Centennial Tahmoor

TAHMOOR COLLIERY
LONGWALL 23A

END OF PANEL MONITORING REPORT

FOR LONGWALL 23A

AT TAHMOOR COLLIERY

Mine Subsidence Engineering Consultants
1/1767 Pittwater Road – Mona Vale – NSW 2103
PO Box 1421 – Mona Vale – NSW 1660
Tel. (02) 9979 1723 Fax. (02) 9979 1726
Email: enquiries@minesubsidence.com

www.minesubsidence.com

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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 23A.

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.

Fifteen (15) monitoring lines have been installed over or near Longwall 23A. These are the Main Southern Railway, Castlereagh St, Byron-Bronzewing, Market St, Fraser St, Thirlmere Way, Milne-Stuart, Macquarie Place, Park St, Elphin St, Remembrance Drive, Bradbury St, Huen Pl, Winpara Cl and Pimelia St monitoring lines.

The locations of the monitoring lines are shown in Drawing No. MSEC235-01.

The end of panel survey along the monitoring lines was conducted between 6 and 9 February 2006, when the longwall had less than 10 metres of coal to extract. The longwall was completed on 21 February 2006. A small amount of subsidence is expected to occur along the monitoring lines near the finishing end of Longwall 23A due to this additional 10 metres of extraction. Further monitoring of these lines will be undertaken during the extraction of Longwall 23B.

The observed total and incremental subsidence profiles are provided in Figs. MSEC235-01 to MSEC235-16. Observed subsidence profiles have not been provided along Stuart Place, Park Street, Huen Place, Winpara Place, Pimelia Street, Elphin Street, Remembrance Drive and Bradbury Street as these monitoring lines have experienced only very small movements.

Comparisons between predicted and observed subsidence, tilt and strain profiles for these lines are provided in the attached figures at the back of this report, and are summarised below.

2.1. Identification of Non-Systematic Subsidence Movements

Irregular, non-systematic 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 error

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 determined, the irregularity is described as an anomaly.

There are two (2) locations at which non-systematic movements have occurred during the extraction of Longwall 23A, and the movements are summarised in Table 2.1. The location at which the non-systematic movements occurred is shown in Drawing No. MSEC235-02, together with the five other sites where non-systematic movements were identified during or following the extraction of Longwall 22.

Table 2.1 Locations of Non-Systematic Movement Identified during Longwall 23A

Monitoring Line	Maximum Upsidence (mm)	Maximum Strain (mm/m)	Maximum Tilt (mm/m)	Type	Impacts to Surface
Market Street	40	-2.1	0.6	Anomaly	Impacts to three houses
Castlereagh Street	30	-2.6	5.1	Valley closure or Anomaly	Minor impacts to two houses and impact to concrete kerb

A number of observations can be made in relation to the identification of non-systematic movements.

- The anomaly identified along the Market Street monitoring line between Pegs MK14 and MK15 appears to coincide with observed impacts to two houses on Market Street and one house on Hunter Street, as shown in Drawing No. MSEC235-02. The anomaly is relatively small and the impacts to surface features have been minor to moderate and substantially less than those that have occurred at previous anomalies over Longwalls 5, 6 and 16 at Tahmoor Colliery and Longwall 5A3 at West Cliff Colliery. All three houses have experienced Category 3 cracks in isolated locations in their external walls, and other minor impacts to internal linings, doors and windows. There are no impacts observed or reported in the pavements or kerbs along Market or Hunter Streets, nor any of the neighbouring properties. No faults have been reported by any of the service infrastructure owners.
  The movements are considered anomalous as they are not coincident with a creek valley and no geological structures have been identified in this area. The orientation of the anomaly appears to be relatively linear at a bearing of approximately 45 degrees (ie north east). It is noted that the irregularity could be identified in earlier ground surveys during the extraction of Longwall 22. The magnitude of the upsidence bump in the observed subsidence profile in Market Street does not appear to have changed since the previous survey, even though subsidence has increased by approximately 60 mm, which is an increase of approximately 15%. Compressive strains have reduced by approximately 0.2 mm/m since the previous survey. The three affected houses have reported minor additional impacts since the previous survey.
- There is a high observed compressive strain of 2.6 mm/m between pegs C19 and C20, which coincides with an impact to the concrete kerb and minor impacts to two houses. There is a small amount of upsidence observed in the subsidence and tilt profiles. The cause of the non-systematic movement is unclear, as the movements have occurred near two small watercourses, are almost in line with the observed anomaly on Market and Hunter Streets and are located within an area which experienced greater subsidence movements than expected.
- There are irregular bumps along Castlereagh Street near Peg C25 and Peg C29. A small amount of upsidence is observed, although no irregular strains are observed.
- It is noted that the anomalies observed along Milne and Fraser Streets above Longwall 22 do not appear to have changed substantially during the extraction of Longwall 23A. While both sites have experienced an increase in subsidence, there has been little or no increase in tilt or curvature.

- There is an observed compressive strain of 1.4 mm/m along Thirlmere Way between pegs T48 and T49, which coincides with a bump and cracks to the pavement. There does not appear to be any upsidence along the subsidence profile. The observed compressive strain is located where maximum systematic compressive strains are expected to occur. The maximum predicted compressive strain following the extraction of Longwall 23A is 1.6 mm/m, which is similar in magnitude to the observed strain. The observed strain is therefore considered to be systematic.

2.2. Comparison between Predicted and Observed Movements

The predicted and observed subsidence profiles for each monitoring line are shown in Figs. MSEC235-01 to MSEC235-16. The difference between observed and predicted subsidence is shown in Drawing No. MSEC235-03. A number of observations have been made following a comparison between these profiles.

- There is generally 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.
- Total and incremental subsidence has been conservatively predicted over the majority of the monitoring lines above the extracted Longwalls 22 and 23A. These include the monitoring lines along Thirlmere Way, Fraser Street and Milne Street.
- There are three cases where observed incremental movements (that is, movements that have occurred during the extraction of Longwall 23A) have exceeded predicted incremental movements above the previously extracted Longwall 22. This has occurred along the Main Southern Railway, Castlereagh Street, Byron-Bronzewing monitoring lines, which are shown in Drawing No. MSEC235-01. Observed subsidence had been substantially less than expected following the completion of Longwall 22.
  This additional subsidence is considered to have been delayed as a result of either a relaxation of stress in the strata or the collapse of previously competent strata near the end of Longwall 22, which have been brought about by the subsequent extraction of Longwall 23A.
  It is noted that total predicted subsidence has generally not been exceeded along the Main Southern Railway and Byron-Bronzewing monitoring lines.
- It can be seen from Drawing No. MSEC235-03 that observed subsidence has exceeded predicted subsidence above the commencing end (southeastern end) of Longwall 23A, and the finishing end (southeastern end) of Longwall 22.
  Observed subsidence has exceeded predicted subsidence along the Castlereagh Street monitoring line between Pegs C2 and C21. The difference between observed and predicted subsidence is relatively uniform and approximately 100 to 130 mm at most points along the line.
  Observed subsidence has exceeded predicted subsidence along the Market Street monitoring line between Pegs MK16 and MK26. The difference between observed and predicted subsidence is varies between 20 to 110 mm along this section of the monitoring line.
  It is noted that there is otherwise a reasonable relationship between the observed and predicted subsidence profiles along these sections of the monitoring lines, and that the observed tilts and tilt profiles compared reasonably well with predicted tilts and tilt profiles.
  The actual extracted seam thicknesses appear to be slightly greater than the seam thicknesses adopted for the predictions, which can partially account for the difference between predicted and observed subsidence in this area.
  Given that these sections of the monitoring line run near the staggered ends of Longwalls 22 and 23A, the predictions of subsidence along this line is complicated. It is therefore possible that the difference between observed and predicted profiles have occurred because the predictions have underestimated the steepness of the shape of the subsidence profile at this end. This has not occurred, however, at the finishing end (northwestern end) of Longwall 23A.
  An alternative reason for the under-prediction is that the additional subsidence is related to the orientation of the anomaly along Market, Hunter and potentially Castlereagh Streets.
  Despite the under-prediction of subsidence, the observed impacts in this area are generally minor and compare well with predicted impacts.

- Far-field vertical movement has been observed around Longwalls 22 and 23A, where the observed limit of subsidence (20 mm) has been found to extend beyond the predicted limit. While this has been observed to some extent previously at Tahmoor Colliery, it appears that these movements have been more prevalent around this panel. The subsidence profile in these areas is particularly flat, with observed tilts and strains less than 0.5 mm/m.
- Observed strains have generally been within the predicted range of 0.6 mm/m tensile and 1.2 mm/m compressive. These maximum strains are slightly less than the predicted maximum strains of 0.8 mm/m tensile and 1.6 mm/m compressive (Report No. MSEC156). It is noted that specified survey tolerances are 2 mm over a bay length of 20 metres, which represents a potential error of 0.1 mm/m. Observed strains have exceeded predicted maximum strains in some cases, although these have occurred in isolated locations and most are associated with non-systematic movements, which were identified in Section 2.1.
- 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 23A

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.	No impacts observed.
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.	Compressive strains concentrated near small watercourse and may be due to valley closure. Rails were de-stressed during scheduled track closure.
Roads (All Types)	Minor cracking and buckling may occur in isolated locations.	Cracking and buckling observed on Thirlmere Way (LW 23A). Four impacts observed on concrete kerbs and gutters on Castlereagh St, King St, Thirlmere Way and Milne St.
Water Pipelines	Minor impact to pipelines, particularly older cast iron pipes with lead joints.	Observed frequency of incidences similar to those in areas not affected by mine subsidence.
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.	Changes in tilt have occurred within predicted range. Observed frequency of incidences similar to those in areas not affected by mine subsidence.
Electricity Transmission Lines or Associated Plants	Ground movements unlikely to adversely impact electrical infrastructure.	One local feed line was loosened on a property on Market St.
Telecommunication Lines or Associated Plants	Ground movements unlikely to adversely impact telecommunications infrastructure.	Air leakage observed two locations on old lead cable on Thirlmere Way at the corner of Pitt Street and near the Bush Fire Brigade building.
PUBLIC AMENITIES	Negligible impacts predicted for all public amenities.	Category 0 crack to plasterboard ceiling of child care centre.

Table 3.1 Summary of Predicted and Observed Impacts during LW 23A (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 7 properties.
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 15 houses, although most are negligible to very slight (sticky doors, minor cracks to internal finishes) No houses with Tilt Impacts. 1 house with Category 1 crack to external wall (Strain Impact Cat 1). 3 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.
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 1 masonry retaining wall. No impacts observed to any other structures.
External Residential Pavements	No impact assessment provided in Report No. WKA137.	Impacts to pavements observed on 8 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 23A 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 and 23A. The remaining houses and public amenities that were identified in Report No. WKA137 or Report No. MSEC156 were not included in this comparison.

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 23A (No.)	Observed after LW 23A (No.)
Tilt Impacts		
Tilt Impact Category A	539	545
Tilt Impact Category B	8	2
Strain Impacts		
Strain Impact Category 0	393	538
Strain Impact Category 1	152	2
Strain Impact Category 2	2	4
Strain Impact Category 3	0	3

It is noted that one (1) house, which has experienced Category B tilt impacts, has also experienced a Category 2 crack. A total of ten (10) houses have therefore experienced impacts greater than Tilt Category A or Strain Category 0. Four (4) of these houses reported impacts during the extraction of Longwall 23A.

It is further advised that an additional 22 houses and one public amenity 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 amenity are shown in Drawing No. MSEC235-02. It can be seen from this drawing that many of the impacts are located near the centre of the Longwall 22, where small anomalous movements have been consistently observed along monitoring lines. The three houses with Category 3 cracks to external walls have experienced non-systematic movements. Both 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 and 23A.

There were also nine structures where preventive works or additional monitoring during mining were 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. Further monitoring of this house will be conducted during the extraction of Longwall 23B.

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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.

Tahmoor Colliery - Total Subsidence Profiles along Main Southern Railway Corridor Line

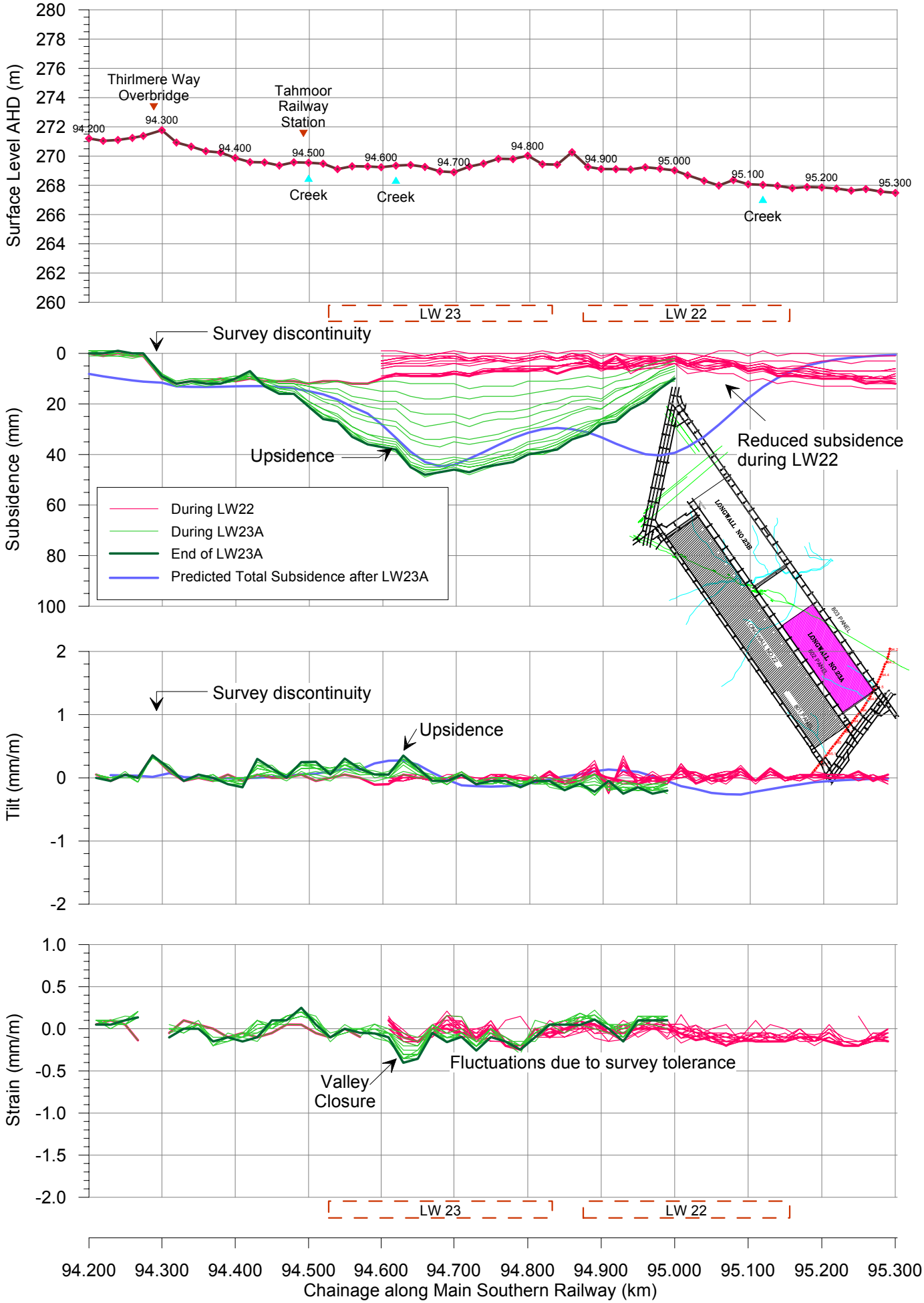

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Fig. MSEC235-01 Rev C

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Tahmoor Colliery - Incremental Subsidence Profiles Main Southern Railway Corridor Line during LW23A

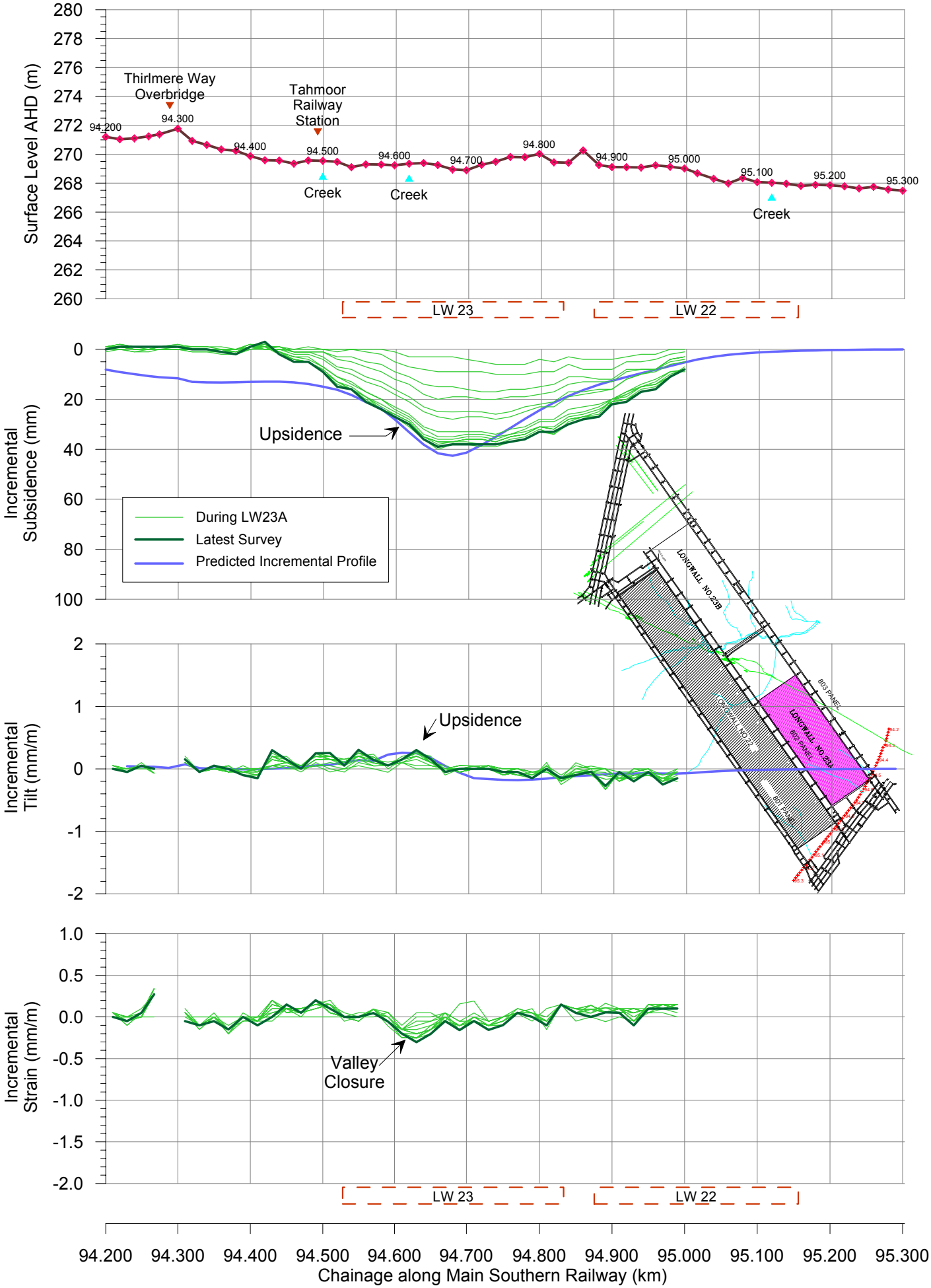

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Fig. MSEC235-02 Rev C

Tahmoor Colliery - Total Subsidence Profiles along Castlereagh Street Line

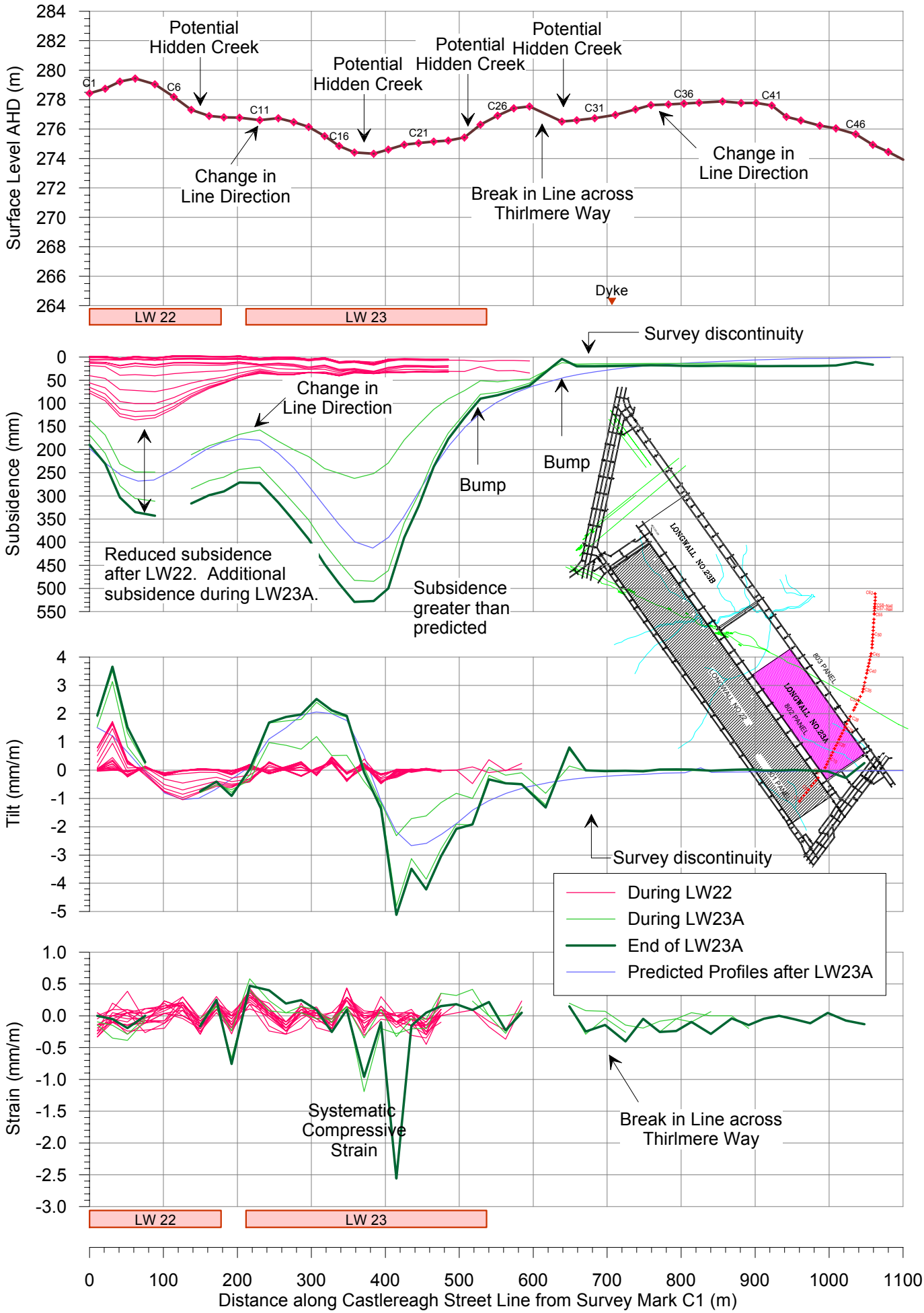

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Fig. MSEC235-03 Rev C

Tahmoor Colliery - Incremental Subsidence Profiles along Castlereagh Street Line during LW23A

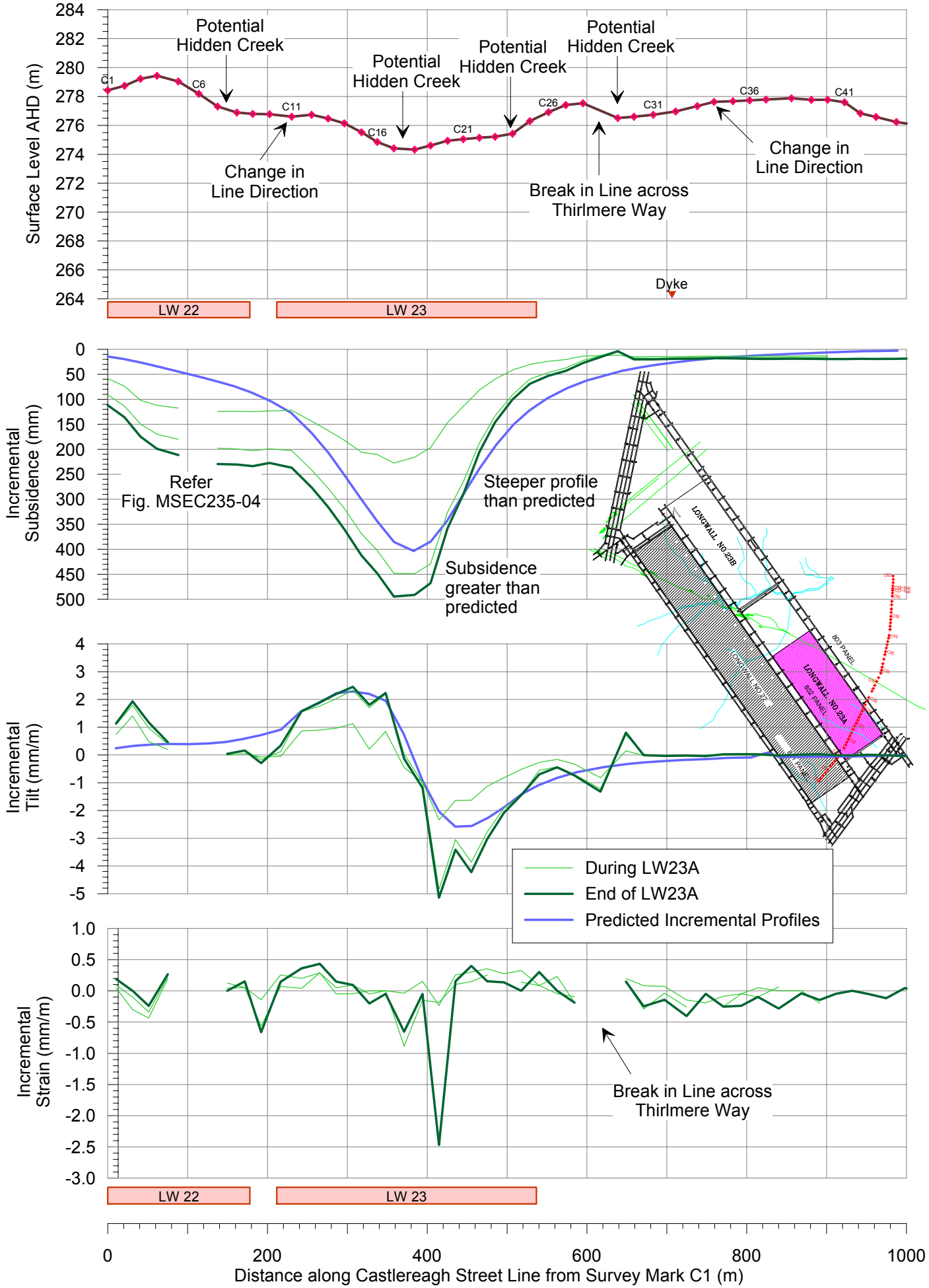

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Fig. MSEC235-04 Rev C

Tahmoor Colliery - Total Subsidence Profiles along Byron-Bronzewing Line

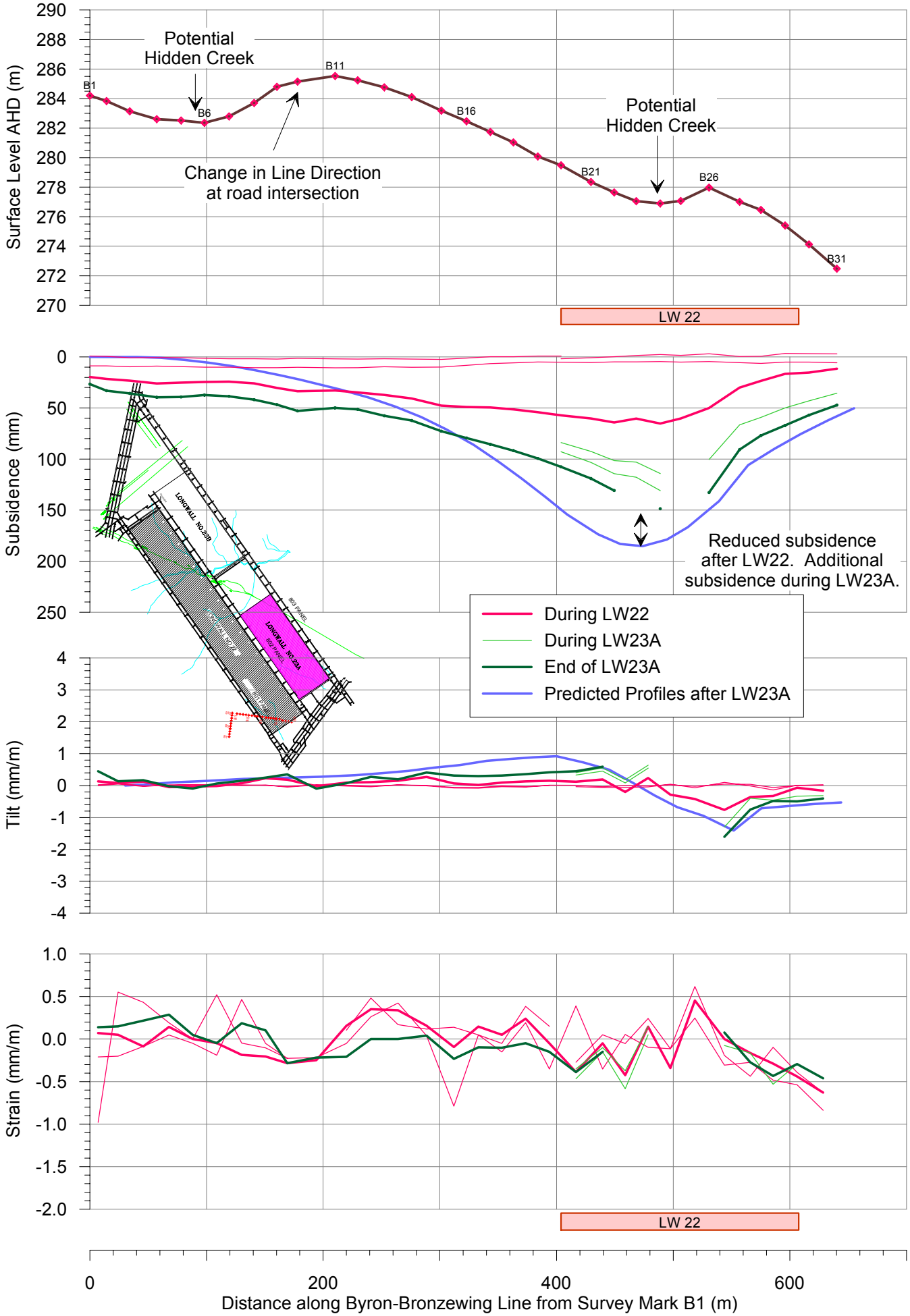

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Fig. MSEC235-05 Rev C

Tahmoor Colliery - Incremental Subsidence Profiles along Byron-Bronzewing Line during LW23A

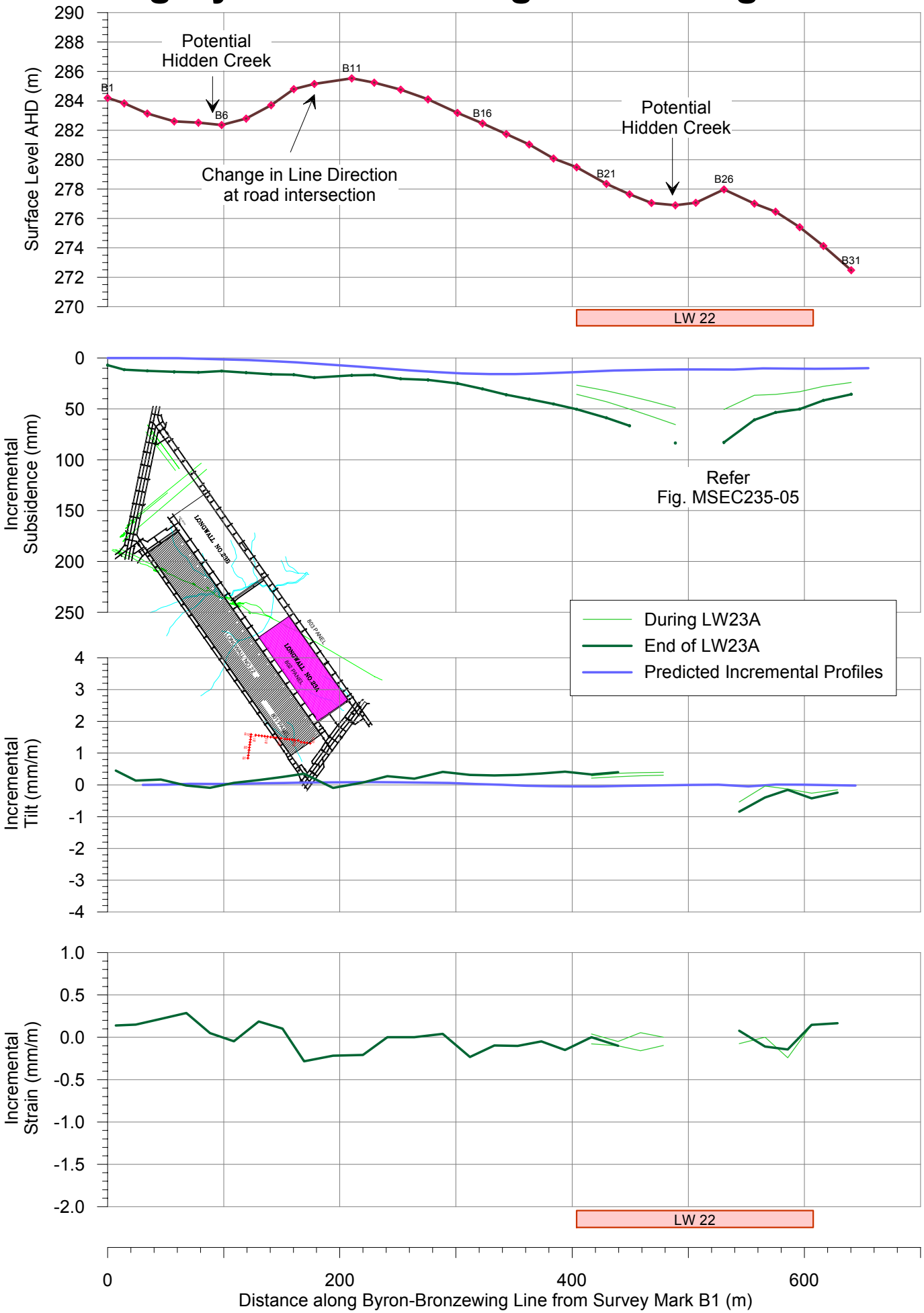

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Fig. MSEC235-06 Rev C

Tahmoor Colliery - Total Subsidence Profiles along Market Street Line

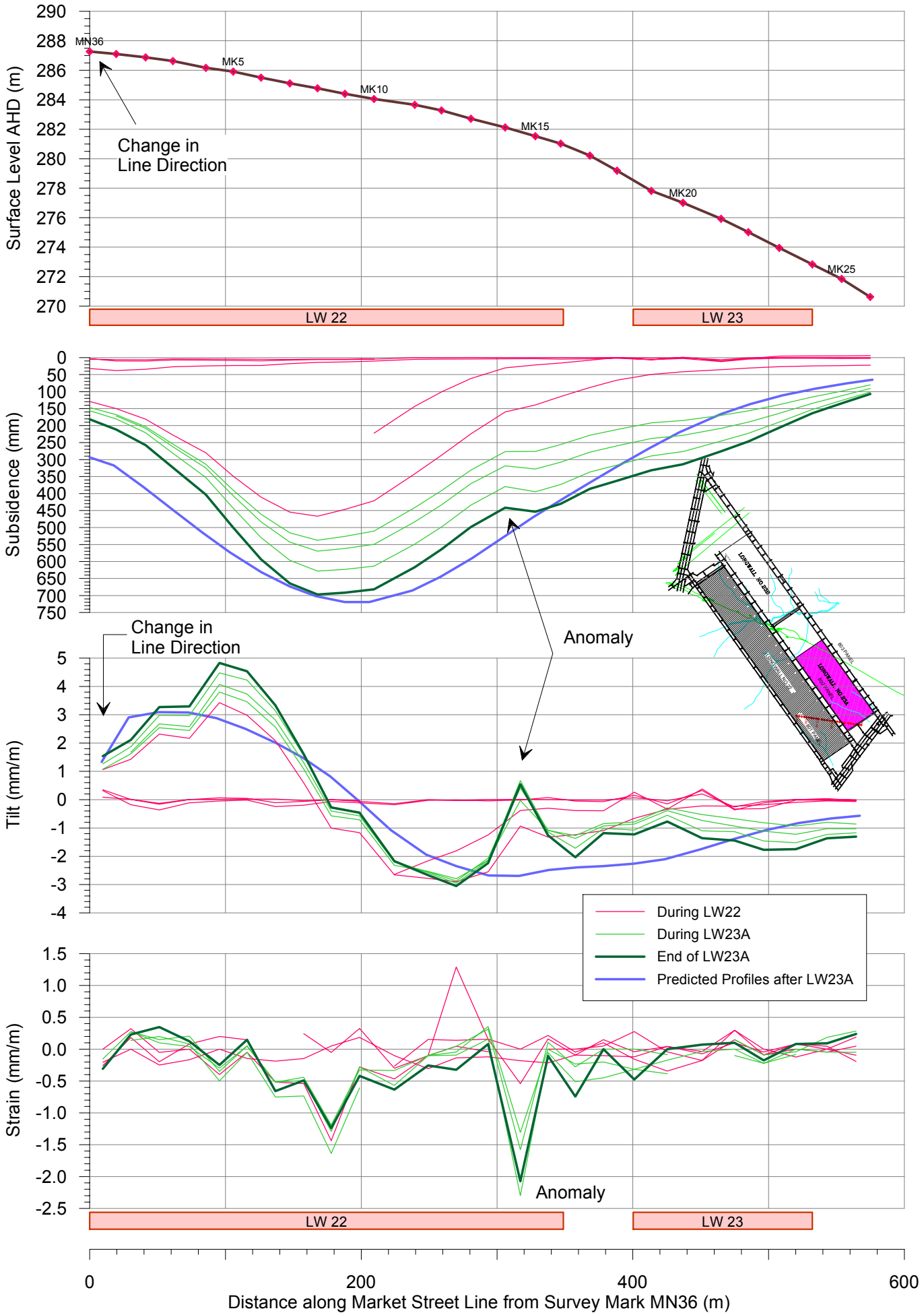

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Fig. MSEC235-07 Rev C

Tahmoor Colliery - Incremental Subsidence Profiles along Market Street Line during LW23A

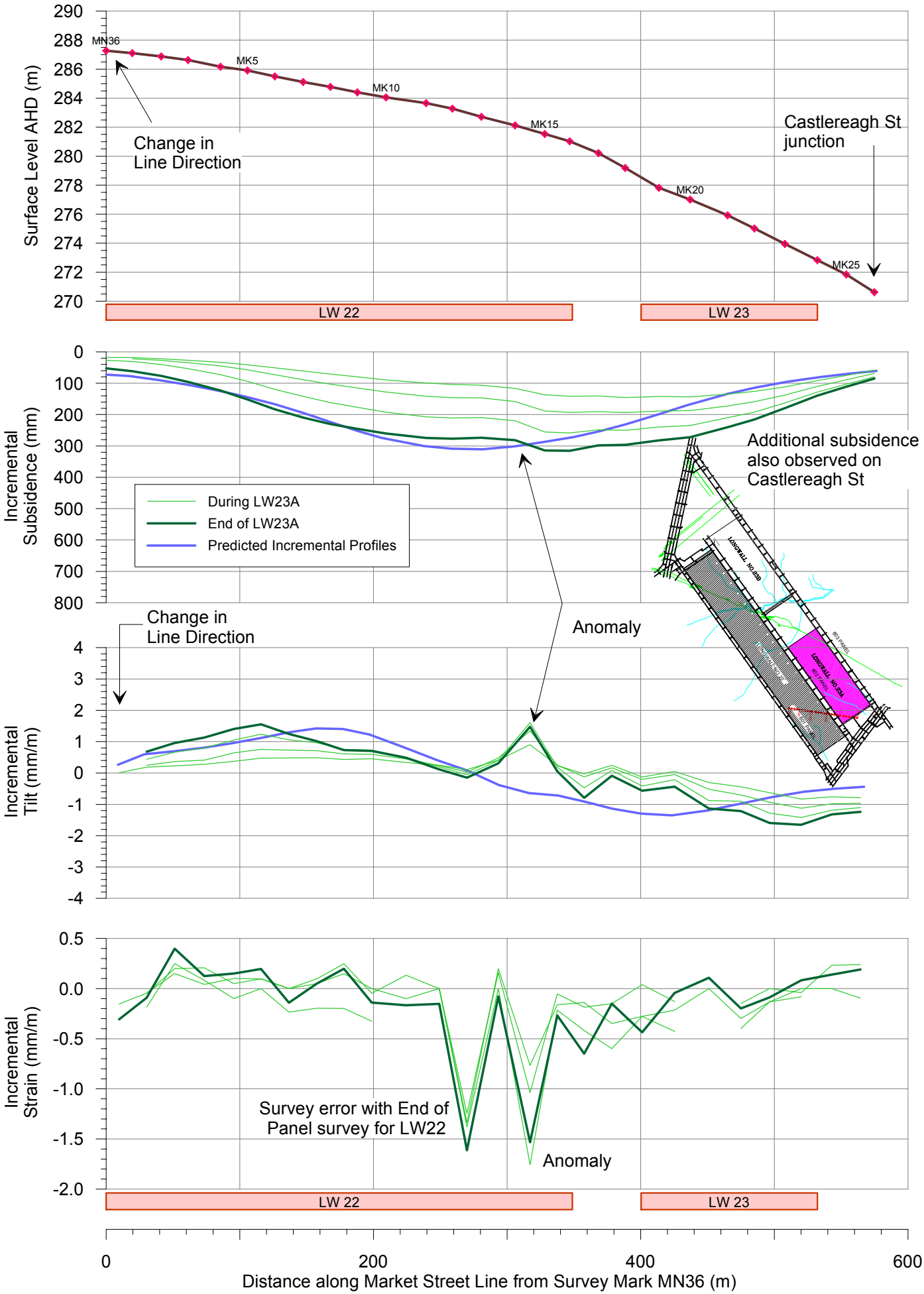

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Fig. MSEC235-08 Rev C

Tahmoor Colliery - Total Subsidence Profiles along Fraser Street Line

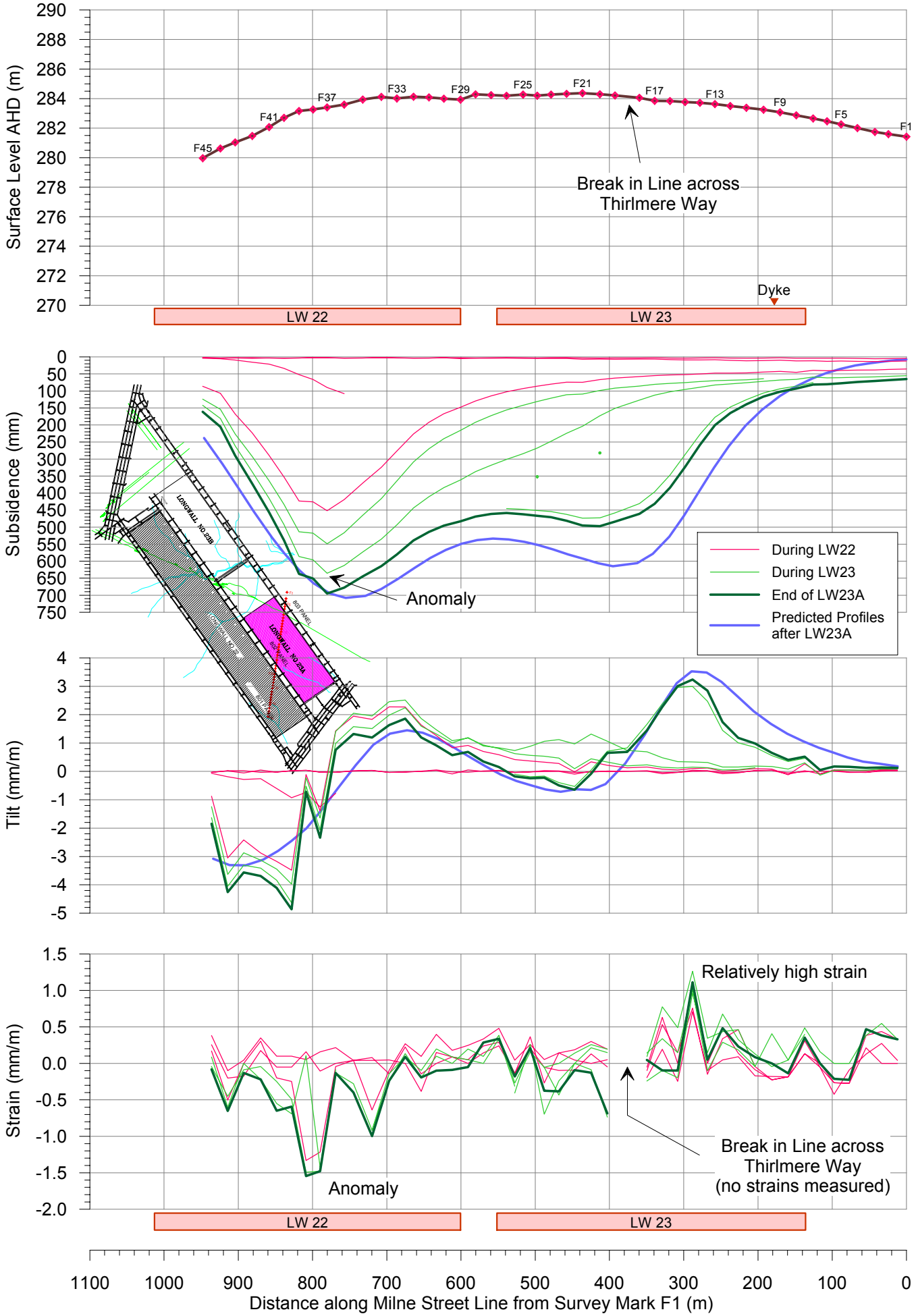

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Fig. MSEC235-09 Rev D

Tahmoor Colliery - Incremental Subsidence Profiles along Fraser Street Line during LW23A

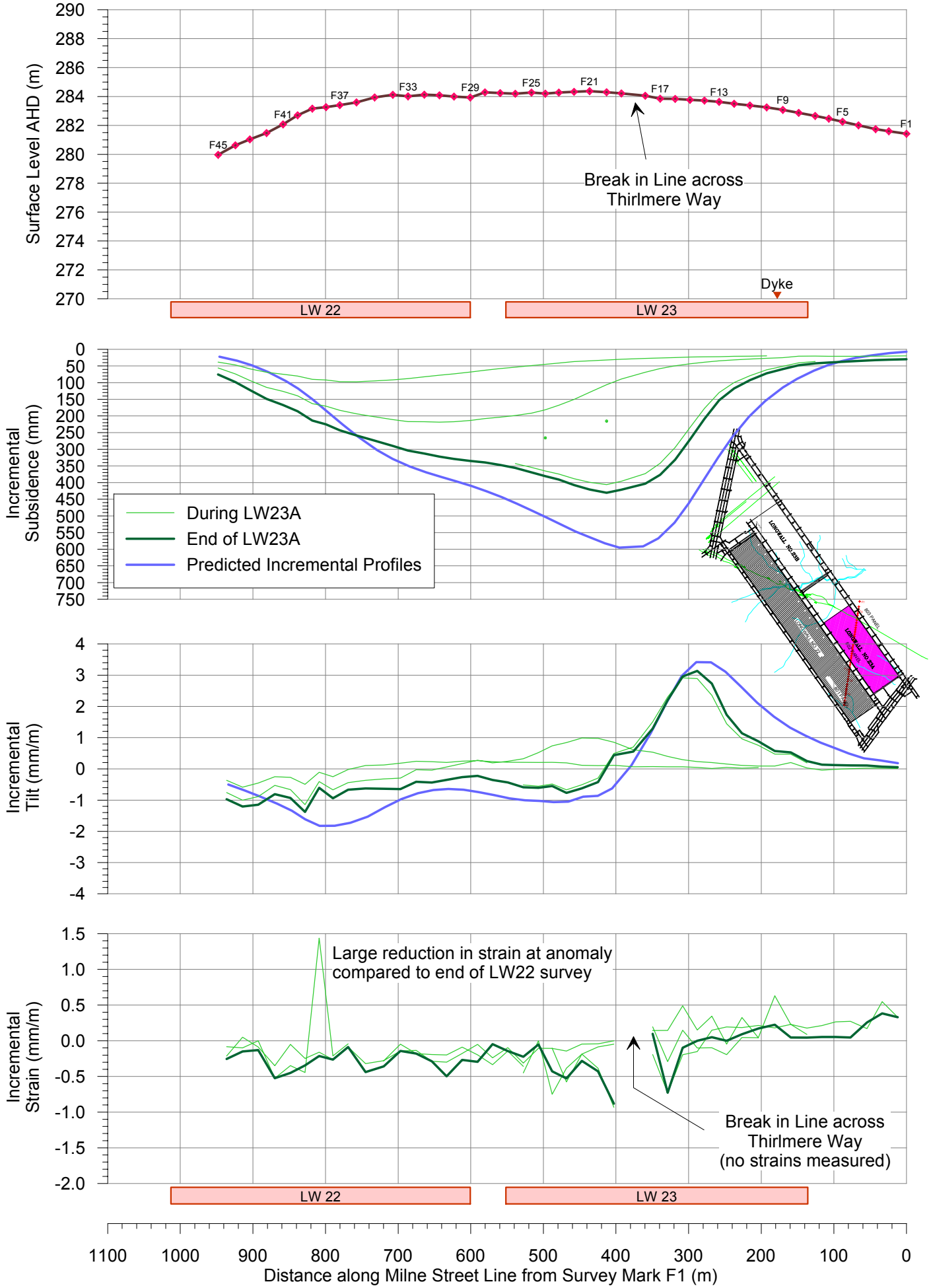

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Fig. MSEC235-10 Rev D

Tahmoor Colliery - Total Subsidence Profiles along Thirlmere Way Line

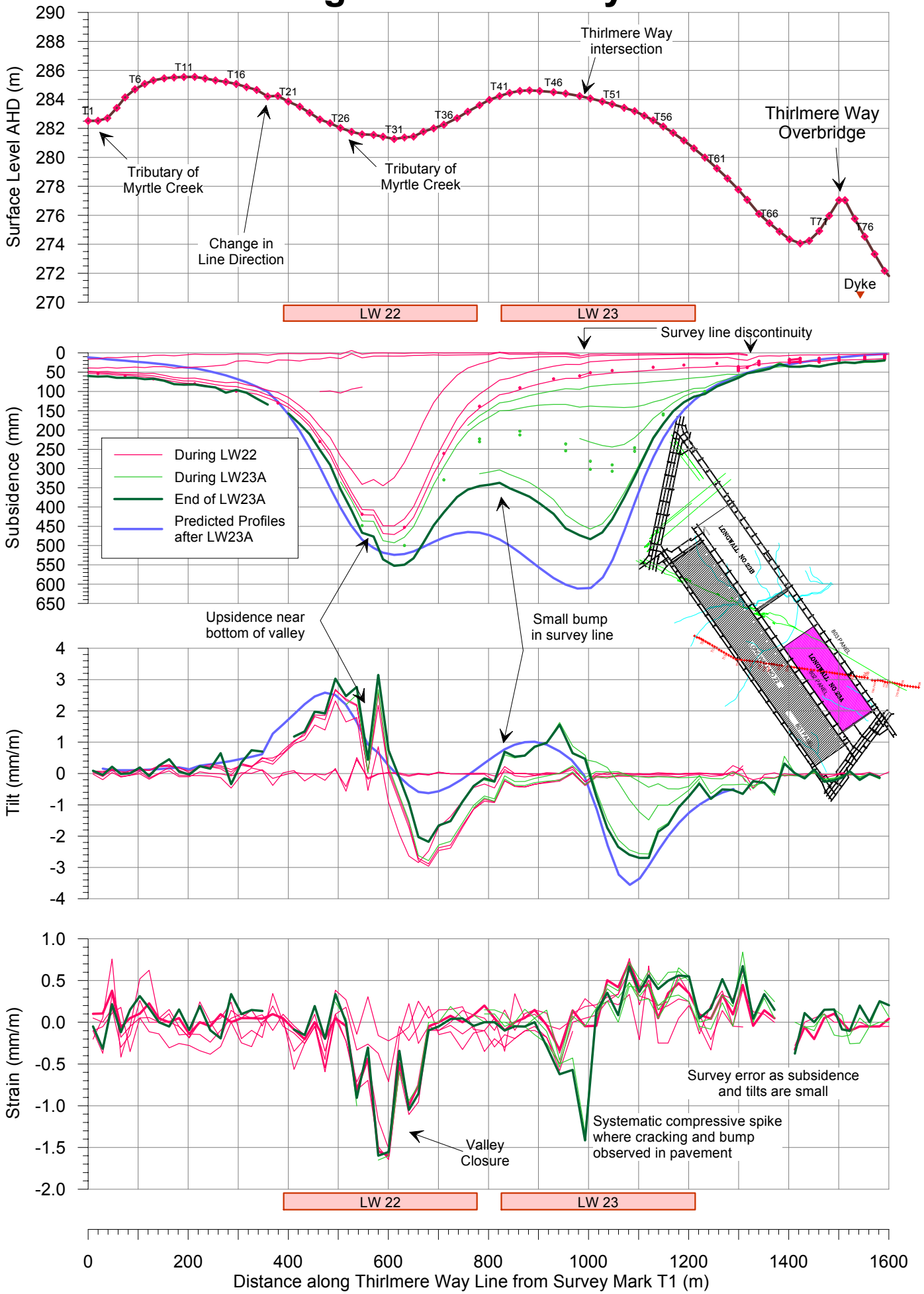

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Fig. MSEC235-11 Rev E

Tahmoor Colliery - Incremental Subsidence Profiles along Thirlmere Way Line during LW23A

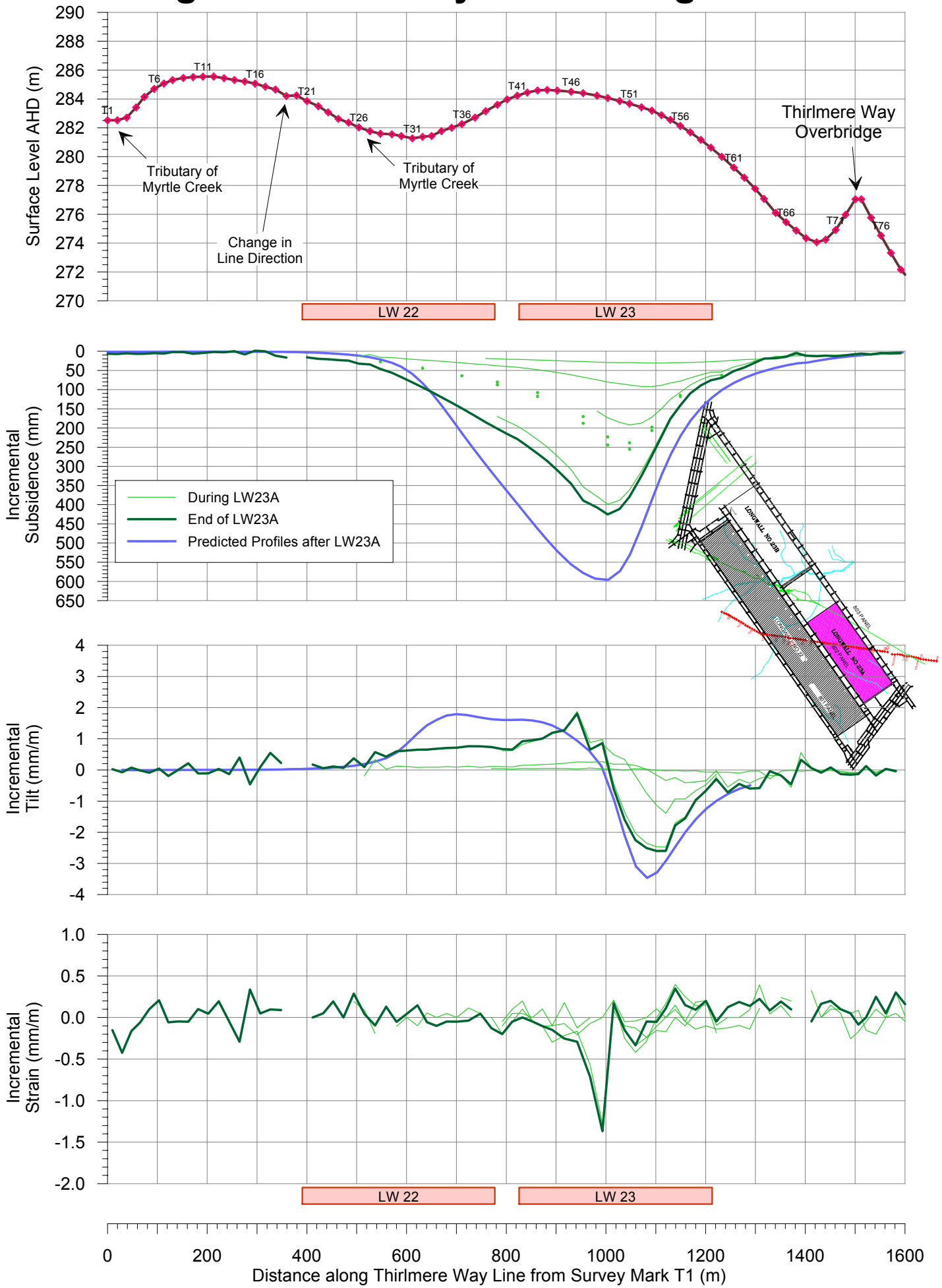

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Fig. MSEC235-12 Rev E

Tahmoor Colliery - Total Subsidence Profiles along Milne Street Line

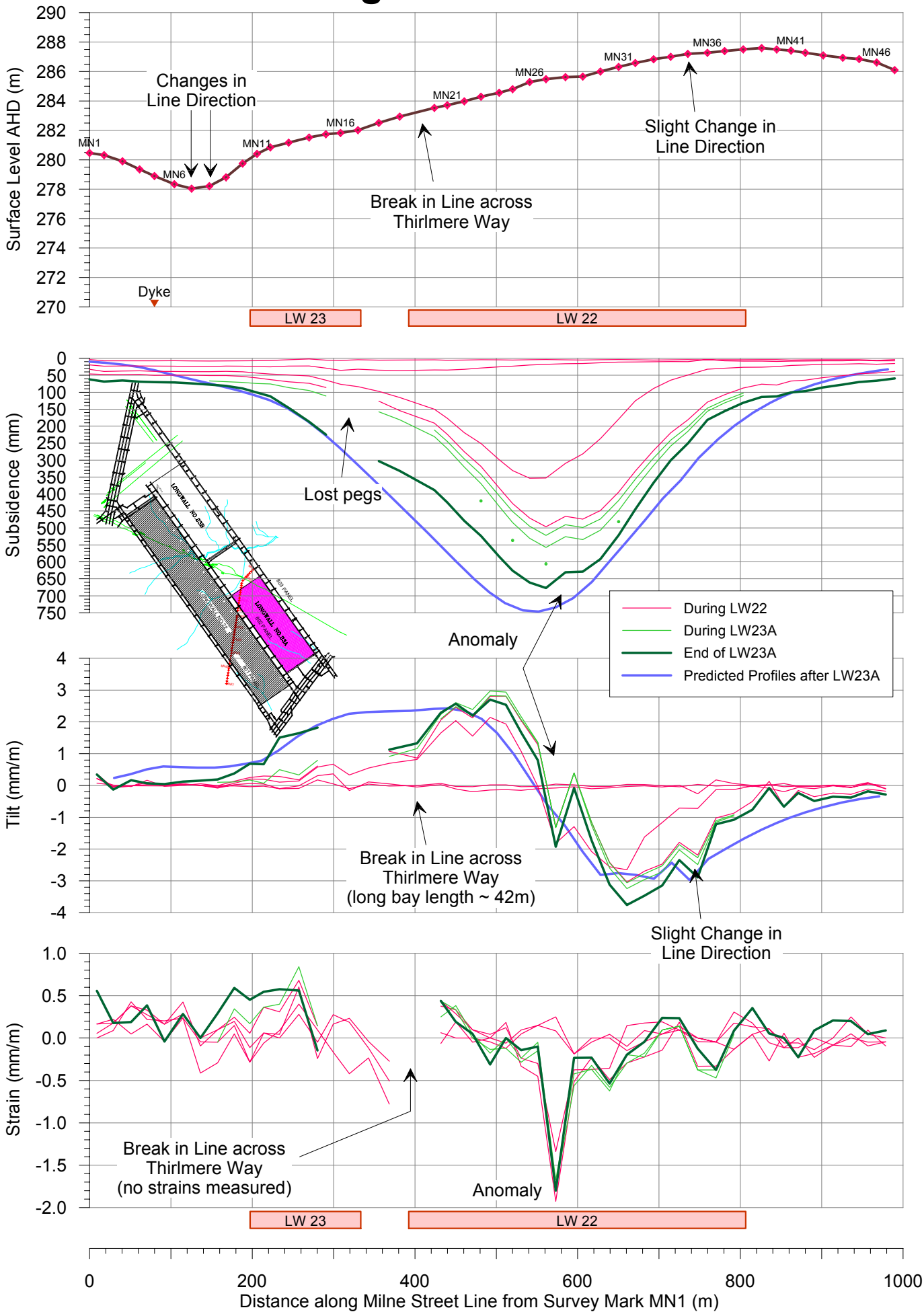

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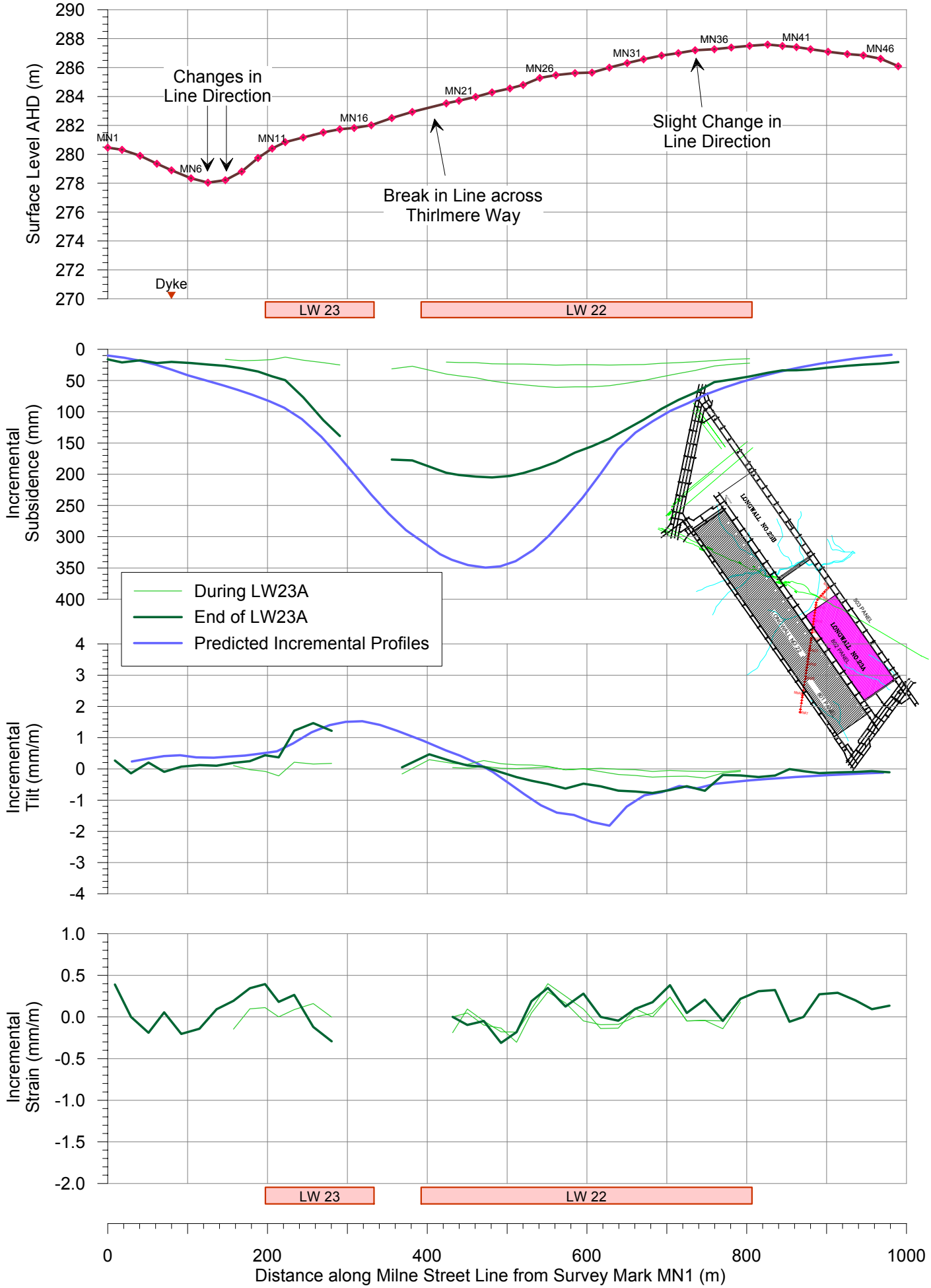
Fig. MSEC235-13 Rev C

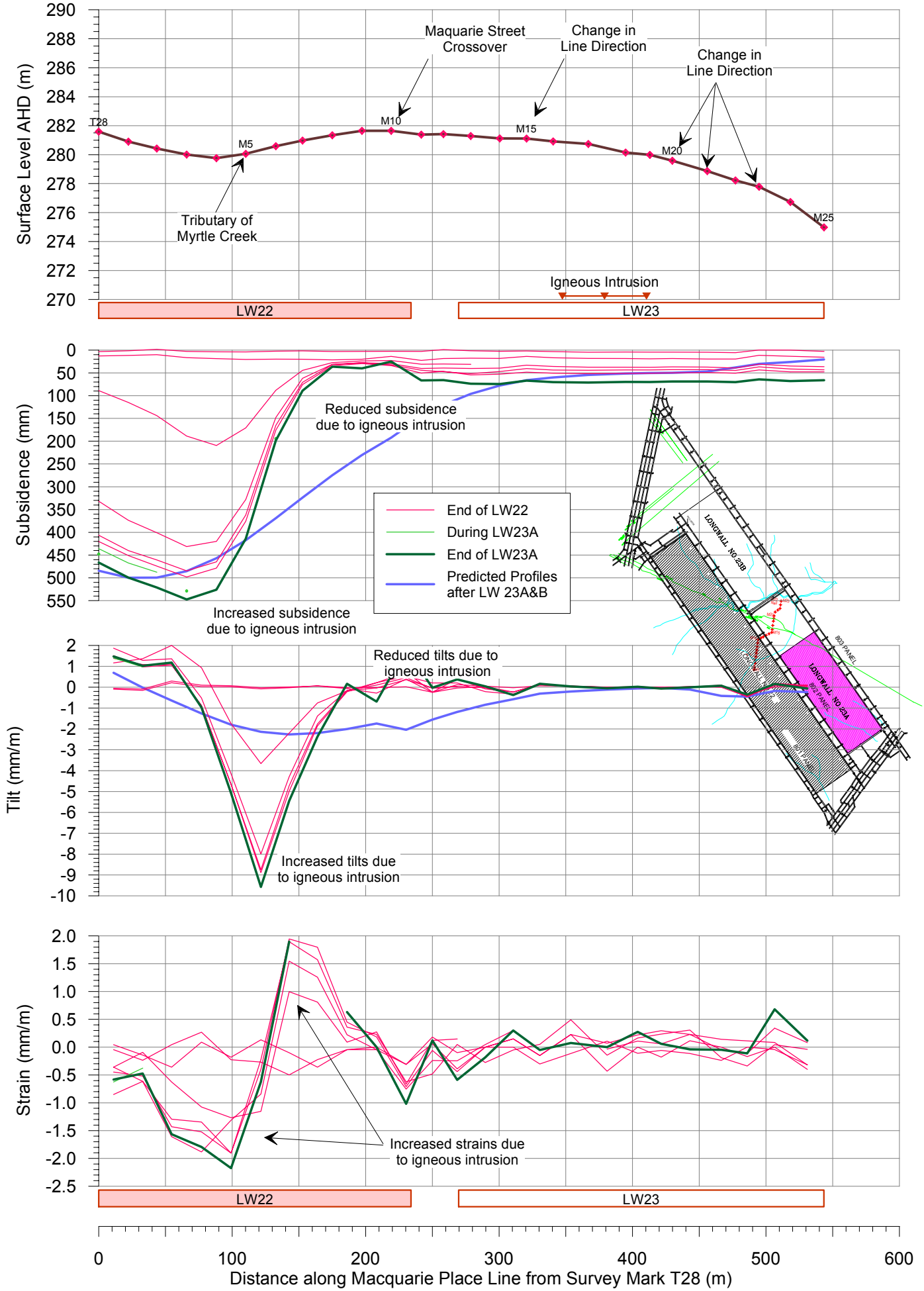
Tahmoor Colliery - Incremental Subsidence Profiles along Milne Street Line during LW23A



Mine Subsidence Engineering Consultants

Fig. MSEC235-14 Rev C

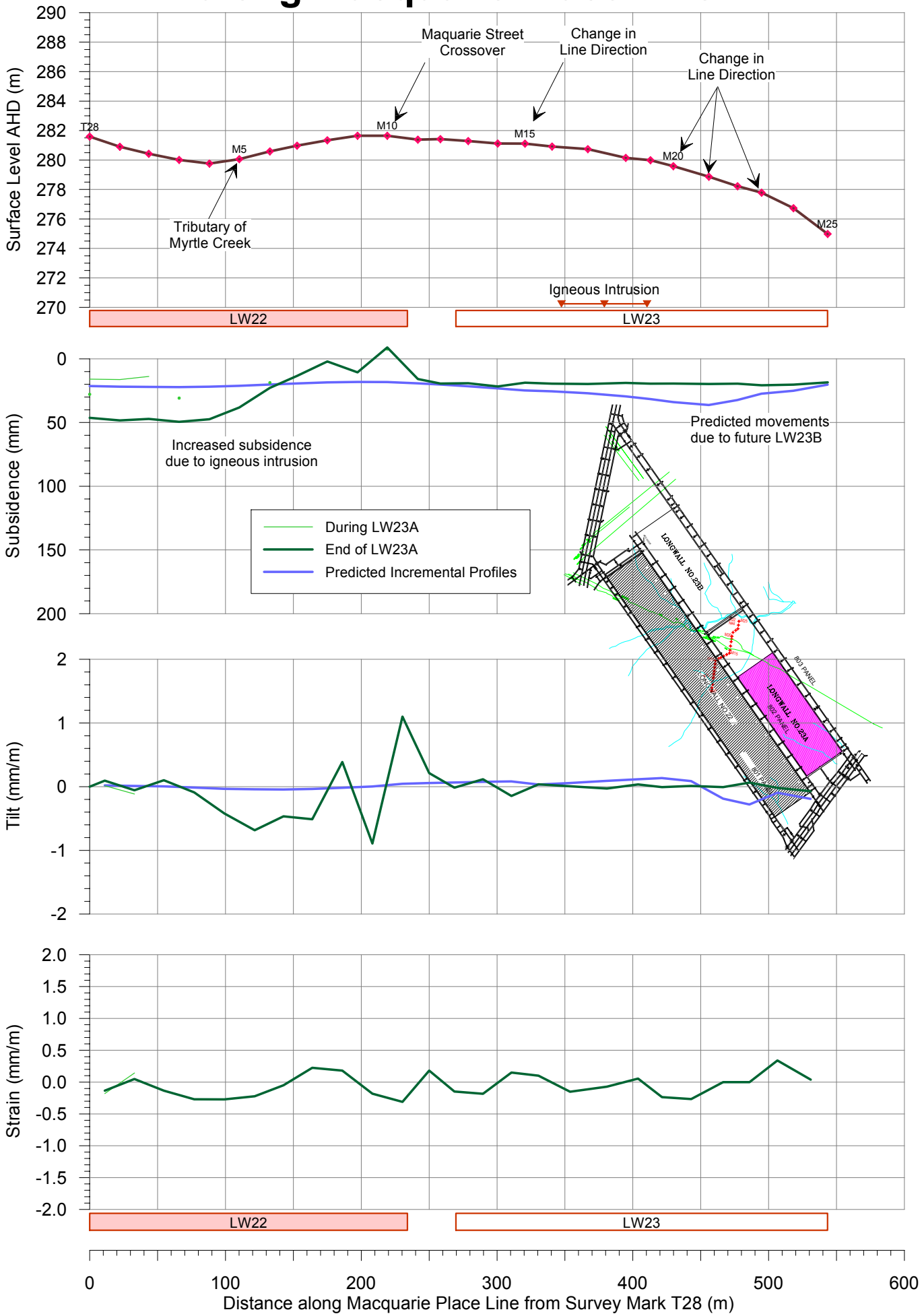
Tahmoor Colliery - Total Subsidence Profiles along Macquarie Place Line



Mine Subsidence Engineering Consultants

Fig. MSEC235-15 Rev A

Tahmoor Colliery - Incremental Subsidence Profiles along Macquarie Place Line



Mine Subsidence Engineering Consultants

Fig. MSEC235-16 Rev A

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MINE SUBSIDENCE ENGINEERING CONSULTANTS
1/1767 Pittwater Road - P O Box 1421, Mona Vale NSW 1660
Tel. (02) 9979 1723 Fax: (02) 9979 1726

Centennial Tahmoor

TAHMOOR COLLIERY

MONITORING LINES OVER LONGWALLS 22 AND 23A

DATE:	SCALE:	DRAWING No:	Rev No
1 Mar 06	1:12 500	MSEC235-01	C

Grid to MGA co-ordinates

276 500
277 000
6 212 500
6 212 000
6 211 000
6 210 500
6 210 000
6 209 500

LW No.27
LW No.26
LW No.25
LW No.24B
LW No.24A
LW No.23B
LW No.23A
LW No.22
LW No.35
LW No.3
LW No.4
LW No.5
LW No.6

MYRTLE CREEK
MACQUARIE PL
STUART PL
HUEN PL
ELPHINST
PARK ST
FRASER ST
CASTLEREAGH ST
MILNE ST
BRONZEWING ST
MARKET ST
TURNER-DENMEAD
THIRLMERE WAY
BYRON ST
REMEMBRANCE DRIVE
BRADBURY ST

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MINE SUBSIDENCE ENGINEERING CONSULTANTS
1/1767 Pittwater Road - P O Box 1421, Mona Vale NSW 1660
Tel. (02) 9979 1723 Fax: (02) 9979 1726

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TAHMOOR COLLIERY
LONGWALLS 22 AND 23A
OBSERVED IMPACTS TO PROPERTIES

DATE:	SCALE:	DRAWING No:	Rev No
1 Mar 06	1:10 000	MSEC235-02	K

Grid to MGA co-ordinates

LW No.23B
LW No.22
LW No.23A
20

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

C:\ACADData\Tahmoor\MSEC235 LW23A\MSEC235-03 Comparison between Predicted & Observed Subs- LWs22&23A.dwg

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1/1767 Pittwater Road - P O Box 1421, Mona Vale NSW 1660
Tel. (02) 9979 1723 Fax: (02) 9979 1726

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TAHMOOR COLLIERY

COMPARISON BETWEEN PREDICTED AND OBSERVED SUBSIDENCE DUE TO LONGWALLS 22 AND 23A

DATE:	SCALE:	DRAWING No:	Rev No
1 Mar 06	1:12 500	MSEC235-03	A

Grid to MGA co-ordinates

276 500
277 000
6 212 500
6 212 000
6 211 000
6 210 500
6 210 000
6 209 500

LW No.24B
LW No.23B
LW No.25
LW No.26
LW No.27
LW No.22
LW No.35
LW No.23A
LW No.24A
LW No.4
LW No.3
LW No.5

MYRTLE CREEK
MACQUARIE PL
STUART PL
LINDEN PL
WINPARA CL
PIMELEA ST
ELPHIN ST
PARK ST
FRASER ST
CHARLEE REACH
THIRLMERE WAY
TURNER GLENMEAD
MARKET ST
MILNE ST
BRONZEWING ST
CHARLEE REACH DRIVE

F10 F15 F18 F19 F25 F30 F35 F40 F45

LEGEND

- Predicted < Observed by -150mm to -100mm
- Predicted < Observed by -100mm to -50mm
- Predicted > Observed by 50mm to 100mm
- Predicted > Observed by 100mm to 150mm
- Predicted > Observed by 150mm to 200mm
- Predicted > Observed by 200mm to 250mm