Transport for NSW

Appendix G
Preliminary hazard analysis

NSW GOVERNMENT

G-1 Preliminary hazard analysis

A qualitative risk assessment has been carried out consistent with the requirements for a level 1 preliminary hazard described in *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (Department of Planning, 2011a) and *Multi-level Risk Assessment* (Department of Planning, 2011b). The approach to the preliminary hazard analysis was informed by the principles of the Australian/New Zealand Standard *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* (Standards Australia, 2009a). The analysis involved a preliminary, desktop level risk assessment to broadly identify potential hazards and risks associated with constructing and operating the project.

The analysis involved assessing the risk level of each identified potential impact by identifying the consequences of the impact and the likelihood that the impact can occur using Transport for NSW's risk criteria (Transport for NSW, 2020d).

G-1-1 Evaluating consequence and likelihood

Consequence is defined as the implication of an impact. The consequences of an impact require a degree of subjective assessment as the likely consequences of an impact may consist of several elements.

In accordance with the Transport for NSW's risk criteria, the elements that have been considered in this risk assessment are described in Table G.1.

The likelihood of an impact occurring can be described in terms of probability. Overlaying this is the need to recognise the uncertainty that may be associated with the possible impacts, particularly during the initial risk assessment process. Where there is scientific uncertainty, a cautious approach would identify a higher level of risk (worst-case scenario).

Each identifiable impact can be assigned likelihood between almost unprecedented and almost certain (see Table G.2). In simplifying the possible impacts for the purpose of a risk assessment, an element of subjectivity is introduced. The purpose of the risk assessment is not necessarily to agree on the probability of any particular impact, but to facilitate an understanding of the relative probability of different impacts.

Table G.1 Consequence definitions

Rating / description	C6 Insignificant	C5 Minor	C4 Moderate	C3 Major	C2 Severe	C1 Catastrophic
Safety	Incident and/ or injury/ illness to staff/ customer/ community, not requiring first aid or medical treatment No lost time	Injury or illness to staff/ customer/ community, requiring first aid or medical treatment (non-hospitalisation) No lost time post medical treatment Single event	Minor injuries or illnesses to staff/ customer/ community, requiring professional medical treatment (that is, doctor, nurse, and paramedic) or hospitalisation resulting in lost time Injuries to customer/ community requiring hospitalisation	1 to 10 serious injuries or illnesses to staff/ customer/ community, as defined under section 36 of the *Work Health and Safety Act 2011* (WHS Act) resulting in hospitalisation, lost time and/ or potential permanent impairment Multiple injuries to customer/community requiring hospitalisation Single event and/ or multiple locations Coordinated emergency response required	Single fatality and/or 10 to 20 serious injuries or illnesses to staff/ customer/ community, as defined under section 36 of the WHS Act (resulting in hospitalisation, lost time and/ or potential permanent impairment Could impact safety across the network Coordinated emergency response required	Multiple fatalities and/or more than 20 serious injuries or illnesses to staff/ customer/ community, as defined under section 36 of the WHS Act resulting in hospitalisation, lost time and/or potential permanent impairment. (permanent disabilities/ chronic diseases) Transport unable to assure community and network safety Coordinated emergency response required
Financial sustainability	Capital expenditure (capex), above P50 capital budget of <$10 million Non-infrastructure capex of <$100K Operating expenditure (opex) (including accounting adjustments) of <$1 million Revenue (including fines, penalties, compensation and so on) <$100K	Capex (above P50 capital budget) of $10 million to $25 million Non-infrastructure capex of $100K to $1 million Opex (including accounting adjustments) of $1 million to $10 million Revenue (including fines, penalties, compensation and so on) of $100K to $1 million	Capex (above P50 capital budget) of $25 million to $50 million Non-infrastructure capex of $1 million to $5 million Opex (including accounting adjustments) of $10 million to $25 million Revenue (including fines, penalties, compensation and so on) of $1 million to $5 million	Capex (above P50 capital budget) of $50 million to $150 million Non-infrastructure capex of $5 million to $25 million Opex (including accounting adjustments) of $25 million to $75 million Revenue (including fines, penalties, compensation) of $5 million to $25 million	Capex (above P50 capital budget) of $150 million to $250 million Non-infrastructure capex of $25 million to $50 million Opex (including accounting adjustments) of $75 million to $150 million Revenue (including fines, penalties, compensation and so on) of $25 million to $50 million	Capex (above P50 capital budget) of >$250 million Non-infrastructure capex of >$50 million Opex (including accounting adjustments) of >$150 million Revenue (including fines, penalties, compensation and so on) of >$50 million

Rating / description	C6 Insignificant	C5 Minor	C4 Moderate	C3 Major	C2 Severe	C1 Catastrophic
Environment	No appreciable changes to environment	Change from existing conditions that can be rectified immediately (<1 day) with available resources	Short-term (<1 year) and/ or well-contained environmental impact Minor remedial actions probably required	Short to medium term (between 1 year and <5 years) environmental impact Considerable remedial actions probably required	Medium-term (>5 years) environmental impact Extensive remedial actions probably required	Long-term (>10 years) large- scale environmental impact Extensive and ongoing remedial actions probably required
Reputation and integrity	Single negative article in local media Limited social media commentary Goodwill, confidence and trust retained Confined to the branch Local council may want to discuss	Series of negative articles in local media (district/ electorate based adverse media) Some social media commentary Confidence remains - minor loss of goodwill Confined to branch but requiring notification to division Council requires written explanation Recoverable with little effort or cost. Some continuing scrutiny/attention	Extended local media coverage with some broader regional media coverage Extended negative social media coverage Confidence and trust of stakeholders dented (recoverable at modest cost within existing budget and resources) Division formal response needed to State - government/ regulator	State media coverage, short term negative national media coverage Widespread social media coverage Project/activity credibility under question TfNSW and/or Minister's office requires update	Sustained negative State media coverage Regular 'talk-back' programs questioning credibility and capability Confidence and trust are severely damaged Widespread negative social media coverage Regular updates demanded by the Minister Stakeholders withdraw their support recoverable at considerable cost, time and staff effort	Sustained, high profile media attention at national level Material change in the public perception of the agency Extensive negative social media coverage Confidence and trust non- existing. Government forced to reverse decision Stakeholders are actively campaigning against the organisation

Rating / description	C6 Insignificant	C5 Minor	C4 Moderate	C3 Major	C2 Severe	C1 Catastrophic
Everyday service delivery	Antisocial behaviour on service or resulting in minor delays Minor traffic incident resulting in minor delays Passenger(s) unable to disembark due to technical asset failure for more than five minutes Business as usual (BAU) service delays	BAU cancelations of service due to various causes including asset failure Partial or full closure of a line/route/run or incidents resulting in minor to moderate delays such as track failure Access and operation compromised (for example, closed entry and exits) for >30 minutes	Police operation on a transport asset (for example, threat, suspicious package, security incident, civil unrest) Incident requiring investigation by statutory authorities (WorkSafe, EPA, ONRSR/ OTSI, NSW Police Force)	Police operation on a transport asset (for example, threat, suspicious package, security incident, civil unrest) resulting in a significant delay for a prolonged period of time and likely to attract significant media attention such as no services during peak periods Incidents resulting in a significant detrimental impact to a transport mode or multiple transport modes for a prolonged period of time in excess of an hour, or likely to attract significant media attention such as derailment, overcrowding at stations, significant delays or no services during peak periods, injury to school children, multiple injuries, person overboard, fire on a service Evacuation or unplanned closure, caused by flood, fire, smoke, or hazardous substance spill, and suspicious substance	Serious injury or fatality to member of staff Fatality on a service or asset/station/ interchange (not self-harm)	Multiple injuries or fatality due to asset failure/derailment or significant ongoing threat

Table G.2 Likelihood definitions

Rating / description	L6 Almost unprecedented	L5 Very unlikely	L4 Unlikely	L3 Likely	L2 Very likely	L1 Almost certain
Qualitative expectation	Not expected to ever occur during time of activity or project Very little or no real chance of this risk occurring History shows that this risk hardly ever happens, if at all	Not expected to occur during the time of activity or project Only an unusual chance of this risk occurring History shows that this risk rarely happens, usually under unusual circumstances	More likely not to occur than occur during time of activity or project Chance of this risk occurring but not very History shows that this risk does happen but not very frequently often	More likely to occur than not occur during time of activity or project Chance of this risk occurring in the current period History shows that the risk has occurred on a number of occasions	Expected to occur occasionally during time of activity or project Good chance of this risk occurring History shows that the risk occurs unacceptably too often	Expected to occur frequently during time of activity or project Very strong chance of this risk occurring History shows that it is something that occurs frequently
Quantitative frequency	Risk event will occur at least once every 50 years Less than 2% probability of risk/event occurring within the next 12 months	Risk event will occur at least once every 25 years Greater than 2% and up to 4% probability of risk/event occurring within the next 12 months	Risk event will occur at least once every 10 years Greater than 4% and up to 10% probability of risk/event occurring within the next 12 months	Risk event will occur once every year Greater than 10% and up to 50% probability of risk/event occurring within the next 12 months	Risk event will occur between 2 times and 10 times per year Greater than 50% and up to 80% probability of risk/event occurring within the next 12 months	Risk event will occur more than 10 times every year Greater than 80% probability of risk/event occurring within the next 12 months

Based on the assessment of likelihood and consequence, the identified impacts and risks were assigned a risk level (from low to very high) using the matrix shown in Table G.3. The corresponding Transport for NSW risk appetite is provided in Table G.4.

Table G.3 Risk matrix

Description			Consequence					
			Insignificant	Minor	Moderate	Major	Severe	Catastrophic
			C6	C5	C4	C3	C2	C1
Likelihood	Almost certain	L1	Low	Medium	High	Very high	Very high	Very high
	Very likely	L2	Low	Medium	High	High	Very high	Very high
	Likely	L3	Low	Medium	Medium	High	High	Very high
	Unlikely	L4	Low	Low	Medium	Medium	High	High
	Very unlikely	L5	Low	Low	Low	Medium	Medium	High
	Almost unprecedented	L6	Low	Low	Low	Low	Medium	Medium

Table G.4 Transport for NSW risk appetite/ tolerance

Risk rating	Response	Review frequency
Very High	'Very High' risks are generally intolerable and should be avoided except in extraordinary circumstances. An alternative solution shall be found and all necessary steps shall be taken to reduce the risk below this level without delay.	Monthly update of risk register by the risk owner
High	'High' risks are undesirable. They can only be tolerated if it is not reasonably practicable to reduce the risk further. High risks are considered to be on the verge of being unacceptable and shall be given immediate priority.	Monthly update of risk register by the risk owner
Medium	'Medium' risks are generally tolerable if it is not reasonably practicable to reduce the risk further. Additional treatment measures should be sought if significant benefit can be demonstrated and/or an additional treatment measure available which is recognised as good practice in other like environments.	Two monthly update of risk register by the risk owner
Low	'Low' risks are considered to be broadly acceptable. If options for further risk reduction exist and costs are proportionate to the benefit, then implementation of such measure should be considered.	Quarterly update of risk register by the risk owner

G-1-2 Results

The results of the level 1 preliminary hazard analysis are provided in Table G.5. A mitigation approach has also been provided for each key risk or group of risks, and is based on implementation of the mitigation measures provided in Table 19.3.

The risks/hazards identified as high are considered tolerable by Transport for NSW if they are managed 'so far as is reasonably practicable'. Where high risks have been identified for the high pressure dangerous good pipelines, the implementation of the mitigation measures identified in Table G.5, in addition to the following is considered, to be consistent with managing the risks 'so far as is reasonably practicable':

- ongoing engagement and consultation with utility owners
- continuing to refine the design to avoid utilities where possible
- undertaking a safety management study in accordance with Australian and New Zealand Standard *AS/NZS 2885.6:2018 Pipelines – Gas and liquid petroleum, Part 6: Pipeline safety management*.

Table G.5 Hazard identification and preliminary hazard analysis

Event	Causes	Potential results	Risk context	Consequence	Likelihood	Risk	Mitigation approach[1]
Telecommunication utility strike	Impact during construction	1. Telecommunication service disruption, including customer complaints	1. Reputation	1. Minor	1. Unlikely	1. Low	CEMP (HR3)
Water utility strike – water main	Impact during construction	1. Flooding, including environmental damage/ sink holes	1. Environmental	1. Major	1. Unlikely	1. High	CEMP (HR3) Condition assessment (HR5)
		2. Water service disruption, including customer complaints	2. Reputation	2. Moderate	2. Unlikely	2. Medium	Incident and emergency response plan (HR6)
Power utility strike – gas	Impact during construction, high pressure in pipeline	1. Flammable gas release, no ignition but area evacuation.	1. Reputation	1. Minor	1. Unlikely	1. Low	CEMP (HR3) Incident and emergency response plan (HR6) AS 2885.6 safety management study (HR7)
		2. Flammable gas release, immediate ignition, and multiple fatalities	2. Safety	2. Catastrophic	2. Unlikely	2. High	
		3. Flammable gas release, delayed ignition, and multiple fatalities	3. Safety	3. Catastrophic	3. Unlikely	3. High	
		4. Flammable gas release, ignition, and third-party property damage	4. Financial	4. Major	4. Unlikely	4. Medium	
		5. Gas service disruption, including customer complaints	5. Reputation	5. Moderate	5. Unlikely	5. Medium	
Power utility strike – fuel	Impact during construction, high pressure in pipeline	1. Flammable liquid release, no ignition but area evacuation.	1. Reputation	1. Minor	1. Unlikely	1. Low	CEMP (HR3) Incident and emergency response plan (HR6) AS 2885.6 safety management study (HR7)
		2. Flammable liquid release, immediate ignition, and multiple fatalities	2. Safety	2. Catastrophic	2. Unlikely	2. High	
		3. Flammable liquid release, ignition, and third-party property damage	3. Financial	3. Moderate	3. Unlikely	3. Medium	
		4. Soil contamination	4. Environmental	4. Moderate	4. Likely	4. Medium	
		5. Fuel service disruption, including customer complaints	5. Reputation	5. Minor	5. Unlikely	5. Low	

Event	Causes	Potential results	Risk context	Consequence	Likelihood	Risk	Mitigation approach[1]
Power utility strike – electricity (below ground)	Impact during construction	1. Electrocution and single fatality	1. Safety	1. Severe	1. Unlikely	1. High	CEMP (HR3)
		2. Electricity service disruption, including customer complaints	2. Reputation	2. Minor	2. Unlikely	2. Low	
Power utility strike – electricity (above ground)	Impact during construction	1. Electrocution and single fatality	1. Safety	1. Severe	1. Unlikely	1. High	CEMP (HR3)
		2. Electricity service disruption, including customer complaints	2. Reputation	2. Minor	2. Unlikely	2. Low	
Loss of containment of chemicals	Damage/ impact, wear & tear, spill during construction	1. Soil/ water contamination	1. Environment	1. Minor	1. Likely	1. Medium	CEMP (HR3) Soil and water management plan (HR4) Compliant transportation (HR8)
		2. Personal injury	2. Safety	2. Minor	2. Unlikely	2. Low	
Power utility – gas release	Release during operation, high pressure in pipeline	1. Flammable gas release, no ignition but area evacuation.	1. Reputation	1. Minor	1. Very unlikely	1. Low	AS 2885.6 safety management study (HR7)
		2. Flammable gas release, immediate ignition, and multiple fatalities	2. Safety	2. Catastrophic	2. Very unlikely	2. High	
		3. Flammable gas release, delayed ignition, and multiple fatalities	3. Safety	3. Catastrophic	3. Very unlikely	3. High	
		4. Flammable gas release, ignition, and third-party property damage	4. Financial	4. Major	4. Very unlikely	4. Medium	
		5. Gas service disruption, including customer complaints	5. Reputation	5. Moderate	5. Very unlikely	5. Medium	
Power utility– fuel release	Release during operation, high pressure in pipeline	1. Flammable liquid release, no ignition but area evacuation.	1. Reputation	1. Minor	1. Very unlikely	1. Low	AS 2885.6 safety management study (HR7)
		2. Flammable liquid release, immediate ignition, and multiple fatalities	2. Safety	2. Catastrophic	2. Very unlikely	2. High	
		3. Flammable liquid release, ignition, and third-party property damage	3. Financial	3. Moderate	3. Very unlikely	3. Low	

Event	Causes	Potential results	Risk context	Consequence	Likelihood	Risk	Mitigation approach[1]
		4. Soil contamination	4. Environmental	4. Moderate	4. Likely	4. Medium	
		5. Fuel service disruption, including customer complaints	5. Reputation	5. Minor	5. Very unlikely	5. Low	
Member of public struck by light rail	Light rail movement during operations	1. Single fatality	1. Safety	1. Severe	1. Likely	1. High	Safety in Design process (HR2) Public communication (HR9)

Note 1: Mitigation measures referenced are as per Table 19.3 in Chapter 19 (Hazards and risk)