



**Centennial
Tahmoor**

**TAHMOOR COLLIERY
LONGWALL 23B**

**END OF PANEL MONITORING REPORT
FOR LONGWALL 23B
AT TAHMOOR COLLIERY**



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DOCUMENT REGISTER

Revision	Description	Author	Checker	Date
01	Report after 300m of Extraction – LW23A	DJK	AAW	Nov 2005
02	Report after 500m of Extraction – LW23A	DJK	DRK	Dec 2005
03	End of Panel Report for LW23A	DJK	DRK	Feb 2006
04	Report after 300m of Extraction – LW23B	DJK	DRK	June 2006
05	Report after 600m of Extraction – LW23B	DJK	DRK	July 2006
06	End of Panel Report for LW23B	PLD	DJK	Nov 2006

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Compliance with conditions attached to the s138 Application for The Department of Primary Industries – Minerals

LIST OF DRAWINGS AND ILLUSTRATIONS

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CHAPTER 1. INTRODUCTION

This report has been prepared to compare observed and predicted subsidence, tilt and strain profiles along monitoring lines, and observed and predicted impacts on surface features, following the completion of Longwall 23B. The location of Longwall 23B is shown in Drawing No. MSEC235-01, which together with all other drawings, is attached at the back of this report.

CHAPTER 2. MONITORING LINES

As set out in the Surface Safety and Serviceability Management Plan, for Tahmoor Colliery Longwalls 22 and 23, regular subsidence surveys have been conducted along monitoring lines that have been established in selected streets. The monitoring is being undertaken to compare observed movements against predicted movements, and to identify any anomalous movements that might potentially have an adverse effect on surface features.

The locations of all of the monitoring lines near Longwall 23B are shown in Drawing No. MSEC235-01.

Four (4) monitoring lines have been installed over or near Longwall 23B. These are the Brundah Rd, Turner-Denmead, Marion Street, and Macquarie Place monitoring lines.

The end of panel survey along the monitoring lines was conducted between 4 and 6 September 2006. Mining of the longwall commenced on 22 March 2006 and was completed on 26 August 2006. Further monitoring of these lines will be undertaken during the extraction of Longwall 24.

The observed total and incremental subsidence profiles are provided in Figs. MSEC235-15 to MSEC235-20.

Comparisons between predicted and observed subsidence, tilt and strain profiles for these lines are discussed below.

2.1. Identification of Non-Systematic Subsidence Movements along Monitoring Lines

Irregular subsidence movements can be found in observed subsidence, tilt and strain profiles. The most common causes of irregular movements in subsidence profiles are listed below.

- Valley closure and upsidence,
- Geological structures,
- Change in direction of monitoring line,
- Bumped or damaged pegs,
- Survey line discontinuities, where survey lines are extended after the subsidence has already occurred,
- Survey inaccuracies, and
- Anomalous movements

Irregularities that have occurred as a result of the surveying process are not considered to be non-systematic subsidence movements.

Anomalous movements have been identified by a process of elimination. If a cause behind an irregularity in a subsidence, tilt or strain profile cannot be explained, the irregularity is described as an anomaly.

The monitoring results do not reveal any new non-systematic movements during the extraction of Longwall 23B. However, two previously identified locations of non-systematic movement continued to develop during mining of this longwall, as shown in Table 2.1 below.

Table 2.1 Locations of Previously Identified Non-Systematic Movements over Longwall 23B

Monitoring Line	Maximum Upsidence (mm)	Maximum Strain (mm/m)	Maximum Tilt (mm/m)	Type	Impacts to Surface
Turner-Denmead (Pegs 54 & 55)	60	-4.4	5.3	Anomaly	Buckling and cracking to road pavement. Cracks in paddock. Impact to house.
Macquarie Place (Pegs T28 to M10)	None	+2.2	9.7	Igneous intrusion	Cracking to road pavement. Impact to house.

A number of further observations can be made with regard to the subsidence monitoring results during mining of Longwall 23B.

- The Turner-Denmead line was established prior to the commencement of Longwall 22. The compressive strain associated with upsidence along Denmead Street between pegs 54 and 55, has increased to 4.4 mm/m which is an increase of 1.2 mm/m since the completion of Longwall 22. The pavement first cracked during mining of Longwall 22, which is shown in Drawing No. MSEC235-02. Further minor movement was observed on the road pavement and footpath during mining of Longwall 23B.
- A small bump of 25 mm has appeared at peg 29 along the Turner-Denmead line. The resulting maximum tilt and strain at the location of the bump are 1.1 mm/m and 0.6 mm/m respectively, which are very small. No impacts have been observed at this location.
- The Macquarie Place line was established prior to the commencement of Longwall 22. The pavement first cracked during the extraction of Longwall 22, which is shown in Drawing No. MSEC235-02. There was a slight widening of cracking to the road pavement due to the extraction of Longwall 23B. No further impacts have been observed since the 600 metre street monitoring report.
- The Brundah Street and Marion Street lines were established just before the completion of Longwall 23A. Both subsidence plots generally follow the predicted subsidence profiles. However, irregularities of up to about 20 mm have been noted and these may be due to the effects of faults in the area, disturbance of pegs or an error in the initial survey. It is noted that the irregularities appear to have occurred between the initial survey and first survey with little variation in subsequent surveys. The locations of known geological features, at seam level, are presented on MSEC Drawing No. MSEC235-01, and are also plotted on the monitoring line subsidence profiles.

2.2. Identification of Non-Systematic Movements Beyond Monitoring Lines

- A bump appeared near the corner of Bell and Denmead Streets following surveys conducted for the 600 metre street monitoring report. The bump was first reported after Longwall 23B had passed the site by approximately 120 metres and is discussed in the previous 600metre street monitoring report. The bump is measured to be approximately 50 mm in height. It is not certain whether this impact to the pavement is due to normal systematic movements or non-systematic movements, as there is no monitoring line at the site and the impacts are minor. If the movements are non-systematic, they would not be due to valley closure or upsidence as there is no creek or small watercourse evident in the surface contours at this site. No further impacts have been observed at this site since the 600 metre survey.
- A property in Glenanne Place has experienced a differential tensile horizontal movement between two structures (Structure Ref. O14a and b as located in Drawing No. MSEC235-02) that has resulted in substantial impacts to some brick columns. Differential movements have also been observed between the structures and external concrete pavements. There is no evidence of cracking or bulging of the ground around the structures. The house is located adjacent to a small watercourse. The property remains safe and serviceable.
- A tensile crack has formed in a paddock within another property in Glenanne Place (Structure Ref. O16). The crack is approximately 40 metres long and between 10 and 65 mm wide and 200 mm deep. The crack in the ground is shown in Drawing No. MSEC235-02. As shown in this drawing, the orientation of this crack does not align with Structures O14a and O14b. However, the crack is located adjacent to the same watercourse that runs past those structures. A common factor between the two impact sites is the small watercourse. It is possible that the impacts are related to the behaviour of the strata along this drainage line. The movements may be related to upsidence and closure movements, or may be due to the way the strata along this drainage line has failed or responded to subsidence movements.
- Cracking has been observed in the bed of Myrtle Creek near the commencing end of Longwall 23B, as located in Drawing No. MSEC235-02. These may be due to non-systematic upsidence and closure movements. Further details will be provided in a report by Geoterra Pty Ltd.
- Surface cracks have been observed in a property on the corner of Bell and Denmead Streets (Structure Ref. O03a) as shown in Drawing No. MSEC235-02. The crack is approximately 40 metres long and up to 40 mm wide.
- A unit within the Macquarie Grove Retirement Village had claimed for impacts to its rear patio, which has reportedly dropped 10 mm in relation to the house structure. This was reported in previous monitoring reports. However, the Mine Subsidence Board has refused the claim.

2.3. Comparison between Predicted and Observed Movement Profiles

The predicted and observed subsidence, tilt and strain profiles for each monitoring line are shown in Figs. MSEC235-15 to MSEC235-20 inclusive. A number of observations have been made following a comparison between these profiles.

- No monitoring lines are located in the central area of the longwall panel as there are no streets in this location. It is therefore not possible to compare observed and predicted maximum subsidence above Longwall 23B. Experience from comparisons above Longwall 23A suggests that the ground surface would have subsided in a similar manner as predicted, with maximum subsidence in the order of 600 mm.
- There is a reasonable correlation between observed and predicted subsidence and tilt profiles. The main exception to this observation is the Macquarie Place monitoring line, which is influenced by the igneous intrusion in Longwall 23, as shown in Drawing No. MSEC235-01.
- It can be seen from Figure No. MSEC235-17 that observed subsidence has exceeded the predicted subsidence over much of the Turner-Denmead monitoring line (pegs 1 to 51 and 61 to 78). The maximum observed subsidence exceeds the predicted maximum subsidence by about 50mm. While there is a good match between the observed and predicted profiles, it appears that the location of the subsidence profile is approximately 20m to 30m further out of the longwall.
- Far-field vertical movements beyond the predicted limit of subsidence were noted in previous panel reports for Longwalls 22 and 23A. This has also been observed during extraction of Longwall 23B in the Brundah Road, Turner-Denmead, and Marion Street monitoring lines. The tilts and strains in these areas are generally less than 0.5mm/m.
- The predicted and observed profiles do not compare well where non-systematic movements have occurred, which is understandable. Non-systematic movements were identified in Section 2.1.

CHAPTER 3. IMPACTS TO SURFACE FEATURES

3.1. Summary of Impacts to Surface Features

A comparison between predicted and observed impacts to surface features is summarised in Table 3.1 below. It can be seen from that the impacts to surface features have been relatively minor. The predicted and observed impacts to surface features compare reasonably well, with the exception of locations where non-systematic movements have occurred.

Table 3.1 Summary of Predicted and Observed Impacts during Longwall 23B

SURFACE FEATURE	PREDICTED IMPACTS	OBSERVED IMPACTS
NATURAL FEATURES		
Myrtle Creek	Potential cracking in creek bed. Potential surface flow diversion. Potential reduction in water quality during times of low flow. Potential increase in ponding.	Cracking observed. No surface flow diversion or reduction in water quality observed. No increase in ponding.
Aquifers or Known Groundwater Resources	See Farmland and Facilities - Wells and Bores	No impacts observed.
Natural Vegetation	No impacts anticipated.	No impacts observed.
PUBLIC UTILITIES		
Railways	Ground movements unlikely to impact operation of railway.	Not applicable.
Roads (All Types)	Minor cracking and buckling may occur in isolated locations.	Bump in road at corner of Bell St and Denmead St. Continued impact to pavement and footpath observed on Denmead St. Impact to pavement observed on Macquarie place.
Water Pipelines	Minor impact to pipelines, particularly older cast iron pipes with lead joints.	No impacts observed.
Gas Pipelines	Ground movements unlikely to adversely impact pipelines.	No impacts observed.
Sewerage Pipelines	Mining induced tilt may reduce gradient of some pipes to less than that required for self-cleansing.	No impacts observed.
Electricity Transmission Lines or Associated Plants	Ground movements unlikely to adversely impact electrical infrastructure.	No impacts observed.
Telecommunication Lines or Associated Plants	Ground movements unlikely to adversely impact telecommunications infrastructure.	No impacts observed.
PUBLIC AMENITIES	Negligible impacts predicted for all public amenities.	Not applicable.

Table 3.1 Summary of Predicted and Observed Impacts during Longwall 23B (continued)

SURFACE FEATURE	PREDICTED IMPACTS	OBSERVED IMPACTS
FARMLAND AND FACILITIES		
Farm Buildings or Sheds	Negligible impacts predicted for all farm buildings and sheds.	No impacts observed.
Fences	No impact assessment provided in Report No. WKA137.	Impacts to fences or gates observed on 4 properties (One above Longwall 23B).
Farm Dams	Potential cracking and leakage. Ground movements unlikely to result in overflowing or reduction in dam capacity.	No impacts observed.
Wells or Bores	Potential differential horizontal movements.	No impacts observed.
INDUSTRIAL, COMMERCIAL & BUSINESS ESTABLISHMENTS	Negligible impacts predicted for all business and commercial establishments.	No impacts observed.
AREAS OF ARCHAEOLOGICAL OR HERITAGE SIGNIFICANCE	Negligible impacts predicted for items of heritage significance.	No impacts observed.
ITEMS OF ARCHITECTURAL SIGNIFICANCE	No items of architectural significance located within the area impacted by Longwall 23A.	
PERMANENT SURVEY CONTROL MARKS	Ground movement predicted at identified survey marks.	Ground movement occurred.
RESIDENTIAL ESTABLISHMENTS		
Houses	Tilt Impact Category B for 8 houses due to systematic mine subsidence movements. Strain impact Category 1 for 152 houses and Category 2 for 2 houses due to systematic mine subsidence movements. Potential for non-systematic movement to occur. All structures expected to remain safe, serviceable and repairable during and following mining.	Some impacts observed for 23 houses, although most are negligible to very slight (sticky doors, minor cracks to internal finishes). Only 4 of these are located above or near Longwall 23B. Most are above Longwall 23A (late claims). 1 house with Category B Tilt Impact. 1 house with Category 1 crack to external wall (Strain Impact Cat 1). 2 houses with Category 2 crack to external walls (Strain Impact Cat 2). 1 houses with Category 3 crack to external wall (Strain Impact Cat 3). All structures were safe, serviceable and repairable during and following mining.
Retirement or Aged Care Villages	Negligible impacts predicted for Macquarie Grove Retirement Village.	No impacts observed.

Table 3.1 Summary of Predicted and Observed Impacts during Longwall 23B (continued)

SURFACE FEATURE	PREDICTED IMPACTS	OBSERVED IMPACTS
Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts	Potential impact to pipes connected to in-ground septic tanks. Negligible impacts predicted for non-residential domestic structures, including swimming pools and tanks.	Crack to 2 masonry retaining walls, 1 masonry meter box, garage, breezeway and pagoda.
External Residential Pavements	No impact assessment provided in Report No. WKA137.	Impacts to pavements observed on 5 properties.

3.2. Impacts to Houses and Public Amenities

As set out in the Surface Safety and Serviceability Management Plan, Revision C (SSSMP), for Tahmoor Colliery Longwalls 22 and 23, a field investigation program has been implemented to monitor impacts on a number of buildings that will be affected by Longwalls 22 and 23. The timing and frequency of ground and building surveys around buildings is set out in Appendix B of the SSSMP.

The Stage 1 Report (Report No. MSEC184-02) documented the findings of the pre-mining field investigations of 119 buildings. Since that report, an additional building (a new child care centre) has been added to the sample, which revises the total to 120 buildings. In accordance with the SSSMP, these buildings were re-inspected after the longwall passed each building by between 150 and 300 metres and following the completion of Longwall 23A.

Impacts have also been reported by residents who did not take part in the field investigation program.

3.2.1. Comparison between Predicted and Observed Impacts to Houses and Public Amenities

Predicted impacts for buildings have been amended since the last published reports, which were Report No. WKA137, Report No. MSEC156 and Report No. MSEC184-02. The predicted impacts have been amended to account for the introduction of the coal barrier between Longwalls 23A and 23B.

A summary of predicted impacts for houses and public amenities, following the completion of Longwall 23B is provided in Table 3.2. The count of houses and public amenities includes only those buildings that were predicted to experience more than 20 mm of subsidence due to the extraction of Longwalls 22, 23A and 23B. The remaining houses and public amenities that were identified in Report No. WKA137 or Report No. MSEC156 were not included in this comparison.

Observed impacts have been reconciled with the MSB records. Some residents had previously reported impacts to Tahmoor Colliery but the residents have not lodged claims to the MSB after some weeks have passed, despite requests by the colliery to do so. These properties were previously identified as experiencing impacts but have now been removed from the count.

Observed tilt impacts have been categorised, based upon a classification of tilt-related impacts as described in Report No. WKA137. Observed strain impacts are based upon a measurement of maximum vertical crack width in external walls, as the empirical method of strain impact assessment was based upon this objective measurement. A summary of impacts is provided in Table 3.2.

Table 3.2 Comparison between Predicted and Observed Impacts

	Predicted after LW 23B (No.)	Observed after LW 23B (No.)
Tilt Impacts		
Tilt Impact Category A	550	555
Tilt Impact Category B	8	3
Strain Impacts		
Strain Impact Category 0	386	545
Strain Impact Category 1	169	3
Strain Impact Category 2	3	6
Strain Impact Category 3	0	4

It is noted that one (1) house, which has experienced Category B tilt impacts, has also experienced a Category 2 crack. A total of fifteen (15) houses have therefore experienced impacts greater than Tilt Category A or Strain Category 0. Five (5) of these houses reported impacts during the extraction of Longwall 23B, two of which are located above or near Longwall 23B and three above previously mined Longwall 23A.

It is further advised that an additional 40 houses have experienced minor impacts that have not resulted in a classification of impact greater than Tilt Category A or Strain Category 0. These impacts include door jams, slight door swings, minor cracks to internal linings or floor finishes.

It can be seen from the above summary that the great majority of the observed impacts compare well with predicted impacts, although there are some buildings that have experienced greater impacts than previously predicted. On an overall basis, fewer buildings have experienced impacts greater than Tilt Impact Category A or Strain Impact Category 0 when compared to predicted impacts.

The locations of affected houses and public amenities are shown in Drawing No. MSEC235-02. It can be seen from this drawing that the great majority of impacts have occurred directly above the extracted longwall panels. However, in a small number of cases, some minor impacts were reported prior to the longwall directly mining under the properties. The three houses with Category 3 cracks to external walls have experienced non-systematic movements. Two of the houses that have experienced Category B tilt impacts are located near non-systematic movements. It is therefore concluded that whilst some houses have experienced greater impacts when compared to their predicted impact assessments, the impacts are mainly due to non-systematic movements, which cannot be predicted prior to the commencement of Longwalls 22, 23A and 23B.

There were also nine structures where preventive works or additional monitoring during mining was recommended due to non-conformance to Australian Standards or potential vulnerability to subsidence impacts. Only one of these identified structures, House M09a, has reported any adverse impacts and this occurred during the extraction of Longwall 22. This house is likely to have been affected by non-systematic movements. It was recommended that a bulkhead be monitored during mining, and it is reported that cracking has occurred to the internal linings around this bulkhead. However, the cracking does not pose a hazard to the safety of the residents. The house was monitored during the extraction of Longwall 23B and no further impacts were observed.

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Waddington, A.A., Kay, D.R. and Kay, D.J. (2004). *Challenges for Assessment of Tilt Impacts due to Mining a Series of Longwalls*, Proceedings of the 6th Triennial Conference on Mine Subsidence, Maitland, November 2004.

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Mine Subsidence Engineering Consultants, (2004). *Stage 1 Report on Site Investigation of Structures that will be affected by Mine Subsidence due to extraction of Longwalls 22 and 23 at Tahmoor Colliery*. Report No. MSEC184-02, December 2004.

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Waddington Kay & Associates, (2003). *Tahmoor North Longwalls 22 & 23 Report on the Prediction of Subsidence Parameters and the Assessment of Subsidence Impacts on Natural Features and Surface Infrastructure (in support of a Section 138 Application)*. Report No. WKA137, October 2003.



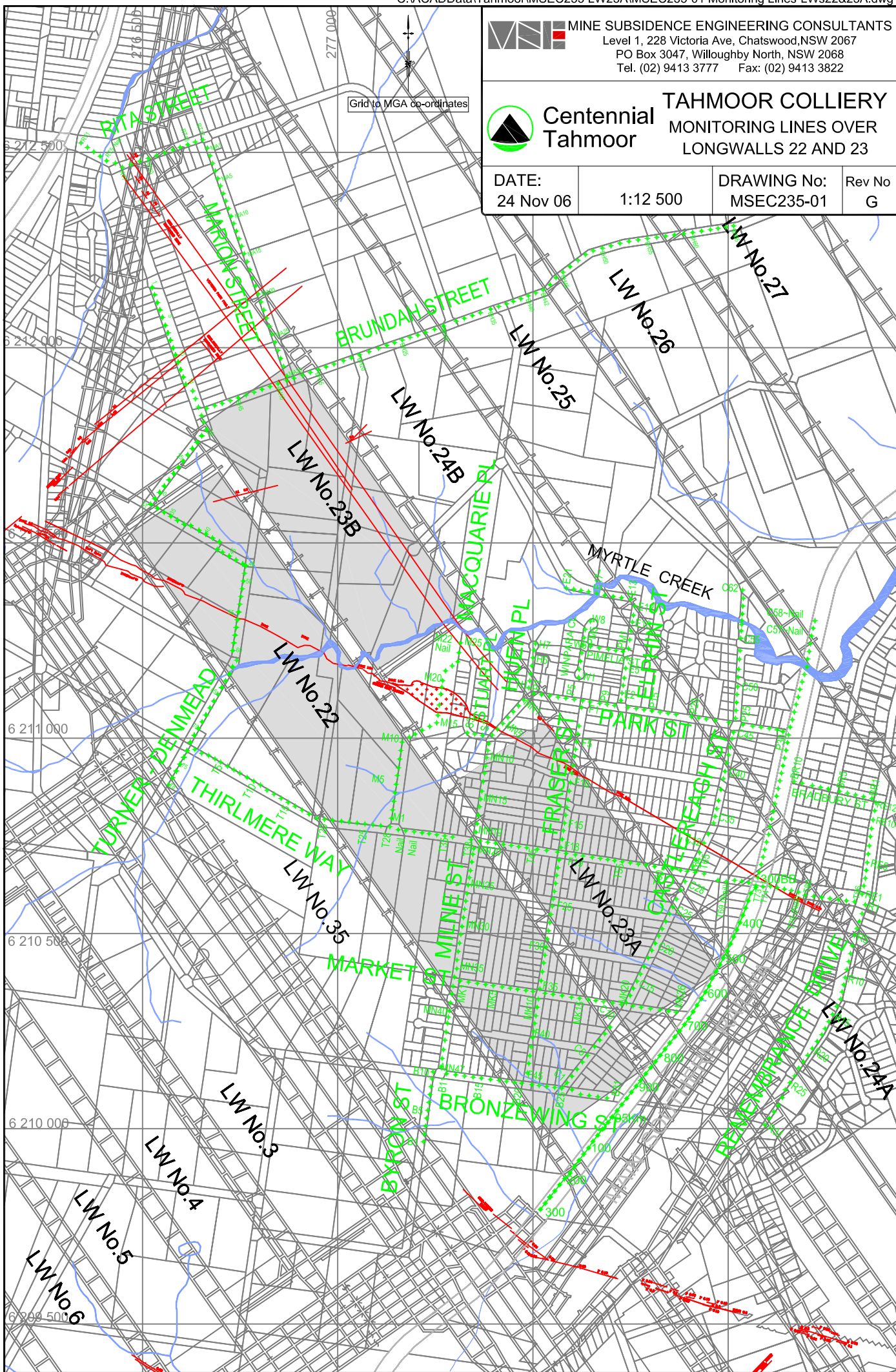
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TAHMOOR COLLIERY MONITORING LINES OVER LONGWALLS 22 AND 23

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TAHMOOR COLLIERY
 LONGWALLS 22 AND 23A
 OBSERVED IMPACTS
 TO PROPERTIES

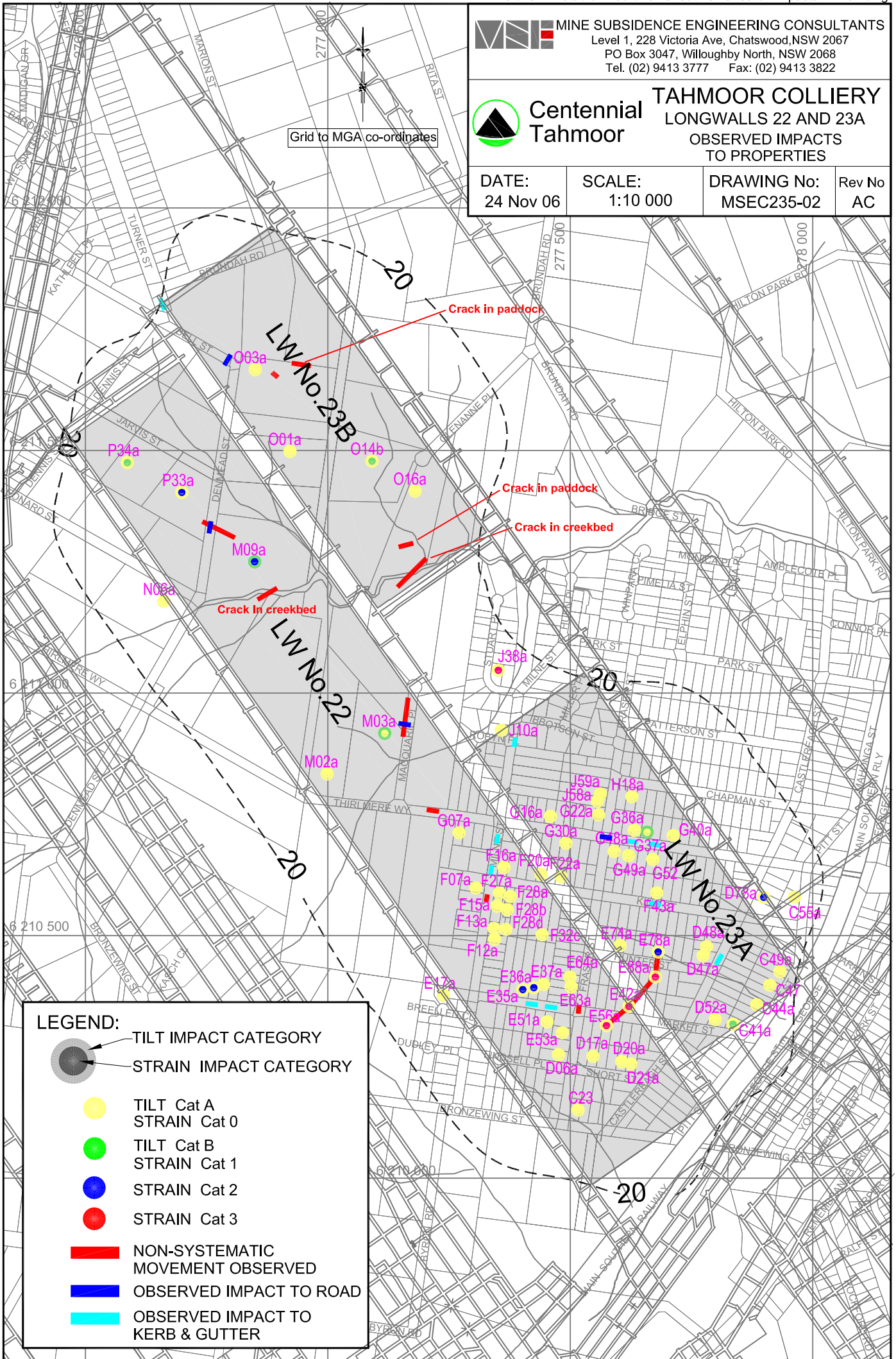
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Rev No
AC

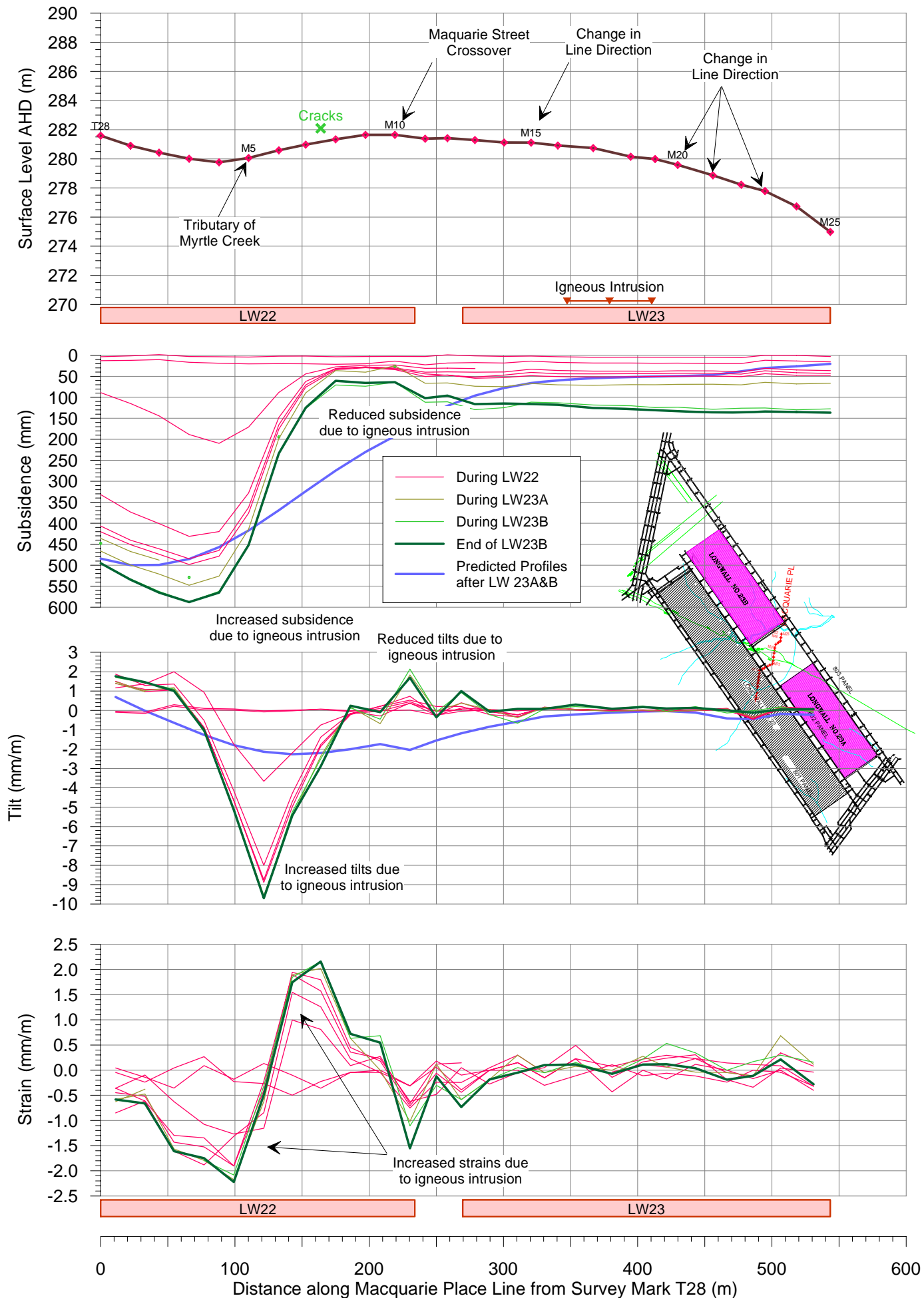
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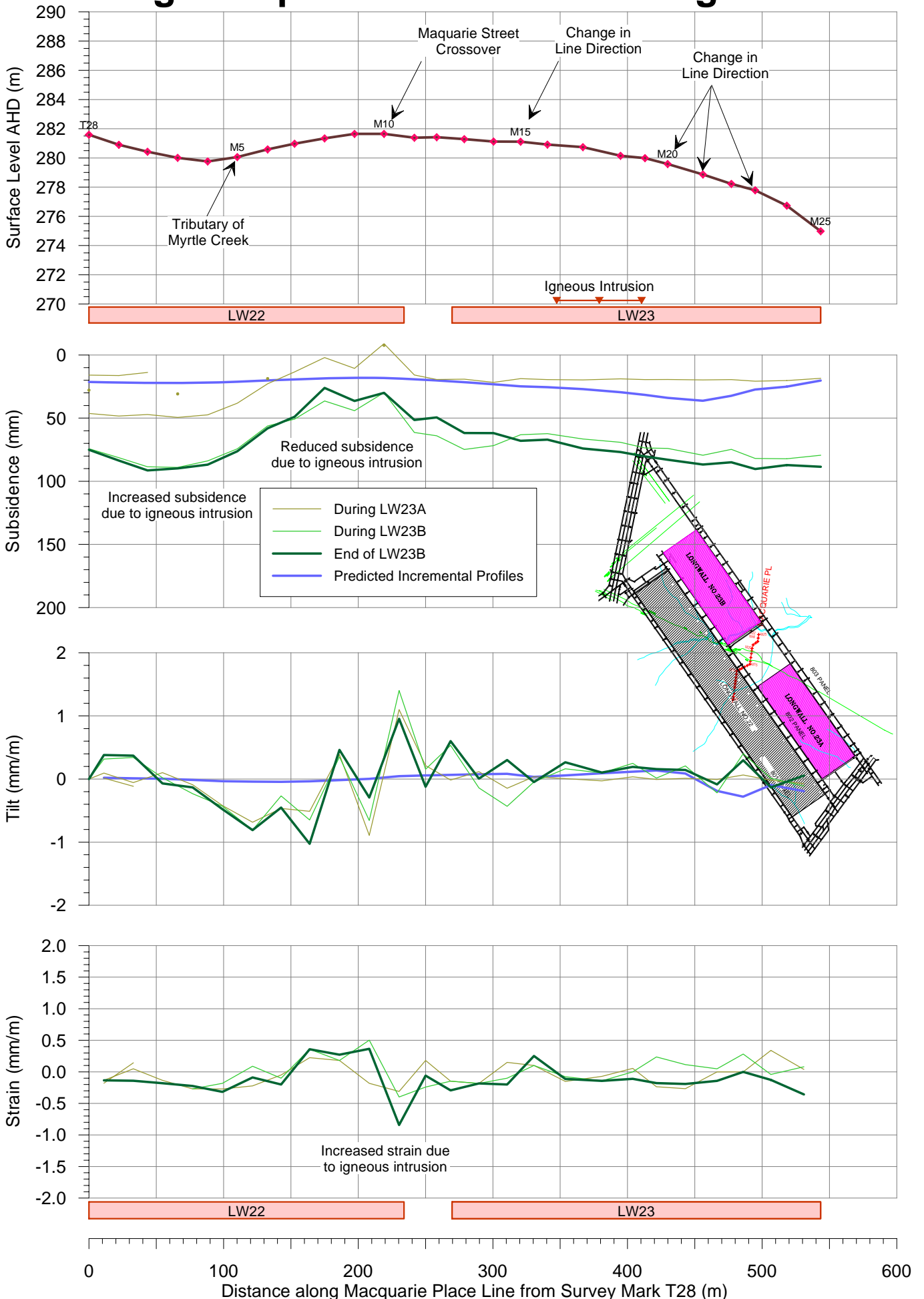
LEGEND:

- TILT IMPACT CATEGORY
- STRAIN IMPACT CATEGORY
- TILT Cat A
STRAIN Cat 0
- TILT Cat B
STRAIN Cat 1
- STRAIN Cat 2
- STRAIN Cat 3
- NON-SYSTEMATIC
MOVEMENT OBSERVED
- OBSERVED IMPACT TO ROAD
- OBSERVED IMPACT TO
KERB & GUTTER

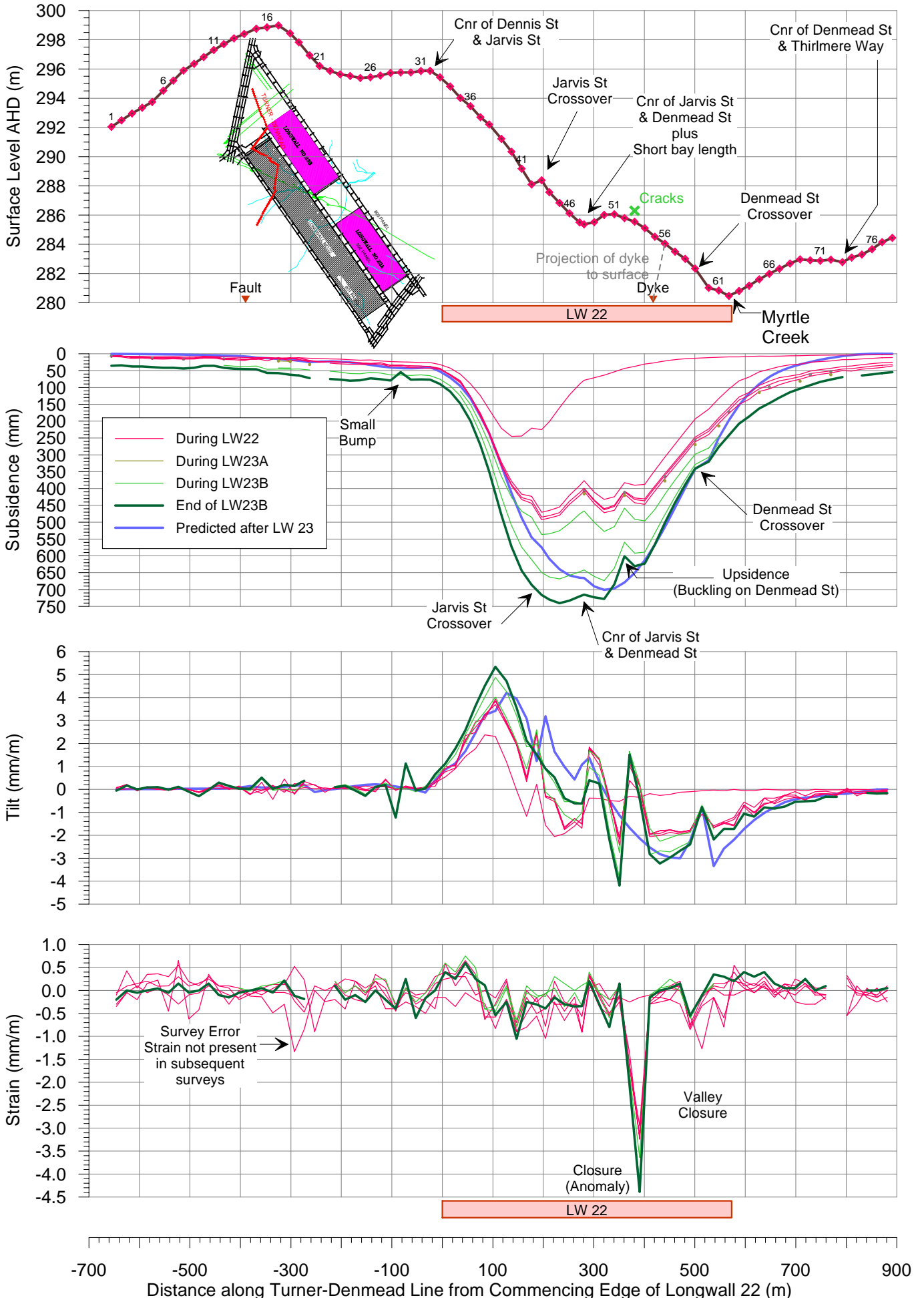
Tahmoor Colliery - Total Subsidence Profiles along Macquarie Place Line



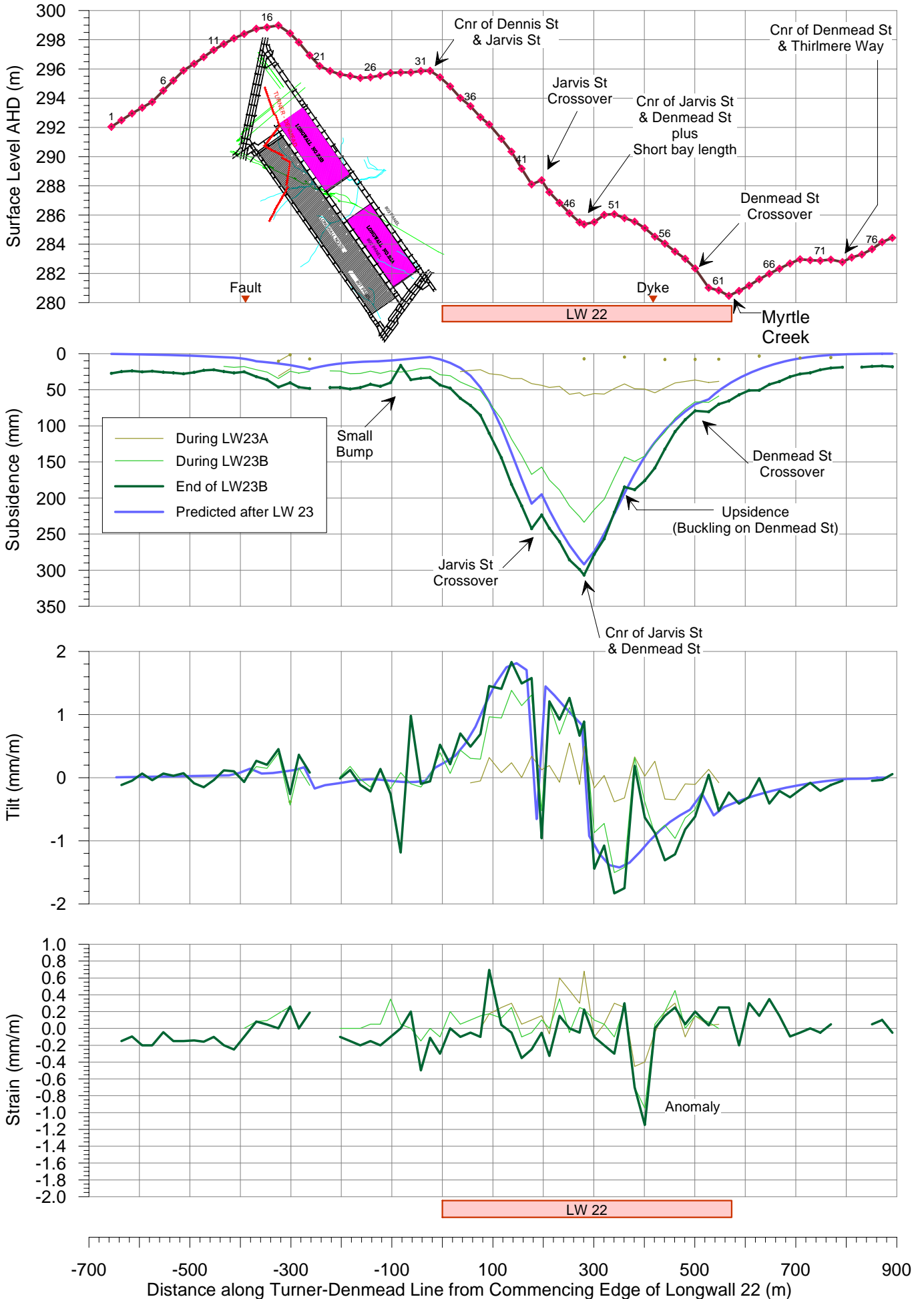
Tahmoor Colliery - Incremental Subsidence Profiles along Macquarie Place Line during LW23



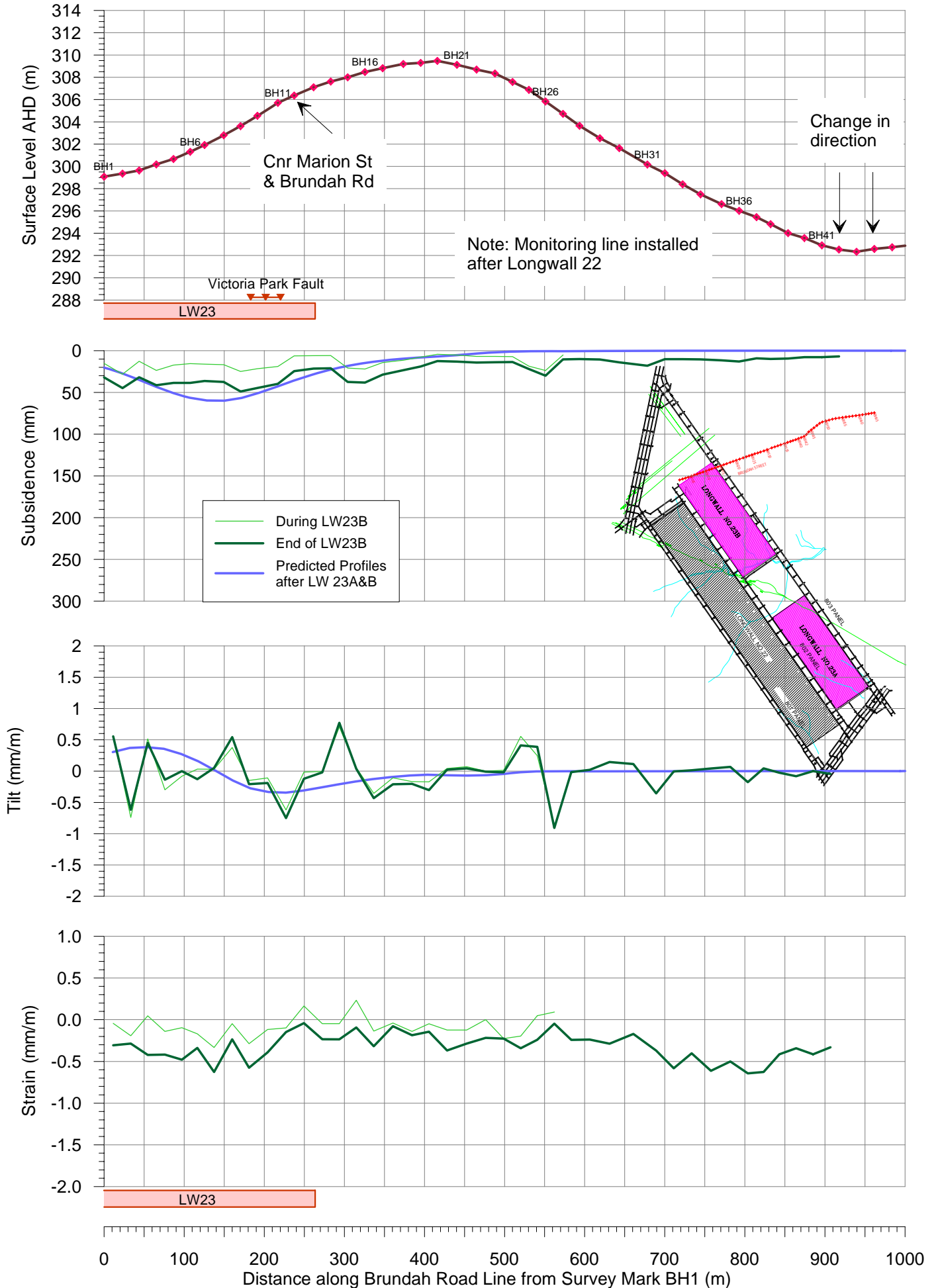
Tahmoor Colliery - Total Subsidence Profiles along Turner-Denmead Monitoring Line



Tahmoor Colliery - Incremental Subsidence Profiles along Turner-Denmead Monitoring Line during LW23



Tahmoor Colliery - Total Subsidence Profiles along Brundah Road Line



Tahmoor Colliery - Total Subsidence Profiles along Marion Street Line

