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EL 2542

ZADOWS HILL

ANNUAL AND FINAL REPORTS FOR THE PERIOD 26/8/98 TO 22/12/2000

Submitted by

Redfire Resources NL
2001

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PRIMARY INDUSTRIES AND RESOURCES SA

REDFIRE RESOURCES N.L.

ACN 009 423 858

EXPLORATION LICENCE 2542

MANNUM - MURRAY BASIN, SOUTH AUSTRALIA

Annual Report for 12 Month Period

to 25 August 1999

Distribution:

PIRSA	*2*
RFR Sydney	*1*
RFR Adelaide	*1*

Prepared by:
P. Blampain
August 1999

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1 Summary

Activities completed for Exploration Licence 2542 during this reporting period include:

1. Literature review and assessment of potential for this licence to host the marginal marine Loxton Sands sequence, known to be the host of heavy mineral deposits elsewhere in the Murray Basin
2. A field programme that included sampling roadcuttings and quarries to determine the presence of the Loxton Sands
3. Stereoscopic interpretation of aerial photographs to produce a photogeological map that outlined a number of sub parallel features which are interpreted to be buried palaeo shorelines
4. Digital elevation model interpretation to identify potential sedimentary traps for heavy mineral concentration and generate targets for drilling
5. Scout drilling programme prepared

2 Introduction

This is the first annual report by Redfire Resources NL on exploration for EL2542 and covers the 12 months to August 25, 1999. Redfire acquired this licence to explore for heavy mineral sands on the western margins of the Murray Basin.

This licence is considered prospective for the discovery of heavy mineral sands concentrations with a number of proximal discoveries reported to date. These include the Perponda, Mercunda and Mindarie deposits currently explored by Murray Basin Minerals NL (MBM) and RGC Ltd's Matilda prospect, all located to the east of the licence area. The target Loxton marine to marginal marine sands has been well documented in past exploration of this region of the Murray Basin. Recently MBM have announced further discoveries proximal to these deposits suggesting the presence of a 'nest' of strandline systems.

A literature search revealed a number of drill lines have been completed within the current tenure by Aberfoyle Resources Ltd. and BHP in the late 1980s and early 1990s, and that the stratigraphic sequence intersected further east by MBM and RGC is also present within this licence area.

REDFIRE RESOURCES N.L.
Murray Basin project - South Australia
Location of EL 2542

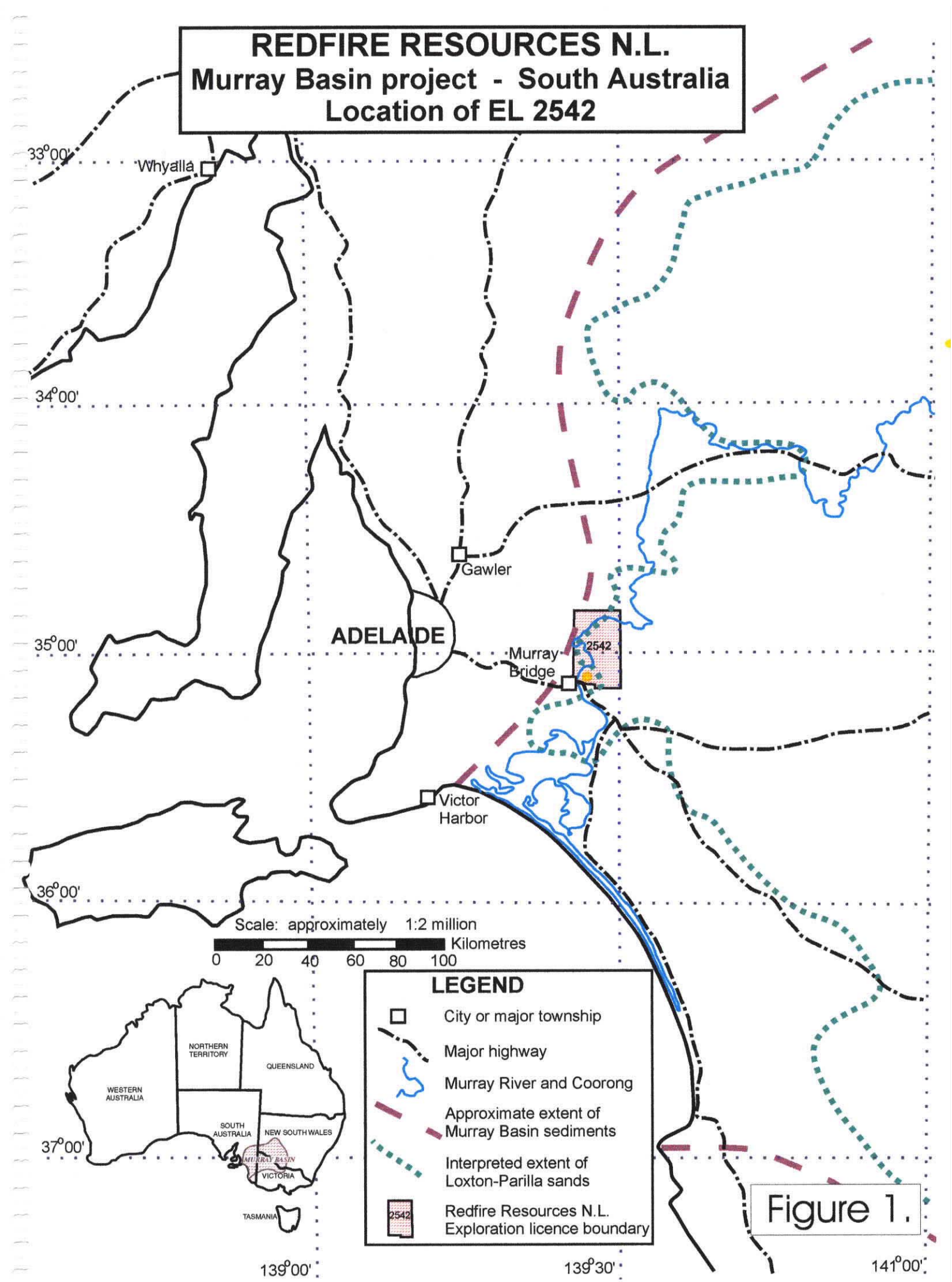


Figure 1.

3 Conclusions

- Previous drilling by Aberfoyle Resources and BHP has indicated widespread distribution of the target Loxton sands within the licence area, some of which recorded the presence of heavy minerals
- DTM imagery suggests there are significant geological features which may reflect the development of buried strandline systems, which do not appear to have been adequately tested during previous exploration phases
- Landsat images show 'ridge and swale' trend lines within the licence area, which may also reflect strandline systems
- proximal heavy mineral discoveries being evaluated by RGC and Murray Basin Minerals will determine the likely economic potential of mineral sand concentrations in the Mannum area
- the area was subject to the normal processes associated with the development of heavy mineral accumulations, as recognised elsewhere in the basin during the Tertiary Period.
- preliminary data suggests the areas east and west of the Murray River show a marked variation in thickness of cover above the Loxton sands, which reflects an influence of alluvial sediments shedding from the Adelaide Fold belt in the west onto this western margin of the Murray Basin
- drilling density within the licence area is insufficient determine if concentrations of heavy mineral sands are likely to be present

4 Tenure

4.1 Tenure and Location

Exploration Licence 2542 covers an area of 739 km^2 .The Murray Bridge township is situated in the southwestern corner of the licence area (Refer figure 1)

The licence is in its 1st year of grant with an anniversary date August 26.

The Adelaide (SI54-19) and Barker (SI54-13) 1:250 000 mapsheets, Mannum (6728) and Mobilong (6727) 1:100 000 mapsheets and Mannum (6728-2) and Mobilong (6727-1) 1:50 000 mapsheets cover the licence area

4.2 Access

Easy access is gained via the main arterial roads to and from the Mannum and Murray Bridge townships with a well developed network of minor roads. The licence area is dissected by the Murray River flowing from the northeast to the southwest.

4.3 Land use and Vegetation

Topographic relief is moderate with the area reflecting low undulating hills and larger flatlands. A wide distribution of sand dunes exists and the area is mainly used for agricultural purposes (grazing and cropping).

5 Geology

5.1 Regional Geology

The exploration Licence is located in the southwestern portion of the Murray Basin. The following description of the Murray Basin is largely derived from Brown and Stephenson (1991) and from Mason et al. (1998)

The Murray Basin is a low lying saucer shaped basin defined by flat lying Cainozoic sediment which extends over an area of 320 000km^2 in NSW, VIC and SA. Cainozoic sediment unconformably overlies Proterozoic and lower Palaeozoic basement rocks over much of the basin. Rocks of Devonian to Cretaceous age fill restricted infrabasins and occur as thin erosional remnants of platform cover.

The Cainozoic sedimentary blanket is generally less than 200-300m thick but may be up to 600m thick in the deeper west-central part of the basin. The Tertiary succession (refer figure 2) accumulated over three major depositional events, each separated by a disconformity and all involving marine sedimentation in the center and SE of the basin. Only those sediments of the third depositional sequence are important in the present exploration for heavy mineral sand deposits.

The third sequence, from Upper Miocene to Pliocene, formed in an environment of fluvial floodplain to the east, flanking an extensive marine strandplain of prograding beach ridges with inter-ridge fluvial and estuarine quartz sand deposits to the west and south. Initial marine transgression resulted in the deposition of marine clays of the Bookpurnong beds, and marginal marine to fluvial clastics of the Loxton Sands and equivalent Parilla sands. To the east, fluvial and lacustrine deposits of the contemporaneous Calivil Formation formed a widespread sand sheet. The subsequent Pliocene marine regression resulted in the westward migration of the shoreline and the widespread distribution of the quartz sand sheet of the Loxton Sands, characterised by the development of extensive shoreline dune ridges. In the east, clay, silt, sands and gravel of the Shepparton Formation were deposited in a flood plain environment.

The Loxton Sands are described as marginal marine, beach and estuarine sediments whilst the Parilla Sands in northern Victoria and NSW, are described as sediments of valley fill, lagoonal and fluvio-lacustrine environments. Victoria has traditionally termed these as the lower and upper units of the Parilla Sands. In South Australia the Parilla Sands are closer in style to the Loxton Sands. Throughout much of the Basin there is an erosional contact between the Loxton and Parilla Sands that can easily be recognised in drilling. This contact is not currently as readily recognised in the southwestern portion of the Murray Basin. The Loxton Sands is characterised by its

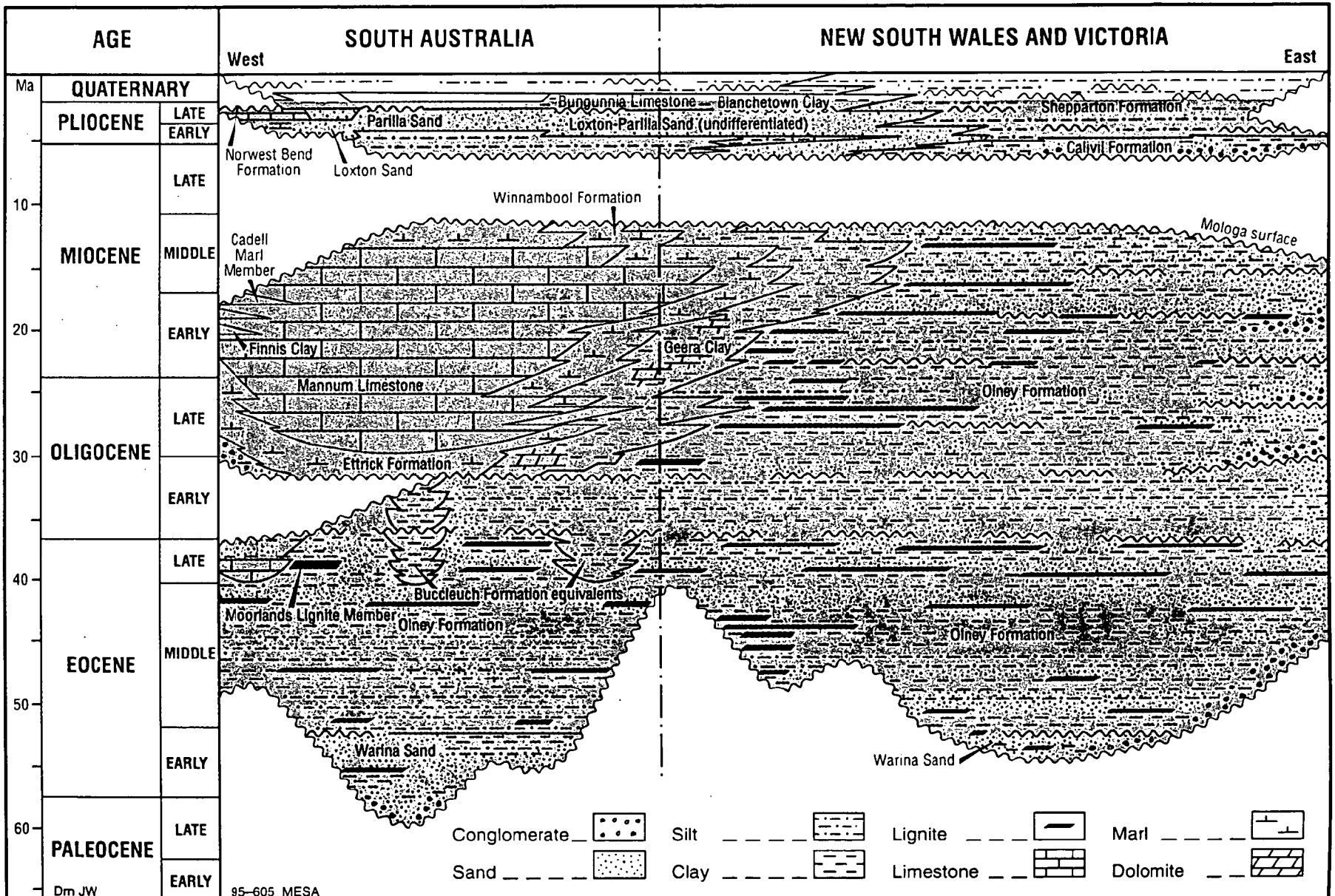


Figure 2 Generalised Murray Basin Stratigraphy

Stratigraphic units in the Murray Basin (after Brown and Stephenson, 1991).

fine to medium grained, pale grey to yellow/brown sands, containing minor clay and silt, in which the grains are subangular to rounded.

Shepparton Formation deposition continued into the Early Pleistocene, and it forms the ground surface of the basin in much of the area east and southeast. The fluvio-lacustrine Blanchetown Clay was deposited over a wide area in the west at the same time.

Throughout most of the Murray Basin, but particularly in the centre and west, the Tertiary and Early Pleistocene sediments are almost entirely concealed beneath a veneer of Late Pleistocene to Early Holocene unconsolidated sediment formed in an arid to semi arid environment. The most extensive of these are the aeolian sands of the Woorinen Formation, and the Molineaux and Lowan Sands. There are also numerous small and widely distributed occurrences of saline lake deposits, lacustrine clay, aeolian dunes, calcrete, colluvial deposits and alluvium of relict and active river channels.

5.2 Local Geology

Literature research suggests exploration drilling by companies such as BHP and ARL have intersected a typical Tertiary sequence as recognised in the south Australian portion of the Murray Basin.

A general stratigraphic sequence as reported by BHP consists of:

Stratigraphic code	Lithology	Description
Qa	Alluvium	Silty sand and gravel/boulder beds along the Marne River Valley in the north. Distinctly micaceous, sandy silt in the Southwest.
Qdm	Molineaux Sand	Stabilised sand dunes. Calcareous
Qca	Bakara Calcrete	Calcrete, calcareous soil, sand, clay
Tps	Loxton–Parilla Sand	Fine quartz sand, part clayey. Clay horizons in Mannum area partly calcareous
Tml	Mannum Formation	Massive, fossiliferous, porous buff coloured limestone. Calcareous quartz sands.
Pz	Basement	Undifferentiated mica, quartz-mica to schist, basic to acid intrusives.

Drilling by BHP concentrated on the west side of the licence, as well as to the southwest and north. Drilling by ARL in the east of the licence reported widespread distribution of the Loxton Sands, however they failed to penetrate the full Loxton sequence.

Thin cover is evident in much of the eastern area of the licence. Exposures of the Miocene Mannum Formation limestones are clearly visible along the Murray River, which is characterised by a series of pronounced cliff faces which are a reflection of the Palmer Fault. This in turn is likely to relate to the Lake Frome lineament.

6 Previous Exploration

6.1 BHP Exploration

Within and around the licence area BHP completed a 110 hole drilling programme between 1991 and 1994 focusing on exploration for heavy mineral sands and base metals. The ground was relinquished due to poor results.

Most of the drilling was sited along the western margin of the lease, coinciding with the basin margins. The latter period of exploration focussed on base metals with most of the exploration targeting basement with shallow cover.

The majority of assays produced were on samples, which are interpreted to reflect a combination of alluvials shed from the Adelaide Fold belt as well as deeper probable Loxton Sands. A scattering of assays and mineralogical assessments were completed with variable results.

These results are therefore inconclusive in respect of the extent of obvious beach face Loxton Sands and the development of models for palaeo shorelines in the licence area based on these results is difficult.

6.2 ARL Exploration

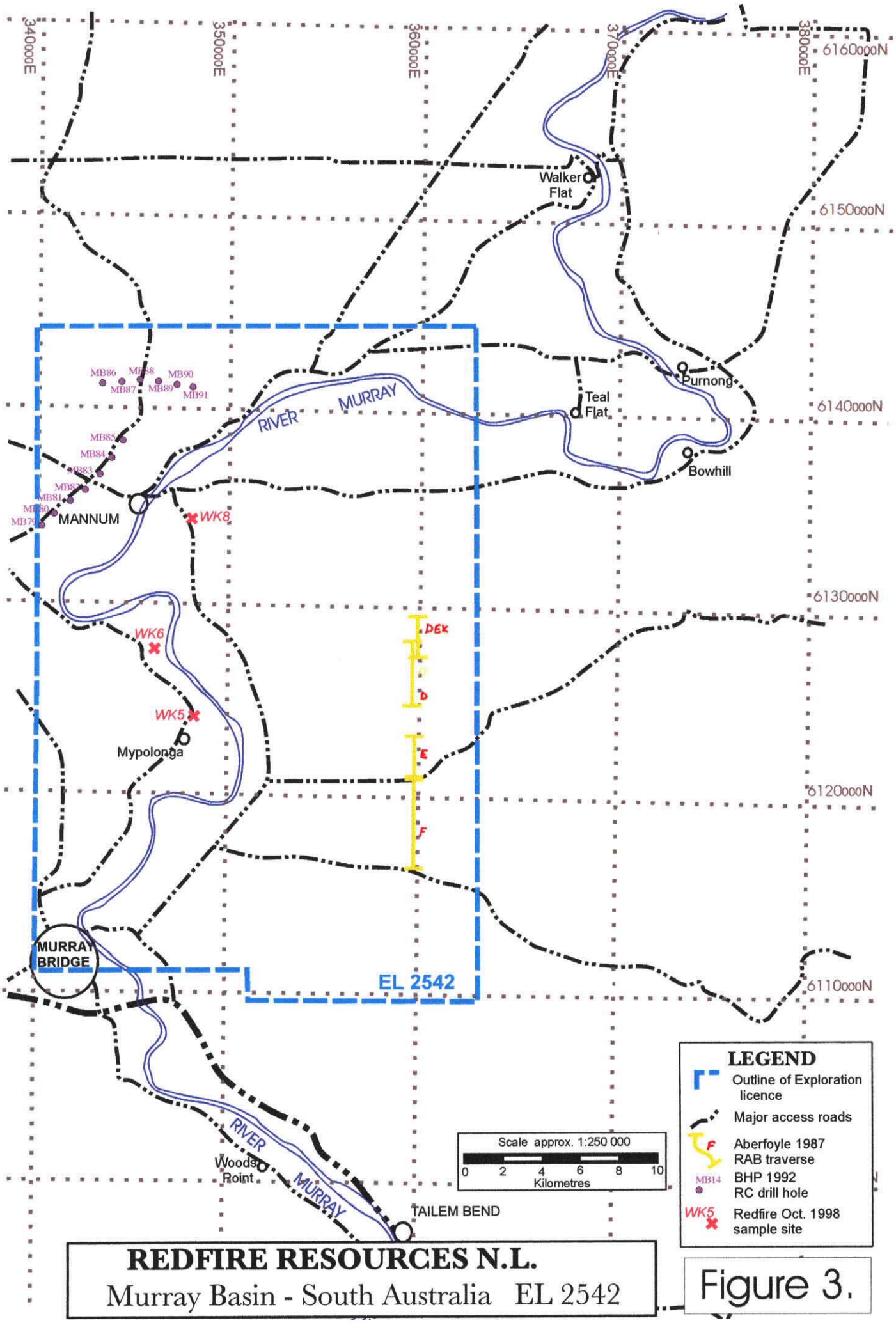
Exploration was conducted between 1986 and 1991 along the eastern portion of the lease and further across to the east.

Rotary airblast drilling concentrated on targeting interpreted palaeo strandlines along public roads with holes spaced 100m to 400m. Depths rarely exceeded 18m.

Results from within the lease confirmed the widespread distribution of the target Loxton Sands, however few samples were deemed worthy of assay.

Successful exploration to the east led to the discovery of the Perponda and Upsndowns deposits located some 20km away.

Figure 3 shows exploration drilling by BHP and ARL within the current boundary of EL 2542.



REDFIRE RESOURCES N.L.

Murray Basin - South Australia EL 2542

Figure 3.

6.3 Other work

A number of other bores were drilled in the licence area for water. Due to the aim of these activities little detail pertinent to mineral sands exploration is available. What can be inferred is the probable presence of Loxton Sands from the logging.

7 Current Investigations

7.1 DTM

A number of geomorphological features can be observed in the Digital Elevation Model of the lease area and surrounds (figure 4). DTM imaging for the area shows an array of drainage patterns, linear features and topographic highs, which have each directly contributed to the distribution, preservation and extent of the Loxton Sands. These complicate correlation between the limited drill data and observations recorded to date, particularly between the areas west and east of the Murray River.

The generational movements along Encounter Lineament (A-A'), and the Palmer and Morgan Faults (B-B', C-C') (*Lake Frome lineament?),* coupled with cyclic sea level changes during and since the Tertiary Period have each directly influenced the sedimentary patterns of that time and subsequent preservation of the target Loxton Sands. This in turn creates an uncertainty in correlation between drill hole data and affects the current understanding of the distribution of the Loxton Sands. These fault systems are located on the west and central portions of the lease area. The extent and effects from the fault systems is unknown and require more drilling to adequately model the area.

Current drainage systems emanating from the ranges have provided sediment containing heavy minerals into the Murray Basin. These sediments have in turn preserved or modified the distribution of the Loxton Sands within this portion of the lease. The current Murray River dissects the lease and preliminary observations suggest that there is a distinct variation in geomorphology between the two portions. Significant topographic highs can be traced in the eastern portion of the lease area.

If drill data from the Perponda deposit located to the east is extrapolated into the lease area, namely an RL of around 60m for the host mineralised horizon, then it may indicate that significant cover will be encountered in some of the licence area. It has been noted however, that in other areas such as Redfire's Geranium prospect (EL 2279) a number of mineralised horizons exist. It is hoped that a similar sequence may be encountered here.

Linear topographic features known to be associated with mineralisation in Murray Basin Mineral's tenure, trend into EL2542 and are marked as lines D. Possible remnants of a repeated cycle are also present further south (marked as lines E). These trend lines are primary targets for exploration.

E139°
E139°30´
E140°
E140°30´
S34°30´
S35°
S35°30´
A'
B'
C'
A
B
C
D
E
Encounter Lineament

LEGEND

EL 2542

Lineament

Fault

Trend line

N

Map Projection: Lambert Conformal Conic
Central Meridian: 142.5 degrees East, Southern Hemisphere
Standard Parallels: 32 degrees and 37 degrees South
Geodetic Datum: Australian National Spheroid (AGD66)

Scale 1:500 000

0 7 14 21 28

Kilometres

Figure 4

Redfire Tenure over DTM

REDFIRE RESOURCES NL

MURRAY BASIN
Redfire Tenure over
Digital Elevation Model
HSI Colour Model

Date: August 1999 | By: MDH | Plan No. 1

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7.2 Satellite Imagery

LANDSAT images across the southwestern portion of Murray Basin show distinct arcuate lines (refer figure 5), which generally trend southeast to the northwest. They also tend to mimic the current coastal morphology of southeastern South Australia.

These features are thought to represent ridge and swale topography, possibly reflecting stranded beach ridges. In places they have been targeted during exploration with mixed success.

Many of the ridges have been entirely removed by wind erosion and remnant traces of former ridge and swale sets are thought to have been preserved, in places, as resistant calcrete ridges formed by fluctuating water levels beneath the dunes and swales.

In the field these long trending features in some places show obvious non-marine sediments, (clays of Lake Bungannia? and calcrete), whilst others seem to consist of sand, which may be either the target Loxton Sands or aeolian dunes.

Significantly these arcuate features are present within the lease and are considered targets for exploration.

7.3 Aerial Photo Interpretation

Colour aerial photographs at 1:40 000 scale were obtained and regolith consultants Brian Senior & Associates undertook photogeological interpretations. Observations show an overview of linear and curvilinear topographic features, which are thought to mirror the positions of former marine, beach strandlines (see plans 1 & 2).

The features take the form of sub-parallel linear to curvilinear sand ridges approximately 10m in height, which extend for distances up to 9km. In places they are eroded or segmented due to the presence of wind gaps or cross cutting drainage. Most are modified by more recent aeolian activity and have small semi-fixed or active dune forms along their crests.

These 'strandlines' terminate towards the Murray River and are thought to have been eroded. Interpretations of these trends seem to be equivalent to those observations made using LANDSAT imagery.

7.4 Reconnaissance Field trip

An exploration field programme was undertaken to assess the stratigraphy, surface distribution of the Loxton Sands and the potential of the lease, and surrounding Redfire tenure, to host heavy mineral concentrates. An emphasis was placed on visiting quarries, roadside cuttings and riverbanks in an attempt to model the local stratigraphy. Where warranted, samples were taken (refer plans 1 & 2) and a GPS reading obtained. Two samples outside the lease area were submitted for heavy mineral assay. Visually all samples observed seem to show a trash dominant mineral assemblage.

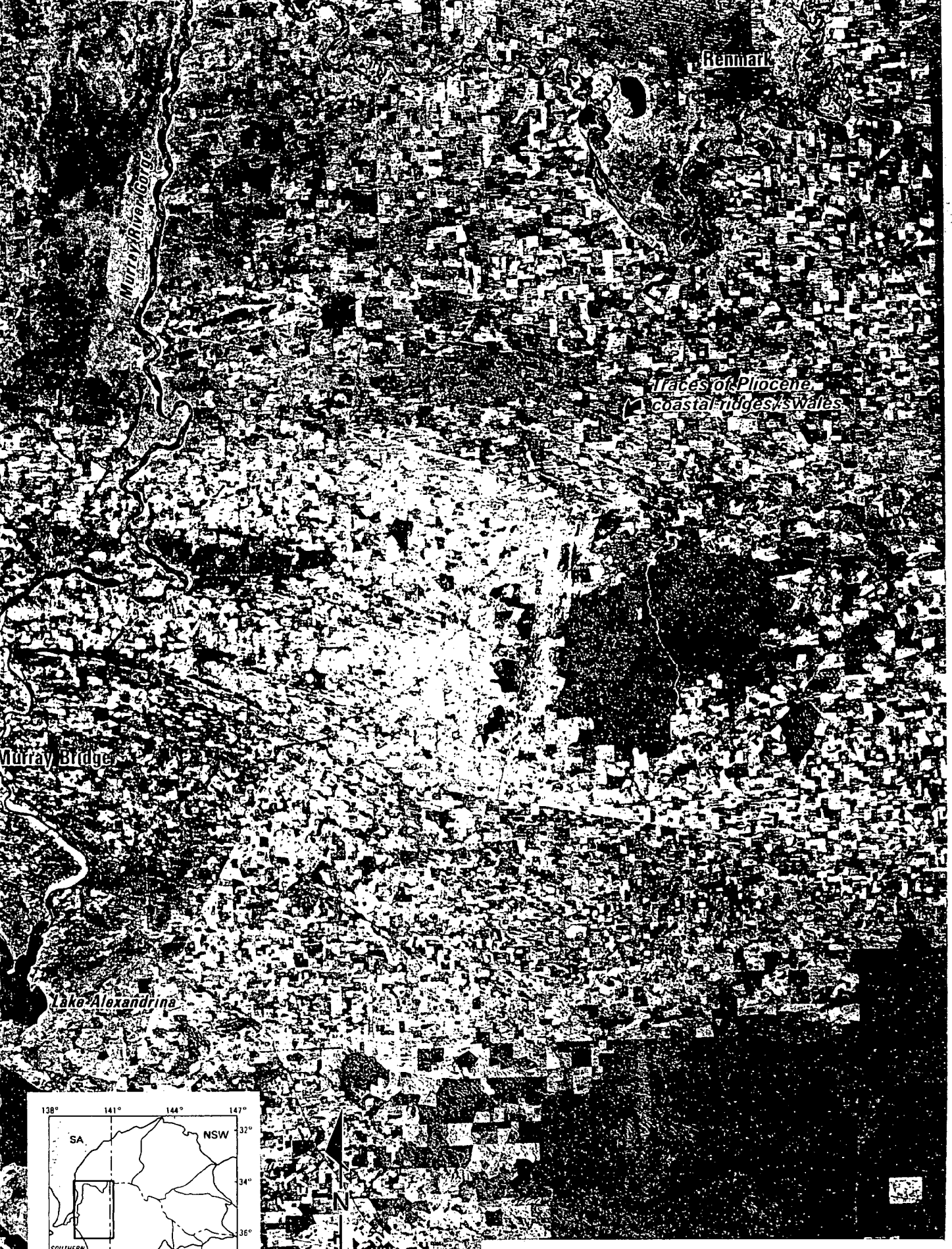

Figure 5

LANDSAT Image showing arcuate *fabric* suggesting presence of palaeo shorelines

The target Loxton Sands were widely observed and characterised by a clean, fine, micaceous and yellow sand, often cross bedded and in places unconformably overlying the Mannum Formation.

Some sites showed abundant oyster shells (Norwest Bend Formation), which reflect a Loxton equivalent sediment deposited in an environment not subject to the usual prolonged processes of storm wave activity and longshore drift. This type of material seemed more prevalent westwards.

Three sites were examined within the lease, WK5, WK6 and WK8. Full descriptions of all observations can be found in appendix 1.

Possible paleao strandlines interpreted from the aerial photos were inspected where they were intersected in roadside cuttings. Results were inconclusive as some observations reported clay and calcrete dominant sequences whilst others showed an obvious uniform sand dominant component. These sands in some places are interpreted to reflect late stage aeolian sand dune systems, however the depth of these sands was difficult to gauge and require drilling to determine the underlying formation.

8 Discussion and Conclusions

There appears to be a trend for a higher proportion of trash minerals within the heavy mineral suites in a westerly direction. The likely presence of an economic heavy mineral suite within the Mannum licence will depend on the results of current drilling programmes testing mineral sand concentrations to the east.

Although the licence area exhibits potential for the discovery of heavy mineral concentrations, it is unlikely that any discovered deposit(s) will present an economic development opportunity in their own right. It is likely then, that the development of any deposits within this licence will depend on other emerging development opportunities such as Murray Basin Minerals' Mindarie and Mercunda deposits.

9 Bibliography

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Plans

1:50 000 TOPOGRAPHIC SERIES

MANNUM

SOUTH AUSTRALIA

THIRD EDITION

MANNUM
6728-2

PUBLISHED ..... By authority of the Minister of Environment and Natural Resources.

PRODUCTION ..... Resource Information Group, Department of Environment and Natural Resources.
PROJECTION ..... Transverse Mercator Projection. Australian Geodetic Datum, 1984.
CONTROL ..... Triangulation and Traverse by the Australian Surveying and Land Information Group, the Royal Australian Survey Corps and the South Australian Department of Environment and Natural Resources.
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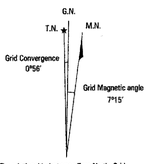
ELEVATION ..... Australian Height Datum. Elevation in metres.
ACCURACY ..... Horizontal: 90% of well defined detail within ±25 metres of true position. Vertical: 90% of elevations within ± 5 metres.
DETAIL ..... Aerial Photography, Svy SA 4852, October 1994.

GRID REFERENCE

GRID ZONE DESIGNATION 54H	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES		
100 000 METRE SQUARE IDENTIFICATION: UG	SAMPLE POINT: ○ tower		
	1 Read letters identifying 100 000 metre grid square in which the point lies:	UG	
	2 Locate first VERTICAL grid line to LEFT of point and read LARGE figures labelling the line in either the top or bottom margin:		56
	3 Estimate tenths from grid line to point:		7
	4 Locate first HORIZONTAL grid line BELOW point and read LARGE figures labelling the line in either the left or right margin:		29
	5 Estimate tenths from grid line to point:		3
IGNORE the SMALLER figures of any grid number: these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number: example: 341000mE	SAMPLE REFERENCE:		UG567293
	If reporting beyond 16° in any direction, prefix Grid Zone Designation as:		54HUG567293

Before giving a grid reference users should state the number and name of this map.



The relationship between True North, Grid North and Magnetic North is shown diagrammatically for the centre of this map. Magnetic Value is correct for 1990. Annual change is 02' Easterly.

SCALE 1:50 000

KILOMETRES 0 1 2 3 4 5 6 KILOMETRES

CONTOUR INTERVAL 10 METRES

Some roads and tracks shown on this map series are private and not available for public use.

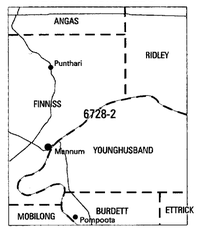
Built-up area. Parks, recreation areas. .....
Road, sealed surface, two or more lanes. National route marker. .....
Road, sealed surface, one lane. .....
Road, unsealed surface, two or more lanes. Bridge. .....
Road, unsealed surface, one lane. Gate. Cattle grid. .....
Vehicular track. .....
Railway, multiple track. Station. Siding. .....
Railway, single track. Cutting. Embankment. .....
Administrative boundary. .....
Building. Post office. Police station. School. ..... PO PS S
Hospital. Church. Mine. Windmill. ..... H C
Fence. Quarry. .....
Power transmission line. Levee or bank. .....

Survey beacon. Spot elevation. ..... △ 124
Rock, bare or awash. Reef. .....
Lake, perennial. Watercourse. .....
Lake, intermittent. Land subject to inundation. .....
Lake, mainly dry. Land subject to occasional flood. .....
Dam or waterhole on watercourse. Tank. Small dam. .....
Contours. Depression contours. .....
Sand. Sand ridges. .....
Cliff. Escarpment or low cliff. .....
Pine plantation. Orchard or vineyard. ..... pines
Windbreak. .....
Trees and scrub, scattered. .....
Trees and scrub, medium, dense. .....

WORLD GEODETIC SYSTEM

To convert World Geodetic System 1972 to Australian Geodetic Datum 1984 co-ordinates on which this map is based:
Increase the numerical value of latitude by 5.2" equivalent to 156m.
Decrease the numerical value of longitude, by 4.3" equivalent to 111m.
To obtain heights above mean sea level, decrease satellite heights by 3m.

INDEX TO HUNDREDS



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MONARTO 6727-4	MOBILONG 6727-1	WYNARKA 6827-4

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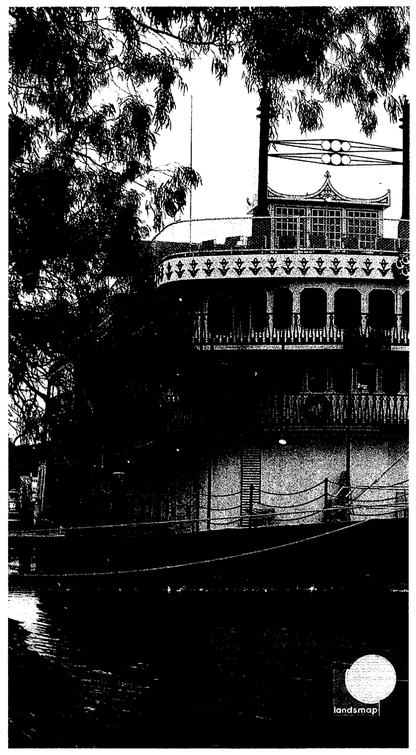
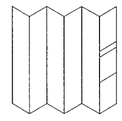


MV Murray Princess berthed at the Mannum wharf

vertical folds



horizontal folds

unfolded copies of this map are also available

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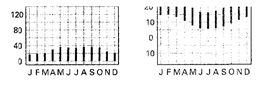
Murray Basin EL 2542 - Mannum

Sheet 1 of

Legend

EL boundary
WK8 Airphoto interpreted lineaments
Field excursion sample site



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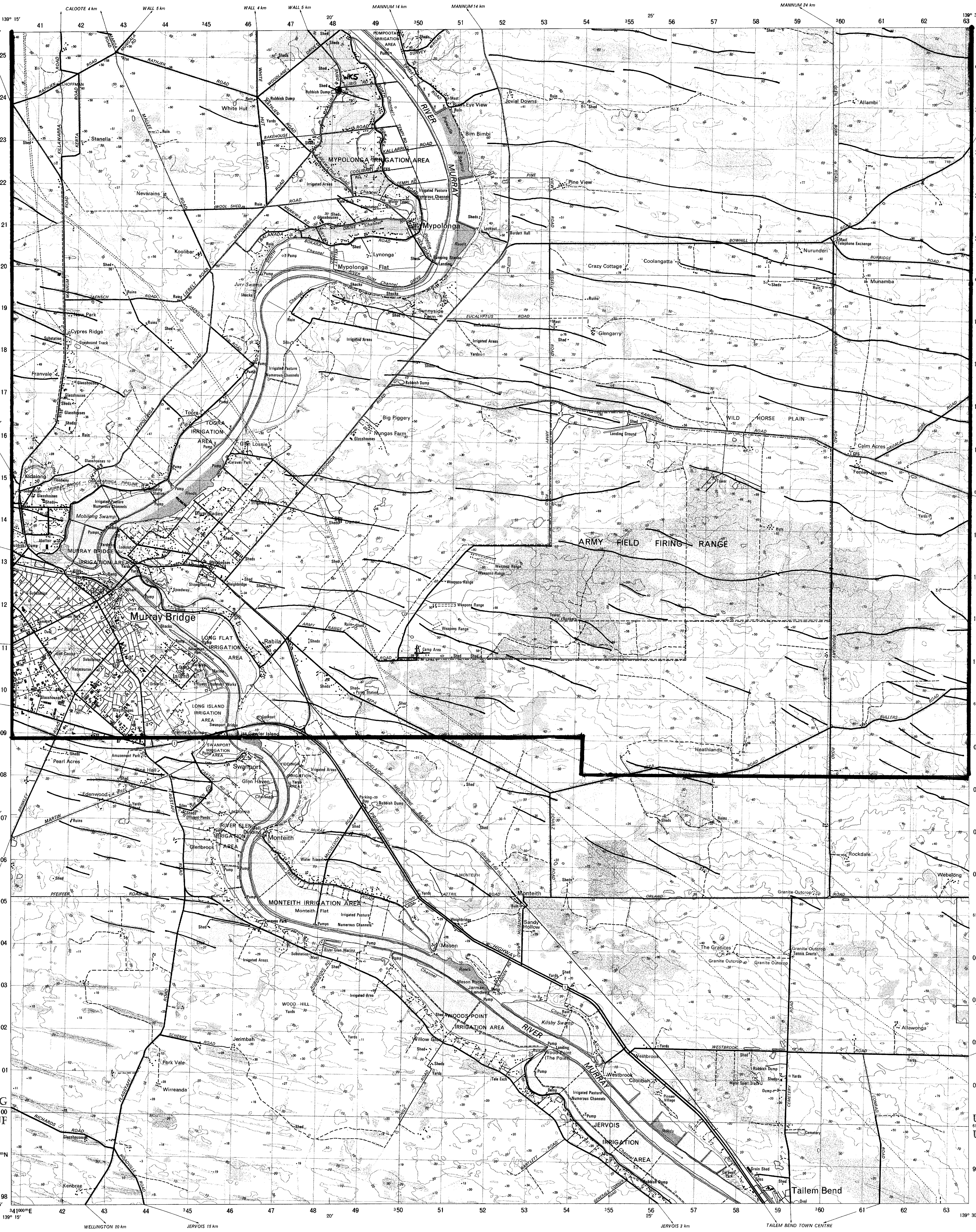

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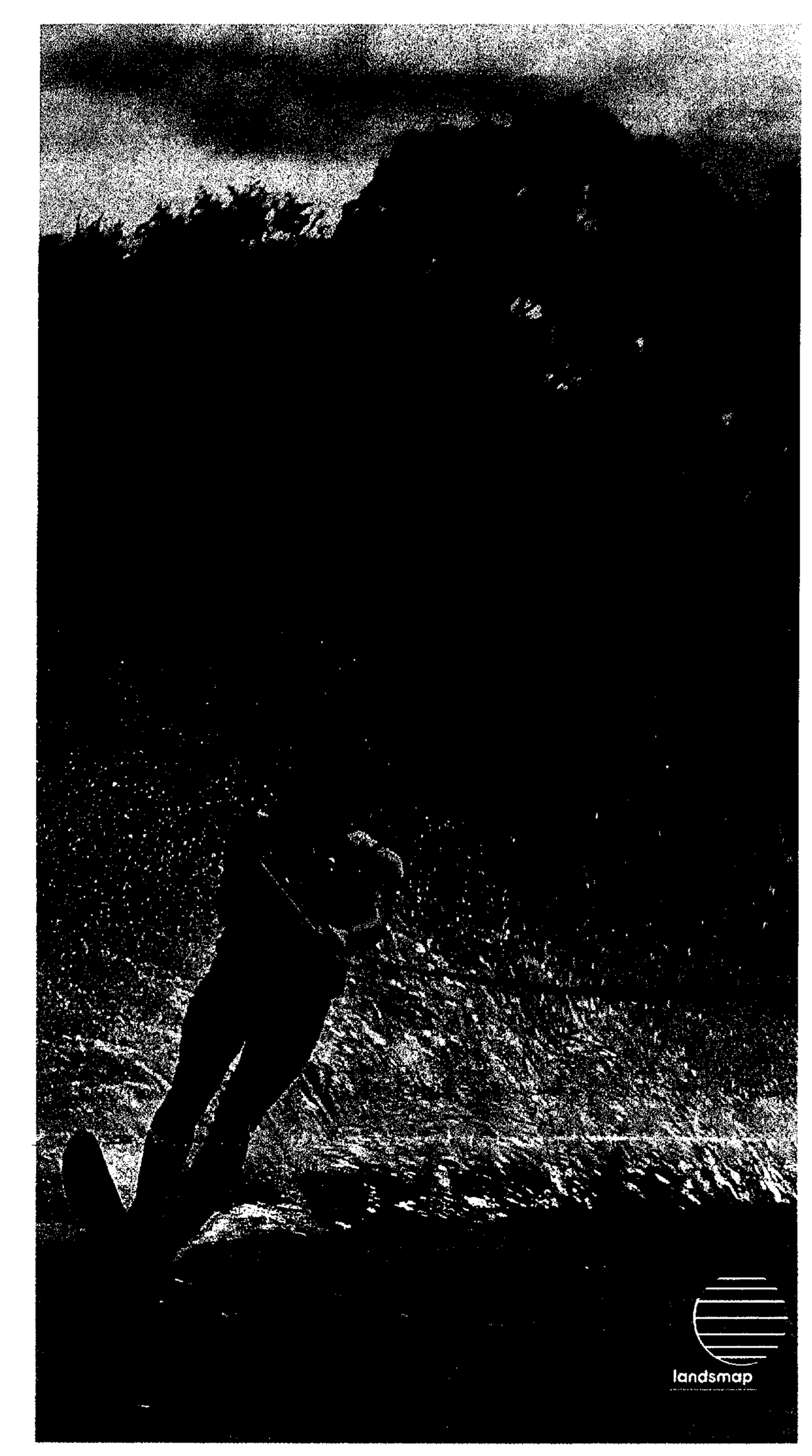
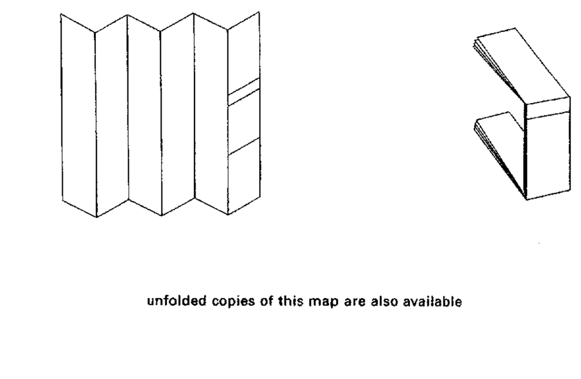


Cover Photo Tourism South Australia



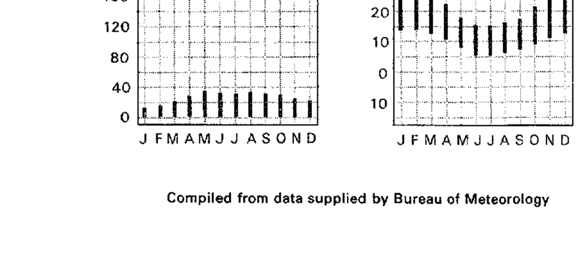
unfolded copies of this map are also available

REDFIRE RESOURCES NL
Murray Basin EL 2542 - Mannum

Sheet 2

Legend

EL boundary
Airphoto interpreted lineaments
WKS Field excursion sample site



Compiled from data supplied by Bureau of Meteorology

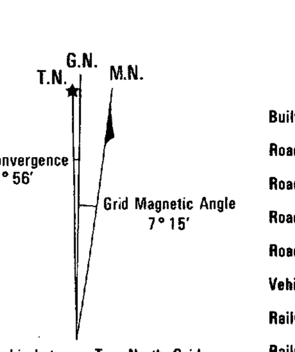
PUBLISHED .... By authority of the Minister of Lands. Prepared under the direction of the Surveyor General.

PRODUCTION........ The Department of Lands. landsmap
PROJECTION .... Transverse Mercator Projection. Australian Geodetic Datum, 1984.
CONTROL .... Triangulation and Traverse by the Australian Surveying and Land Information Group, the Royal Australian Survey Corps and the South Australian Department of Lands.
GRID.............. Australian Map Grid 1984. Zone 54, Central Meridian 141°E.
ELEVATION .... Australian Height Datum. Elevation in metres.
ACCURACY .... Horizontal: 90% of well defined detail within ± 25 metres of true position. Vertical: 90% of elevations within ±5 metres.
DETAIL .... Aerial Photography, Svy. S.A. 4188 & 4195, September, 1990.
PHOTOLITHOGRAPHY . . A.B. Caudell, Government Printer, 1991.

GRID REFERENCE

GRID ZONE DESIGNATION: 54H	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES	
100 000 METRE SQUARE IDENTIFICATION: UG / 6100 / UF	SAMPLE POINT: ○ Lookout	
	1 Read letters identifying 100 000 metre square in which the point lies:	UG
	2 Locate the first VERTICAL grid line to LEFT of point and read LARGE figures labelling the line in either the top or bottom margin:	46
	3 Estimate tenths from grid line to point:	5
IGNORE the SMALLER figures of any grid number; these are for finding the full co-ordinates. Use ONLY the LARGER figures of the grid number; example: 341000mE	4 Locate first HORIZONTAL grid line BELOW point and read LARGE figures labelling the line in either the left or right margin:	09
	5 Estimate tenths from grid line to point:	4
	SAMPLE REFERENCE	UG465094
	If reporting Beyond 18° in any direction, prefix Grid Zone Designation as:	54HUG465094

Before giving a grid reference, users should state the number and name of this map.



The relationship between True North, Grid North and Magnetic North is shown diagrammatically for the centre of this map. Magnetic Value is correct for 1985. Annual Change is 01′ Easterly.

SCALE 1:50 000

KILOMETRES 0 1 2 3 4 5 6 KILOMETRES

CONTOUR INTERVAL 10 METRES

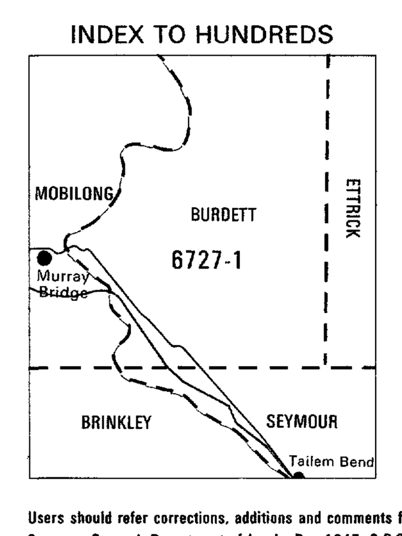
Some roads and tracks shown on this map series are private and not available for public use.

- Built-up area; Parks, recreation areas.
- Road, sealed surface, two or more lanes; National route marker.
- Road, sealed surface, one lane.
- Road, unsealed surface, two or more lanes; Bridge.
- Road, unsealed surface, one lane; Gate; Cattle grid.
- Vehicular track.
- Railway, multiple track; Station; Siding.
- Railway, single track; Cutting; Embankment.
- Administrative boundary.
- Building; Post office; Police station; School. (•PO •PS •S)
- Hospital; Church; Mine; Windmill. (•H •C)
- Fence; Quarry.
- Power transmission line; Levee or bank.
- Survey beacon; Spot elevation. (•124)
- Rock, bare or awash; Reef.
- Lake, perennial; Watercourse.
- Lake, intermittent; Land subject to inundation.
- Lake, mainly dry; Land subject to occasional flooding.
- Dam or waterhole on watercourse; Tank; Small dam.
- Contours; Depression contours.
- Sand; Sand ridges.
- Cliff; Escarpment or low cliff.
- Pine plantation; Orchard or vineyard. (Pines)
- Windbreak.
- Trees and scrub, scattered.
- Trees and scrub, medium, dense.

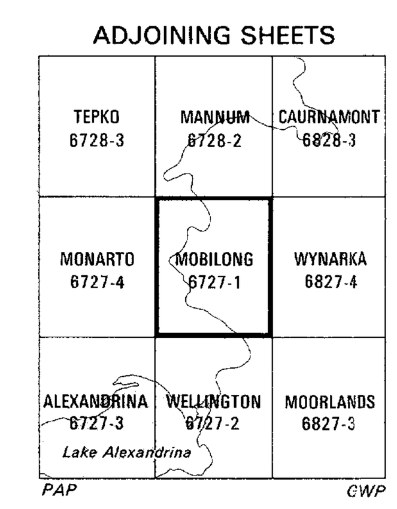
WORLD GEODETIC SYSTEM

To convert World Geodetic System 1972 to Australian Geodetic Datum 1984 co-ordinates on which this map is based:
Increase the numerical value of latitude by 5·1" equivalent to 158m.
Decrease the numerical value of longitude by 4·3" equivalent to 110m.
To obtain heights above mean sea level, decrease satellite heights by 2m.

INDEX TO HUNDREDS



ADJOINING SHEETS



Users should refer corrections, additions and comments for improving this product to Surveyor General, Department of Lands, Box 1047, G.P.O., Adelaide, S.A. 5001.

9551-2

MOBILONG
6727-1

Appendix 1

Field Trip Sample Descriptions

MURRAY BASIN FIELD EXCURSION (Mannum area EL's) October 1998 SAMPLE LIST

Sample number	Date collected	Location		Strat. interp.	Sample type	Collection site	Colour	Magnetic content	Calcite content	grainsize & roundness	main constituents	HM content (panned)	Description in hand specimen
		easting	northing										
WK1	19-Oct	369 060	6153 675	Loxton sands	Grab sample, spoil from a rabbit hole	North of Walker Flat	cream-brown	very small trace, grains <0.1mm size	slight reaction in nodular patches	fine grained SA quartz to 1mm in size	quartz, mica	Trace, light and trashy?	Very fine grained clean sands with abundant coarse mica.
WK2	19-Oct	369 190	6153 030	Loxton sands	Chip sample from face of road cutting	Road cutting (near ferry) east of Walker Flat	yellow-brown	very small trace, grains <0.1mm size	none	fine grained SA quartz to 1mm in size	quartz, mica	Trace, light and trashy?	Very fine grained clean sands, with abundant coarse mica, and trace biotite (to 1mm).
WK3	19-Oct	369 190	6153 030	Norwest Bend formation	As Above	As Above	grey-brown	none	major	fine to medium SA-RR quartz to 2mm size	shell fragments, quartz, mica	Small trace, light and trashy?	Cemented oyster shells (to 15cm long) and sands (carbonate cement?), minor broken bivalvue and bryozoan shells.
WK4	19-Oct	363 845	6157 595	Norwest Bend formation	Chip sample from face of road cutting	Road cutting to South of Marne River valley	yellow-brown	none	major	fine grained SA quartz to 1mm in size	shell fragments, quartz	0.1%	Uncemented oyster shells (to 10cm long) and major sands, minor broken bivalvue and bryozoan shells.
WK5	20-Oct	348 150	6124 220	Parilla sands	Chip sample from face of road cutting	Road cutting near Ibis Rd, north of Mypolonga	red	trace SR grains to 0.5 mm grain size	none	fine SA quartz to 1mm in size within clays	quartz, silty clays	0.1%	Fine to medium grained sands in a red clay matrix.
WK6	20-Oct	346 485	6127 355	Mannum Limestone	Chip sample from cliff face	Cliffs near dump, south of Wall Flat	yellow	-	Abundant	fine SA quartz to 1mm in size within carbonate	shell fragments, quartz	-	Bryozoan limestone, also containing minor bivalvue shell fragments, in a sandy weakly carbonate cemented matrix.
WK7	20-Oct	372 495	6136 530	Loxton sands	Chip sample from face of road cutting	Road cutting to west of Bowhill	brown	very small trace, grains <0.1mm size	partially reactive	very fine SA quartz to 0. 5 mm in size	quartz, mica	0.5%	Clean fine grained micaceous sands, trace biotite grains (to 1mm). some carbonaceous nodules in unreactive sands
WK8	20-Oct	347 610	6134 495	Loxton sands	Chip sample from face of road cutting	Road cutting to east of Mannum	red-brown	very small trace, grains <0.1mm size	partially reactive horizons	fine grained SA quartz to 0.8 mm in size	quartz, mica, silts	0.1%	Relatively clean fine grained micaceous sands, trace biotite grains (to 1mm). banded non-calcareous clay rich horizons and more reactive nodular sands

REDFIRE RESOURCES LTD.

ABN 27 009 423 858

EXPLORATION LICENCE 2542

PART MANNUM – LAMEROO PROJECT
MURRAY BASIN - SOUTH AUSTRALIA

Annual Report for 12 Month Period

to 25 August 2000

Distribution:

PIRSA	***2***
RFR Sydney	***1***
RFR Adelaide	***1***

Prepared by:
P. Blampain
September 2000

Table of Contents

Figures		**Scale**
Figure 1	EL 2542 Location Plan	1:1 200 000 approx.

1 Summary

Redfire has demonstrated the presence of heavy mineral bearing palaeo shorelines within the Mannum-Lameroo project, which encompasses Exploration Licences 2542, 2564 and 2279. Analysis of the heavy mineral products and strand types suggest that the resource potential is of insufficient size to constitute a stand alone mining proposition and will require integration into a much larger resource base in the Western Murray Basin region.

Redfire has identified base metal potential in the shallow basement and is currently seeking interest from a major mining company with significant interest in the area.

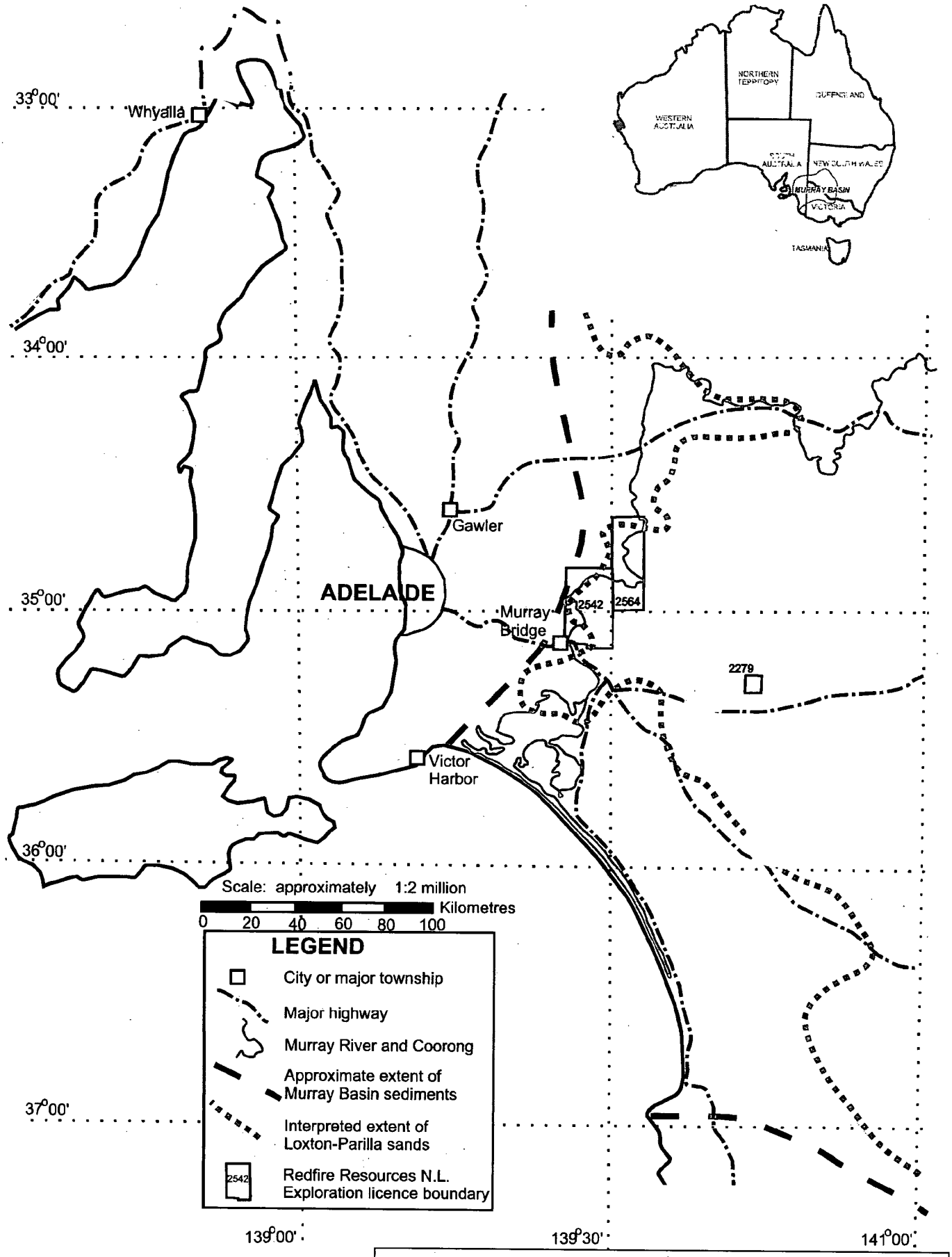
2 Introduction

This is the second annual report by Redfire Resources on exploration for EL 2542 and covers the 12 months to August 25, 2000. Redfire acquired this licence to explore for heavy mineral sands on the western margins of the Murray Basin.

The licence is considered prospective for the discovery of heavy mineral sand concentrations with a number of proximal discoveries reported to date. These include the Perponda, Mercunda, Mindarie, Long Tan and Lone Pine deposits currently under evaluation by Murray Basin Minerals NL (MBM).

Exploration Licence 2542 is part of a wider project area incorporating ELs 2279, 2542 and 2564, the Mannum – Lameroo project (refer figure 1). Geological evaluation by Redfire has confirmed the widespread distribution of the target Loxton Sands within the project area.

Redfire has also identified base and precious metal potential in the shallow basement rock beneath the Murray Basin sediments in the licence area.



Redfire Resources NL Mannum –Lameroo Project
Murray Basin - South Australia

Figure 1

3 Conclusions

Results to date show:

- drilling by Aberfoyle Resources and BHP has indicated widespread distribution of the target Loxton sands exists in this licence area
- DTM imagery suggests there are significant geological features which may reflect the development of buried strandline systems, which do not appear to have been adequately tested during previous exploration phases
- Results of the TEISA survey shows large scale features that can be traced within the project area and may bear a relationship to buried palaeo shorelines
- Landsat images show 'ridge and swale' trend lines within the licence area, which may also reflect strandline systems
- drilling density within the licence is insufficient to discount the potential of this licence to host significant concentrations of heavy mineral sands
- the resource potential of the licence is unlikely to be of sufficient size to host a stand alone mining operation and will require integration into a much larger resource base for development
- base and precious metal potential exists in the shallow basement rock beneath a thin cover of Murray Basin sediments
- widespread calcrete distribution should facilitate low cost effective geochemical exploration for base and precious metals

4 Tenure

This section has been covered in the first annual report by Redfire and is not repeated here.

5 Geology

This section has also been covered in previous reporting and is therefore not repeated in this report.

6 Previous Exploration

Details of previous exploration can be found in Redfire's first annual report on exploration for this licence.

7 Current Investigations

Investigations during this reporting period have concentrated on the evaluation of EL 2542 as part of a wider project area. Results to date suggest it is unlikely that the licence would host resources of sufficient size to accommodate an economically viable stand alone mining operation and that integration into a much larger resource base would be required.

Redfire has reviewed the TEISA C1 airborne survey data, which partially covers the project area. Interpretation of the Digital Terrain Model, show large-scale features that can be traced through the project area, which may bear some relationship to palaeo shoreline development. The scale at which development of a mineralised strandline system occurs however, is unlikely to be reflected in the data at this scale and would probably require infill surveys.

The Murray Basin sediments overlie basement that is prospective for base and precious metals. Magnetic data indicates large-scale regional deep-seated faults and intrusive/volcanic rock types are present, that elsewhere in the region host mineralisation. A joint venture partner is being sought to further evaluate the basement potential.

8 Discussion and Conclusions

Although the licence area exhibits potential for the discovery of heavy mineral sand concentrations, it is unlikely that any discovered deposit(s) will present an economic development opportunity in their own right. It is likely then, that the development of any deposits within this licence will depend on other emerging development opportunities such as the deposits currently being evaluated by Murray Basin Minerals.

This does not mean that exploration should not be completed on this licence but that any exploration focus for mineral sands is significantly governed by the development of the mineral sands industry in this portion of the Murray Basin.

9 Bibliography

Blampain P, 1999. Redfire Resources NL, Annual Technical report to South Australian Department (PIRSA). Exploration Licence 2542 Mannum - Murray Basin, South Australia. Annual Report for 12 Month Period to 25 August 1999

REDFIRE RESOURCES LTD.

ABN 27 009 423 858

EXPLORATION LICENCE 2542

PART MANNUM – LAMEROO PROJECT
MURRAY BASIN - SOUTH AUSTRALIA

Final Report

February 2001

Distribution:

PIRSA	***1***
RFR Sydney	***1***
RFR Adelaide	***1***

Prepared by:
P. Blampain
February 2001

Table of Contents

Figures **Scale**

1 Summary

Redfire has demonstrated the presence of heavy mineral bearing palaeo shorelines within the Mannum-Lameroo project, which encompasses Exploration Licences 2542, 2564 and 2279. Analysis of the heavy mineral products and strand types suggest that the resource potential is of insufficient size to constitute a stand alone mining proposition and will require integration into a much larger resource base in the Western Murray Basin region.

Due to this, the likely heavy mineral suite assemblage and potential thickness of cover the project is not considered to warrant further work. Redfire has therefore relinquished the title.

2 Introduction

This is the third and final report by Redfire Resources on exploration for EL 2542, which was acquired to explore for heavy mineral sands over the western margin of the Murray Basin.

The western Murray Basin is known to host accumulations of heavy mineral sands with a number of discoveries proximal to the project area. These include the Perponda, Mercunda, Mindarie, Long Tan and Lone Pine deposits currently under evaluation by Murray Basin Minerals NL (MBM).

Exploration Licence 2542 is part of a wider project area incorporating ELs 2279, 2542 and 2564, the Mannum – Lameroo project (refer figure 1). Geological evaluation by Redfire has confirmed the widespread distribution of the target Loxton Sands within the project area.

3 Conclusions

Results to date show:

- Drilling by Aberfoyle Resources and BHP has indicated widespread distribution of the target Loxton sands exists in this licence area
- DTM imagery suggests there are significant geological features which may reflect the development of buried strandline systems
- Results of the TEISA survey shows large scale features that can be traced within the project area and may bear a relationship to buried palaeo shorelines
- Landsat images show 'ridge and swale' trend lines within the licence area, which may also reflect strandline systems
- The resource potential of the licence is unlikely to be of sufficient size to host a stand alone mining operation and will require integration into a much larger resource base for development
- The mineral assemblage defined to date is generally comprised of low value iron rich minerals

4 Tenure

Exploration Licence 2542 covers an area of 739 km^2 .The Murray Bridge township is situated in the southwestern corner of the licence area (Refer figure 1)

The Adelaide (SI54-19) and Barker (SI54-13) 1:250 000 mapsheets, Mannum (6728) and Mobilong (6727) 1:100 000 mapsheets and Mannum (6728-2) and Mobilong (6727-1) 1:50 000 mapsheets cover the licence area

5 Geology

5.1 Regional Geology

The exploration Licence is located in the southwestern portion of the Murray Basin. The following description of the Murray Basin is largely derived from Mason et al.

The Murray Basin is a low lying saucer shaped basin defined by flat lying Cainozoic sediment which extends over an area of 320 000km^2 in NSW, VIC and SA. Cainozoic sediment unconformably overlies Proterozoic and lower Palaeozoic basement rocks over much of the basin. Rocks of Devonian to Cretaceous age fill restricted infrabasins and occur as thin erosional remnants of platform cover.

The Cainozoic sedimentary blanket is generally less than 200-300m thick but may be up to 600m thick in the deeper west-central part of the basin. The Tertiary succession accumulated over three major depositional events, each separated by a disconformity and all involving marine sedimentation in the center and SE of the basin. Only those sediments of the third depositional sequence are of any importance in the present exploration for heavy mineral sand deposits.

The third sequence, from Upper Miocene to Pliocene, formed in an environment of fluvial floodplain to the east, flanking an extensive marine strandplain of prograding beach ridges with inter-ridge fluvial and estuarine quartz sand deposits to the west and south. Initial marine transgression resulted in the deposition of marine clays of the Bookpurnong beds, and marginal marine to fluvial clastics of the Loxton Sands and equivalent Parilla sands. To the east, fluvial and lacustrine deposits of the contemporaneous Calivil Formation formed a widespread sand sheet. The subsequent Pliocene marine regression resulted in the westward migration of the shoreline and the widespread distribution of the quartz sand sheet of the Loxton Sands, characterised by the development of extensive shoreline dune ridges. In the east, clay, silt, sands and gravel of the Shepparton Formation were deposited in a flood plain environment.

The Loxton Sands are described as marginal marine, beach and estuarine sediments whilst the Parilla Sands are described as sediments of valley fill, lagoonal and fluvio-lacustrine environments. Victoria has traditionally termed these as the lower and upper units of the Parilla Sands. The Loxton Sands is characterised by its fine to medium grained, pale grey to yellow/brown sands, containing minor clay and silt, in which the grains are subangular to rounded.

Shepparton Formation deposition continued into the Early Pleistocene, and it forms the ground surface of the basin in much of the area east and southeast. The fluvio-lacustrine Blanchetown Clay was deposited over a wide area in the west at the same time.

Throughout most of the Murray Basin, but particularly in the centre and west, the Tertiary and Early Pleistocene sediments are almost entirely concealed beneath a veneer of Late Pleistocene to Early Holocene unconsolidated sediment formed in an arid to semi arid environment. The most extensive of these are the aeolian sands of the Woorinen Formation, and the Molineaux and Lowan Sands. There are also numerous small and widely distributed occurrences of saline lake deposits, lacustrine clay,

aeolian dunes, calcrete, colluvial deposits and alluvium of relict and active river channels.

5.2 Local Geology

Literature research suggests exploration drilling by companies like BHP and ARL have intersected a typical Tertiary sequence as recognised in the south Australian portion of the Murray Basin.

A general stratigraphic sequence as reported by BHP consists of:

Stratigraphic code	Lithology	Description
Qa	Alluvium	Silty sand and gravel/boulder beds along the Marne River Valley in the north. Distinctly micaceous, sandy silt in the Southwest.
Qdm	Molineaux Sand	Stabilised sand dunes. Calcareous
Qca	Bakara Calcrete	Calcrete, calcareous soil, sand, clay
Tps	Loxton–Parilla Sand	Fine quartz sand, part clayey. Clay horizons in Mannum area partly calcareous
Tml	Mannum Formation	Massive, fossiliferous, porous buff coloured limestone. Calcareous quartz sands.
Pz	Basement	Undifferentiated mica, quartz-mica to schist, basic to acid intrusives.

Drilling by BHP concentrated on the west side of the licence, as well as to the southwest and north. Drilling by ARL in the east of the licence reported widespread distribution of the Loxton Sands, however they failed to penetrate the full Loxton sequence.

Thin cover is evident in much of the eastern area of the licence. Exposures of the Miocene Mannum Formation limestones are clearly visible along the Murray River, which is characterised by a series of pronounced cliff faces which are a reflection of the Morgan Fault. This in turn is likely to relate to the Lake Frome lineament.

6 Previous Exploration

6.1 BHP Exploration

Within and around the licence area BHP completed a 110 hole drilling programme between 1991 and 1994 during exploration for heavy mineral sands and base metals. The ground was relinquished due to poor results.

Most of the drilling was sited along the western margin of the lease, coinciding with the basin margins. The latter period of exploration focussed on base metals with most of the exploration targeting basement with shallow cover.

The majority of assays produced were on samples, which are interpreted to reflect a combination of alluvials shed from the Adelaide Fold belt as well as deeper probable Loxton Sands. A scattering of assays and mineralogical assessments were completed with variable results.

These results are therefore inconclusive in respect of the extent of obvious beach face Loxton Sands and the development of models for palaeo shorelines in the licence area.

6.2 ARL Exploration

Exploration was conducted between 1986 and 1991 along the eastern portion of the lease and further across to the east.

Rotary airblast drilling concentrated on targeting interpreted palaeo strandlines along public roads with holes spaced 100m to 400m. Depths rarely exceeded 18m.

Results from within the lease confirmed the widespread distribution of the target Loxton Sands, however few samples were deemed worthy of assay.

Successful exploration to the east led to the discovery of the Perponda and Upsndowns deposits located some 20km away.

6.3 Other work

A number of other holes were drilled in the licence area for water. Due to the aim of these activities little detail pertinent to mineral sands exploration is available. What can be inferred is the presence of Loxton Sands from the logging.

Desk top studies and reconnaissance field trips have indicated the Loxton Sands are widely represented throughout the project area. No drilling has been completed within EL 2542 by Redfire due to a lack of encouraging results from the nearby Matilda prospect and previous drilling by Redfire on the Lameroo project. These areas are considered to be strike equivalents to EL 2542.

7 Discussion and Conclusions

Although the licence area exhibits potential for the discovery of heavy mineral sand concentrations, it is unlikely that any discovered deposit(s) will present an economic development opportunity in their own right. It is likely then, that the development of any deposits within this licence will depend on other emerging development opportunities such as the deposits currently being evaluated by Murray Basin Minerals.

Redfire has therefore relinquished the title.

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Blampain P, 2000. Redfire Resources Ltd, Annual Technical report to South Australian Department (PIRSA). Exploration Licence 2542 Mannum - Murray Basin, South Australia. Annual Report for 12 Month Period to 25 August 2000

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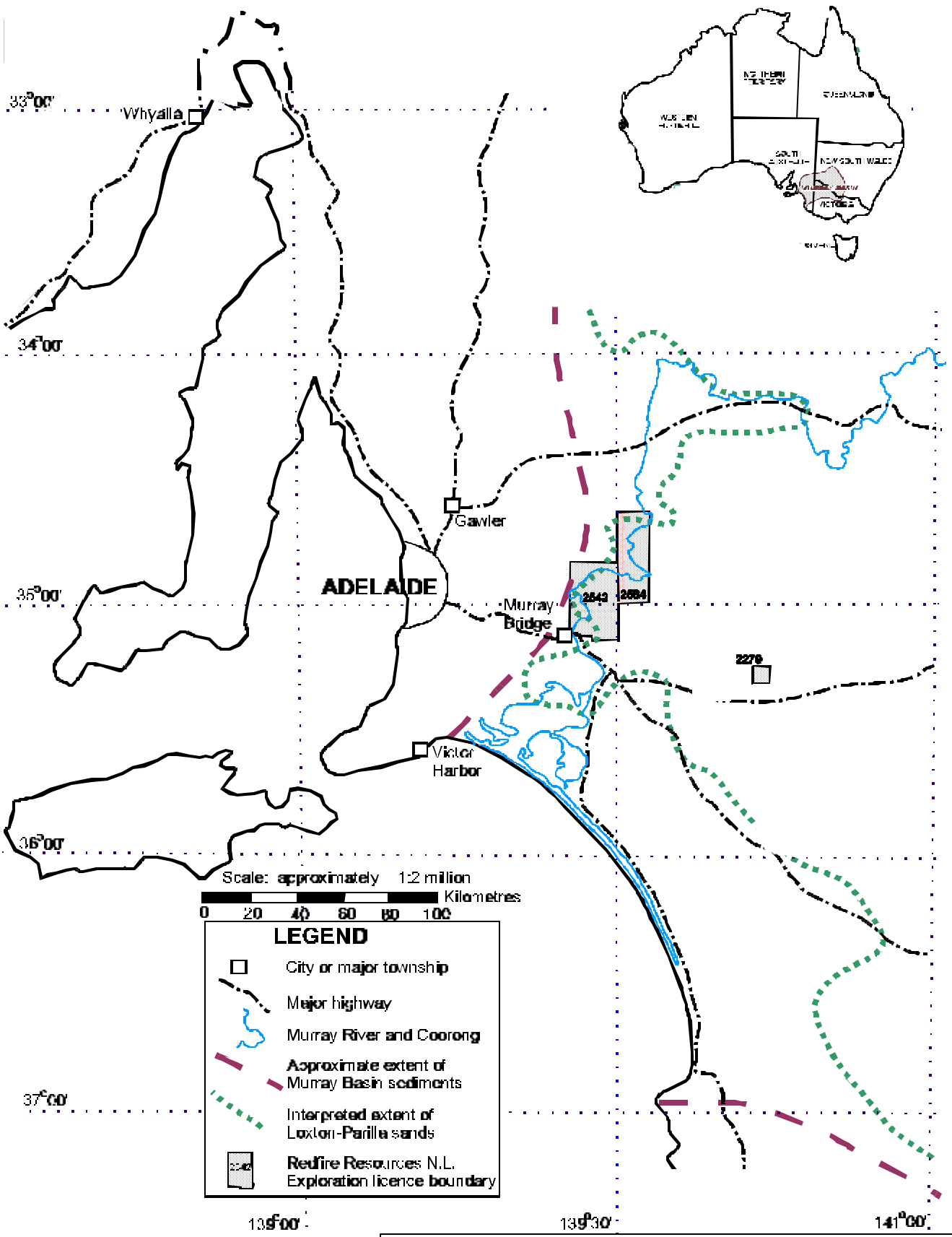
Teakle M, 1991. Aberfoyle Resources Limited, Final and Quarterly reports for EL 1356 – Karoonda & EL 1357 – Parrakie. *SADME open file envelope 6762*



Redfire Resources NL Mannum –Lameroo Project
Murray Basin - South Australia

Figure 1