



Ballater Flood Protection Study

Defence Condition Survey

April 2018

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1 INTRODUCTION

1.1 BACKGROUND

Ballater is located within the Cairngorms National Park in West Aberdeenshire, Scotland. The River Dee, which is a Special Area of Conservation for salmon, trout, otters and freshwater pearl mussels, flows through Ballater. The confluences of the River Gairn and the River Muick with the Dee are also located within the town (Figure 1.1).

The Ballater Flood Protection Study (FPS) focuses on management of the main source of flood risk from the River Dee and its two significant tributaries - the Rivers Gairn and Muick. The FPS is being undertaken as part of the current cycle of the Flood Risk Management Plan.

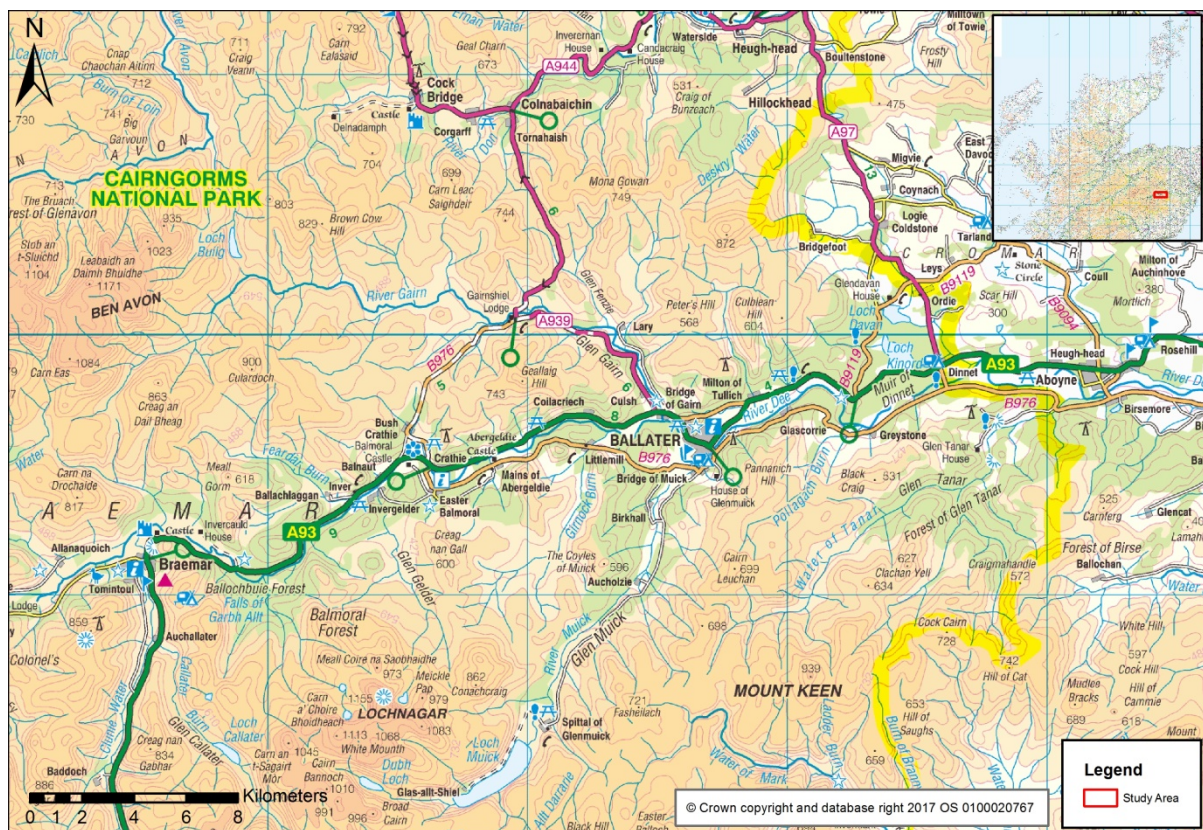


Figure 1.1 Location of Ballater, West Aberdeenshire

1.2 OBJECTIVES OF THE STUDY

The aims of the Ballater Flood Protection Study are summarised below:

- Undertake site visits and topographical surveys of the relevant reach of the upper River Dee, including the associated tributaries the River Gairn and River Muick to understand the local flood flow pathways and flood history.
- Complete a hydrological assessment to include and update of the hydrology for the three watercourses and incorporation of the available river gauges and completion of hydrological analysis to determine the design flows at Ballater. Also to derive inflows for 50%, 20%, 10%, 3.33%, 2%, 1%, 0.5%, 0.1%, 3.33% plus climate change and 0.5% plus climate change fluvial annual exceedance probabilities (AEP).
- Construct and deliver a new hydraulic model extending over all River reaches.
- Complete an environmental walk-over of the site, scope environmental impacts and complete an environmental survey.
- Undertake a visual condition assessment of the existing flood defences in Ballater.
- Calibrate the Ballater model through simulation of at least three events and verify performance through simulation of at least one event. Likely events include: December 2015.
- Undertake sensitivity analysis for the 0.5% AEP (1 in 200 year return period) event and/or the AEP closest to bank top level.
- Produce flood mapping for a number of design events with and without defences for 50%, 20%, 10%, 3.33%, 2%, 1%, 0.5%, 0.1%, 3.33% plus climate change and 0.5% plus climate change fluvial AEPs.
- Develop options to manage flood risk and provide recommendations for the most sustainable option.

The purpose of this report is to document the findings of the visual condition survey undertaken for the existing informal flood defence structure along the River Dee in Ballater, as indicated on Figure 1.2. Details of the work undertaken to fulfil the other objectives is located in separate reports.

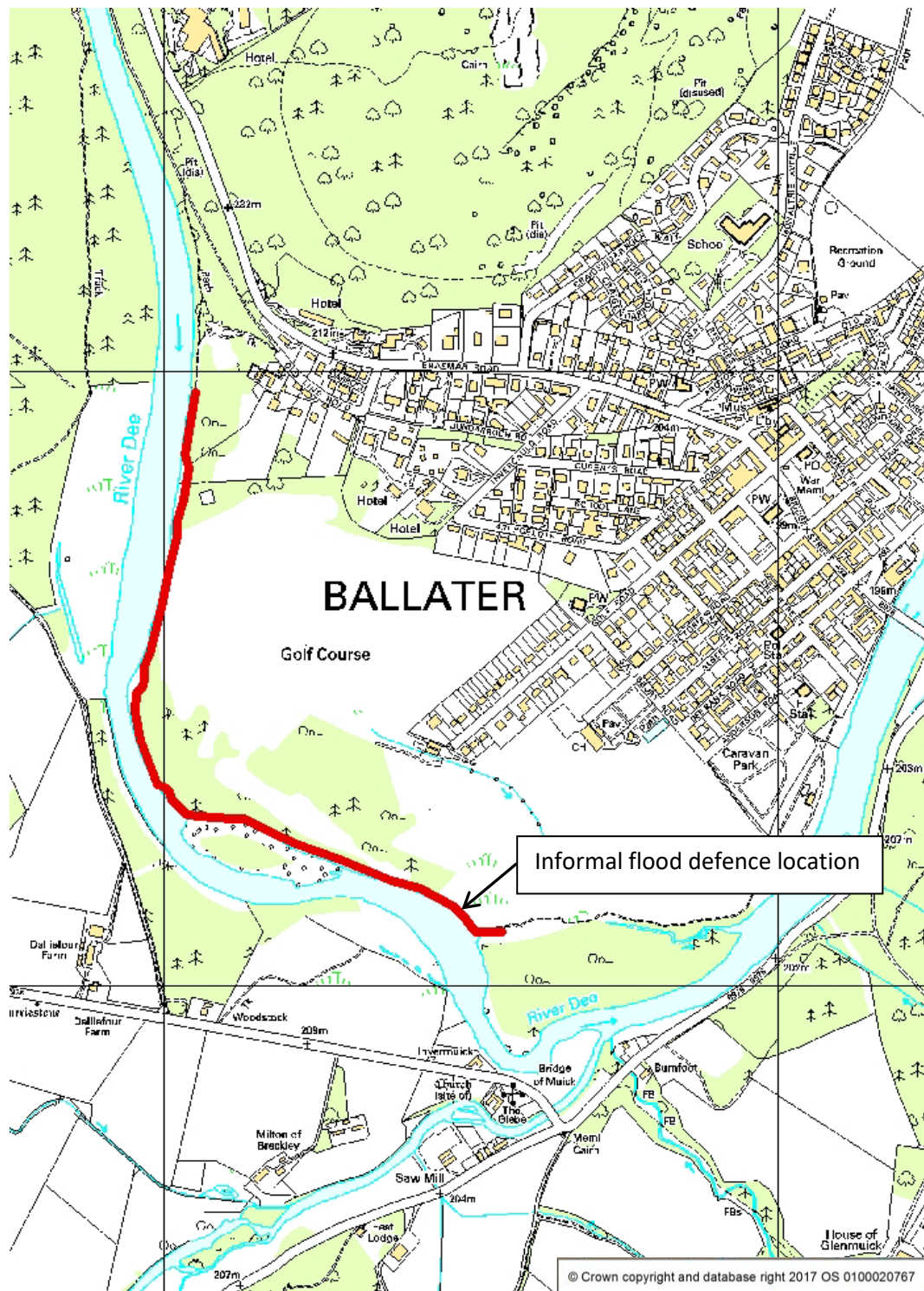


Figure 1.2 Location of informal flood defence in Ballater

2 DEFENCE CONDITION SURVEY

2.1 RECORD DRAWINGS

Aberdeenshire Council supplied RPS with a brief record of repairs that were undertaken by the Council in 2016. No other records relating to the structures along the Dee at Ballater were provided, consequently the inspection and condition assessment have been completed without detailed knowledge of the construction of the defences or the sequence of development.

2.2 VISUAL CONDITION ASSESSMENT

An experienced Coastal/River Engineer from RPS visited Ballater on 18th and 20th April 2018 to undertake a visual inspection of the existing defences, based on the procedures set out in the Environment Agency Condition Assessment Manual. Weather conditions during the survey were fair, although river levels were elevated as a result of snow melt. The surveyor initially walked the length of the defences in the company of a representative of Aberdeenshire Council starting at Salisbury Road and working upstream. A subsequent follow up visit was undertaken to check anomalies in initial GPS positions and re-examine key areas.

A series of photographs were taken during the walkover survey (Figure 2.1 and Plates 1 to 25). No evidence of any raised embankment or other flood defence structure was observed at the Caravan Park or along the section of the River Dee extending westwards from the upstream boundary of the caravan park along the southern boundary of the Golf Course. The first flood defence embankment was encountered at Grid Reference 36549,95086 and extended upstream along the bank of the River Dee until circa grid reference 36049,95965 (as shown in Figure 1.2).

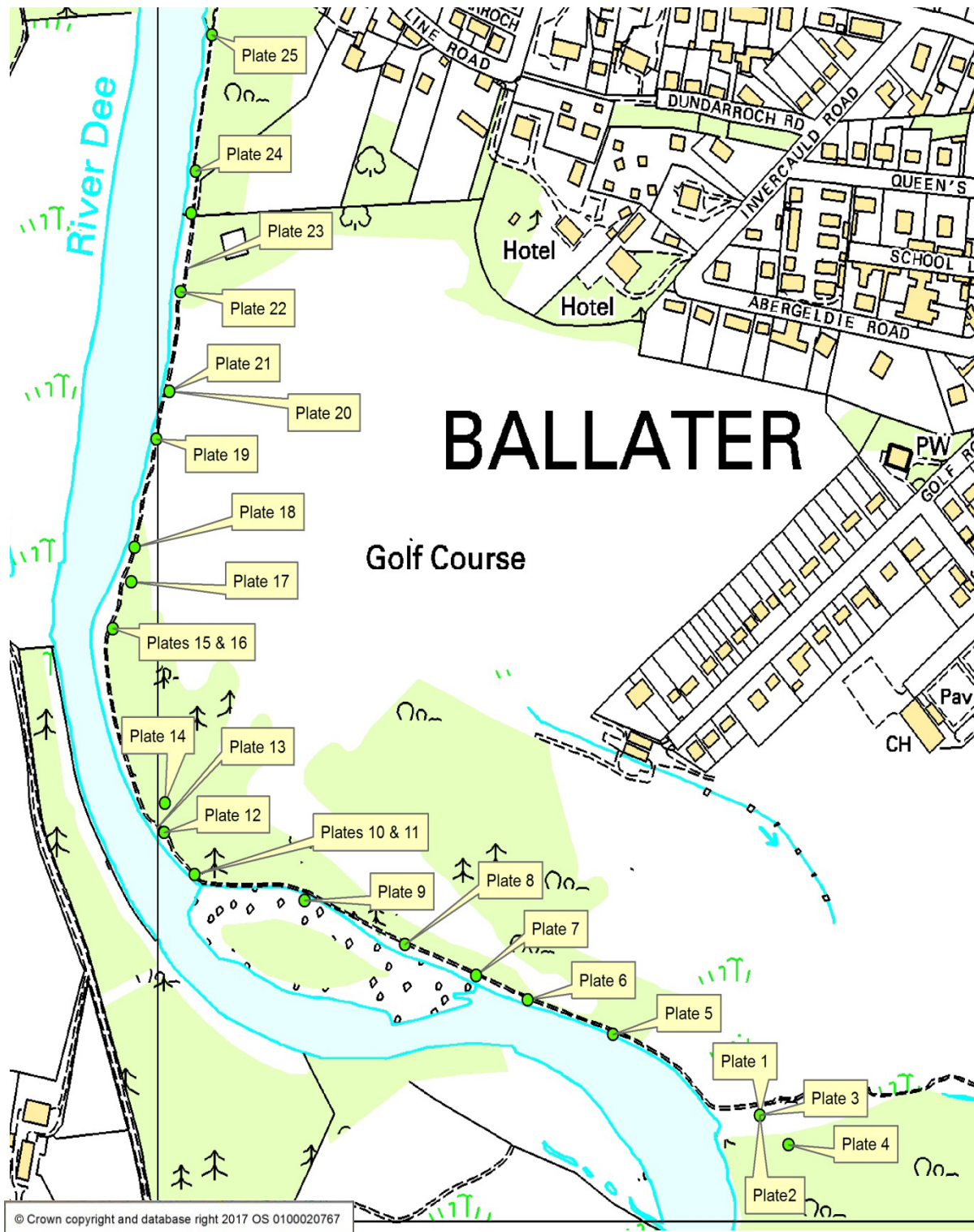


Figure 2.1 Location of each Plate on informal flood defence in Ballater



Plate 1: Embankment at south end of Golf Course looking NW



Plate 2: Embankment at south end of Golf Course looking SE



Plate 3 View from embankment at south end of Golf Course looking towards Caravan Park

The embankment between 36617,95012 and 36465,95159 was observed to be constructed of river bed material and the observed lack of significant vegetative cover indicates this to be of relatively recent construction. The extensive cover of deposited cobble and gravel on the land behind this section of the defences, shown in Plate 3, was considered indicative of a recent breach and extensive inundation by flood waters. This observation was further reinforced by the presence of extensive tree debris within the forested area to the east of this defence as shown in Plate 4. The embankment in this area stands between 1.5 and 2m above the ground behind with a crest width of 2-3m.



Plate 4: Tree debris behind the defences at the south end of the golf course

This section of the Ballater flood defences was assessed to be in **Fair** to **Poor** condition on account of the steep faces of the embankment and the lack of significant stabilising vegetation.

Continuing north-westward along the embankment the formation changes to incorporate a boulder toe on the river side as shown in Plate 5. This form of construction extends from 36465,95139 to around 36323,95186 beyond which the boulder toe ceases although erosion protection is provided by a vegetated bank of river deposits. It was part of this section of the embankment that was the subject of the repairs Aberdeenshire Council undertook in 2016.

The core of the embankment appears to be composed of a mix of cobble, gravel and sandy soil, potentially river bed material, however it is significantly more heavily vegetated than the embankment to the south, as shown in Plate 6. The ground to the rear of this section of the embankment was noted to be significantly higher than to the south with the embankment height being observed to be circa 1m with a similar crest width to the previous section of the embankment. There was no significant evidence of the deposition of material on the ground behind or of recent breach/over-topping of this section of the embankment. In general this section of the embankment was classified as being in **Good** condition.



Plate 5: River side embankment with boulder toe



Plate 6: Vegetation on section of embankment with boulder toe

Continuing westwards the embankment remains in **Good** condition, Plates 7 and 8, until approximately 36133,95261 where the river side face was observed to be partially eroded, Plate 9. This was considered to most likely be due to pedestrian activity given the very localised nature of the erosion although it is possible that it was the result of the removal of a large tree and root system during recent floods. However the damage is such that this localised section was assessed as being in **Poor** structural condition due to the exposure of the core material.

This section of the embankment has a relatively low height (1-1.5m) and good crest width (circa 3m). Again the embankment appears to have been formed from typical river/glacial deposits with evidence of cobble visible amongst the vegetative cover.



Plate 7: Typical view of embankment beyond Golf Road



Plate 8: Typical view of embankment



Plate 9: Partial breach of embankment at 36133,95261

The embankment continues in a similar form with extensive vegetation, including mature trees evident until circa 36000,95275 as shown in Plates 10 and 11.



Plate 10: Pathway on embankment crest



Plate 11: Mature trees both sides of embankment

Beyond 35005,05316 the embankment appeared to have been recently re-constructed, re-profiled using sand and gravel as shown in Plates 12 and 13. These works appears to be in response to the

previous embankment having been over-topped as evidenced by the present of riverine detritus and debris scattered amongst the forest area behind, Plate 14.



Plate 12: Re-profiled embankment



Plate 13: Un-vegetated face of re-profiled embankment



Plate 14: Riverine deposits behind embankment, including former fisherman's hut

This condition of the repaired section of the embankment was classified as being **Poor** to **Very Poor**, principally on account of the nature of the material used and the lack of vegetative cover to resist erosion and hold the material in place. It is likely that over time vegetation would establish on this section of the embankment, however even with this in place the condition grading is unlikely to be better than Fair.

The repairs / re-profiling of the embankment continues with some brief interruption to circa 35958,95482 beyond which it reverts to a similar vegetated form to the previous sections although in this area there was more exposed cobble noted on the river side, Plates 15 and 16. It was not obvious from the visual inspection if this was the remnants of a deliberate attempt to armour the exposed face of the embankment or simply the results of selective erosion having removed much of the finer material, however the embankment appeared relatively stable as evidenced by the presence of mature trees growing out of the river facing slope. The embankment continues in this form, Plate 17, until the 14th Tee.

This section of the embankment was assessed to be in **Good** condition at the time of the site inspection.



Plate 15: Typical view of embankment south of the 14th Tee



Plate 16: Embankment south of the 14th Tee showing exposed cobble



Plate 17: View of embankment approaching 14th Tee

Alongside the 14th Tee there was a noticeable gap in the presence of mature vegetation on the embankment, Plate 18. It is not known if this is a result of deliberate vegetation management or the consequence of a reported breach during storm Frank.



Plate 18: Scrub vegetation on embankment at 14th Tee

Irrespective of the reason for this lack of mature vegetation the riverside face of the embankment was observed to be “armoured” with exposed boulders and cobble as shown in Plate 19, which was assessed to be in Good condition. There was no evidence of armouring on the landward face and the vegetation cover was limited to grass, but again this would warrant a **Good** classification.



Plate 19: Exposed cobbles/boulders on river side of embankment at 14th Tee

Immediately north of the 14th Tee the landward face of the embankment was composed of built masonry as shown in Plate 20. This form of construction may also have extended to the riverside face, however it is now interrupted by the establishment of mature trees and other vegetation as shown in Plate 21. Generally this section of the embankment appeared to be in **Fair** condition.



Plate 20: Masonry revetment to rear face of embankment north of 14th Tee



Plate 21: River face of embankment north of 14th Tee

North of approximately 36020,95756 the riverside path drops off the crest of the embankment to run along the ground behind the embankment as shown in Plate 22 and continues like this until circa 36034,95854. The embankment along this section comprised a narrow bank approximately 1.2-1.3m high with no significant crest, Plate 23.



Plate 22: Transition of riverside path from top of embankment to land behind



Plate 23: Typical view of embankment north of 36020,95756

This embankment appears to be formed of a pile of predominantly cobble and while vegetated there were numerous holes visible as shown in Plate 24. These holes did not show any clear evidence of being animal burrows and are thought to be related to the makeup of this structure being predominantly large cobbles and boulders with little fine material. The structure was assessed as being or **Poor** condition.



Plate 24: Holes in raised embankment

North of approximately 36034,95854 the path again re-joins the riverbank with a low “embankment” running along the landward side of the path as shown in Plate 25 as far as 36049,95965 beyond which no form of flood defence was observed. This structure was noted to be circa 0.5m in height with a similar crest width and was assessed as being in **Good** condition.



Plate 25: **Low embankment on landward side of path**

2.3 SUMMARY OF DEFENCE CONDITION ASSESSMENT

In summary the visual assessment of the existing flood defence structures at Ballater undertaken by RPS shows that the condition of the existing defences ranges from Good to Very Poor with the lower grading generally applying to areas that appeared to have been repaired recently where vegetation cover was almost absent. Thus with time and vegetation establishment may provide some erosion protection and hence allow these structure to be re-graded as Fair and possibly Good although that is probably dependent on the number and frequency of flood events that they are subject to during this period.

While the preceding assessment has considered the condition of the embankment slopes the presence of the unbound path along the crest of virtually all of these defences represents a potential weakness should they be overtopped and there is nothing to bind this material together and resist erosion. Thus in terms of the EA condition assessment guidelines virtually all of the structures could only achieve an overall grading of **Fair**.