



Australian Government

**BUILDING OUR FUTURE**



# M1 Pacific Motorway extension to Raymond Terrace

Environmental impact statement –  
Chapter 23: Cumulative impacts

Transport for NSW | July 2021



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## 23. Cumulative impacts

Cumulative impacts may arise from the interaction of construction and operation activities of the project, and other developments in the area. When considered in isolation, specific project impacts may be considered minor. These minor impacts may, however, be more substantial when the impact of multiple projects on the same receivers are considered.

This chapter presents an assessment of the potential cumulative impacts associated with the construction and operation of the project when considered together with other developments and activities occurring near the project and presents the approach to the management of these impacts.

**Table 23-1** outlines the SEARs as they relate to cumulative impacts and where they are addressed.

Table 23-1 SEARs (cumulative impacts)

Secretary's requirement	Where addressed in EIS
2. Environmental Impact Statement	
1. The EIS must include, but not necessarily be limited to, the following:	
(o) An assessment of the cumulative impacts of the project taking into account other projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed	Projects identified for the cumulative impact assessment, including their approval status, are described in <b>Section 23.2</b> . For this assessment, these projects are referred to as "developments". An assessment of the potential cumulative impacts of the project on key environmental issues (as identified in the SEARs) is provided in <b>Section 23.3</b> .

### 23.1 Assessment methodology

The following websites were searched in September 2020 for recent or proposed developments that could interact with the project:

- NSW DPIE Major Projects Register
- Transport for NSW (formerly Roads and Maritime Services)
- Port Stephens Council
- Cessnock City Council
- City of Newcastle.

Developments considered in the cumulative impact assessment were selected based on the following criteria:

- Size: all major developments or known developments planned in the study area were considered
- Location: includes developments planned near the project
- Timeframe: relevant developments recently completed or likely to be carried out at some point during the construction of, and would interact with, the project.

Generally, cumulative impacts have been qualitatively assessed, with the expected cumulative impacts determined based on the perceived likelihood of impact and scale of interaction between the project and those identified for the cumulative assessment (refer to **Table 23-2**). In some cases, a quantitative assessment (e.g. traffic modelling) was also carried out to identify and assess the potential cumulative impacts of the project. Further information on the planned or proposed upgrades to the road network that were included in the operational traffic assessment are provided in **Section 7.2.3**.

Consultation with the relevant stakeholders for the developments listed in **Table 23-2** has been ongoing in order to understand how these other developments interact with the project and ensure they are appropriately considered in the cumulative impact assessment.

## 23.2 Identified developments

Identified developments that may contribute to the cumulative impacts of the project are described in **Table 23-2** and their relative location compared to the project shown on **Figure 23-1**. As the alignment for the Lower Hunter Freight Corridor development has not yet been determined, this development is not shown on **Figure 23-1**. The Chichester Trunk Gravity Main is also not shown on **Figure 23-1**, but is described as an existing utility in **Section 5.3.15**.

Where construction timeframes are not known, predictions have been made about the likelihood of overlapping construction periods, based on the most current and publicly available information. As discussed in **Chapter 5**, construction of the project is expected to begin in 2023 and be completed in 2028, with work occurring across the full length of the construction footprint during this period.

Table 23-2 Developments considered in the cumulative impact assessment

Project	Description	Status	Proximity	Construction timeframes	Relevance in consideration of cumulative impact
Black Hill Employment Lands	<ul style="list-style-type: none"> <li>Part of the Emerging Black Hill Precinct</li> <li>Subdivision of land (about 223 hectares) to create 39 light industrial lots and one environmental conservation lot. The development will be delivered in six stages, including the remediation of the site and removal of vegetation to ensure that the site is suitable for future industrial use.</li> </ul>	Refused in October 2020 by the Hunter and Central Coast Regional Planning Panel, but subject to current Land and Environment Court appeal proceedings.	In Black Hill; south of John Renshaw Drive and west of the M1 Pacific Motorway	No timeframe information (construction overlap assumed)	<p>For the purpose of the cumulative impact assessment, it has been assumed that this land will be developed in the future, even though development consent has not yet been granted to the current proposed development of the land. For the purposes of this assessment, the following has been assumed:</p> <ul style="list-style-type: none"> <li>Located about one kilometre west of the construction footprint, near John Renshaw Drive, Black Hill</li> <li>Likely to be some overlap in the construction timeframes</li> <li>Likely to be in concurrent operation with the project.</li> </ul>
Black Hill Hunter Business Park	<ul style="list-style-type: none"> <li>Part of the Emerging Black Hill Precinct</li> <li>A three lot “englobo” industrial subdivision of the site which has an area of about 183 hectares. The development will be delivered in stages, with stage one comprising of a 62 lot industrial subdivision totalling 41.7 hectares</li> <li>Land clearing of the whole development footprint, to be undertaken in stages.</li> </ul>	Pending outcome of the development application lodged with Newcastle City Council in January 2021.	Next to the construction footprint in Black Hill; south of John Renshaw Drive and west the M1 Pacific Motorway	No timeframe information (construction overlap assumed)	<p>For the purpose of the cumulative impact assessment, it has been assumed that this land will be developed in the future even though development consent has not yet been granted to the current proposed development of the land. For the purposes of this assessment, the following has been assumed:</p> <ul style="list-style-type: none"> <li>Located next to the construction footprint in Black Hill, south of John Renshaw Drive and west of the M1 Pacific Motorway</li> <li>Likely to be some overlap in the construction timeframes</li> <li>Likely to be in concurrent operation with the project.</li> </ul>

Project	Description	Status	Proximity	Construction timeframes	Relevance in consideration of cumulative impact
Kinross Industrial / Weathertex, Heatherbrae	<ul style="list-style-type: none"> <li>Subdivision of land to create 142 commercial and industrial lots, to be carried out in nine stages.</li> </ul>	Approved in 2009	In Heatherbrae; partially within the construction footprint, including land proposed to be used for AS16, AS18 and AS19	Construction and operation is progressing in stages, with some stages under construction in 2021-22.	<ul style="list-style-type: none"> <li>Located in Heatherbrae to the east and west of Masonite Road, partially within the construction footprint</li> <li>Likely to be consecutive (back to back) construction and concurrent operation</li> <li>If the Kinross Industrial / Weathertex development is constructed prior to, or at the same time as the project, AS16, AS18 and AS19 may be unavailable for use.</li> </ul>
Newcastle Power Station	<ul style="list-style-type: none"> <li>The construction and use of a 250 megawatt gas-fired power station. Associated infrastructure will include gas pipelines, electricity transmission lines, site access provisions and associated ancillary facilities. An underground gas supply line will connect the new power station with the existing Newcastle Gas Storage Facility.</li> </ul>	Approved in March 2021	In Tomago, between Old Punt Road and the Pacific Highway; within the construction footprint next to AS12 and AS13.	Construction planned between 2021 and 2022. Construction expected to take up to two years.	<ul style="list-style-type: none"> <li>Located within the construction footprint at Tomago, between Old Punt Road and the Pacific Highway</li> <li>Potential to be consecutive (back to back) construction and concurrent operation</li> <li>Consideration of the project has been given in the siting and layout of the power station.</li> </ul>
Hunter Gas Pipeline	<ul style="list-style-type: none"> <li>A planned underground gas pipeline from the Wallumbilla Gas Supply Hub near Roma, Queensland to connect to the NSW gas transmission network in Newcastle.</li> </ul>	Approved in 2009	Planned to cross the Pacific Highway at Tomago.	Construction planned between 2023 and 2028.	<ul style="list-style-type: none"> <li>This development will interact with the construction footprint as it will cross the Pacific Highway at Tomago</li> <li>Likely to be some overlap in the construction timeframes.</li> </ul>

Project	Description	Status	Proximity	Construction timeframes	Relevance in consideration of cumulative impact
Pacific Highway improvements at Hexham (Hexham Straight)	<ul style="list-style-type: none"> <li>Widening of about 6km of the Pacific Highway from four to six lanes. The development includes replacing the bridge at Ironbark Creek, adjustments to connecting roads and relocation of utility assets.</li> </ul>	In planning	At Hexham, between Sandgate and Hexham Bridge; south of the construction footprint	Timing is to be confirmed, however may occur within the same timeframe	<ul style="list-style-type: none"> <li>Located about one kilometre south of the project at Hexham</li> <li>Potential to be concurrent or consecutive (back to back) construction, and concurrent operation.</li> </ul>
Lower Hunter Freight Corridor	<ul style="list-style-type: none"> <li>A planned future rail infrastructure development enabling a dedicated freight rail line between Fassifern and Hexham, bypassing Newcastle, while improving regional and interstate links</li> <li>This development is currently under preliminary investigation.</li> </ul>	In planning	Between Black Hill and Tarro	No timeframe information available	<ul style="list-style-type: none"> <li>The investigation area extends from Fassifern to Hexham and Tarro</li> <li>The design of the project allows for the Lower Hunter Freight Corridor.</li> </ul>
Richmond Vale Rail Trail to Shortland, including Shortland to Tarro cycleway	<ul style="list-style-type: none"> <li>A 32km cycling and walking track along the former Richmond Vale rail line between Kurri Kurri and Hexham, along the former Chichester to Newcastle water pipeline between Shortland and Tarro, and through the Hunter Wetlands National Park.</li> </ul>	In planning	Between Kurri Kurri and Hexham, to Shortland and Tarro	No timeframe information available	<ul style="list-style-type: none"> <li>The Shortland to Tarro Bike Trail would intersect the project at Tarro</li> <li>The Richmond Vale Rail Trail has been considered in the design of the project.</li> </ul>
Chichester Trunk Gravity Main upgrade – Tarro	<ul style="list-style-type: none"> <li>Construction of 2.2km of new 1200mm diameter buried water main between Beresfield and Tarro</li> </ul>	Completed in 2016	At Tarro, south of the New England Highway, within the construction footprint	Completed	<ul style="list-style-type: none"> <li>A section of the upgraded water main would be impacted by the project and would require protection and/or relocation.</li> </ul>



Project	Description	Status	Proximity	Construction timeframes	Relevance in consideration of cumulative impact
M1 Pacific Motorway Upgrade – Weakleys Drive and John Renshaw Drive	<ul style="list-style-type: none"> <li>Replacement of a roundabout with a signalised intersection, including additional turning lanes and cyclist provisions</li> </ul>	Completed in 2019	At Black Hill at the intersection of Weakleys Drive and John Renshaw Drive, within the construction footprint	Completed	<ul style="list-style-type: none"> <li>The project provides a connection to the recently upgraded Weakleys Drive and John Renshaw Drive intersection via northbound and southbound ramps</li> <li>The project has been designed to operate in conjunction with the recent intersection upgrade.</li> </ul>



Figure 23-1 Developments considered in the cumulative impact assessment

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## 23.3 Assessment of potential impacts

As described in **Section 23.2**, the identified developments with the potential to interact with the project are in various stages of delivery and planning, with a number of developments yet to be approved by the relevant authority. The likely impacts of these developments will be assessed by the relevant approval authority as part of the development consent process for each development.

The potential cumulative impacts during construction and/or operation are described and assessed in **Table 23-3**.

Table 23-3 Potential cumulative impacts during construction and operation

Key issue	Level of cumulative impact	Potential cumulative impact
Traffic and transport	<ul style="list-style-type: none"> <li>• Minor negative short-term impacts.</li> <li>• Positive long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative traffic and transport impacts should the construction timeframes and/or operation of the developments identified in <b>Section 23.2</b> overlap with the project's construction timeframe.</p> <p>To support the cumulative traffic impact assessment and characterise likely future traffic conditions, the traffic model for the project included consideration of the Hexham Straight and the developments proposed in the Emerging Black Hill Precinct (Black Hill Employment Lands and Black Hill Hunter Business Park). The traffic model has also taken into account forecasts for population and employment growth, and inter-regional traffic growth for future years. Refer to <b>Chapter 7</b> (traffic and transport) and the Traffic and Transport Working Paper (<b>Appendix G</b>) for further details.</p> <p>With the exception of construction work on the southern side of the M1 Pacific Motorway / Weakleys Drive intersection, construction of the project is not expected to interact with the construction of developments in the Emerging Black Hill Precinct. Should the project and the Emerging Black Hill Precinct developments be constructed concurrently, it is unlikely that construction accesses would be impacted. Further, cumulative traffic volumes from these potential interactions would be considered minor when compared with existing traffic volumes on the road network in this location. Transport would be responsible for managing any approvals to works at this potential conflict point and should the other upgrades be required in this location associated with the development, construction works on this important part of the road network would be managed closely by Transport with clear controls and conditions in place to minimise cumulative construction impacts.</p> <p>Cumulative construction traffic volumes are not expected to exceed capacity (including heavy vehicle capacity) across the road network, however overlapping construction timeframes may extend potential disruptions relating to amenity (such as travel times) for road users.</p> <p>Any developments requiring construction work to be carried out on, or utilising, the National Land Transport Network or state roads would be subject to approval by Transport, and conditions would be applied to facilitate collaborative construction work arrangements with the project.</p>

Key issue	Level of cumulative impact	Potential cumulative impact
		<p><b>Operation</b></p> <p>The employment-driving developments planned in the Emerging Black Hill Precinct are expected to be key generators of traffic in the region in future years. The Emerging Black Hill Precinct is expected to account for 11 per cent of all trips in the study area by 2038, and 12 per cent of all trips by 2048. By 2048 (when the precinct is assumed to be 100% complete), the precinct is expected to account for 7,528 trips to Black Hill in the morning peak period, and 8,635 trips in the evening peak period.</p> <p>Once operational, the project would provide an improved highway environment for road users, with additional benefits to be experienced with the implementation of the Hexham Straight development. The improved road network performance associated with the project would assist in mitigating the likely increases in traffic volumes and travel times expected to result from the developments identified in <b>Section 23.2</b>.</p> <p>However, the Emerging Black Hill Precinct developments substantially impact the performance of the network in future horizon years due to the magnitude of traffic generated out of the developments. These developments would be required to implement additional capacity improvements, such as alternate access and road upgrades, to ensure future operation through this area of the road network.</p> <p>Cumulative impacts on traffic and transport are further discussed in <b>Chapter 7</b> (traffic and transport) and the Traffic and Transport Working Paper (<b>Appendix G</b>).</p>
Noise and vibration	<ul style="list-style-type: none"> <li>• Minor negative short-term impacts</li> <li>• Minor negative long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative noise and vibration impacts where construction timeframes overlap, particularly in areas close to sensitive receivers. Generally, construction works for the project would occur over a temporary period at one particular location then move to another, so impacts would be short-term in nature. Project construction work would typically also be located closer to sensitive receivers than the other developments identified in <b>Section 23.2</b>, meaning construction noise from other developments would be substantially less than the construction noise from the project.</p> <p><b>Operation</b></p> <p>Noise and vibration impacts have been assessed using the traffic model for the project, which accounts for forecasted traffic growth and traffic generated by the Emerging Black Hill Precinct for the design year 2038. The noise mitigation measures identified in <b>Chapter 8</b> (noise and vibration), such as low noise pavements, noise barriers and at property treatments, have therefore considered the cumulative impacts of forecast increases in traffic noise generated by the developments identified in <b>Section 23.2</b>.</p> <p>Cumulative impacts on noise and vibration are further discussed in the Noise and Vibration Working Paper (<b>Appendix H</b>).</p>

Key issue	Level of cumulative impact	Potential cumulative impact
Biodiversity	<ul style="list-style-type: none"> <li>Moderate negative long-term impacts.</li> </ul>	<p>Cumulative biodiversity impacts associated with the direct loss of native vegetation and increased habitat fragmentation have the potential to have impacts in the long-term. The developments which have the highest potential to add to the cumulative biodiversity impacts of the project are the Emerging Black Hill Precinct developments, the Newcastle Power Station and the Kinross Industrial / Weathertex development. Should the developments identified in <b>Section 23.2</b> be developed, it is estimated that a total of 180 hectares of vegetation would be removed, including threatened flora species, PCTs, TECs, threatened fauna and Koala habitat and Coastal Wetlands. This is a conservative estimate based on publicly available information. The project would involve the removal of an additional 174 hectares of vegetation (of which around 136 hectares comprise TECs).</p> <p>The project would also directly impact 161 individuals of <i>Diuris arenaria</i>, which is listed as Vulnerable under the TSC Act. In addition, clearing for the Kinross Industrial / Weathertex development (in the location of ancillary facility AS16) has already occurred, removing about 25 hectares of remnant vegetation, including <i>Diuris arenaria</i>. Cumulatively, the project and the Kinross Industrial / Weathertex development would impact 721 plants of this species, representing around 49.8 per cent of the estimated local population.</p> <p>Cumulative impacts on biodiversity are further discussed in the Biodiversity Assessment Report (<b>Appendix I</b>).</p>
Hydrology and flooding	<ul style="list-style-type: none"> <li>Negligible-minor negative short-term impacts</li> <li>Negligible-minor negative long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>Should construction of the project take place concurrently with the developments identified in <b>Section 23.2</b>, there is potential for increased rates, volumes and velocities of construction runoff and stormwater to be discharged into the nearby receiving waterways, such as Windeyers Creek, Viney Creek and the Hunter River. It is expected that the developments identified in <b>Section 23.2</b> would implement appropriate construction management measures to control discharge.</p> <p>Potential cumulative impacts on groundwater flow during construction are expected to be minor to negligible as no material impacts to groundwater level and flow are anticipated to occur due to the project.</p> <p><b>Operation</b></p> <p>During operation, it is expected that cumulative impacts on flow, geomorphic stability and sensitive receiving environments will be negligible, however some of the developments identified in <b>Section 23.2</b> are expected to result in minor cumulative flooding impacts. The Kinross Industrial / Weathertex development is expected to result in cumulative flooding impacts of up to a 0.04m total increase in 1% AEP flood levels around this project. The Newcastle Power Station development is also expected to result in a minor additional increase in flood levels on the eastern floodplain of the Hunter River between Tomago and Heatherbrae, particularly in the 20% AEP event, due to an anticipated 30 per cent increase in runoff volumes from the power station site. It is expected that these developments would effectively manage and mitigate their associated flood risks.</p> <p>Cumulative impacts on hydrology and flooding are further discussed in the Hydrology and Flooding Working Paper (<b>Appendix J</b>).</p>

Key issue	Level of cumulative impact	Potential cumulative impact
Surface water and groundwater quality	<ul style="list-style-type: none"> <li>• Negligible short-term impacts</li> <li>• Negligible negative long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>Potential cumulative impacts on surface water and groundwater quality during construction are expected to be negligible. Should construction of the project take place concurrently with the developments identified in <b>Section 23.2</b> there is potential for construction runoff to be discharged into nearby receiving waterways, which may result in elevated levels of heavy metals, hydrocarbons or other contaminants such as litter that may impact aquatic ecosystem health. There is also potential for increased erosion and sedimentation, and subsequent cumulative downstream water quality impacts. However, with the implementation of management measures it is expected that downstream water quality impacts and erosion and sedimentation would be mitigated.</p> <p>There is potential for earthworks and excavation associated with the Kinross Industrial / Weathertex development to result in changes to drinking water quality in the Tomago Sandbeds Catchment Area, however construction activities associated with the developments identified in <b>Section 23.2</b> are expected to be managed to avoid impacts to the Tomago Sandbeds Catchment Area. Construction discharges would be designed and implemented in accordance with standard practices and guidelines to ensure minimal water quality impacts. No cumulative groundwater quality impacts are expected.</p> <p><b>Operation</b></p> <p>With the implementation of water quality control measures, cumulative impacts on surface water and groundwater quality during operation, including to the Tomago Sandbeds Catchment Area, are expected to be negligible, as drainage structures and water quality control measures for runoff would be designed to ensure minimal impacts and to comply with licenced discharges.</p> <p>Cumulative impacts on surface water and groundwater quality are further discussed in the Surface Water and Groundwater Quality Working Paper (<b>Appendix K</b>).</p>

Key issue	Level of cumulative impact	Potential cumulative impact
Aboriginal heritage	<ul style="list-style-type: none"> <li>Major permanent impacts for lower altitude areas that fringe the Hexham Swamp</li> <li>Moderate permanent impacts for higher altitude areas at Black Hill</li> <li>Moderate permanent impacts in the Tomago Sands area</li> <li>Minor permanent impacts on the Hunter River floodplain.</li> </ul>	<p>For Aboriginal heritage, overlapping construction or operational timeframes do not usually add to the overall level of impact as it does for other environmental impacts. This is because once physical changes are made, regardless of whether they are made at the same time or separately, the impact level does not change.</p> <p>Land within the construction footprint has historically been extensively disturbed by farming and settlement to the point that there is little undisturbed land remaining. Other past disturbing activities include the establishment of rail and road corridors, bridges, petrol stations, industrial precincts, warehouses and saleyards. In consideration of these historical matters, the design of the project has adopted as narrow a footprint as possible in all areas in order to minimise cumulative impacts to Aboriginal sites. The design has also placed the main alignment as close as possible to existing infrastructure to further limit impacts to previously undisturbed areas.</p> <p>The impacts of the historical development on the cultural landscape where the project is located have been substantial, including the relocation of the Chichester Trunk Gravity Main. All identified Aboriginal archaeological sites within the construction footprint have been considered in relation to the project, however some level of impact is unavoidable. While the project is a relatively narrow, linear infrastructure project, when assessed cumulatively with previous development in the area the overall impact on the remaining resource is increased. Cumulative impacts are considered to be comparatively high for the lower altitudes in the Black Hill area that fringe Hexham Swamp however, lesser in the Tomago Sands area and Black Hill, and even less so in the Hunter River floodplain.</p> <p>Cumulative impacts on Aboriginal heritage are further discussed in the Aboriginal Cultural Heritage Assessment Report (<b>Appendix L</b>).</p>
Socio-economic	<ul style="list-style-type: none"> <li>Minor negative and positive short-term impacts</li> <li>Minor positive long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>It is anticipated that there would be minor short-term socio-economic impacts on local communities as residents and businesses in close proximity to the construction footprint may experience a range of amenity impacts such as noise, vibration, visual changes, air quality and traffic and access impacts.</p> <p>Where construction timeframes for the developments identified in <b>Section 23.2</b> would occur sequentially, there is also potential for extended period of disturbance and disruptions for local communities (for example, construction noise, dust, traffic delays and disruptions), potentially resulting in construction fatigue for some community members. The developments identified in <b>Section 23.2</b> would also cumulatively increase construction traffic on the road network and result in increased demand for construction workers.</p> <p>The project would have a positive cumulative impact for local businesses and workers due to increased demand for goods and services to support construction activities, as well as an increased demand for construction workers from the Hunter region.</p> <p><b>Operation</b></p> <p>During operation, the project is expected to have a minor positive cumulative impact on future industrial development in the area through improved access and connectivity for freight and commercial vehicles.</p> <p>Cumulative impacts on socio-economics are further discussed in the Socio-economic Working Paper (<b>Appendix M</b>).</p>

Key issue	Level of cumulative impact	Potential cumulative impact
Land use and property	<ul style="list-style-type: none"> <li>• Minor negative short-term impacts</li> <li>• Minor positive long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative land use and property impacts associated with the loss of farming land and prolonged disruptions to private property accesses. The project is located next to existing road infrastructure where possible to minimise land use and property impacts, however extended disruptions on land uses surrounding the project and developments identified in <b>Section 23.2</b> may be experienced due to sequential or consecutive construction timeframes. Impacts from the Lower Hunter Freight Corridor may result in additional property acquisition, loss of farming land and disruption to private property accesses in the Black Hill and Tarro areas.</p> <p><b>Operation</b></p> <p>Following construction, the project is expected to have positive cumulative impacts in relation to road access and transport efficiency, particularly for freight and commercial vehicles. The project would support existing land uses and future industrial and commercial growth and development in the area, for example in the Emerging Black Hill Precinct. Cumulative impacts on land use and property are further discussed in the Land Use and Property Working Paper (<b>Appendix N</b>).</p>
Urban design, landscape character and visual amenity	<ul style="list-style-type: none"> <li>• Minor short-term impacts</li> <li>• Minor long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative urban design, landscape character and visual amenity impacts associated with extended periods of traffic disruptions and altered access arrangements, extended periods of impacts on local communities in the study area (including noise, dust, traffic, lighting and visual disruptions leading to construction fatigue), and an increase in construction traffic on the road network.</p> <p><b>Operation</b></p> <p>Permanent land use changes as a result of other developments identified in <b>Section 23.2</b> would contribute to the cumulative landscape character and visual impact of the project once operational. This would also involve changes to the built form and spatial character of the area.</p> <p>As the project is located in an area undergoing considerable change and development, the contribution of the project to cumulative landscape character and visual amenity impacts on communities in the area is considered minor.</p> <p>Cumulative impacts on urban design, landscape character and visual amenity are further discussed in the Urban Design, Landscape Character and Visual Amenity Working Paper (<b>Appendix O</b>).</p>



Key issue	Level of cumulative impact	Potential cumulative impact
Soils and contamination	<ul style="list-style-type: none"> <li>• Minor negative short-term impacts</li> <li>• No negative long-term impacts expected.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative soils and contamination impacts associated with ground-disturbing activities for the developments identified in <b>Section 23.2</b>. Considering the project is generally located next to existing infrastructure, the cumulative soils and contamination impacts of the project are expected to be minor.</p> <p>Potential cumulative soils and contamination impacts during construction represent an increased risk of ASS exposure and mobilisation of contaminants into waterways surrounding the project. Should construction of the project be carried out consecutively or simultaneously with the construction of the developments identified in <b>Section 23.2</b>, cumulative impacts associated with dust generation and ground contamination may be experienced.</p> <p><b>Operation</b></p> <p>No cumulative impacts on soils and contamination are expected during project operation.</p> <p>Cumulative impacts on soils and contamination are further discussed in the Soils and Contamination Working Paper (<b>Appendix P</b>).</p>
Non-Aboriginal heritage	<ul style="list-style-type: none"> <li>• Negligible impacts.</li> </ul>	<p>For non-Aboriginal heritage, overlapping construction or operational timeframes do not usually add to the overall level of heritage impact as it does for other environmental impacts. This is because once physical changes are made to a heritage place, regardless of whether they are made at the same time or separately, the impact level does not change.</p> <p>The project would have a direct impact on some non-Aboriginal heritage items, as well as indirect visual impacts on other heritage sites and landscapes. A number of the developments identified in <b>Section 23.2</b> either would, or have the potential to, impact on non-Aboriginal heritage items, however the project is not expected to result in any further, cumulative impacts to these items.</p> <p>Cumulative impacts on non-Aboriginal heritage are further discussed in the Non-Aboriginal Heritage Working Paper (<b>Appendix Q</b>).</p>
Air quality	<ul style="list-style-type: none"> <li>• Minor negative short-term impacts</li> <li>• Negligible negative long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>Potential cumulative air quality impacts during construction are expected to be negligible. Some of the developments identified in <b>Section 23.2</b> would contribute to local air quality during construction, with cumulative air quality impacts expected where construction timeframes overlap. However, the contribution of the developments identified in <b>Section 23.2</b> to local air quality is not significant enough to influence the assumed background levels or outcomes of the air quality assessment.</p> <p><b>Operation</b></p> <p>Cumulative local air quality impacts are expected to be negligible during project operation.</p> <p>Cumulative impacts on air quality are further discussed in the Air Quality Working Paper (<b>Appendix R</b>).</p>

Key issue	Level of cumulative impact	Potential cumulative impact
Waste	<ul style="list-style-type: none"> <li>• Negligible negative short-term impacts</li> <li>• Negligible negative long-term impacts.</li> </ul>	<p><b>Construction</b></p> <p>There is the potential for minor cumulative waste impacts during construction associated with overlapping construction timeframes.</p> <p>Construction of the project is expected to produce manageable waste quantities and waste that is generated by the project will be managed using the waste hierarchy as a guideline. Waste that is not able to be reused onsite will be processed at a licensed waste facility. Construction of concurrent developments would affect the amount of waste that is generated in the area, however additional waste generated by the developments identified in <b>Section 23.2</b> are expected to have a negligible impact on the capacity of regional waste facilities.</p> <p><b>Operation</b></p> <p>The project is expected to generate minimal waste during operation. Waste expected from the other developments identified in <b>Section 23.2</b> is expected to be minimal, except for Black Hill Employment Lands and Black Hill Hunter Business Park, which would likely generate more operational waste.</p> <p>Cumulative impacts on waste are further discussed in the Waste Working Paper (<b>Appendix S</b>).</p>
Climate change risk	<ul style="list-style-type: none"> <li>• Minor negative long-term impacts.</li> </ul>	<p>Construction and operational greenhouse gas emissions arising from the project would contribute towards the total annual greenhouse gas emissions of NSW and Australia.</p> <p>By reducing road traffic congestion, the project would result in lower carbon emissions per kilometre travelled when compared to the 'without project' scenario. The project would therefore have a positive cumulative impact on carbon emissions per kilometre travelled for road users travelling on the project to and from the developments identified in <b>Section 23.2</b>.</p> <p>The contribution of the project to the cumulative impact on climate change risk and greenhouse gas in the area is minor. Cumulative impacts on climate change risk and greenhouse gas are further discussed in the Climate Change Risk Working Paper (<b>Appendix U</b>).</p>

## 23.4 Environmental management measures

Developments which have the potential to interact with the project have been considered during the development of the project design (refer to **Chapter 4**).

In addition to the measures outlined in **Chapter 7** (traffic and transport) to **Chapter 22** (safety and risk), the environmental management measures presented in **Table 23-4** will be implemented to minimise the cumulative impacts of the project.

Table 23-4 Environmental management measures (cumulative impacts)

Impact	ID	Management measure	Responsibility	Timing
Cumulative impacts	CI01	The construction contractor will review traffic impacts before the start of construction and as required during construction. Any changes to manage cumulative traffic impacts will be included in the Traffic Management Plan (TMP).	Contractor	Prior to construction/ construction