
BEVERLEY URANIUM MINE
Declaration of Environmental Factors

A proposal to install the Beverley gas lateral

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 **HEATHGATE RESOURCES PTY. LTD.**

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1. INTRODUCTION

Heathgate Resources Pty Ltd (Heathgate Resources) is in the process of constructing a commercial uranium mine at Beverley in northern South Australia. Beverley is located on the arid plains between the North Flinders Ranges and Lake Frome, approximately 600 km north of Adelaide and 300 km north-east of Port Augusta, as shown in Figure 1.

Mining by in-situ leach methods was trialed during 1998 (the Field Leach Trial) with the aim of establishing the technical, environmental and economic feasibility of a commercial uranium mine producing approximately 1,000 tonnes U_3O_8 per annum, for sale and export over a minimum of 15 year mine life. The uranium mineralisation is present within Mineral Lease No 6036 covering an area of 8 km², located entirely within the Wooltana Pastoral Lease.

As part of developing commercial production of uranium, Heathgate Resources is seeking approval to construct and install a gas pipeline from the Epic Energy Moomba-Adelaide pipeline to the Beverley mine site for the purposes of generating electricity, as proposed in the Beverley EIS. To date, diesel-powered generation on site has been the only source of electricity used for the Field Leach Trial operation and current construction activities.

2. EIS AND PRECEDING DOCUMENTATION

The development program at Beverley has been the subject of the following formal environmental proposals and associated approvals:

- *Declaration of Environmental Factors for Exploration Drilling Programs (Heathgate Resources 1996);*
- *Declaration of Environmental Factors for Drilling and Pump Testing in the Central and North Beverley Areas (Heathgate Resources 1997a);*
- *Declaration of Environmental Factors for the establishment and operation of a Field Leach Trial (Heathgate Resources 1997b);*
- *Supplement to the Declaration of Environmental Factors for the establishment and operation of a Field Leach Trial concerning outcomes of pump testing (Heathgate Resources 1997c);*
- *Environmental Impact Statement for the Beverley Uranium Mine under the SA Development Act 1993 and the Commonwealth Environment Protection Act (Impact of Proposals) Act 1974 (Heathgate Resource 1998a);*
- *Supplement/response document to the Environmental Impact Statement for the Beverley Uranium Mine (Heathgate Resources 1998b).*

Associated with the *Environmental Impact Statement for the Beverley Uranium Mine (EIS)* are 15 supporting documents dealing with all environmental aspects of the Beverley site, infrastructure requirements and of the surrounding area.

3. NEED FOR PROPOSAL

Heathgate Resources, to operate the commercial Beverley Uranium mine, will require an electricity supply of approximately 2.7 MW for a production rate of 1,000 tonnes of uranium oxide concentrate per year. Alternatives for power supply considered in the EIS were:

- on-site generation using diesel-fired generators;
- electricity transmission to the site, sourced either from the Moomba-Adelaide gas pipeline Compressor Station 3 or from connection to the State grid;

- on-site generation using gas-fired generators with natural gas sourced from the Moomba-Adelaide gas pipeline

On-site gas-fired generation is the preferred option, and as such a new pipeline is required from the Moomba-Adelaide gas pipeline to the Beverley site

Diesel-powered generation, used for the Field Leach Trial, will necessarily be used as backup (emergency) power for the proposed commercial operations. It was rejected as the primary source of power for the project generally as follows:

- there is major impact and hazard potential inherent in the large volume fuel storage required for complete diesel-powered generation. Storage facilities would be an order of magnitude larger, safety aspects would become more problematical, and worst-case spills would directly affect larger areas and indirectly require larger facilities for disposal than would be the case for a small backup system.
- transportation requirements would add significantly to traffic volumes generated by the development, with significantly increased transportation risks
- greenhouse gas emissions would be significantly greater than for gas-fired generation, not only because of lower efficiency of generation but also because of the fuels burnt in transporting the diesel from refinery to the site.
- the cost of both the diesel fuel and its transportation would be high, and significantly reduce the cost-effectiveness of the operation

Possibilities of connection to the State grid at Copley or Hawker were explored, particularly since such a connection could also open options for power supply to other power-disadvantaged communities in the Flinders Ranges, such as the Arkaroola tourist facility and pastoral stations along the route including the Gammon Ranges National Park headquarters at Balcanoona

Connection to the State grid was rejected as an alternative for reasons including the following:

- the long run of power line would be a major infrastructure expense to the project;
- power line development would itself be likely to require the production of a separate major Environmental Impact Statement, given the tourism importance of the region through which it would run and given potential problems associated with visual amenity;
- a power distributary has been provided to the Nepabunna community, lessening the utility to the community at large of access to a new feeder

Transmission from the existing generator at Compressor Station 3 was also considered, and rejected as an alternative for reasons including the following:

- it would require expansion of the existing generating capacity at Compressor Station 3;
- the electricity market not being totally deregulated, there are legal bars limiting the ability of the pipeline operator to supply electricity for other purposes;
- the construction of the transmission line (33 kV, three conductor, 13.3 m poles at 300 m intervals), although of less initial impact than a trenched gas pipeline, would result in a greater permanent visual impact on the open plains, particularly within visual range of the public Balcanoona-Moolawatana road

4. PROPOSED PIPELINE DESCRIPTION

The proposed pipeline will extend from a hot tap connection to the Moomba-Adelaide gas pipeline to the Beverley mine site, as shown in Figure 2. The total length of the proposed pipeline is approximately 15,000 m. Two pressure reduction stations will be required—one situated adjacent the hot tap point as a combination meter station/pressure reduction facility and the other a primary pressure reducing station adjacent the power station at the Beverley site

The gas pipeline would be a high-pressure steel pipe 88.9 mm in diameter, generally buried less than one metre underground and marked with standard location and warning signs with a clear line of sight between signs. Additional signs would be placed at all road and track crossings to ensure that excavations did not unearth or rupture the pipeline. The signpost markers will be spaced at interval as determined as a result of a risk assessment of the pipeline, but will be at distances of no greater than 5000 m.

The proposed pipeline will be buried adjacent main mine access road, which is currently under construction. The pipeline will not digress from the main access road, and will, therefore be confined to already disturbed areas. The route entails one major creek crossing at Paralana Creek, at approximate chainage of 6163m, and also crosses several shallow floodways. The pipeline will be constructed with additional depth of cover at the major creek crossing and floodways to ensure protection against flash flooding. Weight coating to prevent pipeline buoyancy will not be required. A summary of the design criteria for the proposed pipeline is shown in Table 1.

Table 1 Design summary

Design	Pipeline
Outside diameter (mm)	88.9 mm
Wall thickness (mm)	4.0 mm
Length (m)	15 000 m
Grade	X56
Location class	Rural R1
MAOP	7000 KPag
Coating	Yellow jacket
Cathodic protection	Yes
Joining	Welded
Non destructive testing	X Ray or gamma radiography
Joint coating	Yellow jacket or tape wrapping
Coating repairs	Field repairs but joints coated with compatible protective tape wrapping system
Hydrostatic test pressure	8750 Kpag
Pressure Reduction	1 station @ MAP connection; 1 primary pressure reduction station at Beverley power station site
Depth of cover (m)	0.75 m (2.0m at major creek and road crossings)
Road crossings	1—Moolawatana Road
Rail crossings	Nil
Creek crossings	1—Paralana Creek
Marker spacing (m)	5000 m
Buried tape	No
Over pressure control	Yes
Leak detection	Yes
Odourisation	No

Construction of the pipeline will involve the following:

- the route will have been graded for the construction of the mine access road to a maximum width of 14 m with adequate road verge allowed for pipeline installation;

- a trench will be excavated to a depth of approximately 750 mm, enough to allow sufficient cover of fill and comply with AS2885 1—1997. Additional cover will be provided at creek and road crossings;
- the pipeline will be integrity tested prior to insertion into the trench, with a minimum of 10 % of all welds tested using radiography to comply with AS2885 2—1997. The pipeline end of line facilities and the required number of tie-ins will be 100 % radiographed;
- when pipe welds have passed the integrity test, the string of pipe will be lowered into the trench with suitable sand bedding;
- the trenches will be backfilled with the excavated spoils to a depth and width sufficient to adequately cover the pipeline. Sand fill may need to be imported in certain areas where the existing excavated spoil is unsuitable;
- the complete pipeline will be hydrotested in a pressure controlled test, which will incorporate a leak test to comply with AS 2885.1—1999;
- the environmental guidelines will be incorporated into the pipeline construction contract and compliance by the contractor will be mandatory.

Where construction activity occurs in the vicinity of the existing Moomba-Adelaide gas pipeline, work will be supervised by Epic Energy.

5. OPERATION AND MAINTENANCE

Heathgate Resources will operate and maintain the pipeline and associated facilities as required under licence conditions within the provisions of the Petroleum Act, 1940—Part 2B Pipeline Licences. Operation and maintenance requirements such as pipeline surveillance, safety and operating plans, and emergency plans will be undertaken as per AS2885 3—1997.

The associated power station on the Beverley site will be designed with a gas detection system. Gas detection above a preset level will trigger shutdown and alarm annunciation. Gas supply into a power house shall be provided with an automatic slam shut valve upon activation of gas detection.

6. ROUTE SELECTION

A new road is under construction between Compressor Station 3 and the mine site, and the proposed pipeline will follow this route in part. Figure 2 shows the proposed route, which requires approximately 15 km of new construction. The primary constraint affecting road development is flooding of Paralana Creek, which will be crossed just below its junction with Mulga Creek; although the route entails some 3 km of floodplain crossing, Paralana Creek at this point is confined to a single small channel about 25 m wide and approximately 2.5 m deep.

The access road will run from the 250 km marker on the gas pipeline road, on the higher ground, to the edge of the Paralana Creek floodplain about 3 km south-east of Mulga Creek Well. From there the road will be slightly raised above the floodplain, with adequate through-drainage provided, and will link to the existing track into the mine slightly to the north of the present entrance on the Balcanoona to Moolawatana Road.

The road alignment has been chosen to maximise the length on the higher ground, and minimise floodplain crossings and construction through channels. Cutting of the main channel banks will be required but a location has been chosen where no tree removal will be needed. Most of the alignment follows existing pastoral track.

7. SITE ACCESS AND FACILITIES

Access roads

Access to the proposed pipeline route will be on sealed roads via National Route 20 to Yunta, and unsealed roads from Yunta to the Epic Energy Moomba-Adelaide gas pipeline road. Travel to the proposed pipeline is along the Moomba-Adelaide gas pipeline road until reaching the 250 km marker. From here, local access to the Beverley mine site will be via the proposed construction detailed in Section 6 above

Power

Diesel-powered generation has been used in operations to date, and will necessarily be used as backup (emergency) power for the proposed commercial operations. Diesel-powered generation will also, where necessary, be used as the power supply for construction activities related to the proposed gas pipeline.

Water

Water for construction of the proposed pipeline will be from the newly installed wells along the Epic Energy pipeline road. This water is sourced from shallow aquifers associated with floodouts from the Flinders Ranges

Accommodation

During construction of the proposed gas pipeline, construction personnel would be accommodated at either the temporary construction camp or the newly constructed permanent camp at the Beverley mine site. Alternate accommodation is available, if necessary, at the Epic Energy Compressor Station 3 camp

8. THE EXISTING ENVIRONMENT

The primary source for information on the existing environment is the *Environmental Impact Statement for the Beverley Uranium Mine* (Heathgate Resources 1998a, 1998b) and the supporting documents associated with it.

Terrain

The proposed gas pipeline route lies along the western boundary of a broad, almost featureless plain approximately 45 km wide lying between the eastern margin of the Flinders Ranges and Lake Frome. The Flinders Ranges rise abruptly on the western margin of the plain to about 600 m above sea level and visually dominate the landscape. Lake Frome, approximately 30 km to the east of the lease area, lies within a broad drainage basin with a level varying from +0.5 to -3 m relative to mean sea level.

The surface of the High Plain from the coalescing fans at the footslopes of the Ranges forms a gentle easterly sloping plateau or piedmont plain with only a few diffuse drainage lines. West of the Beverley mine, the almost flat surface has a superimposed finely undulating surface of alternating gibber stone and soil, or gilgai patterning and this is typical for much of the plateau surface. Micro-topographical undulations are generally within 100 mm but can be up to 150 mm. The gibber dominates the surface, covering approximately 60% of the area.

To the east of the Beverley mine, surface slopes rapidly decrease to 1% or less forming the Low Plains. This broad floodplain with low-angle fans emanating from all of the major streams and occasional dunes in the lower elevations extends to the western shore of Lake Frome. Most of the pipeline route traverses the Low Plains.

Soils

The High Plains and the upper elevations of the Low Plains, with gibber/gilgai patterning, have brown cracking soils supporting a cover generally of Mitchell grass. Profiles are duplex, crusty red-brown sandy and silty clays overlying heavier blocky brown clays. There is a pronounced gibber shelf/gilgai patterning with the surface soils in the weak depressions being siltier than those of the gibber shelves. On the lower elevations of the Low Plains there are extensive fluvial sediments forming very low angle fans and sheet deposits. These sediments comprise a thin veneer of reddish brown sands and silty and clayey sands.

In the streams, there are two main classes of alluvial soils, the very recent and reworked deposits of major stream channels and the finer alluvium of levees and adjacent flats. Stream deposits in the area are deep clean sands within the major channels and gravels and sands in the banks and bars.

Susceptibility to erosion

Most of the soils along the pipeline route are susceptible to erosion by wind and/or by water and examples of natural and induced erosion can be seen in many areas. The pipeline route also shows evidence of induced erosion from historical grazing activity.

Most of the surface soils along the pipeline route contain finer silt and clay sized particles in a weakly bound soil mass, which are easily moved by winds from bare and disturbed surfaces. Many of the measures to be instigated during and after installation of the pipeline will be concerned with the stabilisation of these soils to ensure that wind erosion and the resulting dust do not occur.

Surface hydrology

There are no natural permanent waters closer to the site than the Flinders Ranges. Watercourses flow occasionally, after major rainfall events. Rainfall runoff modelling and floodplain mapping were undertaken for the mining lease area and immediate surrounds as part of EIS baseline and subsequent studies, but did not extend into the surrounding district.

For the bulk of the proposed pipeline route, limits to floodplains are indicated by vegetation and terrain. Approximately 3 km of route crosses flats associated with the main course of Paralana Creek, through chenopod low very open shrubland (*Maireana aphylla* and *Rhagodia spinescens*). Some areas of tall very open shrubland of prickly wattle *Acacia victoriae* also indicate occasional flooding.

Flooding frequency within these floodplain areas is not known. Given the vegetation, some local inundation could be expected in a normal summer, following major thunderstorms in the area. Generally, inundation would be shallow and slow-moving.

Flows in Paralana Creek at the proposed crossing would normally be limited to the actual bed, rather than extending onto the surrounding land. In contrast to areas a few kilometres upstream, such as the Balcanoona-Moolawatana road crossing, flows at the proposed pipe crossing are not frequent enough to permit the development of a continuous fringe of red gum (*Eucalyptus camaldulensis*).

Vegetation

Between the Moomba-Adelaide pipeline and the Paralana Creek crossing, vegetation on the proposed route varies with soils on the outwash sandplain. Very low sandy rises carry tall shrubland of hopbush (*Dodonaea viscosa*) with a grassy sparse ground cover dominated by *Enneapogon* and *Aristida* spp. Clayey sands and lighter sandy clay plain carries a low very open shrubland of *Rhagodia spinescens* with some cottonbush *Maireana aphylla*, with patches of sparse punty bush (*Senna artemisioides* subspecies). Heavier sandy clays immediately about Paralana Creek course

have low very open *Rhagodia spinescens* shrubland, equivalent to the upper floodplain vegetation described in the Beverley EIS for the Four Mile Creek

At the proposed Paralana Creek crossing, a discontinuous fringe of red gum (*Eucalyptus camaldulensis*) 15-20 m high, lines the incised streambed. On the immediately adjacent stream terraces, *Acacia victoriae* and white teatree (*Melaleuca glomerata*) form discontinuous thickets. Ground cover is relatively sparse, with a high proportion of alien species present. The full species list would appear equivalent to that for Four Mile Creek in the Beverley EIS (Heathgate Resources 1998a). West of Paralana Creek, the main cover is Mitchell grassland with a very high component of *Sclerolaena* spp. on the Low Plains. This cover is maintained where the pipeline climbs to the High Plains, with slopes and minor drainage on the latter also carrying shrubland or open shrubland of *Eremophila latrobei*.

All vegetation communities crossed by the proposed pipeline are extensive in the region (Heathgate Resources 1998a). All are also represented and conserved in the plains section of the Gammon Ranges National Park.

Two rare or threatened plant species are known or believed to be present in the district generally. *Frankenia subteres* is listed as rare in Schedule 9 of the *National Parks and Wildlife Act 1972*. It has been recorded at a sampling site on the High Plains within the Mineral Lease and at another site on the Low Plains beyond the Mineral Lease. It is likely that the species is present throughout Mitchell grass areas as a sparsely distributed plant, and accordingly there is a possibility that it may be present at some point along the pipeline route. The other species, *Swainsona murrayana* is listed as vulnerable under the *Endangered Species Protection Act 1992*. It was noted in October 1996 at three sites, none of which are near the proposed pipeline route.

Alien species

Alien plant species in the Beverley region are mainly associated with drainage due to their high water demand. There is some potential for additional alien species to establish, particularly where there is additional runoff from new built surfaces such as the mine access road. However, it appears that there have been no new alien species introduced to the area as a consequence of exploration activities dating to the 1970's.

Fauna

A total of ninety-four native vertebrate fauna species have been recorded in baseline survey about the Mineral Lease, including 19 mammal, 21 reptile, 1 amphibian and 53 bird species. Six introduced species have also been recorded. Listings are provided in the Beverley EIS (Heathgate Resources 1998a).

Mammal and reptile species are a habitat-determined subset of species found throughout the North Olay Plains. Habitats and environmental features of the proposed pipeline route and the mineral lease area are both widespread in the district and represented nearby in the Gammon Ranges National Park.

The greatest bird diversity is associated with major and minor drainage lines, which support the most structurally and floristically diverse habitats in the general vicinity. In comparison, relatively few avifauna species utilise the Mitchell Grass-gibber areas. Due to the significant seasonal variation in water availability in the general area, there will be considerable variation in bird species present. Many species, particularly waterbirds, would migrate out of the area during the dry season and return when rainfall recurs.

Forrest's Short-Tailed Hopping Mouse (*Leggadina forresti*), listed as rare under the *SA National Parks and Wildlife Act 1972*, is present on gibber landscapes including the mineral lease, but is considered widespread and common in areas of suitable habitat in the surrounding area and in the wider North Olay Plains region.

Cultural liaison

All activities of Heathgate Resources on the site to date have involved Aboriginal Heritage clearances. Native Title Claims have been registered covering the site variously by Adnyamathanha and Kuyani peoples, and representatives have inspected the site and access routes. There has been regular consultation with the representatives since December 1996 through Advisory Committees. The route of the proposed pipeline from the Moomba-Adelaide pipeline to the Beverley site has been subject to archaeological and anthropological surveys and cleared by native title claimants.

A formal agreement, including continuing liaison requirements, exists between Heathgate Resources and the lessee of Wooltana Station.

9. POTENTIAL IMPACTS, CONTROLS AND AMELIORATION

The major impacts most likely to occur in the construction of the proposed pipeline are loss of vegetation, surface soil disturbance, cutting and filling and alterations to the drainage pattern. The characteristics that determine how the landscape will react to these impacts are closely linked to the soil profile characteristics, the surface cover and local drainage.

The vegetation, habitats and environmental features on the Beverley site and those in the general vicinity are neither unique nor restricted in extent. They are widespread throughout the general region and are represented in regional conservation reserves. The native plant species have survived more than 150 years of pastoral use. Native fauna species and habitats present at this locality appear tolerant of varying degrees of disturbance and human activity, as indicated by their persistence through previous and ongoing disturbance.

The main objectives of the environmental management plan associated with the construction and installation of the pipeline are to:

- minimise vegetation and habitat clearance outside of the approved pipeline trench;
- minimise the period and extent of vegetation and habitat loss around the pipeline trench;
- prevent the establishment of additional alien species, and particularly pest plant species, around the pipeline trench;
- design and construct the pipeline trench to avoid where possible, and to minimise where not, impacts on the major creek habitats;
- avoid entrapment of vertebrates in the pipeline trench during construction;
- ensure the protection of heritage sites in accordance with State and Commonwealth legislation;
- minimise the generation of waste;
- minimise the impact on the environment of waste handling and disposal methods.

Terrain

Pipeline construction will be carried out according to specification, and all workers will be informed that they are working in an arid zone environment. All work will be contained within the road easement and excursions from the easement will not be permitted. Any camps, vehicle turnouts and parking areas will be approved at the planning stages of the work and will not be changed. To minimise the long term effects of any of the activities associated with construction of the pipeline vehicle impacts will be minimised by avoiding the use of any unsheeted tracks when wet.

Soils

Mitigation measures will include minimisation of both the extent of bared areas and the period for which they are bared, to avoid buildup of topsoil stockpiles. The main mitigation tools will be a

combination of soil stabilisation, maintenance of some surface roughness and rehabilitation as soon as possible after completion of the pipeline

Surface hydrology

Once filled and compacted, the pipeline trench will not significantly affect surface hydrology. Any minor effects would in any case be masked by the influence of the adjoining access road, for which impact reduction measures specific to road development would be undertaken in any case. The buried pipe easement will not significantly alter the flow patterns of Paralana Creek.

Vegetation regrowth

Although access roading will have been cleared prior to construction of the pipe, it may still be necessary to clear a narrow strip adjacent to the road easement for the pipeline trench. If required, this easement would be no greater than 2 m wide, in addition to the 15 m wide road easement. Plant material and topsoil removed from the trench line will be put aside for subsequent respreading over the completed trench. Pipelaying impacts will be minimised by utilising the access road as the pipe construction/service track.

The main impact will be on Mitchell grass communities, with minor areas of chenopod shrubland and hopbush (*Dodonaea viscosa*) communities also affected. The crossing of the one major drainage line, at Paralana Creek, will not significantly add to the relatively minor impact on fringing woodland already imposed by the access road construction. The crossing point for the latter was selected to minimise long-lived tree and tall shrub removal, in a fringing community which is itself discontinuous. Respreading of material cleared for the trench construction is expected to lead to a rapid rehabilitation of the line.

Alien species

It is not expected that the construction and installation of the gas pipeline will introduce new alien species to the Beverley region. However, workers are not permitted to bring plants into the region, and drivers of vehicles will be required to remove any excess soil and plant debris from their vehicles prior to entering the area.

Fauna

The pipeline trenching, while linearly extensive, modifies only a very small total net area of habitat, and with rehabilitation will be largely a transient impact. Construction and filling will be progressive. Where long sections of trench await pipelaying, some ramping will be provided to reduce the pitfall effect of the trench. After infilling, residual impacts on fauna are expected to be minimal, if any.

Cultural

A survey of the area of the Paralana Creek crossing was made in detail as this area was known to have previous camp locations. It has been possible to establish a layout of the proposed pipeline route without impinging on these features.

The only evidence of non-indigenous occupation of the Beverley mine site relates to the pastoral use of the land, holding no historic value. Installation of the proposed pipeline will, therefore have no impact on the European heritage of the area.

Waste management

All solid wastes generated by the construction and installation of the gas pipeline will be held at the construction site in mini-skip type waste containers. The contents of the skips will be inspected routinely, and when full will be transferred to the proposed sanitary waste disposal facility at the Beverley Uranium Mine site.

The only liquid wastes generated by the construction and installation of the pipeline will be sewage, which will be collected in temporary transportable toilets. The sewage collected in the toilets will be disposed to the Beverley Uranium Mine site septic system if required.

10. ENVIRONMENTAL MANAGEMENT ON COMPLETION OF WORKS

Before land disturbance or the construction of the proposed pipeline is initiated, a visual inspection of the area will be undertaken by Heathgate Resources environmental personnel. A written authority to undertake the specified activities will be prepared which documents the conditions under which the activities would operate (to minimise the impact of disturbance and so facilitate rehabilitation). The conditions of a written authority to proceed will include, where appropriate:

- retention of vegetation;
- re-direction of development to minimise disturbance;
- stockpiling of vegetation and topsoil where appropriate for re-use on rehabilitation areas.

Rehabilitation

The objectives of the rehabilitation will be to rehabilitate the disturbed trench areas and to ensure the long-term viability of rehabilitated areas. The process of achieving these objectives includes:

- rehabilitating areas disturbed by trenching activities, once they have been backfilled;
- conducting a monitoring program to quantify the effectiveness of rehabilitation.

Rehabilitation planning will commence when areas are first disturbed. Both passive and active methods of rehabilitation will be used where appropriate. Passive methods will be used in small areas of minor disturbance, where nearby plants provide some shelter and seed for the area being rehabilitated. Active methods will be used where the rehabilitation area is larger or disturbance more pronounced. Rehabilitation will, if necessary, include any or all of the following:

- site cleanup to remove construction solid wastes;
- re-spreading of topsoil over bare surfaces with landscaping/shaping of the soil;
- surface scarifying or ripping where appropriate or necessary;
- supplementary seeding using locally collected seed or respreading of stockpiled vegetation.

The rehabilitated soil surface will reflect the natural topographic and geological forms of the surrounding area. The soil will be allowed to re-vegetate to minimise soil erosion by wind and rain, and so that the rehabilitated trenches have an erosion rate lower than that of the surrounding land.

Monitoring

Ongoing monitoring of the effectiveness of rehabilitation techniques, and in determining indicative erosion rates, will be carried out each year during the spring months, and will involve the monitoring of quadrats along the trench and of control sites on undisturbed areas. Rehabilitation will be deemed to be complete when 80 % of the total cover of perennials calculated from control sites in the relevant association is achieved. Rehabilitation sites to be deemed complete must also have 80 % of the cover provided by the dominant perennial species surrounding the disturbed area in the equivalent landform type. When criteria are met the sites are removed from the rehabilitation monitoring program.

Other monitoring will be undertaken as directed by the relevant governmental authority.

Auditing

An environmental audit of the completed pipeline trench will be undertaken to assess the effectiveness of the environmental management program. This audit will include the:

- observation of unauthorised tracks;
- removal of tracks and vehicle turnouts by scarification;
- removal of all campsites and toilet facilities;
- removal of all construction wastes;
- scarification and or ripping of the cleared trenched area;
- respreading of topsoil and vegetation on the cleared trenched area;

The environmental audit is scheduled to occur one calendar month after the completion of the pipelaying activities

11. REFERENCES

AS2885.1—1997: *Pipelines—Gas and liquid petroleum: Design and construction.*

AS 2885.2—1995: *Pipelines—Gas and liquid petroleum: Welding*

AS2885.3—1997: *Pipelines—Gas and liquid petroleum: Operation and maintenance*

Heathgate Resources, 1996: *Declaration of Environmental Factors for Exploration Drilling Programs*

Heathgate Resources, 1997a: *Declaration of Environmental Factors for Drilling and Pump Testing in the Central and North Beverley Areas*

Heathgate Resources 1997b: *Declaration of Environmental Factors for the establishment and operation of a Field Leach Trial*

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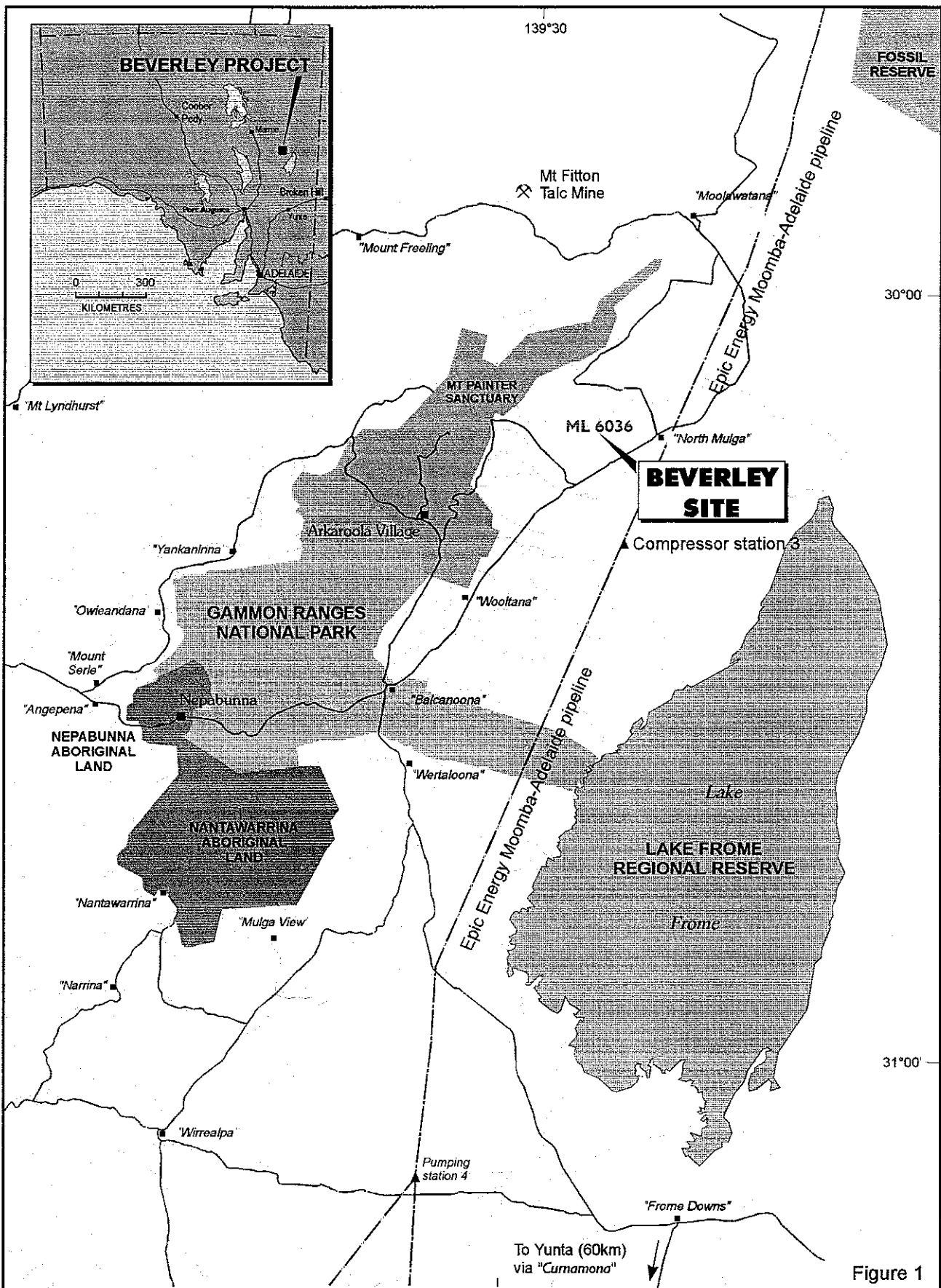
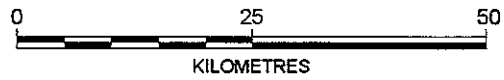


Figure 1



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**Beverley Uranium Project
Regional location plan**

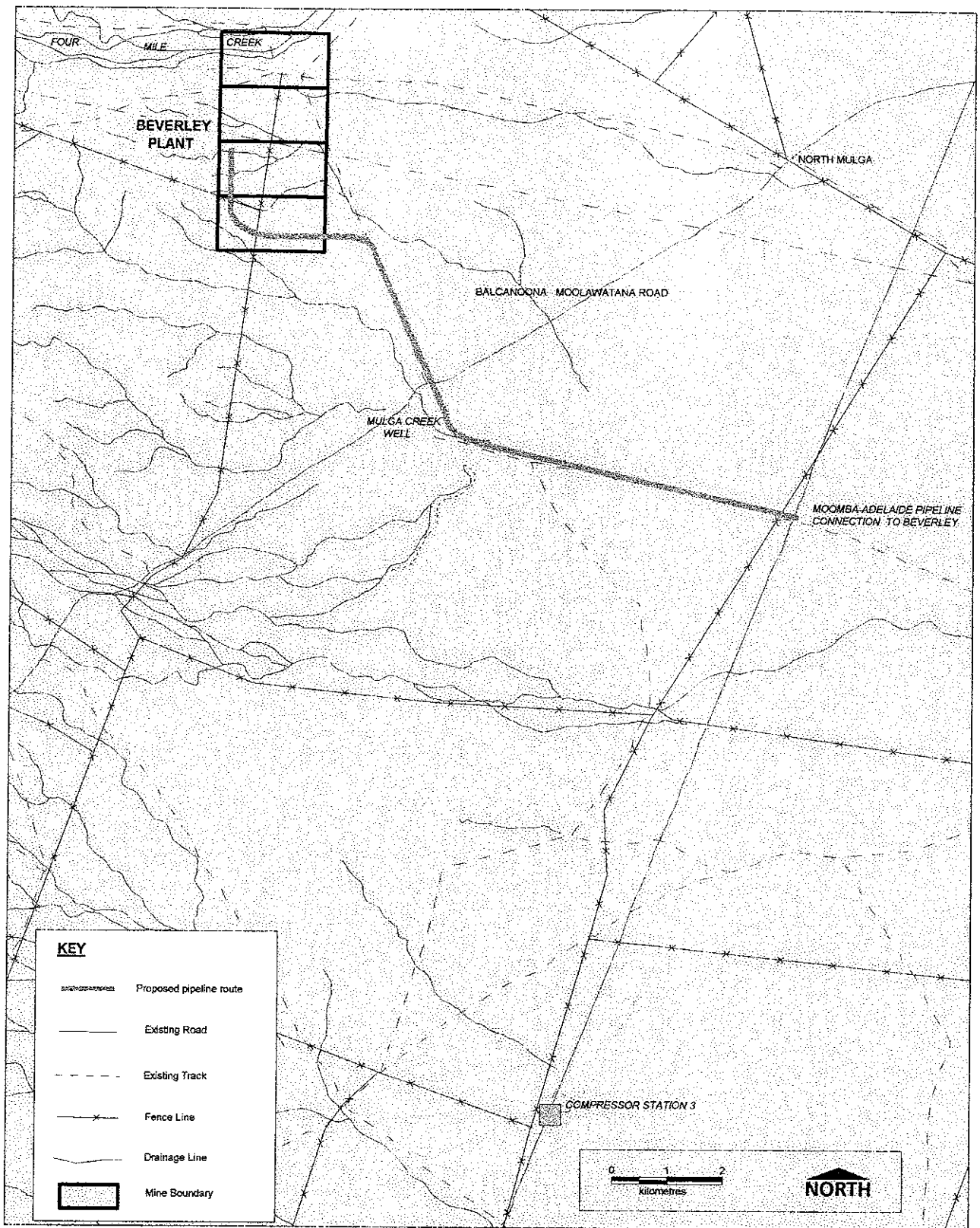


Figure 2 Proposed pipeline route