REPORT

Spring Gully Water Treatment Facility Quarter 1 2014 Discharge Water Quality Report (1 January to 31 March 2014)

Q-LNG01-15-RP-0722

Australia Pacific LNG Upstream

The details summarised in this report provides evidence that Spring Gully Water Treatment Facility consistently and reliably treats CSG water to a standard which is safe for discharge into a source of public drinking water.

Revision	Date	Description	Originator	Checked	QA/Eng	Approved
0	12/05/2014	Issued for Use	B Goebel	C Noble	R Pappalardo	B Visser 12/5/14

Release Notice

This document is available through the Australia Pacific LNG Upstream Project controlled document system TeamBinder™. The responsibility for ensuring that printed copies remain valid rests with the user. Once printed, this is an uncontrolled document unless issued and stamped Controlled Copy.

Third-party issue can be requested via the Australia Pacific Upstream Project Document Control Group.

Document Conventions

The following terms in this document apply:

- **Will**, **shall** or **must** indicate a mandatory course of action
- **Should** indicates a recommended course of action
- **May** or **can** indicate a possible course of action.

Document Custodian

The custodian of this document is the Australia Pacific Upstream Project – Environmental Compliance Manager. The custodian is responsible for maintaining and controlling changes (additions and modifications) to this document and ensuring the stakeholders validate any changes made to this document.

Deviations from Document

Any deviation from this document must be approved by the Australia Pacific Upstream Project - Environmental Compliance Manager.

Table of Contents

Table of Figures

List of Tables

1. Summary

Australia Pacific LNG is a joint venture between Origin, ConocoPhillips and Sinopec, to deliver a coal seam gas (CSG) to liquefied natural gas (LNG) project which will deliver gas to domestic and overseas markets.

Australia Pacific LNG is the leading CSG producer in Queensland, supplying more than 40% of the State's domestic gas requirements.

The Spring Gully Water Treatment Facility (SGWTF) has been designed using the best available technology to treat water produced as part of the gas extraction process. CSG water is treated to a quality consistent with potable water. The high quality water is suitable for a variety of beneficial uses and is currently utilised to irrigate a 300 hectare Pongamia plantation. During periods of high rainfall where irrigation is not required, surplus treated CSG water is discharged into Eurombah Creek, which flows into the Dawson River. To further reduce the requirement to discharge treated CSG water into Eurombah Creek, Australia Pacific LNG gained approval to undertake a 12 month trial to reinject treated water into the Precipice sandstone. This pilot was successful and is currently being upgraded to a full scale operation.

This report presents a summary of the water quality monitoring results obtained during the first quarter of Calendar Year 2014. During this quarter there has been *one exceedance in water quality criteria* from the SGWTF, further details of which are provided in Section 4.3. This Report has been produced in accordance with the Queensland Government's *Public Reporting Guideline for Recycled Water Schemes* (DERM, 2011) and the *Water Supply (Safety and Reliability) Act 2008* (the Act).

2. Introduction

CSG production relies on the removal of water from the coal seams allowing gas to be readily extracted. The removed water is referred to as CSG water.

CSG water is generally of low quality with very few applications for direct use. Due to the low quality and permeability of the coal seams, use of water from coal seams is generally restricted to a small number of agricultural and industrial operations. To maximise the potential future value of CSG water, Australia Pacific LNG has chosen to utilise an advanced desalination process to treat the water to a quality consistent with domestic potable water supplies.

The SGWTF is one of Australia Pacific LNG's major installations where CSG water is treated. The desalinisation process within the SGWTF utilises the best available technologies to a quality consistent with domestic potable supply.

Once treated, the CSG water is used onsite for Australia Pacific LNG's business activities, including a 300 hectare *Pongamia* irrigation plantation and construction activities. This reduces Australia Pacific LNG's reliance on other water resources.

In the first quarter of 2014, approximately 95% of water was utilised for beneficial reuse. The remaining treated CSG water was discharged to augment the flows within Eurombah Creek, a tributary of the Dawson River.

The Dawson River is an essential resource to the local communities and landowners in the region. It is the principal drinking water supply for the Cracow, Theodore, Moura, Baralaba, and Duaringa townships located more than 200 kilometres downstream from the SGWTF. The river is also used for agricultural irrigation and to support local industries. Protection is therefore vital to ensure its long term sustainable use. Modelling has shown that the treated CSG water discharged from SGWTF, on average, makes up less than 1% of the total flow at the closest drinking water supply (i.e. at the Gyranda Weir).

Figure 1 - SGWTF Discharge Location

To ensure the safety and reliability of the treated CSG water entering potential sources of drinking water, Australia Pacific LNG undertakes a comprehensive monitoring program of water quality sampling, testing and reporting. This report summarises the results of that monitoring conducted during the first quarter (from 1 January to 31 March) of 2014.

In presenting this information, Australia Pacific LNG honours its commitment to providing transparency and ensuring the community, landowners and other key stakeholders have confidence that the treated CSG water can safely be discharged into Eurombah Creek.

All the reporting is publicly available and can be viewed and downloaded from the Australia Pacific LNG website at www.aplng.com.au. Any enquiries relating to this report should be made to the toll free number 1800 526 369.

Alternatively, general enquires can be made by email (contact@aplng.com.au) or mail to Australia Pacific LNG Pty Limited, GPO Box 148, Brisbane, QLD, 4001.

3. Spring Gully Water Treatment Facility Scheme Description

The SGWTF uses a series of water screening, filtration and desalination processes to remove impurities from the CSG water to ensure its safety and reliability for supply into a drinking water source and beneficial uses. The key treatment processes include:

- Feed pond;
- Filtration;
- Reverse osmosis; and
- Treated CSG water conditioning.

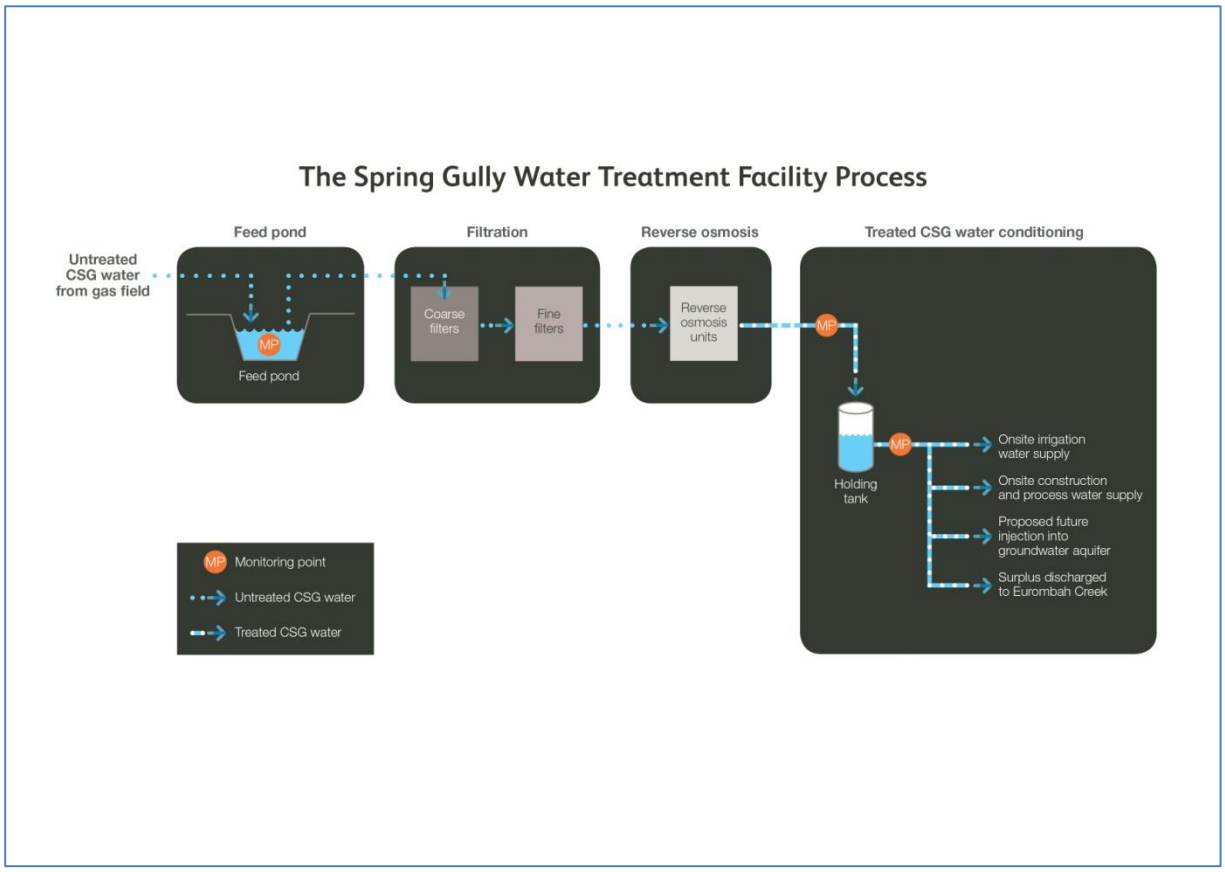

Figure 2 – SGWTF Process Schematic

3.1. Feed Pond

Untreated CSG water gathered from the gas field is temporarily stored in a feed pond prior to its treatment at the SGWTF. The feed pond holds the untreated CSG water for approximately one to two weeks. This allows the settlement of coarse suspended sediments and provides an opportunity for the untreated CSG water to aerate and oxygenate.

3.2. Filtration

The untreated CSG water is then passed through a coarse filter and then a fine filter to remove any particles or suspended sediments that have not settled within the feed pond. A disinfectant commonly used in domestic water treatment facilities is also added after the filtration process to protect the treatment system and membranes used in the following reverse osmosis process.

3.3. Reverse osmosis

Reverse osmosis involves passing the untreated CSG water through fine membranes at high pressure. This removes most of the dissolved salts and other trace elements. At this point the water is either transferred to beneficial reuse applications onsite or discharged.

3.4. Treated CSG water conditioning

The pH and conductivity of the treated CSG water is continuously monitored to ensure it is safe to use or discharge. When the treated CSG water is discharged to Eurombah Creek, calcium is added. This conditioning is undertaken to ensure a minimum level of this element is present in the water released to Eurombah Creek to protect the environment.

4. Approvals, Monitoring and Results

In order to discharge to Eurombah Creek, Australia Pacific LNG gained approval from the Queensland Government's Department of Environment and Heritage Protection (EHP), formerly known as the Department of Environment and Resource Management (DERM). The approval was granted under two separate pieces of Queensland legislation - the *Environmental Protection Act 1994* and the Act. This report deals with the latter approval.

Regular and comprehensive water quality monitoring is required by the Act, now administered by the Queensland Water Supply Regulator (QWSR) to guarantee the ongoing effectiveness of the SGWTF in treating CSG water.

This monitoring includes:

- quarterly external, independent testing of the treated CSG water quality; and
- continuous live monitoring throughout various stages of the SGWTF process to ensure operational performance against the plant's design specifications.

On 31 July 2012, Australia Pacific LNG received an amended exclusion decision under the Act for the discharge of treated CSG water to Eurombah Creek. This exclusion decision recognises that Australia Pacific LNG is not likely to have a material impact on any downstream drinking water supplies.

The content of this quarterly report reflects the reporting requirements outlined within this amended exclusion decision, and the reporting frequency aligns with that outlined in section 274 of the Act.

EHP also approved the use of treated CSG water from the SGWTF for the aquifer injection project trial. The aquifer injection project trial was conducted between the dates of 21 April 2012 and 20 April 2013.

4.1. Regular External Laboratory Monitoring

The treated CSG water is sampled on a quarterly basis and sent to independent laboratories for testing. The sampling takes place at the exit from the desalination process immediately prior to discharge.

The samples are tested for a comprehensive range of parameters. This water quality monitoring is undertaken using an industry-wide protocol developed by Standards Australia and EHP. Following these standards ensures the water samples are correctly obtained, stored and transported to allow accurate and representative testing in the laboratory.

The water is tested at a variety of laboratories that are independent of Australia Pacific LNG's operations. Each laboratory is accredited by the National Association of Testing Authorities (NATA).

"NATA is the authority that provides independent assurance of technical competence through a proven network of best practice industry experts for customers who require confidence in the delivery of their products and services" – NATA website.

The water quality monitoring results of treated CSG water from the SGWTF is summarised in Table 1. These results showed that four parameters exceeded the Water Quality limits for the sampling event on 26/3/14. These parameters were Barium, Fluoride, Iodide and Benzene. It should be noted that the Benzene result was still below the limit of detection of the laboratory but the detection limit for this sample was raised above the Water Quality Limit due to matrix interferences. This event is discussed further in section 4.3. The complete water quality monitoring results of treated CSG water from the SGWTF is provided in Appendix 1.

4.2. SGWTF Online Indicator Monitoring

Water quality indicators such as pH, turbidity and conductivity are monitored by an online monitoring system to provide a real time overview of the performance and integrity of the treatment process within SGWTF.

Should any of these indicators vary from their expected ranges, the onsite use and discharge of water to Eurombah Creek is suspended immediately. No discharge occurs until further investigation, and monitoring and corrections are made to ensure the final water quality is safe. This process ensures the quality of water from the SGWTF is maintained at the highest level possible.

4.3. Discharge Treated CSG Water Quality

During the first quarter of 2014, there has been one instance of exceedance of 4 parameters in water quality from the SGWTF. This exceedance was notified to QWSR on 26 March 2014 in accordance with condition 6.10 of the amended exclusion decision. This exceedance was related to a release which occurred during a significant rainfall event.

A detailed investigation was carried out and the findings were reported to QWSR in accordance with condition 6.11 of the amended exclusion decision. The report titled 'QWSR Spring Gully Incident Regulator Report' was submitted to QWSR on 16 April 2014. In summary, the treated CSG water outflowing as per the operating procedure from the treated CSG water pipeline to Eurombah Creek caused a siphoning effect with the overflow discharge pipe from Spring Gully Pond A cell 2. This resulted in untreated CSG water from Pond A entering the treated CSG water pipeline and mixing with the treated CSG water prior to release. Following a detailed investigation, Origin Energy installed a siphon break on the overflow discharge pipe as part of its corrective and preventative actions that have been implemented to prevent recurrence of the incident.

The potential for impact on any downstream drinking water supplies due to this exceedance is considered to be low as it occurred during a period of high rainfall and flow, and hence any exceedance related to the release would have been significantly diluted by the high flow. Sampling and testing of the downstream water 1 hour after cessation of the release showed that the water quality parameters were mostly below the approved limits.

Table 1 - Summary of the Characterisation Testing - Showing Detected Maximum Monitoring Results for Treated CSG Water during the first Quarter of 2014

Parameter		Compliance with Water Quality Limit	Water Quality Limit	Unit	Concentration of Treated CSG Water (prior to discharge)
BTEX	Benzene	0%*	1	µg/L	ND**
	Ethylbenzene	100%	300	µg/L	ND
	Toluene	100%	800	µg/L	ND
	Xylene Total	100%	600	µg/L	ND
Endocrine-Disrupting Chemicals and Hormones	Bisphenol A	100%	200	µg/L	ND
	Nonylphenol	100%	500	µg/L	ND
Inorganic Compounds	Bromide	100%	7000	µg/L	3470
	Fluoride	0%*	1500	µg/L	2940
	Iodide	0%*	500	µg/L	988
Metals	Aluminium	100%	200	µg/L	22
	Barium	0%*	700	µg/L	1900
	Boron	100%	4000	µg/L	2000
	Lead	100%	10	µg/L	0.53
	Manganese	100%	500	µg/L	60
	Molybdenum	100%	50	µg/L	0.73
	Strontium	100%	4000	µg/L	1600
	Vanadium	100%	50	µg/L	1.9
	Zinc	100%	3000	µg/L	3.2
Poly Aromatic Hydrocarbons	PAH (as B(a)P TEF)	100%	0.01	µg/L	ND
Radiological Products	Alpha Emitters	100%	0.5	Bq/L	0.048
	Beta Emitters	100%	0.5	Bq/L	0.101
Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons	100%	200	µg/L	ND

* These results are discussed in section 4.3 on page 8

** This result was below the detection limit but the detection limit for this sample was raised above the Water Quality Limit due to matrix interferences.

Appendix 1: Summary of Weekly Treated CSG Water Quality Monitoring Results

The following section presents a summary of the quarterly monitoring undertaken on the treated CSG water discharged to Eurombah Creek. The results cover the first quarter of 2014, from 1 January 2014 to 31 March 2014. The water quality monitoring results have been summarised to show the following:

Parameter – This lists the public health water quality parameters tested at the point of discharge. An explanation of the parameters is provided in the Glossary.

Water Quality Limit – This shows the limits set by QWSR.

Unit – This shows the corresponding parameter unit of measurement. It is presented in micro-grams (µg) per litre (L) unless otherwise stated. This unit can also be represented as 'parts per billion' (ppb). Exceptions to this are listed in the reporting tables.

Maximum Detected Concentration Treated CSG Water – Shows the maximum concentration recorded for samples taken immediately prior to discharge to Eurombah Creek.

Sampling Results – As SGWTF is under an amended exclusion decision, sampling for public health is only required once a quarter. This means that there was no missed sampling in the first quarter of 2014 because if sampling could not be conducted one week it is undertaken the following week.

Table 2 – Complete Characterisation Testing - Showing Detected Maximum

Parameter		Water Quality Limit	Unit	Concentration of Treated CSG Water (prior to discharge)
BTEX	Benzene	1	µg/L	ND
	Ethylbenzene	300	µg/L	ND
	Toluene	800	µg/L	ND
	Xylene Total	600	µg/L	ND
Endocrine-Disrupting Chemicals and Hormones	Bisphenol A	200	µg/L	ND
	Nonylphenol	500	µg/L	ND
Inorganic Compounds	Bromide	7000	µg/L	3470
	Cyanide Total	80	µg/L	ND
	Fluoride	1500	µg/L	2940
	Iodide	500	µg/L	988
Metals	Aluminium	200	µg/L	22
	Antimony	3	µg/L	ND
	Arsenic	7	µg/L	ND
	Barium	700	µg/L	1900
	Boron	4000	µg/L	2000
	Cadmium	2	µg/L	ND
	Chromium	50	µg/L	ND
	Copper	2000	µg/L	ND
	Lead	10	µg/L	0.53
	Manganese	500	µg/L	60
	Mercury	1	µg/L	ND
	Molybdenum	50	µg/L	0.73
	Nickel	20	µg/L	ND
	Selenium	10	µg/L	ND
	Silver	100	µg/L	ND
	Strontium	4000	µg/L	1600
	Vanadium	50	µg/L	1.9
	Zinc	3000	µg/L	3.2
Poly Aromatic Hydrocarbons	PAH (as B(a)P TEF)	0.01	µg/L	ND
Radiological Products	Alpha Emitters	0.5	Bq/L	0.048
	Beta Emitters	0.5	Bq/L	0.101
Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons	200	µg/L	ND

Glossary

The parameters required to be monitored by Australia Pacific LNG by Queensland Water Supply Regulator are in many cases not found within treated CSG water or the water treatment industry. The monitoring undertaken by Australia Pacific LNG is designed to provide a conservative level of assurance to ensure the protection of public health. A brief definition of the sets of parameters contained within the reported information is provided below.

BTEX – BTEX is an acronym representing benzene, toluene, ethylbenzene, and xylenes. These are compounds that may be associated with oil and gas production. BTEX are generally not associated with CSG production, although may occur at trace levels.

Chlorinated Hydrocarbons – These are organic compounds that may be generated as a by-product of chlorination. They are considered common place in everyday life and can occur naturally, in some animals or as the by-product of fires.

Disinfection By-products – Disinfectants are routinely used in water treatment facilities to remove biological contaminants (predominantly algae and bacteria) that may decrease the efficiency and integrity of the water treatment process. Disinfectants may react with naturally-occurring matter to form by-products.

Endocrine-Disrupting Chemicals (EDCs) and Hormones – The two relevant compounds include Bisphenol A (BPA) and Nonylphenol. BPA is often associated with moulded plastic. Nonylphenol can be found in commercial detergents.

Haloacetic acids – These can be a by-product of drinking water chlorination or chloramination (that is the use of disinfectant). These are routine methods used for disinfection of drinking water to remove bacteria and other microbiological organisms.

Inorganic Compounds – These compounds are non-carbon based elements. In terms of drinking water chemistry they include compounds such as ammonia, bromide and fluoride.

Metals – These naturally occur in drinking water due to the water passing through metal-enriched rock. Certain metals are essential for life. Also specific metal-based salts, namely calcium, is added to the treated CSG water prior to discharge to the Eurombah Creek to ensure a minimum level is present to protect the environment.

Nitrosomines – These compounds are commonly associated with water treatment facilities that utilise choramines for disinfection and include N-Nitrosodiethylamine (NDEA) and N-Nitrosodimethylamine (NDMA).

Poly Aromatic Hydrocarbons (PAH) – PAH occur in oil, coal and tar products and may be associated with water extracted from coal seams at low levels. They are naturally occurring and do not readily dissolve in water.

Total Petroleum Hydrocarbons (TPH) – TPH is the term given to a mixture of hydrocarbons (compounds that contain hydrogen and carbon) that occur naturally and in oil, coal and tar products. TPH is associated with CSG water at low levels.

Trihalomethanes – These include the branch of chemical compounds that may be formed as a by-product of disinfecting drinking water with chorine or monochloramine.

Radiological Products – These occur naturally in drinking water at extremely low concentrations via contact with certain rocks such as granite.

Abbreviations & Acronyms

Term/Abbreviation/Acronym	Definition
µg	Micrograms (1 x 10^{-3} grams)
Australia Pacific LNG	Australia Pacific LNG Pty Limited
Bq	Becquerel
CSG	Coal seam gas
EHP (DERM)	Department of Environment and Heritage Protection (formerly known as the Department of Environment and Resource Management)
L	Litre
LNG	Liquefied natural gas
NATA	National Association of Testing Authorities
ND	Not detected
QWSR (OWSR)	Queensland Water Supply Regulator (formerly known as Office of the Water Supply Regulator)
QLD	Queensland
SGWTF	Spring Gully Water Treatment Facility
the Act	*Water Supply (Safety and Reliability) Act 2008*