

APPENDIX C
Groundwater Resource Assessment by EWLS

Appendixes to this report are not included.

Appendix available on request.



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Groundwater Resource Assessment - Construction of Bonaparte Gas Pipeline

for

EcOz Environmental Services Pty Ltd

by

EWL Sciences Pty Ltd

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EXECUTIVE SUMMARY

Australian Pipeline Trust (APT) is proposing to construct and operate the Bonaparte Gas Pipeline (BGP) from the Blacktip gas plant facility at Wadeye to the Amadeus Basin - Darwin Gas Pipeline (ADP) at Ban Ban Springs, located 275 km to the north-east. Pipeline construction is likely to commence in 2008 from Ban Ban Springs.

Water is required for two purposes:

1. potable water is needed for up to two construction camps, estimated at 75 kL/day (300 persons using 250 L/day/person); and
2. non-potable water is needed for hydrotesting of the pipeline and as dust control/track maintenance.

A geological and hydrogeological data evaluation has been undertaken to determine groundwater availability along the pipeline route and develop a strategy for the provision of water supplies.

Data have been collated and assessed to determine the adequacy of groundwater resources along the route of the proposed pipeline. Groundwater availability along the proposed pipeline route has been segmented into four zones, reflecting the variability of groundwater conditions.

The assessment has identified bores that should provide sufficient groundwater to meet APT's water requirements along most of the length of the proposed pipeline.

Site reconnaissance and specific bore testing will be required east of Palumpa (RN31978) to confirm bore access, bore condition, groundwater sustainability and water quality.

INTRODUCTION

1.1 PROJECT DESCRIPTION

Australian Pipeline Trust (APT) is proposing to construct and operate the Bonaparte Gas Pipeline (BGP) from the Blacktip gas plant facility at Wadeye to the Amadeus Basin - Darwin Gas Pipeline (ADP) at Ban Ban Springs, located 275 km to the north-east. The BGP will transport treated gas from the gas plant to supply fuel for Power and Water Corporation's electricity generation facilities. ENI Australia (ENI) is proposing to bring gas and condensate onshore from the Blacktip Gas Field via a pipeline to the gas plant facility, located approximately 12 km west of Wadeye (Port Keats).

Construction is likely to commence from the Ban Ban Springs end in 2008. Water is required for two purposes:

1. potable water is required for up to two construction camps, estimated at 75 kL/day (300 persons using 250 L/day); and
2. non-potable water is required for hydrotesting of the pipeline as well as dust control/track maintenance.

Hydrotest water (about 5 ML, pumped in at 40 L/s) would initially be required near Ban Ban springs. Depending on the availability of water along the pipeline route, it is possible that the initial volume could be moved westward through the pipeline for re-use. Dust control/track maintenance would require about 100 kL/day (ideally available every 20 km or less).

The NT Government has indicated that groundwater resources in the Wadeye area require a high level of protection, given that groundwater quality is good and because they are utilised by the Wadeye community and surrounding outstations.

1.2 STUDY OBJECTIVE

Determine water availability along the pipeline route and develop a strategy for the provision of water supplies.

1.3 AVAILABLE DATA

The following data were collated and assessed:

- bore testing reports;
- drilling data / bore completion reports;
- regional geology & hydrogeology maps;
- NRETA reports; and
- groundwater levels and water quality data.

With the exception of groundwater level data from NT Government monitoring bores, there are no data available that confirm the long-term sustainability of groundwater resources.

2 GEOLOGY

2.4 WADEYE REGION

The key geological/aquifer unit in the Wadeye region is the Hyland Bay Formation, which dips to the west and is of Upper Permian age (Laws & Brown, 1976). The unit is about 400 m thick and was deposited in a deltaic environment during a period of marine transgression. The extent of the unit is shown in dark green in Figure 1.

Overlying the Hyland Bay Formation are undifferentiated sediments that have been heavily leached/altered to form a blanket cover of laterite and laterised clays and sandstones (Jamieson, 1991).

The uppermost sediments (in the Hyland Bay Formation) comprise weathered, fine to coarse, clean to clayey sandstone and rounded quartz gravels with interbeds of clay and siltstone. Fracturing within the Hyland Bay Formation sedimentary deposits has resulted in the development of secondary permeability and highly permeable dual-porosity aquifers. These aquifers have been intersected by a number of bores and used as a water supply source by the Wadeye community (Jamieson, 1991). The aquifers are semi-confined to semi-unconfined, with pumping typically resulting in a delayed yield from surrounding sediments (Jamieson, 1991).

The lowermost sediments comprise pink to dark grey clays which are at least 50 m thick. This clay unit sub-crops immediately to the east of Wadeye.

2.5 PEPPIMENARTI-NAUYIU REGION

The oldest geological units in the region are Archaean and Early Proterozoic igneous and metamorphic, undifferentiated rocks shown in orange in Figure 1. Mid-Proterozoic siltstones, sandstones and dolomites overlie these rocks. Both these units form the escarpment rocks.

Overlying the Proterozoic sediments are Cambrian Limestone units of the Daly River Group, shown in purple in Figure 1.

2.6 HAYES CREEK REGION

The geology of the Hayes Creek region is characterized by the presence of a complex of Proterozoic rocks of the Pine Creek Geosyncline and Archaean basement. Rocks include sandstones and siltstones of the Tolmer Group and greywackes, siltstones and shales of the Burrell Creek and Wildman Siltstone and siltstones, cherts and shales of the Mount Bonnie and Koolpin Formations (based on the 1:250,000 *Hydrogeology of the Pine Creek Region* map).

South of Hayes Creek, basin limestone units (Oolloo and Tindal Limestone) of the Daly River Group are present.

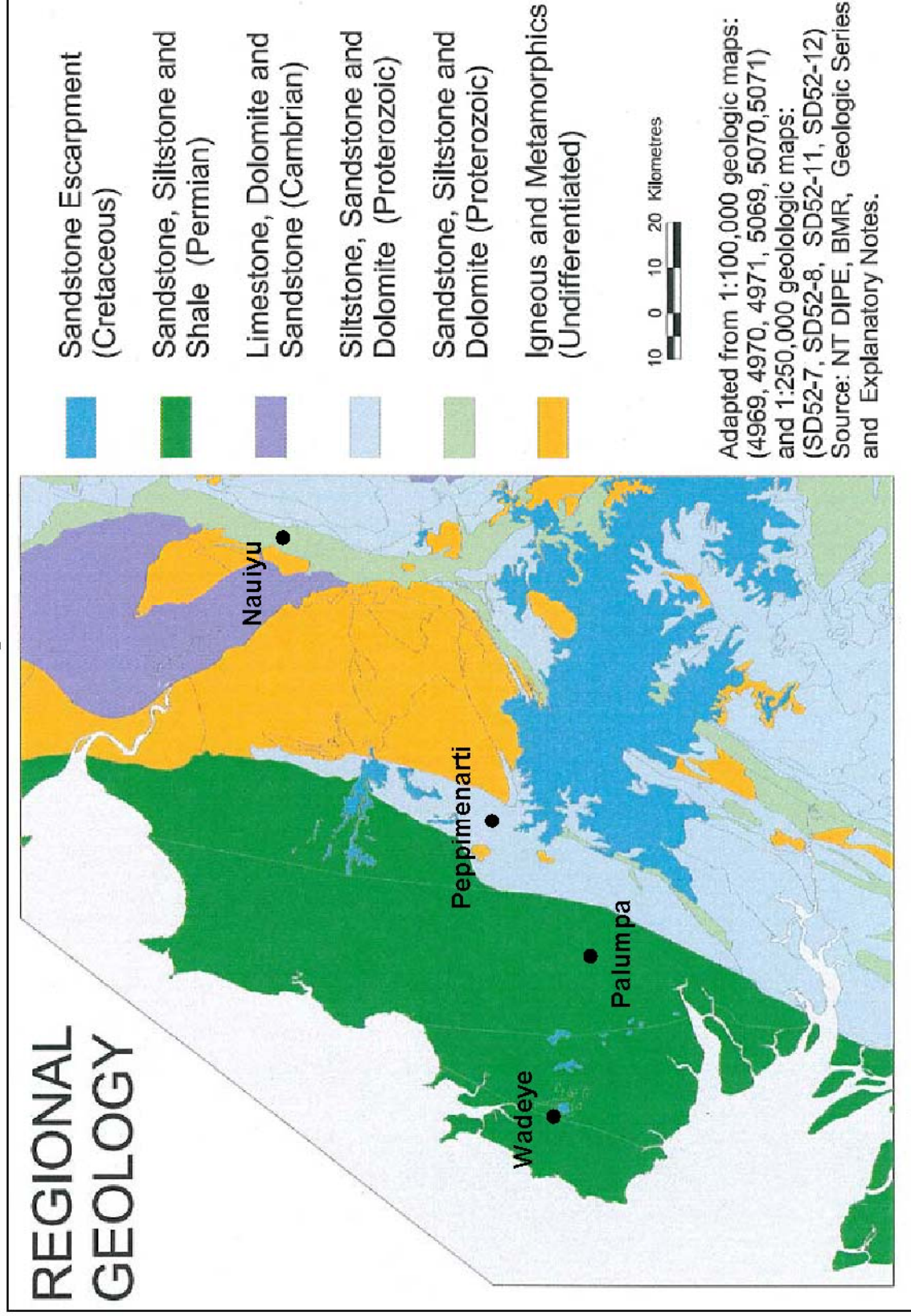


Figure 1 - Simplified Regional Geology (adapted from Haig & Matsuyama, 2003)

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3 HYDROGEOLOGY

3.1 WADEYE REGION

The hydrogeology of the Wadeye region is well understood. Long-term groundwater pumping and monitoring data at Wadeye and surrounding communities has enabled a groundwater map of bore supplies to be developed (Figure 2).

The Hyland Bay Formation, shown as *dark blue* in Figure 2, contain aquifers where there is a 'good chance' of drilling a bore that yields 5 L/s and a 'moderate chance' of drilling a bore that yields 10 L/s. However, bore yields are very inconsistent and vary between 0.5 and 22 L/s (Haig and Matsuyama, 2003). These aquifers provide groundwater for the community of Wadeye (1,300 kL/day) and the outstations of Ditchi, Nangu, Kuduntiga, Ngardiniitchi, Old Mission, Kuy and Yedderr (Haig and Matsuyama, 2003). Water quality in these aquifers is usually good.

Water supplies for the Wadeye community are sourced from production bores 70/2, 70/3 and 78/1 and the NT Government (Department of Natural Resources, Environment and the Arts, NRETA) currently monitors WR90/1 to 6 and WR90/8-14, WR90/4, 5, 9, 10 & 11 (Figure 3). Based on hydrograph data, groundwater levels are typically less than 5 m from surface (ie shallow) and show wet-dry season fluctuations of around 2 to 3 m each year. A summary of bore completion information is contained in Appendix A.

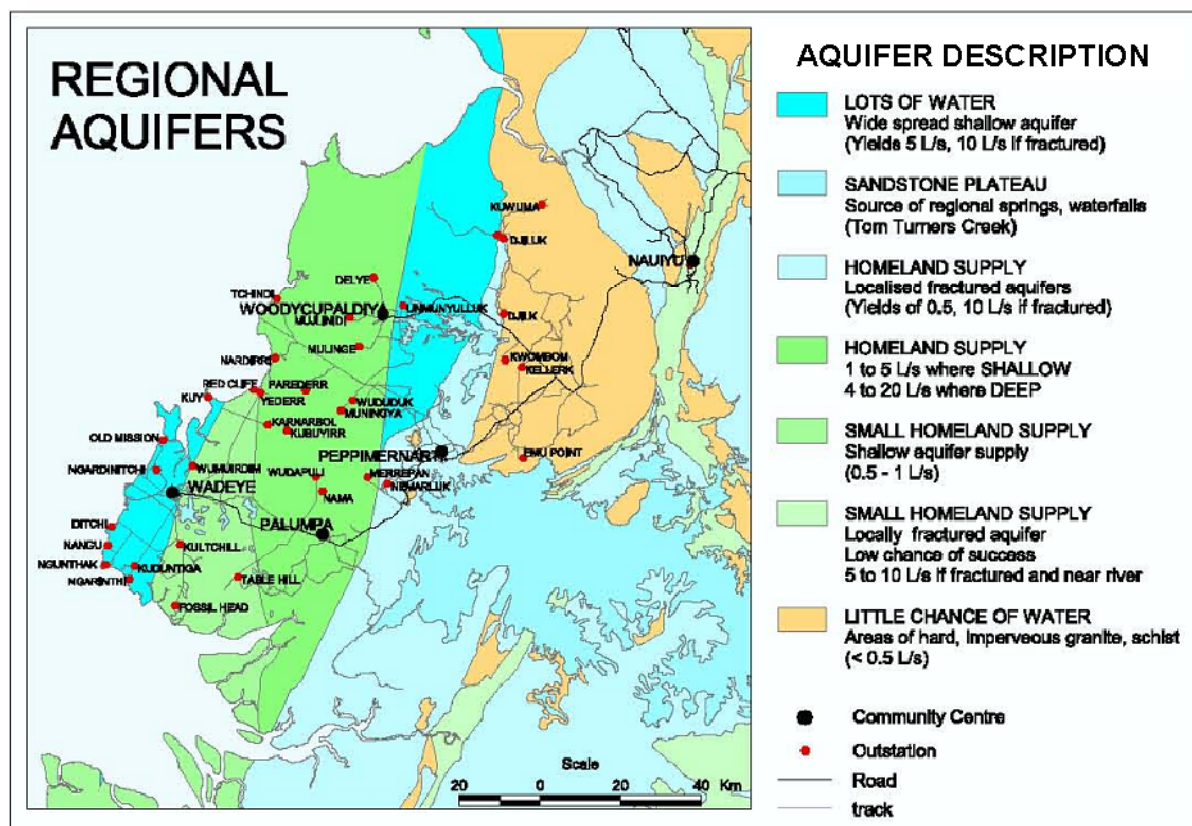
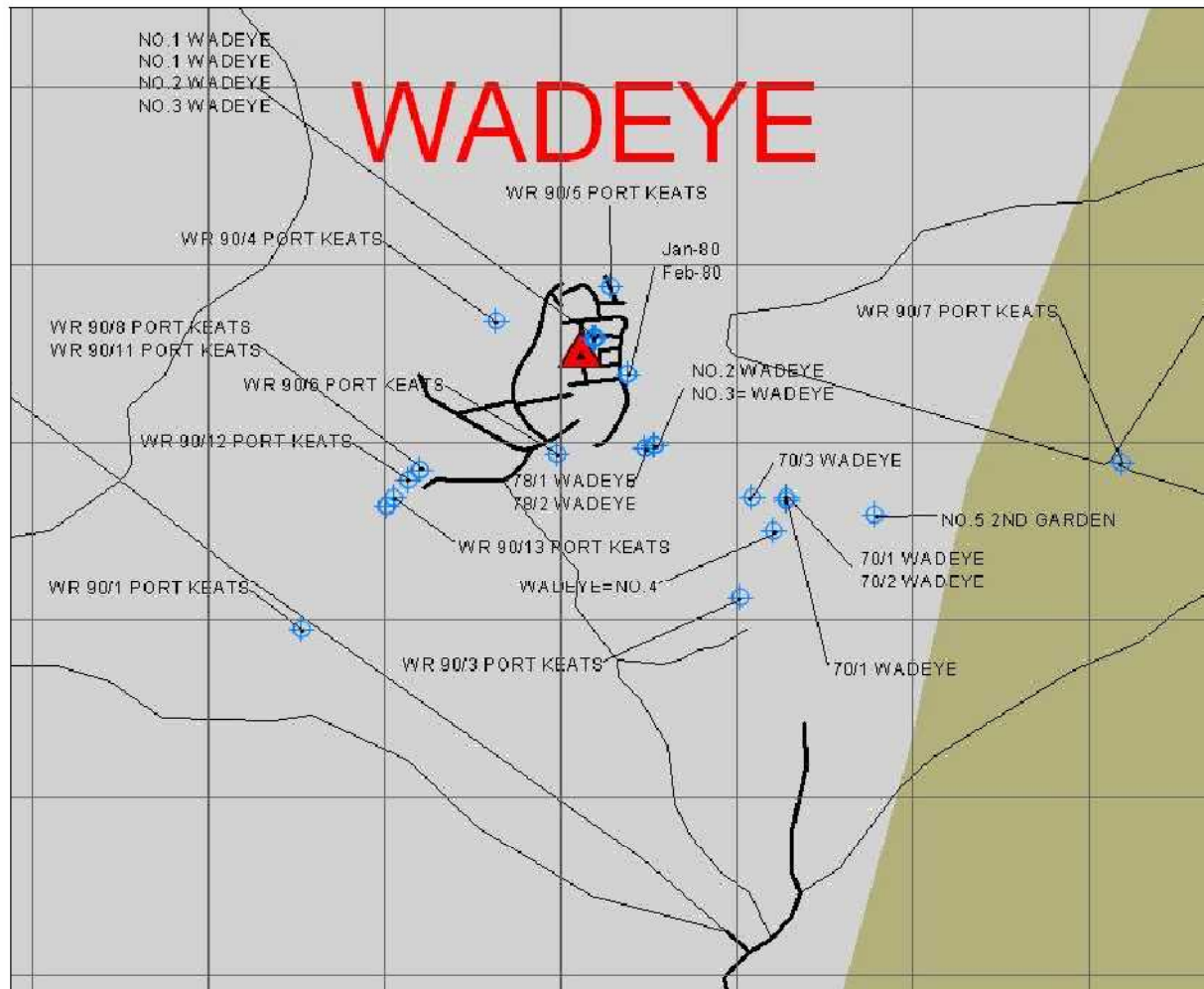


Figure 2 - Regional Water Availability (adapted from Haig & Matsuyama, 2003)



Note: information in figure is based on data provided by NRETA; each square is 1 km by 1 km.

Figure 3 - Locations of Community/Outstation Bores in the Wadeye Region

3.2 PEPPIMENARTI-NAUYIU REGION

With the exception of areas where Archaean basement outcrop (shown in *yellow* in Figure 2), groundwater yields from bores are highly variable. The *medium green* areas immediately to the east of Wadeye represent areas where low yielding supplies (of up to 1 L/s) can be obtained from shallow sandstone and siltstone aquifers (eg RN023256, RN020228, RN033300 – refer to Appendix A).

The *pale green* and *pale blue* regions are areas where bores are likely to encounter aquifers if fractured rocks are intersected, with groundwater yields of between 0.5 and 10 L/s typical (eg RN032939, RN028355 – refer to Appendix A).

3.3 HAYES CREEK REGION

According to the 1:250,000 *Hydrogeology of the Pine Creek Region* map, high yielding groundwater bores have been constructed in fractured siltstones, cherts and shales of the Mount Bonnie and Koolpin Formations and adjacent chert/tuffaceous deposits, in the South Howley and Cosmo Howley mining areas north-west of Hayes Creek. For example yields of 5.0, 10.1 and 6.25 L/s at bores RN022642, RN020788 and RN026241, respectively (Appendix A).

Lower yielding bores have also been constructed to the east of Hayes Creek in siltstones and shales of the Burrell Creek and Wildman Siltstone formations. For example yields of 1.25 and 3.0 L/s at bores RN003842 and RN025004, respectively (Appendix A).

Based on a search of the NRETA reports database, and with the exception of an early report by Verma (1989), there are no hydrogeological reports available describing hydrogeological conditions in the Hayes Creek region.

3.4 BORES LOCATED CLOSE TO THE PIPELINE ROUTE

Bores situated within 10 km of the proposed pipeline route are presented in Figure 4. Summary construction details for these bores are contained in Appendix A. It shows bores are concentrated at Wadeye, Palumpa and Nauiyu and Hayes Creek communities.

Data indicate that there are significant numbers of groundwater bores located close to the proposed pipeline route. However, the absence (mostly) of bore testing and/or ongoing monitoring data means that it is difficult to determine the likely bore yields and performance of the bores over time. Site reconnaissance together with local knowledge will be required to confirm that the bores can be accessed and utilised.

Bores located within 10 km of the pipeline route, which are likely to intersect aquifers and are located at regular intervals along the pipeline route, are presented in Figure 5. The bore construction details and water quality data are contained in Table 1 and Table 2, respectively.

Although there are two boreholes that are characterised by mildly low pH (ie 4.5 and 5.5), overall pH values are circum-neutral with low electrical conductivity and solute concentrations. These data indicate that groundwater from bores along the proposed pipeline route would appear to be of potable quality, although this needs to be confirmed.

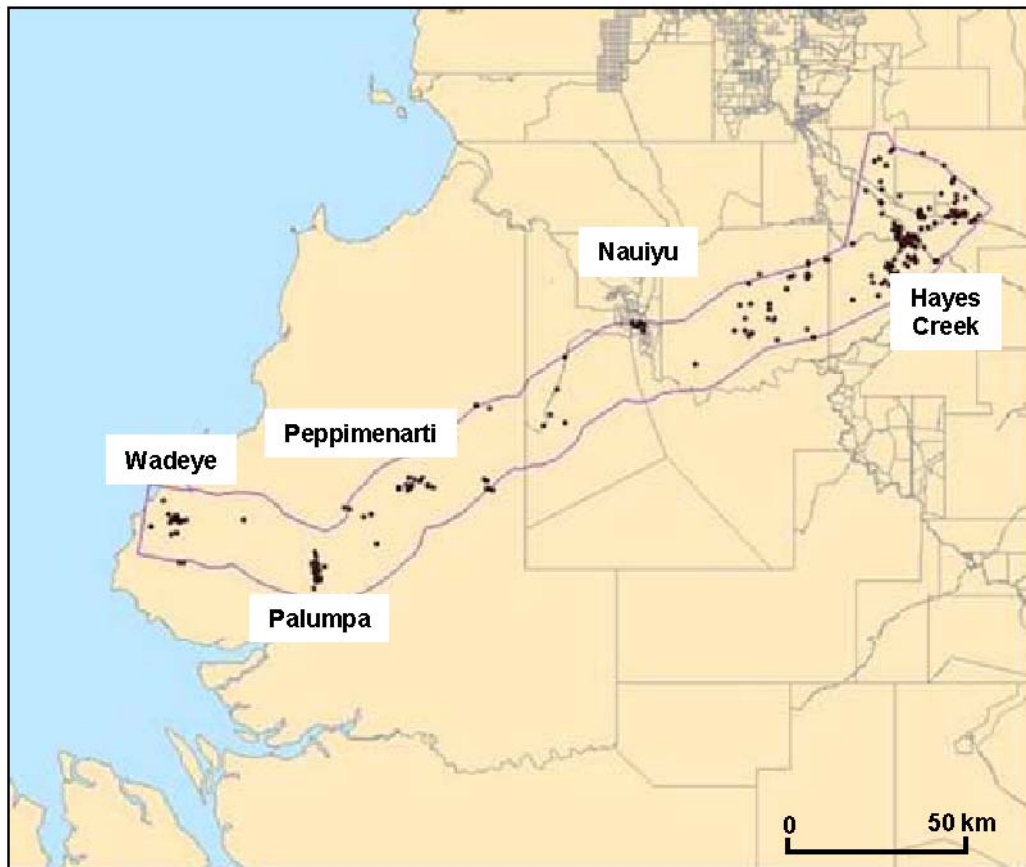


Figure 4 – Bores located within 10 km of the pipeline route

Four zones of similar hydrogeological conditions and groundwater availability have been identified (Figure 5). A summary of key information, for bores proposed to be used, is contained in Table 3.

Zone 1: Wadeye to Palumpa

High yielding bores RN31978, RN31979 and RN31980 were recently constructed by the Department of Planning & Infrastructure – Construction Division (DPI). Airlift data (Table 3) indicate that groundwater supplies should be more than adequate to meet APT requirements along this section of the pipeline.

Zone 2: Palumpa to Emu Point (outstation)

Low to moderate yielding 'community' bores (RN23285, RN27325 and RN32939) exist in this zone. These bores screen Proterozoic sandstones, siltstones and quartzites.

Zone 3: Emu Point (outstation) to Nauiyu

Although there are few bores in this zone, a low yielding community bore has been identified at Kellerk Outstation (RN33300). Other bores (RN20651-3) have been identified but bore construction and groundwater yield data are unavailable. Bore RN33300 intersect Proterozoic schistose and gneissic rocks including quartz and quartzite.

Zone 4: Nauiyu to Hayes Creek

Moderate to high yielding bores (RN28238, RN05921, RN005849 and RN001434) were identified within this zone. Other bores at Brocks Creek and Cosmo Howley may also be used (eg RN25519, RN25523 and RN22642, Appendix A).

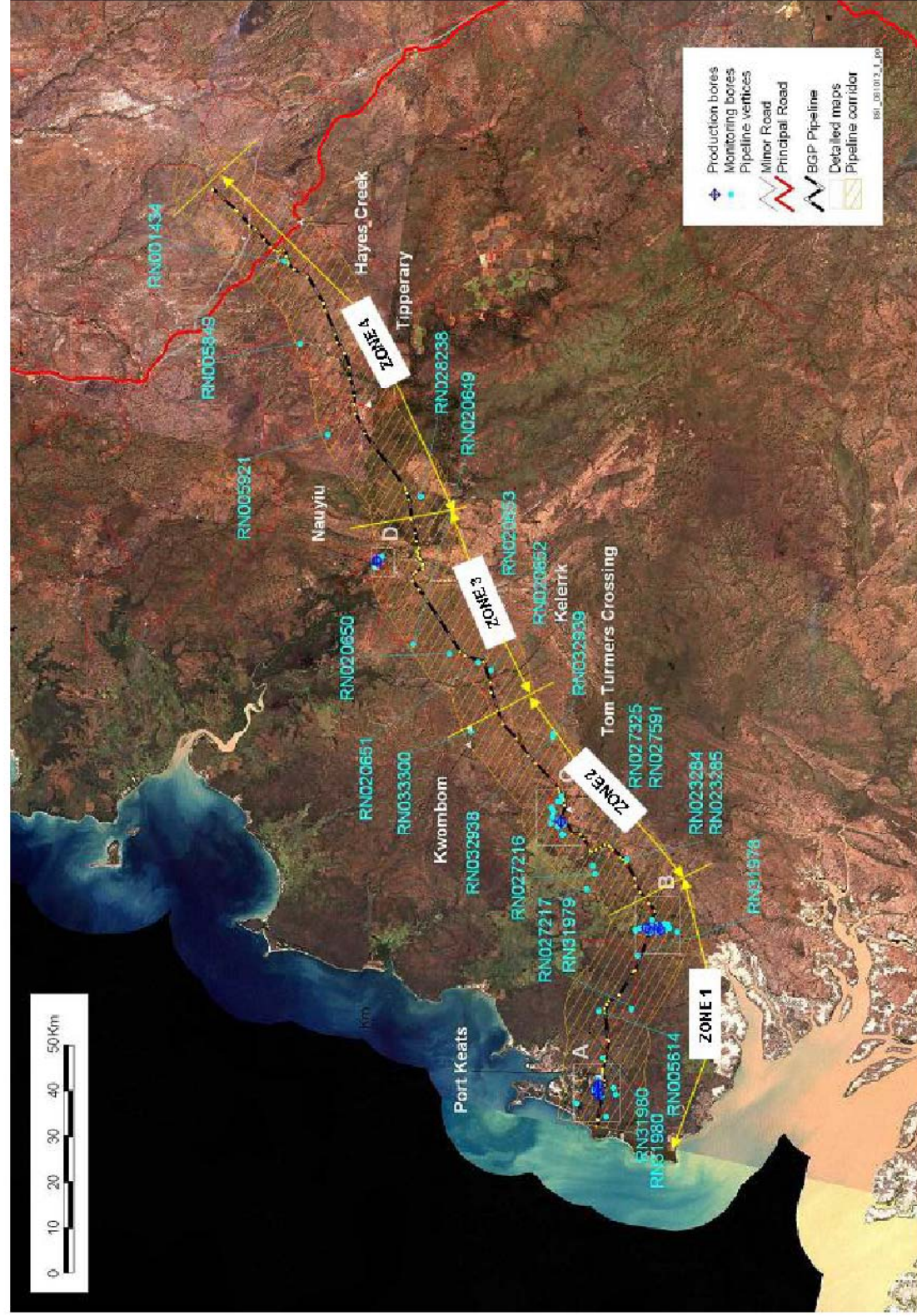


Figure 5 - Key Groundwater Bores (located within 10 km of the pipeline route)

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Table 1 – Summary of Key Bore Drilling and Construction Data

BORE NO.	BORE NAME	EASTING	NORTHING	LOCALITY	GENERAL LITHOLOGY	CASING	SWL (m)	YIELD (L/s)	DRILL DEPTH (m)	BORE DEPTH (m)	COMPLETED DATE	Test Pumping / Comments
RN001434	ARMY NO.312 FENTON AIRSTRIP	756,380	8,500,961	FENTON AIRSTRIP TIPPERARY 5170	NA	NA	NA	2.5	NA	NA	NA	
RN005614	NO.4 MISSION WADEVE	575,131	8,424,761	WADEVE	NA	125mm nom diam	9	NA	30	0	30-Sep-86	
RN005849	CLAREY BORE D.B. NO.1 TIPPERARY STATION	736,480	8,497,261	TIPPERARY STN TIPPERARY 5170	NA	NA	NA	8.8	NA	NA	NA	
RN005921	D.B.3 CAMP BELLS BORE TIPPERARY STATION	714,330	8,490,711	TIPPERARY STN DALY RIVER 5070	NA	NA	NA	25	NA	NA	NA	
RN020649	T.P.D.7 MOBIL ENERGY MINERALS AUST.	663,631	8,470,161	MOBIL ENERGY MINERALS AUST.	NA	"capped"	5	NA	20.0	20.0	22-Oct-80	
RN020650	MOBIL ENERGY TPPD 11 ELIZABETH DOWNS STN	661,431	8,461,261	ELIZABETH DOWNS STN	NA	"capped"	10	NA	NA	NA	07-Jan-81	
RN020651	MOBIL ENERGY TPPD 15 ELIZABETH DOWNS STN	659,331	8,454,161	ELIZABETH DOWNS STN	NA	"capped"	5	NA	NA	NA	07-Jan-81	
RN020652	TPPD 19 MOBIL ENERGY - DALY BASIN	667,441	8,450,961	MOBIL ENERGY - DALY BASIN	NA	"capped"	14	NA	NA	NA	02-Dec-80	
RN020653	MOBIL ENERGY TPPD 22 ELIZABETH DOWNS STN	663,331	8,451,661	ELIZABETH DOWNS STN	NA	"capped"	12	NA	25.0	25.0	02-Dec-80	
RN023284	1/84 P APANGALUA O.S.TN.	611,481	8,417,861	P APANGALUA O.S.TN.	Siltstone and quartzite	168mm diam	10.70	2.0	75.5	75.5	10-Oct-84	step-tested, constant-rate tested @ 2L/s for 8hrs; recommended pump rate of 1.5 L/s; bore decommissioned
RN023285	2/84 P APANGALUA O.S.TN.	611,481	8,417,851	P APANGALUA O.S.TN.	Siltstone and quartzite	168mm diam	12.25	2.0	64.5	64.3	11-Oct-84	
RN027216	WR 9071 NEWARLUK WADEVE	608,031	8,425,561	WADEVE	Shale, with clay and sandstone	backfilled	NA	seepage	94.2	94.2	06-Oct-90	
RN027217	WR 9071 MADAPAN WADEVE	604,331	8,427,761	WADEVE	Sandstone and shale	200mm nom diam	NA	NA	73.3	73.3	08-Oct-90	
RN027325	WR 902 NEWARLUK WADEVE	609,981	8,426,261	WADEVE	Sandstone & clay, quartzite	150mm nom diam	9.90	0.7	26.3	26.3	21-Nov-90	step-tested, constant-rate tested @ 0.52L/s for 5hrs; recommended pump rate of 0.4 L/s; bore decommissioned
RN027591	WR 9171 NEWARLUK PORT KEATS	609,981	8,426,211	PORT KEATS	Quartz sandstone	150mm nom diam	5.10	0.6	19.0	18.6	21-Jun-91	step-tested, constant-rate tested @ 0.13L/s for 3hrs; recommended pump rate of 0.1 L/s; bore decommissioned
RN028238	GEOP EKO STOCK BORE TIPPERARY STATION	699,330	8,468,011	TIPPERARY STATION DALY R. 5070	Shale	150mm nom diam	4.80	3.0	24.0	24.0	23-Oct-93	
RN031978	TBA	588,226	8,415,091	PALUMPA				8.0	TBA	TBA	SEP 06?	
RN031979	TBA	575,510	8,416,566	MIDWAY WADEVE PALUMPA				5.0	TBA	TBA	SEP 06?	
RN031980	TBA	563,752	8,423,756	WADEVE				5.0	TBA	TBA	SEP 06?	
RN032938	NA	641,246	8,435,944	EMU POINT OUTSTATION	Quartzite/Granite	200mm nom diam	2.03	seepage	71.2	0.0	03-Oct-01	
RN032939	NA	642,034	8,435,719	EMU POINT OUTSTATION	Quartz, Quartzite/Granite	200mm nom diam	7.44	1.25	27.6	27.3	03-Oct-01	step-tested, constant-rate tested @ 2L/s for 8hrs; recommended pump rate of 1 L/s
RN033300	NA	642,633	8,456,113	KELLERK OUTSTATION	Schist w/ quartz & quartzite, gneiss	200mm nom diam	10.60	0.50	30.8	30.4	05-Oct-01	step-tested, constant-rate tested @ 0.8L/s for 8hrs; recommended pump rate of 0.7L/s

Notes:
1. no gamma logs on all bores
2. bores are currently not monitored
3. all bores are located in Zone 52, datum is MG494

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Table 2 – Bore Water Quality Data

BORE NO.	BORE NAME	Date Sampled	Field pH	Field EC	pH	EC	TDS	Na	K	Ca	Mg	Fe	Total Hardness (as CaCO ₃)	Total Alkalinity (as CaCO ₃)	Silica (SiO ₂)	Cl	SO ₄	Bicarbonate (HCO ₃)	F	NaCl
RND05614	NO.4 MISSION WADEYE	28-Sep-01			5.60	43	45	4	2	<1	<1		<1	<1	29	4	<1		<0.1	7
RND0649	T.P.D.7 MOBIL ENERGY MINER	29-Sep-01			7.50	673							275	320		14		390		22
RND0650	MOBIL ENERGY TPPD 11 ELIZAB	30-Sep-01			6.70	133							34	55		6		67		8
RND0651	MOBIL ENERGY TPPD 15 ELIZAB	01-Oct-01			7.20	463							174	200		6		244		
RND0652	TPPD 19 MOBIL ENGERY - DALY	02-Oct-01			6.90	433							84	178		12		217		20
RND0653	MOBIL ENERGY TPPD 22 ELIZAB	03-Oct-01																		
RND03264	1/84 PAPANGALA O/STN.	28-Nov-84	NA	140	8.20	97	80	5	7	3	4	7	24	38	27	2	4	46	0	3
RND03265	2/84 PAPANGALA O/STN.	19-Dec-84	NA	NA	6.10	103	75	6	5	3	5	8	29	39	37	2	2	47	0	3
RND07216	WR 90/1 NEMARUK WADEYE												not available							
RND07217	WR 90/1 MADAPANI WADEYE												not available							
RND07325	WR 90/2 NEMARUK WADEYE	15-Jul-92	7.40	30	5.50	35	30	2	1	4	<1	1	10	10	10	5	1	<1	<0.1	8
RND07591	WR 91/1 NEMARUK PORT KEAT	25-Jun-91	7.80	32	4.60	23	15	1	<1	<1	<1	<1	<1	<1	1	4	<1	<1	<0.1	7
RND08298	GEOPEKO STOCK BORE TIPPER												not available							
RND031978	TBA												should become available once bore water sampled and tested							
RND031979	TBA												should become available once bore water sampled and tested							
RND031980	TBA												should become available once bore water sampled and tested							
RND032938	NA	14-Oct-01	7.54	138																
RND032939	NA	23-Oct-01	7.80	272	6.90	277	187	21	1	1.4	15	0	97	141	52	1	7	172	1	2
RND033300	NA	16-Oct-01	8.00	220	7.10	233	162	26	2	2.3	14	0.3	63.5	118.1	44	3	7	144	1	4.9

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4 DEVELOPMENT AND USE OF AVAILABLE GROUNDWATER RESOURCES

4.1 GENERAL APPROACH

The general approach to the development and use of available groundwater resources is to:

1. Identify existing groundwater bores that are located in close proximity to the proposed pipeline and have reasonable yields.
2. Conduct site reconnaissance to confirm access to the bores and bore condition. Consultations with bore owners to seek permission to draw water is required.
3. Bores which require specific hydraulic testing to ascertain more accurately hydrogeological properties, and hence confirm water supply rates, will need to be identified. Testing at some sites will need to be implemented to provide APT with a degree of assurance of supply availability.
4. In the event of insufficient groundwater resources at key points along the route, new locations for drilling investigations would be suggested.

4.2 APT WATER REQUIREMENTS

According to APT's water requirements, described in detail in Appendix C, pipeline construction water is required such that...*"The water sources should be relatively close to the construction area if possible, and be available at intervals not exceeding 40 kilometers... This yields a daily construction water requirement in the range of 240 cubic meters."* In addition, there is a requirement for camp (potable) water... *"These figures yield a camp water demand in the range of at least 50 and possibly 75 cubic meters of water per day. Current planning indicates that only two main camp locations will be required."*

4.3 STRATEGY

Using the available hydrogeological data and bore information, four zones of groundwater availability have been identified (Figure 5). A summary of key information, for bores proposed to be used, is contained in Table 3.

A proposed strategy for each zone is provided below:

Zone 1: Wadeye to Palumpa

APT should contact DPI (William Moodie ph 8999 4706) and formally request permission to use the high yielding bores RN31978, RN31979 and RN31980.

Other community water supply bores at Wadeye and Palumpa could also be used but would require negotiation with the respective community councils.

Zone 2: Palumpa to Emu Point (outstation)

On-site evaluation of bore access, condition and actual community use of bores RN23285, RN27325 and RN32939 is needed. Consent to use the bores will need to be negotiated with the Thanarrurr Regional Council (Geoff Thorne Municipal Services ph 8978 1088).

Field testing of these bores should also be undertaken to confirm water quality and that groundwater yields have not changed since initial construction.

Turkey's nest dams will need to be constructed to store water given that bore yields seem to be less than APT's water requirements.

Zone 3: Emu Point (outstation) to Nauyiu

Site reconnaissance is required to determine accessibility and condition of the identified bores (RN33300 and bores RN20651-3). If these bores are available, bore testing should be undertaken, otherwise access to water from production bores at Nauiyu Community would need to be negotiated with Thanarrurr Regional Council.

Turkey's nest dams will also need to be constructed to store water, given that bore yields are likely to be less than APT's water requirements.

Zone 4: Nauyiu to Hayes Creek

Moderate to high yielding bores (RN28238, RN05921, RN005849 and RN001434) were identified within this zone. These bores are mostly privately owned. Bores RN28238, RN05921 and RN005849 are situated on the Tipperary Station. Use of these bores would need to be negotiated with management (John Vereker/Rodney Illingworth ph 8978 2433). Site reconnaissance to inspect the condition of bores and access is required. Use of this bore or others on Department of Defence property would need to be negotiated with Philip Wright (Regional Development) or Ros Lague (Manager, Technical Services).

Table 3- Summary of Key Bore Location Information

BORE NO.	GENERAL LOCALITY	APPROX. PIPELINE CHAINAGE (KM)	APPROX. MINIMUM DISTANCE FROM BORE TO PIPELINE (KM)	AIRLIFT YIELD (L/s)	RECOMMENDED (MAXIMUM) PUMPING RATE (L/s)	BORE OWNERSHIP
RN031980	WADEYE	15.5	<1	5.0	NA	Dept. of Planning & Infrastructure (Construction Division)
RN031979	MIDWAY WADEYE-PALUMPA	29.6	4	5.0	NA	
RN031978	PALUMPA	39.4	<1	8.0	NA	
RN023285	PAPANGALA OUTSTATION	62.7	<1	2.0	1.5	Thanarrurt Regional Council
RN027325	NEMARLUK	71.8	3	0.7	0.4	
RN032939	EMU POINT OUTSTATION	97.2	7	1.3	1.0	
RN033300*	KELLERK OUTSTATION	109.2	7	0.5	0.7	Tipperary Station
RN028238	TIPPERARY STATION DALY R. 507	156.3	2	3.0	NA	
RN005921	TIPPERARY STN DALY RIVER 507	176.8	7	25	NA	
RN005849	CLAREY BORE D.B. NO.1 TIPPERARY	198.6	8	8.8	NA	Department of Defence
RN001434	ARMY NO.312 FENTON AIRSTRIP	217.6	<1	2.5	NA	

* possibly also 20651-3, site reconnaissance required

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5 CONCLUSIONS

To permit construction of the Bonaparte Gas Pipeline, available geological and hydrogeological data have been collated and assessed to determine the adequacy of groundwater resources along the route of the proposed pipeline.

The assessment has resulted in the identification of bores that should provide sufficient groundwater supplies to meet APT's water requirements along most of the length of the proposed pipeline.

Site reconnaissance and specific bore testing will be required east of Palumpa (RN31978) to confirm bore access, bore condition, groundwater sustainability and water quality.

6 REFERENCES

- Haig, T. and Matsuyama, A. 2003. *Wadeye/Nauiyu Water Study. Vol. 1 Water Resources of Wadeye (Port Keats) and Nauiyu (Daly River) Region, Main Report*. DIPE, Darwin, NT.
- Jamison, M. 1991. *Wadeye Groundwater Resource Evaluation, 1990-1991*. Power and Water Authority, Water Resources Division. Report 51/1991. September 1991.
- Laws, R.A. and Brown, R.S., 1976. *Bonaparte Gulf Basin – South Eastern Part*. In Leslie, Evans & Knight "Economic Geology of Australia and Papua New Guinea – 3. Petroleum. AusIMM, 1976.
- Northern Territory Government, 2005. *Blacktip Gas Project, Environmental Assessment Report and Recommendations*. Office of Environment and Heritage, Northern Territory Government. Assessment Report 50. October 2005.
- Verma, M., 1989. *Investigation of the South Alligator Group – Cosmo Howley Area*. DLPE report No. 07/89D. Water Resources Division. July 1989.

APPENDIX A – SUMMARY DETAILS OF BORE COMPLETION DETAILS

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Prepared for: EcOz Environmental Services
Prepared by: EWL Sciences Pty Ltd

December 2006
Job No 2-141

BORE NO.	BORE NAME	EASTING	NORTHING	LOCALITY	SWL (m)	YIELD (L/s)	COMPLETED DEPTH (m)	COMPLETED DATE
RN000334	RAAF NO.345 109 MILE STUART H/WAY	760330	8496360.9	109 MILE TIPPERARY 5170	18.2	0.38	0	
RN001192	HOMESTEAD WELL BAN BAN SPRINGS	771179.8	8519660.8	BAN BAN SPGS MCKINLAY RIV 5271	0	0	0	
RN005872	HOMESTEAD BORE ADV.13/67 BAN BAN SPRINGS	771179.8	8519660.8	BAN BAN SPGS MCKINLAY RIV 5271	6.3	1.2	21.3	19670901
RN007715	HOMESTEAD NO.2 BAN BAN SPRINGS	771179.8	8519660.8	BAN BAN SPGS MCKINLAY RIV 5271	6.4	11.9	30.5	19710725
RN006198	NO 3 ADV.15/67 BAN BAN SPRINGS	771829.8	8515360.8	BAN BAN SPRG MCKINLAY RIV 5271	21.3	0.8	31.7	19670801
RN025496	WB 3 BAN BAN SPRINGS	771729.8	8513660.8	BAN BAN SPRGS	19	1	42	19871117
RN024132	MAGNUM RESOURCES LTD BAN BAN SPRINGS	771429.8	8512860.8	BAN BAN SPRINGS	0	0	0	19850926
RN007714	A 69/71 BAN BAN SPRINGS	767729.9	8515710.8	BAN BAN SPRINGS BATCHELOR 5171	6.1	5	38.1	19710729
RN026323	BRITANIA BAN BAN SPRINGS STN	764479.9	8511410.8	BAN BAN SPRINGS BATCHELOR 5171	10.8	1.5	29	
RN026329	T. STARR BAN BAN SPRINGS STN	768379.8	8523660.7	BAN BAN SPRINGS BATCHELOR 5171	3.8	0	0	
RN026330	MAGNUM RESOURCES BAN BAN SPRINGS STN	771729.8	8513660.8	BAN BAN SPRINGS BATCHELOR 5171	0	0	22.1	
RN020018	SITE A/79 BAN BAN SPRINGS	771829.8	8515460.8	BAN BAN SPRINGS P.L.631	20	0.56	52	19791107
RN030684	WILD HORSE 4/96	762479.9	8526960.7	BAN BAN SPRINGS STATION	0	3	21.1	19960715
RN030685	HOWLEY 5/96	756279.9	8515210.8	BAN BAN SPRINGS STATION	0	1.5	26.5	19960717
RN026328	STARR T BAN BAN SPRINGS STN	770879.8	8518760.8	BAN BAN SPRINGS STN BATCHELOR	10.1	0	25	
RN026252	WHR 15 SITE 8 BAN BAN STN ROCHE BROS PTY LTD	774279.8	8514410.8	BAN BAN STN MCKINLAY RIVER	17.4	6.5	46	19880820
RN024149	NORTHERN GOLD BRIDGE CK	751330	8513310.7	BRIDGE CK	12	0.7	0	19850904
RN025574	MBENO 1 BRIDGE CREEK GOLD MINE	751110	8513340.7	BRIDGE CK MINE BATCHELOR 5171	5.4	3	43	19871001
RN025575	MBENO 1A BRIDGE CREEK GOLD MINE	751030	8513410.7	BRIDGE CK MINE BATCHELOR 5171	7.5	1.4	43	19871001

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