

Poynton Lake
Spillway Upgrade : Further Investigation of Option 3C

BRJ10627-J470-DOC-002 | 01

15th October 2021

Cheshire East Council

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
01	15 th Oct 2021	Draft For Client review	■	■	■	■

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
01	CG	October 21	Cheshire East Council	For Client review

Spillway Upgrade : Further Investigation of Option 3C

Poynton Lake

Project No: BRJ10627
Document Title: Spillway Upgrade : Further Investigation of Option 3C
Document No.: BRJ10627-J470-DOC-002
Revision: 01
Document Status: For Client Information
Date: 15th October 2021
Client Name: Cheshire East Council
Client No: Client Reference
Project Manager: [REDACTED]
Author: [REDACTED]
File Name: BRJ10627-J470-DOC-002-01 Spillway Upgrade Further Consideration of Option 3C
[REDACTED].docx

Jacobs Consultancy Ltd.

1180 Eskdale Road
Winnersh, Wokingham
Reading RG41 5TU
United Kingdom
T +44 (0)118 946 7000
F +44 (0)118 946 7001
www.jacobs.com

© Copyright 2021 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Contents

Executive Summary	3
1. Introduction	4
2. Aspirations of Stakeholders	5
3. Existing Conditions	6
4. Description of Options (including costs etc)	7
4.1 introduction.....	7
4.2 Consideration of Options.....	7
4.3 Option 3C(i) – Raise path remote from water line including dwarf wall and clear trees.....	8
4.4 Option 3C (ii) - Raise path along bank edge and installation slope wave protection	9
4.5 Option 3C(iii) - Regulate Crest by Installing Crest Marker Only.....	9
4.6 Additional Work to be Carried out.....	9
5. Works Downstream of the A523	10
6. Costs	11
7. Buildability Review	12
7.1 General.....	12
7.2 Access.....	12
7.3 Timescales	12
7.4 Re-planting Strategy	12
7.5 Downstream of the A523	12
7.6 Utilities	12
7.7 Existing Path Network	13
8. Recommendations	14
9. Further Discussion	15
9.1 Overflow area.....	15
9.2 Works Downstream of the A523.....	15
9.3 Not including the Crest Path in the Works.....	15
9.4 Re-planting Strategy	15
9.5 Implementation programme.....	15

Appendix A. Original Concept for Option 3C Upper and Lower

Appendix B. Sketches of Options

Executive Summary

The Development of Option 3 considers the following three sub-options.

- Option 3C (i) – Raise path remote from water line including dwarf wall and clear trees
- Option 3C (ii) - Path raising and installation of upstream slope wave protection, to minimise tree loss.
- Option 3C (iii) - Regulate crest by installing crest marker only, including clear trees.

The first two sub-options include the installation of a new path along the crest whereas Option 3C (iii) only allows for the installation of a crest marker along the northern part of the embankment. A high-level cost estimate has been prepared and summarised below.

Option	Option 3C i) Path Raising remote from waterline	Option 3C ii) Path Raising along bank edge	Option 3C iii) Crest Marker only
Total Project cost	£560,000	£1,340,000	£312,000

Based on the estimated cost and the need to do minimal works to the crest whilst still addressing the recommendations set out in the 10(6) certificate of the 5th of December 2019 by [REDACTED] it is therefore recommended that Option 3C (iii) is taken forward by Cheshire East Council.

This option will require some element of tree clearance along the crest and is suggest that this is carried out this winter out with bird nesting season, with the view that construction work can start next year with an estimated completion and sign off by December 2022 This would be within the four years recommended in the 10(6) Certificate i.e. by December 2023.

[REDACTED]
[REDACTED]
[REDACTED] However, there may be opposition [REDACTED]
[REDACTED] For this reason, it would be acceptable to not carry out works to the lower embankment as the works defined in Option 3C(iii) already addresses the recommendation n the 10(6) Certificate.

1. Introduction

A ten-yearly review of dam safety under Section 10 of the Reservoirs Act 1975 in May 2016 included a Mandatory recommendation in the interests of safety to review the spillway capacity. This was completed in 2019 and a recommendation made in the 10(6) certificate to review the feasibility of increasing spillway capacity by 5th June 2020, and if works are proportionate then they should be designed and built by 5th December 2023. An initial Options Report was issued to Cheshire East Council (CEC) as draft in February 2021, and then finalised in June 2021 following a workshop to review the draft on 13th April 2021. The report defined 5 Options ranging from Full Engineering Standard to Risk Based Approach, the options were as follows.

- 2 and 3A – Increase pipe capacity by different amounts, no change to dam crest.
- 3B – No works across road; provide emergency spillways on upper and lower embankments to reduce risk of damage to dam in floods but there would be a significant visual impact with loss of trees.
- 3C upper – Increase resilience to extreme floods by regularise dam embankment crest to spread out overflow over longer length; locally raise crest to reduce risk of breach [REDACTED]; no change in risk of flooding A523. Significant uncertainty in optimising works on the crest.
- 3C lower - Emergency spillway on lower embankment reduces risk of damage to lower embankment, half of which [REDACTED]

Following discussions with CEC in a meeting on 7th July 2021 it was agreed that a risk-based approach would be taken, and it was agreed that the minimum the All Reservoir Panel Engineer (ARPE) overseeing the report would accept is Option 3C Upper. It was also recommended that the works to the lower embankment, Option 3C lower should also be done as part of the works. Drawings outlining the original concept for option 3C Upper and Lower are Included in Appendix A.

A site walkover took place on the 14th July 2021 with CEC, the ARPE's Representative, Ringway and the various stakeholders with an interest in the works to be carried out at Poynton Reservoir. This led to a request to develop the options for Option 3C, specifically,

- *Draft a short supplementary report that discusses the aspirations of the various stakeholders involved in the project and the practicalities from an engineering perspective in relation to the measure in the interests of safety. As part of the report, we will present concept sketches and high-level costs for three options to a concept design level for the upper embankment crest, these being,*
 - Regulate path (including dwarf wall on downstream side) and clear trees along dwarf wall alignment*
 - Path raising and installation of upstream dwarf wall and slope wave protection, this being the option preferred by the arboriculturists.*
 - Regulate crest by installing crest marker only.*
- *Provide commentary on the possible solutions available to the Council in relation to the works downstream of the A523.*
- *High level programme and scope of activities to completion of detailed design including drawings*

The purpose of the report is to look at in more detail the discussions that took place on the site visit and outline the available design possibilities, including estimated costs and impacts on the existing environment to allow the Council to make an informed decision on how to progress the works, in a manner that will ensure the acceptance of the ARPE.

This report should be read as a supplement to the Initial Options report dated June 2021 (v2).

2. Aspirations of Stakeholders

During the site walkover the aspirations of the stakeholders in attendance were discussed and summarised by Andy Kehoe in his email of the 16th of July 2021, these are listed below.

1. *All agreed that the work was required. AK set out the issue facing the Council, managing the risk of the reservoir overtopping and a catastrophic collapse.*
 - a. *It was noted that there was a timeline to agree what needed to be done and then commence works. 6 months to 'agree' 18 months to implement.*
 - b. *Failure to progress the matter would see the Council being dealt with on a statutory basis by the EA.*
2. *The solution discussed was level the top. This is the engineers preferred solution and also the least cost solution. An additional, larger outfall was discussed as an enhancement to the proposal.*
3. *It was noted that trees present a risk. Normally trees are not allowed on dam walls. The risk they present in an overtopping event is the roots are washed out and the tree falls over, increasing the erosion at the time of the event, speeding up wall failure.*
4. *The preference discussed was to minimise the impact to trees whilst also delivering the work*
 - a. *The Engineers design would see a path with a level kerb on the bank side of the path. This would have an elevated risk of impact on trees.*
 - b. *At the meeting a kerb at the Pool side of the path was discussed. This may mean the loss of pool side trees. This was seen as more acceptable and would be considered by the engineering team.*
 - c. *A geotextile overlaid by construction materials to form the 'path' was discussed as a possible solution to minimise the impact on tree roots. Again, this would need to be considered by the engineers.*
 - d. *Softening of the bank by treating with reeds was seen as a sensible thing to do, as water action against a hard surface would impact*
5. *A run of c400m of path would be addressed by the project. There would be a need for the service to do additional works on the path.*
6. *A tree survey has been undertaken this will identify the location and condition of the trees. This will be shared with the relevant services.*
7. *A piece of work relating to water catchment has been undertaken. This will be shared with Ian, who will share it with the engineer. It is understood that the catchment is small.*
8. *An additional piece of work to allow more water into the reservoir had been discussed at previous meetings. This proposal was to be looked into.*
9. *Condition of trees was an issue that the Council is dealing with. There is a requirement for the service to deliver maintenance and there may be a need for the service to put forward a request for revenue funding to achieve this.*
10. *We discussed the issue of the other side of the road. There was some discussion about a solution that would be attractive to the residential owner, possibly construction of a wall and other treatments to reduce the risk of water accessing*

The above have been considered in the preparation of the Options presented in Section 4 of this report

3. Existing Conditions

The existing dam is understood to have been constructed in 1750 as an ornamental lake within the grounds of Poynton Park and consists of an 800m long embankment with a crest width of between 10m and 12m over most of its length widening to 20m at the southern end.

The existing dam crest is considered to be a "wood" by the local park rangers, with the vegetation deliberately left unmanaged and thus generally inaccessible. Use of the area by the public has worn an earth path along the lake side which varies in width from 1.2m to around 2m along the full length of the dam crest and is typically round 200 to 300mm below general CREST level (assessed visually). Chippings and other debris have been placed in the "wood" in places, so the existing ground level within the "wood" is irregular. Other constraints on Option 3C are shown in Table 5.5 of the Initial options report

The downstream face has the main A523 Road running along a berm at the upstream side of the road there is a low masonry retaining wall extending over much of the embankment, approximate height 1m. At the northerly section of the embankment this wall has been discontinued at the downstream face is formed by a stepped slope of 1(v) to 2(h) with a height of approximately 2m.

The downstream face below the road (berm) is typically only 1m high, however this increases to approximately 5m in height over a 30m length locally where it crosses a narrow valley at the northern end of the reservoir, at the location of the spillway outfall.

The key parameters for the dam and the reservoir it retains are summarised below.

Feature	Units	Dimensions as shown on		Source/Comment
		2016 S10	2019 Survey	
Reservoir Capacity	m ³	130,000	N/A	2016 S10
Reservoir Area at TWL	m ²	68,000	N/A	2016 S10
Embankment Crest	m (AOD)	90.92	91.24 (Typical) 90.93 (Lowest)	As shown on the 2019 Topo Survey, See Note 1.
Spillway Weir Crest	m (AOD)		90.55	
Lowest Level on A Road	m (AOD)	N/A	89.31	
Downstream Toe	m (AOD)		84.3	
Design Flood Category	B			
EA Risk Designation	High Risk			
Notes				
1.	Site inspection on 19th June 2021 noted that from around Ch 450 to 800 ground level in undergrowth downstream appeared to be around 200-300mm higher than levels on footpath.			

4. Description of Options (including costs etc)

4.1 introduction

The requirements for regulating the crest, to meet the Reservoirs Act 1975, are that it will,

- spread out overflow uniformly along the length of the crest and therefore be able to tolerate a larger overflow before a breach occurs

and

- Raised locally so overflow [REDACTED].

4.2 Consideration of Options

Several variations of Option 3C were considered as part of this report in order to determine the best solution to meet the criteria defined above the options considered are as follows

- i. Raise path remote from waterline including dwarf wall and clear trees
- ii. Path raising along bank edge and installation of upstream slope wave protection.
- iii. Regulate crest by installing crest marker only.
- iv. Building a new wall along downstream toe.
- v. A meandering path through the Wood forming the level crest
- vi. Constructing a path above the root zone.

However, Options (iv) to (vi) these have been discounted. A brief description of the option and the reasons for discounting them is provided below.

- Building a new wall at downstream toe – the current downstream face has two distinct profiles, the southern section has a short wall along the footpath, and the northern section having no wall and the downstream face meeting the pavement. It would be possible to construct a wall along the northerly section to form a level crest. However, this would be visually imposing along the A523 as this would be around 2m in height and would require to be substantial to resist forces imposed on it from the any overflow and associated loading from wet soil. There would also be disruption to trees on the downstream face and an impact of services running along the footpath.
- Meandering path through wood – this option would include a path that meanders through the woodland and be set at a level that would provide the crest marker. Although this does provide a level crest marker through time it is felt that the woods will become overgrown and tree roots will disturb the crest marker, meaning that maintenance will have to be considered on a regular basis to ensure that the path is providing a level surface for any overflow to spill over consistently.
- Raising the path above the root zone – this was discussed with the view that the trees could be retained as the option would see the use of a root protection matting being installed as the foundation for a new path. The path would still require having a crest marker. It was felt that that as the root systems of the nearby trees would be in place the potential for the path to become disturbed was high, which over a prolonged period of time would lead to continual ongoing maintenance costs. Additionally there is a risk of leakage and internal erosion in the root zone during impounding events when the reservoir was high

The following three options have therefore been identified as possible solutions that are suitable to be taken forward to a concept design level. These options are;

- i. Raise path including dwarf wall and clear trees
- ii. Path raising and installation of upstream slope wave protection.
- iii. Regulate crest by installing crest marker only.

A detailed description of each option is provided in the following text, with sketches in Appendix B

4.3 Option 3C(i) – Raise path remote from water line including dwarf wall and clear trees

The requirement that the new path is the highest point on the crest means that the path has to be raised to above the general crest level, with a dwarf wall along the whole length to form the high spot. To avoid having to reconstruct the wave protection the path would be set back from the water's edge and have a finished level of approximately 100mm higher than the average level in the wood, which means that trees would need to be cleared to allow space for the path and construction access. To reduce damage to tree roots the dwarf wall would be on the upstream side of the path with a 1 in 100 cross fall in a downstream direction

For pricing purposes, we have assumed that to be above ground level on the crest would have to be raised 300mm, but this should be reviewed following completion of a detailed survey of the crest.

This could take various forms but the installation of "High Kerbs" such as those used for bus stops may provide ease of construction as they are of suitable height and being precast units means that they can be installed using small plant. One advantage of using the kerb is that top of the kerb can be set 100mm proud of the level of wood and act as a crest marker. From this point a new 3m wide path would be constructed, using recycled material to form a flexible permeable footpath along 420m length of embankment from chainage 400m to chainage 820m. The ground beyond the path would be infilled to provide shallow fall to tie into existing ground levels.

The formation of the new footpath will require the removal of trees along the 420m length to facilitate the construction of the footpath, many of these trees are mature and will have complex root structures which if left in place would be compromised by the construction of the path/wall and subsequently the weakened root system could make any trees unstable and compromise the safety of the dam. It is assumed that mature trees will need to be removed approximately every 10m therefore it is estimated that the 40no trees will require to be removed, including the grinding of stumps down to below the formation level of the path allowing the path to be level.

In addition to this we recommend the provision of two specific areas of tree removal to provide defined areas where any overflow has a clear path over the downstream face with no obstructions. This would obviously require further tree removal, however, would improve the safety of the dam during an overflow event and provide an additional level of protection [REDACTED] We recommend an overall 10% of the length, i.e. two area of 20m each m [REDACTED]

Over the length of the crest there is existing protection against wave erosion by trees/vegetation and short sections of wall. There has been no allowance made for raising the wall along the water line for this option

The estimated cost for carrying out the works are shown in Section 7.

4.4 Option 3C (ii) - Raise path along bank edge and installation slope wave protection

The path construction would be similar to Option 1, but the path would be aligned along the extreme upstream edge of the crest.

As this option would leave exposed soft fill material used in the construction of the raised section and footpath subject to wave action and scour from the reservoir rip-rap would require to be installed. The protection would be required over the full 420m length of the regulated crest. If this option were progressed other options such as sheetpiles and/or gabion wall could be investigated but are likely to be more expensive.

At this stage design of wave protection has not been carried out, but it has been assumed that a 500mm depth of stone protection (preliminary D50 of 250mm) is required in layers of approximately 250mm depth.

Clearly raising the crest along the upstream water line is likely to destroy the fishing platforms, and at this stage no allowance has been made for reinstatement of these. At detailed design we could investigate sheet pile along the edge, but this is likely to be a more costly option.

The formation of the new footpath would require localised vegetation clearance and tree clearance would likely to be required on the upstream edge of the embankment. The removal of these trees was considered more acceptable by the arboriculturists during the visit as they were deemed to be low value and, in some cases, had died. It is estimated that the number of trees over this length to be in the region of 15 number trees as it is less densely populated than the downstream side of the crest. The removal will include for the removal of all stumps by grinding to below formation level.

The estimated cost for carrying out the works are shown in Section 7.

4.5 Option 3C(iii) - Regulate Crest by Installing Crest Marker Only

This option sees the original crest path retained and the installation of a crest marker only along the 420m length of crest. The crest marker would consist of a high kerb positioned along the downstream side of the existing path. The kerb would be finished such that the top would be approximately 100m higher than the average level within the wood. Similar to Option 3C(i) the ground beyond the path would be infilled to provide shallow fall to tie into existing ground levels.

This option still requires the removal of trees along the 420m length to allow the installation of the kerb marker and therefore the assumption relating the number of trees to be removed is the same as previously discussed in Option 3C(ii) above. It is likely that this would be done as enabling works to allow the crest marker to be installed.

The installation of just the crest marker provides the council with a cost saving and allows the works to progress quicker as they are less labour intensive. Should the Council wish to carry out the installation of the footpath then they can so when budgets/timescales without having any delay addressing the MIOS.

The estimated cost for carrying out the works are shown in Section 7.

4.6 Additional Work to be Carried out

The Council have expressed an interest in reinstating the full path along the crest of the embankment a length of approximately 800m, however 420m of this is already covered by Options 3C(i) and Options 3C(ii). The path with be of the same construction of that described in Options 3C(i) and Options 3C(ii) i.e. flexible and permeable.

Estimated costs for the works denoted above are shown in Section 7.

5. Works Downstream of the A523

Works to the lower embankment below the A523 to increase its resilience to overflow should be considered to be carried out in conjunction with the options discussed above and would consist of the existing steep slope at the low spot on the road being flattened from around 2H;1V to 4H;1V to reduce the risk of failure under overflow. However, the steep downstream face extends [REDACTED]

Access for maintenance and surveillance of the toe of the dam [REDACTED] will be required as this area forms part of the dam. It is therefore suggested that a design which minimises the need for maintenance and inspection would be preferred this would likely include some form of scour protection such as "Grasscrete" as this would provide the required level of protection whilst still providing a semi-natural appearance.

Further information on the constraints is given in the Initial options report, in

- in Section 5.5.2 - Description of Works
- Section 6.6.1 - [REDACTED]

It is noted that currently any depth of overflow over the low point of the road in excess of 200mm depth [REDACTED] [REDACTED] [REDACTED] to retain the flattened slope, but this wall would need to turn and run along the pavement, in effect channelling water into [REDACTED]

For Details of the proposed works refer to Sketches CR-9 and CR-10.

Estimated costs for the works denoted above are shown in Section 7.

6. Costs

A summary of high-level estimated project costs are summarised below.

The costs are an indication, at pre-feasibility level, of activity costs sufficient to compare options and determine the incremental cost of reservoir safety work is disproportionate. Allowances are made for preliminaries (30 measured items) and professional fees for planning etc to arrive at a project cost.

The following table outlines the estimates of project cost for the three options and optional works that have been considered.

Option	Option 3C	Option 3C	Option 3C	Option 3C Lower	Additional Path works
	i) Path Raising remote from water	ii) Path Raising along bank edge	iii) Crest Marker only	D/S Embankment	Additional Path works
Enabling works	£104,000	£39,000	£102,648	£18,666	£25,662
Permanent works	£120,000	£437,000	£7,000	£44,000	£120,000
Temporary works	£13,000	£83,000	£13,000	£71,000	£0
Minor items	£48,000	£112,000	£25,000	£27,000	£30,000
Contractor's Preliminaries	£60,000	£140,000	£31,000	£34,000	£37,000
Construction Contract Value	£345,000	£811,000	£178,648	£194,666	£212,662
Professional fees, surveys etc.	£79,000	£216,000	£58,000	£58,000	£0
Optimism bias	£130,000	£310,000	£72,000	£78,000	£66,000
Total Project cost	£560,000	£1,340,000	£312,000	£338,000	£286,000

Table 5.1 – Summary of High-level Estimated Project Costs

It is assumed that there will be no professional fees etc for additional path works should these works be carried out as part of the Main works.

In the initial options report, it was estimated that the works for Options 3 would be in the region of £540,000 from Table 5.1 above you will see that the cost for Option 3C (i) is of a similar magnitude, with the increase being from the formation of the dwarf wall from a "high-kerb".

The cost for Option 3C(iii) is almost double the original price estimated, this is due to the inclusion of the stone pitching required to protect against potential scour along the upstream face and the additional earthworks required to form this.

Option 3C(iii) is by far the cheapest of the options and addresses the requirements of the MIOS and does not allow for any works to the path network. The path could be added by the Council at a later date when funds become available.

7. Buildability Review

A buildability review was conducted in conjunction with Ringway Jacobs (RJ) in a teams call on the 11th of October 2021 where the options were discussed, and comments were made and summarised below.

7.1 General

The construction of all of the proposed options would be carried out using small plant such as dumpers and excavators to form excavations and place materials, it anticipated that these would be in the region of 3 tonnes.

For all three options a tree survey and detailed topographic survey is required, to allow setting of the level of the crest marker, which should be above the general level of the crest within the woodland (provisionally 100mm above average level). This is best done over winter when vegetation has died back, ideally after tree clearance.

7.2 Access

For Options 3C (i) and (ii) access is likely to be possible from the car park at the northern end of the site meaning that plant will be required to work from one end and track back and forth along the crest of the dam. RJ commented that there would be no great reduction in time if the working area on the crest was widened to allow plant to run side by side. RJ noted that natural passing places did exist along the length of the crest where trees/vegetation had died.

Options 3C(iii) is a less labour-intensive option and will require only excavation and placement of kerbstones to form the crest marker so plant movement will be limited to these operations.

7.3 Timescales

The timescales for carrying out the construction of the three options were discussed, and the approximate timeframes based on using small plant and include site establishment times are as defined as follows.

- Option 3C (i) – 12 Weeks
- Option 3C (ii) – 15 Weeks
- Option 3C (iii) – 6 weeks

7.4 Re-planting Strategy

There was acceptance that all there is some form of tree loss with all three options, this was discussed and agreed that to offset this loss, replanting locally could be considered. The area to the east of the lake "Ponyton Park" could be a possibility to do this, however this would need to be discussed with the Council and the relevant stakeholders and users of the park.

7.5 Downstream of the A523

The proposals for the works downstream of the A525 were discussed and RJ commented that there was no requirement to install slot drainage along the western edge of the A525 where the kerb is proposed to be lowered. RJ confirmed that there is currently no road drainage in this area and any run-off from the road drains to the field. The inclusion of a slot drain system would also require high levels of maintenance to keep it operational.

7.6 Utilities

Initial checks on potential utilities located in the overall vicinity of the works, particularly the A523 London road North have identified the following utilities that may be impacted by the proposed works at Poynton Reservoir. The utilities identified are as follows.

- 4 No 33kV electricity cables along centreline of A532 (Depth ~900mm)

- 4 No LV electricity cables in centre of northbound carriageway (Depth Unknown)
- 1 No LV overhead electricity cable feeding the 4 properties and street lighting to west of road.
- United Utilities Distribution main along western verge and pavements (Assumed 25mm diameter at 750mm depth.
- Carriageway drainage on eastern side of A523.

Prior to any detailed design works a comprehensive utilities check will be required.

7.7 Existing Path Network

The existing path around the lake is popular with pedestrians so temporary diversions will have to be implemented for the duration of the works.

There are currently two existing paths that allow pedestrians to access the embankment from the pavement along the A523. These will require to be tied into any modifications to the crest.

8. Recommendations

Based upon the information presented above and discussions with the ARPE it is recommended that the works described as Option 3C (iii) be taken forward. This is the minimum that the ARPE would consider to sign off the works.

This decision to recommend Option 3C(iii) was based upon the following reasons.

- Cost – The works defined in Option 3C(iii) are more cost effective than those in other two options simply because there is no provision of a new path network. The option only addresses the MIOS requirement.
- Ease of Construction - The use of precast kerb units and materials that can be delivered to site using relatively small plant means that minimal disruption will occur to the existing crest and woodland areas.
- Reservoir Safety – Regulating the crest over its full length promotes any overflow to spread out uniformly along the length of the crest and therefore be able to tolerate a larger overflow before a breach occurs and the local raising directs flow [REDACTED]

Inevitably trees will require to be removed from the embankment to allow the construction, although this is not desirable to the arboriculturist or the park rangers and is likely to raise concerns from the public, the trees pose reservoir safety concerns, such as piping due to decaying root structures or damage occurring from an overflow event should the roots be washed resulting in tree(s) falling over, increasing the erosion at the time of the event, exacerbating embankment failure.

In line with this it is also recommended that a minimum of two specific areas of tree removal should be considered to provide defined areas where any overflow has a clear path over the downstream face with no obstructions. This would improve the safety of the dam during an overflow event and provide an additional [REDACTED]
[REDACTED]

9. Further Discussion

The following have been identified as items that require further discussion with the Council when considering the extent of works required.

9.1 Overflow area

All three options include tree clearance for the full width of the crest of around 40m, maintained as grass, to provide an overflow route for floods. This is important to

- a) ensure that undergrowth under the trees does not inhibit overflow, and also to
- b) emphasize that the structure is a dam which comes under Reservoir safety legislation and thus is subject to periodic safety inspections (next one due July 2026)

An overall length of 40m, in say two sections [REDACTED] with the exact location to be agreed.

9.2 Works Downstream of the A523

The works downstream of the A523 do not form part of the minimum works required needed for the ARPE to sign off the MIOS. However, it has been included as an option within this report as it provides a formal path for overflow water to safely pass over the embankment [REDACTED]

[REDACTED] is reduced by the road and berm i.e. the time for erosion of the downstream face would be increased due to these elements. The approach that could be taken by the Council could be that there would be an acceptance that following any overflow event occurring that repairs are carried out as required to repair any damage to the downstream face.

9.3 Not including the Crest Path in the Works

The minimum works required to meet the MIOS is to regulate the crest to provide consistent overflow, as described in Option 3C(iii) there is no provision for the construction of a footpath, the Council should consider this with the option of constructing the footpath at a later date.

9.4 Re-planting Strategy

As discussed in Section 6.4 above if the decision is taken to remove trees and vegetation from the dam then a replanting strategy should be considered local to the site to offset the loss of trees from the embankment. The strategy would need to be agreed with the Arboriculturists and the relevant stakeholders.

9.5 Implementation programme

The 10(6) Certificate issued by [REDACTED] on the 5th December 2019 stated that *“Complete a feasibility study of options to increase spillway capacity, within 18 month and complete the works within four years”*. Although the study date has now lapsed, as progress is being made the completion date for works of Dec 2023 should still be achieved. It is therefore reasonable for the Supervising Engineer to assume that at present there is no need to call for an early S10 inspection of the Reservoir.

An indicative programme showing the various stages and durations to completion has been provided below, showing completion by Dec 2022. This should be critically reviewed and agreed.. The critical activity now is tree clearance over the winter of 2021-22, and topo survey to allow the level of the crest marker to be defined . If construction were programmed for summer 2023, then the topography survey could be carried out after the tree clearance, which would improve the ease of survey.

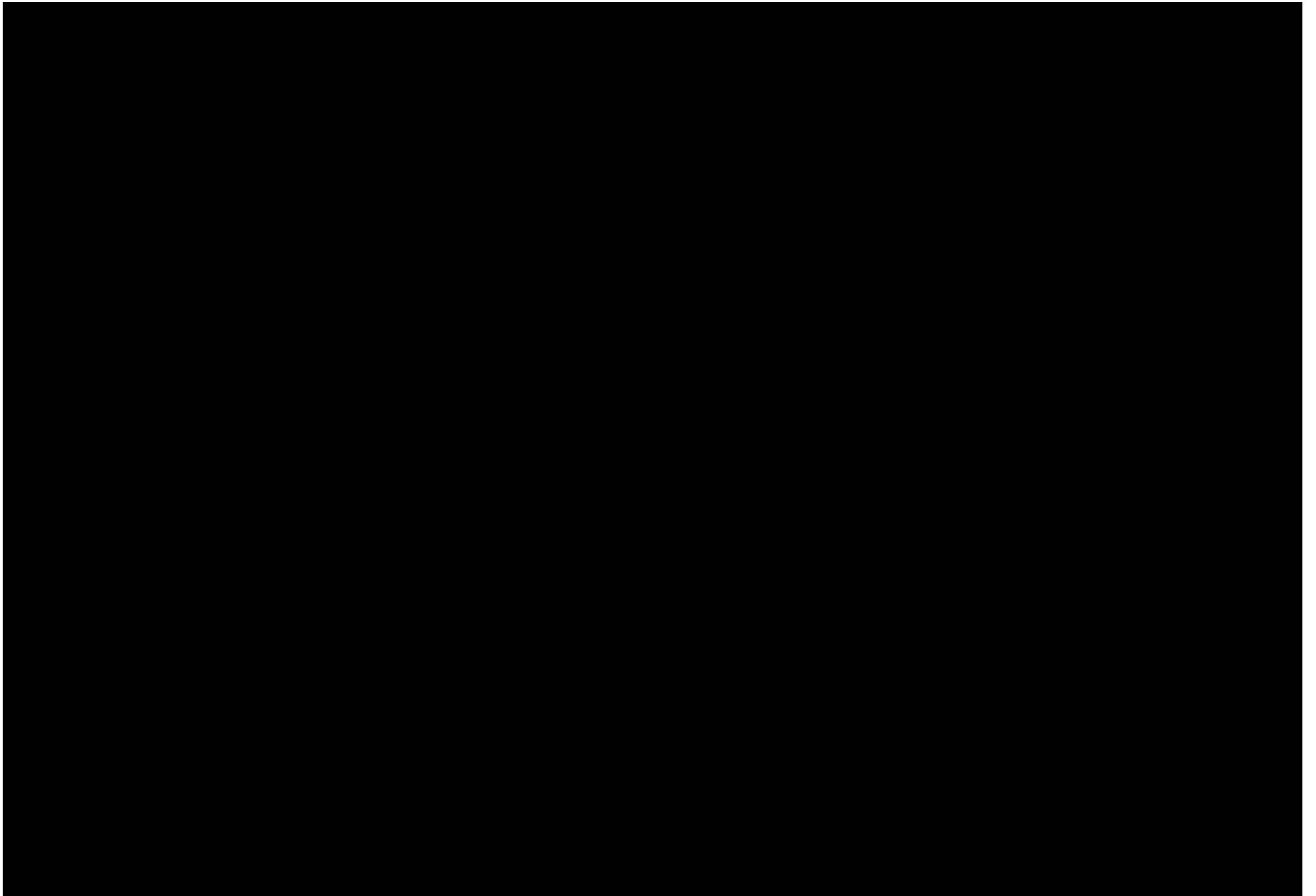
Spillway Upgrade : Further Investigation of Option 3C

Figure 9-1 Indicative high level programme for dam safety works

Task	Assumption	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Decide on Preferred Option	Assume Option to be approved by cabinet	Yellow	Yellow												
Tree Survey		Yellow	Yellow												
Enabling Works to Clear Trees	To be carried out outwith bird nesting season			Red	Red										
Topographic survey					Orange										
Appoint Designer	Time to agree scope fees etc			Yellow											
Detailed Design/Construction Drawings/ Tender Docs	Assume planning not required				Blue	Blue	Blue								
Tender Period								Yellow	Yellow						
Award Contract for Construction										Yellow					
Mobilisation											Red				
Construction	Assumes a 3-month construction period											Red	Red	Red	
APRE Sign off															Blue

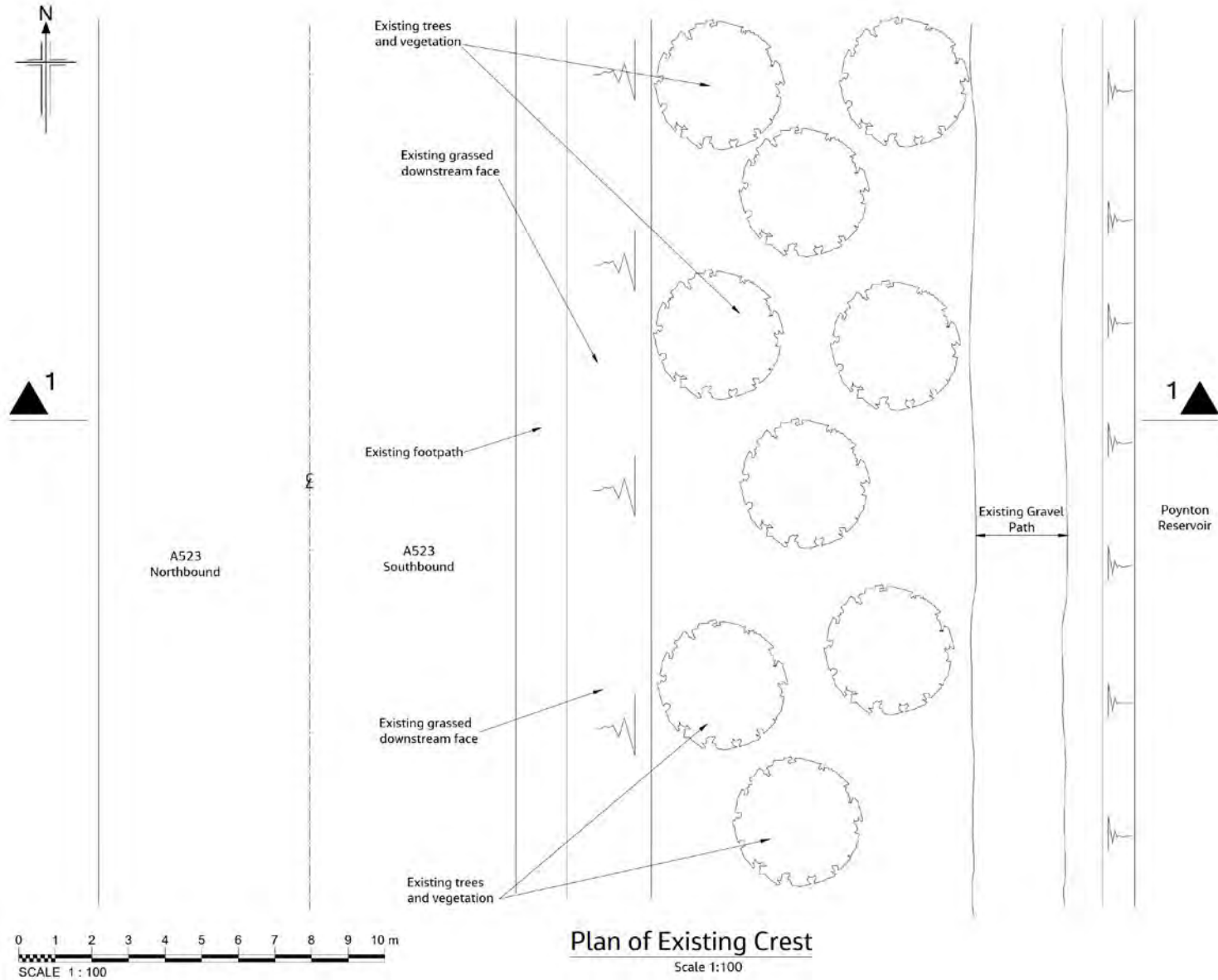
- Cheshire East Council
- Designer ARPE
- Contractor

Appendix A. Original Concept for Option 3C Upper and Lower

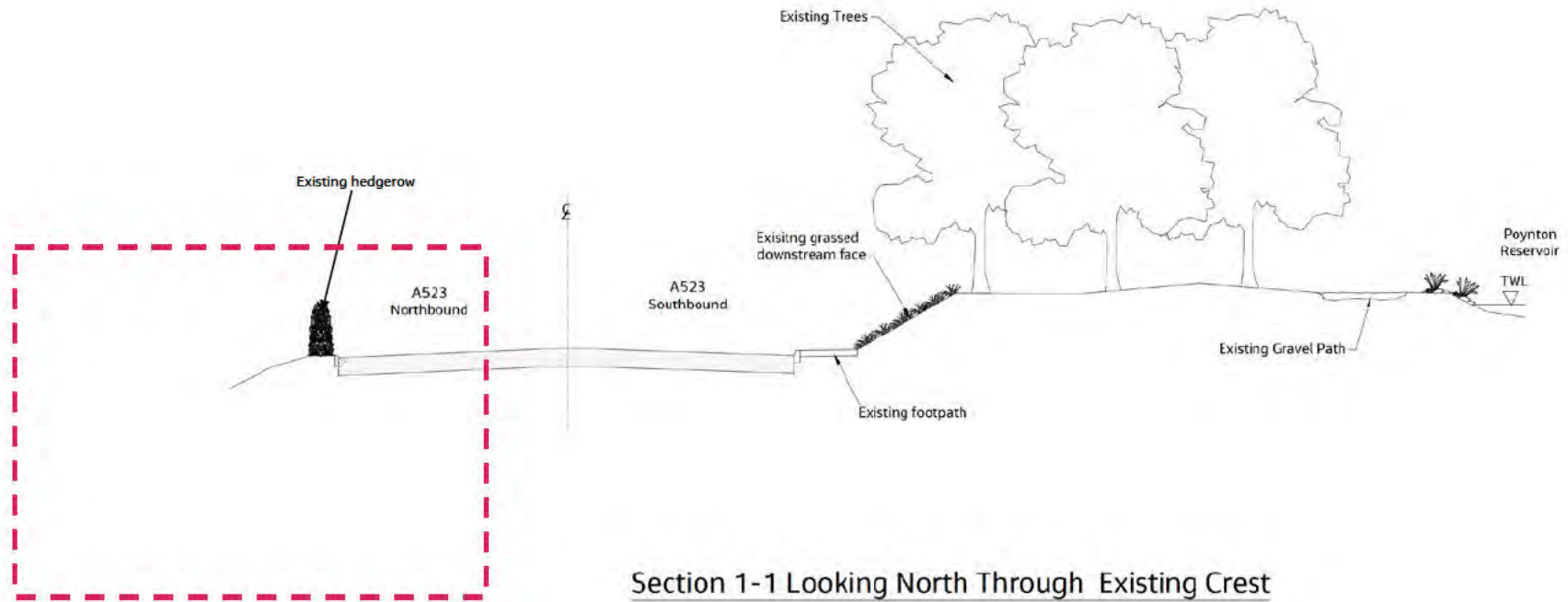


Appendix B. Sketches of Options

Sketch CR-1

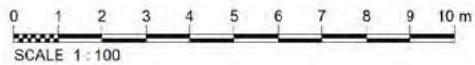


Sketch CR-2



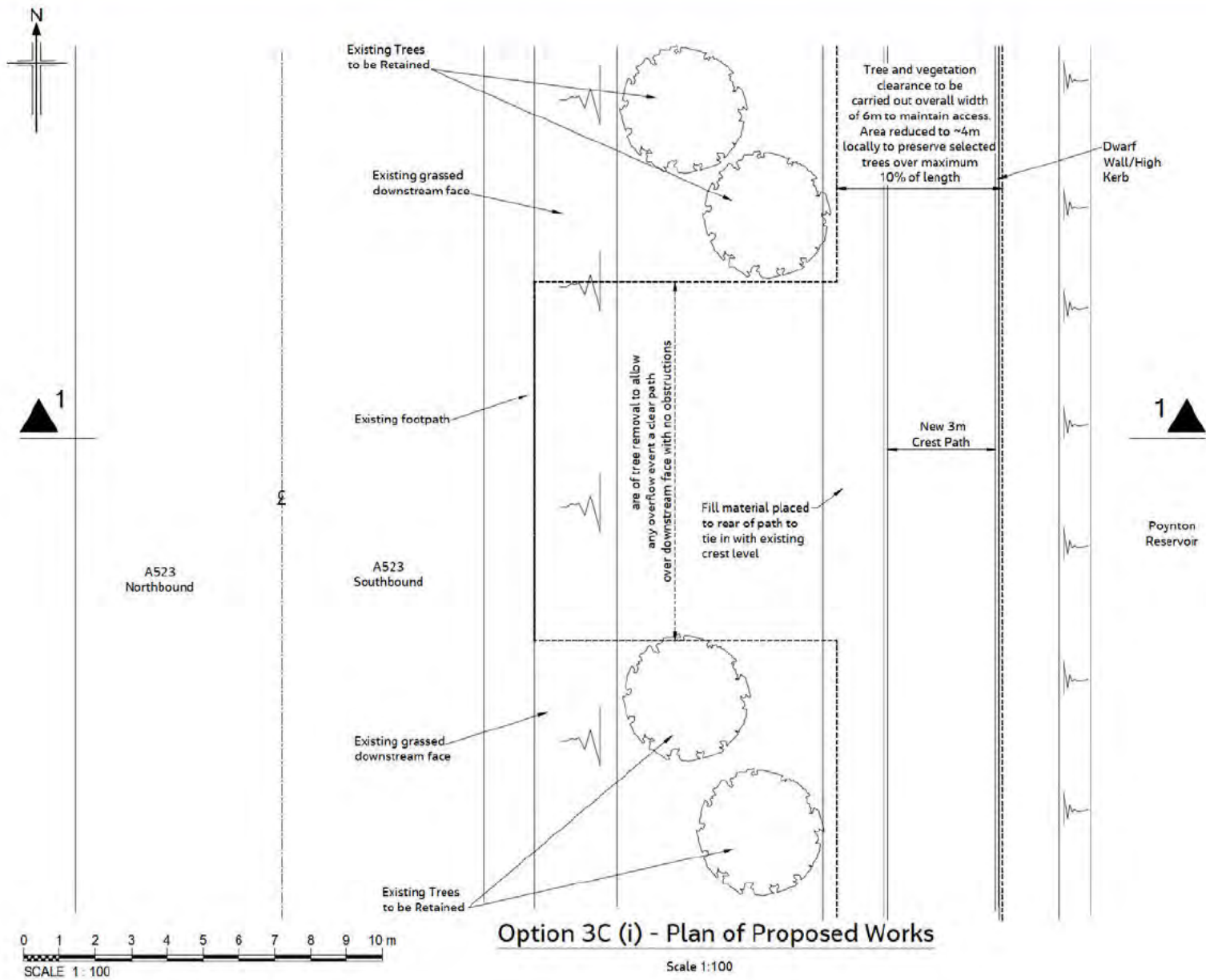
For Details of lower slope refer to Sketch CR-10

Scale 1:100



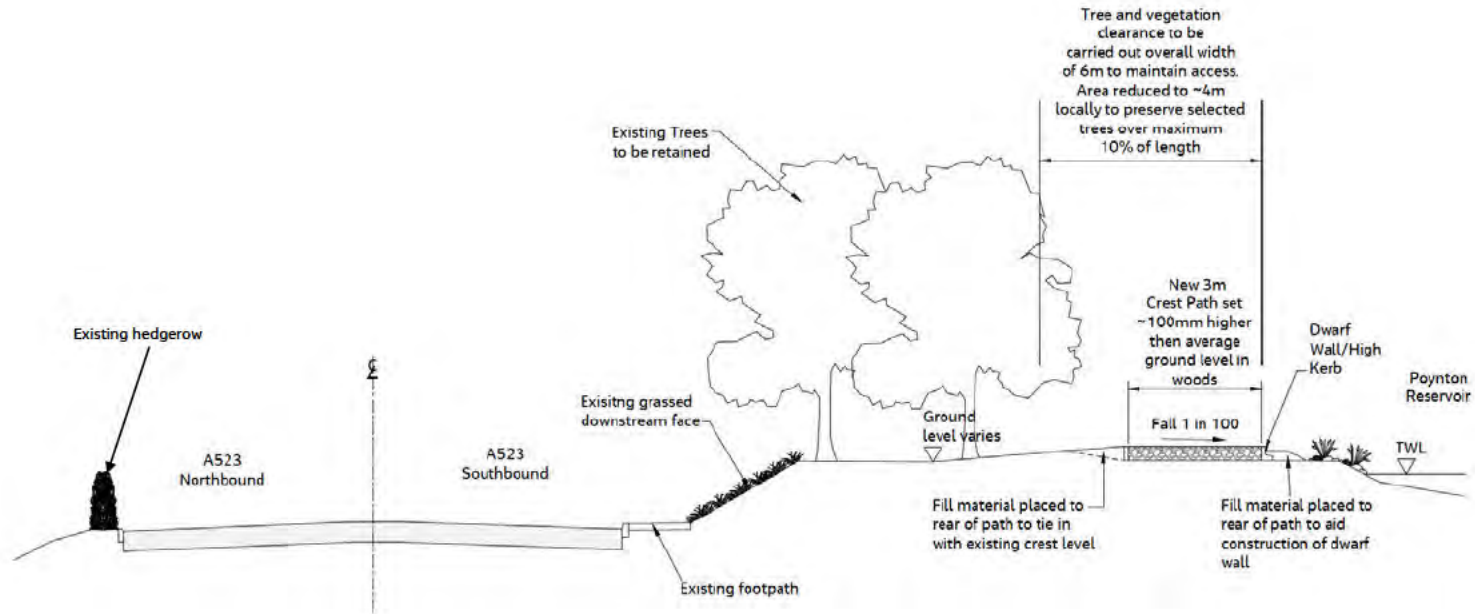
Spillway Upgrade : Further Investigation of Option 3C

Sketch CR-3



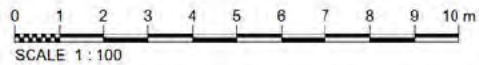
Option 3C (i) - Plan of Proposed Works

Sketch CR-4

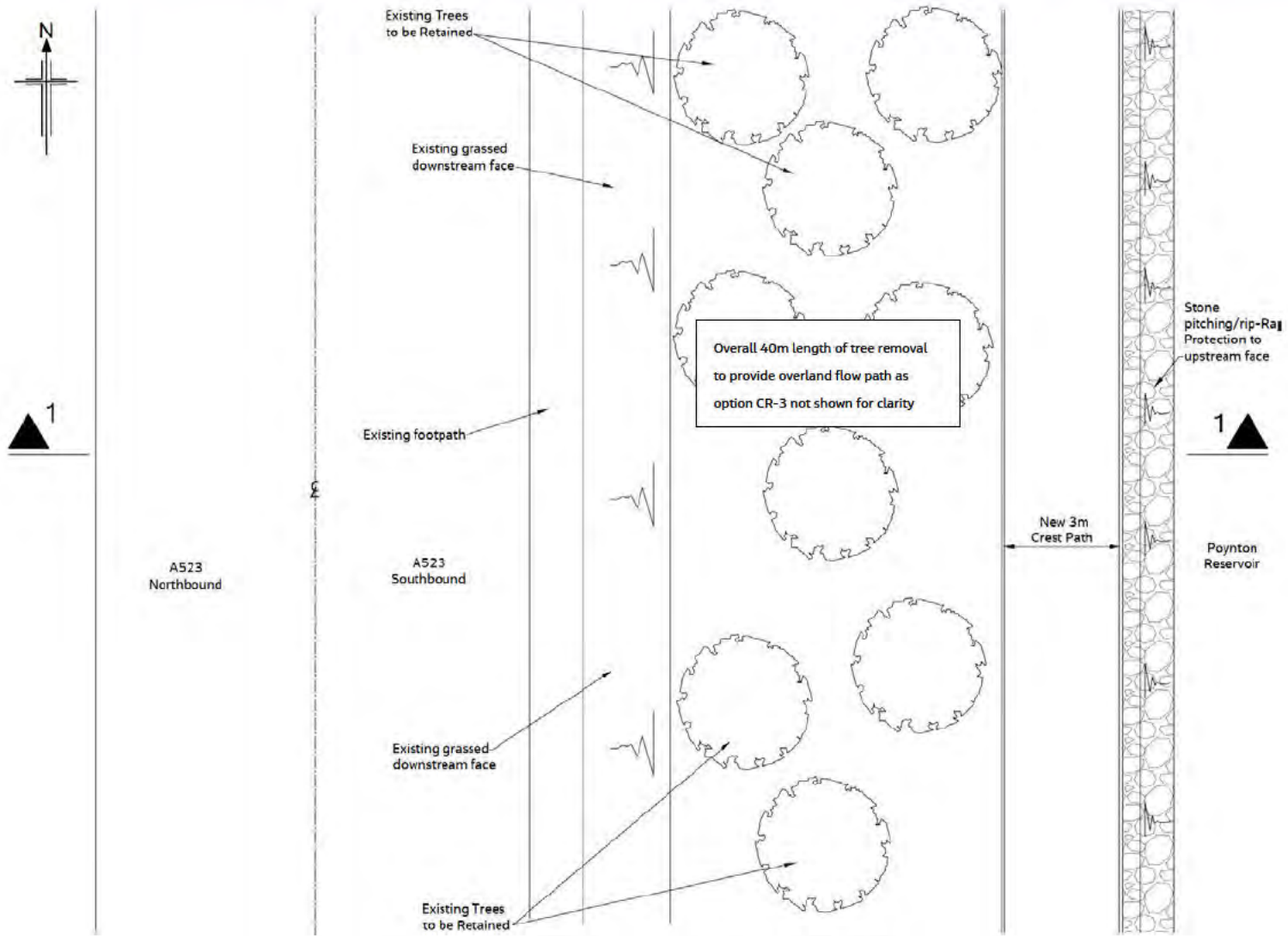


Option 3C (i) - Section 1-1 Looking North Through Proposed Works

Scale 1:100



Sketch CR-5

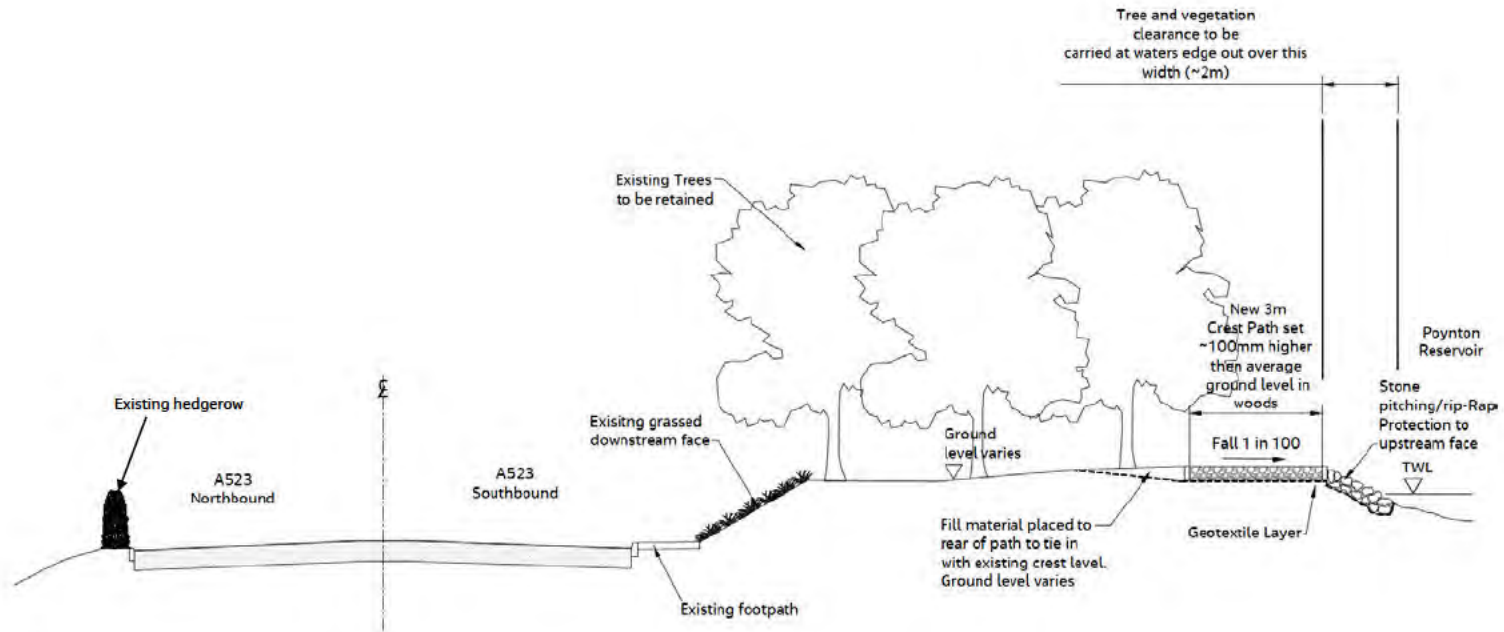


Option 3C (ii) - Plan of Proposed Works

Scale 1:100

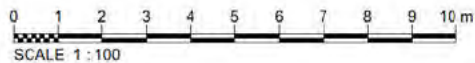


Sketch CR-6

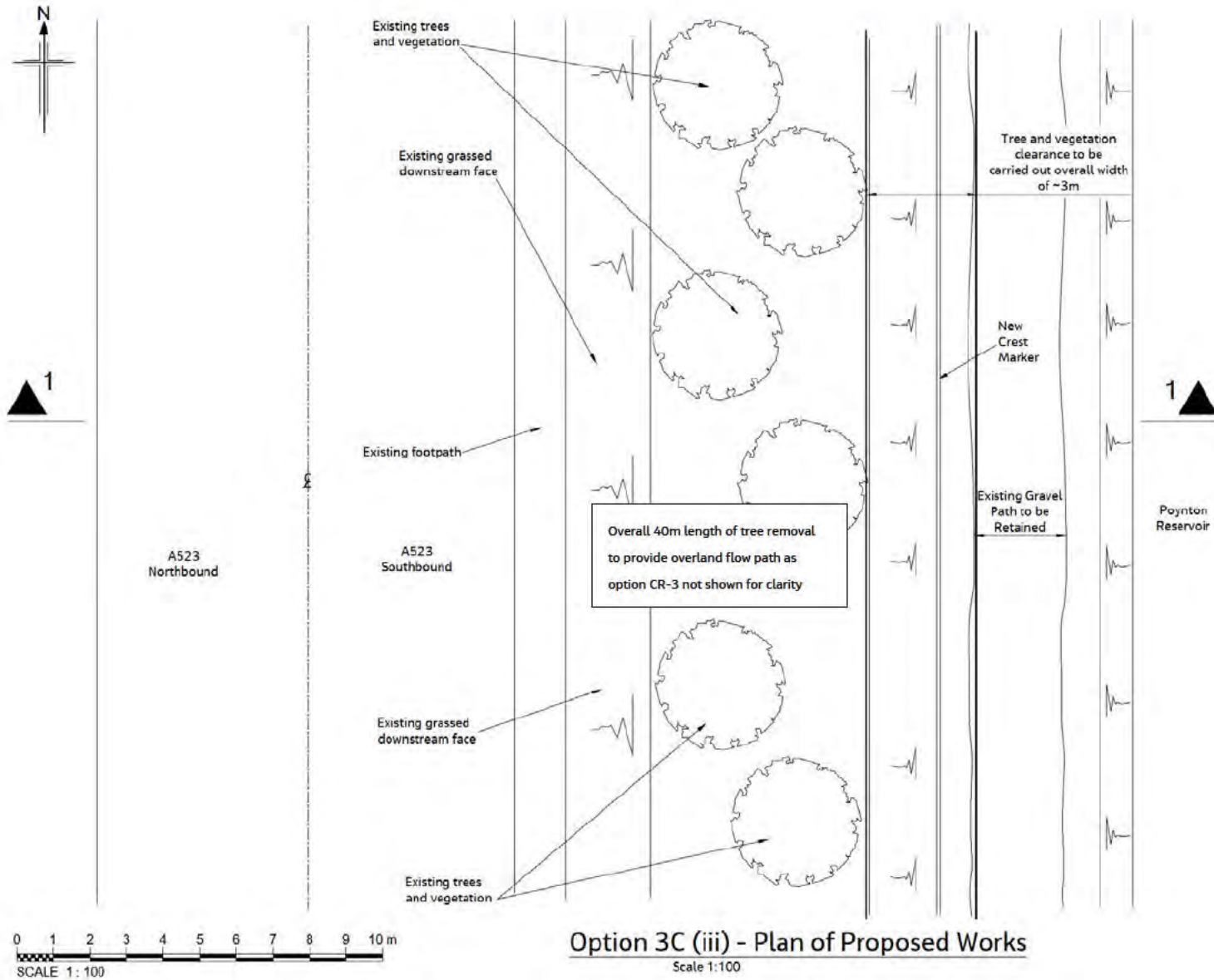


Option 3C (ii)- Section 1-1 Looking North Through Proposed Works

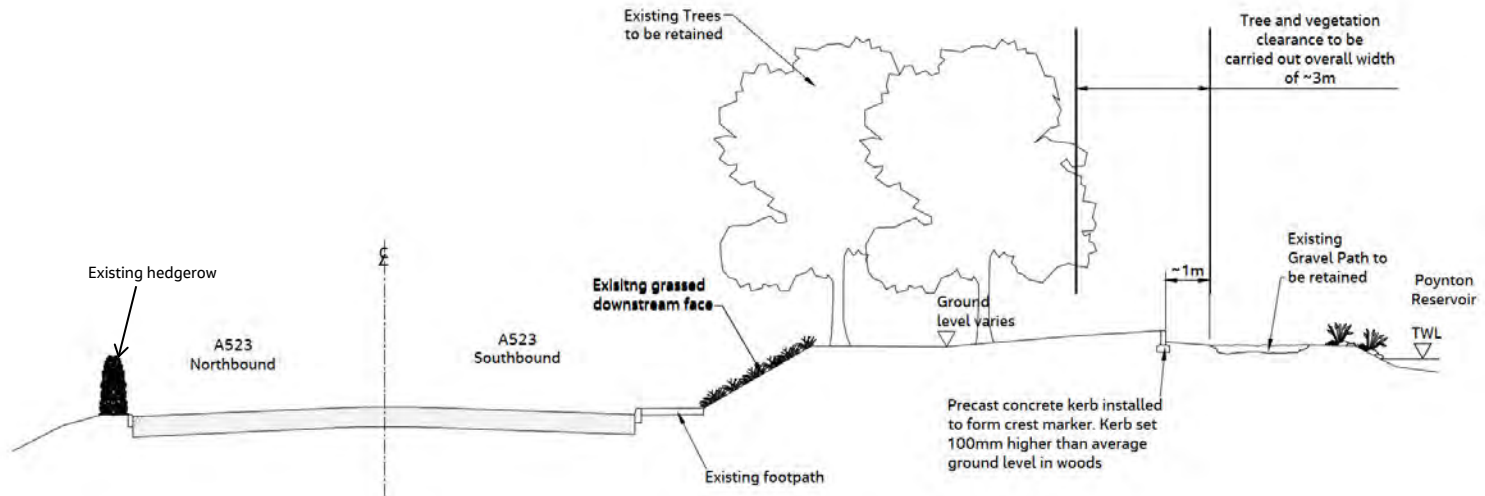
Scale 1:100



Sketch CR-7

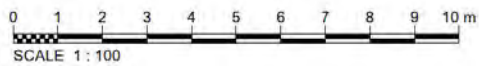


Sketch CR-8

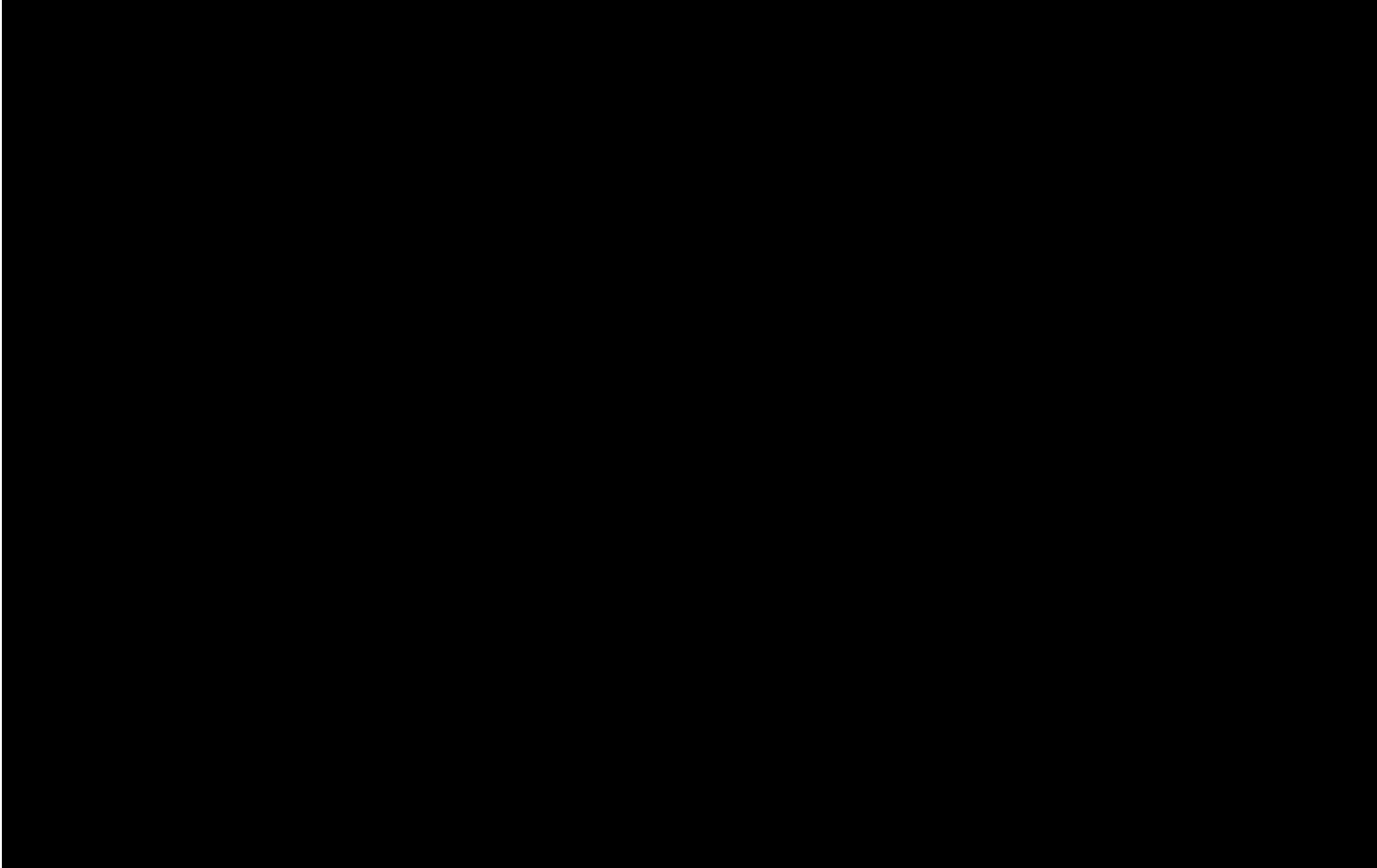


Option 3C(iii) - Section 1-1 Looking North Through Proposed works

Scale 1:100

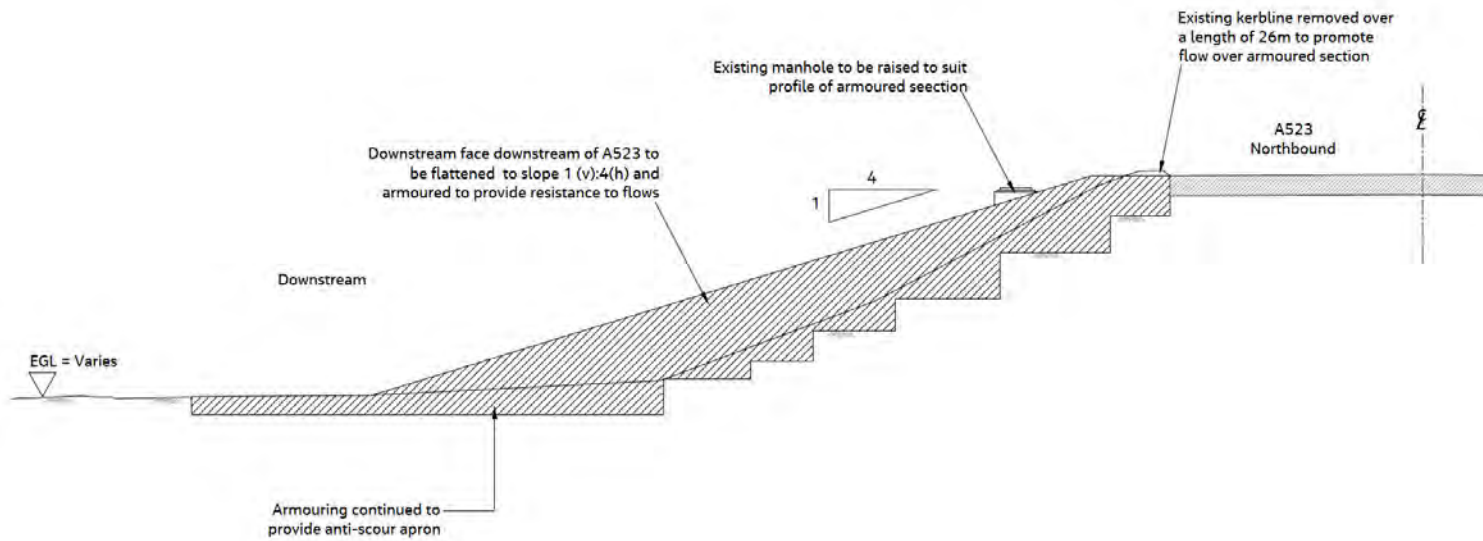


Spillway Upgrade : Further Investigation of Option 3C



Spillway Upgrade : Further Investigation of Option 3C

Sketch CR-10



Section Looking North Through Proposed Armoured Downstream Slope

Scale 1:100

