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M12 Motorway

Amendment Report – Appendix I

Surface water quality and hydrology
supplementary technical memorandum

October 2020

Memorandum

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Subject	M12 Motorway amendment report – surface water quality and hydrology supplementary technical memorandum
Client	Transport for NSW
Project	M12 Motorway
Date	October 2020

1. Introduction and background

1.1 Overview

Transport for New South Wales (TfNSW; formerly Roads and Maritime Services) proposes to build the M12 Motorway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham (the project), over a distance of about 16 kilometres. The project would provide the main access from the Western Sydney International Airport at Badgerys Creek to Sydney's motorway network and is expected to be opened to traffic before the opening of the Western Sydney International Airport.

TfNSW is seeking approval under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to construct and operate the project. An environmental impact statement (EIS) was prepared to assess the potential impacts of the project and recommend management measures to appropriately address those impacts. The key features of the project as described in the EIS is provided in Section 1.1 of the amendment report. This EIS was placed on public exhibition from 16 October to 18 November 2019.

TfNSW proposes to amend the project following further design development since the exhibition of the EIS. The proposed changes include design changes and construction updates. These provide functional improvements to the design and improved integration with surrounding major transport infrastructure projects and potential future development. They also respond to issues raised in community and stakeholder submissions, and, in some instances, further reduce the potential impacts of the project as described in the EIS.

The proposed changes are described in **Section 1.2**.

1.2 Proposed changes

The proposed changes to the project as described in the EIS are summarised below and are described in detail in Chapter 3 and Chapter 4 of the amendment report:

- Amendments to the motorway-to-motorway interchange at the M7 Motorway, including:
 - Changes to Elizabeth Drive and Cecil Road intersections, proposed exit ramps, the Wallgrove Road connection to Elizabeth Drive and proposed shared user path realignments
 - The widening of Elizabeth Drive under the M7 Motorway and approaches
- An option to provide a new connection between the M12 Motorway and Elizabeth Drive near the M7 Motorway interchange
- Two new signalised intersections into the Western Sydney International Airport, with provisions for future connection to potential developments north of the Western Sydney International Airport
- Additional ancillary facilities to support the delivery of the project.

Refinements have also been made as part of the ongoing development of the project since the EIS was exhibited. Refinements are changes that are consistent with the parameters of the project description as described in the EIS. For completeness, however, these refinements have been factored into the amended construction and operational footprint and included in the impact assessment described in this supplementary technical memorandum. The refinements are described in Section 3.3 and Section 4.2 of the amendment report and include:

- Lowering the height of the M12 Motorway in and around the Western Sydney International Airport interchange
- Reduction in the scope of work associated with the M12 Motorway and The Northern Road intersection
 - This intersection would still be constructed, but the main infrastructure work would be delivered as part of The Northern Road upgrade project
- Relocation of utilities
- Changes to property access and acquisition
- Changes to drainage
- Adjustments to construction access, hours, haulage, timing and material quantities.

The project with all proposed changes is referred to as the amended project.

1.3 Amended project

1.3.1 Overview

The amended project would continue to provide the main access from the Western Sydney International Airport at Badgerys Creek to Sydney's motorway network and be located between The Northern Road in the west and the M7 Motorway in the east. The amended project includes an option for a direct connection between the M12 Motorway and Elizabeth Drive at the eastern extent of the project. This option would include some realignment of Wallgrove Road and widening of Elizabeth Drive at the motorway-to-motorway interchange at the M7 Motorway to facilitate the connection. Therefore, two options are being proposed for the amended project at the interchange with the M7 Motorway.

The two options for the amended project would be consistent from The Northern Road in the west until Duff Road in the east. At the motorway-to-motorway interchange with the M7 Motorway, the project is proposed to be either:

- Option 1 – Without Elizabeth Drive connection
 - Interchange provides entry and exit ramps between the M12 Motorway and the M7 Motorway; in addition, it would maintain the existing connection of the M7 Motorway to Elizabeth Drive with new entry and exit ramps
- Option 2 – With Elizabeth Drive connection
 - Interchange as per option 1 and also provides entry and exit ramps between the M12 Motorway and Elizabeth Drive, Cecil Road and Wallgrove Road.

This section of the amended project is shown in **Figure 1-1**, with the Elizabeth Drive connection associated with option 2 shown in a different colour and detailed in inset A. The decision on which option would be built is dependent on funding being available to include the Elizabeth Drive connection. This will be determined during the detailed design and construction phase of the project. The key features of each option are described in the following sections.

The proposed changes (see **Section 1.2**) would result in an amended construction footprint (**Figure 1-2**) and an amended operational footprint (**Figure 1-3**). The footprints would be the same for both options, with each footprint assuming the worst case scenario (ie option 2).

The assessment of potential impacts described in **Section 5** relates to the worst case scenario and covers both options, unless stated otherwise.

The key features of the amended project are listed in **Section 1.3.2** and include both options.

1.3.2 Key features of the amended project

The key features of the amended project are listed below. Where the description of the proposed amended project key features differs from the description listed in the EIS (see Section 1.1 of the amendment report), those changes are shown in **bold** text:

- A new dual-carriageway motorway between the M7 Motorway and The Northern Road with two lanes in each direction with a central median allowing future expansion to six lanes
- Motorway access via three interchanges/intersections:
 - A motorway-to-motorway interchange at the M7 Motorway and associated works (extending about four kilometres within the existing M7 Motorway corridor) **with the following options:**
 - **Option 1 – without connection between the M12 Motorway and Elizabeth Drive**
 - **Option 2 – with connection between the M12 Motorway and Elizabeth Drive**
 - A grade-separated interchange referred to as the Western Sydney International Airport interchange, including a dual-carriageway four-lane airport access road (two lanes in each direction for about 1.5 kilometres) connecting with the Western Sydney International Airport Main Access Road
 - A signalised intersection at The Northern Road with provision for grade separation in the future
- Bridge structures across Ropes Creek, Kemps Creek, South Creek, Badgerys Creek and Cosgroves Creek
- A bridge structure across the M12 Motorway into the Western Sydney Parklands to maintain access to utilities, including the existing water tower and mobile telephone/other service towers on the ridgeline in the vicinity of Cecil Hills, to the west of the M7 Motorway
- Bridge structures at interchanges and at Clifton Avenue, Elizabeth Drive, Luddenham Road and other local roads to maintain local access and connectivity
- Inclusion of active transport (pedestrian and cyclist) facilities through provision of pedestrian bridges and an off-road shared user path, including connections to existing and future shared user path networks
- Modifications to the local road network, as required, to facilitate connections across and around the M12 Motorway including:
 - Realignment of Elizabeth Drive at the Western Sydney International Airport, with Elizabeth Drive overpassing the airport access road and rail infrastructure
 - **Two new signalised intersections from Elizabeth Drive into the Western Sydney International Airport, with provisions for future connection to potential developments to the north**
 - **Widening of Elizabeth Drive under the M7 Motorway and approaches**
 - Realignment of Clifton Avenue over the M12 Motorway, with associated adjustments to nearby property access

- Relocation of the Salisbury Avenue cul-de-sac, on the southern side of the M12 Motorway
- **Realignment of Wallgrove Road to connect to Cecil Road, including a connection between Elizabeth Drive and Wallgrove Road via Cecil Road with a signalised intersection with Elizabeth Drive**
- Adjustment, protection or relocation of existing utilities
- Ancillary facilities to support motorway operations, smart motorways operation in the future and the existing M7 Motorway operation, including gantries, electronic signage and ramp metering
- Other roadside furniture, including safety barriers, signage and street lighting
- Adjustments of waterways, where required, including Kemps Creek, South Creek and Badgerys Creek
- Permanent water quality management measures including swales and basin
- Establishment and use of temporary ancillary facilities, temporary construction sedimentation basins, access tracks and haul roads during construction
- Permanent and temporary property adjustments and property access refinements as required.

An overview of the amended project is shown in **Figure 1-1**.

1.4 Purpose of document

This supplementary technical memo has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued 30 October 2018 to support the assessment. The purpose of this memo is to identify and assess the potential construction, operation and cumulative surface water quality and hydrology impacts of the amended project, including an assessment of the proposed design changes against the impacts documented in the M12 Motorway EIS and, where required, recommend any changes or feasible and reasonable additions to the management measures.

2. Policy and planning setting

The NSW and Commonwealth legislation and the guidelines relevant to the surface water quality and hydrology assessment of the project are outlined in Section 7.9.1 of the EIS and discussed in detail in Chapter 2 of Appendix M of the EIS. These policies and strategies are also relevant to the amended project.

The EIS lists the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) as a relevant guideline (see Section 7.9.1 of the EIS). This guideline has since been updated to incorporate new science and knowledge developed over the past 20 years. The updated guidelines (ANZG, 2018) have now been applied to this supplementary assessment to understand the current health of the waterways in the surface water study area and the ability to support nominated environmental values, particularly the protection of aquatic ecosystems.

The ANZG (2018) guidelines provide recommended trigger values which have been considered in this assessment when describing the existing water quality and key indicators of concern. However, many of the guideline values are still in draft form (eg physical and chemical stressors for aquatic ecosystems for the relevant geographic region the south-east coast have not yet been completely updated). As such, the ANZECC/ARMCANZ (2000) guidelines continue to apply to the physical chemical stressors for slightly to moderately disturbed lowland river ecosystems associated with the project, as described in Section 2.3 of Appendix M of the EIS.

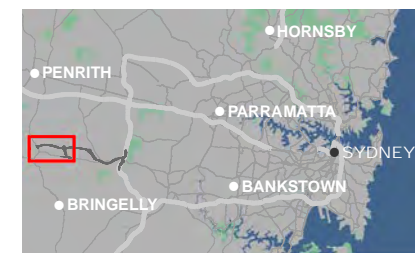
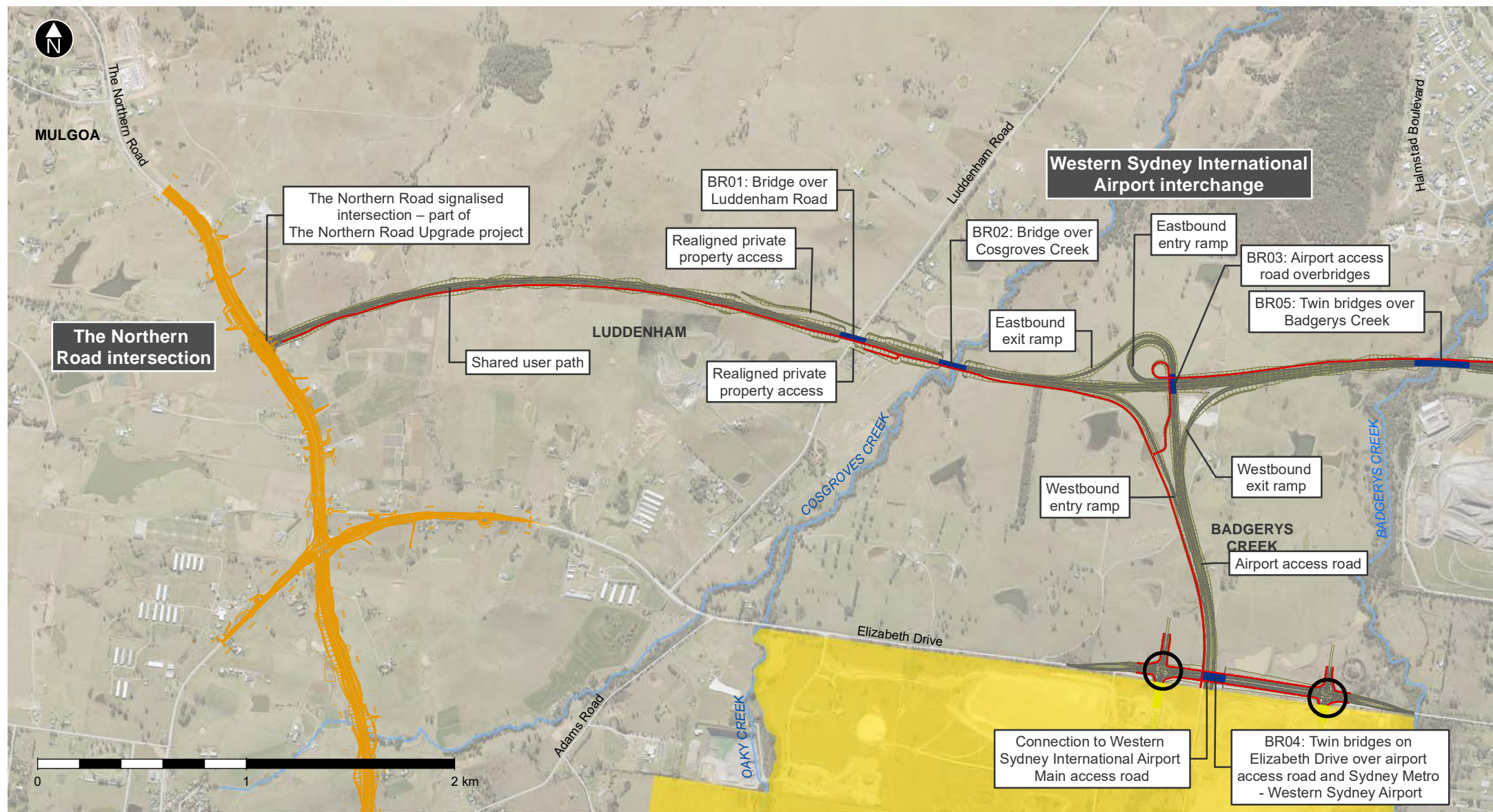
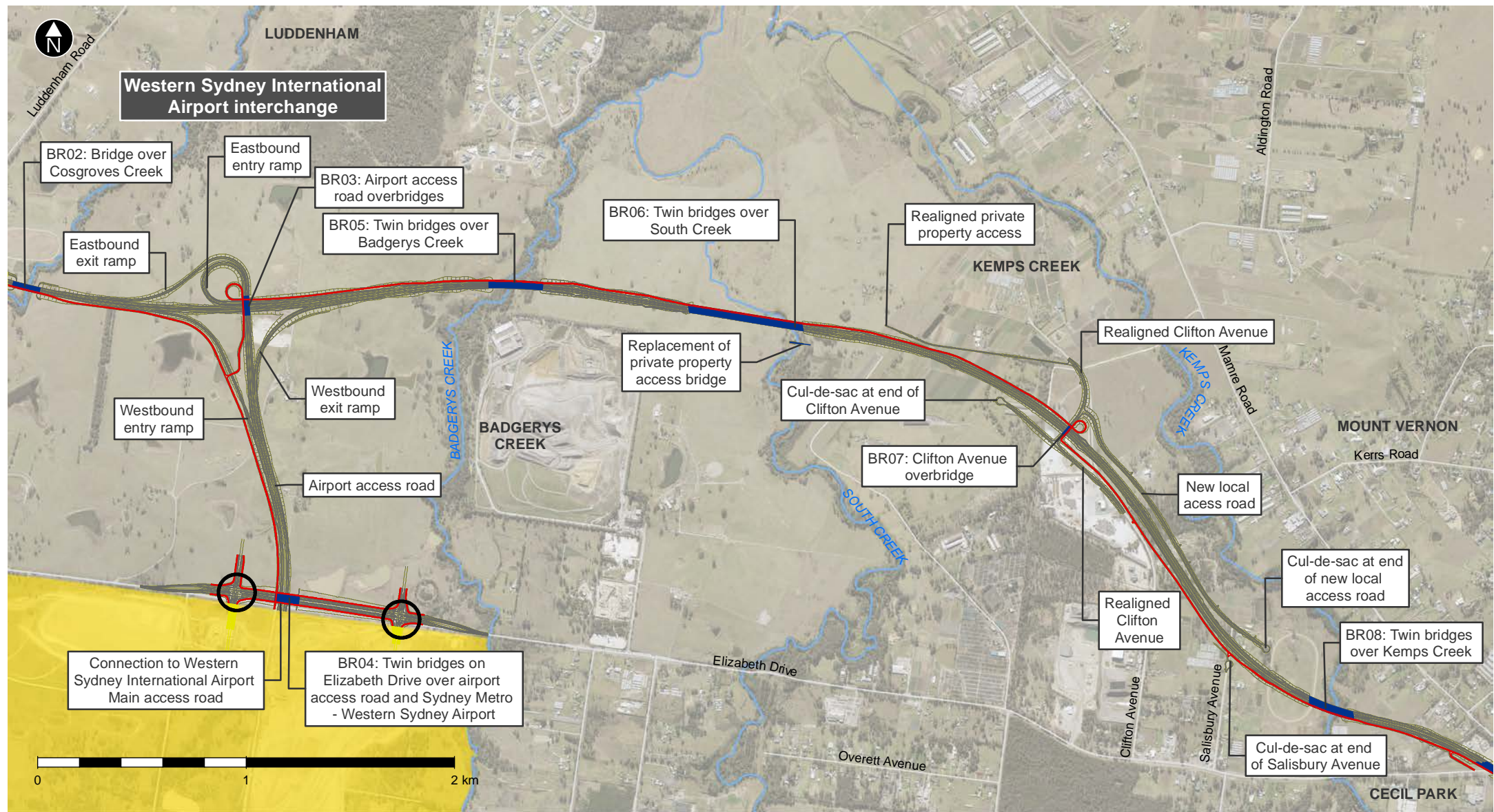
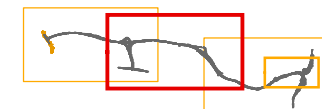


Figure 1-1 Key features of the amended project



- The amended project
- Existing roads
- Western Sydney International Airport
- Shared user path
- Waterways
- Signalised intersections into the Western Sydney International Airport
- Note: Indicative, subject to detailed design
- Bridges



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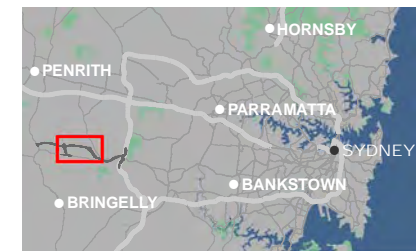


Figure 1-1 Key features of the amended project

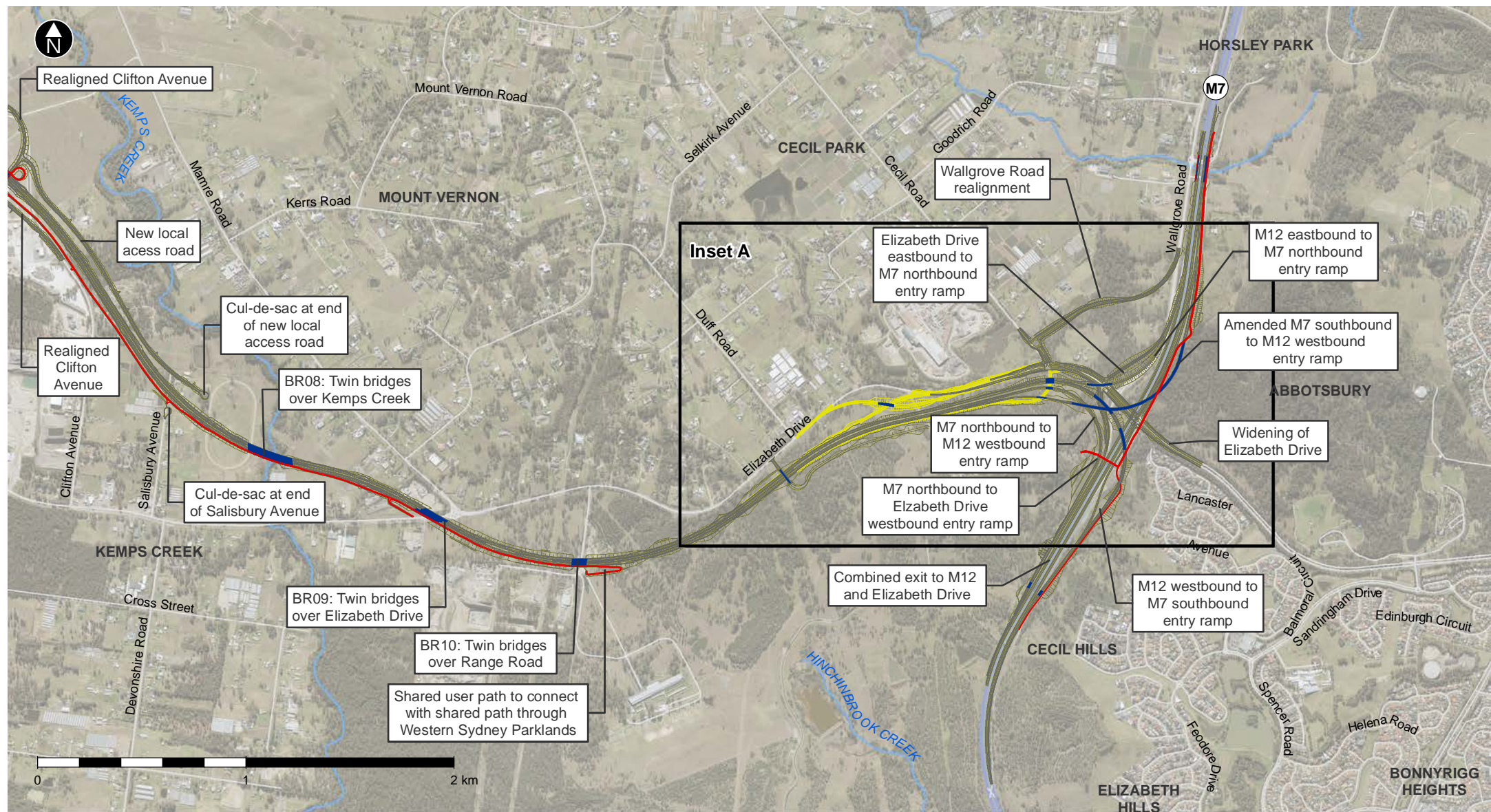
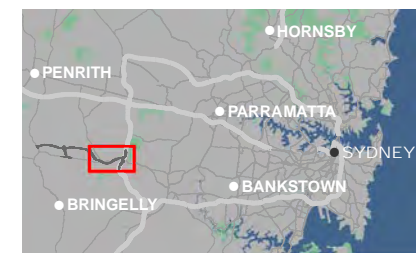
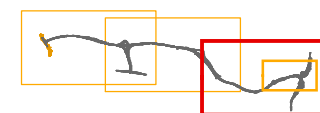
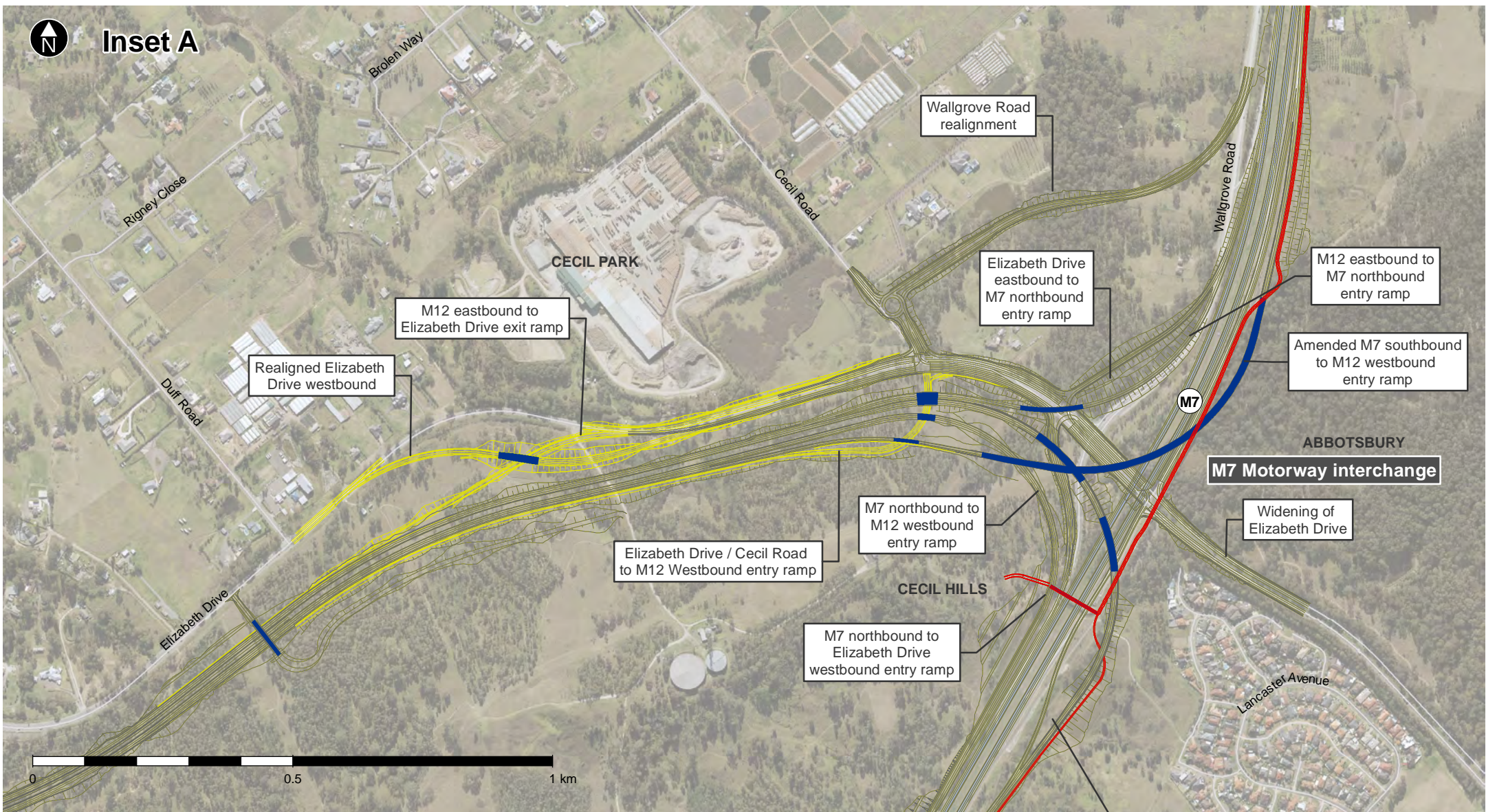
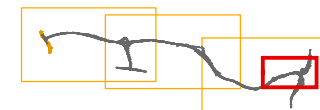


Figure 1-1 Key features of the amended project





- The amended project
- The amended project with Elizabeth Drive connection
- Shared user path
- Bridges
- Motorway
- Existing roads



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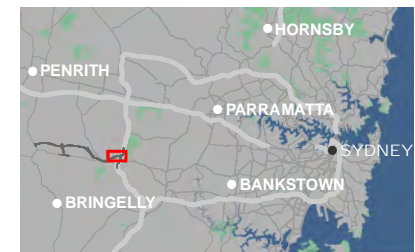
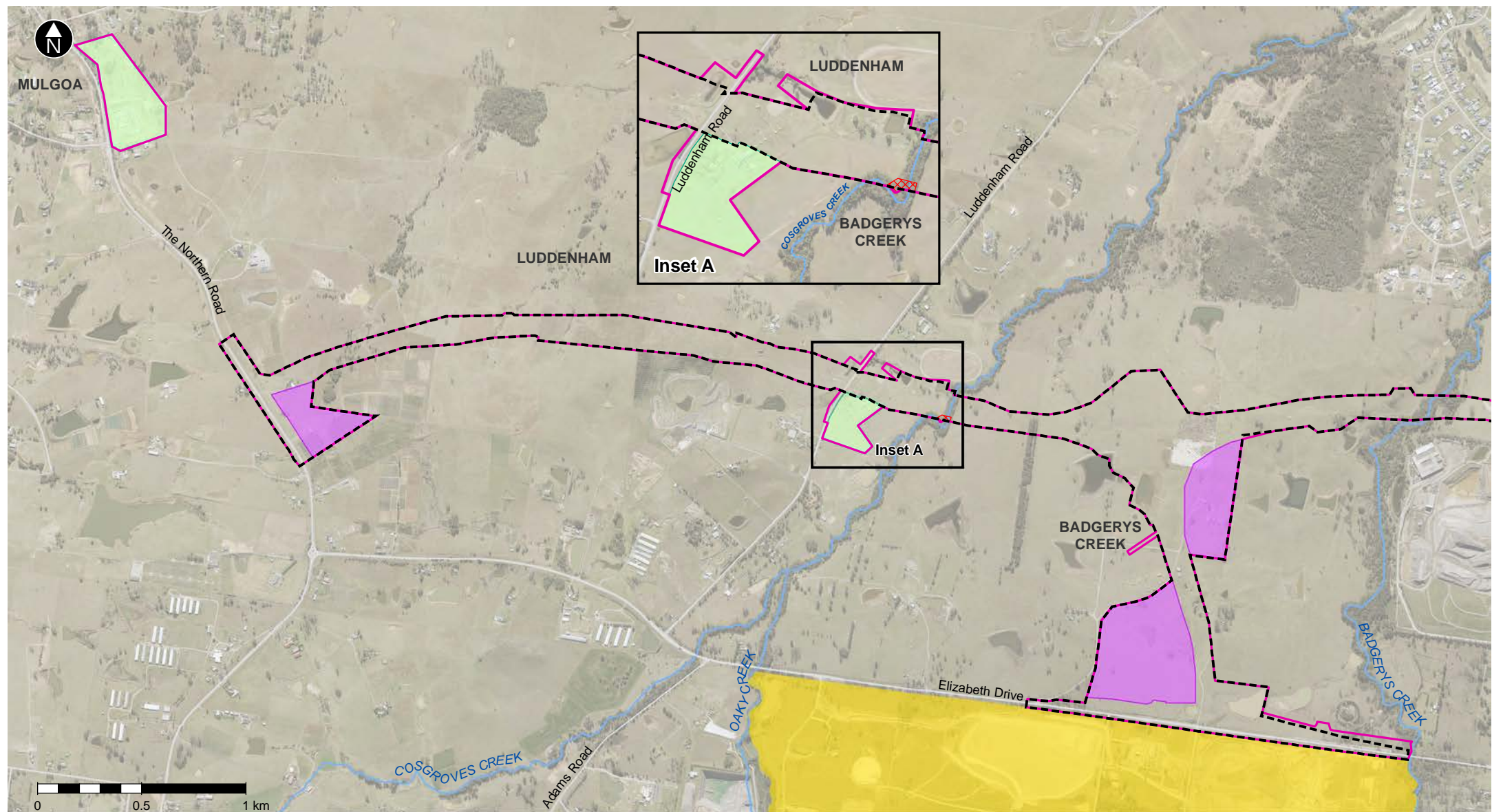
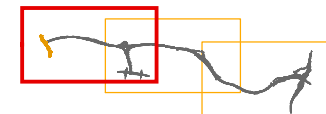


Figure 1-1 Key features of the amended project



- The project construction footprint as per the EIS
- The amended project construction footprint
- The amended project exclusion zones

- Ancillary facilities as per the EIS
- Additional ancillary facilities
- Western Sydney International Airport
- Waterways
- Motorway
- Existing roads



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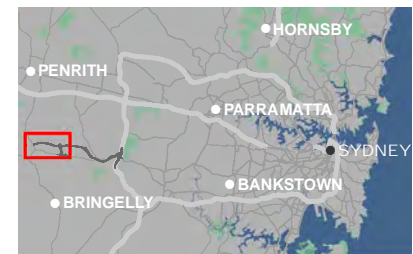
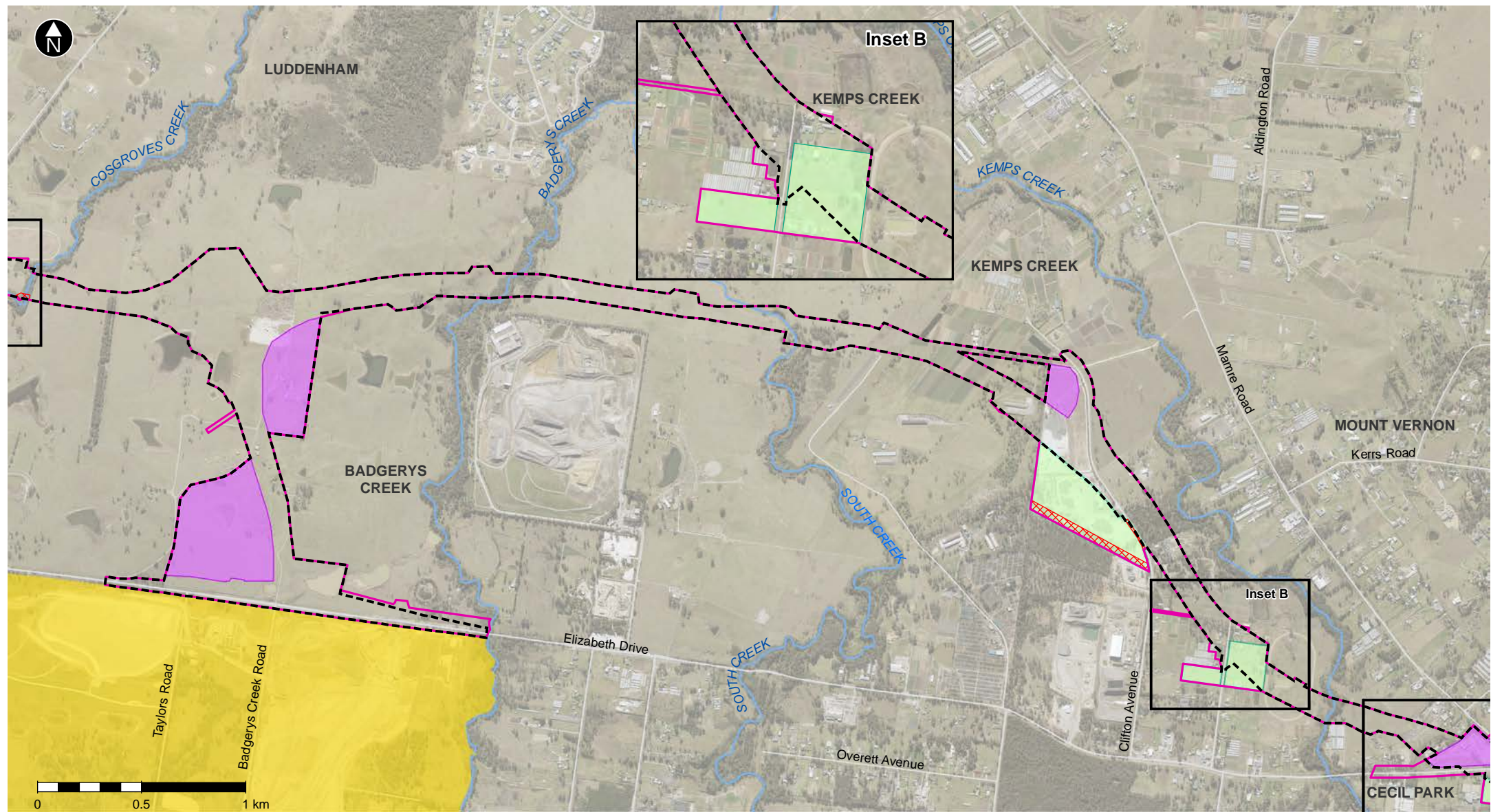
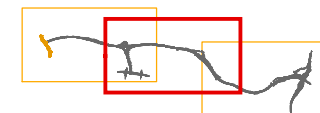


Figure 1-2 Construction footprints of the amended project and the project as described in the EIS



- The project construction footprint as per the EIS
- The amended project construction footprint
- The amended project exclusion zones

- Ancillary facilities as per the EIS
- Additional ancillary facilities
- Western Sydney International Airport
- ~~~~~ Waterways
- Motorway
- Existing roads



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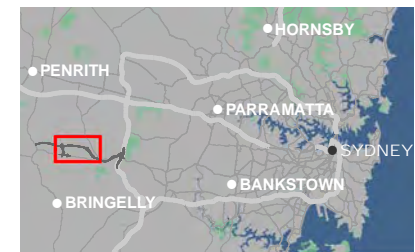
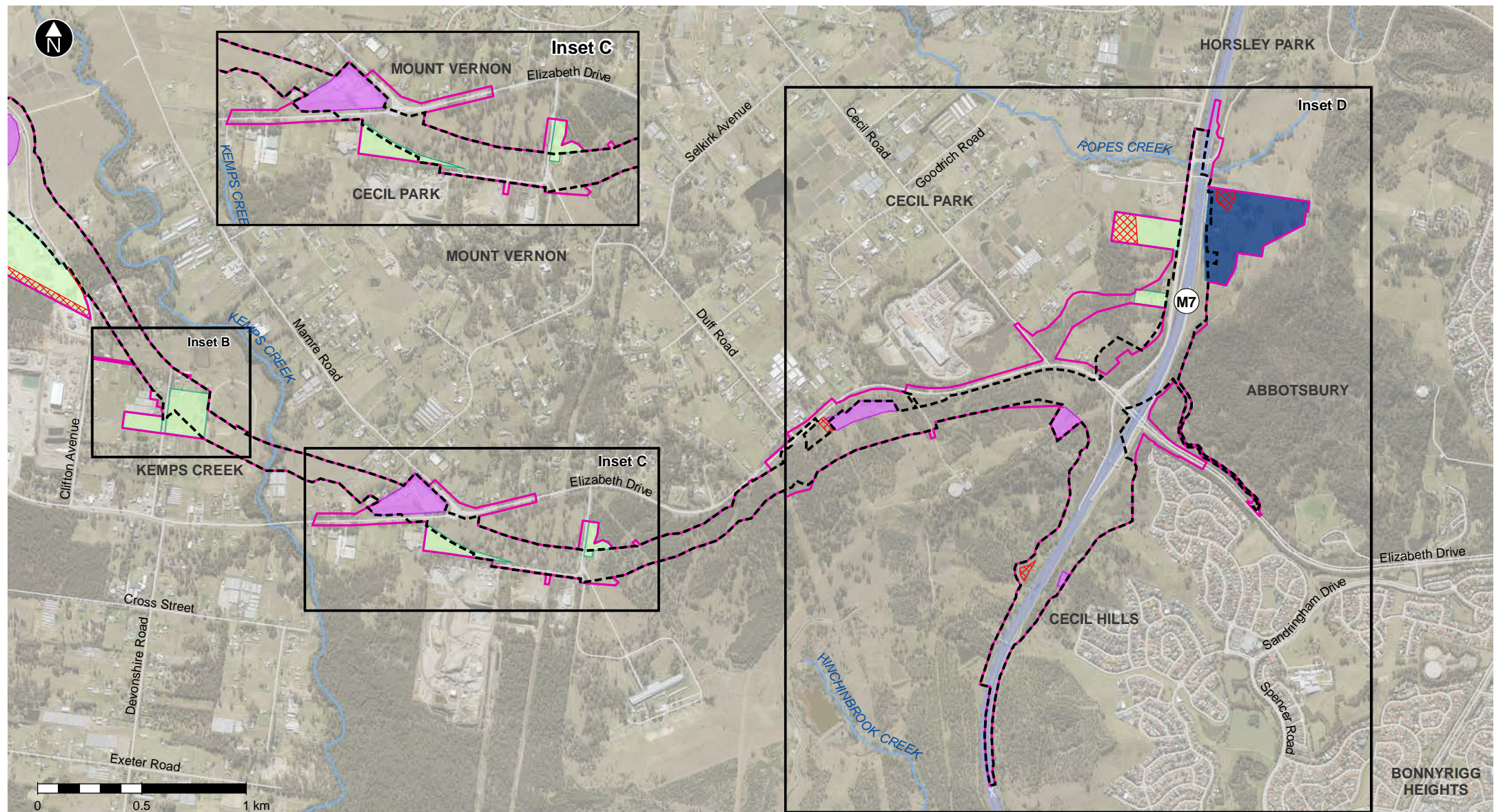
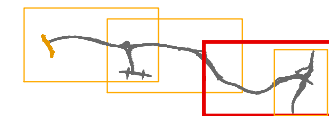


Figure 1-2 Construction footprints of the amended project and the project as described in the EIS



- The project construction footprint as per the EIS
- The amended project construction footprint
- The amended project exclusion zones

- Ancillary facilities as per the EIS
- Additional ancillary facilities
- Amended ancillary facilities
- Waterways
- Motorway
- Existing roads



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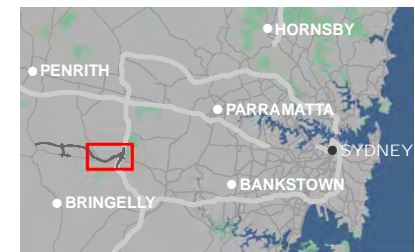
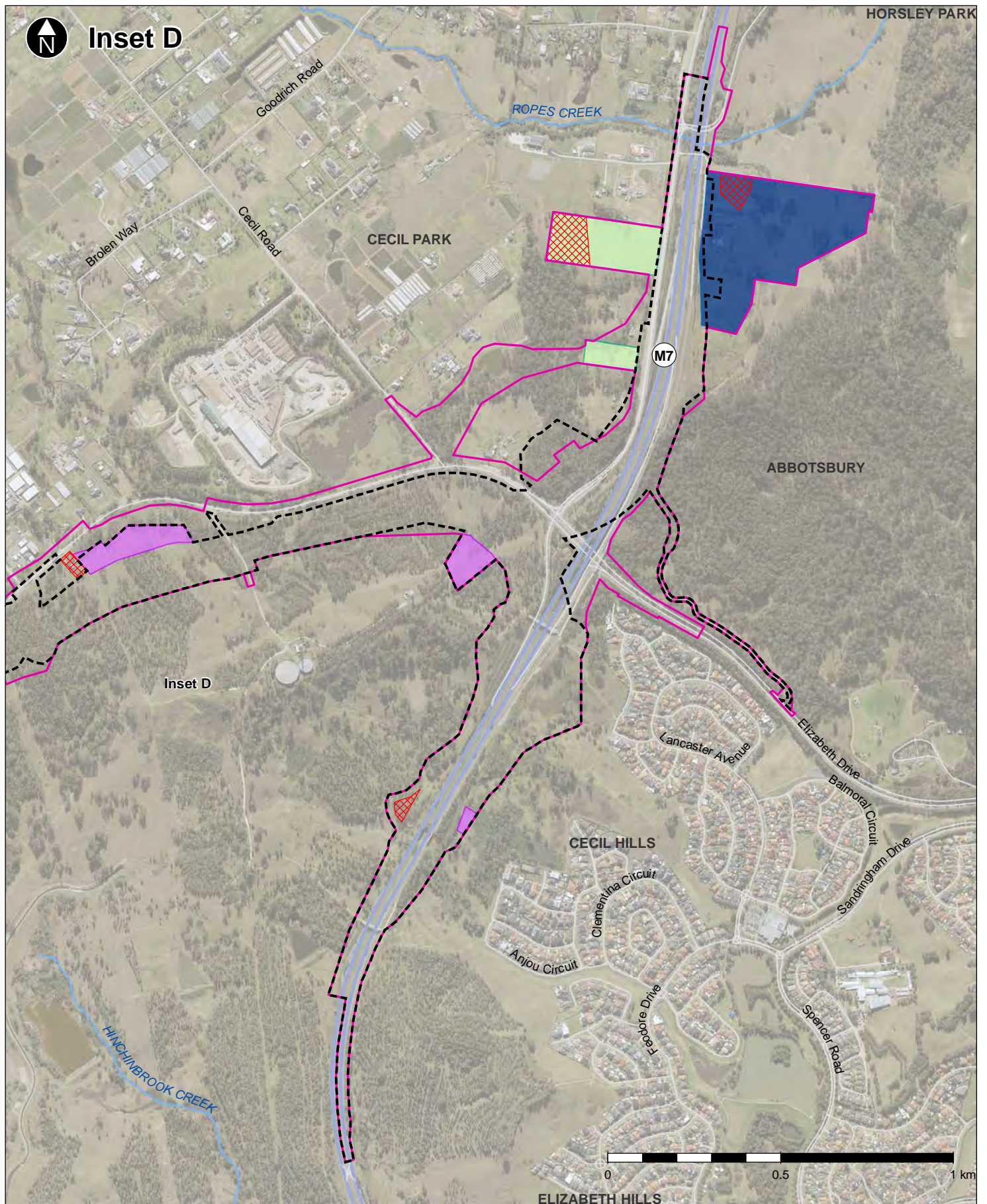
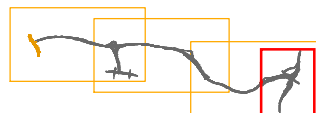


Figure 1-2 Construction footprints of the amended project and the project as described in the EIS



- The project construction footprint as per the EIS
- The amended project construction footprint
- The amended project exclusion zones
- Ancillary facilities as per the EIS
- Additional ancillary facilities
- Amended ancillary facilities



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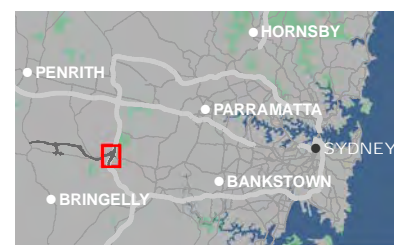
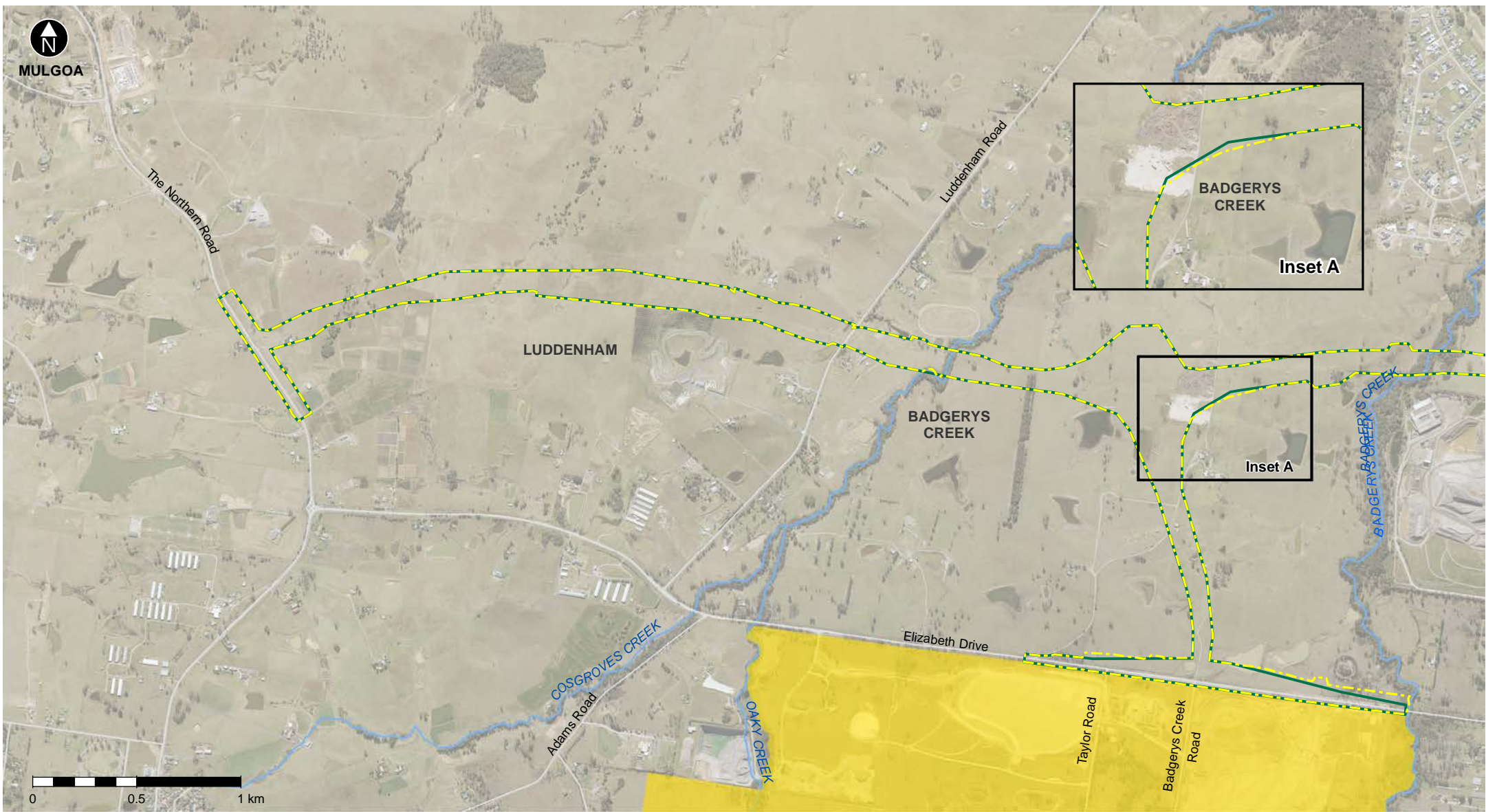
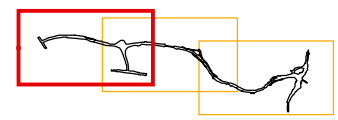


Figure 1-2 Construction footprints of the amended project and the project as described in the EIS



- The project operational footprint as per the EIS
- The amended project operational footprint
- ~~~~~ Waterways
- Western Sydney International Airport
- Existing roads



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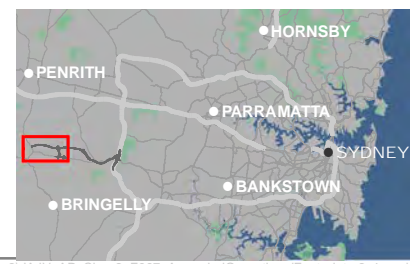
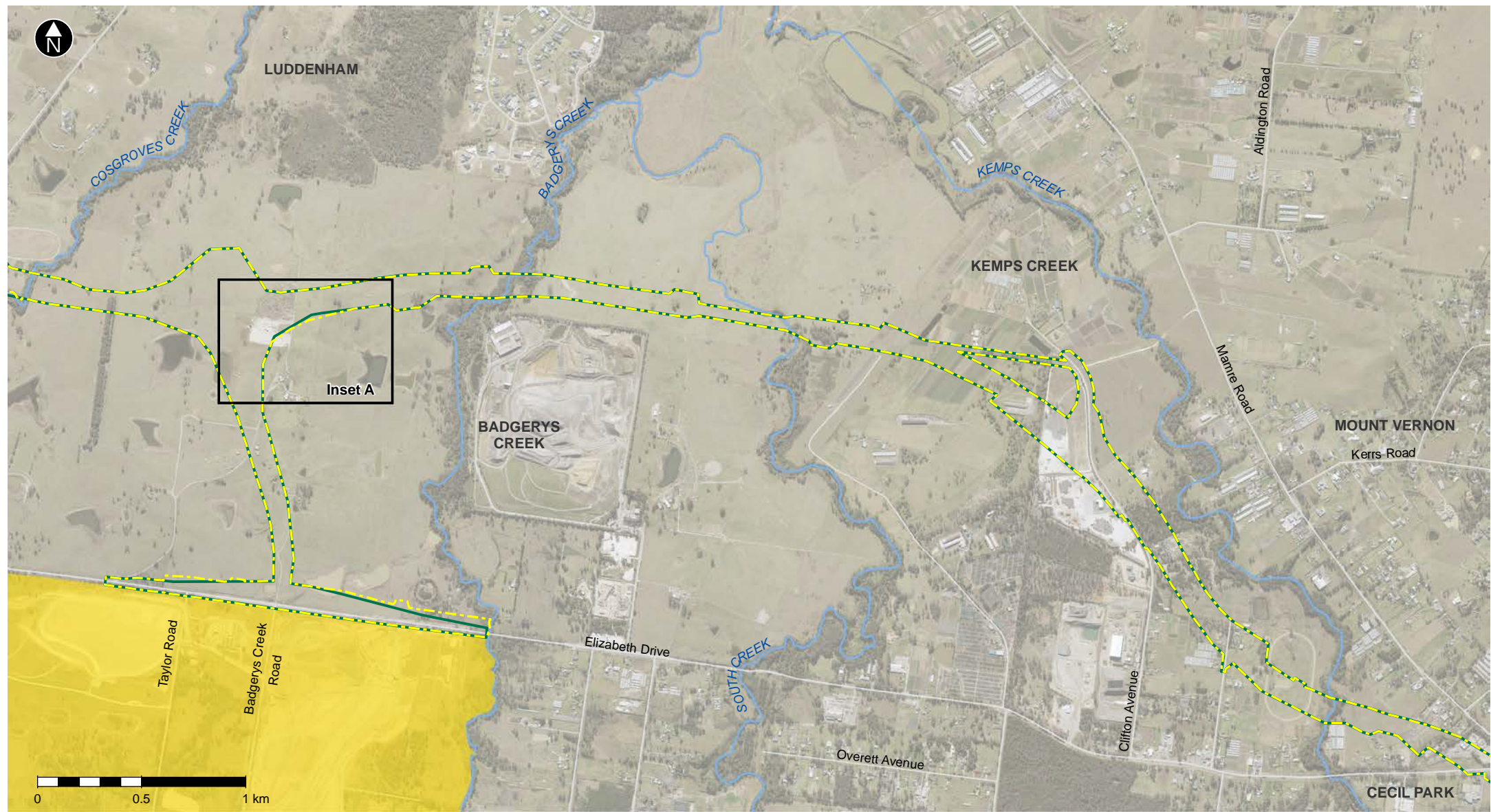
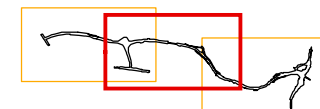


Figure 1-3 Operational footprints of the amended project and the project as described in the EIS



- The project operational footprint as per the EIS
- The amended project operational footprint
- ~~~~~ Waterways
- Western Sydney International Airport
- Existing roads



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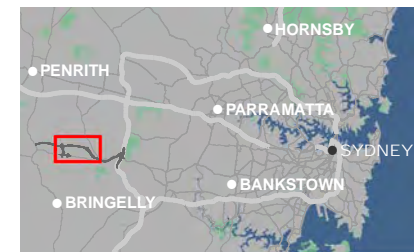
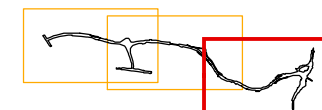
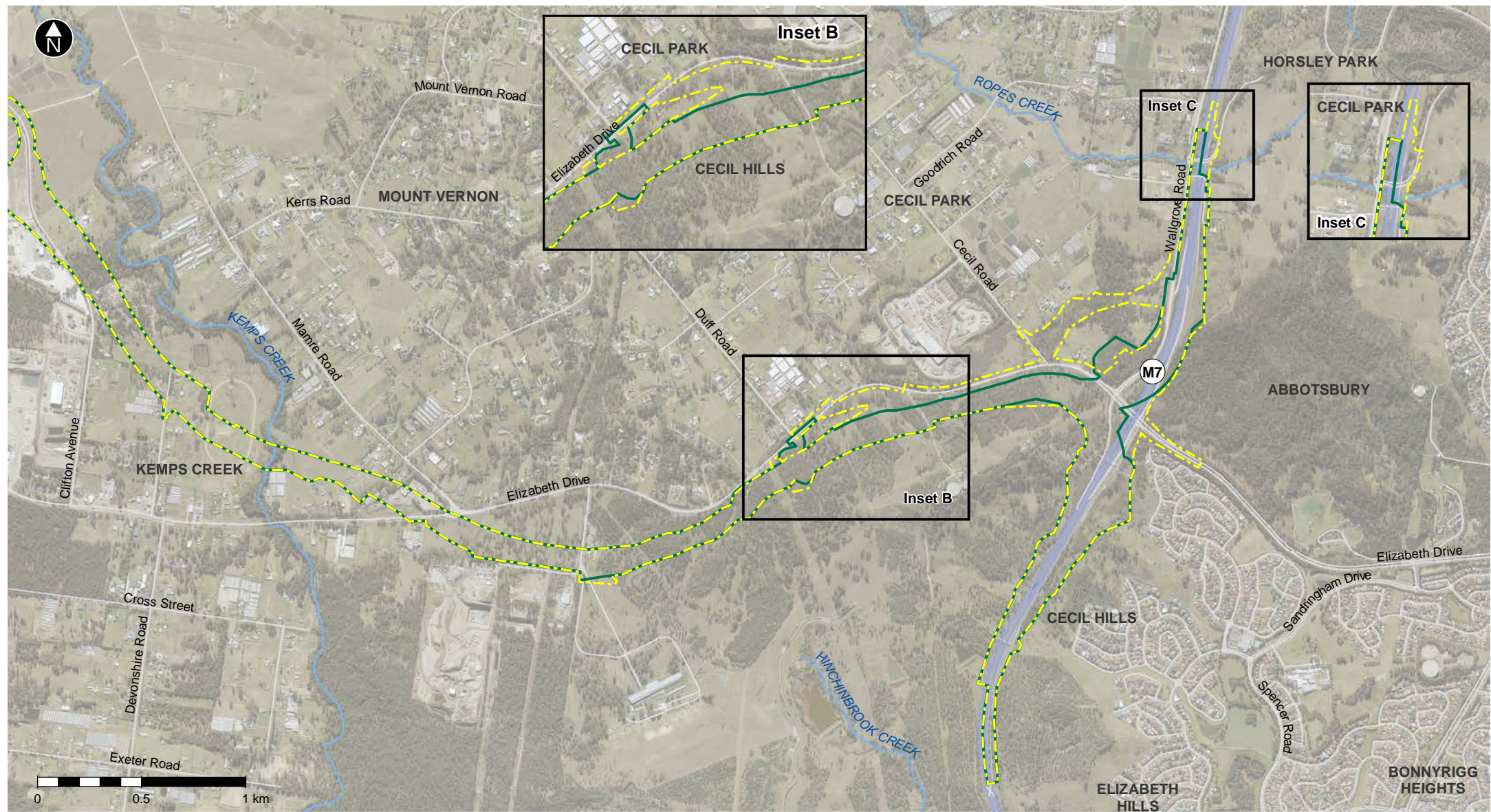


Figure 1-3 Operational footprints of the amended project and the project as described in the EIS



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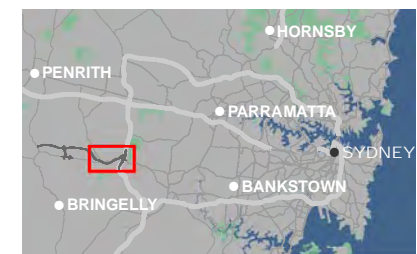


Figure 1-3 Operational footprints of the amended project and the project as described in the EIS

The guidelines for toxicants are as per the ANZG (2018) and are presented in **Error! Not a valid bookmark self-reference..** It should be noted that for the nominated toxicants the default guidelines are the same as those documented in ANZECC/ARMCANZ (2000).

Table 2-1 Default guidelines for toxicants (ANZG (2018))

Indicator	ANZG (2018) default guidelines for toxicants for the protection of aquatic ecosystems (mg/L)
Arsenic	0.013
Cadmium	0.0002
Chromium (VI)	0.001
Copper	0.0014
Lead	0.0034
Mercury	0.0006 ¹
Nickel	0.011
Zinc	0.008

¹ Represents the 99% trigger values as this chemical bioaccumulates

3. Assessment methodology

This supplementary assessment focuses on the changes in potential impacts associated with the proposed changes to the project, which include design changes and construction updates. The assessment is detailed in **Section 5** and assesses impacts to both options described in **Section 1.3**, unless stated otherwise.

The methodology for the supplementary assessment of surface water quality and hydrology is outlined in the following sections and has included:

- Desktop review
- Assessment of the impact of construction and operation activities of the amended project on water quality and hydrology
- Identification of appropriate measures to mitigate the potential impacts that would need to be updated or added.

These are detailed further in the following sections.

The water quality criteria used for the amended project is largely consistent with the EIS with the exception of those documented in **Table 2-1**. This supplementary assessment did not include further site investigations. However, data from additional monitoring that has been completed since the preparation of the EIS has been included. Further detail regarding the additional monitoring undertaken is provided in **Section 4.2**.

3.1 Study area

The study area as described in the EIS comprised the construction and operational footprints and a 500 metre buffer around the M12 Motorway alignment. For the supplementary assessment, the study area was updated as the amended construction and operational footprints and a 500 metre buffer around the amended project alignment (see **Figure 3-1**).

3.2 Desktop review

The desktop review for the surface water quality assessment involved the following:

- Review of the proposed changes associated with the amended project compared to the project as described in the EIS, as they relate to surface water quality, hydrology, geomorphology, environmental water availability and water quality objectives
- Review of and confirmation of the sensitive receiving environments crossed by and adjacent to the amended project
- Review of the EIS, including:
 - Treatment measures and water quality controls identified in the EIS
 - Environmental management measures identified in the EIS
 - Monitoring program proposed in the EIS.

3.3 Assessment of the impacts

An assessment of the impact of the amended project on water quality and hydrology was carried out with reference to the updated ANZG (2018) Water Quality Guidelines. This supplementary assessment focused on the proposed project changes as detailed in Chapter 3 and Chapter 4 of the amendment report.

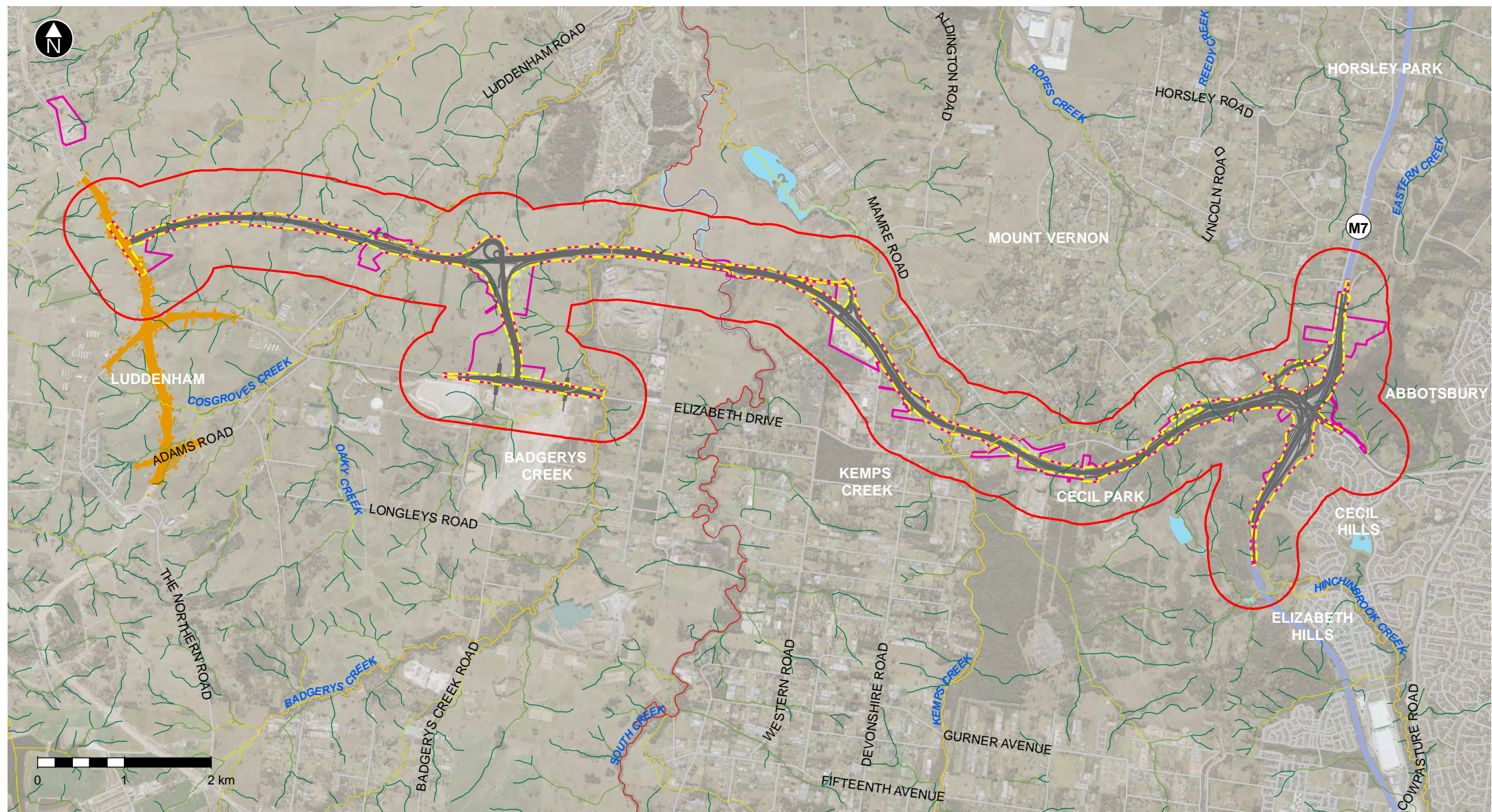
The assessment of the operational impacts for the minor drainage lines involved the following:

- Assess the existing and proposed catchments associated with the minor drainage lines where the road design changes have occurred
- Identify any changes to the catchment characteristics such as areas and percentage of land classified as impervious and update the hydrological model in DRAINS that was used in the EIS (see Appendix M of the EIS)
- Assess flows and identify locations of potential adverse impacts.

3.4 Review of management measures

The review of management measures involved the following:

- Update of environmental management measures identified in the EIS where necessary to accommodate proposed changes
- Identification of water quality controls that require modification as a result of the proposed changes
 - The MUSIC model used for the project as described in the EIS was updated to provide the amended proposed permanent (operational) water quality basins sizes (see **Section 6.2**)
- Identification of any additional monitoring requirements.



- The amended project
- Part of The Northern Road upgrade project
- The amended project construction footprint
- - - The amended project operational footprint
- Surface water and hydrology study area

- | | | |
|------------|-----------------------|---|
| Waterways | Strahler Stream Order | 3 |
| Motorway | 1 | 4 |
| Main roads | 2 | 6 |

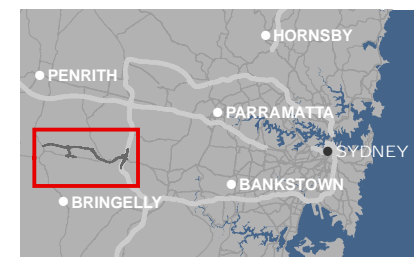


Figure 3-1 Study area for the supplementary surface water quality and hydrology assessment

4. Existing environment

4.1 Overview

Section 7.9.3 of the EIS provides a detailed description of the existing environment within which the project is located including:

- Rainfall and climate
- Surface water hydrology
- Existing surface water quality
- Sensitive receiving environments
- Soils.

The existing environment for the amended project is consistent with Section 7.9.3 of the EIS. However, additional data has been made available on the existing surface water quality as a result of monthly water quality monitoring carried out within key watercourses, and this is detailed below in **Section 4.2**.

4.2 Existing surface water quality

As identified in the EIS, the key watercourses (and the tributaries) within the study area are Cosgroves Creek, Badgerys Creek, Kemps Creek, South Creek, Ropes Creek and Hinchinbrook Creek (see **Figure 3-1**). Water quality data was available for all creeks, with the exception of Ropes Creek, during the assessment done as part of the EIS. The water quality within these creeks is generally poor and degraded due to low dissolved oxygen concentrations and elevated nutrients and in some instances elevated metal concentrations.

Monitoring upstream and downstream of the named waterways has continued during the preparation and exhibition of the EIS. Monthly baseline monitoring has occurred between April and September 2019 and will continue until construction commences. The resulting data confirms that the creeks continue to exhibit very poor water quality due to elevated nutrients and metals (particularly arsenic, copper and zinc) (GHD 2019). Additionally, pesticides have been detected infrequently at Badgerys Creek, South Creek and Kemps Creek, and, on a single occasion, at Ropes and Hinchinbrook Creeks.

4.2.1 Ropes Creek water quality

Ropes Creek water quality data was not available at the time of writing the EIS because the creek was dry at the time water quality monitoring was undertaken and monitoring data from Council or other stakeholders was unavailable.

Monthly water quality monitoring of Ropes Creek was subsequently completed over a six month period by GHD between April and September 2019, both upstream and downstream from the project and data made available in October 2019. The water quality monitoring results (median values) are presented in **Table 4-1**. **Bold** values in the table denote results that falls outside guideline limits for slightly to moderately disturbed ecosystems.

Table 4-1 Median water quality results from Ropes Creek monitoring (GHD, 2019)

Indicator	Upstream	Downstream	ANZECC Water Quality Guidelines
pH	7.9	7.8	6.5-8.5
Electrical conductivity (µS/cm)	2190	1044	125-2200
Dissolved oxygen (% saturation)	79	68	85-110
Turbidity (NTU)	4	3	6-50
Total suspended solids (mg/L)	15	9	No guideline
Ammonia (mg/L)	0.08	0.02	0.02
Oxidised nitrogen (mg/L)	0.07	0.1	0.04
Total nitrogen (mg/L)	0.9	0.633	0.35
Filterable reactive phosphorus (mg/L)	0.045	0.06	0.02
Total phosphorus	0.130	0.105	0.025
Chlorophyll-a (µg/L)	46	2	3

While only the median values are presented in the above table, monitoring data collected shows water quality during this time was poor with frequent exceedances of the nominated guideline values. Electrical conductivity was elevated upstream, however median concentrations fell within the recommended limit. This is likely attributed to low flow conditions and possible intrusion of groundwater, which is generally more saline due to geology of the soils. The low flow also contributed to low dissolved oxygen levels which fell below the lower recommended limit of 85 per cent saturation for protection of aquatic ecosystems both upstream and downstream.

Median nutrient concentrations (including total nitrogen, ammonia, oxidised nitrogen, total phosphorus and filterable reactive phosphorus) were elevated both upstream and downstream and data collected indicated frequent exceedances in the recommended guideline limits.

Concentrations of the metals arsenic, chromium, copper and zinc were also detected on occasions that exceeded the recommended limit for 95 per cent species protection of aquatic ecosystems. The pesticide Dimethoate was also detected on a single occasion in Ropes Creek downstream of the project.

In summary, the water quality of Ropes Creek is reflective of a waterway with limited flow that drains into a catchment that has been significantly altered from its natural state. The catchment is a combination of agricultural and urban land uses with much of the vegetation removed. In addition, the creek is already traversed by the M7 Motorway at Cecil Hills, along with other road and rail assets (GHD, 2019).

5. Assessment of potential impacts

This section provides an assessment of the potential surface water quality and hydrology impacts that may result due to the construction and operation of the amended project. These impacts focus on the proposed changes in relation to the surface water quality and hydrology impacts documented in the EIS. The assessment of potential impacts described in this section relates to both options presented in **Section 1.3** unless stated otherwise.

5.1 Construction impacts

The potential impacts to surface water quality and hydrology associated with the construction of the project as described in the EIS are presented in Section 7.9.4 of the EIS, and included assessment of the following:

- **Surface water quality**
- **Water balance**
- Impacts to SEPP Coastal Wetlands
- Construction discharges
- Erosion and sedimentation
- Hydrology and geomorphology
- Environmental water availability and flows
- Performance against NSW water quality objectives.

Where the amended project would likely result in changes to the above impacts (shown in **bold** above), these are described in the sections below. The rest of the issues identified above were also assessed, however it was determined that the proposed construction updates for the amended project would not result in a substantial change to the nature of the impacts identified in the EIS. As a result, the assessments provided in Section 5.1 of the EIS still apply to these issues and they have therefore not been discussed further in this assessment.

Impacts associated with surface water quality and water balance would be managed in accordance with the environmental management measures described in **Section 7** of this memorandum and Chapter 7 of the amendment report.

5.1.1 Surface water quality

The potential impacts to surface water quality associated with the proposed design changes are presented in **Table 5-1**.

Table 5-1 Potential construction impacts on surface water quality

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
<p>Earthworks, cuttings, stockpiling</p> <p>Erosion and exposure of sediments and contaminated soils from exposed areas, open cuts and stockpiles due to wind and stormwater runoff leading to sedimentation and contamination of downstream waterways.</p>	<p>Sediments, nutrients, hydrocarbons, metal contaminants and gross pollutants</p>	<p>The amended project would potentially result in increased sedimentation due to more exposed areas at the new intersections connecting Elizabeth Drive with the Western Sydney International Airport, at the widened Ropes Creek bridge and at additional ancillary facilities. While the extent of impact is likely to increase, the nature of impacts would generally be consistent with those described in the EIS including:</p> <ul style="list-style-type: none"> • Altered geomorphology of waterways which can smother and reduce biological productivity of aquatic systems through reduced light penetration, thereby decreasing available plant material for fish to feed on • Increased nutrient levels in waterways which can lead to algal blooms. This reduces the environmental value of water by limiting its potential uses • Greater turbidity levels which can reduce visual amenity 	<p>As identified in the EIS, all waterways within the study area have the potential to be impacted by sedimentation. The following water ways have an increased risk as a result of the amended project:</p> <ul style="list-style-type: none"> • Badgerys Creek • Ropes Creek <p>Waterways within 50 metres downstream of an ancillary facility including unnamed first order tributaries of:</p> <ul style="list-style-type: none"> • Badgerys Creek • Kemps Creek • Ropes Creek

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Demolition Dust, litter and other pollutants from building materials associated with demolition which can enter downstream waterways due to wind and stormwater runoff	Sediments, gross pollutants	No change in impact from the EIS as no additional structures or elements are expected to be demolished beyond what was described in the EIS (see Table 5-2 in Appendix M of the EIS)	No change from the receiving waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS)
Pollution – leakages and spills Leakage or spills of petroleum, oils and other toxicants from construction machinery, plant equipment, refuelling and vehicles traveling to and from site. Spills and leakages could potentially be transported to downstream waterways	Hydrocarbons, oil and grease, hydraulic fluids, high pH, zinc and other hazardous chemicals	Additional ancillary facilities and construction activities near waterways as part of the amended project would potentially increase the risk of leakages and spills. This would result in the following potential impacts: <ul style="list-style-type: none"> • Oily films on surface water reducing visual amenity • Decreased biodiversity, loss of habitat and fish kills from increased concentrations of toxicants • Increased alkalinity and pH impacting aquatic organisms 	All waterways within the study area have the potential to be impacted by leakages and spills. Waterways at a higher risk due to the amended project when compared with the EIS include: <ul style="list-style-type: none"> • Unnamed tributary of South Creek (and the South Creek downstream receiving environment) • Unnamed tributary of Kemps Creek (and the Kemps Creek downstream receiving environment) • Ropes Creek • Unnamed first order tributaries of Badgerys Creek and Ropes Creek
Concreting Concrete dust, concrete slurries or washout water discharged to downstream waterways or where the existing bridge crossing South Creek is proposed to be demolished	High pH, chromium, solids	No change in impact from what was described in the EIS as the amended project would not result in substantially more concreting activities (see Table 5-2 in Appendix M of the EIS)	No change from the identified waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS)

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Vegetation clearing and mulching Soil and bank erosion and mobilisation of sediments to waterways via direct disturbance of waterway (due to installation of culverts, clearing of riparian vegetation etc) or via stormwater runoff and wind. Tannin leachate from clearing and mulching entering downstream waterways	Sediment, nutrients, heavy metals (bound to sediments or resuspended in instream works), high Biological Oxygen Demand (BOD) and tannins	The amended project would result in about 7 ha of additional native vegetation clearing across the amended project construction footprint including riparian vegetation near Ropes Creek. While the extent of clearing has increased, the nature of impacts would be consistent with the impacts described in the EIS (see Table 5-2 in Appendix M of the EIS)	All waterways within the study area have the potential to be impacted by vegetation clearing as identified in the EIS (see Table 5-2 in Appendix M of the EIS). However there would be an increased risk of impact at Ropes Creek as a result of the amended project
Cut and Fill Sediment runoff from excavation and excess spoil storage to downstream waterways. Water pollution from dust generated from stockpiles or inappropriate storage, handling and disposal of spoils. Contaminants associated with previously land uses could be exposed and transported downstream	Sediment, hydrocarbons, metals, and nutrients	Due to changes in the vertical alignment, the volume of cut for the amended project has increased when compared to the EIS, while the volume of fill has decreased. Overall, however, impacts would be consistent with those described in the EIS (see Table 5-2 in Appendix M of the EIS)	No change from the receiving waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS)
Drainage and surface road works Soil and bank erosion and mobilisation of sediments into receiving waterway during the direct disturbance of waterway bed and/or banks as a result of the construction of instream structures and associated earthworks	Sediments, nutrients and heavy metals stored in bed sediments	As part of the amended project, an instream structure would be constructed at Ropes Creek to widen the existing M7 Motorway bridge. The nature of impacts expected in this location would be consistent with those described in the EIS (see Table 5-2 in Appendix M of the EIS)	In addition to the waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS), Ropes Creek would also be at risk due to bridge work proposed as part of the amended project.

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Bridges Elevated concentrations of sediments entering and polluting the waters from disturbance and erosion of bed and banks. Pollutants from construction machinery or concrete spills entering waterways	Sediments and nutrients, high pH, fuels, chemicals, oils, grease and petroleum hydrocarbons	Bridge widening is proposed at Ropes Creek as part of the amended project. The nature of impacts expected due to this work would be consistent with those described in the EIS (see Table 5-2 in Appendix M of the EIS)	In addition to the waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS), Ropes Creek would also be at risk due to bridge work proposed as part of the amended project
Adjustment of waterway Bed and bank disturbance causing soil and streambank erosion which in turn can result in sediments being transported to downstream waterways	Sediments, nutrients, metals	No change in impact from the EIS as there are no additional waterway adjustments proposed as part of the amended project (see Table 5-2 in Appendix M of the EIS)	No change from the receiving waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS)
Temporary watercourse crossings Increased sediments to downstream water courses due to scour and disturbance of creek banks. Spills from construction machinery and vehicles hauling material over crossings	Sediment, nutrients, chemicals, heavy metal, oil and grease and petroleum hydrocarbon	An additional temporary waterway crossing may be required at Ropes Creek to widen the existing M7 Motorway bridge. The nature of impacts expected at Ropes Creek would, however, be consistent with impacts described in the EIS (see Table 5-2 in Appendix M of the EIS)	In addition to waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS), Ropes Creek would also be at risk due to bridge widening proposed as part of the amended project

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Dewatering Dewatering and infilling for farm dams. Discharges from sediment basins to downstream waterways	Sediments, nutrients	The amended project would impact one additional farm dam and would result in a number of dams being fully infilled instead of partially infilled. The nature of impacts due to these changes is expected to be consistent with impacts described in the EIS (see Table 5-2 in Appendix M of the EIS)	No change from the waterways identified in the EIS (see Table 5-2 in Appendix M of the EIS)

5.1.2 Amended project water balance

Section 5.1.2 of Appendix M of the EIS presented the water balance for the project, which consisted of tabulated water demands and discussion around how the demands would be met. Section 5.1.2 of Appendix M of the EIS indicated that where non-potable demands could not be met through opportunistic use of sediment basins or farm dams within the construction footprint, the demand would be met using potable water either via the Sydney Water network or via water tankers. In Section 5.1.2 of Appendix M of the EIS, surface water runoff and groundwater inflows were not tabulated alongside the project's water demands because both of these sources were not considered viable secure water sources. This is because the sediment basins require emptying within five days of a rain event and because the estimated groundwater inflow rate was negligible.

A revised water balance based for the amended project is summarised in **Table 5-2** and compared to the project as described in the EIS. All construction activities would result in an increase in both total and annual average water demand with the exception of potable water at the main ancillary facilities. There is no change for this activity.

Table 5-2 Amended project water balance

Construction activity	Total water demand (ML)		Annual average water demand (ML)	
	Project as per EIS	Amended project	Project as per EIS	Amended project
Dust suppression	270	320	90	106.67
Earthworks compaction	270	320	90	106.67
Concrete pavements	38	46	12.6	15.33
Potable water at main ancillary facilities	10	10	2.86	2.86
Potable water at (eight) outpost sites	16	32	4.57	9.14
Concrete bridges	63	76	21	25.33
Wheel washing (nine sites)	9	18	3	6
Total	676	822	224	272

With regards to groundwater inflows, Section 5.1.1 of Appendix N of the EIS concluded that the maximum estimated annual groundwater inflow rate was 2.46 megalitres per year. For the amended project, due to two additional areas of potential groundwater inflow, the total estimated annual groundwater inflow rate is 7.96 megalitres per year, which is 5.5 megalitres per year higher than the rate estimated in the EIS.

The surface water discharge as shown in **Table 5-3** was extracted from an updated version of the MUSIC model that was referenced in Appendix M of the EIS. The primary update to the model was incorporating catchment area outside of sensitive receiving environments, as this was not included in the EIS version of the model.

A breakdown of the total modelled mean annual surface water runoff from the amended project is summarised in **Table 5-3**. While not documented in the EIS, the estimated surface water runoff for the amended project is considered to be very similar to that which would have occurred due to the EIS design.

Table 5-3 Summary breakdown of modelled mean annual surface water discharge from project

Receiving environment	Mean annual surface water runoff (ML/year)
Badgerys Creek	18
Cosgrove Creek	7
Kemps Creek	18
South Creek	20
Hinchinbrook Creek	27
Remaining smaller catchments (including Ropes Creek)	179
Total	269

5.2 Operational impacts

Potential operational surface water quality and hydrology impacts assessed in Section 7.9.4 of the EIS include an assessment of impacts on:

- **Surface water quality**
 - **Stormwater quality**
 - **Spills**
- Performance against NSW water quality objectives
- **Hydrology and geomorphology**
 - **Major watercourses**
 - Creek adjustments
 - Culverts
 - **Minor receiving drainage lines**
- Impacts to SEPP Coastal Wetlands.

Where the amended project includes changes to the above operational impacts (shown in **bold** above), these are described in the sections below. The potential impacts associated with the remainder of the issues above were assessed for the amended project and it was determined that there would be no change to the impacts as described in the EIS. As a result, the assessments provided in Section 7.9.4 of the EIS still apply to these issues and they have therefore not been discussed further in this assessment.

Operational surface water impacts would be managed in accordance with the environmental management measures described in **Section 7** of this memorandum and Chapter 7 of the amendment report.

5.2.1 Surface water quality

The potential impacts to surface water quality associated with the proposed design changes are presented in **Table 5-4**.

Table 5-4 Potential operational impacts on surface water quality

Operational element / source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Spill events Discharge of spill directly into waterways (should spill event happen on a bridge) or via runoff into the drainage system.	Oil and grease, fuel and various hazardous chemicals transported by vehicles.	Widening the bridge at Ropes Creek would result in an increased risk of spills in this location. The nature of impacts would be consistent with the impacts described in the EIS (see Table 5-3 of Appendix M of the EIS)	As identified in the EIS (see Table 5-3 of Appendix M of the EIS) all waterways would be at risk, however Ropes Creek has increased risk of spill events due to the amended project.
Stormwater runoff Untreated stormwater from impervious surfaces which are not conveyed to treatment systems.	Gross pollutants and litter, sediments, total suspended solids, nutrients, BOD, heavy metals and hydrocarbons, oil and grease	While the amended project would result in an increase in impervious surface area, the area is minimal and impacts are expected to be generally consistent with those described in the EIS (see Table 5-3 of Appendix M of the EIS).	No change from the waterways identified in the EIS (see Table 5-3 of Appendix M of the EIS).
Hydrology and scour protection Permanent instream structures	Elevated concentrations of sediments and nutrients	<p>As described in the EIS bridges would be located over Cosgroves Creek, Badgerys Creek, South Creek and Kemps Creek. Proposed creek adjustments and placement of bridge piles out of the creeks has resulted in no permanent instream structures proposed at these locations.</p> <p>The existing M7 Motorway bridge at Ropes Creek is proposed to be widened as part of the amended project and would require a pile located within Ropes Creek to align with the existing bridge piles.</p> <p>As such, this permanent instream structure could change the characteristics of Ropes Creek due to changes in flow rates and flow paths leading to scour and deposition of sediments. As the new instream structure would be aligned with the existing bridge piles the risk of impact would be minimised</p>	Ropes Creek

5.2.2 Hydrology and geomorphology

Major watercourses

The comparison between the percentage of impervious areas pre- and post- development at the major creeks demonstrates that the proposed road pavement associated with the project as described in the EIS would contribute only a minor increase in catchment imperviousness. The amended project would only slightly increase the percentage of impervious areas. This would not result in a significant change.

It is therefore anticipated that the minor increase in catchment imperviousness of the amended project would translate to negligible impact to the natural hydrological attributes including volumes and duration and would have negligible impact on the geomorphology of the receiving waterways.

Minor receiving drainage lines

The following proposed design changes have resulted in changes to the minor drainage line assessment documented in the EIS, as follows:

Table 5-5 Minor receiving drainage lines changes to assessment

Proposed change	Resulting minor drainage line assessment
Amendments to motorway-to-motorway interchange at the M7 Motorway (see Section 3.1 of the amendment report)	The additional road works for the connection to Elizabeth Drive under option 2 would result in increases in the imperviousness of the catchments that drain to the tributary of Ropes Creek. Adjustment of catchment areas and percentage imperviousness has been incorporated to account for road proposed design changes and the calculations for the impact assessment have been updated. Flow calculations have been updated for all minor drainage lines in the vicinity of Elizabeth Road widening carried out as part of road design amendment for the connection of Elizabeth Road to the M12 Motorway.
	Road design changes are proposed around the intersection of the M7 Motorway, Elizabeth Drive and Wallgrove Road, including amendment to exit ramps and overbridges. This would result in changes to the catchments for the minor drainage line discharging to Hinchinbrook Creek at CH 15350. The catchment areas have been amended (see Figure 5-1) and the flow calculations updated to assess the potential downstream impacts.
	The existing Ropes Creek southbound bridge would be widened and the widening of the M7 Motorway would be extended north of the existing bridge across Ropes Creek. These proposed design changes to the road and bridge has warranted an assessment of the minor drainage line that discharges flow from the motorway to the existing drainage in Wallgrove Road on the western side of the M7 Motorway at the northern end of the bridge. At around CH 11500 diversion of existing catchment flow would occur due to the motorway alignment for both of the motorway road design options. An assessment of the catchment flow has been undertaken at this location to inform the flow reduction to the existing creek and the requirement to provide a creek diversion work if required.

Proposed change	Resulting minor drainage line assessment
Lowering in and around the Western Sydney International Airport interchange (see Section 3.3.1 of the amendment report)	The motorway alignment has been regraded in the area resulting in additional catchment flow to the existing minor drainage line on the southern side of the amended project. Catchments have been reviewed and adjusted to suit the road proposed design changes.
Signalised intersections into the Western Sydney International Airport	There is an existing minor drainage line at reference CH 6000 around the airport access road. This drainage line receives major flow from the Western Sydney International Airport site. Pavement drainage from the M12 works in Elizabeth Drive also discharges flow into this drainage line. Assessment of the flow to this minor drainage line has been included.

A summary of the impacts on minor drainages associated with the above proposed design changes is provided in **Table 5-6**. The revised minor drainage channel catchments are shown in **Figure 5-1**. Impacts to other minor drainage lines remain consistent with those discussed in Section 5.2.3 of Appendix M of the EIS.

5.3 Cumulative impacts

The cumulative surface water quality and hydrology impacts would be likely to remain unchanged from the assessment presented in Section 7.9.5 of the EIS. The cumulative impact assessment in the EIS concluded that the project is expected to have a minor contribution to cumulative surface water quality and hydrological impacts. As the project is not expected to generate significant water quality or hydrological impacts during construction or operation, outside of the potential for minor erosion and sedimentation, accidental spills and increased stormwater runoff, the M12 Motorway is anticipated to have a minor contribution to cumulative surface water quality and hydrological impacts associated with the project and other identified projects in the vicinity.

While the proposed changes associated with the amended project would result in some changes to the expected water quality and hydrological impacts described in the EIS, these are also expected to have a minor contribution when considering the contribution of other surrounding developments. The amended project is therefore not anticipated to have a significant cumulative impact on surface water quality and hydrology.

Table 5-6 Summary impacts and suggested mitigations at minor drainage lines

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Cosgroves Creek	All drainage lines		No change from EIS (see Table 5-9 in Appendix M of the EIS)			
South Creek	All drainage lines		No change from EIS (see Table 5-9 in Appendix M of the EIS)			
Badgerys Creek	BC DL 5150 BC DL 5160 BC DL 5300		No change from EIS (see Table 5-9 in Appendix M of the EIS)			
Badgerys Creek	BC DL 5870	Private	+27 to +54 which is higher than the project as described in the EIS (of -3 to +3)	<ul style="list-style-type: none"> The EIS predicted no adverse impact on the receiving drainage line due to the minor change in flow Increased flows to the farm dam associated with the amended project would be about 27 per cent in 100 year Average Recurrence Interval (ARI) which would adversely impact on the performance of the existing spillway and its scour protection 	<ul style="list-style-type: none"> No mitigation measures were proposed in the EIS as no impacts were expected. However additional measures are required mitigate impacts from the amended project During detailed design an assessment would be undertaken into the impact the project would have on the characteristics of flow over the spillway of the affected dam. Adjustments may need to be made to the spillway of the dam that would include its armouring using dumped rock rip rap. 	<ul style="list-style-type: none"> The EIS predicted a very minor reduction in rate and volume of runoff into the farm dam, however there would be increase in the rate and volume of runoff into the farm dam as a result of the amended project The EIS predicted the dam would fill and overtop less frequently due to the reduction in the volume of runoff, however the dam is likely to fill and overtop more frequently as a result of

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
				<ul style="list-style-type: none"> • Increase in the peak flow rate can cause scour of the downstream drainage line 	<ul style="list-style-type: none"> • During detailed design an assessment would be undertaken on the potential alternative design including discharging the pavement drainage to Badgerys Creek on the other side of the motorway instead of directing the flow to the existing farm dam to minimise the potential impacts on the existing dam. 	<p>an increase in the volume of runoff associated with the amended project</p> <ul style="list-style-type: none"> • The EIS predicted a very minor change in the peak flow rate and volume of runoff to the receiving downstream drainage line, however there would be a substantial increase as a result of the amended project
Badgerys Creek	BC DL 6000	Private	-1 to +1	<ul style="list-style-type: none"> • Drainage line was not identified as being impacted in the EIS (new impact) • The amended project would not have an adverse impact on the receiving drainage line due to the minor change in flow 	<ul style="list-style-type: none"> • No mitigation measure is proposed at this location 	<ul style="list-style-type: none"> • There would be a minor increase in the rate and volume of runoff into the receiving drainage line

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Kemps Creek	KC DL 8700 KC DL 8930 KC DL 9140 KC DL 9701 KC DL 10510 KC DL 12030 KC DL 12300 KC DL 13180 KC DL 13080		No change from EIS • (see Table 5-9 in Appendix M of the EIS)			
Ropes Creek	RC DL 13500 RC DL 13790 RC DL 13910 RC DL 14040 RC DL 14190 RC DL 13570 RC DL 13700 RC DL 13890 RC DL 14000 RC DL 14640		No change from EIS (see Table 5-9 in Appendix M of the EIS)			

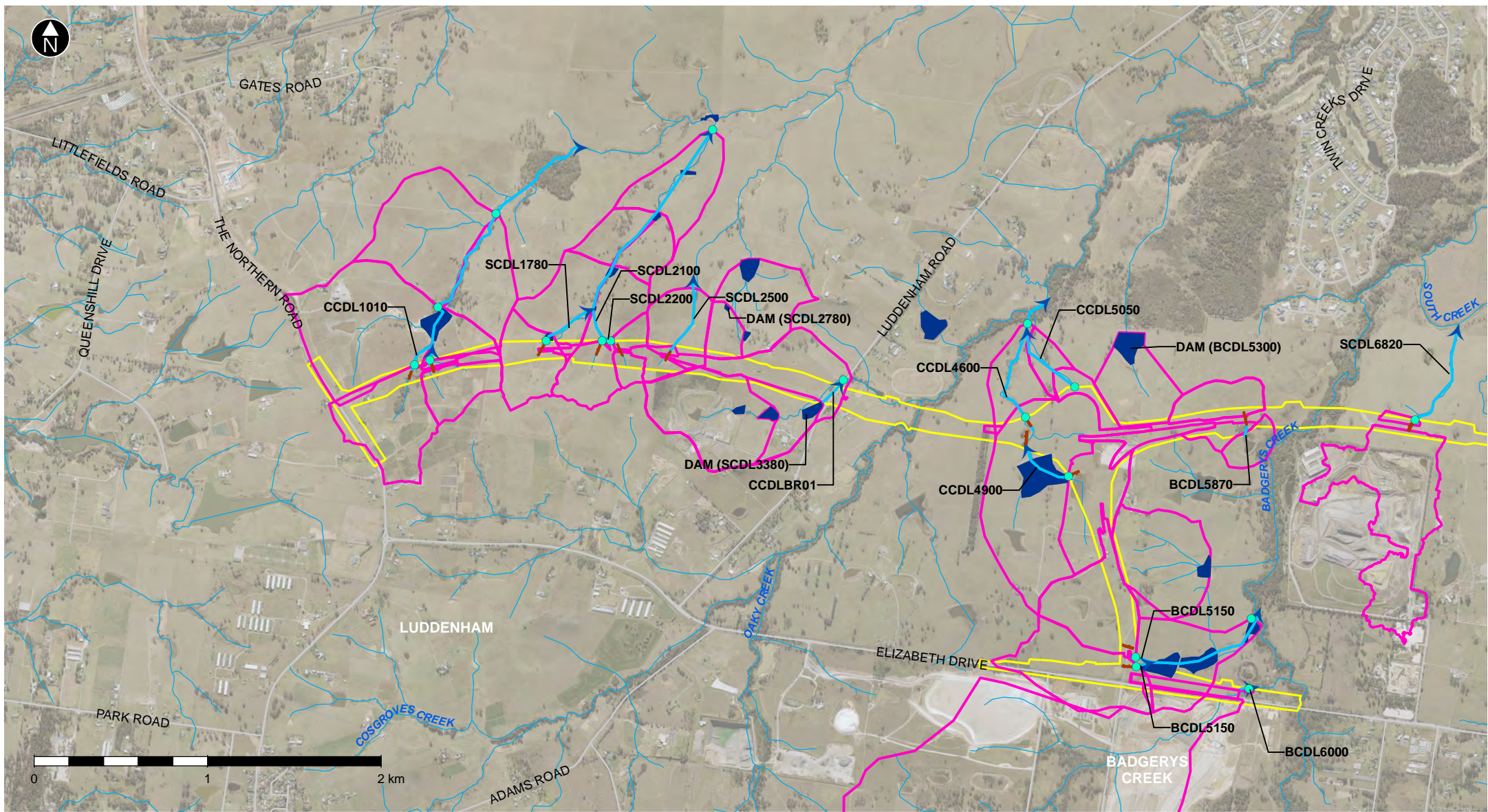
Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Ropes Creek	RC DL 14220	Private	+12 to +54, which is higher than the project as described in the EIS (of -4 to +25)	<ul style="list-style-type: none"> The EIS predicted that an increase in the 2 to 10 year ARI flow may impact adversely on the existing culverts beneath Wallgrove Road/Elizabeth Drive intersection, potentially causing flooding at the intersection for these storm events The increase in the two to 100 year ARI flow as a result of the amended project may impact adversely on the existing culverts beneath Wallgrove Road/Elizabeth Drive intersection. This may cause flooding at the intersection for these storm events. 	<p>Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> Further modelling would be undertaken during detailed design to verify the amended project impacts on the characteristics of flows in the culverts beneath the Wallgrove Road/Elizabeth Drive intersection. Subject to modelling and verification of the amended project impacts, mitigation could include provision of a detention basin within the amended operational footprint to minimise the potential adverse impacts to the existing culverts. The modelling would also be used to demonstrate that the proposed mitigation measures will be effective based on the design as modelled. 	<p>The residual impacts of the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> There would be a minor increase in the rate and volume of runoff into receiving drainage line The assessment found that the project would not increase the scour potential in the receiving drainage line
Unknown catchment	UC DL 14810		No change from EIS (see Table 5-9 in Appendix M of the EIS)			

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Hinchinbrook Creek	HB DL 15350	Private	-29 to +37, compared to the project as described in the EIS (of -19 to +37)	<p>Potential impacts of the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> No increase in peak flow rates for storm events from 10 year ARI to 100 year ARI Peak flow rate would increase in the 2 year ARI storm event, increasing risk of scour potential in the downstream receiving drainage line. 	<p>Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> Further modelling would be undertaken during detailed design to verify the amended project impacts on the characteristics of flows in this receiving drainage line. Subject to modelling outcomes and verification of project impacts, mitigation could include provision of scour protection and a detention basin within the amended operational footprint. 	<p>Potential residual impacts of the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> There would be a minor increase in the rate and volume of runoff into receiving drainage line in the frequent rain events. However, there would be a significant reduction in the rate and volume of runoff into the receiving drainage line in the major storms. The assessment found that the amended project would not increase the scour potential in the receiving drainage line
Hinchinbrook Creek	HB DL 15520	No change from EIS (see Table 5-9 in Appendix M of the EIS)				

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Ropes Creek	RC DL 14450 ¹	Private	+3 to +31, compared to the project as described in the EIS (of +11 to +53)	<ul style="list-style-type: none"> The EIS predicted an afflux of 10 millimetres on the existing watercourse in the private property at the project (operational) boundary, however under the amended project there may be flooding impacts to private properties (lot 28/DP654786, 1/724970 6/629798 and 2/2954 at the amended operational footprint) The increase in the peak flow rate attributable to the amended project has the potential to increase the scour potential in the receiving downstream drainage line. This is consistent with the EIS 	<p>Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include:</p> <ul style="list-style-type: none"> Further modelling would be undertaken during detailed design to confirm the impact on flows to this drainage line and the appropriate mitigation measures which could include a detention basin and scour protection. Modelling at detailed design would be used to confirm that proposed mitigation measures are effective and feasible. All potential management measures would be considered in consultation with the affected property owner. 	<ul style="list-style-type: none"> The EIS identified there would only be a minor increase in the rate and volume of runoff into receiving drainage line The EIS assessment found that the project would not increase the scour potential in the receiving drainage line However scour potential associated with the amended project may increase in the receiving drainage line if appropriate mitigation measures are not implemented.

Catchment	Drainage line	Land ownership	Approximate change in peak flow at operational footprint (%)	Potential impacts prior to the implementation of environmental management measures	Proposed mitigation measures	Residual impacts
Ropes Creek	RC DL 15800	Public	+1 to +4	<ul style="list-style-type: none"> This drainage line was not identified as being impacted in the EIS (new impact) The increase in the peak flow rates due to the road and bridge widening of the M7 Motorway associated with the amended project is minor. However, this may impact on the performance of the downstream drainage system. 	<ul style="list-style-type: none"> Further modelling would be undertaken during detailed design to verify the amended project impacts on the characteristics of flows in this receiving drainage line. Subject to modelling outcomes and verification of project impacts, mitigation could include provision of upgrade to downstream drainage or a detention basin within the amended operational footprint. 	<ul style="list-style-type: none"> There would be a minor increase in the rate and volume of runoff into receiving drainage line as a result of the amended project

¹ This drainage line was incorrectly referred to as RC DL 15450 in the EIS. Corrected here to RC DL 14450.



- Waterways
- Main roads
- The amended project operational footprint
- Points of interest
- Minor drainage lines that have been assessed in the EIS and/or the amended project
- Direction of flow
- Farm Dams that have been assessed
- Cross drainage culverts
- Minor drainage channel catchments - with project

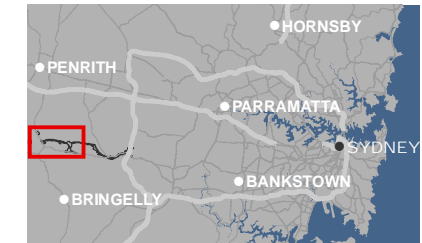
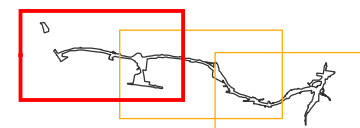
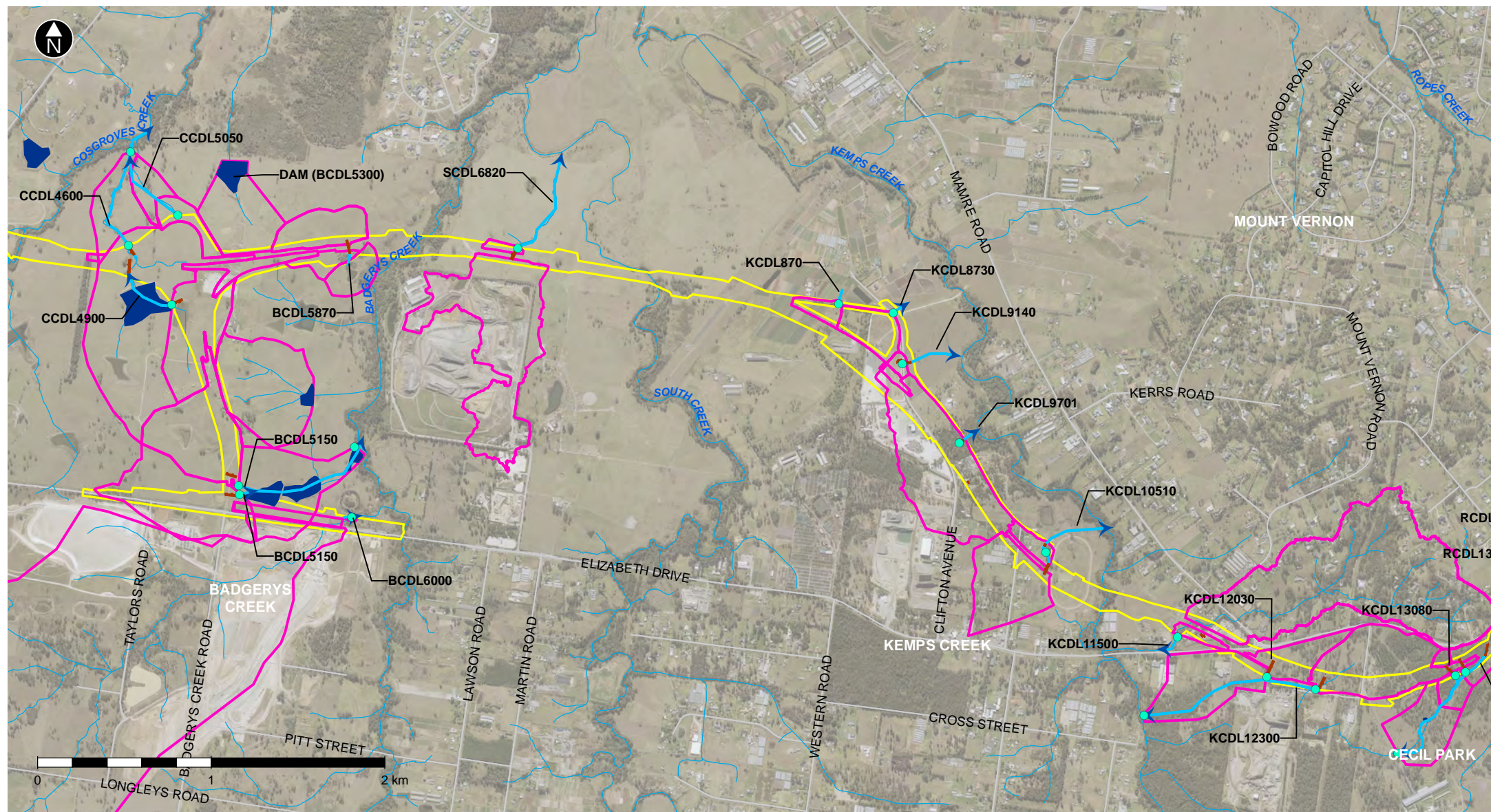


Figure 5-1 Minor drainage channels and farm dams



- Waterways
- Main roads
- The amended project operational footprint
- Points of interest
- Minor drainage lines that have been assessed in the EIS and/or the amended project
- Direction of flow
- Farm Dams that have been assessed
- Cross drainage culverts
- Minor drainage channel catchments - with project

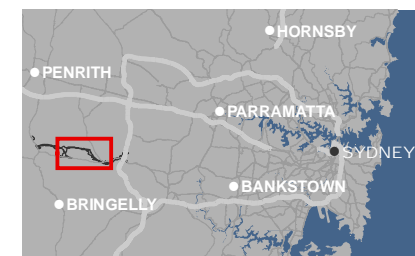
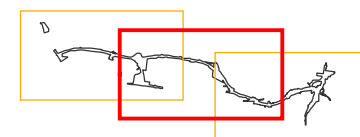
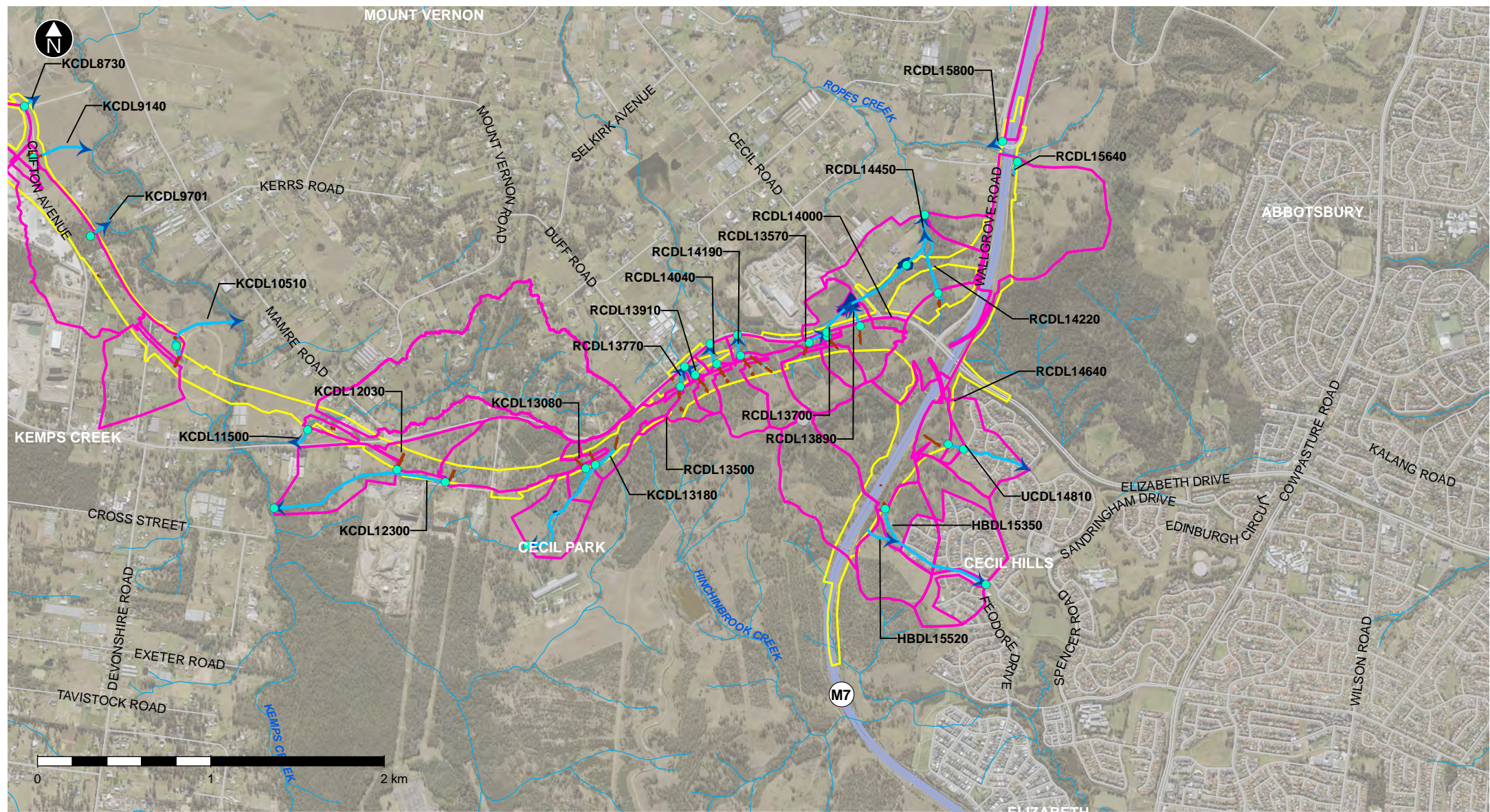


Figure 5-1 Minor drainage channels and farm dams



- | | | |
|---|--|--|
| Waterways | Points of interest | Farm Dams that have been assessed |
| Motorway | Minor drainage lines that have been assessed in the EIS and/or the amended project | Cross drainage culverts |
| Main roads | Direction of flow | Minor drainage channel catchments - with project |
| The amended project operational footprint | | |

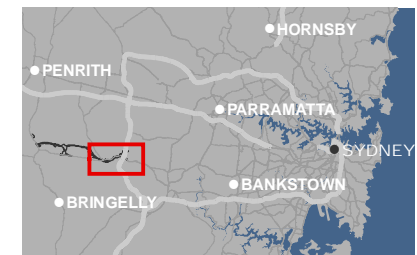
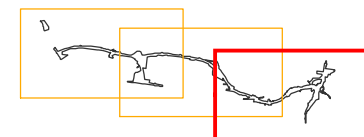


Figure 5-1 Minor drainage channels and farm dams

6. Amended water quality and hydrology controls

The proposed changes associated with the amended project have been reviewed to identify any changes to the construction and operational water quality controls identified in Chapter 6 in Appendix M of the EIS.

6.1 Construction phase

Construction erosion and sediment controls at the additional construction ancillary facilities would be consistent with the controls described in Chapter 6 of Appendix M of the EIS.

Table 5-1 in Section 5.1 provides more information on the specific potential impacts and the nominated water quality controls for construction outlined in the EIS would be sufficient in managing these impacts.

6.2 Operational phase

The proposed design changes would require changes to six proposed permanent (operational) water quality basins (refer to **Figure 6-1** to **Figure 6-3**):

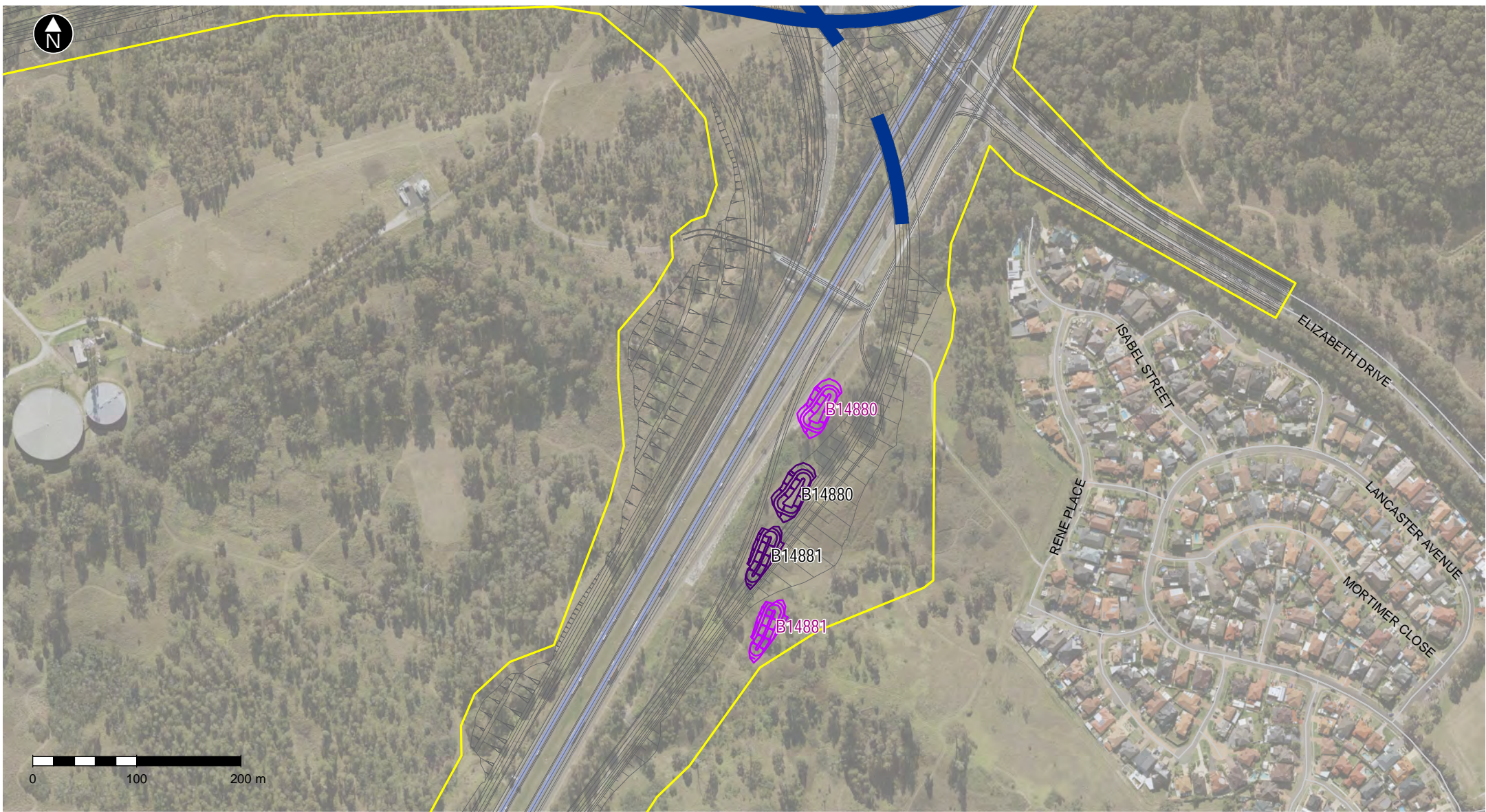
- Three permanent basins would require relocation because the horizontal road alignment has been modified:
 - Two would be located near the M7 Motorway southbound (**Figure 6-1**)
 - One would be located near the Elizabeth Drive intersection at the Western Sydney International Airport (**Figure 6-2**)
- Two permanent basins would require an increase to their sizes and one basin could be decreased in size (**Figure 6-3**)
 - Two would be located near Badgerys Creek on the main M12 alignment and would be approximately 30 per cent larger due to an increase of the road pavement catchment area discharging towards these two basins. These changes are needed due to the road design crest shifting by approximately 500 metres which increased the drainage catchment area towards Badgerys Creek.
 - A third basin located upstream of Cosgrove Creek would be reduced in size by approximately 25 per cent due to the reduced road pavement catchment as a result of the road crest design change.

The proposed design changes at Elizabeth Drive include a small shift in the horizontal alignment and a small increase in width which would result in an increase of less than five per cent in impervious catchment. Such a minor increase does not warrant any changes to the proposed water quality controls in this area.

The proposed design changes at the motorway-to-motorway interchange at the M7 Motorway area resulted in small changes to the road surface runoff direction and insignificant increases to the impervious road catchments which were estimated to be less than four percent.

The proposed design changes did not result in any substantial changes to the amount of pavement runoff distribution discharging towards Ropes Creek and Hinchinbrook Creek from the water quality perspective.

Other proposed design changes would not require modifications to the remaining operational water quality controls described in the EIS. The performance water quality controls set out in the EIS will be verified as the detailed design develops for the project to ensure the objectives of the project are achieved.



- The amended project
- Bridges
- The amended project operational footprint
- Permanent water quality basins as per EIS
- Amended permanent water quality basin

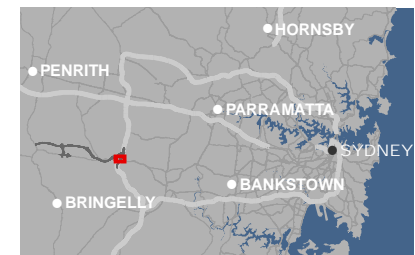
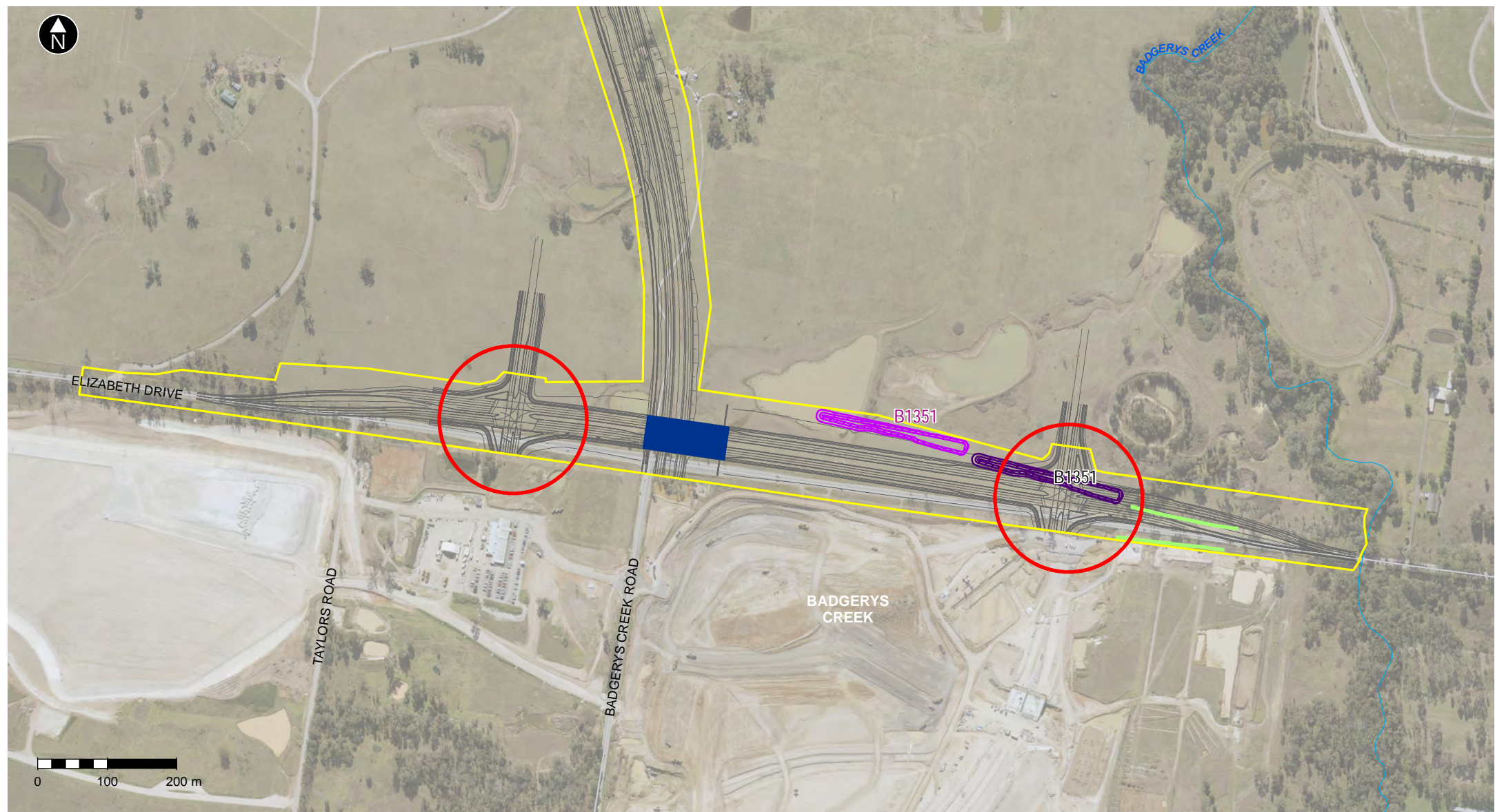


Figure 6-1 Revised location of permanent water quality basin B14880 and B14881



- | | | |
|---|----------------------|---|
| — The amended project | Waterways | Permanent water quality basins as per EIS |
| The amended project bridges | Water quality swales | Amended permanent water quality basin |
| The amended project operational footprint | | Intersection connecting into the Western Sydney International Airport
Note: Indicative, subject to detailed design |

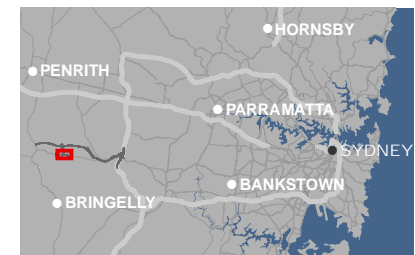
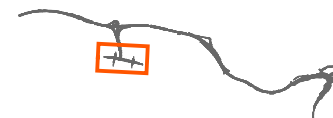


Figure 6-2 Revised location of permanent water quality basin B1351



- The amended project
- The amended project bridges
- The amended project operational footprint
- ~ Waterways
- Water quality swales
- Permanent water quality basins as per the EIS
- Amended permanent water quality basins

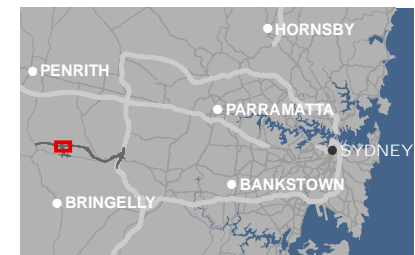


Figure 6-3 Permanent water quality basins requiring an increase in size

7. Revised environmental management measures

Surface water quality and hydrological impacts associated with the proposed design changes are generally consistent with impacts described in the Chapter 7.9 of the EIS and would be managed through the implementation of the proposed management measures described in Chapter 7 of the amendment report.

However, there would be three updated measures. One measure required updating to reflect that surface water monitoring will be carried out in accordance with the updated guidelines and would include those sites presented in Section 7.9 of the EIS. Two other measures has also been updated to incorporate the results of this assessment. The revised environmental management measures for potential surface water and hydrology impacts is outlined in Table 7-1, with additional text (to that presented in the EIS) shown in **bold** and deleted text shown as strikethrough text.

Table 7-1 Supplementary environmental management measures (Surface water and hydrology)

Impact	Reference	Environmental management measure	Responsibility	Timing
Surface water quality impacts	SWH05	<p>A construction water quality monitoring program will be developed and included in the CSWMP for the project to establish baseline conditions, observe any changes in surface water and groundwater during construction, and inform appropriate management responses.</p> <p>The program will be based on the water quality monitoring methodology water quality indicators and the monitoring locations identified in the Surface water and hydrology assessment report (Appendix M of the EIS) and supplementary memo (Appendix I of the amendment report), and Groundwater quality and hydrology assessment report (Appendix N of the EIS) and supplementary memo (Appendix J of the amendment report).</p> <p>Baseline monitoring will be carried out monthly for a minimum of 12 months before the start of construction. As a minimum this will include three wet weather sampling events over six months where feasible.</p> <p>Sampling locations and monitoring methodology to be carried out during construction will be further developed in detailed design in accordance with the Guideline for Construction Water Quality Monitoring (RTA 2003b) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) 'ANZECC water quality guidelines' (ANZECC/ARMCANZ 2000). It will include collection of samples for analysis from sedimentation basin discharge points, visual monitoring of other points of release of construction waters and monitoring of downstream waterways.</p>	TfNSW / Contractor	Prior to construction, and during construction and operation

Impact	Reference	Environmental management measure	Responsibility	Timing
	SWH07	<p>The performance water quality controls developed for the design set out in the EIS and the amended water quality and hydrology controls outlined in the amendment report document (including but not limited to temporary and permanent sediment basins) will be verified as the detailed design develops for the project to ensure the objectives of the project are achieved.</p> <p>In the instance that water quality (MUSIC) modelling carried out during detailed design-it can not be demonstrated that the water quality controls would be effective in mitigation potential impacts, additional mitigation measures would be identified and implemented where possible.</p>	Contractor	Detailed design
Impacts on water bodies	SWH13	<p>A set of hydrologic and hydraulic models will be developed, which are to be used to define the nature of both main stream flooding and major overland flow along the full length of the project operational footprint under pre- and post-project conditions. The hydraulic model is to extend a sufficient distance upstream and downstream of the amended project operational footprint, to negate any boundary effects and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow. The hydraulic model(s) is to be based on the TUFLOW (or equivalent) two-dimensional (in plan) hydraulic modelling software.</p> <p>The models will be used to verify the nature and extent of impacts and to confirm the type of mitigation measures required, including potential mitigation measures identified throughout the EIS (see Table 5-9 in Appendix M of the EIS) and the amendment report (see Table 5-6 in this memorandum).</p> <p>The models will also be used during detailed design to describe the interaction between the project and flows particularly with respect to culverts and to assist in refining the design for flows arriving at and travelling through culverts.</p>	Contractor	Detailed design

8. Conclusion

The surface water quality impacts during construction of the amended project would be similar to that of the project as described in the EIS where there is no change to the construction of the project and no significant increase in the construction footprint adjacent to waterways, with the exception of:

- Ropes Creek bridge widening as part of the proposed amendments to motorway-to-motorway interchange at the M7 Motorway
- Extension of the airport access road as part of the proposed signalised intersections into the Western Sydney International Airport
- Additional ancillary facilities proposed to be located within 50 metres of waterways.

The key impacts to water quality would be associated with erosion and sedimentation and spills and leakages of fuels and chemicals from construction machinery. The waterways with the potential to be impacted include:

- Ropes Creek
 - Including unnamed first order tributaries of Ropes Creek
- Badgerys Creek
 - Including unnamed first order tributaries of Badgerys Creek
- Kemps Creek.

The surface water quality impacts during the operation of the amended project would be similar to that of the project as described in the EIS. There would, however be an increased risk of a spill event over Ropes Creek due to the widening of the existing southbound bridge.

The amended project would slightly change the catchment areas and its percentage of imperviousness in the areas of the motorway where the road designs have been changed. This would alter the catchment flows to the minor drainage that discharge into the tributaries of Ropes Creek, Badgerys Creek and Hinchinbrook Creek during operation. However, there would be negligible to minor impacts to the minor drainage lines and this would be managed through environmental management measures.

Construction and operational water quality controls (basins and swales) would remain unchanged with the exception of six permanent water quality basins. Three of these five basins would need to be shifted to accommodate the amended road alignment while the remaining three basins would require changes to their sizes.

It has been concluded that the amended project would not lead to unacceptable surface water quality and hydrology impacts and there would be no need for more detailed assessment. However, it is recommended to do some additional hydrological modelling during the detailed design as recommended in the EIS.

This conclusion is based on the determination of potential impacts to surface water quality and hydrology during both construction and operation, including potential cumulative impacts, of both options 1 and 2 of the amended project. With the application of the appropriate safeguards, it is anticipated that water quality and hydrological impacts from the amended project would be effectively managed.

9. References

ANZECC & ARMCANZ 2000, [Australian and New Zealand Guidelines for Fresh and Marine Water Quality](#). Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments. Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

Austroroads (2010) *Guide to Road Design, Part 5: Drainage Design*, Sydney.

GHD (2019). M12 Motorway Surface Water Monitoring Six Monthly Report – April to September 2019. Roads and Maritime Services, November 2019.

RMS (2019) *M12 Motorway Environmental Impact Statement*. Roads and Maritime Services, 2019s