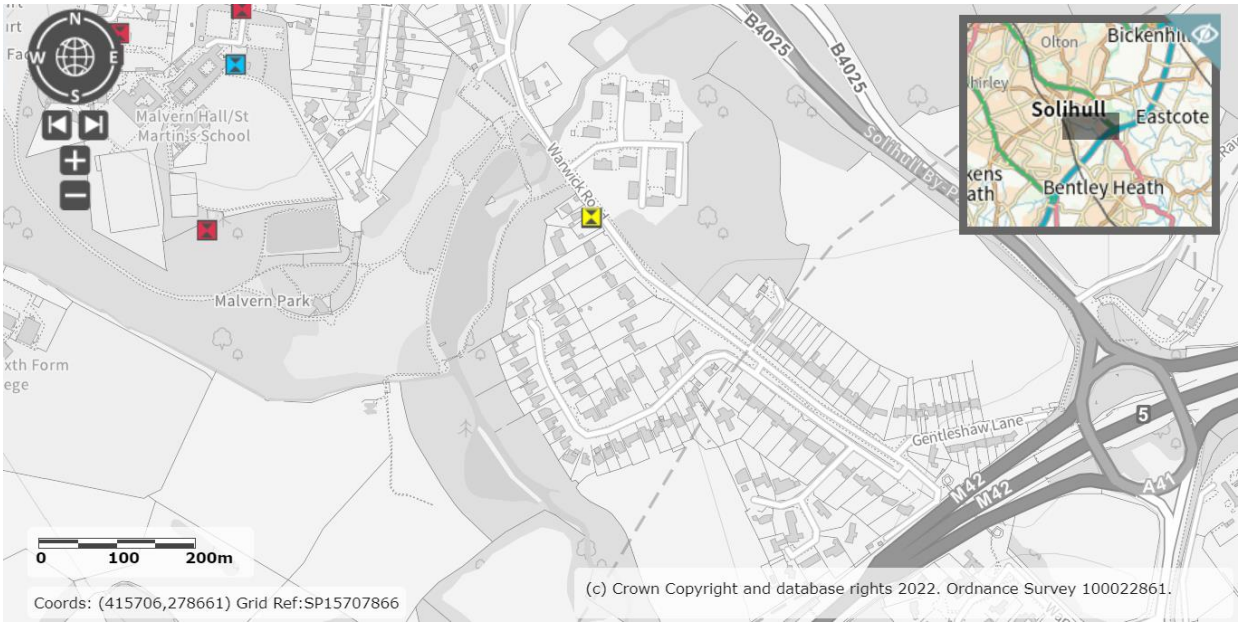

Figure 2.16. Location of Listed Buildings in the vicinity of the study reach at Brueton Park, source Defra Magic website

3 Optioneering, Modelling and Design

3.1 Optioneering

A review and identification of options following the desk study (including review of topographic data), field audit and initial modelling has been undertaken and the options proposed below aim to replace the rock ramp feature with more appropriate morphology along the local watercourse, whilst slightly improving the impounded zone upstream (the river is low gradient even without the influence of the rock ramp) and maintaining a flow split into the Lake at its current level.

The main constraints on the optioneering process are:

- The existing shallow gradient even without the influence of the rock ramp meaning a low energy reach with or without modification;
- The flow split to the Lake;
- Impacts to local flood risk.

A short list of options were initially formulated and discussed with the client, these are summarised below.

3.1.1 Do Nothing - Rock ramp remains

Under this scenario, the rock ramp and impacted reach remains unchanged. Flows will continue to split into the Lake although this could be impacted if the rock ramp suffered further significant deterioration (likely medium to long-term) that resulted in a significant change to the level of the feature. The impounded reach upstream of the rock ramp would remain. The current conditions are shown below in Figure 3.1.

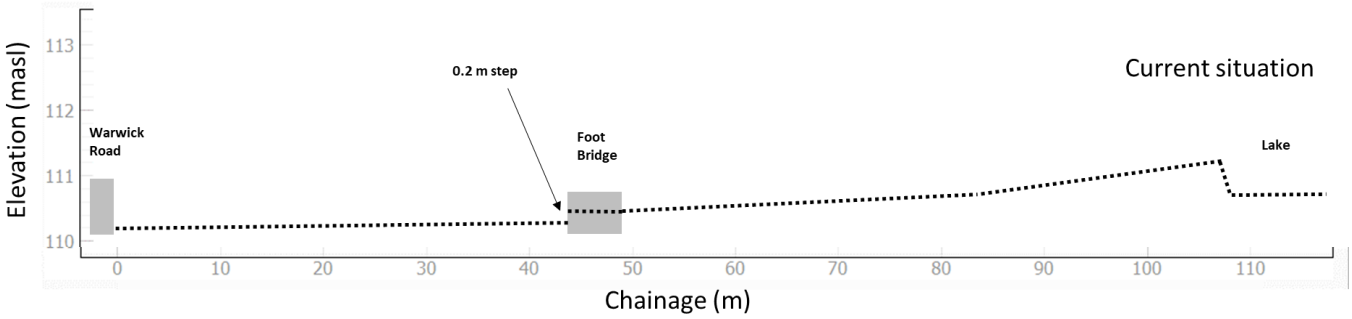

Figure 3.1. Current long section through rock ramp and downstream

3.1.2 Option 1 - Rock ramp removal, regrade and install local riffles, with downstream bend riffles

This option involves removal of the rock ramp feature and local regrading of the bed following removal of the feature. Two riffles are then constructed through the former rock ramp location, with the upstream riffle finished as the same level as the rock ramp previously finished to maintain the flow split into the Lake. Proposals are also made for improvement to the meander bend downstream of the footbridge to add further functionality to the feature and encourage natural processes, with enhancement of the entrance and exit riffles and of the inner bend point bar. This option is demonstrated below in Figure 3.2.

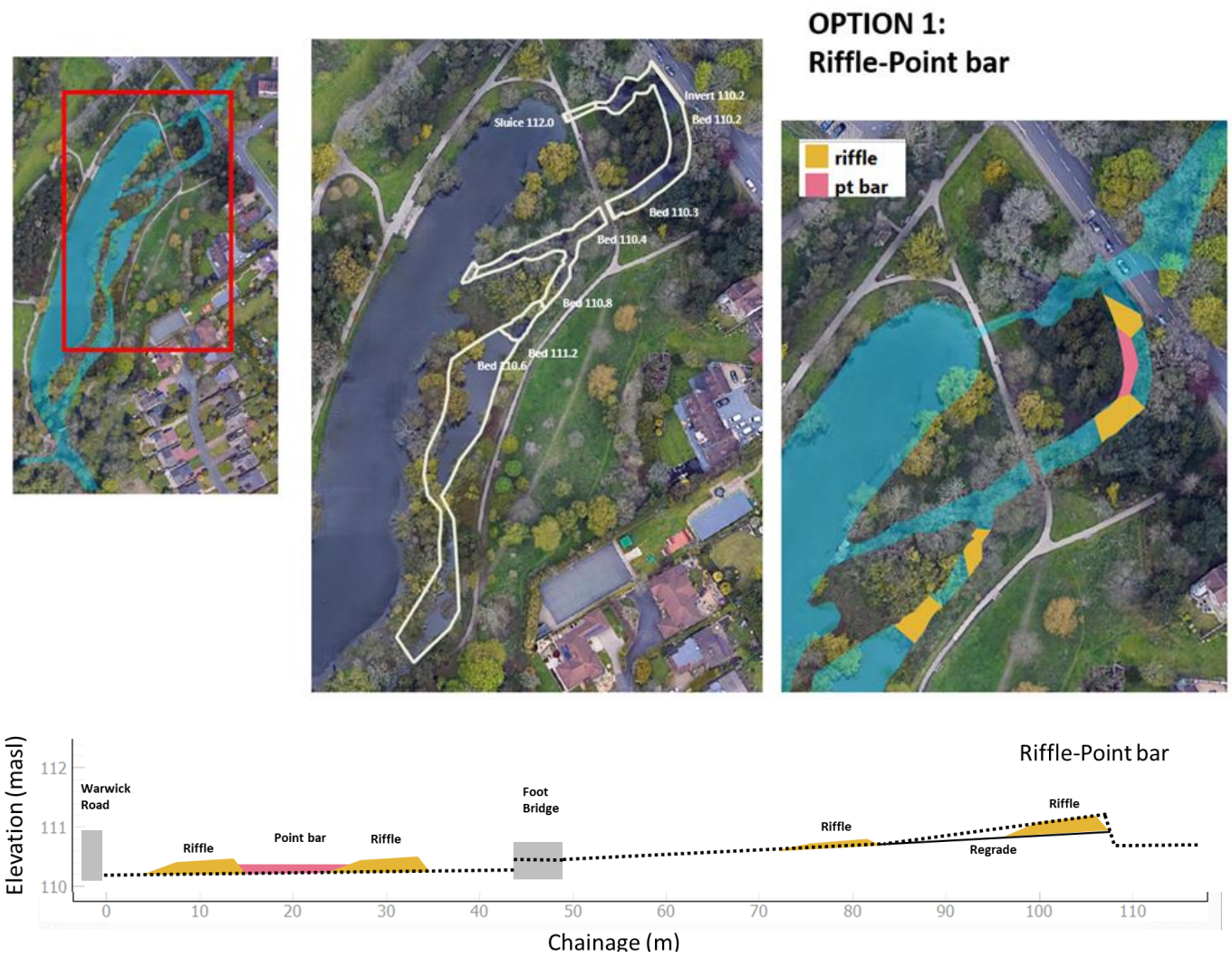

Figure 3.2. Option 1 overview and indicative long section showing regrading, riffle creation and point bar improvements.

3.1.3 Option 2 - Rock ramp removal, regrade and install local riffles, with downstream bend apical pool

This option involves removal of the rock ramp feature and local regrading of the bed following removal of the feature. Two riffles are then constructed through the former rock ramp location, with the upstream riffle finished at the same level as the rock ramp previously finished to maintain the flow split into the Lake. Proposals are also made for improvement to the meander bend downstream of the footbridge to add further functionality to the feature and encourage natural processes, with enhancement of apical pool around the outside of the bend, this would result in no impact to water levels through the footbridge just upstream compared to Option 1 above. This option is demonstrated below in Figure 3.3.

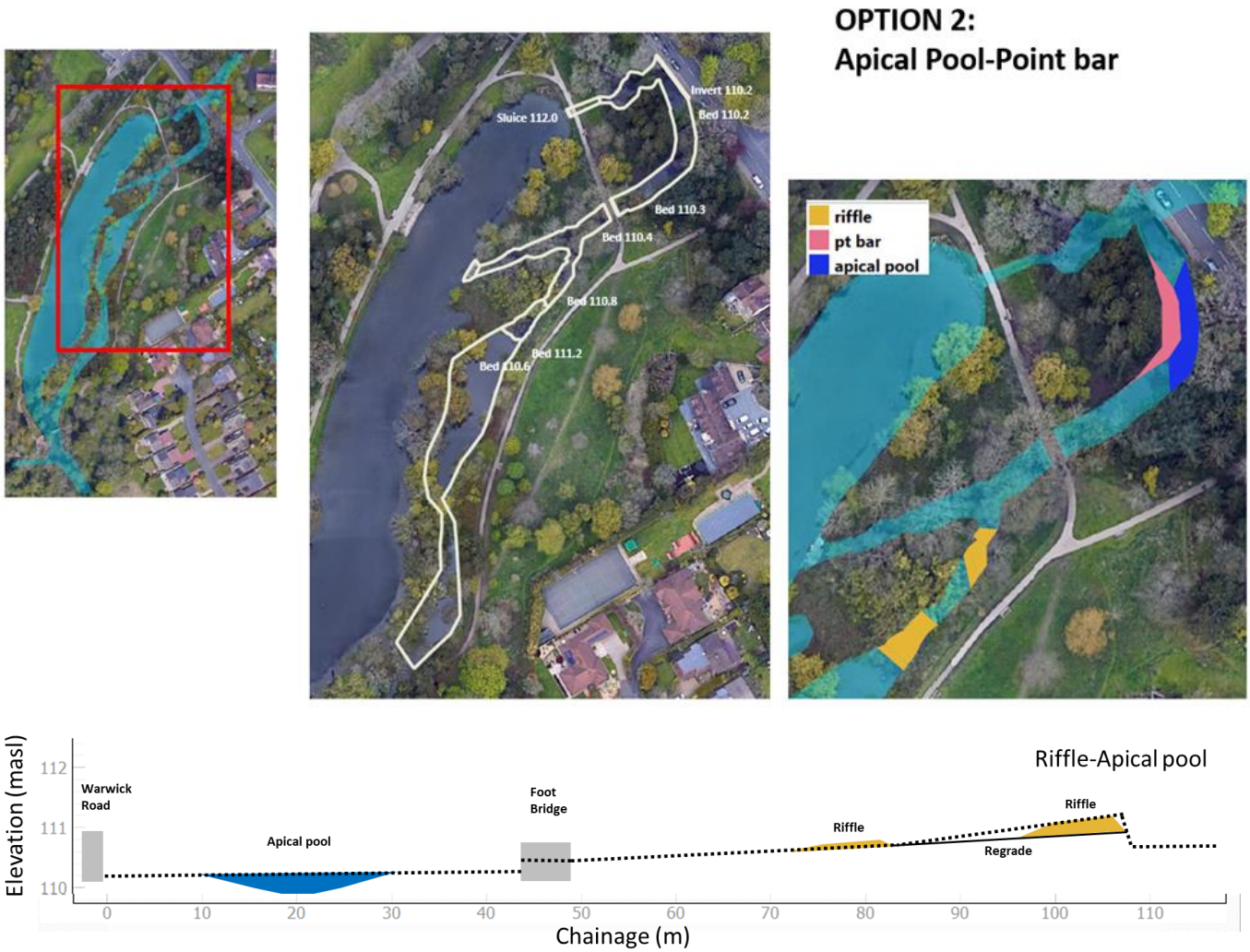

Figure 3.3. Option 2 overview and indicative long section showing regrading, riffle creation and apical pool creation.

3.1.4 Option 3 - Rock ramp removal, regrade and install local riffles and riffles further upstream

This option involves removal of the rock ramp feature and local regrading of the bed following removal of the feature. Two riffles are then constructed through the former rock ramp location, and two additional riffles are added further upstream, with the most upstream riffle finishing at the same level as the now removed rock ramp to maintain the flow split into the Lake. This would result in release of a small amount of impoundment compared to current conditions, but would still be low energy and riffles may be subject to some fine sediment infilling and vegetation colonisation over time. However, the aesthetics of the reach would be significantly improved compared to current conditions. This option is demonstrated below in Figure 3.4.

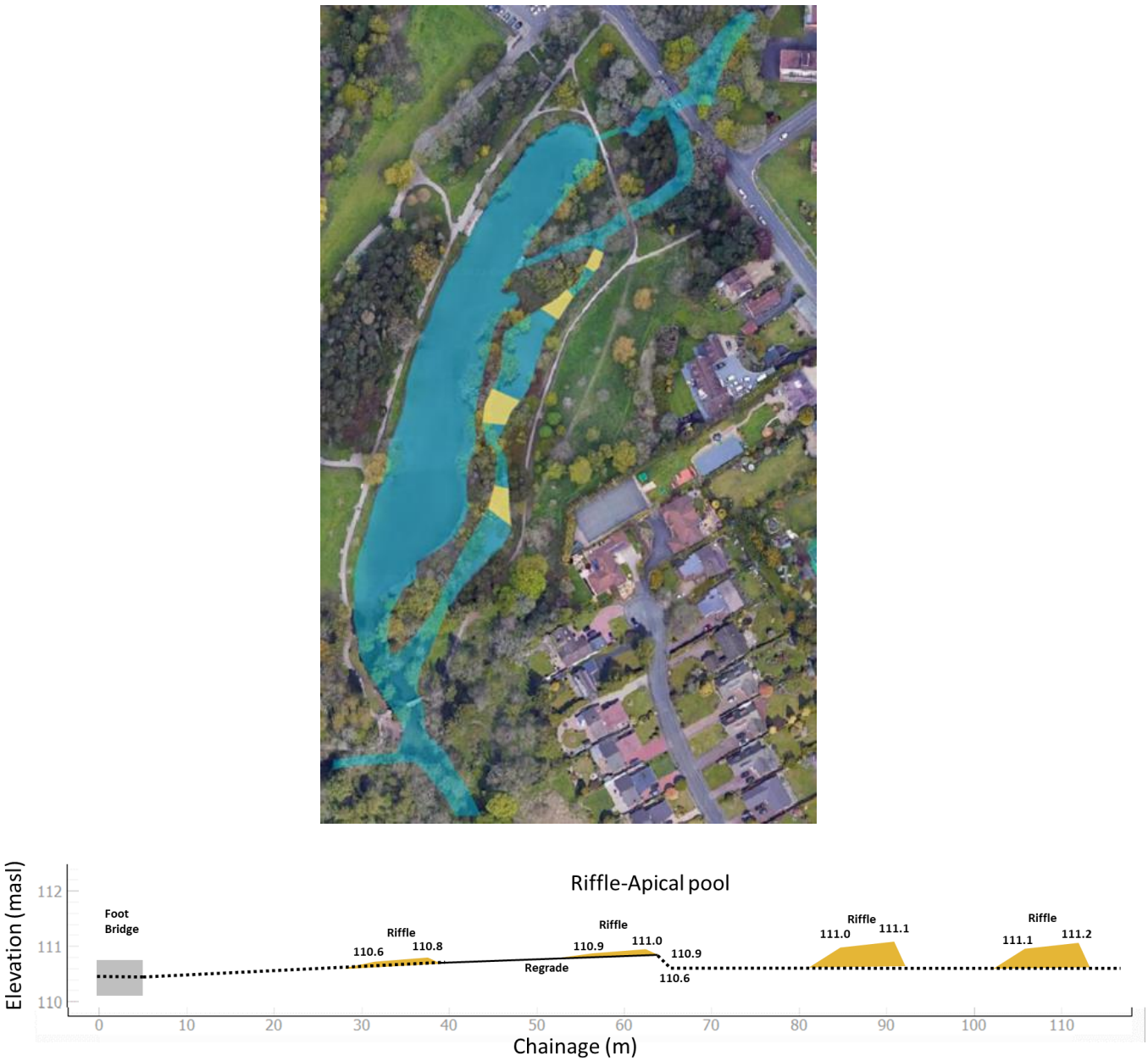

Figure 3.4. Option 3 overview and indicative long section showing regrading and riffle creation.

3.1.5 Option 4 - Rock ramp removal, regrade and install full reach riffles, point bars and downstream bend apical pool

This option involves removal of the rock ramp feature and local regrading of the bed following removal of the feature. Two riffles are then constructed through the former rock ramp location, and three additional riffles are added further upstream, with the most upstream riffle finishing at the same level as the now removed rock ramp to maintain the flow split into the Lake. This would result in release of a small amount of impoundment compared to current conditions but over a longer length compared to Option 3, but would still be low energy and riffles and point bars may be subject to some fine sediment infilling and vegetation colonisation over time. However, the aesthetics of the reach would be significantly improved compared to current conditions. This option also includes improvements downstream to the meander bend through improvement to the apical pool and point bar. This option is demonstrated below in Figure 3.5.

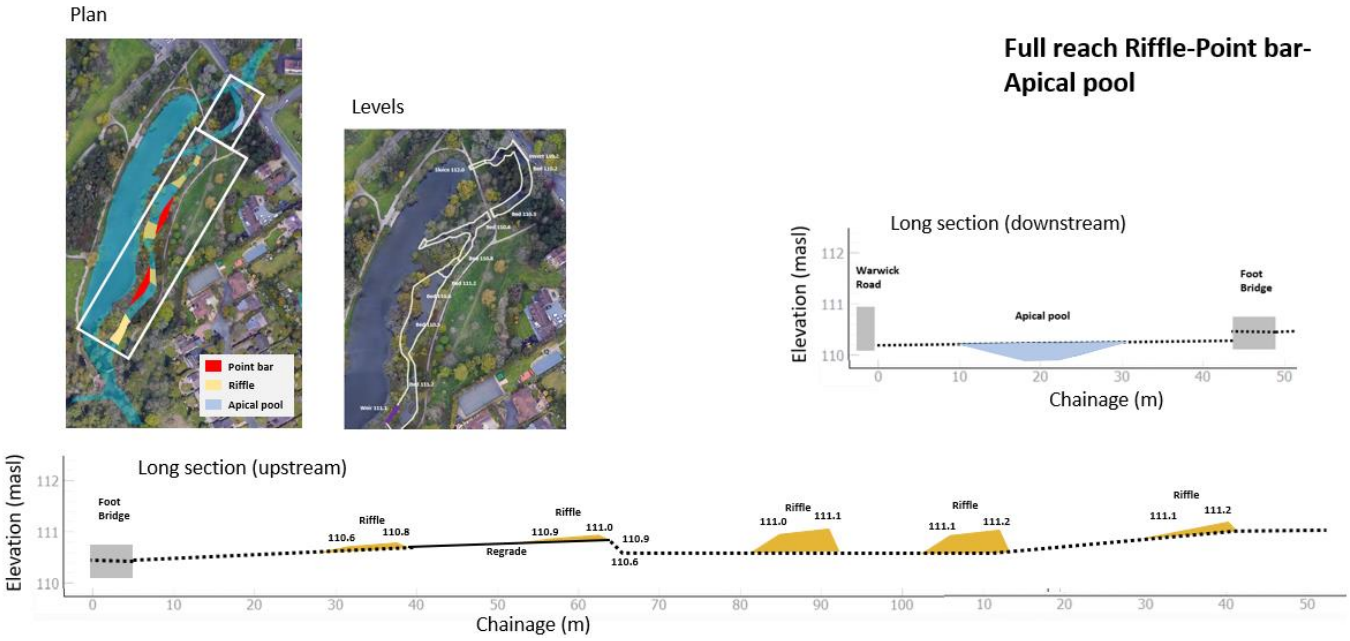

Figure 3.5. Option 4 overview and indicative long section showing regrading, riffle and point bar creation and apical pool proposals.

3.2 Preferred Option

Following completion of the data review, site visit, optioneering described above and liaison with the client, Option 4 was selected as the preferred option for this reach as this maximises the reduction in impounded length, despite this being low energy still, would significantly improve the aesthetics of the reach and would introduce morphology to the channel that is more aligned to the natural processes than the current rock ramp. The proposed riffles and point bars may be subject to some fine sediment infilling and vegetation colonisation over time dependent on inputs from upstream etc. The flow split into the Lake would be maintained.

Example features that would be created as part of this option are shown below in the following sub sections. It should be noted that these are indicative only as river systems vary significantly, as does feature functionality.

3.2.1 Riffles and point bars

Riffle – pool sequences characterize low-moderate energy, single thread, temperate river systems and are associated with inner bend point bars on more sinuous reaches. They are now much rarer in-channel features due to dredging and channel management. The Brueton Park River Blythe site is low energy, but riffle and bar features may still form functional units but could be subject to some fine sediment pressures over time (as noted above). Examples of riffles and point bar units restored on the Trout Beck near Townfoot Farm, Cumbria are shown in Figures 3.6 and 3.7.

Figure 3.6. Restored riffle on the Trout Beck at Townfoot Farm.

Figure 3.7. Restored point bar on the Trout Beck at Townfoot Farm.

3.3 2D Flow Model Construction

To help refine the preferred option for the study reach of the River Blythe at Brueton Park, described in section 3.1 and 3.2 above, a 2D HEC-RAS (v6.1) model of the study reach has been developed, using available Environment Agency 1 m cell size LIDAR and survey information supplied by the client (it should be noted that there remains some uncertainty in levels where vegetation and sedimentation has occurred along the reach, therefore there may be some discrepancy in baseline levels). Flow information for the model was developed using an AutoRefH approach and low flows software, we have assumed this is acceptable to the Environment Agency. The model was developed at a 1 m cell size to enable suitable representation of the channel, and floodplain.

The purpose of the modelling was to appraise the preferred option identified above. This enabled assessment of the impacts to in-channel processes and the hydrological regime and iteration of these

features to provide the acceptable benefits. The model has also assessed the impact on flood risk both locally and downstream through use of a flow monitoring line at the downstream extent of the model.

The model has been built using a Digital Elevation Model (DEM) across the model domain that provides a ground elevation value for each 1 m grid cell. The model extent (also showing grid orientation) and resulting model surface for the proposed option is shown in Figure 3.8 below.

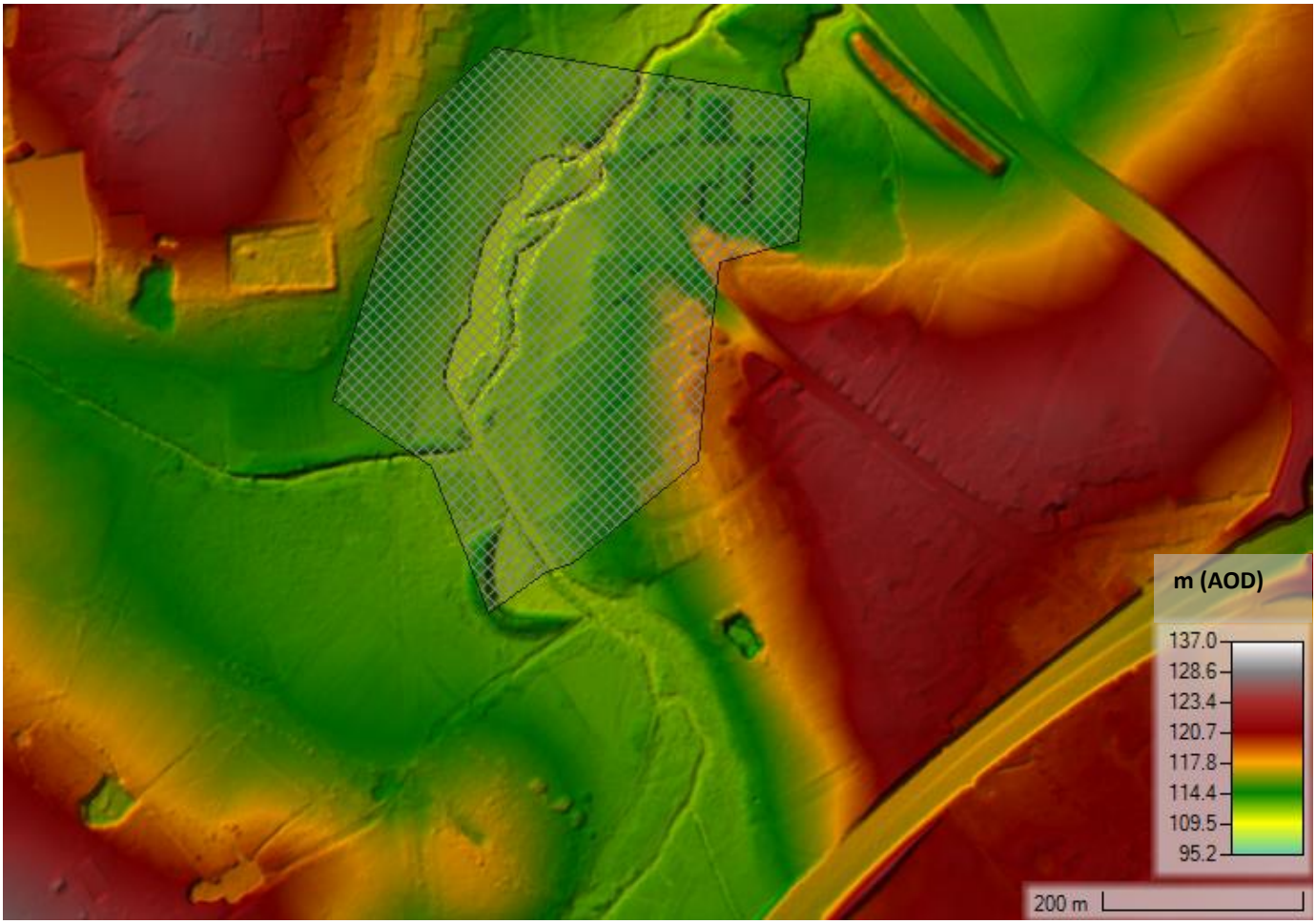

Figure 3.8. Model extent for River Blythe at Brueton Park study reach

3.4 Model Run Parameters

Default parameters were used in the 2D HEC-RAS model setup. Simulated depths, velocities, water level, bed shear stress, and flow were output to assess flood extents across the model domain. Monitoring lines were used at the downstream end of the model to determine likely downstream flood risk impacts. Model outputs were sensibility checked. The downstream boundary of the model is a normal depth boundary, with the rating calculated using the underlying model surface information.

Manning's 'n' roughness values

Manning's 'n' roughness coefficients have been applied to the 2D model surface and have been informed through published information with regards to appropriate roughness values[1]. These values are:

[1] Chow, V.T. (1959) Open Channel Hydraulics. McGraw-Hill, New York

Model domain feature	Manning's 'n' value
Open channel – low energy river system with some in-channel vegetation growth	0.045
Floodplain – some high grass and light brush/vegetation cover, generally similar across whole model domain	0.05

3.5 Hydrology

Flow inputs to the upstream end of the 2D model domain for the River Blythe were derived from an AutoRefH (RefH2) approach. For the purposes of this modelling assessment, a 1 in 100yr plus allowances for climate change (+33% uplift) [2], 1 in 20yr and 1 in 2yr return period flood event have been run through the model as well as representative low flows Q95 (typical summer) and Q10 (typical winter), estimated using Low Flows 2 software. The corresponding flows were:

Main channel:

- 100yrCC – 42.2 m^3/s
- 20yr – 18.9 m^3/s
- 2yr – 10.9 m^3/s
- Q95 – 0.05 m^3/s
- Q10 – 1.00 m^3/s

3.6 Utility information

A services search has not been conducted for the site at the request of the client. Dynamic Rivers accept no liability with regards to the presence of services and whether these are encountered or impacted on site during the works. The client assumes all liability in this respect. It is strongly recommended the client and/or contractor should undertake a services search prior to the works and undertake additional C.A.T4 / radio-detection scanning before commencing works.

Contractors should be made aware of their location as it is possible that some may be crossed / passed under to undertake the proposed works. The contractor should set up goalposts in the vicinity of overhead lines so that machinery operators are aware of their presence. They should also locate any buried services before excavation begins in liaison with the service provider. Track mats may be required across buried services. Other private services, such as land drains not already mapped, that are not picked up by utilities service searches, could be encountered during the works. This should be monitored and managed by the contractor and client on site.

All services should be considered carefully by the contractor undertaking the works in terms of safe working procedures, access and crossing these utilities. It should be noted that standard services searches do not identify all local land drains. If encountered, these should be managed on site by the contractor and client.

Dynamic Rivers accept no liability of any kind for the presence or location of utilities in the vicinity of the designed features. A full and comprehensive utilities search should be undertaken prior to construction. Design drawings provided remain marked not for construction as per this recommendation.

[2] https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow

3.7 Final Design

The preferred restoration design option is shown in Figure 3.9 below following liaison with the client and iterations following discussions. Detailed design drawings have been produced alongside a Method Statement that outlines how a contractor might safely deliver the works, a Designers Risk Register that highlights all risks related to the project and a Bill of Quantities. The below sections outline the bed shear stress review that has undertaken to help with sizing of the proposed gravel features, and hydraulic habitat has been mapped to show the impact compared to baseline. The flood risk impacts as a result of the preferred scheme design have also been assessed.

Import of gravel material will be required to ensure the correct mix of gravel as per the design specification for proposed riffles and point bars. Some material from the bed regrading, following riddling, may be appropriate for use.

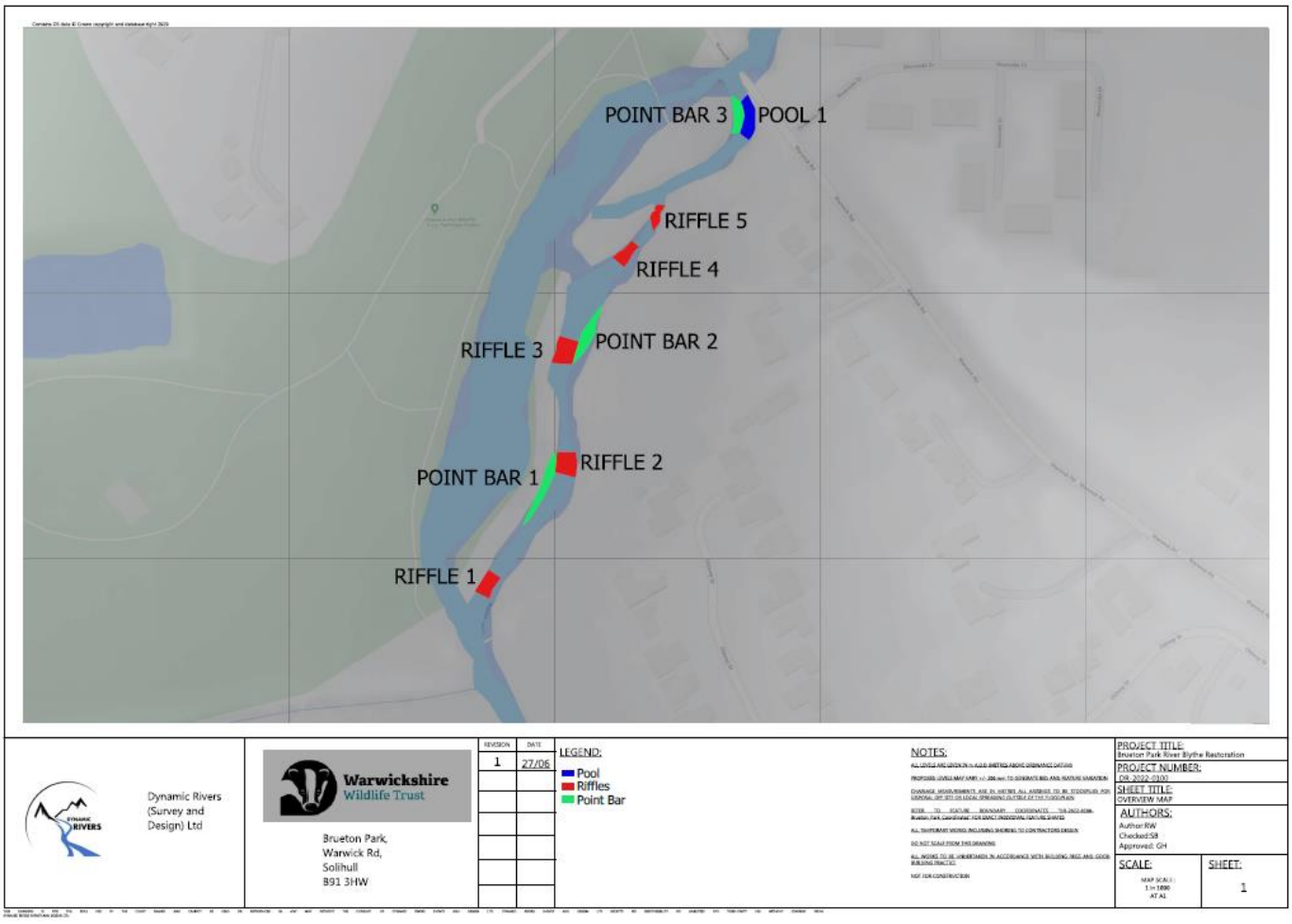

Figure 3.9. Final design for the River Blythe at Brueton Park

3.8 Bed Shear Stress

Baseline bed shear stress model outputs show that generally under extreme and lower order flood flows values range between 10-150 N/m^2 (Figure 3.12 and 3.13) with the majority of these falling within the lower estimate of this range, particularly across the wetted floodplain area. Values within the channel are generally around 10-40 N/m^2. This is unsurprising given the shallow gradient of the watercourse and floodplain area. Higher values are located through and across the various structures along the study reach. This range does not change significantly for the restored model scenario, mainly as a result of the low intervention nature of the proposed in-channel features and still shallow gradient along the reach following the works. This is similarly true for the low order flood flows shown in Figure 3.13. There are some shears around 30-50 N/m^2 across the introduced riffle features and this has been used to help size the riffle material. Shears across the rock ramp feature are slightly reduced once replaced with the riffle features as the gradient is being taken out over a longer length using the riffles.

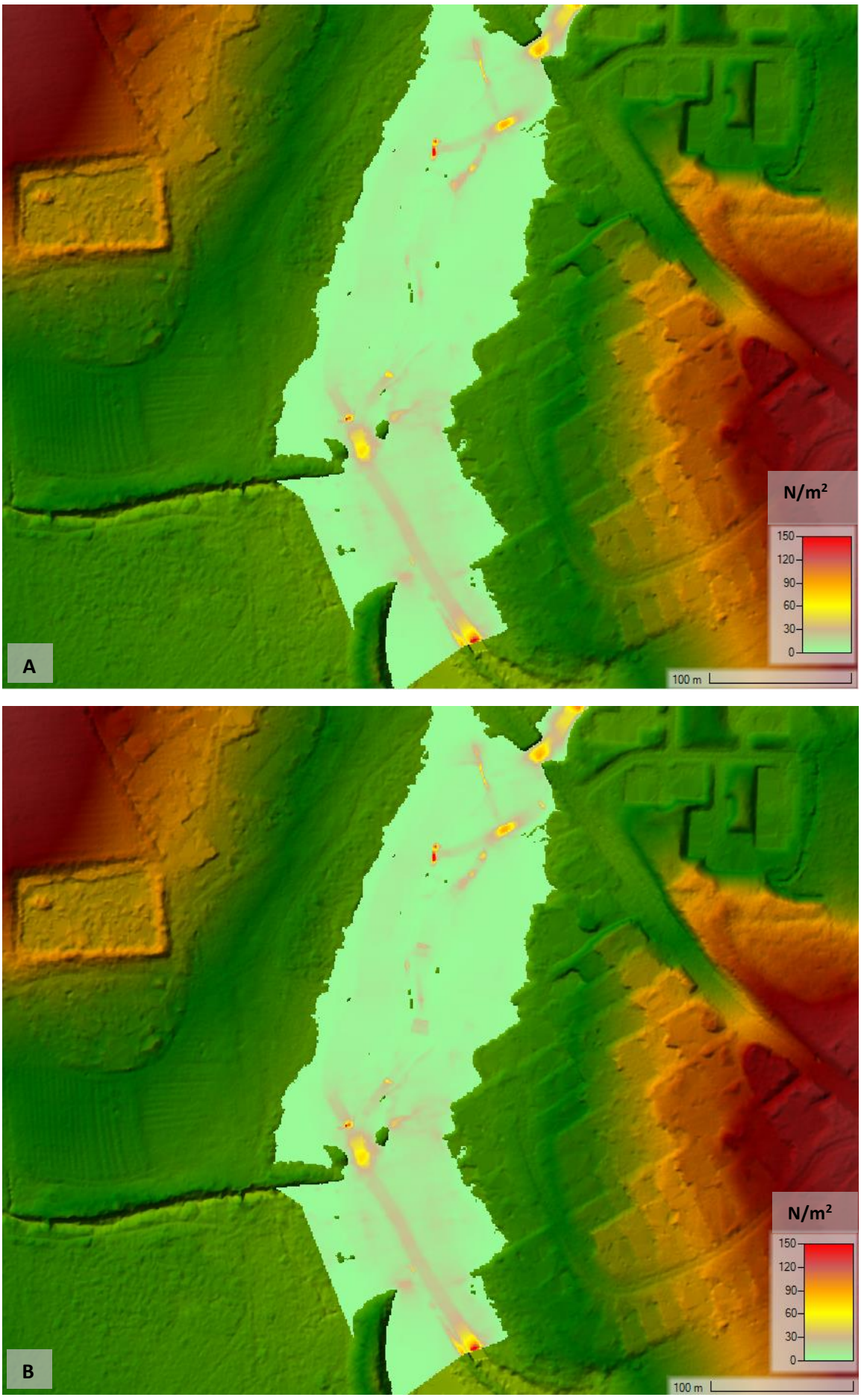

Figure 3.10. Predicted extreme shear stress (N/m²) levels across the baseline (A) and restored (B) along the River Blythe study reach.

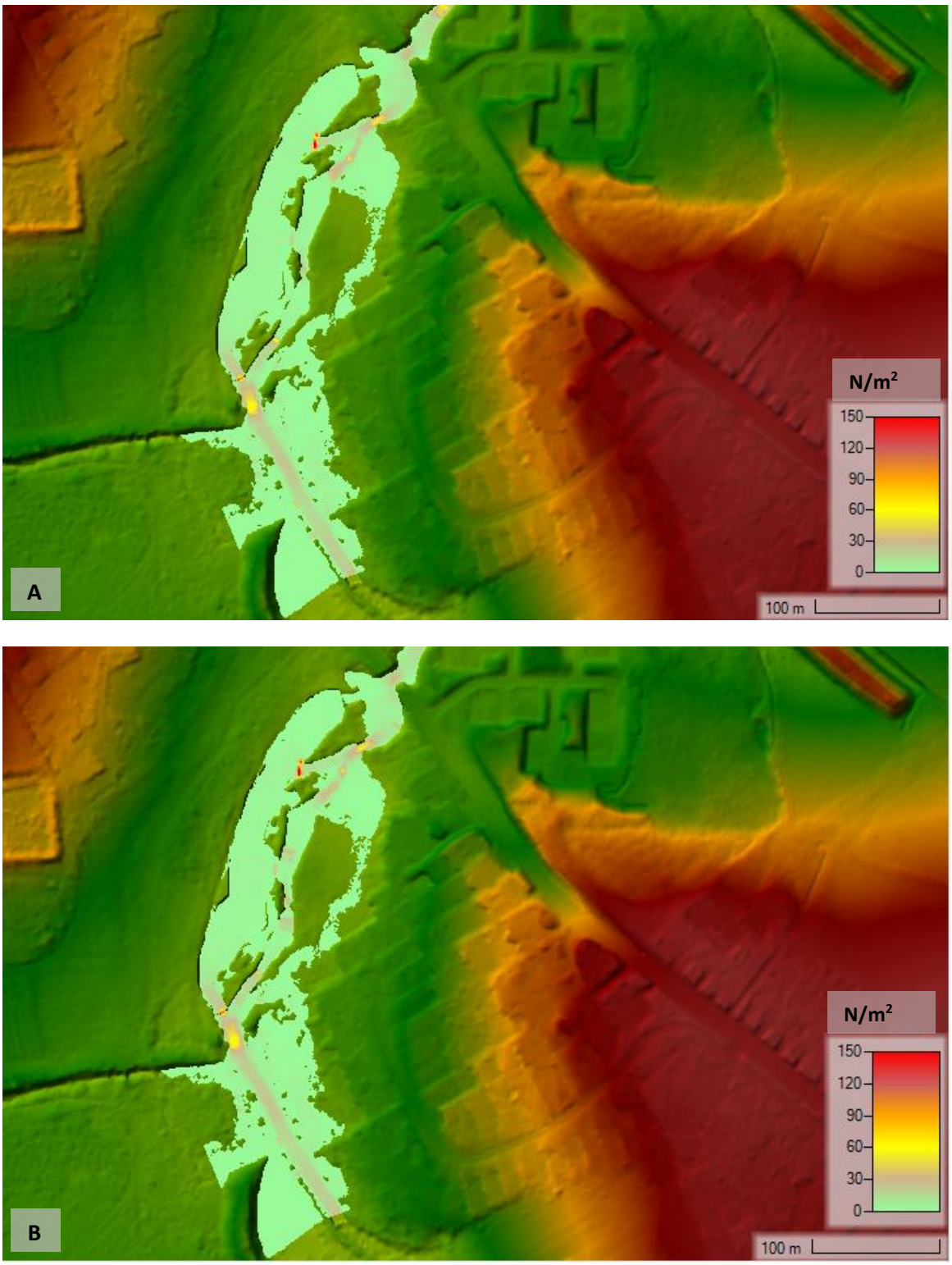

Figure 3.11. Predicted low order flood shear stresses (N/m^2) across the baseline (A) and restored (B) along the River Blythe study reach.

3.9 Hydraulic Habitat Creation

Figure 3.12 shows the hydraulic habitat change, compared to baseline, under summer flow conditions as a result of the preferred scheme option for the rock ramp removal and gravel feature creation along the Brueton Park reach of the River Blythe.

There is a change in hydraulic habitat diversity although not in overall hydraulic habitat area as a result of the preferred scheme for a summer flow (as overall flow area does not significantly change). There is increase in higher energy biotopes overall (riffles) as a result of the impact of the introduced riffle features undertaken through the Brueton Park site and a small reduction in lower energy pool as a result.

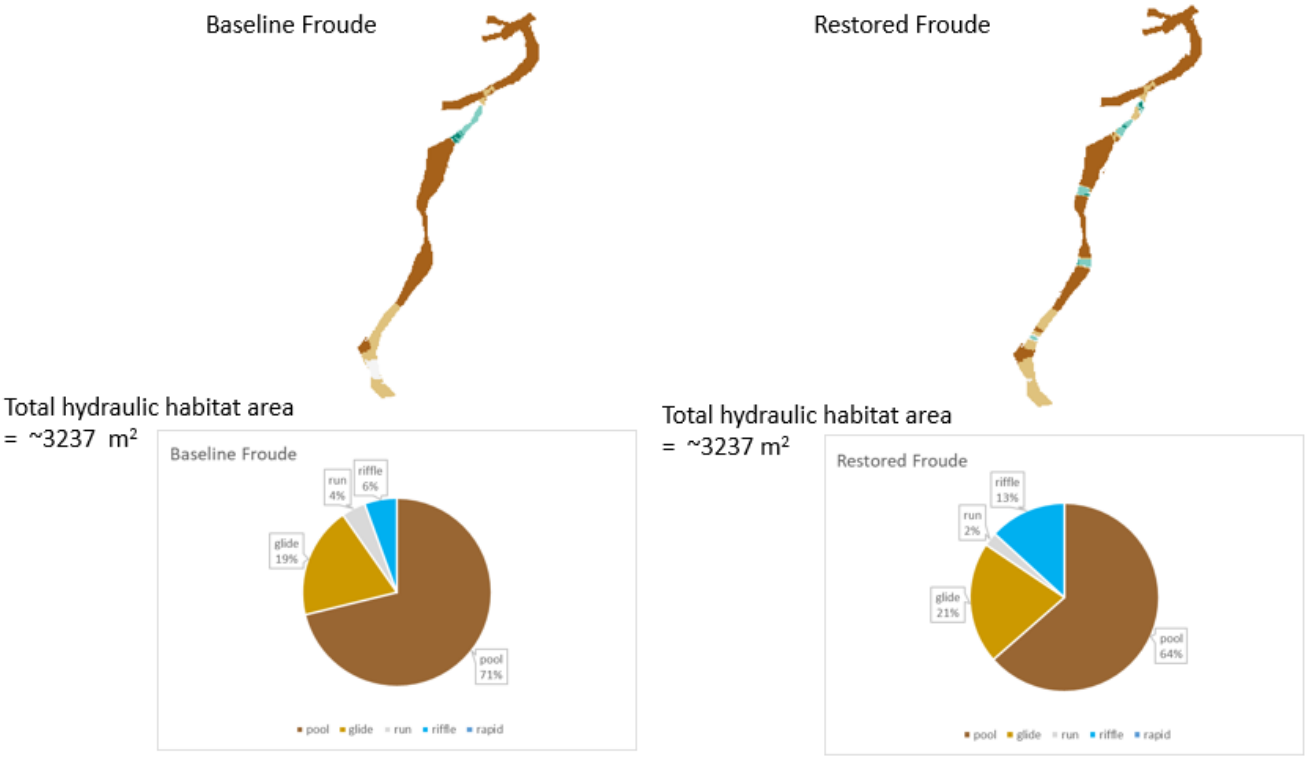

Figure 3.12. Summer flow hydraulic habitat / biotope change compared to baseline for the study reach and associated overall habitat area and diversity change (pie charts scaled to area).

3.10 Water Level

Figures 3.13 to 3.15 below demonstrate the water level changes upstream of the proposed riffle features and demonstrate the retention of water levels similar to baseline to retain a flow split into the Lake similar to current levels for the 1 in 2yr, Q10 and Q95 flow respectively. The numbers on the Figures below show depth analysis points along the modelled reach of the River Blythe upstream at the offtake to the Lake. Positive figures/numbers show a depth reduction compared to baseline, negative figures show a depth increase compared to baseline. As can be seen, there are very little changes as a result of the works (of the order of millimetres that are changes generally beyond the tolerances of the model).

Figure 3.16 shows the small increase in hydraulic gradient, compared to baseline, following the removal of the rock ramp and replacement with a series of riffle features and point bars.

Figure 3.13. 1 in 2yr 2D depth change samples upstream of proposed features

Figure 3.14. Typical winter 2D depth change samples upstream of proposed features

Figure 3.15. Typical summer 2D depth change samples upstream of proposed features

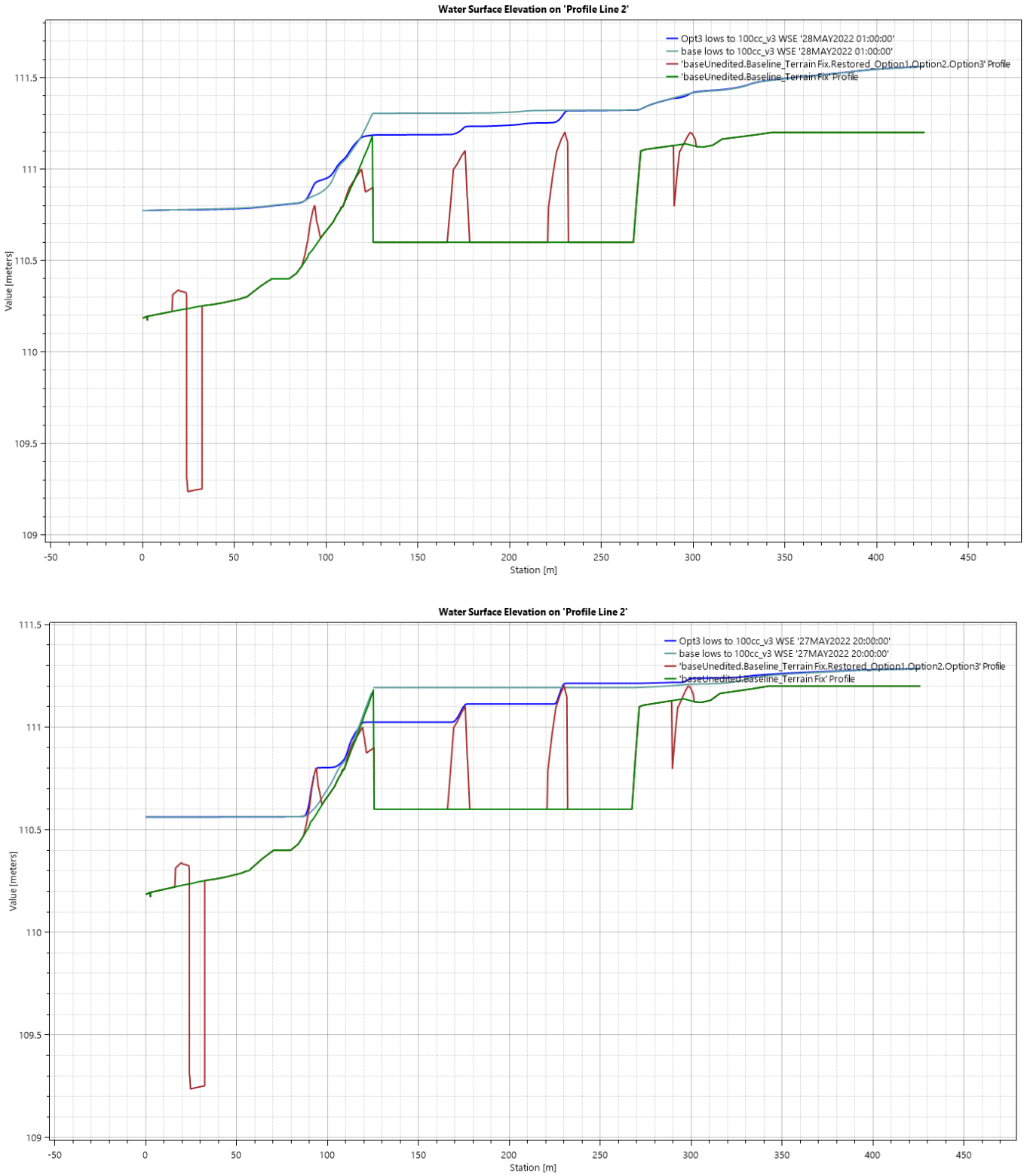

Figure 3.16. Q10 (top) and Q95 (bottom) water surface long profiles showing comparison to baseline.

3.11 Flood Extent Change

Flood modelling for the current and restored site scenario has been undertaken to determine the fluvial flood risk impacts as a result of the proposed scheme. This has been undertaken for the 1 in 100 yr plus allowances for climate change, 1 in 20 yr and 1 in 2 yr events

Figures 3.17 to 3.19 demonstrate the flood extent changes for each of the flood return periods listed above, with baseline shown in blue and the restored scenario shown in red (no change areas are shown in purple).

As can be seen, there are no significant changes in flood extent as a result of the proposed works for any of the return period events modelled. This is unsurprising given the low intervention nature of the proposed works and the existing reasonable connectivity of the river with the local floodplain area.

Figure 3.17. 1 in 100yrCC flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase, purple indicates no change and blue indicates reduction in flood extent).

Figure 3.18. 1 in 20yr flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase, purple indicates no change and blue indicates reduction in flood extent).

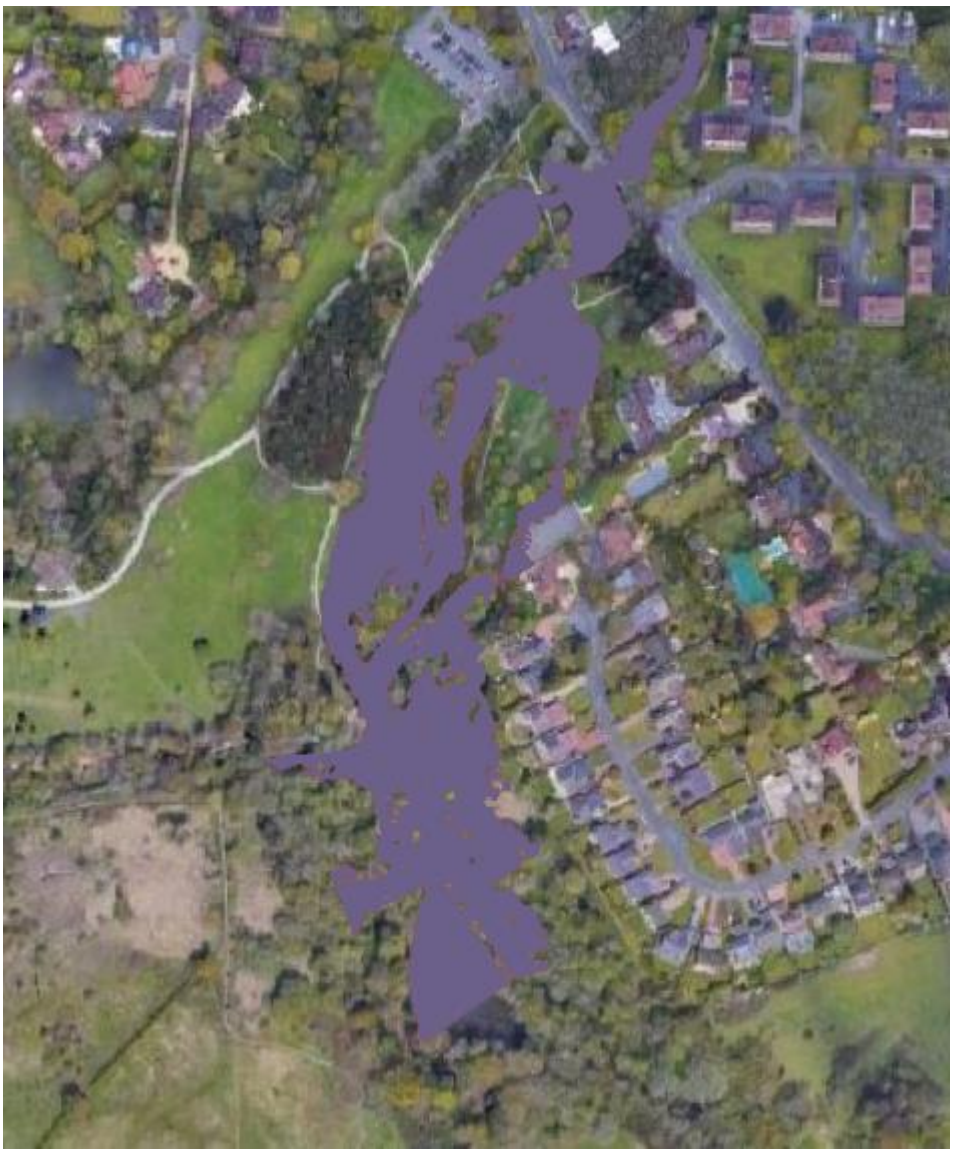

Figure 3.19. 1 in 2yr flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase, purple indicates no change and blue indicates reduction in flood extent).

Downstream, the impact of the proposed works for all the modelled flood flows is negligible in terms of the peak hydrograph flow monitored at the downstream end of the model (Figures 3.20 to 3.22). Again, this is a result of the low intervention and relatively small-scale nature of the proposed works.

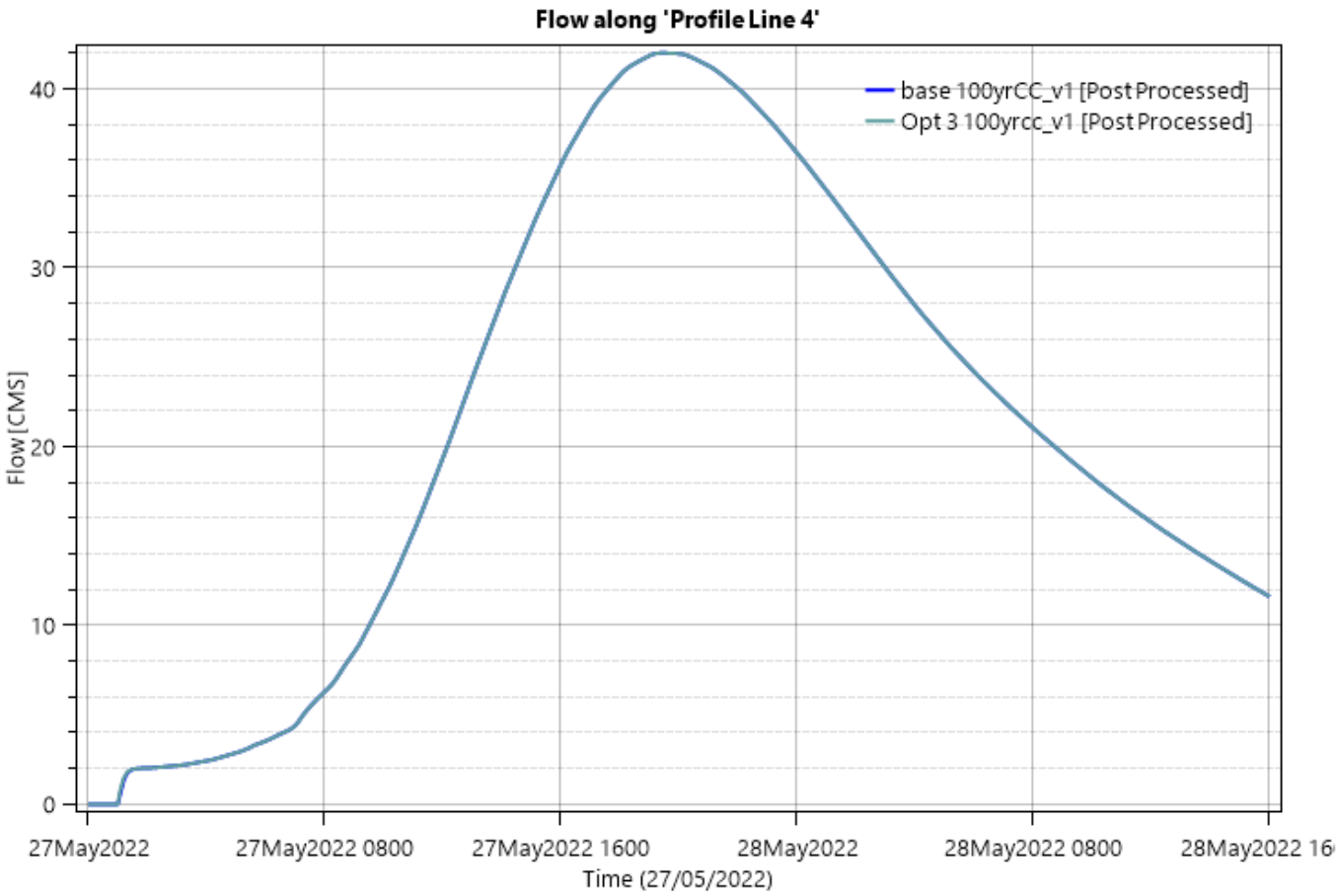

Figure 3.20. Downstream flood hydrograph change for the 1 in 100yrCC baseline and restored scenarios.

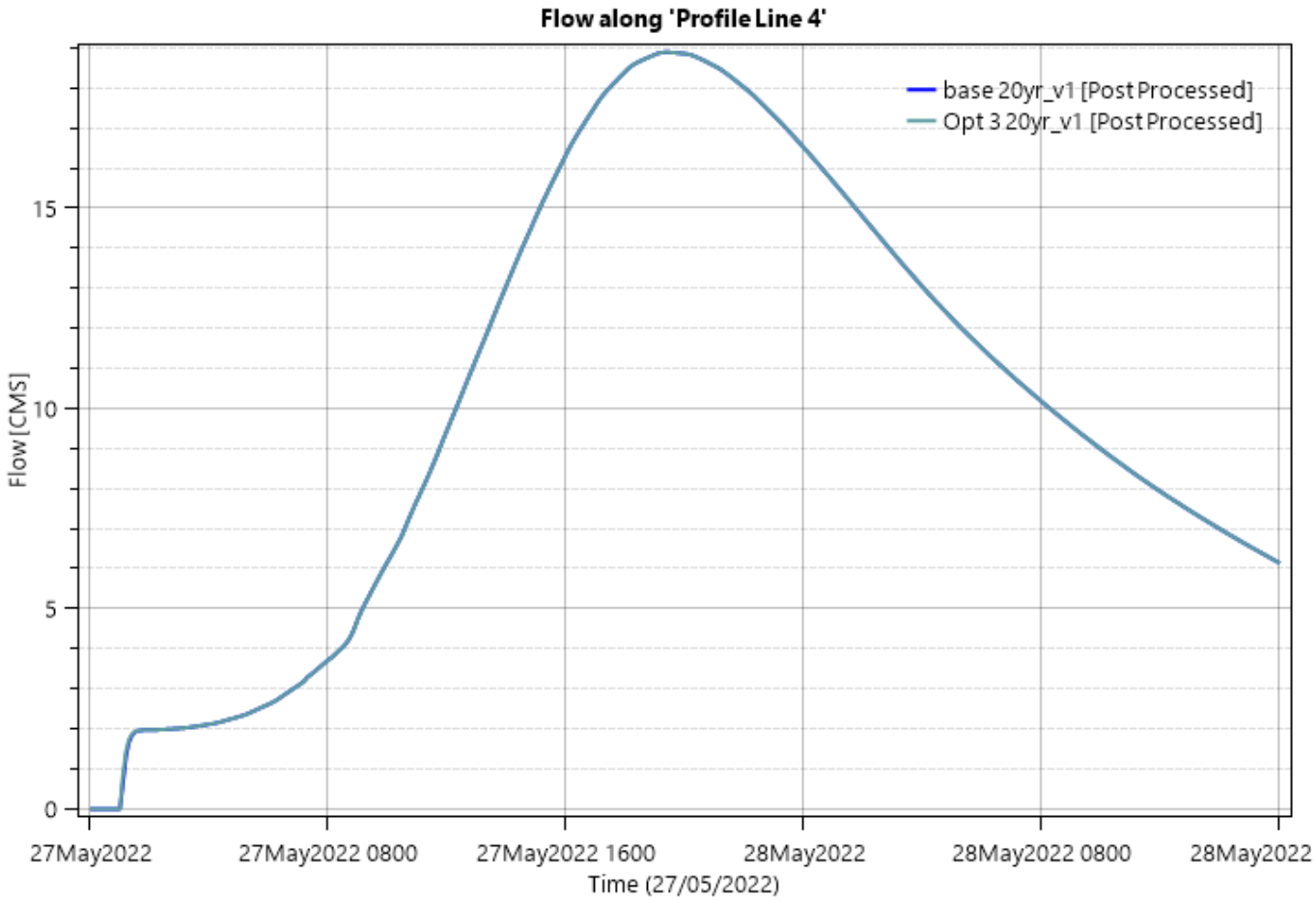

Figure 3.21. Downstream flood hydrograph change for the 1 in 20yr baseline and restored scenarios.

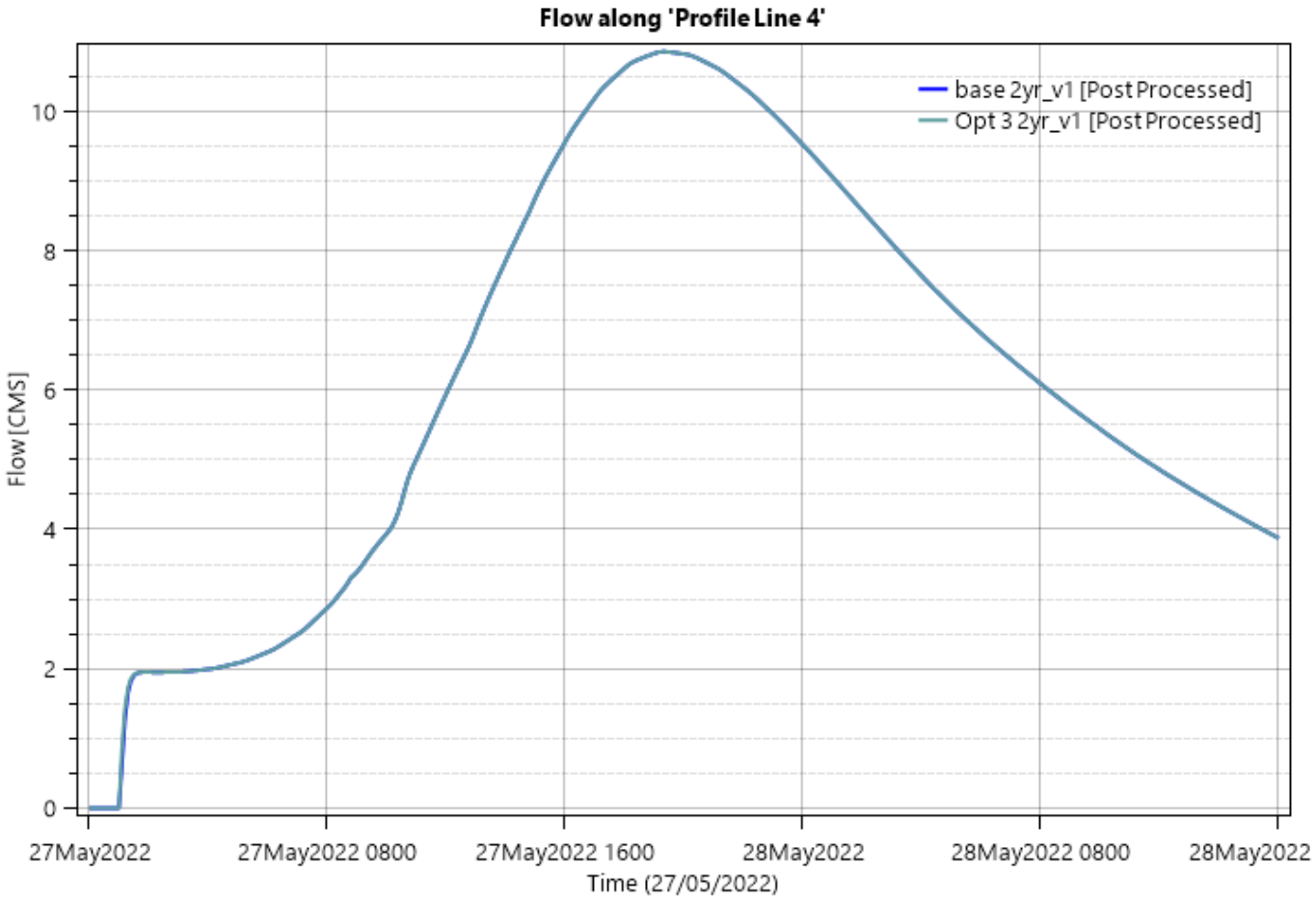

Figure 3.22. Downstream flood hydrograph change for the 1 in 2yr baseline and restored scenarios.

4 Conclusions and Recommendations

4.1 Conclusions

- The headwaters of the River Blythe are just north of Tanworth in Arden, approximately 11km upstream of Brueton Park, flowing in a general northerly direction before heading west once it has flowed through Brueton Park, eventually confluencing with the River Tame at Blyth End. The river presently exhibits a moderately sinuous, single thread nature elsewhere along the watercourse, but is likely to have been historically straightened at Brueton Park. The slope on the watercourse is shallow with the LiDAR for the site and reaches upstream and downstream suggesting a value of ~0.001 for the reach.
- The rock ramp itself impounds water to at least the offtake into the Lake over the left-hand bank (facing downstream), and is the control on the water split between the Lake and the main channel of the Blythe through the reach. Water levels in the Lake are then controlled by sluice gates at the downstream end of the feature and a side weir that operates at a slightly higher level that would spill back into the Blythe downstream of the rock ramp. The rock ramp is composed mainly of small boulder/ large cobble sized material that is out of character for the study reach. This is becoming flanked over the left-hand side of the feature and exposed sheet piling suggests an overall over-engineered design for the feature that maintains the flow split into the Lake and poor construction is leading to issues across the feature.
- Following completion of the data review, site visit, optioneering described and liaison with the client, Option 4 was selected as the preferred option for this reach as this maximises the reduction in impounded length, despite this being low energy still, would significantly improve the aesthetics of the reach and would introduce morphology to the channel that is more aligned to the natural processes than the current rock ramp. The proposed riffles and point bars may be subject to some fine sediment infilling and vegetation colonisation over time dependent on inputs from upstream etc. The flow split into the Lake would be maintained.
- Baseline bed shear stress model outputs show that generally under extreme and lower order flood flows values range between 10-150 N/m^2 with the majority of these falling within the lower estimate of this range, particularly across the wetted floodplain area. Values within the channel are generally around 10-40 N/m^2. This is unsurprising given the shallow gradient of the watercourse and floodplain area. Higher values are located through and across the various structures along the study reach. This range does not change significantly for the restored model scenario, mainly as a result of the low intervention nature of the proposed in-channel features and still shallow gradient along the reach following the works. This is similarly true for the low order flood flows. There are some shears around 30-50 N/m^2 across the introduced riffle features and this has been used to help size the riffle material. Shears across the rock ramp feature are slightly reduced once replaced with the riffle features as the gradient is being taken out over a longer length using the riffles.
- There is a change in hydraulic habitat diversity although not in overall hydraulic habitat area as a result of the preferred scheme for a summer flow (as overall flow area does not significantly change). There is increase in higher energy biotopes overall (riffles) as a result of the impact of the introduced riffle features undertaken through the Brueton Park site and a small reduction in lower energy pool as a result.
- There are no significant changes in flood extent as a result of the proposed works for any of the return period events modelled. This is unsurprising given the low intervention nature of the proposed works and the existing reasonable connectivity of the river with the local floodplain area

4.2 Recommendations

- It is critical that the hydraulic regime across the site is in line with the newly created features to ensure the site will function, it is recommended that Dynamic Rivers supervises the site works during construction, as detailed in the accompanying Method Statement.

- A services search has not been conducted for the site at the request of the client. Dynamic Rivers accept no liability with regards to the presence of services and whether these are encountered or impacted on site during the works. The client assumes all liability in this respect. It is strongly recommended the client and/or contractor should undertake a services search prior to the works and undertake additional C.A.T4 / radio-detection scanning before commencing works.

- Dynamic Rivers accept no liability of any kind for the presence or location of utilities in the vicinity of the designed features. A full and comprehensive utilities search should be undertaken prior to construction. Design drawings provided remain marked not for construction as per this recommendation.