17

Cumulative, Consequential and Indirect Impacts

This chapter considers the potential cumulative impacts of the Project and its interaction with other known and proposed developments and activities within or close to the Project area.

17.1 Introduction

The DGRs for the Project state

> the environmental assessment shall consider the proposed relationship of the project to other existing regional water storages; their associated infrastructure within the area (Chichester Dam, Seaham Weir) and the operational rules governing this infrastructure.

To a large extent, this has been documented in Chapter 10 and the related Working Paper D. This is summarised in Section 17.2.

As with any major infrastructure project, there is also potential for interaction with other local and regional developments which could give rise to various cumulative and consequential impacts. The approach to the assessment of these impacts is outlined in Section 17.3 and subsequently considered in Sections 17.5 and 17.6 in relation to construction and operation respectively.

17.2 Relationship to other existing regional water supply infrastructure

In summary, the purpose of Chapter 10 (and Working Paper D) was to holistically consider the potential impacts of the Project on the Williams River with specific reference to water quality and hydrology, fluvial geomorphology, and aquatic ecology recognising the myriad of interdependencies between these various environmental aspects.

Section 2.2 of Working Paper D provides a detailed description of the current operation of the Williams River. This covers infrastructure operated by HWC including Chichester Dam, Seaham Weir and Balickera Pumping Station as well as existing river access licences and other water users such as stock and domestic users. It also acknowledges other uses such as for recreation.

From consideration of the above environmental aspects, a strategy for managing the delivery of water to Grahamstown Dam via Balickera Pumping Station has been developed which seeks to equitably balance the competing demands of these aspects. This acknowledges that some sections of the Williams River would experience significant impacts, notably the reach immediately downstream of the dam and above the Chichester River confluence which would experience a loss of sediment and the consequent loss of dependent aquatic habitats. The management strategy incorporates an environmental flow component for the maintenance of downstream habitats, both aquatic and riparian, while the bulk transfer of flows would be undertaken in a manner which mimics, as close as possible, the movement of low events down the Williams River.

Development of the strategy has involved consultation with DWE and other relevant stakeholders including DECC and DPI. Given that Tillegra Dam would be an integral component of the lower Hunter water supply system, by necessity a system-wide view must be taken of the operation of not just Tillegra Dam but also of Chichester Dam, Seaham Weir and all other sources within the system such as Grahamstown Dam and the various groundwater sources.

The operational flow release strategy proposed for Tillegra Dam includes an increase in the environmental flow release made from Chichester Dam in order to compensate for reductions in flow along the upper reach of the Williams River.

17.3 Assessment of other potential cumulative impacts

For the purposes of the assessment, cumulative impacts are defined as impacts that are over and above the impacts of the Project as assessed against the existing environment (ie often referred to as the 'baseline'). That is, the impact assessment as documented in Chapters 10-16 inclusive already inherently addresses impacts from, and on, existing activities.

Specific cumulative impacts considered in this chapter are thus confined to those impacts that could occur due to other proposed projects not yet under construction and/or in operation which do not yet contribute to the existing/baseline condition and which could occur regardless of the Project. This chapter also considers consequential impacts. These are generally indirect impacts that arise as a consequence of the project.

The cumulative impacts considered relevant for examination for the Tillegra Dam project include:

- the impact of other, potentially multiple ,construction projects undertaken which could interact with the impacts of construction and/or operation of Tillegra Dam
- local and regional social and economic effects, including impacts on employment, businesses and traffic
- local amenity impacts including noise and vibration, visual quality and air quality
- local and regional environmental changes including effects on water quality, hydrology, biodiversity, land use and landscape values.

For this assessment, cumulative impacts were considered in terms of spatial (site, local and regional) and temporal (short, medium and long term) environmental effects. For the purpose of the assessment the spatial and temporal parameters were defined as:

- site–the Project's construction work areas
- locality–the area within approximately 10 kilometres of the works
- regional–the lower Hunter Valley area
- short term–construction period of the Project

- medium term–over the 10 year period from the commencement of operation of the Project
- long term–being approximately 30 years (the average life of constructed assets) from the commencement of operation of the Project.

In Section 17.4, the potential cumulative impacts of the Project have also been considered in terms of the relationship of the Project with other major HWC projects and other major projects generally in the Hunter region, identified by searching DoP's register of major projects.

17.4 Identification of other projects

Other major HWC projects

In addition to the Tillegra Dam project, HWC is currently proposing to undertake one other major project in the region, this being the Tomago trunk main upgrade along approximately three kilometres of Ash Island (within the Hunter River Estuary). The Tomago trunk main upgrade includes the replacement of an existing 900 millimetre diameter trunk water main with a new 1,350 millimetre diameter underground water main. This project is located within the Newcastle LGA and is located approximately 60 kilometres from the site of the Tillegra Dam project.

Other major projects

The Tillegra Dam project is a unique project in that although there are numerous other projects in the region, none relate specifically to water resource management. A search conducted on 18 July 2008 of the DoP register of major projects within the Hunter region yielded 61 major projects across 10 LGAs. These have been broadly categorised and are listed in Table 17.1.

TABLE 17.1 MAJOR PROJECTS IN THE HUNTER REGION (AS AT 18 JULY 2008)

PROJECT TYPE	LOCAL GOVERNMENT AREA										
	NEWCASTLE	CESSNOCK	DUNGOG	SINGLETON	UPPER HUNTER	PORT STEPHENS	MAITLAND	GREAT LAKES	MUSWELLBROOK	LAKE MACQUARIE	TOTAL
Industrial (new)	2					2				1	5
Industrial (modification)		1									1
Mining (new)		1		1		2		1	1		6
Mining (modification)		1		4			1		1		7
Energy	1			1	1				1	1	5
Commercial								1			1
Mixed use	2	1				1		2			6
Residential (new)		2				3		3		5	13
Residential (modification)	1	1									2
Marina/tourist facility	2					1		2		2	7
Demolition/remediation	2									1	3
Water infrastructure	1		1								2
Dredging								1			1
Rail/intermodal terminal	1			1							2
Total	12	7	1	7	1	9	1	10	3	10	**61**

Cumulative construction impacts could potentially occur should any of these projects be constructed and/or operated concurrently with the Tillegra Dam project. Potential construction phase cumulative impacts are discussed in Section 17.5. Potential operation phase cumulative impacts are considered in Section 17.6. This also considers the long term interrelationship with other major projects in the region.

The Tillegra Dam project is currently the only proposed major project to be constructed within the Dungog LGA. It is noted that Railcorp has plans to expand production at the Martins Creek quarry but no formal application had been lodged at the time of finalisation of this EA Report.

There are only two other major projects (a residential subdivision at Karuah and a mixed use development in Cessnock) that would be within 50 kilometres of Tillegra Dam. As such, the potential for local and possibly regional cumulative impacts is considered to be minor.

17.5 Construction

17.5.1 Water resources

Construction phase cumulative impacts relevant to water resources include potential impacts on surface and groundwater hydrology, potential flooding impacts, water consumption issues and water quality. Irrespective of whether other major projects identified in the region directly affect surface or groundwater resources in the region, they are not situated close enough to the Tillegra Dam project to contribute to impacts on these resources, or to other matters such as flooding behaviour.

The water resources consumed cumulatively as a result of construction of other major projects identified within the region would be relatively minor. Given the expected imposition of statutory water quality controls, cumulative water quality impacts would also be considered minor.

17.5.2 Ecology

The Project would result in a number of construction phase biodiversity impacts as identified in Chapters 10 and 11. These would include impacts on aquatic and terrestrial habitats such as vegetation loss, habitat fragmentation and/or loss and direct fauna mortality. The impacts identified in these chapters are not considered to be cumulative.

At the local and/or regional level, given there are no other known projects within the Dungog LGA and only two major projects identified within 50 kilometres of the Tillegra Dam project, there is considered to be limited potential for cumulative construction phase impacts. Furthermore, it is not considered that the extent of loss/impact as a result of identified major projects in the region would be a trigger for increasing the relative vulnerability for any of the species and/or habitat types affected.

17.5.3 Geology

It is not anticipated that there would be any cumulative construction phase geological impacts.

17.5.4 Socioeconomic issues

As has been previously noted, given there are no other known projects within the Dungog LGA and only two major projects identified within 50 kilometres of the Tillegra Dam project, there is considered to be limited potential for cumulative impacts during construction with respect to socioeconomic issues. The impacts identified and discussed in Chapter 12 are not regarded as cumulative impacts.

17.5.5 Traffic

Section 7.3 identifies MR101 and MR301 as key access routes to Dungog for the Project. Potential construction phase cumulative traffic impacts would be limited to concurrent materials haulage occurring on MR101 and MR301. Given the lack of major projects identified within 50 kilometres of the Tillegra Dam Project, the cumulative traffic impacts are considered to be minor. The winning of some construction materials (rock fill for the embankment) would actually contribute to reducing cumulative impacts on traffic.

A potential cumulative traffic impact could, however, occur should the Martins Creek quarry obtain approval to increase its extraction volume and subsequently increase extraction activities during the construction phase of the Project. An increase in material extraction volume at the Martins Creek quarry would increase heavy vehicle volumes on local and regional roads, including possibly MR101 and MR301 depending on delivery destinations. It is likely that traffic generated from Martins Creek would predominantly use MR101 while traffic associated with the Tillegra Dam project would be predominantly limited to MR301, thereby preventing significant overlap and cumulative impacts.

The concurrent construction of the major projects identified in Table 17.1 has the potential to increase construction traffic on the regional road network. However given the reasonable distances between these projects and the Tillegra Dam project, the cumulative construction phase traffic impacts on identified haul roads would be extremely limited.

17.5.6 Visual amenity

There would be no cumulative impacts on visual amenity during the Project's construction phase as there are no other known planned or existing projects located within the various viewsheds of the Tillegra Dam project.

17.5.7 Noise and vibration

There would be no cumulative noise and vibration impacts during the Project's construction phase as the closest known major projects are located approximately 50 kilometres from the Tillegra Dam project.

17.5.8 Contemporary and Aboriginal heritage

Items of known contemporary heritage significance are identified either locally through each council's local environmental plan or for more significant items through interrogation of state and nation wide heritage databases. The contemporary heritage assessment conducted for the Project has identified a number of items and localities which would be affected by the Project. Given that the Project is currently the only major development in the Dungog LGA, localised cumulative impacts on contemporary heritage items are not expected during construction.

Aboriginal heritage must be considered in terms of cultural and archaeological heritage. Apart from searching the AHIMS database, site specific surveys and consultation with relevant stakeholders provides information regarding Aboriginal heritage. As with the contemporary heritage assessment, the Aboriginal heritage assessment conducted for the Project identified likely and potential impacts associated with the Project. Given that the Project is currently the only major development in the Dungog LGA, localised cumulative impacts on Aboriginal heritage items are not expected during construction.

17.5.9 Air quality

In general, it is not anticipated that there would be any cumulative construction phase air quality impacts. One possible exception could be if one or more bushfires occurred in the general vicinity during construction. In this case, the bushfire would likely be the greater influence on local air quality. It is possible that construction activities could be significantly curtailed or temporarily halted due to safety concerns in which case the Project would not contribute to a cumulative impact on air quality.

17.5.10 Greenhouse gas emissions

The issue of GHG emissions has been considered in the Project assessment, principally in relation to the Project's potential impact on climate change. While an estimate has been made of these, the cumulative effect of GHG emissions as a result of construction of the Project with other local and regional project activities is difficult to determine meaningfully without information on the quantum of these other emissions.

17.5.11 Resource management

It is not anticipated that there would be any cumulative construction phase resource management issues. Virtually all of the fill material required for the construction phase would be sourced from on site with other material resources such as cement, steel and bitumen sourced from local suppliers where possible. The winning of material locally could in fact be considered to mitigate cumulative impacts on construction resources. Other identified major projects are located generally greater than 50 kilometres from the Project and would likely source materials from a variety of sources.

17.5.12 Amenity

Construction phase cumulative amenity impacts would be directly related to traffic, air quality and noise issues. Locally, and as with traffic issues discussed previously, cumulative amenity impacts would largely be influenced by the generation of construction traffic on the road network. As noted in Section 17.5.5, should the Martins Creek quarry obtain approval to increase its extraction volume and upscale extraction activities during the construction phase of the Project, additional noise, air quality and traffic impacts could occur. It is not expected that the increase in heavy vehicle movements as a result of expansion of the Martins Creek quarry would have a significant effect on the overall traffic volumes, and air quality and noise.

17.5.13 Land use

There are no other substantive activities or projects in the locality that would influence land use, these impacts are considered to be project-specific. As such, it is considered that the Tillegra Dam project would not contribute to construction phase cumulative land use changes.

17.6 Operation

17.6.1 Water resources

The Williams River is a tributary of the Hunter River, the confluence of the two rivers being at Raymond Terrace some 50 kilometres from the Tillegra Dam site. Long term hydrology and hydraulics behaviour for local and regional watercourses, including the relationship between releases from Tillegra and Chichester and their influence on Seaham Weir, are identified and discussed in Chapter 10.

Potential cumulative water resource issues are considered to relate more to the potential for the level of water consumption to increase as a result of the public perception that there would be increased water security as a result of construction of the Tillegra Dam project. This could induce a change in the public's water use behaviour. The current user pays pricing structure implemented by HWC is likely to manage this issue. Further, HWC would be well positioned, as the responsible authority for implementing and administering water restrictions, to control public consumption of water resources in the region. This potential cumulative impact is considered minor and manageable.

17.6.2 Ecology

The Project would result in a number of potential operational phase biodiversity impacts as identified in Chapters 10 and 11 including some aquatic impacts (fish passage, breeding, lifecycle, habitat) and terrestrial impacts such as vegetation loss, habitat fragmentation and/or loss and direct fauna mortality. The impacts identified in these chapters are not considered to be cumulative.

The extent of ecological impact as a result of the Project in addition to the ecological impact as a result of the construction/operation of other currently approved projects within the region would constitute a cumulative ecological impact. Given that there are no other major projects located within approximately 50 kilometres of the Project site, the extent of cumulative ecological impact at a local and regional level would be considered limited. There are extensive areas of National Parks and State forests in the region that would not be affected by major projects in the wider region.

Notwithstanding, specific details relating to ecological impacts as a result of other identified projects on a regional scale could not be ascertained based on available information, noting that EECs (endangered ecological communities) in the Hunter region are typically situated adjacent to watercourses and therefore cumulative impacts on these EECs would only occur should other projects require removal of vegetation adjacent to watercourses. The Project includes the establishment of a habitat corridor which would, over time, provide a substantial area of vegetation that would contribute to mitigating cumulative impacts on threatened species and on EECs, and which would also seek to improve connectivity for fauna between extensively vegetated areas.

17.6.3 Geology

It is not anticipated that there would be any cumulative operation phase geological impacts.

17.6.4 Socioeconomic issues

From the point of view of there being no other known existing or planned major developments in Dungog Shire (with the possible exception of the Martins Quarry expansion), it is considered there would not be any significant cumulative operation phase impacts associated with the Project.

As has been discussed elsewhere in this assessment, the storage when fully operational (ie when water level is in the normal operating range of 90–100 per cent of FSL) would represent a significant regional asset with regard to a range of possible water and land-based recreational activities. Commercial opportunities may arise to provide services to visitors to the area. This is regarded as a positive consequential impact contributing to local economic growth.

17.6.5 Traffic

In the absence of any other major projects within the general vicinity of the Project, the likelihood of cumulative operational impacts is considered very low. However, as the storage progressively fills, there would be increasing potential for it to be used for a variety of water-related recreational activities. Various areas around the storage perimeter would also be available for activities such as bush walking, picnicking, etc. These would draw visitors to the area with the consequential impact being an increase in local traffic volumes. The extent of such an increase is difficult to quantify at this point in time and in any case is initially likely to be low with respect to the proposed facilities identified in the draft ILUP (Working Paper N).

17.6.6 Visual amenity

As noted in Chapter 15, the Project would introduce significant new elements into the local landscape. The dam and spillway would represent major changes to the rural character of the area. However, the new section of Salisbury Road would be broadly consistent with other roads within the area while the storage, when eventually full, would also be broadly consistent with the rural environment. The consequential impact of this could be regard as positive.

It is not expected there would be any cumulative impacts on visual amenity during the Project's operation phase as there are no other known projects located within the various viewsheds of the Tillegra Dam project.

17.6.7 Noise and vibration

The assessment concluded that operational noise emissions would, in general, be negligible and largely restricted to the immediate vicinity of the dam itself. The use of the storage for water-based recreational activities, particularly those involving the use of power boats could represent a consequential impact. It is noted there are currently few receptors that would eventually be located in proximity to the FSL (full supply level). It is further noted that the operation of power boats (and associated noise emission) on the storage would likely come under the control of NSW Maritime.

It is not expected there would be any other significant operation phase cumulative noise and vibration impacts as the closest known major projects are located approximately 50 kilometres from Tillegra Dam.

17.6.8 Contemporary and Aboriginal heritage

It is considered that cumulative contemporary and Aboriginal heritage issues would be limited to those identified for the construction phase. The Aboriginal heritage assessment identified the potential for undetected artefacts/sites, should they occur on river margins, to be impacted through erosion of river banks. However, the geomorphological assessment indicated the likelihood of a reduction in channel forming events and increased stability of banks. Accordingly, the likelihood of this consequential impact is considered low.

17.6.9 Air quality

The assessment did not identify any significant effects on local (or regional) air quality during operation. Consequently, it is not anticipated that there would be any cumulative operation phase air quality impacts.

17.6.10 Greenhouse gas emissions

The assessment identified there would be a significant contribution to GHG emissions as vegetation in the inundation area decays. A carbon neutral strategy has been developed for the Project (refer Working Paper F) which indicates that a balance in GHG emissions could be achieved approximately 15 years into operation of the dam. As part of the strategy, the Project provides for the establishment of a habitat corridor supplemented by plantings both within the Project area and on other HWC-owned land to offset GHG emissions.

The reduction of GHG emissions is ultimately a global issue and therefore those associated with the operation of the dam and storage could be regard as a cumulative impact. However, as noted in discussion of potential construction phase cumulative impacts, is difficult to determine meaningfully the Project's contribution without information on the quantum of these other emissions.

17.6.11 Resource management

The demand on resources during operation is likely to be minimal and expected to be mostly related to materials required for maintenance activities. It is anticipated these would be obtained from sources suitably licensed to provide them which would have included consideration of relevant impacts. Consequently, it is not anticipated that the Project would have any significant associated cumulative operation phase impacts.

17.6.12 Amenity

The assessment identified some potential impacts on local amenity such as an increase over time in traffic volumes associated with visitors travelling to the locality, for example to participate in various recreational activities. While this represents an incremental impact at the broad local level, it is not considered to be a cumulative operation phase impact.

17.6.13 Land use

As indicated in Working Paper N, there is likely to be land surplus to HWC's operational requirements and this would be progressively disposed of in accordance with applicable State government procedures. The use of this land by purchasers would be governed by the zoning applying to it under the Dungog LEP which currently is 1(a) Rural. The possible purchase of some of this land by existing property owners in the immediate locality could contribute to a small increase in the area of land in agricultural production.

Overall, however, it is not anticipated that the Project would have any significant associated cumulative operation phase impacts.

17.7 Mitigation and management measures

A general principle of management and mitigation of environmental impacts is that where possible the identified impacts should be managed and mitigated to the greatest extent possible within the boundaries of the Project and where necessary within the immediate vicinity of the Project.

The issues identified in this chapter that could give rise to potential cumulative impacts would therefore be principally and most effectively addressed at the individual project level through the application of management and mitigation measures as identified throughout this assessment and in particular, in the SOC (refer Appendix A). In addition, the assessment has taken a precautionary

approach and identifies management and mitigation measures and associated decision making processes (eg consultation with stakeholders) that provide sufficient mitigation to offset both immediately identified impacts and potential additional or cumulative impacts that may arise.

Consequently, the consolidated SOC are considered sufficient to address both the impacts identified at their source and the potential cumulative effects that these impacts may have in conjunction with similar issues arising on other projects and activities in the locality/region. Accordingly, no further commitments are considered necessary for the management and mitigation of cumulative impacts.