



Annual Report Licence  
Term 2 Year 1,  
GRLs 3 - 12,  
11 May 2012 to  
10 May 2013

Environmental



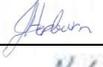
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## 1. INTRODUCTION

Geothermal Retention Licences (GRL's) 3 – 12 were granted to Geodynamics Limited on 10 May 2007 for a period of 5 years. Renewal was granted and executed by DMITRE on 20th June 2012 for a further five (5) years.

This report details the work conducted during Licence Year 1 of this new licence period (11 May 2012 to 10 May 2013) in accordance with Regulation 33 the *Petroleum and Geothermal Energy Regulations 2013*.

## 2. PERMIT SUMMARY

For the duration of the licence year, licensees for Geothermal Retention Licence (GRL's 3-12) were:

- Geodynamics Limited 70% (operator)
- Origin Energy Limited 30%

### Proposed Minimum Work Program

The proposed minimum work program has a primary focus on further exploration and appraisal activities with a view to defining sufficient geothermal reserves for a commercial scale geothermal development. The minimal level of activity will be the drilling of Habanero 4 and the stimulation and testing of the main fracture zone at Habanero 4.

Further activities will be determined following the outcomes of the initial Habanero 4 activities e.g. Commissioning of the 1MW Power Plant and Reservoir & Plant Testing added to Year 1 below.

Licence Year	Licence Dates	Minimum Proposed Activity
Year 1	11/05/12 to 10/05/13	<ul style="list-style-type: none"><li>• Drilling of Habanero 4</li><li>• Stimulation and testing of Habanero 4</li><li>• Assessment and analysis of results following stimulation and testing of Habanero 4</li><li>• <i>Commissioning of the 1MW Power Plant</i></li><li>• <i>Reservoir and Plant Testing</i></li></ul>
Year 2	11/05/13 to 10/05/14	<ul style="list-style-type: none"><li>• Assessment and analysis of Habanero field results to determine future activities</li><li>• Continuation of Reservoir and Plant Testing</li><li>• Renewal of 1MW Power Plant Environmental Impact Report (EIR) &amp; Statement of Environmental Objectives (SEO)</li></ul>
Year 3	11/05/14 to 10/05/15	<ul style="list-style-type: none"><li>• Assessment and analysis of Habanero field results to determine future activities</li></ul>
Year 4	11/05/15 to 10/05/16	<ul style="list-style-type: none"><li>• Assessment and analysis of Habanero field results to determine future activities</li></ul>
Year 5	11/05/16 to 10/05/17	<ul style="list-style-type: none"><li>• Assessment and analysis of Habanero field results to determine future activities</li></ul>

### **3. REGULATED ACTIVITIES**

#### **3.1 Drilling**

##### **3.1.1 Habanero**

In late August 2012, Drilling and completion of Habanero 4 to a target depth of 4,204 m was achieved.

No drilling activities were undertaken at Habanero 1, 2 or 3 during the licence period. Well Intervention activities took place at Habanero 1 and are stated in Section 3.2.1 under Well Operation Activities.

##### **3.1.2 Jolokia**

No drilling activities were undertaken at Jolokia during the reporting period.

##### **3.1.3 Savina**

No drilling activities were performed in the Savina geothermal field during the reporting period.

#### **3.2 Well Operation Activities**

##### **3.2.1 Habanero**

###### **Habanero 4**

Following completion of the well and installation of the temporary open flow system, Habanero 4 was opened up for clean-up flow on 17 October, 2013. This initial flow was designed to flush drilling mud out of the well bore and leave the well ready for open flow testing. The well performed as expected and over four days of intermittent operations produced approximately 1,100 m<sup>3</sup> of completion brine, drilling mud and formation brine into a lined pit on surface. The maximum rate recorded during this clean-up flow was approx 30 kg/s and the maximum flowing temperature recorded at surface was 203°C. After this clean-up flow the well was shut in whilst the equipment for testing and stimulation was assembled on site.

The first open flow test commenced on 10 November. A new pressure and temperature sonde, designed for long-term use in high temperature wells, was deployed in the hole. Unfortunately, even though the sonde had been tested earlier in a high temperature well, it failed at Habanero and had to be removed without recovering any useful data. An alternate, older technology, pressure and temperature sonde was deployed instead. This device performed well, although it could only be left in the hole for a few hours to avoid overheating.

The first open flow test included flow at several rates to investigate the flow behaviour immediately around the well bore. Fluid samples were captured at surface and also down hole using custom-built titanium fluid samplers. The final high rate flow period achieved a flow of approximately 35 kg/s for 52 minutes. Flowing wellhead pressure declined slowly during this high rate test, reaching 27.7 MPa (4,020 psi) before the well was shut-in.

###### **Habanero 1 Well Intervention**

All components of the 'Christmas Tree' valve assembly above the lower master valve have been replaced.

The initial attempt to remove the plug from Habanero 1 using Slick Line was unsuccessful. An updated well intervention activity to remove the plug at Habanero 1 using a Coil Tubing Unit was undertaken and successfully completed on April 10, 2013. Habanero 1 will be used as the injection well, connecting with Habanero 4 through the fractured reservoir to form the closed loop. Upon safe removal of the plug, an injectivity test was performed to confirm the Habanero fracture zone was still open. Pipe work including the emergency shutdown valve has been installed to connect the reinjection pump to the well, mechanically completing the closed loop. Initial re-injection flows have been established with the well and pump performing well under the conditions.

### **1MW Commissioning**

Geodynamics issued notification to DMITRE that it intended to commence commissioning of the plant on 3 April. Commissioning of the plant started with the introduction of hot brine flow from Habanero 4 into the plant to warm-up the brine system. Following plant warm-up, steam was generated via the heat exchangers and approximately 35 steam blows were performed.

### **Reservoir and Plant Testing**

The trial operation of the 1MW Plant commenced in May 2013.

The trial has a number of key objectives, including:

- Testing the impact of geothermal brine chemistry on the surface brine system
- Testing performance of the caustic cleaning system engineered to remove stibnite from the brine heat exchanger and monitoring of stibnite levels in the brine as it is cycled through the reservoir
- Testing of the thermosiphon effect. The thermosiphon effect is natural convection created by density differences in the geothermal brine occurring due to temperature gradients, aka the “buoyancy drive”
- Testing and optimising of the computer control system, to integrate the brine loop with the steam power plant
- Testing of reservoir permeability by operating the closed loop system at various flow rates
- Testing of the reservoir volume by observing the transit of tracers through the reservoir
- Measurement of temperature and pressure profiles in both wells once stable closed loop operation has been established

#### **3.2.2 Savina**

No well operation activities were undertaken at the Savina 1 well during the reporting period.

#### **3.2.3 Jolokia**

No well operation activities were undertaken at the Jolokia 1 well during the reporting period.

### **3.3 Seismic Data Acquisition**

Passive seismic data from the Habanero seismic monitoring network was collected for the entire period of the Licence Year.

### **3.4 Seismic Data Processing and Reprocessing**

Seismic data processing and reprocessing was undertaken throughout the Licence year.

This included real time monitoring and processing of all seismic data between the 13 November 2012 and 4 December 2012 which covered the stimulation of Habanero 4. Daily reports were submitted on seismic activity to DMITRE during this time.

### **3.5 Geochemical, Gravity, Magnetic and other surveys**

No geophysical surveys were carried out during the Licence year.

### **3.6 Pipeline/Flowline Construction and Operation**

No Pipeline/Flowline Construction and Operation occurred during the Licence Year.

### **3.7 Preliminary Survey Activities**

Nil.

## **4. COMPLIANCE ISSUES**

### **4.1 Licence and Regulatory Compliance**

A notice of non-compliance was issued to Geodynamics by DMITRE on 5 March 2013 due to a breach of the 1MW Geothermal Plant SEO. The breach related to weeds being introduced or spread at site (assessment criteria for Objective 3 in the SEO). Geodynamics' has responded to the notice and grass has been removed from the area in question. As no material harm has impinged on the surrounding environment no further action is to be taken.

Three (3) independent compliance audits have been carried out during the Year 1 licence period:

- Geodynamics' Compliance with Enhanced Geothermal Systems, Reservoir Stimulation & Evaluation SEO (October 2012)
- Geodynamics' Compliance with Enhanced Geothermal Systems, Reservoir Stimulation & Evaluation SEO (March 2013)
- Geodynamics' Compliance with 1MW Power Plant SEO (March 2013)

One (1) non-compliance was detected in the October 2012 audit relating to the contamination of soil on the Habanero 4 drill pad by geofluid condensate generated during the recent clean-up flow (detail is provided in Appendix A). No non-compliance instances were detected in the March 2013 audit.

### **4.2 Management System Audits**

During this licence year the following audits were undertaken:

- Emergency Response Exercise Report (September 2012)
- SEO Compliance Audits as listed in Section 4.1. (October 2012 & March 2013)
- External Site Environmental Audits (October 2012 & March 2013)
- Surveillance audit by SAI Global of Geodynamics Environmental Management System (July 2012)
- Internal audit of Geodynamics Environmental Management System (April 2013)
- Cooper Basin Sites Rehabilitation Assessment Report (April 2013)

- External review by Dickson Environmental Consulting & Audit of Geodynamics Environmental Management System (May 2013)
- Site HSE Audits (Monthly)

Actions and recommendations from the findings of these audits are captured through Geodynamics' internal action tracking process and routinely reviewed to work towards closure and continued improvement.

### 4.3 Report and Data Submissions

Pursuant to Regulation 33(2) (e) under the Act, an annual report must include:

“a list of all reports and data relevant to the operation of the Act generated by the licensee during the licence year”.

Table 4-1: List of report and data submissions during current licence reporting year

Description of Report/Data	Due Date	Date Submitted	Compliant / Non-Compliant
Quarterly Well Monitoring report April 2nd Quarter 2012	31/07/2012	20/07/2013	Compliant
Quarterly Cased Hole Activity Report 2nd Quarter - 2013	31/7/2013	5/06/2013	Compliant
Quarterly Reportable Incidents Report 1st Quarter 2013	30/04/2013	19/4/2013	Compliant
Quarterly Well Monitoring Report 1st Quarter 2013	30/04/2013	17/04/2013	Compliant
Quarterly Cased Hole Activity Report 1st Quarter - 2013	30/04/2013	2/04/2013	Compliant
Licence Renewal GEL 268	23/3/2013	21/3/2013	Compliant
Management of Change for amendment to Well Intervention Habanero 1 Activity Notification (updated Notice of Entry sent 28/02/2013)	Must be submitted and approved by the Minister before the proposed activity can commence	18/2/2013 (1st issue) 11/3/2013 (2nd issue)	Compliant
Quarterly Well Monitoring Report 4th Quarter 2012	31/01/2013	22/01/2013	Compliant
End of Well Completion Report	Within 6 months after rig release	18/01/2013	Compliant
Quarterly Cased Hole Activity Report 4th Quarter 2012	31/01/2013	8/01/2013	Compliant
Quarterly Well Monitoring report July 3rd Quarter 2012	31/10/2012	22/10/2012	Compliant
Quarterly Cased Hole Activity Report 3rd Quarter 2012	31/10/2012	3/10/2012	Compliant
Quarterly Cased Hole Activity Report 2nd Quarter 2012	31/07/2012	5/07/2012	Compliant
Activity Notification (including Notice of Entry) 1MW Commissioning and Operation	Must be submitted and approved by the Minister before the proposed activity can commence	2/7/2012	Compliant
Well Cutting Samples	Within 6 months after rig release	This was carried out by Challenge Geological Services who submitted directly to DMITRE	Compliant

#### **4.4 Incidents**

Pursuant to Regulation 33(3) (f), an annual report must include:

“in relation to any incidents reported to the Minister under the Act and these Regulations during the relevant licence year –

- i. an overall assessment and analysis of the incidents, including the identification and analysis of any trends that have emerged; and
- ii. an overall assessment of the effectiveness of any action taken to rectify non-compliance with obligations imposed by the Act, these regulations or the licence, or to minimise the risk of recurrence of any such non-compliance”.

The following incidents were reported to the Minister in the relevant year:

- On 17/02/2013 - Fuel leak from heavy transport vehicle arriving at Habanero site.

#### **4.5 Threat Prevention**

Pursuant to Regulation 33(3) (g) under the Act, an annual report must include:

“a report on any reasonably foreseeable threats (other than threats previously reported on) that reasonably presents, or may present, a hazard to facilities or activities under the licence, and a report on any corrective action that has, or will be taken”.

HAZOP/HAZID and general risk workshops were carried out as part of the Stimulation, Well Intervention, Commissioning and Operating Activities.

In addition, Geodynamics' Environmental Aspects Register (part of the Environmental Management System) was reviewed by senior management in January 2013. The Environmental Aspects Register and Geodynamics' Risk Register (outcomes of general risk workshops) are routinely updated and reviewed.

#### **4.6 Future Work Program**

The Future Work Program for GRL 3 - 12 for the Financial Year 2013 - 2014 to be determined as a result of the Reservoir and Plant Testing being conducted in the period April to August 2013.

The five year review (required under Regulation 14 of the Petroleum & Geothermal Energy Regulations) of the current SEO and EIR for the operation of the 1MW Power Plant is due in August 2013. This review process is currently underway and will be completed during the Financial Year 2013 - 2014.

### **5. EXPENDITURE STATEMENT**

Pursuant to Regulation 33(4) under the Act, an annual report must contain:

“An annual report must be accompanied by a statement of expenditure on regulated activities conducted under the licence for the relevant licence year, showing expenditure under each of the following headings:

- (a) drilling activities;
- (b) seismic activities;

- (c) technical evaluation and analysis;
- (d) other surveys;
- (e) facility construction and modification;
- (f) operating and administration expenses (not already covered under another heading)".

Below is an expenditure statement for the current reporting period.

**Expenditure Statement (FY 2012-2013)**

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# **Appendix A Geodynamics' Compliance for Stimulation & Evaluation SEO (October 2012)**

REQUIREMENT	ASSESSMENT CRITERIA	GUIDE TO HOW OBJECTIVES CAN BE ACHIEVED	EVIDENCE OF IMPLEMENTATION & COMMENTS
<p>SEO 1 Remediate and rehabilitate areas affected by EGS stimulation &amp; evaluation activities</p>	<p>A score of at least <math>\geq 0</math> (minimize visual impacts and revegetation) is to be achieved for the rehabilitation of any areas affected by EGS stimulation &amp; evaluation activities in accordance with the criteria set out in the Field Guide for the Environmental Assessment of Abandoned Petroleum Wellsites in the Cooper Basin, South Australia, PIRSA</p>	<p>Disused pipelines laid on surface are to be removed Any soil contaminated by fuel/oil spillage to be immediately cleaned up and removed from pump site for treatment/disposal in accordance with GDY waste disposal procedure Pipelines to be constructed/laid above ground – not trenched (except under roads) No trees or shrubs to be removed or damaged during laying of low pressure HDPE pipelines – such pipelines must be directed around these The salts left behind from evaporation will be disposed of to licensed facilities</p>	<p>As the site is a current operational area no rehabilitation activities have been commenced</p>
<p>SEO 2 Minimise impact on flora, livestock &amp; fauna &amp; endangered ecological communities</p>	<p>No unauthorized clearing or damage to threatened flora and fauna or endangered ecological communities Avoid vegetation damage/mortality from condensate in steam vapour</p>	<p>Assessment of impact on any threatened flora and fauna species to be undertaken by ecologist prior to selection of dam/pond site to avoid sensitive areas where possible The requirements of GDY's Native Vegetation &amp; Fauna Environmental Guidance Note (EGN) to be implemented at all times Daily monitoring of dams/ponds to be undertaken to check for livestock and fauna activity to ensure fences are functioning appropriately Escape ramp/device to be installed in ponds/sumps with vertical walls Dams/ponds to be allowed to evaporate once stimulation/evaluation process complete if not required for future activities Wind direction to be monitored prior to and during testing to ensure drift onto vegetation does not occur Nearby vegetation to be monitored during production and open loop testing to check for damage/mortality and cease testing as necessary (eg under certain wind directions) if drift over vegetation cannot be prevented A personnel protection fence to be erected along high pressure/temperature pipelines Test sites will be fenced to prevent access by livestock and native fauna</p>	<p>Daily checks of dams and sumps in the Habanero area are made for fauna (a record of this will be kept via the Enviro Inspection Checklist in the future)  The drill sites are surrounded by stockproof fencing and gates are locked from 6pm – 6am.  Astroturf has been installed in Hab 2 dam to assist fauna escape (Plate 3)  Wind socks installed at Hab 4 site office and main Habanero camp.  No evidence of damage to vegetation surrounding Hab 4 site from clean-up flow 2m high cyclone mesh fence installed adjacent to high pressure pipeline. Fence to be extended from Hab 3 to Hab 4 site.</p>

REQUIREMENT	ASSESSMENT CRITERIA	GUIDE TO HOW OBJECTIVES CAN BE ACHIEVED	EVIDENCE OF IMPLEMENTATION & COMMENTS
<p>SEO 3</p> <p>Avoid disturbance to sites of indigenous and non indigenous heritage</p>	<p>No unauthorized impacts on aboriginal or other heritage sites</p>	<p>Assessment of impact on any aboriginal or other heritage sites to be undertaken by archaeologist prior to selection of dam/pond site to avoid significant heritage areas</p> <p>Implementation of GDY's Aboriginal &amp; European Heritage Guidance Note</p>	<p>Hab 4 site within area cleared for heritage items by Allan Lance (Heritage Consulting Australia) in September 2010.</p> <p>Online site induction of EBS ecologist observed on 25 October 2012 includes coverage of heritage issues</p>
<p>SEO 4</p> <p>Avoid contamination of environment by geofluid</p>	<p>No contamination of soil, shallow groundwater or surface waters by geofluid</p>	<p>Ponds used to store geofluid will be lined with HDPE with a minimum thickness of 2mm and be of sufficient volume to hold all geofluid discharged</p> <p>Splash board/panel to be used where necessary to ensure all geofluid discharged drains to lined pit or pond</p> <p>Well heads designed to 68Mpa (10,000 psi)</p> <p>Automated and manual shut down systems in place</p> <p>High pressure failure audible alarm</p> <p>High pressure/temperature pipelines designed, maintained and operated in accordance with AS 4041-2006 &amp; NACE for H2S &amp; CO2 and any other relevant industry standards.</p> <p>Strategically located diversion bunds/drains/dams established to ensure high volume discharges cannot discharge into sensitive areas (eg Cooper Creek or other water courses)</p> <p>If wind is directing flow away from the dam the operation will be temporarily shut down</p>	<p>It was noted that geofluid condensate from the well clean-up flow (17-20 October) (Plate 1) has been deposited as a salt crust on the drill pad (Plate 2). The presence of high salt levels in the soil could inhibit future regrowth on this part of the pad.</p> <p>Evidence of as built specification of dam liners at Hab 1, 2 &amp; 4 required</p> <p>Evidence of compliance (or process to ensure compliance) with AS 4041-2006 &amp; NACE requirements &amp; well head design to 68Mpa required</p>
<p>SEO 5</p> <p>Avoid contamination of soil, shallow groundwater &amp; surface waters with chemicals, fuels, oils etc used in stimulation or evaluation testing</p>	<p>No contamination of soil, shallow groundwater or surface waters</p>	<p>All fuels, chemicals, oils etc to be stored in accordance with GDY's Environmental Guidance Note for Chemical &amp; Fuel Storage and consistent with the requirements of the South Australian EPA's bunding guideline 080/07 Bunding &amp; Spill Management (June 2007)</p> <p>Any spills or leaks shall be cleaned up using Spill Kits available on site and reported to the GDY Environment Manager for further advice in relation to cleanup and disposal of contaminated materials</p> <p>Material Safety Data Sheets shall be available at each test site for all chemicals used in the stimulation and evaluation phase</p>	<p>Fuel and chemicals generally stored in bunded areas with following exceptions:</p> <p>Caustic soda stored on ground outside chemical store (Plate 4)</p> <p>Spilled dry chemical on ground outside chemical store (Plate 5)</p> <p>MSDS sheets sighted at Hab 4 site</p>

REQUIREMENT	ASSESSMENT CRITERIA	GUIDE TO HOW OBJECTIVES CAN BE ACHIEVED	EVIDENCE OF IMPLEMENTATION & COMMENTS
		<p>and the requirements of these MSDSs shall be complied with</p> <p>If wind is directing geofluid spray drift away from the dam the operation will be temporarily shut down</p> <p>Should flooding in Cooper Creek be predicted any chemicals, fuels etc to be relocated to higher ground at GDY's warehouse facility near Innamincka</p> <p>The invert level of the geofluid ponds will be designed and constructed higher than flood levels</p> <p>High pressure/temperature pipelines designed, maintained and operated in accordance with relevant industry standards</p>	office
<p>SEO 6</p> <p>Avoid radiation and other contamination hazards to the public, third parties, workers and environment</p>	<p>Concentration of the radioactive element radon in the atmosphere in the vicinity of production and open loop tests to not exceed 1000 Bq/m<sup>3</sup></p>	<p>Continuous Radon monitoring of atmosphere in vicinity of discharges to atmosphere during production and open loop tests</p> <p>Concentration of radioactive elements (Uranium, Thorium, Radium) in geofluid tested periodically at NATA registered laboratory</p> <p>Wind direction to be monitored prior to and during testing to ensure geofluid spray drift onto workers &amp; amenity/accommodation areas does not occur</p> <p>Sediment deposited on dam/pond floor to be tested for contaminants (including flocculant wastes) prior to being exposed to air to determine risks of exposure to windblown dispersal and to identify if special management or disposal measures are required</p>	<p>Radon monitoring and testing of geofluid for radioactive elements undertaken during clean-up flow – evidence of report &amp; compliance with 1000Bq/m<sup>3</sup> requirement to be provided</p>
<p>SEO 7</p> <p>Prevent the occurrence of seismic activity that could damage surface infrastructure or cause community concern</p>	<p>Peak particle velocity at the nearest sensitive receiver or infrastructure will not exceed 10mm/sec due to seismic activity caused by stimulation of the granite</p>	<p>A site specific seismic analysis study will be undertaken by an external expert to define the event magnitude that would result is a peak ground velocity of 10 mm/sec at the nearest sensitive receiver or infrastructure. The study will identify the seismic event levels at which the stimulation pump pressure should be reduced or the stimulation halted.</p> <p>Seismic monitoring will be commenced prior to stimulation operations to obtain baseline information and will continue throughout the stimulation/evaluation phase</p> <p>If magnitudes of seismic events remain above predetermined level at reduced injection rates the well shall be shut in</p> <p>Acoustic monitoring shall be undertaken to detect the development of fracture stimulation within the granite</p>	<p>Seismic analysis of Jolokia 2010 stimulation provided with H4 Activity Notification in March 2012 identified seismic event levels to be applied during Hab 4 stimulation. No stimulation of Hab 4 has occurred to date.</p>

REQUIREMENT	ASSESSMENT CRITERIA	GUIDE TO HOW OBJECTIVES CAN BE ACHIEVED	EVIDENCE OF IMPLEMENTATION & COMMENTS
SEO 8 Prevent contamination of the GAB or oil and gas resources with geofluid	No contamination of GAB or oil and gas reserves by geofluid from basement granite	Casing & cement shall be pressure tested to 62MPa (9000psi) Acoustic monitoring shall be undertaken to detect the development (both extent & direction) of fracture stimulation within the granite to ensure that any impact on the overlying GAB & oil & gas reserves is avoided  Real time acoustic monitoring will detect growth of seismic activity upwards from the granite and if this occurs stimulation will be shut down	No stimulation of Hab 4 has occurred to date so no acoustic monitoring had occurred at time of audit.
SEO 9 Prevent noise impacts on sensitive receivers (including campers)	Airborne noise impact from stimulation operations do not exceed 35 dB(A) at nearest sensitive receiver location (including campers)	A site specific airborne noise assessment of the stimulation (fracking) operation will be undertaken as part of the activity notification utilizing the noise levels in Table 7 of the EIR (or other noise data if required)  If necessary mitigation measures will be implemented to achieve the Rural Living noise goals of 47 dB(A) between 7am-10pm and 40dB(A) between 10pm-7am at the nearest receiver location/s	Acoustic assessment carried out as part of Activity Notification in March 2012
Incident Reporting	Serious incidents must be reported to Minister immediately with written report within 3 months  Reportable incidents must be included in Quarterly Report	See table below for definitions of serious & reportable incidents	No serious or reportable incidents are known to have occurred up to the date of the audit associated with the preparations for stimulation of Hab 4

# **Appendix B Geodynamics' Compliance for Stimulation & Evaluation SEO (March 2013)**

SEO No	REQUIREMENT	ASSESSMENT CRITERIA	EVIDENCE OF IMPLEMENTATION & COMMENTS <i>(suggested guidance/potential evidence to be sought or provided indicated below in italics)</i>
SEO 1	Remediate and rehabilitate areas affected by EGS stimulation & evaluation activities	<ul style="list-style-type: none"> <li>A score of at least <math>\geq 0</math> (minimize visual impacts and revegetation) is to be achieved for the rehabilitation of any areas affected by EGS stimulation &amp; evaluation activities in accordance with the criteria set out in the <i>Field Guide for the Environmental Assessment of Abandoned Petroleum Wellsites in the Cooper Basin, South Australia, PIRSA</i></li> </ul>	<p>Habanero 4 &amp; 1MW Power Plant sites are still active EGS operational areas so rehabilitation has been limited to reducing site footprint &amp; encouraging native vegetation regrowth by cordoning off areas not required for operations (see below)</p> 

<p>SEO 2</p>	<p>Minimise impact on flora, livestock &amp; fauna &amp; endangered ecological communities</p>	<ul style="list-style-type: none"> <li>• No unauthorized clearing or damage to threatened flora and fauna or endangered ecological communities</li> <li>• Avoid vegetation damage/mortality from condensate in steam vapour</li> </ul>	<p>A diffuser box has been constructed since the last audit and placed over the open flow discharge point to prevent the fallout of saline geofluid condensed from the vapour phase onto the surrounding soil (see below)</p> 

Dams used to store stimulation water and geofluid produced from open flow tests are fenced off to prevent stock access and records were sighted that demonstrate daily inspections are carried out to check for trapped fauna. The Mega Dam installed at Habanero 2 and used to store water for stimulation of Habanero 4 has an escape ramp of Astroturf installed (see below)



A wind sock is installed at the Habanero camp and Habanero 4 well site and a weather station is installed at Habanero camp to monitor wind and weather conditions prior to stimulation activities that produce vapour into the atmosphere

SEO 3	Avoid disturbance to sites of indigenous and non indigenous heritage	<ul style="list-style-type: none"> <li>No unauthorized impacts on aboriginal or other heritage sites</li> </ul>	<p>Relocation of the site boundary south of the 1MW Power Plant was not approved using the Site Selection &amp; Disturbance Checklist. This could have resulted in inadvertent damage to the indigenous heritage area located to the south of the site boundary in this area. This incident was investigated by the Operations Manager and in an email dated 18/4/13 advised the auditor that the heritage exclusion zone was not impacted.</p> <p>GDY site induction and Green Book provided to new site staff covers heritage management measures and controls</p>
SEO 4	Avoid contamination of environment by geofluid	<ul style="list-style-type: none"> <li>No contamination of soil, shallow groundwater or surface waters by geofluid</li> </ul>	<p>Diffuser box has been installed to prevent contamination of soil by geofluid condensed from vapour phase fallout (see above). Automated and manually controlled emergency shutdown valve is in place to prevent any discharge of geofluid that exceeds operational pressure limits or in event of system malfunction.</p> <p>High pressure failure audible emergency alarm is in place and can be manually sounded.</p>
SEO 5	Avoid contamination of soil, shallow groundwater & surface waters with chemicals, fuels, oils etc used in stimulation or evaluation testing	<ul style="list-style-type: none"> <li>No contamination of soil, shallow groundwater or surface waters</li> </ul>	<p>Spill kits are available on site (see below) to clean up any chemical or fuel spills.</p> 

			<p>Chemicals used in stimulation/evaluation are stored appropriately in bunded storage areas and shipping containers (see below) with MSDS sheets available (see MSDS sheets on door of chemical store in photo below)</p> 
SEO 6	Avoid radiation and other contamination hazards to the public, third parties, workers and environment	<ul style="list-style-type: none"> <li>Concentration of the radioactive element radon in the atmosphere in the vicinity of production and open loop tests to not exceed 1000 Bq/m<sup>3</sup></li> </ul>	<p>Assessment of radiation impacts undertaken during open flow of Habanero 4 (<i>Exposure Monitoring - H4 Cleanup Flow October 2012, January 2013 (HSM-FN-OT-RPT-00509)</i>) indicates there are no health impacts likely as a result of exposure to radioactive substances or radon emissions from the geofluid or its vapour phase.</p>
SEO 7	Prevent the occurrence of seismic activity that could damage surface	<ul style="list-style-type: none"> <li>Peak particle velocity at the nearest sensitive receiver or infrastructure will not exceed 10mm/sec due to seismic</li> </ul>	<p>The information required to assess compliance with this SEO was not available at the time of the audit.</p>

	infrastructure or cause community concern	activity caused by stimulation of the granite	
SEO 8	Prevent contamination of the GAB or oil and gas resources with geofluid	<ul style="list-style-type: none"> <li>No contamination of GAB or oil and gas reserves by geofluid from basement granite</li> </ul>	See response to SEO 7 above.
SEO 9	Prevent noise impacts on sensitive receivers (including campers)	<ul style="list-style-type: none"> <li>Airborne noise impact from stimulation operations do not exceed 35 dB(A) at nearest sensitive receiver location (including campers)</li> </ul>	See response to SEO 7 above.
	Incident Reporting	<ul style="list-style-type: none"> <li><i>Serious</i> incidents must be reported to Minister immediately with written report within 3 months</li> <li><i>Reportable</i> incidents must be included in Quarterly Report</li> </ul>	<p>Quarterly Reportable Incident Report made to DMITRE on 9 April 2013 included a fuel leak from a heavy vehicle transporting materials to the site for the 1MW Power Plant site.</p> <p>No 'serious' incidents are known to have occurred at the site since the last SEO audit in March 2012.</p>

# **Appendix C Geodynamics' Compliance for 1MW Power Plant SEO Objectives (March 2013)**

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
1	Minimise impact to soil.	<ul style="list-style-type: none"> <li>No soil contamination due to site activities</li> <li>No erosion due to construction and operation as far as practicable</li> <li>Stockpiles established of topsoil and gibber material in areas to be impacted by site activities unavoidable</li> </ul>	<p>Some evidence of erosion occurring to east of thermal ponds where gully erosion has started to occur (see below)</p>  <p>No evidence of soil contamination was observed and chemicals and fuels were observed to be stored in HDPE bunded containment pallets or bunded shipping containers</p>

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
2	Minimise disturbance to native vegetation	<ul style="list-style-type: none"> <li>• Clearance of native vegetation is avoided as far as practicable</li> <li>• Native vegetation not impacted by dust</li> <li>• Induction of site personnel on requirements relating to native vegetation</li> </ul>	<p>Practical measures to minimise disturbance to native vegetation is evidenced by the cordoning off of areas not required for 1MW Power Plant operations (see below)</p>  <p>Induction record emails from K Speechley for 28/11/12, 3 &amp; 10/12/12 were sighted &amp; sighted M Hardy induction record for 5/2/13. GDY site induction &amp; Green Book provided to new staff on site covers vegetation management measures and controls but the Environmental Control Map showing areas of sensitive vegetation is not included in the induction nor was it observed on site office noticeboards/walls etc.</p>

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
3	Minimise potential for weed introduction and undertake control measures where necessary	<ul style="list-style-type: none"> <li>Weeds not introduced or spread at the site</li> <li>Induction of site personnel on restrictions</li> </ul>	GDY site induction & Green Book provided to new staff on site covers vegetation management measures & restrictions but recently prepared Weed Poster was not available on site
4	Minimise disturbance to fauna	<ul style="list-style-type: none"> <li>Clearance of native vegetation is avoided as far as practicable</li> <li>Pest fauna species not introduced or spread at the site</li> <li>Induction of site personnel on requirements relating to fauna including speed restrictions</li> <li>Noise levels maintained to EPA noise policy requirements</li> </ul>	<p>Native vegetation has been encouraged to re-establish within site areas not required for operations (see photo in SEO 2 above)</p> <p>GDY site induction &amp; Green Book provided to new staff on site covers fauna management measures and controls including speed restrictions on site and in Cooper Basin generally</p> <p>No noise emissions occurring as Power Plant is not currently operational</p> <p>Sighted Habanero dams monitoring register that provides evidence of daily checks being undertaken for any trapped fauna, water levels and liner condition</p>
5	Minimise impact to groundwater	<ul style="list-style-type: none"> <li>No aquifer contamination as a result of site activities including fuel and chemical storage waste storage and operation of wastewater treatment plant</li> </ul>	<p>Appropriate fuel and chemical storage areas were sighted</p> <p>Wastewater treatment and associated transpiration areas were observed to be functioning effectively with no ponding of effluent or seepage/runoff outside designated areas</p>
6	Minimise impact to surface water	<ul style="list-style-type: none"> <li>No disruption to drainage pattern as a result of site activities</li> <li>No contamination of soil due to spill of fuels or discharge from wastewater treatment plant</li> </ul>	<p>Evidence of channeling of runoff leading to potential erosion gully was observed in the area east of the thermal ponds at Habanero.</p> <p>Increased flow offsite at the boundary of site was noted (see photo in SEO1 above)</p> <p>No discharges of effluent from wastewater treatment plant transpiration areas or septic overflow were observed during the audit</p>

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
7	Minimise impact on air quality	<ul style="list-style-type: none"> <li>No significant discharge of dust offsite</li> <li>Combustion emissions in accordance with regulatory requirements</li> </ul>	<p>No dust emissions noted at time of inspection. No visible particulate emissions noted from vehicles used on site. Diffuser placed over open flow discharge (see below) to reduce silica dust fallout during open flows</p> 

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
8 & 9	Minimise impacts to the amenity of stakeholders by dust, noise, odours & minimise visual impact	<ul style="list-style-type: none"> <li>No complaints from public</li> </ul>	No complaints from public have been made concerning the Power Plant to the knowledge of site staff interviewed.
10	Minimise impacts to sites of indigenous and non-indigenous heritage	<ul style="list-style-type: none"> <li>No impacts to sites of indigenous and non-indigenous heritage</li> </ul>	<p>Relocation of the site boundary south of the 1MW Power Plant was not approved using the Site Selection &amp; Disturbance Checklist. This could have resulted in inadvertent damage to the indigenous heritage area located to the south of the site boundary in this area. This incident was investigated by the Operations Manager and in an email dated 18/4/13 advised the auditor that the heritage exclusion zone was not impacted.</p> <p>GDY site induction and Green Book provided to new site staff covers heritage management measures and controls</p>
11	Minimise risks to the safety of the public and workforce	<ul style="list-style-type: none"> <li>No injuries to public as a result of construction and operations</li> <li>No health impacts as a result of exposure to radioactive substances and radon emissions</li> <li>No explosion or fire at site</li> </ul>	<p>Power Plant and ancillary sites (including Warehouse) are securely fenced and signs also erected to warn of no public access.</p> <p>Assessment of radiation impacts undertaken during open flow of Habanero 4 (<i>Exposure Monitoring - H4 Cleanup Flow October 2012, January 2013 (HSM-FN-OT-RPT-00509)</i>) indicates there are no health impacts likely as a result of exposure to radioactive substances or radon emissions from the geofluid or its vapour phase</p> <p>Power Plant is not currently operational so no risk of explosion or fire or exposure due to emissions. CFS and DENR fire fighting training and exercise was recently undertaken by site staff at Innamincka.</p>

SEO No	Objective	Assessment Criteria	Evidence of implementation/comment
12	Minimise impacts to existing land uses	<ul style="list-style-type: none"> <li>• No adverse impact on ongoing use of land for pastoral activity if full scale operations do not proceed</li> <li>• No significant impact to Innamincka Regional Reserve</li> <li>• No reasonable concerns raised by stakeholders left unresolved</li> <li>• No adverse impact on livestock</li> <li>• No impact on local roads due to spills</li> </ul>	<p>No reports of livestock being impacted and none observed near operational areas. Personnel inducted into 80km/h speed restriction on roads in Cooper Basin area.</p> <p>The area surrounding the 1MW Power Plant is securely fenced and well cellars, sumps and dams are effectively enclosed/fenced to prevent stock access.</p>
13	Rehabilitation and closure to be undertaken to agreed standards	<ul style="list-style-type: none"> <li>• Site rehabilitation to acceptable standard</li> <li>• Soil restoration in accordance with Appendix B</li> <li>• Vegetation restoration in accordance with criteria in Appendix B</li> </ul>	Power Plant site and associated areas still operational.