

# Chapter 25

## Human health risks and impacts





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## 25. Human health risks and impacts

Chapter 25 describes the potential human health risks and impacts (HHRI) that may arise from activities associated with the construction and operation of the Moorebank Intermodal Terminal (IMT) Project (the Project). These risks and impacts may arise, for example, from changes in the natural and built environment, such as ambient noise levels, air quality, or traffic and transport networks, as well as through changes in socio-economic conditions.

A detailed Health Impact Assessment (HIA) and Human Health Risk Assessment (HHRA) were prepared by Environmental Risk Services on behalf of Parsons Brinckerhoff and are presented Technical Paper 15 – *Human Health Risk Assessment* and Technical Paper 16 – *Health Impact Assessment* in Volume 9 of this Environmental Impact Statement (EIS). An HIA assesses the impact of a proposed scheme by examining the broader health implications of a proposal. It uses both quantitative and qualitative evidence to provide supportive information during the planning process for a project. Conversely, the HHRA focuses on the local air quality impacts of a project and provides a source of technical information to be drawn upon through the HIA process.

The findings of the HIA and HHRA for the Project are summarised in this chapter, which also addresses the Commonwealth Department of the Environment (DoE)'s EIS Guidelines and the Secretary of the NSW Department of Planning and Environment (NSW DP&E)'s Environmental Assessment Requirements (NSW SEARs) for the Project listed in Table 25.1.

Table 25.1 Relevant Commonwealth EIS Guidelines and NSW SEARs

Requirements	Where addressed
<b>Commonwealth EIS Guidelines under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i></b>	
<ul style="list-style-type: none"> <li>Provide a detailed and comprehensive HIA outlining the potential impacts of the Moorebank IMT on people and communities. The HIA must include an assessment of the likely direct, indirect and consequential impacts of the action on sensitive receivers, including: nearby residences, schools; health facilities and community facilities. The HIA must be consistent with the <i>Centre for Health Equity Training, Research and Evaluation's practical guide to impact assessment</i> (August 2007) and must be reviewed by a suitably qualified expert with extensive demonstrated experience in HIAs.</li> </ul>	<p>Technical Paper 16 – <i>Health Impact Assessment</i> in Volume 9 of the EIS (summarised in this chapter).</p> <p>Peer review endorsement (refer Technical Paper 16 – <i>Health Impact Assessment</i> in Volume 9).</p>
<b>NSW SEARs under the NSW <i>Environmental Planning and Assessment Act 1979 (EP&amp;A Act)</i></b>	
<ul style="list-style-type: none"> <li>A HIA of local and regional health risks associated with the development, including those health risks associated with relevant key issues.</li> <li>Identify impacts of the pollutants on human health, including cumulative impacts from background air pollution.</li> </ul>	<p>HIA and HHRA in Volume 9 of the EIS (summarised in this chapter).</p>

## 25.1 Assessment approach

This chapter is primarily informed by the HIA undertaken for the Project. This section summarises the approach taken in the HIA with further details available in the HIA (Technical Paper 16 – *Health Impact Assessment* in Volume 9) and Chapter 10 – *Impact assessment approach*.

### 25.1.1 HIA overview

The purpose of an HIA is to identify and assess both the beneficial and detrimental health effects of a proposed project. Through its recommendations, the assessment should identify opportunities to enhance the benefits of the Project while minimising its potential detrimental effects.

The HIA adopted a desktop assessment approach (termed a ‘rapid assessment’ under the HIA guidelines adopted for the assessment). The defining feature of a rapid assessment is that no new health data is collected, i.e. no project-specific epidemiological studies or health surveys are undertaken. For the Moorebank IMT HIA, baseline data were largely extracted from existing sources, including studies prepared for the EIS.

The methodology applied to the Moorebank IMT HIA was developed by HIA specialists Enricks, with expert guidance provided by the Centre for Health Equity Training, Research and Evaluation (CHETRE). CHETRE is a working group that focuses on understanding and measuring health equity and informing relevant policies, programs and actions, including that of environmental assessment. CHETRE is part of the University of New South Wales’ Centre for Primary Health Care and Equity (CPHCE).

The HIA assessment process for the EIS was undertaken in accordance with established industry guidance developed and endorsed by Australian health and environmental authorities, notably:

- *Health Impact Assessment: A Practical Guide* (Harris et al. 2007); and
- Health Impact Assessment Guidelines (enHealth 2001).

The HIA drew upon relevant available specialist studies and involved an initial health impact scoping exercise based on:

- formation of a Project-specific Health Impact Assessment Reference Group (comprising Government agency and local council representatives) (the HIA Reference Group);
- review of specialist studies that have an impact on human health (such as visual and urban design, biodiversity, air quality, noise and traffic);
- professional evaluation of the possible health implications of particular environmental, socioeconomic and sustainability impacts; and
- review of relevant stakeholder concerns, including those identified during community consultation and in discussion with the HIA Reference Group.

This process focused on the assessment of key impacts from air quality, noise and traffic, rather than other impacts that have been evaluated as having minimal effects on local health.

As part of the assessment process, a scoping document was produced for the HIA. As part of the process this document was reviewed and endorsed by CHETRE and the HIA Reference Group.

In accordance with the DoE requirement, the HIA has been reviewed by Synergia Ltd, a suitably qualified expert with extensive demonstrated experience in health impact assessments. Synergia's review considered the consistency of the HIA with the guidance supplied by CHETRE and in relation to established HIA practice, including assessment phasing, underpinning principles, scope, analyses of issues, impacts and recommendations. Synergia concluded that the final HIA report is consistent with the intent of CHETRE guidance and subsequently provided an independent endorsement for the HIA. A copy of this endorsement is provided at Appendix G (Volume 2).

As the Project's detailed design is developed, further detailed health impact assessments would be undertaken as part of the approvals strategy for the Project.

### 25.1.2 Project assessment scenarios

While a staged approach is proposed for the construction and operation of the Project (refer to Chapter 7 – *Project built form and operations* and Chapter 8 – *Project development phasing and construction*), in terms of health-related impacts the effects of the construction works and operational works will be broadly similar. As such, the HIA evaluated one construction and one operational scenario, namely:

- a construction scenario comprising 'typical' construction impacts (likely to be encountered during Phases A, B and C); and
- the operation of the completed Project (i.e. operation of the Project during Full Build) – representing a 'worst case' operational scenario in terms of the Project footprint and other impacts.

Consistent with the conclusions of other studies prepared for this EIS, the Early Works phase, comprising localised building demolition and site preparations work, is unlikely to generate detectable health impacts beyond the site boundary and as such is not considered further in terms of HIA.

### 25.1.3 HHRA

The HIA draws upon the findings of the HHRA. In accordance with the NSW SEARs, the HHRA focuses on the local air quality impacts of the Project and their implications for the population health. An HHRA is also required to address a key aspect of the HIA required by the Commonwealth Guidelines. The HHRA has been guided by numerous national and international peer reviewed sources (refer to Volume 9 of the EIS for details). In particular, the HHRA draws upon the following guidelines:

- *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards: 2012* (enHealth 2012a); and
- *Exposure Factors Guide* (enHealth 2012b).

Key steps of the process involved:

- data evaluation and issue identification – a review of available air quality and Project information, particularly the Local Air Quality Impact Assessment (AQIA) (in Volume 6);
- exposure assessment – identification of populations that may be affected by air pollutants and how much they may be exposed to identified key pollutants;
- toxicity assessment – determination of any adverse health effects and quantitative toxicity values of identified key pollutants; and

- risk characterisation – combines quantification of exposure and toxicity to evaluate acute and chronic risk (in consideration of any uncertainties).

#### 25.1.4 Cumulative assessment

In addition, in accordance with the NSW SEARs, this EIS includes a cumulative assessment of the predicted human health impacts of the Project with development of the Sydney Intermodal Terminal Alliance (SIMTA) site and other planned developments within the region. The findings of the assessment are summarised in Chapter 27 – *Cumulative impacts*.

## 25.2 Existing environment

The Project site is located close to the suburbs of Moorebank, Wattle Grove, Holsworthy, Glenfield, Casula, Lurnea and Liverpool. With the exception of Holsworthy, these suburbs contain populations that may be subject to health impacts from the construction and/or operation of the Project, and have subsequently been included in this assessment of potential offsite health impacts.

### 25.2.1 General community profile

This section provides an overview of key community characteristics relevant to this Project's assessment of health impacts. Chapter 24 – *Social and economic impacts* provides a more comprehensive overview and assessment of the local population's social and economic characteristics.

The location of the Project within the Liverpool LGA and the greater Sydney region demonstrates a demographic and socio-economic context that reflects both local and regional influences and trends. In particular, the residents of the Liverpool LGA identify with a number of indicators that suggest greater levels of socioeconomic disadvantage and, potentially, a higher vulnerability to impacts associated with the Project. As compared to Sydney and the rest of the state, these indicators include:

- relatively high proportions of overseas born residents and people speaking a language other than English at home;
- higher levels of unemployment, mortgage stress, and single parent families; and
- lower median incomes.

The LGA also has a higher youth population (persons aged 0 to 19 years as a percentage of the total population), but a lower proportion of persons aged 65 years and over. These populations are particularly vulnerable to HHRI.

As described in Chapter 24 – *Social and economic impacts*, within the local study area, there is considerable variation in population and socioeconomic trends among suburbs in the vicinity of the Project site. For example, Wattle Grove has a comparatively lower level of socioeconomic disadvantage (lower unemployment levels, higher incomes and rates of home ownership, and fewer single parent families) than suburbs such as Liverpool and Lurnea, with the latter suburbs also having higher proportions of overseas born residents and people who speak a language other than English at home.



In terms of employment, clerical and administrative workers (17.5%), technicians and trades workers (15.7%), professionals (15.4%), labourers (10.5%) and machinery operators and drivers (10.5%) were the most common occupations reported in the Liverpool LGA. Excluding professionals, the proportion of residents in these occupations is higher than the Sydney and state averages. Within the Liverpool LGA, Moorebank and Wattle Grove have a higher proportion of professionals, while labourers and machinery operators and drivers represent a higher proportion of occupations reported in suburbs such as Liverpool and Lurnea. Dwelling vacancy rates indicate the supply and distribution of available housing – a consideration for the Project (i.e. incoming workforces), as well as factors influencing housing stress. Across the Liverpool LGA, vacancy rates are relatively low (4.2%) compared to Sydney (7.2%) or the state average (9.7%). Within the local study area, these rates vary from 3.3% in Casula to 7.4% in Glenfield, and between 4% and 6% in the remaining suburbs.

### 25.2.2 Community health profile

Community health is influenced by a range of interactive factors, such as age, socioeconomic status, behaviour, beliefs, culture, social capital, genetics, and access to health and social care. This section summarises the health of the local population based on a wide range of these considerations (refer to the HIA, Volume 9 for further details). However, data for these indicators is only available for wider areas that incorporate the Liverpool LGA. These areas include Liverpool District (which includes the Liverpool LGA and Campbelltown LGA as well as part of the Camden and Fairfield LGAs) and the larger Sydney south-west area. For comparative purposes, data from other LGAs or regions across Sydney and/or NSW have also been included (depending on availability). Other examined LGAs and regions include Greater Western, Greater Southern, North Coast, Hunter and New England, North Sydney and Central Coast, Sydney West, and South Eastern Sydney and Illawarra.

General health indicators for the region, sourced from the South West Sydney Local Health Network (SWSLHN), highlight that while data for life expectancy at birth and deaths from all causes are comparable to the state, local residents have poorer outcomes for a range of other measures. These measures include behaviours linked to poorer health status and chronic disease, such as cardiovascular and respiratory diseases, cancer, and other conditions considered to contribute considerably to morbidity and mortality in later life (SWSLHN 2012). Behaviours include:

- current daily and occasional smoking – 17.0% (higher than NSW and all other examined regions; dominated by the rate of smoking in males);
- adequate physical activity – 49.2% (11% worse than NSW and lower than all other regions, except for females in Greater Western and Southern and Sydney West);
- very high psychological distress – 11.4% (4% higher than NSW); and
- recommended vegetable consumption – 7.9% (17% worse than NSW and lower than all other regions except for males in Sydney West), with a similar trend observed for recommended fruit consumption (lower among females in SWSLHN than in all other suburbs except Greater Southern, and for males except in Greater Western and Southern).

A review of the SWSLHN key mortality indicators and hospitalisations (for all causes, potentially avoidable, cardiovascular disease, lung cancer and chronic obstructive pulmonary disease (COPD) in the elderly 65+ years), with consideration of observations by the SWSLHN (2012), indicates that for South West Sydney (as compared to NSW):

- mortality<sup>1</sup> rates (all causes and potentially avoidable<sup>2</sup>) were slightly higher for males – a trend also observed in the Campbelltown and Liverpool LGAs, while that for females was slightly lower;
- between 1998 and 2007, higher rates of new cases of lung cancer were reported (16% higher than the NSW average), with projections estimating an increase of 63% in new cancer diagnoses within the region (as compared to 42% in NSW); however, 2010 rates were only slightly higher for men and comparable for women;
- mortality rates for cardiovascular disease are 5% higher than the NSW average and are significantly higher in the Liverpool LGA;
- cardiovascular disease is higher in Liverpool East than in Liverpool West, with the highest rates in the area reported in Campbelltown South;
- respiratory disease is higher than the NSW average in South West Sydney, with higher rates reported in Liverpool East and in both north and south Campbelltown;
- hospitalisation rates for COPD (for persons aged 65 years and over) are higher than the NSW average, while hospitalisation rates for cardiovascular disease are lower than the NSW average;
- hospitalisation rates for asthma (5–34 years) are similar in south-west Sydney when compared with the NSW average; and
- hospitalisation rates for diabetes (for principal diagnosis) are slightly higher for women than the NSW average, while that for men is comparable.

Incidences of asthma in the youth population in south-west Sydney and Liverpool LGA are lower than that for NSW; however, there is a higher rate of reliever medication use and lower rate of preventer medication use, indicating that asthma is less well managed in these areas as compared to the state. Based on available data, children aged 2 to 8 years have also reported the highest rate of moderate to extreme interference with daily activities of all the health districts in NSW, while youths aged 9 to 15 years report the lowest (resulting in overall trends for activity interference amongst children aged 2 to 15 years in South West Sydney being comparable to that of the state).<sup>3</sup>

<sup>1</sup> Mortality rate is a death rate from all causes adjusted to consider differences in age composition within the population.

<sup>2</sup> Potentially avoidable deaths are those occurring before the age 75 years that could be avoided by prevention or intervention.

<sup>3</sup> 'Interference with daily activities' refers to persons whose asthma interfered with their ability to manage day-to-day activities, with levels of interference ranging from a little bit, moderately, quite a lot, then extreme (NSW Health 2008).

## 25.3 Community concerns

Since 2010, community issues and concerns have been tracked as part of the Project's community consultation program (refer to Chapter 5 – *Stakeholder and community consultation of the EIS*). To date, issues raised by the community tend to focus on the Project's potential impacts. As outlined in Table 6 of the HIA, a number of these issues relate to general lifestyle and wellbeing considerations, such as congestion (16%), and the potential impacts of changes in air quality and ambient noise or light levels (26%); however, some have raised more specific health issues, including:

- health impacts from diesel emissions (such as respiratory effects, cancer and mortality);
- asthma concerns; and
- impacts on young children.

Issues of inequality have also been raised by the community. These issues particularly relate to the Project's potential impacts on an area already perceived to have high levels of air pollution.

## 25.4 Equity

Equity relates to the potential for the Project to lead to impacts that are differentially distributed in the surrounding population. Population groups may be advantaged or disadvantaged based on age, gender, socioeconomic status, geographic location, cultural background, aboriginality, and current health status and existing disability.

In relation to the proposed Moorebank IMT, equity has been addressed by:

- assessing the potential for impacts to occur in the existing environment, where this differs from other areas in Sydney;
- determining if there are any impacts that are likely to be more significant for any particular group in the surrounding community (including sensitive receivers) and ensuring that these impacts are effectively assessed; and
- considering whether these impacts are significant, unfair and can be changed or modified (such that the changes or modifications will improve equity and reduce the chance of unfair and avoidable impacts occurring for specific population groups).

## 25.5 Impact assessment

This HHRI assessment summarises the findings of the HIA work undertaken for the Project. It considers the outcomes of the HIA screening process, and equity issues and impacts predicted in other technical papers included in this EIS. The assessment incorporated consideration of Early Works impacts, which are predicted to be negligible.

### 25.5.1 HIA screening

As discussed in the methodology (see section 25.1), a screening level HIA was undertaken to provide an initial evaluation of key health issues that may be associated with the Project. This process involved examination of relevant specialist studies (detailed in Volume 9 of this EIS) evaluating current environmental, socioeconomic and sustainability conditions and potential impacts, community health characteristics, and community concerns. Input was also sought from the HIA Reference Group. A range of aspects relating to potential health issues and opportunities was considered under the broad categories of:

- economic environment;
- transport;
- natural environment; and
- sustainability, lifestyle and social environment.

For each aspect, the screening level assessment considered the level of available information relating to potential effects of the Project, (taking into account that the assessments in each case are based on indicative concept layouts, the potential for impacts on the surrounding community, and the nature of the likely effects identified (i.e. whether the effects are likely to be positive or negative).

The screening level HIA assessment was a qualitative exercise conducted for the purpose of identifying aspects of the Project that have the potential for negative health effects within the surrounding community that may require a more detailed assessment. Table 25.2 summarises the screening process, while the HIA (Volume 9) provides the detailed discussion and evaluation.

Based on the screening level assessment it was determined that three of the potential aspects required a detailed health impact assessment; specifically access, congestion and accidents; noise; and air quality. This conclusion was reached because in each case the potential for these impacts to have negative offsite effects relating to health issues has been highlighted as a community concern. Sixteen of the remaining 23 aspects were evaluated to have negligible to low, or positive potential effects pending the implementation of mitigation or enhancement measures, while four were identified as having insufficient information to undertake a further, more detailed assessment.

Table 25.2 Summary of screening level HIA

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
<b>Economic environment</b>				
Growth and employment	<ul style="list-style-type: none"> <li>The provision of increased intermodal capacity in Sydney reduces the unit costs of transporting containers by rail for IMEX and interstate markets. The reduction in rail freight costs means that more containers would be transported by rail, and this is expected to generate ongoing productivity benefits for the community.</li> <li>The Project should result in the creation of up to 1,247 jobs (typical workforce) during construction of the IMEX terminal and warehousing and 275 jobs (typical workforce) during the construction for the interstate terminal. Operation of the Project is expected to generate approximately 2,174 jobs for the south-western Sydney region.</li> <li>Potential increase in employment and income earning opportunities can be associated with reduced incidences of physical and mental health issues associated with unemployment and/or low incomes, including illness and premature death, anxiety, stress, lower self-esteem and feelings of insecurity.</li> <li>Recommendation to encourage local employment due to compatibility between local skill sets and those required for the Project's construction and operation.</li> <li>As the economic changes anticipated as a result of the Project are positive, a detailed assessment has not been undertaken in the HIA; however, an assessment of economics has been undertaken in Chapter 24 – <i>Social and economic impacts</i>.</li> </ul>	Yes (positive)	Yes	No
<b>Transport</b>				
Access, congestion and accidents	<ul style="list-style-type: none"> <li>Potential for congestion and access issues associated with construction (negative), as well as road and rail accidents during both construction and operation.</li> <li>Abovementioned transport issues could result in issues of stress, anxiety and perceptions of safety.</li> <li>Proposed upgrades (and Project generally) would widen roads, improve intersections and reduce freight related vehicle use, in addition to improving signage, access, road markers and other road safety controls.</li> <li>When the IMT is in operation, the net outcome is positive in terms of access, congestion, the potential for accidents, and associated health and safety concerns.</li> </ul>	Yes	Yes	Yes

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
<b>Natural environment</b>				
Noise	<ul style="list-style-type: none"> <li>Potential for noise to be above acceptable levels, with associated health impacts, during both construction and operation.</li> <li>Above acceptable levels, noise can have health impacts including annoyance, sleep disturbance, performance issues (reduced concentration), cardiovascular health problems, hearing problems, mental health effects, and general health impacts (e.g. on the immune system).</li> <li>During construction, noise levels are anticipated to occur within standard construction hours (during the day, Monday to Saturday) and would generally remain within acceptable levels (requiring only standard mitigation measures); however, during the worst case noise generating construction works, noise levels would exceed acceptable levels at some residences in Casula and Glenfield. Additional mitigation measures required to reduce construction noise levels at these locations would be detailed in the construction environmental management plan (CEMP) (see section 12.4.1 of Chapter 12 – <i>Noise and vibration</i>).</li> <li>During operation, night-time activities may exceed acceptable levels and require additional mitigation (see section 12.4.2 of Chapter 12 – <i>Noise and vibration</i>).</li> </ul>	Yes	Yes	Yes
Vibration	<ul style="list-style-type: none"> <li>Potential for issues of annoyance or discomfort to arise as a result of vibration during construction and operation.</li> <li>Evaluated to have negligible offsite impacts due to compliance with regulations and/or and distances between activities and sensitive receptors.</li> </ul>	No	No	No
Light	<ul style="list-style-type: none"> <li>Potential for sleep, gastrointestinal, mood and cardiovascular disorders to arise due to increased light spill during construction and operation.</li> <li>Due to mitigation measures, particularly lighting design and equipment, any increases in light were evaluated to be negligible, except in the case of trains on the proposed rail access over the Georges River at night (evaluated to have a low impact on some Casula residents).</li> <li>Compliance with train lighting regulations required for the route to Port Botany would ensure impacts are minimised on Casula residents (low residual impact).</li> <li>For the above reasons, impacts of light on health have been evaluated to be acceptable (not to require detailed assessment in the HIA); however, a light spill assessment has been undertaken in Chapter 22 – <i>Visual and urban design</i>.</li> </ul>	Yes (low impact only)	Yes	No

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
Hazardous materials management	<ul style="list-style-type: none"> <li>Potential for injury, illness or loss of life as a result of exposure to hazardous materials.</li> <li>Onsite hazardous materials likely to be limited to fuel for refuelling purposes (e.g. diesel and liquid natural gas), as well as carbon dioxide for fire fighting.</li> <li>The distance of storage locations from sensitive receptors and requirement for compliance with strict storage, handling and transport requirements result in negligible risk of offsite impacts on the local community.</li> <li>In light of the above considerations, impacts of hazardous materials on health have been evaluated to be acceptable (not to require detailed assessment in the HIA); however, an assessment of hazardous materials is undertaken in Chapter 14 – <i>Hazards and risks</i>.</li> </ul>	No	No	No
Green space/ ecology	<ul style="list-style-type: none"> <li>Potential for health, recreation and general wellbeing issues to arise as a result of changes in open space or natural environments.</li> <li>Site largely cleared of vegetation; however, riparian vegetation remains alongside the Georges River (some connections to wider ecological communities).</li> <li>Project provides for maintenance, rehabilitation and extension of riparian zone (with the exception of the rail bridge crossing), as well as a series of offset areas to restore and manage flora and fauna.</li> <li>Provided the environmental management plan is adhered to during construction and operation, there would be a net positive impact on local ecology; however, issues of visual amenity and community perceptions may be positive or negative depending on experiences of change.</li> <li>Health impacts of changes in green space or ecology have been evaluated to be acceptable (not to require detailed assessment in the HIA); an assessment of biodiversity impacts has been included under in Chapter 13 – <i>Biodiversity</i>.</li> </ul>	No	Yes	No
Contaminated land and remediation	<ul style="list-style-type: none"> <li>Potential for injury, illness or loss of life as a result of exposure to contaminated land.</li> <li>Previous site uses have resulted in some soil and groundwater contamination.</li> <li>Project remedial action plan would address present site contamination (positive impact), with no offsite impacts anticipated due to proposed mitigation measures.</li> <li>As impacts of remediation required during construction of the Project on health have been evaluated to be potentially beneficial, detailed assessment in this HIA is not required; however, an assessment of contamination and soils has been undertaken in Chapter 15 – <i>Contamination and soils</i>.</li> </ul>	Yes (positive)	Yes	No

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
Water quality and hydrology	<ul style="list-style-type: none"> <li>• Potential for impacts on water quality and hydrology, particularly in cases of flooding (as the development is proposed on a floodplain) and/or impacts associated with stormwater.</li> <li>• Health impacts associated with flooding can include injury, loss of life, property/financial losses (and various associated mental and/or physical issues such as stress and anxiety).</li> <li>• Project has been designed in consideration of flooding (e.g. avoidance of affected areas), and complies with all flood regulations in addition to providing for a conservation zone to assist with flood management.</li> <li>• Potential changes to water quality associated with storm water runoff are mitigated by a stormwater management plan, including provisions to capture, treat and/or use water sensitive design to minimise increases in runoff or changes in water quality, with the risk of offsite impacts being low – pending appropriate design and implementation.</li> <li>• For the above reasons, impacts of changes in water quality and hydrology on health have been evaluated to be acceptable (not to require detailed assessment in the HIA); however, an assessment of hydrology is outlined in Chapter 16 – <i>Hydrology, groundwater and water quality</i>.</li> </ul>	Yes (low risk)	No	No
Air quality	<ul style="list-style-type: none"> <li>• Potential for local and regional air quality to be affected during construction and operation activities, particularly in terms of pollutants from earthworks and emissions from motorised diesel sources.</li> <li>• Assessments have determined that impacts would be largely local (negligible at a regional level during operations, due partly to a reduction in vehicle kilometres travelled (VKT) following the switch from road to rail freight transport), with particulate matter (PM) (notably PM<sub>10</sub> and PM<sub>2.5</sub>) and oxides of nitrogen being pollutants of particular concern.</li> <li>• Exposure to pollutants and PM can contribute to, or exacerbate, respiratory and cardiovascular issues, including premature mortality and morbidity, in addition to increasing associated hospitalisations.</li> <li>• Assessments of individual and cumulative emissions and PM have determined that levels are acceptable, with exposure levels among sensitive receptors, and the risk of health impacts, being low and within regulatory requirements (unlikely to cause significant health impacts).</li> <li>• Based on this assessment, no additional mitigation measures are required other than those assumed to be included in the air quality impact assessment. All of the measures assumed in the air quality impact assessment must be considered in the detailed design and Project approval processes.</li> </ul>	Yes	Yes	Yes



Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
Odour	<ul style="list-style-type: none"> <li>Potential for short term discomfort or irritation as a result of odours that may be generated by construction activities (soil excavation or asphaltting) or in the case of extended power outages (spoilage of perishables on site).</li> <li>Potential for impact is evaluated to be low and short-term, and unlikely to extend offsite.</li> </ul>	No	No	No
Landscape character/visual impact	<ul style="list-style-type: none"> <li>Potential for health and wellbeing issues to arise as a result of perceived or actual changes in amenity and liveability.</li> <li>Project site is largely cleared for current uses, including Department of Defence buildings and a golf course; however, the riparian vegetation along the Project site's western boundary (bordering the Georges River) remains intact.</li> <li>The Project would only result in minor changes to current landscape characteristics, including small changes to vegetation distribution (clearance in some areas for access/buildings, or increases in others due to revegetation), and alterations to the current built environment (presence of light poles or other higher structures in areas that differ from the current situation).</li> <li>The Project would result in some changes to landscape and visual amenity, with the potential for impacts on some members of the community.</li> <li>For the above reasons, health impacts associated with changes in landscape character/visual amenity have been evaluated to be acceptable (not to require detailed assessment in the HIA); however, an assessment of visual and urban design has been undertaken in Chapter 22 – <i>Visual and urban design</i>.</li> </ul>	Yes (low impact; negative for some residents; neutral or positive for others)	No	No
Waste management	<ul style="list-style-type: none"> <li>Potential for injury or illness to arise as a result of poor waste management practices (e.g. as a result of contamination or exposure from poor waste management practices).</li> <li>The Project would generate various types of waste during construction and operation, including demolition waste, green waste, sewage, litter, paper, recyclables and a range of contaminated materials and military materials.</li> <li>A waste management plan has been developed in compliance with regulations and the waste management hierarchy.</li> <li>Assuming appropriate implementation of this plan, any offsite impacts resulting from the Project have been evaluated to be negligible.</li> </ul>	No	No	No

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
Cumulative impacts	<ul style="list-style-type: none"> <li>Potential cumulative impacts on health and wellbeing, particularly in relation to traffic, noise and air.</li> <li>Assessment examined impacts associated with this Project, as well as those of other existing or proposed developments throughout the local area – most notably a potential development by Sydney Intermodal Terminal Alliance (SIMTA) adjacent to the Project site.</li> <li>A review of potential cumulative impacts indicates that key health issues associated with traffic, noise and air quality impacts could be exacerbated if the Project is considered in addition to other developments (i.e. the cumulative human health impacts of the Project plus other potential or planned developments are greater than the impacts of the Project in isolation).</li> </ul>	Yes	Yes	Yes
<b>Sustainability, lifestyle and social environment</b>				
Demographic change	<ul style="list-style-type: none"> <li>Potential increase in population as a result of specialised employment opportunities that may not be able to be filled locally.</li> <li>Demographic change can directly and indirectly affect health by changing community dynamics, including housing and social infrastructure demand (discussed below), or perceptions of crime and safety.</li> <li>Assessment of Project induced demographic change has been evaluated to be negligible.</li> </ul>	No	No (Yes in the case of crime)	No
Housing and accommodation	<ul style="list-style-type: none"> <li>Potential for employment related population migration to the local community and an associated increase in demand for housing (and issues associated with housing availability, affordability and stress).</li> <li>Assessment determined that there is only a small potential for a minor increase in demand for housing as a result of the Project which, in consideration of dwelling vacancies, would have negligible impacts for the community.</li> </ul>	No	No	No
Demand for health infrastructure	<ul style="list-style-type: none"> <li>Potential increase in demand for health infrastructure due to employment related relocation to the community and/or the Project itself (e.g. onsite incidents) and issues associated with capacity and stress.</li> <li>Assessment determined that there would be negligible impacts on health services demand or capacity as a result of any minor Project driven population increases, nor due to the Project itself (as a result of strict workplace health and safety procedures and zero harm goal).</li> </ul>	No	No	No

Aspect	Potential issues and opportunities	Screening level HIA		Detailed HIA required
		Potential for impacts on community	Issue raised during community consultation	
Demand for education services	<ul style="list-style-type: none"> <li>Potential for increase in demand for education services as a result of employment-related relocation to the community (of employees and their families) and issues associated with capacity and stress.</li> <li>Assessment determined that any increases in demand for services would be negligible and manageable within current facility capacities.</li> </ul>	No	No	No
Recreation	<ul style="list-style-type: none"> <li>Limited potential for loss of open space and recreation opportunities and associated health impacts.</li> <li>Assessment determined that the Project would have negligible impacts on local community recreational opportunities.</li> </ul>	No	No	No
Property values	<ul style="list-style-type: none"> <li>Potential for health impacts associated with perceived or actual change in property values as a result of the Project (i.e. increase in values due to increased demand for housing created by employment related relocation may have positive health impacts, while declining values due to amenity impacts may cause stress, anxiety or other adverse health impacts).</li> <li>While there is concern in the local community about the impact of the Project on house prices, there are many factors that influence housing prices in an area. Given the complexity of these factors, it is not possible to predict whether the Project would have any positive or negative impact on housing prices in the local area.</li> <li>For the above reasons, impacts of changes in property values on health have been evaluated to be acceptable (not to require detailed assessment in the HIA); however, an assessment of property values is undertaken in Chapter 24 – <i>Social and economic impacts</i>.</li> </ul>	No	Yes	No
Perceptions of control over life decisions	<ul style="list-style-type: none"> <li>Concern raised by community over perceptions of a loss of control over life decisions.</li> <li>Considered generally throughout the HIA; however, due to the complex and intangible nature of this potential impact, at present, more detailed assessments are not feasible.</li> </ul>	No	Yes	No
Increase use of alternative transport	<ul style="list-style-type: none"> <li>Potential for increase in alternative modes of transport due to incidental upgrades to local facilities and networks.</li> <li>Assessment of this impact has determined that the Project would increase opportunities for cycling, walking and using public transport, thus presenting the potential for associated health benefits; however, at present, more detailed assessments are not feasible.</li> </ul>	Yes	Yes	No
Impacts on future generations	<ul style="list-style-type: none"> <li>Potential for Project impacts to affect future generations.</li> <li>Considered generally throughout EIS; however, more detailed assessments would be considered during detailed design.</li> </ul>	Yes	Yes	No

### 25.5.2 Detailed health impact assessment

Of the 23 potential environmental, socio-economic and sustainability aspects examined in the screening HIA, three were evaluated as requiring more detailed evaluation based on their potential for health repercussions:

- traffic, transport and access;
- noise; and
- air quality.

#### Traffic, transport and access

The three key concerns identified during impact screening included the potential for stress and anxiety as a result of traffic, congestion and access issues, as well as the potential for road and rail accidents. The following subsections address these concerns.

Phase A proposes:

- widening of Moorebank Avenue, the main access route to the Project site, to a dual carriageway between the M5 Motorway intersection and the southernmost site access road;
- expansion of the Moorebank Avenue and Anzac Road intersection;
- expansion or provision of new intersections for remaining access points along Moorebank Avenue; and
- construction of rail connections and network linkages, including a bridge over the Georges River.

Refer to Chapter 11 – *Traffic, transport and access* of the EIS, and the Traffic and Transport Impact Assessment in Volume 3 for further details of the Project's assessment of traffic, transport and access impacts.

The traffic impact assessment has identified that, at present, Moorebank Avenue is congested with some intersections already at capacity. During construction in Phase A (between 2015 and 2018), there may be a temporary increase in traffic volumes within the local area as a result of construction activities (movement of materials and waste); however, once construction and upgrades are complete, the road and intersections would be improved.

During Phase A, congestion on roads within the wider network as a result of the Project's activities would be negligible. Some access to the Project site would be required to construct other aspects of the Project (e.g. the rail bridge on the western side of the Georges River). Such roads would include local roads in Casula and the Hume Highway. These works would be undertaken in accordance with the CEMP, which would include provisions and controls to manage traffic, including parking provisions (to minimise use of local parking space).

During the construction of Phases B and C, as well as during operation, the Project is anticipated to have positive impacts on local roads, as well as those within the wider road network, in relation to congestion. This is because of the upgrades to Moorebank Avenue undertaken during Phase A, as well as the fact that the Project would assist in managing the growth in road traffic – particularly of heavy vehicles – by providing an opportunity to transport freight to and from Port Botany, and eventually interstate, via rail.

Traffic congestion has the potential to contribute to health impacts such as stress and anxiety, reduced air quality, increased noise, and poor perceptions of an area due to safety concerns. Based on the above findings, the Project may have minor, short-term, offsite impacts during construction. This would notably affect users of Moorebank Avenue; however, once proposed mitigation measures are implemented, the Project is anticipated to have net positive health outcomes in relation to traffic congestion.

In terms of road and rail safety and accidents, the upgrade of Moorebank Avenue and a reduction in heavy vehicle traffic on roads within the wider network (as a result of the shift from road to rail freight transport) are anticipated to improve road safety. This outcome, coupled with the controls proposed for Project related vehicles as part of the traffic management plan, has been evaluated to result in a net positive outcome for road safety.

## Noise

The noise impact assessment undertaken for the Project evaluated existing ambient noise at six locations throughout nearby residential areas. In compliance with regulatory requirements, this involved both attended and unattended monitoring to ensure a comprehensive profile of baseline conditions. Refer to Chapter 12 – *Noise and vibration* of the EIS, and the Noise and Vibration Impact Assessment in Volume 3, for more details of the Project's assessment of noise impacts.

It is likely that the Project would generate noise during both construction and operation. During construction, noise would be associated with various activities such as earthworks, the construction of infrastructure, and the transport or removal of materials (traffic related noise). The Noise Impact Assessment undertaken for the Project states that noise levels generated by the Project typically comply with relevant noise management levels, with a range of mitigation measures proposed to manage any anticipated exceedances (refer to Chapter 12 – *Noise and vibration*). Specifically, in accordance with regulatory requirements, construction would generally only occur during standard hours (unless otherwise necessary, e.g. to minimise operational concerns related to road and rail safety or other safety issues, and then only with required approvals), with standard noise mitigation practices proposed as part of the CEMP. Should works outside standard construction hours be required (such as works within the SSFL rail corridor), additional mitigation would be required. Proposed mitigation measures include locating activities at a sufficient distance from sensitive receptors, shutting down equipment when not in use, covering engines at all times when relevant equipment is in use, using broadband reversing alarms over tonal alarms, and continuing to monitor noise levels to ensure they are within acceptable levels.

Operational noise would include the noise generated by activities such as:

- rail operations on the main IMT site and the rail access connection to the Southern Sydney Freight Line (SSFL);
- heavy lifting equipment required for loading and storage activities; and
- road related traffic movements.

Once the Project is fully operational (estimated to be in 2030), operational activities are proposed to occur on a 24-hour basis, with noise levels anticipated to exceed the levels acceptable in the evening and night periods (which are lower than those during the day) for some of the closest receivers. Without noise mitigation measures, the operational noise generated by the Project is anticipated to exceed noise goals by between 9 and 13 dB(A)  $L_{Aeq}$ , under neutral conditions depending on the conceptual layout being considered, with the greatest operational impacts associated with the central rail access option conceptual layout.

During the full operation of the Project, noise levels generated from the use of the rail access connection to the SSFL (rail spur) are predicted to comply with relevant trigger levels at most receivers. However, for the northern rail access option, at some receivers in Casula noise levels from the rail spur would potentially exceed criteria by up to 17 dB(A) during night-time periods (refer Chapter 12 – *Noise and vibration* for more detail).

Mitigation measures that have been proposed or recommended (subject to further assessment and consideration during detailed design) to lower noise levels include:

- use of noise control design and/or measures, such as enclosures, acoustic walls, barriers or earth mounds, which are capable of reducing noise by 10 dB(A) or greater;
- siting the empty container storage in a location that screens plant and equipment to maximise noise mitigation;
- appropriate rail design (e.g. maximising the distance between receivers and rail lines, minimising the acute changes in vertical alignment in the rail tracks, regularly greasing tracks to minimise squeal, and welding tracks to remove joints); and
- appropriate activity scheduling (i.e. restricting, where possible, noisier operations to during the day or early evening – e.g. only undertaking shunting and locomotive maintenance during the day).

Ambient noise monitoring is to continue throughout the construction and operation of the Project to assist in the assessment of changes in the ambient noise environment throughout development.

According to the Environmental Health Council of Australia (EnHealth) and the World Health Organisation (WHO), noise above acceptable levels can have a range of health impacts (EnHealth 2004; WHO 1999). These include annoyance, sleep disturbance, performance issues (reduced concentration), cardiovascular health problems, hearing problems, mental health effects, and general health impacts (e.g. on the immune system). Provided that proposed or recommended mitigation measures are implemented, then noise levels should remain within the acceptable levels specified by regulatory guidelines, with the likelihood and significance of any health impacts being negligible.

### Air quality and HHRA

The local air quality impact assessment (in Volume 6) and the HHRA were undertaken to examine and assess the Project's potential effects on air quality and associated risks for, and repercussions on, human health. The local air quality impact assessment estimated the potential concentrations of applicable air pollutants expected at key Phases (for both construction and operation), namely in 2016, 2023, 2028 and 2030 (estimated dates). The HHRA assessed the potential health risks associated with anticipated emissions on local populations. Both assessments considered incremental and cumulative impacts (respectively, those of the Project only and those of the Project in combination with existing air quality and other local emission sources). Refer to Chapter 17 – *Local air quality* and Chapter 18 – *Regional air quality*, and the local air quality impact assessment (see Volume 6), regional air quality impact assessment (in Volume 6) and the HHRA (see Volume 9) for more details of the Project's assessment of local and regional air impacts and associated human health risks and impacts.

The key Project activities anticipated to generate air pollutants are earthworks during construction, and diesel combustion sources, such as vehicles, trains and machinery, during both construction and operation. Pollutants include PM, carbon monoxide, oxides of nitrogen, sulfur dioxide, volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). These emissions were considered incrementally and in conjunction with representative data from local and regional air quality monitoring stations reflecting other localised sources, including the Glenfield Landfill and the SSFL.

During both construction and operation, levels of oxides of nitrogen, sulfur dioxide, carbon monoxide, VOCs and PAHs were all estimated to be low and acceptable (within state, national and international regulatory guidelines designed to protect public health, particularly of sensitive groups such as the young and elderly).

The predicted air quality results reflected in the local air quality impact assessment indicate that larger particulates (PM<sub>10</sub>) are anticipated to dominate PM emissions during early construction (e.g. earthworks), while smaller particles (PM<sub>2.5</sub>) would increase as the use of diesel combustion sources increases over the Project's life.

Exposure to PM is linked to various health impacts, particularly on respiratory and cardiovascular systems. Exposure above recommended levels can result in premature mortality as well as morbidity effects such as:

- aggravation of existing respiratory and cardiovascular disease;
- changes in cardiovascular risk factors such as blood pressure;
- changes in lung function and increased respiratory symptoms (including asthma);
- changes to lung tissues and structure; and
- altered respiratory defence mechanisms.

Such health impacts can have diverse flow-on effects, including increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days.

Incremental impacts associated with PM<sub>2.5</sub> and PM<sub>10</sub> were evaluated through the HHRA. The evaluation calculated increased lifetime risks and the increase in the number of cases for a range of key health effects. The health effects included premature mortality (from all causes and from specific causes such as cardiovascular, respiratory disease or lung cancer and increased risks of cancer) as well as increased hospitalisations for pre-existing illnesses such as cardiovascular disease and respiratory disease. These calculations have been undertaken on the basis of established exposure-effects relationships for exposure to PM<sub>2.5</sub>, PM<sub>10</sub> and diesel particulate matter (DPM, where 100% of the PM<sub>2.5</sub> from the site is assumed to be DPM) that are relevant to all members of the population including sensitive groups such as the elderly, young children and individuals with pre-existing illness.

A comprehensive assessment of the Project's incremental and cumulative local air quality impacts (as presented in the local air quality impact assessment (Volume 6) and HHRA (Volume 9)) indicated that:

- Existing local concentrations of PM<sub>10</sub> meet regulatory guidelines based on the protection of health, and the Project's additional emissions would not result in significant increases in the total levels of PM<sub>10</sub> (i.e. cumulative (background plus terminal) local concentrations of PM<sub>10</sub> still meet regulatory guidelines).
- Existing local PM<sub>2.5</sub> concentrations generally meet regulatory advisory goals<sup>4</sup>. The Project's additional emissions would not result in measurable changes in existing local PM<sub>2.5</sub> levels, with cumulative (background plus terminal) impacts subsequently not considered to be of concern.

<sup>4</sup> The PM<sub>2.5</sub> criteria established by the National Environment Protection Council are advisory goals based on available health information related to PM<sub>2.5</sub> exposure and resultant adverse health effects. However, as PM<sub>2.5</sub> had not been routinely monitored when air quality criteria were being considered, existing urban (and regional) levels were not known, and the ability to meet advisory goals could not be determined in individual states. Hence these criteria were not established as standards defined in the *National Environment Protection Council Act 1994*. The relevance of any exceedance of these goals will be fully assessed once a sufficient database of monitoring data is available. The goals, however, are based on the protection of population health.

- More specific evaluation of Project-related local increases in PM<sub>10</sub> and PM<sub>2.5</sub> concentrations has shown that any exposure–effect relationships, including increased lifetime risk of premature mortality (of various causes relevant to particulates), changes in hospitalisations (for pre-existing respiratory and cardiovascular disease), and use of asthma medication by children at all sensitive receptor locations, are not measureable or statistically significant, and that health risks or impacts are low and acceptable.
- For the assessment of potential impacts of PM<sub>2.5</sub> and PM<sub>10</sub> from the Project over all phases of operation, and considering all rail access options, potential health impacts would be low and essentially negligible in the surrounding community.
- Overall, on the basis of the assessment conducted, cumulative and incremental impacts of the Project on the health of the adjacent community (including sensitive groups), across all years associated with construction/development and operation, are considered to be low and acceptable (essentially negligible).

Specialist studies have determined that, despite community perceptions and concerns, the Project would not have significant impacts on local sensitive receptors or population health. Based on the evaluation undertaken there is no requirement to incorporate additional mitigation measures.

### 25.5.3 Equity

In considering issues of equity for this development, two types of equity related impacts have been identified – spatial impacts and sensitive receivers. Equity issues relating to both types were considered in the HIA (refer to Volume 9 of this EIS).

It is expected that the Moorebank IMT would provide some limited benefits at a regional level, whereas the negative impacts would be experienced at a local level. Moving the effects of freight handling to an area which also benefits from the provision of an efficient freight handling service would have a positive effect on the equitable spread of costs and benefits.

The assessment identified that the relocation of activities associated with the Project from Port Botany to the Project site (notably road freight) would also subsequently translocate associated impacts (e.g. the abovementioned traffic, noise and air quality impacts). This translocation of impacts would benefit the residents of Port Botany but would have a detrimental effect on those near the Project site. Due to the mixed nature of the suburbs around the development, it is unlikely that one particular population sub-group (e.g. low socioeconomic group or non-English speaking groups) would experience a higher exposure to risk factors (e.g. noise, air pollution, traffic) than the general population in the area surrounding the development.

Within the local area, some population sub-groups, notably children and the elderly, are likely to be more vulnerable to changes that affect health, despite experiencing the same level of exposure as other community members. Recommendations have been developed that take this into consideration (refer to the recommendations section of the HIA in Volume 9). The population profiling undertaken for the assessment identified that there may also be other members of the community with socioeconomic and language vulnerabilities who may also fail to benefit from mitigation measures (discussed below) unless they are developed to specifically consider and target these groups. Again, recommendations in the HIA in Volume 9 have been developed to address this.



## 25.6 Management and mitigation

The HIA for this Project has determined that, based on the findings and conclusions of specialist studies (notably the traffic, noise, and air quality impact assessments) and the HHRA (refer to studies contained in Volume 9), the measures proposed to manage and mitigate these issues would ensure that any human health impacts would remain within acceptable levels during both the Early Works and main Project development phases. This is further delineated in Figure 25.1 and Figure 25.2, which demonstrate the linkages between the various impact areas (identified as 'aspects') and the mechanisms, impacts/benefits and proposed mitigation measures.

Provided that these measures are implemented, the risk and significance of potential health repercussions associated with the Project and its activities during all Project development phases are low and acceptable from a regulatory perspective. However, as part of wider ongoing monitoring and evaluation processes, it is proposed that monitoring data for air quality, noise and traffic is regularly reviewed against the guidelines developed in the specialist studies supporting this EIS, as they are based on protecting the health of the community. Should exceedances be identified in these key indicators as a result of the Project, then a further and more targeted monitoring and management program would be developed as required.

It is considered that the issues associated with equity would largely be addressed by implementing the recommendations identified in Chapter 24 – *Social and economic impacts*; in particular, promotion of employment of local people and engagement of the local supply chain where feasible, and targeted engagement with vulnerable groups as required.

Chapter 28 – *Environmental management framework* provides a summary of the specific management and mitigation measures proposed for impacts that may affect the health of the local population.

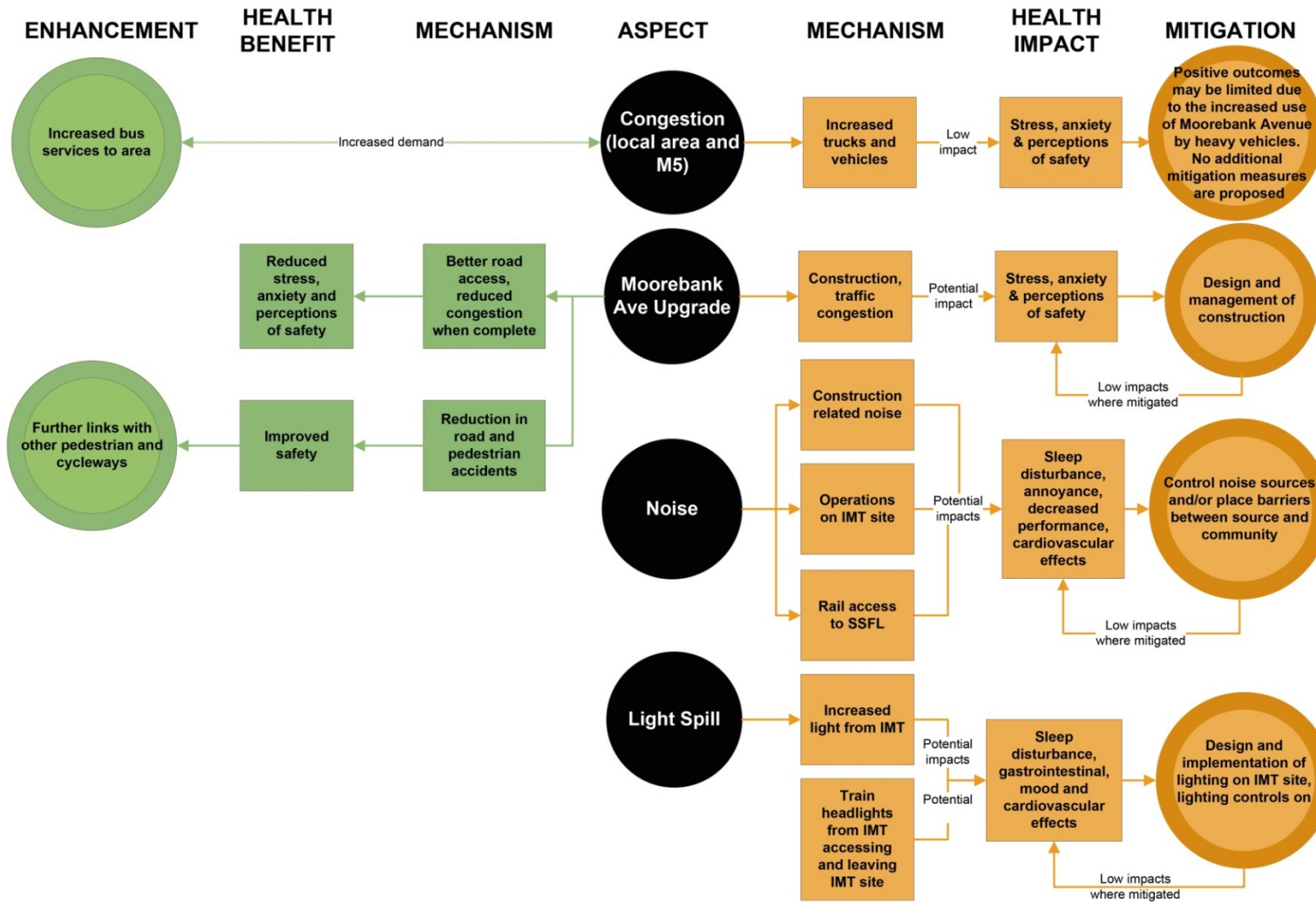


Figure 25.1 Summary of the HIA process and outcomes – Part A (see Part B over page)

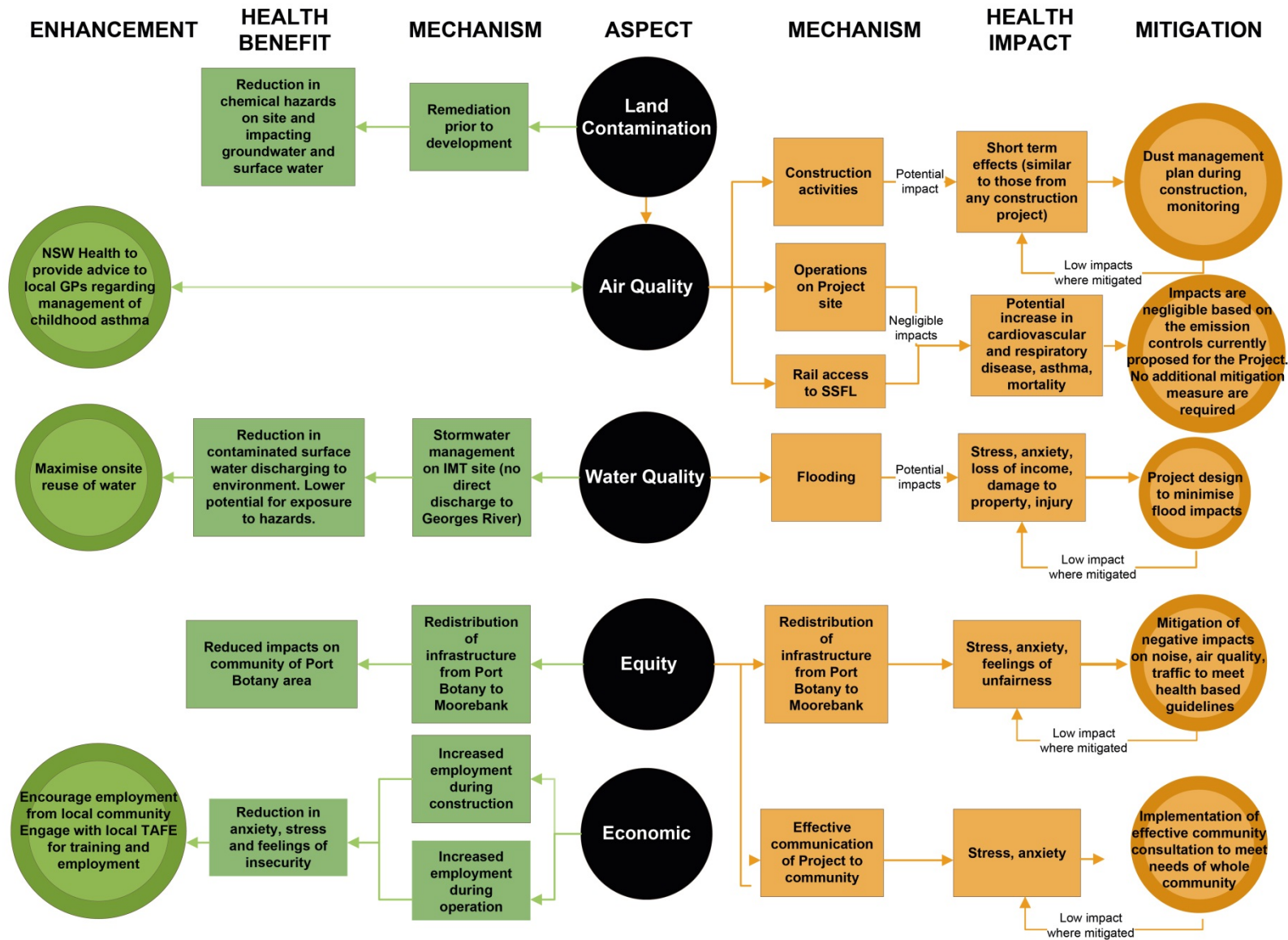


Figure 25.2 Summary of the HIA process and outcomes – Part B

## 25.7 Summary

The key aspects of the HHRA and the HIA are summarised below:

- The HIA screening assessment determined that three of the potential aspects relating to health issues and opportunities required a detailed HIA: traffic, transport and access; noise; and air quality.
- The detailed HIA identified the following:
  - > Traffic congestion has the potential to contribute to health impacts such as stress and anxiety. This would affect users of Moorebank Avenue during construction; however, once proposed mitigation measures are implemented, the Project is anticipated to have net positive health outcomes in relation to traffic congestion.
  - > The upgrade of Moorebank Avenue and a reduction in heavy vehicle traffic on roads within the wider network are anticipated to improve road safety.
  - > Noise can have a range of health impacts such as sleep disturbance and cardiovascular health problems. Without mitigation, construction and operation of the Project would potentially lead to health concerns; however, provided that the proposed mitigation measures are implemented, then the noise levels should remain within the acceptable levels, with the likelihood of any health impact being negligible.
  - > During both construction and operation, levels of oxides of nitrogen, sulfur dioxide, carbon monoxide, VOCs and PAHs were all estimated to be low and acceptable.
  - > Larger particulates (PM<sub>10</sub>) are anticipated to dominate PM emissions during early construction (e.g. earthworks), while smaller particles (PM<sub>2.5</sub>) would increase as the use of diesel combustion sources increases over the Project's life. Exposure to PM is linked to various health impacts, such as respiratory illnesses and changes in cardiovascular risk factors. However, the HIA found that the Project's potential health risks or impacts are low.
  - > Impacts on human health during Early Works would be negligible.

Table 25.3 provides a summary of the human health impact of the Project at Full Build, without mitigation, for each rail access option.

Based on these findings, the mitigation measures proposed for local air quality, noise and vibration and, traffic and access would ensure that any human health impacts remain within acceptable levels.

Table 25.3 Summary of human health impacts at Full Build, without mitigation, for each rail access option

Impact	IMT layout and associated rail access connection option		
	Northern	Central	Southern
<b>Operation of the IMT</b>			
Positive impact on human health as a result of reduced traffic congestion (e.g. reduced stress and anxiety) for users of Moorebank Avenue.	•	•	•
Improved road safety along Moorebank Avenue and the wider road network.	•	•	•
Potential for human health issues as a result of noise from the IMT and associated rail access (such as annoyance, sleep disturbance, performance issues (reduced concentration) and health problems).	•	•	•
Increase in air pollutant concentrations potentially leading to human health issues, where the impacts are considered to be unacceptable (e.g. the impacts are greater than negligible).	-	-	-
Measurable changes in existing PM <sub>2.5</sub> levels leading to various health impacts, such as respiratory illnesses and changes in cardiovascular risk factors.	-	-	-

Key: • = impact, - = no impact