XSTRATA COAL:

Tahmoor Colliery - Longwalls 27 to 30

Management Plan for Potential Impacts to LPI State Control Survey Marks

AUTHORISATION OF MANAGEMENT PLAN

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Date:

DOCUMENT REGISTER

Date	Report No.	Rev	Comments
Mar-06	MSEC286	A	Draft for submission to Department of Lands
Aug-06	MSEC286	B	Chapter 1 amended
May-10	MSEC446-11	A	Updated for Longwall 26
Sep-12	MSEC567-11	A	Updated for Longwalls 27 to 30

References:-

AS/NZS 4360:1999 Risk Management

Tahmoor Colliery Longwalls 27 to 30 - The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Items of Surface Infrastructure due to mining Longwalls 27 to 30 at Tahmoor Colliery in support of the SMP Application. (Report MSEC355, Revision B, July 2009), prepared by Mine Subsidence Engineering Consultants

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Figures

Figures are prefaced by the number of the chapter or the letter of the appendix in which they are presented.

Drawings

Drawings referred to in this report are included in Appendix B at the end of this report.

Drawing No.	*Description*	*Revision*
MSEC567-11-01	Survey Control Marks	A

1.1. Background

Tahmoor Colliery is located approximately 80 kilometres south west of Sydney in the township of Tahmoor NSW. It is managed and operated by Xstrata Coal. Tahmoor Colliery has previously mined 25 longwalls to the north and west of the mine's current location. It is currently mining Longwall 26.

Longwalls 27 to 30 are a continuation of a series of longwalls that extend into the Tahmoor North Lease area, which began with Longwall 22. The longwall panels are located between the Bargo River in the south-east, the township of Thirlmere in the west and Picton in the north. A portion of each longwall is located beneath the urban area of Tahmoor. Permanent survey control marks are located within these areas.

This Management Plan provides detailed information about how the risks associated with mining beneath state survey control marks will be managed by Tahmoor Colliery and Land and Property Information.

The Management Plan is a live document that can be amended at any stage of mining, to meet the changing needs of Tahmoor Colliery and Land and Property Information.

1.2. Maximum Predicted Systematic Parameters

Predicted mining-induced systematic subsidence movements were provided in Report No. MSEC355, which was prepared in support of Tahmoor Colliery's SMP Application for Longwalls 27 to 30.

A summary of the maximum predicted incremental systematic subsidence parameters, due to the extraction of each of the proposed longwalls, is provided in Table 1.1. A summary of the maximum predicted cumulative systematic subsidence parameters, after the extraction of each of the proposed longwalls, is provided in Table 1.2. A summary of the maximum predicted travelling parameters, during the extraction of each of the proposed longwalls, is provided in Table 1.3.

Table 1.1 Maximum Predicted Incremental Systematic Subsidence Parameters due to the Extraction of Each of the Proposed Longwalls 27 to 30

Longwall	Maximum Predicted Incremental Subsidence (mm)	Maximum Predicted Incremental Tilt (mm/m)	Maximum Predicted Incremental Hogging Curvature (1/km)	Maximum Predicted Incremental Sagging Curvature (1/km)
After LW27	755	6.0	0.07	0.14
After LW28	735	5.9	0.07	0.13
After LW29	735	5.9	0.06	0.13
After LW30	725	5.8	0.06	0.13

Table 1.2 Maximum Predicted Cumulative Systematic Subsidence Parameters after the Extraction of Each of the Proposed Longwalls 27 to 30

Longwall	Maximum Predicted Cumulative Subsidence (mm)	Maximum Predicted Cumulative Tilt (mm/m)	Maximum Predicted Cumulative Hogging Curvature (1/km)	Maximum Predicted Cumulative Sagging Curvature (1/km)
After LW27	1260	6.3	0.09	0.15
After LW28	1270	6.2	0.09	0.14
After LW29	1270	6.1	0.09	0.14
After LW30	1270	6.3	0.09	0.14

The values provided in the above table are the maximum predicted cumulative systematic subsidence parameters which occur within the general SMP Area, including the predicted movements resulting from the extraction of Longwalls 22 to 30.

Table 1.3 Maximum Predicted Travelling Subsidence Parameters during the Extraction of Each of the Proposed Longwalls 27 to 30

Longwall	Maximum Predicted Travelling Tilt (mm/m)	Maximum Predicted Travelling Hogging Curvature (1/km)	Maximum Predicted Travelling Sagging Curvature (1/km)
During LW27	3.1	0.04	0.03
During LW28	3.0	0.03	0.03
During LW29	3.0	0.03	0.03
During LW30	3.0	0.03	0.03

1.3. Objectives

The objectives of this Management Plan are to establish procedures to measure, control, and record potential movements that might occur to permanent survey control marks.

The objectives of the Management Plan have been developed to:-

- Ensure the safe and serviceable operation of all surface infrastructure. Public and workplace safety is paramount. Disruption and inconvenience should be kept to minimal levels.
- Monitor ground movements of permanent survey control marks.
- Notify surveyors and other users that the survey marks are potentially affected by subsidence.
- Provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Colliery, Land and Property Information, Mine Subsidence Board, and NSW Department of Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy (DTIRIS), and consultants as required.
- Establish lines of communication and emergency contacts.

1.4. Scope

The Management Plan is to be used to measure, control, and record potential movements that might occur to permanent survey control marks.

The Management Plan describes measures that will be undertaken as a result of mining Longwalls 27 to 30.

1.5. Proposed Mining Schedule

It is planned that each longwall will extract coal working northwest from the southeastern ends. This Management Plan covers longwall mining until completion of mining in Longwall 30 and for sufficient time thereafter to allow for completion of subsidence effects. The current schedule of mining is shown in Table 1.4.

Table 1.4 Schedule of Mining

Longwall	Start Date	Completion Date
Longwall 27	November 2012	October 2013
Longwall 28	November 2013	July 2014
Longwall 29	August 2014	February 2015
Longwall 30	March 2015	October 2016

1.6. Definition of Active Subsidence Zone

As a longwall progresses, subsidence begins to develop at a point in front of the longwall face and continues to develop after the longwall passes. The majority of subsidence movement typically occurs within an area 150 metres in front of the longwall face to an area 450 metres behind the longwall face.

This is termed the “active subsidence zone” for the purposes of this Management Plan, where surface monitoring is generally conducted. The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 metres in front and 450 metres behind the active longwall face, as shown by Fig. 1.1.

Fig. 1.1 Diagrammatic Representation of Active Subsidence Zone

1.7. Ground Monitoring of Streets

A plan showing the timing of ground monitoring along streets during the mining of Longwall 27 is shown in Fig. 1.2.

As a general guide, the frequency of ground monitoring within urban areas is every 200 metres of longwall extraction. The timing of surveys within rural areas is determined by the location of street monitoring lines, where a survey has been scheduled to occur when the longwall face has passed each monitoring line by approximately 200 metres.

At the completion of each longwall, surveys will be undertaken along the full length of each monitoring line, which is expected to have experienced some subsidence movements as a result of mining the longwall.

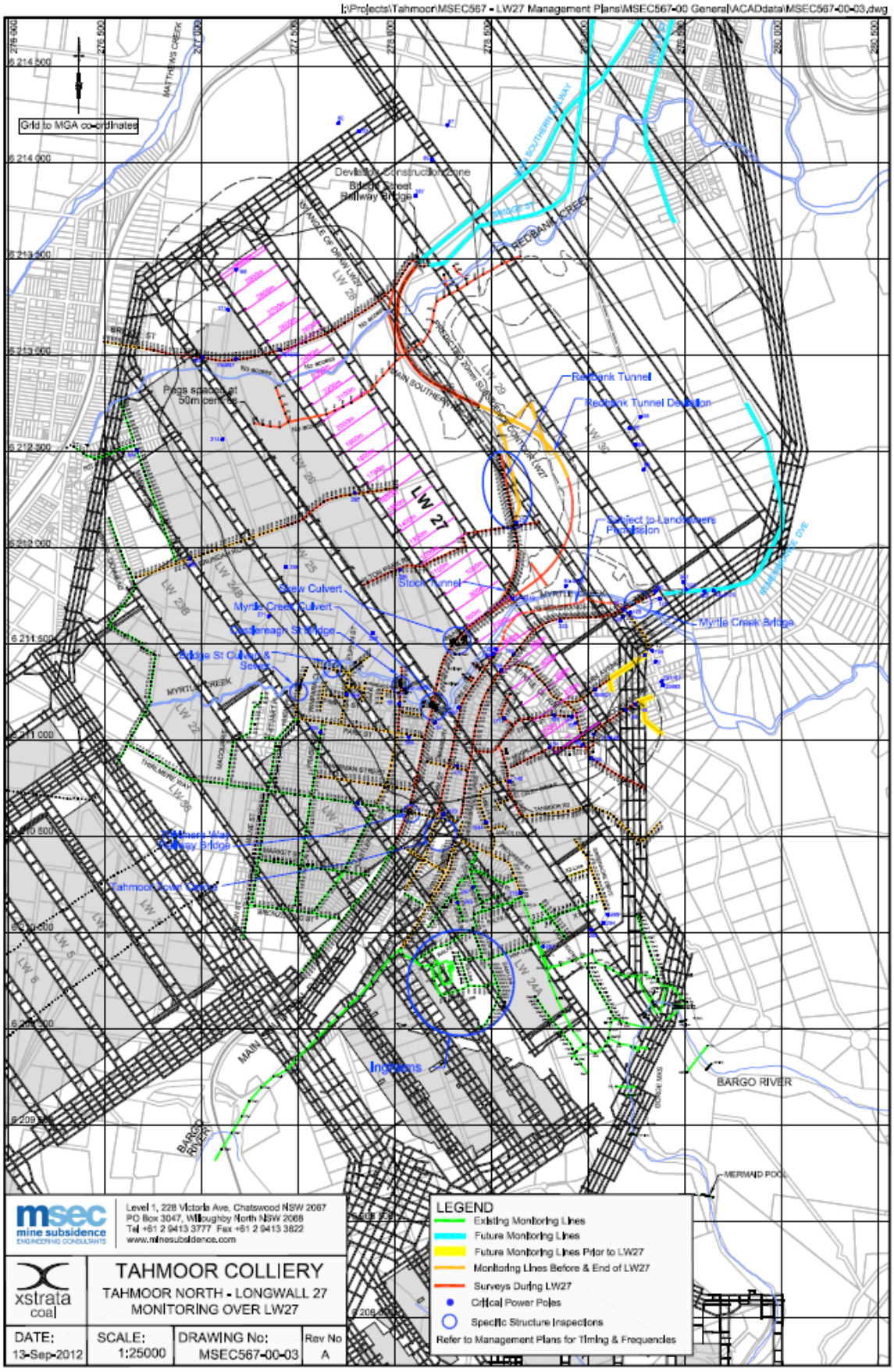

Fig. 1.2 Ground Monitoring along Streets over Longwall 27

2.1. General

The Australian/New Zealand standard for Risk Management defines the terms used in the risk management process, which includes the identification, analysis, assessment, treatment and monitoring of risk. In this context:-

2.1.1. Consequence

'The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.'[1] The consequences of a hazard are rated from very slight to very severe.

2.1.2. Likelihood

'Used as a qualitative description of probability or frequency.'[2] The likelihood can range from very rare to almost certain.

2.1.3. Hazard

'A source of potential harm or a situation with a potential to cause loss.'[3]

2.1.4. Risk

'The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.'[4] The risk combines the likelihood of an impact occurring with the consequence of the impact occurring. The risk is rated from very low to extreme. In this study, the likelihood and consequence are combined via the qualitative risk analysis matrix shown in Table 2.1, to determine an estimated level of risk for particular events or situations.

The Risk Analysis Matrix is similar to the example provided in AS/NZS 4360:1995, Appendix D, p.25.

Table 2.1 Qualitative Risk Analysis Matrix

Likelihood	CONSEQUENCES				
	Very Slight	Slight	Moderate	Severe	Very Severe
Almost Certain	Low	Moderate	High	Extreme	Extreme
Likely	Low	Moderate	High	Very High	Extreme
Moderate	Low	Low	Moderate	High	Very High
Unlikely	Very Low	Low	Moderate	High	High
Rare	Very Low	Very Low	Low	Moderate	High
Very Rare	Very Low	Very Low	Low	Moderate	Moderate

This Management Plan adopts a common system of nomenclature to summarise each risk analysis, which is **"LIKELIHOOD / CONSEQUENCE → LEVEL OF RISK".**

For example, if the likelihood of a risk is assessed as "**UNLIKELY**", and the consequence of a risk is assessed as "**SEVERE**", the risk analysis would be summarised as **"UNLIKELY / SEVERE → HIGH"**.

[1] AS/NZS 4360:1999 – Risk Management pp2
[2] AS/NZS 4360:1999 – Risk Management pp2
[3] AS/NZS 4360:1999 – Risk Management pp2
[4] AS/NZS 4360:1999 – Risk Management pp3

There are 37 Permanent Survey Marks and State Survey Marks that are expected to experience vertical subsidence greater than 20 mm during the mining of Longwalls 27 to 30. The predicted subsidence for these survey marks at the completion of Longwalls 27 to 30 is provided in Table 3.2.

There are numerous other survey control marks that lie outside the extent of Longwalls 27 to 30 which are likely to experience either small amounts of subsidence and/or some small regional horizontal displacements as the proposed longwalls are mined. It is possible that other marks that are located up to 3 kilometres outside the limit of subsidence will also be affected by regional horizontal displacements.

It will be necessary on completion of the proposed longwalls, when the ground has stabilised, to re-establish these marks. However, the predicted subsidence parameters shown in Table 3.2 do not represent the final subsidence values that will occur, as further movements are expected to occur following the extraction of future longwall panels in the series. Consultation between Tahmoor Colliery and Land and Property Information will be required throughout the mining period to ensure that these survey marks are reinstated at an appropriate time, as required.

The risks associated with survey marks are listed below.

- Movement of survey control marks horizontally and vertically; and
- Use of survey control marks by general surveyors, during and after mining prior to recalibration.

3.1. Risk Assessment

It is likely that survey control marks will move horizontally and vertically and require recalibration after the impacts of mine subsidence are finished.

Table 3.1 Predicted Subsidence at Survey Marks due to the mining of Longwall 27

Hazard / Impact	Consequence	Likelihood	Risk
Movement of Survey Control Marks	**SLIGHT**	**ALMOST CERTAIN**	**MODERATE**
Use of Survey Control Marks by General Surveyors – during and after mining, prior to re-calibration (IF NOT IN SCIMS)	**SEVERE**	**LIKELY**	**VERY HIGH**
Use of Survey Control Marks by General Surveyors – during and after mining, prior to re-calibration (NOTATION IN SCIMS TO INDICATE THAT SURVEY MARKS ARE SUBJECT TO SUBSIDENCE)	**SEVERE**	**VERY RARE**	**MODERATE**
Use of Survey Control Marks by General Surveyors – after re-calibration		**NO RISK**	

Table 3.2 Predicted Subsidence at Survey Marks due to the mining of Longwalls 27 to 30

Survey Control Mark	MGA Easting (m)	MGA Northing (m)	Predicted Subsidence after LW27 (mm)	Predicted Subsidence after LW28 (mm)	Predicted Subsidence after LW29 (mm)	Predicted Subsidence after LW30 (mm)
PM 3115	278801	6211620	125	675	850	900
PM 34217	279985	6212130	< 20	< 20	< 20	< 20
PM 46912	278362	6210586	625	625	625	625
PM 46945	278525	6212058	125	725	1000	1075
PM 46947	278986	6212665	< 20	< 20	75	725
PM 59411	277736	6211085	1200	1200	1200	1200
PM 59428	277503	6211540	1050	1050	1050	1050
PM 60508	278252	6211414	1125	1200	1225	1225
PM 60509	278650	6212113	50	525	900	1025
PM 60510	278483	6212683	25	100	750	1025
PM 60511	278032	6213019	50	525	900	1025
PM 60513	278710	6213970	< 20	< 20	< 20	25
PM 66466	278085	6213510	< 20	50	500	900
PM 82399	278933	6211108	375	375	375	375
SS 37357	278680	6212136	50	350	775	900
SS 51761	278402	6213654	< 20	< 20	50	425
SS 54048	279379	6211262	< 20	< 20	< 20	< 20
SS 54834	278437	6210743	875	875	875	875
SS 54835	278483	6210532	875	875	875	875
SS 58554	278025	6211170	1250	1250	1250	1250
SS 81039	278605	6210700	675	675	675	675
SS 81040	278525	6210680	750	750	750	750
SS 103706	277962	6210755	1050	1050	1050	1050
SS 105413	279361	6211329	< 20	< 20	25	25
SS 105415	278000	6210987	1000	1025	1025	1025
SS 118916	278908	6211189	475	500	500	500
SS 118922	278537	6210973	1000	1025	1025	1025
SS 121578	278417	6211078	1075	1100	1100	1100
SS 126924	277725	6211150	1125	1125	1125	1125
SS 133467	278760	6211114	700	700	700	700
SS 135508	278631	6211464	800	1025	1100	1100
SS 141049	278051	6211254	1175	1175	1200	1200
SS 145752	278780	6211611	150	650	825	875
SS 145753	278745	6211670	150	725	925	1000
SS 145760	278959	6211639	75	350	550	600
SS 153933	279116	6211311	75	75	100	100
TS 10706	278678	6212140	50	350	750	900

4.0 RISK CONTROL PROCEDURES

Infrastructure	Hazard / Impact	Raw Risk	Trigger	Control Procedure/s	Frequency	By Whom?	Updated Risk (including Control Procedure)
Survey Control Marks	Movement of Survey Control Marks	**MODERATE**	None	Notify Land and Property Information of predicted subsidence movements of permanent survey marks	Prior to mining LW27	Tahmoor Colliery	C = Slight L = Almost Certain **R = MODERATE**
	Use of Survey Control Marks by General Surveyors – during and after mining, affecting results (prior to re-calibration)	**VERY HIGH**	None	Provide Longwall update	Weekly	Tahmoor Colliery	C = Severe L = Very Rare **R = MODERATE**
				Provide survey information	As survey results become available	Tahmoor Colliery	
				Notation in SCIMS that Survey Control Marks are subject to subsidence.	Before mining	Land and Property Information	
				Notify Land and Property Information when subsidence has completed	After mining and subsidence are complete	Tahmoor Colliery	
				Permanent Survey Marks – re-surveyed	After mining and subsidence are complete	Land and Property Information	**NEGLIGIBLE RISK**

5.0 MANAGEMENT PLAN REVIEW MEETINGS

Management Plan Review Meetings will be held between Tahmoor Colliery and Land and Property Information for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of the Plan Review Meetings will be as requested by any party.

Plan Review Meetings will discuss any incidents reported in relation to the relevant surface feature, the progress of mining, the degree of mine subsidence that has occurred, and comparisons between observed and predicted ground movements.

It will be the responsibility of the meeting representatives to determine whether the incidents reported are due to the impacts of mine subsidence, and what action will be taken in response.

In the event that a significant risk is identified for a particular surface feature, any party may call an emergency Plan Review Meeting, with one day's notice, to discuss proposed actions and to keep other parties informed of developments in the monitoring of the surface feature.

6.0 AUDIT AND REVIEW

The Management Plan will be reviewed following extraction of each longwall.

Should an audit of the Management Plan be required during that period, an auditor shall be appointed by Tahmoor Colliery to review the operation of the Management Plan and report at the next scheduled Plan Review Meeting.

Other factors that may require a review of the Management Plan are:-

- Observation of greater impacts on surface features due to mine subsidence than was previously expected.
- Observation of fewer impacts or no impacts on surface features due to mine subsidence than was previously expected.
- Observation of significant variation between observed and predicted subsidence.

7.0 RECORD KEEPING

Tahmoor Colliery will keep and distribute minutes of any Management Plan Review Meeting.

8.0 CONTACT LIST

Organisation	Contact	Phone	Email / Mail	Fax
NSW Department of Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy (DTIRIS)	Phil Steuart	(02) 4931 6648	phil.steuart@industry.nsw.gov.au	(02) 4931 6790
	Gang Li	(02) 4931 6644 0409 227 986	gang.li@ industry.nsw.gov.au	(02) 4931 6790
Land and Property Information, Division of Finance and Services	Darryl Halls		PO Box 143 Bathurst NSW 2795	
Mine Subsidence Board	Darren Bullock	(02) 4677 1967	d.bullock@minesub.nsw.gov.au	(02) 4677 2040
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay	(02) 9413 3777	daryl@minesubsidence.com	(02) 9413 3822
Xstrata Coal Tahmoor Colliery – Environment and Community Manager	Ian Sheppard	(02) 4640 0156 0408 444 257	isheppard@xstratacoal.com.au	(02) 4640 0140
Xstrata Coal Tahmoor Colliery – Community Coordinator	Belinda Clayton	(02) 4640 0133	bclayton@xstratacoal.com.au	(02) 4640 0140

APPENDIX A. DRAWINGS

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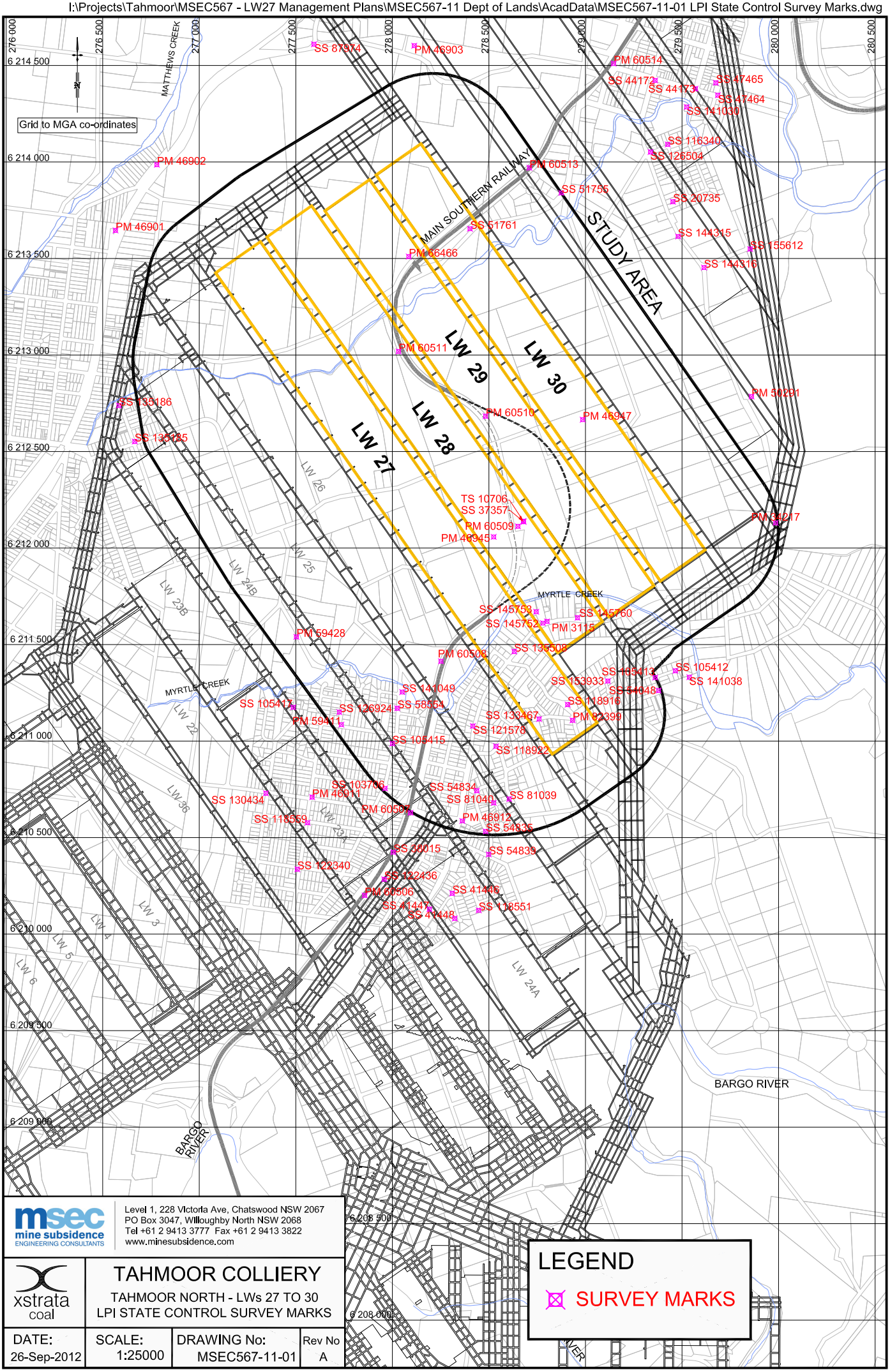

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TAHMOOR COLLIERY

TAHMOOR NORTH - LWs 27 TO 30
LPI STATE CONTROL SURVEY MARKS

DATE:	SCALE:	DRAWING No:	Rev No
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LEGEND

SURVEY MARKS