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SIMEC

SIMEC Mining:

Tahmoor South Longwalls S1A to S7A

Management Plan for potential impacts to Sydney Water Sewer Infrastructure

Sydney WATER

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References:-

AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines

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MSEC (2024) *Tahmoor South – Modification 3 - Longwall S7A - The effects of the proposed addition of LW S7A on previous subsidence predictions and impact assessments. (Report No. MSEC1348, Revision B, March 2024)*, prepared by Mine Subsidence Engineering Consultants.

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1.1. Background

Tahmoor Coal Pty Ltd (Tahmoor Coal), owns and operates Tahmoor Mine, an existing underground coal mine located approximately 80 km southwest of Sydney in the Southern Coalfields of New South Wales (NSW). Tahmoor Coal is a wholly owned entity within the SIMEC Mining division of the GFG Alliance group. Tahmoor Coal has extracted 39 longwalls and completed extraction of LW S3A.

Tahmoor Coal received development consent in April 2021 for the Tahmoor South Project, which is an extension of the current Tahmoor Mine underground coal mining within the Bulli seam towards the south of the existing Tahmoor Mine.

Tahmoor Coal received approval for an Extraction Plan for Longwalls S1A to S6A (LWs S1A to S6A), which are the first longwall panels to be extracted in the Tahmoor South domain. The proposed longwalls are located between Tahmoor's surface facilities to the north and the township of Bargo to the south. Sewer infrastructure owned by Sydney Water is located within this area.

In October 2022, Sydney Water and Tahmoor Coal developed an agreed Revision A of the Management Plan for the mining of LWs S1A to S6A beneath Sydney Water's infrastructure.

Tahmoor Coal subsequently received approval to shorten the commencing (i.e. southern) ends of LWs S3A and S4A by 104 metres from the positions that were approved in the Extraction Plan.

In May 2025, Tahmoor Coal received approval for a Modification to the development consent to extract LW S7A to the side of LW S6A. The proposed LW S7A will not extract directly beneath Sydney Water sewer infrastructure and will result in very minor additional subsidence along Remembrance Drive where the sewer main is located.

A summary of the dimensions of LW S1A-S7A are provided in Table 1.1.

Table 1.1 Longwall dimensions

Longwall	Overall void length including the installation heading (m)	Overall void width including the first workings (m)	Overall tailgate chain pillar width (m)
LW S1A	1,711	283	-
LW S2A	1,768	285	38
LW S3A	1,704	285	36
LW S4A	1,755	285	36
LW S5A	1,949	285	36
LW S6A	1,999	285	36
LW S7A	1,918	285	36

This Management Plan provides detailed information about how the risks associated with mining beneath Sydney Water's sewer infrastructure will be managed by Tahmoor Coal and Sydney Water.

The Management Plan is a live document that can be amended at any stage of mining, to meet the changing needs of Tahmoor Coal and Sydney Water.

1.2. Sydney Water's sewer assets potentially affected by LW S1A-S7A

The locations of Sydney Water's sewer infrastructure in relation to LW S1A-S7A are shown in Drawing No. MSEC1193-05-01.

LW S1A to S5A are planned to mine directly beneath Sydney Water's sewerage infrastructure. The sewerage infrastructure includes a 180 mm diameter welded PE pressure main that generally follows the alignment of Remembrance Drive. The sewerage system was designed to accommodate mine subsidence movements.

A consumer reticulation network is located along the local roads within the Bargo township but the reticulation network is located outside the Study Area and will not be adversely affected by the extraction of LWs S1A to S7A. The properties within the Study Area are connected to septic tank systems.

1.3. Consultation

1.3.1. Consultation with Sydney Water

Tahmoor Coal regularly consults with Sydney Water in relation to mine subsidence effects. This includes consultation during the development of subsidence management plans for previous Longwalls 22 to 32 and LW W1-W4, and regular reporting of subsidence movements and impacts.

Details regarding consultation and engagement are outlined below:

- Risk assessment with Nad Balgunan and Trop Cooper (Sydney Water), Amanda Bateman, Amanda Fitzgerald, Diana Harris (Tahmoor Coal) and Daryl Kay (MSEC);
- Provision of the draft Subsidence Management Plan for LW S1A-S6A to Nad Balgunan (Sydney Water) in October 2022.
- Briefing from Ross Barber (Tahmoor Coal) and Daryl Kay (MSEC) to Troy Cooper and Nad Balgunan (Sydney Water) at Sydney Water Prestons office on 29 March 2023;
- Letter advising planned shortening of LW S3A in March 2024;
- Letter advising planned shortening of LW S4A in November 2024;
- Ongoing reporting of monitoring results during the mining of LWs S1A to S3A.

Tahmoor Coal will continue to consult regularly with Sydney Water during the extraction of LW S1A-S7A in relation to mine subsidence effects.

1.3.2. Consultation with Government Agencies & Key Infrastructure Stakeholders

Government agencies including the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations, Subsidence Advisory NSW and key infrastructure stakeholders including Wollondilly Shire Council, Endeavour Energy, Telstra and Jemena, have also been consulted as part of the Extraction Plan approval process.

1.4. Limitations

This Management Plan is based on the predictions of the effects of mining on surface infrastructure as provided in Report No. MSEC1192 for LWs S1A to S6A by Mine Subsidence Engineering Consultants (MSEC, 2022) and Report No. MSEC1348 for LW S7A by Mine Subsidence Engineering Consultants (MSEC, 2024). Predictions are based on the planned configuration of LW S1A-S7A at Tahmoor Mine (as shown in Drawing No. MSEC1193-05-01), along with available geological information and data from numerous subsidence studies for longwalls previously mined in the area.

Infrastructure considered in this Plan has been identified from site visits and aerial photographs and from discussions between Tahmoor Coal and Sydney Water representatives.

The impacts of mining on surface and sub-surface features have been assessed in detail. However, it is recognised that the prediction and assessment of subsidence can be relied upon only to a certain extent. The limitations of the prediction and assessment of mine subsidence are discussed in report MSEC1192 by Mine Subsidence Engineering Consultants.

As discussed in the report, there is a low probability that ground movements and their impacts could exceed the predictions and assessments. However, if these potentially higher impacts are considered prior to mining, they can be managed. This Management Plan will not necessarily prevent impacts from longwall mining, but will limit the impacts by establishing appropriate procedures that can be followed should evidence of increased impacts emerge.

1.5. Objectives

The objectives of this Management Plan are to establish procedures to measure, control, mitigate and repair potential impacts that might occur to sewer pipelines.

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. Ensure that the health and safety of people who may be present on public property are not put at risk due to mine subsidence;
- Avoid disruption and inconvenience, or, if unavoidable, keep to minimal levels;
- Monitor ground movements and the condition of infrastructure during mining;
- Initiate action to mitigate or remedy potential significant impacts that are expected to occur on the surface;

- Provide a plan of action in the event that the impacts of mine subsidence are greater than those that are predicted;
- Establish a clearly defined decision-making process to ensure timely implementation of risk control measures for high consequence but low likelihood mine subsidence induced hazards that involve potential serious injury or illness to a person or persons that may require emergency evacuation, entry or access restriction or suspension of work activities;
- Provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Coal, Sydney Water, relevant government agencies as required, and consultants as required; and
- Establish lines of communication and emergency contacts.

1.6. Scope

The Management Plan is to be used to protect and monitor the condition of the Sydney Water infrastructure identified to be at risk due to mine subsidence and to ensure that the health and safety of people who may be present on public property or Sydney Water property are not put at risk due to mine subsidence.

The major items at risk are:

- Sewer pipelines

The pipelines are shown in Drawing No. MSEC1193-05-01, classified by pipe size.

The Management Plan only covers infrastructure that is located within the limit of subsidence, which defines the extent of land that may be affected by mine subsidence as a result of mining LWs S1A to S7A only.

Tahmoor Coal is also managing potential impacts on features that may be sensitive to mining-induced differential far field movements, such as bridges including the Remembrance Drive Bridge over the Bargo River, the Bargo River Road Bridge over a tributary to the Bargo River and the Bargo River Road Bridge over the Main Southern Railway. Sydney Water sewer pipelines cross these three bridges and this Management Plan includes measures to manage the pipelines that are located on these bridges.

With the exception of the bridge crossings, the management plan does not include other sewer infrastructure owned by Sydney Water which lies outside the extent of the Study Area.

This Management Plan does not include Sydney Water potable water infrastructure, which is included in a separate management plan.

1.7. Proposed mining schedule

It is planned that LW S1A-S7A will extract coal working northwest from the southeastern ends. This Management Plan covers longwall mining until completion of mining in LW S7A and for sufficient time thereafter to allow for completion of subsidence effects. The current schedule of mining is shown in Table 1.2.

Table 1.2 Schedule of mining

Longwall	Start Date	Completion Date
LW S1A	October 2022	July 2023
LW S2A	August 2023	April 2024
LW S3A	May 2024	December 2024
LW S4A	January 2026	August 2026
LW S5A	September 2026	April 2027
LW S6A	May 2027	December 2027
LW S7A	January 2028	August 2028

Please note the above schedule is subject to change due to unforeseen impacts on mining progress. Tahmoor Coal will keep Sydney Water informed of changes

1.8. 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.

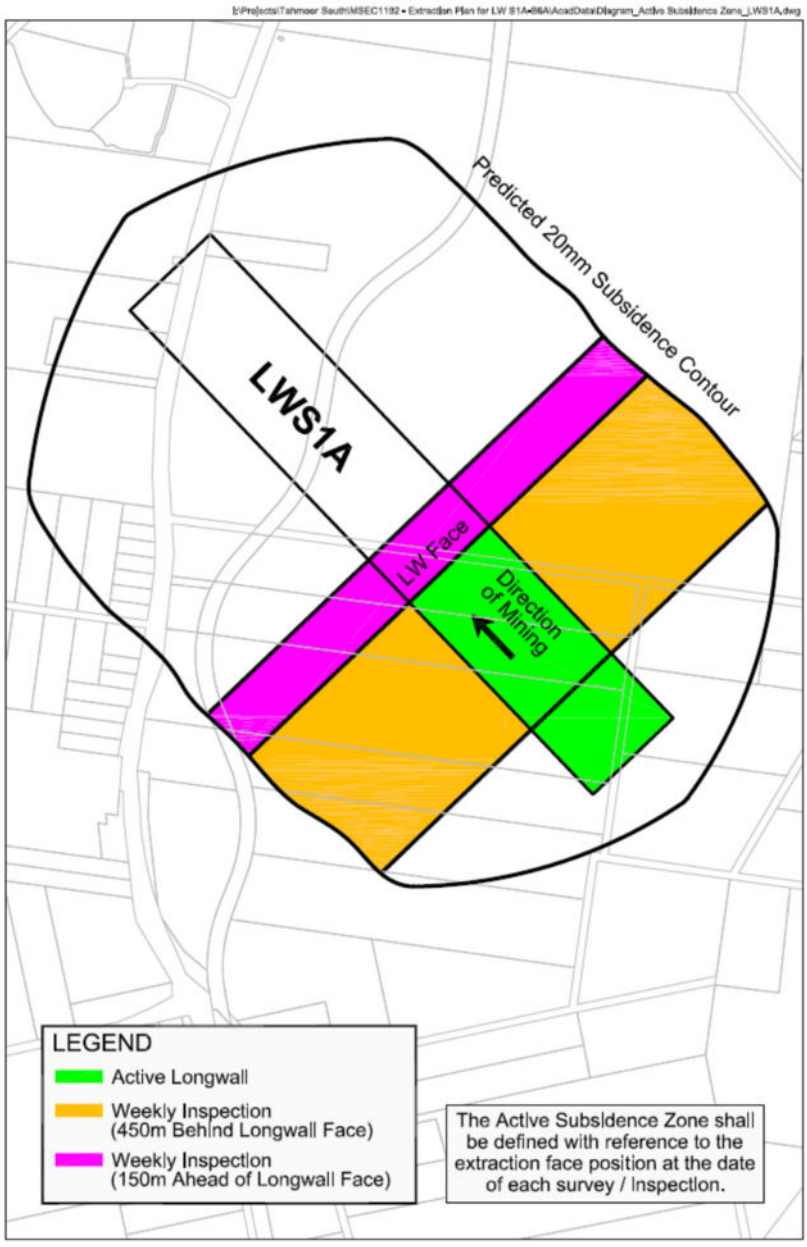

Fig. 1.1 Diagrammatic Representation of Active Subsidence Zone

1.9. Compensation

The *Coal Mine Subsidence Compensation Act 2017* (MSC Act) is administered by Subsidence Advisory NSW (Mine Subsidence Board).

Currently, under the *Coal Mine Subsidence Compensation Act 2017*, any claim for mine subsidence damage needs to be lodged with Subsidence Advisory NSW. Subsidence Advisory NSW staff will arrange for the damage to be assessed by an independent specialist assessor. If the damage is attributable to mine subsidence, a scope will be prepared and compensation will be determined. For further details please refer to *the Approved Procedure – Claiming in active mining areas at* www.nsw.gov.au/departments-and-agencies/subsidence-advisory/claiming-for-mine-subsidence-damage/active-mining-claims.

2.1. NSW Work Health & Safety Legislation

All persons conducting a business or undertaking (PCBUs), including mine operators and contractors, have a primary duty of care to ensure the health and safety of workers they engage, or whose work activities they influence or direct. The responsibilities are legislated in *Work Health and Safety Act 2011* and the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated Regulations (collectively referred to as the 'WHS laws').

The *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* commenced on 1 February 2015 and contains specific regulations in relation to mine subsidence.

As outlined in the Guide by the NSW Department of Trade & Investment Mine Safety:

"a PCBU must manage risks to health and safety associated with mining operations at the mine by:

- *complying with any specific requirements under the WHS laws*
- *identifying reasonably foreseeable hazards that could give rise to health and safety risks*
- *ensuring that a competent person assesses the risk*
- *eliminating risks to health and safety so far as is reasonably practicable*
- *minimising risks so far as is reasonably practicable by applying the hierarchy of control measures, any risks that it is are not reasonably practical to eliminate*
- *maintaining control measures*
- *reviewing control measures.*

The mine operator's responsibilities include developing and implementing a safety management system that is used as the primary means of ensuring, so far as is reasonably practicable:

- *the health and safety of workers at the mine, and*
- *that the health and safety of other people is not put at risk from the mine or work carried out as part of mining operations."*

Detailed guidelines have also been released by the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations (MSO, 2017).

The risk management process has been carried out in accordance with guidelines published by the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations (MSO, 2017). The following main steps of subsidence risk management have been and will be undertaken, in accordance with the guidelines:

1. identification and understanding of subsidence hazard;
2. assessment of risks of subsidence;
3. development and selection of risk control measures;
4. implementation and maintenance of risk control measures, and
5. continual improvement and change management.

Each of the above steps have been or will be conducted together with the following processes.

1. consultation, co-operation and co-ordination, and
2. monitoring and review.

This Management Plan documents the risk control measures that are planned to manage risks to health and safety associated with the mining of LW S1A-S7A in accordance with the WHS laws.

2.2. General

The method of assessing potential mine subsidence impacts in the Management Plan is consistent with the Australian/New Zealand Standard for Risk Management (AS/NZS ISO 31000:2009). The Standard defines the terms used in the risk management process, which includes the identification, analysis, assessment, treatment and monitoring of potential mine subsidence impacts. In this context:

2.2.1. 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.' The consequences of a hazard are rated from negligible to catastrophic.

2.2.2. Likelihood

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

2.2.3. Hazard

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

2.2.4. Method of assessment of potential mine subsidence impacts

The method of assessing potential mine subsidence impacts combines the likelihood of an impact occurring with the consequence of the impact occurring. In this Management Plan, the likelihood and consequence are combined via the SIMEC Risk Matrix to determine an estimated level of risk for particular events or situations (Tahmoor Coal, 2021 for LWs S1A to S6A and Tahmoor Coal, 2025 for LW S7A). A copy of the Risk Matrix is included in the Appendix of this Management Plan.

As there is no material difference between the risks to Sydney Water sewer infrastructure associated with the extraction of LW S7A compared to the risks associated with the extraction of LWs S1A to 6A, the same risk ratings have been adopted in the risk assessment for LW S7A (Tahmoor Coal, 2025).

3.1. Maximum predicted conventional subsidence parameters

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC1192, which was prepared in support of Tahmoor Coal's Extraction Plan for LW S1A-S6A. Tahmoor Coal has revised its forecast extraction heights since the previous predictions were provided in Report No. MSEC1192. The changes are generally minor, in the range of 50 to 100 mm greater subsidence than previously forecast.

Revised predicted mining-induced conventional subsidence movements were provided in Report No. MSEC1348, which was prepared in support of Tahmoor Coal's application to extract LW S7A. The predictions do not materially change the assessment of potential impacts on Sydney Water sewer infrastructure (MSEC1348). This Management Plan provides subsidence predictions based on the revised predictions that were provided in Report No. MSEC1348.

A summary of the maximum predicted values of incremental conventional subsidence, tilt and curvature, due to the extraction of LWs S1A-S7A, is provided in Table 3.1.

The predicted ground strains are discussed in Section 3.3. The predicted tilts provided in this table are the maxima after the completion of each of the proposed longwalls. The predicted curvatures are the maxima at any time during or after the extraction of each of the proposed longwalls.

Table 3.1 Maximum predicted incremental conventional subsidence, tilt and curvature resulting from the extraction of each of the proposed longwalls

Longwall	Maximum predicted incremental conventional subsidence (mm)	Maximum predicted incremental conventional tilt (mm/m)	Maximum predicted incremental conventional hogging curvature (km^{-1})	Maximum predicted incremental conventional sagging curvature (km^{-1})
LW S1A	825	7.0	0.08	0.23
LW S2A	950	8.0	0.09	0.22
LW S3A	950	8.0	0.09	0.22
LW S4A	975	8.0	0.09	0.22
LW S5A	975	8.0	0.10	0.22
LW S6A	975	8.3	0.09	0.23
LW S7A	1,050	8.9	0.10	0.24

A summary of the maximum predicted values of total conventional subsidence, tilt and curvature, after the extraction of LWs S1A-S7A, is provided in Table 3.2.

Table 3.2 Maximum predicted total conventional subsidence, tilt and curvature resulting from the extraction of each of the proposed longwalls

Longwalls	Maximum predicted total conventional subsidence (mm)	Maximum predicted total conventional tilt (mm/m)	Maximum predicted total conventional hogging curvature (km^{-1})	Maximum predicted total conventional sagging curvature (km^{-1})
LW S1A	825	7.0	0.08	0.23
LW S2A	1,050	8.1	0.10	0.23
LW S3A	1,250	8.3	0.11	0.23
LW S4A	1,300	8.7	0.13	0.22
LW S5A	1,350	9.2	0.14	0.23
LW S6A	1,400	9.7	0.14	0.23
LW S7A	1,400	10.0	0.14	0.25

The maximum predicted total subsidence, after the completion of S7A, is 1,400 mm. The maximum predicted total conventional tilt is 10 mm/m (i.e. 0.1.0 %), which represents a change in grade of 1 in 100. The maximum predicted total conventional curvatures are 0.14 km^{-1} hogging and 0.25 km^{-1} sagging, which represent minimum radii of curvature of 7 kilometres and 4 kilometres, respectively.

The values provided in the above table are the maximum predicted conventional subsidence parameters which occur above LWs S1A to S7A. The locations of the maximum predicted conventional subsidence parameters do not necessarily coincide with sewer infrastructure. Specific predictions along sewer infrastructure are provided later in this Management Plan.

3.2. Comparison between observed and predicted subsidence during the mining of Longwalls S1A to S3A

Extensive monitoring has been undertaken by Tahmoor Coal during the mining of LWs S1A to S3A. Observed incremental subsidence due to the extraction of LWs S1A to S3A has correlated reasonably well with predictions, as shown in Fig. 3.1 to Fig. 3.6.

Subsidence was observed to vary in magnitude along the centreline of LW S1A. Maximum subsidence was measured at Peg V51 on the V-Line, which is located between Teatree Hollow and the Tributary to Teatree Hollow. Observed subsidence was reduced in magnitude over the northern half of the longwall panel at the Main Southern Railway and Tahmoor Mine Site (Pier 2).

As shown in Fig. 3.4, observed subsidence at Peg V51 was slightly greater than predicted but within the accuracy of the prediction model of ± 15% (Reports Nos. MSEC1123 and MSEC1192). Observed total subsidence at Peg V51 after the mining of LW S3A is less than predicted, as shown in Fig. 3.4. Observed subsidence values at other locations above LW S1A were less than predicted.

Monitoring during the mining of LW S2A measured subsidence movements within predictions, as shown in Fig. 3.2. Whilst observed subsidence along on Remembrance Drive has been less than predicted, increased compressive strains have been observed at two locations, as shown in Fig. 3.6.

Monitoring during the mining of LW S3A measured subsidence movements within predictions, as shown in Fig. 3.3. Maximum subsidence was measured at Peg MS99500 which is located along the Main Southern Railway and above the centreline of LW S3A. Whilst observed subsidence along the Main Southern Railway has been less than predicted, a bump was observed in the subsidence profile along with a corresponding increased compressive strain at one location, as shown in Fig. 3.5.

As recommended in Report Nos. MSEC1192 and MSEC1348, Tahmoor Coal is monitoring during mining to compare observations with predictions. Tahmoor Coal has extensive experience in successfully managing potential subsidence impacts on surface features, even when actual subsidence is substantially greater than the magnitudes that have been predicted above LW S1A-S7A. Subsidence management plans have been developed to manage potential impacts that could occur if greater than predicted subsidence occurs.

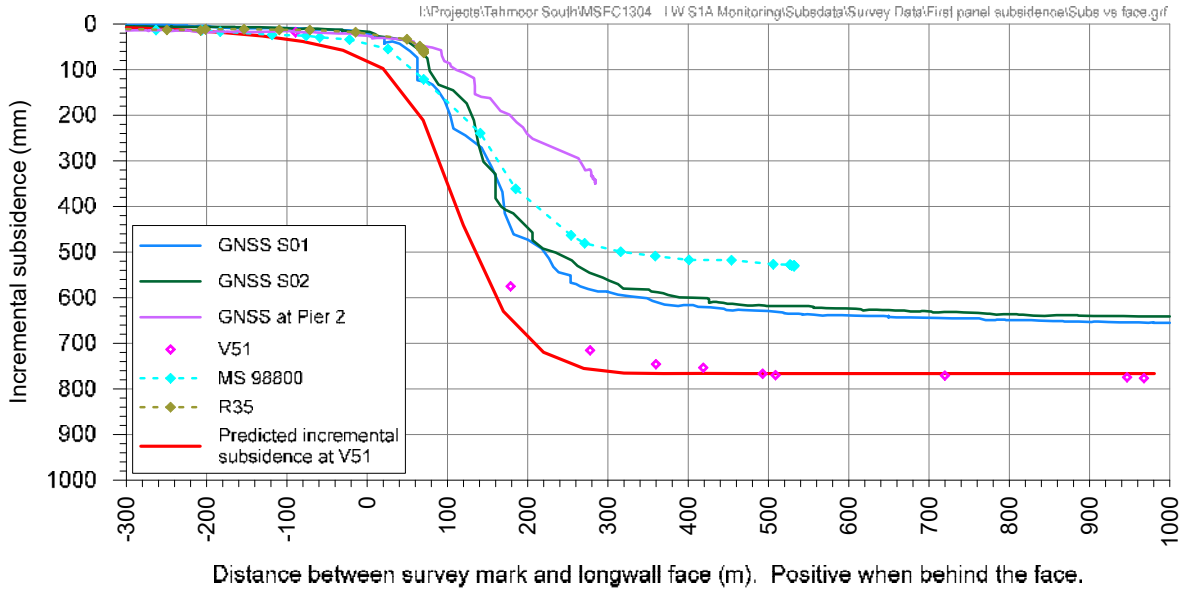

Fig. 3.1 Comparison between predicted and observed subsidence above centreline of LW S1A

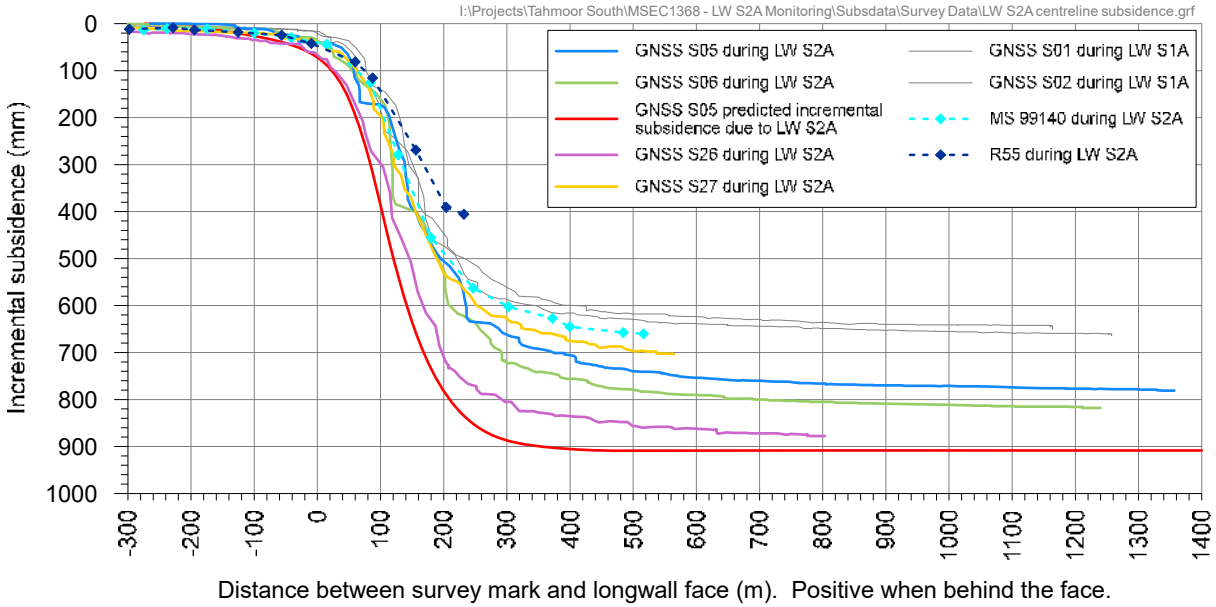

Fig. 3.2 Comparison between predicted and observed subsidence above centreline of LW S2A

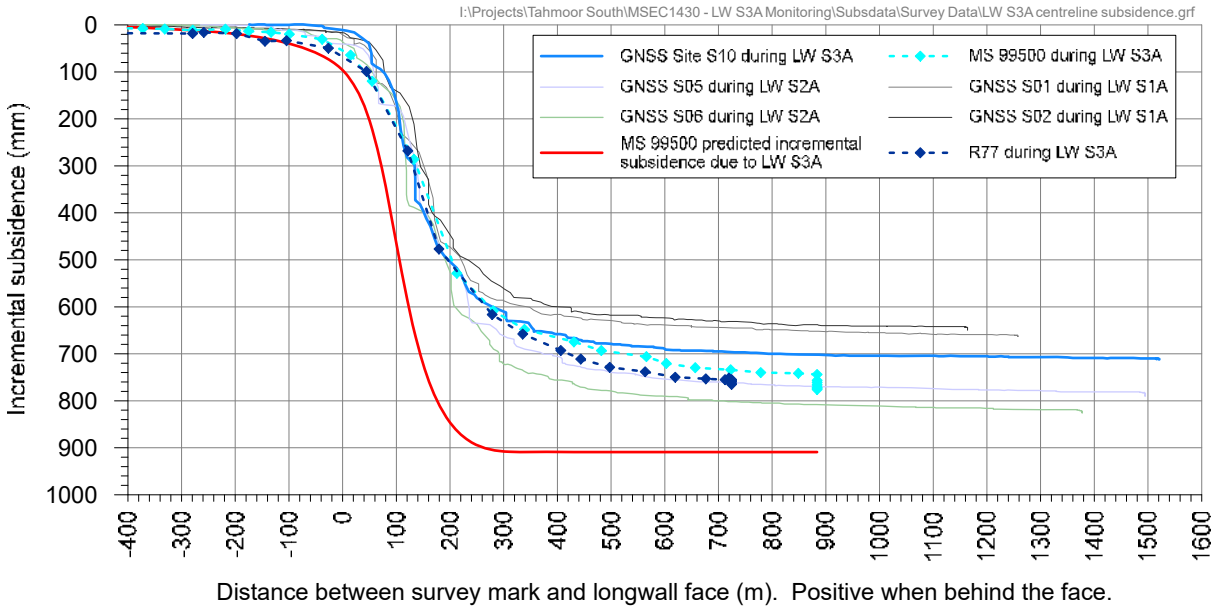

Fig. 3.3 Comparison between predicted and observed subsidence above centreline of LW S3A

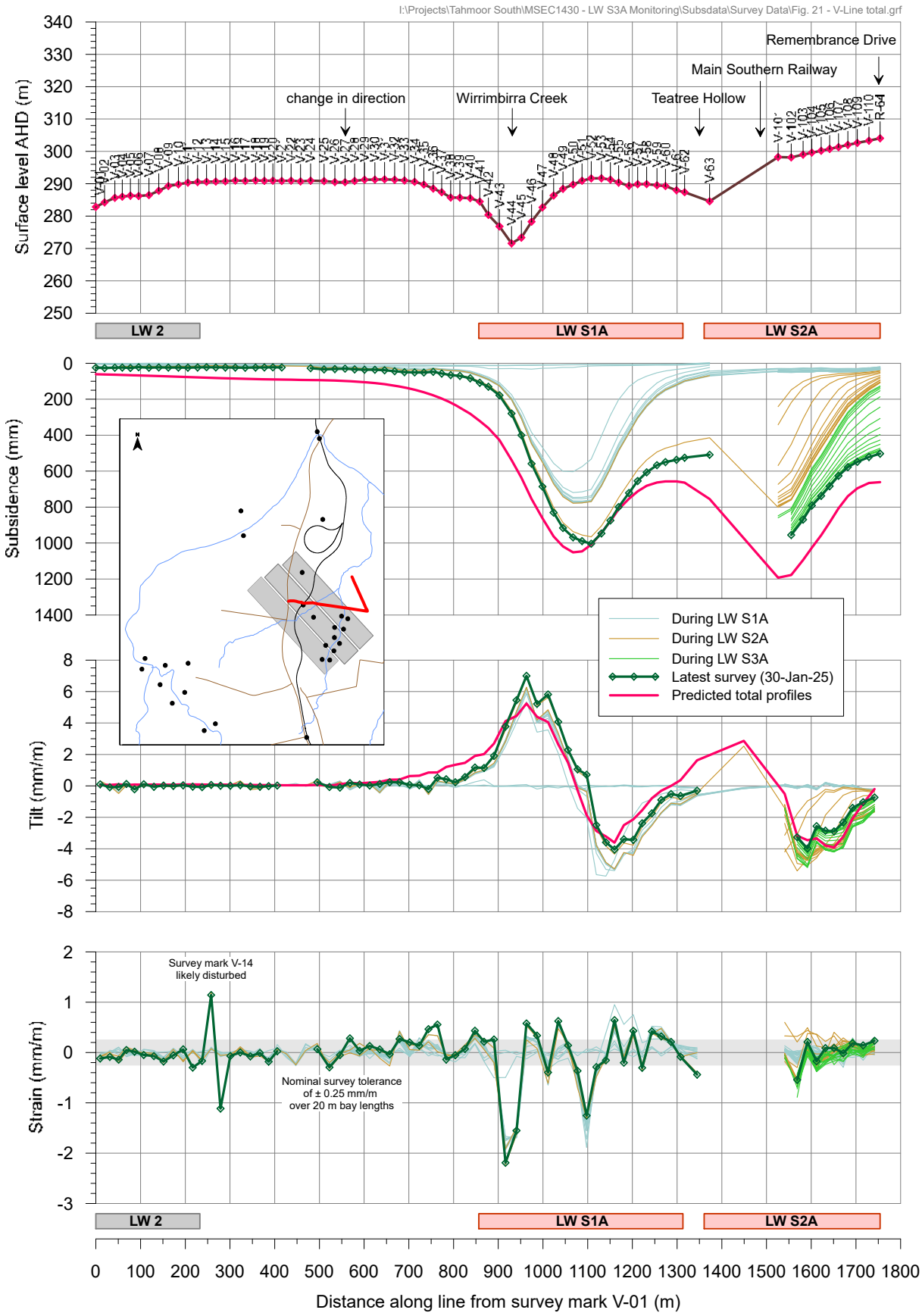

Fig. 3.4 Observed subsidence along V-Line during mining of LW S1A-S3A

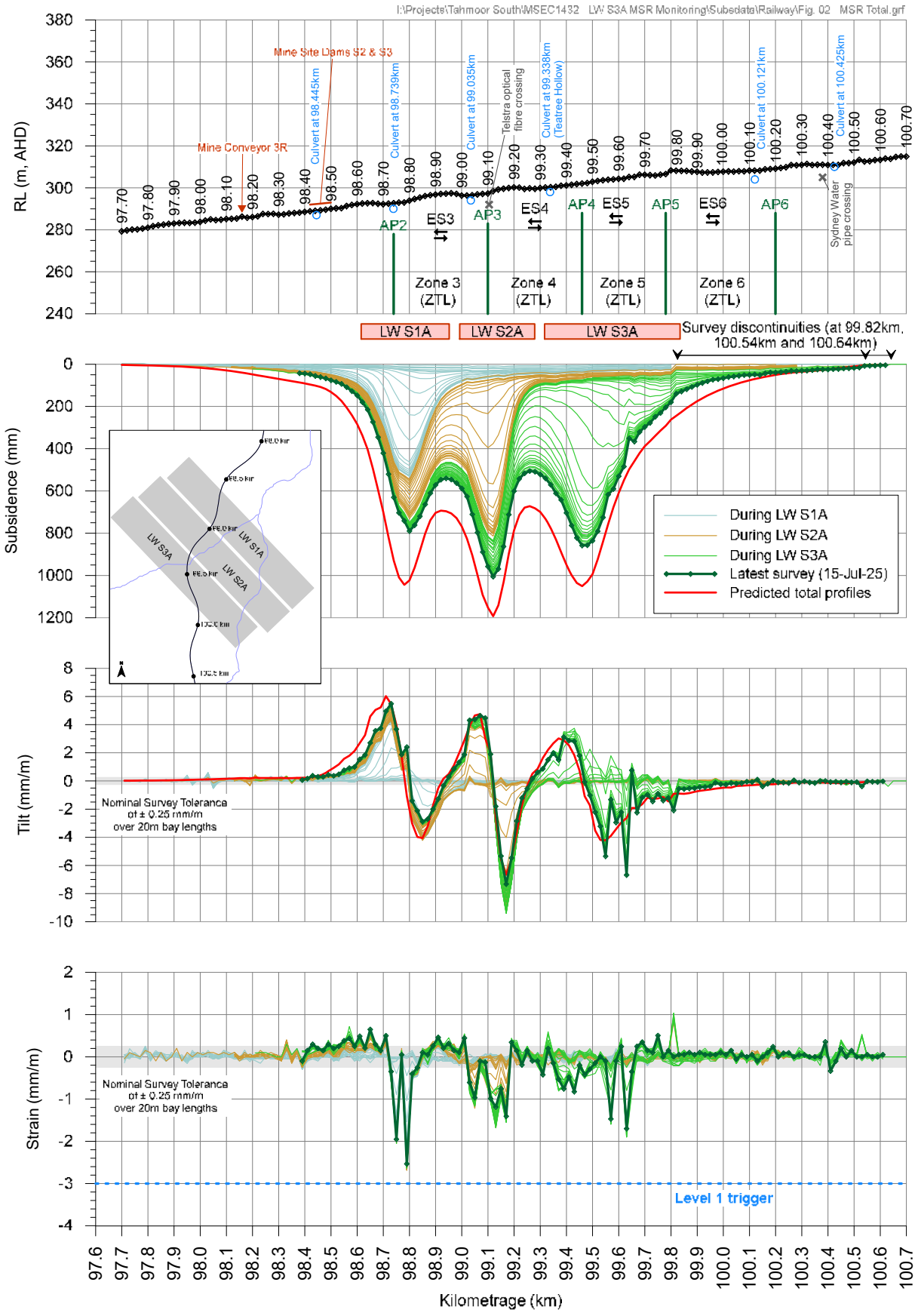

Fig. 3.5 Observed subsidence along Main Southern Railway during mining of LW S1A-S3A

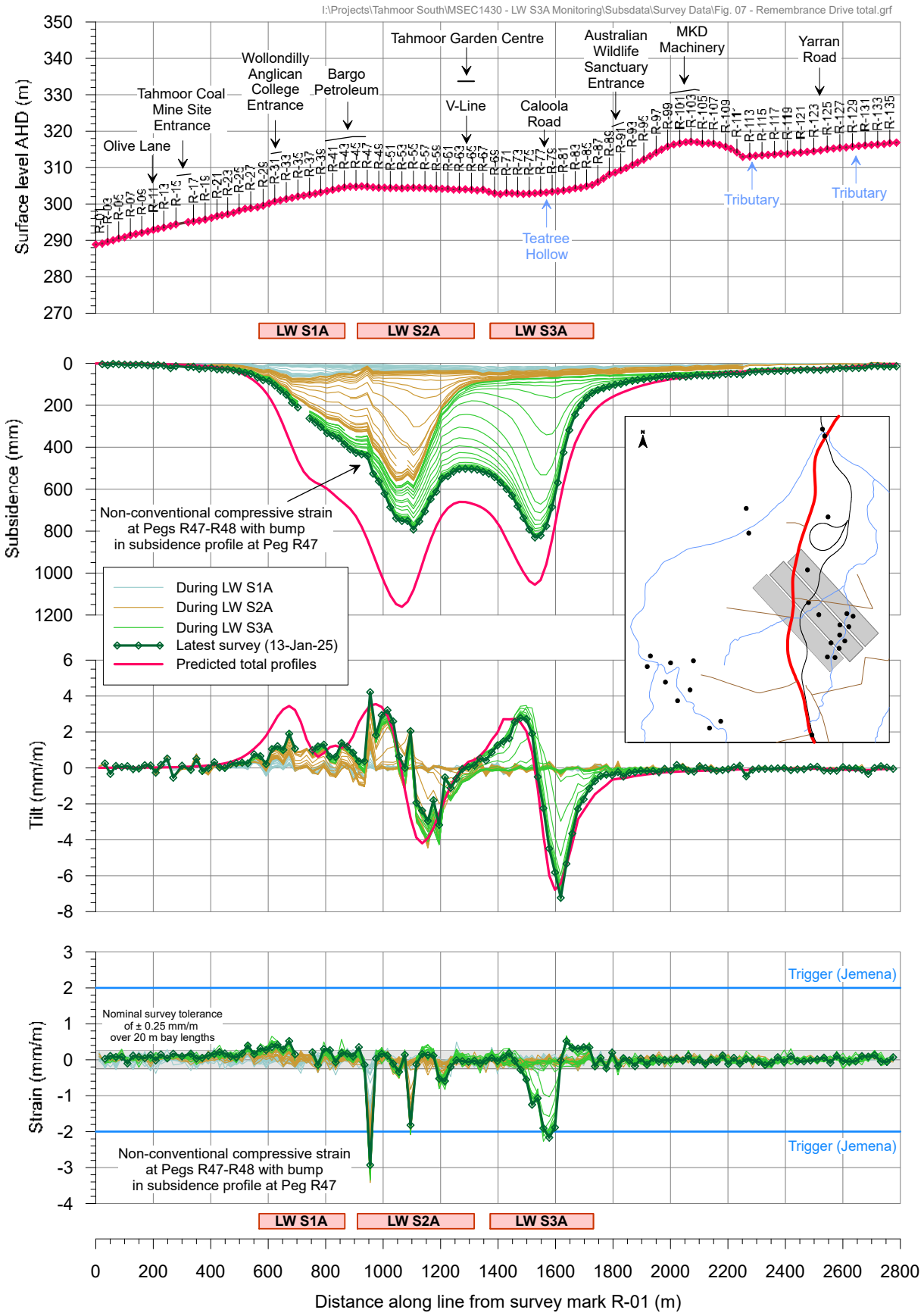

Fig. 3.6 Observed subsidence along Remembrance Drive during mining of LW S1A-S3A

3.3. Predicted strain

The prediction of strain is more difficult than the predictions of subsidence, tilt and curvature. The reason for this is that strain is affected by many factors, including ground curvature and horizontal movement, as well as local variations in the near surface geology, the locations of pre-existing natural joints at bedrock, and the depth of bedrock. Survey tolerance can also represent a substantial portion of the measured strain, in cases where the strains are of a low order of magnitude. The profiles of observed strain, therefore, can be irregular even when the profiles of observed subsidence, tilt and curvature are relatively smooth.

In previous MSEC subsidence reports, predictions of conventional strain were provided based on the best estimate of the average relationship between curvature and strain. Similar relationships have been proposed by other authors. The reliability of the strain predictions was highlighted in these reports, where it was stated that measured strains can vary considerably from the predicted conventional values.

Adopting a linear relationship between curvature and strain provides a reasonable prediction for the conventional tensile and compressive strains. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones and locations that are predicted to experience sagging or concave curvature are expected to be net compressive strain zones. In the Southern Coalfield, it has been found that a factor of 15 provides a reasonable relationship between the predicted maximum curvatures and the predicted maximum conventional strains.

At a point, however, there can be considerable variation from the linear relationship, resulting from non-conventional movements or from the normal scatters which are observed in strain profiles. When expressed as a percentage, observed strains can be many times greater than the predicted conventional strain for low magnitudes of curvature. In this report, therefore, we have provided a statistical approach to account for the variability, rather than providing a single predicted conventional strain.

The data used in the analysis of observed strains included those resulting from both conventional and non-conventional anomalous movements, but did not include those resulting from valley-related effects. The strains resulting from damaged or disturbed survey marks have also been excluded.

3.3.1. Analysis of strains measured in survey bays

For features that are in discrete locations, such as building structures, farm dams and archaeological sites, it is appropriate to assess the frequency of the observed maximum strains for individual survey bays.

Predictions of strain above goaf

A database of survey data has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of the previous longwalls at Tahmoor, Appin and West Cliff Collieries, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as "*above goaf*".

A histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf, for monitoring lines at Tahmoor, Appin and West Cliff Collieries is provided in Fig. 3.7. Probability distribution functions, based on fitted *Generalised Pareto Distributions (*GPDs), have also been shown in this figure.

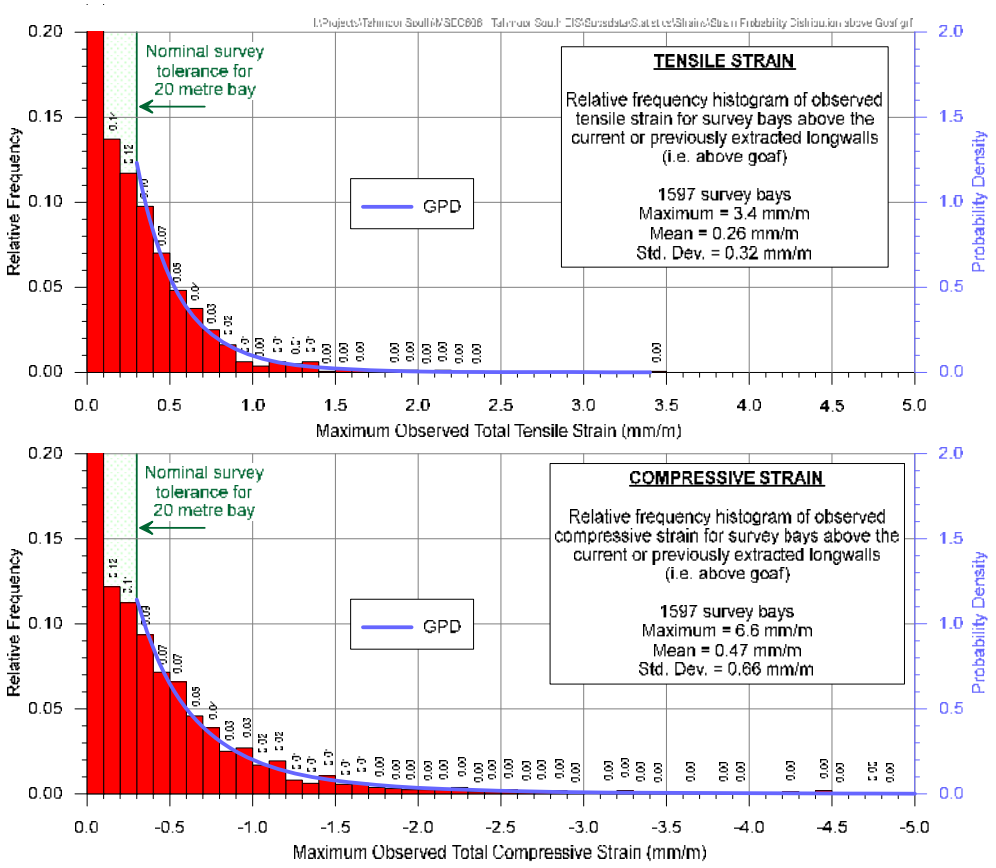

Fig. 3.7 Distributions of the maximum measured tensile and compressive strains for survey bays located above goaf at Tahmoor, Appin and West Cliff Collieries

The 95 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.9 mm/m tensile and 1.6 mm/m compressive. The strains for the proposed longwalls are predicted to be 20 % to 40 % greater than those previously observed at these collieries and, therefore, it is expected that 95 % of the strains measured *above goaf* would be less than 1.3 mm/m tensile and 2.2 mm/m compressive.

The 99 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 1.4 mm/m tensile and 3.1 mm/m compressive. Similarly, it is expected that 99 % of the strains measured *above goaf* for the proposed longwalls would be less than 2.0 mm/m tensile and 4.3 mm/m compressive.

Predictions of strain above solid coal

The survey database has also been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of the previous longwalls at Tahmoor, Appin and West Cliff Collieries, for survey bays that were located beyond the goaf edges of the mined panels and positioned on unmined areas of coal, i.e. outside panels but within 200 metres of the nearest longwall goaf edge, which has been referred to as "*above solid coal*".

A histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal, for monitoring lines at Tahmoor, Appin and West Cliff Collieries is provided in Fig. 3.8. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

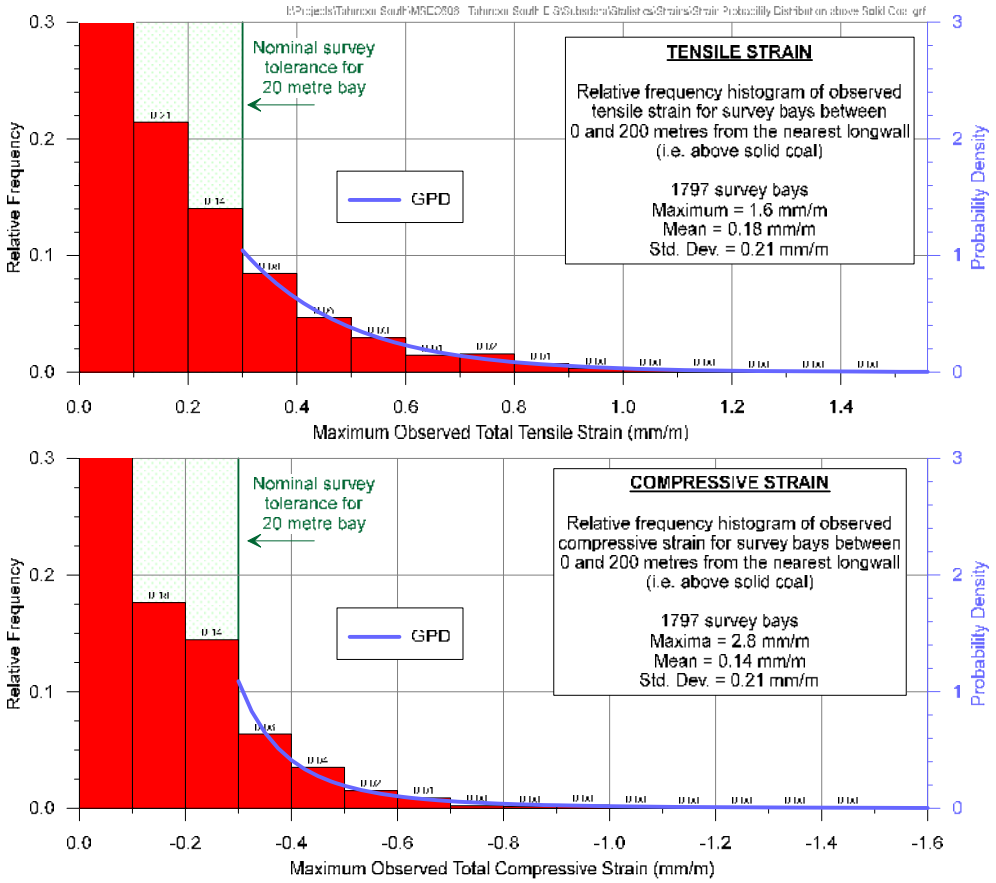

Fig. 3.8 Distributions of the maximum measured tensile and compressive strains for survey bays located above solid coal at Tahmoor, Appin and West Cliff Collieries

The 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.6 mm/m tensile and 0.5 mm/m compressive. The strains for the proposed longwalls are predicted to be 20 % to 40 % greater than those previously observed at these collieries and, therefore, it is expected that 95 % of the strains measured *above solid coal* would be less than 1.0 mm/m tensile and compressive.

The 99 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining at Tahmoor, Appin and West Cliff Collieries were 0.9 mm/m tensile and compressive. Similarly, it is expected that 99 % of the strains measured *above solid coal* adjacent to the proposed longwalls would be less than 1.5 mm/m tensile and compressive.

3.3.2. Analysis of strains measured along whole monitoring lines

For linear features such as roads, cables and pipelines, it is more appropriate to assess the frequency of the maximum strains measured along whole monitoring lines, rather than for individual survey bays. That is, an analysis of the maximum strains measured anywhere along the monitoring lines, regardless of where the strain occurs.

A histogram of maximum observed total tensile and compressive strains measured anywhere along the monitoring lines, at any time during or after the extraction of the previous longwalls Tahmoor, Appin and West Cliff Collieries, is provided in Fig. 3.9.

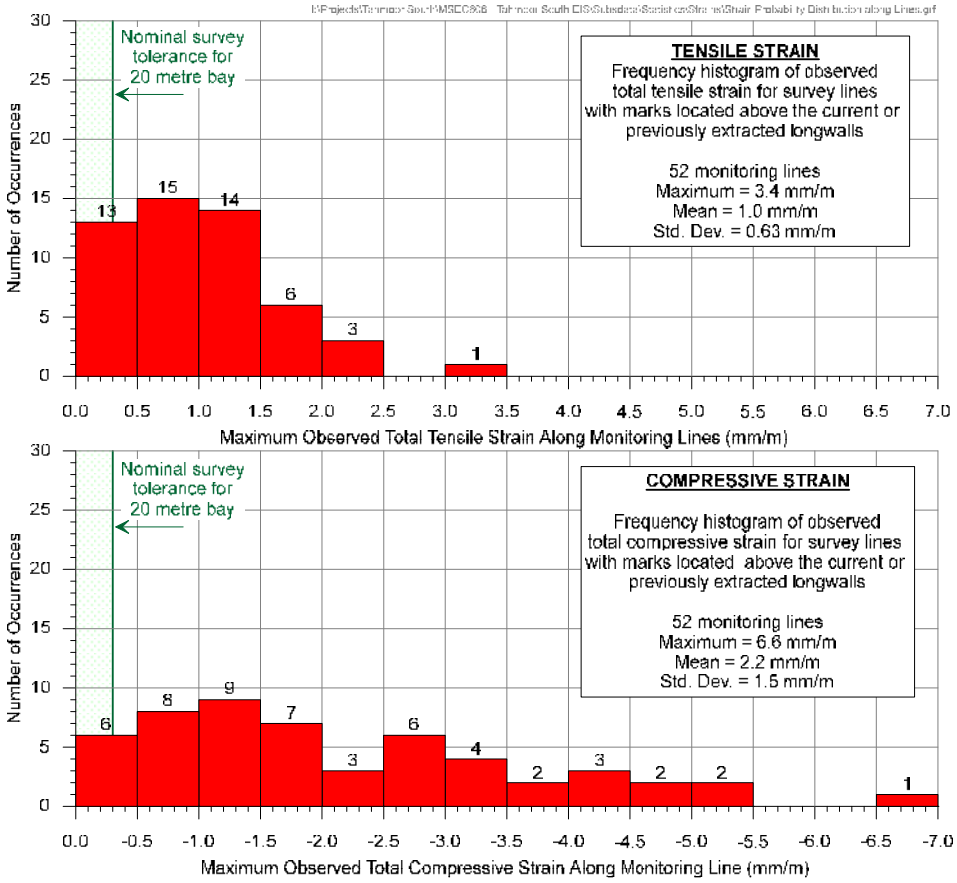

Fig. 3.9 Distributions of maximum measured tensile and compressive strains anywhere along monitoring lines at Tahmoor, Appin and West Cliff Collieries

It can be seen from the above figure, that 42 of the 52 monitoring lines (i.e. 92 % of the total) at Tahmoor, Appin and West Cliff Collieries had recorded maximum total tensile strains of 2.0 mm/m, or less. The strains for the proposed longwalls are predicted to be 20 % to 40 % greater than those previously observed at these collieries and, therefore, it is expected that 92 % of the monitoring lines above the proposed longwalls would experience maximum tensile strains of 3.0 mm/m, or less.

It can also be seen, that 45 of the 52 monitoring lines (i.e. 87 % of the total) at Tahmoor, Appin and West Cliff Collieries had recorded maximum total compressive strains of 4.0 mm/m, or less. The strains for the proposed longwalls are predicted to be 20 % to 40 % greater than those previously observed at these collieries and, therefore, it is expected that 87 % of the monitoring lines above the proposed longwalls would experience maximum compressive strains of 5.5 mm/m, or less.

3.4. Managing public safety

The primary risk associated with mining beneath sewer infrastructure is public safety. Tahmoor Coal has previously directly mined beneath or adjacent to more than 2000 houses and civil structures, commercial and retail properties, the Main Southern Railway and local roads and bridges. It has implemented extensive measures prior to, during and after mining to ensure that the health and safety of people have not been put at risk due to mine subsidence. People have not been exposed to immediate and sudden safety hazards as a result of impacts that have occurred due to mine subsidence movements.

Emphasis is placed on the words “immediate and sudden” as in rare cases, some structures have experienced severe impacts, but the impacts did not present an immediate risk to public safety as they developed gradually with ample time to repair the structure.

In the case of this Subsidence Management Plan, the potential for impacts on public safety has been assessed on a case by case basis.

3.4.1. Subsidence Impact Management Process for Infrastructure

Tahmoor Coal has developed and acted in accordance with agreed subsidence management plans to manage potential impacts during the mining of LWs 22 to 32 and LW W1-W4 at Tahmoor North and LWs S1A to S3A. The management strategy has been reviewed and updated based on experiences gained during the mining of these longwalls, and the strategy for LW S1A-S7A at Tahmoor South includes the following process:

1. Regular consultation with Sydney Water before, during and after mining;
2. Site-specific investigations; and
3. Surveys and inspections during mining within the active subsidence area:
    - Detailed visual inspections and vehicle-based inspections along the streets;
    - Ground surveys along streets; and
    - Specific ground surveys and visual inspections, where recommended by an engineer based on the inspections and assessments.

A flowchart illustrating the subsidence impact management process prior to, during and after Sydney Water infrastructure experiences mine subsidence movements is shown in Fig. 3.10.

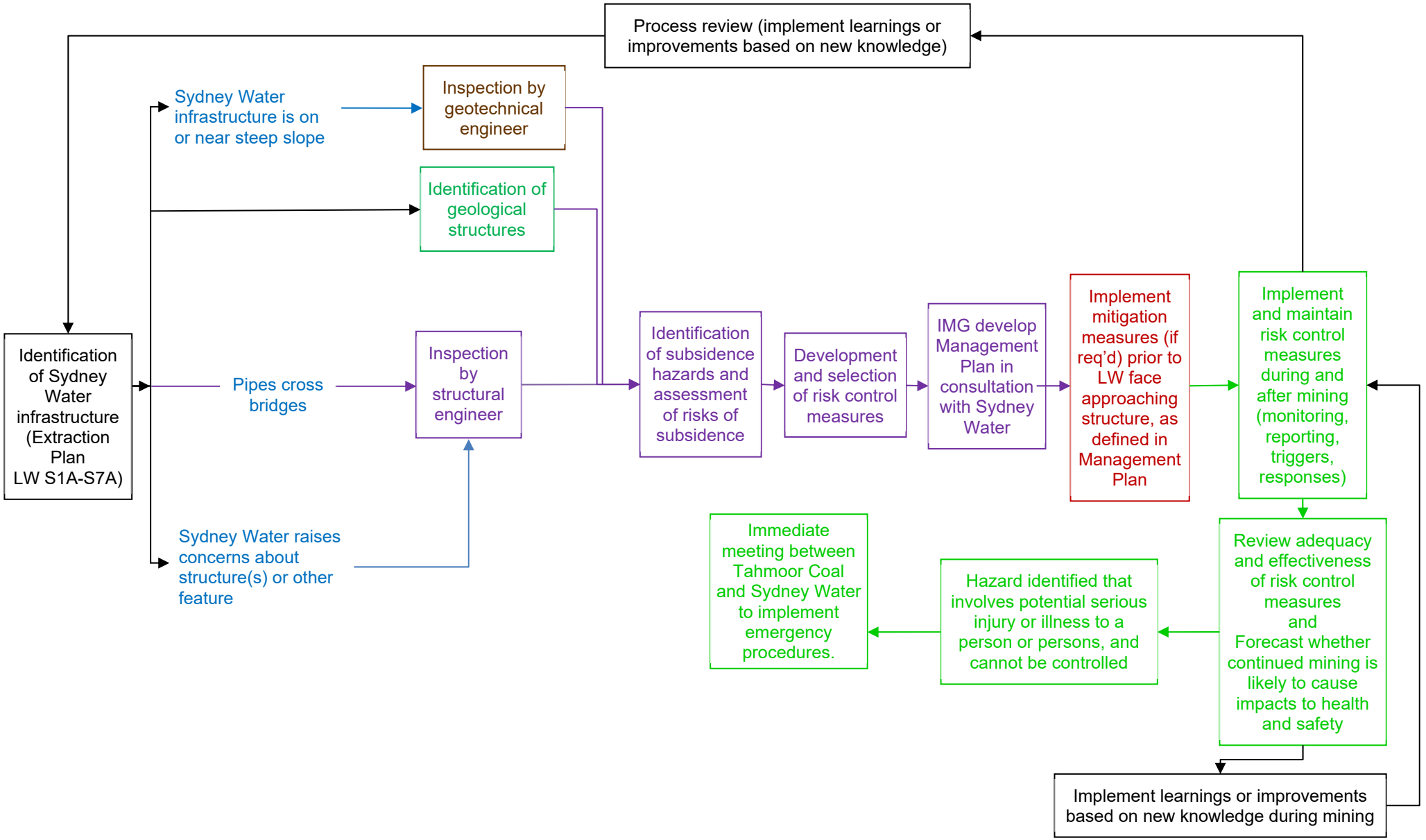

Fig. 3.10 Flowchart for Subsidence Impact Management Process

3.5. Summary of potential impacts

A summary of potential impacts on Sydney Water's Sewer infrastructure is provided in Table 3.3. The summary is consistent with the risk assessment undertaken by Sydney Water and Tahmoor Coal (2022). The results of the risk assessment are included in the Appendix.

Table 3.3 Summary of Potential Mine Subsidence Impacts

Risk	Likelihood	Consequence	Level of Potential Impact
Leakage of 180mm dia PE pipe leading to potential interruption / blocking of sewer service	RARE	MODERATE	LOW
Leakage of 180mm dia PE pipe leading to environmental impacts	RARE	MODERATE	LOW
Leakage of 150mm dia DICL pipe on Remembrance Drive Bridge over Bargo River leading to potential interruption of sewer service and environmental impacts	RARE	MODERATE	LOW

Additional information on each potential impact is provided below.

3.6. Identification of subsidence hazards that could give rise to risks to health and safety

Clause 34 of the Work Health and Safety Regulation (2017) requires that the duty holder (in this case Tahmoor Coal), in managing risks to health and safety, must identify reasonably foreseeable hazards that could give rise to risks to health and safety.

This section of the Management Plan summarises hazards that have been identified in Chapter 3, which could give rise to risks to health and safety of people in the vicinity of Sydney Water's sewer infrastructure.

Using the processes described in Section 3.4 of this Management Plan, mine subsidence hazards have been identified, investigated and analysed in a systematic manner by examining each aspect of the infrastructure, as described in Section 3.7 of this Management Plan. Each of the aspects below could potentially experience mine subsidence movements that give rise to risks to the health and safety of people:

- Leakage of sewer main; and
- Leakage of sewer main at creek crossings.

The following mine subsidence hazards were identified that could give rise to risks to health and safety due to the extraction of LW S1A-S7A:

- Leakage of sewer main.

The identification and risk assessment process took into account the location of infrastructure relative to LW S1A-S7A and the associated timing and duration of the subsidence event, as described in Section 1.8 of this Management Plan.

Whilst mine subsidence predictions and extensive past experiences from previous mining at Tahmoor were taken into account, the identification and risk assessment process recognised that there are uncertainties in relation to predicting subsidence movements, and uncertainties in how mine subsidence movements may adversely impact Sydney Water infrastructure, as discussed in Section 1.4 and Chapter 3 of this Management Plan. In this case, creeks have been mapped that intersect sewer pipelines.

Tahmoor Coal has considered the outcomes of the hazard identification and risk assessment process when developing measures to manage potential impacts on the health and safety of people, and potential impacts on Sydney Water infrastructure in particular. These are described in Chapter 4 of this Management Plan.

3.7. Sewerage pipelines

There is one sewer pipeline located directly above LW S1A-S7A, as shown in Drawing No. MSEC1193-05-01:

- 180 mm diameter PE pressure main
  As shown in Drawing No. MSEC1193-05-01, a 180 mm diameter welded polyethylene (PE) pressure main generally follows the alignment of Remembrance Drive.

The following sewer pipelines are located on the bridge crossings:

- 150 mm diameter DICL pressure main on Remembrance Drive Bridge over the Bargo River
  A 150 mm diameter rubber ring jointed ductile iron cement lined (DICL) pipe is side-mounted to the northbound side of the Remembrance Drive Bridge over the Bargo River, as shown in Fig. 3.11. Expansion joints and expansion loops are located at the ends of the Bridge, as shown in Fig. 3.12 and Fig. 3.13.
- 160 mm diameter steel pressure main on Bargo River Road Bridge over tributary to the Bargo River
  A 160 mm diameter steel pressure main is side-mounted to the upstream side (Tahmoor bound) of the Bridge, as shown in Fig. 3.14. An expansion joint is shown in Fig. 3.15.
- 160 mm diameter PE pressure main over Bargo River Road Bridge over the Main Southern Railway
  A 160 mm diameter PE pressure main has been buried beneath the road pavement across an old masonry arch Bridge over the Main Southern Railway (Potter's Cutting).

No impacts have been recorded to the bridges or the Sydney Water sewer infrastructure connected to them during the extraction of LWs S1A to S3A.



Fig. 3.11 150 mm DICL pressure main on Remembrance Drive Bridge over Bargo River



Fig. 3.12 Expansion loop for 150 mm DICL pressure main on Remembrance Drive Bridge over Bargo River



Fig. 3.13 Expansion joint for 150 mm DICL pressure main on Remembrance Drive Bridge over Bargo River



Photograph courtesy JMA Solutions (2022b)

Fig. 3.14 160 mm steel pressure main on Bargo River Road Bridge over tributary to Bargo River



Photograph courtesy JMA Solutions (2022b)

Fig. 3.15 Expansion joint for 160 mm steel pressure main on Bargo River Road Bridge over tributary to Bargo River

3.7.1. Predicted subsidence movements

The predicted profiles of conventional subsidence, tilt and curvature for the pressure main along the alignment of Remembrance Drive due to the extraction of LW S1A-S7A are shown in Fig. 3.16.

A summary of the maximum predicted total conventional subsidence parameters for Remembrance Drive, after the extraction of each of the proposed longwalls, is provided in Table 3.4.

The predicted tilts are the maxima along the alignment of the road after the completion of each of the proposed longwalls. The predicted curvatures are the maxima in any direction at any time during or after the extraction of each of the proposed longwalls.

Table 3.4 Maximum predicted total conventional subsidence parameters for Remembrance Drive due to the extraction of LWs S1A to S7A

Longwall	Maximum predicted subsidence (mm)	Maximum predicted tilt along alignment (mm/m)	Maximum predicted tilt across alignment (mm/m)	Maximum predicted hogging curvature in any direction (km^{-1})	Maximum predicted sagging curvature in any direction (km^{-1})
LW S1A	325	2.5	5.0	0.06	0.06
LW S2A	1000	5.0	5.5	0.08	0.20
LW S3A	1200	6.5	5.5	0.10	0.21
LW S4A	1300	6.0	6.0	0.12	0.21
LW S5A	1350	6.5	5.5	0.12	0.21
LW S6A	1375	7.5	5.5	0.12	0.21
LW S7A	1400	7.5	5.0	0.12	0.21

The maximum predicted conventional strains for Remembrance Drive, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1.9 mm/m tensile and 3.2 mm/m compressive. Non-conventional movements can also occur as a result of, among other things, anomalous movements. The analysis of strains provided in Chapter 4 includes those resulting from both conventional and non-conventional anomalous movements.

The road and the pressure main beneath it are linear features and, therefore, the most relevant distribution of strain is the maximum strains measured along whole monitoring lines above previous longwall mining. The analysis of strains along whole monitoring lines during the mining of previous longwalls in the Southern Coalfield is discussed in Section 3.3 and the results are provided in Fig. 3.9.

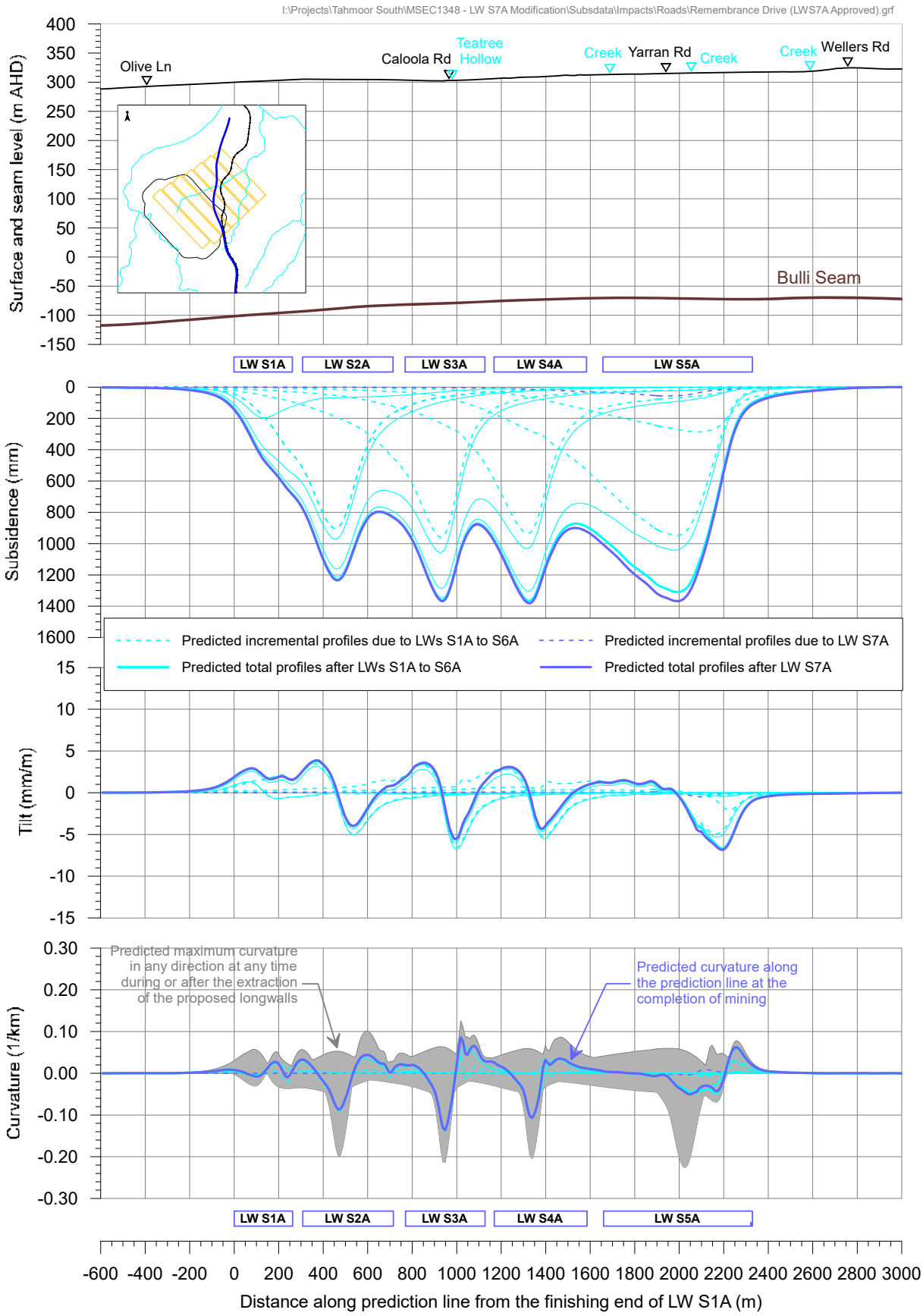

Fig. 3.16 Predicted profiles of total subsidence, tilt and curvature along Remembrance Drive and 180 mm PE sewer main after the mining of LW S1A to S7A

The sewer main along Remembrance Drive crosses Teatree Hollow and a number of its tributaries within the Study Area, as shown in Drawing No. MSEC1193-05-01. Valley-related movements could be experienced in these locations. A summary of the maximum predicted conventional subsidence and valley-related movements for the crossing at Teatree Hollow is provided in Table 3.5.

Maps showing the location of the sewer main on the road embankments are shown in Drawings Nos. MSEC1193-03-07 to MSEC1193-03-10. It can be seen that the sewer main generally runs along the crest of the embankment on the Northbound side of the pavement.

Table 3.5 Predicted Conventional Subsidence and Valley-Related Movements for the creek crossings along Remembrance Drive and sewer main within the Study Area

Location	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Hogging Curvature (1/km)	Maximum Predicted Total Sagging Curvature (1/km)	Maximum Predicted Total Upsidence (mm)	Maximum Predicted Total Closure (mm)
Opposite Tahmoor Mine	1250	0.05	-0.18	100	50
Teatree Hollow (Caloola Road)	1300	0.06	-0.18	250	150
Tributary to Teatree Hollow	1100	0.05	-0.04	125	100
Tributary to Teatree Hollow (Yarran Road)	1300	0.05	-0.22	150	75
Tributary to Teatree Hollow (Wellers Road)	25	< 0.01	< 0.01	40	25

3.7.2. Potential subsidence impacts on PE pressure sewer pipelines

Tahmoor Coal, in consultation with Sydney Water, has successfully mined beneath a sewerage system at Tahmoor and Thirlmere during the mining of LWs 22 to 32 and LW W3-W4. The sewerage infrastructure at Tahmoor and Thirlmere are gravity sewers and consist mainly of PVC pipes. While impacts on the sewerage system at Tahmoor have been successfully managed, the pressurised sewerage system at Bargo will be able to accommodate substantially greater differential subsidence movements in comparison.

The 180 mm diameter welded PE sewer main transports sewage by hydraulic pressure and does not rely on gravity. While the sewer main will experience changes in grade due to subsidence, the changes will not adversely affect it. No impacts have been recorded to Sydney Water sewer infrastructure during the extraction of LWs S1A to S3A.

The PE pipes can accommodate substantial deformations without losing their integrity. Only extreme deformations, such as the development of a step in the ground may adversely impact on the pipes.

The most likely locations for severe ground deformations would be along streams within the Study Area, but they may not transfer into the sewer pipe because it crosses the streams via the crests of road embankments along Remembrance Drive, as shown in Drawings Nos. MSEC1193-03-07 to MSEC1193-03-10. Experience of mining directly beneath railway and highway embankments has found that ground strains transfer directly into linear features on the embankment crests, vertical deformations in the ground are frequently buffered by the embankment fill.

Experience has also found that while railway and highway embankments have experienced substantial mine subsidence movements, no impacts have been observed to embankment stability. The embankments will, however, be monitored by surveys and inspections during periods of active subsidence. The key management strategy is to maintain serviceability of the culverts beneath the embankment. In the unlikely event that the embankment slope experiences impacts during mining, the embankment can be repaired by sealing cracks, or placing permanent fill or rock spall at the base of the embankment.

Severe ground deformations can also occur where the sewer main passes through a rock cutting along Remembrance Drive between Caloola Road and Yarran Road. The cutting is approximately 430 metres long and 5 metres high at its highest point.

Tahmoor Coal has extensive experience of mining beneath railway cuttings in the Southern Coalfield of NSW at similar depths of cover (Kay et al, 2017). While impacts have not previously been observed to batter slopes, non-conventional subsidence movements have been observed to develop within railway cuttings, resulting in impacts on track geometry. The sides of some cuttings (but not all) have been observed to close in response to mine subsidence.

Based on previous experiences in rail cuttings, it is possible that the Remembrance Drive cutting could experience mining-induced impacts on the road pavement and buried pipework. The buried pipework may have minimal cover to the underlying rock such that mining-induced deformations in the bedrock could be reflected in the pavement. The potential impacts can, however, be managed by regular surveys and visual inspections during mining with repairs conducted as required.

The location of the sewer main within the cutting is shown in Drawing No. MSEC1193-03-11. It can be seen that the sewer main appears to traverse the batter slope of the cutting on the northbound side of the pavement, which will be confirmed on site by survey prior to the influence of mining. The cutting will be monitored by surveys and inspections during periods of active subsidence.

If the PE pipe experiences severe deformation, the pipe may become blocked. The severity of ground deformation required to block a 180 mm diameter pipe is substantial, such that it will easily be detected early by regular ground surveys and visual inspections along Remembrance Drive. If ground deformations develop, it would be possible to locally excavate the affected area to straighten the pipe or, in the worst case, locally repair the pipe.

The sewerage system has been designed to store sewage for approximately 8 hours after which time sewage may leak or overflow from the sewerage system. This provides sufficient time to repair a localised section of the sewer main.

A number of valves and chambers are located above the proposed longwalls. These chambers, valves and pipe fittings are small in size and are connected via flange adapters. It is expected that the chambers, valves and fittings will act as anchors to the ground during subsidence, allowing the PE pipe to stretch or compress in response to mining-induced differential horizontal movements. While there is potential for impacts to occur at these locations, many similar structures are located within the Tahmoor sewerage system and no impacts have occurred to chambers, valves and other pipe fittings during mining.

Tahmoor Coal has previously developed and selected risk control measures in consultation, co-ordination and co-operation with Sydney Water in accordance with WHS legislation. The controls were implemented during the mining of LWs 22 to 32 and LW W3-W4 at Tahmoor North.

In this instance, there are no reasonably practicable controls which could eliminate, substitute or isolate the identified risks, nor engineering controls that could put in place a structure or item that prevents or minimises risks. Tahmoor Coal has identified controls that will ensure that Sydney Water's sewer main will remain safe and serviceable during and after the extraction of LW S1A-S7A by implementing the following measures:

- Regular ground surveys along streets located within the active subsidence zone;
- Regular ground surveys along the crest and toe of both sides of embankments and the cutting along Remembrance Drive;
- Regular visual inspections along Remembrance Drive located within the active subsidence zone;
- Regular consultation with the community to report potential impacts;
- Additional surveys and/or inspections, if triggered by monitoring results;
- If triggered by monitoring results, excavate and expose the pipeline to relieve it from ground deformations; and
- In the worst case, repair of damaged pipeline.

3.8. Sydney Water sewer mains on bridge crossings

There are no bridges along local roads within the vicinity of LW S1A-S7A., though some bridges may experience far field movements during the mining of LW S1A-S7A. Sydney Water's sewer mains are located on three bridges.

A summary of the closest distances of LW S1A to S7A to the bridges are provided in Table 3.6.

Table 3.6 Bridges with Sydney Water sewer mains that may be potentially affected by far field movements

Bridge	Closest distance (m)	Closest LW	Closest LW end
Remembrance Drive Bridge over the Bargo River and Main Southern Railway	1,690 m	LW S1A	Finishing end (North-western end)
Bargo River Road Bridge over the Main Southern Railway (Potters Cutting Overbridge)	2,000 m	LW S1A	Finishing end (North-western end)
Bargo River Road Bridge over a tributary to Bargo River	1,790 m	LW S1A	Finishing end (North-western end)

Tahmoor Coal has managed potential impacts on the bridges in consultation with Wollondilly Shire Council and the Australian Rail Track Corporation. The management plans included monitoring of absolute and differential movements at the bridges and visual inspections. The likelihood of differential far field movements at the bridges are very low due to the remoteness of the longwalls to them.

No impacts have been recorded to the bridges or the Sydney Water sewer infrastructure connected to them during the extraction of LWs S1A to S3A. Observed changes in distances between the Bridge abutments were within survey tolerances and less than trigger levels. Whilst GNSS monitoring will continue, monitoring at the bridges have ceased, in accordance with risk control procedures for LWs S1A to S3A of this Management Plan.

Information on the methods that were implemented to manage potential impacts on Sydney Water sewer infrastructure at the bridges can be found in Revision A of this Management Plan.

4.1. Infrastructure Management Group (IMG)

The Infrastructure Management Group (IMG) is responsible for taking the necessary actions required to manage the risks that are identified from monitoring the infrastructure and to ensure that the health and safety of people who may be present on public property or Sydney Water property are not put at risk due to mine subsidence. The IMG develops and reviews this management plan, collects and analyses monitoring results, determines potential impacts and provides advice regarding appropriate actions. The members of the IMG are highlighted in Chapter 8.

4.2. Development and selection of risk control measures

Tahmoor Coal has developed and selected risk control measures in consultation, co-ordination and co-operation with the infrastructure owner in accordance with WHS legislation. In accordance with Clauses 35 and 36 in Part 3.1 of the Work Health and Safety regulation (2017) and the guidelines (MSO, 2017), a hierarchy of control measures has been considered and selected where reasonably practicable, using the following process:

1. Eliminate risks to health and safety so far as is reasonably practicable, and
2. If it is not reasonably practicable to eliminate risks to health and safety – minimise those risks so far as is reasonably practicable, by doing one or more of the following:
   (a) substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk;
   (b) isolating the hazard from any person exposed to it;
   (c) implementing engineering controls;
3. If a risk then remains, minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls; and.
4. If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by ensuring the provision and use of suitable personal protective equipment.

A combination of the controls set out in this clause may be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.

There are primarily two different methods to control the risks of subsidence, namely:

- Method A – Selection of risk control measures to be implemented prior to the development of subsidence, (Items 1 and 2 above); and
- Method B – Selection of risk control measures to be implemented during the development of subsidence (Items 3 and 4 above).

Method A and B risk control measures are described in Section 4.3 to Section 4.6. Prior to selecting Method B risk control measures, Tahmoor Coal has investigated and confirmed that the measures are feasible and effective for the site-specific conditions during the extraction of LW S1A-S7A.

4.3. Selection of risk controls for sewer infrastructure

Based on the above assessments, Tahmoor Coal considered Method A and Method B risk control measures, in accordance with the process described in Section 4.2.

Elimination

In this instance, no reasonably practicable controls could be identified that would eliminate the identified risks.

Substitution

In this instance, no reasonably practicable controls could be identified that will change the environment so the hazards could be substituted for hazards with a lesser risk.

Isolation

In this instance, no reasonably practicable controls could be identified to isolate a hazard from any person exposed to it.

Engineering Controls

In this instance, no reasonably practicable engineering controls could be identified to put in place a structure or item that prevents or minimises risks.

It is noted that Sydney Water's sewer infrastructure was designed to accommodate mine subsidence movements.

Administrative Controls

The following Administrative Controls were identified and selected that will put in place procedures on site to minimise the potential of impacts on the health and safety of people in relation to mining-induced damage to sewer infrastructure:

- Implementation of a Monitoring Plan and Trigger Action Response Plan (TARP)
  As described in the Management Plan, Tahmoor Coal and Sydney Water has developed and implemented a management strategy of detecting early the development of potential adverse subsidence movements in the ground, so that contingency response measures can be implemented before impacts on the safety and serviceability develop. The TARP includes the following:
    - Continuous GNSS monitoring along the centrelines of LWs S1A to S3A, and at each end of the Main Southern Railway Viaduct over the Bargo River (installed and operating). A GNSS unit has also been installed where the rail corridor is located directly above the centreline of LW S5A at approximate rail kilometrage of 100.52 km;
    - Local 2D surveys along local roads as shown in Drawing No. MSEC1193-01-01, including Remembrance Drive;
    - Absolute 3D survey of subsidence along Remembrance Drive;
    - Monitoring along the Main Southern Railway in accordance with the Railway Subsidence Management Plan, including ground surveys, rail stress monitoring, track geometry surveys, and visual inspections;
    - Local 3D / Absolute 3D survey of embankments along Remembrance Drive with pegs spaced along the crest and toe on both sides of each embankment. Pegs spacings are generally every 20 metres. The layout of survey marks is shown in Drawings Nos. MSEC1193-03-07 to MSEC1193-03-10;
    - Local 3D / Absolute 3D survey of the cutting on Remembrance Drive with pegs spaced along the crest and toe on both sides of the cutting. Pegs spacings are generally every 20 metres. The layout of survey marks is shown in Drawing No. MSEC1193-03-11;
    - Local 3D / Absolute 3D of structure and ground marks on the Remembrance Drive Bridge over the Bargo River, as shown in Drawing No. MSEC1193-03-02;
    - Local 3D / Absolute 3D of structure and ground marks on the Bargo River Road Bridges, as shown in Drawing No. MSEC1193-03-03;
    - Survey gaps between the decks and the abutments on the Remembrance Drive Bridge over the Bargo River;
    - Regular visual inspections of the bridges during mining;
    - Baseline survey of expansion joints on the pipework at the bridge joints;
    - Visual inspections along the streets within the active subsidence zone;
    - Additional surveys and/or inspections, if triggered by monitoring results;
    - Regular consultation with the community to report potential impacts;
    - If triggered by monitoring results, excavate and expose the pipeline to relieve it from ground deformations;
    - If triggered by monitoring results, install a new expansion joint at the bridge;
    - In the event of damage to the sewer main, implement Sydney Water's emergency procedures; and
    - In the worst case, repair of damaged pipeline.

4.4. Monitoring measures

A number of monitoring measures will be undertaken during mining.

4.4.1. Continuous GNSS monitoring

Global Navigation Satellite System (GNSS) units are fixed survey stations that continuously measure their absolute horizontal and vertical positions in real time.

The locations of GNSS units are shown in Drawings No. MSEC1193-01-01 and the GNSS units that are relevant to managing Sydney Water infrastructure are summarised below:

- Centrelines of LWs S1A to S3A - The GNSS units are located in bushland within the Australian Wildlife Sanctuary. The units are proposed to track the development of subsidence and horizontal movements above the commencing ends of the longwalls. The monitoring data will provide the first subsidence results for each panel to compare against subsidence predictions. Conventional survey lines are not possible in this area due to thick vegetation, preventing lines of sight;
- Main Southern Railway above centreline of LW S5A – GNSS 28 has been installed where the rail corridor is located directly above the centreline of LW S5A at approximate rail kilometrage of 100.52 km. The purpose of the GNSS unit is to detect the initial development of subsidence and trigger the commencement of regular ground surveys; and
- Railway Viaduct across Bargo River - Two GNSS units have been installed within the Main Southern Railway corridor to measure far field movements, if any, between the abutments of the Viaduct. The two GNSS units will also allow valley closure, if any, to be detected. The results will be cross-checked by manual surveys across the Remembrance Drive over the Bargo River.

4.4.2. Early warning survey lines

LW S1A Tahmoor Mine Boundary

A survey line has been installed along the southern boundary of Tahmoor Mine's property, as shown in Drawing No. MSEC1192-01-01. The survey line has been installed with pegs spaced nominally 20 metres apart. The survey line commences at the south-eastern end at the end of an unsealed road that is accessed from Charlies Point Road. The line terminates at the top of Teatree Hollow due to thick vegetation.

The purpose of the survey line is to measure the subsidence profile across the width of LW S1A prior to experiencing significant subsidence along the Main Southern Railway and Remembrance Drive. It is planned to survey the line once a month during the period of active subsidence of LW S1A. Additional surveys can be conducted, if required.

Main Southern Railway

LWs S1A to S5A will extract directly beneath the Main Southern Railway prior to mining directly beneath Remembrance Drive and Caloola Road.

A survey has been installed along the Main Southern Railway, as shown in Drawing No. MSEC1192-01-01. The survey line has been installed with pegs spaced nominally 20 metres apart.

Surveys along the Railway will provide an early warning of the magnitude of subsidence that is likely to develop. The surveys will also detect the development of non-conventional subsidence movements along the Railway and provide an opportunity to project locations where potential non-conventional subsidence movements may occur along Remembrance Drive. The IMG can assess the monitoring results and assess whether any additional monitoring and management measures may be required to manage potential impacts along Remembrance Drive.

It is planned to survey the line weekly during periods of active subsidence. Additional surveys can be conducted, if required.

4.4.3. Ground Surveys along Remembrance Drive road embankments and culverts

Tahmoor Mine will conduct the following surveys and inspections of culverts and embankments along Remembrance Drive:

- Absolute 3D and 2D surveys along a monitoring line along Remembrance Drive.
- Local 3D / Absolute 3D survey of embankments along Remembrance Drive with pegs spaced along the crest and toe on both sides of each embankment. Pegs spacings are generally every 20 metres. The layout of survey marks is shown in Drawings Nos. MSEC1193-03-07 to MSEC1193-03-10.
- Local 3D / Absolute 3D survey of culverts with survey marks located at the spring point on both sides at the outlet and inlet of the culverts beneath the embankments along Remembrance Drive. Survey marks will also be installed at the midpoint of the 1.8 metre diameter reinforced concrete culvert south of Yarran Road.
- Visual inspections of the pavement, culvert and embankment during mining by a building inspector and geotechnical engineer.

4.4.4. Ground Surveys along Remembrance Drive cutting

Tahmoor Mine will conduct the following surveys and inspections of the cutting on Remembrance Drive:

- Absolute 3D and 2D surveys along a monitoring line along Remembrance Drive.
- Absolute 3D surveys every 20 metres along the toe of the cutting between 88.700 km and 89.050 km and at two locations across the crests of the cutting.
- Visual inspections of the pavement, drains and cutting batters during mining by a building inspector and geotechnical engineer.

4.4.5. Ground and Structure Surveys at the Bridges

Tahmoor Mine will conduct the following surveys and inspections at the Bargo River Road Bridge over a tributary to the Bargo River:

- Continuous GNSS monitoring at two locations across the bend in the Bargo River. The two units S11 and S12 have been installed within the railway corridor near the Railway Viaduct, where access is available.
- Local 3D surveys of structure and ground marks on the Remembrance Drive Bridge over the Bargo River, as shown in Drawing No. MSEC1193-03-02, including a measurement of gaps between the bridge deck and the northern abutment;
- Baseline survey of
- Local 3D surveys of structure and ground marks on the Bargo River Road Bridges, as shown in Drawing No. MSEC1193-03-03, with one mark on the Bridges to be surveyed in Absolute 3D; and
- Visual inspections of the Bridges.

4.4.6. Visual inspections

Visual inspections will be undertaken during the period of active subsidence by an experienced inspector appointed by Tahmoor Coal who is familiar with mine subsidence impacts. The inspector will undertake the following:

- Visual inspections along the pipeline along Remembrance Drive within the active subsidence zone; and
- Visual inspections of culverts, embankments, cuttings and bridges.

4.4.7. Changes to monitoring frequencies

Monitoring frequencies will continue while Sydney Water infrastructure is experiencing active subsidence due to the extraction of LW S1A-S7A. As a general guide, monitoring is likely to continue until the longwall has moved away from the pipeline by a distance of approximately 450 metres. Monitoring, however, may continue if ongoing adverse impacts are observed.

4.5. Triggers and responses

Trigger levels have been developed by Tahmoor Coal based on engineering assessments and consultation with Sydney Water.

Trigger levels for each monitoring parameter are described in the risk control procedures in Table 4.1.

Immediate responses, if triggered by monitoring results, may include:

- Increase in survey and inspection frequencies if required by the IMG;
- Additional surveys and inspections;
- If triggered by monitoring results, excavate and expose the pipeline to relieve it from ground deformations;
- If triggered by monitoring results, install a new expansion joint at the bridge;
- In the event of damage to the sewer main, implement Sydney Water's emergency procedures; and
- In the worst case, repair of damaged pipeline.

The risk control measures described in this Management Plan have been developed to ensure that the health and safety of people in the vicinity of sewer water infrastructure are not put at risk due to mine subsidence. It is also an objective to avoid disruption to services, or if unavoidable, keep disruption and inconvenience to minimal levels.

With respect to the extraction of LW S1A-S7A, no potential hazards have been identified that could reasonably give rise to the need for an emergency response. Of the potential hazards identified in Section 3.6, only leakage of sewerage from a pipe could possibly give rise to the need for an emergency response. The likelihood is considered extremely remote and would require substantial differential subsidence movements to develop before such an event occurs.

As discussed in Section 3.1, mine subsidence movements will develop gradually and there will be ample time to identify the development of potentially adverse differential subsidence movements early, consider whether any additional management measures are required, and repair or adjust affected surface features, in close consultation with Sydney Water.

As documented in Section 4.6, Tahmoor Coal and the IMG will review and assess monitoring reports and consider whether any additional management measures are required on a weekly basis. If potentially adverse differential subsidence movements are detected, it is anticipated that a focussed inspection will be undertaken in the affected area, and a decision will likely be made to increase the frequency of surveys and/or inspections. Additional management measures may also be implemented. It is therefore expected that, as a potential adverse situation escalates, Tahmoor Coal will be present on site on a more frequent basis to survey or inspect the affected site, and that Sydney Water will be consulted on a more frequent basis.

Notwithstanding the above, if a hazard has been identified that involves potential serious injury or illness to a person or persons on public property or in the vicinity of sewer infrastructure, and cannot be controlled, the immediate response is to remove people from the hazard. If such a situation is observed or is forecast to occur by either Tahmoor Coal or by people on public property, Tahmoor Coal and Sydney Water will immediately meet and implement emergency procedures.

4.6. Subsidence Impact Management Procedures

The procedures for the management of potential impacts to Sydney Water infrastructure are provided in Table 4.1.

Table 4.1 Risk Control Procedures during the extraction of Tahmoor South LW S1A-S7A

INFRASTRUCTURE	HAZARD / IMPACT	RISK	TRIGGER	CONTROL PROCEDURE/S	FREQUENCY	BY WHOM?
Sewer infrastructure	Impacts to Sydney Water sewer infrastructure	Low	None	Continuous GNSS monitoring as shown in Drawing No. MSEC1193-01-01	GNSS units installed Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW S7A.	Tahmoor Coal (Unit Zero)
				2D survey line along Tahmoor Mine property boundary	Pegs installed. Baseline survey complete. Monthly survey during LW S1A between 200m and 1300m extraction, and continue if ongoing adverse movements are observed (complete). End of LW S1A (complete).	Tahmoor Coal (SMEC)
				Conduct 2D / Absolute 3D surveys along Main Southern Railway in accordance with Railway Management Plan	Monthly 3D / Weekly 2D surveys for pegs within active subsidence zone during LWs S1A to S7A	Tahmoor Coal (SRS)
				Conduct 2D / Absolute 3D surveys along Remembrance Drive	Pegs installed. Baseline survey complete. Extend line and baseline survey pegs within predicted limit of incremental subsidence of each active LW, prior to active LW face approaching within 600 metres of survey line. Monthly 3D / Weekly 2D surveys for pegs within active subsidence zone commencing as per below: LW S1A: start after 1300m extraction (complete) LW S2A: start after 900m extraction (complete) LW S3A: start after 500m extraction (complete) LW S4A: start after 200m extraction LW S5A: start after GNSS 28 subsides more than 20 mm due to LW S5A or 200m extraction, whichever occurs first LW S6A: start after GNSS 28 subsides more than 20 mm due to LW S6A or 200m extraction, whichever occurs first LW S7A: start after 200m extraction Continue surveys until outside active subsidence zone or one month after end of LW and continue further if ongoing adverse movements are observed. End of LW S1A-S7A.	Tahmoor Coal (SMEC)
				Conduct Local 3D / Absolute 3D survey of Remembrance Drive Embankment over Teatree Hollow at Caloola Drive (RE4) as per Drawing No. MSEC1193-03-07.	Install and baseline survey complete. Monthly 3D / Weekly 2D surveys within active subsidence zone commencing as per below: LW S2A: start after 900m extraction LW S3A: start after 800m extraction LW S4A: start after 800m extraction LW S5A: start after 900m extraction Continue if ongoing adverse movements are observed. End of LW S2A-S6A.	Tahmoor Coal (SMEC)
				Conduct Local 3D / Absolute 3D survey of Remembrance Drive Embankment over Tributary to Teatree Hollow north of Yarran Road (RE3) as per Drawing No. MSEC1193-03-08.	Install and baseline survey complete. 3D Survey at end of LW S3A. Monthly 3D / Weekly 2D surveys within active subsidence zone commencing as per below: LW S4A: start after 300m extraction LW S5A: start after 400m extraction LW S6A: start after 400m extraction Continue if ongoing adverse movements are observed. End of LW S4A-S7A.	Tahmoor Coal (SMEC)
				Conduct Local 3D / Absolute 3D survey of Remembrance Drive Embankment over Tributary to Teatree Hollow south of Yarran Road (RE2) as per Drawing No. MSEC1193-03-09.	Install and baseline survey complete. 3D Survey at end of LW S3A. Monthly 3D / Weekly 2D surveys within active subsidence zone commencing as per below: LW S4A: start after 200m extraction LW S5A: start after 200m extraction LW S6A: start after 200m extraction Continue if ongoing adverse movements are observed. End of LW S4A-S7A.	Tahmoor Coal (SMEC)
				Conduct Local 3D / Absolute 3D survey of Remembrance Drive Embankment at intersection of Wellers Road (RE1) as per Drawing No. MSEC1193-03-10.	Install and baseline survey prior to LW S5A. 3D Survey at end of LW S5A. Monthly 3D after 200m extraction of LW S6A until 800m of extraction and continue if ongoing adverse movements are observed. End of LW S6A and S7A.	Tahmoor Coal (SMEC)

INFRASTRUCTURE	HAZARD / IMPACT	RISK	TRIGGER	CONTROL PROCEDURE/S	FREQUENCY	BY WHOM?
				Conduct Local 3D / Absolute 3D survey of Remembrance Drive Cutting (RC1) as per Drawing No. MSEC1193-03-11.	Install and baseline survey complete. 3D Survey at end of LW S2A. Monthly 3D / Weekly 2D surveys within active subsidence zone commencing as per below: LW S3A: start after 400m extraction LW S4A: start after 400m extraction LW S5A: start after 500m extraction LW S6A: start after 500m extraction Continue if ongoing adverse movements are observed. End of LW S3A-S7A.	Tahmoor Coal (SMEC)
				Conduct Local 3D survey of structure and ground marks on the Remembrance Drive Bridge over the Bargo River as per Drawing No. MSEC1193-03-02, with one mark on the Bridge to be surveyed in Absolute 3D. The survey includes a measurement of the gap between the deck and the northern abutment.	Install and baseline survey complete. Monthly surveys between 1000m and one month after end of extraction of LWs S1A to S3A and continue if ongoing adverse movements are observed. End of LW S1A-S3A (complete).	Tahmoor Coal (SRS)
				Baseline survey of gaps at expansion joints on sewer main on the Remembrance Drive Bridge over the Bargo River	Baseline survey prior to 400m extraction of LW S1A.	Tahmoor Coal (SRS)
				Visual inspection of Remembrance Drive Bridge over the Bargo River	Baseline inspection complete Monthly inspections between 1000m and one month after end of extraction of LWs S1A to S3A and continue if ongoing adverse movements are observed. End of LW S1A to S3A (complete)	Tahmoor Coal
				Conduct Local 3D survey of structure and ground marks on the Bargo River Road Bridge over tributary to Bargo River and Bargo River Road Bridge over Main Southern Railway as per Drawing No. MSEC1193-03-03, with one mark on each Bridge to be surveyed in Absolute 3D	Install and baseline survey complete. Monthly surveys between 1000m and one month after end of extraction of LWs S1A to S3A and continue if ongoing adverse movements are observed. End of LW S1A-S3A. (complete)	Tahmoor Coal (SRS)
				Visual inspection of Bargo River Road Bridges	Baseline inspection complete Monthly inspections between 1000m and one month after end of extraction of LWs S1A to S3A and continue if ongoing adverse movements are observed. End of LW S1A to S3A (complete)	Tahmoor Coal
				Detailed visual inspections of local roads, culverts, embankments and cuttings along the route of the sewer main along Remembrance Drive	Weekly for areas within the active subsidence zone during LWs S1A to S6A and continue if ongoing adverse movements or impacts are observed until one month after the extraction of each LW.	Tahmoor Coal
				Detailed visual inspections by geotechnical engineer along Remembrance Drive embankments and cutting	Monthly during periods of active subsidence of LW S2A to S7A, and continue if ongoing adverse movements are observed.	Douglas Partners / PSM
				Inform Sydney Water Call Centre of mining in area and possible issues.	Completed	Sydney Water
				Notify residents of potential mine subsidence impacts and contact numbers.	Completed	Tahmoor Coal
				Analyse and report results to IMG, including information on the position of the longwall face.	Weekly during LW S1A-S7A after the length of the extraction exceeds 200 metres.	Tahmoor Coal
			Non-conventional ground movement detected	Notify Sydney Water	Within 24 hours	Tahmoor Coal
				Notify Sydney Water and convene an IMG meeting. Consider additional monitoring and mitigation measures based on observed monitoring results, which may include: - increase frequency of ground surveys at affected site - increase frequency of visual inspections - excavate to expose pipe and reduce distortion or strain on pipe - increase frequency of IMG meetings - any other additional management actions	As required by IMG	Tahmoor Coal

INFRASTRUCTURE	HAZARD / IMPACT	RISK	TRIGGER	CONTROL PROCEDURE/S	FREQUENCY	BY WHOM?
			Blockage or leakage of sewage observed	Contact Sydney Water as per contact protocol. Clear blockage as required.	As required by Sydney Water	Sydney Water
				Investigate cause of sewage leak to ascertain whether leak might be due to subsidence	Within 24 hours	Sydney Water
				If blockage is subsidence related, notify all stakeholders, including Sydney Water, Tahmoor Coal, Subsidence Advisory NSW and Resources Regulator	Within 24 hours	Tahmoor Coal
				Convene IMG meeting to consider additional monitoring and mitigation measures based on observed monitoring results, which may include: - increase frequency of surveys along streets - increase frequency of visual inspections - excavate to expose pipe and reduce distortion or strain on pipe - increase frequency of IMG meetings - any other additional management actions	As required by IMG	Tahmoor Coal
			A hazard has been identified that involves potential serious injury or illness to a person or persons on public property or, or in vicinity of sewer water infrastructure and cannot be controlled	IMG, Tahmoor Coal and Sydney Water meet to decide whether any additional management measures are required, including: - emergency evacuation of hazardous area - demarcation to prevent people entering hazardous area	Immediately	Tahmoor Coal and Sydney Water
				Notify IMG of trigger exceedance and any management decisions undertaken (incl Subsidence Advisory NSW, Resources Regulator)	Within 24 hours of decision	Tahmoor Coal
			Closure between abutments on Remembrance Drive Bridge over Bargo River exceeds 7 mm or Closure between abutments Bargo River Road bridges exceeds 5 mm or Impacts observed to bridge	Notify Sydney Water	Within one week	MSEC
				Sydney Water and IMG meet and consider whether any additional management measures are required, which may include: - conduct additional survey of expansion joints on sewer main on Remembrance Drive Bridge over the Bargo River - undertake structural engineering inspection - increase monitoring frequency and reporting procedures - install additional expansion joint on Remembrance Drive Bridge over the Bargo River or Bargo River Road Bridge over tributary to Bargo River - excavate to expose pipe and reduce distortion or strain on pipe on Bargo River Road Bridge over Main Southern Railway - consider potential risks and implement control measures to protect the sewer main if it is decided to conduct modification works on the bridges	Within one week	IMG
				Report trigger exceedance and actions taken to IMG, Sydney Water, SA NSW & MSO in Status Report	Within one week	Tahmoor Coal

5.1. Consultation, co-operation and co-ordination

Consultation, co-operation and co-ordination has taken place between Tahmoor Coal and Sydney Water prior to the development of this Management Plan, as detailed in Section 1.3.1.

The following procedures will be implemented during and after active subsidence of the property to ensure the continued effective consultation, co-operation and co-ordination of action with respect to subsidence between Tahmoor Coal and Sydney Water:

- Reporting of observed impacts to Tahmoor Coal either during the weekly visual inspection or at any time directly to Tahmoor Coal; and
- Distribution of monitoring reports, which will provide the following information on a weekly basis during active subsidence:
    - Position of longwall;
    - Summary of management actions since last report;
    - Summary of consultation with Sydney Water since last report;
    - Summary of observed or reported impacts, incidents, service difficulties, complaints;
    - Summary of subsidence development;
    - Summary of adequacy, quality and effectiveness of management process;
    - Any additional and/or outstanding management actions; and
    - Forecast whether there will be any subsidence impacts to the health and safety of people due to the continued extraction of LW S1A-S7A.
- Convening of meetings between Tahmoor Coal and Sydney Water at any time as required, as discussed in Section 5.2;
- Arrangements to facilitate timely repairs, if required; and
- Immediate contact between Tahmoor Coal and Sydney Water if a mine subsidence induced hazard has been identified that involves potential serious injury or illness to a person or persons on public property or Sydney Water property and may require emergency evacuation, entry restriction or suspension of work activities.

5.2. IMG meetings

The IMG undertakes reviews and, as necessary, revises and improves the risk control measures to manage risks to health and safety, and potential impacts to infrastructure.

The reviews are undertaken weekly during the period of active subsidence based on the results of the weekly surveys and visual inspections and summarised in the monitoring reports, as described in Section 5.1.

The purpose of the reviews is to:

- Detect changes, including the early detection of potential impacts on health and safety and impacts to Sydney Water infrastructure;
- Verify the risk assessments previously conducted;
- Ensure the effectiveness and reliability of risk control measures; and
- Support continual improvement and change management.

IMG meetings may be held between Tahmoor Coal and Sydney Water for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of IMG Meetings will be as agreed between Tahmoor Coal and Sydney Water.

IMG Meetings will discuss any incidents reported in relation to the relevant infrastructure, 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 mine subsidence impact is observed, any party may call an emergency IMG Meeting, with one day's notice, to discuss proposed actions and to keep other parties informed of developments in the monitoring of the infrastructure.

6.0 AUDIT AND REVIEW

This Management Plan has been agreed between parties and can be reviewed and updated to continually improve the risk management systems based on audit, review and learnings from the development of subsidence during mining and manage changes in the nature, likelihood and consequence of subsidence hazards.

The review process will be conducted to achieve the following outcomes:

- Gain an improved understanding of subsidence hazards based on ongoing subsidence monitoring and reviews, additional investigations and assessments as necessary, ongoing verification of risk assessments previously conducted, ongoing verification of assumptions used during the subsidence hazard identification and risk assessment process, ongoing understanding of subsidence movements and identified geological structures at the mine;
- Revise risk control measures in response to an improved understanding of subsidence hazards;
- Gain feedback from stakeholders in relation to managing risks, including regular input from business or property owners;
- Ensure on-going detection of early warnings of changes from the results of risk assessments to facilitate corrective or proactive management actions or the commencement of emergency procedures in a timely manner; and
- Ensure timely implementation of a contingency plan in the event that the implemented risk control measures are not effective.

Some examples where review may be applied include:

- 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; and
- Observation of significant variation between observed and predicted subsidence.

Should an audit of the Management Plan be required during that period, an auditor shall be appointed by Tahmoor Coal to review the operation of the Management Plan and report at the next scheduled Plan Review Meeting. The Management Plan shall be audited for compliance with ISO 31000, or alternative standard agreed with Sydney Water.

7.0 RECORD KEEPING

Tahmoor Coal will keep and distribute minutes of any IMG Meeting.

8.0 CONTACT LIST

Organisation	Contact	Phone	Email
NSW Department of Planning and Environment – Resources Regulator	Ray Ramage	(02) 4063 6485 0442 551 293	ray.ramage@regional.nsw.gov.au
	Alan Blakeney	0473 461 118	alan.blakeney@regional.nsw.gov.au
Subsidence Advisory NSW	-	(02) 4908 4300	subsidenceadvisory@customerservice.nsw.gov.au
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay*	(02) 9413 3777 0416 191 304	daryl@minesubsidence.com
SIMEC Mining Tahmoor Coal Project Manager	Ross Barber*	(02) 4640 0028 0419 466 143	ross.barber@simecgfg.com
SIMEC Mining Tahmoor Coal Environment and Community Officer	Amanda Fitzgerald*	(02) 4640 0057 0414 848 213	amanda.fitzgerald@simecgfg.com
SIMEC Mining Tahmoor Coal Community Liaison Specialist	Amanda Bateman	(02) 4640 0025 0429 442 811	amanda.bateman@simecgfg.com
Sydney Water	Emergency Line	13 20 90	
Sydney Water – Systems Delivery Officer Area Team West	Nad Balgunan*	???	Nad.Balgunan@sydneywater.com.au

* denotes member of Infrastructure Management Group

APPENDIX A. Drawings and Supporting Documentation

The following supporting documentation is provided in Appendix A.

Drawings

Drawing No.	*Description*	*Revision*
MSEC1193-01-01	Monitoring plan	D
MSEC1193-05-01	Sewer Infrastructure	D
MSEC1193-03-02	MSR Rail Viaduct & Remembrance Drive Bridge over Bargo River	B
MSEC1193-03-03	Bargo River Road Bridges	B
MSEC1193-03-07	Remembrance Drive Embankment over Teatree Hollow over LW S3A (RE4)	B
MSEC1193-03-08	Remembrance Drive Cutting and Embankment north of Yarran Road over LWs S4A and S5A (RE3)	B
MSEC1193-03-09	Remembrance Drive Embankment south of Yarran Road over LW S5A (RE2)	B
MSEC1193-03-10	Remembrance Drive Embankment at Wellers Road intersection beyond LW S6A (RE1)	B
MSEC1193-03-11	Remembrance Drive Cutting north of Yarran Road over LW S4A and S5A (RC1)	B

Supporting Documentation

Tahmoor Coal (2022)	*Risk Assessment Report – Infrastructure. Tahmoor Underground – Sydney Water – Sewer and Potable Water*. Tahmoor Coal, October 2022.
Tahmoor Coal (2025)	*Risk Assessment Report – Infrastructure*. Tahmoor South – Extraction Plan, Longwall South 7A, July 2025.

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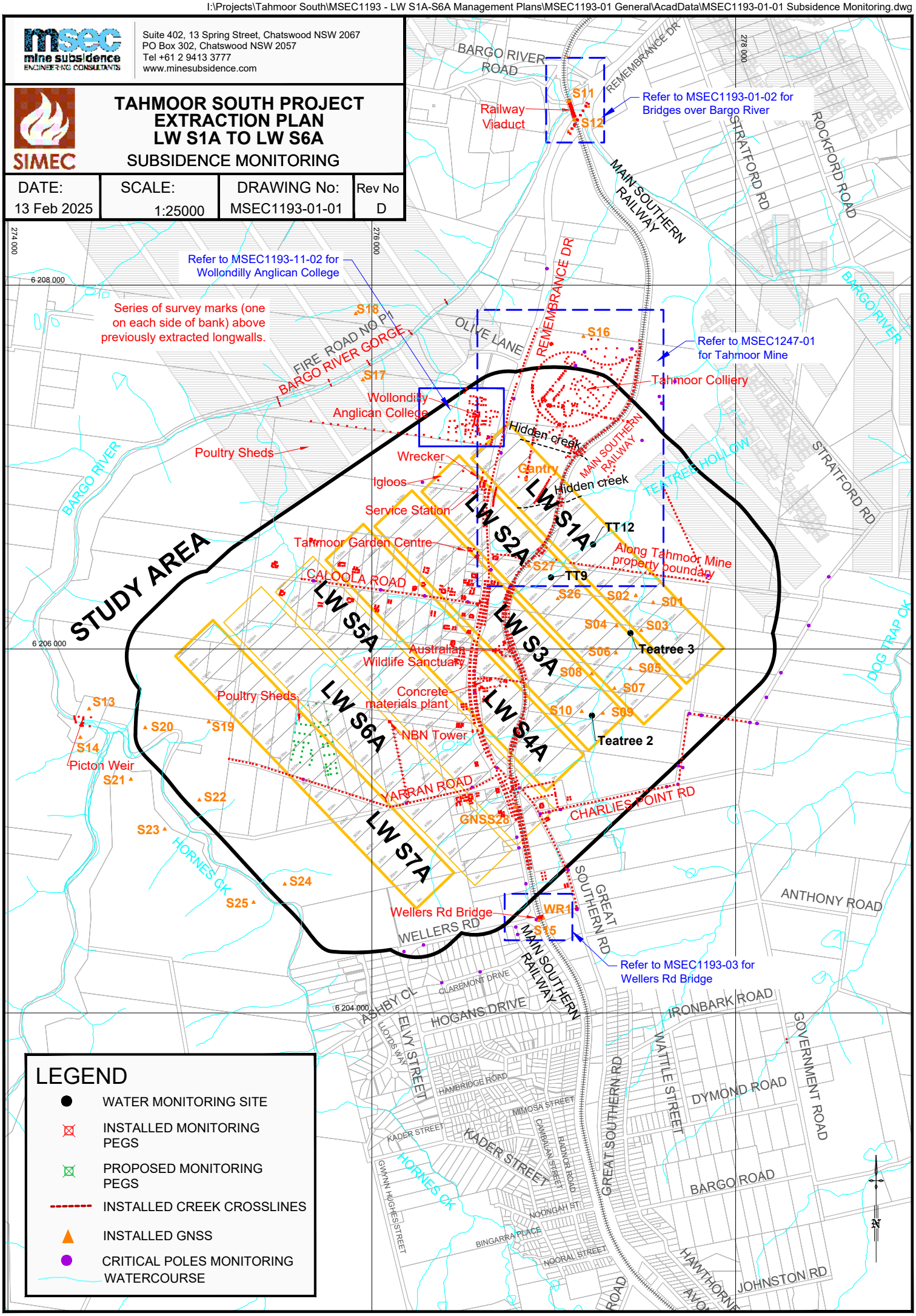
SIMEC

TAHMOOR SOUTH PROJECT EXTRACTION PLAN LW S1A TO LW S6A

SUBSIDENCE MONITORING

DATE:	SCALE:	DRAWING No:	Rev No
13 Feb 2025	1:25000	MSEC1193-01-01	D



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TAHMOOR SOUTH PROJECT MANAGEMENT PLAN LW S1A TO LW S6A

SYDNEY WATER
SEWERAGE INFRASTRUCTURE

DATE:	SCALE:	DRAWING No:	Rev No
23 Oct 2024	1:25000	MSEC1193-05-01	D

PIPE SIZE
- 40 mm Ø
- 50 mm Ø
- 63 mm Ø
- 75 mm Ø
- 90 mm Ø
- 100 mm Ø
- 110 mm Ø
- 125 mm Ø
- 140 mm Ø
- 150 mm Ø
- 160 mm Ø
- 180 mm Ø
- 225 mm Ø
- 630 mm Ø

Downstream sensing:
SF0094 at Tahmoor
upstream of SP0919

278 000

Bargo River Rd over Railway

Railway Viaduct

Remembrance Drive Bridge

Bargo River Rd over tributary

276 000

6 208 000

BARGO RIVER

Hidden Creek

Hidden Creek

T-section
Type: PE
Size: 110mmØ

LW S3A

LW S1A

LW S2A

Type: PE
Size: 180mmØ

LW S4A

6 206 000

TEATREE HOLLOW

LW S5A

LW S6A

LW S7A

TRIBUTARY OF TEATREE HOLLOW

PICTON DAM WALL

T-section
Type: PE
Size: 110mmØ

STUDY AREA

Wellers Rd Bridge
(WR-BR1)

TRIBUTARY 2 OF DOG TRAP CREEK

6 204 000

Upstream sensing:
SS0004 at Bargo
Radnor Road / Hambridge Road
High water alarm issued at SS0004

TRIBUTARY 1 OF DOG TRAP CREEK

Kader St bridge
(KS-BR1)

DOGTRAP CK

Grid to MGA co-ordinates

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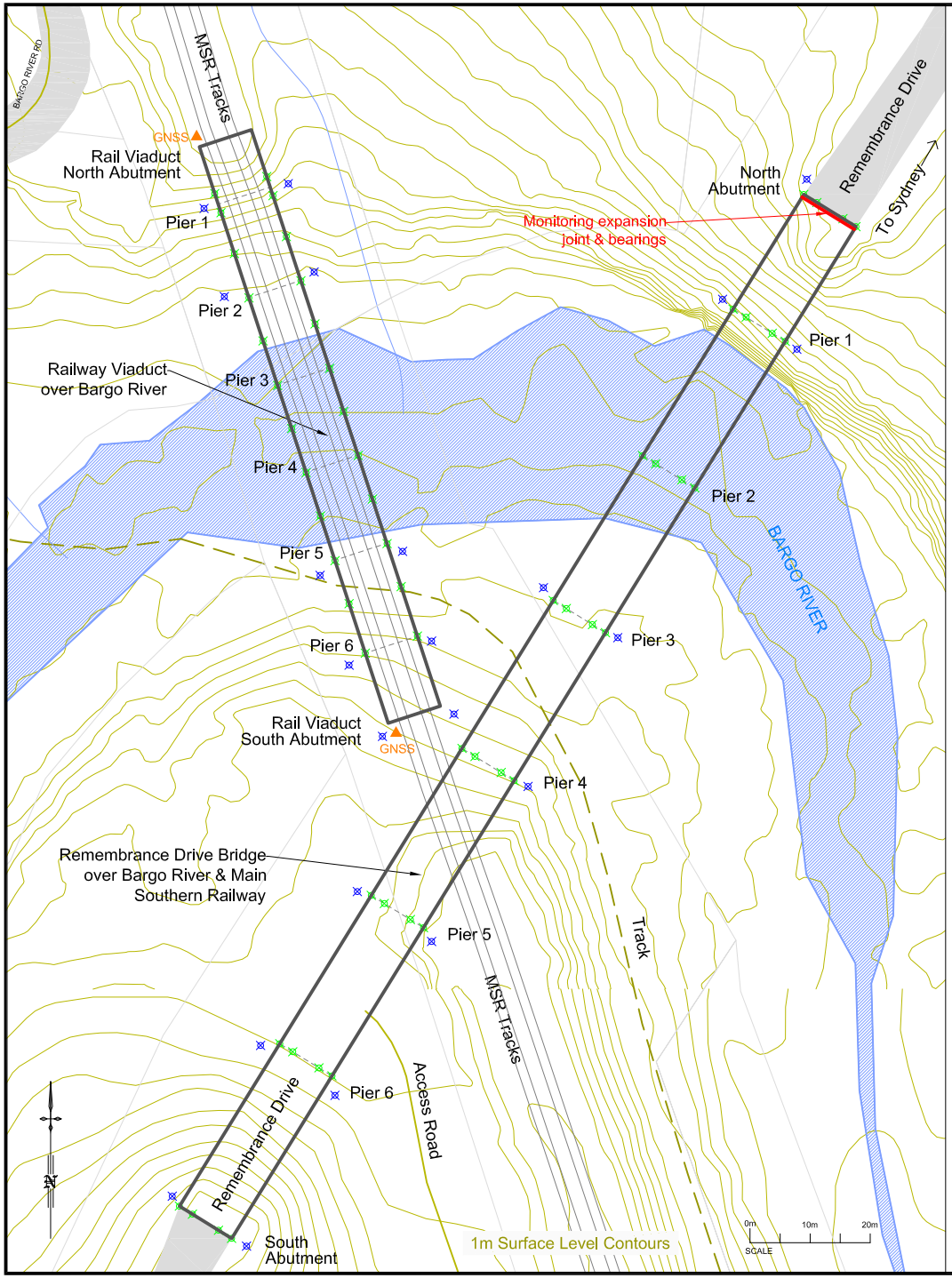
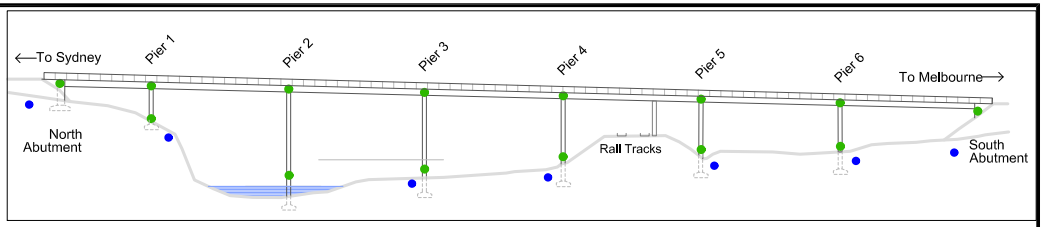
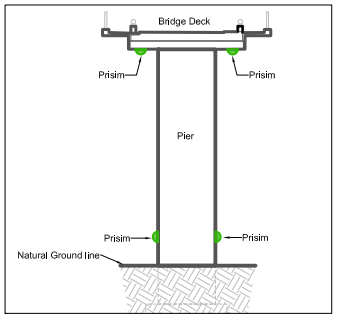
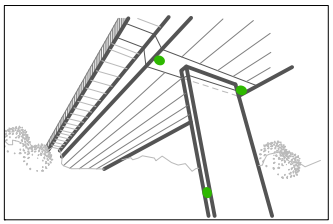




ELEVATION - REMEMBRANCE DRIVE BRIDGE OVER BARGO RIVER

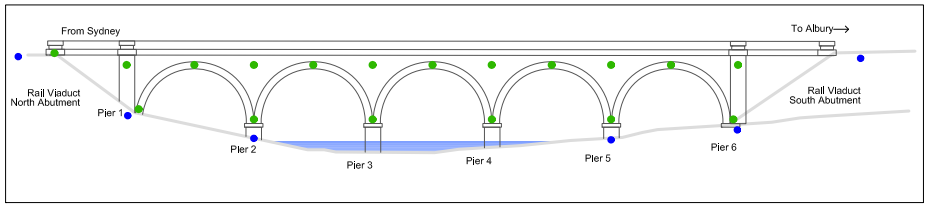


TYPICAL PIER (nts)



DIAGRAM

- PROPOSED STRUCTURE PRISMS
- PROPOSED GROUND PEGS



ELEVATION - RAIL VIADUCT OVER BARGO RIVER

LEGEND

- PROPOSED STRUCTURE PRISMS
- PROPOSED GROUND PEGS
- PROPOSED GNSS

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TAHMOOR SOUTH PROJECT
LWS1A TO LWS6A
MSR RAIL VIADUCT & REMEMBRANCE DRIVE BRIDGE OVER BARGO RIVER

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-02	B

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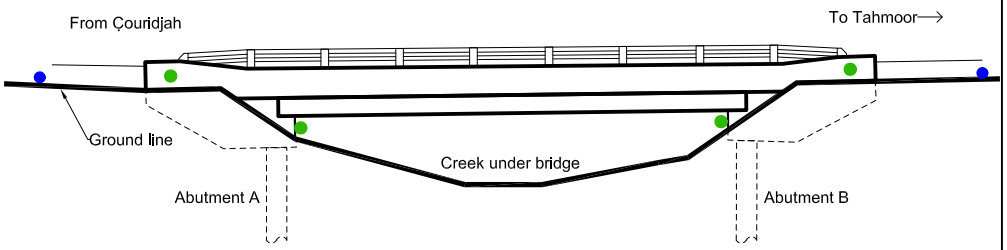
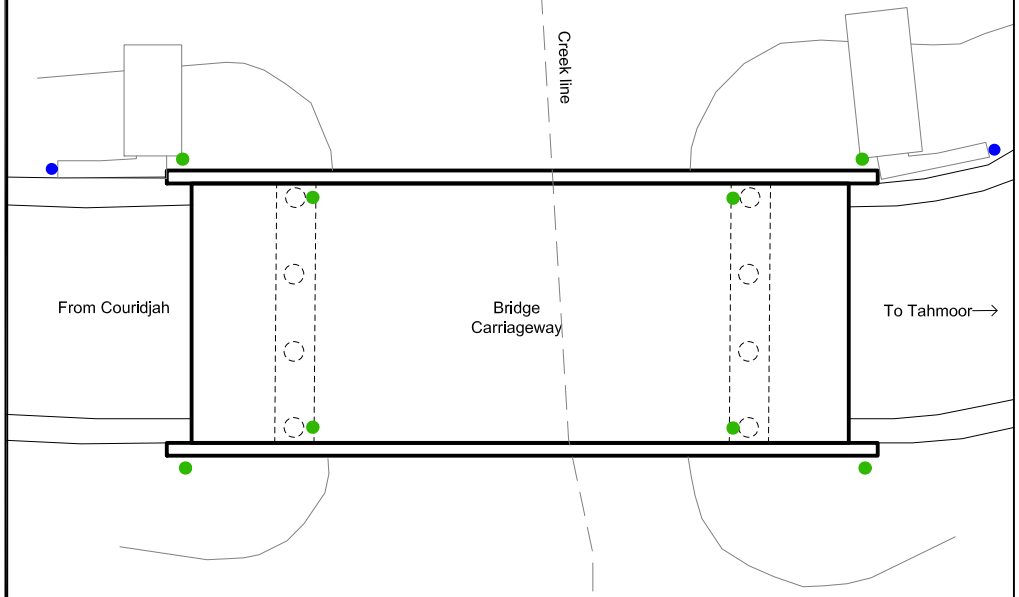
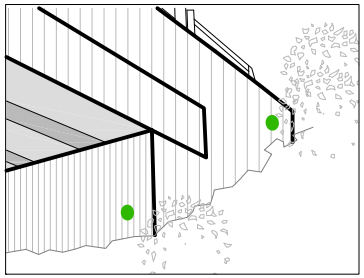


ELEVATION BRIDGE OVER CREEK

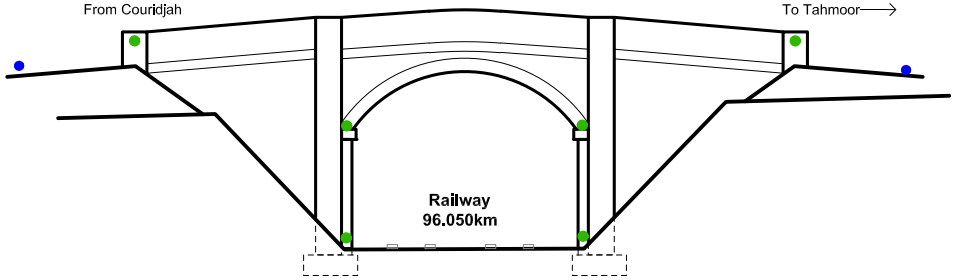


PLAN VIEW BRIDGE OVER CREEK

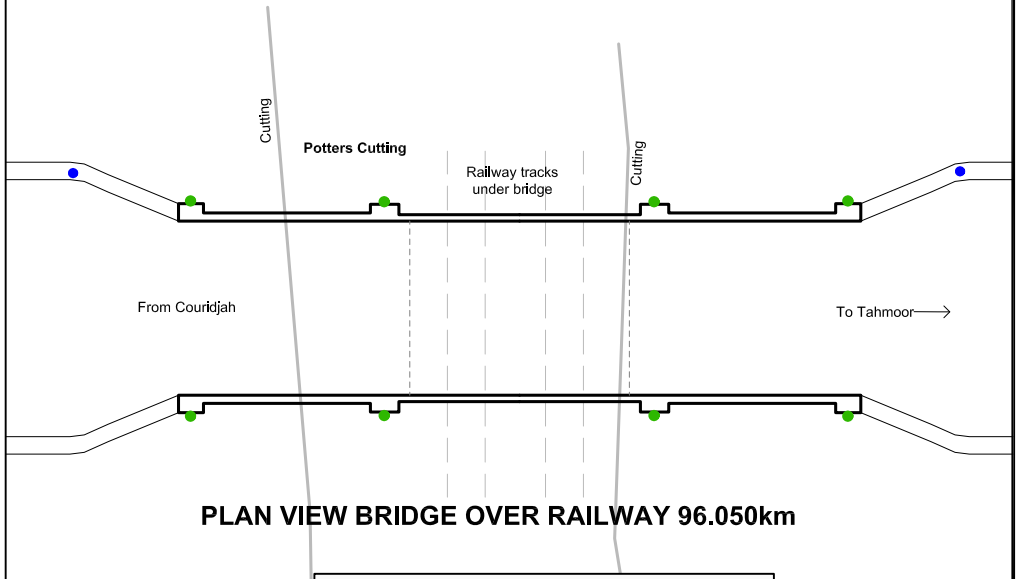
BARGO RIVER ROAD BRIDGE OVER TRIBUARY OF BARGO RIVER



TYPICAL



ELEVATION BRIDGE OVER RAILWAY



PLAN VIEW BRIDGE OVER RAILWAY 96.050km

BARGO RIVER ROAD BRIDGE OVER MAIN SOUTHERN RAILWAY

LEGEND

- PROPOSED STRUCTURE PRISMS
- PROPOSED GROUND PEGS

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TAHMOOR SOUTH PROJECT
LWS1A TO LWS6A

BARGO RIVER ROAD BRIDGES

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	nts	MSEC1193-03-03	B

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TAHMOOR SOUTH PROJECT
LWS1A TO LWS6B

REMEMBRANCE DRIVE EMBANKMENT OVER
TEATREE HOLLOW OVER LW S3A (RE4)

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-07	B

LEGEND
- 11kV POWERLINES
- GAS PIPELINE
- WATER PIPELINE
- SEWER PIPELINE
- OPTICAL FIBRE CABLES

LEGEND
- ANCHOR POINTS
- STRAIN GAUGES
- SWITCHES
- MONITORING PEGS
- EMBANKMENT MONITORING PEGS
- EMBANKMENT MONITORING LINES
- BOREHOLES
- CULVERTS
- 1m SURFACE LEVEL CONTOURS

0m 25m 50m
SCALE

N

853038

798853

LW S3A

LW S2A

ES4

SEWER PIPELINE

GAS PIPELINE

11kV POWERLINES

WATER PIPELINE

REMEMBRANCE DRIVE

OPTICAL FIBRE CABLES

bus shelter

CALOOLA RD

Culvert 99.338

Teatree Hollow

AP4

99.460

99.340

99.400

99.4 km

99.500

99.5 km

99.580

Main Southern Railway

EMBANKMENT 99.338 km

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TAHMOOR SOUTH PROJECT LWS1A TO LWS6B

REMEMBRANCE DRIVE EMBANKMENT NORTH OF YARRAN RD OVER LW S4A & LW S5A (RE3)

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-08	B

LEGEND
- ANCHOR POINTS
- STRAIN GAUGES
- SWITCHES
- MONITORING PEGS
- EMBANKMENT MONITORING PEGS
- EMBANKMENT MONITORING LINES
- BOREHOLES
- CULVERTS
- 1m SURFACE LEVEL CONTOURS

LEGEND
- 11kV POWERLINES
- GAS PIPELINE
- WATER PIPELINE
- SEWER PIPELINE
- OPTICAL FIBRE CABLES

0m 25m 50m
SCALE

CUTTING

LW S4A

LW S5A

11kV POWERLINES

GAS PIPELINE

EMBANKMENT
100.121 km

Culvert 100.121

AP6

EMBANKMENT

WATER PIPELINE

SEWER PIPELINE

REMEMBRANCE DRIVE

OPTICAL FIBRE CABLES

Main Southern Railway

100 km

100.1 km

100.2 km

100.3 km

772375

ES7

To Yarran Rd

N

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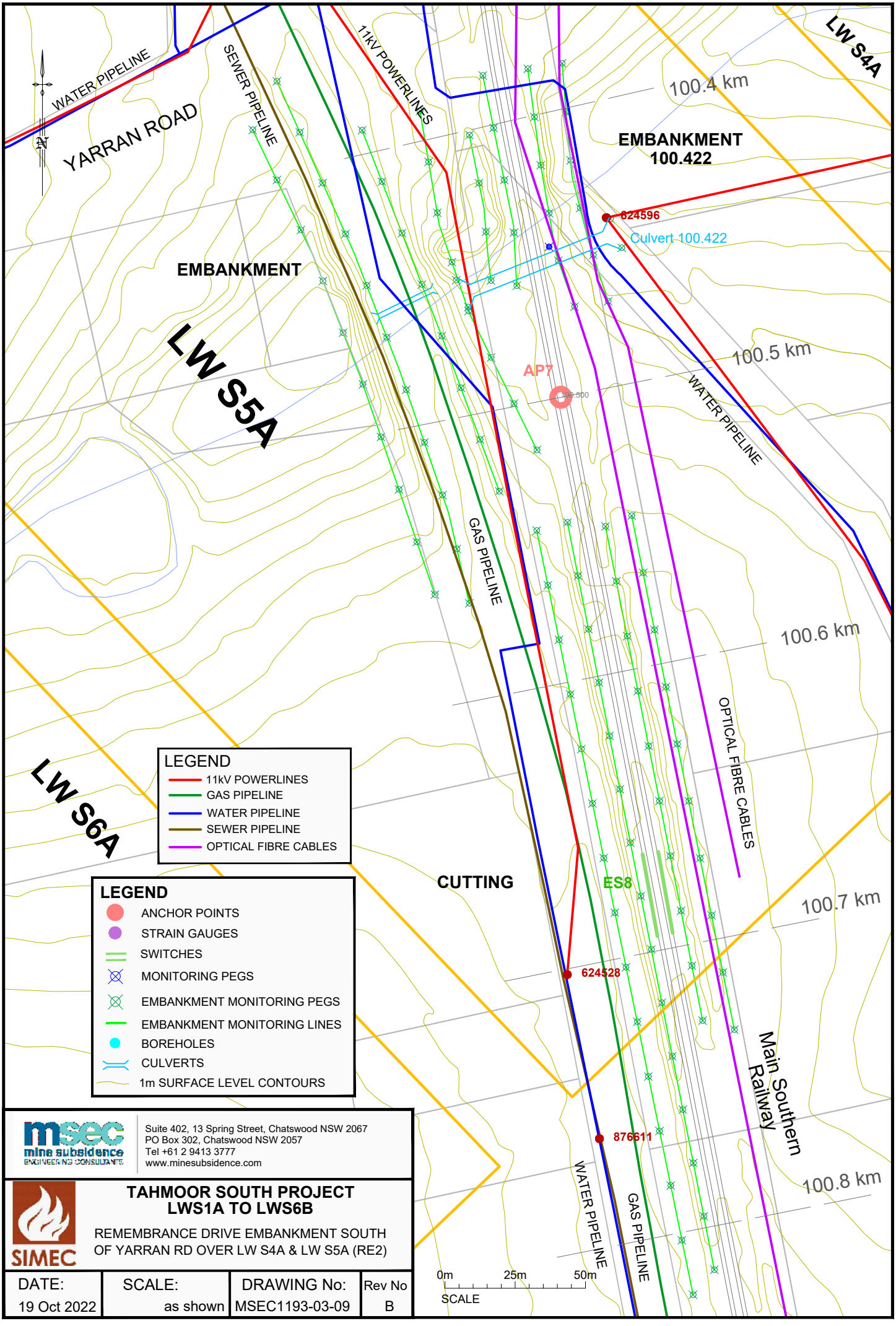

LEGEND
- 11kV POWERLINES
- GAS PIPELINE
- WATER PIPELINE
- SEWER PIPELINE
- OPTICAL FIBRE CABLES

LEGEND
- ANCHOR POINTS
- STRAIN GAUGES
- SWITCHES
- MONITORING PEGS
- EMBANKMENT MONITORING PEGS
- EMBANKMENT MONITORING LINES
- BOREHOLES
- CULVERTS
- 1m SURFACE LEVEL CONTOURS

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TAHMOOR SOUTH PROJECT
LWS1A TO LWS6B

REMEMBRANCE DRIVE EMBANKMENT SOUTH OF YARRAN RD OVER LW S4A & LW S5A (RE2)

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-09	B

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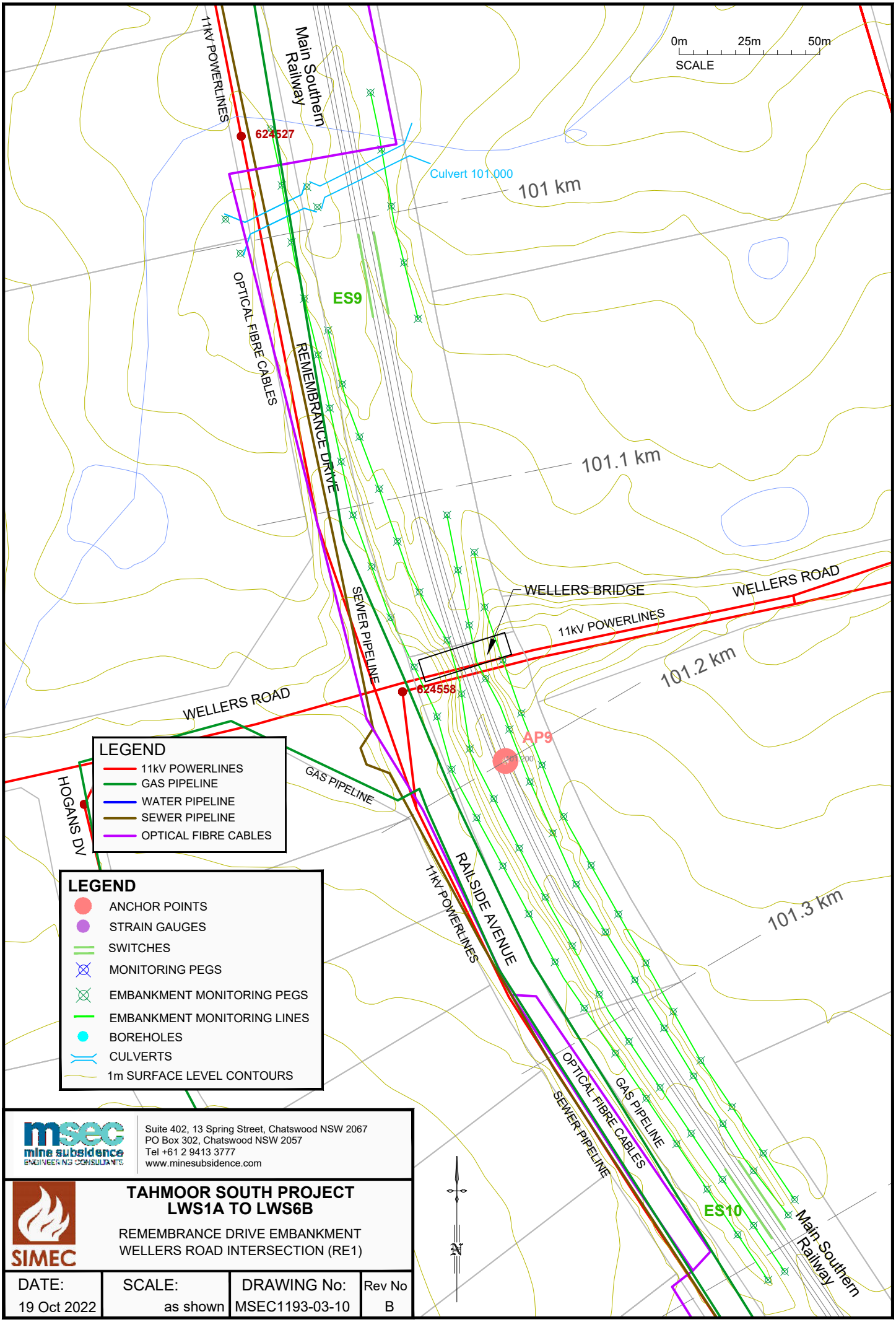

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TAHMOOR SOUTH PROJECT LWS1A TO LWS6B

REMEMBRANCE DRIVE EMBANKMENT
WELLERS ROAD INTERSECTION (RE1)

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-10	B

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TAHMOOR SOUTH PROJECT
LWS1A TO LWS6B

REMEMBRANCE DRIVE CUTTING NORTH OF YARRAN RD OVER LW S4A & LW S5A (RC1)

DATE:	SCALE:	DRAWING No:	Rev No
19 Oct 2022	as shown	MSEC1193-03-11	B

LEGEND
- 11kV POWERLINES
- GAS PIPELINE
- WATER PIPELINE
- SEWER PIPELINE
- OPTICAL FIBRE CABLES

LEGEND
- ANCHOR POINTS
- STRAIN GAUGES
- SWITCHES
- MONITORING PEGS
- EMBANKMENT MONITORING PEGS
- EMBANKMENT MONITORING LINES
- BOREHOLES
- CULVERTS
- 1m SURFACE LEVEL CONTOURS

SCALE 0m 25m 50m

LW S3A
LW S4A
LW S5A
CUTTING
CUTTING
EMBANKMENT
100.121 km
GAS PIPELINE
SEWER PIPELINE
11KV POWERLINES
WATER PIPELINE
REMEMBRANCE DRIVE
OPTICAL FIBRE CABLES
Main Southern Railway
ES5
ES6
AP5
AP6
857627
396228
99.6 km
99.7 km
99.8 km
99.9 km
100 km
100.1 km
Culvert 100.121
To Yarran Rd
N

Major Project Risk Assessment: Tahmoor Underground - Extraction Plan Longwalls 101A to 106A

	Step 2: Assess Type; Key Elements-These change depending on TYPE of Risk Assessment	Step 3: Identify the risks, causes and potential consequences	Step 4: Identify the existing controls to manage the identified risks	Step 5: Determine RCE	Steps 6, 7 & 8: Determine the Expected Consequence / Likelihood applicable to the Expected Consequence / Current level of risk	Step 10: PMC	Step 11: Treat the Risks

☑ Appendix B

Site	Type of Risk Assessment	Key Element (CURA Context/Category)	Sub Key Element (If applicable)	Risk Description - Something happens……	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Expected Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Potential Maximum Category	Treatment plans/tasks (Description)	Task Owner	Due Date	Comments
Tahmoor Underground	Major Project	Built Infrastructure	Sydney Water Sewer Infrastructure	Leakage of sewage	Leakage of sewage requiring repair or replacement	Subsidence	* Management Plans prepared for previous longwalls (AC) * Previous ground survey and visual inspection as part of LW 22-W4 management (AC) * Previous consultation, coordination and cooperation with Sydney Water (AC) * Sydney Water design reduces potential for damage (EC)	2	Property Damage	1	D	2	1	Property Damage	Complete Sydney Water Sewerage Management Plan including TARP	Ross Barber	01-Jul-22	

Major Project Risk Assessment: Tahmoor Underground - Extraction Plan Update to include Longwall South 7A

Step 2: Assess Type; Key Elements-These change depending on TYPE of Risk Assessment	Step 3: Identify the risks, causes and potential consequences	Step 4: Identify the existing controls to manage the identified risks	Step 5: Determine RCE	Steps 6, 7 & 8: Determine the Expected Consequence / Likelihood applicable to the Expected Consequence / Current level of risk	Step 10: PMC	Step 11: Treat the Risks

☑ Appendix B

Key Element (CURA Context/Category)	Sub Key Element (If applicable)	Risk Description - Something happens……	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Expected Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Potential Maximum Category	Treatment plans/tasks (Description)	Task Owner	Due Date	Comments
Built Infrastructure	Sydney Water Sewer Infrastructure	Leakage of sewage	Leakage of sewage requiring repair or replacement	Subsidence	* Management Plans prepared for previous longwalls * Previous ground survey and visual inspection as part of LW 22-W4 management and LW S1A to S3A * Previous consultation, coordination and cooperation with Sydney Water * Sydney Water design reduces potential for damage	2	Property Damage	1	D	2	1	Property Damage	Update Sydney Water Sewerage Management Plan including TARP	Ross Barber	01-Mar-27	