



Sustainable Development

ENVIRONMENTAL MANAGEMENT  
SYSTEM

[Appin Area 7](#)

[Longwall 701-710](#)

**Cliff and Steep Slopes  
Safety Management Plan**

**October 2009**

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**Document No:** P **Responsible Officer:** \_\_\_\_\_  
**(Manager Environmental Approvals)**

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**(Manager Mining Approvals)**



*Licence Number*

*CEM 20004*

# ENVIRONMENTAL MANAGEMENT SYSTEM

## Appin Area 7

### Longwall 701-710

## Nepean River Valley Cliff and Steep Slopes Safety Management Plan

***Revision 1: 6 November 2008***

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# Appin Area 7 Longwall 701-710 Nepean River Valley Cliff & Steep Slopes Safety Management Plan

## Table of Contents:

<b>1.</b>	<b>Introduction</b>	<b>1</b>
1.1	Objectives	2
1.2	Scope	2
1.3	Limitations and Assumptions	3
1.4	Definitions	4
<b>2.</b>	<b>Principal Identified Hazards</b>	<b>5</b>
<b>3.</b>	<b>Monitoring of Cliffs and Steep Slopes</b>	<b>6</b>
<b>4.</b>	<b>Control Procedures and Response Action Plans</b>	<b>6</b>
4.1	Initial Control Measures	6
4.2	Inspections and Investigations	7
4.3	Reporting Procedures	8
4.4	Response Action Plans	9
<b>5.</b>	<b>Training</b>	<b>10</b>
<b>6.</b>	<b>Resources Required</b>	<b>10</b>
<b>7.</b>	<b>Roles and Responsibilities</b>	<b>10</b>
7.1	General Manager Environment and Sustainable Development	11
7.2	Manager Mining Approvals	11
7.3	Manager Environmental Approvals	11
7.4	Principal Geoscientist	12
7.5	Survey Services Manager	12
7.6	Technical Experts	12
7.7	Person(s) Performing Cliff Face And Edge Inspections	12
<b>8.</b>	<b>Plan Monitoring and Corrective Action</b>	<b>13</b>
<b>9.</b>	<b>Communications</b>	<b>13</b>
<b>10.</b>	<b>Record Keeping and Control</b>	<b>13</b>
<b>11.</b>	<b>Document Control</b>	<b>14</b>

## 1. Introduction

BHP Billiton Illawarra Coal (BHPBIC) is planning to extend its underground coal mining operations at Appin Colliery by extracting coal from the Bulli Seam using longwall mining techniques in Appin Area 7. The proposed longwalls are located west of the Nepean River between the Douglas Park and Menangle Weirs. Natural features have been identified within the vicinity of the longwalls, including cliffs and steep slopes adjacent to the Nepean River.

Extraction of coal by longwall methods results in disturbance to the surface above and adjacent to the zone of extraction. In addition to vertical subsidence, horizontal ground movements may occur. These movements are particularly important where the surface topography includes gorges, cliffs and steep slopes. These horizontal movements may be directed towards the extracted mining area, or in the direction of the principal horizontal in-situ stress. Such movements may be observed well beyond the vertical projection of the excavation. Following completion of mining of a longwall block, movement above and adjacent to the extracted area will continue for some time until maximum subsidence and horizontal movement is complete.

The standards relating to initial control actions, the surveying and inspection regime and the responses to pre-determined conditions resulting from movement are addressed in this Management Plan.

A total of 133 cliffs were identified within the general application area adjacent to the Nepean River using remote sensing and field mapping techniques. The stability of a cliff can be affected by mining due to the differential movements that occur along the length or height of the cliff. The differential movements induce stresses within the rockmass which, if sufficiently large, can result in sections of the rock to crack and potentially result in instability. The impact of mining on cliffs can be affected by a number of factors, discussed in detail in the cliff study carried out for the project (MSEC, 2008). The extent of cliff lines and steep slopes in Appin Area 7 is shown in Appendix A.

The majority of the observed cliff instabilities due to mining have occurred after the cliffs have been directly mined underneath and, therefore, have been located over the goaf. Very few (one possible event in the Cataract River associated with Longwall 302) cliff instabilities as a result of longwall mining have been observed outside mined goaf areas in the Southern Coalfield.

Longwalls 701-710 do not directly mine beneath any of the identified cliffs. The identified cliffs are all located a minimum distance of 90 metres from the goaf edges of the proposed longwalls. Consequently, based on the proximity of mining to the cliffs alone, it is considered unlikely that any cliffs will become unstable due to mining of Longwalls 701-710. The subsidence study also concluded that the slopes outside the Nepean River Valley and the alignments of the creeks would be likely to remain stable during and after mining, and that the

chance of soil slippage is small (MSEC, 2008). However, it is possible that some remediation might be required to ensure that mining-induced cracking does not result in the formation of soil erosion. In some cases, erosion protection measures may be needed, such as the planting of additional vegetation in order to stabilise the slopes in the longer term.

Although mining is unlikely to destabilise cliffs and steep slopes, the cliffs in the area are already inherently unstable. Consequently there is the possibility that a rock fall associated with the cliffs may occur naturally during or following the period of mining.

## 1.1 Objectives

This management plan has been developed to prevent environmental impacts and personal injuries as a result of cliff and steep slope instability. This will be achieved by regular monitoring of ground movement and rock face stability in potentially unstable areas and implementing appropriate controls where necessary.

To achieve this it is necessary to define:

- ❑ the surveying locations, standards and frequencies to apply to subsidence and horizontal movement monitoring of the surface topography above, and in areas of the gorge adjacent to and potentially affected by, Longwalls 701-710,
- ❑ the standards relating to initial controls, and in particular warning signs and fences that may be needed,
- ❑ ongoing inspections of the area to monitor cliff face and edge instability,
- ❑ the responses to pre-determined conditions relating to any observed ground movement or deterioration of the cliff faces or edges, and
- ❑ responsibilities for the various actions and responses required. This may include sediment controls and revegetation to prevent soil erosion.

Ground movements, including the disturbance of cliff faces, will be regularly assessed. This will contribute to an improved understanding of the effects of mining on steep slopes, cliffs and gorges, and assist the management of the area to minimise risk to members of the public and landowners. It is anticipated that the monitoring will confirm that no mining induced instability has been generated.

## 1.2 Scope

This Management Plan addresses controls and responses associated with risks to landholders, the public and personnel working within the vicinity of Longwalls

701-710 and possible instability of cliffs and steep slopes in the Nepean River gorge and small tributary creeks. It is recognised that direct overland public access is restricted by private property to this area however, access via the Nepean River is possible for the public. The Plan also applies to any person in any capacity requiring that person to carry out activities required by this plan.

The Plan relates specifically to the potential consequences of surface instability in the vicinity of Longwalls 701-710. Results obtained by the monitoring associated with this Plan will be used to determine ongoing monitoring requirements, appropriate controls and responses relating to potential surface instability associated with the extraction of future longwalls.

### **1.3 Limitations and Assumptions**

This Management Plan uses a combination of initial controls, ongoing monitoring, inspections and investigations and appropriate responses to identified adverse conditions to minimise risk to personnel that may enter the Nepean River valley from exposure to ground instability in the area.

While it is the intention of BHPBIC to maintain safety at all times, there are certain limitations that need to be recognised, despite the fact that mining induced cliff and slope instability is not likely in Appin Area 7.

- ❑ There is natural instability associated with the cliff faces and edges in the area.
- ❑ The interaction of mining induced movements on the natural instability of cliff faces and edges cannot be precisely quantified.
- ❑ Results from inspections, photographing and monitoring cliff faces and edges in the more heavily vegetated areas of the Nepean River valley will not be as precise as non-vegetated areas.
- ❑ In the absence of information to the contrary, the effects of mining Longwall 701-710 will be similar in nature and magnitude to those associated with previous longwalls located in similar areas and the initial controls implemented will be based on this assumption.
- ❑ It is difficult to quantify the risks associated with rock falls and while the probability of resultant injuries may be remote, the potential consequences are severe. Controls will be implemented on this basis.
- ❑ The Nepean River valley is rugged and relatively difficult to traverse on land with only a limited number of practical access points. With the approval of the landholder, warning signs will be prominently displayed at these locations. It is expected that observational monitoring will be undertaken from the river using boat access.

## 1.4 Definitions

Nepean System	That area of the river that will potentially be affected by mining of longwalls at Appin Colliery.
DPIM	Department of Primary Industries Mineral Resources.
Geotechnical	The predicted reaction of the rock mass to induced stress when considering local geological characteristics such as stratigraphy, jointing, faulting and weathering.
Management Plan	This management plan, viz <i>Cliff and Steep Slopes Safety Management Plan Longwalls 701-710</i> .
Public	Any person entering the Nepean River valley or accessing its perimeter along the cliff tops. It is noted that public access to the land associated with Area 7 is restricted however access via the River is possible.
Subsidence	Movements at the surface resulting from coal extraction, including the difference between the surface level at a point before and after a panel is mined. It is considerably less than the thickness of coal removed.
SD	BHP Billiton Illawarra Coal <i>Sustainable Development &amp; External Affairs Department</i> .

## **2. Principal Identified Hazards**

Potential hazards associated with natural instabilities, horizontal ground movement, local stress redistribution and other subsidence related effects, applying to the cliff faces, steep slopes and edges of the Nepean River valley and tributaries include:

- Rock falls resulting in injury to persons.
- Unstable ground associated with the steep slopes, faces and edges of cliffs leading to the risk of persons falling.
- Unstable ground associated with the faces and edges of cliffs resulting in injury to persons walking through these areas.

It is considered that these represent the principal sources of risk to persons within and around the perimeter of the valley. Management of the identified hazards will be by way of:

- Initial controls appropriate to the level of risk.
- Regular monitoring and reporting on areas of potential instability, before, during and after longwall mining.
- Regular inspections and investigations.
- Action plans for response to defined events.

These control measures apply to all areas of the Nepean River valley with the potential to be adversely affected by the extraction of Longwalls 705-710 and previously mined longwall blocks.

### **3. Monitoring of Cliffs and Steep Slopes**

Monitoring currently underway for Appin Area 7 (Longwalls 701-704) will be extended to include Longwalls 705-710.

Ground movements, including any disturbance of cliff faces, will be regularly assessed. This will contribute to an improved understanding of the effects of mining on steep slopes, cliffs and gorges, and assist the management of the area to minimise risk to members of the public, landholders and monitoring personnel in the area.

Results obtained from monitoring associated with this plan will be used to determine ongoing monitoring requirements, appropriate controls and responses relating to potential surface instability associated with progressive longwall extraction.

### **4. Control Procedures and Response Action Plans**

#### **4.1 Initial Control Measures**

The Nepean River is not mined under by Longwalls 701-710 but their extraction will induce some movement within the river valley.

The following control measures shall be established:

- Where practical, a baseline inspection of the cliff faces and edges likely to be affected by Longwalls 701-710 will be conducted prior to mining. It will include photographing any existing deterioration to establish the natural risk associated with such locations. A file of these locations, their initial condition and photographic data shall be established for updating during the mining period.
- Any rock of cliff face identified in the baseline inspection as being at high risk of falling shall, following agreement of the landholder, be signposted to warn specifically of the danger.
- The location of all signs, fences, other remedial or warning provisions established and the location of all falls in the area potentially affected by Longwall 701-710, or previous longwall blocks in the current area shall be marked on a Plan. This Plan shall be maintained as the result of any remedial measures instituted during mining.
- Signs shall be prominently displayed at each key access point to the river valley, and at prominent locations within the valley warning of the potential instability associated with the cliff faces and edges. Where signs are to be installed on private property this will only be done with the agreement of the landholder.

These signs shall read as below or similar:

**BHP BILLITON ILLAWARRA COAL**

**WARNING**

Rock falls may occur from time to time in the Nepean River Valley.  
 Subsidence from coal mining activities may accelerate this natural process.

Please be careful near steep cliffs.

If you notice any rock falls or changes in rock faces,  
 Please report them:

Illawarra Coal Community *Call Line 1800 102210*

#### 4.2 Inspections and Investigations

Inspections of the cliff faces and edges likely to be affected by Longwalls 701-710 will be conducted where practical. Monthly inspection will be conducted during active subsidence and will include photographs of any deterioration of cliff faces with the potential to result in a major fall.

These inspections shall be performed by person(s) deemed appropriate by the BHBIC Environment Field Team Coordinator and shall be conducted (as far as practical) by the same person(s) each month. Inspections shall be carried out while the river valley is affected by the mining operations.

An investigation shall be conducted by the Environment Field Team Coordinator of any large fall associated with the cliff faces or edges in the area of the river valley that may be affected by past or present mining in Area 7. The results of this investigation shall be used in the assessment of the relationship between ground movements, cliff face and edge deterioration and failures. A report shall be submitted to the DPIM outlining the results of these inspections where impacts to the cliffs are observed. Any large rock fall will be notified to key stakeholders within 24 hours of it being identified.

Surveys prior to the commencement, during extraction, and following completion of Longwall 701-710 will be conducted according to the schedule contained in **Table 4.1**.

**Table 4.1 - Cliff Formation and Steep Slope Management**

<b>Monitoring Proposed</b>	<b>Description</b>	<b>Timing/ Frequency</b>	<b>Reporting</b>
Baseline studies prior to mining	- Photographic record with details of site locations including cliff formations	Once prior to mining. Photographic	Via regular reporting processes including annual reports and

		records will be prepared.	subsidence management group meetings
Monitoring during mining	<ul style="list-style-type: none"> <li>- Visual observations of appropriate cliff formations</li> <li>- Visual observations of mining impacts on appropriate steep slopes</li> <li>- Valley closure monitoring</li> </ul>	Monthly routine inspections with weekly inspections during critical periods During mining at a frequency to be determined with the PSE.	Via regular reporting processes including annual reports and subsidence management group meetings Via regular reporting processes including annual reports and strategy and management group meetings
In the event that specific impacts are identified	<ul style="list-style-type: none"> <li>- Discussions with authorities and development of mitigation measures</li> </ul>	Notification within 24 hrs Development of mitigation measures as required	Notification within 24 hrs Development of mitigation measures as required

*If impacts are noted, photographs will record the level of impact and where necessary, remedial action will be taken in consultation with DPIM.*

The following monitoring work is proposed to assess any impacts of mining on the cliff formations in the area:

- ❑ Baseline studies to document and photograph clifflines with characteristics of natural instability that might be at risk due to mining. The monitoring will include photographing any existing deterioration or recent rock falls. A file of these locations, their initial condition and photographic evidence shall be established for updating during mining.
- ❑ Regular inspections and investigations of the condition of the relevant cliff formations will be conducted. Reports will be provided as part of event based and annual reporting procedures to DPIM. In the event that specific impacts are identified, additional monitoring and reporting will be undertaken as required. This monitoring will continue while the area is affected by active subsidence and for a period after mining until it is considered unlikely that there is any significant risk of additional cliff instability as a result of mining.

### 4.3 Reporting Procedures

Reporting of results will include the following information:

- ❑ Date of monitoring.
- ❑ Location including easting and northing positions.
- ❑ Distance the longwall has travelled from the face starting position.

- Distance from the nearest edge of the extracted longwall void to the monitoring site at the time of monitoring.
- Systematic subsidence and valley closure survey measurement data.

The monitoring report will be collated and assessed against the results of the cliff inspection and presented at the monthly Subsidence Management Meeting. If however, the findings of a particular report are deemed to warrant an immediate response the Survey Manager shall immediately notify the Manager Environment who will call a special assessment meeting at the earliest opportunity. Responses will be determined and/or confirmed at this meeting. The Manager Environment shall be responsible for the implementation of the response. All actions taken will be reported to the Mine Manager and DPIM.

The frequency of surveys nominated in Table 4.1 are subject to change based on practical implications with access to the river valley. Delays may be caused, in some cases, by adverse weather conditions, flooding of the river and non-availability of satellites for GPS work. Every effort will be made to conduct surveys and inspections according to the schedules and any deviation and the reasons therefore will be recorded and advised to all parties.

#### 4.4 Response Action Plans

“Trigger” levels have been developed that relate to response actions. These trigger and response actions may change over time in response to an increase in the level of understanding of the effects of longwall mining on the gorge.

**Table 4.2** summarises the “trigger events” and the associated actions required.

**Table 4.2 – Response Action Plans for Defined Events**

Level	Trigger Event	Action	Responsibility
<b>Survey Based</b>			
2	If closure across the valley exceeds predicted movements.	Increase frequency of inspections of adjacent cliff faces and edges to once every two weeks.	Manager Survey
<b>Notification Event Based</b>			
1	If identified or informed of a cliff fall considered to be significant or potentially dangerous.	Initiate an immediate investigation and report result to the DPIM. Initiate appropriate remedial action after gaining agreement of the DPI and landowner.	Manager Environment
2	On becoming aware of a minor fall or change in rock face conditions.	Initiate an investigation at the earliest opportunity. Take appropriate action in accordance with Plan provisions.	

**Notes:**

- (1) Appropriate action will depend on accessibility, safety of persons required to take the action, restrictions imposed by landowners or statutory bodies, the level of assessed risk to others etc. It may include the erection of signs and/or fences, intentionally collapsing strata in a controlled manner, or any other measure decided as appropriate at an assessment meeting.

- (2) Manager Environment shall be responsible for the implementation of agreed actions and shall communicate such actions to relevant Landowners.

## **5. Training**

All field surveying work and analysis of results will be carried out by or under the immediate supervision of a suitably qualified Surveyors. It shall be the responsibility of the Manager Environment to ensure that all persons and organisations having responsibilities under this Plan are trained and understand their responsibilities.

The person(s) performing regular inspections of the cliff faces and edges shall be under the supervision of the Environment Field Team Coordinator and be trained in observation and reporting. The Environment Field Team Coordinator shall be satisfied that the person(s) performing the inspections are capable of meeting and maintaining this standard.

## **6. Resources Required**

The General Manager Sustainable Development and External Affairs provides resources sufficient to support this Plan.

Equipment will be needed for the Control and Response provisions of this Plan. Where this equipment is of a specialised nature, it will be provided by the supplier of the relevant service. All equipment is to be appropriately maintained, calibrated and serviced as required in operation manuals.

Equipment required for this Plan includes, but is not limited to:

- ❑ Signs and signposts.
- ❑ Photographic equipment.
- ❑ Survey equipment.

It shall be the responsibility of the Manager Environment to ensure that personnel and equipment are provided as required to allow the provisions of this Plan to be implemented.

## **7. Roles and Responsibilities**

The overall responsibility for the successful implementation of this Plan resides with the Manager Approvals who shall be the Plan's authorising officer. The responsibility for co-ordination of this Plan resides with the Manager Environmental Approvals, as does the responsibility for its implementation in the field.

### **7.1 General Manager Sustainable Development and External Affairs**

- Ensure that the requisite personnel and equipment are provided to enable this Plan to be implemented effectively.

### **7.2 Manager Approvals**

- Authorise the Plan and any amendments thereto.
- Delegate, to an appropriately qualified person, the responsibility to document any changes to the Plan, recognising the potential for those changes to affect other aspects of the Plan.

### **7.3 Manager Environment**

- Provide regular updates to the Mine Manager on progress of Longwalls 701-710 ground movement issues.
- Arrange community forums as necessary and generally maintain a liaison with the public.
- Prepare a report of all actions determined as being necessary in accordance with the Response Action Plan and distribute to stakeholders should any ‘trigger’ level be reached that requires a response other than increasing frequencies of surveying and/or inspections. Maintain a record of meetings.
- Organise and participate in any other assessment meetings called to review mining impacts on the river valley. These meetings would not be held routinely, but would be called by exception to address any issues related to the stability of the valley. The Environment Field Team Coordinator and the Survey Manager would also normally attend such meetings.
- Within 24 hours, respond to any queries or complaints made by members of the public in relation to mining effects on Nepean River valley.
- Organise audits and reviews and participate in the Plan Review following any audit or other milestone event.
- Address any identified non-conformances immediately, assess improvement ideas submitted and implement if considered appropriate.
- Ensure all data, records and reports arising from the provisions of this Plan are kept for a period of at least 12 months following the completion of Longwalls 701-710.

- Arrange implementation of any agreed remedial measures to protect persons from potential falls. This would include liaison with landowners if required.
- Ensure regular inspections are conducted (including photographing) of areas of the river valley considered to be at risk of impacts. Determine the standards by which such inspections are to be conducted and recorded.
- Ensure surveys required by this Plan are conducted and record details of instances where circumstances prevent these from taking place.

#### **7.4 Environment Field Team Coordinator**

- Instruct suitable person(s) in the required standards for river valley inspection, recording and reporting and be satisfied that these standards are maintained.
- Investigate significant falls of ground or rock.
- Identify and report any non-conformances with Plan provisions.
- Participate in any other assessment meetings called to review the behaviour of the river valley area affected by mining

#### **7.5 Survey Manager**

- Collate survey data and present in an acceptable form for review at assessment meetings.
- Bring to the attention of the Manager Approvals any findings indicating an immediate response may be warranted.
- Bring to the attention of the Manager Environment any non-conformances identified with the Plan provisions or ideas aimed at improving the Plan.

#### **7.6 Technical Experts**

- Conduct the roles assigned to them in a competent and timely manner to the satisfaction of the Manager Environment and formally provide expert opinion as requested.

#### **7.7 Person(s) Performing Cliff Face And Edge Inspections**

- Formally bring to the attention of the Environment Field Team Coordinator any non-conformances identified with the Plan, or ideas aimed at improving the Plan.

- ❑ Conduct inspections of the sites around the river valley identified by the Environmental Field Team Coordinator in a safe manner.

## **8. Plan Monitoring and Corrective Action**

The ongoing effectiveness of the Management Plan requires personnel to be able to highlight non-conformances with Plan provisions and make recommendations to improve the Plan. The corrective action requirements of this Plan facilitate the continual monitoring and improvement of Plan provisions.

## **9. Communications**

The Manager Approvals shall institute subsidence management meetings during the extraction of Longwalls –701-710 for the purpose of maintaining communications necessary for the effective operation of this Plan.

Should any trigger level of ground movement be attained other than an increase in the frequency of surveying and/or inspection, the Manager Approvals shall immediately convene a meeting of all affected parties to formulate an agreed and appropriate response. The Manager Approvals shall be responsible for implementation of the agreed actions and for communication to affected Landowners.

## **10. Record Keeping and Control**

The processes defined within this Management Plan can be demonstrated as being effective in the control of hazards over the mining period. It specifically addresses hazards associated with cliff face and edge deterioration resulting from ground movement.

The following information is collected, reported and maintained to improve the understanding of the effect of subsidence on cliffs and steep slopes:

- ❑ Surveys conducted.
- ❑ Regular review of subsidence movement monitoring and inspections.
- ❑ Interpretation and assessment of the data derived from surveys and observations.
- ❑ Assessment of any response actions implemented.

## **11. Document Control**

This Management Plan shall be controlled as part of the Sustainable Development Document Control System. The Manager Approvals will be responsible for maintaining document control standards for the Plan.

Modifications of this Management Plan may occur from time to time. The Manager Approvals shall approve all modifications and amendments to the Plan or associated documentation.

**Appendix A: Appin Area 7 Cliff Lines and Steep Slopes**

