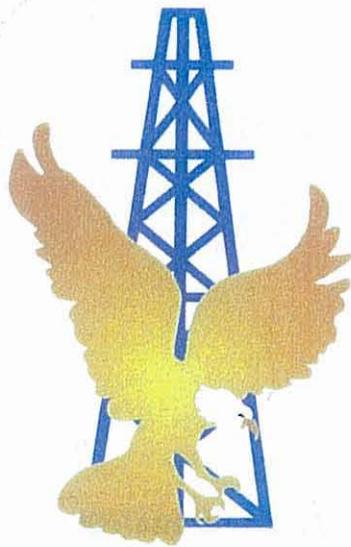


2008

SEL 13/98 Annual Report



Great South Land
Minerals Limited

Great South Land Minerals
August 2008

GREAT SOUTH LAND MINERALS LTD
ANNUAL REPORT 2008

VOLUME 4 OF 5

Great South Land Minerals

SEL 13/98

Annual Report

August, 2008

Gpo Box 1603, Hobart, Tasmania, 7001

Level 3, 65 Murray Street, Hobart, Tasmania, Australia 7000

Phone: 61 3 62319339

Fax: 61 3 62319625

www.gslm.com

Drilling

-Bellevue

-Thunderbolt



Great South Land Minerals Limited

Great South Land Minerals Limited ABN 54 068 650 386

BRIDGING EMERGENCY RESPONSE PLAN (DRILLING)

BELLEVUE 1

SEL 13-98

TASMANIA

2008

Table of Contents

1. Glossary and Definitions
2. Document handling
 - 2.1 Document Distribution
 - 2.2 Document Control
 - 2.3 Document Approval
3. Site Specific Information
 - 3.1
4. Bridging Document Overview
 - 4.1 Project Overview
 - 4.2 Responsibilities
 - 4.3 Objectives
 - 4.4 Scope
 - 4.5 Method
5. HSE Rolls and Responsibilities
 - 5.1 Site Person in Charge (PIC)
 - 5.2 Compatibility of HSE Polices
 - 5.3 HSE Procedures
 - 5.4 Well Control
 - 5.5 Safety Procedures / Emergency Response
 - 5.6 Hazardous Substances
 - 5.7 Safety Systems
6. Operations

APPENDICES

- Appendix 1: Emergency Response Interface
- Appendix 2: Contacts
- Appendix 3: Hunt Energy Emergency Response Manual
- Appendix 4: Hunt Energy Environmental Incident procedure

1 GLOSSARY AND DEFINITIONS

DA	Designated Authorities. The Government Agencies responsible for the administration of the relevant Acts in Tasmania
Drilling Contractor	The owner and operator of the Drilling & Completion Rig. In this case: Hunt Energy Pty Ltd..
Drilling Program	GSLM's written directions for the drilling and completion of the well.
GSLM	Great South Land Minerals Limited (License holder and operator)
ERP	Emergency Response Plan The well or operation specific plan to assist Operator's supervisory personnel in their response to an emergency situation that may arise from, or affect, drilling/completion operations. This plan is to be used in conjunction with the Drilling Contractor's HS&E Manual. Also referred to as Emergency Response or Contingency Manual
ERT	Emergency Response Team The Operator and Drilling Contractor management personnel assigned to develop an emergency response strategy and to carry out response actions in accordance with the Emergency Response Plan and Drilling Contractor's HS&E Manual.
JSA	Job Safety Analysis
License	Government license issued under Mineral Resources Development act giving the holder the right to explore for and develop oil and gas in Tasmania.
Location	The site at which the well is to be drilled.
Operator	Great South Land Minerals Limited the company which holds the license to explore for hydrocarbon accumulations in the Lease area. Or, in a lease area in which one or more companies hold or are earning an interest; the company designated as responsible for the operations.
PIC	Person in Charge; GSLM's Drilling and Completion Supervisor, the person on the wellsite with ultimate responsibility for - <ul style="list-style-type: none"> ▪ The safety, health and welfare of those working at the wellsite. ▪ The conduct of the well drilling & completion operations. ▪ Safeguarding the well and the environment.
MRT	Mineral Resources of Tasmania. The primary regulatory authority for this well.
RFDS	Royal Flying Doctor Service
SAR	Search and Rescue.

Site The Drilling, Well and areas around the rig where drilling equipment is sited or drilling/completion related operations are carried out.

Also referred to as the lease or wellsite.

2.0 DOCUMENT HANDLING

2.1 Document Distribution

- 1. GSLM - Drilling Manager
- 2. GSLM – Drilling Superintendent
- 3. GSLM – Drilling Supervisor
- 4. GSLM – Management Team

HUNT ENERGY

- 5. Contractor Field Manager
- 6. Area Manager

REGULATORY AUTHORITY

- 7. Mineral Resources Tasmania

2.2 Document Control

This Bridging ERP is a “controlled document”. Should the recipient (user) become aware of any changes or corrections that are required, please contact:

Mr. Duncan New: Drilling Manager..... 03 6231 9625

2.3 Document Approval

This Bridging ERP has been reviewed by GSLM and Hunt Energy and it is agreed:

- The drilling presents no high or unacceptable risks either to the safety of personnel associated with project or the environment.
- No new, unique or increased hazards were identified for the campaign;
- The HSE policies and management systems have been jointly reviewed and no fundamental conflicts were found to exist.

This Bridging ERP is approved for the GSLM Bellevue 1 well to be drilled in 2008.

GSLM: D. Neel

Drilling Manager

DUNCAN NEEL

4 JULY 2008

Date:

HUNT ENERGY:

CB
OPERATIONS MANAGER

CHRISTOPHER BROWN

14 7 08

Date:

3. SITE SPECIFIC INFORMATION

3.1 Well and Emergency Response Details

WELL DETAILS

Operator:	<i>GSLM Limited</i>
Permit Area:	<i>SEL 13-98</i>
Name of Designated Authority:	<i>MRT</i>
Initial Authority for Oil Spills:	<i>MRT</i>
Applicable Oil Spill Plan:	<i>Hunt Energy Oil Spill Contingency Plan</i>
Bellevue 1 Details:	<i>Northing: 5,338,600, Easting: 469,830</i>
Depth and Drilling Time of Well:	<i>2600m MDRT / 37 days + rig move</i>
Type of Well:	<i>Oil and Gas Exploration</i>
Estimated Spud Date:	<i>September, 2008</i>

EMERGENCY MANAGEMENT

Emergency Services:	Phone 000
Operations Base:	Hobart
Emergency Management:	Emergency Services / GSLM / Forestry Commission
Name of Drlg Manager:	Duncan New
Name of Drlg Supervisor / PIC:	TBA
Forestry Tasmania:	Robin Hutchings

DRILLING CONTRACTOR

Drilling Contractor:	<i>Hunt Energy</i>
Name of Rig Manager:	TBA
Name of the Rig:	Hunt Energy Rig #3

LOGISTICS

Logistics Base:	Hobart
Logistics Coordinator:	Duncan New
Aviation Base:	Launceston and Hobart
Transport Contractor:	ITAC

MEDICAL ARRANGEMENTS

Preliminary Treatment:	Qualified First Aider / Ambulance Paramedic
Nominated Hospital:	Royal Hobart Hospital, Hobart (Ph 03 6222 8308)
Secondary Hospital:	Launceston General Hospital, Launceston (Ph 03 6348 7111)
Medivac Provider:	Emergency services (ambulance). Ph 000

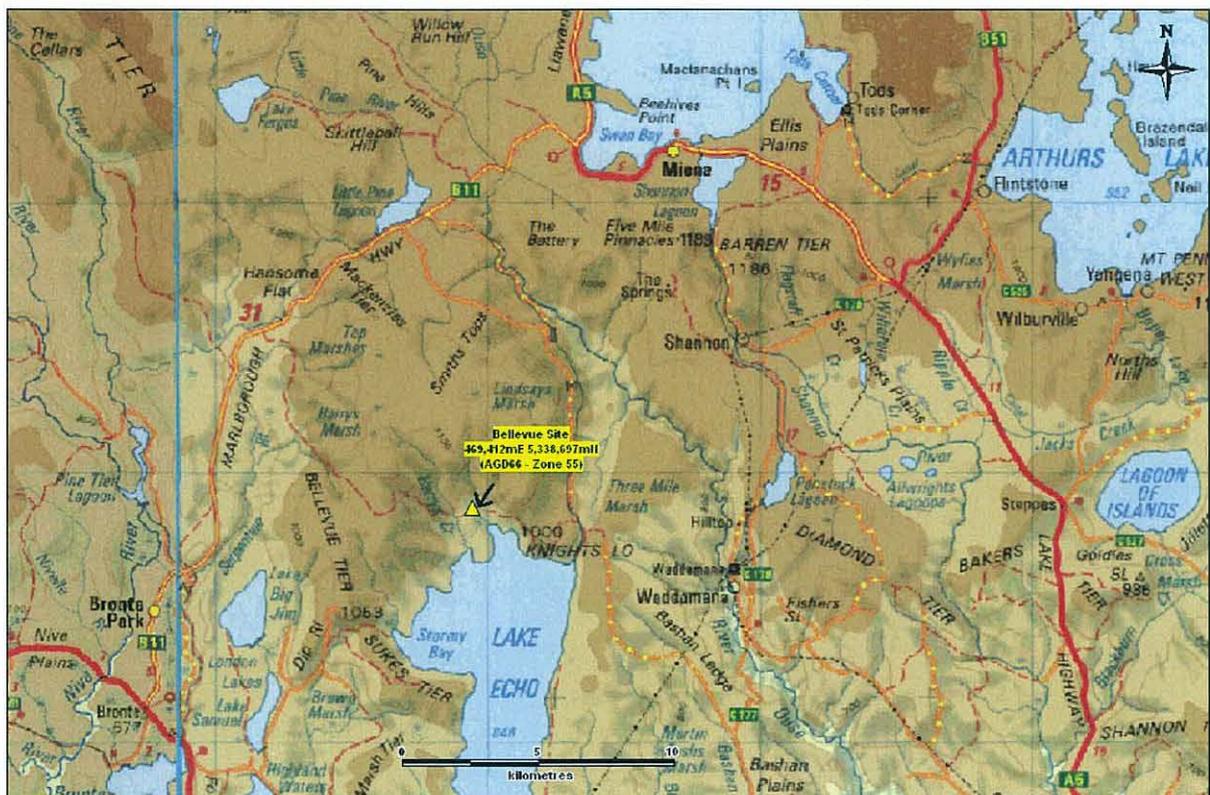
FIRE SERVICES

Tasmanian Fire Service **Head Office** PH: (03) 6230 8600

WELL CONTROL

Well Control Specialist: Alert Disaster Control (Ph 03 8361 6526)

LOCATION MAPS





4. BRIDGING DOCUMENT OVERVIEW

4.1 Project Overview

GSLM propose to drill Bellevue 1 as an oil/gas exploration well to a depth of approximately 2600m in SEL 13-98, using Hunt Energy Rig #3. 17 ½" surface hole will be drilled to 300m and 13 3/8" surface casing run and cemented. 12 ¼" intermediate hole will be drilled to approximately 1300m and the hole evaluated with wireline logs and DST's (if required) 9 5/8" intermediate casing will then be run and cemented. 8 ½" production hole will then be drilled to 2600m and the hole evaluated with wireline logs and drillstem tests as required. The well will then be cased and suspended or plugged and abandoned.

4.2 Responsibilities

In any emergency situation on a drilling location or while moving to/from the location there are shared responsibilities between GSLM and Hunt Energy (see Fig 1 below) and these responsibilities need to be clearly defined and understood by all parties to avoid any confusion or delays during an emergency.

GSLM has overall responsibility for the drilling operation conducted on its behalf and for conformance to the requirements of Mineral Resources Development Act 1995 of Tasmania.

These responsibilities extend to ensuring good environmental management and the respect and preservation of any areas of cultural and Native Title importance. These responsibilities are in addition to the normal corporate responsibilities for employees and the public.

Hunt Energy also has similar corporate responsibilities as above, with direct responsibilities for their personnel and equipment associated with the drilling operation.

As both GSLM and Hunt Energy have similar HSE Systems and Emergency Response Plan's in place, it is necessary to clarify any areas of overlap or possible confusion between the two sets of documentation and to clearly define the rolls and responsibilities of each organisation.

Hunt Energy Emergency Response Plan forms part of this Site Specific Bridging Emergency Response Plan and will be used in conjunction with the GSLM Emergency Response Plan.

4.3 Objectives

The objective of this Bridging Emergency Response Plan is to demonstrate that the HSE and Emergency Management systems covering all mobilization, wellsite and demobilization operations are clearly stated, resulting in the safe drilling of Backnell 1 in SEL 13-98.

It is the intention of GSLM and Hunt Energy, to have a clear demarcation of HSE and emergency management interfaces and to ensure there is no uncertainty as to roles, responsibilities, organizational structure, management of safety, operating procedures and reporting structure.

4.4 Scope

This Bridging Emergency Response Plan encompasses all HSE, drilling and associated operations to be conducted in 2008 at the Bellevue 1 location.

4.5 Method

The process for developing this Bridging Document is summarised as follows:

- HSE System Manual and Emergency Response Plan (ERP) review;
- Review of the Hunt Energy HSE Management System and ERP;
- Review of Hunt Energy Rig #3 Facility Description and Fit For Purpose Documentation;
- Definition of the Hunt Energy HSE management system elements to be used and relevant system interfaces;
- Review of the Hunt Energy Hazard Register for applicability to the Campaign.

5 HSE ROLLS AND RESPONSIBILITIES

5.1 Site Person in Charge (PIC)

The Drilling Supervisor is the designated Person in Charge of the operation in an emergency situation. Hunt Energy Rig Manager will continue to direct rig and camp personnel with respect to normal operations.

Should the Drilling Supervisor be incapacitated, injured or unable to adequately perform the required duties, Hunt Energy Rig Manager shall assume the responsibilities of the PIC until GSLM has positioned a replacement supervisor on site.

The Drilling Supervisor should not operate any of the drilling contractor's plant or equipment and where practical should relay all his instructions, in writing, via the drilling contractor's site manager.

5.2 Compatibility of HSE Policies

Both GSLM and Hunt Energy have compatible HSE Policies in place.

Crew / personnel inductions, toolbox meetings and PTW System procedures can be conducted by both GSLM and Hunt Energy personnel without confusion of content or responsibility. The Hunt Energy rig manager will normally be responsible for giving inductions etc to Century personnel and the GSLM drilling supervisor all 3rd party contractors.

5.3 HSE Procedures

Hunt Energy HSE Procedures will be deferred to in respect to all HSE activities including Permit To Work (PTW), Job Safety Analysis (JSA), Hazard Identification, Risk Assessment and Accident / Incident Reporting.

Hunt Energy Drug and Alcohol policies will also apply, as a minimum standard, to ALL personnel on location, including GSLM and third party contractors.

5.4 Well Control

The Hunt Energy Well Control Procedure will initially be implemented by the Hunt Energy Rig Manager / Driller with subsequent input / calculation and direction from the GSLM drilling supervisor and Hunt Energy rig crews who have been trained and where appropriate accreditation in accordance with Hunt Energy well control procedures. This training and accreditation regime will not be varied. The GSLM drilling supervisor will be the designated Person in Charge of all well control incidents.

Alert Disaster Control can mobilise well control equipment and personnel if required.

5.5 Safety Issues / Muster Stations / Emergency Response

Hunt Energy Emergency Response Procedures will be deferred to in respect to muster stations and responses required to emergencies on-site. Hunt Energy emergency flow charts are included within the Contractor HSE Manual – ERP of the Site Specific ERP.

The flow charts incorporated within the ERP are to be used as a guide and reminder by the GSLM Drilling Supervisor to ensure all the necessary procedures and checks are carried out to GSLM requirements. The ERP details the emergency organisation and responsibilities of the Adelaide Emergency Response Team (ERT) and its support mechanisms to the Hunt Energy Rig Emergency Response Plan, organisation and responsibilities.

5.6 Hazardous Substances

Hazardous substances transported to the Hunt Energy Rig #3 are documented in accordance with Dangerous Goods regulations. Hunt Energy will ensure that all hazardous materials onsite (including 3rd party hazardous materials) and used during the campaign are controlled in accordance with the Hunt Energy HSE Management System.

The Drilling Manager will provide relevant information including Material Safety Data Sheets (MSDS) to Hunt Energy for all chemicals and hazardous materials provided by for the campaign.

All hazardous materials will be transported, handled and stored according to Hunt Energy procedures as a minimum standard.

5.6.1 Drilling Fluids and Cementing Chemicals

Only approved 3rd Party Contractors will control the storage and handling of the cementing, drilling fluids and mudlogging chemicals. This will be done in conjunction with the Hunt Energy safe work practices.

5.6.2 Radioactive Materials

Radioactive materials must be stored in a dedicated and appropriate container. Only approved, trained and certified 3rd Party Contractor personnel will be authorized to handle these materials. Approved contractors will control the storage and handling of these materials in conjunction with the Hunt Energy safe work practices.

5.6.3 Explosives

Only approved, trained and certified 3rd Party Contractor personnel will be authorized to handle these materials. Approved contractors will control the storage, separation and handling of these materials in conjunction with the Hunt Energy safe work practices.

5.7 Safety Systems

The following Hunt Energy safety systems will be used during all stages of the operation:

- Permit to Work
- JSA
- Standard Operating Procedures
- Safety meetings (Pre Spud, pre job, pre tour and weekly)
- Emergency Drills
- Enforcement of Drug and Alcohol Policies

The following safety features will be used to ensure the well is drilled in a safe manner and that GSLM's requirements are compatible with Hunt Energy systems and procedures.

- All drilling operations will conform to GSLM's management policies (Environmental, Safety etc).
- All drilling operations will be carried out in accordance to the procedures outlined in the Drilling Operations Manual (DOM). The DOM provides details of standards to be applied to GSLM wells as well as standard operating procedures for all wells. The DOM is consistent with the standard operating procedures of Hunt Energy.
- A Drilling Program will be prepared that provides a description of the safety features incorporated in the well design. These include casing design, drilling fluid design, well control and other related drilling procedures. The drilling program will be given to Hunt Energy so they can confirm that the planned well does not contravene any of their policies and that the contracted rig is fit for purpose.
- Good communication will be maintained between Hunt Energy and GSLM field representatives
- Good communications will also be maintained between Hunt Energy and GSLM management.
- Regular meetings will be held between GSLM and Hunt Energy to discuss safety and operational issues.

6 OPERATIONS

Operations Base: For drilling in the permit area SEL 13-98, the designated Operations Base will be in Hobart, which will coordinate the activities associated with the drilling program. It will also be the primary point of contact for all emergency notifications from the well site and/or the drilling contractor.

Logistics Base: The designated Logistics Base for the Bellevue 1 well will be GSLM's office in Hobart which will initiate the supply of equipment and materials through the Drilling Manager. In emergency supplies and equipment may also be available from other sources such as the Hunt Energy supply basis in Adelaide.

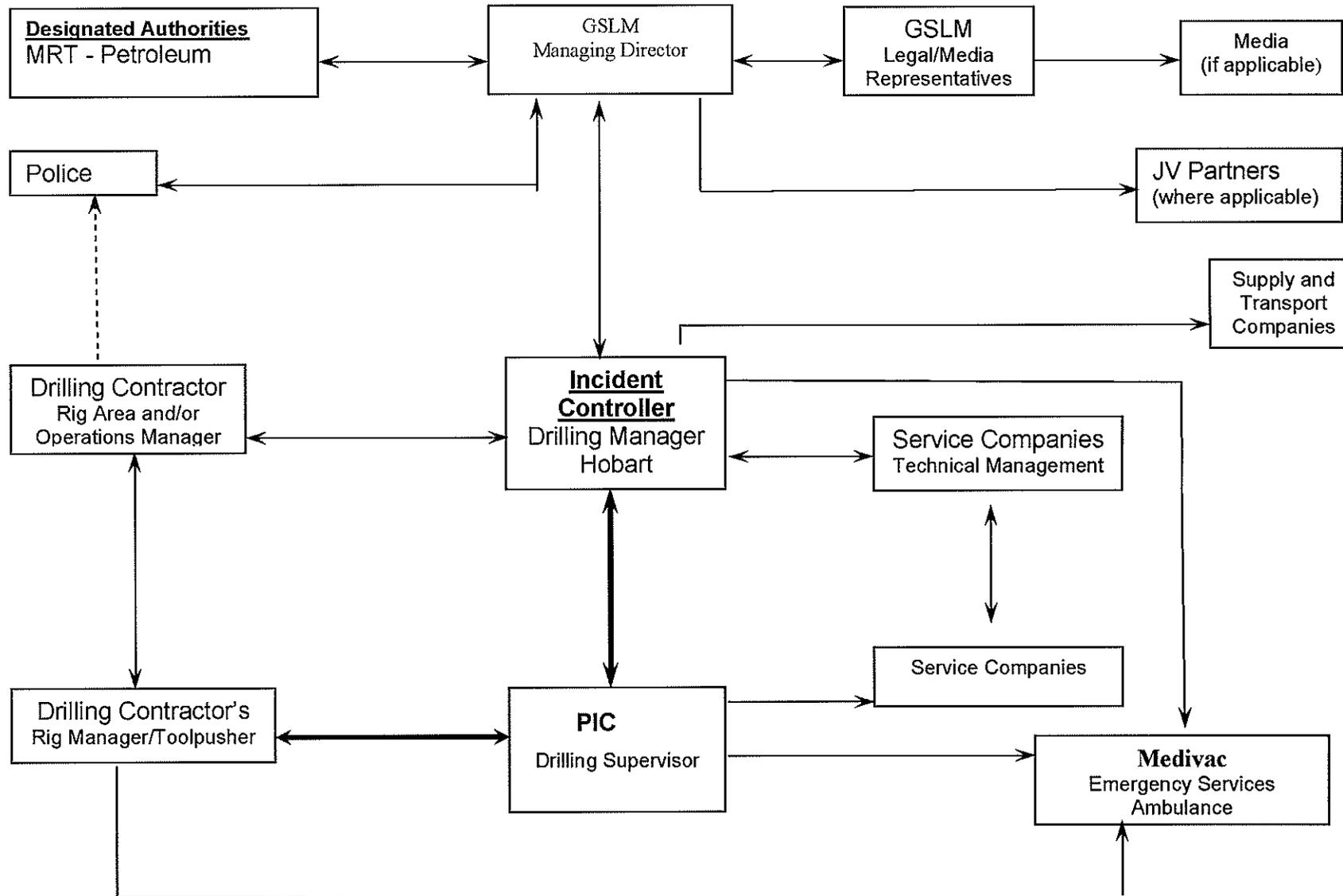
Aviation Support Base: Launceston and Hobart are the designated aviation support bases for the operations and will provide aircraft transfers to/from the rig via commercial aircraft.

APPENDICES

APPENDIX 1: Emergency Response Interface

EMERGENCY RESPONSE INTERFACE

GSLM Ltd and Hunt Energy Pty. Ltd.



APPENDIX 2: Contacts

	Supervisor		
Halliburton SEC (Bits)		(08) 8150 1219	
Roger Ryley	Bit representative	0410 002 373	roger.ryley@halliburton.com
Transco Tools and Bits		(08) 8326 5599	
Jim Stobie	Managing Director	0407 007 643	drillbits@ozemail.com.au
Steve White	Pason technician	0439 814 842	steve.white@pason.com
Hofco (Drilling Tools)		(07) 5527 2939	
Kerstine Plimmer	Operations Manager	0412 377 881	kerstine@hofco.com.au
RMN (Mud)		(08) 8338 7288	
Andre Skujins	Manager	0428 833 872	abc76048@bigpond.net.au
Wood Group (Wellheads)		(08) 8243 4700	
Fraser Melvin	Manager Service	0418 500 806	fraser.melvin@woodgroup.com
Stewart Jury	Manager	0409 179 944	stewart.jury@woodgroup.com
MITO (Casing)		(08) 8224 0226	
John Dickson	Area Manager Contracts	0411 771 630	john.dickson@mitubulars.com.au
Chris Skewers	Manager	0412 21 1608	christopher.skewers@mitubulars.com.au
Midcon (casing)			
IDS (daily reports)		+62 2743 3432	www.idsdatanet.com
Shawn Truesdell	Area Manager	0406 515 387	truesdell@idsdatanet.com
Alert (blowout control)		+65 6545 5088	www.alertdisastercontrol.com.sg
Douglas Wulf	Business Manager	0400 450 065	dwulf@alert.com.sg
Well Evaluation			
Schlumberger		(03) 9674 7131	www.schlumberger.com
Bevan Morrison	Account Manager	0401 994 284	bmorrison@slb.com
Weatherford Logging		(03) 5144 3255	
Rex Tench	Manager		
Geoservices		(08) 8297 5010	www.geoservices.com
Lee Forman	Business Manager	0419 847 734	leigh.forman@geoservices.com
Cathryn Stevens	Personnel Coordinator	0448 338 114	cathryn.stevens@geoservices.com
DST Australia		(07) 4622 2655	www.ozdst.com
Craig thorn	General Manager	0427 691 050	craigthorn@ozdst.com
Sue Thorn	Admin Manager	(07) 4622 2655	mgr@ozdst.com

Farry Riggs		(08) 8240 3222	
Ewan McDonald	Operations Manager	0400 219 709	ewan@farryriggs.com.au
Architectural Acoustics Noise Control			http://tassie.110mb.com/terts/
Pearu Terts	Consultant Engineer	(03) 6249 7165	pterts@southcom.com.au
Logistics/Earthworks			
Gradco (earthworks)		(03) 6339 2535	www.gradco.com.au
Oliver Diprose	General manager	0418 314 438	odiprose@gradco.com.au
ITAC (Logistical coordinator)		(03) 9335 4444	www.itac.com.au
John Higgs	Managing Director	0412 392 692	jhiggs@itac.com.au
Kellara Transport (Local Transport)		(03) 6326 3955	www.kellaratransport.com.au
Ken Hughes	Managing Director	0409 445 515	knekellara@bigpond.com
Regulatory			
MRT			www.mrt.tas.gov.au
Carol Bacon	Managing geologist	(03) 6233 8326	cbacon@mrt.tas.gov.au
John Pemberton	Senior Geologist	(03) 6233 8371	jpember@mrt.tas.gov.au
Wojciech Grun	Mining Engineer	(03) 6233 8320	wgrun@mrt.tas.gov.au

APPENDIX 3: Hunt Energy Emergency Response Manual



HUNT ENERGY & MINERAL CO-AUSTRALIA PTY LTD
ACN 075 814 390 / ABN 52075814390

ONSHORE DRILLING EMERGENCY RESPONSE PLAN

Developed by:

Hunt Energy Safety Manager

Manual No: Uncontrolled

HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN

No. Uncontrolled

To Supervisors and Contractors

The enclosed "Emergency Response Plan" is for Onshore Drilling Operations.
Please sign the following page, "ACKNOWLEDGEMENT OF RECEIPT", of this document
and return it to:

ATTENTION: The Managing Director
 Hunt Energy & Mineral Co – Australia Pty Ltd
 15 Scarborough Way Lonsdale SA 5160

The Plan is to provide guidelines for individual responsibilities of key personnel in the event of an emergency that may threaten the safety of personnel, the well, equipment, or the environment. This Plan should compliment common sense and procedures as described in the Operations & Safety Manual, Government Regulations and other established operations and safety procedures.

Please familiarise yourself with this manual and ensure that all personnel understand their actions, roles and responsibilities in Emergency situations.

This manual should be made available to all personnel involved in the operation for their reference.

LARRY WERECKY
Managing Director

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Reviewed 01/07/06
Updated 02/01/08

HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN

ACKNOWLEDGEMENT OF RECEIPT

EMERGENCY RESPONSE PLAN:

COPY NO: Uncontrolled

I acknowledge receipt of the above-mentioned document.

NAME OF RECIPIENT:.....

TITLE OF RECIPIENT:.....

ORGANISATION NAME:.....

ORGANISATION ADDRESS:.....

SIGNATURE:.....

DATE:.....

NOTE: PLEASE RETURN THIS FORM TO HUNT ENERGY - ADELAIDE OFFICE

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Reviewed 01/07/06
Updated 02/01/08

HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN

DISTRIBUTION LIST

ADELAIDE

File Copy

Managing Director

Safety Manager

Operations Manager

SITE

Drilling Supervisor

Rig Manager

DESIGNATED AUTHORITY

Queensland Department of Natural Resources & Minerals

Victorian Department of Primary Industries

Primary Industries & Resources South Australia.

Department of Minerals & Energy W.A. – Petroleum Division

Mineral Resources Tasmania

(as applicable)

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Reviewed 01/07/06

Updated 02/01/08

HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN

SECTION	<u>TABLE OF CONTENTS</u>
1.0	INTRODUCTION
1.1	PURPOSE OF MANUAL
1.2	COMMUNICATIONS PROCEDURES
1.3	EMERGENCY REPORTING FORMAT
1.4	RESPONSIBILITIES OF PERSONNEL
	1.4.1 Drill Site
	1.4.2 Head Office Operator / Contractor
	1.4.3 Emergency Response Group (ERG)
2.0	EMERGENCY RESPONSE
2.1	GENERAL
2.2	DESIGNATED MUSTER POINTS
2.3	WELL CONTROL
2.4	FIRE OR EXPLOSION (RIG SITE)
2.5	ESCAPE OF GASES / EMERGENCY FACILITIES SCHEMATICS
2.6	FIRE EMERGENCY RIG CAMP / CAMP EVAC. PLAN
2.7	CAMP FIRE EMERGENCY PROCEDURE
2.8	MEDICAL EMERGENCY (MEDIVAC)
3.0	RESPONSIBILITIES AND FUNCTIONS
3.1	GENERAL
3.2	ON SITE PERSONNEL
3.3	OTHER COMPANY & CONTRACTOR PERSONNEL
3.4	OPERATOR'S OFFICE BASED PERSONNEL RESPONSIBILITIES

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Updated 02/01/08

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ONSHORE DRILLING – EMERGENCY RESPONSE PLAN

SECTION	<u>TABLE OF CONTENTS</u>
4.0	EMERGENCY SERVICES
4.1	FIRE BRIGADE / SES
4.2	POLICE
4.3	AMBULANCE / MEDICAL SERVICES
4.4	WORKPLACE SERVICES / PIRSA
5.0	STATE AUTHORITIES AND LOCAL COUNCILS
5.1	QUEENSLAND DEPT OF NATURAL RESOURCES & MINES
5.2-5.5	OTHER STATES
5.6	LOCAL COUNCIL
5.7	POLICE
5.8	CONTACTS - DEPT OF NATURAL RESOURCES & MINES
6.0	DIRECTORY OF ORGANISATIONS AND PERSONNEL
6.1	WELL SITE
6.2	HUNT ENERGY ADELAIDE OFFICE
6.3	DIRECTORY OF HUNT KEY PERSONNEL
6.4	STATE AUTHORITIES
6.5	DISTRICT COUNCIL
7.0	EMERGENCY CONTACT NUMBERS – VIC FAR WEST OPS.
7.1	EMERGENCY INJURY CONTACT NUMBERS
7.2	FIRE SERVICES
7.3	STATE POLICE
7.4	DRILLING CONTRACTOR CONTACTS
7.5	STATE AUTHORITY
7.6	POISONS INFORMATION

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Updated 02/01/08

**HUNT ENERGY & MINERAL CO-AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY RESPONSE PLAN****SECTION 1.0
INTRODUCTION****1.0 INTRODUCTION****1.1 PURPOSE OF THIS MANUAL****Objective**

The objective of this document is to:

- Describe response procedures to be followed in the event of an emergency at or near the well site or rig camp.
- Detail the responsibilities of those personnel involved in the incident and provide a logical reporting procedure.
- Define the role and procedures of the Emergency Response Group (ERG) in mobilising and co-ordinating external support resources for use in an emergency.
- This document should be used as a guide as it is not designed to replace good oil field practices, common sense or statutory regulations.

Revisions

This document and its distribution is controlled by Hunt Energy & Mineral Co – Australia Pty Ltd. The Managing Director shall approve all revisions.

To initiate a revision, the revised or additional article should be submitted to Managing Director for approval.

Associated Manuals

This Plan should be read in conjunction with:

- Operators Onshore Drilling Operations Manual
- Operators Occupational Health and Safety Plan
- Drilling Contractors Operations & Safety Manual
- Minerals Resources Development Act 1995

Definition

An emergency can be defined as an event that has resulted, or may result in the serious injury and/or loss of life to personnel, damage and/or pollution to the environment, loss and/or damage to the well and/or loss or damage to equipment.

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SECTION 1. Page 1 of 7 EMERGENCY RESPONSE

Last updated 02/01/08

**HUNT ENERGY & MINERAL CO-AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN****SECTION 1.0
INTRODUCTION****Potential Causes of an Emergency**

Personnel must be aware of the potential hazards that exist at or around the well site that may cause an emergency. Examples of some potential emergency situations are:

- Fire and Explosion at the well site or in the immediate area of the site.
- Uncontrolled escape of hydrocarbon liquids or gas.
- Uncontrolled escape of formation water.
- Uncontrolled escape of toxic or corrosive gases.
- Spill of hazardous or toxic chemical.
- Major malfunction, structural or mechanical failure of equipment.
- Medical emergency due to personal injury, reptile or spider bite, exposure or heat stress and personal medical condition or allergy.
- Severe storms.
- Motor vehicle accident.
- Failure of a leased aircraft or vehicle to arrive at a designated point at the scheduled time.
- Fire in the accommodation block or other facilities at the rig camp.

IF THERE IS ANY DOUBT AS TO WHETHER THERE IS AN EMERGENCY, TAKE THE DECISION TO INITIATE THE EMERGENCY RESPONSE PROCEDURE.

1.2 COMMUNICATIONS PROCEDURES

The following rules should be adhered to in an emergency:

General

- All communications should be by telephone and/or facsimile or email.
- All verbal instructions and messages should be confirmed by facsimile or email.
- All messages should be kept as brief and accurate as possible.
- All messages/instructions should be accurately logged including times and names of persons making and receiving the calls.

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SECTION 1. Page 2 of 7 EMERGENCY RESPONSE

Last updated 02/01/08

**HUNT ENERGY & MINERAL CO-AUSTRALIA PTY LTD
ONSHORE DRILLING – EMERGENCY RESPONSE PLAN**

**SECTION 1.0
INTRODUCTION**

Well Site

Rig Manager or Designate:

- Make initial contact with the operator Drilling Supervisor, Hunt Energy Managing Director and/or the next member of the Emergency Response Group (ERG) according to duty roster and notification sequence, until a member is successfully contacted.
- Make contact with any emergency service necessary for any immediate action that is required.
- Keep messages as brief and accurate as possible
- Keep a log of all calls related to the emergency to and from the site. Where possible all verbal messages should be confirmed by facsimile.

Operators Head Office

Drilling Superintendent or Designate:

- Contact General Manager & Hunt Energy Managing Director & notify of situation.
- Contact & activate any emergency response service that requires immediate action.
- Provide technical assistance to the well site.
- Keep messages/instructions as brief as possible.
- Keep a log of all calls related to the emergency. All verbal instructions & messages should be confirmed by facsimile or email.

General Manager:

- Contact & activate any emergency response service that requires immediate action.
- Contact & activate Emergency Response Group & Emergency Incident Media Response Plan as necessary.
- Notify any Government Authorities of the emergency as required.
- Keep messages/instructions as brief & accurate as possible.
- Keep a log of all calls related to the emergency using the Emergency Communications Log (Sect. 3) including times & names of persons receiving & making the calls. All verbal instructions & messages should be confirmed by facsimile or email.

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SECTION 1. Page 3 of 7 EMERGENCY RESPONSE

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**SECTION 1.0
INTRODUCTION**

Emergency Response Group:

- Contact & activate any resources necessary to provide assistance to control the emergency.
- Provide information & support to Emergency or Accident Investigation services & police.
- Provide technical assistance to well site.
- Keep messages/instructions as brief and accurate as possible.
- Keep log of all calls related to the emergency. All verbal instructions & messages should be confirmed by facsimile.

1.3 EMERGENCY REPORTING FORMAT

In an emergency situation, it is imperative that all emergency messages & reports clearly & concisely relay the nature of the problem & request for assistance.

The following Emergency Reporting Format is included for reference, as the requirements for each emergency situation may vary. In addition to its use in assisting the formatting of reports, the following format can be used as a quick checklist.

All verbal reports should be confirmed by a facsimile or email.

All emergency reports sent or instructions received should be logged & the names of the caller & receiver noted.

ACCIDENT / INCIDENT REPORTING

- Name of well location.
- Name of Rig.
- Description and severity of accident / incident.
- Time accident / incident occurred.
- Cause of accident / incident if known.
- Status report of well security, equipment, personnel and environment as appropriate.
- Details of any injured, dead and missing personnel including:
 - number of personnel involved
 - name, company, position of personnel
 - cause of injury or death
 - details of injuries
 - details of any treatment given
 - location and time person last seen (if missing person)

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**SECTION 1.0
INTRODUCTION**

Note Medical Evacuation Form should be completed as per Sections 2.6 and 2.7. (Copies are attached in Enclosure).

- Weather conditions (including wind strength and direction, etc).
- Actions taken on site and emergency services activated.
- Details of assistance requested from outside emergency.
- Assistance required from Operators Emergency Response Group (ERG).
- Any other points that may be relevant to the emergency.

1.4 RESPONSIBILITIES OF PERSONNEL

The following is a summary of personnel positions and responsibilities. The Designate will act on the nominated supervisors behalf in his absence.

Safety Priorities are:

- 1. PERSONNEL**
- 2. WELL**
- 3. PROPERTY & ENVIRONMENT**
- 4. EQUIPMENT**

1.4.1 Drill Site

Operator Personnel

Drilling Supervisor	- Responsible for all drill site activities. -DESIGNATE: Well Site Geologist. -Drilling Contractor Personnel
Rig Manager	-Responsible for all activities related to Drilling Contractor equipment and personnel. -DESIGNATE: On tour Driller.
On tour Driller	-DESIGNATE: Off tour Driller.
Site Communications Officer	-Nominated person responsible for all Communications during an emergency. DESIGNATE: As nominated.

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**SECTION 1.0
INTRODUCTION**

Note 1: In the absence of Operators' nominated personnel, the Senior Drilling Contractor person on site will assume responsibility.

Note 2: The Site Communications Officer (and Designate) will normally be a Drilling Contractor employee nominated by the Rig Manager.

1.4.2 Hunt Energy - Head Office

Managing Director	- Responsible for overall Hunt Energy operations. POSITION: Mr Larry Werecky DESIGNATE: Operations Superintendent
Operations Superintendent	-Responsible for co-ordinating logistics of Rig operations. POSITION: Chris Brown DESIGNATE: Drilling Superintendent
Drilling Superintendent	-Responsible for co-ordinating drill site activities. DESIGNATE: Rig Manager

1.4.3 Emergency Response Group (ERG)

- An Emergency Response Group (ERG) will be centred initially at Operator Head Office, and will be made up of a number of key Operator personnel plus other seconded Operator personnel, Contractor Management or Specialist Consultants as deemed necessary.
- The ERG will be responsible for the provision of offsite expertise, assistance to onsite personnel, and co-ordinating all efforts to overcome an on-site emergency situation.
- The ERG will be responsible for liaising with Operators senior management, Emergency Incident Media Response Group, Contractors, and Government authorities.

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SECTION 1. Page 6 of 7 EMERGENCY RESPONSE

Last updated 02/01/08

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**SECTION 1.0
INTRODUCTION**

ERG Membership

The ERG will comprise of a core group of the following Operator personnel:

Adelaide

- Managing Director / General Manager
- Operations Superintendent
- Drilling Superintendent
- Occupational Health, Safety & Environment Manager.

Seconded ERG Members

Operations will second the following personnel as necessary:

- Other Operator personnel
- Drilling Contractor Management
- Service Company Management
- Logistic Contractor Management
- Specialist Consultants.
- Depending on the nature of the emergency, the ERG may relocate to a post close to the well site.

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SECTION 1. Page 7 of 7 EMERGENCY RESPONSE

Last updated 02/01/08

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EMERGENCY RESPONSE****2.0 EMERGENCY RESPONSE****2.1 GENERAL**

- Overall Authority on site during the emergency will be the Operator Drilling Supervisor.
- The Operator Drilling Supervisor will be the primary contact during an emergency.
- All communications off the site regarding the emergency incident are to be directed through the Operator General Manager or designate.
- The Operator Drilling Supervisor is to be informed of any hazards that may affect the safety of the crew, equipment, environment or well.
- Priority will be given to the safety of personnel at all times.
- Operator General Manager & drilling contractor Managing Director to be kept informed of the status of the emergency.
- Drilling contractor Operations Superintendent to be kept informed of the status of the emergency.
- General Manager, (Operator) will have overall authority & responsibility in the event of an emergency.
- The Rig Manager is to co-ordinate on-site efforts to control the emergency in conjunction with the Operator Drilling Supervisor & inform the Hunt Energy Managing Director.
- ERG will co-ordinate activities and provide assistance as necessary to overcome the emergency.

2.2 DESIGNATED MUSTER STATION

In any emergency where the drill site is considered dangerous to personnel, the site will be evacuated as directed by the Drilling Supervisor. All personnel will assemble at the designated MUSTER STATION, and if at **muster point #1**, remove their tag from the Evacuation Board. This designated MUSTER STATION will be nominated prior to commencement of drilling operations and all personnel informed of its location.

The Primary Muster Station shall be located at the corner of the Rig Manager's office adjacent to the Emergency Shutdown system.

An Alternate Muster Station should also be nominated to provide a safe location if the Primary Muster Station is considered unsafe for personnel due to the direction of the prevailing winds or if access is impeded.

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EMERGENCY RESPONSE****2.3 WELL CONTROL**

A Well Control situation may progress through three phases that are described as follows:

Phase 1 (Alert)

- Well has kicked and is being killed using normal well control procedures as detailed in the Operations Manual.

Phase 2 (Alert)

- Well Control may not be achieved due to equipment failure or operational problems.
- When a Phase 2 alert is declared, all non-essential personnel are to evacuate the well site and assemble at the Designated Muster Station.
- All attempts are to be made to control the well, provided personnel safety is not jeopardised.

Phase 3 (Emergency)

- Uncontrolled blowout and control of the well can no longer be regained.

The crew, equipment, well and environment are in imminent danger.

- Alarm to be sounded.
- All personnel to evacuate the site and assemble at the Designated Muster Station.
- All personnel to be accounted for.
- The ERG will begin co-ordination of well capping operations.

Note: Phases will be declared by the Drilling Supervisor in consultation with the Rig Manager.
Operator General Manager or designate & Hunt Managing Director are to be notified of all phases.

2.4 FIRE OR EXPLOSION

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Section 2. Page 2 of 12 EMERGENCY RESPONSE

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EMERGENCY RESPONSE**

- Alarm is to be sounded.
- Immediately confirm the location and extent of the fire.
- Ensure all personnel are accounted for.
- Activate emergency response teams to fight the fire or contain the damage caused by the explosion.
- Administer medical treatment to any injured personnel.
- Arrange for medical evacuation of any injured personnel.
- Activate local resources (e.g. SES) to assist in extinguishing or containing the fire.
- Evacuate non-essential personnel to Designated Muster Station as necessary.
- If site becomes dangerous and poses a risk to personnel safety, **all** personnel to be evacuated and assemble at the safest Designated Muster Station, or alternate site.
- Operator General Manager or designate & Hunt Energy Managing Director are to be notified of the emergency and kept updated on the situation.

2.5 ESCAPE OF GASES

In most cases, gases escaping from a well will be toxic, flammable and corrosive, therefore extreme care should be exercised when entering any area where gas is present.

- Hydrocarbon gases are extremely flammable and are easily ignited. Hydrocarbon gases can also cause death by asphyxiation.
- Hydrogen Sulphide Gas (H₂S) is extremely toxic and corrosive. H₂S can quickly cause death if inhaled at relatively low concentrations. It also leads to the loss of smell at toxic concentrations making it ever more dangerous.
- Carbon Dioxide (CO₂) is toxic and corrosive. CO₂ can cause death due to asphyxiation.

Both CO₂ and H₂S are denser than air and will naturally flow to lower areas (e.g. the cellar, valleys, etc.), therefore, appropriate precautions to test the atmosphere must be taken before entering any suspect area when quantities of these gases are thought to be present.

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**SECTION 2.0
EMERGENCY RESPONSE**

Procedures detailed under Well Control (Section 2.3) should be followed in the event that the escape of gases is from the well.

If the presence of a toxic or corrosive gas release is anticipated or observed, the following procedure should be followed.

- Alarm to be sounded.
- All personnel to be notified.
- Well to be shut in and secured or take other necessary action to cut-off the gas flow.
- All hot work (e.g. welding, friction cutting) to be suspended.
- Shut down all engines if possible.
- If breathing apparatus & tanks are available, ensure compressor inlets are checked before any air cylinders are filled.
- Evacuate all hazardous areas e.g. rig floor, cellar, mud pits, areas immediately down wind, etc.
- Evacuate all non-essential and/or all personnel to up wind Designated Muster Station as deemed necessary.
- All personnel are to be accounted for.
- All personnel entering the affected areas shall wear breathing apparatus.

Note:

Any person using a breathing apparatus must be trained and certified in its use.

- A minimum of '2' persons is to enter a gas-affected area, i.e. Buddy System.
- Administer medical treatment to injured persons.

Note:

Resuscitation should be given immediately to any persons affected by the toxic gas.

Arrange for medical evacuation of injured persons.

- Initiate any local resources to assist.
- Operator General Manager & Hunt Energy Managing Director to be notified of the emergency and kept up to date on the situation.

Note:

If it is anticipated that toxic or corrosive gases will be encountered, then procedures detailed in the Drilling Operations Manual should be followed.

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EMERGENCY RESPONSE****2.6 FIRE EMERGENCY – RIG CAMP**

- If the fire is small & easily contained, use the appropriate fire extinguisher to put the fire out, & then report immediately to the Camp Manager & Rig Manager.
- If in any doubt or the fire is established, **raise the alarm** & initiate evacuation.
- Check rooms & assist other personnel to evacuate if they are having difficulty. Ensure that the First Aid box is collected by the designated camp attendant or other nominated person.
- Shut down camp generators (if safe to do so) where leaving them running creates a more significant hazard. If generators are shut down, turn off supply from diesel tanks if possible.
- Proceed to Muster Point #1 if safe to do so, or Muster Point #2 if the former is in a hazardous position in relation to the fire.
- The Camp Manager or designated replacement will conduct a head count to determine if all personnel are safe. He will also send someone to raise the alarm with the Rig Manager.
- Provide first aid or medical treatment to anyone injured as a result of the fire or evacuation.
- If personnel are missing, a search & rescue attempt will be initiated as appropriate, as well as a fire fighting team if practical, to try & extinguish or contain the fire.
- If the fire is contained to one building, & it is safe to do so, use the front end loader if available to try to drag the burning building away from the others.
- All personnel not directly involved with emergency teams must remain at the muster point until help arrives, or assist as directed by the Camp Manager, Rig Manager or other person in charge.
- Make arrangements to evacuate any seriously injured personnel using services as covered under Section 2.7 & Section 4.
- Complete reporting & investigation as covered under Section 3. of this manual & Section 10.15 of the Onshore Drilling Operations & Safety Manual.

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Section 2. Page 7 of 12 EMERGENCY RESPONSE

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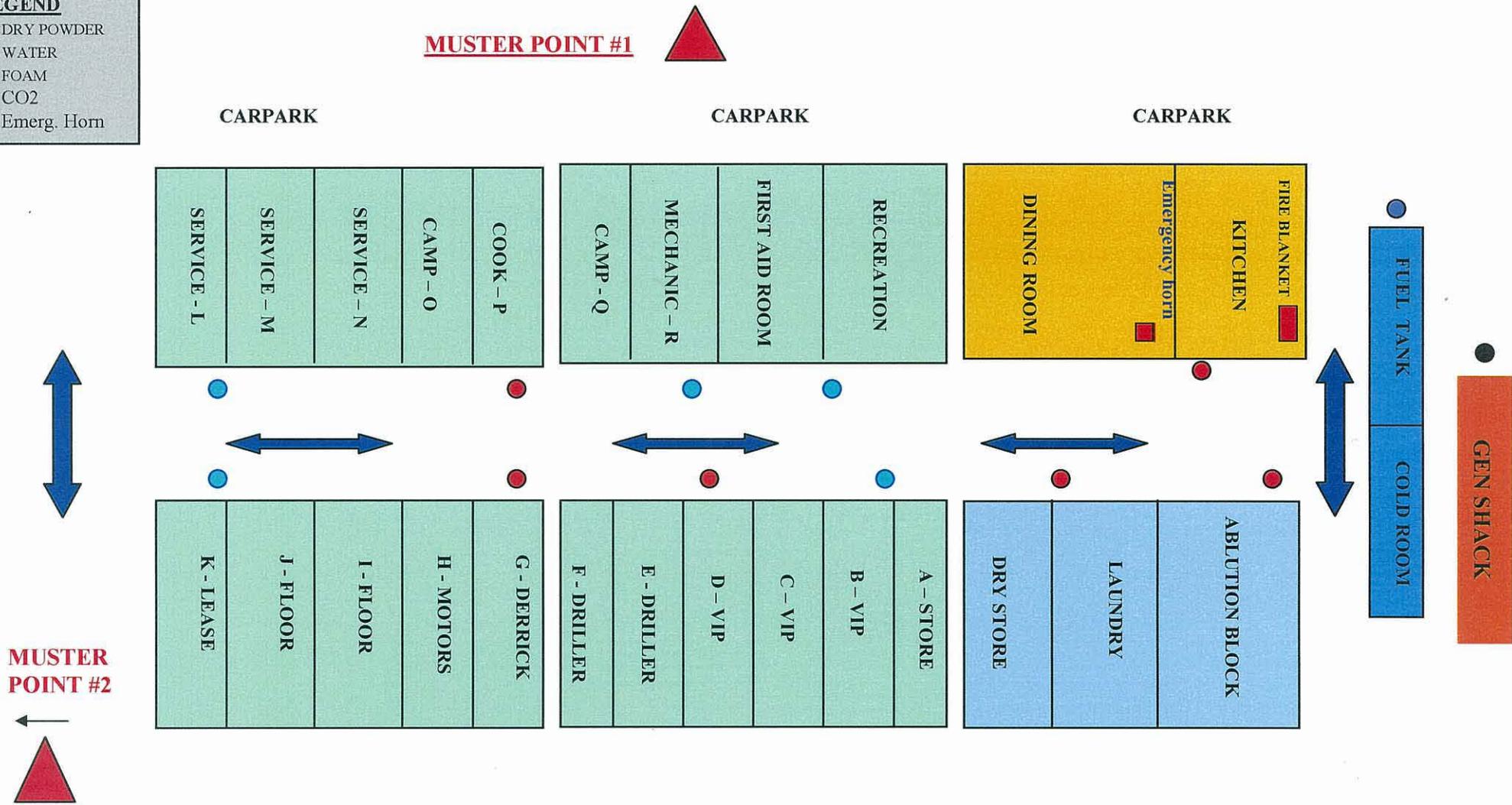
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**SECTION 2.0
EMERGENCY RESPONSE**

RIG #3 CAMP FIRE EXTINGUISHER & EVACUATION PLAN

LEGEND

- DRY POWDER
- WATER
- FOAM
- CO2
- Emerg. Horn



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Section 2. Page 8 of 12 EMERGENCY RESPONSE

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EMERGENCY RESPONSE****2.7 MEDICAL EMERGENCY (MEDIVAC)**

- Make immediate area safe if necessary.
- Check victim for vital signs.
- Administer medical treatments as necessary.
- Move victim to safer or more comfortable position as necessary.
- Arrange for external medical assistance as necessary.
- Arrange for medical evacuations as necessary e.g. site vehicle, ambulance, flying doctor, etc.
- Medivac Patient Information Sheet (as on Page 10 & 11 with blank copies in the enclosure) should be completed and copies sent to ambulance depot, receiving hospital, doctor, & Hunt Energy Operations Superintendent or Operator Drilling Manager or designate as applicable. The original should be kept on site for record.
- Notify police in the case of serious injury or death.
- Notify Operator General Manager of emergency and keep updated on the situation.

Note:

1. If injured person is in a location where further injury is likely then the patient should be moved to a safer location. If an injured person is to be moved, adequate care must be taken to ensure that further injury is not inflicted.
2. In case of serious injury or death the injured/dead person should not be moved until the ambulance/police arrive. The location where the injury occurred should not be disturbed other than to make it safe.
3. If possible, photos of the injured person and general area should be taken for future reference.
4. All actions relating to treatment of the injured are to be accurately documented.
5. All communications, including instructions are to be accurately logged.

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**SECTION 2.0
EMERGENCY RESPONSE**

2.8 MEDIVAC PATIENT INFORMATION SHEET

Name of Patient:

.....
(surname) (given names)

Date of Birth:

Company:

.....

Designation: Nature of Injury/ Illness

.....
.....
.....
.....
.....

Vital Signs:

Colour

State/extent of bleeding (if any)

State of consciousness.

Pulse

Blood pressure

Any other symptoms considered important

Treatment/medication given:

.....
.....
.....

Allergies/any other medications used:

.....
.....

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**SECTION 2.0
EMERGENCY RESPONSE**

If medical problem, any previous history of same or similar nature

.....
.....
.....

Blood group:

Type of medical aid required:

If X-rays required: Yes / No

Ambulance stretcher case: Yes / No

Medical escort required on flight:..... Yes / No

Accommodation or transport required:..... Yes / No

Any other

information:.....

.....
.....

Signature (Medic):

Date:.....

Distribution:

- Copy to be sent with patient copies to Drilling Supervisor and Rig Manager
- Faxed copies: Operations Superintendent, receiving Hospital
- Original to be retained for records

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**SECTION 3.0
RESPONSIBILITIES & FUNCTIONS**

3.0 RESPONSIBILITIES AND FUNCTIONS

3.1 GENERAL

- All personnel on site will have knowledge of the Emergency Response Plan, the Onshore Drilling Operations and Safety Manual, and the Tasmanian Mineral Resources Development Act 1995.
- All personnel on site have the responsibility to immediately report to the Operator's Drilling Supervisor or Drilling Contractors Rig Manager on any actual or potential emergency situations, and to implement actions to prevent or contain the situation if possible. A single extended horn blast will alert of all emergencies, & then specific information will be communicated between the Rig Manager, Driller and the crews. Monitor wind direction daily. The default Muster Point is #1 unless too dangerous.

NOTE: Unless absolutely unavoidable, only the Operator Drilling Supervisor or Designate should initiate the reporting procedure.

3.2 ON SITE PERSONNEL

Operator Drilling Supervisor

The Operating Drilling Supervisor is responsible for the direct control of an emergency. Senior Company and Contractor personnel on site at the time of the emergency may act as advisers.

The Operator Drilling Supervisor will be completely familiar with the operations of the well site and the Emergency Response and Drilling Operations Procedures. In the event of an emergency the Operator Drilling Supervisor will:

- Immediately assume control of the situation.
- Implement and co-ordinate the Emergency Response Procedure.

Assess the extent, nature and cause of the emergency in respect of:

- Possibility of escalation.
- Actual or potential major escape of hydrocarbon.
- Actual or potential major escape of toxic or corrosive gases.
- Actual or potential fire and/or explosion.
- Actual or potential cause of damage or harm to personnel, equipment, well and environment.

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RESPONSIBILITIES & FUNCTIONS**

The Operator Drilling Supervisor should also decide on immediate actions to contain and overcome the emergency. The actions to be considered include:

- Shut down of all or part of the operations including securing the well and activating rescue, fire fighting equipment or other appropriate action including administering first-aid.
- Notify Operator General Manager & drilling contractor Managing Director and keep up-dated on status of emergency.
- Notifying, alerting or calling for assistance from the emergency services as necessary e.g. Fire Brigade, Police, Medical Services or pollution monitoring authorities. (EPA)
- Evacuate all non-essential personnel, or if necessary, all personnel to designated Muster Station, depending on the risk to personnel safety.
- Ensure all personnel are accounted for and co-ordinate rescue and treatment of any injured persons.
- Ensure that the safety of rescue or fire fighting teams is not jeopardised.
- Ensure access gates are opened as necessary.
- Rig Manager and drilling crew to implement and co-ordinate well control procedures and document all events.
- Take photos of damage to equipment or location, etc, if possible provide appropriate reports after the event.
- Ensure Site Communications Officer logs all incoming and outgoing calls & faxes.
- Co-ordinate service company personnel as necessary for well control operation or other emergency operations.
- Ensure that all emergency procedures implemented are in accordance with Government Regulations, Operators Procedures and good oil field practice.

Well Site Geologist

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RESPONSIBILITIES & FUNCTIONS**

- Act as the Drilling Supervisors designate.
- Assist as directed by the Drilling Supervisor.
- Ensure all events and actions are logged.
- Ensure all company and service personnel are accounted for.

Rig Manager

The Rig Manager is responsible for the safety of all Hunt Energy personnel and equipment, and his duties include:

- Ascertain type & extent of the emergency and notify Drilling Supervisor. Keep Drilling Supervisor updated of the situation.
- Co-ordinate all rescues and fire fighting crews.
- Ensure the alarm and appropriate warnings are given for each emergency situation.
- Liase with and assist the Drilling Supervisor as necessary.
- Ensure all Hunt Energy personnel are accounted for.
- Ensure Hunt Energy personnel follow correct emergency procedures.
- Inform and liase with Hunt Energy management as necessary.
- Ensure correct well control procedures are implemented.
- Ensure correct on-site medical treatments and Medivac procedures are followed.
- In conjunction with the Drilling Supervisor, decide on evacuation procedures.
- Ensure that a Site Communication Officer (SCO) is in place and that Emergency Communications Procedures are followed.

Drillers

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**SECTION 3.0
RESPONSIBILITIES & FUNCTIONS**

- Implement initial well shut-in procedures.
- Implement any other immediate emergency response procedures necessary.
- Notify Rig Manager of emergency.
- Take the tour book to the muster point for roll call as a backup in case the magna board is not accessible.
- Act as directed by the Rig Manager.
- Co-ordinate and control drilling crews in rescue and fire fighting response roles.

Site Communication Officer (SCO)

The designated SCO is responsible for manning the designated communication centre & ensuring communications are maintained within and outside the well site in accordance with the Emergency Procedure. At the Drilling Supervisor's direction, notify, alert and call for assistance, & advise Operator General Manager or designate, drilling contractor Managing Director and relevant emergency services. A log of time, people's names, action, requests and events will be maintained. The SCO will ensure that telephone communication lines are kept clear during the emergency.

The SCO must be completely familiar with the communication systems and the requirements of communication in the procedures. In the event of an emergency, the SCO will:

- Immediately man the designated communication centre.
- Implement, at the direction of the Drilling Supervisor, the procedures applicable to the emergency.
- Immediately initiate an emergency log, noting down the time of sequential events and communication. All events, communications, instructions etc, are to be logged.
- Keep copies of all communications and instructions received and sent.
- All medical treatments and instructions to be logged, including names of receiver and caller and time of the call.

Note: To maintain communications, outgoing calls should be made on the facsimile/data line, leaving the designated voice line clear for incoming calls.

Mud Engineer

- Proceed as directed by the Drilling Supervisor to assist or evacuate the location.
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RESPONSIBILITIES & FUNCTIONS**

- Ensure mud is in such a condition to enable the required density increase to be achieved.
- As directed by the Drilling Supervisor, increase mud weight in active system to ensure correct mud properties are achieved.
- Provide back-up well kill calculation if requested.
- Monitor and test mud for corrosive, toxic or hydrocarbon substances as directed.

Cementer

- Proceed as directed by the Drilling Supervisor to assist or evacuate the location.
- Be prepared to circulate/kill the well as directed by the Drilling Supervisor.
- As directed by the Drilling Supervisor, pump kill mud and accurately record all pressures, rates and volumes of fluids pumped.

Mud Logger

- Proceed as directed by the Drilling Supervisor, to assist or evacuate the location.
- Record all pressures, volumes, displacements, etc, relating to the well and circulating system.
- Provide back-up well kill calculations if requested.
- Monitor and test mud for corrosive, toxic or hydrocarbon gases.

SOTA

- Proceed to the Muster Point & provide the names of contract personnel on site.
- Support the Rig Manager as requested to manage personnel, to help with search & rescue, First Aid, or any other duties where assistance is required.

3.3 OTHER COMPANY AND CONTRACTOR PERSONNEL

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Section 3. Page 5 of 9 RESPONSIBILITIES

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RESPONSIBILITIES & FUNCTIONS**

If other company personnel are on site at the time of the emergency situation, they will function under the direction of the Operator Drilling Supervisor who is responsible for direct control of the emergency and has absolute authority in situations involving the safety of all personnel and/or equipment and well control. The Operator Drilling Supervisor may use the services of any personnel on site, or he may decide they should be evacuated from the well site.

NOTE: If senior company personnel on site wish to assume control and responsibilities, then a request to do so must be made in writing to the General Manager, who will then approve in writing that the person or persons shall assume total control and responsibility.

Other Service Company Personnel

Proceed as directed by the Operator Drilling Supervisor to assist or evacuate the location.

3.4 OPERATOR'S OFFICE BASED PERSONNEL RESPONSIBILITIES**Drilling Superintendent**

- Notify General Manager of emergency and keep him up-dated on the situation.
- Provide Drilling Supervisor with technical and emergency back-up.
- In consultation with Hunt Energy Management, evaluate options and recommend action to the Drilling Supervisor.
- Obtain a list of any casualties and details of injuries and pass to Operators' Manager.
- Obtain details of damage to equipment or the environment and pass to the Manager, MRT.
- Authorise responses as appropriate.
- Co-ordinate Medivac operations as required.
- Document all communications, instructions and reports.

General Manager

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RESPONSIBILITIES & FUNCTIONS**

- Activate ERG as deemed necessary.
- Notify, instruct and delegate responsibilities to members of ERG as necessary.
- Notify, advise and instruct Drilling and Service Contractors as necessary.
- Activate the Emergency Incident Media Response Plan as deemed necessary.
- Arrange for Operator's representative(s) to proceed to the well site as necessary.
- Ensure arrangements have been made for reception of Medivac patients or other evacuated personnel.
- Notify and liaise with Government Authorities as necessary.
- Request outside assistance from other Operators and government agencies as required.
- Liaise per Emergency Incident Media Response Plan and keep up-dated of situation (provide details of all injuries and damage, cause (if known), actions taken to control situation, etc).
- After consultation with appropriate technical staff, initiate well capping and/or 'relief well' operations as necessary.
- Ensure that all events and communications are accurately logged.

Emergency Response Group Members

To assist as instructed by the Operator General Manager.

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Section 3. Page 7 of 9 RESPONSIBILITIES

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**SECTION 3.0
RESPONSIBILITIES & FUNCTIONS**

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Section 3. Page 9 of 9 RESPONSIBILITIES

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**SECTION 4.0
EMERGENCY SERVICES**

4.0 EMERGENCY SERVICES

The Emergency Services include:

Fire Brigade, Police, Ambulance, Medical Services, SES and Environmental Control Authorities, Mineral Resources Tasmania & other government agencies as necessary.

The relevant service(s) will be notified in the event of an emergency situation that cannot be controlled, or is not immediately controlled by the facilities on site.

These emergency services would normally be co-ordinated by the ERG, but in situations where immediate actions are required, these services may be contacted directly by the Drilling Supervisor.

Contact numbers are attached in the **Directory - Section 7.0**.

4.1 FIRE BRIGADE / SES

On instruction from the Drilling Supervisor the SCO will notify the Fire Brigade / SES or other available services of the emergency situation.

On receipt of notification of an emergency, the Fire Brigade / SES or other relevant organisation will send appropriate services to the well site.

The Drilling Supervisor will ensure the attending services are fully informed of the situation, ie the nature and extent of the situation and also the exact location of the well site.

4.2 POLICE

On the instructions from the Drilling Supervisor the Police will be notified by the SCO of the emergency and will send appropriate services to the well site.

The Drilling Supervisor will ensure the Police are fully informed of the situation and also the exact location of the well site.

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Section 4. Page 1 of 2 EMERGENCY SERVICES

Revised 04/05/06
Updated 02/01/08

**HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY REPOSE PLAN**

**SECTION 4.0
EMERGENCY SERVICES**

4.3 AMBULANCE & MEDICAL SERVICES

On instruction from the Drilling Supervisor the Ambulance Service will be notified by the SCO of the emergency and will send, if requested, appropriate services to the well site.

The SCO will notify the Ambulance Services of the extent and requirement for emergency services. The Ambulance Services will notify the Royal Flying Doctor Service and relevant hospital(s) as required.

The Drilling Supervisor will ensure that the Ambulance/Medical Services are fully informed of the situation and exact location of the well site.

The relevant hospital will be notified by the SCO of the number and type of injuries to be expected.

Sections 2.6 and 2.7 should be referred to in the case of medical evacuation.

4.4 MINERAL RESOURCES TASMANIA

MRT will need to be contacted in any situation where serious injury or a fatality has occurred at the rig site. They also need to be contacted in the event of serious fire, explosion, major chemical spill, loss of well control, major equipment failure or other traumatic events.

Emergency Contact numbers are attached in the Directory –

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Section 4. Page 2 of 2 EMERGENCY SERVICES

Revised 04/05/06
Updated 02/01/08

**HUNT ENERGY & MINERAL CO-AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY RESPONSE PLAN****SECTION 5.0****5.0 STATE AUTHORITIES AND LOCAL COUNCILS****5.1 SOUTH AUST - PRIMARY INDUSTRIES & RESOURCES S.A.
- WORKPLACE SERVICES.**

The Department will be immediately notified of an emergency situation involving a major escape of hydrocarbons with or without fire, or any other significant emergency including death or serious injury to personnel and significant damage to plant or equipment. The General Manager (Operator), in liaison with Hunt Energy management (as required), will notify the Department of an emergency in accordance with the Emergency Response Reporting Procedure, as required under the Petroleum Act and Regulations.

(See Emergency contact list in Section 7.0)

5.2 VICTORIA – DEPT OF PRIMARY INDUSTRIES

The same procedure will apply as above.

5.3 WESTERN AUST – DEPARTMENT OF MINERALS & ENERGY.

The same procedure will apply as above

5.4 QUEENSLAND – DEPARTMENT OF NATURAL RESOURCES & MINES

The same procedure will apply as above

5.5 TASMANIA – MINERAL RESOURCES TASMANIA

The same procedure will apply as above

5.6 LOCAL COUNCIL

The Shire Council will be immediately notified and kept updated of any emergency situation that may directly involve the local community.

5.7 POLICE

In the event of a serious injury or death, the local Police **MUST** be contacted and given all the required details for them to put their attendance plan into operation. The accident scene will be left **undisturbed** until authorisation is issued by police.

In case of an emergency, **section 4.2** is to be followed and contacts listing **section 7.0** reviewed.

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Section 5. Page 1 of 1 STATE AUTHORITIES

Revised 04/05/06
Updated 02/01/08

**HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY RESPONSE PLAN**

DIRECTORY OF ORGANISATIONS AND PERSONNEL

SECTION 6.0

6.0 DIRECTORY OF ORGANISATIONS AND PERSONNEL

Hunt Energy & Mineral Co –Australia Pty Ltd

6.1 Well Site

	Rig #2	Rig #3
Rig main phone	08 81218950	
Satellite Phone	0145 116 918 / 0145 124796	
Satellite fax	0145 216 918 / 0145 224796	
CDMA Mob:	0428 891 029 / 0427 798 430	
Camp Mob:	0427 163 884 / 0438 375 306	

6.2 Adelaide Office

Address:	15 Scarborough Way Lonsdale SA 5160
Telephone:	(08) 8322 7511
Fax no:	(08) 8322 7533
After Hours:	0418 806 281 (Larry Werecky – Managing Director) 0429 838 202 (Chris Brown – Operations Manager)
Email:	huntenergy@huntenergy.com.au

6.3 Directory of Personnel

Larry Werecky	Managing Director	Mobile 0418 806 281 (all hours) Email: larrywerecky@bigpond.com
Christopher Brown	Operations Manager	Mobile 0429 838 202 (all hours)
Joe Ortuso	Materials /Logistics Manager	
Ken Mee	Safety Manager	
Ian Thomas	Personnel & Training.	
Jill Calder	Accounts / Payroll	

6.4 State Authorities

Mineral Resources of Tasmania	(03) 6233 8326
-------------------------------	----------------

6.5 GSLM contact

Duncan New	Drilling Manager	Office	(03) 6231 9339
		Mob.	0402 344 674

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Section 6. Page 1 of 1 QLD DIRECTORY

Last revision 01/07/05
Updated 02/01/08

**HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY RESPONSE PLAN**

SECTION 7.0

7.0 'M' EMERGENCY CONTACT NUMBERS – TASMANIAN OPERATIONS

RIG LOCATION DIRECTIONS: 'GREEN RISES ROAD'

7.1 EMERGENCY SERVICES CONTACT NUMBERS

POLICE, AMBULANCE EMERGENCY CALL 000

<u>POLICE:</u>	Attendance	131444
Launceston	Office (24hrs)	(03) 6336 3701
Cimiterre St. Launceston TAS. 7250		
Cressy	(Nearest Police to Bracknell #1)	(03) 6397 5010
84 Main Rd, Cressy TAS. 7302		

HOSPITALS:

Launceston General Hospital	Enquiries	(03) 6348 7111
287 – 291 Charles St. Launceston 7250		
Longford Medical Services	Enquiries	(03) 6391 1170
Cnr Smith & George Streets, Longford 7301		
Royal Hobart Hospital	Enquiries	(03) 6222 8308
48 Liverpool St, Hobart 7000		

7.2 STATE FIRE SERVICES EMERGENCY CALL 000

Tasmanian Fire Service Launceston	(03) 6336 5633
State Emergency Services Launceston	(03) 6230 2707
Bracknell Fire Station (volunteers)	(03) 6397 3671

7.3 DRILLING CONTRACTOR CONTACTS

Hunt Energy	Mr Larry Werecky (MD)	0418 806 281
	Christopher Brown (Ops)	0429 838 202
	Adelaide Office	(08) 8322 7511

7.4 STATE AUTHORITY

Mineral Resources Tasmania		
Carol Bacon	Managing Geologist	(03) 6233 8326
John Pemberton	Senior Geologist	(03) 6233 8371
Wojciech Grun	Mining Engineer	(03) 6233 8320

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**HUNT ENERGY & MINERAL CO – AUSTRALIA PTY LTD
ONSHORE DRILLING EMERGENCY RESPONSE PLAN**

SECTION 7.0

7.5 POISONS INFORMATION CENTRE

Australia wide

131126

7.6 WELL CONTROL SPECIALIST

Alert Disaster Control

+65 6545 5088

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Appendix 4: Hunt Energy Environmental Incident Procedure

HUNT ENERGY & MINERAL CO. AUST PTY LTD

ENVIRONMENTAL POLICY

Hunt Energy is committed to the preservation of the environment and will conduct all operations and activities with environmental protection as a prime objective. Hunt Energy will follow guidelines as set down by the Environmental Protection Authority and relevant industry standards. In particular, Hunt Energy will:

Ensure that all employees and contractors are aware of their responsibilities for environmental protection through induction to this policy and customer requirements. In addition, Hunt Energy will:

- Minimise the possibility of pollution to soil water or air, caused by spills of solids, liquids or the emission of gas, by following sound principals of Risk Management. In the event of a spill occurring, immediately follow the principles of contain, control and cleanup, to minimise damage to the environment.
- Manage the transportation, storage and handling of Hazardous Substances and Dangerous Goods in line with the relevant state Regulations.
- Minimise damage to flora and fauna as a result of rig operations and use of heavy equipment, by forward planning and efficient utilisation of such equipment, particularly in relation to prevailing weather conditions.
- Avoid disturbing natural or historical sites, as an ongoing commitment to protection of Aboriginal & European Cultural Heritage.
- Assist through careful rig down & moving operations, with the rehabilitation of the rig site and adjoining areas on completion of the drilling program, to preserve the natural habitat for other land users.

Hunt Energy & Mineral Co.- Aust. Pty Ltd is committed to its endeavor of being a responsible environmental corporate citizen.

L. Werecky
Managing Director

**HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ONSHORE DRILLING OPERATIONS & SAFETY MANUAL****SECTION 13****13.2 ENVIRONMENTAL PRINCIPLES & PROCEDURES.**

Hunt Energy understands the requirement to adopt sound environmental practices in all of its operations to protect both its own and customer interests. Hunt Energy states its overall commitment to the protection of the environment in their Environment & Waste Management Policies, which are displayed on noticeboards at Rig locations & the Adelaide office. The following principles and procedures outline the more specific actions.

Guidelines:

Hunt Energy realises that the performance of its employees and their correct utilisation & maintenance of rig equipment sets the standard for environmental protection. Hunt will actively encourage staff to participate in ongoing development & implementation of its environmental program.

Hunt Energy will undertake to participate in any client sponsored environmental programs relevant to Company operations, subject to personnel availability. They will also ensure that contract personnel working on Hunt Energy locations abide by environmental protection standards. In particular they will continue to:

- Comply with relevant State & Federal legislation and applicable Codes of Practice
- Identify environmental risks and apply sound management strategies.
- Understand the necessity to protect culturally significant sites & artefacts, and advise client management if such sites or items are discovered.
- Ensure that staff is informed of Hunt Energy strategies and policy in regard to environmental management and cultural heritage preservation.
- Review existing work procedures and make changes as applicable.
- Minimise the use of fossil fuels through efficient equipment operation & maintenance programs.

Campsites:

Campsites should be located adjacent to existing tracks or roads to limit requirements for additional clearing.

Naturally clear areas should be used for campsites. Where clearance is unavoidable, the area cleared should be kept to a minimum. Large established trees should not be removed where at all possible.

Topsoil and cleared vegetation should be stockpiled for reuse during site restoration.

Any spills of contaminating product around the camp must be contained, controlled and cleaned up. Special precautions must be taken in the area of camp generators and any such spill incident recorded using the Accident/Incident report form.

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Section 13.2- Page 1 of 3 ENVIRONMENTAL PROTECTION

Updated 25/05/06
Reviewed 02/01/08

**HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ONSHORE DRILLING OPERATIONS & SAFETY MANUAL****SECTION 13****Rig site:**

Although some of the following issues are the direct responsibility of the Operator, Hunt Energy will work closely with them to ensure that the lease is maintained in accordance with the applicable Regulations, & left in an appropriately clean state.

Flare pits must be sited on the lease as far as possible from native vegetation, and clear of access roads. A suitably high bank must be constructed at the rear of the pit to contain returned product and flare-off. Permits should be received from local councils where appropriate before flaring is undertaken.

Where compaction or minor oil spillage has occurred, the ground should be ripped to a depth of 500mm at completion of the well program, as part of ground restoration.

Mud products must be stored in a designated area and maintained in an orderly state on pallets. These products must be kept suitably covered with plastic to prevent degeneration & scattering from the effects of sun, wind & rain, and an MSDS register maintained on site.

Low toxicity chemicals should be used whenever possible to minimise damage to the environment & limit exposure hazards.

- Access to and from the Rig lease and Camp area should be restricted to designated roads in order to minimise damage to flora & fauna. Speed limits must be restricted in these areas for the same reason.

Reporting:

Reporting of all environmental incidents to a Hunt Energy Rig Manager is mandatory.

Employees will be supplied with and trained in the use of the Hunt Energy Accident/ Incident Report forms. They will also be encouraged to use the 'Hazid' forms to identify 'potential' for environmental incidents.

Hunt Energy Management will record the details as per Hunt reporting /recording procedures and relay the information as soon as possible to the client.

Incidents of a serious nature, which are beyond the resources of Hunt will be reported to the client immediately, along with a request for assistance.
A request of this nature will generally come from the Hunt Energy Rig Manager.

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Section 13.2- Page 2 of 3 ENVIRONMENTAL PROTECTION

Updated 25/05/06
Reviewed 02/01/08

**HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ONSHORE DRILLING OPERATIONS & SAFETY MANUAL**

SECTION 13

Auditing:

Hunt Energy will conduct audits of the wellsite and camp at each location, or monthly, whichever is the shorter period, using **Form 6** in the Onshore Drilling Operations & Safety Manual.

Copy of the audit results will be reviewed by the Rig Manager and forwarded to the Adelaide office for inclusion as an agenda item in management Safety Committee Meetings.

Non-compliance with Hunt Environment or Waste Management Policy will require immediate remedial action. The Safety Manager will also conduct compliance audits from time to time during rig visits to ensure that Hunt Energy expectations on environmental protection are maintained.

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Section 13.2- Page 3 of 3 ENVIRONMENTAL PROTECTION

Updated 25/05/06
Reviewed 02/01/08

SECTION 13.3

HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ENVIRONMENTAL AUDIT

RIG SITE

Location: _____

Operator: _____

Rig No: _____

YES NO

1) HAVE ADEQUATE DRAINS BEEN PROVIDED AROUND RIG BASE

.....

2) ARE DRAINS CLEAR OF DEBRIS

.....

3) IS DRAINAGE EFFECTIVE TO HOLDING PITS

.....

4) RIG PUMP AREA FREE OF SPILLS

.....

5) RIG MOTOR AREA CLEAN & FREE OF OIL SPILLS, WASTE CONTAINERS & RUBBISH

.....

OIL STORAGE AREA

6) CLEAN FLOOR, DRY & VOID OF SLIP HAZARDS

.....

7) OIL DRIP TRAYS IN PLACE? NOT OVERFLOWING

.....

8) IS AN EFFECTIVE CLEANUP METHOD USED

.....

9) ARE CONTAINERS LABELLED & SEALED

.....

10) OILY RAGS & RUBBISH PLACED IN COVERED BINS

SECTION 13.3

**HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ENVIRONMENTAL AUDIT**

MECHANIC SHACK

- | | | YES | NO |
|-----|--|--------------------------|--------------------------|
| 11) | CLEAN & TIDY (NO OIL OR GREASE ON FLOORS OR BENCHES)
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 12) | EMPTY GREASE CONTAINERS & OILY RAGS - PLACED IN COVERED BIN
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 13) | PARTS & EQUIPMENT STORAGE CLEAN & TIDY
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 14) | a) PRODUCT CONTAINERS SUITABLY LABELLED & STORED
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) PROVISION FOR CONTAINMENT / CLEAN UP OF SPILLS
..... | <input type="checkbox"/> | <input type="checkbox"/> |

LEASE AREA

- | | | | |
|-----|---|--------------------------|--------------------------|
| 15) | a) IS THERE SUITABLE STORAGE FOR DIESEL ON SITE
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| | b) SOIL AROUND TANKS CLEAR OF SPILLS
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 16) | APPROPRIATE DRAINAGE / BUND TO CONTROL SPILLS
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 17) | CHEMICAL STORAGE AREAS WELL DEFINED & SEGREGATED
..... | <input type="checkbox"/> | <input type="checkbox"/> |
| 18) | ALL PRODUCTS SUITABLY PROTECTED FROM WEATHER | <input type="checkbox"/> | <input type="checkbox"/> |

SECTION 13.3

HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ENVIRONMENTAL AUDIT

-
- 19) MSDS INFORMATION AVAILABLE & LABELS IN GOOD CONDITION
-
- 20) MIXING HOPPER AREA CLEAN & TIDY
-

SUMPS & PITS

- 21) PIT LINERS USED IN SUMP FOR HOLE CUTTINGS
-
- 22) PLASTIC LINER USED BETWEEN SHALE SHAKER TANK & SUMP
-
- 23) TURKEY NEST LINED
-
- 24) FLARE PIT CONSTRUCTED WITH EARTH BANK OF SUITABLE HEIGHT
-
- 25) RIG SITE SHACKS HAVE COVERED SUMPS FOR EFFLUENT
-
- 26) RIG SITE SHACKS HAVE SUITABLE SUMP FOR GREY WATER
-
- 27) PROVISIONS MADE TO BACKFILL SUMPS TO APPROPRIATE DEPTH
-

RIG CAMP

- 28) DOES THE CAMP HAVE A SUITABLE WASTE SKIP / WASTE PIT
-
- 29) DOES CAMP HAVE A SUITABLE VERMIN CONTROL PROCEDURE?
-
- 30) IS GENERAL WASTE FROM LIVING QUARTERS COLLECTED & REMOVED

SECTION 13.3

HUNT ENERGY & MINERAL CO AUSTRALIA PTY LTD
ENVIRONMENTAL AUDIT

-
- 31) KITCHEN SCRAPS, OIL & FAT SUITABLE DISPOSED OF IN LINE WITH ENVIRONMENTAL PRACTICES
-
- 32) a) DOES THE CAMP HAVE COVERED SUMP SYSTEM FOR EFFLUENT
-
- b) IS IT SUITABLY PLACED TO AVOID FLOODING IN WET WEATHER
-
- 33) DOES THE CAMP HAVE A SUITABLE SUMP FOR GREY WATER FROM THE ABLUTION BLOCK, LAUNDRY & KITCHEN
-
- 34) IS THE AREA AROUND THE CAMP CLEAN & TIDY (FREE OF WASTE PAPER, CANS, BOTTLES & PLASTIC)
-
- 35) ARE ENTRY & EXIT ROADS TO THE CAMP DEFINED TO LIMIT DAMAGE TO FLORA & FAUNA
-
- 36) ARE NO SMOKING AREAS DEFINED
-
- 37) IS THERE SUITABLE DRAINAGE AROUND CAMP FOR WET WEATHER CONDITIONS
-
- 38) ARE THERE CONTROL PROCEDURES TO MINIMISE DUST
-

OTHER COMMENTS

.....

.....

.....

.....

AUDITOR..... SIGNED..... DATE:.....

ONSHORE DAYWORK DRILLING CONTRACT

BETWEEN

GREAT SOUTH LAND MINERALS LIMITED

AND

Hunt Energy & Mineral CO. - Australia Pty. Ltd.

ABN 52 075 814 390

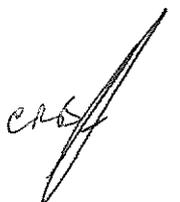
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TABLE OF CONTENTS

RECITALS 2
AGREEMENT 2
1 DEFINITIONS 3
2 HEADINGS 3
3 FURTHER ASSURANCES 3
4 COMMENCEMENT DATE 3
5 LABOUR, EQUIPMENT, MATERIALS, SPECIAL TOOLS, SUPPLIES AND SERVICE 4
6 SUMS PAYABLE TO CONTRACTOR 5
7 TIME OF PAYMENT 6
8 TERM 7
9 EQUIPMENT CAPACITY 9
10 CASING PROGRAMME 10
11 DRILLING METHODS AND PRACTICES 10
12 CORING 11
13 REPORTS TO BE FURNISHED BY CONTRACTOR 11
14 INSURANCE 12
15 CLAIMS 13
16 RESPONSIBILITY FOR LOSS OR DAMAGE 13
17 INDEPENDENT CONTRACTOR RELATIONSHIP 16
18 LAWS RULES AND REGULATIONS 17
19 FORCE MAJEURE 17
20 INFORMATION CONFIDENTIAL 18
21 INGRESS AND EGRESS TO LOCATION AND SOUND LOCATION 18
22 CONFLICTS AND WAIVERS 19
23 ADJUSTMENT 19
24 DISPUTE RESOLUTION 19
25 INDUSTRIAL RELATIONS 20
26 ASSIGNMENT 20
27 NOTICES 20
28 GST 20
29 COST GENERALLY 20
30 GOVERNING LAW 21
31 SEVERABILITY 21
32 COUNTERPARTS AND MULTIPLE ORIGINALS 21
SIGNATURES 21
ATTACHMENTS 22
SCHEDULE A 24
SCHEDULE B 26
SCHEDULE C 31
SCHEDULE D 38
SCHEDULE E 39
SCHEDULE F 45
SCHEDULE G 46
SCHEDULE H 47
SCHEDULE I 48
SCHEDULE J 49
SCHEDULE K 50
ONSHORE DAYWORK DRILLING CONTRACT

THIS CONTRACT:

BETWEEN GREAT SOUTH LAND MINERALS LIMITED a Company duly incorporated in Australia and having its principal office at Level 3, 65 Murray Street, Hobart, Tasmania, 7000

(“Operator”)

AND Hunt Energy & Mineral Co.-Australia Pty Ltd ABN 52 07 814 390 a Company duly incorporated in the State of South Australia and having its principal office at 15 Scarborough Way, Lonsdale, South Australia, 5160

(“Contractor”)

RECITALS

- A. Operator is the owner of SEL 13/98 and has JV rights to drill in SEL 5/2005 in Tasmania, Australia and desires to have wells drilled and completed in search of oil or gas and has requested Contractor to provide drilling services for this purpose (“Services”).
- B. Contractor represents that, to the best of its knowledge and having conducted reasonable due diligence investigations and taken reasonable steps as appropriate, it has drilling equipment, in good working order and safety management systems in place which are fit for purpose and trained, competent personnel capable of efficiently operating such equipment to provide such Services.

AGREEMENT

Operator engages Contractor as an independent contractor to drill the well or wells designated in **Item 1 of Schedule A** in search of oil or gas on a daywork basis.

For purposes hereof the term “daywork basis” means Contractor shall furnish equipment, labour, and perform services as herein provided, for a specified sum per 24 hour day under the direction, supervision and control of Operator (which term is deemed to include any employee, agent, consultant or subcontractor engaged by Operator to direct drilling operations). When operating on a daywork basis, Contractor shall perform all its work on a 24 hours per day 7 days per week basis and shall be fully paid at the applicable rates of payment and assumes only the obligations and liabilities stated herein.

1 DEFINITIONS

In this Contract unless the context otherwise requires:-

"Contract" means this contract, including Schedules A to K inclusive;

"Designated Field Representative" means the person set out in Item 13 of Schedule A;

"GST" means the goods and services tax imposed under the GST Law or similar tax imposed under the GST Law or any similar tax introduced to replace that tax;

"GST Law" means GST Law as defined in Section 195-1 of the "A New Tax System (Goods and Services Tax) Act 1999;

"Governmental Authority" means any government or governmental, semi-government, administrative, fiscal or judicial body, department, commission, authority, tribunal, agency or entity;

"Joint Venture" means the joint venture (if any) between the Operator and any third parties in respect of the well(s) the subject of the Services;

"Rig" or "Drilling Rig" means the rig and other equipment the Contractor provides under this Contract as set forth in Schedule C;

"Regulations or Practices" means the regulations and requirements of the Department of Primary Industries and Resources, South Australia and Natural Resources and Mines, Queensland or such other Governmental Authority that may have jurisdiction in the relevant area of operations;

"Services" means the drilling services provided by the Contractor as set out in Schedule E and in accordance with this Contract.

References to dollars or \$ are references to Australian dollars unless otherwise expressly stated.

2 HEADINGS

The index hereto and the clause headings herein shall not be considered in interpreting the text of this Contract.

3 FURTHER ASSURANCES

Each party shall perform all acts and execute and deliver all documents and give all assurances necessary to give full effect to the provisions of this Contract.

4 COMMENCEMENT DATE

Operator and Contractor agree to use their best endeavours to commence operations at the first Well Site ("first location") on or about 1st of March 2008. Neither operator nor Contractor shall

incur any penalty if delayed by circumstances beyond the Operator or Contractor's control in accordance with **Clause 19**.

5 LABOUR, EQUIPMENT, MATERIALS, SPECIAL TOOLS, SUPPLIES AND SERVICE

- 5.1 Contractor will furnish and use the Drilling Rig, equipment and personnel described in **Schedules C, D and E** to drill and then either abandon or complete as the case may be the well or wells to be drilled pursuant to this Contract. This drilling rig shall be, and remain "Fit for Purpose" and all personnel will be trained for and competent in their jobs.
- 5.2 All labour, equipment, materials, special tools, supplies and services necessary or proper for the operation or maintenance of the Rig and for the drilling and completion of the well or wells shall be furnished in good working condition at the well site or sites by the party designated in **Schedule E** and at the expense of the party designated in **Schedule E**. Should labour, equipment, materials, special tools, supplies or services other than those set forth herein or designated in **Schedule E** be necessary for the drilling or completion of the well or wells the same shall be furnished by Operator at its expense.
- 5.3 If the Operator requests Contractor to provide any labour, equipment, materials, special supplies or services as set forth in **Schedule E** which it is the responsibility of Operator to provide, Contractor, if it agrees to provide the same, and for providing bits, reamers and stabiliser parts, hole opener cutters, swab rubbers and similar items, shall be reimbursed by Operator, for actual Contractor's landed cost at well site or sites plus 15 percent or as otherwise agreed plus GST.
- 5.4 For providing casual or roustabout labour at the request of the Operator, Contractor shall be reimbursed by Operator at actual Contractor's cost plus 15 percent.
- 5.5 Operator will make every effort to stake the first location 14 days before the commencement date specified in **Item 2 of Schedule A**.
- 5.6 Upon termination of this Contract, Contractor shall return to Operator any of Operator's items that are at the time in Contractor's possession and control in as good condition as turned over to Contractor, fair wear and tear excepted.
- 5.7 The Operator may request the Contractor to increase the number of Contractor's personnel and in such event the day rates provided herein shall be adjusted by mutual agreement of the parties hereto.
- 5.8 Contractor shall nominate from time to time one of its personnel as Contractor's representative on site ("**Designated Field Representative**"). The initial Designated Field Representative for the Contractor is set out in **Item 13 of Schedule A**. Such representative shall be in charge of the remainder of Contractor's personnel and shall have full authority to act on behalf of Contractor on all day to day matters which arise between Operator and Contractor.
- 5.9 Contractor will remove and replace in a reasonable time any of Contractor's personnel if Operator so requests in writing provided Operator can show reasonable cause for its requirements.
- 5.10 Operator shall nominate from time to time one of its personnel on site to receive reports as specified in **Clause 13** and act as Operator's representative ("**Designated Field Representative**"). The initial Designated Field Representative for the Operator is set out in **Item 13 of Schedule A**.

-
- 5.11 Contractor shall have the right to request Operator in writing to remove and replace any of Operator's Third Party personnel if Contractor can show reasonable grounds for such request. However Operator shall have the right to make the final decision with respect to any such removals and replacements.
- 5.12 Contractor shall be responsible at its cost for maintaining reasonable stock levels of Contractor's items and replenishing items consumed, damaged or lost.
- 5.13 If required contractor shall conduct a full tubular drilling string and associated down hole tools inspection prior to the commencement of operations hereunder.
- 5.14 Contractor shall supply Operator upon request with copies of reports of any tubular inspections carried out in respect of the Contractor's drilling string and associated down hole tools.
- 5.15 Any tubular and associated down hole tools which failed to pass any such inspection test will be replaced or repaired by Contractor at its expense prior to commencement of or resumption of operations pursuant to this Contract. Any delay caused in the drilling operations as a result of any such replacement or inspection will be at the cost of the Contractor.
- 5.16 Operator may at any time during the term of this Contract request Contractor to arrange to have inspections of Contractor's tubular and down hole tools performed at Operator's expense.
- 5.17 Contractor represents that the equipment described in **Schedule C** conforms in all respects to the Regulations and Practices.
- 5.18 Contractor represents to the Operator that it will, and agrees to maintain the Drilling Rig and all plant and equipment referred to in **Clauses 5.1 and 5.2** in good working order and operating condition at all times throughout the operation of this Contract.
- 5.19 Contractor represents to the Operator that, to the best of its knowledge and having conducted reasonable due diligence investigations and taken reasonable steps as appropriate, the Rig and associated equipment are fit for their purpose and use or intended use and conforms to the agreed industry standards applicable to the equipment certification, safety management systems, maintenance systems and maintenance scheduling in accordance with current industry practice and regulatory requirements and applicable Regulations and Practices.
- 5.20 Contractor also represents to the Operator that all personnel supplied by the Contractor to perform duties on the Rig are competent and trained with respect to the tasks/duties expected of the position(s). Evidence of competence of personnel to be demonstrated by the Contractor to the Operator at quarterly Operations/HSE review meetings measured against Australian Drilling Industry Training Committee endorsed training matrices for onshore Rig personnel.
- 5.21 Contractor agrees the drilling rig to be inspected by a third party inspector prior to spudding and signed off as being fit for purpose. Costs of the inspection will be at Operator's expense; while the cost of any resulting repairs or modifications will be charged at Rig Repair Rate, as per Schedule B, Item 12.4.

6 SUMS PAYABLE TO CONTRACTOR

- 6.1 Subject to the provisions hereof Operator agrees to pay Contractor for the work performed, services rendered, the materials, equipment, and supplies furnished by Contractor as hereinafter provided.

- 6.2 The work other than Rig moves shall be performed on a day work basis and the day work rates per twenty-four (24) hour day shall be as specified in **Schedule B**. Payment of rates shall be calculated on time to the nearest half hour.
- 6.3 The relevant Standby Rate as set out in **Schedule B** will be payable:
- (a) during any period of delay when Contractor is unable to proceed because of an act or omission of Operator including without limitation the failure of Operator to provide items or to furnish services which are the responsibility of the Operator as specified in **Schedule E**; or
 - (b) from the moment Contractor could have spudded in any well had it not been delayed by Operator until the operating rates first become payable.
- 6.4 Contractor agrees to mobilise the Rig, Camp and Crew to the first location, rig up, and ready to drill Rathole & Mousehole prior to spud for the sum designated in **Item 6 of Schedule B**.
- 6.5 Rigging up and preparedness to spud on the first and subsequent locations shall be verified by the Operator's Designated Field Representative.
- 6.6 For demobilisation of Contractor's Rig, Camp and crew at completion of this Contract Operator agrees to pay to Contractor the sum specified in **Item 7 of Schedule B**.
- 6.7 As part of its rig day rate (s) Contractor will furnish a forklift and appropriately trained operator. If Operator uses forklift as per **Item 60 of Schedule E**, Operator agrees to pay hourly rate as detailed in **Item 12.9 of Schedule B**.
- 6.8 If during the term of this Contract Contractor remobilises its personnel after having demobilised such personnel then Operator will reimburse Contractor for Contractor's necessary out-of-pocket costs for such demobilisation and remobilisation provided both demobilisation and remobilisation are done at the written request of Operator. Such necessary out-of-pocket expenses will include by way of example but not be limited to travelling expenses wages and travelling time.
- 6.9 If the Contractor or Operator deems it necessary to shut down the Rig for repairs or maintenance the Contractor shall cease to be paid at the rate specified in **Item 1 of Schedule B** and will be paid the repair rate specified in **Item 4 of Schedule B**. Time chargeable under this rate shall not exceed 8 hours for any one occurrence or 24 hours cumulative per calendar month. Subject to **Clause 21.4** the Contractor shall not be able to charge the Operator any fee for repairs and maintenance carried out in excess of the periods hereinbefore referred to in this clause. The Contractor covenants and agrees with the Operator to use due diligence in effecting such repairs replacement or maintenance in a good and workmanlike manner.
- 6.10 Any obligation on the Operator to pay any amounts under this Contract are subject to the Operator being provided with a tax invoice and to the Contractor establishing it is registered for GST.

7 TIME OF PAYMENT

- 7.1 Subject to the provisions of **Clause 15.2** of this Contract and compliance by Contractor with all the terms and conditions of this Contract and **Schedule B** Operator agrees to make payments to Contractor as herein set out.
- 7.2 Payment shall be due and payable by Operator of the full amount of each of Contractor's invoices within 14 days of receipt of the same by Operator. Invoices shall be submitted on a fortnightly (14 days) basis. Mobilisation fee is to be paid in

full within 14 days of receipt of the relevant invoice. (20 days rig move rate to be prepaid prior to commencing mobilization.)

- 7.3 Any undisputed sum or sums not paid within 14 working days after due date as herein before specified shall bear interest at the rate of 5 percent per annum from such date until payment.
- 7.4 Operator shall notify Contractor within 21 days of receipt of any invoice that the same or any portion thereof is disputed, and will pay any undisputed portion in accordance with the terms set out above. On satisfactory resolution of any dispute in relation to the whole or any portion of any invoice, Operator shall pay any amount proved to have been correctly invoiced within 7 days of such resolution. Any such amount shall at Contractor's option bear interest from the original due date until payment at the rate of 5 percent per annum.

8 TERM

- 8.1 The term of this Contract shall be deemed to commence when each party has executed the same and shall continue in force thereafter until terminated in any of the ways set out.
- 8.2 Except for those provisions of this Contract which are of a continuing nature and subject to the above provisions this Contract shall terminate on completion of the drilling programme outlined in **Schedule A** hereto unless the term hereof is extended by Operator exercising its option to drill an additional well or wells in which case it shall terminate on completion of the drilling programme for that well or those wells. Operator may reduce this program, without penalty, at any time by giving the contractor 30 days notice.
- 8.3 After completion of said drilling programme the Contractor may, if the landowner who owns the land upon which the well site is located agrees, elect to stack the Drilling Rig at the well site, or move the Rig immediately to another location. In the event Contractor elects to stack the Drilling Rig at the well site after completion of said drilling programme, Contractor shall from that point forward bear all risk related to moving the Rig from the well site to the nearest government sealed road, and shall be due no compensation for delays that may result from inability to move equipment from the well site.
- 8.4 Notwithstanding the termination of this Contract the parties shall continue to be bound by any provisions of this Contract that reasonably require some action or forbearance after the cessation of the day rates provided for hereunder.
- 8.5 Early Termination
- (a) This Contract may be terminated without prejudice to any rights accrued to the date of the termination by either party giving to the other written notice of termination when total loss or destruction of the Rig or a major breakdown thereof causes interruption to or prolonged stoppage of operations (whether caused by an event of Force Majeure or any other cause) for a period in excess of 15 consecutive days.
- (b) By Operator:
- i Notwithstanding the provisions of **Schedule A** with respect to the depth to be drilled, Operator shall have the right to direct the stoppage of the work to be performed by Contractor hereunder at any time prior to reaching the specified depth or drilling all the wells outlined in **Schedule A**, even though Contractor has made no default hereunder. In

such event Operator shall reimburse Contractor as set forth in **Clause 8.6** hereof.

- ii In the event that the Contractor has any execution levied against it in excess of Fifty Thousand Dollars (\$50,000), becomes insolvent, enters into, or proposes or attempts to enter into, any compromise or arrangement with creditors, has an order made, or a resolution passed (or attempted to be passed) for the winding up of the Contractor, or a receiver or receiver and manager is appointed or a mortgagee takes possession of the whole or any part of its property or undertaking or an administrator of the Contractor is appointed, or if any other act, matter, thing or circumstance renders the Contractor incapable of performing the Services; or the Contractor breaches any of the terms or conditions hereof, then the Operator shall have the right, without prejudice to any other of its rights or remedies, by written notice to the Contractor, forthwith to terminate this Contract, and the Contractor's right to compensation shall be as set forth in **Clause 8.6(b)**.
- (c) By Contractor:
 - i Notwithstanding the provision of **Schedule A** with respect to the depth to be drilled, in the event Operator shall become insolvent, or be adjudicated a bankrupt, or file, by way of petition or answer, a debtor's petition or other pleading seeking adjustment of Operator's debts, under any bankruptcy or debtor's relief laws now or hereafter prevailing, or if any such be filed against Operator, or in case a receiver be appointed of the Operator or of the Operator's property, or any part thereof, or Operator's affairs be placed in the hands of a creditor's committee, or following ten days prior written notice to Operator if Operator does not pay Contractor within the time specified in **Clause 7.2**, all undisputed items due and owing, Contractor may, at his option, elect to terminate further performance of any work under this Contract and Contractor's right to compensation shall be as set forth in **Clause 8.6**.

8.6 Early Termination Compensation

- (a) In the event Operator terminates the Contract pursuant to **Clause 8.5(b)(i)** prior to the completion of drilling program or to the depth specified in **Item 3 of Schedule A**, or in the event the Contractor terminates the Contract pursuant to **Clause 8.5(c)**, then Contractor and Operator shall negotiate compensation due to Contractor which will cover the Contractor's out of pocket expenses incurred and to be incurred as a consequence of such early termination. These expenses will not include loss of income due to the rig not operating.
- (b) In the event Operator terminates the Contract pursuant to **Clause 8.5(b)(ii)**, then the Operator shall reimburse the Contractor such part of the payment referred to in the Schedules, which may be due for Services rendered prior to the date of termination and such amount shall be received by the Contractor in full satisfaction and discharge of all claims and demands of any nature whatsoever against the Operator in respect of this Contract.

8.7 Suspension

8.7.1 Weather

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In the event that sustained weather conditions, flooding or other ground conditions prevent continuation of the operations, or in the event that the Operator is unable to obtain relevant Joint Venture or regulatory approvals for the next drilling location, the Operator shall have the right to suspend this Contract by notice to the Contractor, in which case the Operator shall pay to the Contractor Standby With Crew Rate as specified in **Item 12(2) of Schedule B** for a 24 hour period, (or until crews can be evacuated) together with the actual costs to transport the Contractor's personnel away from the Rig, and back to the Rig when notice of the lifting of the suspension is given by the Operator, such costs to be calculated in accordance with **Clause 6**.

8.7.2 Safety

If during the performance of the contract, the Operator's Designated Field Representative is of the opinion that the Contractor is either:

- (i) conducting the Services in breach of the Contractor's safety policies or procedures, or any applicable safety Regulations and Practices or any other safety rules and regulations and procedures supplied by the Operator to the Contractor from time to time or;
- (ii) conducting the Services in such a way as to endanger the life or safety of any persons or which may be likely to cause damage to any property, whether belonging to the Operator or otherwise

- 8.7.2.1 Then the Operator's Designated Field Representative shall notify the Contractor in writing of the breach of safety involved and the Contractor shall rectify the breach notified forthwith.
- 8.7.2.2 In the event the contractor does not rectify the breach of safety notified as above as soon as possible, the Operator's Designated Field Representative may direct the Contractor to suspend performance of the services until such time that the Contractor satisfies the Operator's Designated Field Representative that the Services will be provided in conformity with all applicable safety provisions and Regulations and Practices.
- 8.7.2.3 During such periods of suspension, the Operator shall not be liable for or required to make any payments of what so ever nature to the Contractor.
- 8.7.3.4 In the event that the Contractor fails to rectify the breach of safety for which the Services are suspended pursuant to **Clause 8.7.2** within 30 days of the receipt of such notice or if the Contractors performance of the Services has involved recurring breaches of safety pursuant to **Clause 8.7.2** then the Operator may exercise its powers to terminate the contract forthwith without further obligation to the Contractor.

9 EQUIPMENT CAPACITY

If applicable hereunder, operations shall not be attempted under conditions which exceed the capacity of the equipment specified to be used hereunder. Contractor shall make the final decision as to when an operation or attempted operation would exceed the capacity of specified equipment. Contractor hereby represents that the equipment specified in **Schedule C** has

sufficient capacity to drill to a minimum depth of 2,300m with 4½" drillpipe, and to set all strings of casing as specified in **Item 6 of Schedule A** under normal operating conditions.

10 CASING PROGRAMME

- 10.1 The casing programme shall be as provided in **Item 6 of Schedule A**. The exact setting depth of each string of casing the amount of cement and the process to be used in cementing shall be specified by Operator at the time of each casing setting. If Operator requires a variation in the casing programme requiring the use of additional handling tools same will be furnished by Operator at Operator's expense.
- 10.2 Contractor shall run all strings of casing and shall be compensated therefore at day work rates as set out in **Item 1 of Schedule B**.
- 10.3 Except in emergencies Contractor's pumps shall not be used for pumping cement (but may be used for displacing cement) whilst carrying out Operator's casing programme and Operator shall at its own expense furnish all pumps and other special equipment and service necessary for the running of cement in respect of such programme.
- 10.4 Contractor shall be under no liability to Operator for any loss or damage resulting from casing joints being knocked off in the hole as a result of defective pipe, faulty casing seat, faulty cementing or any operating practice directed by Operator or its Designated Field Representative during running casing. Casing and cementing operations shall be supervised by Operator's Designated Field Representative.

11 DRILLING METHODS AND PRACTICES

- 11.1 Contractor agrees to perform all work to be carried out by it under the terms of this Contract and the specifications and conditions set forth in **Schedule A** with due diligence and care and in accordance with good drilling practice.
- 11.2 Contractor represents to the Operator that the Drilling Rig is capable of and will during this Contract remain capable of :
 - 11.2.1 drilling to the depth specified in **Item 3 of Schedule A** with the pipe specified in **Item 4 of Schedule A** and **Schedule C**; and
 - 11.2.2 carrying out any appropriate testing that the Operator may require; and
 - 11.2.3 completing the well.
- 11.3 Any drill pipe drill collars or substitutes in excess of those furnished by Contractor as specified in **Schedule C** shall be supplied by Operator at its expense.
- 11.4 Contractor agrees to maintain well control equipment in good operating condition at all times checking it as prescribed in **Item 11 of Schedule A** and shall use all reasonable means to control and prevent fires and blowouts to protect the hole and to protect Operator's equipment.
- 11.5 Subject to the terms hereof, and at Operator's cost, at all times during the drilling of the well, Operator shall have the right to control the mud programme.
- 11.6 In the event of Operator requiring the use of any fluid chemical or substance in the mud programme in respect of which any Regulations and Practices requiring the provision of additional or special clothing or equipment for Contractor's employees is then in force Operator shall reimburse to Contractor any additional costs incurred by Contractor in complying with such Regulations and Practices.



- 11.7 Contractor agrees that every effort will be made to drill a straight hole to the specifications described in **Item 8 of Schedule A**. Contractor agrees to run deviation surveys, using a Totco survey tool as reasonably required by Operator. Operator may request Contractor to cement off, re-drill or correct the slope of any hole. While correcting the slope of the hole Contractor shall be paid the applicable day work rates specified in **Item 1 of Schedule B**.
- 11.8 In the event of any difficulty arising which precludes either drilling ahead using reasonably normal procedures or the performance of any other operations planned for a well, Contractor may suspend the work in progress and shall immediately notify the Designated Field Representative of Operator of such suspension in the meantime making reasonable efforts to overcome the difficulty.
- 11.9 Contractor shall be solely responsible for the operation of the Drilling Rig including without limitation supervising moving operations and positioning the Drilling Rig and camp at locations as required by Operator as well as such operations at the drilling site as may be necessary or desirable for the safety of the Drilling Rig.
- 11.10 Throughout the drilling of the well and as directed by the Operator, Contractor shall measure and record the depth in metres of all in-hole tubular in service using an appropriate measuring device.
- 11.11 Contractor will be responsible for the implementation and observation of all health and safety laws and instructions as required by the relevant Regulations and Practices, including applicable occupational health and safety legislation, in the State in which the Rig is operating. Contractor will abide by any other reasonable instructions requested by the Operator.
- 11.12 Without limiting the Contractor's obligations in **Clause 11.12**, the Contractor shall develop, implement and enforce:
- (i) safety management plans and systems;
 - (ii) standard operating procedures;
 - (iii) job hazard analysis,
- as appropriate in the provision of the Services. The Operator shall provide all reasonable assistance to the Contractor as is required from time to time to enable the Contractor to meet its obligations under this **Clause 11.13**.
- 11.13 Contractor shall prior to the Contractor demobilising the Rig from all locations at its cost remove and clean up to the satisfaction of the Operator all material, rubbish, debris, packages, drums, paper, waste, oil, fuel, contaminants and any other material brought onto the wellsite by the Contractor during the performance of this Contract and leave the wellsite in the same condition as when the Contractor first arrived at the wellsite to commence the operations under this Contract.

12 CORING

- 12.1 Contractor agrees to take cores as set out in **Item 9 of Schedule A** or as directed by Operator. All coring shall be paid for at the applicable day work rates set out in **Item 1 of Schedule B**. Operator is to furnish containers for the cores.
- 12.2 Rotary cuttings will be sampled as and when required by the Operator who will furnish sample catcher and containers for the same.

13 REPORTS TO BE FURNISHED BY CONTRACTOR

- 13.1 Contractor shall keep and furnish to Operator a daily drilling report showing depth of the hole and work performed. Drilling report forms may be furnished or specified by Operator but otherwise Contractor shall use the standard IADC or Contractor's standard Daily Tour Report Form. A legible copy of said form signed by Contractor's Designated Field Representative shall be furnished by Contractor to Operator by 06:00 hrs every day the rig is operational.
- 13.2 Contractor shall report to Operator as soon as practicable all incidents, accidents or occurrences arising out of or during the course of operations of Contractor or of any subcontractors of Contractor.
- 13.3 If requested by Operator, Contractor shall furnish Operator with copy of delivery dockets covering any material or supplies provided by Operator and received by Contractor.
- 13.4 All labour, equipment, materials, special tools, supplies or services furnished by Contractor for which Operator is obliged to reimburse Contractor shall be recorded on the Daily Drilling Report or Material Shipment Order.
- 13.5 Contractor, in conjunction with the Operator, shall ensure that as a minimum, quarterly HSE / Maintenance / Operations meetings are conducted in either Adelaide or Hobart to review the performance of the Contract. The first such meeting to be held within 1 month of operations commencing.

14 INSURANCE

- 14.1 At any and all times during the continuation of this Contract and any extension thereof Contractor agrees to arrange insurance of the type and in minimum amounts as follows:-
- (a) Workers' Compensation insurance in full compliance with applicable laws and regulations and to include the amount of common law coverage held by the Contractor in the applicable State(s).
 - (b) Public Liability insurance (bodily injury and property damage) with a limit of \$10,000,000 for any one accident or incident.
 - (c) Oil and gas well drilling tools insurance on the Rig for their replacement value.
 - (d) Comprehensive automobile liability insurance with limits of liability of the following:-
 - (i) Bodily injury - in respect of statutory liability - unlimited; otherwise \$5,000,000 per person and \$5,000,000 per occurrence.
 - (ii) Property damage - any one occurrence \$10,000,000. Such coverage shall include owned hired and non-owned vehicles.
 - (e) Aircraft Liability Insurance - In any operations hereunder requiring the regular use of aircraft or helicopters (other than those of major airlines or provided by Operator) the Contractor shall utilise the services of recognised charter companies, and shall ensure such companies have appropriate insurances in place. Contractor shall provide if requested by Operator, details of any relevant insurance held by such charter company.
 - (f) Insurance to cover the risks set out in **Clauses 16.1, 16.8, 16.12(a) & 16.12 (c)**.
 - (g) All such insurance shall be carried in a Company or Companies acceptable to Operator and shall be maintained in full force and effect during the continuation of this Contract and any extension thereof. Contractor is allowed to renew or replace the existing insurance policy provided Contractor provides Operator with a Certificate confirming renewal within 7 days of expiry.

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- (h) If required by Operator, Contractor will increase its insurance or arrange additional cover(s) above those specified herein. Operator will reimburse Contractor for any increase in premiums resulting from such request.
- (i) Contractor shall supply certificates of currency in respect of the nominated insurances prior to commencing operations under this Contract.
- 14.2 If Operator consents to Contractor being a self-insurer as to any one or more of the risks for which coverage is herein required such consent must be in writing and signed by Operator.
- 14.3 The effecting of insurance as required by this **Clause 14** shall not in any way limit the responsibilities, obligations or liabilities of the Contractor under other provisions of the Contract.
- 14.4 If the Contractor fails to comply with the requirements of this **Clause 14** the Operator may at the Operator's sole discretion and at the Contractor's sole cost, impose any one or all of the following measures until such time as the Contractor has achieved full compliance:
- (a) delay the commencement of the Services;
 - (b) suspend the performance of the Services; and/or
 - (c) refuse payment upon any invoice in respect of the Services.

15 CLAIMS

- 15.1 Contractor agrees to pay promptly all proper claims for labour, material, services and supplies furnished by Contractor hereunder (other than labour, material, services or supplies to be paid for by Operator) and agrees to allow no lien or charge to be fixed upon any lease, any well, or the land on which any well is to be drilled, any oil gas or other hydrocarbons produced there from, or other property of Operator. Contractor agrees to indemnify protect and save Operator harmless from and against all such claims and liens, in regard to labour, materials, services and supplies furnished by the Contractor.
- 15.2 If Contractor shall fail or refuse to pay any such proper claim or indebtedness incurred by Contractor in connection with the drilling of any well or wells pursuant to this Contract, Operator shall have the right to pay any such claims or indebtedness out of any money due or to become due to Contractor hereunder. No assignment or transfer by Contractor of rights to monies due to Contractor hereunder shall have any force of effect as far as Operator's rights are concerned until all such claims and indebtedness incurred by Contractor shall have been completely liquidated and discharged.
- 15.3 Before payments are made by Operator to Contractor, Operator may require Contractor to certify that there are no unsatisfied claims for labour, materials, equipment and supplies, or for injuries to persons or property, not covered by insurance which are rightfully the Contractors liability.

16 RESPONSIBILITY FOR LOSS OR DAMAGE

- 16.1 **Contractor's Surface Equipment:** Contractor shall assume liability at all times for damage or destruction of the Rig and Contractor's surface equipment, including but not limited to all drilling tools, machinery, and appliances for use above the surface, regardless of when or how such damage or destruction occurs, and Operator shall be

- under no liability to reimburse Contractor for any such loss except loss or damage under the provisions of **Clause 21.4**.
- 16.2 **Contractor's Down-Hole Equipment:** Operator shall to the extent Contractor's insurance does not compensate Contractor assume liability at all times for damage to or destruction of Contractor's Down-Hole equipment, including but not limited to drill pipe, drill collars, and tool joints unless loss or damage was caused by the negligence of, or breach of this contract by, the Contractor, employees or subcontractors and Operator shall reimburse Contractor for the value of any such loss or damage, the value to be determined by agreement between Contractor and Operator as current repair cost or current new replacement cost of such equipment delivered to the well site less depreciation of the item(s) replaced as detailed in **Schedule H**.
- 16.3 **Contractor's Equipment: Environmental Loss or Damage:** Notwithstanding the provisions of **Clause 16.1**, Operator shall, to the extent Contractor's insurance does not compensate the Contractor, assume liability at all times for damage to or destruction of Contractor's equipment caused by exposure to unusually corrosive or otherwise destructive elements, including those introduced into the drilling fluid from subsurface formations or the use of corrosive additions in the fluid unless such damage was caused or in any way contributed to by the negligence of the Contractor, its employees or subcontractors.
- 16.4 **Operator's Equipment:** Operator shall assume liability at all times for damage or destruction of Operator's equipment, including but not limited to casing, tubing, and well head equipment and Contractor shall be under no liability to reimburse Operator for any such loss or damage unless such loss or damage was caused or in any way contributed to by the negligence of the Contractor, its employees or subcontractors.
- 16.5 **The Hole:** In the event the hole should be lost or damaged, Operator shall be solely responsible for such damage to or loss of the hole, including the casing therein unless such loss or damage was caused by the negligence of the Contractor, its employees or subcontractors.
- 16.6 **Underground Damage:** Operator agrees to defend and indemnify Contractor for any and all claims against Contractor resulting from operations under this Contract on account of injury to, destruction of, or loss or impairment of any property right in or to oil, gas, or other mineral substance or water, if at the time of the act or omission causing such injury, destruction, loss or impairment, said oil, gas or other mineral substance had not been reduced to physical possession above the surface of the earth; and for any loss or damage to any formation, strata, or reservoir beneath the surface of the earth unless such injury, destruction, loss, impairment or damage was caused by or in any way contributed to by the negligence of, or breach of this Contract by, the Contractor, its employees or sub-contractors.
- 16.7 **Inspection of Materials Furnished by Operator:** Contractor agrees to visually inspect all materials furnished by Operator before using same and to notify Operator of any apparent defects therein. Contractor shall not be liable for any loss or damage resulting from the use of materials furnished by Operator provided Contractor has fulfilled its obligation hereunder.
- 16.8 **Contractor's Indemnification of Operator:** Contractor agrees to protect, defend, indemnify, and save Operator, its officers, directors, employees, and joint venturers harmless from and against all claims, demands, and causes of action of every kind

and character, without limit and without regard to the cause or causes thereof or the negligence of any party or parties, arising in connection herewith in favour of Contractor's employees or Contractor's sub-contractors or their employees, or invitees, on account of bodily injury, death or damage to property. If it is judicially determined that the monetary limits of insurance required hereunder or of the indemnities voluntarily and mutually assumed under this **Clause 16.8** (which Contractor and Operator hereby agree will be supported either by available liability insurance, under which the insurer has no right of subrogation against the indemnitees or voluntarily self-insured, in part or whole) exceed the maximum limits permitted under applicable law, it is agreed that the said insurance requirements or indemnities shall automatically be amended to conform to the maximum monetary limits permitted under such law.

- 16.9 **Operator's Indemnification of Contractor:** Operator agrees to protect, defend, indemnify, and save Contractor, its officers, directors, employees and joint owners harmless from and against all claims, demands, and causes of action of every kind and character, without limit and without regard to the cause of causes thereof or the negligence of any party or parties arising in connection herewith in favour of Operator's employees or Operator's contractors or their employees, or Operator's invitees, on account of bodily injury, death or damage to property.

If it is judicially determined that the monetary limits of insurance required hereunder or of the indemnities voluntary and mutually assumed under this **Clause 16.9** (which Contractor and Operator hereby agree will be supported either by available liability insurance, under which the insurer has no right of subrogation against the indemnitee, or voluntarily self-insured, in part or whole) exceed the maximum limits permitted under applicable law, it is agreed that said insurance requirements or indemnities shall automatically be amended to conform to the maximum monetary limits permitted under such law.

- 16.11 **Liability for Wild Well:** Operator shall be liable for the cost of regaining control of any wild well, as well as for cost of removal of any debris, and shall indemnify Contractor in this regard.

- 16.12 **Pollution and Contamination:** Notwithstanding anything to the contrary contained herein, except the provisions of **Clauses 21.4 and 16.4**, it is understood and agreed by and between Contractor and Operator that the responsibility for pollution and contamination shall be as follows:

- (a) Unless otherwise provided herein, Contractor shall assume all responsibility for, including control and removal of, and protect, defend and save harmless Operator from and against all claims, demands and causes of action of every kind and character arising from pollution or contamination, except pollution from reserve pits, which originates above the surface of the land or water from spills of fuels, lubricants, motor oils, normal water base drilling fluid, pipe dope, paints, solvents, ballast, bilge and garbage, wholly in Contractor's possession and control and directly associated with Contractor's equipment and facilities.
- (b) Operator shall assume all responsibility for, including control and removal of, and protect, defend, indemnify and save Contractor harmless from and against all claims, demands, and causes of action of every kind and character arising directly or indirectly from all other pollution or contamination which may occur during the conduct of operations hereunder, including but not limited to, that which may result from fire, blowout, cratering, seepage or any other

uncontrolled flow of oil, gas, water or other substance, as well as, the use or disposition of oil emulsion, oil base or chemically treated drilling fluids, contaminated cuttings or cavings, lost circulation and fish recovery materials and fluids save and except for any loss or damage caused by the negligence of the Contractor, the Contractor's employees or subcontractors.

(c) In the event a third party commits an act or omission which results in pollution or contamination for which either Contractor or Operator, for whom such party is performing work, is held to be legally liable, the responsibility therefore shall be considered, as between Contractor and Operator, to be the same as if the party for whom the work was performed had performed the same and all of the obligations respecting defence, indemnity, holding harmless and limitation of responsibility and liability, as set forth in (a) and (b) above, shall be specifically applied.

- 16.13 **Consequential Damage:** Neither party shall be liable, to the other for special indirect nor consequential damages resulting from or arising out of this Contract, including, without limitation, loss of profit or business interruptions, however same may be caused.
- 16.14 **Termination of Location Liability:** When Contractor has complied to the satisfaction of the Operator with all obligations (if any) of the Contract regarding restoration of Operator's location, Operator shall thereafter be liable for damage to property, personal injury or death of any person which occurs as a result of conditions of the location and Contractor shall be relieved of such liability; provided, however, if Contractor shall subsequently re-enter upon the location for any reason, including removal of the Rig, any term of the Contract relating to such re-entry activity shall become applicable during such period.
- 16.15 Should the Operator elect to use an oil base mud or introduce into and maintain a mud system which contains in excess of 8 percent of oil, then the Operating Rate as set out in **Item 1 of Schedule B** shall be increased by 8 percent. Operator shall be responsible for the cost of replacement of elastomers damaged as a result of the use of such oil.
- 16.16 Should the Operator elect to use air or air/mist or air/foam then the Rig day rates set out in **Item 1 of Schedule B** shall be increased by a factor to be agreed between the Contractor and Operator. The cost or repair or replacement of equipment damaged during the course of such operation shall be at the Operator's expense.
- 16.17 The Operator shall observe drill stem design operating limits and recommended practices contained in API Bulletin RP7G. Should the Operator elect to exceed these limits or depart from these practices, the Operator shall be responsible for loss or damage to the drill stem and shall compensate the Contractor accordingly.

17 INDEPENDENT CONTRACTOR RELATIONSHIP

- 17.1 Contractor shall be an independent contractor with respect to performance of all work hereunder and neither Contractor nor anyone employed by Contractor shall be deemed for any purpose to be the employee, agent, servant or representative of Operator in the performance of any work or service or any part thereof in any manner dealt with hereunder.
- 17.2 The actual performance and superintendence of all work hereunder shall be by Contractor but Operator's Designated Field Representative and his staff designated in **Item 13 of Schedule A** hereto shall have unlimited access to the site of any well

to determine whether work is being performed by Contractor in accordance with Operator's reasonable directions and with all the provisions of this Contract and **Schedule A**. Such Designated Field Representative shall be empowered to act for Operator in all matters relating to Contractor's performance of the work being undertaken.

- 17.3 The Contractor agrees that the Operator's Designated Field Representative shall not be under any personal liability to the Contractor for anything done or omitted to be done in the exercise of the functions of the Operator's Designated Field Representative (as the case may be).
- 17.4 Contractor shall comply with all instructions of Operator consistent with the provisions of this Contract including without limitation drilling well control and safety instructions. Such instructions shall, if Contractor so requires, be confirmed in writing by the Designated Field Representative of Operator. However, Operator shall not issue any instructions that would be inconsistent with good oilfield practices and Contractor's rules policies or procedures pertaining to the safety of its personnel equipment or the Drilling Rig.
- 17.5 Operator acknowledges that the Contractor has a drug and alcohol policy to keep the well site and all personnel working at the well site drug and alcohol free. Operator shall ensure that all Operator personnel and other contractors under the Operator's control shall comply with this policy.

18 LAWS RULES AND REGULATIONS

Contractor and Operator respectively agree to comply with all laws rules and regulations of the Commonwealth, the State of South Australia and any such other Governmental Authority that may have jurisdiction in the relevant area of operations that are now or may become applicable to operations covered by this Contract or arising out of performance of such operations, including the Regulations and Practices.

19 FORCE MAJEURE

- 19.1 Neither Operator nor Contractor shall be liable to the other for any delays or damage or any failure to act due, occasioned or caused by reason of any laws, rules, regulations or orders promulgated by any Federal, State, or Local government body of the rules, regulations, or orders of any public body or official purporting to exercise authority or control respecting the operations covered hereby, including the procurance or use of tools and equipment or due occasioned or caused by strikes, action of the elements, water conditions, inability to obtain fuel or other critical materials, or other causes beyond the control of the party affected thereby. In the event that either party hereto is rendered unable, wholly or in part, by any of these causes to carry out its obligation under this Contract, it is agreed that such party shall give 5 days notice and details of Force Majeure in writing to the other party as promptly as possible after its occurrence. In such cases, the obligations of the party giving the notice shall be suspended during the continuance of any inability so caused. Notwithstanding any such suspension the Operator shall remain obliged to pay the Contractor the appropriate rate specified in **Item 3 of Schedule B**.

- 19.2 Operator shall be liable for costs incurred in transporting Contractor's personnel from and to the site if Contractor and Operator both consider that necessary as a result of the suspension of operations under Clause 19.1.
- 19.3 The party to the Contract whose performance or fulfilment of its obligations under this Contract is hindered or prevented by reason of Force Majeure shall use its best endeavours to put itself as soon as possible in a position to perform or fulfil such obligations.

20 INFORMATION CONFIDENTIAL

All information obtained by Contractor in the conduct of drilling operations on any well drilled pursuant to this Contract including but not limited to formations penetrated and the results of coring, testing and surveying shall be considered confidential and shall not be divulged by Contractor to any person, firm or corporation other than Operator or Operator's Designated Field Representative.

21 INGRESS AND EGRESS TO LOCATION AND SOUND LOCATION

- 21.1 Operator shall secure to Contractor rights of ingress and egress to and from the site on which any well is to be drilled pursuant to this Contract. Operator shall advise Contractor of any limitations or restrictions affecting ingress and egress and Contractor shall abide by and shall have its servants, agents, employees and subcontractors abide by such limitations or restrictions. Should Contractor be denied free access to any site for any reason not within the control of Contractor time lost by such denial shall be paid for by Operator at an applicable rate in keeping with the stage of operations at the time.
- 21.2 Operator shall prepare and maintain drilling locations with inter-alia access roads, drainage, water supply and adequate space so as to enable Contractor to install and operate properly the Drilling Rig at the drilling locations.
- 21.3 Operator agrees at all times to maintain the road and location in such a condition as will give free access and movement to and from the drilling site to an ordinarily equipped highway type vehicle. If Contractor is required to use bulldozers tractors four-wheel drive vehicles or any other specialised transportation equipment for the movement of personnel supplies machinery or equipment over access roads or on the drilling location Operator shall furnish the same at its expense without cost to Contractor.
- 21.4 Operator shall prepare a sound location capable of properly supporting the Drilling Rig and shall be responsible for a conductor pipe program adequate to prevent soil and sub-soil wash out. It is recognised that Operator has superior knowledge of the location and access routes to the location and must advise Contractor of any subsurface conditions or obstructions (including but not limited to mines caverns sink holes streams pipelines power lines and telephone lines) which Contractor might encounter while en route to the location or during operations hereunder.
- 21.5 If subsurface conditions cause a cratering or shifting of the location surface and loss or damage to the Rig its associated equipment or personnel results there from Operator shall without regard to any other provisions of this Contract reimburse contractor to the extent not covered by contractor's insurance for all such loss or damage including payment of applicable rates as specified in Item 4 of Schedule B

hereto during repair or demobilisation of the Drilling Rig if applicable and in such event the provisions of **Clause 6.9** regarding reduction of the Repair Rate payable hereunder after expiry of a specified period of repair time shall not be applicable.

22 CONFLICTS AND WAIVERS

- 22.1 This Contract supersedes and replaces any prior oral or written agreement undertakings covenants representations warranties and communications heretofore made between or given by the parties hereto. If there is any conflict between the provisions hereof and any papers or documents other than **Schedules A to H** which may have been executed by or passed between the parties hereto in connection with the subject matter hereof the provisions hereof shall prevail. If there is any conflict between the provisions hereof and those of **Schedule E** the provisions of **Schedule E** shall prevail.
- 22.2 It is fully understood and agreed that none of the requirements of this Contract shall be considered as waived by either party unless the same is done in writing and then only by the persons executing this Contract or other duly authorised agent or representative of the party.
- 22.3 The terms and conditions of this Contract may be amended at any time by both parties hereto executing an agreement in writing effecting such amendment and not otherwise.

23 ADJUSTMENT

All rates listed in **Schedule B** will remain firm for the duration of the Contract with the exception of the following two (2) items:

- (a) If by reason of any statute or regulation or any award determination (specifically the Oil Drilling Worker's (Onshore) Award) whereby the costs to the Contractor for labour supplied are increased or decreased during the period of this Contract, the daily rates specified in **Schedule B** shall be adjusted in accordance with such increase or decrease as may be applicable to the labour increases.
The base daily personnel rates for this calculation shall be as supplied and detailed in **Schedule B**.
- (b) The delivered cost of fuel for use on the Rig and in the camp.

The Contractor shall nominate in **Schedule B** the delivered cost of fuel delivered to site and included in the relevant rates.

For any variation (increase or decrease) in the cost of fuel delivered to the well site during the duration of the Contract (expressed in cents per litre) the Contractor shall submit documentation of purchase on a monthly basis and Operator shall adjust the relevant invoices (increase or decrease) accordingly.

24 DISPUTE RESOLUTION

- 24.1 Any dispute under this Agreement shall be resolved in accordance with this **Clause 24** and either party may give to the other party to the Dispute a notice in writing ("Dispute

Notice") specifying the Dispute and requiring that it be dealt with in the manner set out in this Clause 24.

- 24.2 Within 7 days of the service of a Dispute Notice, the Dispute, the subject of that notice, shall be referred to a senior executive of the Contractor and a senior executive of the Operator for resolution. Failing such resolution within 14 days of Service of the Dispute Notice, the relevant Dispute may with the agreement of both parties be referred for resolution by:

(24.2.1) mediation in accordance with Clause 24.3; or, failing such agreement,

(24.2.2) determination before the courts of the State of South Australia and any courts which have jurisdiction to hear appeals from those courts.

- 24.3 Where the parties require any Dispute to be referred to mediation then the mediation shall be conducted either in Adelaide or in Hobart by a mediator agreed upon between the parties and failing agreement upon a mediator within 14 days after the date of agreement of the parties to the appointment of a mediator, then to a mediator appointed by the President of the Institute of Arbitrators and Mediators on the application of the parties.

25 INDUSTRIAL RELATIONS

Contractor shall observe the provision of all laws regulations and industrial awards relating to its employees and shall keep Operator informed of all industrial disputes either potential or in progress which affect or may affect the operation of the Rig or the performance of this Contract.

26 ASSIGNMENT

Except in the case of an assignment by the Operator in the event of a transfer of operatorship under the relevant Joint Venture documents, neither party may assign this Contract without the prior written consent of the other, and prompt notice of any such intent to assign shall be given to the other party. In the event of such assignment, the assigning party shall remain liable to the other party as a guarantor or the performance by the assignee of the terms of this Contract. If any assignment is made that materially alters Contractor's financial burden, Contractor's compensation shall be adjusted to give effect to any increase or decrease in Contractor's operating costs.

27 NOTICES

Any notice to be given hereunder shall be deemed to have been properly given and delivered to the party to which it was directed if it is delivered in person or sent by prepaid registered post or facsimile to such party at the appropriate address stated in **Schedule A** or to such other person and or address as such party or its designated representative may hereafter notify to the other party in writing. If any notice is given by prepaid registered post such notice shall not be effective until three (3) days after it has been mailed. If any notice is given by facsimile it shall be effective 24 hours from the time such notice is given.

28 GST

28.1 Definitions

In this Clause and in this Contract where the context demands:

Recipient means the party receiving a taxable supply;

Supplier means the party making a taxable supply;

The expressions **GST, supply, tax invoice** and **taxable supply** have the same meanings as in the GST Law.

28.2 GST Exclusive

Unless otherwise provided for in this document, any amount payable pursuant to this document is expressed exclusive of GST.

28.3 Payment of GST

If a supply made pursuant to this document is a taxable supply, the recipient shall pay to the supplier in accordance with the payment terms agreed, any GST payable on that supply in addition to any other amount that may be payable by the recipient to the supplier for that supply.

28.4 Payment of GST

Notwithstanding **Clause 27.3** or any other term of the document, the recipient is under no obligation to make any payment whatsoever to the supplier unless the supplier has provided to the recipient a tax invoice in the form prescribed by GST Law.

29 COSTS GENERALLY

Each party must bear and is responsible for its own costs in connection with the negotiation, preparation and execution of this document.

30 GOVERNING LAW

This Contract shall be construed under, and matters arising out of this Contract shall be dealt with in accordance with the laws of the State of South Australia and the Courts of South Australia shall have non-exclusive jurisdiction over disputes arising hereunder.

31 SEVERABILITY

If any one provision or group of provisions in this Contract shall be held to be invalid, void or of no effect for any reason whatsoever, such holding shall not be deemed to affect the validity of the remaining provisions of this Contract which can be given effect without the invalid provision, and the provisions of this Contract are declared to be severable.

32 COUNTERPARTS AND MULTIPLE ORIGINALS



This document may be executed in any number of counterparts and all of those counterparts taken together will be deemed to constitute the same document.

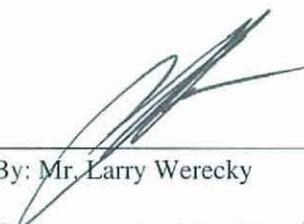
IN WITNESS whereof the parties hereto have executed this Contract on the date set out above.

Signed for and on behalf of
Great South Land Minerals Limited
(OPERATOR)


By: Dr. Clive F. Burrett 14/12/07
Title: Managing Director

Witness: DUNCAN NEEL
D Neel

Signed for and on behalf of
Hunt Energy & Mineral Co-Australia Pty. Ltd.
(CONTRACTOR)


By: Mr. Larry Werecky 14/12/07
Title: Managing Director

Witness: D Neel



Attachments to: ONSHORE DAYWORK DRILLING CONTRACT

Between: Great South Land Minerals Limited ("Operator") and
Hunt Energy & Mineral Co. - Australia Pty. Ltd. ("Contractor")

SCHEDULES ATTACHED TO DRILLING CONTRACT

Between: Great South Land Minerals Limited ("Operator") and
Hunt Energy & Mineral Co. - Australia Pty. Ltd. ("Contractor")

- A WELL SPECIFICATIONS
- B RATES PAYABLE TO CONTRACTOR
- C RIG & EQUIPMENT TO BE FURNISHED BY CONTRACTOR
- D PERSONNEL TO BE SUPPLIED BY CONTRACTOR
- E LABOUR, MATERIALS & SERVICES TO BE PROVIDED AT THE WELLSITE(S)
- F THIS SCHEDULE LEFT BLANK INTENTIONALLY
- G DRILLING TOOLS INSPECTION
- H DEPRECIATION SCHEDULE
- I OCCUPATIONAL HEALTH & SAFETY POLICY
- J ENVIRONMENT POLICY
- K MAP OF OPERATING AREA

SCHEDULE A

WELL SPECIFICATIONS

1. NAME, PERMITS & OPERATOR OF WELL(S)

The Operator plans to drill a minimum of 8 firm wells, potentially comprised of Bracknell #1, Bellevue #1, Butler's Rise #1, Thunderbolt # 1, Interlaken #1, Quamby #1, Fairfield #1, Westwood #1.

2. COMMENCEMENT DATE

It is the intent of the Operator to drill the 8 firm wells in a continuous drilling program in 2008 and this Contract shall take effect from on or about 14 December 2007 or on a date mutually agreed between the Operator and the Contractor.

3. DEPTH

Subject to the right of Operator to abandon any well or to have any well completed at a lesser depth, Contractor agrees to drill wells to Contract depths of up to 2,300 metres with 4 1/2" D.P. and depths of up to 3,500 metres with 3 1.2" D.P. and slim hole assembly.

At Operator's request Contractor agrees to drill to a depth greater than the Contract depth if it is mutually agreed the equipment at the well site is capable of drilling to such a depth.

4. DRILLING EQUIPMENT TO BE SUPPLIED

Refer to Schedule C. Phone system

5. PERSONNEL TO BE SUPPLIED

Refer to Schedule D

6. CASING AND CEMENTING PROGRAMME (for 8 wells as per operators program)

Depth Metres(feet)	Hole Size (inches)	Casing Size (inches)	Casing Wt lb/ft	Comment
1500 metres	8.5	7inch	23lb	

Depth Metres(feet)	Hole Size2 (inches)	Casing Size (inches)	Casing Wt lb/ft	Comment
1500 metres	8.5	7inch	23lb	

-
7. **MUD PROGRAMME**
As per Operator's programme.
8. **STRAIGHT HOLE SPECIFICATIONS**
As per Operator's programme. Totco surveys

SCHEDULE A (continued)

9. **PROPOSED CORING PROGRAMME**

As directed by Operator.

10. **PROPOSED WIRELINE SURVEYS**

As directed by Operator.

11. **BOP PRESSURE TESTS**

As directed by Operator and in accordance with Contractors/Operators BOP Pressure Testing Procedures. Test BOP's on nipple up and then every 14 days.

12. **PROPOSED FORMATION FLUID PRODUCTION TESTS**

As directed by Operator. Open hole DST's both conventional off-bottom and inflate straddle

13. **DESIGNATED FIELD REPRESENTATIVES**

Operator: To be notified

Contractor: To be notified

14. **OPERATOR'S ADDRESS**

Great South Land Minerals Limited
Level 3, 65 Murray Street,
Hobart Tasmania 7000
Telephone: 03 6231 9339
Facsimile: 03 6231 9625

Attention: Managing Director

15. **CONTRACTOR'S ADDRESS**

Hunt Energy & Mineral Co.-Australia Pty Ltd
ABN 52 075 814 390
15 Scarborough Way, Lonsdale, SA 5160
Telephone: 08 8322 7511
Facsimile: 08 8322 7533

Attention: Managing Director

CRB



SCHEDULE B

RATES PAYABLE TO CONTRACTOR

CLARIFICATIONS

Rates applicable to this Contract shall remain fixed for the first six (6) months, and thereafter subject only to changes mutually agreed between the Operator and Contractor.

All rates are exclusive of GST.

1. Operating Rate –

For all work performed on a day work basis Contractor shall be paid a rate for each twenty four (24) hour day.

Operating Rate will be payable when the following operations are performed:

Drilling

Coring

Reaming

Tripping

Circulating mud

Conditioning mud

Drill stem testing

All fishing operations

Working stuck drill pipe

Backing off drill pipe or drill collars

Picking up and laying down drill pipe and/or drill collars and/or reamers and/or stabilisers, etc.

Picking up or laying down core barrel

Picking up or laying down DST tools

Cutting and slipping drilling line

Servicing rig

Changing bits or other drilling tools

Pressure testing BOP equipment including choke manifold, kill and choke lines

Picking up or laying down tubing

Running casing

Production testing operations with Operator's equipment

Waiting on cement to set

Waiting on orders

Logging

A full drilling crew shall consist of the personnel specified in Schedule D.

For each man a crew is short, Contractor's Operating Rate and the Standby With Crew Rate shall be reduced by the daily pay rate for each man short.

CB

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SCHEDULE B (continued)

2. Standby With Crew Rate

The Standby With Crew Rate will be payable during periods when Operator at its sole and reasonable discretion, elects to temporarily postpone the performance of the Services and wishes to keep the Contractor available to recommence the Services at short notice. There will be no prior notice required to place the Contractor on Standby With Crew Rates, and the minimum period of Standby With Crew Rates shall be one (1) hour.

2 (a) Standby Due To Waiting on Trucks/Transportation – as for Standby with Crew
When waiting on trucking is beyond the control of the contractor.

2 (b) Standby Due To Weather – as for Standby with Crew

The Standby Due To Weather Rate shall be payable during periods of Turnkey Rig Moves (refer Schedule B 11.8) when the Contractor is unable to commence or complete a Rig move due to either road closures by designated authorities or when weather conditions prevent access or egress from the location(s). Payment shall cease in either of the following situations:

- when both Operator and Contractor agree road conditions are suitable to allow
recommencement of activities

OR

- when both parties agree that conditions dictate that either Standby Without
Crew or Force Majeure conditions apply.

3. Standby Without Crew Rate

Standby Without Crew Rate shall be payable during periods when the Operator elects due to weather or other circumstances to retain the Rig on Contract. Contractor will require a minimum of 24 hr notification. The cost of mobilizing the Crew in and out of the location will be at Operator's cost.

4. Repair Rate

The Repair Rate will be payable during periods that the Rig is not operating and the Contractor is conducting repairs on the Rig up to 8 hours. If the period to carry out repairs upon the Rig totals more than 8 hours for any one occurrence or twenty four (24) hours cumulatively per calendar month, any payments to the Contractor will be limited to the Camp Rate detailed below at Item 6.

Daily rig greasing and lubricating time shall not be classified as 'repair and maintenance' and time taken for up to one (1) hour per day Contractor will be reimbursed for time taken to grease and lubricate at the rate prevailing at the time these services are performed.

During periods of repair in excess of twenty four (24) hours, payments for third party equipment rented by Contractor on behalf of Operator shall continue until Operator advises release of equipment.

CRB



SCHEDULE B (continued)

5. Camp Rates

Camp rates shall be payable to the Contractor as per 12.5 of **Schedule B** for the provision of camp amenities, messing and accommodation for the Contractor's employees, servants and agents or equivalent.

Camp amenities, accommodation and messing facilities shall also be provided without charge for up to eight (8) of Operator's employees or Operator's sub-contractors involved in the performance of services on the Rig.

Camp Rates shall be payable during periods when the Rig is under repair for periods of more than eight (8) hours for any one occurrence or twenty four (24) hours cumulatively per 28 day period. If repairs exceed more than 48 hours in a 28 day period, ongoing payment of Camp Rates will be reviewed and mutually agreed.

6. Mobilisation

If the Rig is not moved to the first well under a formula Rig move, a Mobilisation Fee will be payable to the Contractor. The fee will cover all costs to mobilise rig, camp, personnel and equipment to the first well site and be rigged up, ready to spud. The Mobilisation Fee is detailed in **Schedule B 12.6**. The operator will pre-pay the mobilisation fee prior to commencement of rig mobilization. *

7. Demobilisation

On completion of the program the demobilisation fee payable shall be in accordance with the formula rig move rates quoted in **Schedule B 12.7**. The demobilization cost will be placed in a mutually agreed escrow account for the duration of the contract.

8. Rig Moves

Day Rate Basis

The Operator may choose to move the Rig and camp on a day rate basis. In this situation, the Contractor will be paid at the rate of Standby with Crew from Rig Release of the previous well until spud of the next well. The Operator will be responsible for the payment of all trucking and other equipment hire costs as may be required to facilitate the move. The Operator will have the option to request the Contractor to organise the trucking and hire equipment services on its behalf.

Operator shall secure to the Contractor rights of ingress and egress to well sites and shall advise the Contractor of any limitations or restrictions. Should the Contractor be denied free access to any well site for any reason not within the control of the Contractor, including weather delays, time lost by such denial shall be paid at the applicable rate in keeping with the stage of operations at the time.

9. Rounding of Time

For day work comprising less than an hour, the Contractor shall be paid the proper fractional part of the amount specified for an hour, rounded to the nearest half hour.

10. Base Fuel Price

Contractor shall itemise the Base Fuel Price used as the basis of the Operating Rate. Base Fuel Price shall be delivered to site and inclusive of all State, Federal Taxes, etc.

For any price variation (increase or decrease) of the Base Fuel Price delivered to site during the duration of this Contract, the Contractor shall submit documentation and the Operator will adjust the relevant invoices (increase or decrease) accordingly. Refer to Schedule B 12. Rates Payable to Contractor

11. Labour Rates

For any Federal award changes to the Oil Drilling Rig Workers Award (Onshore), which may apply during the term of this Contract, wages of persons employed under this Award shall be adjusted accordingly.

CRS



SCHEDULE B (continued)

12. Rates payable to Contractor

1. Operating Rig Rate (excl. camp)	\$28,296.00	per 24 hour
2. Standby With Crew Rate	\$24,566.00	per 24 hour
3. Standby Without Crew Rate	\$8,554.00	per 24 hour
4. Rig Repair Rate	\$1061.00	per hour
5. Camp Rate	\$3,804.00	per day
6. Alternative Accommodation	T.B.A.	

Operator allowance of 8 personnel per day.

Camp Rate shall apply 1 day prior to spud of first well.

Camp Rate shall apply 1 day after release of last well.

Additional meals	\$25.50	each
Additional beds	\$25.50	each

Additional meal rate shall apply for any meals above the 24 meals per day allowance.

Additional bed rate shall apply for any beds above the 8 beds per day allowance.

Additional transportation costs due to fuel surcharges or rate hikes will be passed on to Operator

6. Mobilisation	\$ 400,000.00 plus transportation at cost
7. Demobilisation	\$ 900,000.00
8. Interwell Move Rate(transport at cost plus \$24,566.00/per day rate)	
9. Forklift Usage	\$150.00 per hour \$ 1.00 per litre
10. Fuel	

CRS

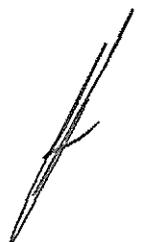
SCHEDULE C

RIG & EQUIPMENT TO BE FURNISHED BY CONTRACTOR

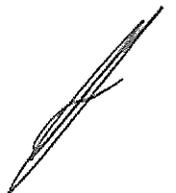
HUNT ENERGY & MINERAL CO - AUSTRALIA PTY LTD

Rig # 3 - Drilling Equipment Specifications

DRAWWORKS:	TSM Model 6000 450HP Single Drum Drawworks Serial # 1018, Powered by 2 only Caterpillar 3306 Diesel Engines coupled to Allison TC475 Torque Converters & Twin Disc Low and High Drum Clutches Foster model 27S Make up and 27B Breakout Catheads Hoisting speeds 4 forward Rotary speeds 2 forward Lebus 1-1/8" Main Drum Grooving 8" x 38" brake drum
RIG CAPACITY:	Drilling Depth 2,300 mtrs with 4-1/2" D.P. Drilling Depth 3,500 mtrs with 3-1/2" D.P. and slim hole
SUBSTRUCTURE:	Tri-Rudd Industries, one piece unit construction, 12ft high, 14ft wide, 40ft long, Drillers Dog House: 9ft wide x 16ft long with 4ft landing one end. Toolhouse: 11ft wide x 10ft long on 40ft skid with water tank 500bbl. Fold up landings, staircase and substructure access for rig moving. Casing Capacity 280,000lbs Setback Capacity 200,000lbs
DERRICK:	Tri Rudd Industries Adeco Model 105-13-4-420, Clear height 105ft, leg spread 13ft 4", GNC 420,000lbs
CROWN BLOCK:	Troy 4 cluster 36" sheaves plus one 36" fastline sheave all grooved for 1-1/8" drilling line
CROWN-O-MATIC:	NL Shaffer crown saver
TRAVELLING BLOCK:	Sowa 150 ton with Web Wilson Hydra Hook, 4 x 36" sheaves grooved for 1-1/8" drilling line



AUXILIARY BRAKE:	TSM-22 Single Hydromatic
FLOOR WINCH:	Pullmaster Model H7A Hydraulic winch
ROTARY SWIVEL:	Tri-Service Machine Model TSM-150 Swivel 150 ton rating @ 100RPM
ROTARY TABLE:	Gardner Denver 17-1/2" c/w Varco 4KRVS 4-1/4" Square drive & TSM split Master Bushing
RIG LIGHTING:	Explosion proof fluorescent & high pressure sodium
MUD PUMP #1	TSM 500 Duplex 7-1/2" x 16" slush pump powered by Caterpillar 3412 engine with 18" Fawick clutch, Barber Rig Saver 58" 10 groove 8 vee belt drive equipped with 2" Oteco pop off valve, Oteco Type 4 Mud Pressure Gauge, Pump Mates 450-60 Pulsation Dampener and 10" Suction line mounted on 12ft x 33ft steel skid.
MUD PUMP #2	TSM 500 Duplex 7-1/2" x 16" slush pump powered by Caterpillar 3412 engine with 18" Fawick clutch, Barber Rig Saver 58" 10 groove 8 vee belt drive equipped with Oteco 2" pop off valve, Oteco Type 4 Mud Pressure Gauge, Hydril K-10 Pulsation Dampener & 10" suction line mounted on 12ft x 33 ft steel skid.
MUD MIXING PUMPS (2)	Harrisburg 5 x 6 Centrifugal pumps powered with 50hp electric motors each manifolded together to run desilter and or desander.
STANDPIPE:	Standpipe Manifold - 4" x 3000lb fitted with Demco 4" Gate Valves, Martin Decker E-17-152 Pressure Sensor & Oteco Model 7 Pressure Gauge, 1 x 5000psi WP kelly hose
MUD SYSTEM:	Rudd & Hodgson fabricated 420bbl Single tank 5 compartment system s/n RHI-26-4383
MUD HOPPER:	Harrisburg
WATER PUMPS (2):	Harrisburg 2 x 2 Centrifugal pumps powered with 10hp electric motor
SHALE SHAKER:	DFE SCR-01 Linear Motion



DEGASSER:	Vertical Type Poor Boy Gas Separator
AGITATOR:	Lightnin Model 72Q7.5 c/w EXP Motor
DESILTER:	Tri-Flo 4" x 8 cone
DESANDER:	Chimo 160mm x 4 cone
BLOWOUT PREVENTORS:	<p><u>Ram BOP</u> (2) Shaffer single gate 11" 3000 LWS Ram Sizes - 2-7/8", 4-1/2", 5" & 7"</p> <p><u>Annular BOP</u> Shaffer 11" 3000 Annular s/n 3632</p>
ACCUMULATOR:	Ross Hill Model C180-IE20-2AG, 7 bottles with operator master control panel, Nitrogen emergency backup.
CHOKE MANIFOLD:	3" 3,000# complete with - 2 only 3" & 9 only 2" 3000 # API flanged standard trim gate valves. 1 only CIW 3-1/8" 5000 HCR Valve c/- H2S Trim.
KILL LINE:	2 only 2" - 3000psi Wood Group M25 Adjustable Chokes.
INSTRUMENTATION:	<p>Martin Decker 7 Pen Recorder with Air Retrieve Martin Decker Type 'AA15' Clipper Weight Indicator Totco 0-3000psi Pump Pressure Gauges Totco Tong Line Pull Gauges Totco Rotary Torque Gauge</p>
MUD MONITORING:	<p>AOI-300 Series Flow Indicator System AOI Digital Read Out Stroke Counters AOI 1000 Series Pneumatic Mud Monitoring System</p>
SURVEY UNIT:	0-8 degree Totco Unit
WIRELINE UNIT:	<p>Model 5 Hydraulic Wireline Unit with Charlyn Orbit Power Hydraulic pump Capacity : (0.92 x 10,000 ft)</p>
KELLY:	1 only 4-1/4" x 41' Varco Square drive

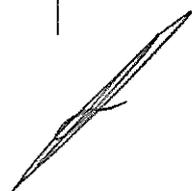
UPPER KELLY VALVE:	M&M Upper Kelly Cock 6-5/8" Regular LH Pin/Box Connections 10,000psi test
LOWER KELLY VALVE:	M and M. 4-1/4" x 10,000 (4"IF Pin/Box) Canister type Lower Kelly Cock.
STABBING VALVE:	Gray 63021 (4"IF) c/w rod and deflector.
DRILL PIPE:	4-1/2" Grade 'E' 16.6lb/ft Range 2 Drill Pipe with 4" if connections 6 each 4-1/2" HWDP
DRILL COLLARS:	3 each 8" Spiral Drill Collar 26 each 6-1/2" Spiral / Slick 4" if Drill Collar
FISHING TOOLS:	As required to fish Contractors string
HANDLING TOOLS:	<p><u>Elevators:</u></p> <p>1 set 7" Centre Latch Casing Elevators 1 set 7" Side Door Casing Elevators 1 set 9-5/8" Centre Latch Casing Elevators 1 set 9-5/8" Side Door Casing Elevators 1 set 13-3/8 Casing Elevators 2 sets 4-1/2" Drill Pipe Elevators</p> <p><u>Slips:</u></p> <p>2 set 4-1/2" - Drill Pipe 1 set 5-1/2" - 7" Drill Collar 1 ser DCS-S 4-3/4" Drill Collar 1 set DCS-L 8" Drill Collar 1 set Varco 9-5/8" Casing Slips</p> <p><u>Safety Clamp:</u></p> <p>1 only Varco MPR</p> <p><u>Main Floor Rotary Tongs</u></p> <p>1 set (2) Drill pipe tongs c/w jaws 3-1/2" - 10-3/4"</p>
SUBS:	<p><u>Bit Subs:</u></p> <p>1 x 6-5/8" regular box x 4" I.F. box bored for float 1 x 4-1/2" regular box x 4" I.F. box bored for float</p> <p><u>X-Over Subs:</u></p> <p>6-5/8" Reg. Pin x 4" If Box. X-over 4-1/2" Reg. x 6-5/8" Reg. (Double Pin)</p>

CR-6



	2 x 4" IF Box x 4" FH Pin 4" FH Box x 4" IF Pin
	<u>Saver Subs:</u> 4" IF Pin/Box (3-1/2 ft) 4" If Pin/Box (12") 4" If Pin/Box (2-1/2 Ft)
	<u>Pickup Subs:</u> 10 x 6-1/2" OD x 4-1/2" OD x 42" long 4" I.F.
PIPE SPINNER:	Greyspin Hydraulic pipe spinner
KELLY SPINNER:	Foster Model # 77
CASING TONG:	Universe Model 01B13E 13-3/8" Tong assembly c/w 13-3/8", 9-5/8" 7" & 5-1/2" jaws
CASING / TUBING DRIFTS:	as required
CUP TESTER:	9-5/8" Casing cup tester
WIRELINE UNIT:	TSM Hydraulic
WELDING EQUIPMENT:	1 x Miller Model SRH-333 Electric Welder 1 x Lincoln AS-400-50 Diesel Powered Electric Welder. 1 x BOC Oxy/Acet Cutting / Welding set
AIR COMPRESSORS (2)	Le roy model 550 compressors
AC GENERATOR:	2 x Caterpillar 3406 Diesel Engines coupled to Brown Boveri Model 523R alternators, 219kva, 60HZ, Mounted in Rudd & Hodgson fabricated steel building
FUEL TANK:	4000gal
PIPE RACKS:	4 sets
CATWALKS:	2 x 30 ft
MUD LAB:	Baroid Mud Laboratory Kit

MUD SAVER:	1 x Oteco MG-602 Mud Saver
MOUSE / RAT HOLE DIGGER:	TSM manufactured
CELLAR PUMP:	Cellar Jet
WATER PUMP:	2 only 3" x 2" Portable Pumps
RIG VEHICLES:	1 X Toyota Troop Carrier 1 X Toyota Tray Top Ute 1 X Caterpillar 966 Loader
RIG ACCOMODATION:	Rig Manager's Accommodation - 1 only Transportable unit 40' x 9' x 9' c/w Sleeping quarters, Ablution facilities & two separate offices. Drilling Supervisor's Accommodation - 1 only Transportable unit 40' x 9' x 9' c/w Sleeping quarters, Ablution facilities & two separate offices.
FIRE EXTINGUISHER:	Certified Units located in strategic positions in and around Rig and Camp.
RIG COMMUNICATION:	Westinghouse Satellite Telephone (Optus) Sharp FO-355 fax machine CDMA Mobile Phone



CAMP**GENERATOR:**

1 only Camp Generator House (fully sound proofed)
(12.0 x 3.0m Skid Mounted)
c/w 14,000litre capacity water tank -Davey Water Pump
2 only Onan Generator sets 100KVA
Fuel tank capacity 7000lts

SLEEPING UNITS:

1 only (14.4 x 3.0m skid mounted) 6 person Bunkhouse
c/w Built in wardrobes, table, beds and bedding.
2 only (14.4 x 3.0m skid mounted) 10 person Bunkhouse
c/w Built in wardrobes, table, beds and bedding.

KITCHEN-DINING:

1 only Kitchen/Diner/Coolroom/Freezer Unit
(14.4 x 3.0m skid mounted) Built-in combined
freezer/chiller unit c/w Commercial Kitchen, Range/Oven,
Microwave, Deep fryer, Mixer/Blender, Bain Marie,
fixed tables, chairs and all necessary utensils.

RECREATION:

1 x Recreation Room / Clinic Unit
(14.4 x 3.0m Skid Mounted) c/w television, video
& lounge chairs
1 x First Aid Room

ABLUTION:

1 x Ablution / Laundry / Store Unit
(14.0 x 3.0m Skid Mounted) c/w 315litre hot water unit,
4 x toilet bays and 5 shower bays.
Laundry c/w 2 x washing machines & 2 x dryers
Storage area with built in shelving

CEB

SCHEDULE D

PERSONNEL TO BE SUPPLIED BY THE CONTRACTOR

Drilling Crew

Rates quoted are based on the Contractor providing a full tour drilling crew on the Rig 24 hours per day. A full tour drilling crew shall consist of five (5) persons, as indicated below:

<i>1 only</i>	<i>Rig Manager</i>
<i>1 only</i>	<i>Driller*</i>
<i>1 only</i>	<i>Mechanic</i>
<i>1 only</i>	<i>Electrician</i>
<i>1 only</i>	<i>Derrickhand*</i>
<i>1 only</i>	<i>Lead Floorhand*</i>
<i>2 only</i>	<i>Floorhand*</i>
<i>1 only</i>	<i>Leasehand**</i>
<i>1 only</i>	<i>HSET Officer</i>

Persons indicated with an asterisk* will comprise a full crew working a 12 hour shift. Alternates will be on site with a further crew on break.

The Rig Mechanic will at all times be available on 24 hour call.

Basic welding skills are to be available on site – if pressure welding is required by the Operator, the Contractor to supply at the Operator's expense.

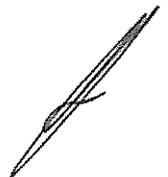
The Electrician will be available as required.

For each person the above complement is short, the Operating Rate, Standby With Crew Rate or Repair Rate, effective at the time will be reduced by the daily rate of pay for each position as detailed in the rates **Schedule B**.

Camp Crew

<i>2 only</i>	<i>Cooks</i>
<i>2 only</i>	<i>Camp Attendants</i>

C&S



SCHEDULE E**LABOUR, EQUIPMENT AND SERVICES TO BE PROVIDED AT THE WELLSITE (S)**

CONTRACTOR = C
 OPERATOR = O

		<u>Provided By</u>	<u>Expense Of</u>
(1)	Complete drilling Rig, as set out in Schedule C, capable of drilling to 2300 metres to carry out Operator's programme.	C	C
(2)	All personnel and supervision necessary to operate the drilling Rig as set out in Schedule D.	C	C
(3)	All transportation equipment for the Contractor's personnel.	C	C
(4)	(a) Rat-hole & mouse-hole drilling for a maximum 8 hours.	C/O	O
	(b) Rat-hole & mouse-hole drilling in excess of 8 hours.	C/O	O
(5)	(a) Conductor pipe supply	O	O
	(b) Conductor pipe -Drill, run & cement	O	O
	(c) Conductor cement	O	O
(6)	(a) Flow pipes and risers	C	C
	(b) Flare Line.	C	C
	© 1" Stinger 4 x 20 ft lengths	C/O	O
(7)	Rig foundations - wooden mats	C	C
(8)	(a) Electric supply for Rig and well-site buildings (240 volts 50 cycle single phase 7.5KVA)	C	C
	(b) light fixtures and bulbs (rig and camp only)	C	C
(9)	(a) Fuel storage	C	C
	(b) Maintaining fuel supply	C	C
	(c) Trucking to maintain fuel supply	C	C
(10)	Mud storage in addition to suction pits. (if req.)	O	O
(11)	Cleaning Solvents	C	C
(12)	Soft rope, rags, etc.	C	C
(13)	Replacement and repair of Contractor's down hole tools damaged as a result of fishing	C	O
(14)	Rig maintenance - (1/2 hour per 24 hour period)	C	O
(15)	Drill pipe wipers	C	C

		<u>Provided By</u>	<u>Expense Of</u>
(16)	(a) Casing and tubing tools (tongs, Casing spider, elevator and slips for 9.5/8", 7" casing, 3 1/2"	C	C
	(b) Rod Handling Equipment	C/O	O
(17)	(a) Welding for rigging up prior to spud	C	C
	(b) Pressure welding (if req.)	C	O
(18)	Automatic Drilling Time Recorder	C	C
(19)	(a) Furnish and maintain adequate roadway to location, right-of-way, including rights of way for fuel and water lines, river crossings, highway crossings gates and cattle guards.	O	O
	(b) Stake location, clear and grade location, and provide turnaround including surfacing when necessary.	O	O
(20)	(a) Site preparation including digging of waste pit and grading location.	O	O
	(b) Construction of cellar including materials	O	O
(21)	Excavation, if necessary, for mud suction pit or tank	O	O
(22)	(a) Communication system for contractor's use.	C	C
	(b) Communication system for operators' use.	C	O
(23)	Clean up:		
	(a) Contractor's supplies and rubbish	C	C
	(b) Camp refuse	C	O
	(c) Sump, pits and site rehabilitation	O	O
	(d) Operators hard rubbish	O	O
(24)	All tubular goods, hangers, packers etc. in connection with formation testings and flow tests.	O	O
(25)	Casing, shoes, float collars, baskets, scratchers, centralisers and other permanent casing accessories.	O	O
(26)	Wellhead connections and all equipment to be installed in or on well or on the premises for use in connection with drilling, testing, completion and operation of well	O	O
(27)	(a) Cement	O	O
	(b) Cementing Pumping services.	O	O
(28)	Materials or service for any permanent installation which will remain part of well	O	O
(29)	Water storage pits (earthen).	O	O
(30)	(a) Rig water supply to within 100' of cellar (includes Dam or Turkey's Nest)	O	O
	(b) Potable camp water supply and delivery	O	O
(31)	(a) Incidental maintenance of water lines within 100' of cellar	C	C
	(b) Water pit pump.	C	C

		Provided By	Expense Of
(32)	Water well pump, if necessary.	O	O
(33)	Water well pump, fuel.	C	O
(34)	Operations and incidental maintenance of water pump.	C	O
(35)	(a) Fuel, oil and grease for rig and associated equipment	C	C
	(b) Fuel, oil and grease for Contractor's vehicles, including forklift.	C	C
(36)	Mud and Chemicals	O	O
(37)	Oil base, oil emulsion or crude oil.	O	O
(38)	Disposal of drilling fluid.	O	O
(39)	Lost circulation materials.	O	O
(40)	(a) Mud storage for special mud other than specified in well programmes.	O	O
	(b) Tarpaulin cover for mud stocks.(if required)	O	O
	(c) Inhibiter for drill string at end of well.	O	O
(41)	Casing or tubing thread lubricant.	O	O
(42)	(a) Transportation of Contractor's drilling equipment and camp to site or between sites.	C	O
	(b) Demobilisation of Contractor's drilling equipment and camp from the drilling site.	C	O
	(c) Additional mobilisation/demobilisation costs incurred due to wash down of equipment etc.	C	O
(43)	Road tax on haulage	C	C
(44)	(a) Stabilisers and reamer bodies.	O	O
	(b) Shock sub.	O	O
	(c) Replacement parts for above	O	O
(45)	Rotary bits.	O	O
(46)	(a) Diamond or conventional coring equipment.	O	O
	(b) Diamond or conventional core heads.	O	O
	(c) Replacement parts for coring equipment.	O	O
(47)	(a) Standard fishing tools for Contractors equipment	C	C
	(b) Special fishing tools and services	O	O
(48)	Formation testing, hydraulic fracturing, acidising and other related services	O	O
(49)	Test Tanks with pipe and fittings.	O	O
(50)	Separator with pipe and fitting	O	O
(51)	Labour to connect and disconnect test tanks and separator.	C/O	O
(52)	Labour to disconnect and clean test tanks and separator.	O	O
(53)	Gun or jet perforating services.	O	O
(54)	Explosives and shooting devices	O	O
(55)	Mud logging services	O	O
(56)	Sidewall coring service.	O	O

		<u>Provided By</u>	<u>Expense Of</u>
(57)	Crane for rigging-up and rigging-down, load out and unload. (a) Turnkey move. (b) Day Rate Move	C C/O	C O
(58)	Transportation of Contractor's spares and maintenance parts for rig.	C	C
(59)	(a) Trucking of Operators materials to site	O	O
	(b) Use of Contractors forklift to unload materials and move around site.	C	C
	(c) Use of Contractors forklift offsite	C	O
(60)	(a) Adequate housing, messing facilities and amenities for Contractor's drilling personnel while engaged on drilling, rigging-up and down, moving, unloading and loading operations.	C	C
	(b) Accommodation and messing for up to eight (8) Operator personnel/subcontractors during moving/rigging up/drilling operations.	C	C
	(c) Accommodation in excess of eight(8) persons	C/O	O
(61)	(a) Electric logging services.	O	O
	(b) Directional, calliper and other special services.	O	O
(62)	Swab rubbers, swab tubing and supplies (if and when considered necessary by Operator notice therefore to be given to Contractor).	O	O
(63)	Transport costs and repairs to tools rented by Contractor at Operator's request.	C	O
(64)	Overtime paid to non-staff drilling personnel working in excess of 12 hours in any one day while engaged in cementing, running casing, lost circulation jobs, etc.	C	O
(65)	Welding service for welding bottom joints of casing, guide shoe, float shoe, float collar and in connection with landing casing.	C	C
(66)	Leave transportation - Contractor's personnel.	C	C
(67)	Roustabout labour to handle Operator's drilling supplies, materials and equipment, etc. on site provided such items can be handled by regular rig crew and equipment.	C	C
(68)	Provision of transport services to move Contractor's personnel, spare parts and perishables.	C	C
(69)	Provision of transport service to move Operator's personnel, spare parts, materials or equipment.	C/O	O
(70)	Corrosion rings.	C	O
(71)	Oxygen and hydrogen sulphide scavenging chemicals and equipment and tubulars.	O	O

		<u>Provided By</u>	<u>Expense Of</u>
(72)	Drill pipe and drill collar inspection in accordance with API RPG7 classification standards by an approved inspection service.		
	(a) Prior to commencement of Contract, if required.	C	C
	(b) Thereafter at six monthly intervals.	C	O
	(c) More frequently than six months necessitated by operating conditions or if requested by Operator and at the end of the Contract.	C	O
	(d) Immediately in the event of three (3) drill-string failures.	C	C
(73)	Mud Engineer, if required (but Contractor will carry out routine mud testing and treatment).	O	O
(74)	Any geological services.	O	O
(75)	Directional drilling equipment and services.	O	O
(76)	(a) Any drill pipe and drill collars, kellys or subs in addition to those furnished by Contractor under Section 4(a) of Exhibit A, including required handling tools.	C	O
	(b) Pony Drill collar 6 1/2" x 10' long	C	C
(77)	(a) Shaker Screens. 1 set up to 84 mesh (inclusive)	C	C
	(b) Additional screens finer than & including 84 mesh. ie, 110, 175, 210 or 250 mesh	C	O
(78)	Safety drill pipe plugs.	C	C
(79)	Medical Kit held on Rig Site locked and under management supervision by Rig Manager	C	C
(80)	Qualified First Aid person(s) as required to comply with relevant legislation	C	C
(81)	Blow-out Preventer Test Equipment		
	(a) Cup Tester	C	C
	(b) Cup Tester Rubbers	C	O
(82)	Crossover Spools and Flanges for wellhead equipment	C	C
(83)	Torque gauges for drill collar make up and casing tongs	C	C
(84)	Flow pipe, risers & flare lines	C	C
(85)	(a) Pit Level Recorder	C	C
	(b) Flow shows	C	C
(86)	Daily cleaning service and regular linen/laundry service for engineer/geologist accommodation unit at well-site	C	C
(87)	(a) Camp Sewerage treatment system to a standard to conform to the requirement of SA Dept of Environment	C/O	O

		<u>Provided By</u>	<u>Expense Of</u>
(88)	Hard rubbish collection bin	O	O
(89)	Cement mix-water tank 360 bbl min.	C/O	O
(90)	Onsite accommodation for Operators Drilling Supervisor	C	C
(91)	Pressure Testing Unit	C	O
(92)	Drilling Jar	O	O
(93)	"Blue Box's" for rig sewerage treatment	C	O
(94)	Satelite phone system for Coman & geologist	C	O



SCHEDULE F

This schedule has been left blank intentionally

CSG



SCHEDULE G

DRILLING TOOLS/EQUIPMENT INSPECTION

Contractor will schedule a mid year shutdown period to address all outstanding maintenance / repair issues.

Payment during this period shall be limited to the turnkey Rig move rate applicable at the time.

Contractor will provide evidence of recent inspections to the following equipment prior to commencing operations under the terms of this Contract.

Drill string

- drill pipe
- drill collars
- hevi-wate drill pipe
- substitutes / crossovers
- kelly/bushings
- fishing tools

Drilling Tools

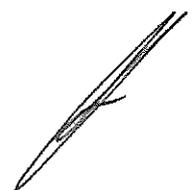
- BOPS
- Drilling spools
- Tongs

Slings and Lifting Equipment

- slings
- tong lines
- links
- hooks/blocks
- swivel-
- elevators
- slips

Rig Components

- brake bands
- rotary table



SCHEDULE H**DEPRECIATION SCHEDULE**

Lost-in-Hole Values

Item	Value at Commencement Date	Depreciation Rate for each 365 working days (% or years)
Drilling unit and surface drilling equipment	USD\$1,500,000.00	10%
Tubulures including :-		
Drill Pipe 4 ½" – unit cost	USD 3,500.00	25%
Drill pipe 3 ½" – unit cost	USD2,350.00	25%
Drill collars 6 ½" – unit cost	USD4,500.00	25%
Drill collars 8" – unit cost	USD6000.00	25%
Hevi-wate drill pipe 4 1/2" – unit cost	USD\$3,100.00	25%
Drilling Jars – unit cost	N/A	N/A
Stabilizer 8 ½" – unit cost	N/A	N/A
NBR 8 ½" – unit cost	N/A	N/A
BOP's	USD140,000.00	15%
Mud Tanks	A\$320,000.00	15%
Light Vehicles	A\$48,000.00	30%
Camp	A\$750,000.00	20%



SCHEDULE I

OCCUPATIONAL, HEALTH, SAFETY & WELFARE POLICY

Contractor details of Safety Manuals/Operations Manuals/JSA Procedures and Work Procedures applicable to the area of operation supplied to the Operator by the Contractor to be read in conjunction with this Contract.

HUNT ENERGY & MINERAL CO. AUST PTY LTD OCCUPATIONAL HEALTH & SAFETY POLICY

Hunt Energy will provide a safe working environment for all employees through commitment to a systems approach in safety management at all sites & facilities under its control. In particular, the organisation will provide:

- Policies and procedures that clearly define the company safety doctrine.
- Plant & equipment in safe working condition.
- Induction & training to educate all new employees on their responsibilities under the relevant state OH&S Act & Regulations.
- Supervision & instruction to ensure that all work is completed safely.

Hunt Energy believes that all work injuries are preventable and will strive to eliminate the hazards that cause them. Through an ongoing process of Risk Assessment the company will endeavour to reduce the potential for harm to its employees, contractors & visitors, and use the hierarchy of control in hazard management to achieve the best possible outcome.

While striving to achieve an accident free workplace, it is Company policy that any incidents or accidents that do occur, must be reported immediately, and appropriate action taken to prevent a recurrence.

Management will actively demonstrate their commitment to safety through support of safety awareness initiatives promoting consultation & communication on safety issues through all levels of the organisation.

Hunt Energy understands that a positive safety culture is a core value for the achievement of sound business practice and to maintain a continuous improvement strategy.

SCHEDULE J

ENVIRONMENT POLICY

Contractor policies and procedures supplied to the Operator by the Contractor relating to environmental matters to be read in conjunction with this Contract.

HUNT ENERGY & MINERAL CO. AUST PTY LTD ENVIRONMENTAL POLICY

Hunt Energy is committed to the preservation of the environment and will conduct all operations and activities with environmental protection as a prime objective. Hunt Energy will follow guidelines as set down by the Environmental Protection Authority and relevant industry standards. In particular, Hunt Energy will:

Ensure that all employees and contractors are aware of their responsibilities for environmental protection through induction to this policy and customer requirements. In addition, Hunt Energy will:

- Minimise the possibility of pollution to soil, water or air caused by spills or the emission of gas, by following sound principals of Risk Management.
In the event of a spill occurring, immediately follow the principles of contain, control and cleanup, to minimise damage to the environment.
- Manage the transportation, storage and handling of Hazardous Substances and Dangerous Goods in line with the relevant state Regulations.
- Minimise damage to flora and fauna as a result of rig operations and use of heavy equipment, by forward planning and efficient utilisation of equipment, particularly in relation to weather conditions.
- Avoid disturbing natural or historical sites, particularly with respect to Aboriginal & European Cultural Heritage.
- Assist with the rehabilitation of the rig site and adjoining areas after the drilling program to preserve the natural habitat for other land users.

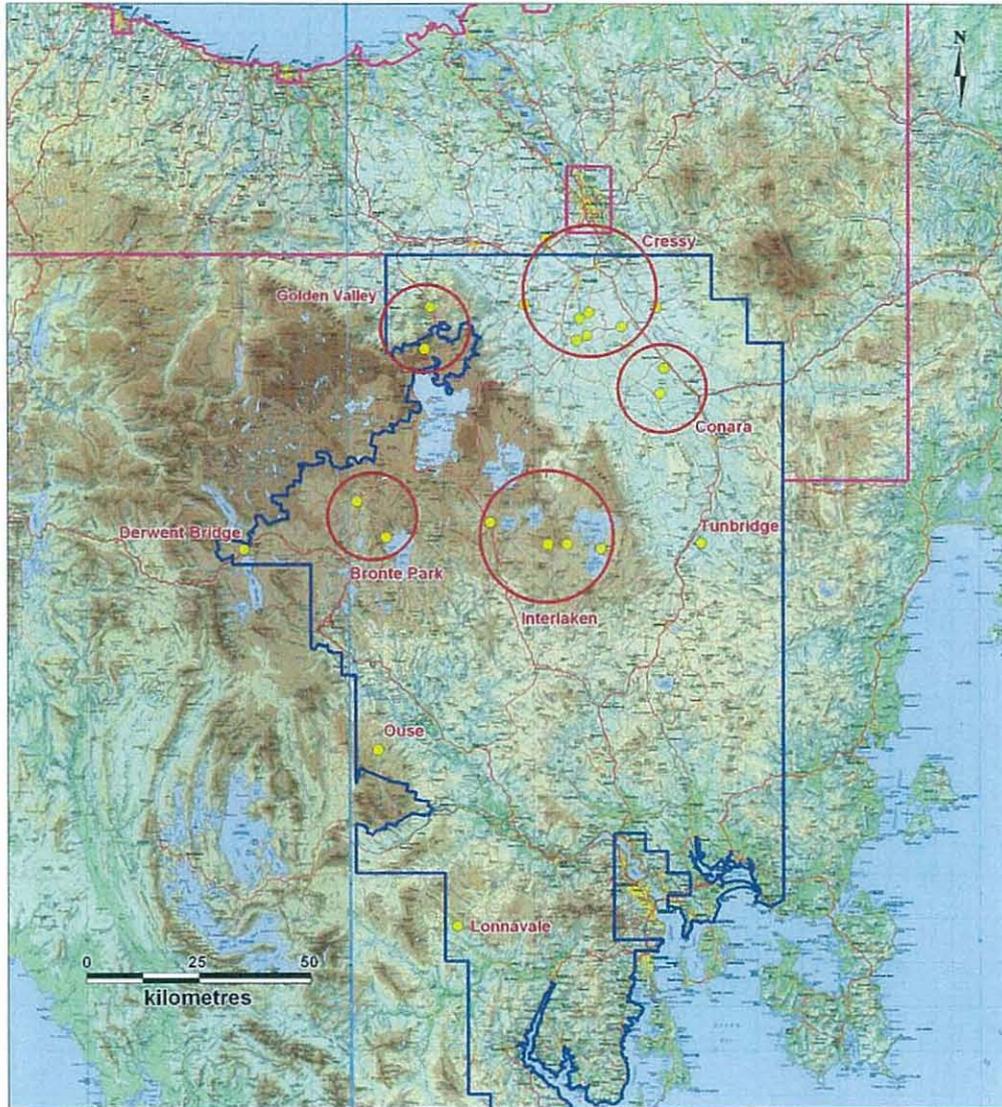
Hunt Energy & Mineral Co.- Aust. Pty Ltd is committed to its endeavour of being a responsible environmental corporate citizen.



SCHEDULE K MAP OF OPERATING AREA(S)



Distances between proposed drill sites



Shortest distance by road (Km)

	Lonnvale	Ouse	Derwent Bridge	Bronte Park	Golden Valley	Interlaken	Tunbridge	Conara	Cressy
Cressy	196	128	134	103	37	66	72	47	0
Conara	191	136	173	142	84	63	40	0	
Tunbridge	151	98	133	104	109	25	0		
Interlaken	136	72	109	78	97	0			
Golden Valley	208	121	104	73	0				
Bronte Park	145	54	30	0					
Derwent Bridge	166	75	0						
Ouse	91	0							
Lonnvale	0								

LEGEND

- Proposed Drill Sites
- SEL 5/2005
- SEL13/1998
- Site Groups

CFS





Great South Land Minerals Limited

Great South Land Minerals Limited ABN 54 068 650 386

DRILLING OPERATIONS MANUAL

Revision Number	Revision Date	Revised Section	Revision Details	Revised By
1	Feb 2008	All	New Operator	DMN

INDEX

DRILLING OPERATIONS MANUAL INDEX - TABLE OF CONTENTS

INDEX OF CHAPTERS	2
INDEX OF TABLES	5
INDEX OF FIGURES	7

DRILLING OPERATIONS MANUAL - INDEX OF CHAPTERS

Chapter 1	Introduction
	Table of Contents
1.1	Distribution
1.2	Purpose
1.3	Application
1.4	Definitions
1.5	References
Chapter 2	Quicklook Drilling Operations Guide
2.1	Objectives
2.2	Quicklook Drilling Operations Guide
Chapter 3	General Drilling Practices
3.1	Objectives
3.2	Responsibilities
3.3	General Drilling Standards
3.4	General Operational Practices
3.5	Prevention of Stuck Pipe
3.6	Prevention of Lost Circulation
3.7	Field Supervision
3.8	Reports and Reporting
	<i>Appendix 1: Tripping Procedures (To be displayed in Doghouse)</i>
Chapter 4	Drill String Equipment
4.1	Objectives
4.2	Responsibilities
4.3	BHA Handling - Notes
4.4	Shock Subs
4.5	Jars
4.6	Drill String Stabilisers
4.7	Drill String Barriers
4.8	Inspection of Drill String Components
Chapter 5	Drilling Fluids
5.1	Objectives
5.2	Responsibilities
5.3	Standards
5.4	Solids Control
5.5	Monitoring, Reporting and Testing
	<i>Appendix 1: Cooper Basin Typical Mud Programmes.</i>
Chapter 6	Trajectory Control
6.1	Objectives
6.2	Responsibilities
6.3	Surveying Standards
6.4	General Survey Requirements
6.5	General Survey Practices and Guidelines
6.6	Directional Drilling - Rotary
6.7	Sidetracking
6.8	Directional Drilling Requirements
	<i>Appendix I.1 Lateral Position Uncertainty</i>
	<i>Appendix I.2 Worked Example</i>
	<i>Appendix I.3 Ellipse of Uncertainty</i>

Chapter 7	Casing
7.1	Objectives
7.2	Responsibilities
7.3	Casing Standards
7.4	Casing Preparation
7.5	Running Casing
7.6	Casing Pressure Tests
Chapter 8	Cementation
8.1	Objectives
8.2	Responsibilities
8.3	Cementing Ingredients
8.4	Cement Slurry Compositions
8.5	Spacers
8.6	Sampling and Laboratory Testing
8.7	Cement Coverage
8.8	Primary Cementing Procedures
8.9	Squeeze Cementation
8.10	Plug Cementation
8.11	Cement Evaluation
8.12	Quality Control and Documentation
	<i>Appendix I.1 Primary Cementation Calculations - Casing</i>
	<i>Appendix I.2 Primary Cementation Calculations - Liner</i>
	<i>Appendix I.3 Primary Cementation Calculations – Balanced Plug</i>
Chapter 9	Evaluation
9.1	Objectives
9.2	Responsibilities
9.3	Electric Logging
9.4	Coring
9.5	Mud Logging
9.6	Drill Stem Testing
Chapter 10	Well Control
10.1	Objectives
10.2	Responsibilities
10.3	General Standards
10.4	Equipment Standards
10.5	BOP System Testing and Inspection
10.6	Well Control Drills
10.7	Well Control Procedures
10.8	Well Control Problems
10.9	Formation Integrity Tests
	<i>Appendix 1.1: General Well Control Formulae</i>
	<i>Appendix 1.2: Well Control Schematic Procedures</i>
	<i>Appendix 1.3: Minimum Well control Equipment Standards</i>
Chapter 11	Suspension and Abandonment
11.1	Objectives
11.2	Responsibilities
11.3	Standards and Guidelines
11.4	Well Suspension
11.5	Well abandonment
11.6	Lease Clean-up and Waste Disposal

Chapter 12	Special Operations
12.1	Objectives
12.2	Responsibilities
12.3	Stuck Pipe
12.4	Stuck Logging Tools
12.5	Milling
12.6	Fishing
12.7	Curing Lost Circulation
12.8	Drilling Depleted Reservoirs
12.9	Air Drilling
	<i>Appendix 1: Stuck Pipe Analysis – Identifying Causes</i>
Chapter 13	Hazardous Materials Handling
13.1	Objectives
13.2	Responsibilities
13.3	Radiation
13.4	Explosives
13.5	Hazardous Chemicals
Chapter 14	Wellhead Information
14.1	Objectives
14.2	Responsibilities
14.3	Standard wellhead Configurations
14.4	Wellhead Schematics
Chapter 15	Report Forms & Calculation Sheets

DRILLING OPERATIONS MANUAL - INDEX OF TABLES

Chapter Title	Table Title	Table No.	Page
1. Introduction	Distribution List	1	1 / 1
3. General Drilling Practices	Responsibilities for Implementation, Supervision and Verification of Drilling Operations	2	3 / 3
	Vertical Wells, Bottom Hole Assembly Configurations	3	7 / 3
	Well Control Guidelines	4	10 / 3
	BHA Handling Guidelines	5	11 / 3
	Solutions to Hole Problems	6	12 / 3
	General Preventative Measures against Stuck Pipe	7	15 / 3
	Preventative Measures against Differential Sticking	8	16 / 3
	Hole Cleaning - Preventative Measures against Stuck Pipe	9	16 / 3
	Prevention of Stuck Pipe due to Hole Instability	10	17 / 3
	Prevention of Key Seating	11	17 / 3
	General Considerations for BHAs in Preventing Stuck Pipe	12	18 / 3
	Procedures for Minimising Losses	13	19 / 3
	Decision Forum, Daily Rig Meeting	14	20 / 3
	Explanation of Terms in DDR	15	22 / 3
4. Drill String Equipment	Responsibilities for Provision of Drill string Equipment at the Wellsite	16	2 / 4
	Section Modulus (I/C) of Drill String Components	17	3 / 4
	Inspection of Drill String Components	18	10 / 4
5. Drilling Fluids	Responsibilities for Planning, Preparing and Maintaining Drilling Fluids	19	3 / 5
	Primary Drilling Fluids Ingredients	20	6 / 5
	Operational Guidelines for Shale Shakers	21	10 / 5
	Hydrocyclone Trouble Shooting Guide	22	11 / 5
	Standard Drilling Fluids Monitoring Reports	23	13 / 5
	Minimum Drilling Fluids Testing Requirements, Units and Standards	24	14 / 5
6. Trajectory Control	Responsibilities for Implementation, Supervision and Verification of Directional drilling and Surveying	25	2 / 6
	Standard Well Plots for Deviated Wells	26	3 / 6
	Survey Requirements	27	6 / 6
	Standard Survey parameters for Vertical Wells	28	8 / 6
	Acceptance Criteria for Well Surveys	29	9 / 6
	Standard BHA Configurations in Nominally Vertical Wells	30	14 / 6
	General Lengths of Windows to Effect a Sidetrack	31	16 / 6
	Bit Selection Guidelines	32	19 / 6
	Recommended Precautionary Measures for Problems in Drilling Directional Well Sections	33	21 / 6
7. Casing	Responsibilities for the Preparation, Execution and Reporting of Casing Operations	34	3 / 7
	Casing Types and Functions	35	4 / 7
	Typical Casings: Physical Properties and Make-up Torques	36	6 / 7
	Casing Design and Loading Criteria	37	7 / 7
	Minimum Standard Centralisation Programme	38	8 / 7
	Generic Casing Equipment Check List	39	11 / 7
	Running Casing Pre-job Checklist	40	12 / 7
	Generic Casing Running Checklist	41	13 / 7

Chapter Title	Table Title	Table No.	Page
8. Cementation Appx 1.1 Appx 1.2 Appx 1.3	Responsibilities for Cementing Operations	42	4 / 8
	Detailed responsibilities for the Execution of Cementing Operations	43	4 / 8
	Allowable (Mix) Water Contaminents	44	5 / 8
	Guide to Standard Cement Slurries	45	6 / 8
	Spacer Formulations	46	7 / 8
	Sample Packaging	47	8 / 8
	Sample Quantities	48	8 / 8
	Minimum Annular Cement Coverage Standards	49	9 / 8
	Cementing Contractor Reporting Requirements	50	20 / 8
	Reports Prepared by DSV prior to and After Cement Jobs	51	20 / 8
	Primary Cementing Calculations - Casing	52	21 / 8
	Primary Cementing Calculations - Liner	53	23 / 8
	Primary Cementing Calculations – Balanced Plug	54	25 / 8
9. Evaluation	Responsibilities for Evaluation - Generic	55	3 / 9
	Responsibilities for Evaluation Activities - Specific	56	4 / 9
	Guidelines to General Logging Operations	57	7 / 9
	Guidelines whilst Attempting to Free Stuck Logging Tools	58	9 / 9
	Standard Mud Logging Units	59	15 / 9
	Checklist to be faxed to DE with DST Schematic	60	18 / 9
10. Well Control	Responsibilities for Well Control	61	4 / 10
	Frequency of BOP Pressure Testing	62	5 / 10
	Kick Detection and Well Monitoring Equipment	63	10 / 10
	Influx Migration Rate and Hydrostatic Pressure Equivalent Calculations	64	25 / 10
	Barite Plug, Barite-Water Mix for Water Based Muds	65	29 / 10
11. Suspension and Abandonment	Responsibilities for Suspension, Abandonment and Lease Clean-up	66	2 / 11
	Minimum Mechanical Barriers - Suspension	67	5 / 11
	Minimum Mechanical Barriers - Abandonment	68	8 / 11
12. Special Operations	Responsibilities for Special Operations	69	2 / 12
	Worked Example for Determining Effective Pull on Stuck Pipe	70	6 / 12
	Guidelines for Jar Types	71	7 / 12
	Free Point Determination Methods	72	8 / 12
	Preparation of Stripping-Over Wireline Logging Cable	73	13 / 12
	Increase in Cable Tension – Problems whilst Stripping	74	15 / 12
	Considerations during Milling	75	16 / 12
	General Operating Recommendations for Milling Operations	76	17 / 12
	Expected Milling Rates	77	17 / 12
	General Guidelines to Milling Junk	78	17 / 12
	Classification of Fishing Tools	79	19 / 12
	Considerations to be Made Before Fishing	80	20 / 12
	Force Multiplying Fishing Tools	81	21 / 12
	Preparation of Washover String	82	24 / 12
Junk Basket Types	83	24 / 12	
Miscellaneous Fishing tools and their Use	84	25 / 12	
13. Hazardous Materials Handling	Responsibilities for Recieval, Storage and Handling of Materials at Wellsite	85	2 / 13
	Categories of Explosives used in Drilling Operations	86	5 / 13
	Precautions when Handling Explosives in the Vicinity of Electricity	87	7 / 13
	Radio Silence Procedures during Electric logging Operations	88	8 / 13
14. Wellhead Information	Responsibilities for Wellhead Equipment	89	2 / 14
	Standard Wellhead Configurations for Conventional and Downsized Wells	90	2 / 14

DRILLING OPERATIONS MANUAL - INDEX OF FIGURES

Chapter Title	Figure Title	Figure No.	Page	
3. General Drilling Practices	Vertical Well Generalised BHA Configurations	1	6 / 3	
5. Drilling Fluids	Centrifuge	2	12 / 5	
6. Trajectory Control	Directional Well Plan – Typical Vertical Section View	3	4 / 6	
	Directional Well Plan – Typical Plan View	4	5 / 6	
	Lateral Position Uncertainty – Tool Comparison	5	23 / 6	
	Simplified Sections of Example Well	6	25 / 6	
	Ellipse of Uncertainty – Along E-W Axis	7	26 / 6	
	Ellipse of Uncertainty – Along N-S Axis	8	26 / 6	
7. Casing	API Casing Grade Identification Colour Codes (API Spec 5CT)	9	5 / 7	
10. Well Control Appendix II Well Control Schematic Procedures Appendix III	Well Control Method Selection – Decision Analysis	10	17 / 10	
	Well Control Problem Indicators	11	27 / 10	
	Kick Drill Condition 1 (On Bottom Drilling)	12	34 / 10	
	Kick Drill Condition 2 (While Tripping)	13	35 / 10	
	Kick Drill Condition 3 (Out of Hole)	14	36 / 10	
	Kick Drill Condition 4 (Drill collars Adjacent to Preventors)	15	37 / 10	
	Well Shut-in Procedure (Drilling or Connection)	16	38 / 10	
	Well Shut-in Procedure (Tripping with Drillpipe)	17	39 / 10	
	Well Shut-in Procedure (Drill Collars Adjacent to Preventors)	18	40 / 10	
	Well Kill Procedure – Wait and Weight Method	19	41 / 10	
	Well Kill Procedure – Drillers Method	20	42 / 10	
	Well Kill Procedure – Volumetric Control Method (Casing Pressure)	21	43 / 10	
	Well Kill Procedure – Volumetric Control Method (Drillpipe Pressure)	22	44 / 10	
	Well Kill Procedure - Bulheading	23	45 / 10	
	Well Kill Procedure – Combined Stripping & Volumetric Method (Annular only)	24	46 / 10	
	Minimum Choke Manifold Arrangement	25	49 / 10	
	11. Suspension and Abandonment	Well Suspension Schematic – Surface Casing in Place	26	6 / 11
		Well Suspension Schematic – Surface and Intermediate Casings in Place	27	7 / 11
		Standard P&A Marker Plate Format	28	10 / 11
	12. Special Operations Appendix I	Diagram of Hole Condition and Typical FPIT Reading	29	9 / 12
		Illustration of Differential Sticking	30	26 / 12
		Typical Air, Mist or Foam Drilling layout	31	28 / 12
		Stuck Pipe Analysis – Identifying Causes	32	29 / 12
		Stuck Pipe Analysis – Rotary Drilling	33	30 / 12
		Stuck Pipe Analysis – Moving Pipe from Static	34	31 / 12
Stuck Pipe Analysis – Tripping in		35	32 / 12	
Stuck Pipe Analysis – Tripping out		36	33 / 12	
Stuck pipe Analysis – Reaming in		37	34 / 12	
Stuck Pipe Analysis – Back Reaming		38	35 / 12	
Stuck Pipe Analysis – Circulating		39	36 / 12	
Stuck Pipe Analysis – Running Casing		40	37 / 12	
14. Wellhead Information Wellhead Schematics	Conventional 3 String well design: 13 3/8" x 9 5/8" 7", 5000 psi	41	4 / 14	
	Conventional 2 String well design: 9 5/8" x 7", 3000 psi	42	5 / 14	
	Conventional 2 String well design: 9 5/8" x 5 1/2", 5000 psi	43	6 / 14	
	Conventional 2 String well design: 9 5/8" x 5 1/2", 3000 psi	44	7 / 14	
	Conventional 2 String well design: 7" x 3 1/2", 5000 psi	45	8 / 14	
	Conventional 2 String well design: 7" x 1/2", 3000 psi	46	9 / 14	

**CHAPTER 1
INTRODUCTION**

TABLE OF CONTENTS

1.1	DISTRIBUTION	2
1.2	PURPOSE	2
1.3	APPLICATION	2
1.4	INTRODUCTION	2
1.5	SAFETY	3
1.6	DEFINITIONS	4
	1.4.1 Abbreviations	4
	1.4.2 Language	4
1.7	REFERENCES	5

**CHAPTER 1
INTRODUCTION**

TABLE OF CONTENTS

1.1	DISTRIBUTION	2
1.2	PURPOSE	2
1.3	APPLICATION	2
1.4	INTRODUCTION	2
1.5	SAFETY	3
1.6	DEFINITIONS	4
	1.4.1 Abbreviations	4
	1.4.2 Language	4
1.7	REFERENCES	5

1.1 DISTRIBUTION LIST

Controlled electronic copy held by Drilling manager

Uncontrolled hard copies of this document are distributed as follows:

Copy No.	Holder
1	Drilling Manager (GSLM office copy)
2	Drilling Supervisor (Rig copy)
3	Drilling Contractor (Office copy)
4	Contractors Rig Manager (Rig copy)
5	Mineral Resources Tasmania
6	

Table 1 Holders of Copies of GSLM's Drilling Operations Manual

1.2 PURPOSE

The purpose of the Drilling Operations Manual is to:

- Illustrate the policies, standards, guidelines, procedures and controls required during the drilling of wells.
- Provide a guide for relevant personnel on the procedures to be followed to ensure that a consistent, thorough and uniform approach is adopted to facilitate delivery of cost-effective wells.
- Provide sufficient information to allow the Drilling Supervisor to supervise, and monitor the drilling operation and control standards and reporting
- Provide sufficient information which can be used as a reference in planning and field drilling operations.

1.3 APPLICATION

The Drilling Operations Manual is the reference manual for GSLM, Drilling Supervisors and Drilling Managers controlling the drilling operations of land wells in Tasmania.

1.4 INTRODUCTION

It is acknowledged that this manual is based on the Drilling Operations Manual used by several operators in the Cooper Basin of South Australia. It is expected that these operations will be very similar to those in Tasmania.

Tasmania is largely unexplored and therefore all personnel have to be aware that unplanned events could occur at any time. All personnel need to be aware of this and trained to react correctly. In all circumstances the safety of the public and personnel on the rig is the prime concern and operations should be carried out with safety as the top priority.

1.5 SAFETY

GSLM is committed to providing a safe and healthy work environment and to protecting its employees from the possibility of injury and risk to health while they are at work.

The company will make available the appropriate resources to ensure that it complies in all respects to the relevant occupational health and safety legislation and to ensure that the workplace is safe and healthy. In order to achieve this GSLM will ensure that:

- A safe working environment and safe systems of work are provided and maintained at the wellsite.
- Equipment is "Fit for Purpose" and maintained in safe condition.
- People working on the rig will be provided with the information, instruction, training, equipment and supervision needed to ensure their health and safety.
- Occupational health and safety standards and procedures are continually reviewed and improved.
- Risk management procedures are in place to identify, assess and control/eliminate hazards. These will include, Work Permits, JSA's, safety meetings, incident reports, rig inspections etc.

All personnel must be trained, capable and certified (where applicable) for the job they are doing. It is the responsibility for the contractor to ensure their personnel are qualified and trained for the job. The DSV should check qualifications where possible prior to the job commencing.

In the event of an incident or emergency at the rig the priorities will be as follows:

- Safety to the Public
- Safety to personnel on the rig
- Environmental Protection
- Prevention of damage to equipment

The current workplace health and safety legislation in Tasmania is:



The Workplace Health and Safety Act 1995

The Workplace Health and Safety Regulations 1998

The Workers Rehabilitation and Compensation Act 1988

1.6 DEFINITIONS

This section contains the abbreviations and terminology used in this Manual. It is strongly recommended that all readers familiarise themselves with the abbreviations and terminology used, to avoid any misunderstanding arising from the use of the terms in the text.

1.6.1 Abbreviations

AC	Alternating Current	AHD	Along Hole Depth
API	American Petroleum Institute	BHA	Bottom Hole Assembly
Bbls	Barrels	bpm	Barrels per Minute
BOP	Blowout Preventer	CCL	Casing Collar Locator
BUR	Build-up Rate	cmt	Cement
CBL	Cement Bond Log	CET	Cement Evaluation Tool
Cu	Cubic		
DC	Drill Collar	DDE	Directional Drilling Engineer
DDR	Daily Drilling Report	DE	Drilling Engineer
DOM	Drilling Operations Manual	DP	Drill Pipe
DSV	Drilling Supervisor	DST	Drill Stem Test
E & D	Exploration and Development	ECD	Equivalent Circulating Density
EMW	Equivalent Mud Weight	EOB	End of Build-up
FIT	Formation Integrity Test	FPIT	Free Point Indicator Tool
ft	Feet	GSLM	Great South Land Minerals
gal	Gallon	GLG	Geologist
gpm	Gallons per Minute	GR	Gamma ray
HSWE	Health, Safety, Welfare and Environment	ht	Height
HTB	High Temperature Blend	HWDP	Heavy Weight Drill Pipe
IADC	International Association of Drilling Contractors	ID	Inside Diameter
IF	Internal Flush		
KOP	Kick-off Point	KB	Kelly Bushing
LCM	Lost Circulation Material	LGS	Low Gravity Solids
MAASP	Maximum Allowable Annular Test Surface Pressure	MBT	Methylene Blue
MDT	Modular Dynamic Tool	min	Minute
MMS	Magnetic Multi Shot	MSS	Magnetic Single Shot
MT	Metric Tonnes	MSDS	Materials Safety Data Sheet
MWD	Measurement While Drilling	MW	Mud Weight
N/A	Not Applicable	NBRR	Near Bit Roller Reamer
NDT	Non Destructive Testing	NMDC	Non Magnetic Drill Collar
		NRV	Non Return Valve System
OD	Outside Diameter	OE	Operations Engineer
OGL	Operations Geologist	OH	Open Hole System
P & A	Plug and Abandon	PE	Petroleum Engineer
Pfc	Final Circulating Pressure	Pic	Initial Circulating Pressure
ppg	Pounds per Gallon	POOH	Pull out of Hole
psi	Pounds per square inch	ppm	Parts per Million
PVT	Pressure Volume Temperature.	PV	Plastic Viscosity
QA/QC	Quality Assurance/ Quality Control		
RFT	Repeat Formation Tester	RIH	Run in Hole
ROP	Rate of Penetration	rpm	Revolutions per Minute
RT	Rotary Table		
SCR	Slow Circulating Rate	sec/ qt	Seconds per quart
SEO	Statement of Environmental Objectives	SF	Safety Factor
SICP	Shut-in Casing Pressure	SIDPP	Shut-in Drill Pipe Pressure
SITHP	Shut-in Tubing Head Pressure	spm	Strokes per Minute
sx	Sacks		
TOC	Top of Cement	TP	Tool Pusher
TVD	True Vertical Depth	TD	Total Depth
UHF	Ultra High Frequency	TLC	Tough Logging Conditions
USIT	Ultra sonic imaging tool)		
VDL	Variable Density Log		
WGL	Wellsite Geologist	WOB	Weight on Bit
WOC	Waiting on Cement		
wt	Weight		

1.6.2 Language

- **Shall or must** indicates a mandatory requirement.
- **Should** indicates a guideline which is strongly recommended.
- **May** indicates a guideline which is to be considered.

1.7 REFERENCES

All references applicable to a section of the text are identified at the foot of the text and prefixed by the  symbol.

This manual should be used in conjunction with the following references.

-  GSLM's Policies and Procedure
-  Dangerous Goods Act 1998
-  Mineral Resources Development Act 1995
-  Mineral Resources Regulations 2006
-  Mineral Exploration Code Of Practice
-  Schedule C of the Exploration License
-  The Workplace Health and Safety Act 1995
-  The Workplace Health and Safety Regulations 1998
-  The Workers Rehabilitation and Compensation Act 1988

CHAPTER 2
QUICKLOOK DRILLING OPERATIONS GUIDE
TABLE OF CONTENTS

2.1	OBJECTIVES	2
2.2	QUICKLOOK GUIDE	3

2.1 OBJECTIVES

The objective of the Quicklook Drilling Operations Guide is to provide a quick reference for a newly assigned Rig Supervisor to the drilling activities carried out by GSLM. The table in Section 2.2 summarises and outlines the sequential steps involved in planning, constructing, evaluating and abandoning a typical conventional well. The table incorporates references to procedures contained in this Manual, and where relevant, the applicable forms which must be completed.

2.2 QUICKLOOK DRILLING OPERATIONS GUIDE

Summary	DOM Chapter	Forms
Preparing Site and Rig -Up		
Ensure all Regulatory and GSLM approvals have been given		
Ensure new location has been inspected and accepted by Drilling Contractor		
Toolpusher should notify local authorities of rig move timing		
Ensure wellsite and camp locations are prepared before the rig arrives.		
Ensure the turkeys nest is filled and water source recorded		
Check rig move distance. Report on morning report.		
Ensure the sump is prepared and lined if required.		
Ensure the rubbish and sewage handling systems are in place.		
Ensure a plastic sheet is positioned between the rig tanks and sump to prevent washing out of the tank base.		
Check condition of roads. Notify DM of any problems. Check for power lines etc.		
Make up pre-spud equipment list including mud chemicals, bits, surface casing, cementing equipment and Bradenhead.		
Pre-spud Checks		
On first well of the program ensure 3 rd party rig inspection is carried out and an action plan prepared for all critical items.		
Ensure rig is completely rigged up and work through Pre-spud Checklist.	3	
Ensure the conductor is set in the cellar correctly.		
Ensure all materials and equipment and back-ups are on site for drilling, casing and cementing the surface hole.	3, 5	
Check that the equipment delivered is what was ordered.		
Ensure adequate supplies of weighting material and LCM are available.	5	
Ensure a water sample is sent to the cementing company for analysis.	8	
Ensure downhole drilling tools (i.e. stabilisers, jars, bits, etc.) are in good condition and within wear limits and hours of usage.	3	
Check grade and specification of casing.	7	
Check Bradenhead matches casing and Drilling Program requirement.	11, 14	
Make up as much new mud as possible prior to spud. If water quality poor consider using fresh to pre-hydrate gel.		
Perform Pre-spud Safety Meeting		
Constructing Cellar		
Ensure the cellar has been dug and the cellar ring installed prior to rig move.		
Setting Conductor (This may be predrilled before rig arrives)		
Auger surface hole to 5-8 m below cellar floor. Set in firm clay.	7	
Ensure the conductor is vertical, the flange level and 'plumb bobbed' central.		
Ensure the conductor is cemented in place. Use 1% CaCl ₂ as accelerator	8	
Drilling Surface Hole (This may be predrilled before rig arrives)		
Ensure bit program, BHA design, survey requirements and mud properties are detailed in the Drilling Program.	3	
Drill-out of conductor with reduced flowrate until drill collars are below conductor to prevent washing out the cellar. Gradually increase flowrate so as to prevent mudrings.		
Drill to programmed casing depth and check the bottoms up sample for consolidated formation. Allow a maximum of 3 m of rathole below casing shoe.		
Wiper trip as required to maintain good hole condition.		
Survey at 30 m KB and every 150 m thereafter.		
Circulate hole clean (Minimum 1.5 times annular volume).	3	
Perform wiper trip at interval TD back to previous wiper trip depth	3	
Strap pipe whilst POOH.		
Grade bit.		
Order cement from cementing contractor. Provide cementing contractor with hole and casing details and ensure they confirm cement volumes.		
Running Surface Casing		
Number, measure and drift casing joints. Clean and inspect casing threads. DO NOT USE DIESEL TO CLEAN THREADS	7	
Space out casing so that Bradenhead flange depth suits rig.	7	
Prepare Casing Tally and adjust section TD to allow for 3m rathole below shoe	7	
Use 2 joint shoetrack. Threadlock shoetrack and centralise as per Drilling Program.	7	
Check circulating swedge to ensure it is the correct size and has the correct threads.		
Pick up casing using suitable thread protectors. Make up circulating swedge and wash last joint down. Do not tag bottom.	7	

Summary	DOM Chapter	Forms
Cementing Surface Casing		
Circulate hole and treat Drilling Fluid (if required) prior to cementing.	8	
Pump spacer.	8	
Load cement head with plugs (top and bottom).	8	
Ensure all lines are pressure tested.	8	
Discuss all cement calculations with DM, prior to cement job.	8	
Mix and pump slurries.	8	
Displace with mud using cementing pump.	8	
Do not over displace more than theoretical, plus half shoetrack volume.	8	
If plug bumps, pressure test casing to 80% of rated burst pressure, bleed-off pressure and measure backflow. Check floats holding	8	
If plug does not bump. Bleed-off pressure and measure backflow.		
Pressure test casing prior to drilling out. Check floats holding.		
Run cement stinger and perform top up cement job with cement unit.	8	
Installing Bradenhead.		
Wait on Cement until surface samples set.		
Slack-off casing		
Back-out landing joint.		
Prior to job check specifications and part numbers of Bradenhead.		
Install Bradenhead as per manufacturer's procedure.	14	
Install BOPs and pressure test BOPs and kill/choke lines (test pressures according to the Drilling Program). If possible test BOP's (on test stump) and choke manifold while drilling surface hole.	10	
Run wear bushing.		
Drilling Intermediate/ Main Hole		
Ensure all equipment is on site to drill entire hole section.	3	
Ensure bit program, BHA design, survey requirements and mud properties are detailed in the Drilling Program.	3	
Drill-out shoe track with mud. Drill maximum of 3 m of new hole		
Circulate hole until mud weight even. Perform LOT	9	
Drill ahead. Make wiper trips approximately every 24hrs if required by hole condition.		
Change bits as required.		
Run wireline surveys every 150 m. Circulate hole prior to each survey. If deviation increases above 3° consider running surveys every 45 m.		
Trip sheets to be filled out on each trip out of the hole. If potential reservoir has been penetrated then trip sheets should also be used on all trips in the hole as well.		
Flow check any significant drilling breaks or unexplained changes in pit volume.		
Control drill as requested by Wellsite Geologist to aid evaluation.		
Adjust mud properties as required to maintain good hole conditions.		
Monitor hours on jar and BHA condition.	3	
Grade bit and gauge stabilisers at each bit trip.		
At section TD, circulate and survey prior to POOH.	6	
Strap pipe whilst POOH		
Perform wiper trip at interval TD back to start of last bit run	3	
Logging Open Hole		
Mobilise logging crew prior to POOH. Confirm logging program with Electric Logging company prior to job.	9	
Make sure fishing equipment available for ALL logging tools.	9	
Measure and record size and lengths of all logging tools.	9	
Monitor well on trip tank while logging. Record losses and gains.	9	
Open Hole DST		
Mobilise testing and separator crews if required.	9	
Confirm test program (times, intervals, water cushion etc.) with DE, tester and wellsite geologist prior to test. Make up running list.	9	
Rig up testing manifold, surface lines and separator (if required) and pressure test. Secure/tie down all lines.	9	
RIH with test string. Correlate with CCL/GR if required	9	
DST tools can not be opened during the hours of darkness unless special dispensation is obtained from MRT and a risk assessment done.		
Set/Inflate packers.	9	

Summary		DOM Chapter
Top-up annulus prior to opening tools.		9
Open tools and perform test according to the relevant procedure (annulus to be continuously monitored whilst testing).		9
Prior to POOH, close test tools, release packers, (pull above any thick coals) reverse circulate string contents. Circulate conventionally. DST tools MUST NOT be pulled out of the hole unless string contents have been reverse circulated.		
Running Intermediate and Production Casing		
Change out pipe rams to suit casing.		7
Number, measure and drift casing		7
Clean and inspect casing threads		7
Space-out casing. Refer to Drilling Program for position of marker joints and centralisers		7
Complete Casing Tally.		7
Threadlock shoetrack and centralise according to Drilling Program.		7
Check float equipment.		7
A two joint shoe track will be run on intermediate casing and a single joint shoe track on production casing.		
Pick up casing using suitable thread protectors.		
Circulating swedge to be available for all grades of casing run.		
Circulate down landing joint.		7
Cementing Casing		
Discuss cement formulations and calculations with DE prior to cement job. Determine displacement fluid type and weight and make up if required.		
Circulate hole and treat mud (reduce YP) prior to cementing.		8
Load cement head with plugs. Top and bottom or bottom plug and top ball.		8
Ensure all lines are tied down and pressure tested.		8
Pump pre-flush.		8
Mix and pump slurries as per the cementing contractors cement program		8
Displace with either rig pumps or cementing unit at pumping rate to give annular velocities approximately the same as when drilling.		8
On intermediate casing displace with mud. On production casing displace with kill weight brine.		
All mud to be left in annulus or between casings must be treated with Biocide.		
Do not over displace by more than half the shoe track volume on intermediate casing		
Pump to bump on all production casing cement jobs.		
When plug bumps, pressure test casing to 500 psi above bump pressure.		8
Bleed-off pressure and measure backflow. Pressure test casing.		
Installing Casing Slips and Tubing/ Casing Spool		
If using tubing spool land spool in bowl. If using casing slips WOC until surface samples set. Pick up BOPs.		
Install slip assembly, slack-off casing, cut casing and install spool according to manufacturers procedure		14
Install blank flange or adaptor flange on production casing.		14
Plugging and Abandonment		
All plugs to be minimum 50 m long (25 m above and 25 m below the top of the formation to be isolated).		
Where possible a cement stinger and mule shoe should be used.		
Confirm Cement Program and plug depths with DM. Obtain formation tops from WGL.		11
Circulate hole prior to cementing. Ensure all lines are pressure tested.		8
Mix and pump slurry. Displace with mud. Pick up above plug and reverse circulate cement from string.		
Pressure test last casing shoe plug.		11
Remove Bradenhead and return to logistics base for re-dress.		11
Dump surface cement plug.		
Install Marker Plate.		
Back-fill cellar.		11
Cleaning-up Lease		
Ensure lease is cleaned up, rubbish disposed of and pits back-filled.		11
Complete End of Well Equipment List.		
Complete lease clean up form.		
Ensure Mud reconciliation is filled out and signed.		
Forward all equipment to next location or logistics base.		

**CHAPTER 3
GENERAL DRILLING PRACTICES**

TABLE OF CONTENTS

3.1	OBJECTIVES	2
3.2	RESPONSIBILITIES	3
3.3	GENERAL DRILLING STANDARDS	4
3.3.1	Depth Referencing	4
3.3.2	Chemical Stocks	4
3.3.3	Equipment Requirements	4
3.3.4	Pressure Control Equipment	7
3.3.5	Kick Detection and Well Monitoring Equipment	8
3.4	GENERAL OPERATIONAL PRACTICES	9
3.4.1	General Practices	9
3.4.2	Primary Well Control	10
3.4.3	Diverter	10
3.4.4	BHA Handling	11
3.4.5	Specific Drilling Procedures	11
3.4.6	Local Hole Problems	12
3.4.7	Tripping Practices	12
3.5	PREVENTION OF STUCK PIPE	15
3.5.1	General Preventative Measures	15
3.5.2	Prevention of Differential Sticking	15
3.5.3	Inadequate Hole Cleaning	16
3.5.4	Formation Instability	17
3.5.5	Key Seating	17
3.5.6	Bottom Hole Assembly Changes	18
3.6	PREVENTION OF LOST CIRCULATION	19
3.6.1	General Preventative Measures	19
3.6.2	Prevention of Differential Sticking	19
3.7	FIELD SUPERVISION	20
3.7.1	Introduction	20
3.7.2	Activities	20
3.8	REPORTS AND REPORTING	22
3.8.1	Reporting relationships	22
3.8.2	Daily Drilling Report	22
3.8.3	Other reports	23
	APPENDIX 1: TRIPPING PROCEDURE (To be displayed in Doghouse)	24

3.1 OBJECTIVES

The objective is to produce a "fit for purpose" wellbore drilled in accordance with agreed specifications and the standard practices and procedures contained in this Manual.

The criteria for a "fit for purpose" wellbore includes the following, in order of importance:

1. Ensure GSLM's safety procedures are followed.
These include accident – incident reporting, rig move policies etc.
2. Ensure the drilling rig and equipment is "Fit for Purpose" and remains in this condition for the duration of the well.
3. Drill the well with the risk to personnel, the environment and equipment reduced to as low as reasonably practicable. Ensure the wellbore design meets the requirements of the approved Environmental and Heritage objectives for the well.
4. Penetrate hydrocarbon bearing intervals without formation impairment.
5. Meet the planned trajectory without dogleg severity in excess of 1.5°/30 m (or as specified in the Drilling Program).
6. Provide hole conditions that allow good quality evaluation (logs, cuttings, cores, DST's etc.).
7. Attain the required bottom hole position.

It is the responsibility of the Drilling Contractor to drill the well to the correct specification. The quality of work must be monitored and controlled by the Rig Supervisor with support from the Drilling Manager to ensure that the well and Health, Safety, Welfare and Environmental objectives are not compromised.

The following must be prevented:

1. Injuries to personnel or environmental damage.
2. Well control incidents that affect safety and integrity.
3. Impairment of the reservoir due to poor drilling fluid properties or excessive overbalance which affect logging and production.
4. Dog Legs due to poor trajectory control which may affect casing and completion running.
5. Washouts due to poor flow regimes which ultimately affect the logging operation and log quality.
6. Drilling practices that cause excessive formation damage.

3.2 RESPONSIBILITIES

Responsibilities for the implementation, supervision and verification of drilling operations are summarised in the table below.

Task	Performed by	Verified by
Report ALL incidents, near misses	Anybody	DSV / DM
Prepare the Drilling Program	DM	CEO
Select equipment	DM	DSV/CEO
Call-out Company supplied equipment	DSV	DM
Call-out Contractor supplied equipment	DSV	DM
Conduct drills	Drilling Contractor	DSV
Inspect tubulars	Drilling Contractor	DSV
Inspect and test BOP	Drilling Contractor	DSV
Monitor well trajectory	DSV	DM
Program and monitor drilling parameters	DSV / DM	DM
Monitor drilling costs versus plan	DM	CEO
Perform BHA design and bit selection	DSV / DM	DM
Measure and tally tubulars	Drilling Contractor / DSV	DSV
Operate rig equipment safely and properly	Drilling Contractor	DSV
Conduct primary well control when required	Drilling Contractor	DSV
Conduct secondary well control when required	Drilling Contractor	DSV
Decide when to conduct check trips	DSV	DM
Carry out flow checks	Drilling Contractor	DSV
Maintain Trip Sheets in and out of the hole	Drilling Contractor & Mud Loggers	DSV
Report drilling problems	Drilling Contractor	DSV
Maintain adequate drilling fluid, chemical, LCM and cement stocks	Drilling Fluids and Cementing Contractors	DSV

Table 2. Responsibilities for Implementation, Supervision and Verification of Drilling Operations.

3.3 GENERAL DRILLING STANDARDS

This section provides an overview of key drilling standards that should be adhered to by the DSV and Drilling Contractor.

3.3.1 Depth Referencing

All depths (either along hole or true vertical) must be referred to the Rotary Table (RT) of the rig which initially drilled the well (original derrick floor elevation). Depths must be reported in meters.

3.3.2 Chemical Stocks

The following are the minimum chemical stocks that shall be available for use at all GSLM wellsites (note barite etc may be stored off location):

- Mud chemical stocks adequate to re-build 1½ times the hole and surface volume of the drilling fluid system in use and the interval being drilled.
- Emergency barite stocks to be able to weight the total drilling fluid system by at least 1.0 ppg.
- Sufficient stocks of LCM material for both above and across the reservoir (as a guide should have enough LCM to add 2 lb/bbl to the entire system if required).
- Sufficient stock of surfactant, weightable pipe-freeing agent, Biocide and corrosion inhibitor materials.

These chemical stocks are based on worst lost circulation criteria and known reservoir pressure parameters.

Specific well requirements are individually documented in the Drilling Program.

Only Barite and KCl/NaCl shall be used as a weighting material unless otherwise specified in the Drilling Program.

3.3.3 Equipment Requirements

The DSV shall ensure that the availability (and serviceability) of equipment is in accordance with GSLM's requirements and the relevant contracts, prior to the commencement of drilling activities. These are summarised below (Sections 3.3.3.1 - 3.3.3.5).

3.3.3.1 Equipment Lists

Equipment Lists will be provided for each well. They provide an overview of the requirements for each hole interval. Note however that each hole section and each well must be considered separately.

3.3.3.2 Surface Equipment

Rig surface equipment requirements shall be detailed in the Drilling Contractor's contract. Critical items to be inspected by the DSV include:

- A trip tank complete with a mechanically operated level indicator, visible from the driller's position.
- A fully functional Crown-o-Matic or equivalent safety brake installed on the draw-works.
- Martin Decker or equivalent weight indicator.
- BOP's with two ram type and one annular preventer.

3.3.3.3 Monitoring Equipment

The minimum level of rig monitoring equipment required:

- Active and trip tanks volume.
- Return flow.
- Total gas at header box. (Mudlogger)
- H2S at shakers, BOP's and drillfloor (Mudlogger)
- Weight on bit.
- Hookload.
- Rotary torque (Relative torque on mechanical rigs).
- Rotary speed.
- Standpipe pressure.
- Casing pressure.
- ROP.
- SPM for each pump.
- Rig air pressure.
- Accumulator unit pressures.
- 6 channel pen recorder (geolograph) or better.

It is the responsibility of the DSV to ensure that the above list of monitoring equipment is available and in working order.

3.3.3.4 Downhole Equipment

The provision of downhole drilling equipment shall be detailed by the DM in the relevant contracts between the Company, the Drilling Contractor and the relevant Service Companies. The following information should be included:

- The dimension of any contractor item run into the hole shall be recorded on the BHA sheet. The Drilling Contractor shall be responsible for providing fishing tools for all contractor supplied equipment.
- Only drill pipe with smooth hardbanding or no hardbanding shall be used when rotating inside casing.
- Only "fit for purpose" drill pipe shall be used (i.e. as defined in the latest edition of API RP7G).
- Drill pipe and BHA shall be NDT inspected every six months. Copies of the inspection records shall be kept on the rig.
- Drilling jars must be used when drilling. The normal procedure shall be to position the jars two or three drill collars from the top of the DC section while drilling vertical wells.
- All roller reamers shall be of the sealed bearing type.
- Either Integral Blade or sleeve type stabilisers will be run. Stabilisers will be 1/64" undergauge when new. Stabilisers will be gauged on each trip and those more than 3/16" undergauge should be laid out.

 API RP7G (specifications for Drill Pipe)

3.3.3.5 Typical Bottomhole Assemblies

Each generalised configuration of bottomhole assembly (BHA) shown below demonstrates a typical directional tendency while drilling.

The effect of each configuration depends on a number of variables, including formation hardness and bed dip, bit type, stabiliser type and diameter, hole size and drilling parameters such as weight on bit and rotary speed.

Stabiliser wear in abrasive formations has a significant effect on directional control, where sleeve stabilisers may be preferable to integral blade types. The general directional tendencies due to stabiliser placement for drilling main hole are described in the following diagram and table.

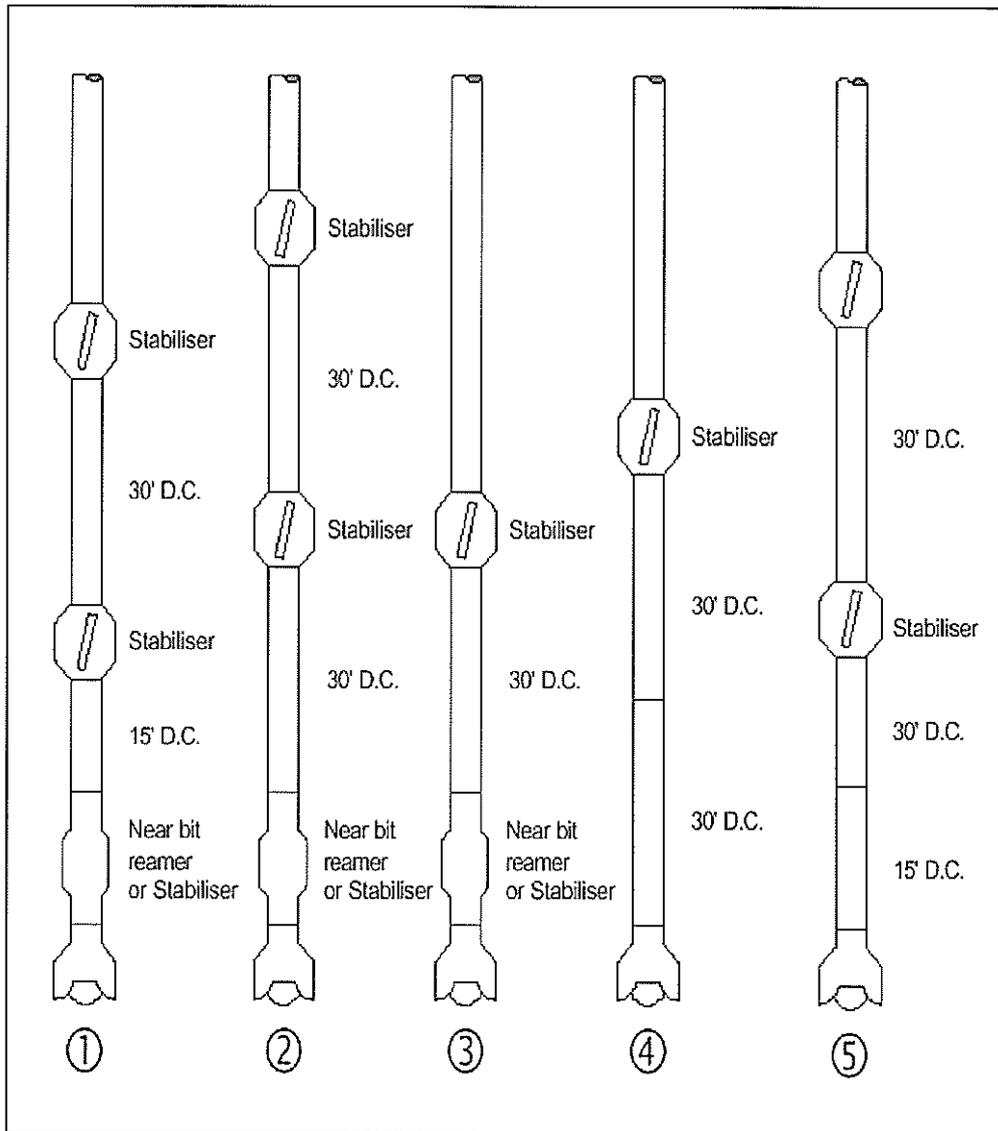


Figure 1. Vertical Well Generalised BHA Configurations

Bottom Hole Assembly Type	Configuration and Directional Tendency
Assembly 1	The near-bit stabiliser or reamer is the primary angle building and hold tool. The stiffer the BHA near the bit, the less likelihood of bit deviation (more contact area gives a higher degree of control). This "locked", "stiff" or "packed" assembly is commonly used to hold angle in vertical and low angle wells; it will drop angle at moderate to high inclinations. The second stabiliser may be moved upward 15 - 20' to ease the degree of stiffness if required.
Assembly 2	This assembly may be more effective in certain areas than Assembly 1 due to the combination of variables listed, but represents a reduced stiffness and therefore a medium or more neutral angle-holding configuration for moderate inclinations. If the distance between the near-bit and next stabiliser is increased towards 45', the assembly may start to demonstrate gentle building tendencies. Also, the diameter of the stabiliser will influence the tendency to either build or drop.
Assembly 3	This configuration will hold angle at higher inclinations, and may also exhibit stronger building tendencies due to the removal of the second stabiliser and resultant reduction in stiffness.
Assembly 4	This configuration is a classic "pendulum", or dropping assembly, with the stabiliser placed as far as possible above the bit without causing wall contact with the pipe. This spacing is typically 60'. However if a low bit weight is used in a low-angle hole, greater drop-off may be achieved with the stabiliser placed further than 60' from the bit. The behaviour is less predictable unless low bit weights are used.
Assembly 5	This configuration is a modified "pendulum" assembly with stabilisers positioned 45' and 75' above the bit. Although the dropping tendency is reduced in comparison to the 60/90' pendulum assembly (described above), the modified assembly allows higher bit weights to be used without compromising directional control. The modified pendulum assembly may be of particular use while drilling vertical wells.

Table 3. Vertical Wells Bottom Hole Assembly Configurations.

3.3.4 Pressure Control Equipment

Pressure control equipment shall be supplied and maintained in accordance with Chapter 10 of this Manual. It is the responsibility of the DSV to ensure that all equipment is in full compliance with the specifications detailed in the relevant contracts between the Company and the Drilling Contractor. A summary of the main requirements are listed below:

- Only original equipment spare parts shall be used in the BOP/Kookey (accumulator) system
- Pressure control equipment shall be function tested every day except the blind rams which shall be tested on every trip and pressure tested every 14 days, or on the closest trip to this date.
- As a minimum the 'Poorboy' mud gas separator should have a minimum 8" vent line and a mud seal of at least 1.5 m (5').
- A full bore kelly cock shall be installed at the base of the kelly at all times. A ball type stabbing valve, with connections or a cross-over to suit the workstring, shall be available on the rig floor at all times, together with an operating handle for the valve.
- During drilling, the outer side outlets of the wellhead exposed to the live annulus shall have manual or hydraulically operated side outlet valves.
- A wellhead wear bushing must be installed in the wellhead during all drilling and logging operations.
- A float must be used while drilling production hole sections.

The following safety equipment shall be on the drilling unit at all times and shall be fully functional:

- Full opening inside BOP.
- Crossovers to allow installation of above into any type of connection used in the drill string or tubing string.

3.3.5 Kick Detection and Well Monitoring Equipment

Kick detection and well monitoring equipment shall be supplied and maintained in accordance with the requirements detailed in Chapter 10.

It is the responsibility of the Drilling Contractor to ensure that the following minimum kick detection equipment is available, tested and fully operational:

- Flowline monitor.
- Active pit volume monitors.
- Gas detection at header box (supplied by the mudlogging contractor).
- ROP recorder.
- Trip tank with a system for accurately monitoring returns during tripping.

The Mudlogging Contractor shall ensure that all gas detection equipment (including H₂S detectors) and alarms are functioning properly. The Drilling Contractor shall ensure continuous monitoring and recording (if applicable) of the following parameters is available on the drilling site for all wells:

- Active pit volume.
- Weight on bit and hook load.
- Rotary torque and speed (not installed on every rig).
- Standpipe pressure and choke pressure.
- Rate of penetration.
- Mud pump SPM.
- Rig air pressure
- Kookey (accumulator) unit pressures

Although kick detection and well monitoring equipment is supplied and maintained by the Drilling Contractor, it is the responsibility of the DSV to ensure that regular equipment checks are maintained. All equipment shall be audited on a regular basis during safety visits by the DE / DS.

Drilling of the main hole section shall not commence without written approval of the DM if any of the above equipment is inoperable.

3.4 GENERAL OPERATIONAL PRACTICES

3.4.1 General Practices

The following general practices shall be adhered to during drilling operations. It is the responsibility of the DSV to ensure conformance.

3.4.1.1 Pre-spud Preparations

The DSV shall ensure that the drilling crew are familiar with Company Well Control Procedures detailed in Chapter 10 and the following are available:

- Adequate mud weighting materials are on site or readily available in sufficient quantities to support the drilling operation.
- All fishing tools relevant to the hole interval are available at the wellsite. Drilling Contractor fishing tools shall be available for all Contractor supplied downhole tools as per the relevant contract.
- The ID of all downhole equipment shall be checked for free passage of a free point indicator tool and survey instrument fishing tools.
- All BOP equipment and drillstring well control equipment.
- The DSV shall also inspect the rig and fill out the Pre Spud Checklist prior to the well being spudded.

3.4.1.2 Drilling Operations

The DSV is responsible for ensuring that all relevant Drilling Contractor and service personnel are aware of the GSLM General Drilling Practices during all hole sections. The General Drilling Practices are detailed below:

- Flow checks shall be performed in accordance with the requirements tabulated in Section 3.4.2. A minimum of one bottoms up shall be circulated prior to any trip out of the hole or after completion of any well kills.
- The trip tank shall be used on all trips out of the hole.
- Trip sheets shall be used in all trips in and out of the hole.
- Slow Circulating Rates (SCR) shall be performed in accordance with the requirements tabulated in Section 3.4.2.
- Drill-off tests may be conducted on each new bit run for optimum WOB
- Kill sheets shall be completed as per the Well Control section.

Detailed procedures for the conduct of well control operations are contained in Chapter 10. The table and text below provides the standard guidelines and practices which must be observed during drilling operations to maintain primary well control.

Operation	Guidelines
Slow Circulation Rates (SCR)	<p><u>Must</u> be performed as a minimum</p> <ul style="list-style-type: none"> • Once per tour. • After every bit change • .After every BHA change. • After significant drilling fluid density or rheology changes. • <u>After any work on mud pumps or surface lines</u>
Flow checks	<p><u>Should</u> be considered in any of the following circumstances.</p> <ul style="list-style-type: none"> • Pit gain or loss. • Significant drilling break. • At start of trip out, after 10 stands, with bit at shoe and at top of BHA.Drilling break. • Variation in pump pressure or speed. • Gas, oil or salt water contamination (chloride increase). • Erratic rotary torque. • Lost circulation. • Variation in observed string weight.

Table 4. Well Control Guidelines

The following guidelines are also applicable to well control:

- Additional checks must be performed whenever there is any concern about well control.
- Kick drills shall be carried out according to procedures defined in Chapter 10.
- Time spent with the pipe out of the hole shall be minimised.
- A minimum of one complete circulation shall be performed after completing all well kills.
- Casing shall be pressure tested to a maximum of 80% of the rated burst pressure of the weakest casing when bumping the plug. If the plug dose not bump the casing must be pressure tested prior to drilling out the shoe.
- Leak-off tests shall be performed after drilling 3 m of new formation at all casing shoes, unless otherwise specified (See Section 9.7).

3.4.3 Diverter

Incidences of shallow gas have been reported in Tasmania so the use of a diverter while drilling surface hole is required.

3.4.4 BHA Handling

BHA handling shall be performed according to the guidelines in the table below.

BHA and Connections	Guidelines
Stabilisers	Serial numbers and rotating hours for each stabiliser must be recorded on the morning report. Make up or break down stabilisers in the drill collar string using a winch line or maintain vertical using a mechanical support (e.g. pin in rotary table, clamp support hooked around drill collar in rotary). Manual support of the stabiliser without mechanical back up while engaging or disengaging the threads is not permitted. All stabilisers shall be gauged on each trip and consideration should be given to laying out all stabilisers more than 1/8" undergauge.
Chicksan Connection	Such connections shall not be made up to a downhole string component before the component is incorporated in the string and lowered through the rotary table to refusal or safe working height. In the event that circumstances dictate otherwise, the chicksan connection shall be safeguarded by attaching a safety line to prevent free fall.
Threaded Connection	Any threaded connection carried on top of a string suspended above safe working height and not made up to the recommended torque, shall be marked with chalk and continuously monitored when rotating (part of) that string.
New Threads	New threads which have been cut shall be broken-in carefully when making up for the first time (i.e. Make/break/make each joint).

Table 5. BHA Handling Guidelines

Rotating the drill string below the rotary to make up pipe once the BHA is run shall be avoided.

Backing the rotary into a string to make up a connection is poor practice and can result in a dropped string or an accident due to damaged threads. This practice is not permitted.

All BHA components shall be measured for OD, ID, length and fishing neck sizes. A diagram of each BHA shall be submitted by the Drilling Contractor to the DSV. The serial numbers and rotating hours of all roller reamers, stabilisers, NMDC, jars etc. shall be recorded on the morning report.

3.4.5 Specific Drilling Procedures

Specific drilling procedures are provided in detail in each Drilling Program to ensure that wells are drilled:

- Safely.
- In line with good oilfield practice.
- In accordance with GSLM's policies, standards and guidelines.

The essential items to observe while drilling a well are contained in this chapter of the Drilling Operations Manual, the Generic Drilling Program and, where relevant, are referenced elsewhere. All critical items shall be included in each Drilling Program to ensure that wells are drilled safely and in line with good oilfield practice, as well as in accordance with the GSLM's policies, standards and guidelines given in this Manual.

3.4.6 Local Hole Problems

Hole problems may be encountered during drilling operations in Tasmania. The problems and solutions are tabulated below.

Cause	Problem	Solution
Dioritic sills (possibly fractured)	Mechanical sticking. Very low ROP. Lost circulation	<ul style="list-style-type: none"> • Drill with slick BHA • Work pipe frequently • Good hole cleaning • Dill bits (eg impreg on motor) • Air drill • Hammer drill • Low mud weights. • LCM
Low pressure and permeable water-bearing sands at shallow depths	Hole instability	<ul style="list-style-type: none"> • Low mud weights and effective hole cleaning are essential to minimise losses and washouts
Poor wall filtercake	Tight hole	<ul style="list-style-type: none"> • Low mud weight combined with optimal rheology, fluid loss and hole cleaning should minimise the problem
Sloughing at deeper depths	Hole instability	<ul style="list-style-type: none"> • Increasing the mud weight, typically up to 9.6 ppg. A relatively in-gauge hole is required to provide a packer seat just above the pay zone.
Fragile coal seams	Packing-off hole	<ul style="list-style-type: none"> • Avoid packing off hole when pulling the BHA and swabbing the hole by pulling slowly through known coal seams. • Cuttings returned to surface should be closely monitored and compared to the ROP. Inconsistencies may indicate a sloughing coal seam higher in the hole • Drilling coal generally requires frequent, short wiper trips to ensure that the hole is kept clear of cuttings and to avoid the risk of stuck pipe. • For thick coal seams drill no more than 5' before picking up and working a full single 2-3 times while maintaining full pump rate.

Table 6. Solutions to Hole Problems.

It is the responsibility of the DSV to ensure that the Drilling Contractor is fully aware of the potential problems.

3.4.7 Tripping Practices

- a) A minimum of bottoms up shall be circulated up prior to any trip out of the hole. In high angle wells this should be increased to at least 2x times bottoms up (at drilling circulating rate) or until the shakers are free of cuttings.
- b) A trip sheet shall be filled out by the Driller and Mud Logging Contractor for each trip in/out of the hole. All variances from expected fill/return shall be investigated. The trip tank shall be used on all trips.
- c) The time spent with the pipe out of the hole shall be minimised wherever possible. Operations such as routine BOP testing, repairs and slipping and cutting of the drill-line shall be performed with pipe at the casing shoe whenever possible.
- d) Check trips may be required in the following cases:
 - During logging when hole conditions deteriorate and become sticky.

- Before RFT/MDT tools are run if previous runs indicate poor or deteriorating hole conditions. If required this wiper trip can be made one logging run before the MDT.
- Before running casing if hole conditions during logging indicate that this is necessary.

Notes

- i. In all of the above cases, the BHA must be as short as possible.
 - ii. In upper hole sections, the BHA should include full gauge stabilisers and be at least equal in stiffness to the casing string if required.
 - iii. Monel DCs shall not normally be run in check trips.
- e) When the condition of the hole is unknown due to a major change in parameters, a short trip shall be made. The procedure is as follows:
1. After circulating bottoms up flow check for 15 minutes. Slowly pull 10-15 stands while using the trip tank to ensure that the hole is taking the correct quantity of mud. Check for flow. Run back to bottom, check for fill and check for flow again.
 2. Circulate bottoms up and condition the mud. Check the mud returns for gas and salinity. Increase the mud weight if there are signs of an influx.
- f) Slow trip speeds while running drill collars (and BHA's) past coal seams is essential to the stability of the seams.

Tripping procedures to be posted in the doghouse are shown in Appendix 1.

Wiper Trips

As a general guide wiper trips may be run as follows:

- Once every 24 hrs or 450 m (1,500'). These trips will generally be made back to the depth of the previous wiper trip, the start of the bit run or the previous casing shoe whichever is deepest.
- Wiper trip back to surface prior to POOH to run surface casing.
- Wiper trip back to old hole when POOH to run intermediate casing, logs, DST's cut cores etc.

Standard Tripping Procedures.

1. Fill the trip tank to the highest recording level using mud from the suction tank. Do not fill the tank by diverting returns - this will allow cuttings to settle. Record the initial volume in the tank.
2. If required, in top hole only:
 - While circulating prior to tripping, prepare a heavy slug (normally 1 ppg heavier than mud weight in use) in the pill tank..
The volume of heavy slug required is calculated as follows:
$$\text{Slug Volume} = (\text{Drop length} \times \text{pipe capacity} \times \text{Mud wt}) / (\text{Slug wt} - \text{Mud wt})$$
3. Prepare the trip sheet. Shut down the pump and flow check. If the hole is stable; (in top hole only, pump the slug) break out and set back the kelly.
4. When the levels have equalised and annulus flow has stopped, switch the returns to the trip tank.

5. Pull the first 5 - 10 stands without continuously filling the hole to allow the level to be visually monitored for piston type swabbing. Wiper rubbers are not to be installed until at least these 5 - 10 stands have been pulled without indication of swabbing.

Remember that bottom hole pressure is reduced by the swab pressure plus the loss of hydrostatic head due to the lower fluid level in the annulus.

6. Start the trip tank pump and run continuously while pulling the remaining pipe.
7. If the hole does not take the full calculated fill, flow check. If the well is flowing the BOP must be closed immediately and the pipe stripped back to bottom if possible.

Under no circumstances must an attempt be made to 'outrun the kick' by running quickly back to bottom without closing the BOP. The situation will deteriorate rapidly and a blow out is almost inevitable.

If the well is not flowing then the reason for the discrepancy must be determined before pulling any further pipe. If there is any doubt, the pipe should be run back to bottom and the hole circulated. Monitor returns while running in.

8. When the trip tank has to be refilled, stop the trip and wait for the tank to fill. Do not trip and fill simultaneously. Take the opportunity to flow check the hole.
9. The crew should develop the habit of watching the hole level while tripping.
10. Perform a flow check with the bit at the casing shoe, and prior to pulling the collars across the BOP rams.
11. If tight hole is experienced, the annulus level must be closely monitored for piston type swabbing. When working the tight hole, work up cautiously ensuring that the pipe can always be run back down. Be aware that if an influx occurs in a tight hole situation, any flow will tend to be directed inside the drill pipe. If the flow occurs with the pipe high in the mast, it may very quickly become very difficult to install the stab valve.

If the tight hole cannot be safely worked through, do not hesitate to pick up the kelly and circulate/ream the hole.

12. While running in the hole the procedure should be reversed so that the volume of mud returns are monitored.
13. The drilling line must not be slipped with pipe out of the hole or with collars across the BOP. The pipe should be run back to the shoe and the stab valve installed.
14. Trip sheets must be retained and filed.

3.5 PREVENTION OF STUCK PIPE

The following guidelines outline key requirements (during well planning and at the wellsite) to minimise the incidence of stuck pipe.

3.5.1 General Preventative Measures

The DM is responsible for identifying all stuck pipe preventative measures during planning and documenting them in the Drilling Program. The DSV is responsible for ensuring that the stuck pipe preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> • The Drilling Programme should include identification of potentially troublesome formations and procedures for their prevention i.e. frequency of wiper trips, etc. • Careful consideration must be given to proper design and selection of BHA's and their components. • The amount of open hole time for each section of the hole must be kept to a minimum. • The drilling fluid system must be properly designed. • Troublesome formations must be cased-off.
Wellsite	<ul style="list-style-type: none"> • Allow sufficient time to properly condition the drilling fluid. • In open hole, keep the drill string moving whenever possible. • Time spent in open hole shall be minimised. • Ensure that the drillers have been told what action to take in the event of tight hole or other problems. • At the first sign of tight hole, the Toolpusher and DSV shall be called to the rig floor. • Exercise extreme caution when tripping in open hole. • Never try to force the string through a tight spot. • Never pull more overpull than the weight of the drill collars as this will almost always result in the string becoming stuck. • The last three joints (at least) should always be washed to bottom. • Always clean the hole before tripping. • Regular wiper trips must be made, either at pre-determined intervals or as hole conditions dictate. • The shale shakers must be monitored regularly by the DSV as well as by the Drilling Fluids Engineer • Utilise all solids control equipment to minimise the amount of drilled solids in the mud.

Table 7. General Preventative Measures against Stuck Pipe.

3.5.2 Prevention of Differential Sticking

The DM is responsible for identifying in the Drilling Program the potential for all likely incidents of differential sticking whilst the DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> ● Highlight in the Drilling Program permeable formations that may lead to differential sticking. ● Estimate the problem formation pressure using the best and most current offset data available. ● Any requests to run RFTs or MDTs should be considered carefully as they may increase the possibility of differential sticking. ● Careful consideration of the number of pad type logging tools employed in holes where differential pressures are known to be high. ● Lubricants can reduce the high coefficient of friction between the wellbore and the drillpipe. ● Reduce the filter cake thickness by the addition of "bridging" material to the drilling fluid. ● Shaker screens must be selected to prevent or minimise a drilled solids build-up, as low gravity solids result in thick and sticky filter cakes. ● HTHP fluid loss must be run on the drilling fluid when drilling in areas of known differential sticking, regardless of the bottom hole temperature. ● Do not program any non-essential surveys, as they are a high risk operation.
Wellsite	<ul style="list-style-type: none"> ● Continuously monitor the differential pressure across permeable formations as accurately as possible. Trends of overpull on connections, trip gas levels, and connection gas levels shall be followed to anticipate changing pressures. ● Keep differential pressures across permeable formations to a minimum by keeping the mud weight at the lowest safe level. ● Maintain drilling fluid parameters within the specifications of the Drilling Programme. ● Stabilisation and spiral drill collars should be used to centralise and minimise wall contact. ● Keep the pipe moving at all times. Reciprocate if possible. Do not leave the pipe static in high risk areas. ● Spot LCM pills across depleted zones while drilling and prior to evaluation. ● Utilise all solids control equipment to minimise the amount of drilled solids in the mud. ● When running wireline surveys consider racking back the kelly and work the string with the elevators.

Table 8. Preventative Measures against Differential Sticking.

3.5.3 Inadequate Hole Cleaning

The DM is responsible for preparing a Drilling Program that minimises the potential for inadequate hole cleaning and stuck pipe. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> ● Circulation rates need to be kept as high as possible in large diameter hole sections. ● Include recommended minimum circulation rates in the Drilling Fluids Program. ● Hole angles between 50o and 60o are the most difficult to clean. The Drilling Program for wells with these angles shall highlight this potential. ● A study of offset well data may indicate signs of over-gauge hole that may need to be included in minimum flow rate calculations.
Wellsite	<ul style="list-style-type: none"> ● The hole shall be circulated clean prior to the start of a trip. Rotation and reciprocation of the pipe will improve cleaning. ● Special tripping and circulating procedures may be necessary in wells with cutting beds and wells with severe over-gauge sections, such as pumping and backreaming out. ● Do not let the flow rate drop below the minimum required to effectively clean the hole. ● Do not continue to drill in anticipation of cleaning the hole at a later stage - that may be too late to avoid getting stuck. ● Utilise all solids control equipment to minimise the amount of drilled solids in the mud.

Table 9. Hole cleaning - Preventative Measures against Stuck Pipe

The following indicators may identify hole cleaning problems:

- Excessive overpull on connections and trips.
- Reduced overpull when pumping.
- Excessive fill after trips.
- Erratic and increasing torque while drilling.
- Lack of cuttings over shakers.

Appropriate action must be initiated when any of the above indicators are encountered while drilling.

3.5.4 Formation Instability

The DM is responsible for highlighting in the Drilling Program all likely zones of formation instability using offset well data. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> • Ensure that the drilling fluid formulation is designed to cope with gumbos and swelling shales where they are indicated.
Wellsite	<ul style="list-style-type: none"> • Trip cautiously through swelling formations. • In tight hole, ream each single. When using a top drive, pick up and ream midway through each stand. If hole conditions are severe, more frequent reaming may be required. • After pulling into a tight spot, run back into gauge hole and circulate before back reaming out. • Sections of the hole found to be tight on the way out of the hole shall always be reamed on the trip back in. • Wiper trips must be conducted regularly as defined in the Drilling Program with additional trips made as required. Consideration of the stuck pipe risks must be made before dropping a single shot survey in tight hole situations. • No unnecessary time shall be spent in open hole.

Table 10. Prevention of Stuck Pipe due to Formation Instability.

3.5.5 Key Seating

The DM is responsible for highlighting in the Drilling Program the possibility of key seating. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> • Offset well data shall be reviewed for incidents of key seating and any occurrences shall be noted in the Drilling Program. • Ensure that a string reamer or key seat wiper (preferred) is available on the rig for each relevant hole size where key seating is considered to be a potential problem.
Wellsite	<ul style="list-style-type: none"> • Ream any severe doglegs to prevent key seats developing. • Use a string reamer with a diameter larger than the drill pipe tool joint and smaller than the drill collars in the drill pipe to wipe the build section or Dog Leg if a key seat is expected or suspected.

Table 11. Prevention of Key Seating.

3.5.6 Bottom Hole Assembly Changes

All BHA changes shall be identified in the Drilling Program by the DM. The DSV is responsible for ensuring that the preventative measures tabulated below are performed by the Drilling Contractor at the wellsite.

Activity	Prevention
Planning	<ul style="list-style-type: none"> • Do not plan a stiff assembly to follow a flexible BHA without flagging in the Drilling Program that care must be taken when tripping in.
Wellsite	<ul style="list-style-type: none"> • Bits and stabilisers shall always be gauged after each trip. • If the bit is pulled undergauge the whole of the section drilled by the previous bit may require reaming. • Do not trip a BHA of increased stiffness into the hole rapidly. Expect to have to ream. • If the hole is suspected to be undergauge, extreme caution must be applied when tripping into the hole.

Table 12. General Consideration for BHAs in Preventing Stuck Pipe.

3.6 PREVENTION OF LOST CIRCULATION

The following guidelines outline the key requirements to prevent or reduce lost circulation while drilling. It is the responsibility of the Drilling Contractor to recognise any lost circulation and immediately inform the DSV of its occurrence.

3.6.1 Procedures to Minimise Losses

There are five procedures that may be performed by the Drilling Contractor to minimise losses. These are tabulated below.

Control to Minimise Loss	Procedure
Mud weight	Ensure that the mud density is not allowed to increase due to build up of solids, by maintaining and fully utilising an efficient solids control system, and by dilution where necessary.
Drilling fluid properties	Excessive gel strengths and viscosity, frequently due to an unacceptable increase in drilled solids, may result in seepage losses as a result of downhole circulating pressures.
Overloading annulus	The drilling rate must be controlled to ensure that the annulus is adequately cleaned and the drilling fluid maintained with an adequate carrying capacity to clean the annulus. Solids control equipment must be fully utilised to maximise removal of solids. Failure to adequately clean the hole may result in the formation of annular "mud rings", causing partial or total impedance to circulation.
Reduce Pump pressure	Pump pressure can be reduced by reducing flow rate, increasing nozzle size or changing mud properties
Pressure surges	Run in hole slowly and steadily to avoid surging the well, especially in the smaller boreholes.

Table 13 Procedures for Minimising Losses.

3.6.2 Lost Circulation Pills

Lost circulation ranges from seepage losses to complete loss of returns.

The recommended lost circulation material (LCM) that may be used across reservoirs and other formations without causing formation damage is Enerseal super fine or its equivalent, Sandseal. Quantities shall be determined on site, and returns shall be carefully monitored. Enerseal can be used either in concentrated slugs or as a general drilling fluid treatment as required.

Where seepage losses increase to more than 20 bbls/hour, a LCM pill may be required to provide more effective prevention than can be achieved by circulating LCM in the drilling fluid.

The generic procedure for the preparation and application of a LCM pill is as follows:

1. Mix a LCM pill in the slugging pit using the recommended LCM material (or alternative approved material where applicable). The actual concentration will be dependent upon the magnitude of the losses and the size of the jets in the drilling bit.
2. Spot the LCM pill on bottom.
3. Pull the bit above the loss zone and the top of the LCM pill.
4. Observe the well for one hour, keeping the hole full as required.
5. Gradually commence circulation and attempt to regain full returns.

3.7.1 Introduction

The implementation of the Drilling Program is carried out by contractors and verified by the DSV. The DSV should ensure that the program is followed to control and minimise risk and to make sure that the ongoing program is safe, efficient and effective.

3.7.2 Activities

2.7.2.1 Prepare and Send Daily Drilling Report to the GSLM Drilling Manager

The DSV shall complete the DDR after receiving the IADC report from the drilling contractor and operational reports from other contractors..

3.7.2.2 Morning Call

The DSV will call the DM each morning to discuss and incidents, logistical requirements and past and future operations. Based on this the DSV and DM shall address the safety, operational or logistics requirements.

3.7.2.5 Issue Work Instructions

Where possible all work instructions should be in writing and given to the contractors rig manager, who shall discuss them with the DSV before issuing them to the driller. The DSV shall issue instructions to third party contractors as required..

3.7.2.6 Afternoon Report

The afternoon report shall be a short summary, unless non standard operations are underway, following the same structure as the Morning Report

3.7.2.7 Verify Rig Operations and Prepare Non-conformance Reports

The DSV shall, on an ongoing basis, verify that work is being carried out in accordance with the Drilling Program, the DOM and HSWE requirements. He shall discuss the work as necessary with the GSLM DM and the rig TP.

Where a serious non-conformance is discovered, the DSV shall complete an incident report form detailing the action taken. The purpose of this is to initiate analysis and help ensure that the non-conformance is not repeated.

3.7.2.8 Analyse Non-conformance

All incident report forms shall be sent to the DM who shall investigate the report, carry out further analysis and discuss the report as necessary.

3.8 REPORTS AND REPORTING

Effective reporting is essential for a safe and efficient drilling operation. The objective is to keep the reports to an effective minimum and to simplify reporting lines wherever possible.

3.8.1 Reporting Relationships

- The DSV reports routinely to management via the DM assigned to the well.
- The DSV shall consult with the DM in the event of incidents occurring outside the scope of the drilling program (e.g. excessive tight hole, well control issues etc.).

Note: Drilling instructions shall ONLY be relayed to the rig via the DM

3.8.2 Daily Drilling Report

The morning report shall be transmitted to the DM by 0700 latest.

EXPLANATION OF TERMS IN DDR	
Term	Explanation
Date	The report is dated for the day of the report (day previous to dispatch).
Addressee	DM
Depth	Current depth at 0600, in feet or meters as specified in Drilling Program
Progress	Progress for previous 24 hours.
Day +/- Curve	Report days ahead (+) or behind (-) the TVD curve as in the Detailed Drilling Program.
Formation Tops	List the type and depth of each formation encountered during the last 24 hours.
Activity Report	Ensure that phase class and operating codes are correct because the software analyses the times by these classifications. Report times to the nearest 30 minutes.
Comments	It is important that the remarks / observation and solution / recommendation section is completed for any and all non-routine occurrences.
Mud Properties	Complete fully and in detail ensuring that the data matches the latest mud check.
Bit Data	Complete in full, note that the new IADC classification is to be used for dull grading.
BHA	Complete in full for the BHA in use. Include serial numbers and rotating hours for all NBRR, Stabilisers, Jars, NMDC, Motors etc.
Bulk Stocks	Complete in full for the stocks at 0600.
Surveys	List the tool type in "Last Tool Type" (i.e. Totco, MSS or MMS).

Table 15. Explanation of Terms in DDR

3.8.3 Other Reports

Casing and Cementing

- The following reports shall be E-mailed to the DM.
 - I. Casing Tubing Tally – Sent to DM for checking and verification prior to the casing being run.
 - II. Casing & Cement Report – Sent to the DM within 24 hours of the cement job.

Leak off Test/Formation Integrity Test

- Complete as per Chapter 9.7 and E-mailed to the DM with the next morning report.

BOP Test Sheet

- Complete for each BOP test.
Ensure that all sections are accurate and E-mail to the DM.

Well Control Kill Sheet

- The pre-recorded data shall be completed at minimum everyday while drilling below the surface casing.
- The form is retained on the rig and may be audited by GSLM and/or regulatory personnel.

Daily Drilling Costs

- The DM shall complete the relevant sections of the daily cost report
-

End of Well Reports

- The following reports shall be completed at the end of the well and faxed to the DS/DE within 24 hours of rig release.
 - (i) Wellhead Installation Report for Conventional wells
 - (ii) Well Abandonment Report - if applicable
 - (iii) End of Well Equipment Report
 - (iv) Rental equipment used on well

End of Hitch Report

- To be completed by the DSV every hitch
- Should be E-mailed to the DM prior to leaving rig.

TRIPPING PROCEDURES

(To be displayed in Doghouse)

Tripping Practices

- a) A minimum of one complete circulation shall be performed prior to any trip out of the hole. When circulating to condition mud, a circulating rate of 50 - 75% of the normal circulating rate shall be used.
- b) A trip sheet shall be filled out by the Driller and Mud Logging Contractor for each trip in/out of the hole. All variances from expected fill/return shall be investigated. The trip tank shall be used on all trips.
- c) The time spent with the pipe out of the hole shall be minimised wherever possible. Operations such as routine BOP testing (except blind rams), repairs and slipping and cutting of the drill-line shall be performed with pipe at the casing shoe whenever possible.
- d) Check trips may be required in the following cases:
 1. During logging when hole conditions deteriorate and become sticky.
 2. Before RFT/MDT tools are run (If supercharged formations are possible, this wiper trip may be made 1 logging run prior to the MDT/RFT run).
 3. Before running casing, if hole indications during logging indicate that this is necessary.

Notes:

- i. In all of the above cases, the BHA must be as short as possible.
 - ii. In upper hole sections, the BHA should include full gauge stabilisers and be at least equal in stiffness to the casing string if required.
 - iii. Monel DCs shall not normally be run in check trips
- e) When the condition of the hole is unknown due to a major change in parameters, a short trip shall be made. The procedure is as follows:
 1. After circulating bottoms up flow check for 15 minutes. Slowly pull 10-15 stands while using the trip tank to ensure that the hole is taking the correct quantity of mud. Check for flow. Run back to bottom, check for fill and check for flow again.
 2. Circulate bottoms up and condition the mud. Check return mud weight and for signs of entrained gas or dilution. Increase the mud weight if there are signs of an influx.
 - f) Slow trip speeds while running drill collars (and BHAs) past coal seams is essential to the stability of the seams.
 - g) The majority of the world's blowouts occur while tripping in normally pressured areas. The main reasons are swabbing in a kick, failure to keep the hole full, or breaking down the formation due to excessive trip speed.

The term 'swabbing' on a rig generally refers to the bit and/or stabilisers acting as a swab or piston and actually lifting the full mud column. This typically occurs with tight or sticky hole when the bit, stabilisers, or collars become packed with wallcake leaving a very restricted passage for the mud. This situation is readily noticeable as the mud level in the annulus tends to rise with the pipe rather than fall. In addition, since the drillstring is picking up all or a portion of the weight of the mud column above, the string weight shows an increase.

Swab and surge pressures actually occur every time the pipe is moved as a result of the viscous drag of the mud. The factors affecting the magnitude of these pressures for a given hole/pipe combination are mud rheology and pipe speed.

The swab situation is more insidious since the influx may occur in very small increments and may not become evident until the influx has migrated almost to surface after a period of hours. By the time this happens, the pipe is a long way off bottom and well control becomes extremely difficult and may become impossible. There are many instances of the drill string being blown out of the hole in these situations.

It is a fundamental fact of life on the wellsite that the hole must be kept full at all times. All too often complacency creeps into operations, corners start to be cut and drillers don't want to 'waste time' filling in trip sheets.

Hole filling should be a continuous operation performed with the trip tank, NOT WITH THE MUD PUMP. In order to fill the hole on a continuous basis a heavy slug must be pumped to allow the pipe to be pulled dry. Pulling wet pipe slows the operation and the loss of mud can make volume accounting difficult.

A trip sheet **must** be filled out for every trip including short wiper trips.

To minimise the risk of influxes occurring and to maximise the speed of detection when they do occur, it is imperative that safe trip procedures are strictly followed.

As always the golden rule is "if in doubt, stop and check". Do not blunder along into a disaster.

When tripping, ensure that the pipe is not set too high in the slips. Setting the pipe high can result in bending the pipe in the slip area.

The maximum height to avoid bending can be calculated. The procedure is shown below for two cases. Case 1 is for the make-up and break-out tongs at 90 degrees to each other; Case 2 is for the make-up and break-out tongs at 180 degrees to each other.

Case 1

$$H_{max} = \frac{0.53 \times Y_m \times L \times (I/C)}{T}$$

Case 2

$$H_{max} = \frac{0.38 \times Y_m \times L \times (I/C)}{T}$$

Where:

- H_{max} = Height of tool joint shoulder above slips - ft
- Y_m = The minimum tensile yield stress of the pipe - psi
- L = Length of tong arm - ft
- P = Line pull - lb
- T = Make up torque applied to tool joint (P x L) = lb.ft
- Z = Section Modulus (I/C) of the pipe – unit of length³ (See table, over)
- Where I = Second Moment of Area (Moment of Section) of the pipe
- C = Outside radius of the pipe

Pipe OD ins	Nominal Wt lb/ft	Z (=I/C)
2 3/8	4.85	0.66
	6.65	0.87
2 7/8	6.85	1.12
	10.40	1.60
3 1/2	9.50	1.96
	13.30	2.57
	15.50	2.92
4	11.85	2.70
	14.00	3.22
	15.70	3.58
4 1/2	13.75	3.59
	16.60	4.27
	20.00	5.17
	22.82	5.68
5	16.25	4.86
	19.50	5.71
	25.60	7.25

Tripping Procedure

1. Fill the trip tank to the highest recording level using mud from the suction tank. Do not fill the tank by diverting returns - this will allow cuttings to settle. Record the initial volume in the tank.
2. If required, and for top hole only
 - While circulating prior to tripping, prepare a heavy slug in the pill tank.
The volume of heavy slug required is calculated as follows:

$$\text{Slug Volume} = (\text{Drop length} \times \text{pipe capacity} \times \text{Mud wt}) / (\text{Slug wt} - \text{Mud wt})$$

Example: Volume of 12.0 ppg slug required to produce a level 300 ft down in 4 1/2" pipe with 9.2 ppg mud in the hole is $(300 \times 0.01422 \times 9.2) / (12.0 - 9.2) = 14 \text{ bbls.}$
3. Prepare the trip sheet. Shut down the pump and flow check. If the hole is stable; (for top hole only - pump the slug) break out and set back the kelly.
4. When the levels have equalised and annulus flow has stopped, switch the returns to the trip tank.
5. Pull the first 5 - 10 stands without continuously filling the hole to allow the level to be visually monitored for piston type swabbing. Wiper rubbers are not to be installed until at least these 5 - 10 stands have been pulled without indication of swabbing.

Remember that bottom hole pressure is reduced by the swab pressure plus the loss of hydrostatic head due to the lower fluid level in the annulus.

**CHAPTER 4
DRILL STRING EQUIPMENT**

TABLE OF CONTENTS

4.1	OBJECTIVES	2
4.2	RESPONSIBILITIES	2
4.3	DRILL STRING DESIGN	2
4.4	BHA HANDLING – NOTES	4
4.5	JARS	6
4.5.1	Jar Types	6
4.5.2	Equipment Details	6
4.5.3	Jar Hours	7
4.6	DRILL STRING STABILISERS	8
4.6.1	Integral Blade (IB) Stabiliser	8
4.6.2	Sleeve Stabiliser	8
4.6.3	Roller reamer	8
4.7	DRILL STRING BARRIERS	9
4.7.1	Float Valves	9
4.7.2	Drop-in Check Valve	9
4.7.3	Inside Blowout Preventor (IBOP)	9
4.7.4	Lower Kelly Cock	9
4.8	INSPECTION OF DRILLSTRING COMPONENTS	10

4.1 OBJECTIVES

This Chapter describes the key items of drill string equipment (jars, stabilisers and drill string barriers) applicable to GSLM's drilling activities. The information contained in this Chapter can be used to gain an informed understanding of the benefits and applications of this equipment.

4.2 RESPONSIBILITIES

As this Chapter primarily provides a description of drill string equipment, very few responsibilities have been defined. Those defined are tabulated below.

Task	Performed by	Verified by
Permanent provision of Inside Blowout Preventer	Drilling Contractor	DSV
Provision of two lower kelly cocks for each size of drill pipe throughout drilling operations	Drilling Contractor	DSV
Inspection and certification of all drillstring components.	Contractor	DSV
Maintaining records of all drillstring inspections on the rig	Drilling Contractor	DSV
Tracking time in hole of BHA components (jars, stabilisers, motors NMDC etc).	Drilling Contractor / DSV	DSV / DM

Table 16. Responsibilities for Provision of Drill String Equipment at the Wellsite.

4.3 DRILL STRING DESIGN

Good drill string design aims to avoid abrupt changes in component cross-sectional area as abrupt changes that lead to concentrations in bending stress, which in turn may result in a twist off. The most important components for concern are the crossovers between drill collars, drill collars and heavy weight drill pipe and heavy weight drill pipe and drill pipe.

4.4 BHA Handling – Notes

- Stabilisers to be made up or broken out of the drill collar string shall either be suspended by a winch line or maintained vertical by means of another mechanical support (e.g. pin in rotary table, clamp support hooked around drill collar in the rotary). Manually supporting the stabiliser without mechanical back up while engaging or disengaging the threads is not permitted. It is dangerous and may cause damage to the stabiliser pin end.
- Stabilisers and roller reamers should be gauged and visually inspected on **each** trip. Consideration should be given to laying out stabilisers that are more than 1/8" undergauge (unless drilling directionally). Serial numbers and rotating hours should be recorded on the daily drilling report.
- No chicksan connection will be made up to a down hole string component before that component is actually incorporated in the string and lowered through the rotary table to refusal or safe working height. In the event circumstances dictate otherwise, the chicksan connection shall be safeguarded by attaching a safety line to prevent free fall.
- Any threaded connection carried on top of a string suspended above safe working height and not made up to recommended torque shall be marked with chalk and continuously monitored when rotating (part of) that string.
- Avoid rotating the drill string below the rotary to make up pipe once the BHA is run. Backing the rotary into a string to make up a connection is not permitted as it can result in a dropped string or an accident due to damaged threads, and should be avoided where possible.

- Redressing of stabilisers will normally be carried out by the supplier/agent.
- Break new threads in carefully when making up for the first time. Clean thread thoroughly, make up with chain tong to recommended torque. Break connection, clean and inspect threads and remake as above.

4.5 JARS

4.5.1 Jar Types

There are two types of jars: mechanical and hydraulic (oil) jars. These are described in the section below.

When jarring down the smaller the quantity of drill collars placed above the jar, the higher the impact force required to free the fish. Conversely, the larger the quantity of drill collars above the jar, the greater the impulse required to move the fish after freeing the pipe.

Mechanical Jars (not often used).

Mechanical jars are pre-set at the surface. They are frequently used in fishing at shallow depths when there is not enough stretch in the drillpipe to create impact with the hydraulic jar.

Hydraulic Jars

A hydraulic jar has a simple operation, in which overpull is applied to trip the jar, and lowering the string resets it. Jarring direction, impact intensity and frequency of impacts can all be controlled by the driller. A long stroke hydraulic jar should always be used where possible.

Some hydraulic jars are adjustable for overpull downhole and can handle torque during jarring. They are available in double-acting mode e.g. the Houston Engineers Hydra-Jar (Ref. Section 4.6.2).

Where a jar is single-acting and only jars upward, a bumper jar or sub can also be run to allow such a jar to jar in both directions..

4.5.2 Equipment Details

A hydraulic jar primarily consists of two moving parts, the inner mandrel installed with the seals, and the outer body. The principal elements in a hydraulic jar that determine effectiveness and reliability are the seal system (which provides the required restriction to the passage of oil when the jar is being set) and the hydraulic oil.

The effectiveness of the seal system is dependent on the seal clearances and their ability to withstand pressure and temperature. The hydraulic oil must retain its viscosity during operating conditions to provide the necessary resistance when the jar functions, and this property is mainly affected by temperature.

Specific details of jar applications and general information on force multiplying tools are contained in Chapter 12 of this Manual.

Rotating hours shall be recorded each tour on the IADC tour report, reported daily on the Daily Drilling Report.

6 ¼" jars shall not normally be run for more than 400 hours before being replaced. If jars have been used extensively for jarring they should be replaced as soon as possible..

4.6 DRILL STRING STABILIZERS

Drill string stabilisation in GSLM's drilling operations is provided by the installation of one or more of the stabiliser types outlined in the following sections. Stabiliser placement to achieve a required borehole trajectory is described in Chapter 3 of this Manual.

The following procedure should be followed with all stabilisers:

- Stabilisers will be manufactured 1/64" undergauge (for vertical wells).
- All stabilisers and roller reamers must be gauged and visually inspected on each trip.
- Stabilisers should be replaced when they are more than 3/16" undergauge (or as required for vertical wells).
- The serial number of all stabilisers run in the hole should be recorded on the GSLM daily drilling report..

4.6.1 Integral Blade (IB) Stabiliser

Integral blade stabilisers are typically spiral to provide full circumference stabilisation over the total blade length. Undergauge sizes are also available for specific requirements. Blade faces are impregnated with hard-facing to prevent stabiliser gauge wear. Additional hard-facing material is applied to stabiliser shoulders.

The IB stabiliser may be a one piece, fully integral design, or a type with changeable blades.

4.6.2 Sleeve Stabiliser

Sleeve stabilisers provide an alternative means to change the blades, in which a removable sleeve incorporates the stabilising blades.

The sleeve is typically screwed onto the body, and is available in a range of sizes and blade face characteristics for each hole size.

4.6.3 Roller Reamer

The roller reamer typically replaces a nearbit or string stabiliser to reduce torque downhole, particularly in a packed BHA configuration, or where increased torque is anticipated such as in deviated hole.

In some cases, the effect of the rollers or cutters can be to stabilise the newly exposed borehole due to the rolling action and avoidance of relative movement between stabiliser blade and surface. Previously, this type of tool has been less reliable due to service life of roller bearings and redress difficulties. There are also concerns about the cross-sectional area with respect to hole cleaning or cuttings packing-off when POOH.

The roller reamer should be inspected every trip and should be changed out if more than

4.7 DRILL STRING BARRIERS

This section describes the different types of drill string barriers. It is the responsibility of the Drilling Contractor to ensure that they are serviced and available on the drill floor as described below. The DSV shall verify their presence prior to and throughout all drilling operations..

4.7.1 Float Valves

Float valves are flapper or plunger type valves that are run just above the drilling bit to prevent uncontrollable flow occurring up the drill string. An installed float valve has the disadvantage that it complicates reading the shut in drill pipe pressure after a kick.

- Float valves shall not be run in surface hole unless detailed in the drilling program.
- Flapper valves shall be run while drilling the intermediate and main hole sections unless otherwise authorised in the Drilling Program.

When using float valves, the following procedures shall be carried out:

1. When RIH, break circulation as soon as all the drill collars and one stand of drill pipe are in the hole. This confirms that the float valve is functioning correctly.
2. Fill up the drill pipe every 10 stands.
3. Run in slowly and carefully, to avoid excessive surging as the drill pipe is effectively closed.

4.7.2 Drop-In Check Valve

A drop-in check valve provides an alternative to the float valve, as there is no check or restriction on return flow up the drillpipe until the check valve is installed.

4.7.3 Inside Blowout Preventer (IBOP)

An Inside BOP (IBOP), also known as a Gray valve, installed with the appropriate connections for the drill string in use, shall be present on the drill floor at all times and ready for immediate use..

4.7.4 Lower Kelly Cock

Two lower kelly cocks for each size of drill pipe in use shall always be available One of which shall be used below the kelly or top drive during all drilling operations. The other shall be on the drill floor complete with removable handles for easy stabbing and connecting. This valve should be kept in the open position for ease of installation..

4.8 INSPECTION OF DRILL STRING COMPONENTS

All drillstring components shall be regularly inspected and certified as shown below. A record of these inspections should be kept on the rig. All BHA components must have a unique serial number to enable the usage of each component can be tracked. The table below shows the type and frequency of inspection for the various drillstring components.

ITEM	TYPE OF INSPECTION	FREQUENCY	PERFORMED BY	VERIFIED BY
Drillpipe	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
HWDP	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Drillcollars	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Crossovers	Magnetic Particle/Calliper	3 months	Inspection Company	DSV
Saver subs	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Jars	Magnetic Particle/Calliper	6 months	Jar supplier	DSV
Stabilizers	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Roller reamers	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Pony DC.	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
NMDC	Magnetic Particle/Calliper	6 months	Inspection Company	DSV
Fishing tools.	Magnetic Particle/Calliper	After use	Inspection Company	DSV
MWD tools	Magnetic Particle/Calliper	After use	Tool supplier	DSV
Motors	Magnetic Particle/Calliper	After use	Tool supplier	DSV

Table 18. Inspection of Drill String Components

Drillstring components that have been subjected to abnormal stress (e.g. jarring or deviated wells) will have to be inspected more frequently.

**CHAPTER 5
DRILLING FLUIDS**

TABLE OF CONTENTS

5.1	OBJECTIVES	2
5.2	RESPONSIBILITIES	3
	5.2.1 Detailed Responsibilities for Key Personnel	3
5.3	STANDARDS	5
	5.3.1 Drilling Fluid Standards	5
	5.3.2 LCM Standards	8
	5.3.3 Stuck Pipe Spotting Fluids (Pipe Free Pills)	8
	5.3.4 Minimum Chemical Stock Requirements	8
5.4	SOLIDS CONTROL	9
	5.4.1 Operating Guidelines for Solids Removal and Equipment	9
5.5	MONITORING, REPORTING AND TESTING	13
	5.5.1 Drilling Fluids Monitoring	13
	5.5.2 Drilling Fluids Testing and Reporting	13
	5.5.3 Water Based Mud Testing Requirements	14

5.1 OBJECTIVES

Selection of the correct drilling fluids is essential to:

- Drill wells safely.
- Drill wells economically whilst avoiding damage to the reservoir or adversely affecting the quality of the evaluation programme.

Every well must have a Drilling Fluids Program which shall be designed to:

- Prevent the influx of formation fluids.
- Minimise reservoir damage.
- Enable the efficient acquisition of data for evaluation.
- Economically overcome potential hole problems by providing the necessary properties for pressure control, hole stability, hole cleaning and formation inhibition.
- Limit the environmental damage caused by discharges of materials and fluids.

The basic API drilling fluids tests shall be conducted at least twice daily during drilling operations and the latest test included on the Daily Drilling Report.

The environmental impact of the drilling fluids system must be evaluated and disposal of drill cuttings, drilling fluids and other wastes must be carried out in accordance with GSLM's guidelines and relevant Government legislation.

All toxicological properties of drilling fluids additives must be understood and controlled. Copies of the MSDS must be held at the wellsite for ALL mud chemicals on location.

5.2 RESPONSIBILITIES

The general responsibilities for planning, preparing and maintaining drilling fluids are outlined in the table below.

Task	Performed by	Verified by
Prepare Drilling Fluids Program	Drilling Fluids Contractor	DM
Monitor and maintain the drilling fluid properties in accordance with the Drilling Fluids Program	Drilling Fluids Engineer	DSV
Conduct routine testing and reporting, advise on any related problems	Drilling Fluids Engineer	DSV
Provide technical and commercial overview of the drilling fluids operation and make recommendations for improvements	DSV/ Drilling Fluids Engineer	DM
Treat the drilling fluids and ensure relevant personnel adhere to the safe handling procedures for chemicals and equipment	Drilling Fluids Engineer / Derrickman	DSV
Ensure that the Barite and drilling fluids stocks are maintained above the minimum levels as per 3.3.2	Drilling Fluids Engineer	DSV
Maintain equipment associated with the handling and treatment of drilling fluids	Drilling Contractor	Drilling Fluids Engineer / DSV
Ensure that health safety and environmental requirements are complied with on site	Drilling Fluids Engineer / Drilling Contractor	DSV
Ensure mud chemicals are correctly stored and transported.	Drilling Fluids Engineer / Drilling Contractor	DSV
Compile Daily Reports	Drilling Fluids Engineer	DSV

Table 19. Responsibilities for Planning, Preparing and Maintaining Drilling Fluids.

The parties responsible for performing the work must ensure that they understand all relevant procedures. They must pre-plan the work, issue instructions for all tasks and be responsible for coordinating the pre-job meeting which shall detail all aspects of the activity.

5.2.1 Detailed Responsibilities for Key Personnel

The Drilling Contractor, Drilling Fluids Engineer and DSV shall work together to ensure that the drilling fluids are handled, maintained and treated in a manner which fulfils the requirements and objectives of GSLM, as outlined in the Drilling Program.

5.2.1.1 Drilling Contractor

The Drilling Contractor shall ensure that all the equipment associated with the handling and treatment of drilling fluids is functioning correctly and is regularly checked and maintained. In addition, the Drilling Contractor shall also liaise with the Drilling Fluids Engineer when:

- Making regular drilling fluids checks.
- Mixing drilling fluids.
- Monitoring drilling fluids.
- Storing and handling chemicals.
- Operation and maintenance of solids control equipment.
- Maintaining an inventory of spares/back-up equipment for the solids control equipment.

5.2.1.2 Drilling Fluids Engineer

The Drilling Fluids Engineer shall be responsible for all issues relating to drilling fluids, including storage at the wellsite, transport and usage during a well operation. The Drilling Fluids Engineer shall ensure the following functions are performed in accordance with the GSLM operational guidelines contained in this Chapter.

- Ensure that the Drilling Fluids Program is followed and that costs are closely monitored.
- Maintain and monitor the drilling fluids properties to specifications outlined in the Drilling Program. Any parameter outside of specification should be noted on the daily mud report.
- Ensure routine testing and reporting is carried out and advise the DSV of all related problems as and when they occur, recommending the appropriate treatment for the drilling fluids. Provide the DSV with the technical and commercial overview of the drilling fluids operation and make recommendations for improving the program or operations as and when necessary.
- Recommend, manage and supervise all treatments to the drilling fluids that shall be based on sound technical and commercial evaluation and pilot testing.
- Ensure all relevant personnel are aware of, and adhere to, the safe handling procedures of all drilling fluids chemicals and equipment (reference Chapter 1 of this Manual).
- Determine the required drilling fluid materials and recommended equipment (e.g. chemicals, shaker screens etc.). Communicate to the DSV to ensure timely requisitioning of same.
- Optimise the solids control equipment to minimise losses and control low gravity solids levels in the drilling fluids. All such equipment suction, returns and discharges shall be monitored and their performance reported daily to the DSV.
- Together with the Drilling Contractor, ensure that the health, safety and environmental objectives of the Drilling Fluids Program are met at the wellsite.
- In conjunction with this, ensure that the disposal of waste fluid and wellbore materials conforms with all relevant GSLM's procedures and Government regulations.

- Ensure that a current copy of Material Safety Data Sheet (MSDS) for each chemical is kept at the rig (Chapter 1 of this Manual).
- Compile all reports required by the Company and the regulatory authorities relating to the transfer, storage, use and maintenance of all drilling fluids and related additives and equipment (Chapter 1, this Manual).
- Compile all drilling fluid Recaps on time and ensure that they contain information required for future well planning.
- Manage stock – Cycle ageing products, ensure stocks are covered, packed, stored and transported correctly so as to minimise damage.
- Record the number of hours the solids control equipment is run each day.
- Record shaker screen usage.

5.2.1.3 Drilling Supervisor

The DSV shall ensure that the quality control of drilling fluids operation, maintenance and treatment is performed and adhered to in a manner that fulfils the well requirements. This shall include, but not be limited to the following:

- In conjunction with the Drilling Fluids Engineer recommend adjustments to the drilling fluid properties to ensure optimal mud performance.
- Perform quality checks on the drilling fluids testing carried out by the Drilling Fluids Engineer.
- Ensure that the Drilling Fluids Engineer submits the required accurate reports on time.
- Ensure that the Drilling Fluids Engineer carries out mud mixing in accordance with the Drilling Fluids Program.
- Ensure that the Drilling Fluids Engineer assists with the optimisation of the solids control equipment.
- Ensure the Drilling Contractor maintains, and optimises the solids control equipment.
- Verify that the Drilling Fluids Engineer maintains an up to date inventory of all drilling fluids material and testing equipment.
- Monitor the usage of shaker screens.

5.3 STANDARDS

This section describes the generic drilling fluids types used during drilling operations and the minimum drilling fluids requirements to be held at the wellsite..

5.3.1 Drilling Fluids Standards

This section describes the standard drilling fluids types, ingredients and formulations of drilling fluids used in drilling operations.

5.3.1.1 Drilling Fluid Types

The generic drilling fluids types that may be used by GSLM are listed below. Additional detail is provided in the remainder of this Chapter:

- Prehydrated Gel (PHG)/ Spud mud.
- Enhanced Spud mud.
- KCl/ PHPA Polymer.
- KCl/Polymer.
- KCl Brines.

5.3.1.2 Primary Ingredients

The primary fluid systems ingredients and their applications are outlined in the table below.

An overview of formulation ranges for each drilling fluid type is shown in Section 5.3.1.3.

Primary Function	Generic / Common Name	Chemical Composition	Typical Uses
Alkalinity Control	Caustic Soda	Sodium Hydroxide NaOH	Adjust pH; treat out Magnesium hardness
	Caustic Potash / KOH	Potassium Hydroxide KOH	Adjust pH; treat out Magnesium hardness; K+ source
	Soda Ash	Sodium carbonate	Treat out Calcium hardness/ cement in low pH muds.
	Bicarb	Sodium Bicarbonate	Treat out cement contamination in high pH muds
	(Slaked) lime	Calcium Hydroxide	Increase viscosity by flocculation of clays; raise pH; treat Carbonate / CO2 gelation problem; Ca++ source
	Citric Acid	Citric Acid	Decrease pH and stop polymer burn -out/ degradation
	SAPP	Sodium Acid Pyro Phosphate	Cement pre-flush additive: thinner sequesters calcium
Biocide	Alkyl Dithiocarbamates		
	Glutaraldehyde	Glutaraldehyde	Prevent bacterial decay of polymers
Corrosion Control	Filming Amine	Proprietary blend	Minimise corrosion of tubulars from oxygen, CO2 and/or H2S
	Multi- component	Proprietary blend	Minimise corrosion of tubulars from oxygen, CO2 and/or H2S
	Zinc Carbonate	Zinc Carbonate	Hydrogen Sulphide scavenger
	Liquid Oxygen Scavenger	Ammonium Bisulphite	Minimise corrosion of tubulars from oxygen
	Solid Oxygen Scavenger	Sodium Sulphite	Minimise corrosion of tubulars from oxygen
Defoamer	Defoam	Proprietary	Defoam aerated muds, surfactant
	Stearate	Aluminium sterate	Defoam aerated muds
Detergent	Mud detergent, DD, etc.	Metallic salty of fatty acid (soap)	Minimise bit balling, emulsifier, rig wash
Dispersant	CF Ligno	Chrome free Lignosulphate	Thinner; reduces fluid loss, emulsifier, shale inhibitor
Fluid Loss Control	PAC LV and/ or PAC REG	Polyanionic cellulose	Reduces fluid loss: viscosifier (YP).
	Starch	Carbohydrate	Reduces fluid loss; inhibits shale hydration / dispersion
	Lignites (Lignon Tannathin, etc)	Lignin resins	Reduces fluid loss; thinner
	CMC LV, CMC REG and/ or CMC HV	Sodium Carboxymethyl cellulose	Reduces fluid loss; viscosifier
	Acrylate (SP 101, Cypan, etc	Sodium Polyacrylae	Reduces high temperature fluid loss; thinner
	Modified polymers	Proprietary Organic polymers	Reduces high temperature fluid loss; thinner
Shale Inhibitor	PHPA	Partially hydrolysed polyacrylimide	Reduce shale hydration by encapsulation; viscosifier
	Salt	Sodium Chloride NaCl	Inhibits shale hydration brine additive (max. 10.0 ppg)
	KCl	Potassium Chloride KCl	Inhibits shale hydration brine additive (max. 9.7 ppg); K+ source
	Polyol	Glycol / Glycerol	shale inhibitor, lubricant blend

Table 20. Primary Drilling Fluids Ingredients (i)

Primary Function	Generic / Common Name	Chemical Composition	Typical Cooper Basin Uses
Viscosifiers	Trugel (various nos)	Locally processed Bentonite	Peptised/ polymerised gel viscosifier (FWYP/gels)
	Wyoming Bentonite	Imported pure Bentonite	Used as cement additive (extender) no polymers
	Biopolymers (XC, XCD, etc.)	Xanthium gum and/ or derivatives	Raise viscosity (YP, gels and low-end rheology)
Weighting Agents	Barite	Barium Sulphate (+ minor metallic ores)	Inert Weighting material (max 20 ppg)
	Limestone	Calcium Carbonate	Acid soluble weighting material (typical / max 12.0 / 16.5 ppg)
Miscellaneous	Calcium Chloride	Calcium Chloride	Brine additive (max. 11.7 ppg); cement accelerator
Lost Circulation Material	Mica – coarse, medium, fine	Muscovite flakes	Reduce seepage losses – total lost circulation
	Cereal husks	Cellulosic fibre materials	Reduce seepage losses – total lost circulation
	Ground shells	Ground Walnut hulls	Reduce seepage losses – total lost circulation
	Limestone	Calcium Carbonate	Reduce seepage losses – total lost circulation
	Fibrous blend	Fibrous flakes and granular blend	Reduce seepage losses – total lost circulation
Pipe Free Agent		Proprietary surfactant blend	Soak solution for differentially stuck pipe

Table 20 (cont'd) Primary Drilling Fluids Ingredients (ii)

5.3.1.3 Standard Formulations

The relevant Drilling Fluids Program takes precedent over the formulations shown in the Drilling Operations Manual.

5.3.2 LCM Standards

Lost circulation or lost returns is defined as the loss to the formation of either drilling fluids or cement slurry used during the drilling or completing of wells.

The recommended Lost Circulation Material (LCM) that may be used across reservoirs etc. to minimise formation damage is normally a cellulose type product such as Enerseal super fine, Sandseal .

5.3.3 Stuck Pipe Spotting Fluids (Pipe Free Pills)

Spotting fluids should only be used when so directed by the DM.

Spotting fluids should be mixed and pumped according to the manufacturer's recommended formulation and procedures, under the following guidelines:

- The pill should be prepared in a clean tank on surface. The volume required shall be determined by the DSV and shall be 50 - 100 % excess over the annular volume around the drill collars.
- Consideration should be given to the density of the pill, which should ideally be the same or greater than the density of the drilling fluids, to minimise the migration of the pill through the static mud column.

Mixing - 20 bbl pill: mix 1 drum (55 gals) surfactant in 19 bbl diesel.
40 bbl pill: mix 2 drums surfactant in 38 bbls diesel.

5.3.4 Minimum Chemical Stock Requirements

The following are the minimum chemical stocks that shall be available for use on the rig. These may either be kept on the rig or at a nearby supply base if transport is readily available.

- Mud chemical stocks adequate to re-build 1½ times the maximum hole volume plus the minimum surface volume of the mud system in use and the interval being drilled.
- The mud system in use and the interval being drilled.
- Emergency barite stocks to be able to weight the total mud system by at least 1.0 ppg.
- Sufficient stocks of LCM material for both above and across the reservoir.
- Sufficient stock of surfactant, weightable pipe freeing agent, Biocide and corrosion inhibitor materials.

The DSV and DM shall individually review specific well requirements.

5.4 SOLIDS CONTROL AND MUD RELATED EQUIPMENT

Solids contamination of drilling fluids is the single most costly drilling fluids control problem. Mechanical treatment is the most economical means of treatment (shakers, desanders, desilters, and centrifuge). The quantity of solids removed must be maximised. However, complete removal of undesirable solids is not practicably feasible.

Mechanical treatment must begin immediately drilling commences rather than to delay until the mud properties start to deteriorate as this will result in the requirement for dilution or treatment with costly chemicals.

The following are the GSLM's solids control guidelines:

- All applicable equipment shall be operating and functional before drilling begins.
- Solids control equipment shall be maintained to appropriate standards.
- Efficiency checks shall be made daily when equipment is in use.
- Manufacturers Maintenance and Operating Manuals for all solids control equipment shall be available at the wellsite.
- Instructions for use and maintenance shall be strictly adhered to at all times.
- Linear motion shakers are the preferred shaker type.
- The vacuum degasser system (where available) should be tested at the start of each well and prior to any DST's.
- The finest practical shaker screens will be used.
- Shaker screens should be inspected frequently and any damaged screens repaired or replaced. The mud engineer should record screen usage on the daily mud report.
- The settling tanks should never be bypassed and should be dumped regularly.
- Desanders and Desilters should be balanced to produce a spray discharge.
- Reuse sump water where possible.

5.4.1 Operations Guidelines for Solids Removal and Equipment

This section describes equipment provided by the Drilling Contractor and the methods for the removal of solids.

5.4.1.1 Flowlines and Jet lines

Flowlines, shaker header boxes (possum bellies) etc., shall be inspected regularly and cleaned out as required, to prevent solids build-up.

Jet lines, if fitted, shall also be inspected regularly to ensure that they function properly.

5.4.1.2 Shale Shakers

Equipment	Operational Guidelines
Shale Shaker	<ul style="list-style-type: none"> • Must be operated as efficiently as possible, at all times, in order to maximise the amount of solids removed after exiting the wellbore. • Must be switched on immediately before running in the hole to clean the mud displaced by the drill string and BHA. • Flow shall be distributed evenly over all available shakers. • Shakers shall be switched off immediately prior to tripping out of the hole. Care must be taken to ensure that the shakers are started before breaking circulation for any reason, e.g. backreaming and pumping out. • Cuttings should not be allowed to dry hard upon the screens. • Shakers shall not be by-passed, unless absolutely necessary and as authorised by the DSV • Shakers should not be run dry as this leads to increased wear and premature screen failure
Shaker Screens	<ul style="list-style-type: none"> • The finest mesh screens shall be selected, taking into consideration maximum solids separation whilst minimising the loss of whole mud, and ensuring that screens are not overloaded. • Screens shall be inspected regularly and changed out or patched immediately when defects are identified. • Operations should not be allowed to continue with a torn or ineffective screen. • Screens shall be washed down regularly e.g. on connections, prior to tripping out of the hole and before shakers are switched off. • Adequate stocks of screens, in an appropriate range of sizes, shall be maintained on location at all times. • The mud engineer should record the number of screens used on the daily mud report. • Ensure shaker screens are installed and tensioned as per the manufactures procedures

Table 21. Operational Guidelines for Shale Shakers

With new water based polymer mud, screen blinding may occur during the initial period of circulation. After one or two circulations, the shakers may be redressed with finer screens as the polymer shears , or the mud heats up.

A reduction in circulation rate and/or changing to coarser screens should alleviate screen blinding problems and drilling fluid losses arising from high viscosity drilling fluids and/or solids-laden drilling fluid after trips. However, circulation rate must only be reduced if it is absolutely certain that effective hole cleaning can be maintained.

5.4.1.3 Settling Tanks

This section describes the operational guidelines for settling tanks. Settling tanks shall:

- Not be by-passed.
- Be checked and dumped regularly.
- Not be dumped while circulating, as a dump valve malfunction could result in suspension of operations.

The operation of the dump valve shall be checked every time the settling tank is dumped and cleaned out. It is not always necessary to dump the complete contents of the settling tank, since this results in the immediate need for a large replacement volume within the circulating system. It may be easier to operate if smaller volumes of solids are dumped at more regular intervals.

Settling may be assisted by dilution, with water, to the returns flowline. However, this practice should not be routinely used with a weighted mud system.

5.4.1.4 Desanders and Desilters

The table below highlights the performance characteristics of the hydrocyclone equipment used for desanders and desilters, and provides an operational troubleshooting guide which may be used to rebalance a unit that is not correctly set up. Incorrect operation is extremely inefficient, and normally results in an excessive wastage of whole mud.

Underflow	Cause	Wear Pattern	Remedy
Spray discharge	Correctly set up	Grooving over lower two inches	None required.
Rope discharge	Overload of solids in feed and/or undersized cone apex (possibly caused by plugging)	Sharp grooving 1/3 way up cone and erosion of cone top due to solids in overflow	Increase apex size until spray discharge is achieved. If unsuccessful remove cone and clean out underflow blockage
Continuous flow discharge	Low inlet velocity that could be due to low feed head. Could also be caused by partial or total plugging of feeder head	Excessive wear at cone apex	Strip and clean feed header and regulate pump to provide + 75ft of head
Plugged discharge	Underflow plugging at cone apex caused by solids overload and/or restriction in underflow opening	Sharp grooving 1/8 way up cone and erosion of cone top due to solids in overflow	Strip down cone. Clean out blockage and reset apex size

Table 22. Hydrocyclone Troubleshooting Guide

In principle, desanders and desilters should only be run with unweighted water-based muds, and consideration should also be given to their use with polymer muds, as a significant proportion of material can be discarded in the process. It is essential that they are properly set up and adjusted.

Desanders and desilters shall be run under the following guidelines:

- Run on a continuous basis when appropriate, to assist in maintaining a low mud weight.
- Balanced to produce a spray discharge.
- Periodically flushed with water (particularly if they have been shut down for a period), to remove any caked solids that could lead to plugging of the feed nozzles or apex bushings.
- For optimum performance, the desander overflow should be rigged up to discharge into the desilter suction tank.
- Each desander and desilter shall be assigned a dedicated pump.
- Where possible, ultra-fine mesh screens should be used on the high speed shakers. This will minimise the requirement for hydrocyclones.

The following guidelines regarding the operation of the cones shall be followed:

- Cones shall be stripped and cleaned after every period of continuous (e.g. at the end of each well) use, particularly the feed nozzle, the two apex adjusting bushings and the body liner. Wear can critically affect hydrocyclone performance.
- The pressure operating within a cone is adjusted by the two apex bushings or the triangular bushing on each cone, and their size also affects the pressure. If large opening bushings are used, a higher capacity centrifugal pump may be required to maintain the optimum feed pressure.
- Required running pressure is as follows: $Pr(\text{psi}) = (MW/8.34) * 75 * 0.433$

5.5 MONITORING, REPORTING AND TESTING

This section describes the monitoring, reporting and testing of drilling fluids as performed by the Drilling Fluids Engineer.

5.5.1 Drilling Fluids Monitoring

The Toolpusher shall designate a suitably trained rig crew member to monitor the shale shakers and mud pits at all times while circulating. Part of the designated duties shall be to measure and record the mud density and funnel viscosity of the drilling fluid at the times shown in the Monitoring Report.

Mud weight and Funnel Viscosity tests shall be carried out on samples taken from the flowline and the suction pit every 30 minutes, or more frequently as determined by the Drilling Fluids Engineer and DSV.

The Drilling Contractor designated personnel shall record all drilling fluids test results and pit levels, where appropriate, in a book containing a format similar to that shown above.

The book shall:

- Be kept in a convenient place for ease of inspection by supervisory personnel.
- Contain all instructions passed to the designated crew member by the Drilling Fluids Engineer or DSV, clearly marking the time and date of the instruction.

The DSV shall determine the required mud weight to ensure safety of personnel and integrity of the wellbore, and shall advise the Drilling Fluids Engineer and the Drilling Contractor of this value.

When any departure from the mud weight specification is detected, the Drilling Fluids Engineer or Drilling Contractor shall inform the DSV immediately..

5.5.2 Drilling Fluids Testing and Reporting

The Drilling Fluids Engineer shall perform a full mud check at least twice daily during drilling operations and record the results on the Daily Mud Report Form. The mud check run closest to the 06:00 depth will be used on the Daily Drilling Report.

Additional reporting on the management of the drilling fluids, chemical usage and solids control equipment shall be performed by the Drilling Fluids Engineer or the DSV on a daily, per well and as required basis. Copies of all reports shall be submitted to the DSV for verification.

The Drilling Fluids Recap shall be continually updated by the Drilling Fluids Engineer during the course of the well. Upon completion of the well, the edited and checked document shall be forwarded at the earliest opportunity to the DM.

5.5.3 Water Based Mud Testing Requirements

The table below summarises the minimum drilling fluids tests required during drilling operations. Additional tests are at the discretion of the DM and DSV, and may also be planned on a well by well basis. All test results shall be recorded on the Daily Mud Report in API Standard Units. These shall be performed by the Drilling Fluids Engineer in accordance with the testing frequency.

Drilling Fluids Property	Unit of Measurement	Standard or Calibration	Measuring Equipment / Method
Mud Weight	ppg	8.34 ppg with fresh water	Mud balance
Funnel Viscosity	sec/qt	26.5 sec with fresh water	Marsh funnel and mud cup
Rheology	rpm	600,300, 200, 100, 6 & 3 rpm.	Six speed rheometer and heating cup
Plastic Viscosity (PV)	cps	600 minus 300	"
Yield Point (YP)	lbs/100sq.ft	300 rpm - PV	"
Gel Strength	lbs/100sq.ft	3 rpm at 10sec, 10min and 30min	"
API Fluid Loss	cc(or ml) per 30 min	Performed at 100psi and ambient temperature	API
HPHT Fluid Loss	cc(or ml) per 30 min multiplied by 2	Performed at 500psi and maximum TD temperature	HHP filter press
Filter Cake	mm or 32nd inch	Description	From fluid loss test
Oil/Water/Solids	% (HGS and LGS) by volume	Test with water (100%)	Retort kit
Sand Content	% by volume	Test with known solutions	Sand kit
pH	acid / alkalinity (0 to 14 scale)	pH test meter	pH meter, colour strips / litmus paper.
Methylene Blue Test (MBT)	lbs/bbl (5 x cation exchange capacity)	Test with known solution	MBT test kit
Chlorides	Mg/l	Test with known solution	Filtrate titration
Potassium Ion / KCl	Mg/l / %	Test with known solution	Titration / centrifugal precipitation
Hardness (Ca and Mg)	Mg/l	Test with known solution	Filtrate titration
Alkalinity (Mud & Filtrate, Pm, Pf, Mf)	ml standard sulfuric acid	Test with known solution	Mud and filtrate titration
PHPA	lbs/bbls (ml or cc precipitation)	Test with known solution	Centrifugal precipitation

Table 24. Minimum Drilling Fluids Testing Requirements, Units and Standards

**CHAPTER 6
TRAJECTORY CONTROL**

TABLE OF CONTENTS

6.1	OBJECTIVES	2
6.2	RESPONSIBILITIES	2
6.3	GENERAL SURVEY REQUIREMENTS	2
6.4	DIRECTIONAL DRILLING	4
6.4.1	Planning Requirements	4
6.4.2	Survey Requirements	6
6.4.3	Magnetic Survey Equipment	6
6.4.4	Tie-in Data	7
6.4.5	Position Uncertainty	7
6.5	GENERAL SURVEY PRACTICES AND GUIDELINES	9
6.5.1	Wellsite Survey Quality Control Procedures	9
6.5.2	MWD Running Guidelines	10
6.5.3	MWD Survey QA/QC Guidelines	10
6.6	DIRECTIONAL DRILLING - ROTARY	12
6.6.1	General Guidelines	12
6.6.2	BHA Stabilisation	12
6.6.3	Bottom Hole Assemblies	13
6.6.4	Directional Drilling with Rotary BHAs	14
6.7	SIDETRACKING	15
6.7.1	Kick-off Point Selection	15
6.7.2	Kick-off Plugs	15
6.7.3	Casing Windows	16
6.7.4	Sidetracking on the Low Side of the Hole	16
6.8	DIRECTIONAL DRILLING REQUIREMENTS	17
6.8.1	Preparation	17
6.8.2	Kick-off and Initial Build Selection	17
6.8.3	High Angle/Extended Reach Tangent Sections	17
6.8.4	Final Build and Horizontal Hold Section	19
6.8.5	Common Problems and Remedies	21
6.8.6	Mudmotor Operating Practices	21
6.8.7	General Recommendations when Using Mudmotors	22
APPENDIX 1		23
1.1	Lateral Position Uncertainty	23
1.2	Worked Example	24
1.3	Ellipse of Uncertainty	26

6.1 OBJECTIVES

The objectives for trajectory control are as follows:

- Attain the required bottom hole position within the required tolerance.
- Achieve the planned trajectory without a Dogleg Severity that exceeds the programmed specification.

In most cases, well trajectory control simply means ensuring that a planned vertical wellbore is drilled vertically.

Note: GSLM shall survey all wellbores from surface to TD, with instruments suitable for this use.

6.2 RESPONSIBILITIES

Responsibilities for the implementation, supervision and verification of directional drilling and surveying are tabulated below.

Task	Performed by	Verified by
Specification of target and surface location	Geology Dept	DM
Preparation of well trajectory plan and kick-off point	Directional Contractor	DM
Equipment selection	DM	DM
Call out of contractor supplied equipment	DM	DM
Monitoring well trajectory	DSV	DM
BHA design and bit selection	DSV / DM	Dm
Wellbore surveying	DSV / Drilling contractor	DSV / DM

Table 25. Responsibilities for Implementation, Supervision and Verification of Directional Drilling and Surveying.

6.3 GENERAL SURVEY REQUIREMENTS

The surveying program shall be defined in the Drilling Program, based on the guidelines below.

Surveys are normally performed using the Totco or Magnetic Single Shot (MSS) tool. Directional surveys can also be run as part of the wireline logging program.

Survey tool selection may be reviewed however, depending on target size and depth, and the level of accuracy required. Survey intervals shall be specified for each well.

The following table provides an outline of the minimum standard survey parameters for vertical wells. Note: Survey frequency may be increased if the deviation increases above the specified limits.

Interval	Survey Tool	Frequency	Maximum Inclination	Maximum DLS
Surface hole	MSS/Totco	Every 150 m	3 degrees	1.5 degrees/30 m
Intermediate hole	MSS/Totco	Every 150 m	5 degrees	1.5 degrees/30 m
Production hole	MSS/Totco	Every 150 m	6 degrees	1.5 degrees/30 m

Table 28. Standard Survey Parameters for Vertical Wells

If the surveys fall outside the above parameters the DM should be notified. No corrective action should be taken without consulting with the DM. Confirm with DM before running surveys through or below known depleted zones.

All survey instruments shall be run as close to the bit as possible. The hole must be sufficiently circulated prior to running surveys (this will normally be at least 1x bottoms up), to ensure that hole conditions are stable and the drill string is kept stationary for as little time as possible.

All surveys recorded on the daily drilling report shall be referenced to Magnetic North, not True North or Grid North. Surveys will be corrected to true north by the DM. Directional surveys will normally reference grid north.

6.4 DIRECTIONAL DRILLING

This section describes the planning, implementation and verification of surveying requirements during drilling operations on deviated or high angle wells.

6.4.1 Planning Requirements

The Drilling Program contains all the information necessary for the preparation and commencement of directional operations. As such the DSV shall check the Drilling Program and associated documentation to ensure that it contains the following:

- Assumed ground level elevation above M.S.L.
- Target co-ordinates, target size and tolerance(s).
- Origin Reference Points for the applicable well surface location.
- Kick-off point, build and turn rates.
- Survey Program.
- Recommended BHA's to be used including agreed dogleg severity potential values for each assembly. The BHA's quoted are to be used as a guide and modified as drilling conditions and directional requirements dictate.

Where the above data has been omitted, it shall be requested by the DSV before the start of operations. The DSV shall ensure that all well plots are available. However no well plots are required for standard vertical wells.

6.4.2 Survey Requirements

All wells shall be surveyed from the wellhead to TD using the guidelines specified in Section 6.3 of this Manual and those below.

Task	Description
Planning	<ul style="list-style-type: none"> • Survey type shall be based on the anti-collision requirements (if applicable), survey tool accuracy, target size and depth. • Survey accuracy objectives shall be specified for each well.
Calculations	<ul style="list-style-type: none"> • The preferred method of survey calculation is the Minimum Curvature method. Other calculation methods may be used to verify survey results. • Magnetic interference calculations based on region and well orientation shall be performed by the Directional Contractor to determine the minimum length of non-magnetic drill collars and stabilisers if required for clean magnetic surveys.
Reporting	<ul style="list-style-type: none"> • All survey data reported to on the Daily Drilling report shall be UNCORRECTED (e.g. referenced to magnetic north). • The Azimuth shall be reported in degrees and not quadrants (i.e. will be reported as 190° not S10°W). • The values for convergence and declination used shall be reported on all definitive surveys. Survey tool accuracy shall be specified on all definitive surveys presented to GSLM. • Survey results shall be referenced to the local grid for reporting purposes.
Verification	<ul style="list-style-type: none"> • The quality of all multi-shot surveys taken shall be checked by the Surveying

	Contractor and verified by the DSV using the approved acceptance criteria (Refer 6.5.1).
--	--

Table 27. Survey Requirements.

6.4.3 Magnetic Survey Equipment

All downhole survey instruments shall have a valid inspection certificate and shall conform to standard DS-1 Drilling Service Category 4. For normal use, certificates shall be valid for a period of up to 18 months; however if any tool has been subjected to rough treatment or has produced erroneous survey data, then it shall be returned to the certified re-calibration facility for re-calibration and testing.

Magnetic interference calculations based on region and well orientation shall be performed by the Directional Contractor to determine the minimum length of non-magnetic drill collars (and stabilisers if applicable) required for clean magnetic surveys.

All tools supplied to the rig shall be accompanied by the appropriate documentation. In accordance with good oilfield practice, all pin connections shall be stress-relieved and all boxes bored back.

From time to time, as operations progress, additional information will be required by the Directional Contractor to facilitate accurate monitoring and reporting of the borehole position. The DM shall ensure that this information is transmitted to the rig, marked for the attention of the DSV, as and when required.

 Standard DS-1 Drilling Service Category 4.

6.4.4 Tie-In Data

For directional wells, tie-in data shall be provided by the Directional Contractor after completion of quality assurance checks on each multi-shot survey.

The Directional Contractor shall forward the data to the DM, who shall validate the results and issue the following data to the rig:

- Tie-in depth RT (m).
- Inclination (degrees).
- Azimuth (degrees).
- TVD RT (m) - True Vertical Depth Rotary Table.
- Northing (m).
- Easting (m).
- Ground Level (m asl)

6.4.5 Position Uncertainty

Borehole position uncertainty can be evaluated in the lateral, radial and vertical directions for both 'good' and 'poor' quality magnetic and gyro surveys. For most practical cases, lateral position uncertainty is the greatest and therefore can be used to estimate borehole position uncertainty.

Computed survey errors have been used to produce curves showing the lateral position uncertainty for various survey tools. These have been normalised to express the relative position uncertainties in feet per 300 m AHD against average inclinations.

Appendix 1 of this Chapter contains a set of curves demonstrating tool comparisons, and provides an approximation of the position uncertainty of a well. Ellipses of uncertainty are included in this section as a quick look guide.

6.5 GENERAL SURVEY PRACTICES AND GUIDELINES

This section describes running guidelines for wireline, multishot and MWD survey equipment and describes the quality control procedures associated with running the tools.

6.5.1 Wellsite Survey Quality Control Procedures

It is the responsibility of the DSV to ensure that the following procedure is performed, following completion of a well survey:

1. The Surveying Contractor shall report the data obtained for each survey run to the DSV.
2. The DSV shall check reported values conform to the acceptance criteria outlined below:

The Variance Between the:	Shall not Exceed
In-run and out-run inclination values for survey data from the same survey station	0.23 degrees
In-run and out-run azimuth values from the same survey Station	1.0 degree for all stations having an inclination of 10 degrees or over
In-run and out-run azimuth values from the same survey station	5.0 degrees for all stations having an inclination below 10 degrees

Table 29. Acceptance Criteria for Well Surveys

3. When the acceptance criteria are met, no further well site QA / QC shall be performed. The final survey report shall be subjected to a full quality control examination by the DM.
4. In the event that all the acceptance criteria are not met, the DSV shall inform the DM who shall advise further action. Repeat surveys shall only be undertaken with the full approval of the DM.
5. In the event of a survey miss-run, DM approval for a repeat survey shall not be required. In this instance the DSV shall ensure that all questionable equipment is replaced with fully checked-out units prior to the re-run of the survey.

6.5.2 MWD Running Guidelines

The MWD tool is a combined magnetic steering and surveying tool run close to the bit. It measures inclination, azimuth and toolface. The following guidelines shall be observed when running an MWD:

- Measure the fishing neck of the MWD tool.
- Run mud filter screens. It is preferable to have these installed in the surface equipment rather than in the top drill pipe single.

- Considerable care should be taken whenever handling MWD tools. They are built to withstand high axial loads but are easily damaged by transverse loading. MWD collars should always be snubbed when being handled out of transport cradles.
- Surveys should always be taken after making a connection in order to reduce the chances of stuck pipe. Although the pipe should remain stationary when the survey is being taken it should be reciprocated during transmission of the data to surface.

Benchmarking surveys should be taken in accordance with the MWD Survey QA/QC guidelines detailed below..

6.5.3 MWD Survey QA/QC Guidelines

The following guidelines should be routinely applied to assess the validity of MWD survey data. Adherence to the procedures below will assist identification of incorrect data.

6.5.3.1 Surface Function Test

The MWD tool shall be function tested at surface according to contractor procedures. Two tools should be prepared to ensure a back-up is ready in the event that the surface test fails. The tests shall be performed as follows:

1. Make up the MWD, aligning the scribe mark on the motor or bent sub to the MWD. The toolface offset shall be recorded by the Directional Drilling Contractor who shall supervise the operation.
2. Circulate directly above the MWD (with the bit and motor made up) at the planned flow rate. Record pressure versus flow rate and check performance of the tool.
3. Check the total gravitational field readings that should be close to unity.

6.5.3.2 Benchmark Survey

The following guidelines should be adhered to when performing a benchmark survey:

1. Take a survey in open hole at a suitable survey station at least 100' below the previous casing shoe to avoid magnetic interference and in order to provide a benchmark. Survey inclination should be within 0.5 degrees of the survey originally recorded at this station. Survey azimuth should agree within 2 degrees for survey stations above 10 degrees inclination.
2. Repeat the benchmark survey at the final survey station of the previous bit run before drilling ahead.
3. If the benchmark survey does not meet the above criteria, work the pipe and check the survey again at this or the following previously surveyed station.

Note: Repeatability of benchmark survey results is prone to variance below 10 degrees of hole inclination. BHA centralisation, borehole anomalies, washouts and deformations could be the cause lack of repeatability. In the event of failure to meet the benchmarking acceptance criteria the DE shall advise further actions.

6.5.3.3 Survey Quality Checks

When the MWD tool transmits a sequence of quality control outputs with every survey, they can be used to validate the quality of the survey and check the correct functioning of the tool.

The level of quality control that is possible with the MWD depends on the number of "full survey" stations which have been obtained with the particular MWD tool within the hole section. At least the first, fourth, seventh, etc, stations shall be taken in full survey mode.

When long survey quality control outputs are obtained, the DSV shall check that all raw magnetic values are similar to computer predictions for the date and location provided by the MWD Service Contractor.

6.6 DIRECTIONAL DRILLING – ROTARY

During directional drilling the DSV shall supervise and monitor the activities of the Directional Drilling Contractor on behalf of GSLM.

6.6.1 General Guidelines

In general, only the bit, drill collars, and stabilisers are considered for trajectory control. The specific drilling operation shall determine the rest of the BHA components (e.g. shock subs, hammers, mud motors, MWD, jars, accelerators, heavy weight drill pipe, transitional drill collars, etc.).

The following guidelines should be considered when checking the proposed BHAs.

- Only the lower 30 m of the BHA provides deviation control. More drill collars and additional stabilisers are used to provide additional weight and to provide standoff from the wellbore and to prevent drill collar "wobble" during drilling.
- In areas of strong formation dip, local knowledge, experience and computer modelling should be used when selecting BHAs to build or maintain hole inclination. These assemblies are more susceptible to the azimuth tendencies imposed by strongly dipping formations. Stabiliser sizes should be varied at the discretion of the Directional Drilling Contractor depending upon conditions encountered in individual wells.
- The following calculation shall be used to determine the neutral point of buckling:

$$\text{Weight of BHA in Air} = \frac{\text{Required WOB}}{\text{Bouyancy Factor} \times \text{Safety Factor}}$$

The Safety Factor depends upon the type of BHA stabilisation. It is generally 85%, unless otherwise specified in the drilling program.

Further analysis is required to determine the neutral point of axial stress for BHA components, e.g. running drilling jars in compression or tension..

6.6.2 BHA Stabilisation

The following considerations shall be used to determine the BHA stabilisation configuration to be used:

- When it is desirable to prevent bending moment being carried through to the bit from the BHA above, a packed hole (or stiff) BHA should be selected. This arrangement can be used either in vertical or deviated wells where it is desirable to hold azimuth and inclination.
- In packed hole assemblies, the near bit stabiliser must be full gauge. The first string stabiliser should normally be full gauge. However, under-gauge, first string stabilisers are sometimes used to hold angle in deviated holes where there is a tendency to drop.
- In addition to improving the steerability of the drilling assembly as described above, stabilisers are also important in providing stand-off of the BHA from the wellbore, decreasing the possibility of differential sticking.
- In general, full 360° wall contact stabilisers should be used to prevent gouging the wellbore. In soft formations, integral blade stabilisers are preferred. As formation strength increases, roller reamers may be used to reduce torque.

6.6.3 Bottomhole Assemblies

Each generalised configuration of bottomhole assembly shown below represents a typical directional tendency while drilling. The effect of the tendency is dependent on a number of variables, including:

- Formation hardness and bed dip.
- Bit type.
- Stabiliser type and diameter.
- Hole size and drilling parameters, such as weight on bit and rotary speed.

Stabiliser wear in abrasive formations has a significant effect on directional tendency.

The diagram below describes the general stabiliser placements for drilling vertical or directional 8½" hole and 6 1/8" hole.

BHA's for directional wells will be detailed in the Drilling Program for that well. Chapter 3 of this Manual provides more detailed summaries of each BHA configuration.

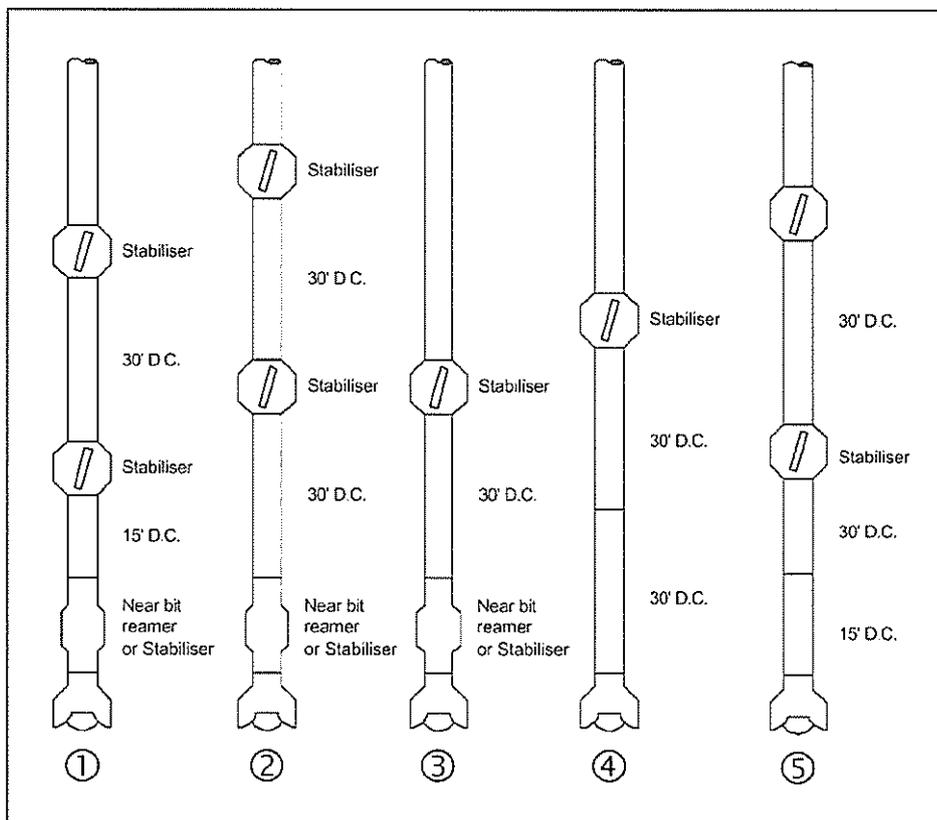


Table 30. Standard BHA Configurations in Nominally Vertical Wells

BHA	17 1/2" Pendulum	12 1/4" Pendulum	8 1/2" Pendulum	8 1/2" Packed	6 1/8" Pendulum	6 1/8" Packed
1	17 1/2" bit	12 1/4" bit	8 1/2" bit	8 1/2" bit	6 1/8" bit	6 1/8" bit
2	2 x 8" DC	8" Motor	6 1/2" Motor	NBRR	4 3/4" Motor	NBRR
3	Stabiliser	2 x 8" DC	6 1/4" DC	6 1/2" motor	4 3/4" DC	4 3/4" Motor
4	1 x 8" DC	Stabiliser	Stabiliser	Stabiliser	Stabiliser	Stabiliser
5	11-15 x 6 1/4" DC	1 x 8" DC	20-26 x 6 1/4" DC	6 1/4" DC	20 x 4 3/4" DC	4 3/4" DC
6	6 1/2" Jars	11-20 x 6 1/4" DC	Jars	Stabiliser	Stabiliser	Stabiliser
7	2 x 6 1/4" DC	6 1/2" Jars	2-3 6 1/4" DC	20-26 6 1/4" DC	20 x 4 3/4" DC	20 x 4 3/4" DC
8	6 x 4 1/2" HWDP	2 x 6 1/4" DC	6 x 4 1/2" HWDP	6 1/4" Jars	4 3/4" Jars	4 3/4" Jars
9		6 x 4 1/2" HWDP		3 x 6 1/4" DC	3 x 4 3/4" DC	3 x 4 3/4" DC
10				6 x 4 1/2" HWDP	6 x 3 1/2" HWDP	6 x 3 1/2" HWDP
Comments	Available WOB 25 - 40 klb	Available WOB 25 - 45 klb A mud motor may be run immediately above the bit.	Available bit weight approx 40klb	Available bit weight approx 40 klb.	Available bit weight approx 33 klb.	Available bit weight approx. 34 klb.

NOTE: Consideration should be given to using a slick BHA when drilling the Diorite commonly found in Tasmania.

6.6.4 Directional Drilling with Rotary BHAs

The natural tendency for a bit to drill perpendicular to bedding at low to moderate dip angles may be used to reach targets by optimum rig positioning. In areas where formation dip influence and directional surveys are well documented, consideration should be given to moving a drilling pad in order to achieve a tight target tolerance using conventional rotary drilling.

In general, the following shall apply (although specific wells may differ):

- In general rotary BHA's tend to build angle and directional control is maintained by selecting a BHA which gives the desired Build-up Rate (BUR).
- Due to generally strong build tendencies, the Directional Drilling Contractor should err on the low side of the deviated section, as it is generally easier to make a build correction than a drop correction.
- Maximum desired Build Up Rate is normally 2 1/2 to 3 degrees/ 30 m. Dog-Leg Severity is generally 5 degrees/ 30 m.
- The abrasive nature of formations must be considered as stabiliser gauge wear can alter during the course of a bit run. This may change the directional characteristics of the BHA.
- Heavy Weight Drill Pipe (HWDP) and drill pipe must have smooth and flush hardfacing in accordance with API RP7G.

 API RP7G (Specifications for Drill Pipe).

6.7 SIDETRACKING

Wells may require side-tracking for various reasons. These include, but are not limited to the following:

- Re-drill the well to a new target.
- Sidetrack past a fish.
- Sidetrack due to hole problems.

The main requirement in sidetracking a well is the development of a lateral force to allow the bit to cut on the side of the hole. This lateral force should be provided by the geometry of the BHA, forcing a cut on the side of the hole. Historically, the most effective BHA configuration to achieve a successful sidetrack kick-off is a mud motor with bent sub or steerable motor. This section provides guidelines and considerations for achieving a successful kick-off.

6.7.1 Kick-Off Point Selection

If possible, the kick-off location should be selected so that the formation is softer than the kick-off plug to increase the chances of obtaining a successful kick-off.

If, however, only medium to hard formations exist at the required side-track depth, operational difficulties and time are increased. A controlled ROP should be maintained until confirmation of a successful kick-off is achieved.

6.7.2 Kick-Off Plugs

The general requirements for setting sidetrack cement plugs are as follows:

- Cement plugs shall have a minimum length of 90 m in open hole.
- Cement slurry shall be a minimum 16.5ppg, to be confirmed by laboratory testing.
- Cement plugs should be batch mixed, if possible.
- Run a tubing stinger at least equal to the length of the cement plug.
- Consider running a pre-flush prior to balanced cement plugs, at least equal to the weight of the mud.
- A Hi-Vis pill may be spotted below the plug.

The procedure for drilling kick off plugs should be as follows:

1. Pull out of plug slowly.
2. Circulate conventionally to clean string (do not reverse circulate, to avoid traces of cement remaining in the string that may fall onto mud motor when drilling recommences).
3. RIH with mill tooth bit. Wait on cement for a minimum of 12 hours.
4. Dress off 5 m, and weight test the plug.
5. If the cement appears to be hard, RIH mud motor and bent sub. Wait a minimum of 24 hours from pumping cement before attempting to kick-off. Wait longer if necessary to achieve hard cement.
6. If the plug does not show signs of compressive strength, drill and wash through sufficient cement to allow placement of a second 90 m plug at a suitable depth for sidetracking.

6.7.3 Casing Windows

When preparing to cut a casing window, the following guidelines should be applied:

- When making the initial cut, care should be taken to avoid casing collars and centralisers.
- The cut should be initiated a minimum of 3 m above a casing collar.
- The lengths of window to facilitate an effective sidetrack are tabulated below:

Casing Size	Minimum Window	Optimum Window
7" Casing	9m (30')	12 m (40')
9 5/8" Casing	10.51 m (35')	15 m (50')

Table 31. General Lengths of Window to Effect a Sidetrack.

6.7.4 Sidetracking on the Low Side of the Hole

At commencement of a sidetrack, the low side sidetrack can take off rapidly. As there is a risk of creating high doglegs in this instance, it may be preferable to come off at a low right or low left angle rather than a direct vertical drop off. Once the new hole has been cut, lateral separation should be maintained to prevent collapse of the old hole onto the new.

6.8 DIRECTIONAL DRILLING REQUIREMENTS

The following section provides a series of guidelines and considerations relating to the drilling of high angle or horizontal wells. The guideline and considerations are presented to augment the well design and directional contractor procedures and provide a broad overview of the required practices, procedures and considerations to assist in the maintenance of safe, efficient and cost effective operations whilst drilling high angle and horizontal hole sections.

6.8.1 Preparation

Effective equipment preparation and full dissemination of programme requirements and drilling procedures are essential for the successful completion of high angle and horizontal wells.

1. Daily Briefings

A routine daily meeting should be held between well site and office to identify potential problem areas, the forward program and logistical requirements for the forthcoming 24hr period.

This section describes the requirements to be considered during directional drilling activities.

6.8.2 Kick-Off and Initial Build Selection

1. An initial kick-off and build section with smooth build rates is required to minimise torque and drag in deeper critical hole sections. The DSV should ensure all personnel are aware of this requirement and that potentially troublesome doglegs are wiped immediately.
2. Excessive doglegs or a drop in build rate have a much greater effect on torque and drag in top hole than in deeper hole sections. Extensive use of torque and drag analysis while drilling shall be made to assess the impact of directional variations on the overall directional operations plan.

6.8.3 High Angle/Extended Reach Tangent Sections

6.8.3.1 Bit Selection

The choice of bit should take into account the degree of reactive torque produced and the limitations of the motor. For instance some PDC bits can make motor tool face control difficult resulting in erratic hole, increased torque and drag and low ROP's. The use of motor bearing three-cone bits is often preferred for these sections.

The design criteria when selecting three-cone bits are:

- Maximise penetration rate to limit open hole time.
- Extended bearing life to reduce the frequencies of bit trips.
- Bits should be resistant to cone erosion as greater than normal flow rates are required for hole cleaning.
- Enhanced gauge protection on cutters, shank and shirt tail in order to withstand the increased lateral loading when used with steerable systems.

The design criteria when considering PDC bits are:

- Maximise penetration rate to limit open hole time.

- Small cutter size to reduce reactive torque and enhance steering capability.
- High cutter density and gauge studs to limit gauge wear.

6.8.3.2 Hydraulic Requirements & Practice

Efficient hole cleaning is essential to the success of directional drilling. As such all hydraulic programs should be designed for maximum hole cleaning capability as follows:

- Circulate at the highest possible rate within the constraints of ECD on weak formations. Install a by-pass nozzle on mud motors to increase flow area if necessary.
- Circulate the hole clean (as much as practical) prior to commencing a trip, a minimum of 1.5 times the bottoms up volume is normally required.
- Consider using a hi vis / low vis / hi vis sweep regime to facilitate disturbance and removal of cuttings beds. Keep pipe rotating while pill circulating.
- Apply enhanced monitoring of drilling parameters for increases in torque and drag.
- Perform wiper trips as required.
- Ensure Fann viscometer 6 rpm reading is 1.0 – 1.5 times hole diameter.

6.8.3.3 Casing Wear Monitoring and Prevention.

- Install 2 ditch magnets in the flowline or possum belly to monitor casing wear. The amount (weight) of recovered shavings should be reported daily.
- HWDP and drill pipe should have smooth hardfacing only.

6.8.3.4 BHA Component Inspections

All BHA components should have received a full inspection prior to use on a directional well. The complete BHA should be returned for further inspection after completion of the well.

Stress relief grooves are required on all components (including non-magnetic components and jars).

6.8.3.5 Drilling Jars

Enhanced hydraulic (up/down) short jars should be used. Use of a drilling accelerator or 2 jars should be considered.

6.8.4 Final Build and Horizontal Hold Section

6.8.4.1 Bit Selection

The criteria for bit selection are identical to those detailed in section 6.8.3 above. The following figure illustrates the common problems encountered when drilling horizontal hole sections and potential preventative measures relating to bit selection.

PROBLEMS ENCOUNTERED	PREVENTATIVE MEASURES
Side-Loading Using Steerable Systems	Shorten shank or gauge length Increase gauge protection Opt for rotary drilling if possible
High Torque - Reduced Directional Control	Use less aggressive PDC Shorten gauge length of PDC bit Increase Number of gauge cutters Opt for Roller Cone Bit
Difficulty Maintaining Hole Angle	Longer Gauge Length on PDC Bits Lug Pads On Roller Cone Bits Use Steerable system
Excessive Cuttings Bed Generation	Use Lug Pads on Roller Cone Bits Increase gauge cutters on PDC bits (Both measures to facilitate efficient back-reaming operations)
Reduced Bit Life Due To Motor Use	Use PDC Use Motor Bearing Roller Cone Bits Use Low speed PDMs Opt for rotary drilling if directional control allows

Table 32. Bit Selection Guidelines

6.8.4.2 Drilling Fluids & Hydraulics

As per 6.8.3., item 2.

6.8.4.3 Drilling Jars

Two sets of jars can be run. Place one set above the DC's. Place a second set in the cased hole section.

6.8.4.4 Drill Pipe Requirements

Drilling horizontal sections places high buckling and torque stresses on the DP. Use of torque and drag analysis is essential to predict actual loads and determine the grade of drill pipe required. Actual requirements and design loads shall be indicated in the Drilling Programme.

Drill pipe should be fully inspected prior to use on high angle or horizontal wells.

6.8.4.5 BHA Design

The directional contractor shall use offset well and contractor experience to design the BHA.. The DSV and Directional Drilling Engineer shall base their BHA configurations on those proposed, however modification based on the previous BHA runs will be required. The use of steerable systems which have a neutral tendency in rotary mode are optimum for these hole sections.

6.8.4.6 Casing Wear Monitoring & Prevention

- Install 2 ditch magnets in the flowline or possum belly to monitor casing wear. The amount (weight) of recovered shavings should be reported twice daily.
- HWDP (and DP rotating within the casing) should have smooth hardfacing only.
- Consideration should be given to using drill pipe casing protectors.

6.8.4.7 Data Recording

Successful performance in horizontal drilling of wells requires the development of a comprehensive database of experience as optimum practice is often very area specific. As such all personnel should be reminded of the requirement to accurately record all possible data, specifically:

- Drilling parameters used, WOB, RPM, Torque, pressures, circulation rates etc.
- Motor condition, stabiliser wear patterns.
- Mud properties.
- Comparison of predicted vs. actual BHA performance.
- Survey data, toolface control data.
- Hole conditions on trips.
- Formation data, hydrocarbon data (gas compositions ratios etc.).

6.8.5 Common Problems and Remedies

Problems commonly encountered in drilling extended reach and horizontal wells are illustrated in the table below.

Problem	Recommended Precautionary Measures
Inefficient Hole Cleaning and Reduced Borehole Stability	<ul style="list-style-type: none"> • Maintain high annular velocity, use turbulent flow pattern wherever possible. • Use low rheology fluid (horizontal sections) 6 rpm = 1.5 to 1.0 x hole size. • Use extended rheology drilling fluids for high angle 12 ¼" and larger hole sections. • Pump in/out of the hole - rotate as much as possible. • Perform frequent wiper trips. • Monitor drilled cuttings for signs of caving.
Poor Tool Face Control - Weight Stacking	<ul style="list-style-type: none"> • Monitor torque closely. • Use single bend steerable systems. • Drill in rotary mode as much as possible. • Orient after connections. • Use water-melon profile stabilisers. • Minimise heavy BHA components. • Monitor helical buckling of drill pipe in orienting mode.
Casing Wear - Excessive Torque and Drag	<ul style="list-style-type: none"> • Use minimum HWDP - smooth hardfacing only (also on DP rotating within casing). • Install flowline magnets - record metal filings recovered twice daily. • Record torque values at the shoe on every trip. • Wiper trip at first signs of increasing torque/drag. • Keep BHA as light as possible. • Use non-rotating DP protectors in casing.
Drill String Failures	<ul style="list-style-type: none"> • Ensure full inspection prior to well. • Perform visual inspection on every trip. • Monitor rotary torque closely. • Ensure adequate back-up equipment availability. • Perform full inspection of drill string after completion of the well.

Table 33. Recommended Precautionary Measure for Problems in Drilling Directional Well Sections.

6.8.6 Mudmotor Operating Practices

The following practices should be applied to ensure efficiency of motor operations:

a. Surface Checks

- Check the bent sub offset to ensure it is as planned.
- Make up the motor, (MWD if used) and bit. Test the motor and MWD at two or 3 differing flow rates, record circulating pressures and rates.
- Lock the hook and ensure bent sub orientation is tracked while RIH (align the I I scribe mark on the motor with that of the MWD, if used).
- Ensure dump valve installed to avoid tripping out wet.

b. Running In The Hole

- Check the string is full every 10 stands, or if a float is used, fill the drill pipe every 10 stands.
- Care should be taken when running in open hole. Damage to the motor bearings or bit may occur from hitting hard ledges of formation, particularly with a high angle bent sub.
- Wash down the last stand, gently tag bottom, establish the required tool face before commence drilling.

c. Tripping Out Of The Hole

- No rotation of the drillstring should occur when using a high angle bent sub (greater than 2 degrees).
- Circulate bottoms up at the shoe where the shoe is at a high angle.

d. Motor At Surface

- Inspect the body for signs of wear and damage.
- Check the play in the bearing section by manipulation of the bit box on the motor to evaluate bearing wear based on the play and determine if the motor is to be re-run.
- Test the motor at the same flow rates as in the surface test in 1 above and compare resulting circulating pressures. It is normal to see some reduction in pressure as the motor/stator tolerance increases.

6.8.7 General Recommendations When Using Motors

a. Bit Selection

Select suitable bit and motor combinations. Where PDC bits are used, they should generally have a diamond reinforced gauge of short length (for steerability).

b. Spiral vs. Straight-blade stabilisers

All stabilisers should have short blade, barrel profiles to reduce wall contact. The difference between spiral and straight blades is formation dependent.

c. High Speed Vs. Low Speed Motors

In general there is little ROP improvement with faster motors. The shorter, high torque, low speed motors enhance steerability and provide longer bearing life for rock bits.

Appendix I: Lateral Position Uncertainty

The set of curves shown below demonstrate tool comparisons and provide an approximation of the position uncertainty of a well. The positional estimate is made by dividing the well into sections and using the curves to estimate the uncertainty for each section. The results are then summed to obtain the total position uncertainty. A worked example is given after the figure below to demonstrate the application of the curves.

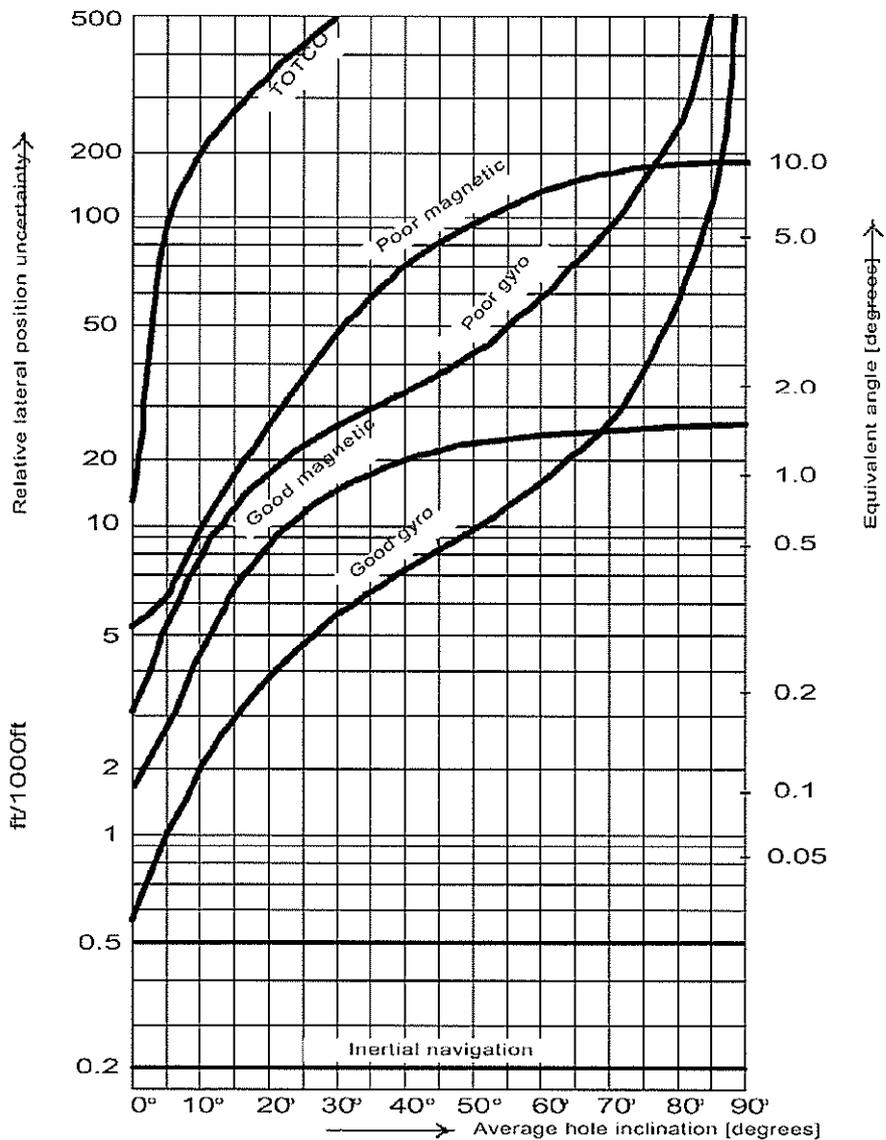


Figure 5. Lateral position Uncertainty – Tool Comparison

Appendix II: Worked Example

The following worked example uses the Lateral Position Uncertainty curves above to demonstrate the approximate positional uncertainty for the well, based on a "good magnetic survey".

The well is divided into 3 sections (see Simplified Sections of Example Well, overleaf)

- Section 1 A vertical section from 0 to 550m (1800') AHD.
- Section 2 A tangent section with an inclination of 18.5° from 550m (1800') to the target at 975m (3200').
- Section 3 A tangent section with an inclination of 18.5° from 975 m (3200') to TD at 1143m (3750').

The position uncertainty from each section can then be estimated.

Section 1 (The vertical section from 0 to 550m {1800'})

From the 'good magnetic' curve at 0° inclination, 1.8' per 1000' is obtained.
The Along Hole depth of this section is 550m {1800'}
the uncertainty radius is $(1800/1000) \times 1.8 = 3.2'$ or 0.975m

Section 2 (The tangent section from 550m to 975 m {1800 to 3200'} AHD)

From the 'good magnetic' curve at 18.5° inclination, 8.25' per 1000' is obtained.
The Along Hole depth of this section is $975-550\text{m} = 425\text{m}$ { $3200-1800' = 1400'$ }
The uncertainty radius is $(1400/1000) \times 8.25 = 11.5'$ or 3.505m

Section 3 (The tangent section from 975m to 1143 m {3200 to 3750'} AHD)

The same uncertainty of 8.25' per 1000' is obtained from the curve.
The Along Hole depth of this section is $1143-975\text{m} = 168\text{m}$ { $3750-3200' = 550'$ }
The uncertainty radius is $(550/1000) \times 8.25 = 4.5'$ or 1.372m

Summation of errors from individual sections

From the above Sections, the position uncertainty at the target will be the uncertainty of Section 1 added to Section 2 = $3.2 + 11.5 = 14.7'$, rounded up to 15' (4.48 m).

Thus the estimated position uncertainty at the target is a circle with radius 15'. (4.48 m)

At TD the uncertainty will be the uncertainty at the target added to the uncertainty of Section 3 which is $15 + 4.5 = 19.5'$ rounded up = 20'. (5.94 m)

Thus the estimated position uncertainty at TD, is a circle with radius 20'. (5.94 m)

Note:

This method of estimating position uncertainty produces a circle of uncertainty, and should only be used as a guide to possible error. In reality the uncertainty will be an ellipsoid which, when calculated with a computer will give a smaller and better defined position uncertainty of a well. For any work involving well position uncertainty, the ellipsoids should be used.

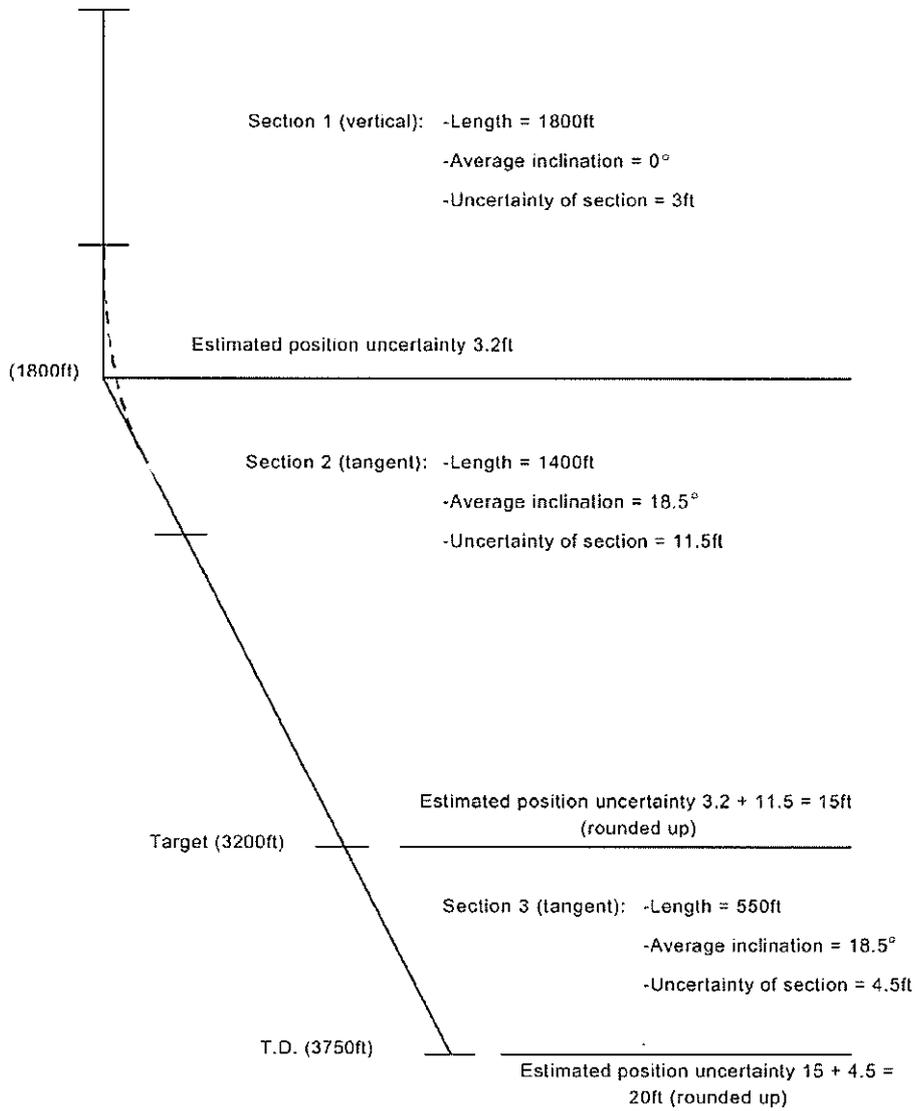


Figure 6. Simplified Sections of Example Well

Appendix III: Ellipse of Uncertainty

**Ellipse of Uncertainty
Along E-W Axis**

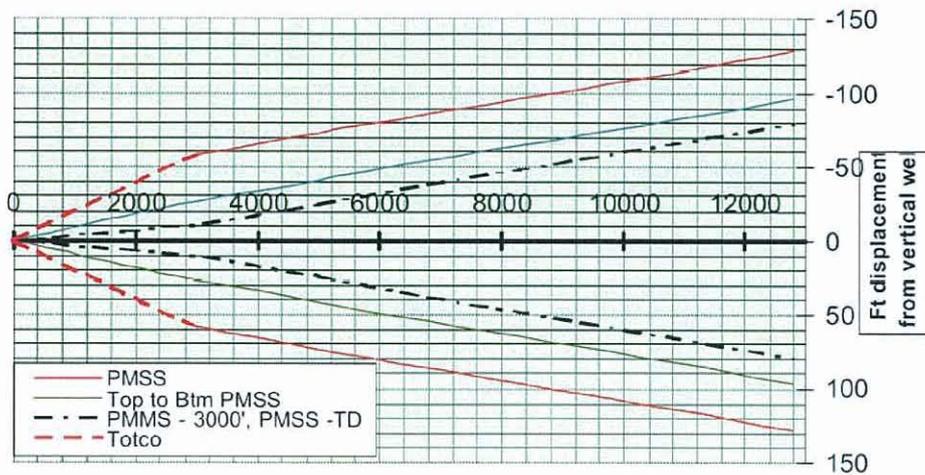


Figure 7. Ellipse of Uncertainty – Along E-W Axis

**Ellipse of Uncertainty
Along Major N-S Axis**

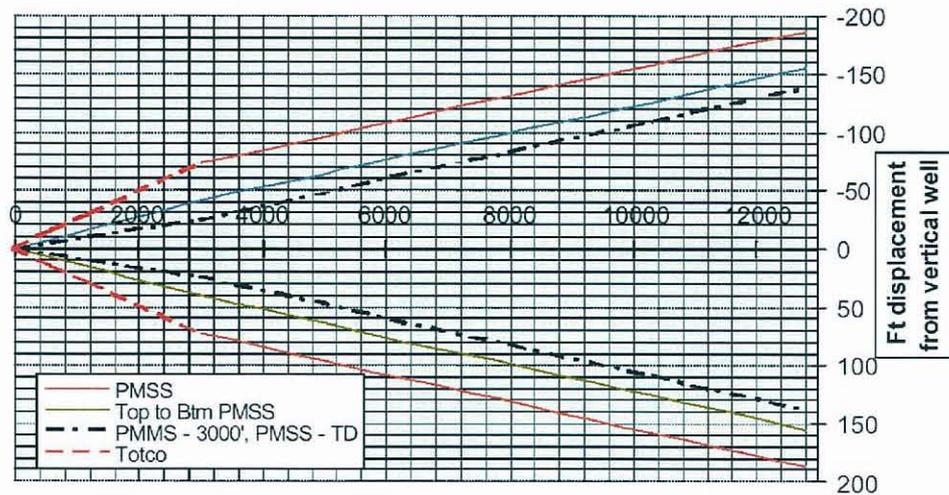


Figure 8. Ellipse of Uncertainty – Along Major N-S Axis