

HAZARD AND RISK ASSESSMENT

CAMELLIA PRECINCT

SUMMARY REPORT OF THE LAND USE SAFETY STUDY

NSW GOVERNMENT DEPARTMENT OF PLANNING AND ENVIRONMENT

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ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
DG	Dangerous Goods
DPE	NSW Government Department of Planning and Environment
HIPAP	NSW Hazardous Industry Planning Advisory Paper
LUSS	Land Use Safety Study
NSW	New South Wales
pmpy	per million per year
QRA	Quantitative Risk Assessment
SEPP	State Environmental Planning Policy

DRAFT

TERMINOLOGY

Term	Definition
Individual risk	The frequency at which an individual may be expected to sustain a given level of harm from the realization of specified hazards.
Risk	The likelihood of a specified undesired event occurring within a specified period or in specified circumstances, It may be either a frequency (the number of specified events occurring in unit time) or a probability (the probability of a specified event following a prior event), depending on the circumstances.
Societal risk	The relationship between frequency and the number of people suffering from a specified level of harm in a given population from the realization of specified hazards.

1 SUMMARY

1.1 Background

The NSW Department of Planning and Environment (DPE) in consultation with a number of stakeholders, including the City of Parramatta Council, has developed a draft Master Plan for the proposed Camellia Town Centre (Town Centre) in the north western part of the Camellia Precinct (the Precinct) and subsequent rezoning proposal (Ref. 1). The draft Master Plan identifies appropriate land uses and build for the Town Centre as well as identifying transport and infrastructure requirements to support future growth.

DPE retained Sherpa Consulting Pty Ltd (Sherpa) to develop a precinct level hazard and risk assessment to inform the Master Plan and assist in detailed precinct planning. For this project, the 'hazard and risk assessment' was called a 'land use safety study' (LUSS) (Ref. 2).

1.2 Scope and objectives

The scope of the LUSS was defined by potentially hazardous activities (facilities and pipelines) within the Precinct. The following criteria were used to identify sites and infrastructure within the scope of the study:

- Facilities that have notified WorkCover that they store dangerous goods and the dangerous goods stored have the potential to cause offsite injury impact.
- Facilities that have submitted a hazard analysis to DPE, under planning legislation.
- Natural gas pipelines defined as secondary gas mains or with higher pressures.
- Pipelines containing hydrocarbons other than natural gas.

Hazardous events outside the Precinct, such as a transport accident on the M4, were outside the scope of the study. The study also excluded hazards and hazardous activities associated with the construction phase of the Precinct.

At a high level, the objective was to develop a LUSS for the Precinct. The study objective was met by the following process:

- Establish the context of the study including active engagement with stakeholders and development of consistent criteria for use in the assessment.
- Review of existing land use planning (risk) studies and consult with regulatory authorities to determine the risk levels from individual sites in the Precinct.
- Liaise with the DPE and the City of Parramatta Council as well as the Urban Designer to ensure all parties were informed of the progress and scale of the risk assessments.
- Identify and assess pipelines in the Precinct and include, as appropriate, into the risk assessment.

- Develop a Precinct level risk model including a cumulative risk profile.

NSW Hazardous Industry Planning Advisory Paper (HIPAP) 10 *Land Use Safety Planning* (Ref. 3), HIPAP 4 *Risk Criteria for Land Use Safety Planning* (Ref. 4), HIPAP 6 *Hazard Analysis* (Ref. 5), HIPAP 11 *Route Selection* (Ref. 6) and the NSW DPE guideline *Hazardous and Offensive Development Application Guidelines – Applying State Environmental Planning Policy (SEPP) No. 33 (January 2011)*, (Ref. 7), were also used as references in this study.

1.3 Methodology

At a high level, the methodology used to develop the LUSS for the Precinct was as follows:

- Context setting which comprises:
 - identification of sites and facilities in the Precinct
 - review of the types and quantities of dangerous goods (DG) at each site
 - DG screening using SEPP 33 guidelines to establish if a facility would be classified as potentially hazardous^a
 - review the existing hazard assessment information for sites in the Precinct
 - collate information on the sites that were identified by DPE, ie Clyde Terminal, Parramatta Terminal, Jemena gas pipelines, Caltex liquid pipelines
 - development of a list of sites based on those that were classified as 'potentially hazardous' for incorporation into the risk model.
- Risk model development which comprised the following for the list of sites identified at the context setting stage:
 - identification of hazards
 - analysis of the consequences of loss of containment events
 - analysis of the frequency of loss of containment events
 - calculation of the Precinct individual risk
 - calculation of the Precinct societal risk using supplied population data
 - qualitative analysis of the Precinct transport risk.
- Risk results, and assessment against the criteria for strategic land use planning in HIPAP 10.

^a Hazardous facilities are not permitted in NSW. Potentially hazardous facilities are those that exceed thresholds defined by quantity and separation distances, they are permissible if the development meets land use planning criteria with appropriate controls in place.

1.4 Precinct risk overview

The precinct risk profile was presented as individual risk contours and a societal risk graph, assessed against criteria in HIPAP 10.

Individual risk contours present the cumulative risk a person would be exposed to if they remained at a fixed point for a year.

Societal risk provides a measure of the chance of accidents that could harm a number of people in one go around industrial facilities.

1.4.1 Individual fatality risk

The individual fatality risk contours for the Precinct are shown in Figure 1.1, and a comparison against the risk criteria is presented in Table 1.2. Additionally, the extent of the 0.5 pmpy and 1 pmpy contours into the land use classified as 'Mixed Use/Town Centre' was analysed in Table 1.3. The analysis was based on the reference points shown in Figure 1.2.

The individual fatality risk for the Precinct is compatible with the proposed commercial, open space and industrial land uses as the risk levels are below the risk criteria for these uses. In the north west of the Precinct, the land use is shown as 'mixed use' in the Master Plan. The mixed-use land use allows residential^b and sensitive^c developments, however:

- 'Sensitive' developments should not be approved or permitted within the 0.5 per million per year (pmpy) individual fatality risk contour.
- 'Residential' developments should not be approved or permitted within the 1 pmpy individual fatality risk contour.

1.4.2 Individual injury risk

The individual injury risk contours for the Precinct are shown in Figure 1.3, and a comparison of the risk against the risk criteria is presented in Table 1.1.

The Master Plan land uses are compatible with the individual injury risk contours. Injury risk from the pipelines is below the criterion of 50 pmpy.

Table 1.1: Comparison with individual injury risk criteria

Description and land use	Criterion (pmpy)	Requirement	Result
Sensitive and residential land uses	50	No intensification of this land use.	No impact on proposed land use.

^b 'Residential' is used in the context of HIPAP referring to "Residential developments and places of continuous occupancy, such as hotels and tourist resorts."

^c 'Sensitive' is used in the context of HIPAP referring to "Hospitals, schools, child-care facilities and old age housing developments."

Figure 1.1: Individual fatality risk contour

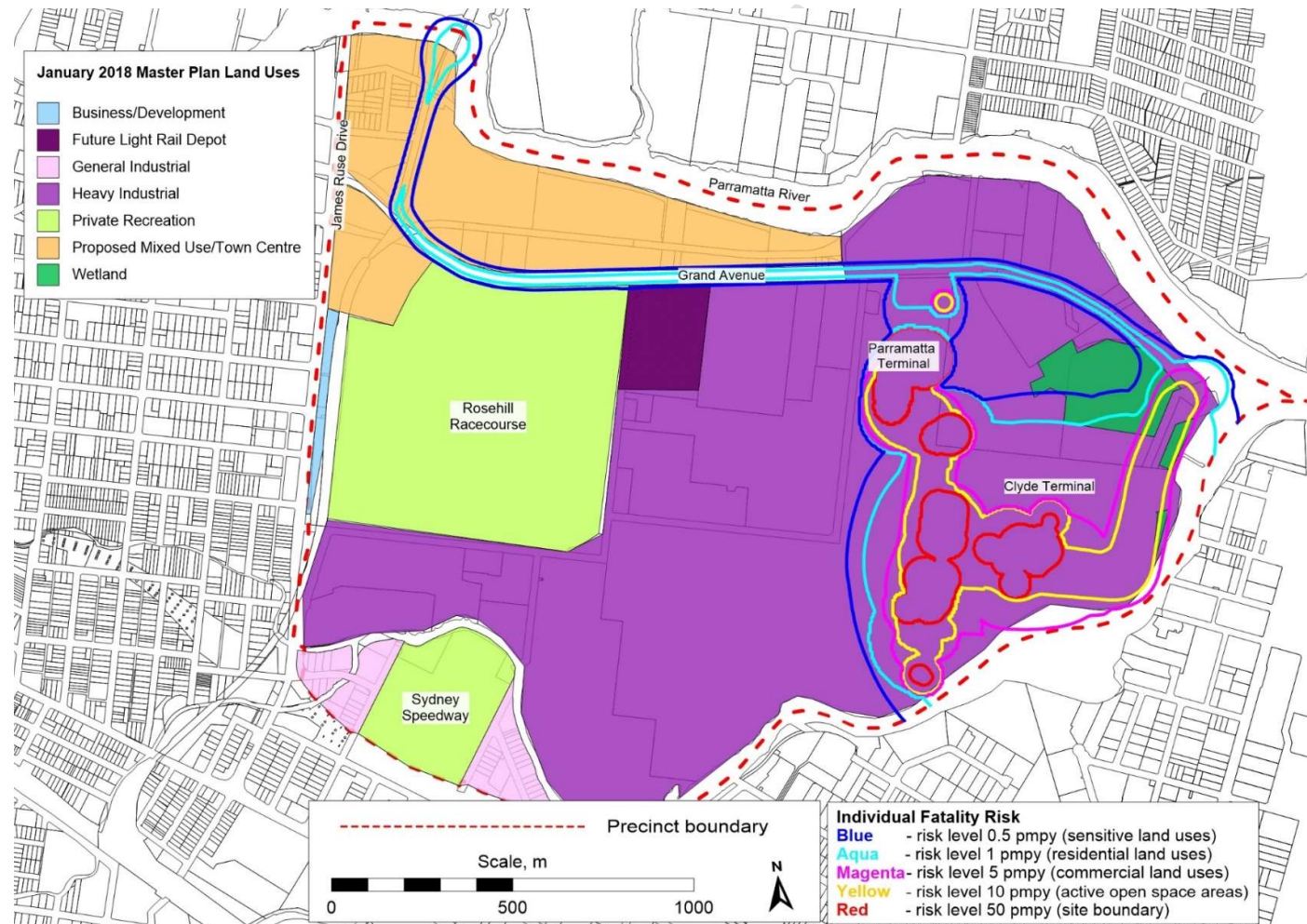


Table 1.2: Comparison with individual fatality risk criteria

Description and land use	Criterion (pmpy)	Requirement	Result
Hospitals, schools, child-care facilities and old age housing (sensitive land uses).	0.5	No intensification of this land use.	Ensure that no sensitive facilities are approved within this contour. No 'sensitive land use' is proposed for the Precinct, but sensitive facilities, e.g. child care centres and schools may be permitted within 'mixed use' land.
Residential developments and places of continuous occupancy such as hotels and tourist resorts (residential land use).	1	No intensification of this land use.	Ensure residential development is not intensified within this contour. Potential impact in the north west of the Precinct, as residential housing may be allowed within 'mixed use' land.
	10	No intensification of this land use.	No impact on proposed land use.
Commercial developments, including offices, retail centres and entertainment centres (commercial land use).	5	Development not appropriate.	No impact on proposed land use.
Sporting complexes and active open space areas.	10	Development not appropriate.	No impact on proposed land use.
Industrial	50	Development not appropriate.	Limits development adjacent to Parramatta Terminal (east).

Figure 1.2: Reference locations map

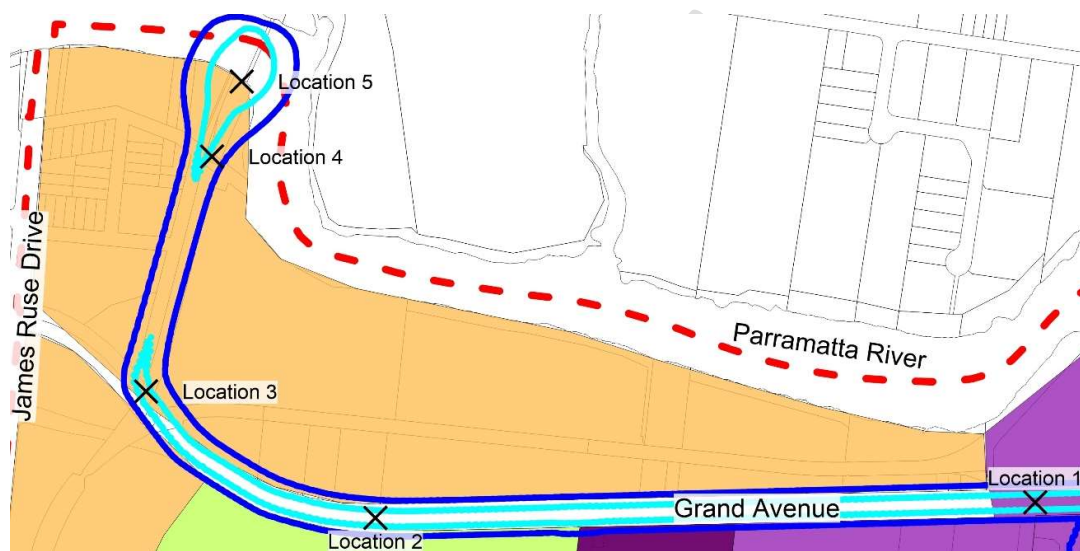
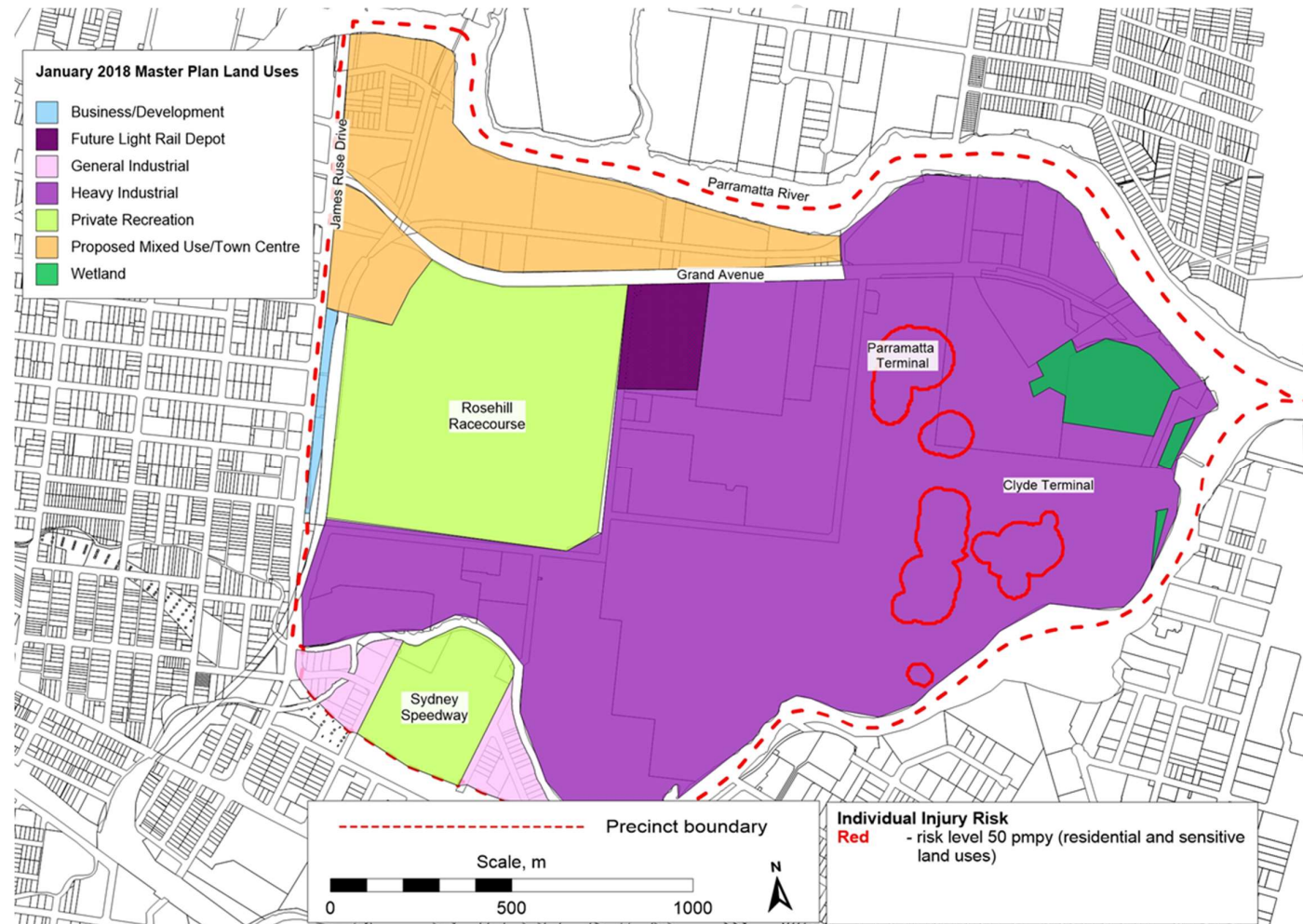


Table 1.3: Comparison with individual fatality risk criteria at reference locations

Description and land use	Criterion (pmpy)	Requirement	Result
Hospitals, child-care facilities and old age housing (sensitive land uses).	0.5	No intensification of this land use.	<p>Distance from the edge of the infrastructure land use (to represent the curb of road along Grand Avenue) to the 5×10^{-7} contour:</p> <ul style="list-style-type: none"> approximately 12 m along locations 1 and 2 approximately 25 m (north) along locations 2 and 3. <p>Distance from the edge of the infrastructure land use (to represent the extent of the rail corridor) to the 5×10^{-7} contour:</p> <ul style="list-style-type: none"> approximately 10 m (east) or 30 m (west) along locations 3 and 4 approximately 22 m (east) or 65 m (west) along locations 4 and 5.
Residential developments and places of continuous occupancy such as hotels and tourist resorts (residential land use).	1	No intensification of this land use.	<p>Distance from the edge of the infrastructure land use (to represent the extent of the rail corridor) to the 1×10^{-6} contour:</p> <ul style="list-style-type: none"> approximately 10 m (west) along locations 3 and 4 approximately 10 m (east) or 30 m (west) along locations 4 and 5.

Figure 1.3: Individual injury risk contour



1.4.3 Societal risk

Societal risk criteria are appropriate for developments that will significantly increase the population near potentially hazardous facilities. Societal risk is a method of expressing the frequency of an incident that leads to a defined number of fatalities. It allows the full range of potential incidents to be presented on a single graph.

Based on a given set of release scenarios it is possible to influence the societal risk graph by:

1. Reducing the exposed population
2. Moving the exposed population away from the source of harm
3. A combination of population reduction and movement.

Sensitivity cases were run to determine the most effective option for managing the societal risk. The first step was to identify the main contributors to the societal risk. Due to the large population proposed to the north west of the Precinct, and the adjacent pipeline corridor, this area was identified as having the most influence.

Several sensitivity cases were then run, including reducing the population by 50% and moving the exposed population away from the pipeline corridors. The sensitivity cases demonstrated that reducing the population had little impact on the results, whereas implementing set-back distances between the pipeline corridors and residential developments had a measurable impact on societal risk levels.

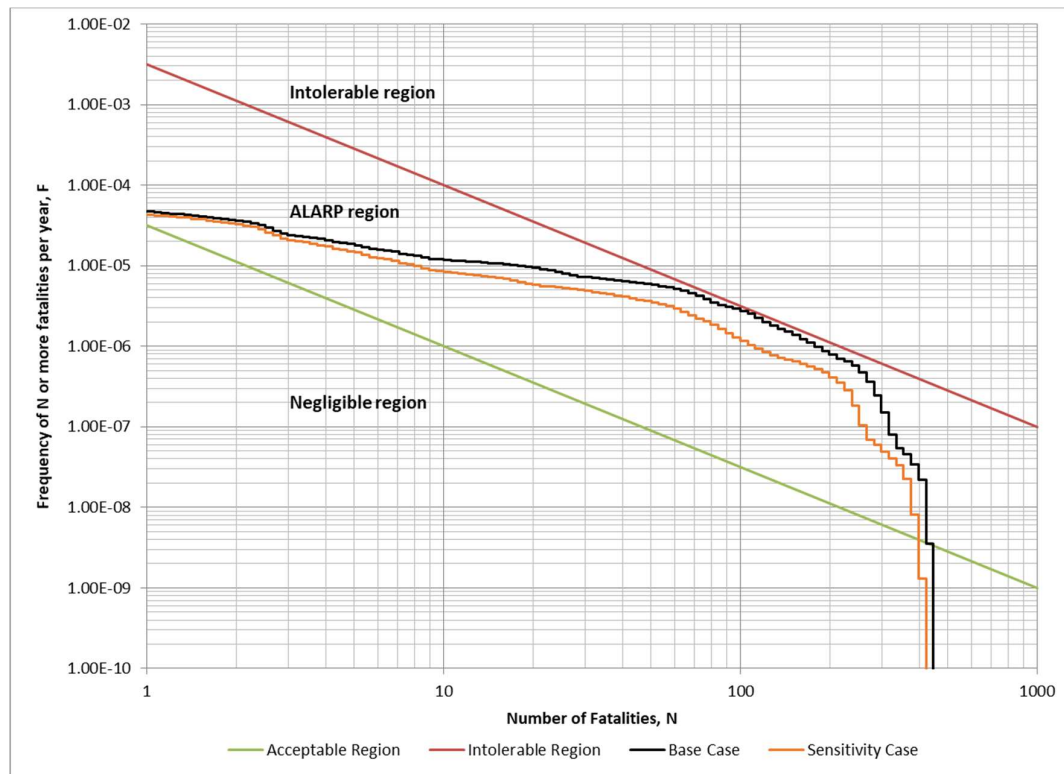
Two set-back cases are presented, based on the wider sensitivity analysis:

- Base Case – based on a 30 m setback distance from the centre of the pipe corridor at the north west of the Precinct
- Sensitivity Case – based on a 50 m setback distance from the centre of the pipe corridor at the north west of the Precinct.

The societal risk in the form of F-N curve is shown in Figure 1.4 for the Base Case and Sensitivity Case. The societal risk in both cases is within the 'As Low As Reasonably Practicable (ALARP)^d' and 'Negligible' regions, and do not extend into the 'Intolerable' region. The societal risk is lower for the Sensitivity Case when compared with the Base Case, due to the larger set-back distance, but does not result in a significantly larger proportion being in the 'negligible region'.

^d The ALARP region includes risks that are tolerable if other risk criteria are satisfied and further risk reduction is not reasonably practicable

Figure 1.4: Societal risk F-N curve



1.4.4 Transport risk

The transport screening thresholds are used for new developments to determine whether a transport hazard analysis is required for the proposed development. As described in HIPAP 11 (Ref. 6), factors to be considered when selecting routes may be grouped into the following interrelated categories:

- Mandatory factors, including statutory requirements and legal and physical constraints.
- Subjective factors that reflect community priorities and values which may not be easily quantified. Such factors include sensitive populations, special land uses and emergency response capability.
- Road and traffic factors including the identification of the most suitable routes.
- Environmental and land use risk, including the identification of hazards and determining the risk qualitatively. These are location dependent.
- Operational factors including economics and operator's requirements.

As the Precinct DG transport volume is above the SEPP 33 transport screening threshold, the above factors should be considered when determining additional transportation routes into and out of the Precinct by the relevant government authority.

1.5 Recommendations

A summary of the recommendations made in this LUSS is shown in Table 1.4.

Table 1.4: LUSS recommendations

No.	Recommendations
1	Sherpa recommends that the operators of the sites covered by this LUSS be consulted on the results, including Caltex, Viva Energy and Jemena.
2	Sherpa recommends that Caltex be consulted to define the measurement length and determine implications of development within this length to ensure consistency between their Pipeline Safety Management Study (SMS) and this LUSS. The SMS is required under the Australian Standard (AS) 2885.
3	Sherpa recommends that any future dangerous goods transport routes should avoid the proposed school to the north of the Precinct and the area of high density residential population, and potential future light rail to north and north west of the precinct.
4	A minimum of 30 m set back distance from the centre of the pipeline corridor should be maintained for developments in the north west of the Precinct, to obtain the Base Case Risk. Further set-back does reduce the risk and should be considered.
5	Buildings adjacent to the pipeline corridor should not use combustible cladding or other combustible exterior materials. This will reduce the likelihood of fires escalating to the buildings and the consequence of an external building fire.
6	Sherpa recommends that DPE reviews the population data that supports the societal risk calculations for the LUSS as the Master Plan is refined. When more detailed population data is available, the societal risk model should be updated.

1.6 Conclusion

The precinct risk profile is based on individual risk and societal risk as identified in this report in accordance with land use safety criteria in HIPAP 10. The two criteria are independent from one another. Therefore, in determining the minimum setback to apply to future development, the greatest setback from the assessment must be applied to ensure that both individual risk and societal risk criteria are met. In the case of the proposed Camellia Town Centre in the north western part of the Camellia Precinct, the minimum setbacks are:

- A 30m setback distance (from the centre of the pipe corridor) for residential
- A 65m setback distance (from the edge of the infrastructure land) for sensitive land uses (such as Hospitals, Schools, Child Care Facilities and Old Age Housing).

APPENDIX A. REFERENCES

- 1 NSW Department of Planning (2018): *Camellia Town Centre Draft Master Plan + Surrounding Land Uses*, provided by NSW DPE via email correspondence received on 15 January 2018.
- 2 Sherpa Consulting Pty Ltd (2018): *Camellia Precinct Land Use Safety Study Report, 20920-RP-001 Rev 0, 19 January 2018*.
- 3 NSW Department of Planning (2011): *Hazardous Industry Planning Advisory Paper No. 10 – Land Use Safety Planning*.
- 4 NSW Department of Planning (2011): *Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Safety Planning*.
- 5 NSW Department of Planning (2011): *Hazardous Industry Planning Advisory Paper No. 6 – Hazard Analysis*.
- 6 NSW Department of Planning (2011): *Hazardous Industry Planning Advisory Paper No. 11 – Route Selection*.
- 7 NSW Department of Planning (2011): *Hazardous and Offensive Development Application Guidelines – Applying SEPP 33*.