

6.17 Cumulative impacts

This section discusses the potential cumulative impacts that may arise as a result of the construction and operation of the proposal, and the interaction of these impacts with other identified major developments within the local area. The cumulative impacts relate to:

- The individual environmental impacts of the proposal
- The combined effects of this proposal and other proposals in the vicinity of the proposal that form part of the wider program to upgrade the Great Western Highway (refer to Section 3.1)
- The combined effects of this proposal and other projects beyond the Great Western Highway program (refer to Section 1.1).

While this REF focuses on the potential environmental impacts of this proposal, it is important these potential impacts are considered in their wider contextual surroundings. Cumulative impacts are those that may not be considered significant on their own but that may be more significant when considered in association with other impacts. Cumulative impacts may occur as the result of the interaction of impacts within a single project or due to the combined effects of a number of projects occurring simultaneously in a given area.

The consequences that may arise from the effects of incremental development are usually described as 'cumulative environmental impacts'. Cumulative impacts have the potential to arise from the following:

- The interaction of individual elements within the proposal and surrounds
- The additive effects of the proposal with other external projects
- The additive effects of the proposal with other road upgrade projects in the Blue Mountains.

In accordance with Clause 228(2) of the EP&A Regulation 2000, any cumulative environmental effects of the proposal with other existing and likely future activities must be taken into account in assessing the potential environmental impacts of the proposal. These can be viewed as either positive or negative cumulative impacts and are discussed below.

An assessment of cumulative environmental impacts has been undertaken based on the following criteria:

- Size of the proposed or existing project which was generally limited to major developments
- Type of project or proposal with emphasis being placed on other road upgrades being or proposed to be undertaken
- Location of the proposal or project with only those projects within the broader Blue Mountains region being considered
- Timeframe of the proposal or project with only those projects likely to be constructed concurrently with the proposal being considered for construction impacts in addition to other proposals that may occur subsequent to the Forty Bends upgrade (such as the future development of the Mount Victoria to Lithgow corridor) being considered for operational impacts.

6.17.1 Study area

The study area for the purpose of the cumulative impact assessment includes the following suburbs within the proposal corridor such as Little Hartley, Hartley, South Bowenfels and Hassans Walls and suburbs adjacent to the proposal corridor such as Bowenfels, Lithgow, Mt Victoria, Littleton, South Littleton, Sheedy's Gully and Kanimbla.

6.17.2 Broader program of work

The proposal forms part of the broader Great Western Highway Upgrade Program between Katoomba and Lithgow. The Great Western Highway Upgrade Program is an infrastructure program of national importance. It will make the Blue Mountains, the Central West and Orana more attractive places to live, and will unlock the potential of regional NSW.

The NSW Government has progressively upgraded sections of the Great Western Highway to make it safer and more reliable for all road users. The broader program will complete the final 34 km connection of a modern dual-carriageway link across the Blue Mountains.

The Great Western Highway Upgrade Program consists of:

- West Upgrade – Little Hartley to Lithgow (the proposal)
- Central Upgrade – Blackheath to Little Hartley
- Medlow Bath Upgrade
- East Upgrade - Katoomba to Medlow Bath and Medlow Bath to Blackheath.

These four proposals (described in Table 6-137) will be occurring both concurrently in timeframe and consecutively geographically and have the potential to result in cumulative impacts to local communities as well as road users throughout the Blue Mountains area.

Each proposal would be subject to a separate environmental assessment in accordance with the *Environmental Planning and Assessment Act 1979*.

6.17.3 Design proposals of the proposal

As described in Section 3.1, the proposal would be divided up into four separate design proposals. These include:

- Forty Bends to Lithgow
- River Lett to Forty Bends
- Little Hartley to River Lett
- Coxs River Road.

The impacts associated with these four design proposals have been considered individually and cumulatively.

6.17.4 Other projects and developments

The following sources were reviewed to identify potential projects within the cumulative impact assessment study area:

- Department of Planning, Industry and Environment Major Projects Register
- Transport for NSW website
- Infrastructure NSW website
- Lithgow City Council website
- Other government agencies and infrastructure providers websites.

Projects identified within the cumulative impact assessment study area were then considered against the screening criteria identified in Section 6.17. A description of projects that meet the screening criteria, along with their construction and operational impacts is provided in Table 6-137.

Table 6-137 Past, current and future projects

Project	Construction impacts	Operational impacts
Past projects		
<p>New Intercity Fleet Springwood to Lithgow Rail Corridor Modifications</p> <p>The project involved modifications to stations and other rail corridor upgrades extending between Springwood Station and Lithgow Station to facilitate the introduction of the new trains which are marginally wider and longer than existing trains. Key features included extension of platforms at Lithgow Station and re-positioning of rail tracks along the length of the rail corridor. Construction of the project commenced in 2018 and was completed 2020.</p>	<p>Impacts to State heritage listed and locally listed heritage items included platform extensions, platform coping modifications and other upgrades.</p>	<p>Operational impacts associated with the project are minimal.</p>
<p>Mount Victoria Village Safety Upgrade</p> <p>Roads and Maritime Services has carried out work on safety upgrades and road improvements on the Great Western Highway through Mount Victoria village including:</p> <ul style="list-style-type: none"> • Improvements along 1.6 kilometres of the existing highway, including changes and upgrades to intersections to make them safer • Widened road shoulders • Concrete footpaths for pedestrian access through the village. <p>The project commenced in 2014 and was completed in 2018.</p>	<ul style="list-style-type: none"> • The removal of about 0.55 hectares of 'Silvertop Ash – Narrow-leaved Peppermint open forest', which is a native vegetation community and removal of about 0.78 hectares of cleared and highly modified habitats. • Acquisition of a part of 18 properties. 	<ul style="list-style-type: none"> • Minor reduction in traffic noise • An increase in impervious land which may impact upstream flood levels and downstream flow rates • Visual impacts due to the removal of trees and widening of the roadway • Improved road safety and traffic performance
<p>Hartley Valley to Forty Bends road safety improvements</p> <p>Roads and Maritime carried out safety upgrades along the highway through Hartley Valley in the Blue Mountains. Improvements include road widening works, new culverts,</p>	<ul style="list-style-type: none"> • The removal of about 3.2 hectares of remnant native vegetation in varying degrees of condition and about 1.2 hectares of cleared and highly modified habitats including 0.86 hectares of the ecological community 'Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in 	<ul style="list-style-type: none"> • Improved road safety • Improved travel efficiency • Improved intersection performance • Improved and safer property access

Project	Construction impacts	Operational impacts
<p>upgrades to nine intersections, and an improved road surface.</p> <p>The project commenced in 2014 and was completed in 2017.</p>	<p>the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions'</p> <ul style="list-style-type: none"> Acquisition of a portions of 18 properties. 	<ul style="list-style-type: none"> Increase in the impervious area of roadway. This would result in an increase in downstream peak flow rates during rainfall events at five locations including a relatively substantial increase in downstream peak flow rates, impacting on a farm dam downstream through scour and loss of capacity

<p>Forty Bends upgrade</p> <p>Roads and Maritime Services upgraded and widened about 2.8 kilometres of the Great Western Highway at Forty Bends to three lanes with a central median along the majority of its length. The project included construction of a new twin bridge across Whites Creek.</p> <p>Construction of the project commenced in 2014 and was completed in 2017.</p>	<ul style="list-style-type: none"> Removal of 7.39 hectares of native vegetation and 15.27 hectares of cleared and modified habitat including 0.05 hectares of the endangered Ribbon Gum – Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highland. Destruction of an Aboriginal site of low significance Permanent acquisition of about 17.7 hectares of land (including the full acquisition of three private properties). 	<ul style="list-style-type: none"> Reduction in operational traffic noise Improved traffic performance and safety Changes to local property access along Great Western Highway to improve safety
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Current projects

<p>McKanes Bridge upgrade</p> <p>McKanes Bridge was built in 1893 and is one of only four remaining McDonald timber truss bridges in NSW. Its restoration would ensure one of the oldest examples of a McDonald timber truss bridge in NSW is conserved. The upgrade includes replacing old timber elements with new timber and new heritage sympathetic materials to strengthen the bridge, while still retaining the appearance and design of the original bridge. Work started in May 2020 and is expected to be complete by late 2021.</p>	<ul style="list-style-type: none"> Loss of non-Aboriginal heritage value through the replacement of some original fabric The removal of several mature trees Detour of traffic and increased travel times during construction due to the road closure Altered visual amenity of the proposal area during construction Water quality risks to Coxs River during construction. 	<ul style="list-style-type: none"> Improved access, reduced traffic disruption due to less frequent maintenance, and improved safety for all road users. Improved heritage outcome through the preservation of one of the last remaining examples of a McDonald timber truss bridge.
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Future projects

Project	Construction impacts	Operational impacts
<p>Medlow Bath Upgrade</p> <p>The proposal involves upgrading and duplicating the existing surface road corridor with intersection improvements and a new pedestrian bridge. The Review of Environmental Factors was exhibited for consultation in July and August 2021, with construction beginning late 2022</p>	<ul style="list-style-type: none"> • Removal of 0.36 hectares of native vegetation including 0.34 hectares of Silvertop Ash – Narrow-leaved Peppermint open forest resulting in a minor impact on habitat of some threatened species • Risk of sedimentation due to earthworks and vehicle movements • Construction traffic impacts resulting in delays and detours • Changes to pedestrian, cyclist and public transport access • Noise and vibration impacts to some receivers including a small number of receivers being highly noise affected • Impacts to the curtilage of the state heritage listed Medlow Bath Railway Station • Impacts to five local heritage items • Landscape and visual impacts particularly near Bellevue Crescent 	<ul style="list-style-type: none"> • Improvements to existing performance of the highway including accommodating future increases in traffic volumes • Improved traffic flows • Improved safety for vehicles with upgrade intersections • Reduced potential for pedestrian/vehicle collisions • A new shared path for pedestrians and cyclists • Operational noise impacts requiring additional noise mitigation at 13 receivers
<p>Central Upgrade – Blackheath to Little Hartley</p> <p>The proposal involves the construction of a tunnel bypass of Blackheath and Mount Victoria, with connectivity between the two proposed tunnels currently under further investigation. The southern end of the proposal would connect to the northern end of this proposal. It is anticipated that the Environmental Impact Statement will be exhibited for consultation mid 2022. Impacts identified in this table are high level only.</p>	<ul style="list-style-type: none"> • Transport and traffic, including road safety impacts • Air quality, including in-tunnel and ambient air quality impacts • Noise and vibration impacts • Socio-economic, land use and property impacts (including impacts on the Blue Mountains National Park) • Urban design, landscape character and visual amenity • Biodiversity impacts • Geology, groundwater and ground movement impacts 	<ul style="list-style-type: none"> • Improvements to existing performance of the highway including accommodating future increases in traffic volumes • Improved traffic flows • Improved safety for vehicles
<p>East Upgrade – Katoomba to Medlow Bath and Medlow Bath to Blackheath</p> <p>Katoomba to Medlow Bath and Medlow Bath to Blackheath – The proposal involves upgrading, duplicating and widening of the existing surface road corridor, with</p>	<ul style="list-style-type: none"> • Transport and traffic, including road safety impacts • Air quality impacts • Noise and vibration impacts • Socio-economic, land use and property impacts • Urban design, landscape character and visual amenity 	<ul style="list-style-type: none"> • Improvements to existing performance of the highway including accommodating future increases in traffic volumes • Improved traffic flows

Project	Construction impacts	Operational impacts
connections to a tunnel portal at Blackheath. It is anticipated that the Review of Environmental Factors will be exhibited for consultation in late 2021. Impacts identified in this table are high level only.	<ul style="list-style-type: none"> • Biodiversity impacts • Geology, groundwater and ground movement impacts 	<ul style="list-style-type: none"> • Improved safety for vehicles

6.17.5 Potential impacts

Potential cumulative impacts associated with the proposal and the other projects identified in Table 6-137 are summarised in Table 6-138. The individual contributions of each project to the cumulative impacts described in Table 6-138. are summarised in Table 6-137. Where project impacts do not meet the screening criteria identified in Section 6.17 they have not been considered further. Impacts that haven't been considered further include temporary impacts, such as noise and vibration, that have occurred greater than one year prior to the project being constructed. Where there is limited information on the impacts of projects, these impacts have been considered at a high level.

Table 6-138 Potential cumulative impacts

Environmental factor	Construction	Operation
Biodiversity	<p>The removal of about 86.69 hectares of native vegetation (of which the proposal accounts for 75.19 hectares) comprising a number of plant community types:</p> <ul style="list-style-type: none"> • Ribbon Gum – Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highland (0.05 hectares removed) • Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions (0.86 hectares removed) • Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South (0.89 hectares removed) Eastern Highlands and South East Corner • Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregion (17.59 hectares removed) listed as Endangered under the BC Act • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern 	<p>Operational biodiversity impact associated with nearby projects identified in Section 6.17.4 were assessed as being minor and therefore cumulative impacts would be minimal.</p>

Environmental factor	Construction	Operation
	<p>Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (5.82 hectares removed) listed as critically endangered under the BC Act and the EPBC Act.</p> <p>This vegetation would provide habitat for threatened fauna species.</p> <p>The removal of about 232.57 hectares of cleared and modified habitat of which the proposal accounts for 215.32 hectares.</p>	
<p>Traffic and transport</p>	<p>Interaction between construction and highway traffic would occur along the proposal area. The most significant impact would be during the AM peak and PM peak periods when the use of the highway is at its highest. However, during off peak periods, construction traffic is not anticipated to adversely impact operational efficiency on the highway.</p> <p>Vehicles travelling along the Great Western Highway between Katoomba and Lithgow would experience concurrent cumulative traffic impacts due to congestion resulting in delays associated with the broader Great Western Highway Upgrade Program. Road users would also experience consecutive cumulative traffic impacts associated with several recent safety upgrades to the Great Western Highway in the project area. This could contribute to construction fatigue.</p>	<p>Traffic modelling of future year periods indicate that the proposed upgrade would provide a safer, reliable and more efficient road corridor on the Great Western Highway between Little Hartley and Lithgow.</p>
<p>Noise and vibration</p>	<p>Potential for concurrent cumulative construction noise impacts associated with the proposal and the Central Upgrade – Blackheath to Little Hartley proposal. Since the construction scenarios required for both proposals would likely require similar items of equipment, concurrent construction work being completed near to a particular area could theoretically increase worst-case noise levels by around three decibels.</p> <p>The various stages of the upgrade of the Great Western Highway would result in overlapping proposals in the wider area. When the impacts from various stages of the program are combined with the impacts generated by the previous projects, they may result in consecutive impacts (i.e 'construction fatigue') at surrounding receivers due to construction works occurring over an extended period.</p>	<p>Operational cumulative noise impacts would generally be associated with construction traffic noise. Due to the linear nature of the Great Western Highway upgrades, cumulative operational traffic noise impacts would not be expected at any one receiver.</p>

Environmental factor	Construction	Operation
	<p>Residential receivers in proximity to the proposal could also experience consecutive cumulative noise and vibration impacts associated with several recent safety upgrades to the Great Western Highway in the project area. This could contribute to construction fatigue.</p>	
<p>Aboriginal heritage</p>	<p>The proposal study area contains a total of 29 Aboriginal sites, of which four sites (AHIMS 45-1105, 45-4-1106, 45-4-1074, 45-4-1075) were not assessed during the test excavation phase. Of the assessable sites, potential direct impact would occur to 20 sites. These direct impacts range from negligible to major. In addition, two sites would be subject to minor indirect impacts associated with vibration and settlement, and one site subject to moderate indirect impacts also associated with vibration and settlement. The sites themselves, whilst being expected site types found within the project area (artefact scatters, isolated artefacts, rock shelters, engravings and one post-contact site), are of increased significance due to their rarity in an increasingly developed environment. Therefore, the regional Aboriginal cultural heritage values across the project would be reduced significantly by the cumulative impacts from the project if serious harm such as complete loss of a site was to occur. However, potential negligible or indirect impacts to a site are not considered to be a risk for cumulative impacts to the region's archaeology should the mitigation measures outlined be followed. With the implementation of the mitigation measures outlined in Section 6.4.4, the potential negligible or indirect impacts associated with the proposal are not considered to be a risk for cumulative impacts to the region's archaeology.</p>	<p>The operation of the proposal would not result in any cumulative impacts to Aboriginal heritage.</p>
<p>Non-Aboriginal heritage</p>	<p>Projects carried out within the vicinity of the proposal have had a minor impact on non-Aboriginal heritage in the region. The proposal would likely have a moderate impact on State and locally listed heritage items when considered individually however would only have a minor impact when considered cumulatively. Potential cumulative impacts would direct physical impacts to non-Aboriginal heritage items. Indirect visual impacts and vibration impacts would also be expected from nearby heritage items.</p>	<p>Operational non-Aboriginal heritage impact associated with nearby projects identified in Section 6.17.4 were assessed as being minor and therefore cumulative impacts would be minimal.</p>
<p>Soils and surface water</p>	<p>Cumulative construction soil and surface water quality impacts would be minimal. Key risks would include increased risk of erosion and</p>	<p>Cumulative operation soils and surface water quality impacts would relate to risk of runoff,</p>

Environmental factor	Construction	Operation
	sedimentation, transport of materials to and from site and accidental spillages however these could be managed with the implementation of mitigation measures.	accidental leaks or spills and erosion from areas that have not been stabilised adequately. These risks would be managed through the implementation of mitigation measures.
Groundwater	Cumulative groundwater impacts associated with the construction of the proposal interacting with other major projects in the area are assessed as unlikely to occur. This is because no material impacts to groundwater due to the proposal are likely provided appropriate management measures are implemented.	Cumulative groundwater impacts associated with the operation of the proposal interacting with other major projects in the area are assessed as unlikely to occur. This is because no material impacts to groundwater due to the proposal are likely provided appropriate management measures are implemented.
Flooding	In a flooding context (stormwater generated outside the proposal) the cumulative impacts of the proposal are negligible. Floodwater would be conveyed across the proposed alignment without significant change in all but the most extreme floods.	The proposal would not result in any cumulative operational flooding impacts.
Social impacts	<p>Cumulative construction social impacts would include:</p> <ul style="list-style-type: none"> • Cumulative delays for people accessing community services and facilities in Lithgow and the wider Blue Mountains and Sydney regions. Extended delays and disruptions for motorists using the Great Western Highway may discourage some people from making trips to access some services and facilities • Extended periods of traffic disruptions for motorists and commercial vehicle movements • Extended periods of impacts on communities in the study area associated with construction noise, dust and traffic • Increased construction traffic on local and regional roads associated with such things as the haulage of materials, plant and equipment and movement of construction workers for the various projects, increasing possible community concerns about road safety risks • Increased demand for construction workers, providing benefits for local workers and potentially affecting the availability of local workers for non-construction related jobs • Potential increase in the number of construction workers within the study area from 	<p>Cumulative operational social impacts would include:</p> <ul style="list-style-type: none"> • Improved travel times, travel reliability and safety for motorists making trips using the Great Western Highway would contribute to improved access and connectivity to community services and facilities such as education uses, major medical and health care facilities, and community support facilities located in regional centres such as Lithgow and Katoomba, and in the western Sydney region • Improved access to facilities within the study area and surrounding areas for people travelling from Sydney and surrounding regions.

Environmental factor	Construction	Operation
	<p>outside of local and regional communities, resulting in potential impacts associated with increased demand for local accommodation and impacts on community values</p> <ul style="list-style-type: none"> Where construction timeframes for proposals occur sequentially, there is potential for disturbance and disruptions for local communities (for example, construction noise, dust, traffic delays and disruptions) to occur over extended periods, potentially resulting in construction fatigue particularly communities at Mount Victoria and Little Hartley due to concurrent works for the Mount Victoria tunnel and Little Hartley to River Lett Hill stage of the proposal. 	
Contamination	<p>Other projects near to the proposal alignment have not been identified that would compound any impacts during construction or operation. Any new projects to be undertaken within the vicinity of the proposal would need to undertake contamination investigations to assess the suitability of the site for the proposed land use. Where contamination is identified, it would need to be remediated to remove or suitably reduce the exposure to human and/or environmental receptors in accordance with the legislative requirements of the <i>Contaminated Lands Management Act 1997</i>. Both the management of contamination sources during construction and operation of these projects and remediation works to render the potential project sites suitable for use is unlikely to increase potential cumulative impacts from contamination exposure to common receptors (i.e. unlikely that cumulative impacts would arise).</p>	<p>The proposal would not result in cumulative operational contamination impacts.</p>
Air quality	<p>Although there several projects within the vicinity of the proposal, none are expected to result in any cumulative air quality impacts with the proposal. The only potential for cumulative impacts which may arise is if construction of adjacent segments of the proposal are completed at the same time such that receiver(s) may be affected by emissions from multiple work areas. These impacts would be minimised through construction planning.</p>	<p>The proposal would not result in cumulative operational air quality impacts.</p>

6.17.6 Safeguards and management measures

Table 6-139 Safeguards and management measures – Cumulative impacts

No	Impact	Environmental safeguards	Responsibility	Timing	Reference	Locations
CU01	Cumulative impacts	Ongoing coordination and consultation will be undertaken with nearby projects as required.	Transport/ Contractor	Prior to and during construction	N/A	All
CU02	Cumulative impacts	The CEMP will be revised to consider potential cumulative impacts from surrounding development activities as they become known.	Contractor	Construction	N/A	All
CU03	Cumulative impacts	Opportunities for further design refinements would be considered during detailed design to reduce potential impacts where feasible.	Contractor	Detailed design	N/A	All
CU04	Dust, exhaust and other emissions during construction	To the extent practical, plan the construction of the various segments of the proposal to avoid situations where sensitive receivers may be affected by emissions to air from multiple work areas.	Contractor	Prior to construction and construction	Appendix O	All

Other safeguards and management measures that would address cumulative impacts are identified in sections 6.13 Air quality.