TECHNICAL NOTE

DATE:	25 September 2024	**CONFIDENTIALITY:**	Public
SUBJECT:	Updated Options Statement – Revision 2		
PROJECT:	70092067 – Dinah's Hollow	**AUTHOR:**	B Ward
CHECKED:	S Rhodes	**APPROVED:**	A Indoe

1 INTRODUCTION

1.1 WSP UK Ltd (WSP) have been instructed by Dorset Council (DC), the Client, to undertake an updated appraisal of the previously presented options to stabilise the slopes at Dinah's Hollow.

1.2 The scope of this technical note is:

- To provide a summary of the options considered as part of the design development;
- To provide commentary on more broadly discussed alternative proposals; and
- To summarise the ecological mitigation strategy developed alongside the preferred option.

1.3 The review of options discussed in this technical note relate solely to the stabilisation measures for the Holloway slopes. Any drainage measures and highway improvements are beyond the scope of this technical note.

2 PROPOSED OPTIONS

2.1 Proposed options are discussed in detail in the Dinah's Hollow Stabilisation Options Report [1].

2.2 The table below provides a summary of those options and comments on suitability.

Table 1 - Stabilisation Options Summary

Option	Solution	Comments
Slope re-grade	Discounted	- Significant land take, material removal and associated costs. - Unacceptable visual and ecological impact.
Retaining structures	Discounted	- Significant construction constraints on site. - High levels of cost. - Unacceptable visual and ecological impact.
Vertical realignment	Discounted	- Not considered suitable to contribute to slope stability improvements if used in isolation. - Site geometry may not be suitable for standard highways alignments. - Realignment of services and drainage would be required, with associated costs and disruption.

Option	Solution	Comments
Bio-engineering*	Discounted	- Limited to typically 1m below surface, and insufficient to resist deeper slip surfaces. - No reliable method to quantify or guarantee vegetation as a stabilisation measure, with particular reference to difficulties establishing certain plant species within the Hollow. - Cannot meet the design life requirements without significant maintenance and planning.
Passive barriers	Discounted	- Not suitable for fine particle / debris style flows failures previously observed at the site. - High visual impact and signifcant engineering works required to construct catchfence at certain locations within the site extents. - Due to site geology and the aperture of mesh used in typical barrier applications, solution unlikely to fully contain a landslip event, resulting in road closures to remove debris. - Undefined maintenance costs over design life, to repair barriers following landslip events.
Soil nailing	Preferred	- Minimal removal of in-situ material and land take. - A proportion of existing vegetation can be retained. - Native vegetation can be re-introduced to maintain habitat diversity. - Lowest visual impact.

* *further discussion is provided in the remaining sections of this techincal note*

2.3 Previous assessments of the observed and potential instabilities present at Dinah's Hollow indicate that slip surfaces of greater than 1m in depth have occurred and are also evidenced through back analysis of slope stability [1]. Vegetation as a remedial solution without other stabilisation measures is not recommended for the mitigation of landslide risk, where assets have previously been affected by slope failures [2].

2.4 Therefore, the application of bio-engineering as the sole stabilisation measure is not considered a robust long term stabilisation solution. The potential risks and disadvantages are further highlighted below:

- Potential installation difficulties within the anticipated ground conditions for techniques such as the installation of willow poles [3];
- Concerns over reliable plant establishment;
- High risk highway environment previously affected by landslides;
- Steep sided slopes with observed and potential slip surfaces greater than 1m; and

- Increased maintenance and management requirements.

2.5 It is recognised that vegetation assists in the very near surface stabilisation of soils and reduction of erosional effects. As referenced in BS 6031:2009 Code of Practice for Earthworks, the benefits highlighted include the reinforcing action of roots and moisture content control [4]. The promotion of vegetation re-establishment will be achieved through incorporation of a planting scheme within the proposed stabilisation solution, this is discussed further in the Ecological Mitigation section below.

2.6 Soil nailing has been considered the most appropriate solution to ensure the global stability of the Holloway slopes and balances the aspects of implementing sustainable engineering solutions against the requirements to reduce the risk to the general public, operatives and maintain long term operation of the highway.

3 ALTERNATIVE PROPOSALS NOT CONSIDERED SUITABLE

ELECTROKINETIC

3.1 Electrokinetic strengthening of slopes utilises the process of electro-osmosis to transport water through fine grained soils with low hydraulic permeability. The technique is applied to fine grained soils which are clay or cohesive soils [5]. The process is not considered suitable in coarse grained soils, which generally have a relatively high hydraulic permeability, such as sands. The geology of Dinah's Hollow has been mapped as the Shaftsbury Sandstone Member passing into the Cann Sandstone Member at the lower, southern end of the Hollow, both of Cretaceous Age. The geological materials of Dinah's Hollow comprises weakly cemented, weak to medium strong medium grained sandstone, weathered to a silty sand. There is evidence on the exposed faces of the Hollow slopes that a localised degree of cementation remains. As such, this material is predominantly a coarse-grained soil and is therefore not considered suitable to be treated using electrokinetic techniques. This is further supported by a review of soil testing against acceptability criteria for the treatment, in which the majority of the values for the insitu material are outside the acceptable ranges [6].

3.2 It should be noted that to strengthen suitable slopes using electrokinetic techniques requires the insertions of anodes and cathodes, which to operate at safe operating voltages need to be installed at close spacings. The power for this system would likely be produced by a diesel generator operating continuously for an extended period of time. The spacings for the anodes and cathodes may be closer than those required for a soil nail and flexible facing system. There is also limited evidence on the long-term performance of Electrokinetic systems and in particular no examples where this system has been used on slopes with gradients similar to those found at Dinah's Hollow.

4 LANDSCAPE AND ECOLOGICAL MITIGATION

4.1 A Landscape and Ecological Mitigation strategy has been developed in conjunction with DC, the details of which can be found in the Landscape and Ecology Report [7].

4.2 A summary extract has been provided below, which outlines the mitigation proposed as part of the stabilisation scheme. This includes:

- Retention of trees to maintain a wooded habitat;
- Retention of as many trees along the west and eastern slope crest lines;
- Key trees of landscape, ecological and amenity value retained on the upper slopes;
- Retention of existing topsoil and avoidance of introducing soils;

- Coppicing of appropriate trees and shrubs;
- Replanting through a range of hole sizes in the mesh facing; and
- Implementation of other planting associated with the eastern drainage works and in other agreed locations such as along the crest of the western slope where opportunities allow.

4.3 It shall be noted that a number of trees and low-lying vegetation will be removed in order to undertake the works. The removal of selected trees is required to enable construction, reduce slope loading, ensure the integrity of the soil nail system, as well as generally reducing any identified current and future maintenance risks.

5 SUMMARY

5.1 The potential stabilisation options have been reviewed for the proposed Dinah's Hollow stabilisation scheme.

5.2 Soil nailing is considered the most appropriate long-term solution to stabilise the slopes of the Hollow, whilst balancing the sensitivity of the environment and maintaining existing landscape and habitat.

5.3 The facing system used in conjunction with the soils will comprise a tensioned flexible mesh combined with erosion protection matting. The erosion protection matting will support re-establishment of vegetation around the retained trees and contribute to surface soil stability, whilst allowing for a return to the typical visual appearance of the Hollow.

REFERENCES

[1] Parsons Brinckerhoff, “Dinah's Hollow Stabilisation Options Report Issue 2,” Parsons Brinckerhoff, London, 2014.

[2] CIRIA, “CIRIA C810 Natural slopes and landslides - condition, assessment, and mitigation,” CIRIA, London, 2023.

[3] TRL, “TRL Report 508 A review of the use of live willow poles for the stabilising of highway slopes,” TRL Limited, 2001.

[4] Bristish Standard, “BS 6031:2009 Code of practice for earthworks,” BSI Standards Publication, London, 2010.

[5] Ground Engineering, “Technical paper: Validation of electrokinetic stabilisation of M5 Junction,” 2019.

[6] ICE, “Electrokinetic geosynthetics: from research to hype to practice,” *ICE Proceedings,* vol. 170, no. CE3, 2017.

[7] T. Harris and D. Alder, “Landscape and Ecology Report Dinah's Hollow Melbury Abbas,” 2024.