Table 6.8 Crossings located in the Marulan Sector

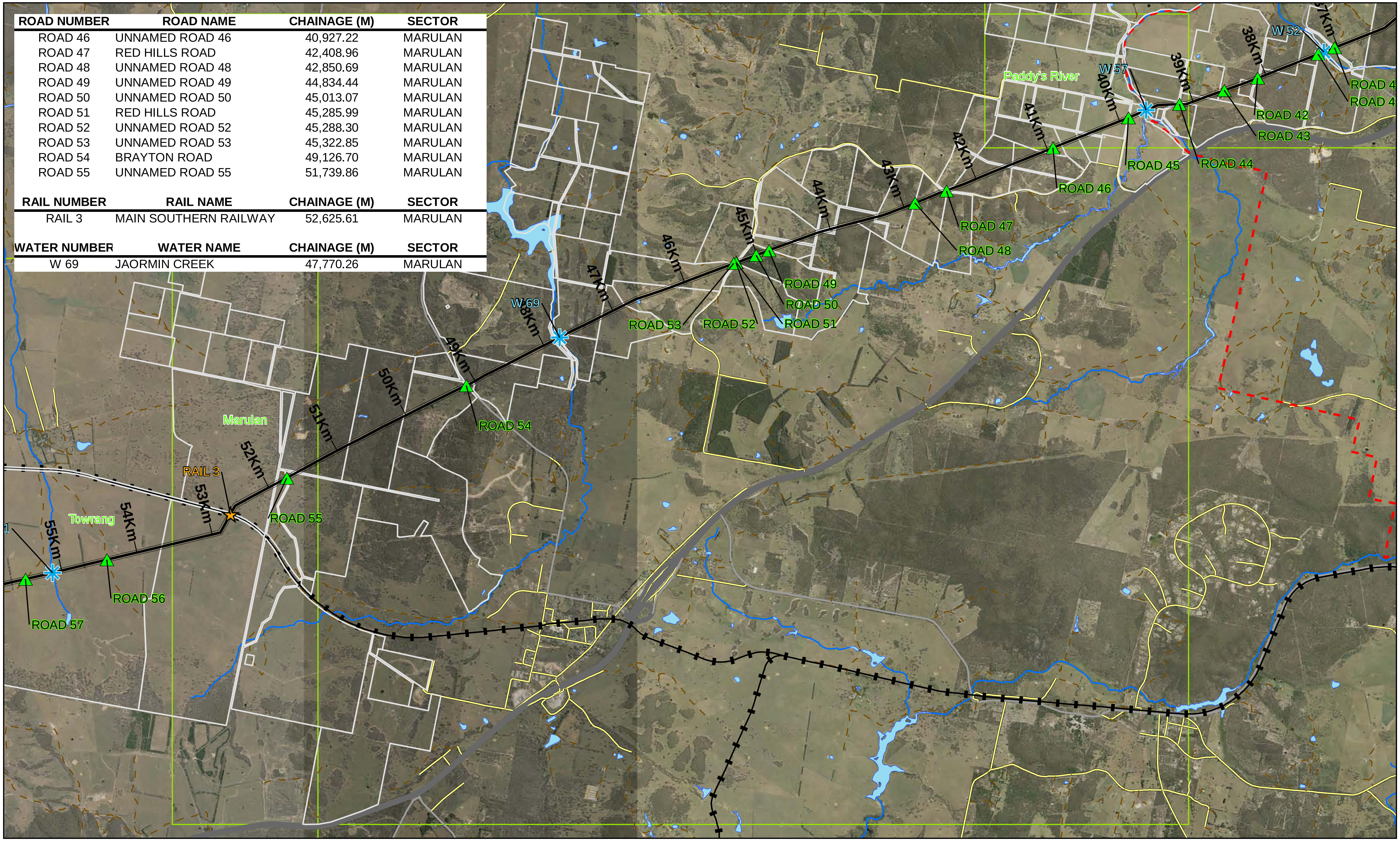
Site ID	Name	Chainage	Primary crossing method
Roads			
ROAD 46	Unnamed Road 46	40 927	Trenched
ROAD 47	Red Hills Road	42 409	Trenched
ROAD 48	Unnamed Road 48	42 851	Trenched
ROAD 49	Unnamed Road 49	44 834	Trenched
ROAD 50	Unnamed Road 50	45 013	Trenched
ROAD 51	Red Hills Road	45 286	Trenched
ROAD 52	Unnamed Road 52	45 288	Trenched
ROAD 53	Unnamed Road 53	45 323	Trenched
ROAD 54	Brayton Road	49 127	Trenched
ROAD 55	Unnamed Road 55	51 740	Trenched
Railway			
RAIL 3	Main Southern Railway	52 626	Thrust boring
Waterways			
W69	Jaorimin Creek	47 810	Horizontal directional drilling

Figure 6.18 Main Southern Railway crossing point No. 2

ROAD NUMBER	ROAD NAME	CHAINAGE (M)	SECTOR
ROAD 46	UNNAMED ROAD 46	40,927.22	MARULAN
ROAD 47	RED HILLS ROAD	42,408.96	MARULAN
ROAD 48	UNNAMED ROAD 48	42,850.69	MARULAN
ROAD 49	UNNAMED ROAD 49	44,834.44	MARULAN
ROAD 50	UNNAMED ROAD 50	45,013.07	MARULAN
ROAD 51	RED HILLS ROAD	45,285.99	MARULAN
ROAD 52	UNNAMED ROAD 52	45,288.30	MARULAN
ROAD 53	UNNAMED ROAD 53	45,322.85	MARULAN
ROAD 54	BRAYTON ROAD	49,126.70	MARULAN
ROAD 55	UNNAMED ROAD 55	51,739.86	MARULAN

RAIL NUMBER	RAIL NAME	CHAINAGE (M)	SECTOR
RAIL 3	MAIN SOUTHERN RAILWAY	52,625.61	MARULAN

WATER NUMBER	WATER NAME	CHAINAGE (M)	SECTOR
W 69	JAORMIN CREEK	47,770.26	MARULAN



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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LEGEND

Proposed Route (29/11/2009)
Properties Intersected By Corridor
Pipeline Water Intersection
Pipeline Road Intersections
Pipeline Railway Intersection
River/Creek
Railways
PrimaryRoad
ArterialRoad
SubArterialRoad
LocalRoad
Track-Vehicular
UrbanServiceLane
GMC / WSC LGA Boundary
Sector boundary
HydroArea

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Goulburn Mulwaree Council
Highlands Source Project

Road, Rail and Water Intersections Along Pipeline
Sector: Marulan

Job Number	23-13312
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Figure 6.19

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Level 7, 16 Marcus Clarke Street Canberra ACT 2601 T 61 2 6113 3200 F 61 2 6113 3299 E cbrmail@ghd.com.au W www.ghd.com.au

Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Table 6.9 Crossings located in the Towrang sector

Site ID	Name	Chainage	Primary crossing method
Roads			
ROAD 56	Unnamed Road 56	54 400	Trenched
ROAD 57	Unnamed Road 57	55 482	Trenched
ROAD 58	Unnamed Road 58	55 993	Trenched
ROAD 59	Carrick Road	61 413	Trenched
ROAD 60	Unnamed Road 60	63 584	Trenched
ROAD 61	Unnamed Road 61	63 638	Trenched
ROAD 62	Towrang Road	64 573	Trenched
ROAD 63	Unnamed Road 63	65 686	Trenched
ROAD 64	Murrays Flat Road	68 097	Trenched
Railway			
RAIL 4	Main Southern Railway	68 034	Thrust boring
Waterways			
W81	Lockyersleigh Creek	55 124	Trenched
W84	Narambulla Creek	57 202	Horizontal directional drilling
W95	Osborns Creek	60 589	Trenched
W105	Wollondilly River	64 073	Horizontal directional drilling
W106	Wollondilly River	65 269	Horizontal directional drilling
W108	Boxers Creek	65 893	Trenched

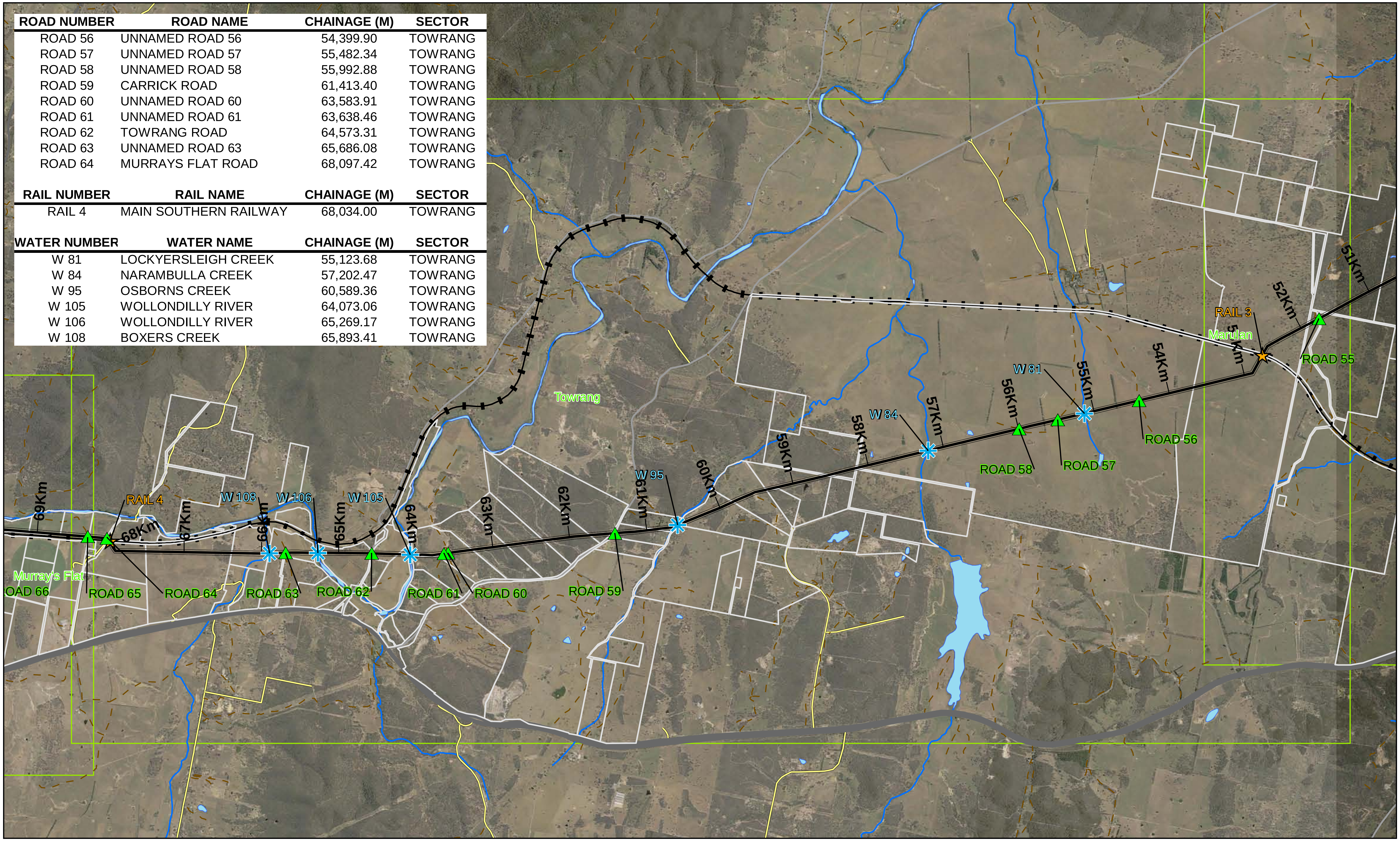
Figure 6.20 Main Southern Railway crossing point No. 3

Figure 6.21 Wollondilly Crossing point No. 1 (W105)

ROAD NUMBER	ROAD NAME	CHAINAGE (M)	SECTOR
ROAD 56	UNNAMED ROAD 56	54,399.90	TOWRANG
ROAD 57	UNNAMED ROAD 57	55,482.34	TOWRANG
ROAD 58	UNNAMED ROAD 58	55,992.88	TOWRANG
ROAD 59	CARRICK ROAD	61,413.40	TOWRANG
ROAD 60	UNNAMED ROAD 60	63,583.91	TOWRANG
ROAD 61	UNNAMED ROAD 61	63,638.46	TOWRANG
ROAD 62	TOWRANG ROAD	64,573.31	TOWRANG
ROAD 63	UNNAMED ROAD 63	65,686.08	TOWRANG
ROAD 64	MURRAYS FLAT ROAD	68,097.42	TOWRANG

RAIL NUMBER	RAIL NAME	CHAINAGE (M)	SECTOR
RAIL 4	MAIN SOUTHERN RAILWAY	68,034.00	TOWRANG

WATER NUMBER	WATER NAME	CHAINAGE (M)	SECTOR
W 81	LOCKYERSLEIGH CREEK	55,123.68	TOWRANG
W 84	NARAMBULLA CREEK	57,202.47	TOWRANG
W 95	OSBORNS CREEK	60,589.36	TOWRANG
W 105	WOLLONDILLY RIVER	64,073.06	TOWRANG
W 106	WOLLONDILLY RIVER	65,269.17	TOWRANG
W 108	BOXERS CREEK	65,893.41	TOWRANG



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Pipeline Water Intersection
- Pipeline Road Intersections
- Pipeline Railway Intersection
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

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Goulburn Mulwaree Council
Highlands Source Project

Road, Rail and Water Intersections Along Pipeline
Sector: Towrang

Job Number 23-13312
Revision 0
Date 09 FEB 2010

Figure 6.22

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Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

Table 6.10 Crossings located in the Murray Flat – Goulburn Sector

Site ID	Name	Chainage	Primary crossing method
Roads			
ROAD 65	Unnamed Road 65	68 345	Trenched
ROAD 66	Unnamed Road 66	69 607	Trenched
ROAD 67	Unnamed Road 67	70 414	Trenched
ROAD 68	Taralga Road	71 737	Trenched
ROAD 69	Unnamed Road 69	72 738	Trenched
ROAD 70	Middle Arm Road	74 016	Trenched
ROAD 71	Crookwell Road	76 715	Thrust boring
ROAD 72	Chinamans Lane	77 805	Trenched
ROAD 73	Clinton Street	80 461	Trenched
Railway			
RAIL 5	Goulburn Crookwell Railway	72 798	Thrust boring
Waterways			
W119	Wollondilly River	70 753	Horizontal directional drilling
W120	Kenmore Creek	70 928	Horizontal directional drilling
W122	Kenmore Creek	71 774	Trenched
W123	Kenmore Creek	71 928	Trenched
W124	Kenmore Creek	72 042	Trenched
W131	Wollondilly River	78 651	Horizontal directional drilling

Figure 6.23 Wollondilly River crossing point No. 3 (W119)

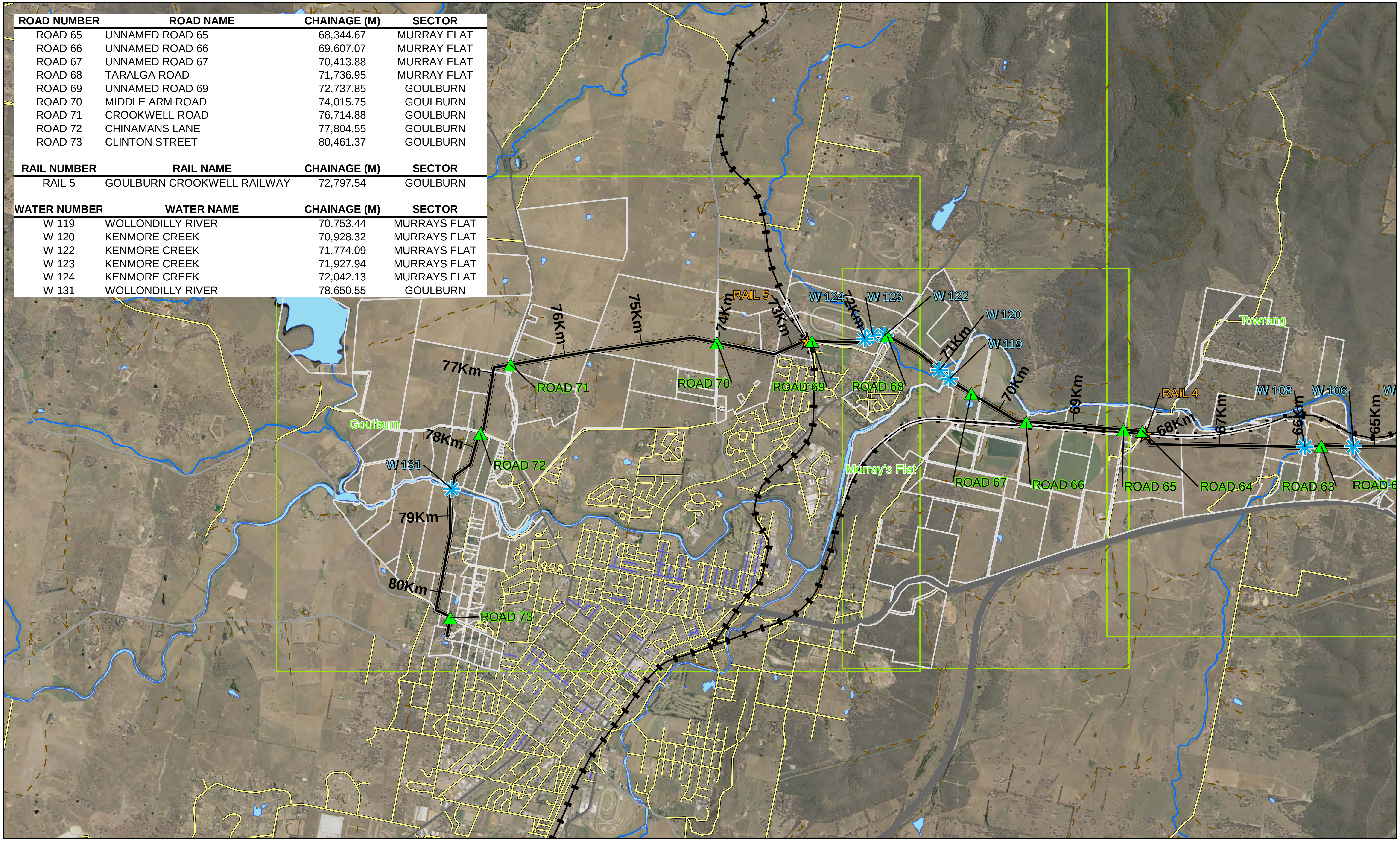
Figure 6.24 Crookwell Road crossing point

Figure 6.25 Wollondilly River crossing point No. 4 (W131)

ROAD NUMBER	ROAD NAME	CHAINAGE (M)	SECTOR
ROAD 65	UNNAMED ROAD 65	68,344.67	MURRAY FLAT
ROAD 66	UNNAMED ROAD 66	69,607.07	MURRAY FLAT
ROAD 67	UNNAMED ROAD 67	70,413.88	MURRAY FLAT
ROAD 68	TARALGA ROAD	71,736.95	MURRAY FLAT
ROAD 69	UNNAMED ROAD 69	72,737.85	GOULBURN
ROAD 70	MIDDLE ARM ROAD	74,015.75	GOULBURN
ROAD 71	CROOKWELL ROAD	76,714.88	GOULBURN
ROAD 72	CHINAMANS LANE	77,804.55	GOULBURN
ROAD 73	CLINTON STREET	80,461.37	GOULBURN

RAIL NUMBER	RAIL NAME	CHAINAGE (M)	SECTOR
RAIL 5	GOULBURN CROOKWELL RAILWAY	72,797.54	GOULBURN

WATER NUMBER	WATER NAME	CHAINAGE (M)	SECTOR
W 119	WOLLONDILLY RIVER	70,753.44	MURRAYS FLAT
W 120	KENMORE CREEK	70,928.32	MURRAYS FLAT
W 122	KENMORE CREEK	71,774.09	MURRAYS FLAT
W 123	KENMORE CREEK	71,927.94	MURRAYS FLAT
W 124	KENMORE CREEK	72,042.13	MURRAYS FLAT
W 131	WOLLONDILLY RIVER	78,650.55	GOULBURN



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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LEGEND

- Proposed Route (29/11/2009)
- Properties Intersected By Corridor
- Pipeline Water Intersection
- Pipeline Road Intersections
- Pipeline Railway Intersection
- River/Creek
- Railways
- PrimaryRoad
- ArterialRoad
- SubArterialRoad
- LocalRoad
- Track-Vehicular
- UrbanServiceLane
- GMC / WSC LGA Boundary
- Sector boundary
- HydroArea

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Highlands Source Project

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Road, Rail and Water
Intersections Along Pipeline
Sector: Goulburn-Murrays Flat

Figure 6.26

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Data Source: NSW Lands Dept: roadsegments, railways,hydroarea, hydroline - 2007; GMC: aerial imagery - 2008; GMC/WSC: Cadastral data - 2009. Created by: ccharalambou

6.5.4 Construction methods

A description of thrust boring and HDD is provided below. Trenching is described in Section 6.2.3.

Thrust boring

RTA controlled roads, and railway lines would be crossed using thrust boring methods to approximately 3 m to 4 m below ground surface. The majority of local roads would be crossed by open trenching.

Thrust boring is a technique for the bored installation of a casing pipe into the ground by driving a closed pipe with a cutter head from a thrust pit into the soil which is displaced. The installation process requires the establishment of a launch pit dimensioned to allow the installation and operation of the thrust boring machine and the required pipe length to be accommodated within it, or at least the length of pipe that it is practical to work with. As the casing pipe is generally manufactured from steel, the welding together of lengths to create the total pipe length required is not a problem. Depth limits are dependent on the size of excavation required to access the auger boring unit and the practical length of pipe that can be installed from what is generally quite a large dimension launch shaft/pit.

The thrust boring machine is set up on a set of tracks or rack and pinion system on the line and level required for the casing installation. The first casing pipe length is positioned at the head of the machine with its auger flight already installed. The cutter head is driven by, and is positioned at the lead end of, an auger string that has been established within the casing pipe. The thrust boring machine rotates the auger flight and thus the cutter head as it thrusts forwards along the track or rack and pinion arrangement. The cutter head excavates the ground and removes spoil to the launch pit for manual or mechanical removal. Spoil is removed by hand or mechanically and generally placed into skips or tipper trucks for removal as it exits the casing pipe. The excavation and thrust process is repeated in this way until the drive length required is completed with the arrival of the cutter head at a reception pit (Figure 6.27).

The drive is completed with the withdrawal of the auger flight chain from within the casing pipe and the casing being cleaned out of all remaining spoil leaving only, the now empty, casing pipe in the ground. The water pipeline would then be installed within the casing pipe on a precise line and level if necessary.

The thrust boring machine can be guided by cameras, lasers or other sensors during construction so that the alignment under roads and around infrastructure is maintained. There is no requirement for drilling fluid or slurry to undertake the work, thus it is a dry method of construction. The typical characteristics and requirements for thrust boring are presented in Table 6.11.

Table 6.11 Typical characteristics and requirements for thrust boring

Key features	Typical characteristics
Carriage drive	Track or Rack & Pinion
Drill pipe length	3 – 9 m
Drilling distance	< 610 m
Installed pipe diameter	Up to 400 mm
Water / drilling fluid requirements	None

Rig footprint area (width x length x depth)	2 x 6 x 1.5 m to 3 x 15 x 3 m
Recommended work area requirements	20 m x 30 m

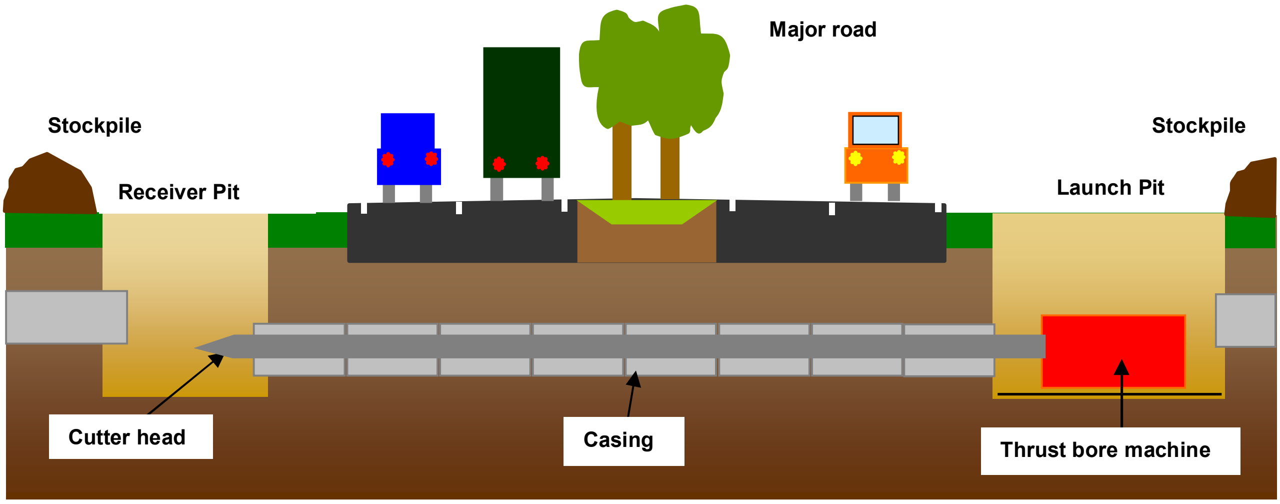

Figure 6.27 Schematic diagram of thrust boring

Horizontal directional drilling

The general process for HDD a crossing point is as follows:

- Excavation and identification of both entry and exit pits;
- Set up of controls and any auxiliary equipment;
- Set up of drilling rig;
- Set up of guidance system;
- Set up of the slurry lines and hydraulic hoses;
- Drill pilot hole through to the exit pit (Stage 1);
- Attach reamer, and commence the reaming process (Stage 2);
- When the bore is large enough, commence pipe pull back process (Stage 3);
- Pipe testing and inspection;
- Removal of the drill rig and other equipment;
- Disposal of any slurry or spoil;
- Grouting of the annular space between the exterior pipes surface with the internal surface of initial installed conduit;
- Lateral services connections (if applicable); and
- Begin the restoration process.

The common under boring tasks listed above are typically undertaken in three stages as follows:

1. **Stage 1 – Pilot Hole:** The drill rig is typically anchored onto the surface on the centreline of the bore path at a distance ranging from 1 m to 6 m away from the entry point and is capable of providing an angled entry of up to 20 degrees. A pilot hole is drilled horizontally using a fluid assisted head and continues under and across the obstacle along a predetermined design path. An electronic transmitter is placed in a housing which is directly behind the cutting head. The transmitter sends a signal to the surface which is read by the receiver, which then transmits the information back to the drill rig operator. The driller then, by using the relayed information, can steer the bore path in any desired direction.
2. **Stage 2 – Pre-ream:** Once the pilot hole is complete, the hole must be enlarged to a suitable diameter for the product pipeline. This is accomplished by "prereaming" the hole to successively larger diameters. Generally, the reamer is attached to the drill string on the opposite end of the borehole from the drill and pulled back into the pilot hole. Slurry is pumped into the hole to maintain the integrity of the hole and to flush out cuttings.
3. **Stage 3 – Pullback:** Once the drilled hole is enlarged, the conduit can be pulled through it. The pipeline is prefabricated at the end of the bore opposite the drill rig. A reamer is attached to the drill string, and then connected to the product by a pulling head and swivel. The swivel reacts to the rotational torques of the drill pipe and prevents the new pipe from any damage as it rotates. The drilling rig then begins the pullback operation, rotating and pulling on the drill string as well as circulating drilling fluids. The pullback continues until the reamer exits the bore path by the drill rig and the pipeline is in place.

Three general sizes of drill rigs are used for HDD. For pipes with diameters between 250 mm and 400 mm a medium size rig is typically used. The general characteristics of a medium size drill rig are listed in Table 6.12.

Table 6.12 Key features and typical characteristics of horizontal directional drilling

Key features	Typical characteristics
Carriage drive	Chain or Rack & Pinion
Drill pipe length	3 – 9 m
Drilling distance	< 610 m
Installed pipe diameter	Up to 400 mm
Power source	150 – 250 hp
Mud pump	190 – 760 L/min
Rig footprint area (width x length)	2 x 6 m to 2.5 x 13.5 m
Recommended work area requirements	30 m x 45 m

The drilling fluid used for HDD is a bentonite-based slurry that is modified by adding a mixture of polymer and water. The fluid acts to stabilise & lubricate the borehole, cool down the transmitter, carry spoil and debris away from the borehole, and assist in the cutting process. The HDD process relies on the drilling fluid as the main means of ensuring the borehole does not collapse. Critical fluid characteristics needing consideration are viscosity, gel strength, fluid loss & fluid density, sand content, pH, and filtration control & filter cake.

HDD projects require separate mixing systems, holding tanks, and mud recycling systems. The mixing system provides proper mixture containment for the drilling fluid, additives and the water. The holding tank is use as a water containment holding area and mixing drilling fluid and other requires washing during the Project. The fluid is mixed to meet requirements dictated by the geological conditions of the Works. Mud recycling systems are used to clean out debris during the cutting so the fluid may be recycled (*e.g.* vacuum truck).

HDD entry is mostly executed from the surface without the need for an entry pit. However, a relatively small containment of drill slurry is usually achieved in shallow entry and exit pits prior to removal or recycling. In addition, an exit pit shall be identified, or excavated, prior to any HDD implementation. HDD works commonly plan for the exit pit to be located and excavated at a tie in point to an existing system, or to utilise existing facilities such as an access chamber or connection valve. Any requirements to excavate small potholes (for accessing crossing utilities either for locating or load limiting reasons) should also be identified and considered.

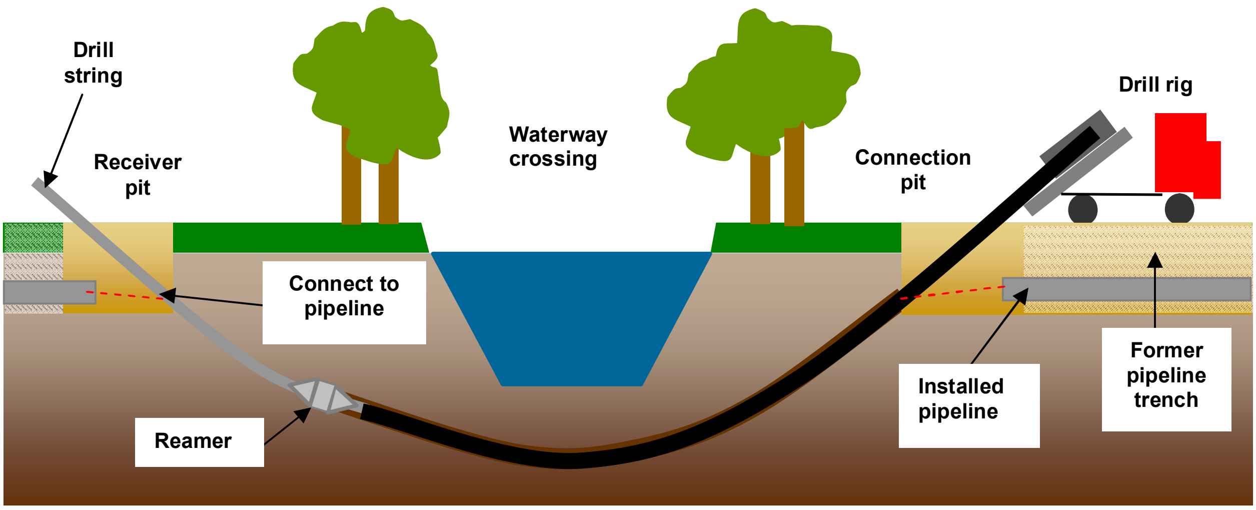

Figure 6.28 Schematic diagram of horizontal directional drilling

6.5.5 Ancillary infrastructure

Access roads/tracks

Access to the pipeline easement from existing roads would be required approximately every 3 km to 4 km along the route. Where possible, existing access roads and farm tracks would be used to access the easement and the proposed easement alignment would be the main thoroughfare through the properties. It is envisaged that access to some terrain would be a problem in some areas along the proposed alignment.

Fences and gates

At completion of construction and restoration of the pipeline construction impact area, property fences would be reinstated and gates installed along the pipeline easement between properties. This would allow for ease of access to the pipeline easement for ongoing maintenance and inspections.

6.6 General construction details

6.6.1 Construction hours

Typical hours of construction would be 7:00am until 6:00pm Monday to Friday and 8:00am until 1:00pm Saturday. Extended working hours would be required on week nights and weekends to ensure the Project is completed within the allocated funding timeframe, particularly for concrete pours and construction material delivery and some road crossings that would need to be completed out of daylight hours to reduce the potential impact to traffic. Thus construction could, where required on occasion, be completed at any time of the day or night. Appropriate measures to mitigate potential impacts to nearby landholders would be implemented in this case, such as identifying work zones away from residences and other sensitive receptors to avoid impacts from light and/or noise.

Some out-of-hours delivery of equipment may also be required. This could occur at any time of the day or night on weekdays and weekends. As such, delivery areas would be located away from residences to minimise disturbance. The need for extended working hours will be determined during the detailed design phase; however assessments of the potential impacts of night work have been included in this Environmental Assessment.

6.6.2 Construction sequencing

The following sequence of construction activities would generally occur for the construction of the pipeline, pump stations and ancillary equipment:

- Identification of access roads / tracks and maintenance where required;
- Identification, delineation and protection of environmentally sensitive areas, including tagging and fencing;
- Preparation of the pipeline construction easement, including right of way clearing of vegetation and removal of topsoil;
- Advanced trenching work including potentially pre-trenching and blasting in rocky areas if required;
- Delivery and stringing of pipes along proposed route;
- Excavation of an open trench along the pipeline route, with trench spoil mounded to one side;
- Thrust boring and horizontal directional drilling of major roads, significant waterways and rail lines;
- Installation of the pipe, including corrosive sleeve protection and jointing and the installation of scour valves, air valves and divide valves;
- Pipe coating repairs and joint reinstatement;
- Padding and backfilling of trench;
- Progressive hydrostatic testing of the pipeline;
- Reinstatement and rehabilitation of the construction easement;
- Installation of marker posts, signs and gates; and
- Commissioning and completion.

At completion of construction and restoration of the pipeline construction impact area, property fences would be reinstated and gates installed along the pipeline easement between properties. This would allow for ease of access to the pipeline easement for ongoing maintenance and inspections.

6.6.3 Construction workforce

There are expected to be four teams on site concurrently, with each team consisting of approximately 20 – 30 personnel. The teams are likely to be as follows:

Team 1 – Pumping station and external connections team constructing connections to existing Wingecarribee / Sydney Water infrastructure and to existing Goulburn Mulwaree infrastructure;

Team 2 – Pipeline construction (western end) constructing pipeline in generally open terrain with three creek crossings, one rail crossing and possibly two RTA road crossings which would involve special horizontal directional drilling work;

Team 3 – Pipeline construction (eastern end) constructing pipeline in generally open grazing country, working adjacent to power lines, with at least two bored crossings under the Hume Highway and the Illawarra Highway east of Moss Vale; and

Team 4 – Pipeline construction (central section) constructing pipeline in generally more undulating, rocky and stony terrain where some blasting may be required. The alignment is following the southern side of gas pipeline easement.

6.6.4 Construction equipment

An indicative list of construction equipment/plant that would be used during construction is provided in Table 6.13.

Table 6.13 Indicative construction plant / equipment

Task	Location	Equipment
Trenching and excavations	Pipeline	65T, 45T, 30T and 20T excavators Vermeer tracked trencher Loader Dump trucks and articulated dump trucks Prime mover and pipe trailer Dual cabs Water cart Fuel trailer Mobile cranes Tracked bobcats Backhoe Tipper
	Pump station	30T, 20T, 8T, 3T excavators

Task	Location	Equipment
	Booster pump station Outlet tanks / connections	Small plant Road trucks Articulated dump trucks
Site preparation	Construction corridor	Grader Dozer Dump trucks Loader
Rock hammer	Pipeline easement - various locations	30T excavator with hammer
Formwork	Construction corridor - various locations	Small tools Generators Trucks Utes
Building works	Pump station	20 – 80 T cranes Concrete boom pump Tool handler
Under boring	Major river crossings RTA roads Railways Some services	Drilling rigs (100 T, 300 T and 500 T) Water truck 45T, 30T and 20T excavators Utes Cranes Loader Dump truck Hand tools

6.6.5 Construction corridor access

Access to the pipeline easement would be gained via public road crossing points (i.e. points along the proposed pipeline easement that intersect with public roads). All plant, equipment and supplies would gain direct access to the proposed pipeline easement from these points (Section 6.5.3 lists all road crossing points). To enable the efficient movement of construction plant and equipment and the supply of materials, access to the proposed pipeline easement would be sought every (approximately) 4 km of easement length. Where the distance between consecutive public road crossing points is greater than 4 km, additional access routes may be required to access to the proposed pipeline easement. The additional access routes would be via private property utilising existing farm tracks or unnamed roads (see ‘unnamed roads’ in Section 6.5.3). No new access tracks are proposed to be constructed. It is not expected that clearing of vegetation would be required where additional access routes are utilised.

The need for using additional access routes would be determined during the detailed design phase and would be negotiated with the affected landholders.

An analysis of those sections of the proposed pipeline easement that may require additional access routes, due to the distance between the public road crossing points, is provided in Table 6.14. The data in Table 6.14 shows that there is likely to be three portions of the proposed pipeline route where additional access routes may be needed. These portions of the proposed pipeline easement are as follows:

- Old Argyle Road and Sallys Corner Road (road crossings R18-R19);
- Hume Highway to Inverary Road (road crossings R23-R40); and
- Brayton Road to Carrick Road (road crossings R54-R59).

Additional access route options are listed Table 6.14. Whether these access route options are utilised would be determined in consultation with the landholders.

6.6.6 Required services

Construction power

The pipeline route traverses through largely uninhabited rural land and as such most of the construction areas and work compounds will not be located near existing electrical power supply. It is proposed to use diesel generators in work compounds.

Night works are not planned as part of the construction phase. Task lighting would only be required during events at night. In winter, some task lighting may be required to assist completion of tasks towards the end of the working day due to less daylight hours.

Security lighting would be used at site compounds for the duration of construction.

Construction water supply and storage

Water for construction is to be sourced mainly from non-potable sources nearby to the construction activity. If suitable non-potable sources cannot be identified in consultation with DECCW for the proposed works, potable sources of water would be used. Water would generally be stored in water tankers that would traverse the pipeline route. GMC would require a licence under the *Water Act 1912* to extract water from waterways for use during construction.

Sewerage

There would be no connections to a sewerage system at the construction sites.

Portable toilets would be available on site for use by construction working for the duration of the Project. A commercial operator would be responsible for maintaining and emptying the facilities on a regular basis.

Table 6.14 Analysis of access routes to the proposed pipeline easement

Sector	Public road crossing points	Public road crossing point names	Distance between public road crossing points (m)	Likelihood of need for alternative access via private property	Possible alternative access options
Glenquarry	R3-R5	Sheepwash Rd to Iona Park Rd	4,948	Yes	Existing farm track via Sproules Lane on Lot 3 DP 543445
	R5-R6	Iona Park Rd to Robertson Rd	1,819	No	-
Werai-Moss Vale	R6-R8	Robertson Rd to Yarrawa Rd	2,467	No	-
	R8-R11	Yarrawa Rd to Bibbys Ln	2,027	No	-
	R11-R12	Bibbys Ln to Mount Broughton Rd	669	No	-
	R12-R15	Mount Broughton Rd to Exeter Road	3,412	No	-
Sutton Forest - Exeter	R15-R18	Exeter Rd to Old Argyle Rd	3,538	No	-
	R18-R19	Old Argyle Rd to Sallys Corner Rd	5,270	Yes	Access track via Lot 5 DP239258 off Sally's Corner Road
	R19 to R22/23	Old Argyle Rd to Hume Hwy	1,393	No	
	R23-R40	Hume Hwy to Inverary Rd	10,627	Yes	Existing farm track on Lot 4 DP 253435 Existing access road on Lot 9 DP 241054 Unnamed Road (R28) on Lot 4 DP 239391 Unnamed Roads (R29 & R30) on Lot 2 DP 239391 Unnamed Road (R38) adjacent to Lot 4 DP 253706 Existing farm track on Lot 62 DP 700454
Paddys River	R40-R45	Inverary Rd to Wollumbi Rd	2,833	No	-

Sector	Public road crossing points	Public road crossing point names	Distance between public road crossing points (m)	Likelihood of need for alternative access via private property	Possible alternative access options
	R45-R47	Wollumbi Rd to Red Hills Rd	2,532	No	-
Marulan	R47-R51	Red Hills Rd (1) to Red Hills Rd (2)	2,877	No	-
	R51-R54	Red Hills Rd (2) to Brayton Rd	3,840	No	-
	R54-R59	Brayton Rd to Carrick Rd	12,286	Yes	3 unnamed roads (R56,R57,R58) on Lot 4 DP 1107232 Existing farm track on Lot 6 DP 700454
Towrang	R59-R62	Carrick Rd to Towrang Rd	3,159	No	-
	R62-R64	Towrang Rd to Murrays Flat Rd	3,524	No	-
	R64-R68	Murrays Flat Rd to Taralga Rd	3,639	No	-
Murrays Flat	R68-70	Taralga Rd to Middle Arm Rd	2,279	No	-
Goulburn	R70-R71	Middle Arm Rd to Crookwell Rd	2,699	No	-
	R71-R72	Crookwell Rd to Chinamans Ln	1,090	No	-
	R72-R73	Chinamans Ln to Clinton St	2,657	No	-

6.6.7 Traffic management

The pipeline would need to cross the RTA designated roads of the Hume Highway, Sheepwash Road, the Illawarra Highway (Robertson Road) and Crookwell Road. It is proposed that the crossings be undertaken using a thrust boring method of construction. This method would allow the continued functioning of the roads without the need for road closure.

There would also be approximately 64 other road crossings (including local Council roads, rural roads and access roads). Construction would involve open trenching and restoration of the road surface. This would involve a part road closure during construction hours (managed by appropriate traffic control). The trench would be covered outside of construction hours. Justification for this construction methodology is discussed in section 7.3.3.

Vehicular access to properties would be maintained, either by keeping one lane open or through the use of diversions and/or steel plates over sections of the trench. The construction of pump stations may require road closures of local roads for short periods when, for example, large pieces of equipment such as the pumps are being delivered and unloaded by crane. Arrangements would be made with property owners to ensure access to their properties is possible at all times. Such closures would be a last resort and would only be used when lane closures and traffic management would not be adequate to address public safety.

Traffic management would be undertaken in accordance with the NSW RTA's *Traffic Control at Worksites Manual Version 3.1*. At the end of construction, roads would be returned to their original state.

6.6.8 Public utility adjustments

An assessment of the potential impacts to public infrastructure has been provided in Chapter 26. The following is a brief description of the identified public utilities located along the pipeline route.

Gas

For a large proportion of the alignment, the pipeline route runs adjacent an existing gas pipeline easement. This gas easement contains two separate gas pipelines; a 32 inch natural gas pipeline and an 8 inch ethane pipeline, both with separate owners.

The gas pipelines are located within an existing nominally 25 m wide easement. The width varies depending on the requirements of various connections and other ancillary equipment forming part of those services works.

There are a number of offtakes from the gas pipelines that the Project pipeline will cross. The three most prominent are located at Taralga Rd in Goulburn, Brayton Rd in Marulan and Sally's Corner Rd in Sutton Forrest.

Telecommunications cables

Various telecommunications cables are located in the vicinity of the pipeline route. Most notable is the AAPT (Powertel) Optic Fibre cables which generally run along the edge of the gas pipeline easement. The AAPT Powertel cables frequently cross between the north and south sides of the easement.

Electricity

The pipeline route follows Transgrid 330 kV powerlines for a portion of its alignment. The powerline easement is 60 m wide centred on the centreline of the infrastructure.

Various other powerlines are crossed locally along the pipeline route.

The Project involves the construction of a pump station at the Wingecarribee Reservoir site. The supply requirements of this component may require major local and upstream augmentation works to Integral Energy's existing electricity network. Electrical supply for the proposed HSP would be subject to compliance with Integral Energy's *Network Connection Contestable Works General Terms and Conditions* and AS/NZS3000 *Wiring Rules and the Service and Installation Rules of NSW*.

Based on the current observed pumping capacity at Wingecarribee Water Treatment Plant, the site has sufficient electrical capacity to supply the relatively minor increase in load from the new pumping station.

Other

Various other services are located in the vicinity of the pipeline route although these are generally local in occurrence with the pipeline either intersecting or running parallel to these services over a relatively short distance. These services include council owned water mains, other gas pipelines, other optic fibre cables, underground and above ground power cables and private irrigation systems.

6.6.9 Deviations of alignment within the Corridor

Given the assessments undertaken to identify and investigate the Project alignment, including stakeholder consultation and negotiations, it is intended that the construction of the pipeline would occur generally along the alignment exhibited in this Environmental Assessment. In practice, a pipeline is normally constructed 'generally in accordance with' an alignment published during an environmental assessment and approval process, as minor variations generally occur both intentionally and unintentionally as a result of construction contingencies and accordingly the easement would be adjusted. The same principles would apply to the pipeline. Any proposed variations in the route would be appropriately assessed.

6.7 Project environmental controls

6.7.1 Erosion and sediment control

Erosion and sediment control prevention measures would be implemented as part of all project construction activities. Significant effort and attention would be given to preventing soil erosion and sedimentation of surface water runoff.

Standard controls to prevent erosion and sedimentation would be implemented for each construction activity. The practices and controls are based on the practices described in the following guidelines:

- *Managing Stormwater: Urban Soils and Construction Vol 1*(Landcom, 2004);
- *Managing Stormwater: Urban Soils and Construction Vol 2A Installation of Services* (DECC, 2008b); and
- *Managing Stormwater: Urban Soils and Construction Vol 2C Unsealed Roads* (DECC, 2008c).

All erosion and sediment control measures would be designed, implemented and maintained in accordance with the above guidelines.

The guiding principles for effective soil and water management that would be adopted during project construction and post construction periods include:

- Prioritise the prevention of erosion rather than to controlling sediment and capturing sediment laden stormwater;
- Phasing and conducting work within the construction corridor to minimise the area of soil disturbance and vegetation removal;
- Managing topsoil so that it is excavated and temporarily stockpiled separately from sub soils and reused on site during rehabilitation;
- Agreeing on the rehabilitation outcomes with the landowner prior to commencement of construction. Progressively rehabilitating disturbed areas and maintaining these areas until the agreed rehabilitation outcomes are achieved.

A site Erosion and Sediment Control Plan would be prepared and incorporated into a Construction Environmental Management Plan (CEMP).

6.7.2 In-stream works

The design and construction of in-stream works would be consistent with the DWE's (now the NOW within the DECCW) *Guidelines for controlled activities - In-stream works* (Feb 2008a) and *Guidelines for controlled activities - Laying pipes and cables in watercourses* (Feb 2008b). The following design principles would be adopted based on these guidelines:

- The full width of the riparian corridor would be considered when designing and constructing the watercourse crossing;
- The extent of disturbances to soil and vegetation within the watercourse and riparian corridor would be minimised;
- All major water courses would be crossed at points adjacent to existing infrastructure easements;
- The natural hydraulic, hydrologic, geomorphic and ecological function of the watercourses, and the natural geomorphic processes such as natural bed and bank profiles, chains of ponds, surface water pools and riffles would be maintained;
- Rehabilitation is to occur immediately following the completion of the crossing construction to re-establish the integrity of the riparian zone. Topsoiling, revegetation, mulching, weed control and maintenance would be undertaken to stabilise disturbed areas;
- Existing channel bed and bank degradation at the crossing points are to be rehabilitated;
- All rehabilitation work would be monitored and maintained until the riparian zone and channel bed and banks are suitably stabilised.
- Trenches are to remain open for a minimal length of time;
- The channel shape and bed level would be restored to preconstruction condition;
- Cave-ins or 'frac-outs' would be avoid by investigating the underlying geology and boring at a appropriate depth;

- Bore entry and exit locations would be located outside riparian corridors; and
- All drilling mud, construction plant and materials would be recovered and removed following completion of construction.

6.7.3 Access tracks across creeks

To allow trenching to occur across waterways (as identified in Section 6.5.2 and Section 6.5.3) temporary access tracks would need to be created to allow machinery to cross the waterway. Most waterways would not require significant additional works to allow this to occur due to their geomorphology (see Chapter 15); however some larger waterways may require some bed level crossings or bridges to be installed during the works. This may also include bank cutting to allow machinery to access the bed or bridge. These waterway crossings would be identified during the detailed design phase and specific access methods and associated erosion and sediment controls, as well as waterway rehabilitation would be fully documented in the project CEMP.

Existing disturbed areas or accessways would be used, where possible, for vehicles that need to cross the waterways. This may include existing farm tracks and culverts or areas where vegetation has already been cleared. Waterways requiring new access tracks, or those that contain saturated ground at the time of construction may require bed level stabilisation in the form of coarse aggregate to allow vehicles to pass through the waterway. Any additional waterway crossings would be appropriately stabilised and rehabilitated and would not consist of culverts or be raised above bed level so as not to impede fish passage. The details of proposed rehabilitation for specific waterways would be determined by a project agronomist and detailed in both the CEMP and the project rehabilitation plan (see Chapter 27).

Waterways that are being underbored (HDD) would be accessed from either side of the crossing and only where existing bridges or accessways are present, would access be gained across the waterway.

No permanent waterway crossings have been proposed in this project. Where access is required post-construction, existing accesses across waterways would be used.

6.7.4 Management of spoil

Spoil would be managed in accordance with the resource management hierarchy of:

a. Avoid generating spoil;

b. Reuse spoil on site;

c. Reuse spoil off site, and (as a last resort option)

d. Appropriate disposal of spoil off site.

Spoil generation would be minimised by keeping the area of ground disturbance as small as possible. If spoil is generated, it would be reused to rehabilitate the disturbed areas. Topsoil would be separated from sub surface materials and used in its original location as final ground cover. In general, spoil would be managed as follows:

- Spoil material would be used to rehabilitate the impacted construction corridor;
- Excess spoil materials would be utilised by the property landowners where ever appropriate;
- Spoil that cannot be reused on site would be taken to nearby landfills for use as capping material where appropriate; and

- Disposal of spoil material off site would occur in accordance with *Waste Classification Guidelines*, (DECCW, 2008).

6.7.5 Management of groundwater

Any groundwater seepage into trenches excavated through watercourses would be pumped out of the excavations into a portable tank to allow for the settlement of sediment and/or treatment by adding a flocculants before being released back into the watercourse. Alternatively the groundwater seepage would be trucked to a nearby farm dam. Treatment of the water could also occur once release into the farm dam.

No sediment laden groundwater seepages would be release to watercourses.

6.7.6 Management of acid sulfate soils

The likelihood of acid sulfate soils (ASS) or potential acid sulfate soils (PASS) being present within the construction corridor is minimal. However, ASS and PASS could occur in waterlogged or swampy areas.

If ASS or PASS were suspected (soils typically containing a sulfuric odour and dark in colour), then works in the area would cease and a qualified soil scientist engaged to undertake an Acid Sulfate Soil Assessment accordance with the *Acid Sulfate Soil Manual* (Stone et al, 1998).

Management of ASS and PASS would be undertaking in accordance with an Acid Sulfate Soil Management Plan (ASSMP) prepared in accordance with the Acid Sulfate Soil Manual.

6.7.7 Management of erosive soils

Saline soils

There is a possibility that the proposed pipeline route would traverse areas where localised dry land salinity has been recorded. If areas impacted by dry land salinity were encountered, the following measures would be implemented:

- Disturbance of saline soils would be minimised wherever possible;
- Following earthworks, reinstatement of the disturbed areas would be undertaken to avoid the creation of surface depressions or drainage barriers, which would lead to waterlogging of soils;
- Rehabilitation of the surface vegetation would consider the use of salt tolerant species; and
- Topsoils would be treated with gypsum or fertilisers as appropriate.

The overall aim would be to ensure the following;

- Rehabilitated areas are well drained;
- Reuse of excavated materials is maximised;
- Topsoil is treated to aid in the re-establishment of a vegetated ground cover; and
- The excavations do not contribute to additional surface water infiltration.

Sodic soils

Localised and widespread sodic soils are likely to exist in areas intersected by the proposed pipeline construction corridor. Sodic soils are highly erodible and would be managed in the following way:

- In areas of high sodicity, trench reinstatement would include compaction to minimise tunnel erosion;
- Reinstatement of banks would also involve compaction and topsoiling with a soil-rock mixture;
- Disturbed sodic areas would be revegetated immediately and maintained to ensure erosion is minimised.

6.7.8 Informing construction workers of responsibilities

All members of construction work crews would undergo informal training to inform them of the Project's 'best practice' approaches to preventing soil erosion and sedimentation. Construction worker's responsibilities and legal requirements with respect to the prevention of soil erosion, surface water pollution and groundwater pollution would be included in the training.

6.7.9 Management of contaminated soil

If during construction works potentially contaminated material is encountered or if soil becomes contaminated during construction or operation of the Project (such as from a fuel spill for example), works in the vicinity of the contaminated area would cease and a qualified environmental consultant with experience in contaminated land investigations would be engaged to investigate the potential risks posed. Soil sampling and laboratory analyses would be undertaken to delineate the degree and extent of contamination if deemed necessary.

Consideration of the duty to notify DECCW of a site that poses or may pose a significant risk of harm to the environment or human health (as required under the *CLM Act*) would be given following any contaminated land investigations.

If appropriate, remediation of contaminated land would be undertaken to ensure the use of the land within the construction corridor and pipeline easement is not inappropriate because of the presence of contamination. In the unlikely event that significant contamination is encountered within the construction corridor, the area would be avoided by rerouting the construction corridor around the contaminated area.

All material removed off site for disposal or re-use would be managed in accordance with the *Waste Classification Guidelines*, DECCW 2008.

To prevent soils from becoming contaminated through construction activities, the storage of all fuels, oils and chemicals would be kept to a minimum. All fuels, oils and chemicals would be stored within the primary site compound in appropriate storage containers as specified in relevant Australian Standards. Storage within the construction corridor would be avoided.

6.8 Rehabilitation

6.8.1 Approach to rehabilitation

The rehabilitation plan is recognised by GMC as the most important part of the post construction environmental process. GMC would dedicate the resources needed to rehabilitate to a high standard. The rehabilitation plan would be developed, with specialist input, to describe the rehabilitation management, objectives and activities necessary to assess and rehabilitate areas impacted by construction works.

The majority of rehabilitation would be undertaken after hydrotesting of the pipeline. However, reinstatement of disturbed areas would be undertaken progressively during the construction period where possible, with ongoing discussion with the Project and construction managers to explore the options for early rehabilitation in areas of the construction corridor that may no longer required during the hydrotesting period.

The rehabilitation plan would include recommendations of the terrestrial flora and fauna impact assessment. Outcomes of consultation with landowners would also be included in the rehabilitation plan.

6.8.2 Rehabilitation principles

The rehabilitation principles would guide the preparation of land access agreements and property plans developed for the construction of the pipeline and the maintenance of the easement. All disturbed ground would be rehabilitated in general accordance with the following principals:

- Rehabilitation objectives would be agreed with the landholder prior to construction. The agreed rehabilitation objectives would be included in the land acquisition agreement negotiated with the landholder;
- The basis of the rehabilitation objectives would be to establish stabilised ground of a nature similar to the pre-construction condition, over approximately 80 per cent of the disturbed area. Rehabilitation is to be designed in general accordance with the documents listed above;
- Rehabilitation of the disturbed areas would be undertaken progressively, immediately after a section of pipeline trench has been backfilled or a crossing has been constructed;
- Erosion and sediment controls would remain in place until the rehabilitation objectives are achieved. GMC would remove all controls once the rehabilitation objectives are achieved; and
- Rehabilitated areas would be periodically inspected, reinstated (if required) and maintained by GMC on an on-going basis until the rehabilitation objectives are achieved.

Much of the construction corridor would exist in areas where there is a high sheet erosion potential and shallow soil cover. As such, rehabilitation of these areas would be undertaken in a two step process. The primary rehabilitation stage would seek to rapidly stabilise disturbed areas. The second phase would seek to establish a permanent cover of the species that originally occurred, whereby restoring the aesthetic quality of the area. This would be endemic species or improved pastures. Separately stored topsoil would be returned and the litter layer restored.

The aim of rehabilitating riparian zones would be to restore the zone to its pre-construction condition taking into consideration the original vegetation, geomorphic structure, hydrology and water quality conditions. Rehabilitation would aim to quickly ensure that the soil in all disturbed areas, especially areas subject to concentrated water flows, is bounded.

Detention basins would be considered where runoff from construction areas has the potential to impact water quality in the associated watercourse.

Maintenance would ensure that the re- vegetation is sustainable established, weeds are controlled and the ground is stabilised.

Stream bank rehabilitation would be designed by a geomorphologist. The original terrestrial and aquatic vegetation would be re-established and river banks would be stabilised using appropriate materials such as rock and gravel to re-establish the original channel form.

6.9 Commissioning

Commissioning would be undertaken at the completion of the pipeline construction; however progressive testing is likely to be carried out during construction at completion of sections of the pipeline, rather than waiting until the completion of the entire length of pipeline.

Testing would normally involve progressively filling up the pipeline from the supply end and using this to hydrostatically test the pipeline. The precise sectioning of this would depend on the methodology for testing that is adopted by the successful construction contractor. The final testing is unlikely to be undertaken until the pipeline (apart from the testing limit points) has been completed.

6.10 Operation of the Project

The water transfers would be made by a pump station located at the Wingecarribee Reservoir. The pipeline would be designed to accommodate a flow of approximately 7.5 ML/day (over a 24 hour period). Initially the pipeline will deliver 5 ML/day. Approximate transfer times are outlined in Table 6.15.

For the raw water transfer option, the water would be delivered from the pipeline into an existing water balance tank upstream of the Goulburn WTP, prior to treatment there. Alternatively it may be delivered to the existing 600 mm diameter rising main from the Rossi Weir system in Goulburn and taken directly to the intake works.

For the treated water transfer option, the water would be delivered from the pipeline into a proposed new covered balance reservoir at Governor's Hill in East Goulburn. The water would then be piped directly into the eastern zone of the Goulburn water reticulation system. Alternatively, the pipeline may connect directly to the existing Goulburn raw water main in North Goulburn, which, through water supply rezoning work, could supply Goulburn's entire network with water from the Wingecarribee Reservoir

There are two options in regard to the mode of operation of the water transfer pipeline:

- Continuous operation – where water from the Wingecarribee Reservoir would be delivered daily to Goulburn so as to contribute some set percentage of the overall daily water demand; or
- Intermittent operation – where water from the Wingecarribee Reservoir would be pumped to the Goulburn water supply system only on occasions where the existing water supply resources were measured to be below some trigger level.

Table 6.15 Water transfer times

Pipeline diameter DN (mm)	Transfer rate (ML/d over 22 h)	Transfer time (h)
300	5.0	25.8
300	7.5	17.2
375	5.0	40.3
375	7.5	26.9

6.10.1 Maintenance activities

During the operation phase of the Project, GMC staff will periodically traverse the route to undertake routine maintenance and ensure the pipeline is functioning adequately. The maintenance crews will remain in the cleared pipeline easement at all times and cause minimal disturbance to the natural environment.

Key operational activities would include:

- Regular maintenance of the pumping station;
- Regular visual inspection of the pipeline, air valves and scour valves; and
- Less frequent maintenance of the pipeline including scouring the pipeline to remove sludge building up.

The potential leakage / failure of the pipeline has also been discussed below.

Maintenance and inspection of the pump station

Regular maintenance of the pumps station would occur in order to maintain its designed functioning capabilities. This would generally involve having one pump on standby at all times to allow for maintenance to occur. Maintenance activities would generally involve repairing malfunctioning or broken components and applying lubricants and oil to the pumps. This would occur within the pump station building.

The pumps would likely have to be replaced approximately every 20 years over the life of the pump station and pipeline operation.

Visual inspection of the pipeline, air and scour valves

Periodic inspections of the pipeline and the valves would be undertaken during the life of the pipeline. This would involve a vehicle accessing the pipeline easement and visually inspecting the integrity of the pipeline and the condition of the valves. Where sensitive environments occur (*i.e.* waterways), inspections would be undertaken on foot.

Scour water management

Scouring of sections of the pipeline are routine maintenance operations that would occur approximately once or twice a year to “exercise” the valves. On most potable and raw water pipelines the water is released directly to the environment following sample testing. Generally landowners are willing to take a water release. In the event that the water quality is unsuitable for release then tankering will need to be arranged. The volumes released can be quite small for each valve exercise and are manageable with tankering to a nearby farm dam where it can be released and, if required, treated depending on the specific water quality issue.

In the event of a planned drain down of a section of the pipeline to undertake repairs or modifications of the pipework, the volume of water to be handled can be pre-calculated. There would be a number of divide valves in the pipeline which could be used to isolate sections. Depending on the location, excess water along the profile may be drained to either the western end of the eastern end of the pipeline. Knowing the volumes, arrangements may then be made to tanker, or to provide temporary piping to a nearby farm dam where prior arrangements with the landholder have been made.

The preferred approach to the management of scour water would be to utilise the water on the properties where scouring occurs. Typically this would involve pumping (via collapsible fabric pipes) non-catchment, scour water to a nearby existing farm dam. Where no suitably located farm dam exists, a small dam could be constructed with the approval of the landholder. This is normally viewed as advantageous by landholders, because of a universal need for water. No scour water would be directly released to watercourses.

The approach to managing the scour water would vary slightly depending on whether the treated water transfer scheme or the raw water transfer scheme is constructed.

Treated water

If the treated water transfer scheme is constructed then the water quality of the water being released during scouring would be of a quality suitable for drinking by humans, and would contain less contaminant than what is typically found in environmental waters. The most pertinent issue would be that the scour water would contain a chlorine residual following chlorination at the Wingecarribee WTP and boosters along the pipeline. The target chlorine residual levels of the piped water would be in the order of 0.02 mg/L at the point of entry to the Goulburn reticulation system, to provide some protection of the supply against microbial contamination. This level of chlorine is greater than the ANZECC (2000) guideline (0.003 mg/L) for the protection of aquatic systems in waterways. However this would be managed in the following ways:

1. Maintenance scheduling: The timing for scour activities would be agreed in advance. This would allow the pipeline to be isolated from the Goulburn water reticulation system and the Wingecarribee WTP, and the shut-down of booster chlorinators for some time period in advance of the scheduled scouring. This would allow the free chlorine residual in the pipeline to decay prior to the scouring, which would not present a supply issue as the water would not be provided for drinking at these times.
2. The chlorine would breakdown on exposure to sunlight once the water is placed in a farm dam.
3. A standard practice procedure would be prepared in consultation with the SCA and DECCW to guide the management of scour water. The procedure would form part of an Operation Environmental Management Plan for the pipeline. As mentioned above, a component of this plan would be that the water would not be released into environmental waterways, and would be pumped into a receiving farm dam for appropriate (stock and domestic) uses agreed to by the landholder and other relevant bodies. The farm dam selected would be, adequately sized and the scour activities coordinated in a manner to prevent the risk of the dam spilling into any nearby waterways.

Raw water

If the raw water transfer scheme were to be built, the physico-chemical properties of the raw water would generally be within the guideline values provided by ANZECC (2000) for the maintenance of aquatic systems and for the use of the water for crop irrigation or livestock watering. The *E. coli* and cyanobacteria (blue-green algae) levels can fluctuate to beyond the ANZECC and other guidance for these parameters.

A standard practice procedure would be prepared in consultation with the SCA and DECCW to guide the management of scour water. The procedure would form part of an Operation Environmental Management Plan for the pipeline. The procedure for managing scour water for the raw water scheme would typically involve the following:

1. Maintenance scheduling - maintenance of pipeline sections and valves would be undertaken in winter when the likelihood of blue-green algae blooms in the Wingecarribee Reservoir are significantly lower

2. Assessing water prior to release from valve - the routine cyanobacteria and *E. coli* monitoring undertaken at the Wingecarribee Reservoir by SCA would be analysed to assess the likely water quality in the portion of pipeline that is being scoured. If the microbial water quality were considered to be undesirable for scouring and release to the farm dam, then management would involve either:
    a. Delaying the scour activity until such time that the monitoring suggests the risks of undesirable quality water being placed in the farm dam were sufficiently low (triggers would be agreed to by the receiving landowner and the SCA and DECCW); or
    b. Providing on-site treatment (filtration or disinfection) by use of a portable treatment plant prior to release of the water to the farm dam (appropriate treatment would be agreed to by the receiving landowner and the SCA and DECCW);
3. Release of water into onsite reservoir. The water would be pumped into a receiving farm dam for appropriate (stock and domestic) uses agreed to by the landholder and other relevant bodies. The farm dam would be selected to be, adequately sized and the scour activities coordinated in a manner to prevent the risk of the dam spilling into any nearby waterways.

Potential pipeline failure and detection

In the event of an emergency failure, water from the pipeline would be lost to the environment. Considering that it is being used for a potable water supply system even be it after treatment, it is unlikely to be highly harmful to the environment as in the case of an oil pipeline or similar. There is, in any case little that can be done to avoid such an incident.

If additional water has to be drained out to affect the repairs, then local arrangements as outlined in the above routine maintenance operations can be made. In the event that chlorine residuals are too high, then arrangements could be made to treat the water that has been put into a local farm dam.

6.11 Project timing

6.11.1 Construction, rehabilitation and commissioning

The construction of the pipeline, air, scour and divide valves, pump stations, connections and outlet tanks is expected to take between eight and ten months. The length of the pipeline construction would ultimately depend on the number of work teams employed by the successful construction contractor and any unforeseen obstacles that may need to be overcome. Construction would commence in July 2010 and be completed by May 2011.

Progressive hydrostatic testing would be undertaken during the construction of the pipeline as stages are completed. Testing would normally involve progressively filling up the pipeline from the supply end and using this to hydrostatically test the pipeline. The precise sectioning of this would depend on the methodology for testing that is adopted by the successful construction contractor. The final testing is unlikely to be undertaken until the pipeline apart from the testing limit points has been completed. The pipeline is expected to be fully commissioned and operational by the end of June 2011.

At any one point on the pipeline easement, the proposed construction, rehabilitation and commissioning activities would occur intermittently over a period of up to 4 weeks.

Table 6.16 Duration of construction activities at any one point along pipeline easement

Activity	Typical duration of activity at or near any single location along pipeline easement
Pipeline trenching	Progress of pipe laying by trenching is expected to be between 1km and 4km per day depending on geological conditions. Therefore trenching activities would likely occur near any one point on the pipeline route for a duration of up to 1 day.
Under bore point	A conservative estimate for under boring a major road or watercourse is approximately 4 weeks and would be dependent on the geological conditions at the crossing location.
Use of material lay down area	Lay down locations are expected to be located approximately 5km to 10km along or nearby the pipeline easement (see Section 6.2.3). Therefore the maximum length of pipeline that would be stored at any lay down area would be approximately 10 km. At a construction rate of 1km to 4km per day, it is expected that a lay down area would be utilised intermittently of a period of up to approximately 10 to 12 days.
Use of access points and tracks	Public road crossing points, providing access to the pipeline easement, are predominantly located at spacings of less than 4 km (see Table 6.13). Where the length between public road crossing points is greater than 4km, additional access points via existing tracks on private property would likely be used (see Section 6.6.5). Therefore the expected maximum length between any access point (public road crossing points and additional access routes) is approximately 4 km in length. Thus on average, an access point would be utilised to access up to approximately 4 km of pipeline (2km of pipeline in either direction of the access point). At a construction rate of 1km to 4km per day it is expected that an access point would be utilised intermittently for up to approximately 4 to 5 days.

6.11.2 Operation and decommissioning

The design life of the main components of the Project is between 50 to 80 years. Mechanical components would need to be replaced at approximately 20 year intervals. The Project would be maintained so that it could be operated for longer if needed, depending on climate conditions and water availability at the time. At the end of its operating life the intake, pump stations and outlet structure would be dismantled and materials recycled, where possible. The pipeline would be left in the ground, access points would be locked off and/or covered over and easements would be removed from property titles.

6.12 Incorporating sustainability into the Project

6.12.1 Compatibility with the principles of ecologically sustainable development in NSW

The *Environmental Planning and Assessment Act 1979* adopts the definition of ecologically sustainable development contained in the *Protection of the Environment Administration Act 1991*. Clause 6 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* lists the principles of ecologically sustainable development as:

- Precautionary principle;
- Inter-generational equity;
- Conservation of biological diversity and ecological integrity; and