6.9 Surface water quality and hydrology

The surface water quality and hydrology supplementary technical memorandum is provided in **Appendix I**, and a summary is provided below. This section should be read in conjunction with Section 7.9 of the EIS and the surface water quality and hydrology assessment report provided in Appendix M of the EIS.

6.9.1 Assessment methodology

This surface water quality and hydrology supplementary assessment focused on the changes in potential impacts associated with the proposed changes to the project, which include design changes and construction updates (see **Chapter 3** and **Chapter 4**).

The methodology included:

- A desktop review, including:
 - A 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
 - A review of and confirmation of the sensitive receiving environments crossed by and adjacent to the amended project
 - A review of the environmental management measures and other treatment or monitoring measures proposed for the project as described in the EIS
- Assessment of the impact of construction and operation activities of the amended project on water quality and hydrology, including:
 - An assessment of changes to catchment characteristics
 - An update of the hydrological model in DRAINS that was used for the project as described in the EIS
 - Assessment of flows and identification of locations of potential adverse impacts
- Identification of appropriate measures to mitigate the potential impacts that would need to be updated or added, including water quality controls and monitoring requirements
 - Update of the MUSIC model used for the project as described in the EIS to determine amended proposed permanent operational quality basin sizes.

The study area was updated for the supplementary assessment to include the construction and operational footprints, and a 500 metre buffer surrounding the road alignment for the amended project (see **Figure 6-50**).

Water quality criteria used for the amended project is largely consistent with that used for the project as described in the EIS. An additional guideline was used for the supplementary assessment, however. The amended project was prepared in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (2018) guidelines. These have been updated from the ANZECC/ARMCANZ 2000 guidelines that were used in the assessment of the project as described in the EIS. Section 2 of **Appendix I** provides a summary of these guidelines.

6.9.2 Existing environment

The existing environment described in Section 7.9.3 of the EIS is still applicable to the amended project. Additional surface water quality data has been collected, however, for all key watercourses, including Ropes Creek, since the preparation of the EIS. This new data is summarised below.



Figure 6-50 Study area for the supplementary surface water quality and hydrology assessment

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As identified in the EIS, the key watercourses (and the tributaries) within the study area are Cosgrove Creek, Badgerys Creek, Kemps Creek, South Creek, Ropes Creek and Hinchinbrook Creek. Water quality data was available for all creeks during the assessment of the project as described in the EIS, with the exception of Ropes Creek.

Monitoring upstream and downstream of the named waterways has continued during the preparation and submission of the EIS. Monthly 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 Creek and Hinchinbrook Creek.

Monthly water quality monitoring of Ropes Creek, both upstream and downstream of the project, was completed by GHD between April and September 2019. Monitoring data shows that water quality during this time was poor with frequent exceedances of the nominated guideline values. 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. The creek is also currently traversed by the M7 Motorway at Cecil Hills, along with other road and rail assets (GHD, 2019).

6.9.3 Assessment of potential impacts

6.9.3.1 Construction

Section 7.9.3 of the EIS identified a number of surface water quality and hydrology impacts that may occur during construction of the project. This section focuses on the additional impacts that are likely to occur as a result of the amended project when compared to the project described in the EIS. These impacts include:

- Surface water quality
- Water balance.

A number of other impacts may occur that would be consistent with those assessed for the project as described in the EIS. These include:

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

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 amendment report.

Impacts associated with surface water quality and water balance would be managed in accordance with the environmental management measures described in **Section 6.9.5** and **Chapter 7** and are discussed in the following sections.

Surface water quality

The potential impacts to surface water quality associated with the amended project are presented in **Table 6-51**. **Table 6-51** only presents the impacts that are likely to change as a result of the amended project. A full list is provided in Table 5-1 of **Appendix I**. It is noted that the additional project bridges described in **Section 3.1** are not anticipated to result in potential surface water impacts, as these bridges do not extend over any waterways and would not require any creek adjustments or placement piles located in the vicinity of waterways.

Water balance

A revised water balance for the amended project is summarised in **Table 6-50** 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 main ancillary facilities. There is no change for this activity.

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 facility	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	

Table 6-50 Amended project water balance

The project as described in the EIS would have a maximum estimated annual groundwater inflow rate of 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. This would be 5.50 megalitres per year higher than the rate estimated for the project as described in the EIS.

A breakdown of the total modelled mean annual surface water runoff from the amended project is summarised in **Table 6-52**. 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.

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
Earthworks, cuttings, stockpiling Erosion and exposure of sediments and contaminated soils from exposed areas open cuts and stockpiles due to wind and stormwater runoff leaving to sedimentation and contamination of downstream waterways.	Sediments, nutrients, hydrocarbons, metal contaminants, gross pollutants,	 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: 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. 	 As identified in the EIS, all waterways within the study area have the potential to be impacted by sedimentation. The following waterways, however, have an increased risk as a result of the amended project: Badgerys Creek Ropes Creek. Waterways within 50 metres downstream of an ancillary facility including unnamed first order tributaries of: Badgerys Creek Kemps Creek Ropes Creek.

Table 6-51 Potential construction impacts on surface water quality associated with the amended project

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
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: 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: 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.
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.

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
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).	As identified in the EIS (see Table 5-2 in Appendix M of the EIS), all waterways are at risk of impacts from drainage and surface road works, however, Ropes Creek would be at an increased risk due to the amended project.
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.

Construction activity/source of pollutants	Pollutants of concern	Potential Impacts prior to the implementation of environmental management measures	Receiving waterways
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.
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 EIS (see Table 5-2 in Appendix M of the EIS).

Table 6-52 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

6.9.3.2 Operational impact

Section 7.9.4 of the EIS identified the surface water quality and hydrology impacts that may occur during operation of the project. This section focuses on the additional impacts that are likely to occur as a result of the amended project when compared to the project described in the EIS. These impacts include:

- Surface water quality
 - Stormwater quality
 - Spills
- Hydrology and geomorphology
 - Major watercourses
 - Minor receiving drainage lines.

Impacts associated with the above would be managed in accordance with the environmental management measures described in **Section 6.9.5** and **Chapter 7** and are discussed in the following sections.

A number of other impacts may occur that would be consistent with those assessed for the project as described in the EIS. These include:

- Performance against NSW water quality objectives
- Hydrology and geomorphology
 - Creek adjustments
 - Culverts
- Impacts to SEPP Coastal Wetlands.

While all potential impacts were assessed, the proposed changes associated with the amended project (see **Chapter 3**) would not substantially alter these impacts, as the relevant changes are similar when compared to the design of the project as described in the EIS.

Surface water quality

The potential impacts to surface water quality associated with the amended project are presented in **Table 6-53**. **Table 6-53** only shows the impacts that are likely to change as a result of the amended project. Refer to Section 5.1.1 of **Appendix I** for a full assessment.

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	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.	Ropes Creek
		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.	
		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.	

Table 6-53 Potential operational impacts on surface water quality

Hydrology and geomorphology

Major watercourses

The amended project would result in only a slight increase in percentage of impervious areas when compared to the project described in the EIS. It is anticipated that this 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 receiving major watercourses.

Minor receiving drainage lines

Three of the proposed changes listed in **Chapter 3** would result in adjustments to the catchments and flows to minor drainage lines. The locations of the revised minor drainage channel catchments are shown in **Figure 6-51** and a summary of the impacts on minor drainage lines associated with the above proposed design changes is provided in **Table 6-54**. **Table 6-54** only shows the impacts that are likely to change as a result of the amended project. Refer to Section 5.2.2 of **Appendix I** for a full assessment.

Impacts to other minor drainages remain as documented in Section 5.2.3 of Appendix M of the EIS.

6.9.3.3 Cumulative impacts

The cumulative impact assessment for the project as described in the EIS concluded that the project was expected to have a minor contribution to cumulative surface water quality and hydrological impacts. As the project was 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 was 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 substantial cumulative impact on surface water quality and hydrology and the cumulative surface water quality and hydrology impacts would be likely to remain consistent with those of the project as described in the EIS.

6.9.4 Amended water quality and hydrology controls

6.9.4.1 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.



Figure 6-51 Minor drainage lines and farm dams

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Figure 6-51 Minor drainage lines and farm dams





Figure 6-51 Minor drainage lines and farm dams

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
Badgerys Creek	BC DL 5870	Private	+27 to +54 which is higher than the project as described in the EIS of (of -3 to +3)	 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 Increase in the peak flow rate can cause scour of the downstream drainage line 	 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. 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. 	 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 an increase in the volume of runoff associated with the amended project 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

Table 6-54 Changes to the minor drainage line assessment as a result of the proposed design changes

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
Badgerys Creek	BC DL 6000	Private	-1 to +1	 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 	No mitigation measure is proposed at this location.	There would be a minor increase in the rate and volume of runoff into the receiving drainage line.
Ropes Creek	RC DL 14220	Private	+12 to +54, which is higher than the project as described in the EIS of (of -4 to +25)	 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. 	 Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include: 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. 	 The residual impacts of the amended project would remain consistent with those identified in the EIS. They include: 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.

Catchment Drainag line	e 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 15350	Private	-29 to +37, which is higher than the project as described in the EIS of (of -19 to +37)	 Potential impacts of the amended project would remain consistent with those identified in the EIS. They include: 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. 	 Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include: 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. 	 Potential residual impacts of the amended project would remain consistent with those identified in the EIS. They include: 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 substantial reduction in the rate and volume of runoff into the receiving drainage line in the fract and volume of runoff into the receiving drainage line in the the amended project would not increase the scour potential in 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
Ropes Creek	RC DL 14450 ¹	Private	+3 to +31, which is higher than the project as described in the EIS of (of +11 to +53)	 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. 	 Mitigation measures for the amended project would remain consistent with those identified in the EIS. They include: 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. 	 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	 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. 	 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. 	There would be a minor increase in the rate and volume of runoff into receiving drainage line as a result of the amended project.

6.9.4.2 Operational phase

The amended project would require changes to six permanent operational water quality basins:

- Three permanent basins (B14880, B14881 and B1351) would require relocation (**Figure 6-52** and **Figure 6-53**)
 - Two would be located near the M7 Motorway southbound
 - One would be located near the Elizabeth Drive intersection at the Western Sydney International Airport
- Three permanent basins would require changes to their sizes (as documented in the EIS) due to changes in the road pavement catchment area (**Figure 6-54**)
 - Two operational water quality basins would be located near Badgerys Creek on the main M12 Motorway alignment and would be approximately 30 per cent larger (B5800 and B6200)
 - One operational water quality basin located upstream of Cosgrove Creek would decrease in size by approximately 25 per cent (B4080).

Other proposed 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.

6.9.5 Environmental management measures

Surface water quality and hydrological impacts associated with the proposed changes are generally consistent with impacts described in Section 7.9 of the EIS. Three environment management measures have been revised, however, to include the updated guidelines and address the assessment undertaken for the amended project. The revised environmental management measures for impacts of surface water quality and hydrology contamination are outlined in **Table 6-55**, with additional text shown in **bold** and removed text shown as strikethrough text.

Table 6-55 Revised environmental management measures (surface water quality and hydrology) (bold and strikethrough text shows change from EIS)

Impact	Reference	Environmental management measure	Responsibility	Timing
Surface water quality impacts	SWH05	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.	TfNSW / Contractor	Prior to construction, and during construction and operation
		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).		

Impact	Reference	Environmental management measure	Responsibility	Timing
		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. 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.		
	SWH07	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. In the instance that water quality (MUSIC) modelling carried out during detailed design it cannot be demonstrated that the water quality controls would be effective in mitigation potential impacts, additional mitigation measures would be identified and implemented where possible.	Contractor	Detailed design
Impacts on water bodies	SWH13	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.	Contractor	Detailed design

Impact	Reference	Environmental management measure	Responsibility	Timing
		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).		
		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.		



Figure 6-52 Basin moved near M7 Southbound

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Figure 6-53 Revised location of permanent water quality basin B1351

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The amended project
 The amended project bridges
 The amended project operational footprint

Water quality swales

Permanent water quality basins as per the EIS Amended permanent water quality basins



Figure 6-54 Permanent water quality basins requiring an increase in size

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