APPENDIX 1 - SUBSIDENCE MOVEMENTS PREDICTED FOR SWAMPS AND ARCHAEOLOGICAL SITES

Seam Depths

Swamp	RL of Bulli Seam Floor (mAHD)	Surface RL (m AHD)	Overburden Depth to Bulli Seam (m)	Overburden Depth to Balgownie Seam (m)	Overburden Depth to Wongawilli Seam (m)
CCUS1	75	360	285	295	320
CCUS2	85	370	285	295	320
CCUS3	55	355	300	310	335
CCUS4	50	340	290	300	325
CCUS5	38	310	272	282	307
CCUS6	65	350	285	295	320
CCUS7	85	355	270	280	305
CCUS8	75	345	270	280	305
CCUS9	52	345	293	303	328
CCUS10	50	330	280	290	315
CCUS11	5	345	310	320	340
CCUS12	15	370	355	365	390
CCUS13	5	340	335	345	370
CCUS14	115	390	275	285	310
CCUS15	60	385	325	335	360
CCUS16	0	300	300	310	335
CCUS17	60	385	325	335	360
CCUS18	60	385	325	335	360
CCUS19	60	385	325	335	360
CCUS20	70	360	290	300	325
CCUS21	70	350	280	290	315
CCUS22	-2	315	317	327	352
CCUS23	55	365	310	320	345
CRUS1	50	350	300	310	335
CRUS2	65	275	210	220	245
CRUS3	80	375	295	305	330
BCUS1	90	360	270	280	305
BCUS2	50	335	285	295	320
BCUS3	50	315	265	275	300
BCUS4	35	330	295	305	330
BCUS5	37	310	273	283	308
BCUS6	17	325	308	318	343
BCUS11	25	360	335	345	370
52-2-3939					340
52-2-3940					340
52-2-3941					355
52-2-0603					380
Wonga East 4					300
Wonga East 5					300
52-3-0320					340
52-3-0325					315
52-3-0311					285
52-3-0310					385
52-2-0099					355
52-2-0229					365

Subsidence Movements after Bulli Seam was Mined

Swamp	Subsidence Used (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS1	0.7	285	3.7	7.4	12
CCUS2	0.1	285	0.5	1.1	2
CCUS3	1	300	5.0	10.0	17
CCUS4	0.1	290	0.5	1.0	2
CCUS5	0.5	272	2.8	5.5	9
CCUS6	1	285	5.3	10.5	18
CCUS7	1	270	5.6	11.1	19
CCUS8	0.1	270	0.6	1.1	2
CCUS9	0.1	293	0.5	1.0	2
CCUS10	0.5	280	2.7	5.4	9
CCUS11	1	340	4.4	8.8	15
CCUS12	0.5	355	2.1	4.2	7
CCUS13	0.1	335	0.4	0.9	1
CCUS14	1	275	5.5	10.9	18
CCUS15	0.1	325	0.5	0.9	2
CCUS16	0.5	300	2.5	5.0	8
CCUS17	0.1	325	0.5	0.9	2
CCUS18	0.1	325	0.5	0.9	2
CCUS19	0.1	325	0.5	0.9	2
CCUS20	1	290	5.2	10.3	17
CCUS21	1	280	5.4	10.7	18
CCUS22	0.5	317	2.4	4.7	8
CCUS23	0.1	310	0.5	1.0	2
CRUS1	0.5	300	2.5	5.0	8
CRUS2	0.5	210	3.6	7.1	12
CRUS3	0.4	295	2.0	4.1	7
BCUS1	1	270	5.6	11.1	19
BCUS2	0.5	285	2.6	5.3	9
BCUS3	0.5	265	2.8	5.7	9
BCUS4	0.5	295	2.5	5.1	8
BCUS5	0.5	273	2.7	5.5	9
BCUS6	0.1	308	0.5	1.0	2
BCUS11	0.5	335	2.2	4.5	7

Site ID	Subs at Site (m)	Adjacent Subsidence Used for Strain and Tilt Calcs (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)	Compressive Horizontal Movement Along 20m Section of Cliff (mm)
52-2-3939	0.2	0.2	340	0.9	1.8	3	40
52-2-3940	0.1	0.1	340	0.4	0.9	1	20
52-2-3941	0.2	0.2	355	0.8	1.7	3	40
52-2-0603	0.3	0.3	380	1.2	2.4	3.9	50
Wonga East 4	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
Wonga East 5	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
52-3-0320	0.1	0.1	310	0.5	1	2	20
52-3-0325	0.3	0.3	285	1.6	3	5	60
52-3-0311	< 0.1	< 0.1	255	< 0.5	< 1	< 2	< 20
52-3-0310	0.1	0.1	355	0.4	1	1	20
52-2-0099	0.1	0.1	325	0.5	1	2	20
52-2-0229	0.2	0.2	335	0.9	2	3	40

Incremental Subsidence Measured During Balgownie Seam Mining

Swamp	Subsidence Used (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS1	0.8	295	4.1	8.1	14
CCUS2	1	295	5.1	10.2	17
CCUS3	1	310	4.8	9.7	16
CCUS4	0.8	300	4.0	8.0	13
CCUS5	0.1	282	0.5	1.1	2
CCUS6	1	295	5.1	10.2	17
CCUS7	0.1	280	0.5	1.1	2
CCUS8	0.1	280	0.5	1.1	2
CCUS9	0.1	303	0.5	1.0	2
CCUS10	0.1	290	0.5	1.0	2
CCUS11	0.1	340	0.4	0.9	1
CCUS12	0.1	365	0.4	0.8	1
CCUS13	0.1	345	0.4	0.9	1
CCUS14	0.1	285	0.5	1.1	2
CCUS15	0.5	335	2.2	4.5	7
CCUS16	0.1	310	0.5	1.0	2
CCUS17	0.3	335	1.3	2.7	4
CCUS18	0.1	335	0.4	0.9	1
CCUS19	0.1	335	0.4	0.9	1
CCUS20	1	300	5.0	10.0	17
CCUS21	1	290	5.2	10.3	17
CCUS22	0.1	327	0.5	0.9	2
CCUS23	1	320	4.7	9.4	16
CRUS1	0.1	310	0.5	1.0	2
CRUS2	0.1	220	0.7	1.4	2
CRUS3	0.1	305	0.5	1.0	2
BCUS1	0.1	280	0.5	1.1	2
BCUS2	0.1	295	0.5	1.0	2
BCUS3	0.1	275	0.5	1.1	2
BCUS4	0.1	305	0.5	1.0	2
BCUS5	0.1	283	0.5	1.1	2
BCUS6	0.1	318	0.5	0.9	2
BCUS11	0.1	345	0.4	0.9	1

Site ID	Subsidence at Site (m)	Adjacent Subsidence Used for Strain and Tilt Calcs (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)	Compressive Horizontal Movement Along 20m Section of Cliff (m)
52-2-3939	< 0.1	< 0.1	340	< 0.5	< 1	< 2	< 20
52-2-3940	< 0.1	< 0.1	340	< 0.5	< 1	< 2	< 20
52-2-3941	< 0.1	< 0.1	355	< 0.5	< 1	< 2	< 20
52-2-0603	< 0.1	< 0.1	380	< 0.5	< 1	< 2	< 20
Wonga East 4	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
Wonga East 5	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
52-3-0320	1.1	1.2	320	5.6	11	19	200
52-3-0325	N/A	N/A	295	N/A	N/A	N/A	N/A
52-3-0311	< 0.1	< 0.1	265	< 0.5	< 1	< 2	< 20
52-3-0310	N/A	0.1	365	N/A	N/A	N/A	N/A
52-2-0099	N/A	0.1	335	N/A	N/A	N/A	N/A
52-2-0229	N/A	0.2	345	N/A	N/A	N/A	N/A

Incremental Subsidence for Proposed Mining of Wongawilli Seam

Swamp	Subsidence Used (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS1	1.5	320	7.0	14.1	23
CCUS2	2	320	9.4	18.8	31
CCUS3	1.5	335	6.7	13.4	22
CCUS4	2	325	9.2	18.5	31
CCUS5	1.5	307	7.3	14.7	24
CCUS6	2	320	9.4	18.8	31
CCUS7	0.1	305	0.5	1.0	2
CCUS8	0.1	305	0.5	1.0	2
CCUS9	0.1	328	0.5	0.9	2
CCUS10	0.8	315	3.8	7.6	13
CCUS11	2	340	8.8	17.6	29
CCUS12	1.5	390	5.8	11.5	19
CCUS13	0.1	370	0.4	0.8	1
CCUS14	0.1	310	0.5	1.0	2
CCUS15	0.1	360	0.4	0.8	1
CCUS16	0.1	335	0.4	0.9	1
CCUS17	0.1	360	0.4	0.8	1
CCUS18	0.1	360	0.4	0.8	1
CCUS19	0.1	360	0.4	0.8	1
CCUS20	0.1	325	0.5	0.9	2
CCUS21	2	315	9.5	19.0	32
CCUS22	0.1	352	0.4	0.9	1
CCUS23	1.5	345	6.5	13.0	22
CRUS1	1.5	335	6.7	13.4	22
CRUS2	0.1	245	0.6	1.2	2
CRUS3	0.1	330	0.5	0.9	2
BCUS1	0.1	305	0.5	1.0	2
BCUS2	0.1	320	0.5	0.9	2
BCUS3	0.1	300	0.5	1.0	2
BCUS4	1.5	330	6.8	13.6	23
BCUS5	0.1	308	0.5	1.0	2
BCUS6	0.1	343	0.4	0.9	1
BCUS11	1.5	370	6.1	12.2	20

Site ID	Subsidence at Site (m)	Adjacent Subsidence Used for Strain and Tilt Calcs (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)	Compressive Horizontal Movement Along 20m Section of Cliff (m)
52-2-3939	0.8	2	340	8.8	18	29	350
52-2-3940	0.6	1.5	340	6.6	13	22	250
52-2-3941	1.2	1.5	340	6.6	13	22	250
52-2-0603	1.5	1.5	340	6.6	13	22	250
Wonga East 4	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
Wonga East 5	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
52-3-0320	0.7	2	340	8.8	18	29	350
52-3-0325	1.1	1.5	315	7.1	14	24	250
52-3-0311	< 0.1	< 0.1	285	< 0.5	< 1	< 2	< 20
52-3-0310	< 0.1	< 0.1	385	< 0.5	< 1	< 2	< 20
52-2-0099	0.4	1	355	4.2	8	14	150
52-2-0229	0.7	1	365	4.1	8	14	150

Cumulative Subsidence at the Completion of Bulli and Balgownie Seam Mining

Swamp	Subsidence Used (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS1	2	285	10.5	21.1	35
CCUS2	1.1	285	5.8	11.6	19
CCUS3	1.1	300	5.5	11.0	18
CCUS4	0.9	290	4.7	9.3	16
CCUS5	0.6	272	3.3	6.6	11
CCUS6	2	285	10.5	21.1	35
CCUS7	1	270	5.6	11.1	19
CCUS8	0.1	270	0.6	1.1	2
CCUS9	0.1	293	0.5	1.0	2
CCUS10	0.6	280	3.2	6.4	11
CCUS11	1	340	4.4	8.8	15
CCUS12	0.5	355	2.1	4.2	7
CCUS13	0.1	335	0.4	0.9	1
CCUS14	1.2	275	6.5	13.1	22
CCUS15	0.2	325	0.9	1.8	3
CCUS16	0.5	300	2.5	5.0	8
CCUS17	0.1	325	0.5	0.9	2
CCUS18	0.1	325	0.5	0.9	2
CCUS19	0.1	325	0.5	0.9	2
CCUS20	2	290	10.3	20.7	34
CCUS21	2	280	10.7	21.4	36
CCUS22	0.5	317	2.4	4.7	8
CCUS23	0.9	310	4.4	8.7	15
CRUS1	0.5	300	2.5	5.0	8
CRUS2	0.6	210	4.3	8.6	14
CRUS3	0.6	295	3.1	6.1	10
BCUS1	1	270	5.6	11.1	19
BCUS2	0.5	285	2.6	5.3	9
BCUS3	0.5	265	2.8	5.7	9
BCUS4	0.6	295	3.1	6.1	10
BCUS5	0.5	273	2.7	5.5	9
BCUS6	0.1	308	0.5	1.0	2
BCUS11	0.5	335	2.2	4.5	7

Site ID	Subsidence at Site (m)	Adjacent Subsidence Used for Strain and Tilt Calcs (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)	Compressive Horizontal Movement Along 20m Cliff (m)
52-2-3939	0.2	0.7	340	3.1	6.2	10	120
52-2-3940	0.1	0.7	340	3.1	6.2	10	120
52-2-3941	0.2	0.7	355	3.0	5.9	10	120
52-2-0603	0.3	0.6	380	2.4	4.7	7.9	120
Wonga East 4	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
Wonga East 5	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
52-3-0320	1.1	1.2	320	5.6	11	19	200
52-3-0325	0.3	0.3	315	1.4	3	5	60
52-3-0311	< 0.1	< 0.1	285	< 0.5	< 1	< 2	< 20
52-3-0310	0.1	0.1	385	0.4	1	1	20
52-2-0099	0.1	0.1	355	0.4	1	1	20
52-2-0229	0.2	0.2	365	0.8	2	3	40

Total Cumulative Subsidence at Completion of Bulli, Balgownie and Wongawilli Seam Mining

Swamp	Subsidence Used (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS1	2	285	10.5	21.1	35
CCUS2	3	285	15.8	31.6	53
CCUS3	2.5	300	12.5	25.0	42
CCUS4	2.4	290	12.4	24.8	41
CCUS5	1.8	272	9.9	19.9	33
CCUS6	3.8	285	20.0	40.0	67
CCUS7	1	270	5.6	11.1	19
CCUS8	0.1	270	0.6	1.1	2
CCUS9	0.1	293	0.5	1.0	2
CCUS10	1.5	280	8.0	16.1	27
CCUS11	3	340	13.2	26.5	44
CCUS12	1.5	355	6.3	12.7	21
CCUS13	0.1	335	0.4	0.9	1
CCUS14	1.3	275	7.1	14.2	24
CCUS15	0.2	325	0.9	1.8	3
CCUS16	0.5	300	2.5	5.0	8
CCUS17	0.1	325	0.5	0.9	2
CCUS18	0.1	325	0.5	0.9	2
CCUS19	0.1	325	0.5	0.9	2
CCUS20	2	290	10.3	20.7	34
CCUS21	3.8	280	20.4	40.7	68
CCUS22	0.5	317	2.4	4.7	8
CCUS23	2.1	310	10.2	20.3	34
CRUS1	0.8	300	4.0	8.0	13
CRUS2	0.6	210	4.3	8.6	14
CRUS3	0.6	295	3.1	6.1	10
BCUS1	1	270	5.6	11.1	19
BCUS2	0.5	285	2.6	5.3	9
BCUS3	0.5	265	2.8	5.7	9
BCUS4	2	295	10.2	20.3	34
BCUS5	0.5	273	2.7	5.5	9
BCUS6	0.1	308	0.5	1.0	2
BCUS11	2	335	9.0	17.9	30

SiteID	Subs at Site (m)	Adjacent Subsidence Used for Strain and Tilt Calcs (m)	Overburden Depth (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)	Compressive Horizontal Movement Along 20m Section of Cliff (m)
52-2-3939	1	2.4	340	10.6	21.2	35	450
52-2-3940	0.7	1.6	340	7.1	14.1	24	300
52-2-3941	1.4	1.6	355	6.8	13.5	23	250
52-2-0603	1.8	1.8	380	7.1	14.2	23.7	300
Wonga East 4	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
Wonga East 5	< 0.1	< 0.1	300	< 0.5	< 1	< 2	< 20
52-3-0320	1.8	3.2	340	14.1	28	47	450
52-3-0325	1.4	1.8	315	8.6	17	29	250
52-3-0311	< 0.1	< 0.1	285	< 0.5	< 1	< 2	< 20
52-3-0310	< 0.1	< 0.1	385	< 0.5	< 1	< 2	< 20
52-2-0099	0.5	1	355	4.2	8	14	150
52-2-0229	0.9	1	365	4.1	8	14	150

APPENDIX 2 – RESPONSE TO SUBMISSIONS TO PPR

RESPONSE TO SUBMISSIONS TO PREFERRED PROJECT REPORT

The response to submissions to the PPR report presented in this section is a slight revision of SCT Letter Report NRE14123A dated 23 December 2013. Many of the issues raised in this initial response have been included in this updated version of the PPR Subsidence Assessment.

The submissions considered in this response are those from:

1. Independent Review of Subsidence Impact Assessment by Professor B. Hebblewhite.
2. NSW Government Department of Resources and Energy (DRE).
3. Sydney Catchment Authority (SCA).
4. NSW Government Office of Environment and Heritage (OEH).
5. Wollongong City Council (WCC).
6. NSW Department of Primary Industries (DPI).
7. Dams Safety Committee (DSC).
8. NSW Government Transport Roads and Maritime Services (RMS).
9. NSW Government Heritage Council (Heritage).
10. Environmental Protection Authority (EPA).

As there are several issues raised in multiple submissions, the response to an issue is presented in most detail the first time it is raised in the order of the list above. Where it is raised in subsequent submissions, reference is made to the earlier response for brevity and expanded as necessary, but reading the document in its entirety is recommended. We note that there are several submissions – specifically those from the DSC, RMS, Heritage, and EPA – where the PPR has addressed or substantially addressed subsidence related issues raised in earlier submissions to the NRE1 No 1 Colliery – Underground Expansion Project (MP09-0013) and these submissions are not considered further in this report.

Where the issue discussed has been directly addressed in the updated report, the update is noted.

A2-1 INDEPENDENT REVIEW BY PROFESSOR B.K. HEBBLEWHITE

Professor Hebblewhite's comments are all considered to be valid points that are well made. The response in this section is mainly in relation to clarification of some of the terms used and further explanation of the reasoning behind some of the issues that may not have come through clearly in the PPR Subsidence Assessment presented in SCT (2013).

A2-1.1 Point A3 – "Essentially Predictable" Behaviour

In response to this point, the term "essentially" has been removed in the updated copy of the PPR.

The use of the term "essentially predictable" in the original PPR was intended to convey the concept that the multi-seam subsidence behaviour observed above Longwalls 4 and 5 has characteristics that are very similar to the subsidence behaviour observed above longwall panels where only one seam has been mined. These characteristics are also evident from other sites that have yet to become available in the public domain given the relatively recent development of multi-seam longwall mining in NSW. Although the effects of multi-seam subsidence are yet to be fully characterised, the monitoring experience available confirms that the behaviour is consistent with single seam subsidence but with some differences associated with the disturbance caused by previous mining.

Even for single seam mining, regarding subsidence behaviour as being "entirely predictable" may be somewhat optimistic. However, an approach based on understanding the mechanics of the various processes involved – specifically sag subsidence over individual longwall panels and elastic strata compression above and below the chain pillars but also various forms of non-conventional subsidence behaviour – provides a basis to predict subsidence behaviour with a degree of certainty that is usually sufficient to allow appropriate management of potential impacts.

In a multi-seam subsidence environment where extracted coal seams are relatively close together such as in the PPR project area, there appears to be three main characteristics that are slightly different to single seam subsidence behaviour and they all relate to the fact that initially intact overburden strata is softened somewhat above each extracted panel to a height approximately equal to the panel width. As a result:

1. Overburden strata softened by previous mining has reduced shear stiffness (i.e. is softer in "bending") compared to undisturbed strata so the strata is less effective at bridging across the void created by mining a new panel. The subsidence engineering concepts of sub-critical and super-critical subsidence behaviour still apply, but the width at which full subsidence develops (supercritical width) is much less in a multi-seam environment.

2. The "reworking" of already subsided overburden strata causes an increase of maximum subsidence in supercritical width panels (very wide relative to depth) from 50-65% of seam thickness typical of single seam operations to 60-80% of combined seam thickness. In the PPR, the panels are still subcritical in width and so maximum subsidence is limited by panel width.

3. Goaf edge subsidence is somewhat greater at 200-300mm where there has been previous mining in the overlying seams compared to 100-200mm typical of undisturbed strata. The goaf edge subsidence profile is also somewhat more gradual.

Pillar instability may also cause additional subsidence where previously stable standing pillars in the overlying coal seams are destabilised. This effect is considered separately in Section A2-1.6.

A2-1.2 Points A6 and A7 - Adaptive Management

The concept of adaptive management was forwarded in the PPR as a method of managing closure across Cataract Creek and at a strategic level (rather than on an individual swamp basis) for managing impacts on swamps. In this section, the application of this approach is discussed further.

A2-1.2.1 Point A6 - Cataract Creek

The experience of monitoring closure across Cataract Creek during mining of Longwall 5 indicates characteristics that make an adaptive management approach likely to be suitable to manage the magnitude of closure across Cataract Creek. This monitoring indicates that the closure commenced when Longwall 5 was about 400m from Cataract Creek and has continued at a steady rate of about 12mm/100m of longwall retreat since then. A six week period of longwall stoppage when Longwall 5 was approximately 130m away from finishing showed low level additional closure of less than 5mm. This steady, predictable response allows planning for a pre-determined level of closure across Cataract Creek well in advance of reaching any given set target.

The challenge with an adaptive management approach for Cataract Creek is determining the level of closure when impacts are considered to be significant. A target of 200mm has been adopted based on experience of mining near creeks and rivers in Hawkesbury Sandstone strata. Recognising that the base of Cataract Creek is located within the outcrop of the Bald Hill Claystone, it is possible that closure may be occurring on the Hawkesbury / Bald Hill Claystone contact without causing any perceptible impact to the creek bed.

Available evidence including the absence of any significant fracturing or other impacts in the creek bed from previous mining including Longwalls 4 and 5 indicates that closure movements may be occurring above the level of the creek bed so that the types of impacts observed in Hawkesbury Sandstone where horizontal shear and resulting closure typically occurs below the level of the creek bed may not be occurring in Cataract Creek. However, further surveying scheduled for the end of Longwall 5 and analysis of this monitoring data is required to confirm this hypothesis. In the meantime, visual inspections continue to form a critical part of the adaptive management strategy for Cataract Creek and so far there has been no perceptible impact.

A2-1.2.2 Point A7 - Adaptive Management of Swamps

The concept of adaptive management for swamps is not considered valid on the scale of individual swamps because the changes are unlikely to occur in a timeframe that is appropriate to managing longwall retreat. However, the approach is considered to be a valid method of managing mining impacts on swamps more generally at a strategic level given that the data available from previous longwall mining in the Balgownie Seam does not indicate high levels of subsidence related impact to any of the swamps in the area (Biosis 2013).

While it is accepted that there is no baseline data available from this earlier mining, the fact remains that CCUS4 was subsided by up to 0.9m and appears to have continued to thrive. Other swamps in the general area have also been similarly subsided and also appear to continue to thrive. Thus there is opportunity to study the impacts of previous mining on swamps over the longer terms of 30 years for the Balgownie Seam longwalls and 60-80 years for Bulli Seam monitoring at least on a comparative scale with similar swamps where coal has been extracted.

The proposal to mine Longwall 6 below CCUS4 provides the opportunity to get some baseline data and then monitor the changes that occur over the longer term. It is accepted that there may be some changes, but the magnitude of the changes are not thought likely to be significant based on the experience of previous mining below the site. By carefully measuring any physical changes including rainfall, subsidence movements, vegetation, groundwater pressures, and surface flows it should be possible to determine over the medium to long term how significant any impacts may be. This experience will then be available to inform future assessments of similar swamp types.

A2-1.3 Point A9 – Explanation of Bulli Seam Goaf on 0.7 Times Depth Protection Barrier

This point has been clarified in the updated PPR subsidence assessment but is discussed in more detail below.

A 0.7 times depth protection barrier to the full supply level (FSL) of Cataract Reservoir has been used as the basis to design the layout of longwall panels in the Wonga East mining area. The presence of a Bulli Seam goaf in areas between the ends of the proposed longwall panels and the Cataract Reservoir reduces the effectiveness of the 0.7 times depth barrier but it does not mean that the barrier is ineffective. In this section, an explanation of the nature of the barrier and its effectiveness is provided. This explanation drifts into a discussion on groundwater issues which is starting to get outside the domain of a subsidence assessment and therefore wasn't discussed in detail in the subsidence assessment report (SCT 2013). However, given the significance of the issue raised by Professor Hebblewhite, a more detailed explanation is provided here to clarify the point that was being made.

The key issue for controlling the effectiveness of a barrier is maintaining the integrity of the pathway for flow from the reservoir to the mine workings. The FSL is at RL289.9m while in the area beyond the end of Longwall 7, the Bulli Seam mining horizon is approximately RL35m and the Wongawilli Seam horizon is approximately RL0m.

The only credible pathways for leakage from the reservoir to the mine are either horizontally from the reservoir to the subsided strata above the longwall goaf and then downward through this strata into the mine or via geological structures. The potential for through going geological structures is discussed separately below. Any vertical pathway to the mine roadways directly below the reservoir is clearly not of high enough hydraulic conductivity to be an issue given that these roadways already exist and there is no evidence of any inflow.

The 200m horizontal barrier (equivalent to 0.7 times 290m) provides a significant barrier to horizontal flow given the hydraulic conductivities of rock strata and, supported by the fact that there is no experience of leakage from reservoirs or water bodies for barriers of this size, appears more than adequate. However, the presence of an existing goaf in the Bulli Seam within this barrier may reduce the effectiveness of this barrier against possible leakage into the mine as noted in SCT (2013). Some very good work presented by Tammetta (2012) allows this potential to be investigated.

Tammetta (2012) presents an empirical relationship that is based on published experience from all around the world of longwall mining interactions with groundwater. The relationship allows the height of depressurisation above the mining height to be calculated as a linear function of panel width multiplied by seam thickness mined raised to the power of 1.4 and overburden depth raised to the power of 0.2.

The height of depressurisation is significant because it defines the point above the mining horizon at which the vertical hydraulic conductivity of the overburden strata reduces sufficiently to support a hydrostatic water pressure profile in the overburden strata. Looking at it the other way around, the height of depressurisation is the height below which vertical leakage through the subsided overburden strata starts to become significant as a pathway for inflow. A source of surface recharge is still required for inflow to occur, but the pathway exists at overburden depths less than the height of depressurisation.

Monitoring at Russell Vale Colliery and at other sites confirms the Tammetta relationship. The widest of the Bulli Seam goaf areas within the barrier to the reservoir is approximately 180m. For a 2.4m high mining height (assuming complete extraction and a conservative seam height) at 280m deep, the height of depressurisation is approximately 160m, so there is still 120m of strata with sufficiently low hydraulic conductivity to maintain a hydrostatic groundwater profile above the top of any of the Bulli Seam goafs in the barrier. The presence of this 120m of strata means there is still no significant vertical pathway to the mine despite the presence of the extracted panels in the Bulli Seam.

The observation that mining in the Wongawilli Seam causes vertical ground movements that are substantially within the footprint of the panel means that ground movements and overburden disturbance are substantially limited to within the panel footprint.

The height of depressurisation can be conservatively estimated as the combined thickness of mining in all seams at the depth of the lowest seam and a panel width of the panel being mined. Monitoring experience at GW-01, a groundwater pressure monitoring borehole near where Mount Ousley Road crosses Cataract Creek, confirms the Tammetta relationship still applies in an area where both the Balgownie and Bulli Seams have been mined.

Longwall 7 is 125m wide at a depth of approximately 290m. Apart from one small area where there is a narrow overlap, there is nowhere that all three seams are fully extracted together and certainly nowhere within the 0.7 depth barrier.

For the proposed 125m wide Longwall 7 mined below the Bulli Seam (there is no mining in the Balgownie Seam at the south western end of Longwall 7), the height of depressurisation is calculated using the Tammetta relationship to be 260m (for a combined mining height in the two seams of 5.0-5.4m). This means that the height of depressurisation may be approaching the surface and although there may still be some barrier to vertical flow near the surface, the main protection against inflow from the reservoir is the horizontal barrier of 200m. This barrier is maintained all around Longwall 7 and so there is considered to be no potential for significantly increased inflow from the reservoir to the mine as a result of mining Longwall 7.

Even if there were to be some further instability in the Bulli Seam goafs within the barrier as a result of mining Longwall 7, which is considered most unlikely, the height of depressurisation considered above is for the worst case of full extraction or complete destabilisation of all pillars and the height of depressurisation is therefore not expected to be greater than 260m.

Notwithstanding the discussion presented above that indicates there is no potential for Longwall 7 to significantly increase inflow from the reservoir to the mine, there is still a need to continue to confirm the heights of depressurisation above multiple goafs and to confirm that any depressurisation over Longwall 7 is not causing a change in the groundwater regime between the reservoir and the mine.

Further groundwater pressure monitoring boreholes are planned to be drilled including one at a site above Longwall 4 where all three seams have been mined, several others between the end of Longwall 7 and the reservoir, and another near Cataract Creek to monitor depressurisation as Longwall 7 approaches. The first borehole is aimed to confirm the height of depressurisation above three mined seams before Longwall 7 starts. The several boreholes between the reservoir and the start of Longwall 7 are aimed to confirm the direction of groundwater flow continues to be toward the reservoir above the 200m barrier.

A2-1.4 Point A10 – Body of Evidence to Support Predictions of Multi-Seam Subsidence

The subsidence monitoring data available from Russell Vale Colliery is valuable data but there are other sites where high quality multi-seam data is emerging. Unfortunately, it is early days and data from these sites has yet to make its way into the public domain so it can be referenced in a subsidence assessment report of this type. The results are nevertheless convincing and surprisingly consistent. It is anticipated that the experience from additional sites should be available in the public domain by mid-2014.

A2-1.5 Point C1 – Swamp Constraints

The point is made that the constraint in relation to upland swamps lacks quantitative or measurable definition of how the impacts of mining are translated into a design constraint. This point is accepted. The challenge is that there does not seem to be a large body of evidence available to confirm whether upland swamps that depend for their water primarily on rainfall recharge are significantly impacted by mining subsidence. The issue of impacts of mining on upland swamps is an area that requires further work at a strategic level to confirm that there are indeed long term impacts and the nature of these impacts.

Previous mining in the Bulli Seam and the Balgownie Seam at Russell Vale Colliery and in the Bulli Seam all along the Illawarra Escarpment provide a long history of the effects of mining subsidence on these types of swamps. While there is limited baseline data currently available, it seems that the swamps above Wonga East provide an opportunity to get not only baseline data but also data on the scale of any impacts. A comparative study is therefore planned to monitor swamps where there will be no further mining to swamps that will be mined under.

CCUS4 is a swamp that was mined under and subsided about 0.9m in the early 1980's. CCUS4 appears to still be in good health (Biosis 2013). To step Longwall 6 around CCUS4 would significantly reduce the coal resource able to be recovered from Longwall 6. By accepting that there may be some impacts to this swamp but also that these impacts may not significantly affect the health of the swamp (as per previous mining), the opportunity exists to monitor the ground movements, groundwater impacts, and any ecological changes to provide evidence to guide future strategic planning of longwalls in close proximity to these types of upland swamps.

Mining is proposed under the fringes of CCUS5 which has been partly mined under previously in the Bulli Seam and CRUS1 which has been significantly mined under previously in the Bulli Seam. The opportunity exists to monitor any ecological changes as a function of distance from Longwall 7 as a guide to offset distances that may be required in the future.

The need for more of this type of monitoring is reiterated elsewhere by Professor Hebblewhite's comments and emphasised in Point G1. The need for more monitoring is recognised and accepted.

A2-1.6 Point C6 – Pillar Run

This point has been clarified in the updated PPR subsidence assessment.

The point made in respect of not including elastic compression subsidence in the same discussion as "pillar run" is accepted and the two mechanisms are recognised to be unrelated. The linking of these two completely separate processes was in response to concerns raised by DRE in earlier submissions to the NRE1 No 1 Colliery – Underground Expansion Project (MP09-0013) and again in their response to the PPR discussed further in Section A2-2.

The DRE concern under the heading "pillar run" was not just, or even primarily, about conventional pillar run caused by pillar instability, although this is clearly an issue in some localised areas. Their concern appears to be more directed toward possible low level goaf remobilisation from both horizontal stress relief and additional elastic pillar compression of barriers that they were concerned may affect infrastructure such as Mount Ousley Road, Picton Road Interchange, and the high voltage power lines located between Mount Ousley Road and the Illawarra Escarpment. There is not a universal term for these types of movements, but the term "pillar run" is accepted as perhaps not best suited to describe them.

A2-1.7 Point C9 – Balgownie Seam Subsidence Monitoring and Swamp Impacts

SCT is not aware of any ecological monitoring in relation to swamps from the period of mining longwall panels in the Balgownie Seam from 1970 to 1982. This information would be most useful as baseline monitoring if it is available.

Unfortunately, most of the Balgownie Seam subsidence monitoring (all except Longwall 11) comprises only vertical subsidence. The period when the Balgownie Seam was mined was very early in the development of subsidence monitoring in NSW and survey instruments suitable for routine monitoring of subsidence in three dimensions were not yet widely available or affordable. Although the monitoring is considered to be of a high standard for the time, the monitoring detail is relatively limited by contemporary standards.

A2-2 DRE Submission

The DRE submission dated 26 November 2013 presents feedback to the PPR on several areas of DRE responsibility. The response presented in this section relates only to subsidence issues raised in the submission.

The potential for some remobilisation of the overlying Bulli Seam pillars is accepted and the differences of definition between a "pillar run" associated with underground safety and the use of the term to describe irregular or additional subsidence possibly beyond the boundaries of proposed mining are recognised.

Experience to date of monitoring subsidence from Longwalls 4 and 5 does not show any evidence of significant irregular or additional subsidence beyond that which would be expected in a multi-seam environment where both main heading pillars and pillar extraction areas are present. There is some evidence of small movements of less than a few centimetres on Mount Ousley Road that can properly be attributed to normal subsidence beyond the goaf edge, to the far-field redistribution of horizontal stresses, and to downslope movement but these are of low level and these have occurred incrementally rather than suddenly. There is evidence that these low level movements are localised at pre-existing goaf edges consistent with remobilisation of existing fractures within the overburden strata as would be expected.

There is also some evidence from subsidence monitoring undertaken during longwall mining in the Balgownie Seam of additional subsidence of up to about 0.7m directly over longwall panels that again can be properly attributed to remobilisation of Bulli Seam workings and destabilisation of pillars within the Bulli Seam. These areas have all been associated with areas where additional subsidence would be expected because of the irregular extraction geometry in the Bulli Seam. There is some softening of the goaf edge apparent, but the surface subsidence does not appear to have been unduly irregular as a result of the overlying Bulli Seam pillars.

Further geotechnical investigations are planned and further consultation with DRE on these concerns is recommended.

A2-3 SYDNEY CATCHMENT AUTHORITY (SCA)

The SCA submission discusses a range of issues. Only those that relate to subsidence, geological structure, and groundwater interactions are discussed in this section. The SCA expresses major concerns about:

- Lack of geological investigations.
- Induced leakage from Cataract Reservoir.
- Longwall mining within the Dams Safety Notification Area.
- Impacts on swamps such as CCUS4.

A2-3.1 Point 4 – Review of Geological Structures

Previous mining in the Bulli Seam and Balgownie Seams are considered to provide a very strong basis for defining geological structures in the area the proposed mining. The Bulli Seam records are considered poor to reasonable due to the drafting standards of the time but nevertheless show the location of major structure. The Balgownie Seam records are considered to be to a high standard. The degree of confidence in the location of geological structures is much greater than would normally be possible at a green fields site based on drilling and seismic investigations because it has been possible to accurately locate all faults and dykes underground, determine their throw, and directly inspect some of them. This circumstance is fortunate given the very real issues of surface access limitations in the SCA administered Special Area.

There still seems to be some confusion about the naming and extent of geological fault structures and the ability of drilling to delineate fault structures. Further discussion with the site geologist is recommended to clarify the confusion that appears to still exist. Some of this confusion may be a result of naming conventions, particularly in relation to the Rixons Pass Fault which is located to the north of the PPR mining area and well outside of any area likely to be affected by mining subsidence. Previous reporting by others indicated that Dyke D8 may have been an extension of Rixons Rass Fault but this interpretation has been revised on the basis of more detailed information (Clark 2013).

There is also seems to be an underlying concern that the presence of geological faults has potential to significantly modify the response of the 300m of overburden strata to subsidence movements. In the author's experience, the concept of geological fault structures significantly changing the response of the overburden strata is not supported by experience. Near surface thrust faults have occasionally been apparent in subsidence profiles and a closely spaced pair of dykes is known to have once locally modified a subsidence profile, but these are very unusual.

The concept of geological structures interacting with overlying pillars causing them to become unstable is not considered a significant issue in the context of the proposed mining. The creation of a longwall goaf directly below remnant pillars in the Balgownie and Bulli Seams is expected to destabilise small pillars as discussed in the body of this report. The presence or otherwise of geological fault structures does not significantly change this process and the additional subsidence that results from any instability has already been factored into the subsidence estimates.

Again it is reiterated, the level of geological detail available at this site from being able to mine up to and through all the geological structures in the area is far in excess of the detail that is usually available. This detail is more than adequate to confirm that there is no potential for geological fault structures to significantly affect the height of depressurisation, the magnitude of subsidence, or the connectivity between the reservoir and the mine at the mining depths in this area.

A2-3.2 Point 4.1 – Subsidence Predictions

In the section of the SCA submission titled "Subsidence Predictions" the method of subsidence prediction and the recommendations from SCT (2013) are restated but with some slight changes compared to what was intended. In this section the methods used to predict subsidence and the recommendations are clarified.

The subsidence prediction method is based primarily on empirical observations made during mining of Longwalls 4 and 5 recognising that previous mining in the overlying seams has modified the shear stiffness of the overburden strata.

Previous subsidence data from longwall mining in the Balgownie Seam, and from mining in the Bulli Seam further to the west are also presented to show that there has previously been significant subsidence below Cataract Creek and most of the swamps within the PPR mining area. Bulli Seam subsidence data from further west was used because no subsidence data is available for the mining in the Bulli Seam within the PPR area due to the age of the workings.

Maximum tilts and strains are estimated using empirical data presented by Holla and Barclay (2000) for the increment of subsidence associated with mining the Wongawilli Seam. Holla and Barclay (2000) did not present an incremental subsidence approach. The approach used should not to be confused with the incremental profile method routinely used by Mine Subsidence Engineering Consultants Pty Ltd (MSEC) and which has not been used here.

SCT did not recommend confirmation that there are no geological structures with potential to provide elevated hydraulic conductivity between the reservoir and the mining horizon. SCT already considers that there is sufficient confirmation that there are no such structures based on the high level of geological information available and considers that there is no potential for these structures to be significantly impacted by mining subsidence. However, it was noted that the protection strategy relies on having this information.

SCT is not aware of any recommendation for a program of work to test the hydraulic conductivity of the dyke. The experience of mining through dykes in the Southern Coalfield is that they do not provide a pathway for inflow for the mining depths at this site.

The increase in subsidence over Longwall 4 due to mining Longwall 5 is consistent with compression of the chain pillar and surrounding strata as expected. As the pillar and strata above and below the chain pillar compress at the edge of panel, so the subsidence in the adjacent previously mined panel increases by about half the compression on the edge of the panel. Further subsidence over previous panels is routinely measured and the increased subsidence observed over Longwall 4 is entirely consistent with expectation.

The statement is made that "*SCA considers it highly likely that the actual vertical subsidence of Longwall 5 will surpass the revised predicted values if Longwall 6 and others are mined*". The predictions have been made based on a conservative interpretation of the available information, but SCT would be pleased to learn of and discuss in more detail the approach that SCA has used to support this statement.

The comment that the "*reliability of subsidence predictions are critical for the assessment of other impacts and environmental consequences*" is considered to be something of an overstatement. Certainly the subsidence predictions need to be soundly based, but it should be recognised that any small differences between predicted and actual subsidence do not usually change the way that surface impacts are managed. The greater challenge is determining the relationship between any given level of subsidence and the environmental consequences so that impacts can be more appropriately assessed.

It is unclear what the call for comprehensive assessment of the behaviour of all faults and dykes in the proposed mining area is aiming to achieve particularly given the high level of detail currently available. The Corrimal Fault tapers out in the vicinity of proposed Longwalls 6 and 7 in the Wongawilli Seam. The ground movements associated with subsidence from mining in the Bulli Seam do not appear to have had any adverse impact on the surface or on hydraulic connectivity with the reservoir. The D8 dyke has been thoroughly tested by mining in the Balgownie and Bulli Seams, again without becoming apparent on the surface in the subsidence profiles or otherwise increasing the hydraulic conductivity of the overburden strata. Some further discussion to better understand the requirements is recommended.

A2-3.3 Point 4.1 – Impacts on Cataract Reservoir

The 200m wide barrier to Cataract Reservoir is considered to provide a high level of protection to the stored waters of Cataract Reservoir. The explanation relating to concerns about the Bulli Seam goafs are discussed above in Section A2-1.3.

The concept of restricting mining within the DSC Notification Area does not appear to be based on experience of impacts or the understanding outlined in the Reynolds Inquiry and subsequently administered by the DSC. The experience base and the restrictions to mining are based on depth to mining and include significant factors of safety. It is entirely appropriate that there be a DSC Notification Area to provide a mechanism to provide timely engagement of mining companies with the DSC so that suitable protection measures can be developed. However, this requirement for timely engagement has no relation to the physical protection barrier required to protect the stored waters.

The recommendation to use exploration drilling to confirm the extent of the Corrimal Fault is not considered practical, likely to be effective, or necessary. Development roadways will prove the existence, location, and displacement of this structure prior to any longwall mining. Further discussion is recommended to better understand the concerns that are being raised.

A2-3.4 Point 4.1 – Impacts on Cataract Creek

On the basis that the definition of “presumptive” as stated in the Chambers Twentieth Century Dictionary is “grounded on probable evidence” and “an assumption made failing proof to the contrary” the statement that SCA considers it presumptive of SCT to suggest that there has not been any impact on the creek is accepted. The original comment in SCT (2013) was intended to convey the point that despite 1.4m of subsidence and a probable closure of several hundred millimetres associated with this subsidence, there is no apparent evidence to suggest that Cataract Creek is losing significant flow into the mine or there is significant flow diversion into and along the stream bed.

The issues relating to adaptive management of closures on Cataract Creek are discussed in Section A2-1.2.1. The experience to date indicates that closure can be managed through adaptive management practices. The main challenge relates to determining how much closure is tolerable.

A2-3.5 Point 4.1 – Impacts on Swamps

The issues relating to adaptive management of swamps are discussed in Section A2-1.2.2.

Proposed longwall mining below CCUS4 is expected to cause some physical changes to the swamp and the first order stream that flows from it. However, the swamp has previously been subsided by up to 0.9m and SCT understands that there are not known to have been any significant adverse consequences over the long term (30 years since that subsidence occurred). There is therefore some basis to consider that further subsidence will not cause impacts that are significant enough to be an issue for the long term health of the swamp.

The context of the suggestion to monitor CCUS4 closely during mining of Longwall 6 is to provide high quality information that can be used to make informed strategic judgements for other swamps in the area.

A2-4. OFFICE OF ENVIRONMENT AND HERITAGE (OEH)

OEH raises concerns in relation to:

- Impacts on coastal upland swamps EEC.
- Potential loss of water to deep storage.
- Impacts on threatened species.

These are not subsidence related issues, but some of the issues raised by OEH relate to subsidence estimates. The following section focuses on clarifying the subsidence related aspects.

A2-4.1 Attachment A - Upland Swamps

The concept of valley closure is raised in respect to upland swamps. Some clarification of this concept may assist the discussion. Valley closure occurs primarily as a result of dilation of the subsiding overburden strata below topographic high ground. Dilation is a natural characteristic or rock and rock like materials when subject to disturbance and occurs in all directions.

When sloping terrain is subsided, strata dilation forces are unopposed on the downslope side and following principles of conservation of energy (i.e. following the path of least resistance) horizontal movements occur in the direction of least resistance which is directly downslope. This direction gives rise to the term "horizontal movements in a downslope direction" or "downslope horizontal movements".

Downslope movements give rise to valley closure in topographic low points and stretching at topographic high points. Below the level of valley floor, the potential for downslope movement is curtailed by the buttressing effect of strata below the opposite bank and movement toward the valley of strata below the base of the valley is effectively prevented. The difference in movement is accommodated as horizontal shear movements on horizontal bedding planes at a level close to the base of the valley.

In Hawkesbury Sandstone strata, the bedding planes that are activated by horizontal movements in a downslope direction are typically at a level 3-6m below the base of the river channel because these bedding planes appear to be active as part of the natural valley forming processes that occur over geological time. In some circumstances, it is possible for lower strength shear horizons to be preferentially activated above the base of the creek so that the bedrock in the creek bed is not overloaded in compression and fractured.

These processes are occurring on a scale of whole valleys. For instance closure movements measured during mining of Longwall 5 show that closure of up to 50mm has occurred along a 1km section of Cataract Creek. On the scale of individual upland swamps of the size present in PPR mining area, there is typically not enough energy available within the subsiding rock strata either side of the shallow valleys where the swamps are located for valley closure to be significant enough to fracture rock. In effect, the entire swamp moves down the slope toward the main valley of Cataract Creek rather than the sides of the shallow valley moving laterally across the slope toward the swamp.

The main subsidence processes that are likely to cause cracking of the bedrock below the swamps in the PPR are associated with systematic horizontal movements and associated conventional strains. The estimates of maximum strain and tilt provided in Appendix 1 are based on maximum credible values in the general vicinity of the swamp for the level of subsidence anticipated. However, these predictions are not expected to occur at all locations within any given swamp and may not occur within a given swamp at all.

A2-4.2 Attachment A – Surface Water

OEH describes a range of studies that help to quantify the effect of mining on potential inflows from the surface. It is noted that the findings of these studies remain consistent with studies conducted in the 1970's as part of the Reynolds Inquiry and which have been used to regulate mining adjacent to stored waters since that time. The height of depressurisation above individual longwall panels has recently been shown by Tammetta (2012) to be predictable with a high degree of confidence confirming that the Reynolds Guidelines are very conservative (as they should be).

The changes in panel widths and chain pillar widths referred to by OEH have been designed to both control surface inflows and inflows from the reservoir and the third and fourth order sections of Cataract Creek. The first and second order sections of Cataract Creek have not been specifically protected but are generally also protected.

In the original NRE1 No 1 Colliery – Underground Expansion Project (MP09-0013), large chain pillars were required to maintain low levels of surface subsidence in the expectation that the overburden strata would bridge across each individual panel. Subsidence monitoring from Longwalls 4 and 5 have shown that previous mining has compromised the bridging capacity of the overburden strata and, consistent with the adaptive management strategy being used at this site, the mine layout has been redesigned in the PPR so that there is no mining directly below the third and fourth order sections of Cataract Creek. The lack of overburden bridging and the mine layout redesign make the need for overly large chain pillars to reduce subsidence redundant. The chain pillars have consequently been resized to sizes that are appropriate to maintain stable working conditions underground and move Longwall 7 outside the 0.7 depth barrier to Cataract Reservoir.

It is recognised that OEH and other agencies have not had the benefit of being able to examine the groundwater studies.

A2-5 Wollongong City Council (WCC)

WCC has expressed a number of concerns. The concerns that relate to subsidence that have not been addressed by the PPR are mainly in relation to proposed mining under swamps CCUS4, CCSU5, and CRUS1. These issues are discussed in previous sections of this report, specifically Sections A2-1.2.2, A2-1.7, A2-3.4, and A2-4.1 of this Appendix.

A2-6 NSW Department of Primary Industries (DPI)

DPI has raised a number of concerns. The concerns that relate to subsidence mainly relate to changes in panel dimension. Other concerns relate to groundwater and these are not specifically addressed in this report although some of the discussion around height of depressurisation is relevant. It is recognised that DPI and other agencies have not had the benefit of being able to examine the groundwater studies.

The changes in panel width are discussed in Section A2-4.2, but are discussed further here for clarification. The width of the longwall panels is maintained at a maximum of 150m across most of the PPR with reduced width in Longwalls 1, 2, and 7 to fit within various constraints and provide protection to surface features and the existing main heading developments underground.

The subsidence predictions that have been made are based on the results of monitoring above Longwalls 4 and 5 and these results provide a strong basis for predicting the magnitude of subsidence that can be expected above the remaining panels in the PPR with sufficient accuracy to enable management strategies to be developed