2 Proposed modification

2.1 Description of the existing environment

2.1.1 Overview

The proposed modification applies to land in the lower Hunter region of NSW, within the Hunter River catchment management area. The Seaham and Brandy Hill sections are in the Port Stephens LGA, the Millers Forest section is in the Maitland LGA and the Tomago section traverses both the Maitland and Port Stephens LGAs. The assessment corridor for the Tomago section, shown on Figure 1.6, marginally extends into the Newcastle LGA. However, this is at a location proposed to be underbored by HDD, with no surface works. The Newcastle LGA is therefore not discussed in detail in this report.

The pipeline corridor realignments generally traverse rural and semi-rural landscapes mostly comprising cleared agricultural land with isolated stands of remnant vegetation, and utility and access track corridors. Consistent with the approved project, it crosses roads, waterways and drainage lines. There are some residences in the surrounding area, including in the suburbs of Brandy Hill and Woodberry, however the corridor is further from most of them than the approved route. The pipeline ends at the proposed TRS at the NGSF, which is within an industrial area.

Given the minor nature of the realignments, the existing environment is generally consistent with that described by AECOM (2009a) for the approved pipeline route. A brief summary for each realigned section is provided in Sections 2.1.3 to 2.1.6 and more detail is provided in the technical assessments in this report.

It is noted that the AECOM (2009a) EA referenced kilometre points (KPs) for the full length of the pipeline corridor, starting at 0 at the central processing facility, and culminating at 96 at the HDS. The realignments have slightly shortened the pipeline and the revised KPs are shown on the figures in this report, and referenced in some of the technical assessments. The proposed realignments apply to the sections of pipeline generally between KP 64 and 65 (Seaham); KP 76 and 81 (Brandy Hill); KP 86 and 89 (Millers Forest); and KP 89 and 94.6 (Tomago) (Figures 1.1 and 1.3 to 1.6).

2.1.2 Land parcels and ownership

The modified pipeline corridor alignment comprises freehold land variously owned by private landowners and AGL, other than the Hunter River bed below the mean high water mark which is Crown Land; Council-owned road easements; and the Pacific Highway and adjoining land parcel owned by the NSW Roads and Maritime Services (RMS). Lot and DP numbers and ownership details for the realigned sections are provided in Table 2.1 and shown on the zoning plans in Figures 4.2 to 4.5.

The proposed realignments reduce the number of privately owned lots traversed by the corridor. AGL either has or is in the process of negotiating easement agreements with all landowners along the realigned pipeline corridor. A schedule of lands for the entire pipeline route is provided in Appendix B, and includes the land subject of this modification application. It also identifies those parcels from the approved GGP, which, subject to approval of the modification, would no longer form part of the application area.

Table 2.1 Land parcels and ownership

Pipeline corridor section	Land parcels	Landowner
Seaham	Lot 20, DP815759	AGL
	Lot 10, DP753216[1]	NPWS[1]
Brandy Hill	Lot 26, DP1101305	Private landowner
	Lot 2, DP1053896	Private landowner
	Lot 260, DP1182734	**Private landowner**
	Lot 201, DP1074238	Private landowner
	Lot 4, DP1016694	Private landowner
	Lot 30, DP1109502	Private landowner
	Lot 301, DP506711	Private landowner
	Lot 2, DP1110919	Private landowner
	Lot 343, DP740220	Private landowner
Millers Forest	Lot 371, DP825895	Private landowner
	Raymond Terrace Road	Maitland City Council
	Lot 11A, DP197	Private landowner
	Lot 9A, DP197	Private landowner
	Lot 7A, DP197	Private landowner
	Lot 5A, DP197	Private landowner
	Lot 202, DP1014215	Private landowner
	Turners Road	Maitland City Council
Tomago	Lot 201, DP1014215	Private landowner
	Woodberry Road	Maitland City Council
	Lot 6, DP262053	Private landowner
	Lot 1, DP803276	Private landowner
	Lot 1, DP1174500	Private landowner
	Lot 2, DP803276	**Private landowner**
	Hunter River	Crown land
	Lot 7310, DP1165716	Crown land
	Lot 51, DP739336	**RMS**
	Pacific Highway	RMS
	Lot 201, DP1173564	**AGL**

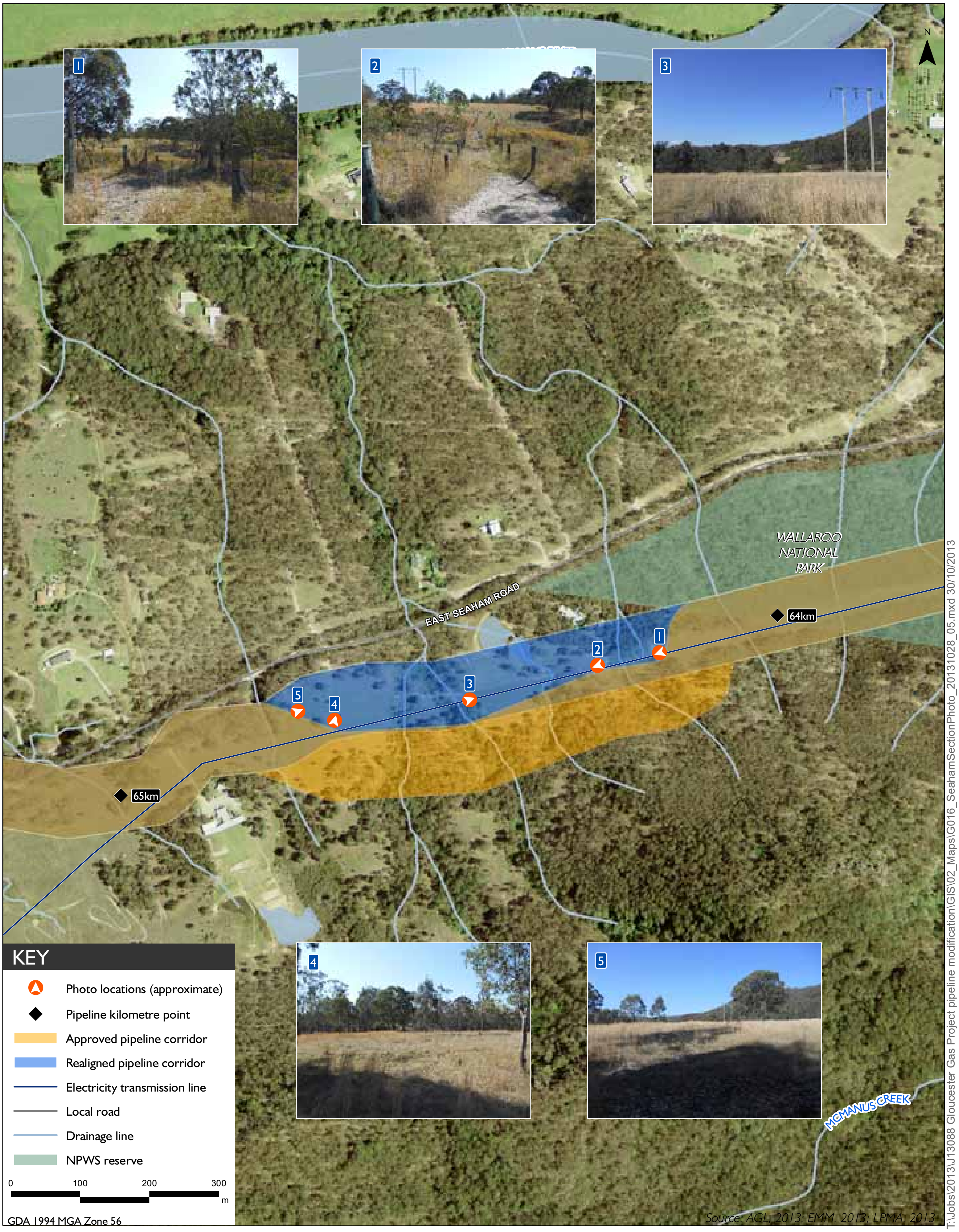
Notes *Bold font denotes land parcels which did not form part of the original project application approved under PA 08_0154.*

1. A small area of Wallaroo National Park is within the 100 m wide modified pipeline corridor alignment within the Seaham section, continuous with that part of the approved pipeline corridor that is in the national park (refer Figure 1.3). However, the ROW for the Seaham section will not be within this area of national park.

2.1.3 Seaham section

The Seaham section comprises approximately 650 m of the pipeline corridor at East Seaham, which is proposed to be straightened and realigned up to 100 m north (Figures 1.3 and 2.1).

The Seaham section traverses the north-western edge of a 160 hectare (ha) AGL-owned property, which was purchased as a proposed biodiversity offset for the GGP. It is predominately within gently undulating, cleared land coinciding with a TransGrid transmission line easement and former grazing land. It is outside of that part of the property being used for biodiversity offsets. Photographs are provided in Figure 2.1.



Seaham section - photo log

Minor pipeline corridor realignments EA

Figure 2.1

The Seaham section will include a main line valve (MLV) which will be the same as that described in the AECOM (2009) EA, and which formed part of the approved project. While the 2009 EA identified that an MLV was required approximately half way along the pipeline, further detail on its potential location was not available at that stage. The current preferred location has since been identified to be within the Seaham section, and it has been considered accordingly in this EA. The MLV needs to be set back from the transmission line, and so this part of the corridor is proposed to be within the cleared area immediately north of the transmission line easement (Figure 1.3). The MLV's exact location and design will be confirmed during its detailed design.

Vegetation is predominately native and introduced grasses and weeds with scattered native trees and regrowth vegetation. Native woodland (Ironbark - Spotted Gum Woodland) extends into the southern and eastern edges of the 100 m corridor, generally where it overlaps with the approved corridor. The realignment is largely to minimise clearing of this woodland, approved under PA 08_0154. Further, the ROW will be sited so as to avoid clearing of Ironbark - Spotted Gum Woodland that is within the corridor.

The corridor is also traversed by gravel access tracks and ephemeral drainage lines, which ultimately drain to the Williams River, approximately 800 m to the north. The drainage lines were dry and grassed at the time of the site inspection in September 2013.

Other features surrounding the proposed realigned corridor include:

- a farm dam which adjoins the corridor's northern edge;
- East Seaham Road, approximately 20 to 140 m north, which will be used for site access, and is a locally listed heritage item;
- rural residential properties between East Seaham Road and the Williams River (the realigned corridor is up to 100 m closer to these sensitive receptors);
- Wallaroo National Park, immediately to the east;
- woodland and forested areas of AGL's proposed biodiversity offset property to the south, which are contiguous with bushland in Wallaroo National Park; and
- a gun club and grazing properties to the west, with scattered residences.

2.1.4 Brandy Hill section

The Brandy Hill section comprises approximately 5 km of the pipeline corridor west of Brandy Hill, which is proposed to be straightened and realigned generally up to 335 m west (Figures 1.4 and 2.2).

Consistent with the approved route, the Brandy Hill section traverses grazing properties on the Hunter River floodplain and swamp margins, which include ASS. The northern 2.5 km (approximate) follows a boundary fence between rural allotments. The southern 2 km is adjacent to Barties Creek, which drains to the Hunter River. At this location Barties Creek comprises an artificially canalised channel, with no riparian vegetation. The route also crosses farm access tracks. Photographs are provided in Figure 2.2.

Vegetation is predominately introduced pasture grasses with scattered native trees. There are isolated stands of vegetation, which are representative of endangered ecological communities (EECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), being Swamp Oak Floodplain Forest and Hunter Lowland Redgum Forest. As a result of clearing and grazing practices these stands are modified with virtually no remnant understorey. The proposed realignment was partly to reduce the area of Hunter Lowland Redgum Forest EEC to be cleared.

Siting of the ROW within the pipeline corridor will avoid Barties Creek, and where feasible mature trees and patches of remnant vegetation. A small number of trees will need to be cleared, however the realignment has reduced vegetation clearing required in this area.

Other features surrounding the proposed realigned corridor include:

- forested areas interspersed with rural residences as far as Clarence Town Road, approximately 265 m to the north, beyond which are forests surrounding Brandy Hill Quarry;
- Brandy Hill Drive, immediately east of the corridor's northern end, and which will be used for site access;
- a rural residence on Brandy Hill Drive, immediately adjacent to the corridor's northern end;
- cleared agricultural land backed by residential properties in Brandy Hill to the east (the realigned corridor is up to 335 m further from these sensitive receptors); and
- cleared rural properties on the Hunter River floodplain to the south and west which are used for livestock grazing and cultivation and include swamps around Barties Creek. Some of these properties use Barties Creek for irrigation.

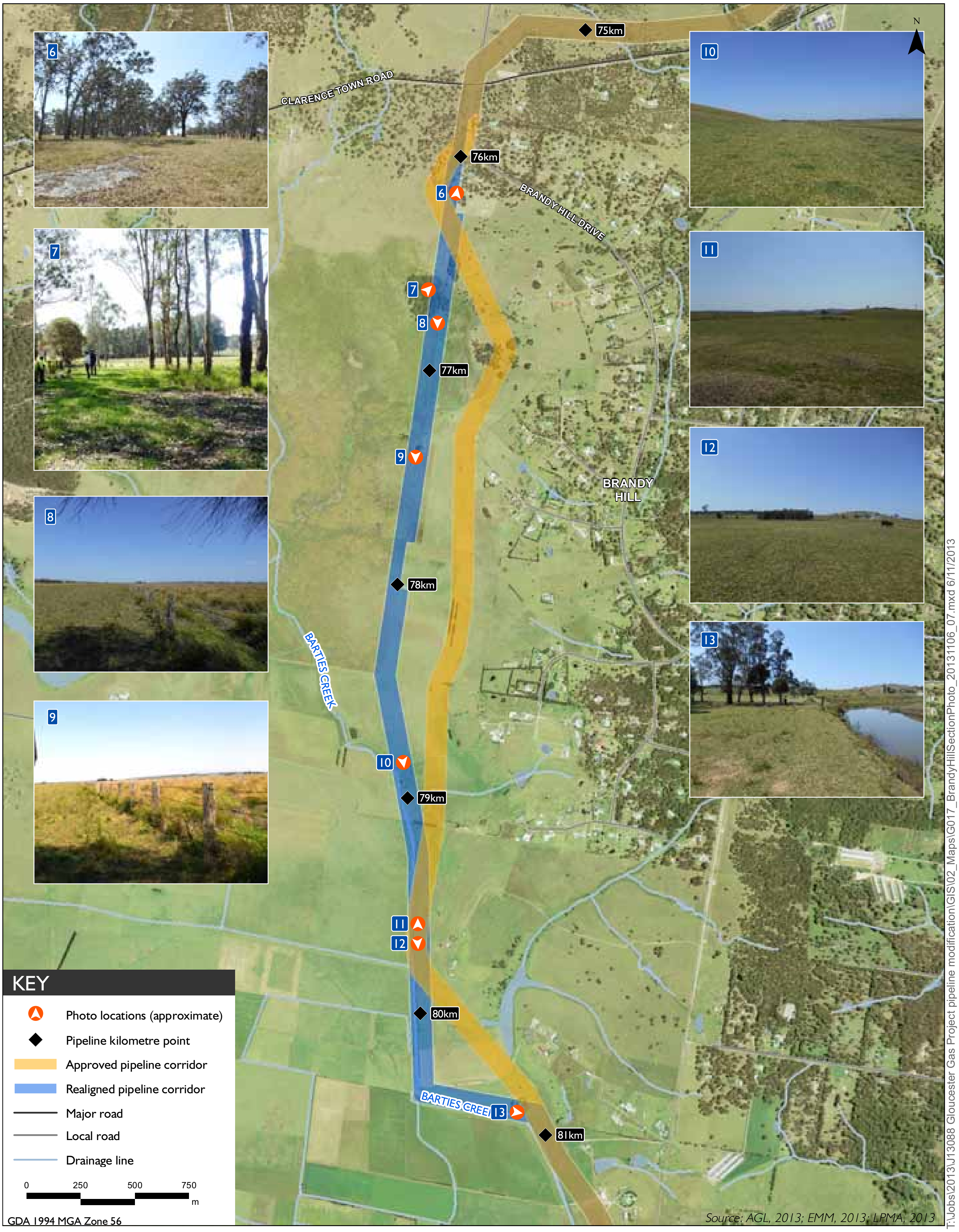
2.1.5 Millers Forest section

The Millers Forest section comprises approximately 2.5 km of the pipeline corridor at Millers Forest, which is proposed to be straightened and realigned around 50 m east to avoid the recently-constructed TransGrid Tomago to Stroud high voltage transmission line (Figures 1.5 and 2.3).

Consistent with the approved route, the Millers Forest section traverses low-lying agricultural land on the Hunter River floodplain, used for cultivation and grazing, and which comprises ASS. Also, consistent with the approved route it crosses Raymond Terrace Road, Turners Road, fences, artificial drainage channels, levee banks and electricity transmission line easements. Vegetation is predominately native and introduced pasture grasses. Photographs are provided in Figure 2.3.

Other features surrounding the proposed realigned corridor include:

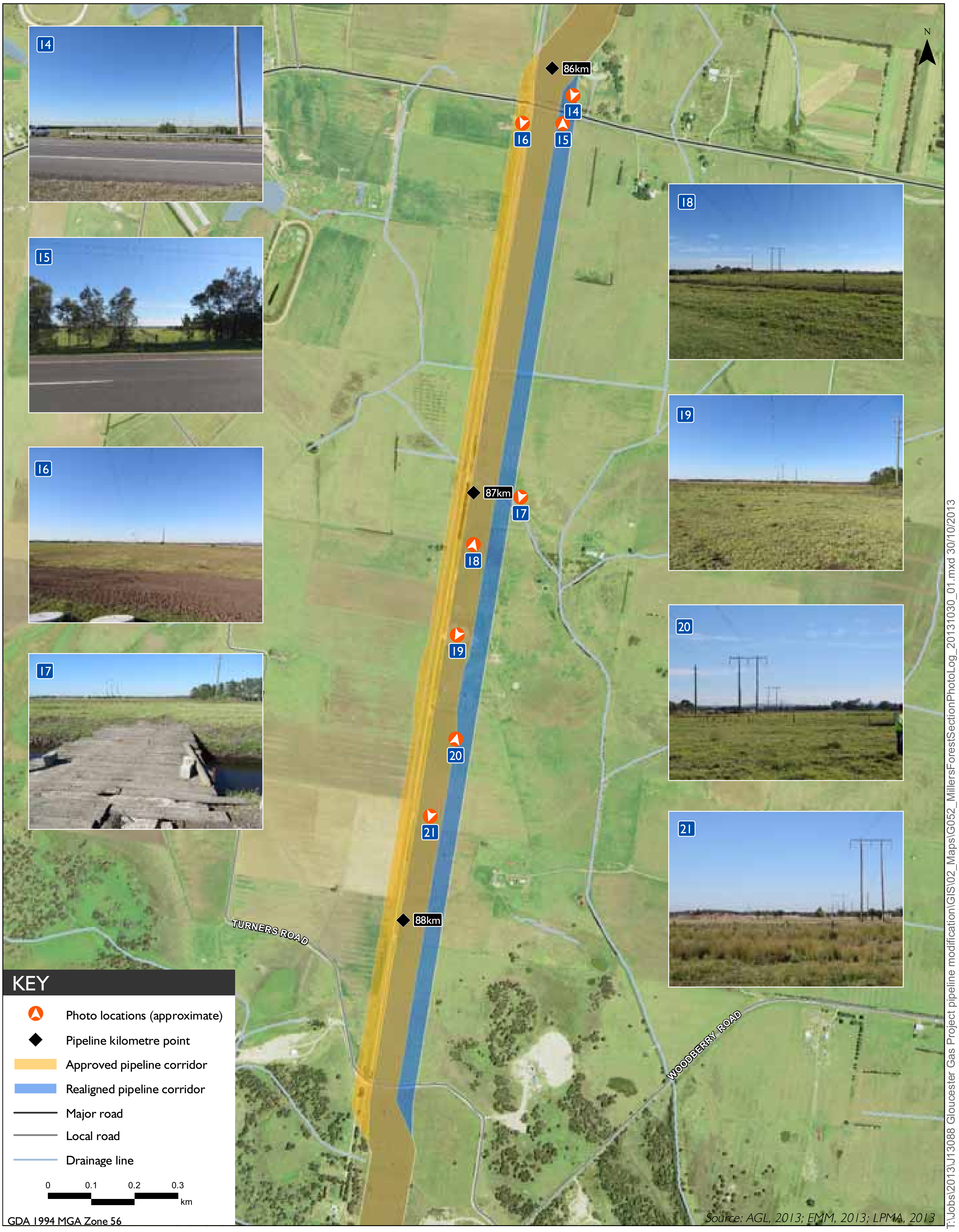
- cleared agricultural land with scattered rural residences to the north, east, south and west, including a residence on Raymond Terrace Road, immediately adjacent to the corridor's northern end. The proposed realigned corridor is around 50 m closer to residences to the east and 50 m further from those to the west than the approved route;
- an artificially constructed drainage channel that drains to Scotch Creek, a tributary of the Hunter River, adjacent to the part of the corridor's western side. This channel is bordered in sections by tree plantings and has an unsealed vehicle track and the Hunter Water Corporation (HWC) water pipeline from Chichester Dam on its western side; and
- a residential area in the suburb of Woodberry approximately 900 m to the south.



Brandy Hill section - photo log

Minor pipeline corridor realignments EA

Figure 2.2



Millers Forest section - photo log

Minor pipeline corridor realignments EA

Figure 2.3

2.1.6 Tomago section

The Tomago section comprises approximately 6.5 km of the pipeline corridor's southern end, which is proposed to be realigned from around Woodberry Road, to connect with the NGSF at the Tomago industrial area via the TRS (rather than the HDS) (Figures 1.5 and 2.4).

The western part of the Tomago section, as far as the Hunter River, traverses low-lying agricultural land on the Hunter River floodplain, used for cultivation and grazing. It runs adjacent to Francis Greenway Creek and an artificial drainage channel which drains to the creek for around 700 m. Vegetation is predominately pasture grasses and weeds, with scattered native trees. There are some small isolated patches of degraded Swamp Oak Floodplain Forest along the modified alignment, which are representative of a TSC Act-listed EEC.

This western part of the corridor crosses Woodberry Road, farm access tracks, fences, levee banks, electricity transmission line easements and the artificial drainage channel which is a tributary of Francis Greenway Creek.

The central portion of the Tomago section is proposed to be constructed by HDD, with no surface disturbance. It will pass under the Hunter River, mangroves and the edge of a SEPP 14 wetland at the river's edge; a parcel of RMS-owned land containing wetlands and grazing land on the eastern side of the river; and the Pacific Highway. The proposed realignment avoids disturbance to SEPP 14 wetlands to the south, and only involves one crossing of the Hunter River (rather than the two crossings approved).

The HDD entry point will be at cleared land east of the highway (around KP 93), and a temporary laydown area will be established at this location. The HDD exit point will on the western side of the Hunter River at around KP 92. A temporary laydown and pipe stringing area will also be required in this area, on cleared farmland within and adjacent to the 100 m wide pipeline corridor. No vegetation clearing will be required for this and ground disturbance will be minimal, likely to limited to gravel access tracks which will be rehabilitated upon completion of construction activities. The anticipated maximum footprint for these activities is shown indicatively on Figure 1.6 and has been considered accordingly in this assessment.

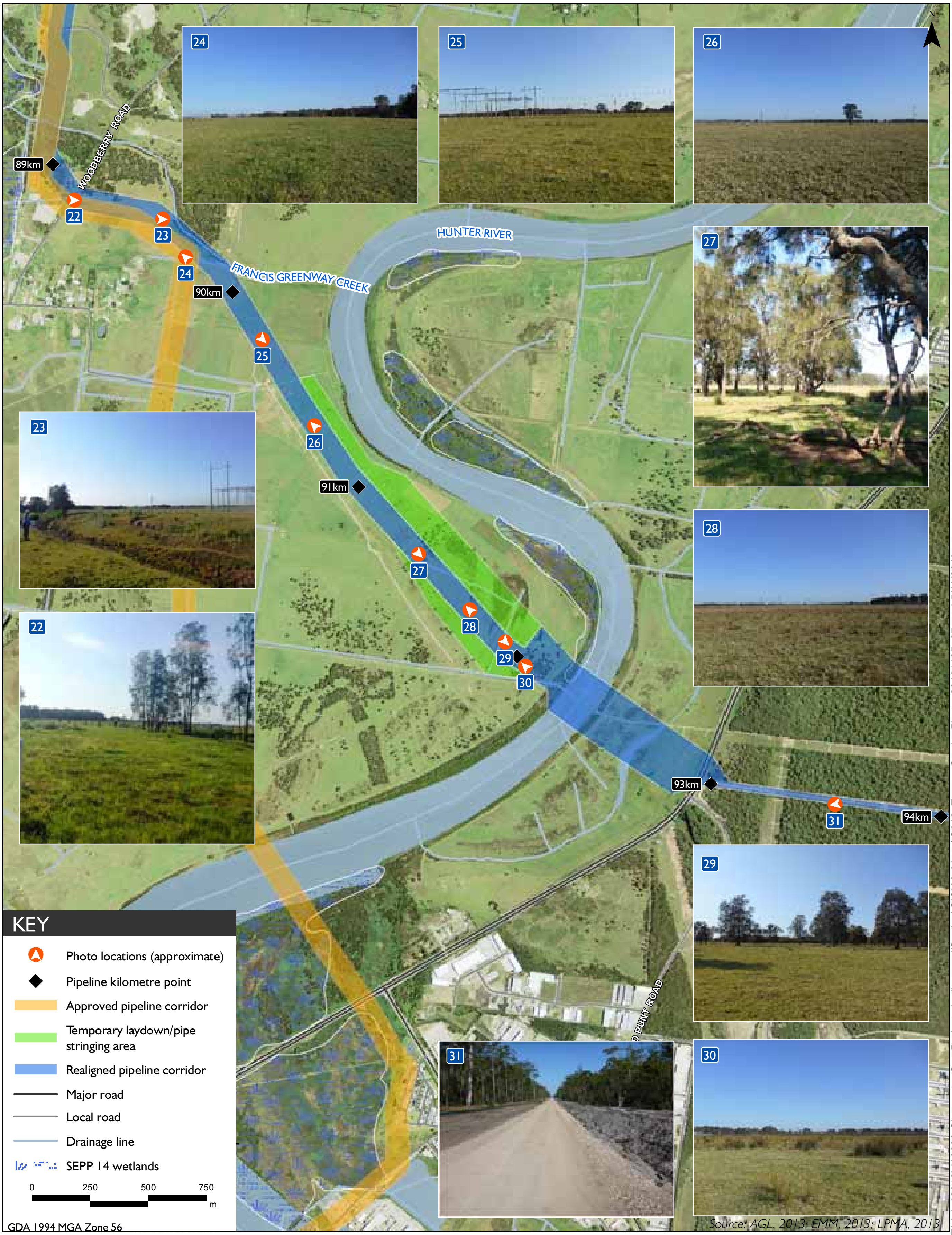
The remainder of the pipeline corridor, as far as the proposed TRS location, is along an existing 30 m wide cleared utility easement that is between the Pacific Highway and NGSF. This easement is AGL-owned and contains a high pressure gas transmission pipeline that runs from the NGSF to Hexham, and an access track. It is at the northern edge of the Tomago industrial area.

The Tomago section includes ASS, however the realignment has reduced the amount of ASS to be disturbed. Consistent with the approved corridor, the Tomago section is underlain by aquifers in the Hunter River alluvium west of the river and those within the Tomago Sandbeds to the east.

Other features surrounding the proposed realigned corridor include:

- cleared agricultural land with scattered rural residences and remnant patches of native vegetation to the north. East of the Pacific Highway the area to the north is however characterised by an approximately 180 m wide strip of bushland north of AGL's cleared NGSF gas pipeline access corridor (also referred to as the 'cleared utility easement' in this report), beyond which is a cleared TransGrid transmission line easement and bushland within the Hunter Region Botanic Gardens;

- Tomago industrial area south of the NGSF, including the Tomago Aluminium Company aluminium smelter facility;



T:\Jobs\2013\J13088 Gloucester Gas Project pipeline modification\GIS\02_Maps\G018_TomagoSectionPhoto_20131105_07.mxd 5/11/2013

Tomago section - photo log

Minor pipeline corridor realignments EA

Figure 2.4

- cleared agricultural land backed by residential properties in Woodberry south and west of the corridor's western end (the realigned corridor is more than 40 m further from these sensitive receptors);

- several SEPP 14 wetlands, including wetlands in the bend of the Hunter River to the south, which would have been impacted by the approved pipeline route to the HDS, and are now avoided;

- Hunter Wetlands National Park more than 2.7 km to the south and east, and more than 4 km downstream of the proposed Hunter River crossing; and

- Hunter Estuary Wetlands Ramsar site more than 2.8 km to the south and east, and more than 6.5 km downstream of the proposed Hunter River crossing.

2.2 Overview of the proposed modification

As described in Section 1.3, AGL has approval to construct and operate the GGP. One component of the GGP is an approximately 95 to 100 km long underground high pressure gas transmission pipeline from a central processing facility at Stratford to the HDS.

The proposed modification is for minor realignments to four sections of the pipeline corridor to minimise its environmental impacts, avoid recently-constructed utilities, achieve economic and efficiency benefits and connect to the NGSF via the TRS, instead of the HDS. The TRS and connection to the NGSF will replace the currently approved HDS. End of pipeline facilities, including an odourant station, water bath heater, filtration systems and flow control valves are proposed at the TRS, similar to those previously assessed and approved for the HDS. The need for the modification is discussed in Section 1.4.

The proposed pipeline construction and operating activities are unchanged from those described in the AECOM (2009a) EA for the original (approved) pipeline route. In summary, it will mostly be constructed by open trenching, though sections that cross significant infrastructure or sensitive environments will be by thrust boring or HDD. This includes the proposed Pacific Highway and Hunter River crossing by HDD. Construction will generally involve site preparation and excavation of a trench, followed by construction of the pipeline commencing with pipe stringing, through to lowering in, backfilling, clean up and rehabilitation. The pipeline will then be commissioned. The Seaham section will include an MLV facility which will be the same as that described in the AECOM (2009a) EA for the approved GGP.

To allow flexibility in final siting and design of the pipeline, and consistent with the approach in the AECOM (2009a) EA for the approved project, this assessment has generally considered a 100 m wide pipeline corridor. Exceptions include the final 1.6 km (approximate) of the Tomago section where the route is confirmed as being along an existing 30 m wide utility easement that is already cleared. A wider corridor is also shown on Figure 1.6 for the HDD crossing of the Pacific Highway and Hunter River. This is to accommodate the HDD which may need to be curved either north or south to overcome various constraints, which are outlined in Section 2.3.3(vii). As discussed in Sections 2.1.6 and 2.3.4(ii), and shown on Figure 1.6, a temporary laydown and pipe stringing area is also proposed within and adjacent to the 100 m wide pipeline corridor at the Tomago section.

While a 100 m wide corridor has generally been considered, the disturbance footprint for pipeline construction will be within a ROW up to around 30 m wide. In some environmentally sensitive areas this will be reduced to 15 to 20 m. The final alignment of the ROW will be confirmed during its detailed design. Disturbed areas will be rehabilitated consistent with the existing land use after construction, with ongoing maintenance activities limited to an approximately 10 m wide easement above the buried pipeline.

The proposed corridor realignments were sited with consideration to the same sensitivity criteria described by AECOM (2009a) EA for the approved route, and took into account outcomes of landowner consultation, ground-truthing and aerial surveys of the route. The proposed realignments are considered to have a beneficial outcome when considering these criteria, which are as follows:

- ecological sensitivities including threatened flora and fauna and avoidance of trees where possible, including isolated clumps and significant trees;
- protected areas such as national parks;
- constraints such as geology, ASS, steep areas, erosion potential, elevated groundwater levels and watercourses;
- items of heritage significance (Aboriginal and non-Aboriginal);
- land use (existing and future) and legislative constraints;
- buildings and infrastructure;
- social impacts;
- length of pipeline, with the shortest length usually being the most efficient and economical; and
- use of existing easements where possible as they provide a corridor with pre-existing encumbrance to the land and minimise impacts to the land use and development potential.

The EA and the approval conditions include a range of environmental management, mitigation and monitoring measures, including for construction and operation of the gas transmission pipeline and HDS. Several of these are also proposed to be applied to the proposed modification subject of this EA. Minor changes to some approval conditions are required to accommodate the proposed modification, predominately to reference the TRS and connection to the NGSF, and remove reference to the HDS, which is no longer proposed. These changes are detailed in Chapter 11.

A description of proposed construction and operating activities was provided in the AECOM (2009a) EA and is reproduced in the following sections where relevant to the pipeline and TRS, with some additional detail provided where relevant, including on the MLV.

2.3 Pipeline construction – description of approved activities

2.3.1 Site preparation

i Survey of pipeline route

The pipeline route would initially be surveyed to demarcate the clearing width along the corridor. Survey stakes would be placed either side of the corridor to be cleared, to ensure only the designated work area is disturbed. Environmentally sensitive areas to be protected would also be marked out and clearly identified by high visibility temporary barricading.

ii Clearing

Vegetation clearing within the ROW would be undertaken where necessary using graders and bulldozers. Where necessary, large trees away from the trench line (but within the ROW) would be cut off at ground level to preserve the root stock and thus assist with soil stabilisation and enhance natural regeneration.

The ROW would typically require a 30 m wide corridor be cleared, with cleared vegetation temporarily stockpiled on the non-working side of the ROW. A reduced ROW of approximately 15 to 20 m wide may be used in some environmentally sensitivities areas such as ecologically sensitive areas and river crossings (Figure 2.7, Photograph 1). Conceptual ROW layouts are provided in Figure 2.5, including a conceptual layout for a reduced ROW width at a watercourse crossing.

iii Grading

The ROW and temporary laydown areas would be graded, where required, to provide an even, safe working area for pipeline construction. This would involve removing topsoil, and possibly sub-soil in some areas. Topsoil would typically be removed from the trench area to a depth of around 100 to 150 mm and stockpiled adjacent to the cleared vegetation on the non-working side of the ROW as shown in Figure 2.5. Excavated sub-soil would be stockpiled separately to the topsoil. Erosion and sediment controls would be installed where required.

iv Trenching and earthworks

A trench would be dug using a specialised bucket wheel trencher or chain trencher (Figure 2.7, Photograph 2). The trench would be a sufficient depth to allow a minimum cover of 750 mm over the top of the pipeline. The depth of the trench may vary according to the terrain (eg rock and watercourse crossings), its proximity to infrastructure and buried utilities and land use. Excavated soil would be stockpiled and environmental safeguards implemented to manage the soil stockpiles, including erosion and sediment controls, and rehabilitation procedures.

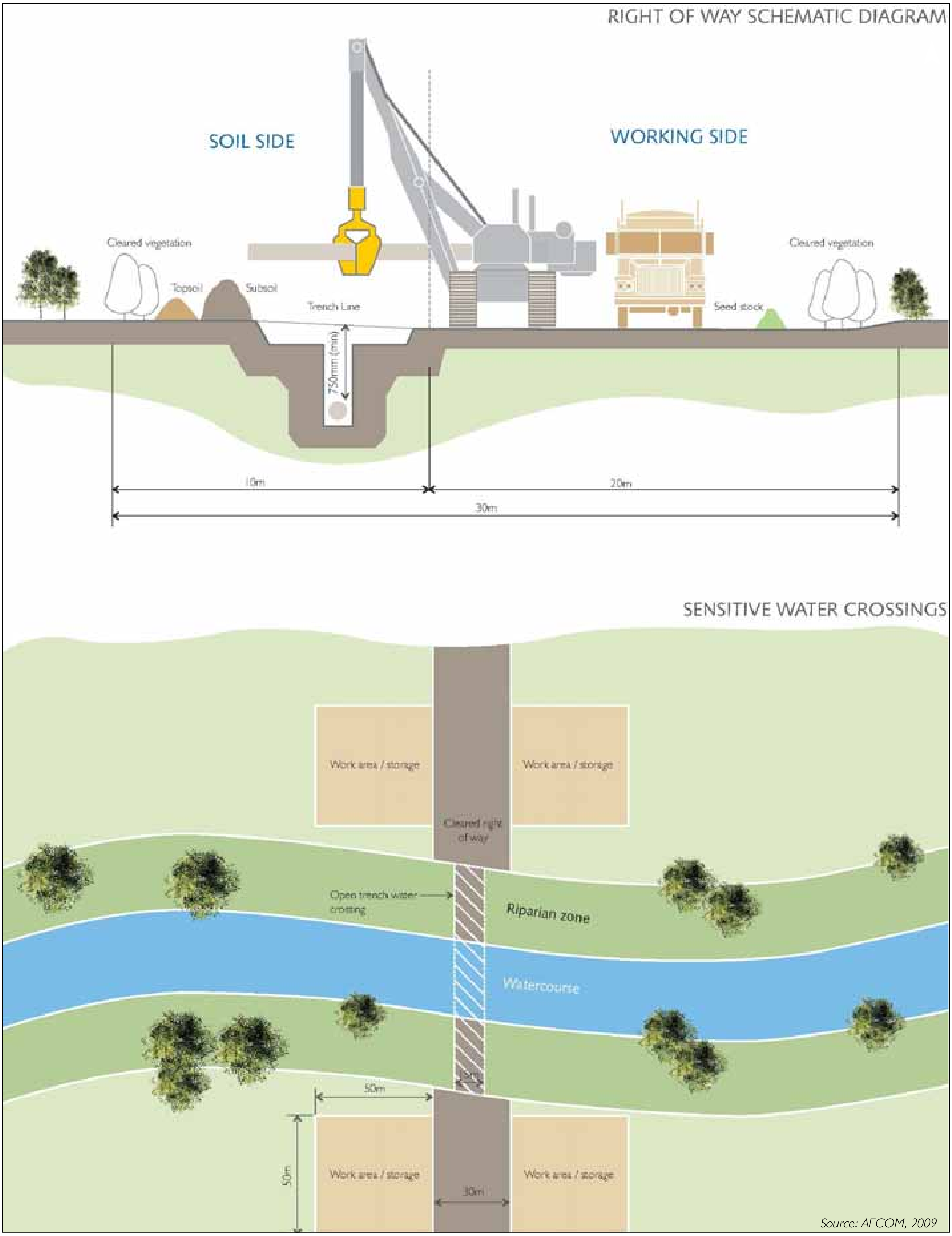
2.3.2 General construction process

i Pipe stringing

High pressure steel pipe lengths of 12 m and 18 m long and up to 18 inches in diameter would be delivered by flatbed trucks after clearing and grading. The pipes would be unloaded and lined up along the pipeline route in preparation for welding. The pipe lengths would be placed on sandbags and raised on blocks of wood (timber skids) to facilitate subsequent handling and to protect the pipe from corrosion and coating damage. Special pipeline handling procedures would be employed if the studies on the effects of stray currents and touch potential indicate there is a potential risk of electric shock at locations where the pipeline is close to high voltage powerlines. These would include earthing the pipeline, equipotential mats, gloves and boots rated for high voltage insulation.

ii Bending and welding

Pipe lengths may be bent using a hydraulic bending machine, where necessary, to account for either changes in elevation or direction of the pipeline. Pipe lengths would then be welded into continuous lengths of up to 1 km, known as pipe strings. Pipe strings would be earthed to the ground using earthing stakes as well as the measures mentioned above for pipe stringing in areas identified as having increased risk of high voltage shocks.



Pipeline right of way - schematic dragrams

Minor pipeline corridor realignments EA

Figure 2.5

iii Radiography and joint coating

Each weld would be inspected using x-ray or ultrasonic equipment in accordance with the relevant Australian standard (currently AS 2885.2). Where a weld is found to be non-conforming, the joint would either be removed or repaired and re-tested to confirm that it conforms. The surface of the welds would then be cleaned by grit blasting or wire brushing and a protective coating applied to each weld to inhibit corrosion.

iv Cathodic protection system

The pipeline would use an impressed current cathodic protection system designed in accordance with the relevant Australian standard (currently AS 2832.1). Cathode protection test points would be installed at approximately 1.5 km intervals and fitted with equipotential grids for personnel protection. Where the pipeline comes above ground into the TRS, the pipeline would be electrically isolated from the station pipework using monolithic insulation joints fitted with surge protection. The station pipework would be earthed.

v Padding

Padding involves placing fine material at the base of the trench prior to lowering in the pipe and also around the pipe prior to backfilling for protection against abrasion (Figure 2.7, Photographs 3 and 5). Padding machines would be used to sift the excavated trench subsoil back into the trench, removing coarse material. In some instances (eg very rocky soils) imported sand may be used for padding.

vi Lowering-in and backfilling

The welded pipe string would be lowered into the trench using side-boom tractors and/or excavators (Figure 2.7, Photographs 4 and 5). It may be necessary to dewater the trench prior to lowering in the pipe if rainwater or groundwater from a shallow aquifer has accumulated in it, and this water would be infiltrated nearby. For the Tomago section east of the Hunter River, any water removed from the trench will be infiltrated a short distance away from the dewatering location using a temporary and transportable battery of spearpoints, that can be moved along as trenching progresses. As discussed in Section 10.3.2, this is not likely to have any adverse impact on the local aquifers.

Impermeable trench blocks (otherwise known as trench or sack breakers) may be installed after lowering in and prior to backfilling to control water movement along the backfilled trench line. These are commonly installed adjacent to watercourses, on steep slopes and where drainage patterns change.

Trench spoil is then returned to the trench and material compacted to eliminate the likelihood of soil subsidence over the pipe.

vii Hydrostatic testing

Hydrostatic testing would be used to assess the pipeline's integrity in accordance with the relevant Australian standard (currently AS 2885.2). Prior to testing, the pipe test section would be capped with test manifolds. The pipe string would then be cleaned (ie flushed with water), gauged, filled with water and subject to a strength test as per the relevant Australian standard. The pipe would then undergo a leak test for a period of between 24 and 72 hours. The pipeline would have a maximum allowable operating pressure of between 10.2 and 15.3 MPa during its operation.

The pipeline may be tested in multiple sections, determined based on water availability and the pipeline elevation profile. The pipeline may be hydrotested in separate test sections if the elevation profile is significant and the static water head pressure is higher than the maximum allowable test pressure. The total volume of water for a single test section would depend on the size of the pipe, though would generally 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.

A hydrostatic test plan would form part of the pipeline's Construction Environmental Management Plan (CEMP).

viii Clean-up and rehabilitation

The final major stages of the pipeline's construction would be clean-up and rehabilitation along the ROW and associated work areas. The clean-up would involve removing materials such as pipe off-cuts, pipe caps and timber skids. The ROW and work areas would be re-contoured to match the surrounding land and erosion controls constructed where necessary. Any excess soil would be removed from the ROW, unless otherwise requested by the landowner.

Separately stockpiled topsoil and any cleared vegetation would then be respread evenly across the disturbed area to assist in soil retention. Rehabilitation would include broadcast of seedstock and/or planting seedlings, or establishing crop cover in accordance with landowner requirements. Stream beds and banks would be restored as close as possible to their original condition and provided with scour protection as required. Rehabilitation of the pipeline corridor and watercourse crossings will be undertaken in accordance with measures in the Watercourse Crossing Management Strategy, required by Condition 7.3(b) of the Project approval.

Fences would be reinstated where required and permanent gates installed in consultation with landowners to allow access along the pipeline.

ix Pre-commissioning

Pipeline pre-commissioning activities would include calibrating instrumentation and checking looping to ensure it is correctly installed. Equipment would be inspected to ensure it has been installed in accordance with the design. Hydrotest and non-destructive testing records would be checked to ensure all equipment has been tested in accordance with the applicable standards. The pipeline cathodic protection system would be commissioned to ensure pipeline potential is in accordance with the design. The pipeline would then be ready for commissioning with natural gas.

x Commissioning

Pipeline commissioning involves purging and pressurisation. Process calculations would be performed to calculate the purge pressure to ensure an explosive mixture of natural gas and air cannot be created when the pipeline is being filled. The purge process would involve injecting gas into the pipeline at a predetermined pressure and flow rate. When the appropriate level of gas is detected at the TRS the purge would be stopped and the pipeline pressurised. A slug of inert gas, usually nitrogen is often injected ahead of the natural gas to prevent explosive mixtures. It is envisaged that venting would occur at the MLV at the Seaham section (refer Section 2.3.4(v)).

2.3.3 Construction techniques for infrastructure and waterway crossings

i Overview

As for the approved pipeline, the modified pipeline corridor crosses waterways, drainage lines, roads and other infrastructure. Watercourse crossings are proposed within the Seaham, Millers Forest and Tomago sections, at the locations identified in Chapters 6 and 10. The only road crossings for the realigned sections are Raymond Terrace and Woodberry Roads (proposed to be by thrust bore or HDD), Turners Road (proposed to be by open trench) and the Pacific Highway (proposed to be HDD), all of which were approved to be crossed for the original pipeline route. Some private access tracks would be crossed by open trenching.

A description of the various methods to be used for infrastructure and watercourse crossings is provided in the following sections. The method to be selected for each location will depend on the sensitivity of the area and the relevant Australian standards and guidelines.

ii Infrastructure crossing

Infrastructure crossings would be managed through standard pipeline construction procedures in accordance with Australian standards. Prior to constructing the pipeline, underground services would be identified initially via 'dial before you dig' and then accurately located in the field by an authorised service locator. During construction, the service would typically be crossed by careful excavation around the utility and the pipe placed at a suitable depth to satisfy the required separation distance. A utility owner representative may be present to oversee the construction activity.

iii Open trench watercourse crossing (no flow diversion)

Open trenching would be applied in dry or shallow low flow watercourses, but may also be used in sensitive streams where rapid construction is considered the best means of minimising environmental impacts. This method involves standard trenching techniques using an excavator or backhoe, ensuring the watercourse bed and bank material and trench spoil are stockpiled separately, clear of the channel. A prefabricated pipe would subsequently be placed across the watercourse, lowered and the trench immediately backfilled. The prefabricated pipe will have been welded and appropriate coating protection applied prior to its installation in the trench.

Design measures such as concrete casing or bolt-on weights would be used at watercourse crossing locations and areas of significant inundation to weigh the pipeline down in the trench and reduce its buoyancy and to protect the pipe. Tie-in points (where the section of pipe used for the watercourse crossing is connected to the adjacent section of pipe) would be set back from the watercourse and the top of its banks (Figure 2.5).

iv Open trench watercourse crossing (with stream flow diversion)

Stream flow diversion techniques will be used as a modification to the standard open trenching for locations where higher water volumes and flows are present (typically for flows up to 1,000 litres per second). This technique involves in-stream trenching and pipe laying within a temporarily dewatered section of the watercourse. One of several methods could be used to form the temporary dams, for example sheet piling, sandbags or AquaDams. Stream flows would be maintained by pumping the water around the dewatered section or by the installation of a bypass flume. Dewatering may be required at the crossing area, for example via strategically located sumps. Prefabricated pipes would be installed in the same way described above and the trench backfilled with appropriate coating protection if required, followed by controlled removal of the downstream dam and subsequently the upstream dam.

v Open trench road crossing

Open trench road crossings would be used for minor/intermediate roads and tracks, such as farm tracks, and would involve standard trenching methods. Where required, one lane would be constructed and reinstated at a time in order to allow traffic to bypass and minimise delays. Traffic control would be used where required for the duration of the road crossing, however, the works associated with open trench road crossings would be completed as quickly as possible in order to minimise inconvenience to road users. In accordance with Condition 3.43 of the Project approval, AGL:

> shall ensure that any disturbance to public roads associated with the pipeline crossing or any road upgrades to accommodate the construction or operational traffic associated with the project is designed and constructed in consultation with and to meet the reasonable requirements of the relevant road authority (relevant Council or the RTA), to the satisfaction of the Director-General.

vi Thrust boring

Thrust boring may be used to install pipelines beneath infrastructure such as roads, railways and buried utilities, and for some watercourse crossings. Thrust boring involves drilling from below ground within trench areas, known as bell holes, on either side of the area to be bored, as shown in the schematic diagram in Figure 2.6 and in Figure 2.7, Photograph 6. The bell hole in which the thrust bore rig operates is typically 30 m long and 4 to 5 m wide. The receiving bell hole is typically 4 to 5 m long and 3 m wide.

vii Horizontal directional drilling (HDD)

HDD may be used to cross major watercourses or at sites where open cut methods are not suitable. This will include the Hunter River and Pacific Highway crossing in the Tomago section. This method involves drilling a hole at a shallow angle beneath the surface, then pulling the welded pipe string back through the drill hole as shown in Figure 2.6 and Figure 2.7, Photograph 8. Drilling mud (normally bentonite) would be used as the fluid for hydraulic drilling, as a coolant during drilling, to return the drill cuttings to the surface, and to seal and line the drilled hole to facilitate insertion of the pipe. The returning bentonite, carrying the drill cuttings, would be screened at the entry side and recycled into the system.

A cuttings settlement pit and a mud pit may be required to be excavated at the bore entry and exit points. Once the pipe string is installed and connected to the pipeline on either side, the entry and exit points would be remediated. The excess material (ie bentonite and drill cuttings) would be dewatered and buried on-site, where appropriate. Management measures for the drill cuttings would be incorporated into the CEMP. Drill cuttings containing ASS would be handled or disposed of in accordance with the Acid Sulfate Soils Management Plan (ASSMP). The dewatered drill fluid and natural water-based additives would be disposed of at an appropriately licensed waste disposal facility.

HDD requires a specialist drill rig, equipment and operator which may vary in size depending on the length of the HDD and the site geology. Smaller HDD rigs may be self-contained (eg on the back of a semi-trailer) while larger HDD rigs, such as that required for the Hunter River and Pacific Highway crossing, may require a designated pad.

As shown on Figure 1.6, a corridor wider than 100 m has been considered in this EA for the HDD crossing of the Pacific Highway and Hunter River. This is to accommodate the HDD which may need to be curved either north or south to overcome various constraints and achieve the required pipeline entry and exit angles and locations. The constraints include the following:

- land access, being the need to avoid the property south-west of the proposed HDD exit point;
- utilities, including avoidance of Ausgrid and TransGrid utilities;

- ecological, specifically to ensure the HDD exit pit avoids mangroves and SEPP 14 wetlands near the river bank and an EEC at around KP 92;
- geotechnical, including the river depth and profile which influence the required pipe depth and in turn the HDD entry and exit points. The pipe material has a maximum allowable bend angle. The HDD length is therefore governed by pipeline depth. Curving the HDD route to the north or south can help to optimise the length and depth profile of the HDD; and
- other considerations such as latent conditions, groundwater level and soil stability.

The final alignment of the HDD will be determined during its detailed design, following detailed geotechnical investigations. The wider corridor shown on Figure 1.6 provides flexibility to ensure the design can be achieved. It is mostly for an area that will be under-bored, with no surface disturbance. It also incorporates cleared land adjacent to the EEC at around KP 92 which will allow the pit and disturbance footprint at the HDD exit pit to be established without directly impacting this adjacent EEC.

2.3.4 Ancillary activities

i Road upgrades and access tracks

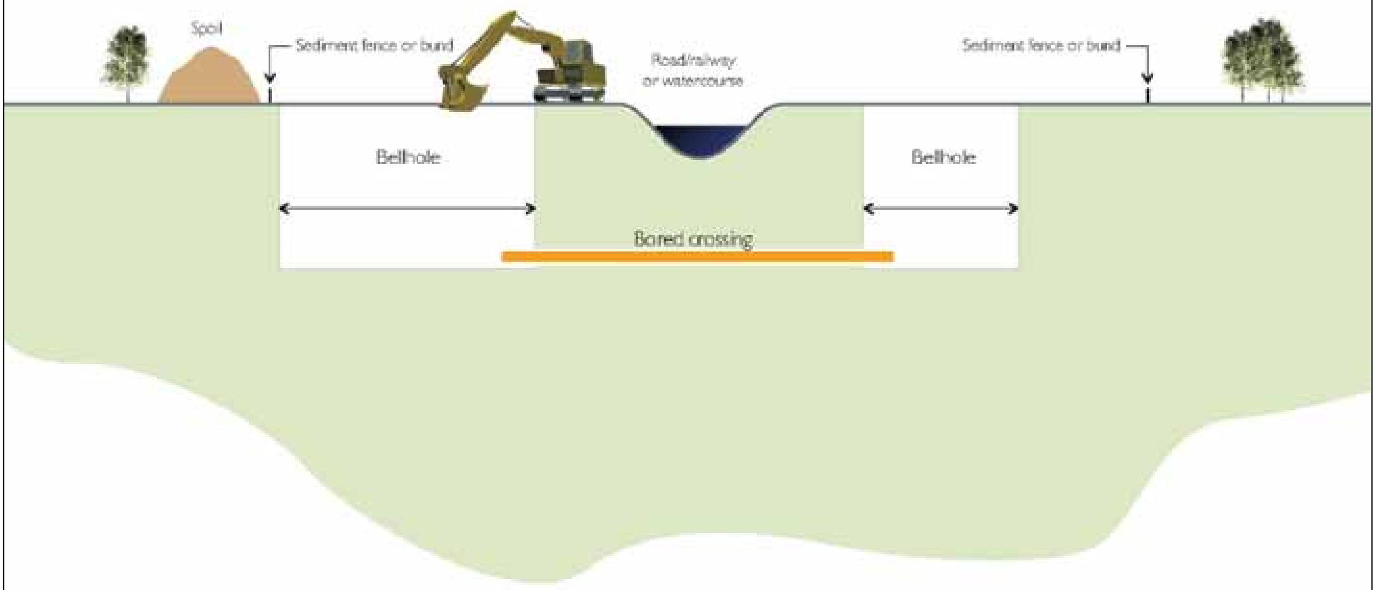
Some existing roads and tracks along the pipeline corridor would need to be upgraded for construction vehicles and plant to safely access the ROW. In areas where there are no existing roads or tracks, access tracks typically around 4 m wide may need to be constructed. Some of these tracks may be retained for pipeline maintenance purposes, while others would be remediated after construction in accordance with the CEMP. Access tracks on private land would be sited to minimise environmental impacts and be subject to consultation with the relevant landowners.

ii Temporary laydown areas

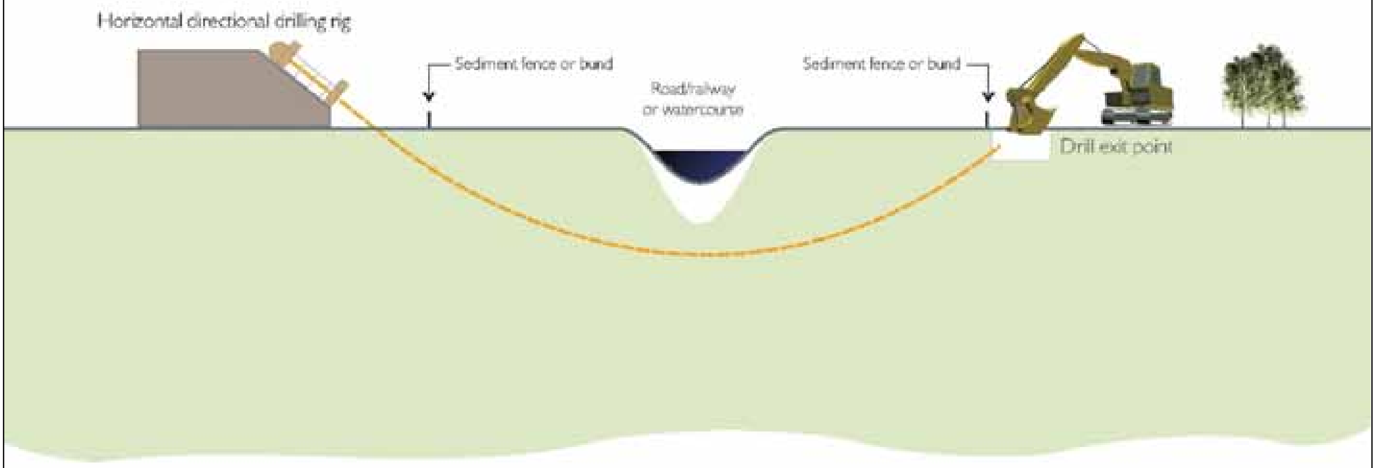
The AECOM (2009a) EA identified that temporary work areas would likely be required at HDD sites and for pipe storage. It was anticipated that three pipe laydown areas would be required along the length of the pipeline corridor, at the start, end and approximately halfway along the corridor. It is confirmed that work/laydown areas will be established within the Tomago section, on cleared land near the HDD entry and exit points (Figure 1.6). The proposed laydown area near the entry point is readily accessible from the Pacific Highway. Gravel access tracks may need to be established for the temporary laydown and pipe stringing area near the exit point (Figure 1.6). Whilst unlikely given the relatively flat landscape in this area, minor localised grading may also be required (as described in Section 2.3.1). No native vegetation will be removed for preparation of the temporary laydown area. As documented in the AECOM (2009a) EA, siting of laydown areas would take into account the following:

- use of existing cleared areas where possible;
- proximity to existing access tracks with reasonable accessibility to the regional road network;
- appropriate distance from watercourses; and
- maximise distance to potentially sensitive receptors, to minimise noise and amenity impacts.

Upon completion of construction activities, the temporary laydown areas will be rehabilitated in accordance with the CEMP.



SCHEMATIC PROFILE OF BORED CROSSING



SCHEMATIC PROFILE OF HORIZONTAL DIRECTIONAL DRILLING

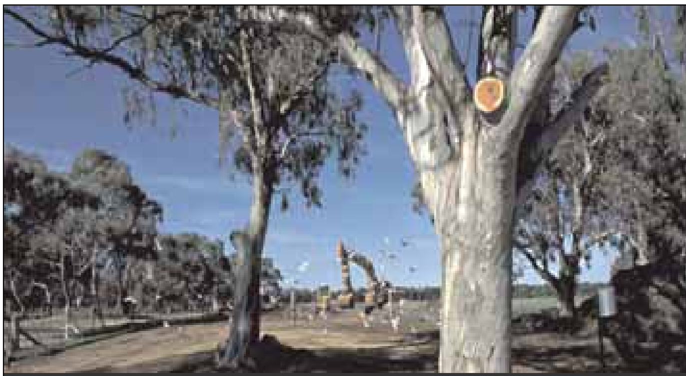
Source: AECOM, 2009

EMM

Thrust boring and HDD - schematic dragrams

Minor pipeline corridor realignments EA

Figure 2.6



Photograph 1
Reduced ROW, minimising clearing of remnant vegetation

Photograph 2
Trenching

Photograph 3
Padding of pipe trench prior to lowering of pipe

Photograph 4
Lowering of pipe

Photograph 5
Pipeline padding and trench backfilling. Lowering in of pipe in background

Photograph 6
Thrust boring

Photograph 7
Completed HDD operation with pipe having been pulled under river.
(Note no damage to riparian vegetation in background)

Photograph 8
Reinstatement of ROW including pipeline marker

EMM

Photos of typical pipeline construction process

Minor pipeline corridor realignments EA

Figure 2.7

iii Marker signs

Pipeline information marker signs would be installed along the route to ensure the pipeline can be properly located and identified, in accordance with the relevant Australian standard (currently AS 2885.1). Marker signs would be placed at regular intervals so that from any given location a marker sign can be clearly seen in both directions (Figure 2.7, Photograph 8). Signs would be placed closer together on either side of road crossings and at bends, fences and watercourse crossings.

iv Static earth systems

Any above ground pipework, such as the MLV, will be earthed to local earthing grids. The pipeline will be electrically isolated from the above ground earthing systems using monolithic insulation joints. Cathodic protection equipment would be connected to the pipeline. Cathodic protection test points would be fitted with equipotential earthing grids to ensure touch potentials remain within safe limits. Sections of pipeline subject to higher risk from earth potential rise would be isolated using insulation joints. Any maintenance on these sections would require equipotential earthing mats and appropriate personal protective equipment (PPE). The risk of earth potential rise along the pipeline would be determined based on calculations using specialised software for calculating touch potential and induced current in pipelines. Further mitigation and management measures are described in the AECOM (2009a) EA and will be applied along the pipeline where relevant.

v Main line valve

The AECOM (2009a) EA identified that an MLV would be required approximately halfway along the pipeline, to act as an isolation point in the event of an emergency. It has since been confirmed that the current preferred location is on AGL-owned land within the Seaham section, within the general area indicated on Figure 1.3. The exact location and design will however be confirmed during its detailed design. The MLV is the same as described in the AECOM (2009a) EA for the approved project. It will constructed within the ROW, as part of the pipeline's construction program, and using the same construction hours and equipment as for the rest of pipeline.

Construction of the MLV facility will involve installation of the MLV at the gas transmission pipeline, underground piping (vent line) running from the MLV to a remote vent, electricity supply (either by connection to the grid or solar panels), communications systems (either by cable connection or satellite communications dish), a control equipment cabinet, security fencing and a 5 m wide gravel access track that connects to the local road network. The MLV facility will be within a fenced compound that is above the 1 in 100 year flood level. The MLV facility is subject to detailed design however the compound is expected to be approximately 27 m long by 21 m wide, plus batters if the ground needs to be built up. A conceptual schematic diagram of the MLV facility is included on Figure 1.3.

Detailed design and siting of the MLV will be subject to a hazard and risk assessment as part of the Final Hazard Analysis required under Condition 3.47 of the Project approval, and take into account minimum set back distances required from the overhead transmission lines and trees.

2.3.5 Construction plant and equipment

Anticipated construction plant and equipment requirements include:

- bulldozers;
- grading machines;

- trenching machines;
- rock saw;
- semi trailers (for pipe and materials movements);
- excavators for trenching and lifting;
- tip trucks;
- mobile padding machines for backfill processing;
- water trucks for dust control;
- mobile welding units on trucks for pipeline welding;
- lowering in machines or sidebooms;
- thrust boring machine; and
- HDD rig.

The pipeline equipment would access the worksites from suitable access points within the surrounding road network and would then largely work along the ROW. However certain machinery may need to be moved short distances on the surrounding road network to access new work fronts.

2.3.6 Construction staging and hours

Construction of the entire pipeline, including the realigned sections subject of this modification, is expected to take approximately 12 months. However this would be weather-dependant and may need to be extended if inclement weather is experienced.

Pipeline construction would be staged, and spread along the length of the pipeline corridor. This approach would be taken in approximately 20 km segments with each 20 km segment of pipeline taking some 8 to 12 weeks to complete, depending on terrain and subsurface conditions. The construction activities described in the preceding sections would be undertaken in sequence from site preparation and trench excavation, to pipe stringing and installation, through to backfilling, clean up and rehabilitation. Each activity in the construction process would be undertaken for the full length of the pipeline working segment, with the next consecutive activity commencing immediately after the previous activity has been completed in the respective working section.

Pipeline construction would typically be undertaken on a 37 day cycle with crews working 28 days on followed by nine days off. In accordance with the Project approval conditions, construction works that would be audible at any sensitive receptor would typically take place between 7.00 am and 6.00 pm Monday to Saturday and 8.00 am and 6.00 pm on Sundays and public holidays. Construction works that are inaudible at the nearest sensitive receptor may extend outside of these hours. Some activities such as HDD may need to extend outside of these hours in certain situations; once commenced, HDD needs to continue without interruption for safety and geotechnical reasons. In accordance with Condition 3.16 of the Project approval, AGL will provide details to the Director-General regarding construction activities proposed to be outside of these hours and seek the Director-General’s written approval for these.

2.3.7 Construction workforce

Construction of the entire pipeline, inclusive of the realigned sections subject of this modification, is expected to involve a peak construction workforce of approximately 300 people.

2.4 Pipeline operation – description of approved activities

2.4.1 General

As described in the AECOM (2009a) EA, the pipeline will be operated in accordance with approval documentation, an Operation Environmental Management Plan (OEMP) inclusive of an Emergency Response Plan, the relevant Australian standard (currently AS 2885) and the APIA (2005) *Code of Environmental Practice – Onshore Pipelines*. The pipeline would also be constructed and operated according to the Pipeline Protection Safety Measures.

The pipeline would be managed by a pipeline operator(s) who would be responsible for patrolling the pipeline and landowner liaison. The operator(s) would also issue permits for any future construction work inside the pipeline easement. This would include locating the pipeline and witnessing excavation work to ensure it is not damaged. Activities associated with the pipeline operation would generally be undertaken by operations staff and specialist service companies.

2.4.2 Patrolling and inspections

Patrolling and inspections of the pipeline would be undertaken to monitor and audit environmental conditions and for maintenance activities. This would necessitate access to private property. Patrolling and inspections would be in accordance with the relevant Australian standard (currently AS 2885). Pipeline patrols will be undertaken at a frequency that enables AGL to be assured that external interference threats are identified and managed. The patrol method and frequency will be appropriate to the pipeline environment and location class and to the assessed likelihood of external interference. The boundaries and responsibilities for patrolling will be defined in the pipeline management system. The patrols would include inspections to assess for damage or activities which have the potential to cause damage to the pipeline. Patrols would also facilitate detection of variations to surface conditions such as ground movement or erosion. The frequency of patrols and inspections would depend on whether a particular issue required monitoring and may range from weekly to monthly. Patrols would be more frequent in more densely populated areas, such as close to towns.

2.4.3 Line of sight clearance

Some vegetation clearing may be undertaken along the ROW to ensure line of sight is maintained in the vicinity of pipe markers, for example where tall shrubs or trees regenerate. Trees retained on the easement during construction would not be removed. However, in accordance with the relevant Australian standard, it may be necessary to remove trees that regenerate in close proximity to the pipeline which may pose a threat to pipeline integrity or impede free passage along the pipeline route.

2.4.4 Weed control

Weed control would be undertaken along the pipeline ROW, particularly within the first 12 months after construction. For example this may include localised spraying of weeds.

2.4.5 Cathodic protection and coating integrity surveys

Annual surveys would be undertaken to measure the cathodic protection point output at each of the above-ground posts and to assess the integrity of the coating conductivity, to determine if there are any defects in the pipe's external protective coating. Excavation and repair of the external coating would be required to any parts of the pipeline where defects are detected that cannot be protected by the cathodic protection system.

2.4.6 Supervisory control and data acquisition system (SCADA)

A SCADA system would be used to continually monitor pipeline operating conditions such as pressure, temperature, gas flows, valve status, cathodic protection and gas quality. Such information would be relayed via a radio signal to the control room. The SCADA system would allow the pipeline operator to remotely control the pipeline operating system, for example the operating pressure and gas flow rates, and to open and close valves.

2.4.7 Pigging

The pipeline's integrity would be periodically assessed through the use of a pipeline inspection gauge (pig), referred to as an 'intelligent pig', in a process known as 'pigging'. The pigging process can be undertaken while the pipeline is operating and involves inserting the intelligent pig into the pipeline via a 'pig launcher' at one end of the pipeline. The intelligent pig collects data which is then interpreted to provide information on aspects such as the pipe thickness and location and size of defects. It may be fitted with a camera to allow internal inspection of the pipe. The pig is removed at the other end of the pipeline.

2.4.8 Main line valve

The MLV in the Seaham section would act as an isolation point for the pipeline in the event of an emergency. Normally natural gas would flow though the MLV (no bypass) however, in the event of an emergency necessitating depressurising of the pipeline, natural gas could be vented via the pipe (vent line) that runs from the MLV to the remote vent (Figure 1.3). The MLV may be either automated (remote) or manually (local) operated, to be confirmed during its detailed design.

2.5 Tomago Receiving Station

The gas transmission pipeline will connect to the NGSF. End of line facilities will be established at the connection point, within a compound referred to as the TRS. They will be similar to those assessed and approved for the HDS. The proposed TRS is in place of the HDS, which is no longer proposed. A conceptual layout for the TRS is shown on Figure 2.8, though will be refined during its detailed design. The TRS will include the following:

- inlet shutdown valve for remote pipeline isolation and over pressure shutdown;
- dual redundant inlet dry gas filtration with isolation for removing dust and other contaminants in the pipeline;
- dual redundant water bath heaters to preheat the gas to ensure it retains a margin above the water dew point;

- dual redundant flow control valves with overriding pressure control to control gas flow into the downstream pipeline;
- dual redundant ultrasonic meters to provide custody transfer accuracy metering;
- dual redundant gas chromatographs and dew point analysers to perform gas quality measurement and to provide gas heating values for energy flow calculations; and
- odourant facility where odourant is added to the natural gas. This facility will include odourant storage vessels, from where it will be injected into the natural gas stream via an approximately 100 mm diameter line. Two options are being considered for the odourant facility's location, only one of which will be adopted:
    - Option 1 - within the TRS, adjacent to the NGSF compound; or
    - Option 2 - within the NGSF compound.

  The odourant facility location will be confirmed during its detailed design. This EA has considered both options.

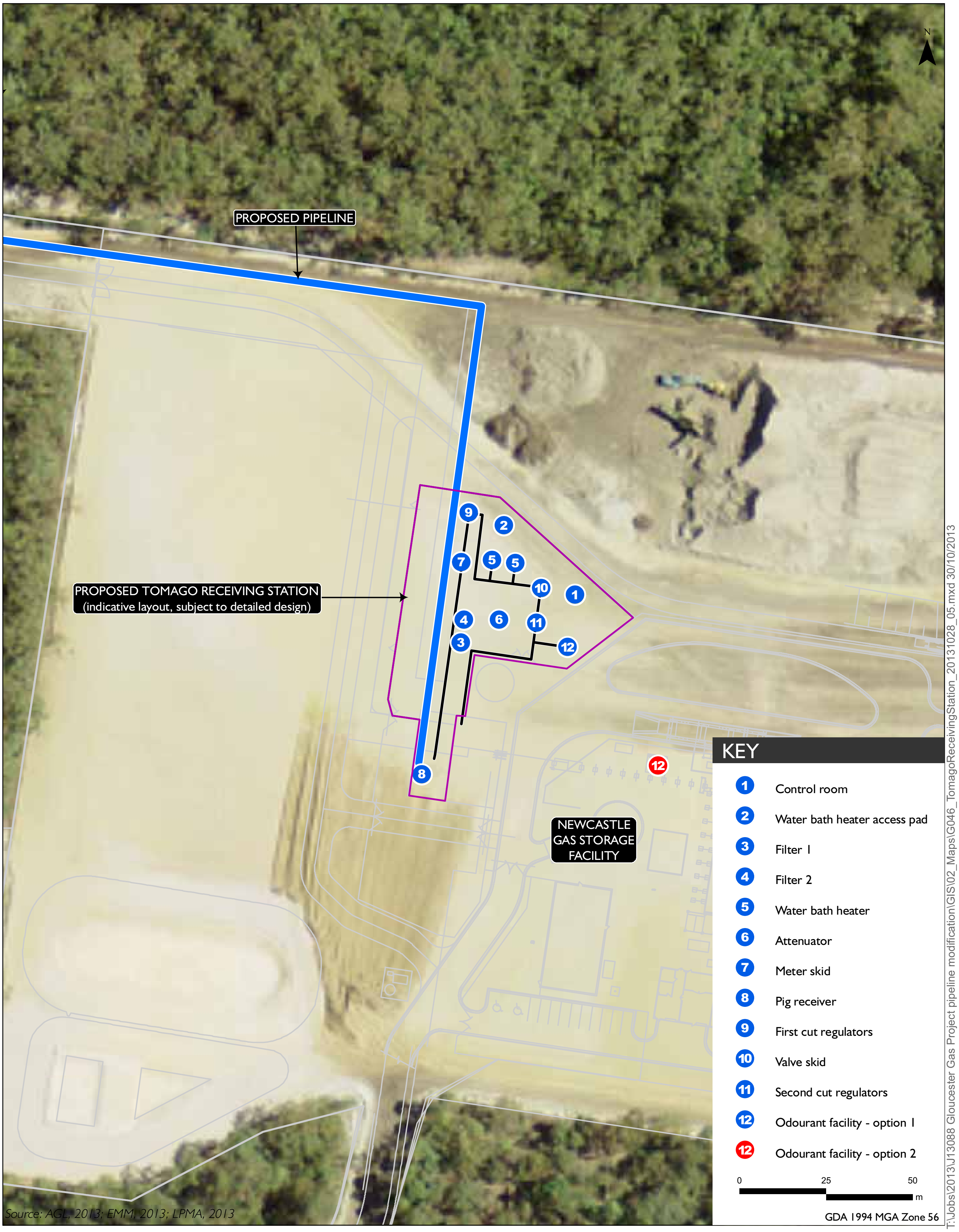
Machinery and equipment required for construction of the TRS will include:

- concrete delivery;
- light crane;
- site preparation vehicles including bobcat, grader, dozer, piling truck, roller and water and dump trucks;
- equipment transport and delivery including of the control room, water bath heater access pad, filters, water bath heaters, attenuator, pig receiver, regulators, valve and meter skids and odourant facility;
- pipework skids; and
- pipe/valve trucks.

These items would be delivered to site via public roads and existing access tracks.

All GGP components proposed within and adjacent to the NGSF, including the TRS and the option for an odourant facility within the NGSF compound are covered by this modification application. No modification to the NGSF Project approval is required to accommodate the GGP, inclusive of this proposed modification.

Once the gas transmission pipeline starts operating, the TRS will operate continuously.



EMM

Tomago Receiving Station - indicative layout

Minor pipeline corridor realignments EA

Figure 2.8

2.6 Pipeline decommissioning – description of approved activities

When the infrastructure is no longer required, the pipeline may be suspended or abandoned in accordance with requirements of the relevant Australian standard (currently AS 2885) and accepted industry practice at the time. At present, abandonment procedures require the removal of all above ground infrastructure and the restoration of associated disturbed areas. If use of the pipeline is suspended, it would be filled with an inert material and the cathodic protection system maintained to prevent corrosion. Opportunities for future use of the pipeline may be considered. If no longer required, the pipeline would be abandoned by being purged of gas and below ground facilities allowed to gradually degrade in-situ. All above ground facilities including signage would be removed.