10 Other environmental considerations

This chapter provides an assessment of potential impacts of the proposed minor pipeline corridor realignments and TRS for other environmental considerations. It references information from the AECOM (2009a) EA and other publicly available information. It also reviews the existing management framework and requirements within the Project approval for management measures and techniques to be implemented with respect to the proposed modification.

10.1 Soils and agricultural suitability

10.1.1 Existing environment

i Seaham section

The proposed minor pipeline corridor realignment at Seaham represents a very minor change to the approved alignment. As such, the soil landscape of the proposed pipeline corridor realignment is the same as the approved alignment and this is shown in Figure 10.1. ASS are not likely to occur in the area.

This section of the pipeline corridor comprises land suitable for grazing. The proposed modified pipeline corridor alignment traverses the same land capability types as the approved alignment.

ii Brandy Hill section

The proposed pipeline corridor realignment will result in a straighter and slightly shorter pipeline in this section. Due to the minor change in alignment the soil landscapes traversed are generally the same as for the previously assessed and approved pipeline corridor alignment (Figure 10.2).

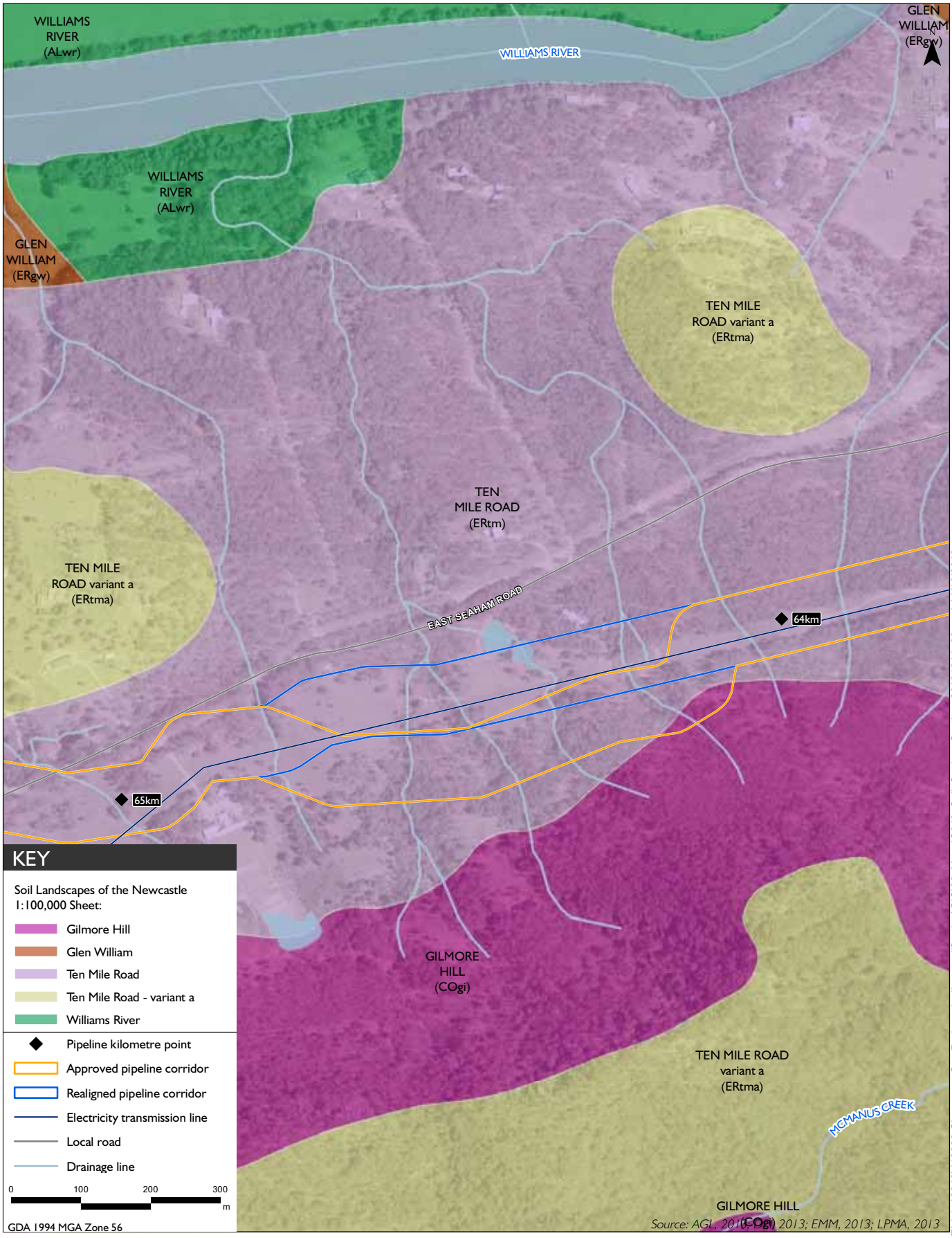
The proposed modified pipeline corridor alignment will traverse some areas of lower elevation mapped as having a high probability of ASS at 1 to 4 m depth (Figure 10.5). The approved alignment within this section, to the east, included land with a high probability of ASS, though was mostly at areas with a low probability of ASS.

Similar to the approved alignment, the proposed modified pipeline corridor traverses land suitable for grazing with some areas capable of occasional cultivation (LPMA 2013). The southern end traverses land suitable for regular cultivation. However, the proposed pipeline corridor generally runs alongside a drainage channel (Barties Creek) or fence-line, which minimises the potential for reduction in land available for cultivation.

iii Millers Forest section

Due to the minor change in alignment for the Millers Forest section the soil landscape is the same as the previously assessed and approved pipeline corridor alignment (Figure 10.3). As for the approved alignment, it traverses land with a high probability of ASS occurring at 1 to 2 m depth (Figure 10.5).

This section comprises land suitable for grazing and regular cultivation. The proposed pipeline corridor alignment runs alongside a drainage channel and an electricity transmission line, which minimises the potential for any reduction in land available for cultivation.

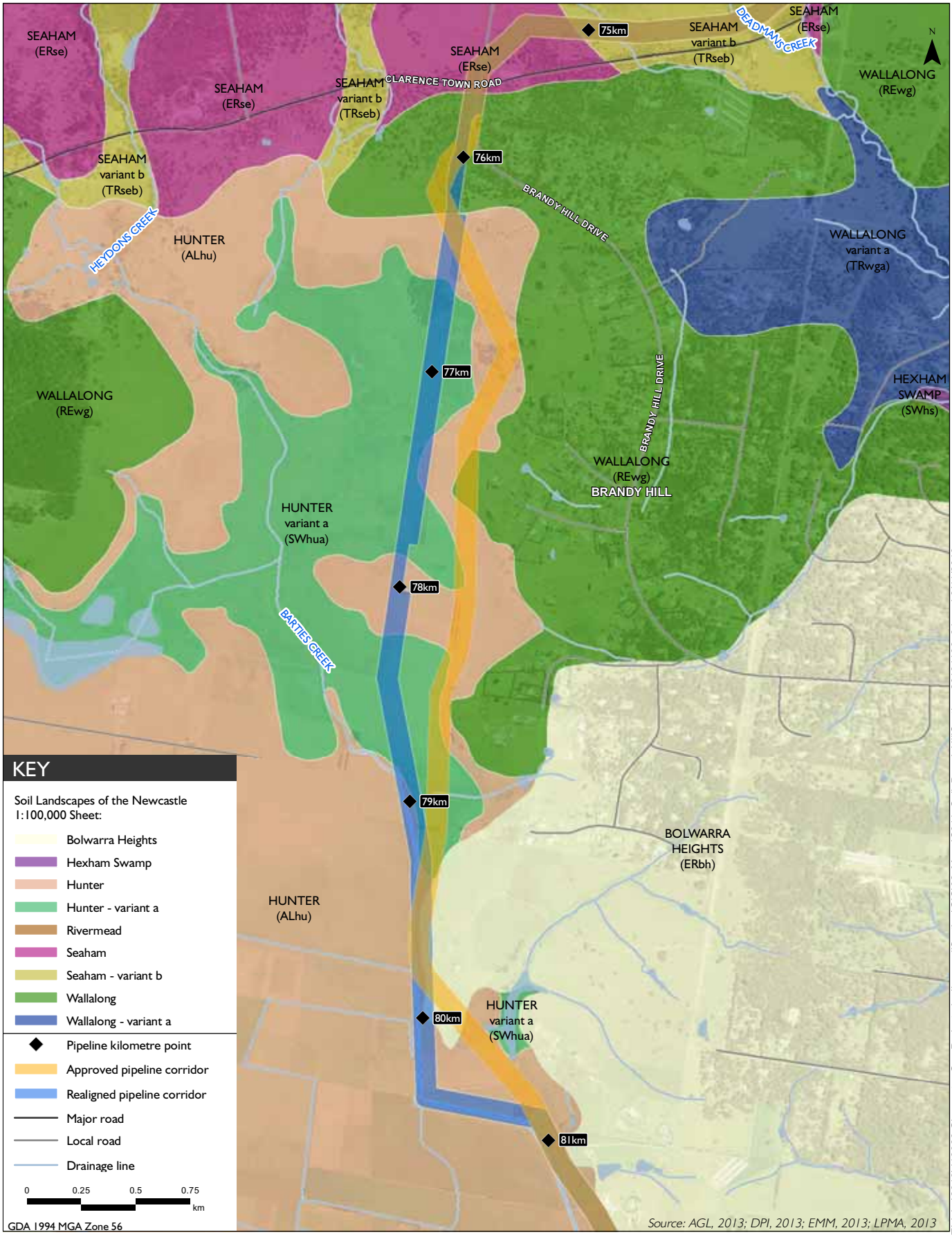


EMM

Seaham section - soil landscapes

Minor pipeline corridor realignments EA

Figure 10.1



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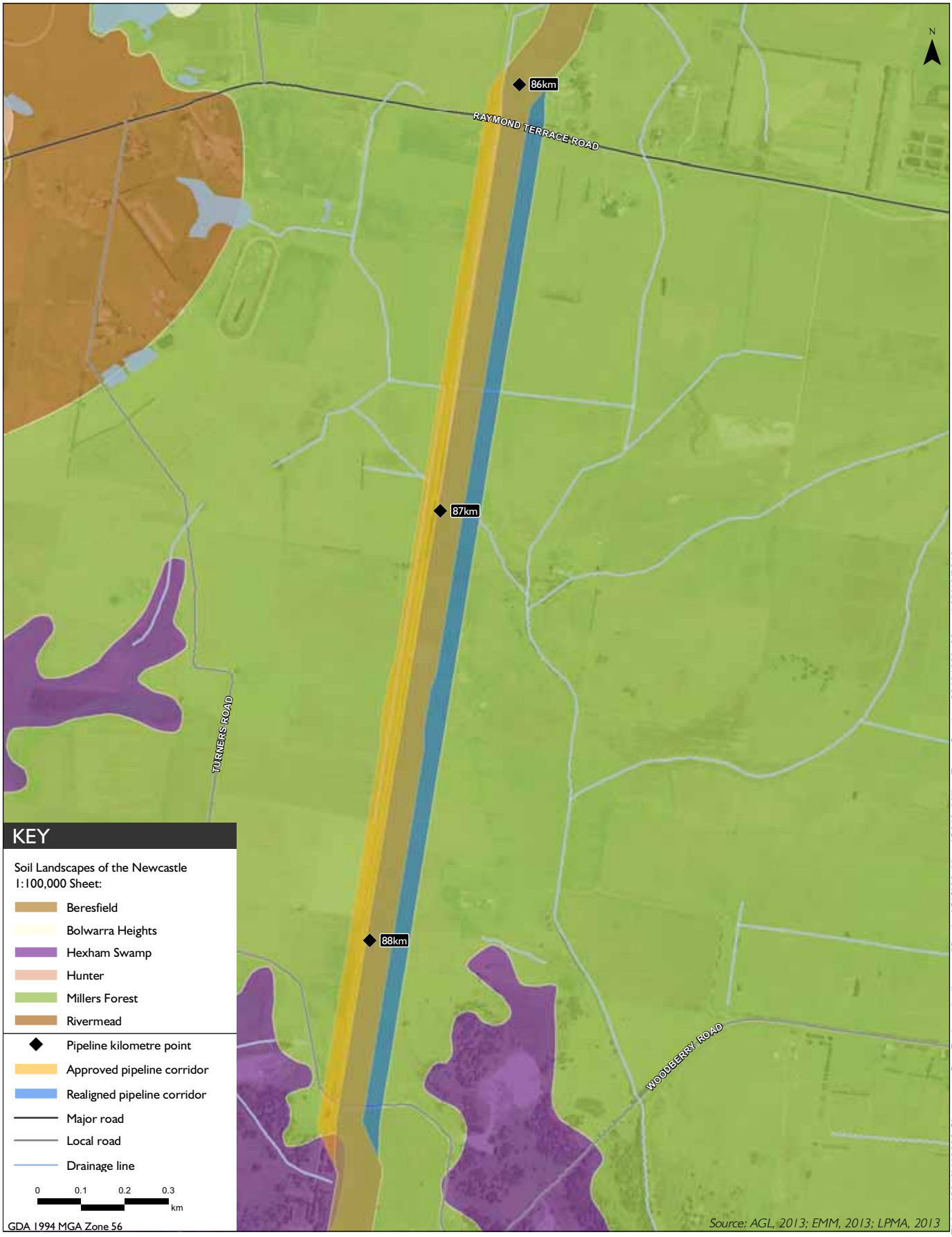
Brandy Hill section - soil landscapes

Minor pipeline corridor realignments EA

Figure 10.2



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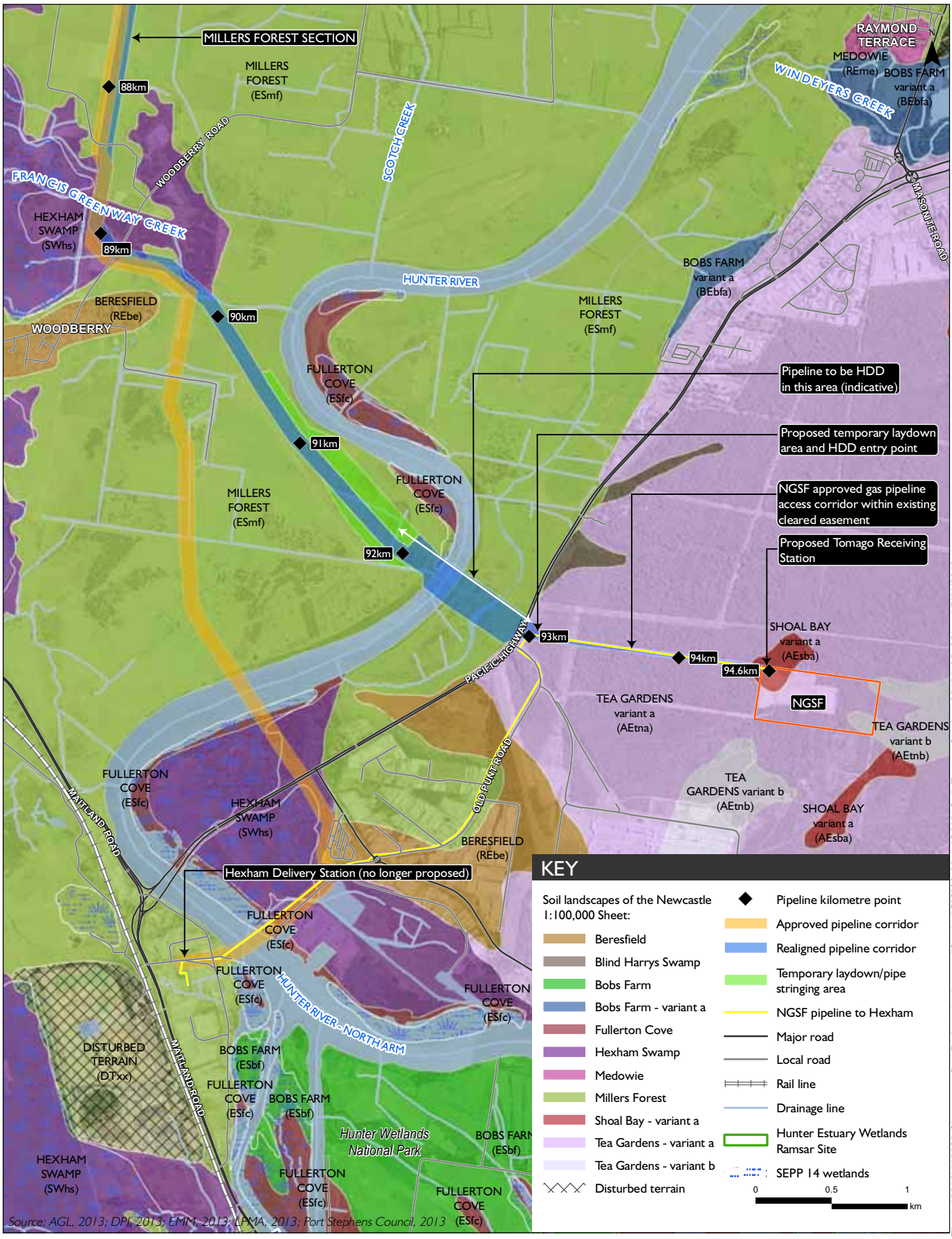
Millers Forest section - soil landscapes

Minor pipeline corridor realignments EA

Figure 10.3



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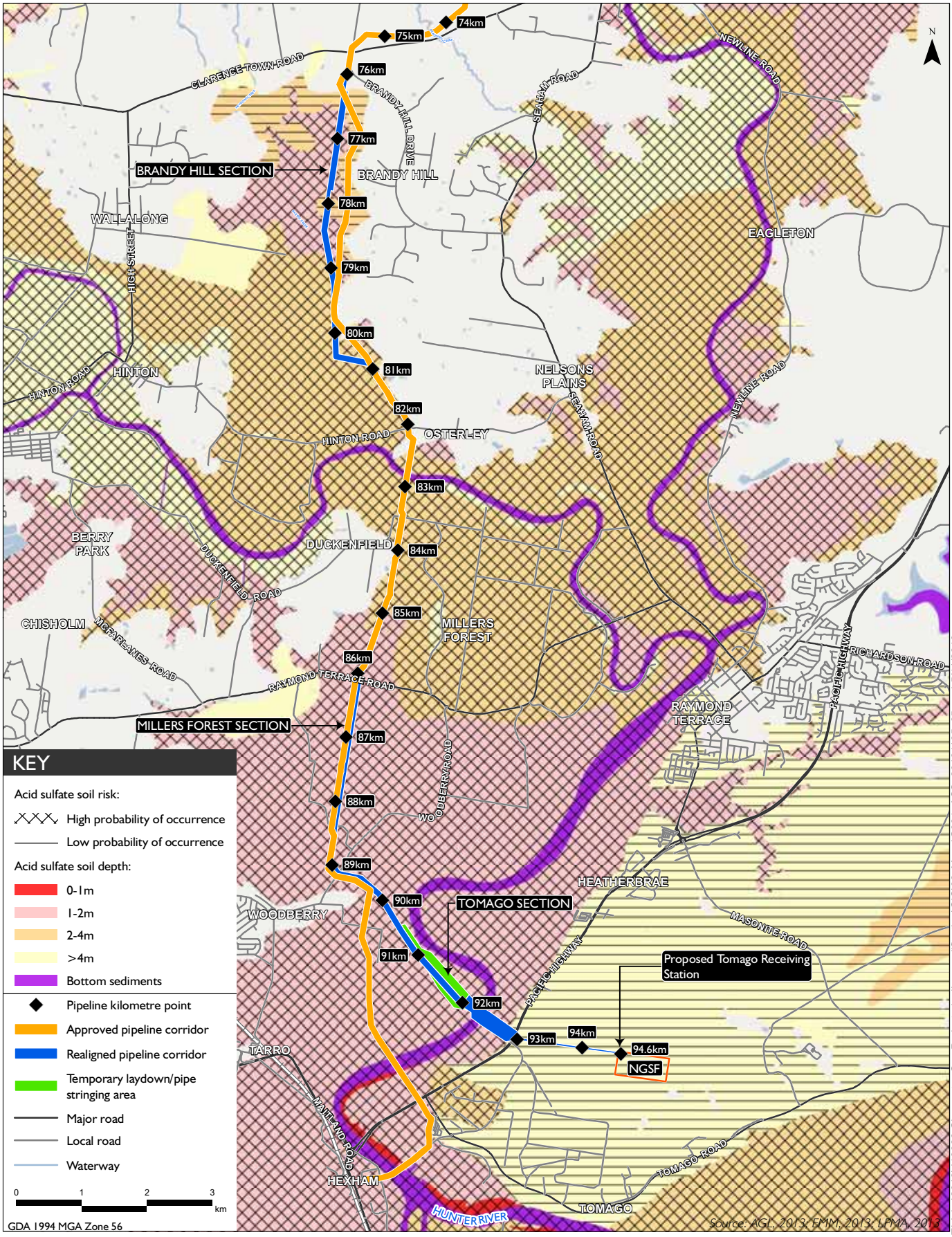
Tomago section - soil landscapes

Minor pipeline corridor realignments EA

Figure 10.4



EMM

Brandy Hill to Tomago section - acid sulfate soils

Minor pipeline corridor realignments EA

Figure 10.5

iv Tomago section

The proposed realignment will substantially reduce the amount of the Hexham Swamp (hs) soil landscape traversed (Matthai 1995). As for the approved route it will mostly be across the Millers Forest (mf) soil landscape. That part of the Tomago section east of the HDD entry point will now cross the Tea Gardens variant a (tna) and Shoal Bay variant a (AEsba) soil landscapes (Matthai 1995) (Figure 10.4). At Tomago, sand consistency above the water table is generally medium-dense to dense, and dense to very dense below the watertable (Coffey 2011).

Less ASS is likely to be encountered in this area as a result of the proposed pipeline corridor realignment (Figure 10.5). Similar to the approved alignment, the proposed modified pipeline corridor alignment traverses land suitable for grazing with some of it capable of cultivation (LPMA 2013).

10.1.2 Impact assessment

As described in Chapter 2, the construction techniques for the realigned sections of pipeline and TRS will be the same as those previously assessed and approved for the pipeline and HDS.

i Seaham section

At the Seaham section, the pipeline will encounter the same soil landscape as the previously assessed and approved pipeline route. The construction techniques will also be the same as those previously approved. The total disturbance will be less than for the approved pipeline as it is a shorter distance. No additional soil impacts will occur as a result of the proposed realignment.

The proposed pipeline corridor realignment, by avoiding woodland areas, is likely to result in minor additional disturbance of grazing land compared to the approved alignment. However, this section of pipeline is within and adjacent an existing TransGrid transmission line easement and the pipeline will be buried. Whilst the MLV facility will be surface infrastructure retained during the life of the pipeline, its footprint is relatively small, and it is confined to AGL-owned land. Therefore, there is expected to be minimal reduction in agricultural suitability of land as a result of the proposed pipeline and MLV facility.

Disturbed areas will be rehabilitated consistent with the existing land use after construction. The potential impacts of the proposed modification at the Seaham section will be similar to those previously assessed and approved.

ii Brandy Hill section

The proposed pipeline corridor realignment will result in a slightly shorter length and less disturbance than for the approved route.

As for the approved pipeline route, the Brandy Hill section will encounter soils with a high probability of ASS occurrence (Figure 10.5). The Project approval requires a Soil Water Management Plan, inclusive of investigations and a management strategy to control potential ASS impacts (Condition 7.3 (c)) during construction. A draft ASSMP has been prepared as part of the Project approval requirements and will be finalised and submitted to DP&I prior to construction. The draft ASSMP prescribes a field test schedule for the Brandy Hill section to further characterise the major soil horizons regarding the presence of ASS. It also describes methods and protocols to manage and monitor construction activities and provides contingency measures that would apply to construction of this section of the pipeline.

The approved pipeline corridor alignment between approximately KP 76 and KP 81 in this section is addressed within the draft ASSMP and the requirements are applicable to the proposed modified pipeline corridor alignment. This plan will not need alteration as a result of the proposed modification.

The proposed pipeline corridor realignment is likely to result in less disturbance of land capable of occasional cultivation compared to the approved alignment but more land suitable for regular cultivation in the southern end of this section (LPMA 2013). Most of the corridor is however adjacent to a drainage channel or fence-line (as distinct from the approved route which was mostly across open farmland) which minimises the potential for reduction in land capable of cultivation.

Disturbed areas will be rehabilitated consistent with the existing land use after construction. The potential impacts of the proposed pipeline at the Brandy Hill section on soils and land capability will be similar to those previously assessed and approved. A greater area of land with high probability of ASS will be disturbed, however the existing approved management measures are suitable to address this risk.

iii Millers Forest section

The modified pipeline corridor alignment will result in marginally less disturbance compared to the approved alignment, due to it being slightly shorter.

As for the approved route, the Millers Forest section will encounter soils with a high probability of ASS at 1 to 2 m depth (Figure 10.5). As stated previously, a draft ASSMP has been prepared in accordance with provisions of the Project approval. Similar to the Brandy Hill section, the approved pipeline corridor alignment between KP 86 and KP 89 is addressed within the draft ASSMP and these management measures can be applied to the proposed modified section of pipeline. This plan will not need alteration as a result of the proposed modification.

The proposed pipeline corridor realignment is unlikely to result in any increase in disturbance of land suitable for regular cultivation. It is within and adjacent to an electricity transmission line corridor and drainage line, which will minimise the potential for impacts.

Disturbed areas will be rehabilitated consistent with the existing land use after construction. The potential impacts of the proposed pipeline at the Millers Forest section on soils and land capability will be similar to those assessed previously and approved.

iv Tomago section

The proposed modified pipeline corridor alignment traverses similar land to the approved alignment south-east toward the Hunter River, with a high probability of ASS (Figures 10.4 and 10.5). The draft ASSMP prescribes a field test schedule for the area from Woodberry and to Hexham. The proposed modification removes this section of the pipeline and replaces it with the proposed connection into the NGSF via the TRS. The proposed realignment will mean that less ASS are likely to be encountered along this section of the pipeline. The implementation of measures and procedures within the ASSMP will ensure that potential downstream impacts through disturbance and exposure of ASS will be avoided. It is considered appropriate to amend the draft ASSMP to include the relevant portions of the Tomago section within the field test schedule.

The modified pipeline corridor alignment will require one less underbored crossing of the Hunter River. The underboring of the Hunter River by HDD will be undertaken from east of the Pacific Highway (around KP 93) and exit on the western side of the Hunter River (around KP 92). The HDD cutting would be de-watered with water disposed of at an appropriately licensed facility as detailed in Section 5.6.4 of the AECOM (2009a) EA. As this will be within an area of potential ASS, the mitigations and management practices of the ASSMP would be implemented to ensure that no potential impacts occur within the locality or off-site/downstream.

The proposed pipeline corridor realignment is likely to result in less disturbance of land capable of regular cultivation compared to the approved alignment (LPMA 2013). Disturbed areas will be rehabilitated consistent with the existing land use after construction. The impacts of the proposed pipeline corridor realignments on soils and land capability and ASS-related impacts will be similar to or less than for the approved pipeline route.

10.1.3 Management and monitoring

No additional management or monitoring requirements over and above those already outlined in the AECOM (2009a) EA and the Project approval are required as a result of the modified pipeline corridor alignment. These include a Soil and Water Management Plan, required under Condition 7.3(c), and erosion and sediment controls during construction in accordance with Condition 3.2.

The methods outlined in the existing draft ASSMP will not need modification and remain applicable to manage the modified pipeline corridor alignments. However, inclusion of the relevant aspects of the Tomago section with a high probability of ASS occurrence in the ASSMP will be completed prior to construction.

10.1.4 Conclusion

The construction techniques will be the same as those previously assessed for the approved project. Construction of the pipeline within the realigned sections will generally encounter the same or similar soil types to those for the approved pipeline. It is not expected to result in additional soil impacts from those identified in the AECOM (2009a) EA. Similarly, no additional effects to land capability are anticipated. The existing approved management measures to be implemented during construction are considered appropriate for these sections. The existing draft ASSMP includes applicable methods, protocols and contingencies for the management of ASS should they be encountered during construction within these sections. The draft ASSMP will be updated to remove measures for the pipeline corridor connection into the HDS and include the relevant portions of the Tomago section.

In summary, no additional impacts to soils or land capability are expected to result from the proposed modification.

10.2 Surface water and flooding

10.2.1 Existing environment

i Seaham section

The Seaham section is approximately 800 m south of the Williams River. A total of four watercourses will be crossed, all of which are crossed by the approved route. These are all ephemeral first order drainage lines that originate from the south-west foothills of the Wallaroo National Park, pass through the Seaham section and flow into the Williams River. These watercourses were identified to be crossed by the approved pipeline corridor and recorded as ID numbers 138, 139, 140 and 141 in the AECOM (2009a) EA (Figure 6.1). They are of low sensitivity and will be crossed with open trenching methods. Further description is provided in the ecological assessment in Chapter 6 and Appendix C.

No areas within the Seaham section are flood prone.

ii Brandy Hill section

The proposed pipeline corridor realignment removes the watercourse crossing (first order stream – ID number 164) previously approved within the Brandy Hill section.

Barties Creek is the closest watercourse to the proposed pipeline corridor realignment. It generally flows in a southerly direction into the Hunter River and is immediately west of the proposed pipeline corridor. Barties Creek has been modified in sections to serve as an irrigation channel to support surrounding agricultural uses. Land within and west of the Brandy Hill section is subject to flooding associated with the Hunter River floodplains.

iii Millers Forest section

The Millers Forest section is more than 1.4 km west of Scotch Creek, which flows in a generally southerly direction to the Hunter River. The proposed pipeline corridor realignment crosses the same two minor tributaries of Scotch Creek as the approved pipeline corridor alignment. One of these tributaries runs adjacent to the corridor's western side for approximately 1 km before crossing it (Figure 6.3). These watercourses were identified and recorded as ID numbers 168 and 169 in the AECOM (2009a) EA. These are artificially modified watercourses of low sensitivity, proposed to be crossed with open trenching methods. Further description is provided in the ecological assessment in Chapter 6 and Appendix C.

Some areas in this section are flood prone.

iv Tomago section

The Tomago section is bisected by the Hunter River. All watercourses within the Tomago section drain into the Hunter River. A total of eight watercourse crossings were identified for the approved pipeline route to the HDS in the GGP EA:

- two first order streams (ID numbers 171 and 172);
- four second order streams (ID numbers 173 to 176); and
- two crossings of the Hunter River, a fourth order watercourse (ID numbers 177 and 178).

With the exception of the Hunter River and an unnamed watercourse (ID number 171), all other watercourses were defined as artificial drainage channels (ID numbers 172 to 176), draining to Francis Greenway Creek and an unnamed tributary that served surrounding agricultural uses.

The proposed pipeline corridor realignment will now only require two watercourse crossings in this area (ID 171 and 177 – the Hunter River) (Figure 6.4). The Hunter River will only be underbored once, upstream of the approved crossing points. Within the pipeline corridor north-west of the HDD exit point, an artificial drainage channel (ID number 171) will be crossed (see Photograph 10.1). This is of low sensitivity.

Photograph 10.1 Constructed drainage line to be crossed by the pipeline

This ephemeral drainage line does not support aquatic vegetation and is generally vegetated by Kikuyu and Blady Grass (*Imperata cylindrical)*. Its general condition is poor due to clearing, weeds and bare ground. It is are unlikely to provide fish habitat (Class 4 waterways) and is considered to be a first order stream. Further description is provided in the ecological assessment in Chapter 6 and Appendix C.

The eastern portion of the Tomago section is within the Tomago Sandbeds Catchment Area, which includes the Tomago Sandbeds aquifer (Figure 10.6). This aquifer is one of the potable water supplies in the region and is recharged by rainfall. Groundwater is discussed in Section 10.3.

SEPP14 Coastal Wetlands are present along the western bank of the Hunter River within this section. However, these wetlands will not be directly intercepted due to the proposed use of HDD techniques.

Some areas in this section are flood prone.

10.2.2 Impact assessment

i Overview

The proposed pipeline and TRS construction activities are the same as those previously assessed and approved. These activities are described in Chapter 2 and include earthworks, grading, trenching, excavating, stockpiling materials, access track usage and movements of vehicles and plant.

The current approved project includes hydrostatic testing (ie pressurised with water) of each section of pipeline to ensure its integrity (refer to Chapter 2). The total volume of water for a single test section would depend on the size of the pipe and would vary from 5 to 15 ML. Equipment and piping for pumping, testing and water transfer would be temporarily positioned at either end of each test section as required (AECOM 2009a). As required by the Project approval, a hydrostatic test plan, will be developed as part of the CEMP to include precautions to avoid spills/leaks of the hydrostatic water. This plan will incorporate the proposed pipeline corridor realignments.

As stated in the AECOM (2009a) EA, watercourses with permanent high water flows and stream ordering greater than third order (Strahler system) would be crossed using HDD to avoid impacts to surface water and riparian vegetation. This includes the Hunter River. For small, intermittent drainage lines and streams of stream order typically less than third order with low sensitivity, open trench techniques would be used. This would ensure that the watercourse crossing works are completed in the least amount of time possible, in order to minimise potential impacts. Whilst not anticipated within the realigned sections, open trenching with stream flow diversion may be used to reduce impacts where water flows are present in watercourses.

A list of watercourses to be crossed by the modified pipeline corridor, their sensitivity and the proposed construction method for the pipeline crossing is shown in Table 10.1. This was prepared with reference to the AECOM (2009a) EA (see Table 12-4).

Table 10.1 Watercourse crossings for the modified pipeline corridor

Section	ID number (AECOM 2009a)	Watercourse	Relative sensitivity criteria	Sensitivity[4]	Construction method
Seaham section	138	Unnamed watercourse	First order	Low	Open trench
	139	Unnamed watercourse	First order	Low	Open trench
	140	Unnamed watercourse	First order	Low	Open trench
	141	Unnamed watercourse	First order[3]	Low	Open trench
Brandy Hill	n/a	n/a	n/a	n/a	n/a
Millers Forest	168	Unnamed watercourse	First order	Low	Open trench
	169	Unnamed watercourse[2]	First order	Low	Open trench

Table 10.1 Watercourse crossings for the modified pipeline corridor

Section	ID number (AECOM 2009a)	Watercourse	Relative sensitivity criteria	Sensitivity[4]	Construction method
Tomago	171	Unnamed watercourse	First order Woodberry Swamp nearby.	Medium	Open trench with flow diversion if required
	(177)[1]	Hunter River and SEPP 14 wetlands	Fourth order. Class 1 fish habitat. Fishery downstream.	High	HDD

Notes: *1. 177 is the northern HDD crossing point in the AECOM (2009a) EA. For the purposes of Table 10.1, this has been modified to represent the revised HDD crossing point of the Hunter River.*

2. 169 is labelled as Scotch Creek in the AECOM (2009a) EA however appears to be an unnamed tributary of Scotch Creek at this location.

3. 141 was identified as a second order stream in the AECOM (2009a) EA. However, recent surveys undertaken as part of this proposed modification has classified it as a second order stream.

Source: *AECOM 2009a.*

ii Seaham section

As the modified pipeline corridor alignment will cross the same watercourses, using the same techniques as approved, no additional potential impacts are envisaged. In accordance with the existing Project approval conditions, appropriate management measures will be in place during construction and the watercourse crossings, including erosion and sediment controls, to minimise the potential for surface water impacts. This section does not traverse land prone to flooding so no flooding-related impacts are predicted. The pipeline will be buried and the MLV facility will be within a fenced compound above the 1 in 100 year flood level. No operational impacts to surface water or flooding are expected.

iii Brandy Hill section

The modified pipeline corridor alignment removes the watercourse crossing required for the approved route. However, it will be closer to a constructed irrigation channel (Barties Creek). Implementation of management measures contained in the AECOM (2009a) EA and the Project approval conditions, including erosion and sediment controls, will minimise risks of potential impacts to this nearby irrigation channel and its users.

The modified pipeline corridor alignment traverses land prone to flooding. However, no permanent above-ground structures that would impede flood water are proposed in these areas. The approved management measures in the AECOM (2009a) EA are appropriate for the modified design. For example, installation of silt fences and other sediment control devices downslope of stockpiles and between construction areas and watercourses to minimise sedimentation, particularly during heavy rainfall. During construction topsoil will be stockpiled away from flood prone areas.

No operational impacts to surface water are expected.

iv Millers Forest section

As the modified pipeline corridor alignment will cross the same watercourses, using the same techniques as approved, no additional potential impacts are envisaged. In accordance with the existing Project approval conditions, appropriate management measures will be in place during construction and the watercourse crossings, including erosion and sediment controls, to minimise the potential for surface water impacts.

The modified pipeline corridor alignment traverses land prone to flooding. However, no permanent above-ground structures that would impede flood water are proposed in these areas. The management measures mentioned above, including stockpiling topsoil away from flood prone areas, are appropriate for the modified design.

No operational impacts to surface water are expected.

v Tomago section

The modified pipeline corridor alignment will involve six less watercourse crossings than the approved alignment. This includes one less crossing under the Hunter River and no surface crossing over SEPP 14 Coastal Wetlands. No additional potential impacts to those previously assessed and approved are envisaged. In accordance with the existing Project approval conditions, appropriate management measures will be in place during construction and the watercourse crossings, including erosion and sediment controls, to minimise the potential for surface water impacts.

The modified pipeline corridor alignment traverses land prone to flooding. However, no permanent above-ground structures that would impede flood water are proposed in these areas. The management measures mentioned above, including stockpiling topsoil away from flood prone areas, are appropriate for the modified design.

No operational impacts to surface water are expected given the implementation of existing requirements under the Project Approval (see Section 10.2.3).

10.2.3 Management and monitoring

A Watercourse Crossing Management Strategy and a Soil and Water Management Plan (sub-components of the CEMP) will be prepared in accordance with Conditions 7.3(b) and (c) of the Project approval. These plans will incorporate the proposed modification and will be prepared in consultation with NOW and DPI (Fisheries).

In accordance with Condition 3.4 of the Project approval, AGL will ensure that:

- any disturbance to watercourses and/or associated riparian vegetation is rehabilitated to a standard equal to or better than the existing condition in consultation with the NOW, Hunter-Central Rivers Catchment Management Authority and Department of Primary Industries (DPI (Fisheries);

- measures to facilitate the long-term rehabilitation of the site (including land stabilisation and re-vegetation) shall be implemented within six months of the cessation of construction activities at the relevant area; and

- unless otherwise agreed to by the Director-General, AGL shall monitor and maintain the condition of the rehabilitated area until such time that the area (including revegetated areas) has been verified by an independent and suitably qualified expert (whose appointment has been agreed to by the Director-General) as being well established, in good health and self sustaining and rehabilitated to the standard required by this condition.

Further, the relevant management measures outlined in the AECOM (2009a) EA will be implemented to minimise potential impacts such as accidental spills or leaks of fuel and oil from vehicles during operation or refuelling. This includes development of a hydrostatic test plan as part of the CEMP, which will include precautions to avoid spills or leaks of hydrostatic water.

10.2.4 Conclusion

Construction of the proposed modified sections of the pipeline and TRS is not expected to result in additional surface water or flooding impacts to those identified in the AECOM (2009a) EA. As for the approved route, the modified pipeline corridor alignment traverses land prone to flooding. No permanent above-ground structures that would impede flood water are proposed in these areas. The existing approved management measures and techniques for watercourse crossings and erosion and sediment controls to be implemented during construction are considered appropriate for the proposed modified sections of pipeline corridor and TRS. Measures for these sections can be incorporated into the management plans required by the existing Project approval conditions. No additional measures are needed. No operational impacts to surface water are anticipated.

10.3 Groundwater

10.3.1 Existing environment

i Regional aquifers

The Seaham, Brandy Hill and Millers Forest sections have the same groundwater environment as the approved pipeline corridor alignment. There is minimal groundwater information available for the Seaham section which lies within the New England Fold Belt Groundwater Management Unit. It overlies Carboniferous undifferentiated sediments which outcrop in the area and are not considered to be regional aquifers. The Brandy Hill and Millers Forest sections lie within the Hunter River Alluvium groundwater source. At this location the alluvium is not considered to be a regional aquifer.

The Tomago section, inclusive of the proposed TRS location, crosses the same groundwater sources as the approved GGP, being the Tomago-Tomaree-Stockton Sandbeds and the Hunter River alluvium. Groundwater conditions for the new alignment are therefore similar to the already approved GGP. The Tomago section east of the Hunter River is underlain by the Tomago Sandbeds aquifer which is a low salinity, high yield water source that forms an important part of the regional potable water supply. To the west of the Hunter River, the proposed pipeline corridor realignment is underlain by the Hunter River alluvium, which is accessed by only a few groundwater users (Figure 10.6).

ii Groundwater levels and flow

Groundwater levels and local flow paths are likely to mirror topography in the Seaham, Brandy Hill and Millers Forest sections. Groundwater levels in the fractured rock aquifers range from 2 to 20 m below ground level (mbgl).

The thickness of the Tomago Sandbeds reaches a maximum of 50 m, but on average is 20 m deep with some sections in the vicinity of the proposed pipeline corridor alignment less than 10 mbgl. The aquifer is recharged by rainfall and the highly permeable sandbed aquifer provides water for ongoing extraction.

Groundwater levels in the Tomago Sandbeds aquifer have been recorded at five monitoring sites within the NGSF (near the proposed TRS location) between June 2011 and June 2013 (AGL 2013). The results show that groundwater levels at the NGSF range between approximately 3.5 mbgl and 0.8 mgbl, after prolonged dry periods, and 2.2 mbgl to above ground after significant rainfall. Groundwater monitoring at the NGSF is ongoing.

Groundwater flow (direction and rate) is influenced by a groundwater divide (a high point in the water table). This divide is approximately 700 m south of the NGSF. To the north of the divide, groundwater flows to the north-west and to the south of it flows to the south-east.

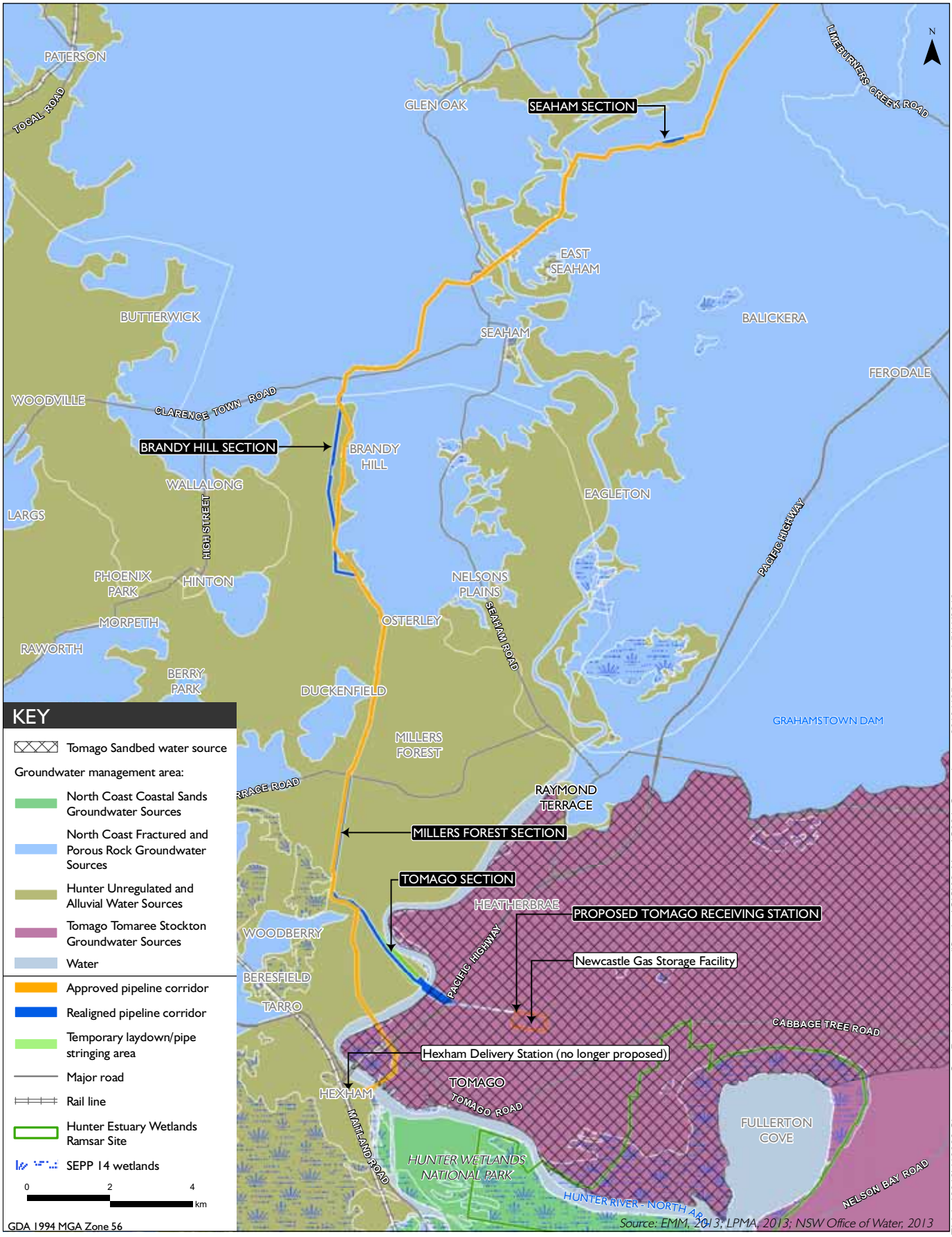
Based on AGL's recent experience with the NGSF construction, it is unlikely that water licences will be required for construction of the proposed modification however, temporary transfer of HWC allocations under the Tomago-Tomaree Water Sharing Plan may be required. As part of the CEMP preparation (Conditions 7.2 and 7.3 of the Project approval), AGL will liaise with HWC and NOW prior to construction regarding any licence requirements for construction within the Tomago section.

iii Groundwater resources

Regional groundwater resources of economic significance do not occur within the Seaham, Brandy Hill or Millers Forest sections.

HWC uses groundwater from the Tomago Sandbeds aquifer to supplement water supplies to Newcastle and the Tomaree Peninsula. HWC supplies approximately 200 ML of drinking water per day to the region. The Tomago Sandbeds aquifer provides approximately 20% of total water demand to the lower Hunter's drinking water supply (Hunter Water 2010). The aquifer is a reserve supply during drought and in the event of any water quality issues (or other shortfalls) in the surface storages (Hunter Water 2010).

The aquifer is a special area under the *Hunter Water Act 1991* and activities in the area are covered by the *Hunter Water Regulation 2010* and *Water Sharing Plan for the Tomago Tomaree Stockton Groundwater Sources 2003* (NSW Government 2003) which is regulated by NOW. In addition to being used for town water supply, the Tomago Sandbeds aquifer is accessed to supply industry and for irrigation. In particular, irrigation of golf courses, playing fields and recreation reserves, domestic use, and water for livestock.



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Groundwater management areas

Minor pipeline corridor realignments EA

Figure 10.6

iv Groundwater quality

Based on the information available for the Seaham, Brandy Hill and Millers Forest sections, the groundwater salinity in these areas is likely to be brackish (AECOM 2009a).

Groundwater quality testing for the NGSF EA (Coffey 2011) and subsequently as part of the ongoing monthly groundwater monitoring program (AGL 2013) confirmed that water in the Tomago Sandbeds aquifer has a low salinity. HWC treats the groundwater to remove iron prior to use as part of the potable supply, however, even without treatment it typically meets the health-based Australian drinking water guidelines (NHMRC 2011).

v Groundwater dependent ecosystems

The Bureau of Meteorology's groundwater dependent ecosystems atlas, and the NSW SEPP 14 coastal wetlands protected areas were used to identify potential groundwater dependent ecosystems in the vicinity of the four sections. No groundwater dependent ecosystems were identified within the Seaham or Millers Forest sections.

In the Brandy Hill section, the local vegetation is identified as 'ecosystems that rely on subsurface presence of groundwater' however, the potential for groundwater interaction is classified as low.

Some vegetation in the vicinity of the Tomago section is classified as having a moderate potential to rely on groundwater. The proposed modified pipeline corridor will pass through a cleared easement near this vegetation, east of the Hunter River. There are some low-lying SEPP 14 wetlands along the Hunter River which are prone to inundation when groundwater levels rise in response to prolonged rainfall.

10.3.2 Impact assessment

As described in Chapter 2, the construction techniques for the proposed modification are the same as for the approved GGP. No additional aquifers are potentially affected by the proposed change in the pipeline corridor alignments (Figure 10.6). Therefore, the potential impacts remain the same as identified in the AECOM (2009a) EA.

i Construction

a. Groundwater levels

Pipeline construction will include clearing, grading and excavation works which would potentially disturb surface and subsurface soils, and very shallow aquifers. The excavation methodology is detailed in Section 2.3. The maximum excavation depth of the pipeline trench is not likely to exceed 3 m.

It is unlikely that groundwater will be intercepted during excavation works for the pipeline along much of its length due to the shallow excavations proposed. However, shallow groundwater is likely to be encountered in the Tomago section. Should dewatering be required in this area during pipeline and TRS construction it will be localised, minor (drawdowns of less than 1 m) and short-term.

All extracted water will be reinjected into nearby shallow aquifers using a transportable and temporary battery of spearpoints that can be moved along as trenching progresses. The minor dewatering required and reinjection using spearpoints will minimise changes in water levels. This is not expected to result in any adverse impacts on the local aquifers.

b. Groundwater quality

Potential contamination sources during construction include:

- discharge of water from hydrostatic testing or trenches and other excavations during construction that has been exposed to existing (although not anticipated) contaminated soil or groundwater, or ASS;
- accidental spills or leaks of fuel and oil from vehicles during operation or refuelling; and
- spills during construction, eg welding and coating materials from HDD (drilling fluid will not be used in HDD activities).

Poorly designed or managed construction activities have the potential to cause groundwater contamination and potentially degrade water quality and impact the classified beneficial use of the resource. However, there is only a minor potential for spills that would cause contaminants to infiltrate the Tomago Sandbeds aquifer (Tomago section). The implementation of approved management measures and requirements in the Project approval will mitigate this risk.

c. Groundwater dependent ecosystems

Shallow groundwater is likely to be encountered in the Tomago section. It is envisaged that drawdown associated with dewatering during pipeline and TRS construction in this section will be isolated and localised. It is expected to be minor, with temporary drawdown of less than 1 m anticipated for very short durations. In addition, all extracted water will be reinjected into nearby shallow aquifers using a transportable and temporary battery of spearpoints. This will maintain groundwater levels for dependent ecosystems. Localised drawdowns of this magnitude and duration will not result in adverse impacts on groundwater dependent ecosystems.

ii Operation

No impacts on groundwater are predicted during operations.

10.3.3 Management and monitoring

The existing Project approval requires the development of a Soil and Water Management Plan (Condition 7.3(c)) to manage identified potential impacts to groundwater resulting from construction. This includes pre-construction investigations for potential groundwater interception including where this is coupled with potential ASS, and identification of monitoring requirements and management strategies. The proposed modified sections of pipeline corridor and the TRS will be incorporated into this plan to effectively manage these matters.

No impacts on groundwater are predicted during operations, and therefore no specific management or monitoring requirements for the modification are proposed. Further, the self-assessment undertaken for potential impacts to water resources as a MNES under the EPBC Act concluded that no significant impacts are expected (refer to Section 4.4.3).

10.3.4 Conclusion

The Seaham, Brandy Hill and Millers Forest sections have the same groundwater environment as the approved alignments and therefore the results of the AECOM (2009a) EA are unchanged by the proposed modification in these areas. It is unlikely that groundwater will be intercepted during construction works for most of the pipeline. However, shallow groundwater is likely to be encountered during construction within the eastern part of the Tomago section. Should dewatering be required in these areas it will be localised, minor (drawdowns of less than 1 m) and short-term. All extracted water will be reinjected into nearby shallow aquifers using spearpoints, which will further minimise changes in water levels. The groundwater assessment concluded the proposed works are not expected to adversely impact local aquifers or groundwater dependent ecosystems.

The existing measures in the Project approval conditions, including development of a Soil and Water Management Plan, are suitable for the proposed modification. No additional mitigation or management measures are required.

10.4 Air quality

10.4.1 Existing environment

i Seaham, Brandy Hill and Millers Forest sections

The Seaham, Brandy Hill and Millers Forest sections have the same local air quality environment as the approved pipeline corridor alignment given the proposed minor changes. There are no major contributors to dust generation or pollution in either location. The Seaham section is closer to receptors to the north. The Millers Forest section is closer to receptors to the east and further from those to the west. The Brandy Hill section increases the distance between the pipeline corridor and the most receptors in Brandy Hill. The closest receptors are shown in Figures 8.1 to 8.3 and identified in Table 8.5.

ii Tomago section

As previously described the Tomago section and TRS replace the currently approved HDS and the pipeline to it. Similar to the nearby Hexham area, climate in the Tomago area is temperate, with generally warm to hot summers and mild winters. Daily temperatures are lowest in July and highest in January. Mean annual rainfall is 1,124 mm with the wetter months between January and June. Prevailing winds are from the north-west during winter and from the east and south-east during summer (CBI 2012).

Air quality in Tomago is influenced by industry, including the Tomago Aluminium Company smelter facility. High traffic volumes also influence air quality, with the Pacific Highway passing along the western edge of Tomago and linking Bulahdelah and Newcastle. The proposed realignment within the Tomago section increases the distance between the proposed pipeline corridor and TRS and nearby receptors, when compared to the approved pipeline and HDS. There are no nearby receptors east of the Pacific Highway other than industry and the Hunter Region Botanic Gardens.

10.4.2 Impact assessment

i Construction

The construction techniques and associated potential dust sources for the modified pipeline corridor alignment and TRS are the same as those previously assessed and approved.

The four sections will be constructed as outlined in the Project approval. Pipeline construction works will be transient, with the duration of works (and associated potential for dust exposure) for most locations along the pipeline corridor expected to be less than three weeks.

The Tomago section includes a HDD under the Hunter River and Pacific Highway. As discussed in Chapter 2 and shown in Figure 1.6, the entry point for the HDD is within an existing cleared utility easement east of the Pacific Highway, with the exit point on the western side of the river. Emissions from the HDD are expected to be similar to those for the construction of other sections of the pipeline described above.

Condition 3.14 allows the construction of the pipeline from 7 am to 6 pm for seven days per week on a 28 day cycle separated with a nine day respite period. This construction timetable was developed to ensure that construction is undertaken in a timely manner, and receptors are not exposed to construction works for longer than required.

The air quality impact assessment (AQIA) prepared by AECOM (2009c) and the DP&I assessment report (DP&I 2010) for the GGP considered that the construction of the pipeline did not present a risk to air quality and management of dust generating activities would be done through construction management procedures recommended in the EA and contained within the Project approval. Similarly, construction of the TRS near the NGSF, within the existing cleared utility easement, is unlikely to result in significant dust emissions to sensitive receptors, given its activities and proximity to sensitive receptors.

Given the temporary nature of construction, the minor modification proposed and that no sensitive receptors were identified closer to the modified pipeline corridor alignments than those identified and assessed for the approved alignment, there are unlikely to be any additional dust impacts to those already assessed and approved.

ii Operation

Proposed components at the TRS are similar to those assessed and approved at the HDS. These include an odourant facility and water bath heaters (Figure 2.8). Together, these components are a continuously operating pipeline junction system which is not expected to affect air quality in the Tomago area.

As described in Chapter 2, two options are presented for the odourant facility. Option 1 is within the TRS adjacent to the NGSF and Option 2 is within the NGSF. Odourant injection is not considered to be a source of odourous emissions during operations as it is a fully enclosed system. As such, odour was not considered further in the assessment.

The original AQIA (AECOM 2009c) included a quantitative assessment of the proposed gas-fired dual water bath heater. The results of the original AQIA (AECOM 2009c) are considered relevant and applicable to this proposed modification as the anticipated layout of the TRS (Figure 2.8) is similar to that of the HDS.

The original AQIA (AECOM 2009c) used a dispersion model in a domain 30 km by 30 km to quantify emissions from operational components of the GGP, such as the dual water bath heater. The dispersion modelling was undertaken in accordance with guidelines in the DECCW (now EPA) (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the Approved Methods). The model accounted for domain effects of terrain, building wake, horizontal and vertical dispersion curves, buoyancy, surface roughness, plume rise, wind speed categories and wind profile components. The meteorological data used for the dispersion modelling was obtained from the DECCW (now EPA) monitoring station at Beresfield, approximately 4 km from the HDS and 6 km from the TRS. The results of the original AQIA (AECOM 2009c) for the HDS are considered applicable to the proposed location of the TRS.

Emission rates for the dual water bath heater were obtained from expected gas usage rates and emission factors from the National Pollution Inventory (AECOM 2009c). These are relevant for the proposed TRS. The pollutant emission rates considered for the dual water bath heater included:

- oxides of nitrogen (NOx);
- carbon monoxide (CO);
- particulate matter less than 10 microns in aero diameter (PM_{10}); and
- volatile organic compounds (VOCs).

It was assumed that the dual water bath heater was continuously operating and emitting low level pollutants 24 hours a day, 7 days a week for the assessment year. Benzene was conservatively chosen as an indicator pollutant for VOCs as it has the lowest criterion of all individual VOCs.

The maximum ground level concentrations of all pollutants predicted by the dispersion modelling were well below criteria at the boundary of the premises. This is shown in Table 10.2.

Table 10.2 Dual water bath heater maximum ground level concentrations (µg/m^3)

Pollutant	Averaging period	Concentration[2]	Criteria
NO_2	1 hour	96.5 (190.5)	246
	Annual	7.2	62
CO	15 minute	29.8	100,000
	1 hour	29.5	30,000
	8 hour	22	10,000
PM_{10}	24 hour	1.7 (45.7)	50
	Annual	0.19 (20.8)	30
Benzene[1]	1 hour	0.14	29

Notes: 1. All VOC conservatively assumed to be present as benzene.

2. Numbers in brackets are highest values at any point in the modelling domain of 30 km x 30 km grid.

Source: AECOM 2009c.

The results in Table 10.2 can be applied to the proposed dual water bath heater at the TRS. The modelling showed (numbers in brackets in Table 10.2) that the highest predicted values within the modelling domain (30 km by 30 km) are well below criteria. The proposed TRS at Tomago is further from sensitive receptors than the previously assessed HDS at Hexham. Therefore, it is reasonable to conclude that the inclusion of the dual water bath heater at the TRS will not result in effects to sensitive receptors above prescribed criteria.

10.4.3 Management and monitoring

The management measures outlined in the EA and the Project approval prescribe management and mitigation measures which provide for the protection of nearby receptors during construction of the pipeline.

The existing Project approval requirements for minimising dust emissions during construction and preparation of a CEMP (Conditions 3.28 and 7.2) are considered appropriate to manage dust from construction within the Seaham, Brandy Hill, Millers Forest and Tomago sections. No additional management or monitoring measures are considered necessary for dust control.

Similarly, the Project approval (Condition 3.30) prescribes a monitoring point for the dual water bath heater at Hexham with discharge limits (Condition 3.31). Discharge limits for oxides of nitrogen and VOCs or carbon monoxide are provided in Condition 3.31. These limits are reproduced in Table 10.3. It is considered appropriate that these limits, or as otherwise agreed with the EPA, also apply to the water bath heater proposed at the TRS. Conditions 3.30 and 3.31 will require modification to include the dual water bath heater at the TRS and remove reference to the HDS (refer to Chapter 11).

Table 10.3 Maximum allowable discharge concentration limits (air)[1]

Discharge point	Pollutant	Units of measure	100 percentile limit	Averaging period	Reference conditions
Water bath heater	Oxides of nitrogen	mg/m^3	350	1 hour	Dry, 273 K, 101.3 kPa, and 3% O_2
	VOCs or CO	mg/m^3	40 (VOC) 125 (CO)	Rolling 1 hour	Dry, 273 K, 101.3 kPa, and 3% O_2

Source: PA 08_0154.

Condition 4.5 of the Project approval describes the monitoring requirements for the dual water bath heater and the test methods as defined in the Approved Methods (DECCW 2005). This information is reproduced in Table 10.4 below. It is considered appropriate that these also apply to the dual water bath heater at the TRS, unless otherwise agreed with the EPA. This necessitates modification of Condition 4.5 to reference the TRS (refer to Chapter 11).

Table 10.4 Periodic pollutant and parameter monitoring (air)[1]

Discharge point	Pollutant/ parameter	Units of measure	Method	Frequency
Dual water bath heater	Oxides of nitrogen	mg/m^3	TM-11	Post-commissioning and annually thereafter
	CO or VOCs	mg/m^3	T-34 or TM-32	
	Velocity	m/s	TM-2	
	Volumetric flow rate	m^3/s	TM-2	
	Temperature	^oC	TM-2	
	Moisture	%	TM-22	
	Dry gas density	kgm^3	TM-23	
	Molecular weight of stack gases	g/gmol	TM-23	
	Oxygen	%	TM-25	
	Carbon dioxide	%	TM-24	
	Selection of sampling positions	-	TM-1	-

Source: PA 08_0154.

10.4.4 Conclusion

The proposed pipeline corridor realignments will result in similar dust emissions during construction to those previously assessed and approved for the GGP. Significant dust impacts at nearby receptors are not anticipated during construction of the modified sections of pipeline or TRS.

The previous AQIA (AECOM 2009c) for the GGP included dispersion modelling of the dual water bath heater at the HDS, which predicted that emissions would be well below criteria at its boundary. Therefore, the TRS, which is further from sensitive receptors than the HDS, is unlikely to result in emissions above the relevant criteria at sensitive receptors.

To ensure consistency with the existing Project approval, it is proposed that the existing monitoring requirements and discharge limits for the dual water bath heater at the HDS be applied to the water bath heater at the TRS.

10.5 Socio economic

10.5.1 Existing environment

The proposed modification traverses three LGAs which are within the sub-region of the Lower Hunter:

- Seaham section – Port Stephens LGA;
- Brandy Hill section – Port Stephens LGA;
- Millers Forest section – Maitland LGA; and
- Tomago section – Maitland LGA, Newcastle LGA and Port Stephens LGA.

As shown in Figure 4.5 and discussed in Chapter 4, the extent of the Newcastle LGA boundary intersecting the proposed pipeline corridor realignment is limited to the Hunter River underbore interface. As no landowners within the Newcastle LGA will be affected by the pipeline, the Newcastle LGA is not considered further in this section.

i Land uses

Existing land uses are described in Section 2.1. In general, land use in the vicinity of the northern reaches of the proposed modified pipeline corridor is characterised by agriculture and rural residential properties. Agriculture is dominated by beef cattle, dairying, poultry, equine enterprises and viticulture. In this area, agricultural enterprises are predominately beef cattle and dairying, and with large areas dedicated to nature reserves. These areas are characterised by semi-rural residential land and semi-rural lots. Other notable land uses in proximity to the southern section of the gas transmission pipeline route include Newcastle Airport, Department of Defence lands, extractive industry and native vegetation (for example within the Hunter Region Botanic Gardens) and the industrial area of Tomago. The types of land uses associated with the four sections are discussed in the following sections.

a. Seaham section

The Seaham section is AGL-owned land adjoining the Wallaroo National Park. The proposed pipeline corridor realignment is generally within and adjacent to an existing TransGrid transmission line easement.

b. Brandy Hill section

The elevated suburb of Brandy Hill is east of the proposed pipeline corridor realignment, which consists of large acreage lots. At the time of the 2011 census, Brandy Hill had a population of 693 residents (ABS 2011). Large, working agricultural lots (predominately cattle grazing) are to the south and west. Land uses are restricted in these areas due to flooding associated with the Hunter River floodplains.

The proposed modified pipeline corridor alignment is more than around 335 m further west of Brandy Hill. It will run alongside existing perimeter fencing of the agricultural lots and an irrigation channel.

c. Millers Forest section

The Millers Forest section is characterised by working agricultural lots (predominantly cattle grazing, and some cultivation). Land uses are restricted in these areas due to flooding associated with the Hunter River floodplains.

The proposed pipeline corridor realignment will be adjacent to the recently-constructed Tomago to Stroud transmission line and an irrigation channel.

d. Tomago section

The Hunter River divides the Tomago section into two areas. The area west of the Hunter River is within the suburb of Woodberry which at the time of the 2011 census, had a population of 3,155 residents (ABS 2011). Woodberry is characterised by a mixture of land uses including the residential settlement of Woodberry (where the majority of the population resides), agricultural land and coastal wetlands along the banks of the Hunter River. The proposed pipeline corridor realignment will be further from Woodberry. It will cross existing transmission line easements.

The area east of the Hunter River is within the industrial area of Tomago. Coastal wetlands and agricultural lots characterise the eastern bank of the Hunter River. These lots are bounded to the east by the Pacific Highway. Protected bushland within the Hunter Region Botanic Gardens, infrastructure easements and industrial uses (NGSF and Tomago Aluminium Company) are east of the Pacific Highway. The eastern end of the pipeline will be within an existing AGL-owned utility easement east of the Pacific Highway.

ii Socio-economic characteristics

The socio-economic characteristics of the areas surrounding the Seaham, Brandy Hill, Millers Forest and Tomago sections are given in Table 10.5, compared against those of the Port Stephens and Maitland LGAs and NSW more broadly. This data is updated from that presented in the AECOM (2009a) EA, to reflect the more recent 2011 Census results.

Table 10.5 Socio-economic characteristics summary: Lower Hunter sub-region

Parameter	East Seaham	Brandy Hill	Millers Forest	Woodberry	Tomago	Maitland LGA	Port Stephens LGA	NSW
Population	359	673	321	3,155	271	67,478	64,807	6,917,660
Median age	41	45	46	35	50	36	42	38
Young children (0 to 14 years)	18.6	17.0	14.6	24.3	8.8	22.0	19.5	21.3
Working age (15 to 64 years)	71.4	74.1	69.5	65.3	74.5	65.2	61.2	64.0
People aged 65+ years	10.1	8.9	15.9	10.4	16.7	12.8	19.3	14.7
Industry structure	Transport and logistics, Agriculture and Education	Education, Retail trade and Construction	Manufacturing , Construction and Agriculture, forestry and fishing	Retail trade, Health care and social assistance and Transport & logistics	Transport and logistics, Food processing and Health care and social assistance	Mining, Education and Retail trade	Defence, Education and Cafes and retail	Health care and social assistance, Retail trade/ Manufacturing
Occupational structure	Technicians and trades, Professionals and Managers	Professional, Technicians and trades and Clerical & admin	Technicians and trades, Professionals and Managers	Labourers, Technicians and trades and Sales	Technicians and trades, Labourers and Clerical and admin	Technicians and trades, Professionals and Clerical and admin	Technicians and trades, Professionals and Clerical and admin	Technician and trades, Professionals and Clerical and admin
Unemployment rate	2.6	3.4	5.9	8.9	9.3	5.0	6.2	5.7
Average household size	2.8	3.1	2.9	2.7	1.8	2.7	2.5	2.6

Source: ABS (2011).

Key socio-economic characteristics of the four sections are:

- Relative size of areas: With the exception of Tomago (which is an industrial area) and Millers Forest, the population size is generally smaller when further from Newcastle.
- Population structure: Woodberry's population is relatively younger than the other areas but in line with the Maitland LGA. Millers Forest's population is relatively older compared with the Maitland LGA. Tomago's population is considerably older compared to the Port Stephens LGA and NSW.
- Economic structure: Transport and logistics, retail trade and education are the dominant industries employing local residents. Brandy Hill has a higher proportion of residents in 'white-collar' industries whereas Tomago has a higher proportion of residents employed in 'blue-collar' industries.
- Workforce and occupation structure: Technicians and trade workers are generally the dominant occupation across all areas. However, Brandy Hill has a higher proportion of residents classified as professionals. The sections closest to the Hunter River (Millers Forest, Woodberry and Tomago) have higher unemployment rates. East Seaham and Brandy Hill have full employment levels.

iii Community infrastructure and services

Woodberry has two community halls, a primary school, a high school and recreational ovals. There is no community infrastructure or services around the Seaham, Brandy Hill or Millers Forest sections. These areas will be serviced by other centres such as Maitland which have a broader range of infrastructure and services and the majority of higher order facilities.

There are limited community facilities and services in Tomago. Higher order facilities serving Tomago will be in Raymond Terrace or Newcastle.

No community facilities or services will be affected by the proposed modification.

10.5.2 Impact assessment

i Properties and landowners

The proposed pipeline corridor realignment utilises existing utility easements where possible and is closer towards some property boundary lines, which minimise impacts on surrounding land uses. As currently approved, a ROW will be established over the pipeline. No reductions in agricultural productivity are expected in the modified sections due to permanent restrictions on use of land within existing easements and the pipeline corridor. An analysis of the impacts for the four sections is provided below.

a. Seaham section

The proposed pipeline corridor realignment will traverse AGL-owned land. The corridor will closely align with the existing TransGrid transmission line easement along the northern boundary of the property. This will minimise the need for additional clearing of vegetation and ensure an efficient use of land within and adjacent to an existing infrastructure easement.

b. Brandy Hill section

The proposed pipeline corridor realignment has been shifted further from residential properties within Brandy Hill. The corridor will run along the boundaries of agricultural lots west of the Brandy Hill. This will eliminate the need for a ROW traversing through the centre of the properties and assist in maintaining the efficient and productive uses of these agricultural lots.

The southern portion of the Brandy Hill section is in close proximity to an irrigation channel that serves the surrounding agricultural lots. Whilst no impacts are anticipated, access to irrigation can be perceived as a concern for farmers.

c. Millers Forest section

The proposed pipeline corridor realignment has been adjusted approximately 50 m east to accommodate the recently-constructed Tomago to Stroud transmission line, which occupies the approved pipeline corridor at this location. This adjustment is closer to residences to the east, though further from those to the west.

The proposed pipeline corridor realignment will, in places, move further away from an existing irrigation channel that serves the surrounding agricultural lots. No impacts are anticipated, however access to irrigation can be perceived as a concern for farmers.

d. Tomago section

The proposed pipeline corridor realignment has been shifted further from residential properties at Woodberry. The corridor will follow existing utility easements in places. This will consolidate the areas associated with the easements and improve the efficient and productive uses of the remaining areas within these semi-rural lots.

ii Construction impacts

a. Construction workforce and construction workers camps

The presence of construction workforce and construction workers camps along the pipeline has been assessed as part of the AECOM (2009a) EA. There will be no increase in workforce numbers or changes to locations of temporary construction workers camps to construct the proposed modification. Accordingly, there will be no additional impacts as a result of the proposed modification.

b. Residential amenity

Potential impacts to sensitive receptors are primarily related to amenity and include noise, air quality, traffic, visual and hazard and risk aspects. These aspects have been assessed as part of this EA. Given the temporary nature of the construction period and transient nature of construction works, potential amenity impacts to sensitive receptors are likely to be minimal.

iii Operational impacts

As the pipeline will be underground, it is envisaged there will be no impact from operations. There will be some surface infrastructure on AGL-owned land, being the TRS in the Tomago section and MLV facility in the Seaham section. However, this infrastructure will be secured appropriately and not result in any socio-economic impacts.

10.5.3 Management and monitoring

The majority of the land to be impacted by construction and operation of the proposed modification is AGL-owned or used for agricultural purposes. Whilst the proposed modification is unlikely to result in a reduction in productivity, AGL will liaise with affected landowners regarding appropriate measures to minimise these impacts. A community and stakeholder engagement plan will be prepared in accordance with Condition 6.5 of the Project approval, as well as a complaints procedure in accordance with Conditions 6.2 and 6.3. This plan and procedure will incorporate the proposed modification. The environmental management and monitoring measures described elsewhere in this report, including for noise, air quality, traffic, visual amenity and hazards and risks are also appropriate for addressing potential social impacts.

10.5.4 Conclusion

The impact of the proposed modification's construction activities to residential properties will be minimal. There may be temporary nuisance and amenity impacts to landowners and surrounding residents from access and works within the modified pipeline corridor alignments. However, access to properties will be maintained during pipeline construction and disturbed areas progressively rehabilitated consistent with the existing land use after construction, which will minimise impacts on land use. As required by the Project approval, a community and stakeholder engagement plan will be prepared and will incorporate the proposed modification.

10.6 European and non-Aboriginal heritage

10.6.1 Existing environment

Europeans first settled the Newcastle region in 1804 when a convict settlement was established. By 1818 European settlement extended as far north as the Hunter Valley. The creation of the port of Newcastle on the Hunter River in the late 18th century also served to promote European settlement of the region.

The greater Hunter Valley, including in the vicinity of the approved GGP, was closed to free settlement up until 1825 because of its close proximity to the Newcastle penal colony. Europeans first arrived in the Gloucester Valley in 1826, when early settlement was encouraged in the area due to its ideal appearance for grazing and agriculture. By 1903, subdivision and good promotion by Gloucester Estate Limited had resulted in rapid growth in the Gloucester area.

Historic heritage items in the vicinity of the Seaham and Tomago sections are described in Table 10.6. No historic heritage items were identified in the vicinity of the Brandy Hill or Millers Forest sections.

Table 10.6 Heritage items in vicinity of proposed modification

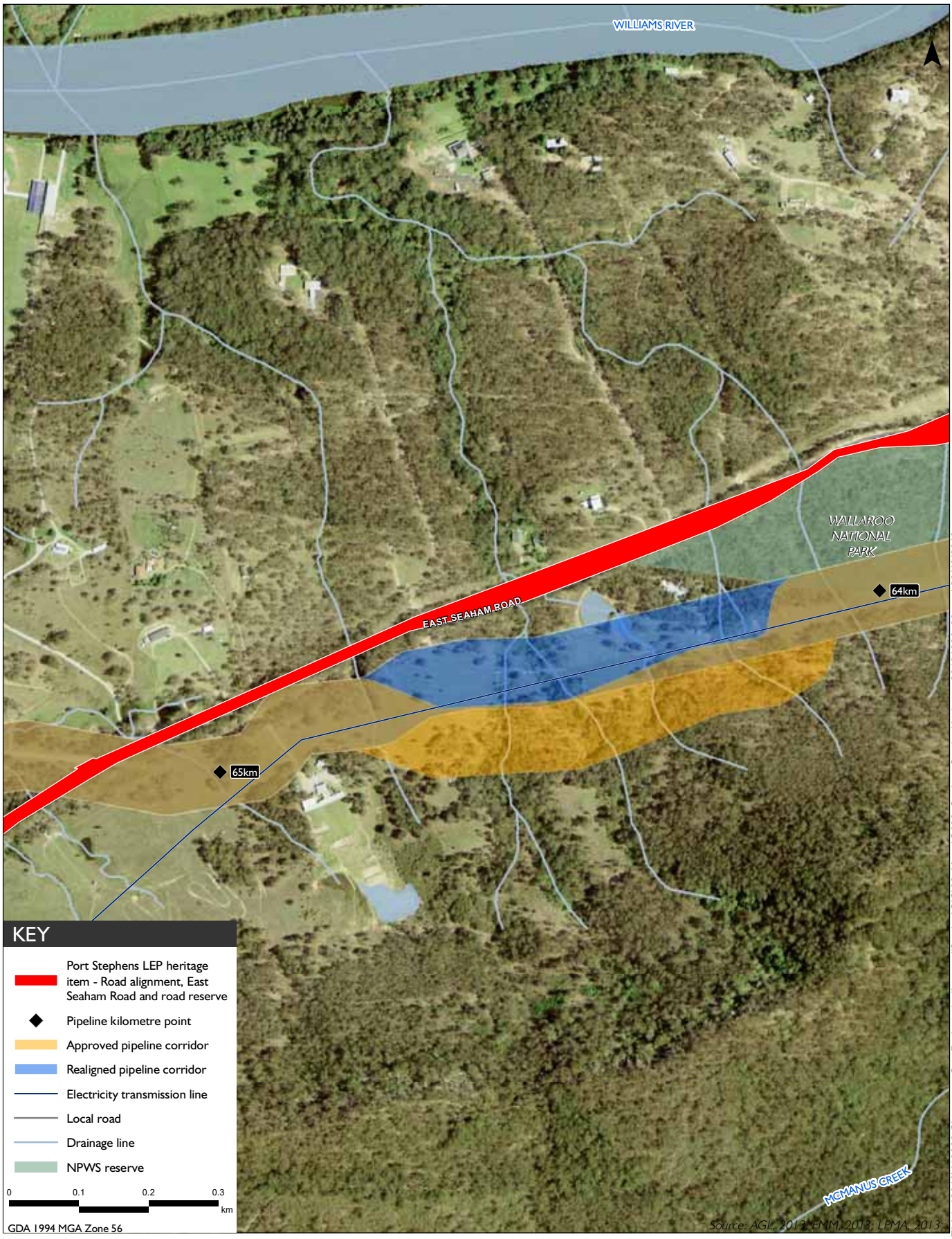
Item	Address	Listing
Seaham section		
Road alignment and indigenous roadside vegetation (including Spotted Gum (*Corymbia aculate*), Iron Bark (*Eucalyptus siderophloia*), Forest Red Gum (*Eucalyptus tereticornis*) and Grey Gum (*Eucalyptus punctata*)); also listed as Road alignment	East Seaham Road and road reserve	Port Stephens LEP; draft Port Stephens LEP
Tomago section		
Tomago House (including Tomago House chapel)	421-423 Tomago Road	Port Stephens LEP; draft Port Stephens LEP; NSW State Heritage Register

10.6.2 Impact assessment

The locally-listed road alignment of East Seaham Road (Table 10.6) is in close proximity to the Seaham section, as shown on Figure 10.7. The proposed modification does not involve any alteration of the road alignment of East Seaham Road. The works may involve the removal of disturbed grassland within and adjacent to the existing TransGrid transmission line easement for construction and vehicle access to the ROW and MLV facility. All efforts will be made to avoid impacts to indigenous vegetation during construction of this section. Accordingly, the potential for impacts to the characteristics that give this item its heritage value will be minimised.

Tomago House, including Tomago House chapel, is approximately 1.2 km from the proposed TRS at Tomago, and will not be affected by the proposed modification.

The Tomago section will be marginally closer to two historic sites identified during field surveys for the AECOM (2009a) EA. However, AECOM (2009a) assessed the significance of these sites and neither was considered to have any heritage value (AECOM 2009a).



EMM

Seaham section - historic heritage items

Minor pipeline corridor realignments EA

Figure 10.7

10.6.3 Management and monitoring

No additional management or monitoring measures over and above those already outlined in the AECOM (2009a) EA and Project approval are required as a result of the proposed modification.

10.6.4 Conclusion

There is minimal potential for impacts to historic heritage beyond those assessed in the AECOM (2009a) EA for the approved project as a result of the proposed modification. The proposed modification will be undertaken in accordance existing environmental safeguards outlined in the Project approval. No further safeguards are required in respect of historic heritage.

10.7 Visual

10.7.1 Existing environment

i Seaham section

The alignment of this section is along a cleared area within and adjacent to a transmission line easement. The topography slopes moderately upward to the south and gently down to the north to East Seaham Road. There is dense vegetation surrounding parts of the easement and scattered vegetation elsewhere along the alignment, including along East Seaham Road and around nearby residential properties. Site photographs are provided in Figure 2.1.

ii Brandy Hill section

The Brandy Hill section is through pastoral landscapes with scattered tree stands. The topography is generally flat, though slopes gently upward to the east to residential properties off Brandy Hill Drive. Site photographs are provided in Figure 2.2.

iii Millers Forest section

The alignment of this section is through cleared pastoral landscapes, on generally flat land. Site photographs are provided in Figure 2.3.

iv Tomago section

The alignment of this section is through pastoral and agricultural land, to the east of the Hunter River. There are scattered tree stands along this stretch of the section, and Francis Greenway Creek flows to the Hunter River to the north. The alignment west of the river is through an existing cleared easement to the NGSF that is surrounded by dense vegetation. The topography is generally flat to gently sloping. There are residential properties to the south and west at Woodberry. Site photographs are provided in Figure 2.4.

10.7.2 Impact assessment

The pipeline construction and operating activities are unchanged from those described in the AECOM (2009a) EA for the approved pipeline corridor alignment. The pipeline will mostly be constructed by open trenching, though some sections will be by thrust boring or HDD.

The proposed modification will not result in any significant change to visual impacts from those assessed in the AECOM (2009a) EA for the approved project. Construction activities (and associated short-term temporary visual impacts) will be closer to a small number of residences along the pipeline corridor than the approved alignment, however will be further from most potentially sensitive receptors than the approved pipeline and HDS. The pipeline will be buried and disturbed areas rehabilitated consistent with the existing land use, which will avoid the potential for adverse visual impacts following construction.

The Seaham section will include an MLV facility which will be the same as that described in the AECOM (2009a) EA, and which formed part of the approved project. No visual impacts beyond those assessed in the AECOM (2009a) EA are expected to result from the MLV facility.

This proposed TRS will be similar in appearance to the adjacent NGSF, though its footprint will be much smaller. There are no sensitive receptors at this location. The existing Project approval includes conditions for minimising visual amenity and lighting impacts. Provided these conditions are implemented, visual and lighting impacts of the TRS are expected to be negligible.

10.7.3 Management and monitoring

Design and construction of the TRS will be in accordance with Conditions 3.40 and 3.41 of the Project approval. No additional management or monitoring measures are required for the proposed modification beyond those already contained in the Project approval.

10.7.4 Conclusion

The proposed modification will not result in any significant change to visual impacts from those assessed in the AECOM (2009a) EA for the approved project. Construction activities (and associated short-term temporary visual impacts) will be closer to a small number of residences along the pipeline corridor than the approved alignment, however will be further from most potentially sensitive receptors than the approved pipeline and HDS. The pipeline will be buried and disturbed areas rehabilitated consistent with the existing land use after construction, which will avoid the potential for any adverse visual impacts. Surface infrastructure to which the proposed modification relates, being the MLV facility and TRS, is not expected to adversely impact visual amenity. The TRS will appear similar to the surrounding industrial facilities. The existing approved environmental safeguards are considered appropriate to manage any potential visual impacts.

10.8 Greenhouse gases

The AECOM (2009a) EA included a greenhouse gas (GHG) assessment of each of the relevant GGP components. The aspects relevant to the proposed modification include the pipeline and the water bath heaters now proposed to be at the TRS instead of the previously-proposed HDS. The proposed modification includes a minor reduction in the total pipeline length and replacement of the HDS with the TRS. Table 10.7 presents a qualitative assessment of the relevant changes to the GGP GHG emissions. The results indicate that the proposed modification, principally the reduction in the total length of the pipeline, would result in a minor (0.08%) decrease in annual GHG emissions from the GGP in its entirety.

Table 10.7 Estimated annual greenhouse gas emissions - Scopes 1, 2 and 3

Source of GHG	Approved project (including the HDS)		Modified project (including the TRS to replace the HDS)	
	Number	t CO_{2-e}	Number	t CO_{2-e}
Dual water bath heater (Scope 1 emission source)	1	375	1	375
Pipeline (Scope 3 emission source)	98 km	855	95 km	829
Total GGP	**-**	**492,343**	**-**	**492,317**

Source: AECOM 2009c.

10.9 Traffic and access

The proposed pipeline and TRS construction and operating activities are unchanged from those described in the AECOM (2009a) EA for the approved pipeline corridor alignment and HDS.

Construction within the Tomago section will include HDD under the Hunter River and Pacific Highway. During construction, access for construction equipment, materials and personnel to the existing cleared utility easement at Tomago will be directly from its intersection with the Pacific Highway, however this will be temporary. Access to the TRS will be via public roads and existing access tracks.

The proposed modification is not expected to result in any material change to traffic generation during construction or operations from that assessed in the 2009 EA for the approved project. Traffic generation was predicted to be minimal compared to background road traffic volumes. Roads to be used by vehicles accessing the proposed modified sections of pipeline corridor and TRS will be generally consistent with those to be used for the approved GGP.

All the public roads to be crossed by proposed modified pipeline corridor alignment are crossed by the approved alignment.

The proposed modification, including construction within the Tomago section, is not expected to result in any additional impacts to traffic or access beyond those assessed in the AECOM (2009a) EA.

The existing traffic, transport and access management measures in Conditions 3.43 to 3.45 of the Project approval are suitable for the proposed modification and no additional mitigation or management measures are required.

10.10 Bushfire

The proposed pipeline construction and operating activities are unchanged from those described in the AECOM (2009a) EA for the approved pipeline corridor alignment. The proposed pipeline corridor realignments within the Seaham, Brandy Hill and Millers Forest sections are minor and in the same vicinity, with less vegetation to be disturbed than approved. No additional bushfire risk is expected within these sections.

The Tomago section replaces the Hexham section connecting to the HDS. The western end of the Tomago section traverses similar landscape to the approved Hexham section and no additional bushfire risk is anticipated in this area.

The eastern end of the Tomago section is within an existing cleared utility easement. This easement is bordered by bushfire-prone vegetation to the north and east. The Hunter Region Botanic Gardens to the north is managed for conservation of biodiversity and drinking water supplies, meaning that biological thresholds rather than asset protection govern the use of fire within these areas. Few human-made structures exist within these areas, minimising the potential risk of bushfire impacts on life and property (EMM 2013).

The nearest fire stations are in Raymond Terrace and Williamtown, which form a part of the wider fire fighting resource base in the Port Stephens LGA. The Rural Fire Service carries out hazard reduction burning during the cooler months of March through to October. The Fire and Rescue NSW fire brigade is in Tarro and Raymond Terrace.

Fuels, lubricants and some chemicals will be used during construction of the pipeline and TRS. There is the potential of increased ignition sources as a result of routine construction activities such as the use of machinery. However, the existing cleared utility easement comprises a buffer to vegetation on either side; the pipeline and TRS will be cleared land near the NGSF. Therefore, the level of bushfire risk will be minimal. These buffers will be maintained through the life of the GGP.

Notwithstanding, Conditions 3.47(a) and 3.47(d) of the Project approval requires AGL to prepare a Fire Safety Study and a Construction Safety Study that considers the bushfire risk during construction. It is considered that these requirements are sufficient to effectively manage bushfire risk for the proposed pipeline corridor alignments and the TRS. These plans will incorporate the proposed modification should it be approved.

10.11 Cumulative impacts

AECOM (2009a) assessed cumulative impacts of the GGP and other projects and proposals in the surrounding areas. The assessment considered two known major projects in the Hexham vicinity and concluded that there would be negligible cumulative effects and no significant net residual effects associated with its interactions with these known projects.

The proposed modification removes the pipeline corridor to Hexham and replaces it with the proposed Tomago section and connection to the NGSF via the TRS. The NGSF and its potential interaction with construction and operation of the pipeline and TRS have been considered in this EA, principally in the noise and hazard and risk assessments (see Chapters 8 and 9 respectively). These assessments concluded that minimal cumulative effects were expected provided the required environmental management measures under the existing Project approval were implemented.

In summary, the proposed modification will have minimal environmental consequences beyond the approved GGP and will result in some environmental benefits and outcomes including an overall reduction in the length of the pipeline corridor and disturbance area during construction and reduced vegetation clearing. Given this and minimal effects from the adjacent NGSF, cumulative impacts from the proposed modification are not anticipated.