REPORT

LOXTON SALT INTERCEPTION SCHEME – HIGHLAND INVESTIGATIONS AND WELLFIELD CONSTRUCTION

Government of South Australia
Department for Water

LOXTON SALT INTERCEPTION SCHEME - HIGHLAND INVESTIGATIONS AND WELLFIELD CONSTRUCTION

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FOREWORD

South Australia's Department for Water leads the management of our most valuable resource—water.

Water is fundamental to our health, our way of life and our environment. It underpins growth in population and our economy—and these are critical to South Australia's future prosperity.

High quality science and monitoring of our State's natural water resources is central to the work that we do. This will ensure we have a better understanding of our surface and groundwater resources so that there is sustainable allocation of water between communities, industry and the environment.

Department for Water scientific and technical staff continue to expand their knowledge of our water resources through undertaking investigations, technical reviews and resource modelling.

Allan Holmes
CHIEF EXECUTIVE
DEPARTMENT FOR WATER

ACKNOWLEDGEMENTS

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SUMMARY

The Loxton irrigation area is located adjacent to the River Murray in the northwest region of the Murray Basin in South Australia. Run-of-river salinity surveys indicated that a salt load of approximately 98 t/d entered the river in the Loxton reach between river kms 482 and 500 at flows of up to 5,000 ML/d. The salt load may double to 188 t/d at flows of 20,000 - 30,000 ML/d due to the leaching of salt from floodplains and the flushing of backwaters.

The construction of a salt interception scheme was proposed to intercept the groundwater flux before it discharged to the river. Between 2003 and 2011, the Department for Water, in partnership with SA Water and with support from the Murray Darling Basin Authority, undertook investigations and has constructed the $21.4m Loxton SIS to assist in managing River Murray salinity in South Australia.

The floodplain wellfield component of the Loxton SIS was constructed by early 2006, however the construction of highland infrastructure had been delayed due to the hydrogeological complexities.

In-river EC data obtained by DFW-SA Water late in 2006 indicated possible high salinity zones in the river between the Loxton Pumping Station and Thiele's Homestead (between river kms 494 and 495), an area believed to be contributing significant salt loads to the river and corresponding with the interpretation of the in-river NanoTEM data. In November 2007, SA Water requested that DFW undertake an investigation program targeting the Loxton Pumping Station and Thiele's Homestead area (between river kms 494 and 495) aimed at building on existing knowledge through further in-river and hydrogeological investigations, undertake a Pata Formation wellfield trial (later extended to include a Loxton Sands wellfield trial) and determine the most appropriate infrastructure for completing the highland wellfield. In August 2008, the investigation area was extended to include two additional areas, Rilli's Cliffs (between river kms 501 and 502) and Northern Thiele's floodplain (between river kms 492.5 and 493).

This report:

1. Details the hydrogeological investigations that were undertaken to further characterise the Loxton Sands and Pata Formation and their hydraulic connectivity and to determine the source and magnitude of the groundwater flux (and salt load) discharging to the river.
2. Details the results and interpretation of the long-term pumping tests conducted on the Proud Avenue investigation site Pata Formation trial wellfield and Loxton Sands trial wellfield.
3. Details the results and interpretation of the long-term pumping test conducted on the Rilli's Cliffs investigation site Loxton Sands trial wellfield.
4. Details the results of site-specific groundwater modelling which was carried out to compare the interception efficiency achieved by the Loxton horizontal well with that obtained from the Loxton Sands trial wellfield.
5. Summarises the design and construction of the highland wellfield, comprising 27 production wells, which was drilled and constructed in the Loxton Pumping Station and Thiele's Homestead area during November and December 2009.
6. Provides recommendations for the future extension of the Loxton Sands highland wellfields.
7. Provides results from the regional groundwater modelling which predicted the in-river salt load benefits resulting from the highland wellfield and from the overall Loxton SIS as constructed, both floodplain and highland. The highland wellfield (excluding the horizontal drainage well) was

predicted to provide a salt load benefit of 8.6 t/d at three years, increasing to 10.7 t/d at 100 years. All components of the Loxton SIS operating in concert (floodplain wellfield, highland wellfield, horizontal well and cliff-toe drain) are predicted to provide a salt load benefit of 60.4 t/d at 100 years.

1. INTRODUCTION

1.1. BACKGROUND

The Loxton irrigation area is located adjacent to the River Murray in the northwest region of the Murray Basin in South Australia (Fig. 1). Prior to European settlement, a naturally occurring flux of saline groundwater discharged to the river in the Loxton area. This groundwater flux was small in comparison to the current post-irrigation development groundwater flux which is driven by a large groundwater mound formed by irrigation drainage. A small additional groundwater flux resulting from the clearing of the Mallee region for dryland farming will also impact the river in the future.

Run-of-river salinity surveys provide valuable information on salt accession to the river on a kilometre-by-kilometre scale and indicated that a salt load of approximately 98 t/d entered the river in the Loxton reach between river kms 482 and 500 at flows of up to 5,000 ML/d. The salt load may double to 188 t/d at flows of 20,000 - 30,000 ML/d due to the leaching of salt from floodplains and the flushing of backwaters. Interpretation of in-river nanoTEM data indicated the majority of the groundwater flux was likely to occur between river kms 488 and 502 (Fig. 1). Saline groundwater (7,000 - 50,000 mg/L) discharges to the river predominantly by lateral flow from the Loxton Sand aquifer (highland) and Monoman Formation aquifer (floodplain) and to a small degree by slow upward leakage through the underlying Bookpurnong Formation from the semi-confined Pata Formation aquifer (the uppermost aquifer of the regionally confined Murray Group Limestone). The formal boundaries of the Loxton salt interception scheme (SIS) project area are river kms 486 to 502.

Between 2003 and 2011, the Department for Water - DFW (formerly the Department of Water, Land and Biodiversity Conservation), in partnership with SA Water and with support from the Murray Darling Basin Authority (MDBA), undertook investigations and has constructed the Loxton SIS to assist in managing River Murray salinity in South Australia.

The $21.4 million Loxton SIS is a shared project under the Murray-Darling Basin Ministerial Council's Basin Salinity Management Strategy and the National Action Plan for Salinity and Water Quality. The scheme was funded by the New South Wales, Victorian, South Australian and Australian Governments through the Murray-Darling Basin Authority (MDBA) and by South Australia and the Commonwealth through the National Action Plan for Salinity and Water Quality. Although the scheme is jointly owned by New South Wales, Victoria, South Australia and the Commonwealth of Australia, the MDBA manages these works on behalf all the owners.

The Loxton SIS is an interception curtain and includes floodplain and highland wellfields comprising 100 production and observation wells and also the innovative horizontal well and cliff-toe drain, which pump to intercept the groundwater flux and salt load discharging to the river. Groundwater is pumped from the scheme at a rate of around 75 L/s (based on the results of investigations and operational experience) and piped to the Noora evaporation basin for disposal. The scheme provides an 11.66 EC (MDBA BigMod run September 2010) salinity benefit at Morgan over a 30 year average period. Reduced river salinity will benefit the environment, irrigators and consumers serviced by the SA Water pipeline infrastructure which supplies Adelaide and regional towns including Port Pirie, Port Augusta and Whyalla. It is anticipated that the scheme will result in a beneficial impact on the Basin economy of the order of $1.347m/a (MDBA 5 year review of Bookpurnong and Loxton SIS 2012). The scheme addresses a key objective of South Australia's Strategic Plan i.e. that South Australia maintains a positive balance on the MDBA salinity register.

INTRODUCTION

The design and construction of the floodplain wellfield is documented in Howles *et al*. (2007). The floodplain wellfield intercepts the groundwater flux in areas where the floodplain (underlain by the Monoman Formation) separates the river channel from the highland area. Extraction from a curtain of conventional vertical production wells controls the hydraulic gradient towards the river by reducing the watertable in the Monoman Formation down to river pool level elevation.

It was estimated that potentially one-half of the salt load in the Loxton reach may originate from the highland area where it is in direct hydraulic connection with the river (making the Loxton Sands aquifer the primary target). This aquifer posed considerable technical difficulties due to its unpredictable hydraulic nature and the fact that the most permeable coarse-grained sands occur at the top of the sequence (and therefore frequently unsaturated) and the least permeable fine sands at the base). It was therefore critical that a technically feasible interception option be found. Investigation drilling had identified a thin competent layer at the base of the Loxton Sands up to 2 m in thickness comprised of poorly sorted sands and reworked shelly material (shell hash) which had a reasonable yield and occurred close to river pool level.

It was recognised that conventional vertical production wells may not provide cost effective or hydraulically efficient interception in the highland areas and in 2004 horizontal drainage wells were proposed as a potential solution. Four sites in the Loxton area had been previously identified as being suitable for the possible construction of horizontal wells. Construction of a trial horizontal well targeting the shell hash layer commenced in July 2005. The exhaustive investigation into the horizontal well interception efficiency, in relation to intercepting the groundwater flux discharging to the river from the Loxton Sands, is detailed in Smith and Howles (2008). While construction of the horizontal well was successful, the decision to drill similar horizontal wells required an intensive hydrogeological investigation program to determine hydrogeological conditions in other highland areas. Concerns about the cost effectiveness of horizontal wells resulted in an assessment of the alternative infrastructure option of closely spaced conventional vertical production wells.

Golder Associates was engaged by the MDBA in early 2006 to independently review the results of all the work undertaken at that time (Campbell *et al*. 2007). The review supported the conceptual hydrogeological model and the targeting of the unconfined aquifers for salt interception because of a dominant lateral groundwater flux discharging to the river, rather than targeting the deep confined Murray Group Limestone which would indicate a dominant vertical flux. The report raised concerns in relation to knowledge of hydrogeological conditions on the highland and the infrastructure that would be required for salt interception. Extensive geotechnical investigations were recommended which were used as a basis for undertaking the investigations discussed in this report.

In-river EC data obtained by DFW late in 2006 indicated possible high salinity zones in the river between the Loxton Pumping Station and Thiele's Homestead (between river kms 494 and 495), an area believed to be contributing significant salt loads to the river (Fig. 2). This corresponded with the interpretation of the in-river NanoTEM data.

In November 2007, SA Water requested that DFW undertake an investigation program targeting the Loxton Pumping Station and Thiele's Homestead area aimed at building on existing knowledge through further in-river and hydrogeological investigations, undertake a Pata Formation wellfield trial (later extended to include a Loxton Sands wellfield trial) and determine the most appropriate infrastructure for completing the highland wellfield. Evidence available at that time had indicated the Pata Formation would not be a viable target aquifer for salt interception in the Loxton region. In August 2008, the investigation area was extended to include two additional areas, Rilli's Cliffs (between river kms 501 and 502) and Northern Thiele's floodplain (between river kms 492.5 and 493). The final highland wellfield, comprising 27 production wells, was drilled and constructed in the Loxton Pumping Station and Thiele's Homestead area during November and December 2009.

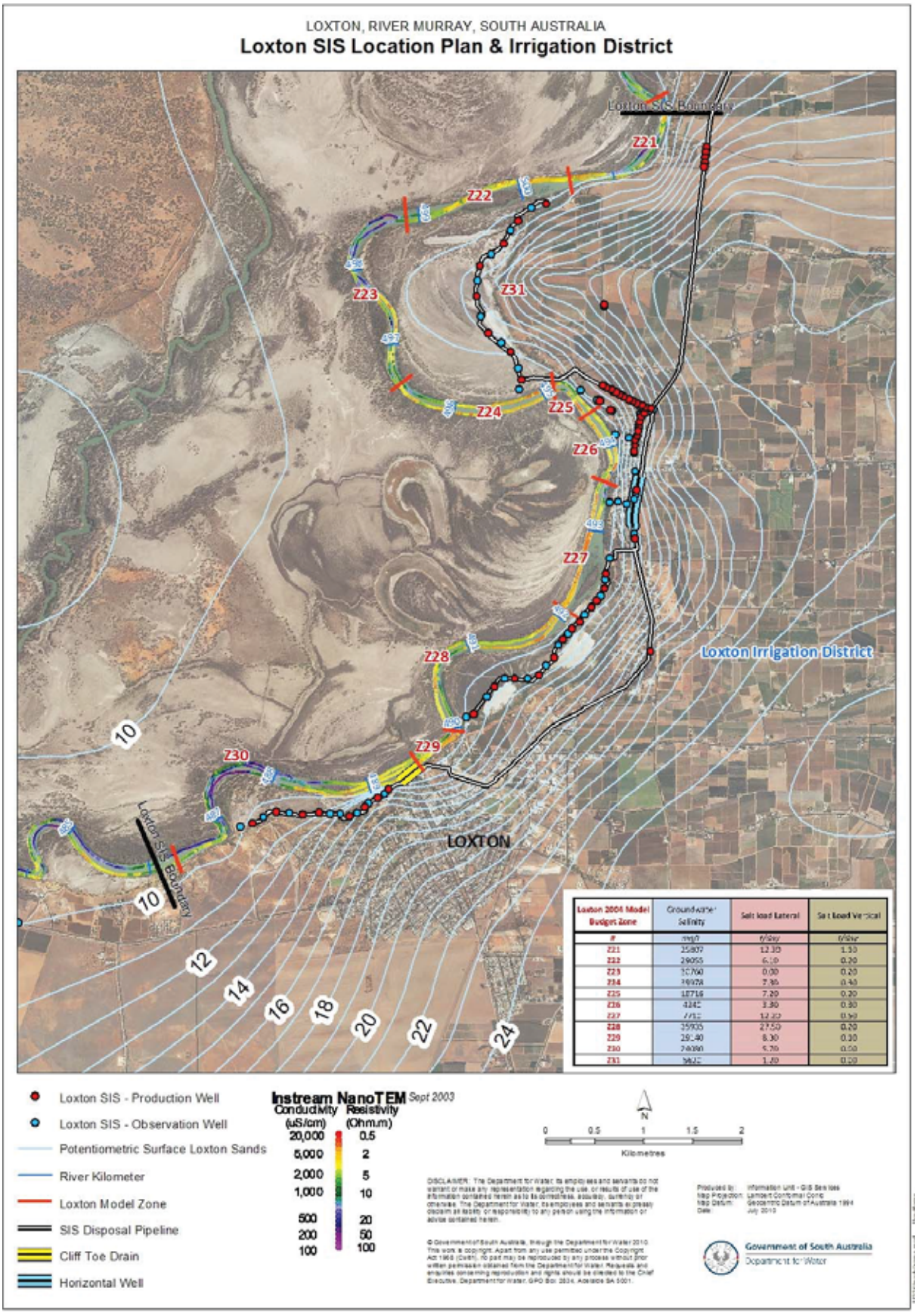


Figure 1. Location of Loxton SIS and in-stream nanoTEM

Figure 2. In-river EC data between Loxton Pumping Station and Thiele's Homestead

1.2. OBJECTIVES OF INVESTIGATION

The objectives of the investigations at the three sites (located in Fig. 3) are presented below. Given the length and complexity of the investigations covered in this report, a chronology of important events is presented in Appendix A. It should be noted that investigations first commenced at what is known as Site-2.

Site-1 (Rilli's Cliffs)

1. Determine the magnitude of the groundwater flux and salt load discharging to the river from the Loxton Sands via the eastern (left bank) (the highland) between river kms 501 and 502.
2. Determine the effectiveness of a Loxton Sands trial wellfield to intercept the groundwater flux discharging to the river from the Loxton Sands.
3. Provide recommendations for the highland wellfield infrastructure option.

Site-2 (Loxton Pumping Station to Thiele's Homestead)

1. Determine the magnitude of the groundwater flux and salt load discharging to the river from the Loxton Sands via the left bank (the highland) between river kms 494 and 495. It was assumed that groundwater discharged only from the Loxton Sands.
2. Determine the effectiveness of a Pata Formation trial wellfield to intercept the groundwater flux discharging to the river from the Loxton Sands.
3. Determine the effectiveness of a Loxton Sands trial wellfield to intercept the groundwater flux discharging to the river from the Loxton Sands.
4. Provide recommendations for the highland wellfield infrastructure option.

Site-3 (Northern Thiele's Floodplain)

1. Determine the source of saline groundwater and magnitude of the groundwater flux contributing to increasing river EC from the left bank (the floodplain) between river kms 492.5 and 493.
2. Provide recommendations for the SIS infrastructure option.

1.3. SCOPE OF REPORT

This report details the hydrogeological investigations that were undertaken to further characterise the Loxton Sands and Pata Formation and their hydraulic connectivity and to determine the magnitude of the groundwater flux and salt load discharging to the river from the Loxton Sands. The investigations included the long-term pumping tests conducted on Pata Formation trial wellfield and Loxton Sands trial wellfield.

It also details the results of site-specific groundwater modelling which was carried out to compare the interception efficiency achieved by the Loxton horizontal well with that achieved by the Loxton Sands trial wellfield. Results from the regional groundwater modelling which predicted the in-river salt load benefits resulting from the highland wellfield and from the overall Loxton SIS (floodplain and highland) are also presented.

The report summarises the design and construction of the Loxton Sands highland wellfield and provides recommendations for the future wellfield extension.

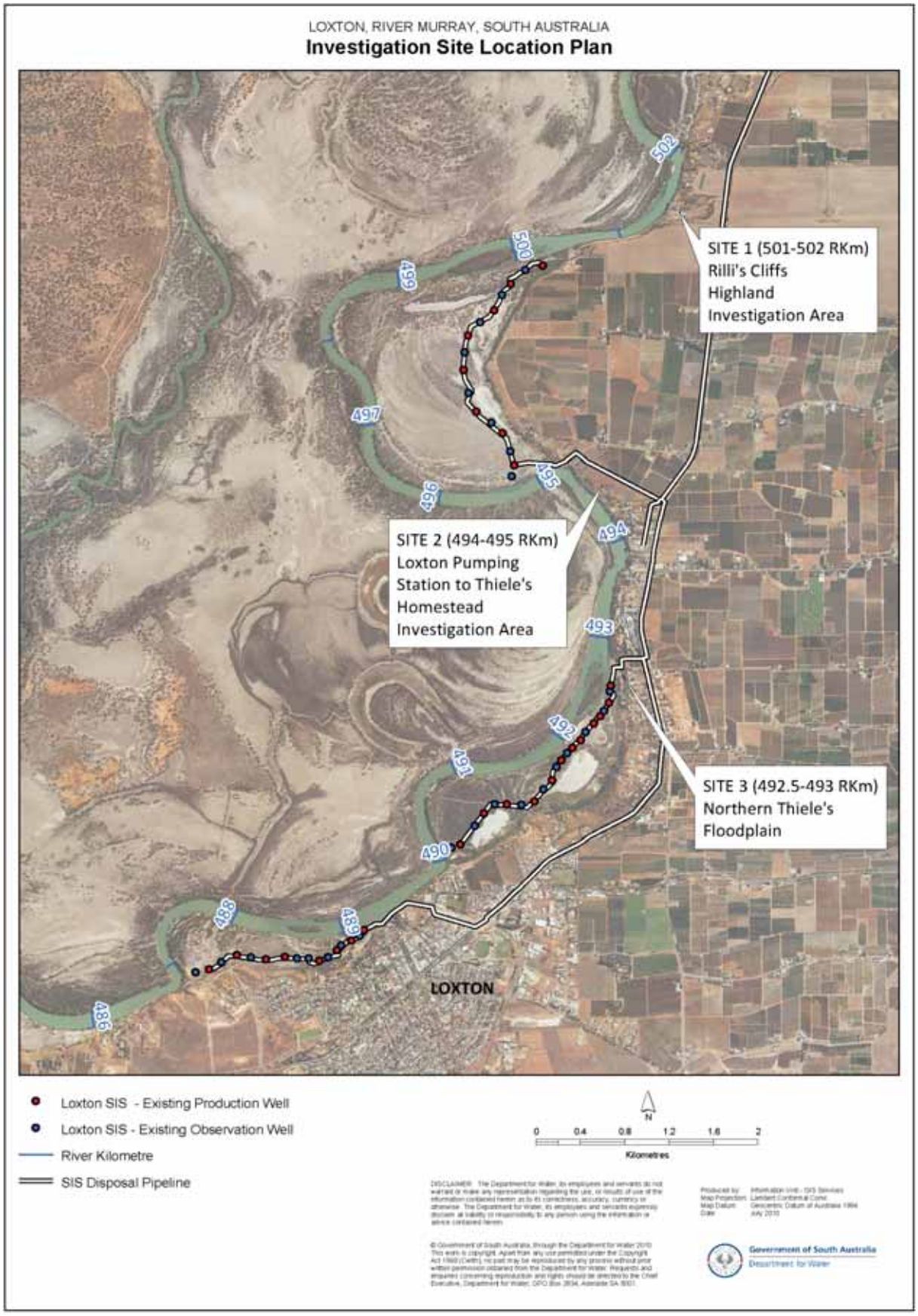


Figure 3. Investigation sites location plan

2. REGIONAL HYDROGEOLOGY

2.1. HYDROGEOLOGICAL UNITS

The characteristics of the hydrogeological units in the project area that overlie the Murray Group Limestone are discussed in order of increasing depth below ground surface.

2.1.1. COONAMBIDGAL FORMATION

The Coonambidgal Formation clay layer occurs ubiquitously across the floodplain and comprises clay and silts deposited during periods of episodic flooding. The unit is commonly 4 to 5 m thick in the middle of the respective floodplains, but can vary in thickness from 1 to 11 m, with the greater thicknesses observed at the break in slope between the floodplain and highland.

2.1.2. MONOMAN FORMATION AQUIFER

The Monoman Formation unconfined to semi-confined aquifer was the primary target for salt interception on the floodplain. The unit consists of relatively clean, fine to coarse grained, fluvial sands deposited as point bar sands within a wide floodplain. The unit occasionally comprises minor clay and silt layers and occasional lignite bands towards the base. The unit is commonly 4 to 10 m thick and is thin to absent at the break in slope. However, it can reach a thickness of up to 25 m in deep incised channels within the meander belt. As a consequence of the depositional environment, the unit is a highly variable aquifer with yields ranging between 0.5 and 10 L/s. This variability makes it difficult to predict likely yields across the floodplain.

Due to its semi-unconfined nature, the potentiometric surface for the Monoman Formation has been merged with the Loxton Sands (Fig. 1). At the break of slope on the eastern side of the river (the transition between the Loxton Sands and Monoman Formation) the potentiometric heads are up to 2 m above the river pool level of 9.8 m AHD. On the western side of the river, potentiometric heads are either close to or below river pool level with the exception of a slightly elevated potentiometric head (11 m AHD) in the area of the Katarapko Island disposal basin, to which irrigation drainage water from the Comprehensive Drainage System network is pumped.

Groundwater salinity values in the Monoman Formation are highly variable, possibly as a result of evaporative effects on the floodplain and range between 7,000 and 60,000 mg/L.

2.1.3. LOXTON SANDS AQUIFER

The Loxton Sands unconfined aquifer was the primary target for salt interception on the highland however it posed the most difficulty due to the variable nature of the hydraulic properties.

Detailed sedimentological analysis, downhole geophysical logging and airborne electromagnetic (HEM) geophysical surveys (Hill *et al*. 2004) helped to unravel the complexity of the Loxton Sands and provide some confidence in predicting suitable facies for salt interception close to the river pool level.

The most permeable coarse grained and frequently unsaturated sands occur at the top of the sequence with the least permeable fine sands (and occasional shell hash) found at the base of the succession. These sands grade to a low permeability silty clay and shell facies towards the base, referred to in this report as the Lower Loxton Clay and Shells. This upward coarsening sequence represents a shift from offshore to near shore and back beach/dune depositional environments, reflecting cyclic eustatic sea level drops resulting in progradational clastic packages.

The Loxton Sands was targeted for salt interception in the Loxton area where no floodplain exists. However, the elevation of the base of the fine sands and shell hash occurs close to river pool level and therefore has a significant impact on the production well spacing required to achieve effective salt interception. Although the Loxton Sands is commonly between 25 and 30 m thick, the permeable basal shell hash and coarse sand unit that occur at the base of the succession in the Loxton area is only 2 to 3 m thick. Yields up to 1.5 L/s were obtained in production wells completed in the basal shell hash facies. Elsewhere yields vary from <0.5 L/s in fine-grained sands up to 5 L/s in coarse-grained facies in the area targeted for highland interception in the Bookpurnong SIS area.

The combined potentiometric surface for the Loxton Sands and Monoman Formation for May 2004 is given in Fig. 1. A prominent groundwater mound trending northeast-southwest occurs in the Loxton Sands in the Loxton irrigation area with a maximum height of 26 m AHD. A smaller mound occurs in the Bookpurnong area.

Groundwater salinity values in the Loxton Sands vary dramatically across the Loxton-Bookpurnong region reflecting the impact of low salinity irrigation drainage on the saline native groundwater. Groundwater salinity data were sourced from pumping tests and HYDROLAB geophysical sonding. The latter demonstrating stratification with the heavier dense saline groundwater underlying fresher irrigation water. For the purposes of predicting salt loads entering the river, the more saline native groundwater values were adopted for various zones along the river ranging between 5,000 and 40,000 mg/L.

2.1.4. BOOKPURNONG FORMATION

The Bookpurnong Formation aquitard occurs between the Loxton Sands and the underlying Pata Formation. The unit consists of poorly consolidated plastic silts and shelly clays that are differentiated from the Lower Loxton Clay and Shells (grey in colour) on the basis of colour (light to dark khaki) and increased plasticity. The unit reaches a maximum thickness of 15 m in the Loxton area but is highly variable with no discernable trend observed. The unit is thin to occasionally absent on all floodplains in the Loxton area more likely as a consequence of erosion but possibly as a result of depositional thinning.

2.1.5. PATA FORMATION

The Pata Formation semi-confined aquifer occurs throughout the Loxton-Bookpurnong region and consists of a poorly consolidated bryozoal limestone with interbedded friable sand layers. The unit outcrops to the south of Loxton where it is exposed at river pool level downstream from the Loxton Caravan Park (river km 486) and is dry five kilometres to the west. The unit dips gently to the northeast to depths of about 70 m below ground surface at Bookpurnong (-25 m AHD). In the Loxton area, the unit commonly occurs between 35 and 40 m below ground surface on the highland, but can occur as shallow as 10 m beneath the surface on the floodplains. The unit is typically between 10 and 15 m in thickness with an observed thickening to the northeast.

Although described as a limestone, the Pata Formation is considered a poor aquifer due to the high marl content. Pumping tests conducted by DFW at both floodplain and highland sites have returned yields of between 0.5 and 1 L/s. The unit is underlain by the Winnambool Formation aquitard.

Table 1 presents a summary of the hydrogeologic units.

Table 1. Hydrogeological Units of the Loxton Area

Hydrogeological Unit	Aquifer/aquitard	Salinity range (mg/L)	Yield (L/s)
Coonambidgal Formation	Clay layer	N/A	N/A
Monoman Formation	Aquifer unconfined to semi-confined in river valley	7,000 - 60,000	0.5 - 10
Loxton Sand	Aquifer unconfined on highland	7,000 - 40,000	0.5 - 5
Lower Loxton Clay and Shells	Aquitard - clay, shells	N/A	N/A
Bookpurnong Formation	Aquitard - clay	N/A	N/A
Murray Group Limestone (Pata Formation)	Aquifer - limestone (semi-confined upstream of river km 486)	10,000 - 30,000	0.5 - 1

2.2. GROUNDWATER FLOW SYSTEM

The two principal aquifers targeted for salt interception in the Loxton region are the Loxton Sands in the highland area and Monoman Formation in the floodplain adjacent to the river.

The Loxton Sands aquifer forms a regionally extensive unconfined to semi-unconfined aquifer into which the channel of the ancestral River Murray is incised. Within this channel, the Monoman Formation and the overlying Coonambidgal Formation have been deposited and it is within this sequence that the channel of the smaller modern river is incised. Saline groundwater (between 7,000 and 50,000 mg/L) discharges to the river via a number of pathways including:

1. Direct lateral inflow via seepage from exposed Lower Loxton Sands at or near the base of cliffs adjacent to the river.
2. Direct lateral inflow from the Monoman Formation that acts as a conduit for lateral flow from the Lower Loxton Sands and for slow upward leakage from Murray Group limestone aquifers underlying the floodplains.
3. Discharge from the Monoman Formation and localised hypersaline lakes (salinas) often at the back of the floodplain that deliver high salt loads during and after periods of flood.
4. Slow upward leakage through the Bookpurnong Formation from the underlying confined Murray Group Limestone.
5. Slow upward leakage from Murray Group Limestone that may be in direct hydraulic connection with the river due to erosion of the Lower Loxton Clay and Shells and Bookpurnong Formation.

These processes are summarised in the conceptual hydrogeological model illustrated in Fig. 4. The figure indicates the groundwater flow between the aquifers, the broader regional groundwater flow system, inter-aquifer flow and local recharge mechanisms. The hydraulic connection between the Loxton Sands and the Monoman Formation is an important component in controlling the salt movement on the area. The groundwater flux discharging to the river is dominated by the hydraulic conductivity of the Loxton Sands and the head difference between the river and nearby groundwater. As the river is mainly in contact with Loxton Sands and Monoman Formation in the study area, the majority of the salt load entering the river is provided by these two aquifers. Hence it was these aquifers that were the targets for salt interception in the Loxton area.

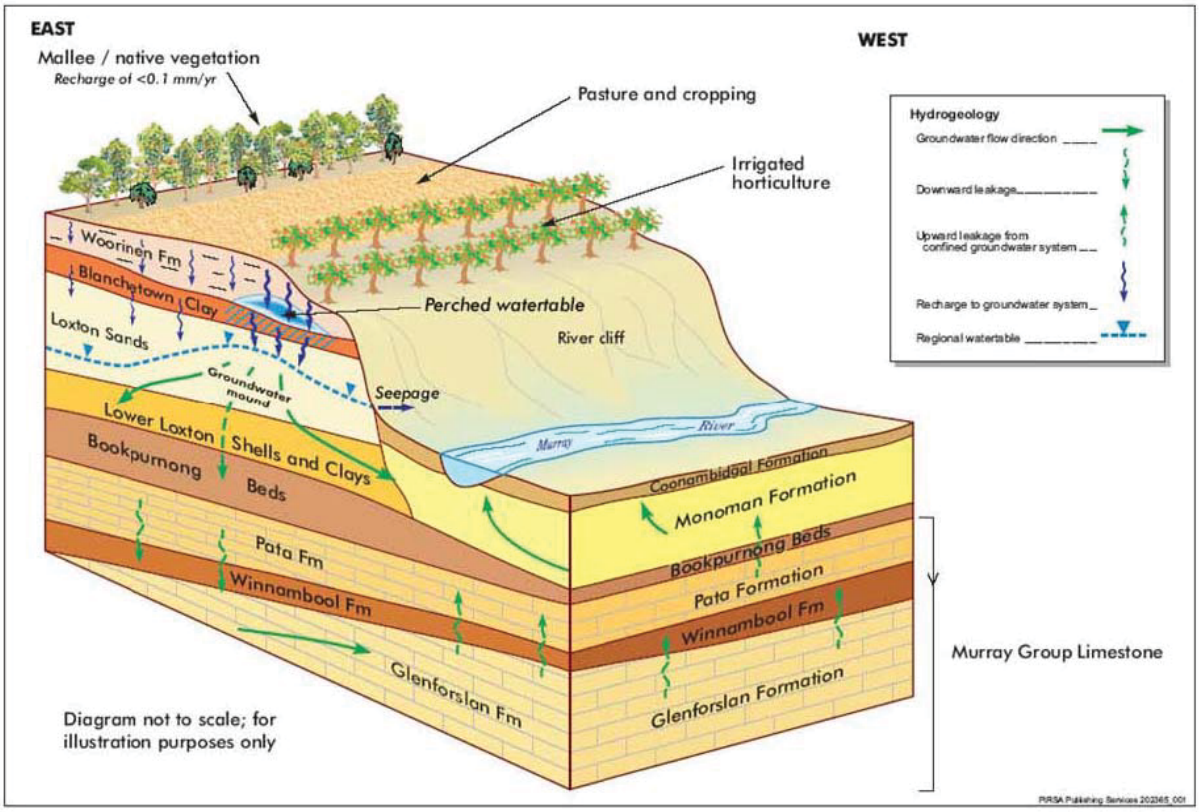


Figure 4. Conceptual hydrogeological model

3. SITE-1 INVESTIGATIONS

A number of investigation, production and observation wells were drilled during previous investigations associated with the Loxton SIS in the Site-1 (Rilli's Cliffs) investigation area between river kms 501 and 502, however significant data gaps existed and further drilling and pumping tests were required. This regional investigation, approved in December 2008, targeted the Loxton Sands aquifer and underlying Pata Formation aquifer to gain a better understanding of the hydrostratigraphy, the magnitude of groundwater flux and salt load discharging to the river from the Loxton Sands and the aquifer hydraulic connectivity, which were required to determine the most appropriate SIS infrastructure. The investigations were consistent with the recommendations of the Golder review. A reference base map indicating key features is given in Fig. 5.

The objectives of the regional investigation program included:

1. Determine the source of and magnitude of groundwater flux discharging to the river from the left bank (the highland). It was assumed at that time that groundwater discharged from the Loxton Sands.

    a. Characterise the Loxton Sands (including Shell Hash unit where present) and underlying Bookpurnong Formation (including Lower Loxton Clay and Shells):
        - Determine the areal extent, thickness, nature and lithology of the Loxton Sands and Bookpurnong Formation.
        - Determine the spatial and vertical salinity distribution of the Loxton Sands.
        - Determine the hydraulic parameters of the Loxton Sands.

    b. Determine the hydraulic parameters of the Pata Formation and overlying Bookpurnong Formation aquitard (including Lower Loxton Clay and Shells) and therefore the level of hydraulic connectivity at the site of the trial wellfield:
        - Determine the hydraulic parameters of the Pata Formation.
        - Determine the hydraulic parameters of the Bookpurnong Formation.

        Following the results of the Site-2 investigations and Pata Formation trial wellfield this component of the investigations was not carried out.

    c. Determine the magnitude of the groundwater flux discharging to the river from the Loxton Sands and correlate with the in-river work if possible. Following the results obtained from the Site-2 investigations, this component was not pursued. Calculated salt load benefits derived from the regional groundwater model have been reported.

    d. Determine, using in-river methods, locations where saline groundwater was likely to be discharging to the river (and the magnitude of the flux if possible). Following the results obtained from the Site-2 investigations this component was not pursued.

In addition to the regional investigations:

2. Determine the effectiveness of SIS infrastructure options being: either horizontal drainage wells completed in the Loxton Sands or conventional vertical production wells completed in the Pata Formation, the Loxton Sands, or both; in intercepting the groundwater flux discharging to the river from the Loxton Sands by transferring the results from Site-2.
3. Provide recommendations for the SIS infrastructure option.

Following discussion and agreement with SA Water in mid 2009, the original intention of transferring the Site-2 Loxton Sands trial wellfield recommendations and design throughout the Site-1 area, where less detailed hydrogeological information was available (and for which site-specific groundwater modelling had not yet been undertaken), was considered too great a risk without undertaking a wellfield trial. As a result, the drilling and construction of a Loxton Sands trial wellfield was recommended.

The objectives of this investigation included:

1. Determine the effectiveness of a Loxton Sands trial wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands.
2. Make recommendations regarding the most appropriate SIS infrastructure including final SIS design in terms of well types, well locations and well yields.

3.1. REVERSE AIR CIRCULATION DRILLING

Extensive use was made of reverse air circulation (RAC) investigation drilling throughout the Loxton SIS project including the pre-drilling of most production well sites. This technique allowed the accurate metre by metre strata sampling throughout the geological profile and the collection of bulk samples for particle size distribution analysis where required. This strategy was extremely beneficial in that it ensured:

1. Accurate knowledge of particle size, critical for screen aperture design.
2. Predetermined screen settings.
3. Confident ordering of well casings and screens.
4. Clear instruction of drilling contractors prior to commencing the work.
5. Minimal on-site decision making during the drilling and construction of production wells.

An RAC investigation drilling program was undertaken to further characterise the Loxton Sands (and its base) and the thickness and nature of the underlying Bookpurnong Formation. Investigation drillholes (referred to as Master RAC Drillhole in Appendix B) were positioned close to the sites of proposed production and/or observation wells to assist with future well design and construction.

Drillholes and wells are referred to in this report by the Drillhole Name. The correspondence between the Drillhole Name, Unit Number and Permit Numbers is given in Appendix B. Investigation drillholes were ordered sequentially and prefixed by LFA for the floodplain and LHA for the highland. Observation wells were ordered sequentially and prefixed by LFO for the floodplain and LHO for the highland. Production wells were ordered sequentially and prefixed by LFP for the floodplain and LHP for the highland. Pata Formation observation and production wells were ordered sequentially with the number prefixed by LHO and LHP respectively and suffixed with P.

3.1.1. DECEMBER 2008 DRILLING PROGRAM

Underdale Drillers undertook the regional RAC investigation drilling program under DFW supervision in December 2008. The location of the investigation drillholes are given in Fig. 6. Drillhole specifications are given in Appendix B with geological logs presented in Appendix C. Drillholes that fully penetrated the Bookpurnong Formation were grouted across the aquitard to ensure hydraulic separation of the aquifers.

The program included:

1. Nine investigation drillholes at 100 m spacing commencing near LHA56 and continuing parallel to the river where possible, for a distance of 800 m north.

2. Ten investigation drillholes at 100 m spacing along Bookpurnong Road.

3.1.2. OCTOBER 2009 DRILLING PROGRAM

Underdale Drillers undertook further RAC investigation drilling under DFW supervision in October 2009. The locations of the investigation drillholes are given in Fig. 6. Drillhole specifications are given in Appendix B with geological logs presented in Appendix C. Drillholes fully penetrating the Bookpurnong Formation were grouted across the aquitard to ensure hydraulic separation of the aquifers.

All Investigation drillholes were bulk sampled at one metre intervals, where such samples were obtainable. Three to four representative samples were taken from each drillhole for particle size distribution analysis. Emphasis was placed on sampling the Loxton Sands immediately above the Bookpurnong Formation to assist in production well screen selection.

Figure 5. Site-1 pre-2008 investigation drillhole and well location plan

Figure 6. Site-1 investigation drillhole location plan

3.2. NOVEMBER TO DECEMBER 2009 TRIAL WELLFIELD DRILLING PROGRAM

The drilling and construction of production and observation wells comprising the Rilli's Cliffs investigation site (250 m in length) was undertaken to enable a long-term pumping test to be conducted on the Loxton Sands trial wellfield. Underdale Drillers undertook the mud rotary well drilling program under DFW supervision in November and December 2009. The location of the wells is given in Fig. 7. Well specifications are given in Appendix B with geological logs presented in Appendix C.

The trial wellfield included:

1. Five Loxton Sands production wells spaced at 50 m (LHP78, LHP79, LHP80, LHP81 and LHP82).
2. Two Loxton Sands observation wells, LHO96 (positioned at the mid-point between LHP78 and LHP79) and LHO95 (positioned at the mid-point between LHP79 and LHP80).

3.2.1. PRODUCTION WELL SPECIFICATIONS

The drilling and construction of the Loxton Sands production wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Australian Mud Company Biovis and CR650. Bentonite was not used due to concern regarding its effect on development.
2. Drilling fluids were controlled in two 4,000 L mud tanks instead of open pits as this was determined to be the best method to control mud weights and keep the sites orderly.
3. Drilling was undertaken using a 14" (355 mm) diameter rotary blade bit.
4. Wells were cased with IPLEX 200 mm ID class 12 UPVC.
5. The base of each production zone was set 1 m below the base of the Loxton Sands, i.e. 1 m penetrating the Lower Loxton Clays and Shells in order to maximise drawdown during long-term pumping.
6. Wells were completed with 12 m of 200 mm ID class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5%. Wells were competed with a 5 m sump to allow for maximum drawdown to the base of the Loxton Sands using Airwell pumps that were trialled in this wellfield.
7. The annulus between the drillhole and the slotted casing was filled with 8:16 gravel pack emplaced by gravity up to 2 m above the top of the production zone.
8. The annulus between the drillhole and casing above the gravel pack was sealed with 1 m (40 L) of bentonite pellets.
9. The annulus between the drillhole and the casing was grouted to surface by tremie line with a 5% bentonite to cement mix. No accelerants were used in the cement mixture.

Figure 7. Site-1 Loxton Sands trial wellfield location plan

10. Development commenced after a minimum grout setting time of 24 hours. Wells were developed by:
    a. Airlift surging at 690 KPa for one hour in the production zone with a jetting tool until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
    b. Injecting 500 L of water and 2 Kg (min) of Boreclean through the drill string and jetting tool into the production zone.
    c. Airlift surging (after a waiting time of one hour) for one hour with a jetting tool until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
11. A groundwater sample was collected during development and submitted to the DFW laboratory for EC determination.
12. Wells were sterilised by dosing with a hypochlorite solution which was agitated for about 15 minutes. The wells were purged after 24 hours to remove any residual chlorine.
13. Additional well development was requested by SA Water in January 2010.
14. The well head was completed above ground level with a Table E flange and 2 x bolts, painted with yellow and red paint for visual safety and fitted with an aluminium tag giving Permit No and Drillhole Name.

3.2.2. OBSERVATION WELL SPECIFICATIONS

The drilling and construction of the Loxton Sands observation wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Biovis and CR650. Bentonite was not used due to concern regarding its effect on development.
2. Drilling fluids were controlled in two 4,000 L mud tanks.
3. Drilling was undertaken using an 8” (178 mm) diameter rotary blade bit.
4. Wells were cased with IPLEX 80 mm ID class 12 UPVC.
5. Wells were completed with 10 m of 80 mm ID class 12 UPVC radial slotted casing in-line screens (1 mm aperture) and with a 1 m sump. Wells were completed with a 10 m production zone to enable Electrical Conductivity (EC) profiling to be conducted.
6. The annulus between the drillhole and the slotted casing was filled with 8:16 gravel pack emplaced by gravity up to 2.0 m above the top of the production zone.
7. The annulus between the drillhole and casing above the gravel pack was sealed with 1 m (20 L) of bentonite pellets.
8. The annulus between the drillhole and the casing was grouted to surface by tremie line with a 5% bentonite to cement mix. No accelerants were used in the cement mixture.
9. Development commenced after a minimum grout setting time of 24 hours. Airlift surging occurred for a minimum of one hour within the production zone (with a jetting tool lowered by tremie line) until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.

10. A groundwater sample was collected during development and submitted to the DFW laboratory for EC determination.
11. Following development and sampling, the wells were sterilised by dosing with a hypochlorite solution which was agitated by pumping for about 15 minutes.
15. The well head was finished at ground level with a concrete gattic cover, painted with yellow and red paint for visual safety and fitted with an aluminium tag giving Permit No and Drillhole Name.
12. Surveying

Interim surveying was conducted by DFW staff after drilling using a portable differential GPS (Trimble) in order to attain indicative surface elevations and the relationship of hydrostratigraphy with the river pool level. All wells were subsequently surveyed by SA Water, Survey and Land Management Group on 18 January 2010, with results included in Appendix B. Additional surveying was required after SA Water site works to reconcile the modifications to final headworks and associated infrastructure (below surface concrete boxes).

3.2.3. GROUNDWATER SALINITY

Results from groundwater samples collected from production wells during development are given in Appendix B. Groundwater salinity is given in Fig. 8.

The following general comments can be made in relation to the groundwater salinity of the Loxton Sands at Site-1:

1. Groundwater salinity ranged between 12,500 and 24,178 mg/L along the Loxton Sands trial wellfield.
2. A groundwater sample subsequently collected by SA Water from LHP82 indicated a value of 23,500 mg/L.
3. A single combined groundwater sample obtained within the first 16 hours of the wellfield trial returned a value of 18,029 mg/L.
4. A single combined groundwater sample obtained 47 days into the wellfield trial returned a value of 15,700 mg/L. This is lower than the value of 25,807 mg/L used in the groundwater model Zone 21.

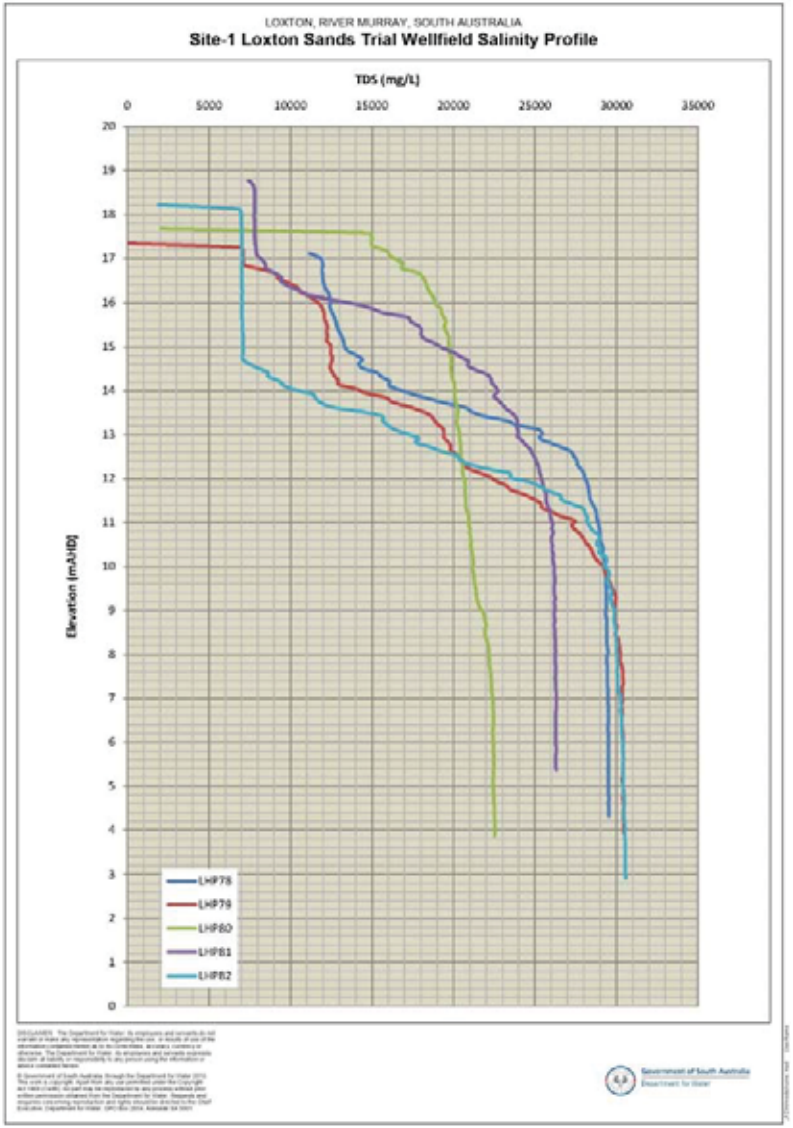
3.2.4. SALINITY PROFILING

DFW Groundwater Technical Services conducted downhole logging on Loxton Sands production wells LHP78 through LHP82 using a Hydrolab (EC, pH) probe which was run in undisturbed wells. The salinity and pH profiles from the production zone for all wells are combined in Fig. 9

The following general comments can be made in relation to the groundwater salinity profile of the Loxton Sands at Site-1:

1. The Hydrolab profiles indicate the Loxton Sands has significant salinity stratification. Increases in salinity with depth were recorded in all wells.
2. Generic salinity values ranged between 6,000 and 12,000 mg/L at the top of the production zone and increased with depth to above 20,000 mg/L at the base.
3. Salinity stratification was less pronounced in well LHP80, ranging from 15,000 mg/L at the top of the production zone to 22,000 mg/L at the base.
4. High salinity readings (over 30,000 mg/L) were recorded at base of production zone within wells LHP78, LHP82 and LHP79.

Figure 8. Site-1 Loxton Sands groundwater salinity distribution



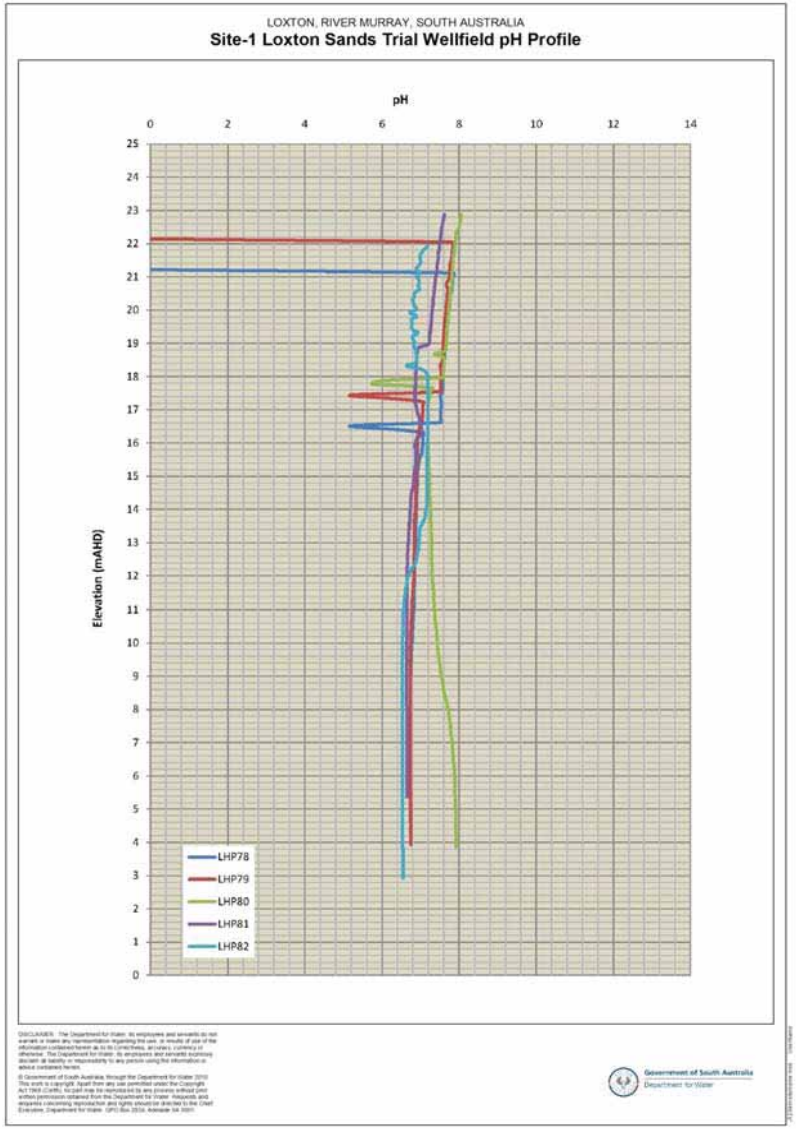


Figure 9. Site-1 Loxton Sands trial wellfield salinity and pH profiles

5. Groundwater samples taken during development were consistent in all wells along the Loxton Sands trial wellfield with salinity ranging from 21,700 to 23,000 mg/L, with the exception of production well LHP82 which had a range between 10,000 and 15,000 mg/L.
6. Hydrolab profiles indicate a pH range between 7.5 at the top of the water column to 6.5 at the base. The pH increased to 8.0 at the base of production well LHP80.

3.2.5. DOWNHOLE GEOPHYSICAL LOGGING

DFW Groundwater Technical Services conducted downhole geophysical logging on production wells LHP78 though LHP82 and observation wells LHO95 and LHO96 along the Loxton sands trial wellfield.

The following geophysical tools were used for logging:

- Gamma probe on LHP78 to LHP82, LHO95 and LHO96
- Neutron probe on LHP78 to LHP82, LHO95 and LHO96
- Induction probe on LHP78 to LHP82, LHO95 and LHO96
- Density probe on LHP80

3.3. AQUIFER AND AQUITARD CHARACTERISATION

The location of three cross-section transects D - D1 (north-south), E - E1 (north-south) and F - F1 (east-west) are given in Fig. 10. The cross-sections indicate the elevations and relationships of the major hydrogeological units, the potentiometric surface of the Loxton Sands and river pool level, together with well construction details.

3.3.1. TRANSECT D - D1

The hydrostratigraphy and elevations of the major hydrogeological units along transect D - D1 are presented in Fig. 11 and can be summarised as follows:

Woorinen Formation

The ground surface (top of Woorinen Formation and recent aeolian surface deposits) occurred between 40 and 45 m AHD. The Woorinen Formation was identified along the entire length of the transect. The base of the unit occurred between 33 and 40 m AHD and was 7 m thick.

Blanchetown Clay

The Blanchetown Clay underlies the Woorinen Formation and overlies the Loxton Sands. The unit was observed in the majority of investigation drillholes except LHA100 and LHA127. This clay presented as a thin lens up to 1 m thick.

Loxton Sands

The Loxton Sands underlies the Blanchetown Clay and overlies the Lower Loxton Clay and Shells. The Loxton Sands (sand unit) consisted of fine gravels and coarse sands becoming finer with increasing silt content with depth. The sands grade to the low permeability silty clay and shell facies of the Lower Loxton Clay and Shells towards the base. The watertable occurred at 17.5 m AHD. The saturated thickness of the Loxton Sands was 8 m.

The base of the unit occurred between 7 and 10 m AHD between investigation drillholes LHA98 and LHA107. The base was identified at 13 m AHD at LHA1. A 2 m thick consolidated sandstone band was identified during drilling, mid elevation within the Loxton Sands between LHA107 and LHA106.

Figure 10. Site-1 Location of cross sections

Lower Loxton Clay and Shells

The Lower Loxton Clay and Shells unit underlies the Loxton Sands and overlies the Bookpurnong Formation. The unit consisted of low permeability shelly, grey, clayey silt turning to silty clay at the base. The top of the unit was relatively consistent with the base of the Lower Loxton Sands. The base of the unit occurred between -5 and -1 m AHD and was 12 m thick.

Bookpurnong Formation

The Bookpurnong Formation underlies the Lower Loxton Clay and Shells and overlies the Pata Formation. The base of the unit occurred between -8 and -4 m AHD and was between 1 and 4 m thick.

Upper Murray Group Pata Formation

The Pata Formation underlies the Bookpurnong Formation. The unit presented as a grey, friable, low permeability silty fossiliferous limestone. The top of the unit was defined between investigation drillholes LHA106 and LHA98 as it was intersected by exploration drilling at 100 m spacing. The unit occurred at between -8 and -4 m AHD. No drillholes fully penetrated the entire thickness of the unit.

3.3.2. TRANSECT E - E1

The location of this transect was positioned as near to the cliff face as possible. The hydrostratigraphy and elevations of the major hydrogeological units along transect E - E1 are presented in Fig. 12 and can be summarised as follows:

Woorinen Formation

The ground surface (top of Woorinen Formation) between investigation drillholes LHA48 and LHA91 was 25 to 40 m AHD. Northward, between LHA91 and LHA56 the surface elevation was 35 m AHD. The unit was 6 m thick.

Blanchetown Clay

The Blanchetown Clay was observed in the majority of investigation drillholes between LHA48 and LHA92. The base of the unit occurred between 25 and 28 m AHD and was 2 m thick. Between LHA91 and LHA56, the unit was barely evident.

Loxton Sands

The Loxton Sands underlies the Blanchetown Clay and overlies the Lower Loxton Clay and Shells. The watertable occurred at 16.5 m AHD. The base of the unit occurred between 7 and 10 m AHD and the saturated thickness was 6 to 10 m.

Lower Loxton Clay and Shells

The base elevation of the Lower Loxton Clays and Shells occurred between -4 and -2 m AHD and was 11.5 m thick.

Bookpurnong Formation

The base of the Bookpurnong Formation occurred between -7 and -4 m AHD.

Upper Murray Group Pata Formation

The Pata Formation occurred between -7 and -4 m AHD.

3.3.3. TRANSECT F - F1

The hydrostratigraphy and elevations of the major hydrogeological units along transect F - F1 are presented in Fig. 13 and can be summarised as follows:

Woorinen Formation

The ground surface inclines from 34 to 42 m AHD (at production well LHP80). The Woorinen Formation and Recent aeolian surface deposits were encountered along the length of the transect. The unit was 6.5 m thick.

Blanchetown Clay

The Blanchetown Clay was not readily observed except in investigation drillhole LHA103.

Loxton Sands

The elevation of the watertable inclines from river pool level up to 17.5 m AHD 650m to the east at production well LHP80. The average thickness of the Loxton Sands was 26 m while the average saturated thickness was 6 m. The base of the unit occurred between 5.5 and 9 m AHD.

Lower Loxton Clay and Shells

The base of the Lower Loxton Clays and Shells occurred between -4 and -3 m AHD and was 11 m thick.

Bookpurnong Formation

The base of the Bookpurnong Formation occurred at -6 m AHD.

Upper Murray Group Pata Formation

The Pata Formation occurred at -6 m AHD.

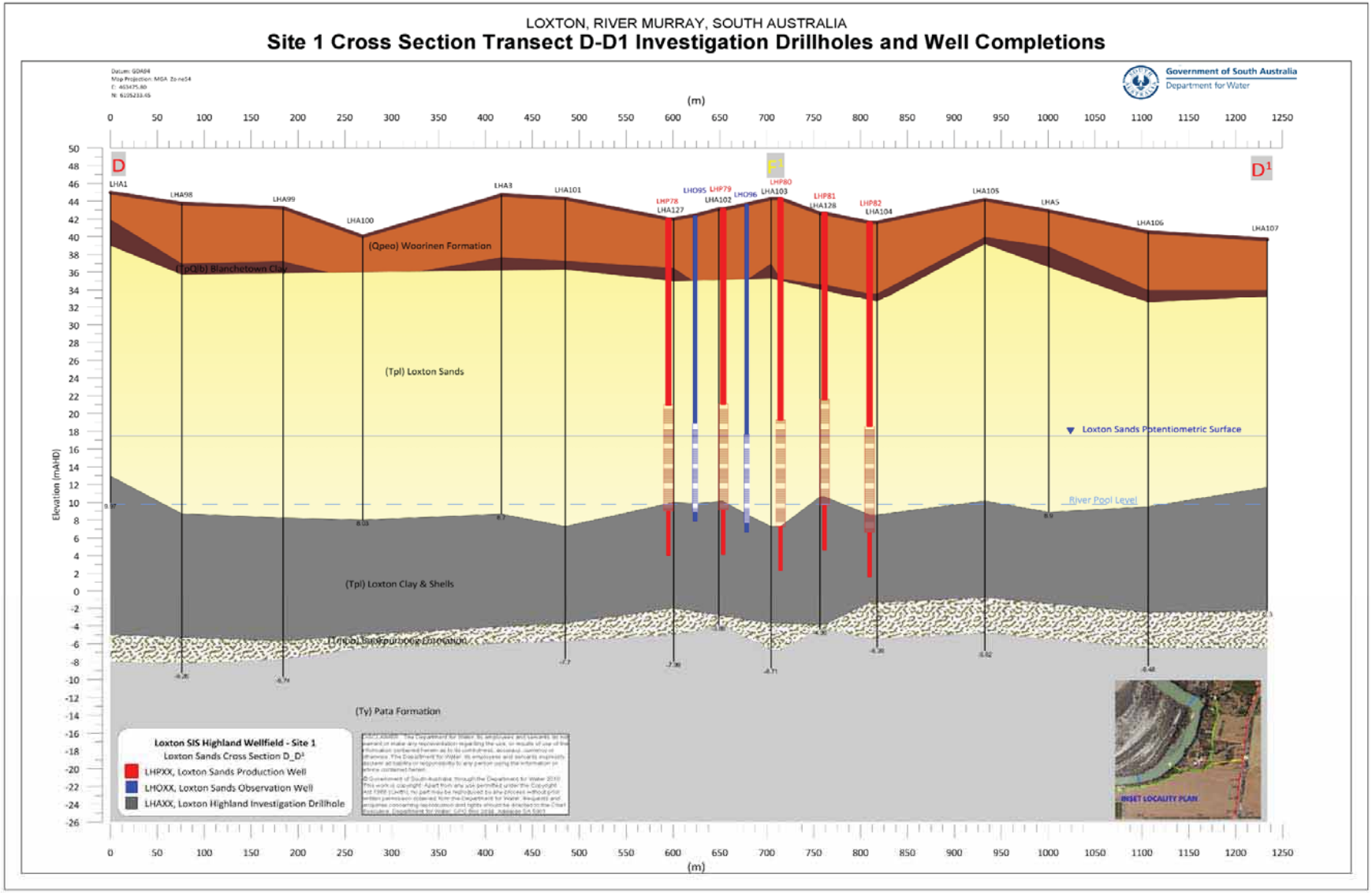


Figure 11. Site-1 Transect D - D1

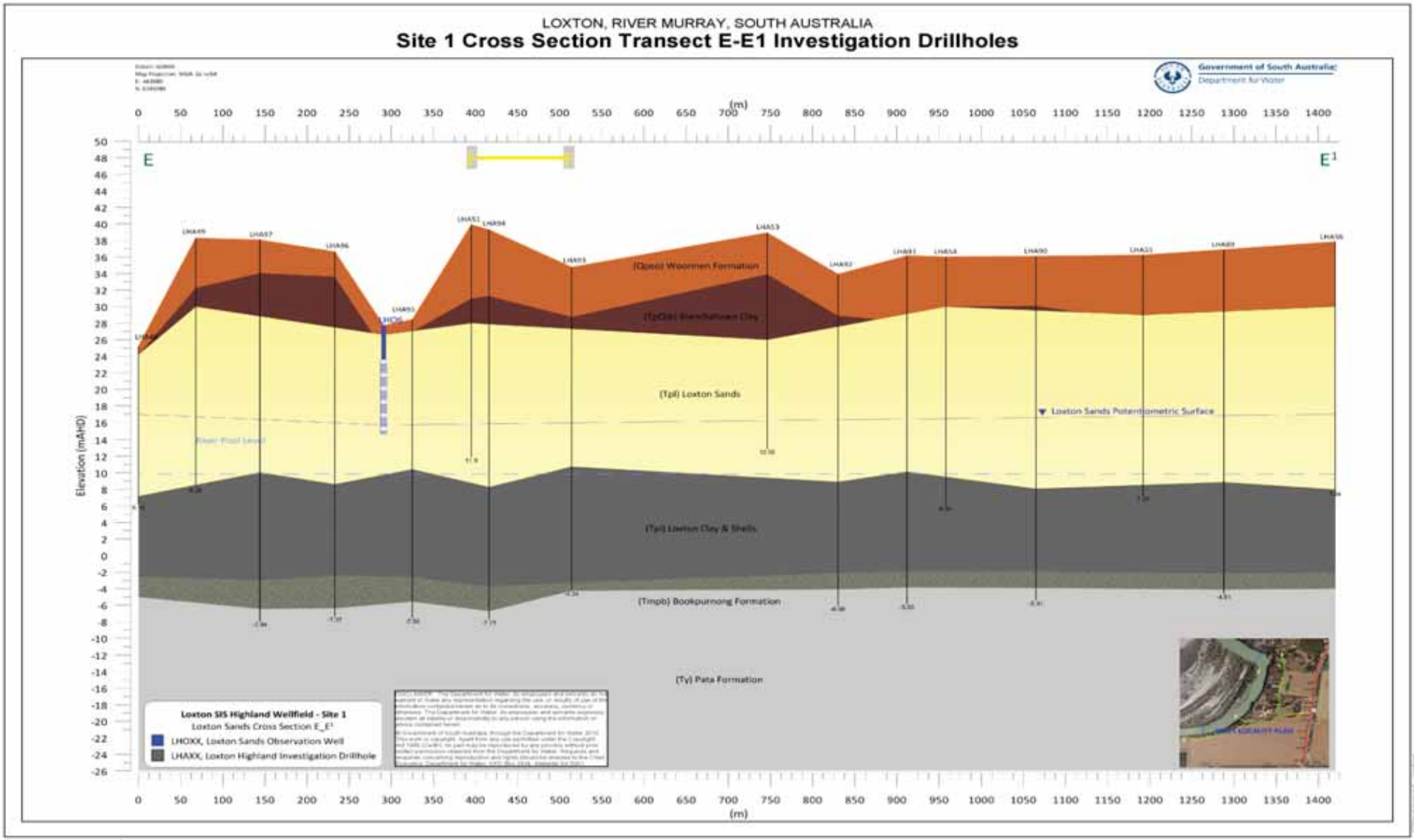


Figure 12. Site-1 Transect E - E1

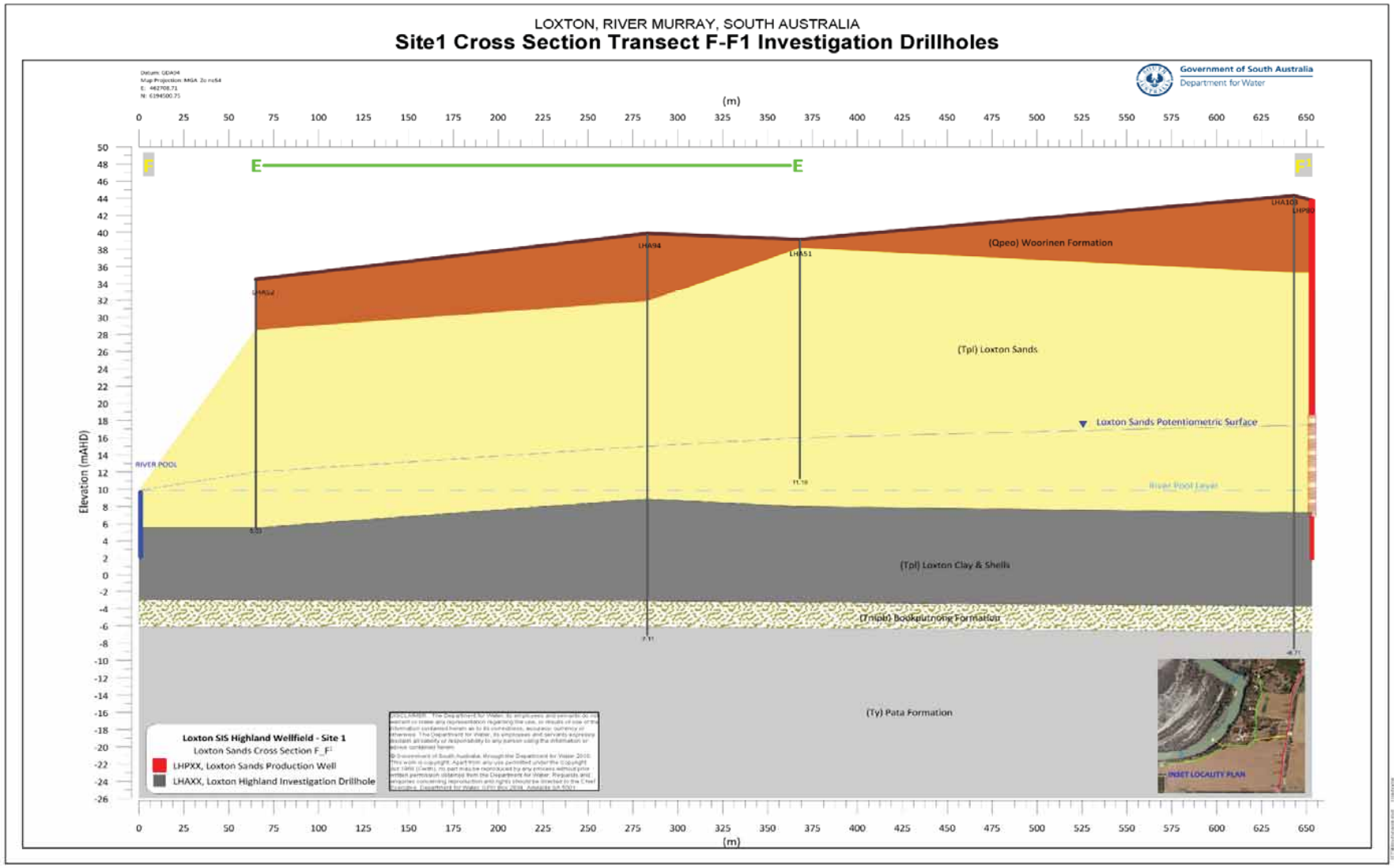


Figure 13. Site-1 Transect F - F1

3.4. PUMPING TEST PROGRAM

Between 15 and 20 February 2010, DFW Groundwater Technical Services conducted a series of development pumping tests on the Loxton Sands trial wellfield production wells (LHP78 through LHP82) using a submersible hydraulic pump lowered into the well sump. The objective of the tests was to determine indicative well yields and purge wells of any residual drilling fluids prior to commencing formal pumping tests.

In response to the low well yields additional acid dosing of the wells was then undertaken to remove any residual carbonates from the annulus and immediate vicinity of the production zone. This strategy was recommended by SA Water after a similar strategy had proved successful in improving well yields at the Site-2 Loxton Sands trial wellfield.

On 24 February 2010 SA Water injected production wells with an acid concentrate and air agitated. The acid concentrate consisted of:

- 40 L Sokolan
- 40 L MSA Acid
- 100 Kg Sulphamic Acid and
- 2,000 L fresh water

On 27 February 2010, DFW Groundwater Technical Services completed a second round of development which included the removal of acid solution from each production well.

3.4.1. STEP DRAWDOWN TESTS

DFW Groundwater Technical Services conducted step drawdown tests on Loxton Sands production wells LHP80 and LHP82 in March 2010. The tests conducted on wells LHP80 and LHP82, which were completed with slotted casing screens and are positioned 100 m apart, were carried out at pumping rates ranging between 0.2 and 1.0 L/s. Test details and results are given in Appendix D.

The objective of step drawdown testing was to determine the well equation which relates drawdown, pumping rate and time. This equation allows prediction of the hydraulic performance of production wells for a design-pumping rate and generation of yield-drawdown curves for any given time.

The well equation is:

$$s = (a Q + c Q2) + b \log10 (t) Q$$

where:

s = drawdown (m)

Q = pumping rate (m^3/min)

t = time (min)

a = constant related to well loss for laminar flow

b = constant related to aquifer loss for laminar flow

c = constant related to well loss for turbulent flow

and:

Well loss (m) = a Q + c Q2

Aquifer loss (m) = b log10 (t) Q

Specific capacity [(L/s)/m of drawdown] = Q / S(t)

Well efficiency = (Aquifer loss / s) x 100

Data was analysed using the Hazel Method. The results of the analysis are given in Fig. 14 and 15 respectively. The analysis of the step drawdown tests resulted in well equation constants discussed below:

LHP80

- Date of test = 18 March 2010.
- Pumping rates at Q = 0.2, 0.25 and 0.3 L/s.
- Step duration 100 mins.
- Well equation constants:-

'a' = -2
'b' = 48
'c' = 2,920

A pumping rate of around 1 L/s was expected from this well (commensurate with that of the other production wells). The negative 'a' value and the anomalously high 'c' value of were indicative of an underperforming well. This may be due to failure of the bentonite seal and the loss of grout into the annular space of the gravel pack during construction.

LHP82

- Date of Test = 22 March 2010.
- Pumping rates at Q = 0.5, 0.8 and 1.0 L/s.
- Step duration 100 mins.
- Well equation constants:-

'a' = 23
'b' = 10
'c' = 183

Based on an average pumping rate of 1 L/s and a pumping duration of 1,000,000 minutes the predicted well efficiency and specific capacity were 64% and 0.18 (L/s)/m respectively.

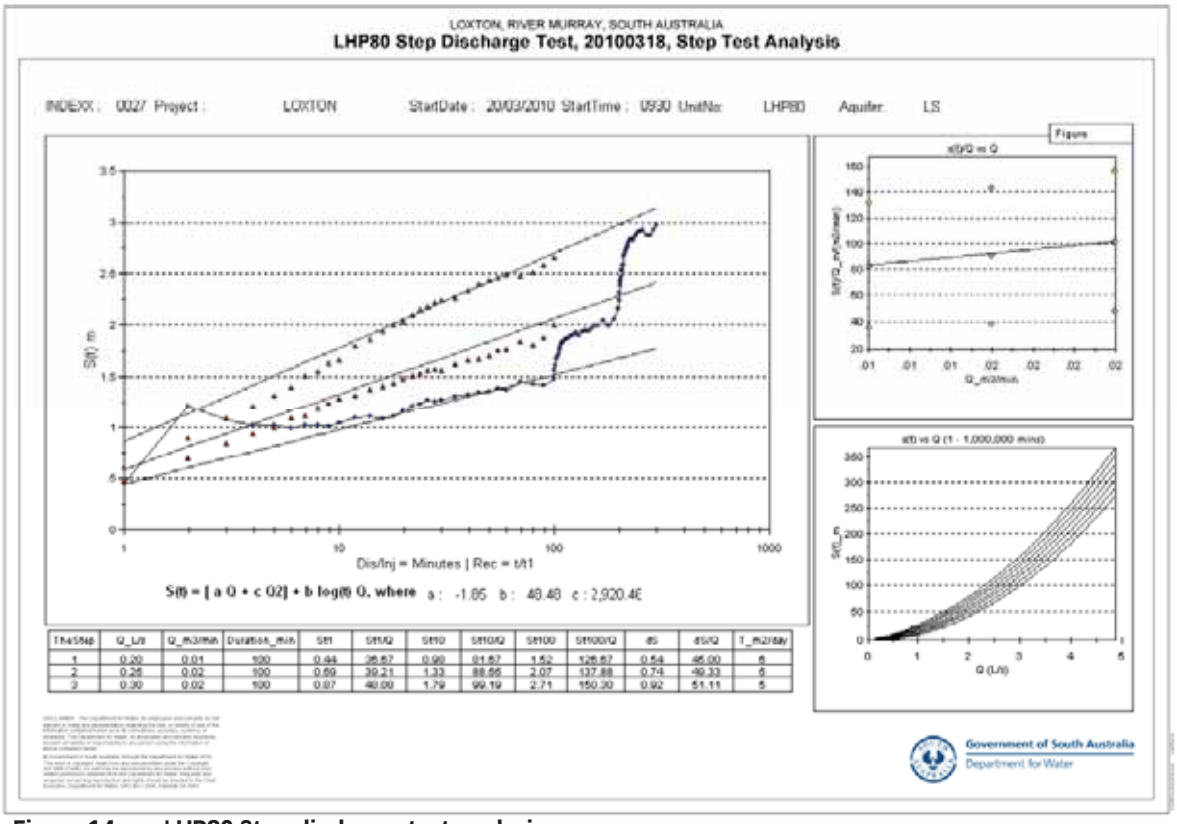


Figure 14. LHP80 Step discharge test analysis

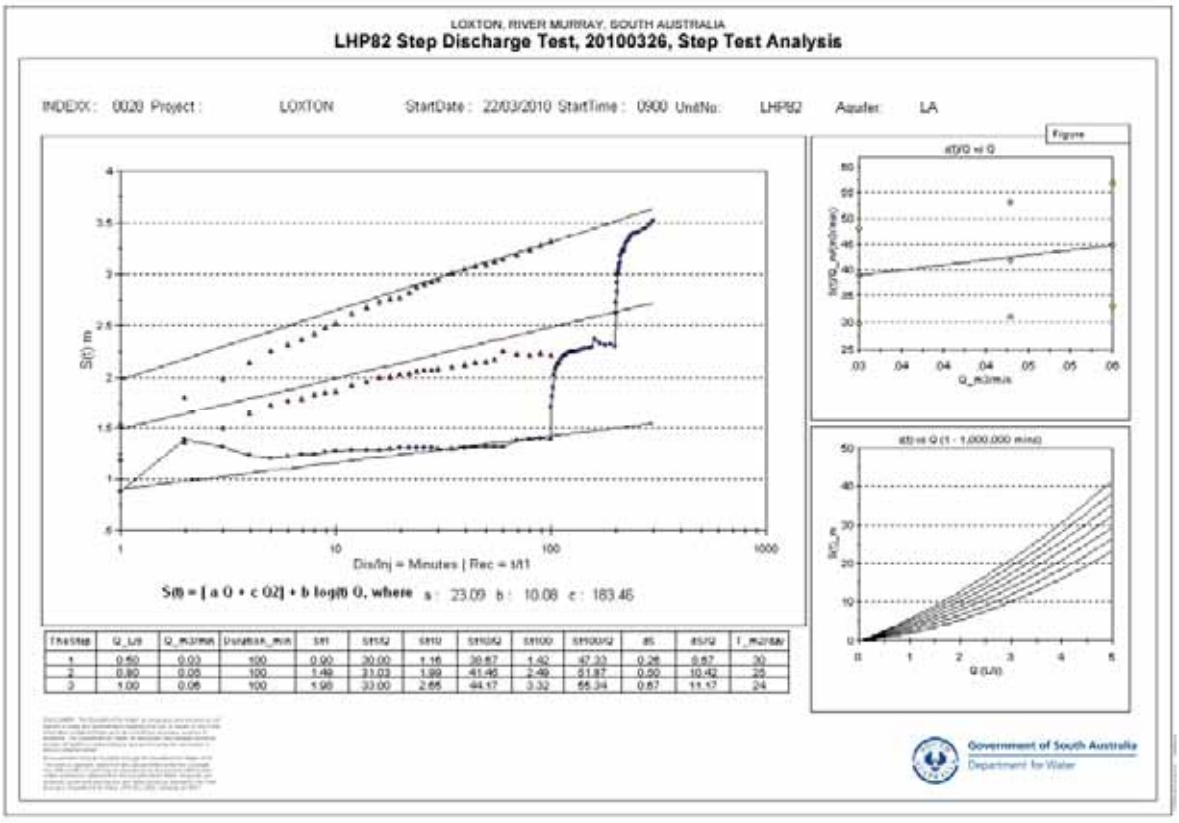


Figure 15. LHP82 Step discharge test analysis

3.4.2. LOXTON SANDS CONSTANT RATE DISCHARGE TEST

DFW Groundwater Technical Services conducted a constant rate discharge test on the mid-point Loxton Sands production well LHP80 commencing on 20 March 2010. Test details and results are given in Appendix D. Data was analysed using the Schlumberger Water Services software package AquiferTestProV4.2.

The objective of constant rate discharge test was to determine the aquifer hydraulic parameters, hydraulic boundaries and extent of pumping influence in the production aquifer by observing the drawdown relationship with time in the production well and two observation wells LHO95 and LHP79 positioned at radial distances from the production well of 33 and 58 m respectively. It is important to note that production well LHP80 was identified as being a low yielding well and exhibited characteristics that may indicate defective completion.

Production well LHP80

The constant rate discharge test conducted on production well LHP80 was at a pumping rate of 0.3 L/s for a duration of 2,880 minutes. The data from production well was analysed using the Cooper-Jacob method (Fig. 16).

The following general comments can be made:

1. The results are of limited value due to the problems associated with the well construction noted during the step drawdown testing.
2. The Loxton Sands exhibited drawdown signatures at the production well consistent with an unconfined aquifer.
3. The Loxton Sands transmissivity was calculated to be 8.64 m^2/d which is an order of magnitude lower than would be expected and again indicates problems associated with the construction of the well and its hydraulic response to pumping during the test.
4. The groundwater salinity was 17,248 mg/L.

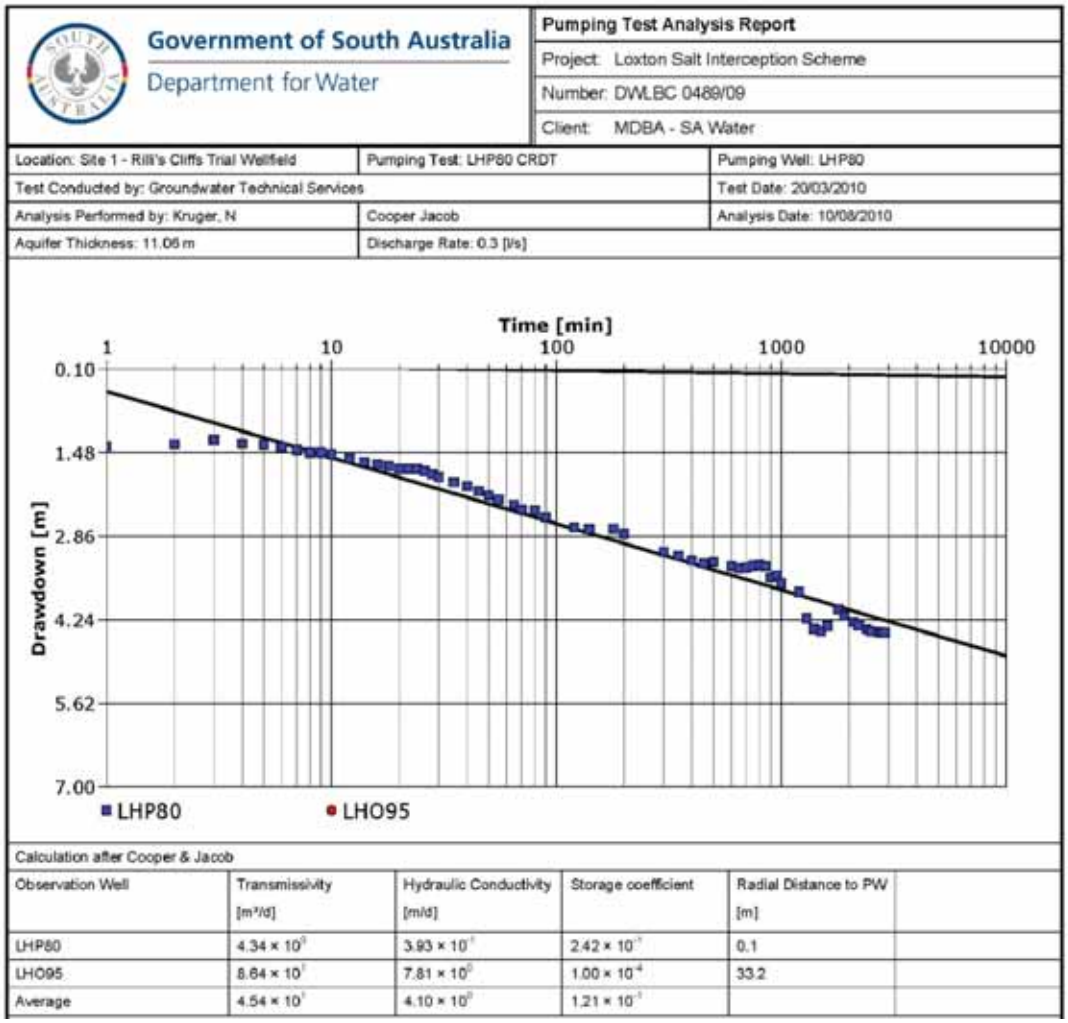


Figure 16. LHP80 Constant rate discharge test analysis (Cooper-Jacob)

3.5. LOXTON SANDS TRIAL WELLFIELD PUMPING TEST

In order to investigate the ability of the Site-1 Loxton Sands trial wellfield (production wells LHP78, LHP79, LHP80, LHP81, LHP82) to lower groundwater levels and intercept the groundwater flux and salt load discharging to the river from the Loxton Sands aquifer, a long-term pumping test was conducted. The test would also determine the long-term pumping rate of the wellfield and provide indications of the optimal production well spacing for a more extensive and complete wellfield.

The objectives of the long-term pumping test conducted on the trial wellfield were to:

1. Determine the hydraulic behaviour of the aquifer system to pumping the wellfield and the effectiveness of the wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands, by testing the capacity of the wellfield to reduce the watertable in the Loxton Sands to river pool level of 9.8 m AHD at the mid-point observation wells.
2. Determine the long-term pumping rate of the wellfield.
3. Determine the optimum production well spacing for a more extensive and complete wellfield.

The test commenced on 28 October 2010 and continued for a period of 187,000 minutes (130 days). The test commenced at individual production well pumping rates ranging between 0.3 and 1.2 L/s, with total

wellfield extraction of 3.7 to 3.9 L/s. The configuration of the wellfield is given in Fig. 7, with a cross-section presented in Fig. 11.

3.5.1. GROUNDWATER LEVEL MONITORING

The changes in groundwater levels were monitored by pressure transducers throughout the long-term pumping test in the five production wells and two observation wells (LHO95 and LHO96). DFW installed an automated and telemetric groundwater level logging system to monitor the wellfield in September 2010.

The wells were fitted with Greenspan PS700, 0 to 20 m pressure transducers wired to a common data-logging unit programmed to record a pressure reading from production wells just prior the time of discharge of groundwater from the Airwell pumps. Due to the variations in individual well pumping cycle rates, the data-logging unit was programmed to monitor the pumping cycles in addition to groundwater levels. The data logger unit was programmed to record readings at milliseconds before the pumping cycle commenced and as close as possible to a 30 minute increment. Observation wells were monitored at exactly 30 minute increments.

Manual observations of groundwater levels were made to verify the accuracy of the pressure transducer data and to backup to the automated system.

3.5.2. PUMPS, METERS AND DISPOSAL

SA Water installed four one metre long Airwell pumps in the sumps of the five Loxton Sands production wells to allow the potential for maximum development of drawdown to the base of the production zone. The saline groundwater pumped during the test was collected in a header tank, directed into a collector main and then directed into the SIS regional disposal main for discharge to the Noora evaporation basin.

3.5.3. GROUNDWATER SAMPLING

Groundwater sampling from individual production wells was not undertaken during the long-term pumping test; however the combined groundwater salinity was monitored prior to discharge into the regional disposal main for the duration of the test. A single combined groundwater sample obtained 47 days into the long-term pumping test returned a value of 15,700 mg/L. This is lower than the value of 25,807 mg/L used for Zone 21 in the groundwater model.

3.5.4. CONDUCT OF TEST

The following points are important in regard to the conduct of the long-term pumping test:

1. Pumps were set to allow the maximum pumping rate of each well to be between 0.3 and 1.2 L/s.
2. The initial total wellfield extraction was 3.7 to 3.9 L/s. The long-term wellfield extraction rate was lower than 3 L/s due to pump stoppages, infrastructure maintenance and also due to pumping from the lower transmissivity units of the Lower Loxton Sands (i.e. as the groundwater level was lowered toward the base of unit).
3. Production well LHP80 (the lowest yielding well), had a maximum pumping rate of 0.3 L/s.
4. Production well LHP82 (the highest yielding well) had a maximum pumping rate of 1.2 L/s.
5. Several pump stoppages occurred during the testing as a result of power failures which can be seen as recovery events in groundwater level data recorded in production wells LHP81 and LHP82. These stoppages went unnoticed as there was no pump failure alarm system and because weekly site visits

occurred. Upon re-commencement of pumping, the pre-existing drawdown regime was quickly re-established.

6. Two pre-existing regional observation wells, LHO6 (down gradient of the wellfield) and LHO7 (up gradient of the wellfield), initially considered to be outside the short term influence of the wellfield were monitored by logger at six hourly intervals and manually on a fortnightly basis for the duration of the test.
7. The test was terminated on 2 February 2011 due to the need for SA Water to undertake standard maintenance operations on the regional disposal main. Pumping recommenced on 25 February 2011 with total wellfield extraction in excess of 5.0 L/s.

3.5.5. HYDRAULIC RESPONSE TO PUMPING STRESS

The long-term pumping test conducted on the Loxton Sands trial wellfield indicated the hydraulic behaviour of the wellfield and hydraulic response of the aquifer system to pumping stress. The pressure transducer drawdown recorded during the long-term pumping test is presented in Fig. 17 and the groundwater level elevations are presented in Fig. 18.

The following general comments can be made regarding the test results at 187,000 minutes (130 days):

1. Drawdown developed very slowly in the Loxton Sands mid-point observation wells with only 0.6 m recorded at the key mid-wellfield observation well LHO96 at 10,000 minutes. Between 10,000 and 187,000 minutes, the drawdown continued to develop to 1.4 m. It was clear that drawdown would continue to develop in a similar fashion to the Site-2 Loxton Sands trial wellfield.
2. A long-term drawdown of 0.26 m developed at observation well LHO6 positioned at a distance of 275 m west of the wellfield (down gradient) and 200 m east of the river.
3. A long-term drawdown of 0.07 m developed at observation well LHO7 positioned at a distance of 440 m east of the wellfield (up gradient). This response was likely to be due to the effects of both the pumping test and the long term declining trends observed in the regional groundwater mound of the Loxton Sands.
4. The watertable in the Loxton Sands was drawn down to between 7 and 9 m AHD (i.e. below river pool level of 9.8 m AHD) at all production wells (with the exception of LHP82 which was noted to have a potential well construction problem).
5. Drawdown may have developed further if pump stoppages had not occurred.

3.5.6. CONCLUSIONS

The following general comments can be made regarding the test results:

1. Drawdown of up to 1.4 m (groundwater level elevation of 16.2 m AHD) developed slowly in the Loxton Sands mid-point observation wells along the wellfield at 187,000 minutes, which is still 6.2 m above river pool level of 9.8 m AHD. It was clear that drawdown would continue to develop as in the case of the Site-2 Loxton Sands trial wellfield.
2. The 50 m spacing for the Loxton Sands production wells would require a significant period of time before drawdown at the mid-point observation wells would reach river pool level.
3. Long-term production well pumping rates ranged between 0.3 and 1.2 L/s.

Despite the hydrogeological difficulties associated with the site, the response of the aquifer system to the long-term pumping test was considered satisfactory and the trial wellfield was incorporated into the operational highland wellfield.

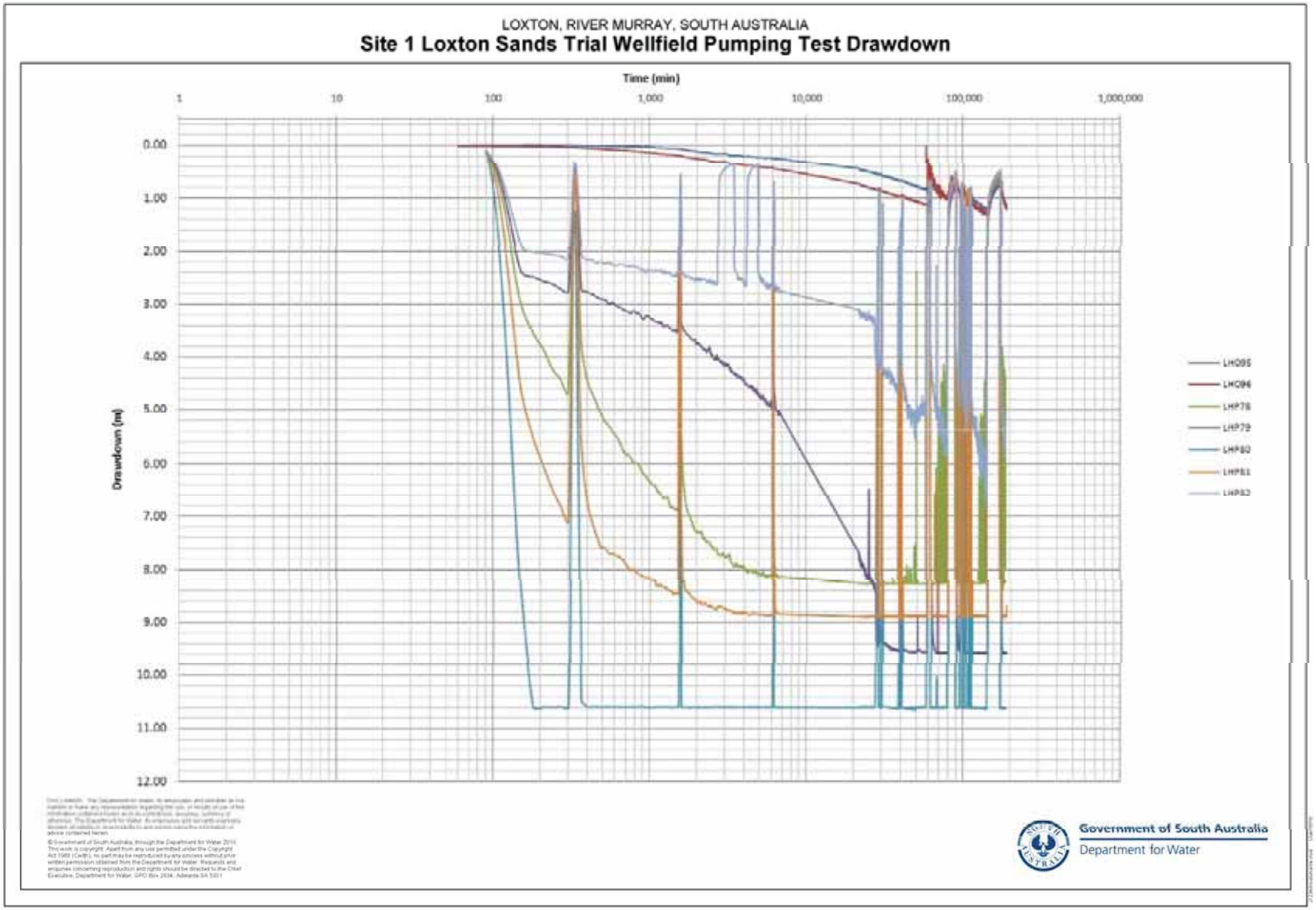


Figure 17. Site-1 Loxton Sands trial wellfield pumping test drawdown levels

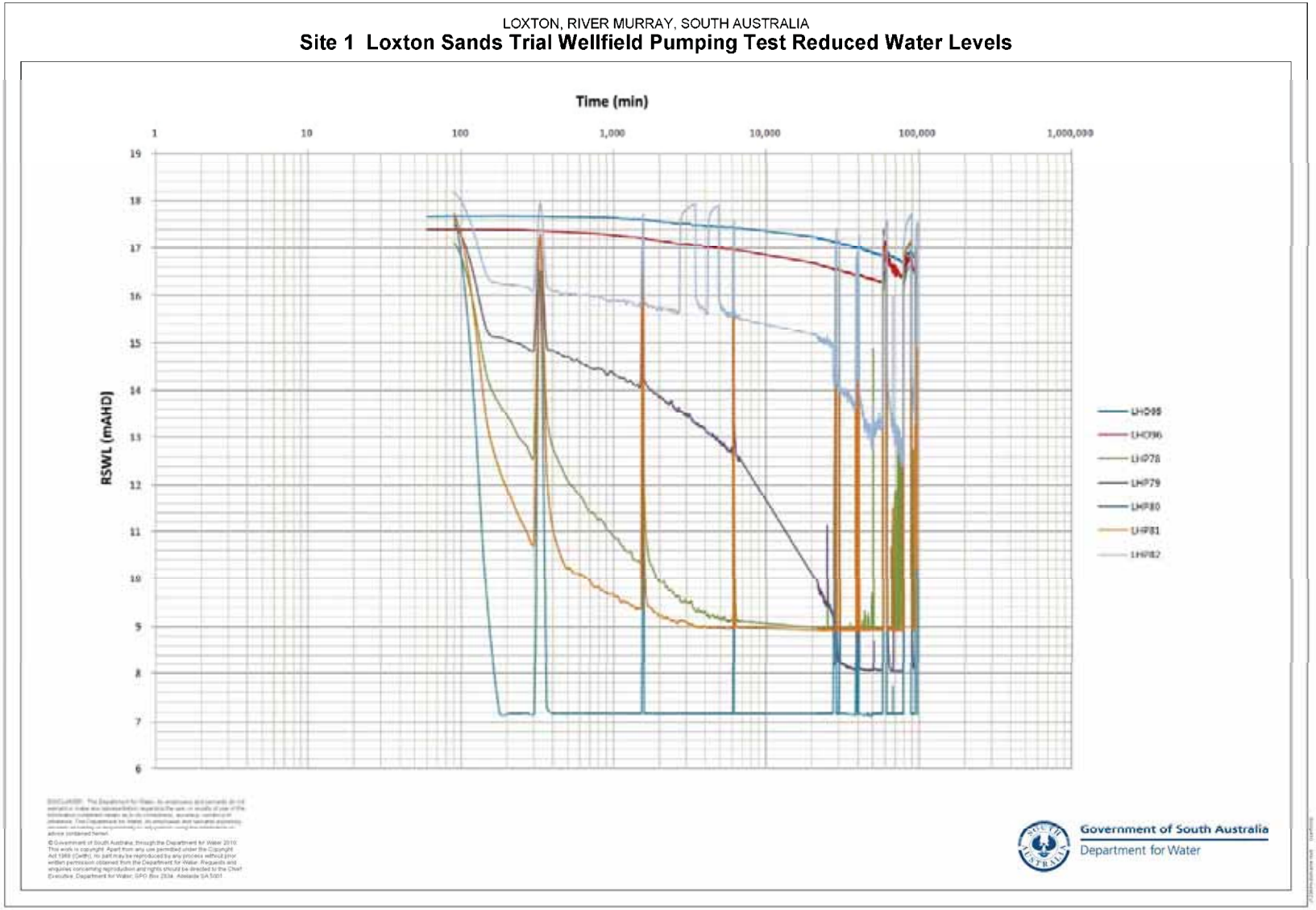


Figure 18. Site-1 Loxton Sands trial wellfield pumping test groundwater level elevations

4. SITE-2 INVESTIGATIONS

A number of investigation, production and observation wells were drilled during previous investigations associated with the Loxton SIS in the Site-2 (Loxton Pumping Station and Thiele's Homestead) investigation area between river kms 494 and 495, however significant data gaps existed and further drilling and pumping tests were required. This regional investigation, approved in December 2008, targeted the Loxton Sands aquifer and underlying Pata Formation aquifer to gain a better understanding of the hydrostratigraphy, the magnitude of groundwater flux and salt load discharging to the river from the Loxton Sands and the aquifer hydraulic connectivity, which were required to determine the most appropriate SIS infrastructure. The investigations were consistent with the recommendations of the Golder review. A reference base map indicating key features is given in Fig. 19.

The objectives of the regional investigation program included:

1. Determine the magnitude of groundwater flux discharging to the river from the Loxton Sands from the left bank (the highland). It was assumed at that time that groundwater discharged from the Loxton Sands.
    a. Characterise the Loxton Sands (including Shell Hash unit where present) and underlying Bookpurnong Formation (including Lower Loxton Clay and Shells):
        - Determine the areal extent, thickness, nature and lithology of the Loxton Sands and Bookpurnong Formation.
        - Determine the spatial and vertical salinity distribution of the Loxton Sands.
        - Determine the hydraulic parameters of the Loxton Sands.
    b. Determine the hydraulic parameters of the Pata Formation and overlying Bookpurnong Formation aquitard (including Lower Loxton Clay and Shells) and therefore the level of hydraulic connectivity at the site of the trial wellfield:
        - Determine the hydraulic parameters of the Pata Formation.
        - Determine the hydraulic parameters of the Bookpurnong Formation.
    c. Determine the magnitude of the groundwater flux discharging to the river from the Loxton Sands and correlate with the in-river work if possible. Calculated salt load benefits derived from the regional groundwater model have been reported.
    d. Determine, using in-river methods, locations where saline groundwater was likely to be discharging to the river (and the magnitude of the flux if possible).

In addition to the regional investigations:

2. Determine the effectiveness of a Pata Formation trial wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands.
3. Determine the effectiveness of a Loxton Sands trial wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands.
4. Provide recommendations for the SIS infrastructure options.
    a. Determine the effectiveness of infrastructure options being: either horizontal drainage wells completed in the Loxton Sands or conventional vertical production wells completed in the Pata Formation, the Loxton Sands, or both.

b. Make recommendations regarding the most appropriate infrastructure including final SIS design in terms of well types, well locations and well yields.

4.1. REVERSE AIR CIRCULATION DRILLING

An RAC investigation drilling program was undertaken to define the base of the Loxton Sands and the thickness and nature of the underlying Bookpurnong Formation. Emphasis was placed on the proposed Proud Avenue trial wellfield. Investigation drillholes (referred to as Master RAC Drillholes in Appendix B) were positioned close to the sites of proposed production and/or observation wells to assist with future well design and construction. Drillholes and wells are referred to in this report by the Drillhole Name. The correspondence between the Drillhole Name, Unit Number and Permit Numbers is given in Appendix B.

4.1.1. MARCH 2008 DRILLING PROGRAM

Underdale Drillers undertook the regional RAC investigation drilling program under DFW supervision in March 2008. The location of the investigation drillholes are given in Fig. 20. Drillhole specifications are given in Appendix B with geological logs presented in Appendix C. Drillholes that fully penetrated the Bookpurnong Formation were grouted across the aquitard to ensure hydraulic separation of the aquifers.

The program included:

1. Thirteen Investigation drillholes:
    a. At 50 m spacing along Bookpurnong Road commencing at Alamein Avenue and continuing for a distance of 600 m north (towards Thiele's property).
    b. At 100 m spacing between Bookpurnong Road and Thieles's Homestead.
2. Five Investigation drillholes at 50 m spacing at the location of the Loxton Sands observation (production wells) at the Pata Formation trial wellfield (as planned at that time). These drillholes were drilled through the Lower Loxton Clay and Bookpurnong Formation into the top of the Pata Formation.
3. One RAC drillhole positioned at the centre of the trial wellfield, drilled to the base of the Pata Formation.

4.1.2. OCTOBER 2009 DRILLING PROGRAM

Underdale Drillers undertook further RAC investigation drilling under DFW supervision in October 2009. The locations of the investigation drillholes are given in Fig. 21. Drillhole specifications are given in Appendix B with geological logs presented in Appendix C. Drillholes fully penetrating the Bookpurnong Formation were grouted across the aquitard to ensure hydraulic separation of the aquifers.

The program included:

1. Seven investigation drillholes at 50 m spacing north of observation well LHO78 along Proud Avenue to inform final wellfield production (at 50 m spacing) and observation well (at 100 m spacing) design. Every second drillhole was drilled through the Lower Loxton Clay and Bookpurnong Formation into the top of the Pata Formation.
2. Eleven investigation drillholes at 50 m spacing northwest from production well LHP62 to Thiele's Homestead. Every second drillhole was drilled into the top of the Pata Formation.

SITE-2 INVESTIGATIONS

All Investigation drillholes were bulk sampled at one metre intervals, where such samples were obtainable. Three to four representative samples were taken from each drillhole (for particle size distribution analysis) with emphasis placed on sampling the Loxton Sands immediately above the Bookpurnong Formation to assist in production well screen selection.

Figure 19. Site-2 Pre-2008 investigation drillhole and well location plan

Figure 20. Site-2 March 2008 investigation drillhole location plan

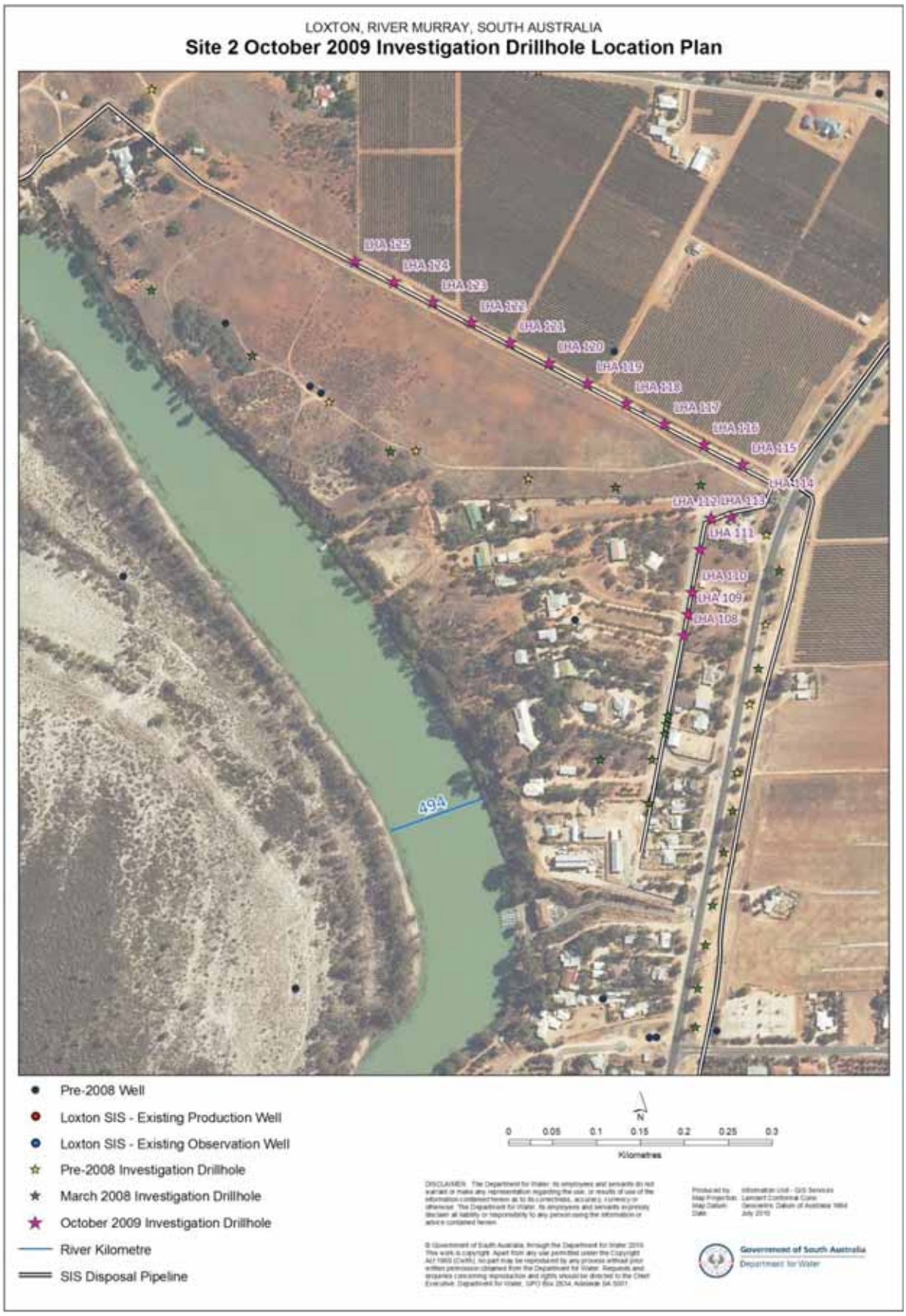


Figure 21. Site-2 October 2009 investigation drillhole location plan

4.2. REGIONAL PRODUCTION AND OBSERVATION WELLS

4.2.1. APRIL TO JUNE 2008 DRILLING PROGRAM

The drilling and construction of production and observation wells was undertaken to further characterise the Loxton Sands through the investigation area where data gaps existed. Underdale Drillers undertook the mud rotary well drilling program under DFW supervision between April and June 2008. The location of the wells is given in Fig. 22. Well specifications are given in Appendix B with geological logs presented in Appendix C.

The program included:

1. Three Loxton Sands regional observation / production wells (LHP51, LHP55, LHP59). These wells were positioned to act as mid-point observation wells for the Pata Formation trial wellfield, but were drilled to production well specification.
2. Two Loxton Sands regional production wells (LHP61, LHP62) and associated observation wells (LHO80, LHO79 respectively). These wells were positioned with regard to existing regional test production wells.

4.2.2. PRODUCTION WELL SPECIFICATIONS

The drilling and construction of the Loxton Sands production wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Biovis and CR650. Bentonite was not used due to concerns regarding its possible detrimental effect on development.
2. Drilling was undertaken using an 8” (203 mm) diameter rotary blade bit with a 12” (305 mm) reamer.
3. Wells were cased with 200 mm ID class 12 UPVC.
4. Wells were completed in the Loxton Sands / Shell Hash with the production zone set over the lower half of the saturated aquifer. Variations to the production zone occurred in the following wells:
    a. LHP61 and LHP62 were completed with 200 mm ID class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5% and with a 1 m sump.
    b. LHP51, LHP55 and LHP59 were completed with 200 mm ID 904 stainless steel wirewound in-line screens (1 mm aperture) and with 5 m sumps of 200 mm ID class 12 UPVC (in anticipation of future installation of Airwell pumps).
5. The annulus between the drillhole and the screen / slotted casing was filled with 8:16 gravel pack emplaced by gravity to a minimum of 1.5 m above the production zone.
6. The annulus between the drillhole and the casing was grouted to surface using a tremie line with a 5% bentonite to cement mix and left overnight to allow time for the grout to cure before further work was undertaken.
7. Wells completed with wirewound screens were developed by jetting for an hour per metre of screen and airlifted until groundwater was clear of drilling fluids and free of, or contained only minor amounts of, suspended solids.
8. Wells completed with slotted casing were developed by airlifting until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of, suspended solids.

9. Following development, wells were sterilised by dosing with a chlorine solution which was agitated for 15 minutes. The wells were purged after 24 hours to remove any residual chlorine.

Figure 22. Site-2 April 2008 well location plan

4.2.3. OBSERVATION WELL SPECIFICATIONS

The Loxton Sands observation wells were cased with 80 mm ID class 12 UPVC casing and 80 mm ID class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with 1 m sumps. The screens were set over the full saturated thickness of the aquifer to enable EC profiling to be conducted.

4.3. TRIAL WELLFIELD CONSTRUCTION

4.3.1. APRIL TO JUNE 2008 TRIAL WELLFIELD DRILLING PROGRAM

In November 2007, SA Water requested that investigations include a Pata Formation trial wellfield, revised in January 2008 to include a Loxton Sands trial wellfield. It is important to note that evidence at that time had not indicated the Pata Formation as a viable target aquifer for salt interception in the Loxton region. DFW recognised there was benefit in conducting a long-term pumping test on a Pata Formation trial wellfield but stressed that such a trial was unlikely to indicate the benefits of pumping from the Pata Formation.

Following discussion in with SA Water, it was agreed that the trial wellfield be constructed at Proud Avenue, as previous investigation drilling at this site had indicated a particularly thick sequence of Loxton Sands extending for several hundred metres with the base of the aquifer several metres below the river pool level. It was anticipated that the results would enable recommendations regarding the most appropriate highland wellfield infrastructure option including well spacings, well design and construction. It was anticipated that satisfactory conclusion of investigations would also result in the inclusion of relevant infrastructure into the operational highland wellfield.

The trial wellfield comprised an array of both Pata Formation and Loxton Sands production wells and observation wells. The Loxton Sands production well spacing of 50 m was not expected to demonstrate efficient interception, as evidence from previous investigations indicated that the well spacing would need to be significantly less to achieve a high level of interception. The configuration of the wells comprising the 300 m long trial wellfield transect was determined following the completion of the RAC investigation drilling program.

Underdale Drillers undertook the mud rotary well drilling program under DFW supervision between April and June 2008. The location of the Pata Formation wells is given in Fig. 23, the Loxton Sands wells in Fig. 24 and the combined trial wellfield in Fig. 25. Well specifications are given in Appendix B with geological logs presented in Appendix C.

Figure 23. Site-2 Pata Formation trial wellfield location plan

The trial wellfield included:

The program included:

1. Six Pata Formation production wells (Fig. 23) spaced at 50 m (LHP50P, LHP52P, LHP54P, LHP56P, LHP58P and LHP60P). This conservative well spacing was chosen to ensure adequate and rapid drawdown development in the Pata Formation below river pool level.
2. Seven Pata Formation observation wells (Fig. 23):
    a. Three mid-point wells on the wellfield transect (LHO71P, LHO72P and LHO77P).
    b. Three wells on a transect towards the river (LHO73P, LHO76P and LHO83P) to observe the aquifer response to pumping between the wellfield and the river.
    c. One well on Katarapko Island (LHO84P) to observe the aquifer response to pumping at a distance from the wellfield of 450 m.
3. Five Loxton Sands production wells (Fig. 24) spaced at 50 m (LHP51, LHP53, LHP55, LHP57 and LHP59, note that LHP51, LHP55 and LHP59 already having been drilled in the preceding part of the drilling program) positioned at the mid-point between the Pata Formation production wells. These wells were used as Loxton Sands observation wells during the Pata Formation wellfield long-term pumping test. It was subsequently noted that the screens in these wells should have been set slightly deeper in the aquifer profile.
4. Five Loxton Sands observation wells (Fig. 24):
    a. LHO78 at the northern end of the wellfield transect 25 m north of well LHP59.
    b. LHO70 at the southern end of the wellfield transect 25 m south of well LHP51.
    c. Three wells on a transect towards the river (LHO74, LHO75 and LHO82) to observe the aquifer response to pumping between the wellfield and the river.
    d. LHO81, a regional well.
5. Two additional Loxton Sands observation wells (Fig. 25) were drilled in November 2008 prior to the Loxton Sands wellfield long-term pumping test commencing:
    a. LHO85 at the centre of the wellfield transect at the mid-point between LHP55 and LHP57. This well was drilled to production well specification thus enabling pump installation and potentially testing of 25 m spaced production wells.
    b. LHO86 at the mid-point between LHO85 and LHP57.

4.3.2. PRODUCTION WELL SPECIFICATIONS

Drilling and construction of the Loxton Sands production wells occurred as previously specified. However, all wells were completed with wirewound in-line screens and with 5 m long sumps in anticipation of the potential for future installation of Airwell pumps. The drilling and construction of Pata Formation production wells (with the exception of LHP56P) occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Biovis and CR650. Bentonite was not used due to concern regarding its potential detrimental effect on development.
2. Drilling into the top of the Pata Formation was undertaken using an 8” (203 mm) diameter rotary blade bit with a 12” (305 mm) reamer. Drilling in the Pata Formation was undertaken using an 8” (203 mm) diameter rotary blade bit.

3. Wells were cased with 200 mm ID class 12 UPVC.

Figure 24. Site-2 Loxton Sands trial wellfield location plan

Figure 25. Site-2 Combined formations trial wellfield location plan

4. The annulus between the drillhole and the casing was grouted to surface using a tremie line with a 5% bentonite to cement mix and left overnight to allow time for the grout to cure before further work was undertaken.
5. Initial attempts to drill the production zone with air failed due to insufficient compressor capacity. Subsequently, drilling was undertaken using polymers including Biovis and CR650. Bentonite was not used due to concern regarding its effect on development.
6. All wells (with the exception of LHP56P) were completed open hole over the entire thickness of the aquifer.
7. Wells were developed by airlifting through the drill string until groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
8. Following development, wells were sterilised by dosing with a chlorine solution which was agitated for 15 minutes. The wells were purged after 24 hours to remove any residual chlorine.

The drilling and construction of production well LHP56P occurred in accordance with the following specifications:

1. Drilled to total depth.
2. Cased with 200 mm ID class 12 UPVC and 200 mm ID class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5% and with a 1 m sump.
3. 8:16 gravel pack emplaced to 2 m above the production zone.
4. Casing grouted to surface using tremie line.
5. Development.
6. Sterilisation.

4.3.3. OBSERVATION WELL SPECIFICATIONS

Drilling and construction of the Loxton Sands observation wells occurred as previously specified. The Pata Formation observation wells were cased with 100 mm ID class 12 UPVC casing and completed open hole over the entire thickness of the aquifer.

All wells were surveyed by SA Water, Survey and Land Management Group and the results are included in Appendix B.

4.3.4. GROUNDWATER SALINITY

Groundwater samples were submitted to the DFW laboratory for EC determination. Results from samples collected from production wells during pumping tests (where conducted) are given in Appendix B. Where wells were not tested, results are reported for samples collected during development. A groundwater salinity plan is given in Fig. 26.

The following general comments can be made in relation to the groundwater salinity of the Loxton Sands at Site-2:

1. Groundwater salinity ranged between 8,000 and 17,000 mg/L in wells along the Loxton Sands trial wellfield.
2. Groundwater salinity in regional wells located north to northwest of the trial wellfield ranged between 4,000 and 18,000 mg/L.

3. Groundwater salinity confirmed the value of 18,716 mg/L used in the regional numerical groundwater model Zone 25, but was generally lower.
4. Groundwater salinity along the trial wellfield was higher than the value of 4,240 mg/L used in the numerical groundwater model Zone 26.

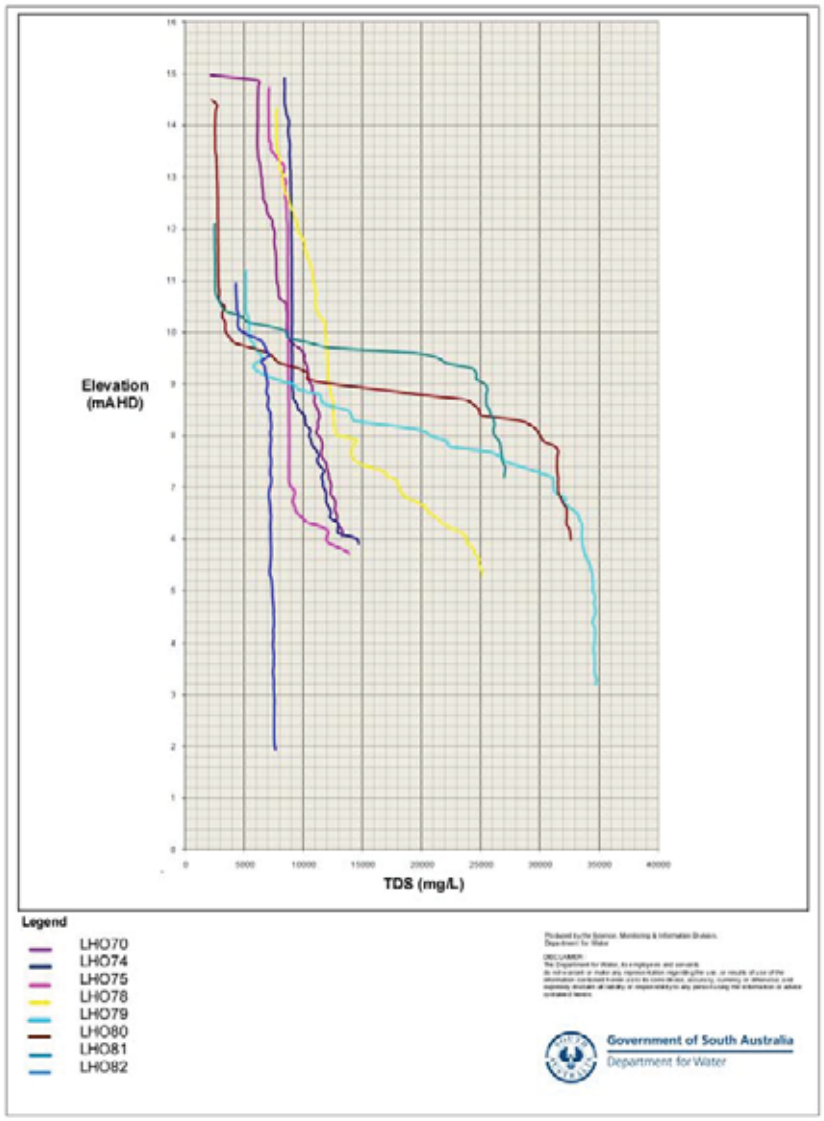
4.3.5. SALINITY PROFILING

DFW Groundwater Technical Services conducted downhole logging on a number of Loxton Sands observation wells using a Hydrolab (EC, pH) probe which was run in undisturbed wells. The salinity and pH profiles from the production zone for all wells are combined in Fig. 27.

The following general comments can be made in relation to the groundwater salinity profile of the Loxton Sands at Site-2:

1. Hydrolab profiles indicate the Loxton Sands has significant groundwater salinity stratification. Increases in salinity with depth were recorded in all wells.
2. Groundwater salinity, in general, ranged between 2,000 and 8,000 mg/L at the top of the production zone and increased with depth to greater than 13,000 mg/L at the base of the production zone.
3. High salinity readings (in excess of 25,000 mg/L) were recorded towards the base of the production zone in observation wells LHO78, LHO79, LHO80 and LHO81.
4. Hydrolab profiles indicate a pH range between 7.6 and 8.8 in all Loxton Sands wells.

Figure 26. Site-2 Loxton Sands groundwater salinity distribution plan



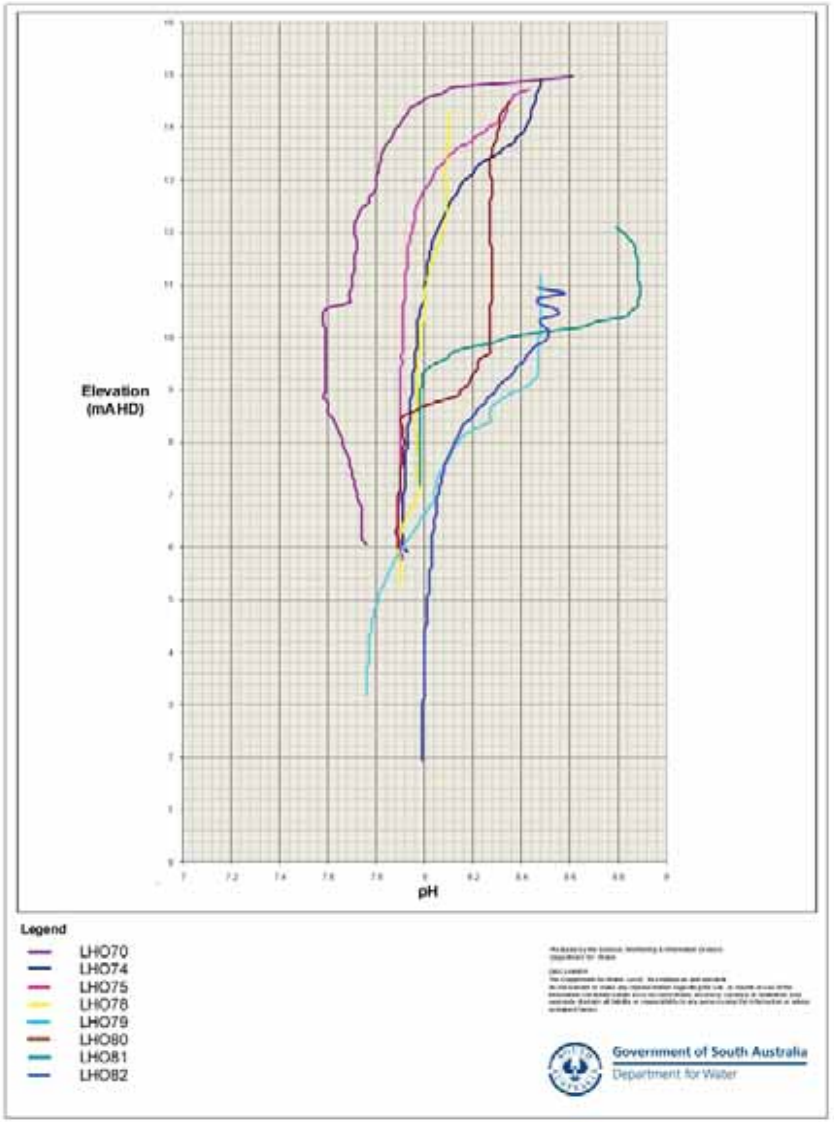


Figure 27. Site-2 Loxton Sands trial wellfield salinity and pH profiles

4.3.6. DOWNHOLE GEOPHYSICAL LOGGING

DFW Groundwater Technical Services conducted downhole geophysical logging on a number of production wells and observation wells completed in the well drilling program (Appendix E).

The following geophysical logging was undertaken:

- Gamma, Neutron, Induction and Density on all Pata Formation production wells.
- Caliper on Pata Formation production wells completed open hole.

In general, a good correlation can be made between lithological and geophysical logs. The following general comments can be made in relation to the hydrogeology at Site-2:

1. The shallow clays of the Woorinen Formation and Blanchetown Clay presented as high gamma readings (between 40 and 80 API) from ground surface to between 2 and 5 m below ground level.
2. The transition from the Blanchetown Clay to the Loxton Sands was clearly identifiable in the gamma logs by lower (between 10 and 45 API) readings. The transition between the units occurs sharply at depths generally between 2 and 5 m below ground surface.
3. Bands of fine silt or clay can be identified within the Loxton Sands by the geophysics and present as higher readings in the gamma log.
4. The increase in silt and clay content with depth in the Loxton Sands and Lower Loxton Clay and Shells can generally be identified by a gradual shift to the right in the gamma log, with readings increasing with depth.
5. Higher gamma readings (between 50 and 90 API) were recorded in most logs over a thin (1 m thick) section at the base of the Lower Loxton Clay to the start of the Bookpurnong Formation.
6. The Pata Formation presented in the gamma log between 20 and 40 API.

4.4. AQUIFER AND AQUITARD CHARACTERISATION

The location of the three cross-section transects A - A5 (north-south), B - B1 (east-west) and C - C1 (east-west) are given in Fig. 28. The cross-sections indicate the elevations and relationships of the major hydrogeological units, the potentiometric surface of the Loxton Sands and river pool level, together with well construction details.

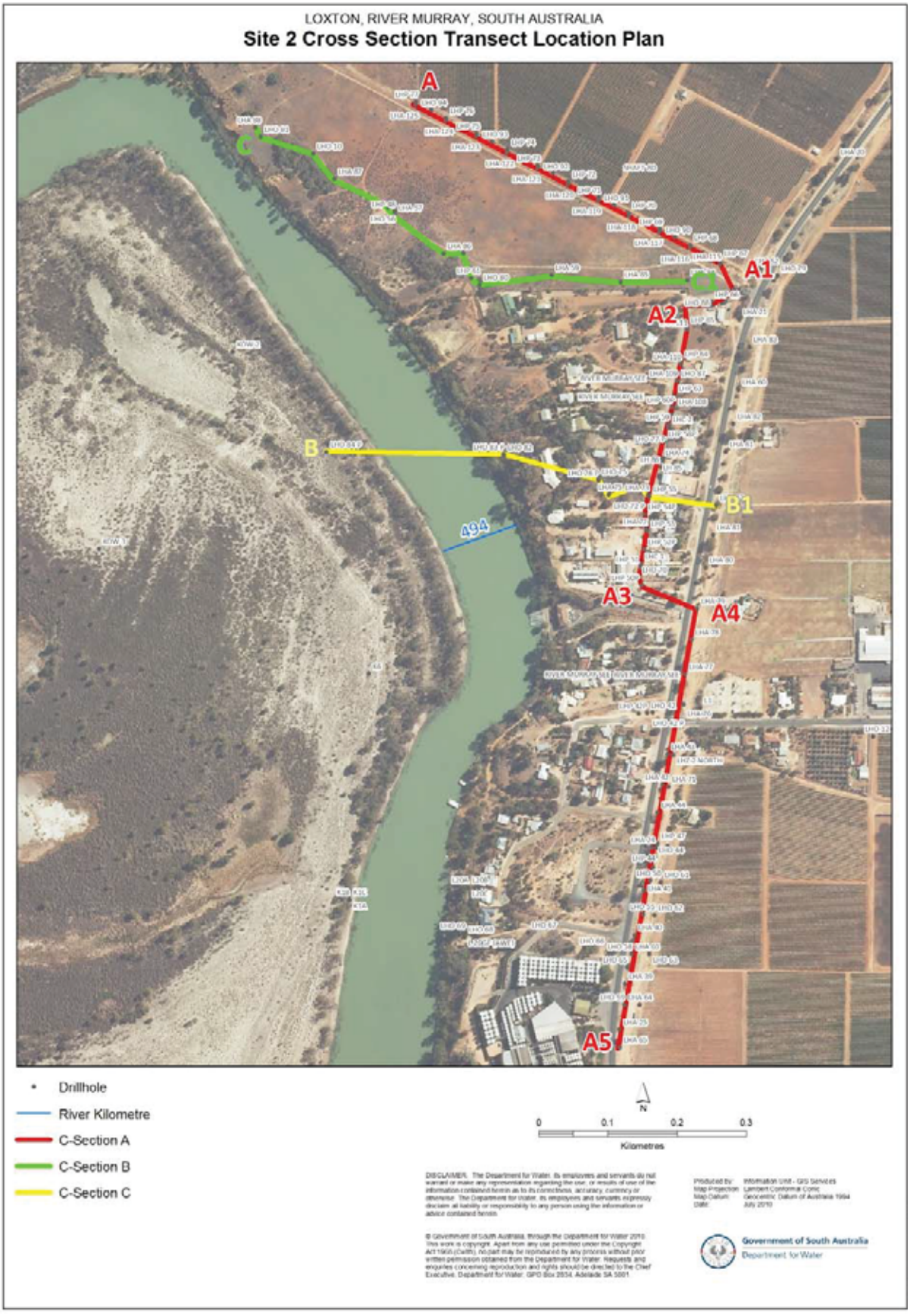


Figure 28. Site-2 Location of cross sections

4.4.1. TRANSECT A - A5

The hydrostratigraphy and elevations of the major hydrogeological units along transect A - A5 are presented in Fig. 29 and can be summarised as follows:

Woorinen Formation

The ground surface (top of Woorinen Formation and recent aeolian surface deposits) occurred between 29 and 34 m AHD. The Woorinen Formation was identified across the entire length of the transect and was 4 m thick. The base of the unit occurred between 26 and 31 m AHD.

Blanchetown Clay

The Blanchetown Clay underlies the Woorinen Formation and overlies the Loxton Sands. The unit was observed in the majority of investigation drillholes and is about 1.5 m thick. The base of the unit occurred between 25 and 29 m AHD.

Loxton Sands

The Loxton Sands underlie the Blanchetown Clay and overlie the Lower Loxton Clay and Shells. The Loxton Sands sand unit consisted of fine gravels and coarse sands becoming finer with depth (increased silt content), grading to the low permeability silty clay and shell facies of the Lower Loxton Clay and Shells towards the base. The watertable occurred between 16 and 17.5 m AHD. The saturated thickness of the Loxton Sands between investigation drillholes LHA125 and LHA76 was 12 m, with the base occurring between 2 and 8 m AHD. South of LHA76, the saturated thickness was 5 m. Between LHA76 and LHA43, the base of the unit sharply inclined to 13 m AHD, about 3 m above the river pool level.

A shell hash unit about 1 to 2.5 m thick was observed at 6 m AHD between LHA110 and LHA65, directly overlying the Lower Loxton Clay and Shells. The top of the shell hash unit inclined to 12 m AHD between LHA43 and LHA65. Clean shell hash was not identified between LHA125 and LHA110, with the material at the base of the Loxton Sands consisting of silt to poorly sorted sands with minor to moderate shell fragments. A 2 to 5 m thick consolidated sandstone bed was identified by hard drilling, sandstone plugs and poor sample returns from LHA123 and LHA116 between 14 and 20 m AHD.

Lower Loxton Clay and Shells

The Lower Loxton Clay and Shells underlies the Loxton Sands and overlies the Bookpurnong Formation. The unit consisted of low permeability shelly, grey and clayey silt turning to silty clay at the base. The top of the unit was relatively consistent with the base of the Loxton Sands shell hash unit; however due to the gradual increase in clay content with depth, the top of the Lower Loxton Clay and Shells was difficult to define and was open to interpretation. The base of the unit occurred between -5 and -3 m AHD and was between 10 and 14 m thick.

Bookpurnong Formation

The Bookpurnong Formation underlies the Lower Loxton Clay and Shells and overlies the Pata Formation. The base of the unit occurred between investigation drillholes LHA125 and LHA76 at between -7 and -6 m AHD and was 2 to 3 m thick. The lack of deep investigation drillholes targeting the Pata Formation between LHA43 and LHA65 prevent establishing a base between LHA43 and LHA65.

Upper Murray Group Pata Formation

The Pata Formation underlies the Bookpurnong Formation. The unit presented as a grey, friable, low permeability silty fossiliferous limestone. The top of the unit was well defined between investigation drillholes LHA125 and LHA76 as was intersected by exploration drilling at 100 m spacing. The unit occurred between -9 and -7 m AHD. The unit was not identified between LHA43 and LHA65 and its depth was inferred at -5 m AHD for the purpose of the cross-section. No drillholes fully penetrated the entire thickness of the unit.

4.4.2. TRANSECT B - B1

The hydrostratigraphy and elevations of the major hydrogeological units along transect B - B1 are presented in Fig. 30 and can be summarised as follows (note that river bathymetry is inferred):

Coonambidgal Clay and Monoman Formation

The Coonambidgal Clay overlies the Monoman Formation on the floodplain. The base of the Coonambidgal Clay was approximately at river pool level and it was 4 m thick. The base of the Monoman Formation was 4 m AHD and it was 6 m thick. The Monoman Formation was identified in observation well LHO84P and was considered to be in hydraulic connection with the river.

Woorinen Formation

The ground surface between observation wells LHO83P and LHO75 inclined from 16 m AHD to 32 m AHD over a horizontal distance of 150 m. The Woorinen Formation was not identified at the highland cliff edge, but presented as a reworked Loxton Sands between well LHO75 and investigation drillhole LHA62. The unit was 2 m thick.

Blanchetown Clay

The Blanchetown Clay was observed on the highland between observation well LHO75 and investigation drillhole LHA62. The base of the unit occurred at 28 m AHD and was 2 m thick.

Loxton Sands

The Loxton Sands was exposed at the highland interface between observation wells LHO82 and LHO75. The watertable occurred at 12 m AHD at LHO82 (30 m east of the river) and inclined to 16.5 m AHD at investigation drillhole LHA62. The base of the unit occurred at 4 m AHD.

Lower Loxton Clay and Shells

The base of the Lower Loxton Clays and Shells occurred at -5 m AHD and was between 10 and 18 m thick.

Bookpurnong Formation

The base of the Bookpurnong Formation occurred between -6 and -7 m AHD.

Upper Murray Group Pata Formation

The Pata Formation occurred at -7 m AHD.

4.4.3. TRANSECT C - C1

The hydrostratigraphy and elevations of the major hydrogeological units along cross-section transect C - C1 are presented in Fig. 31 and can be summarised as follows:

Woorinen Formation

The elevation of the ground surface between investigation drillholes LHA88 and LHA84 was 32 m AHD. The Woorinen Formation was identified along the length of the transect. The unit was between 2.5 and 4 m thick.

Blanchetown Clay

The Blanchetown Clay occurred in all investigation drillholes except LHA86. The base of the unit occurred between 25 and 28 m AHD and it was 2 m thick.

Loxton Sands

The Loxton Sands underlies the Blanchetown Clay and overlies the Lower Loxton Clay and Shells. The watertable occurred at 15 m AHD. The base of the unit occurred between 6 and 7 m AHD and the saturated thickness was 8 m. A thin shell hash layer was identified between investigation drillholes LHA57 and LHA85 at 8 m AHD.

Lower Loxton Clay and Shells

The base of the Lower Loxton Clays and Shells occurred at -4 m AHD and it was 10 m thick.

Bookpurnong Formation

The base of the Bookpurnong Formation occurred between -8 and -6 m AHD.

Upper Murray Group Pata Formation

The Pata Formation occurred at -6 m AHD.

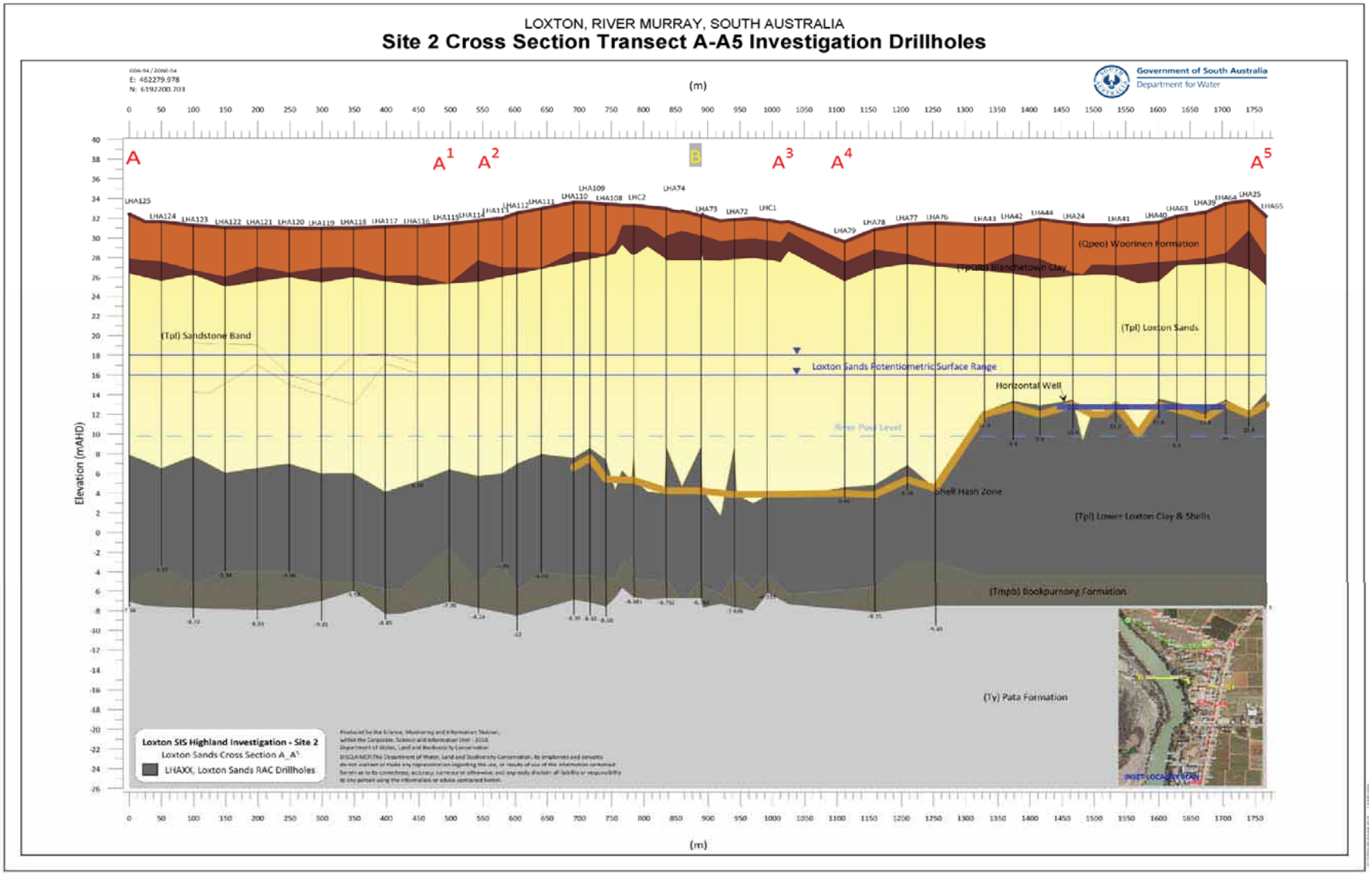


Figure 29. Site-2 Transect A - A5

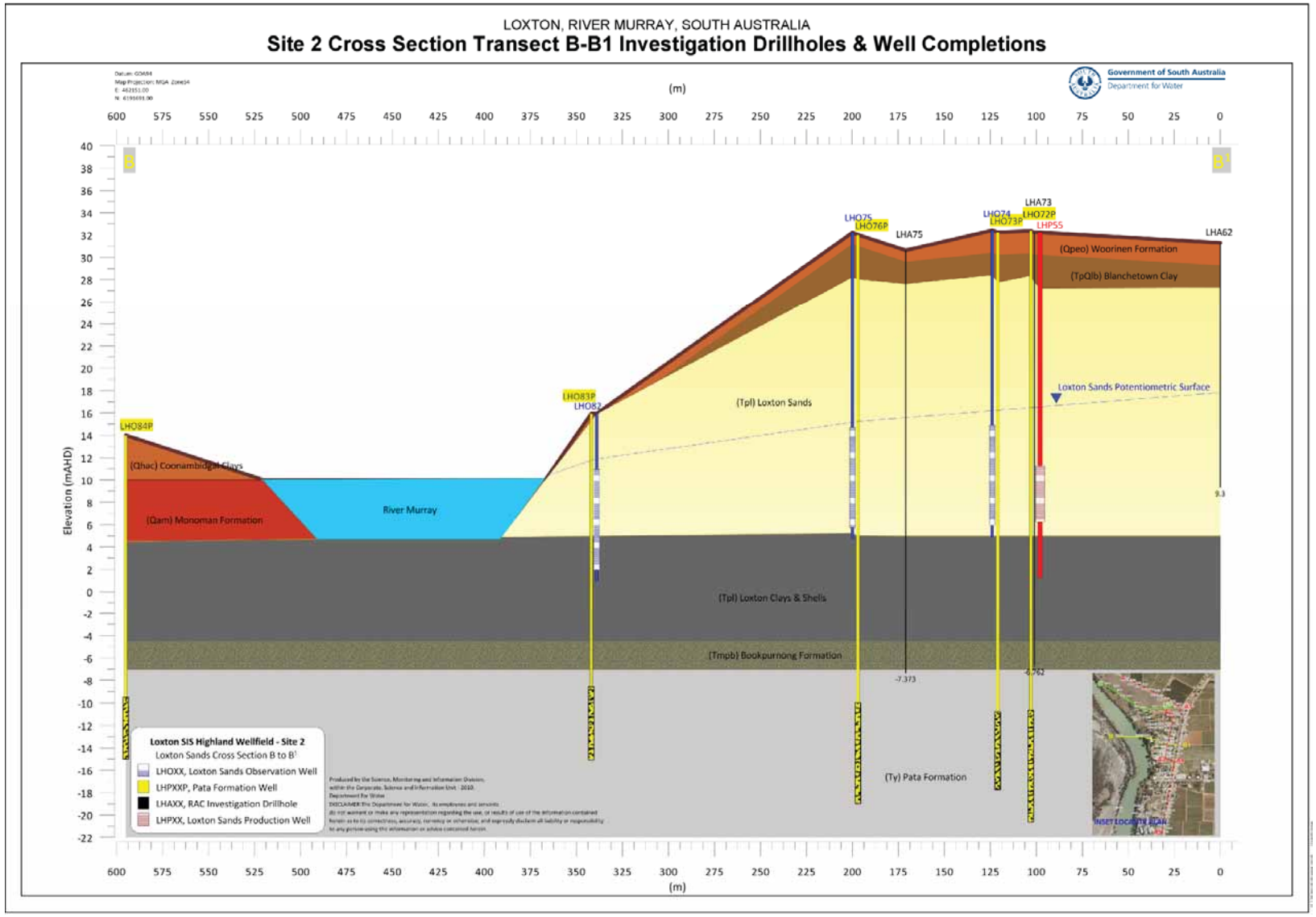


Figure 30. Site-2 Transect B - B1

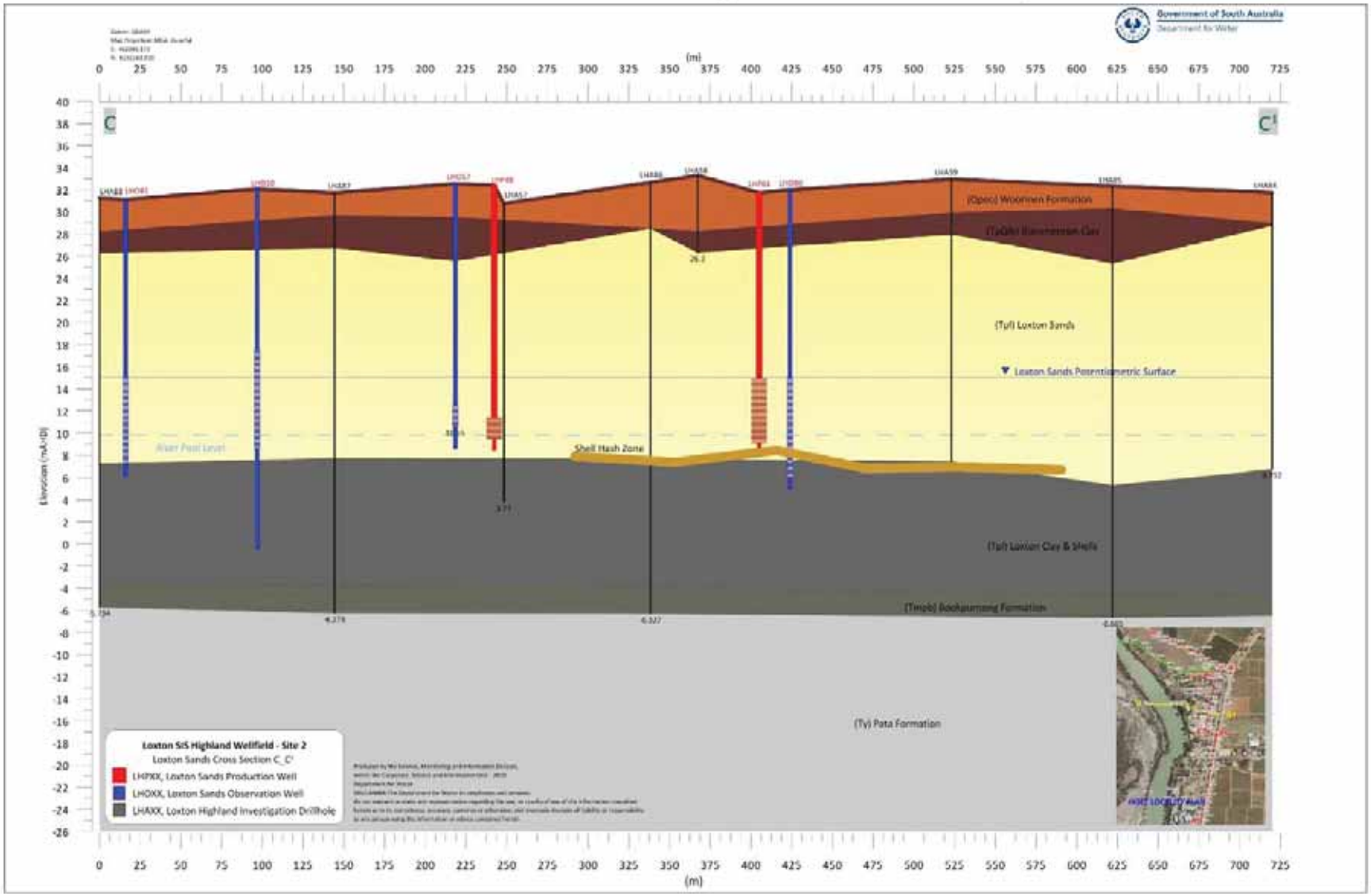


Figure 31. Site-2 Transect C - C1

4.5. PUMPING TESTS PROGRAM

4.5.1. STEP DRAWDOWN TESTS

DFW Technical Officers conducted step drawdown tests on the Loxton Sands production wells and the Pata Formation production wells completed in the well drilling program in June 2008. Test details and results are given in Appendix D. Data was analysed using the Hazel Method.

The objective of step drawdown testing was to determine the well equation which relates drawdown, pumping rate and time. This equation allows prediction of the hydraulic performance of production wells for a design-pumping rate and generation of yield-drawdown curves for any given time. The components of this equation were discussed earlier in this report.

4.5.1.1. Loxton Sands trial wellfield production wells - general hydraulic behaviour

Step drawdown tests were conducted on five Loxton Sands trial wellfield production wells completed with wirewound screens (LHP51, LHP53, LHP55, LHP57 and LHP59, Figs. 32 to 36 respectively), at pumping rates ranging between 0.3 and 1.5 L/s. The analysis of the step drawdown tests resulted in well equation constants with the range:

‘a’	17 - 39	average	27
‘b’	3 - 14	average	7
‘c’	13 - 36	average	24

Based on the average values, the predicted well efficiency and specific capacity at an average pumping rate of 1.0 L/s and a pumping duration of 1,000,000 minutes were 58% and 0.25 (L/s)/m respectively.

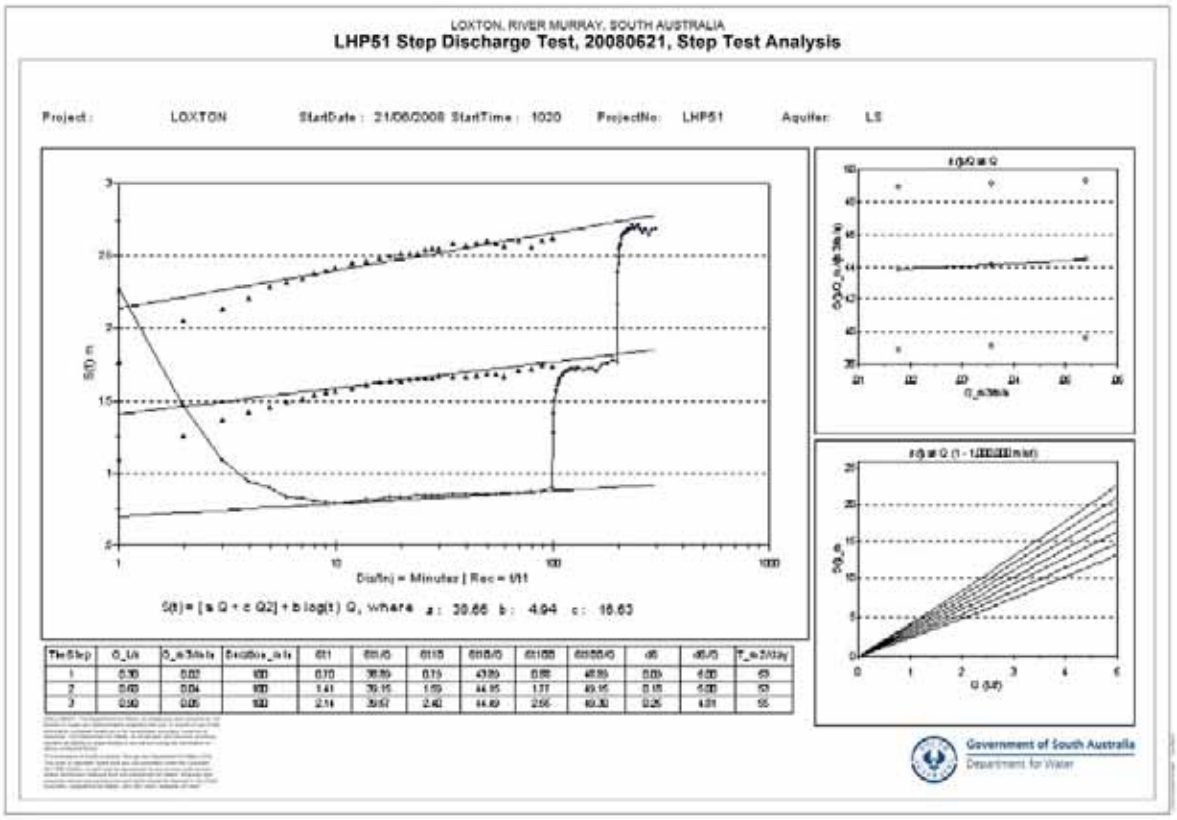


Figure 32. LHP51 Step discharge test analysis

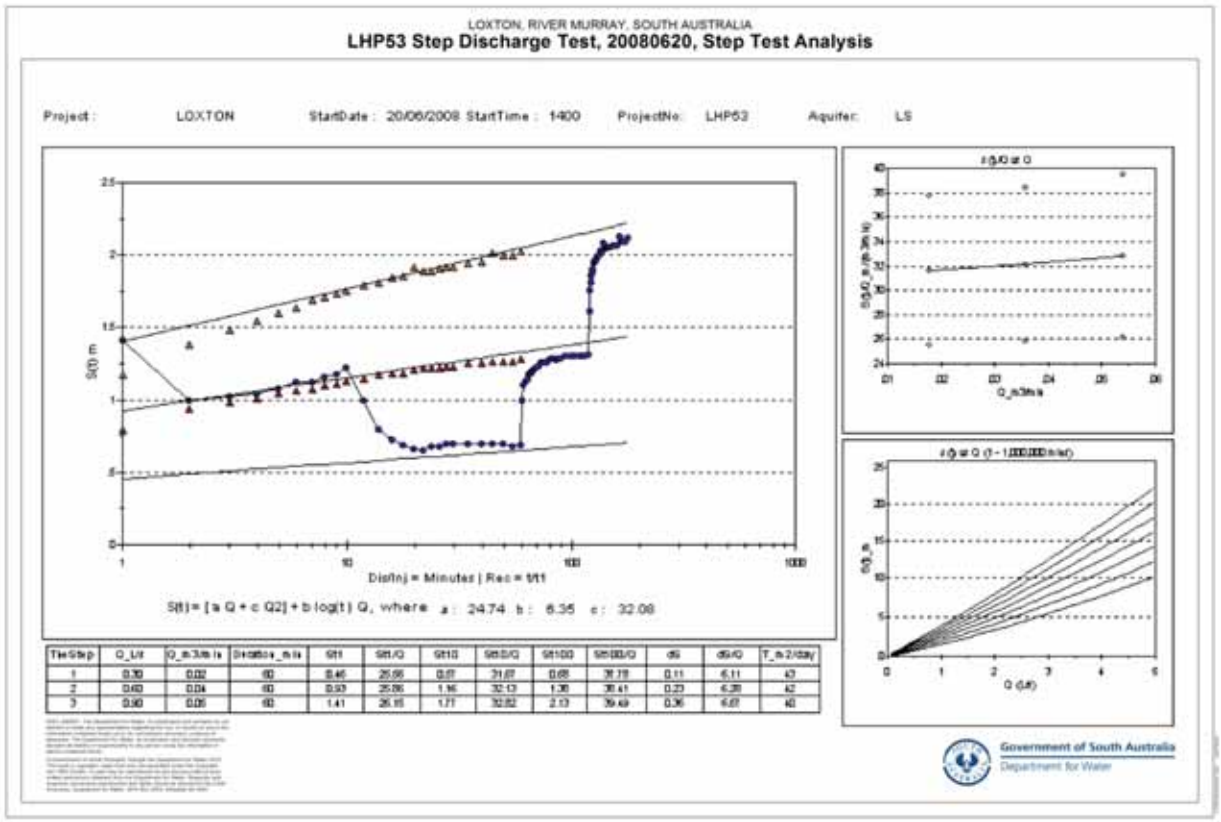


Figure 33. LHP53 Step discharge test analysis

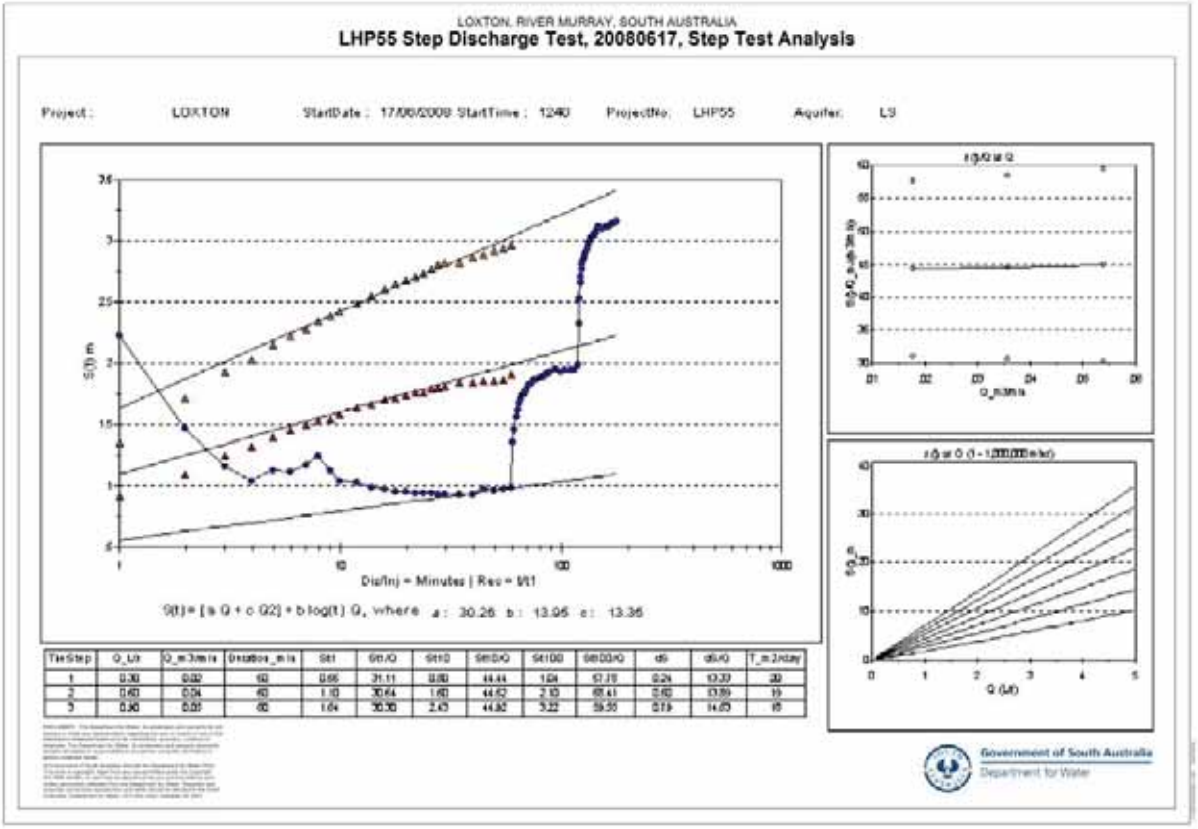


Figure 34. LHP55 Step discharge test analysis

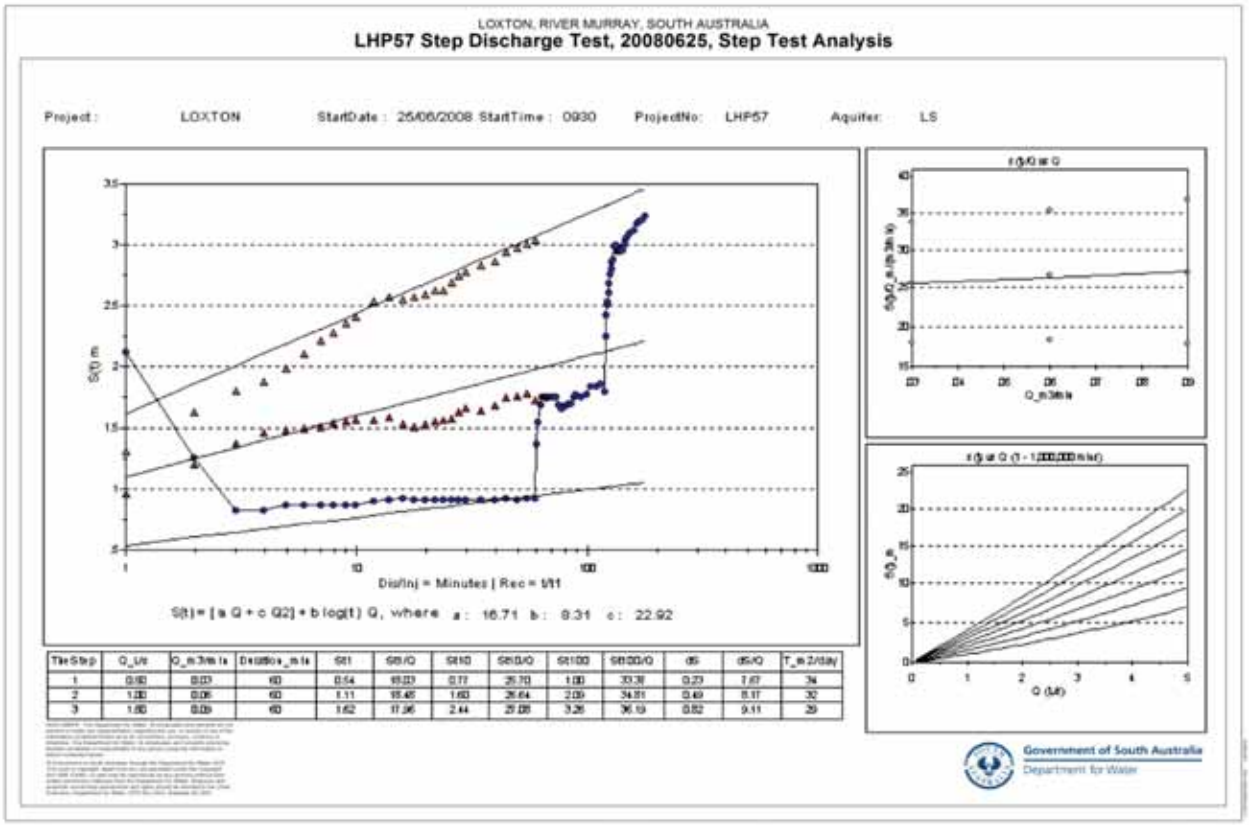


Figure 35. LHP57 Step discharge test analysis

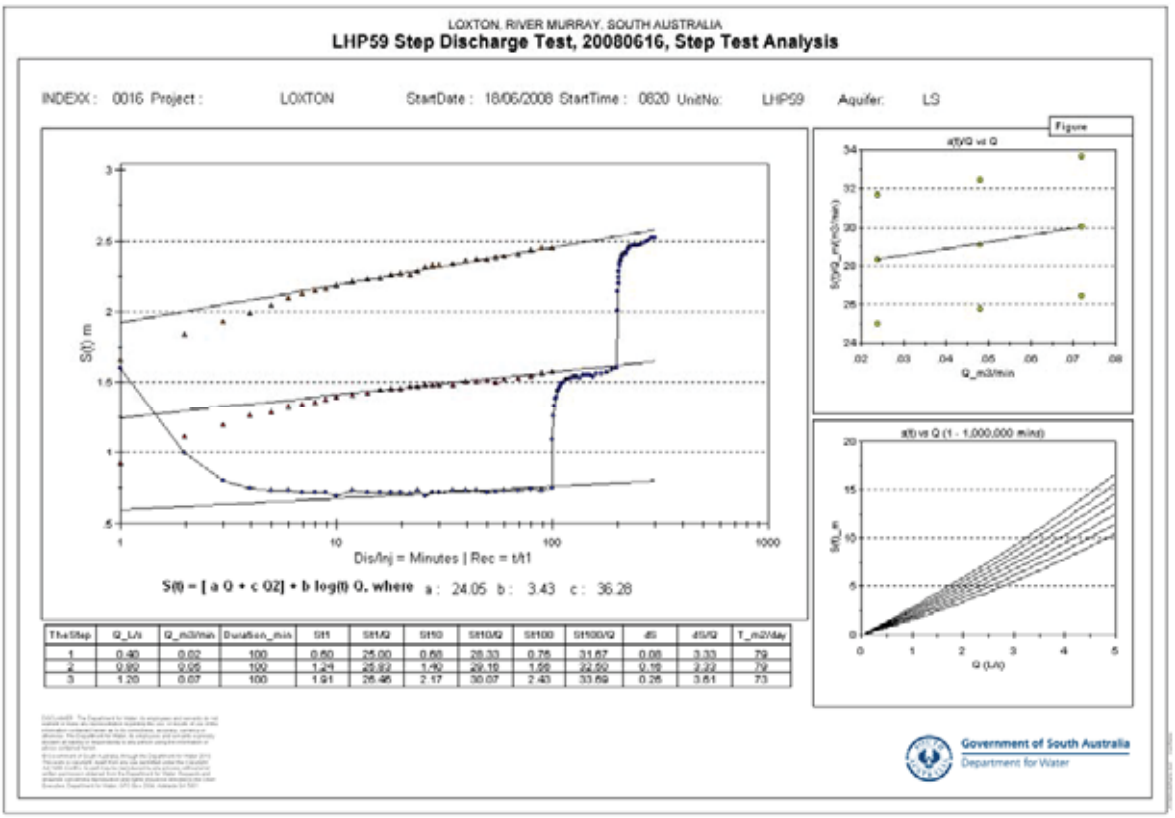


Figure 36. LHP59 Step discharge test analysis

4.5.1.2. Loxton Sands regional production wells - general hydraulic behaviour

Step drawdown tests were conducted on two Loxton Sands regional production wells (LHP61 and LHP62, Figs. 37 and 38 respectively), completed with slotted casing screens, at pumping rates ranging between 1 and 3.9 L/s. The analysis of the two step drawdown tests resulted in well equation constants with the range:

'a' 3 - 15

'b' 1 - 2

'c' 8 - 32

Based on the average values, the predicted well efficiency and specific capacity at an average pumping rate of 1 L/s and a pumping duration of 1,000,000 minutes were 41% and 1.0 (L/s)/m respectively. The reduction in well efficiency was consistent with the use of slotted casing screens with an open area of 5% in comparison to the wirewound screens which have an open area of 30%.

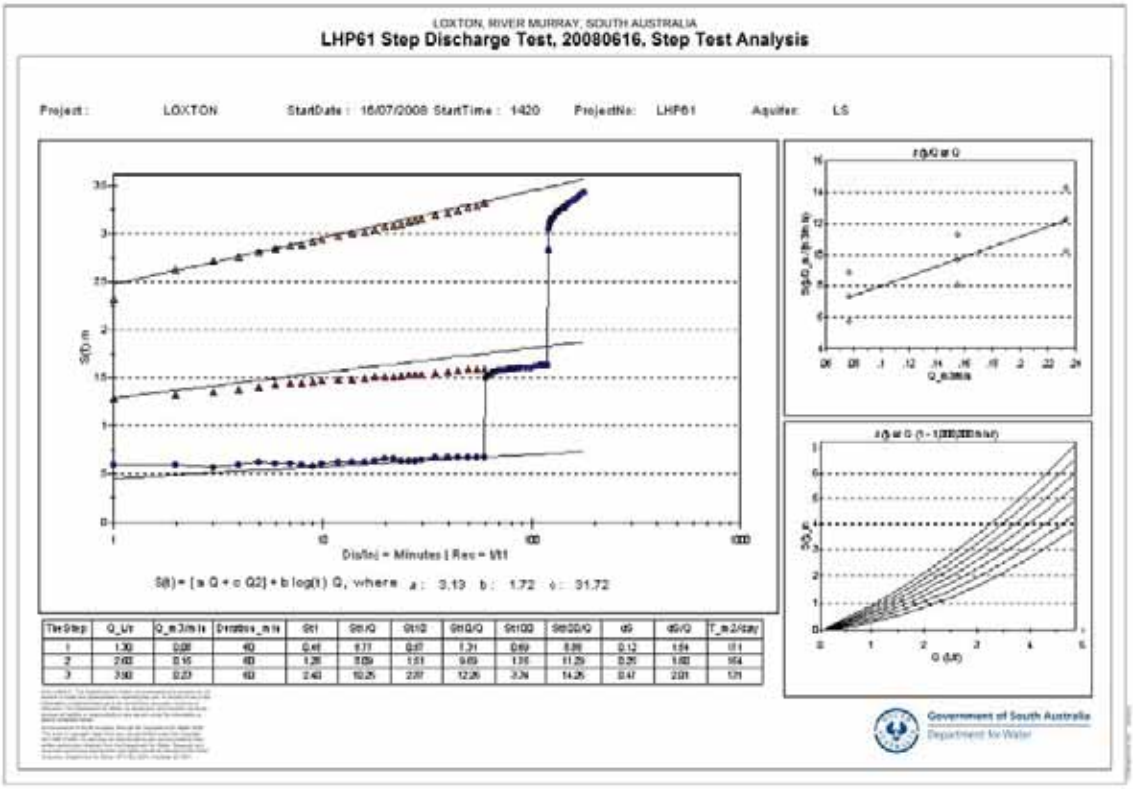


Figure 37. LHP61 Step discharge test analysis

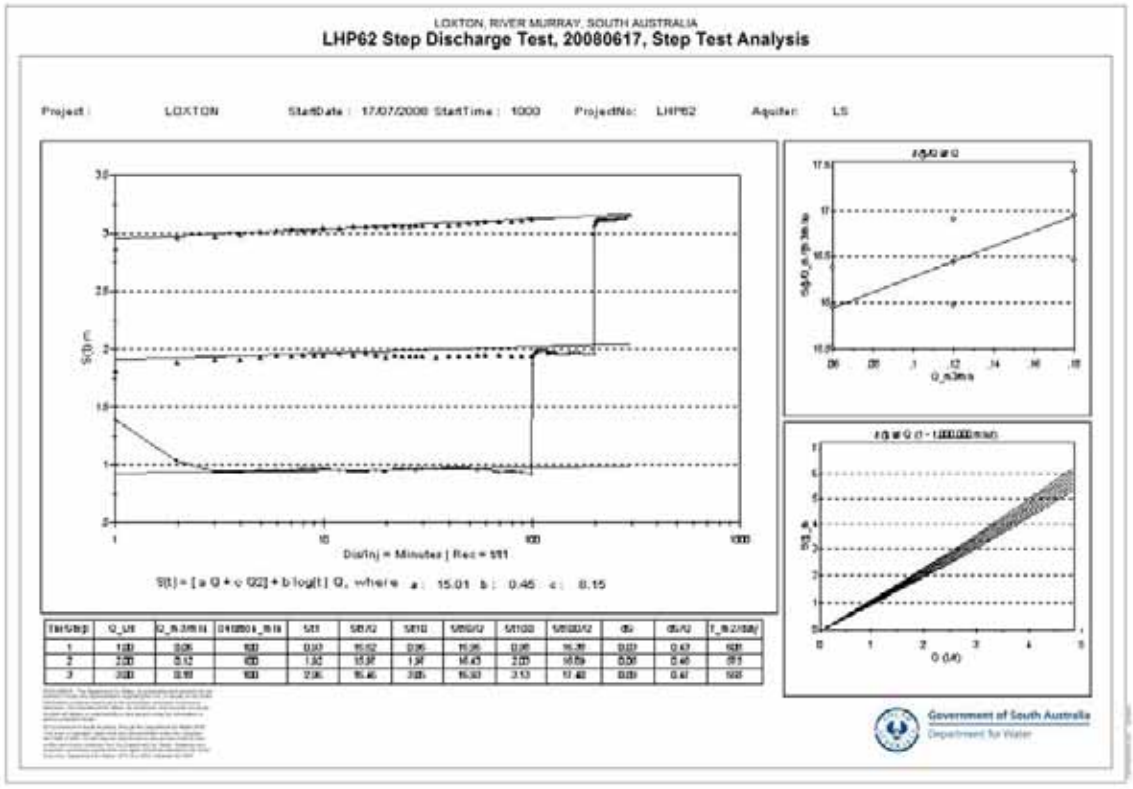


Figure 38. LHP62 Step discharge test analysis

4.5.1.3. Pata Formation trial wellfield production wells - general hydraulic behaviour

Step drawdown tests were conducted on five Pata Formation wellfield production wells with open hole completion (LHP50P, LHP52P, LHP54P, LHP56P, LHP58P and LHP60P) and one completed with a slotted casing screen (LHP56P), at pumping rates ranging between 0.2 and 0.9 L/s (Figs. 39 to 44 respectively). The analysis of the step drawdown tests for the wells completed open hole resulted in well equation constants with the range:

'a'	61 - 107	average	99
'b'	113 - 232	average	170
'c'	59 - 1,039	average	365

The extremely low permeability of the aquifer resulted in high values for the well equation constants, especially the value of 'c'. These results were similar to those obtained from step drawdown tests previously conducted on Pata Formation production wells.

Based on the average values, the predicted well efficiency and specific capacity at an average pumping rate of 0.5 L/s and a pumping duration of 1,000,000 minutes were 90% and 0.02 (L/s)/m respectively. It is interesting to note that the well efficiency was greater than for wells completed in the Loxton Sands.

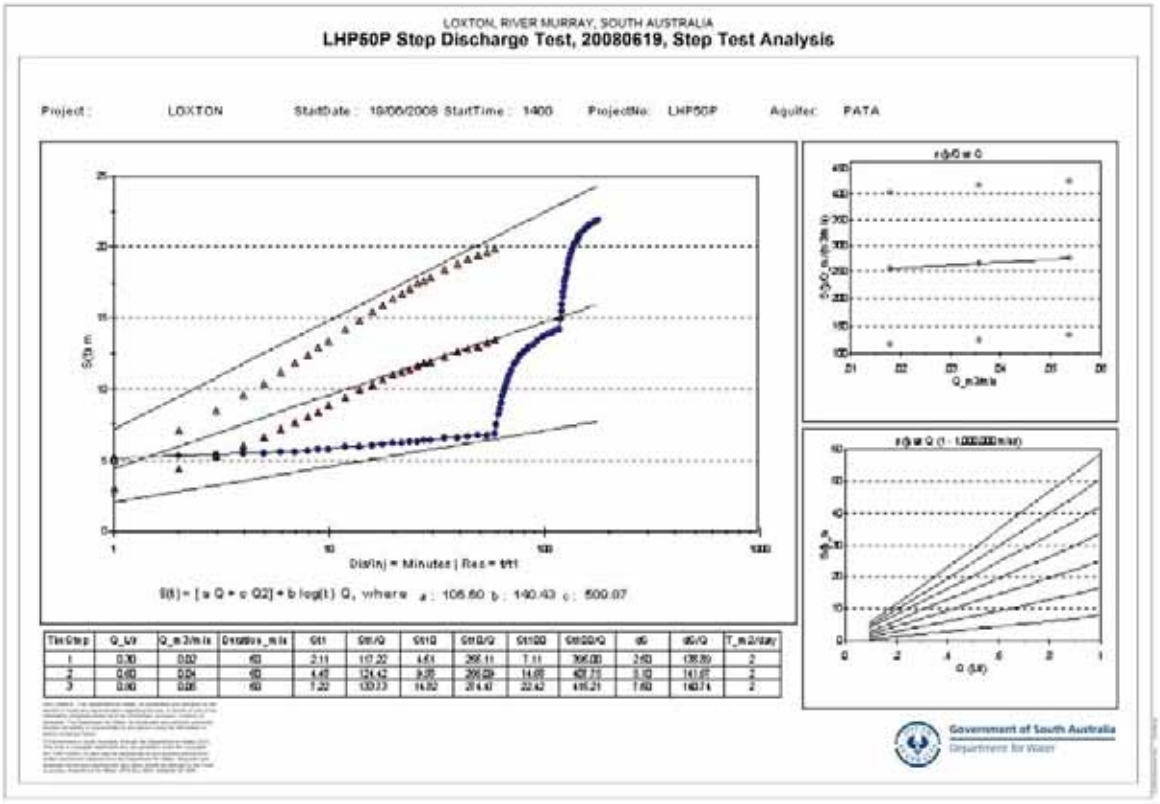


Figure 39. LHP50P Step discharge test analysis

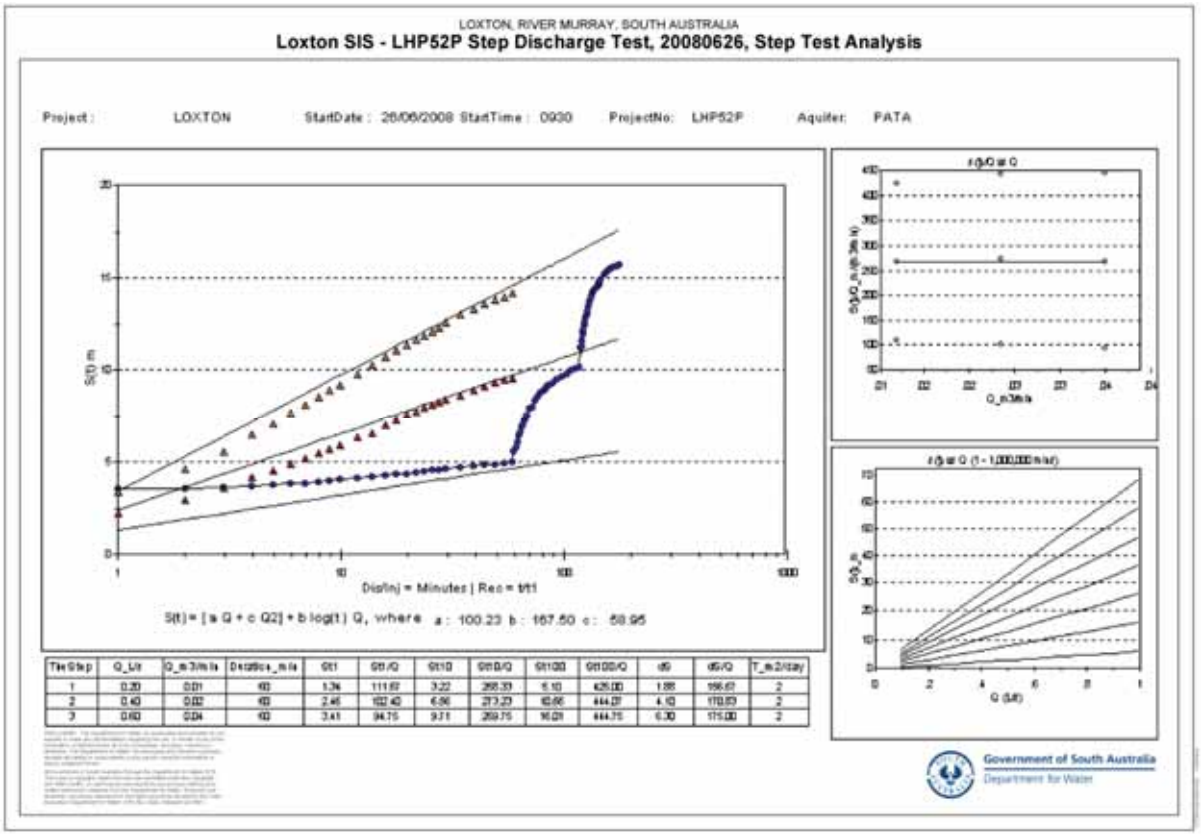


Figure 40. LHP52P Step discharge test analysis

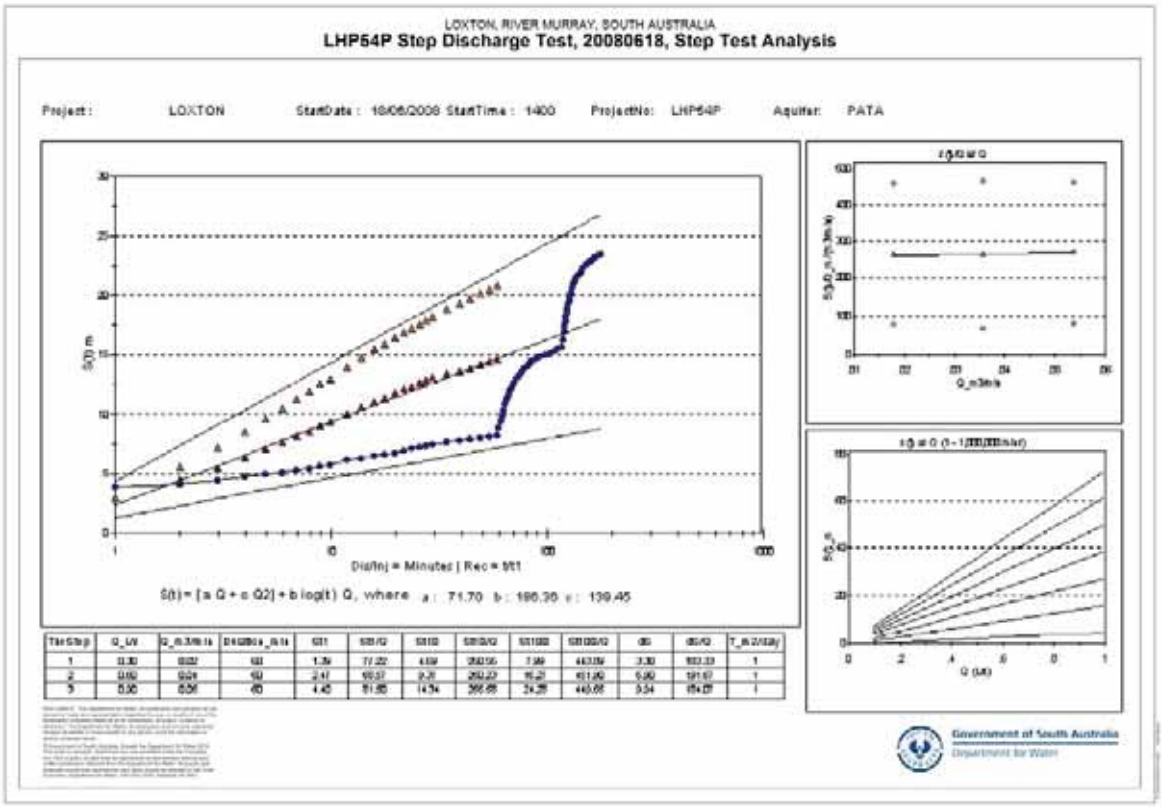


Figure 41. LHP54P Step discharge test analysis

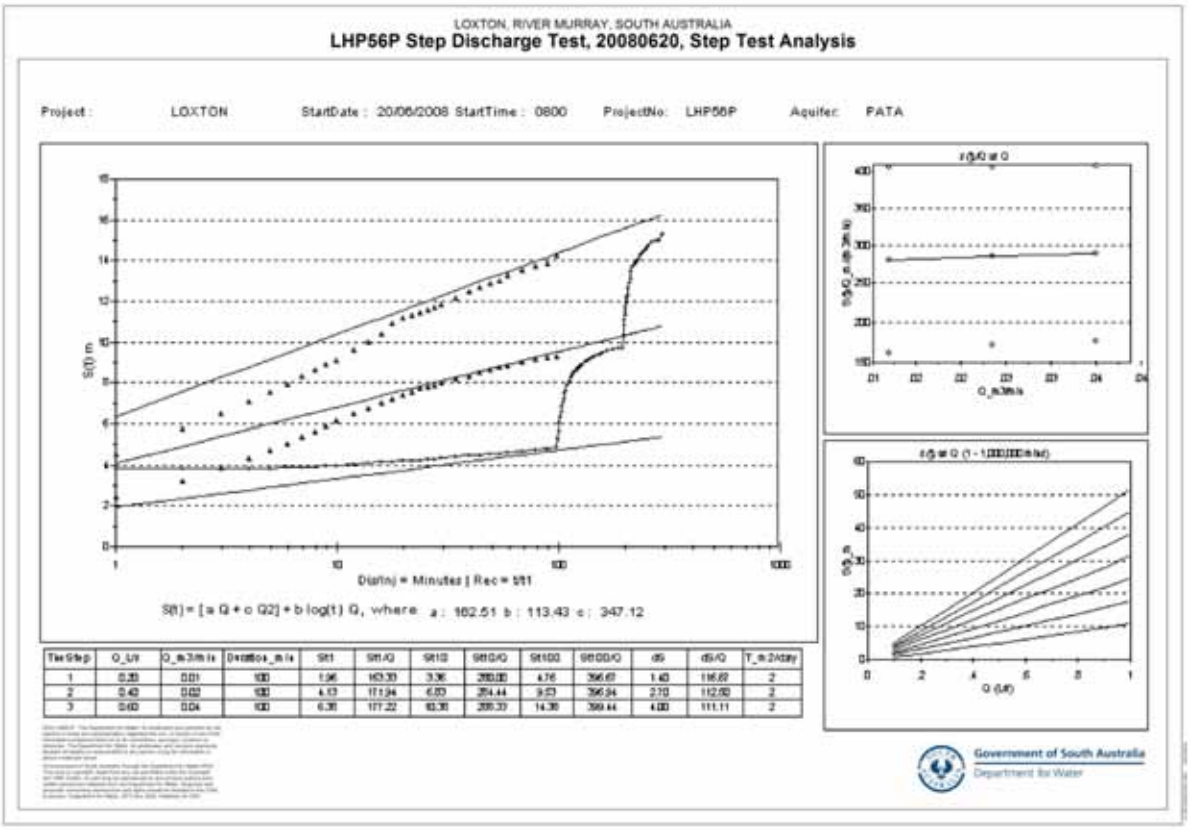


Figure 42. LHP56P Step discharge test analysis

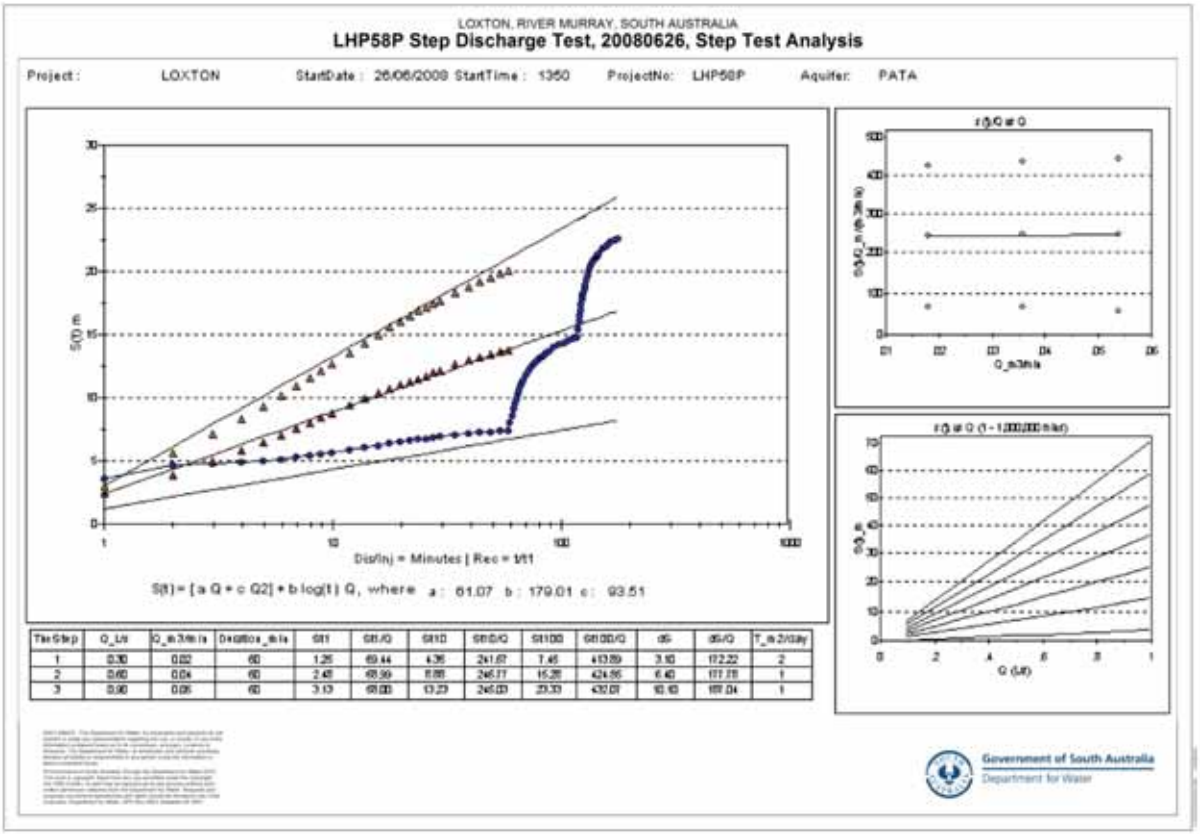


Figure 43. LHP58P Step discharge test analysis

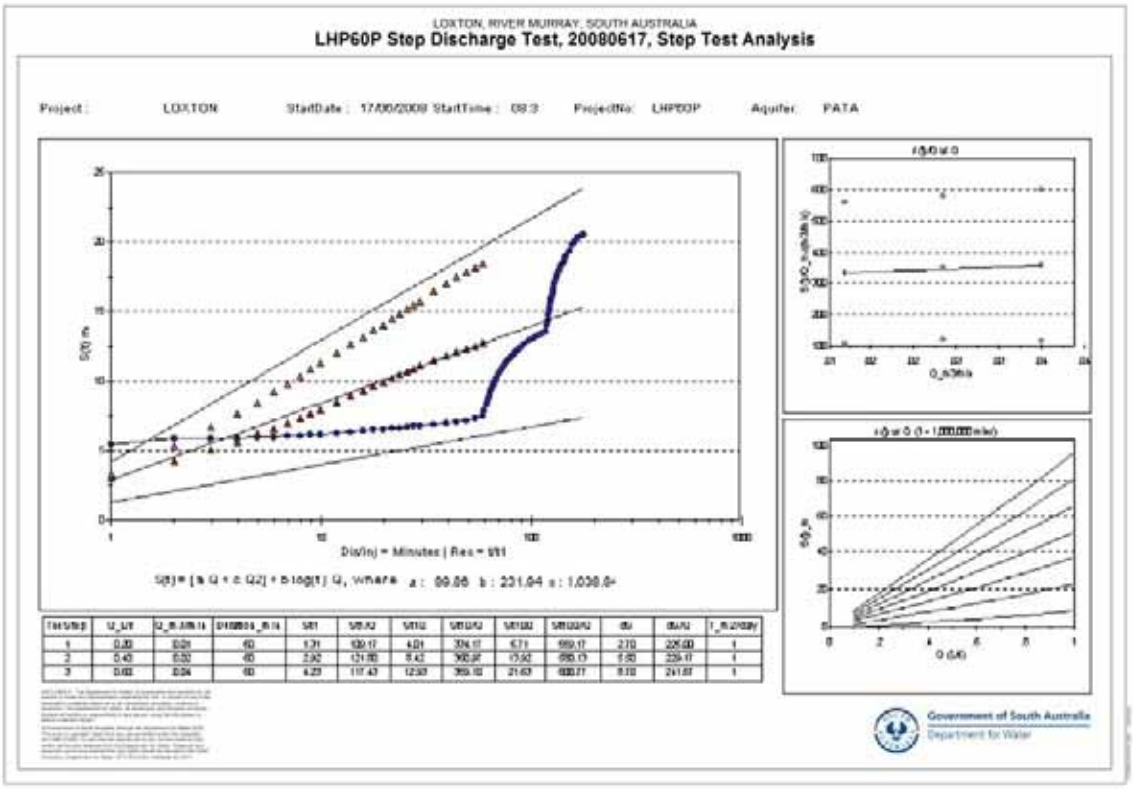


Figure 44. LHP60P Step discharge test analysis

4.5.2. LOXTON SANDS CONSTANT RATE DISCHARGE TESTS

DFW Groundwater Technical Services conducted constant rate discharge tests on Loxton Sands production wells completed in the well drilling program between June and September 2008. Test details and results are given in Appendix D. Data was analysed using the Schlumberger Water Services software package AquiferTestProV4.2.

The objective of the constant rate discharge tests was to determine the aquifer (Loxton Sands) hydraulic parameters, hydraulic boundaries and extent of pumping influence in the production aquifer.

Constant rate discharge tests were conducted on three Loxton Sands trial wellfield production wells completed with wirewound screens (LHP51, LHP55 and LHP59).

Production well LHP51

The constant rate discharge test conducted on production well LHP51 was at a pumping rate of 0.9 L/s for a duration of 1,440 minutes. The data from the key observation well, LHO70 at r = 15.0 m, was analysed using the Cooper-Jacob method (Fig. 45), the Neuman method (Fig. 46) and the early time data using the Theis method (Fig. 47).

The following general comments can be made:

1. The Loxton Sands exhibited drawdown signatures at the observation well consistent with an unconfined aquifer.
2. A drawdown of 0.15 m developed in observation well LHO70.

3. The Loxton Sands indicated a transmissivity range between 230 and 255 m^2/d and hydraulic conductivity of 22 m/d. The specific yield of 0.008 was considered too low which indicated that the data may not have been amenable to the analysis method.
4. Reduced groundwater levels recorded during the test are given in Fig. 48 which indicate:
    a. A groundwater level elevation of 12.4 m AHD developed in production well LHP51.
    b. A groundwater level elevation of 14.74 m AHD developed at observation well LHO70.
    c. The potentiometric surface could not be readily drawn down to the river pool level in observation wells close to the production well.
5. Groundwater salinity was 10,200 mg/L.

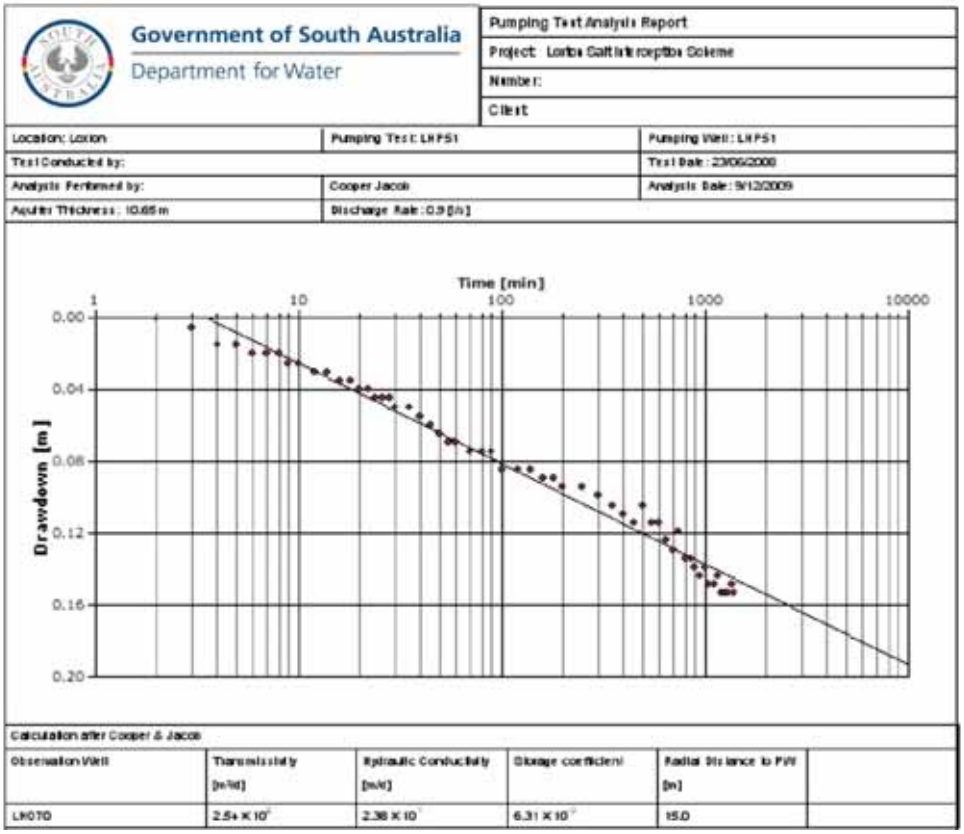


Figure 45. LHP51 Constant rate discharge test analysis (Cooper-Jacob LHO70)

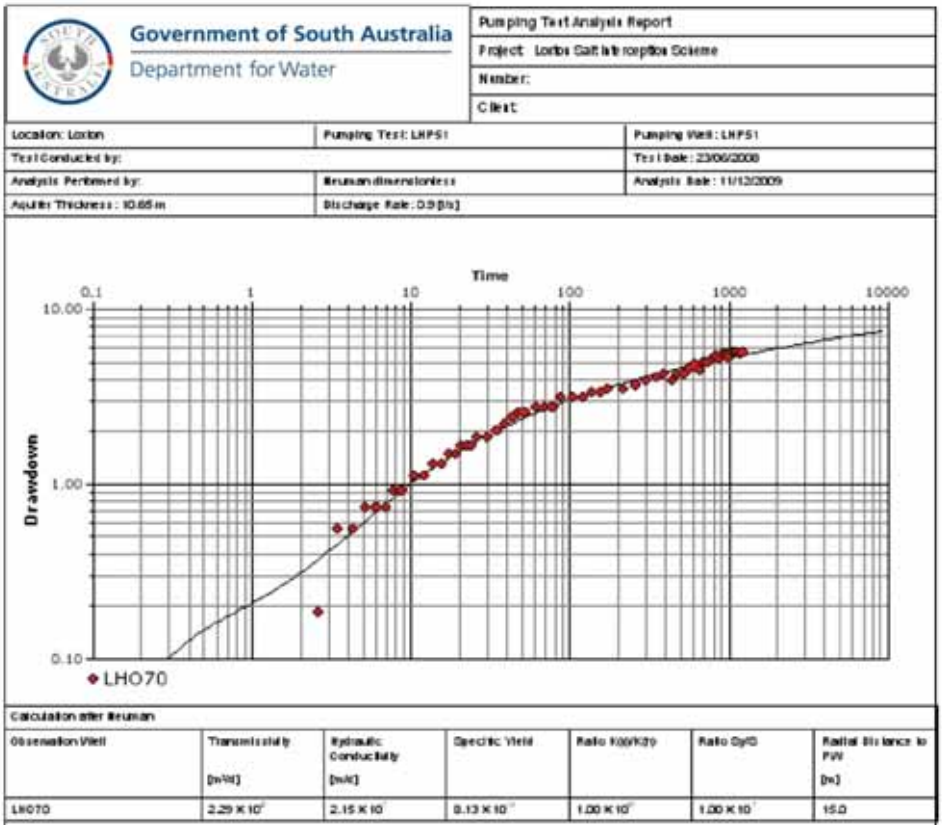


Figure 46. LHP51 Constant rate discharge test analysis (Neuman LHO70)

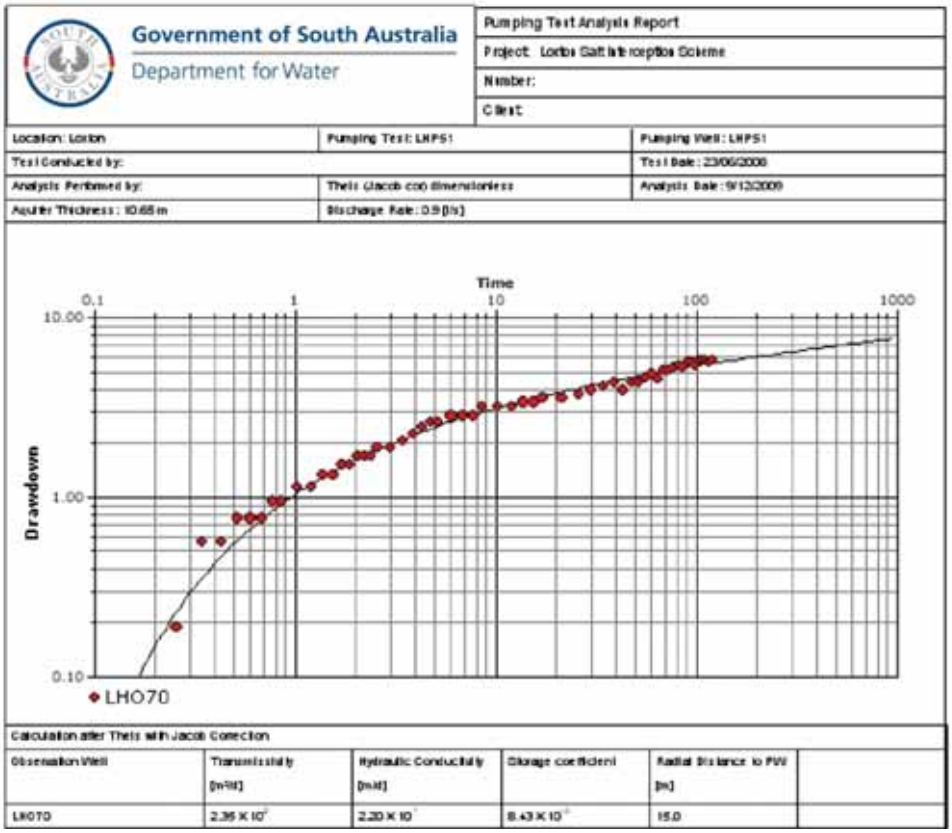


Figure 47. LHP51 Constant rate discharge test analysis (Theis LHO70)

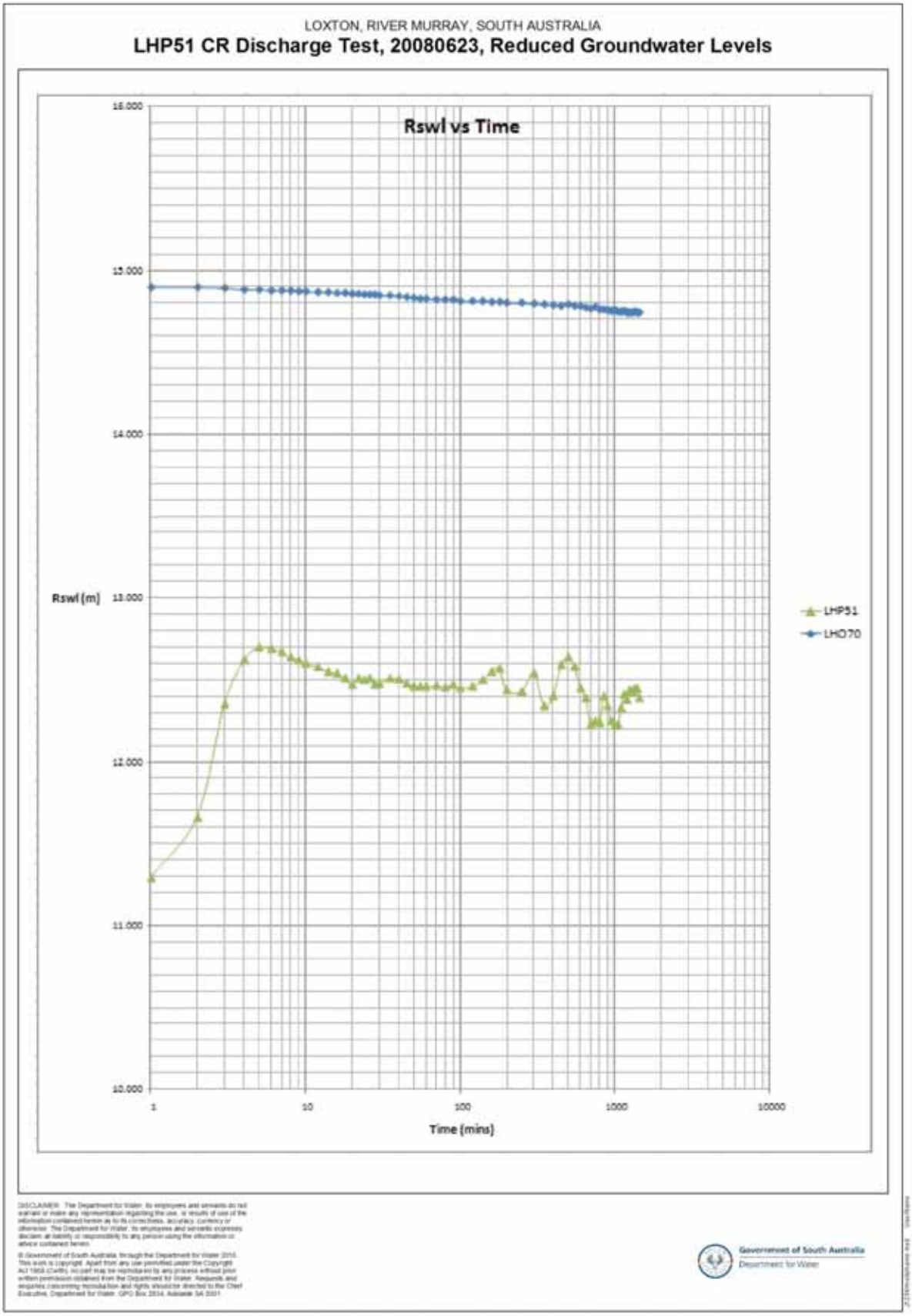


Figure 48. **LHP51 Constant rate discharge test groundwater level elevations**

Production well LHP55

The constant rate discharge test conducted on production well LHP55 was at a pumping rate of 0.85 L/s for a duration of 10,000 minutes (but only the initial 1,500 minutes of manual data is available). The logger data (to 8,668 minutes) from the key observation well, LHO74 at r = 21.65 m, was analysed using the Cooper-Jacob method (Fig. 49) and the early time data using the Theis method (Fig. 50). The data was not amenable to Neuman analysis.

The following general comments can be made:

1. The Loxton Sands exhibited drawdown signatures at the observation well consistent with an unconfined aquifer. There was evidence of low permeability material at distance from production well.
2. A drawdown of 0.095 m developed in observation well LHO74.
3. The Loxton Sands had a transmissivity range between 340 and 370 m^2/d and hydraulic conductivity of 30 m/d. The specific yield could not be adequately determined from the test.
4. Groundwater level elevations recorded during the first 1,500 minutes of the test are given in Fig. 51 which indicate:
    a. A groundwater level elevation of 13.5 m AHD developed in production well LHP55.
    b. A groundwater level elevation of 15.7 m AHD developed at observation well LHO74.
    c. The watertable could not be readily drawn down to river pool level in observation wells close to the production well.
5. Groundwater salinity was 11,100 mg/L.

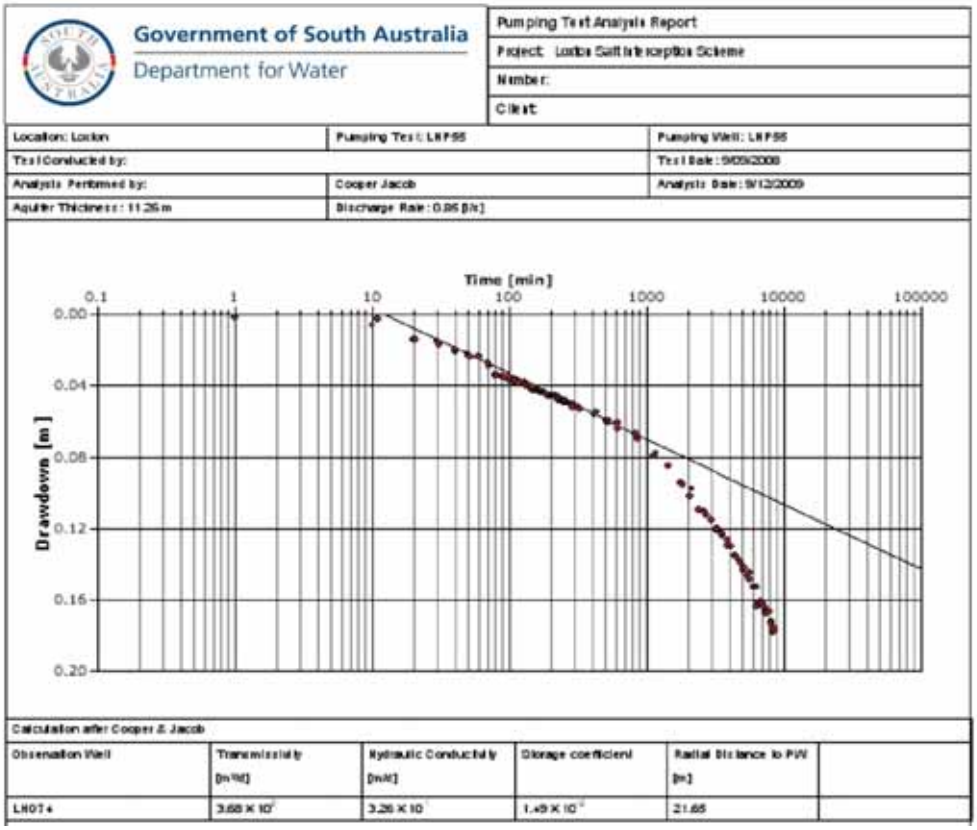


Figure 49. LHP55 Constant rate discharge test analysis (Cooper Jacob LHO74)

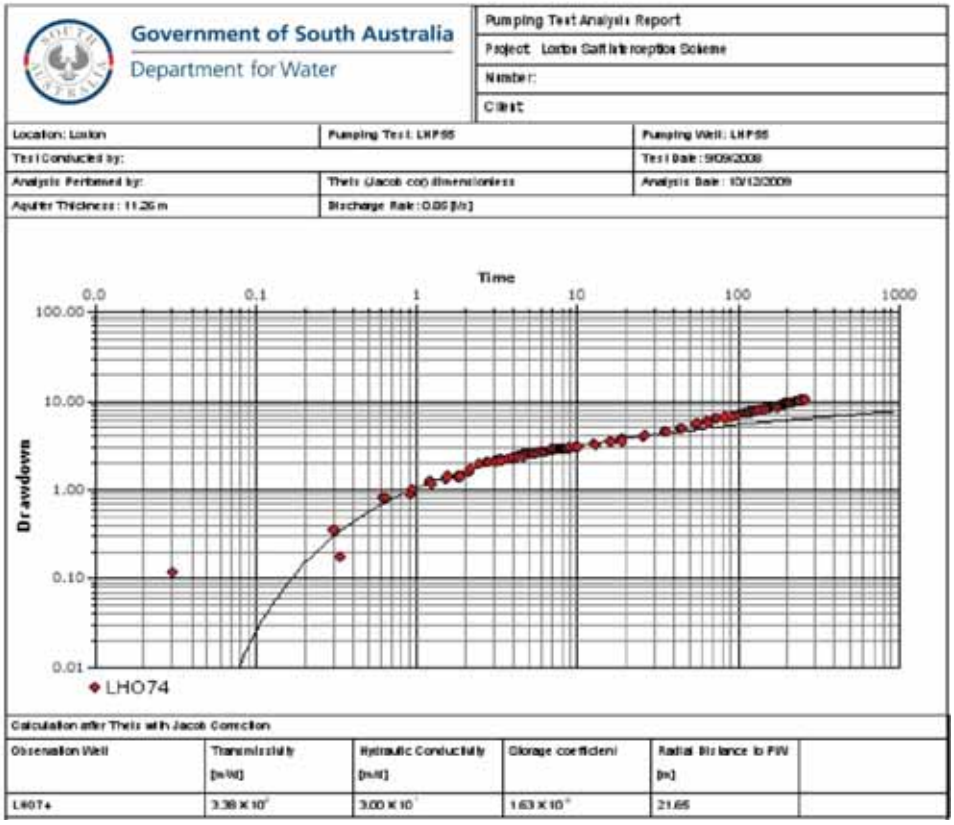


Figure 50. LHP55 Constant rate discharge test analysis (Theis LHO74)

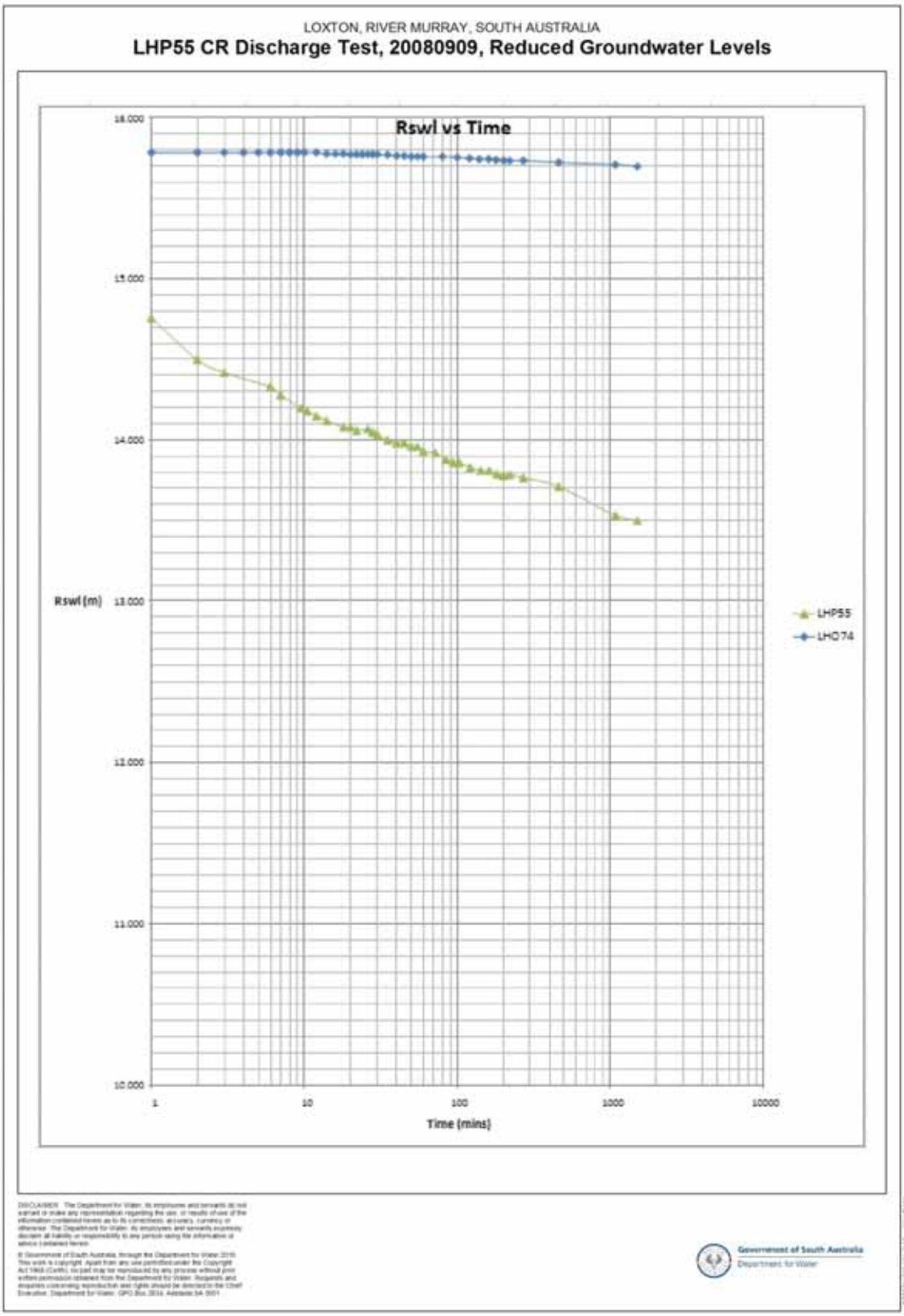


Figure 51. **LHP55 Constant rate discharge test groundwater level elevations**

Production well LHP59

The constant rate discharge test conducted on production well LHP59 was at a pumping rate of 1.3 L/s for a duration of 1,440 minutes. The data from the key observation well, LHO78 at r = 14.9 m, was analysed using the Cooper-Jacob method (Fig. 52) and the Neuman method (Fig. 53) and the early time data using the Theis method (Fig. 54).

The following general comments can be made:

1. The Loxton Sands exhibited drawdown signatures at the observation well consistent with an unconfined aquifer.
2. A drawdown of 0.1 m developed in observation well LHO78.
3. The Loxton Sands had a transmissivity range between 310 and 680 m^2/d and hydraulic conductivity range of 30 to 65 m/d. The calculated specific yield of 0.008 was considered too low which indicated that the data may not have been amenable to the analysis method.
4. Groundwater level elevations recorded during the test are given in Fig. 55 which indicate:
    a. A groundwater level elevation of 13.67 m AHD developed in production well LHP59.
    b. A groundwater level elevation of 16.48 m AHD developed in observation well LHO78.
    c. The watertable could not be readily drawn down to the river pool level in observation wells close to the production well.
5. Groundwater salinity was 11,000 mg/L.

In conclusion, the constant rate discharge tests conducted on Loxton Sands trial wellfield production wells (LHP51, LHP55 and LHP59) indicate transmissivity values increasing from 250 m^2/d at the southern end (at LHP51), to between 300 and 700 m^2/d at the northern end (at LHP59).

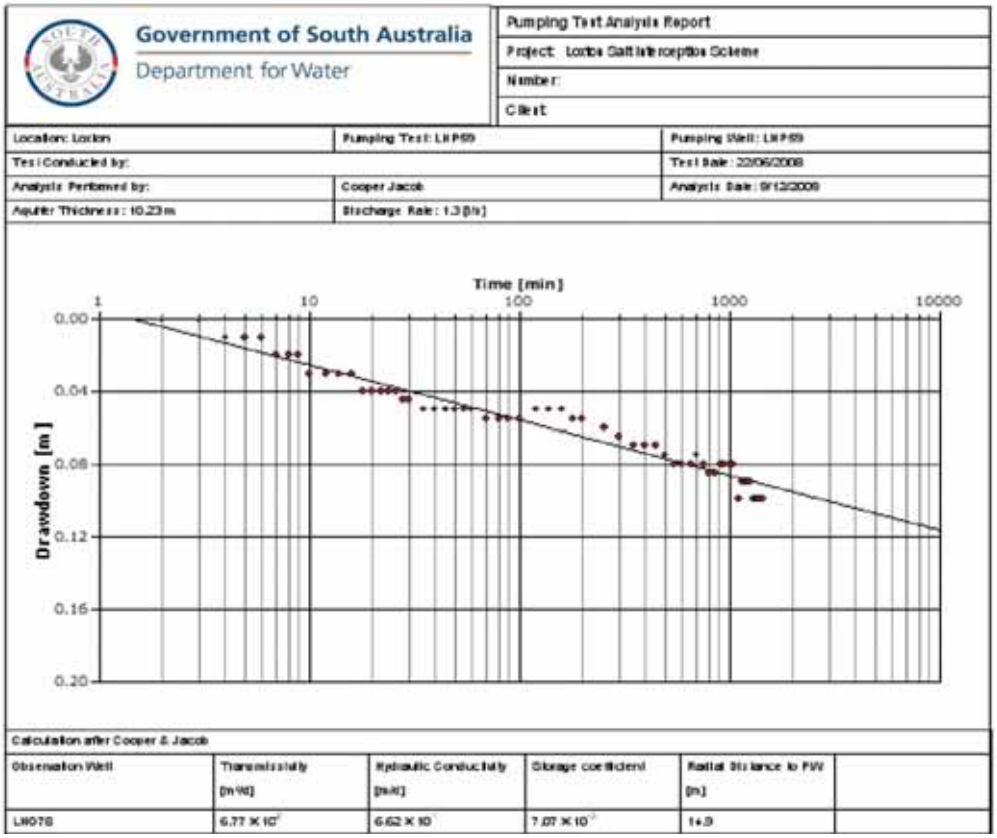


Figure 52. LHP59 Constant rate discharge test analysis (Cooper Jacob LHO78)

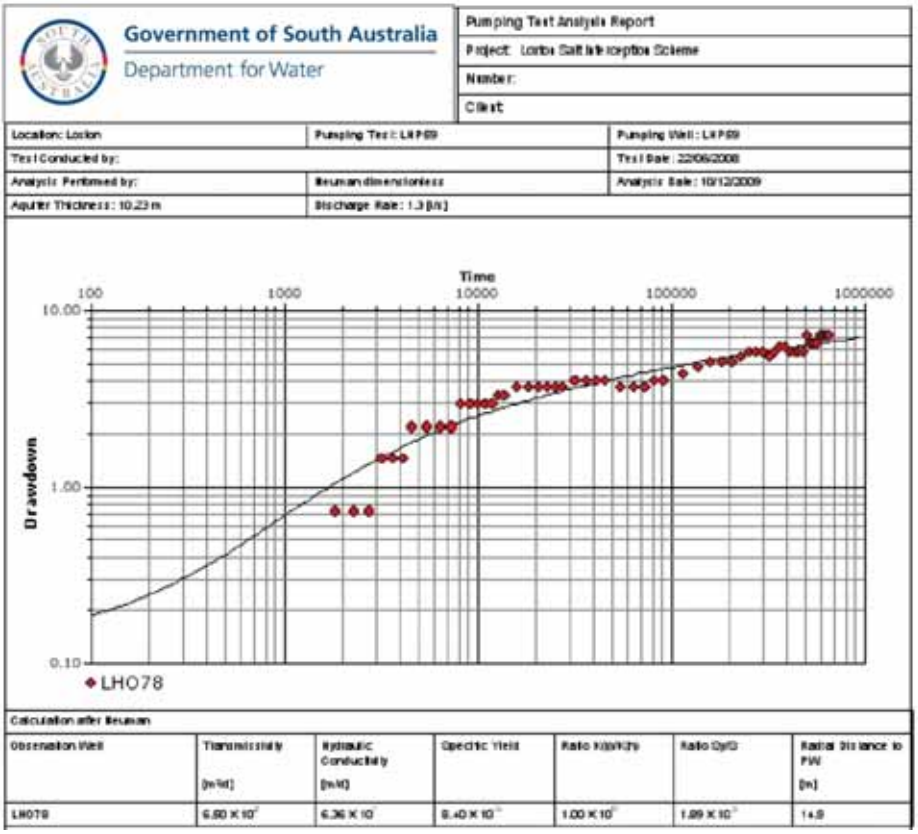


Figure 53. LHP59 Constant rate discharge test analysis (Neuman LHO78)

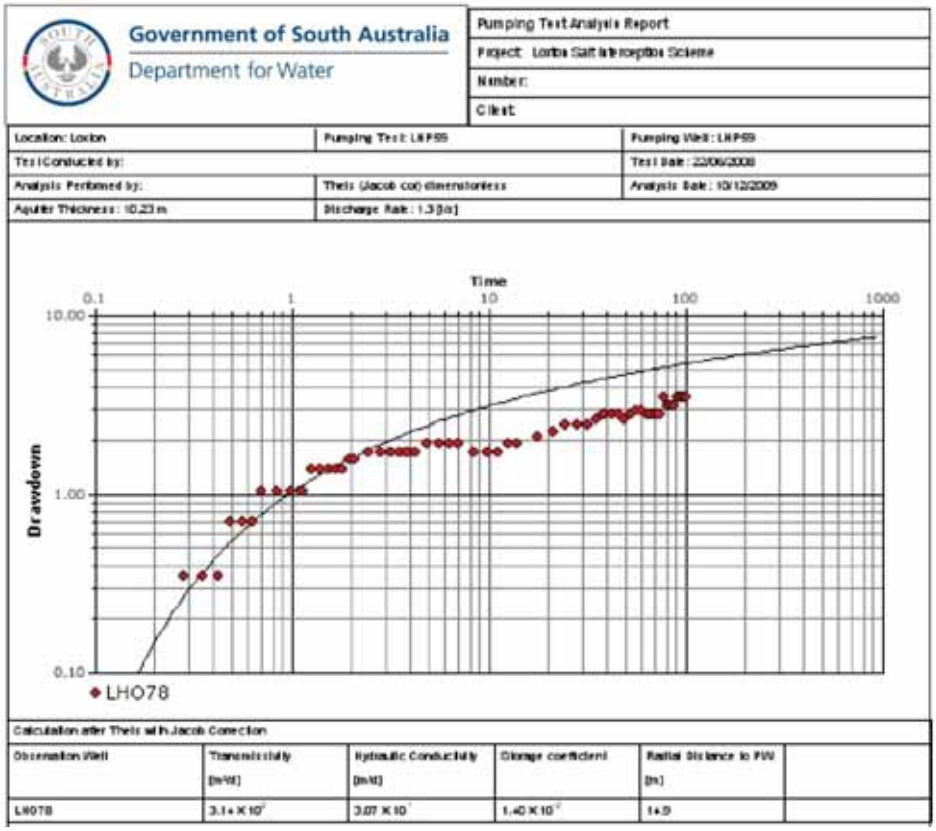


Figure 54. LHP59 Constant rate discharge test analysis (Theis LHO78)

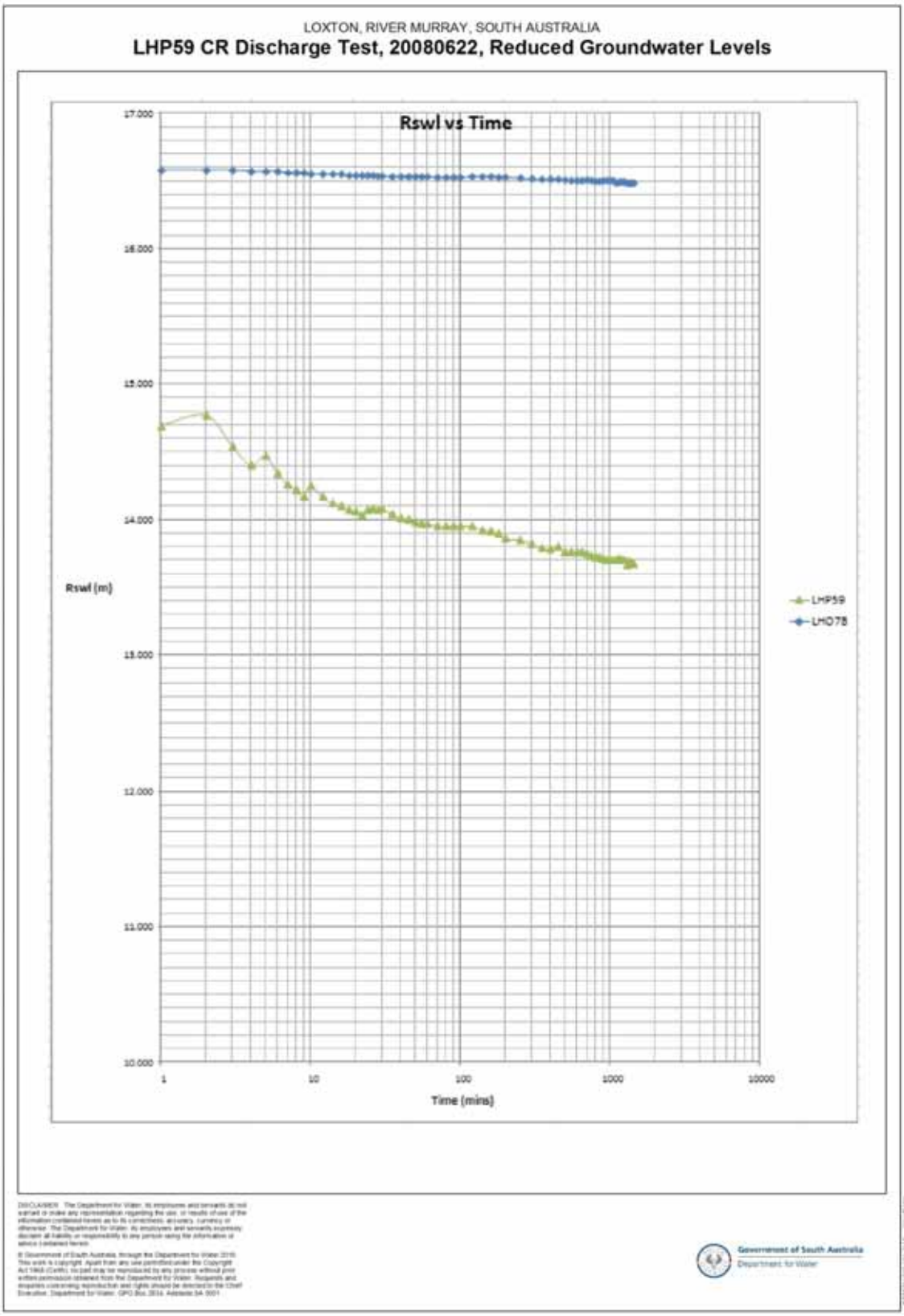


Figure 55. **LHP59 Constant rate discharge test groundwater level elevations**

Constant rate discharge tests were conducted on two Loxton Sands regional production wells completed with wirewound screens (LHP61 and LHP62).

Production well LHP61

The constant rate discharge test conducted on production well LHP61 was a pumping rate of 3.2 for a duration of 1,440 minutes. The data from the key observation well, LHO80 at r = 15.5 m, was analysed using the Cooper-Jacob method (Fig. 56) and the early time data using the Theis method (Fig. 57). The data was not amenable to Neuman analysis.

The following general comments can be made:

1. The Loxton Sands exhibited drawdown signatures at the observation well consistent with an unconfined aquifer. There was evidence of low permeability material at distance from production well.
2. A drawdown of 0.265 m developed in observation well LHO80.
3. The Loxton Sands had a transmissivity range between 650 and 700 m^2/d and hydraulic conductivity range of 80 to 90 m/d. The specific yield could not be adequately determined from the test.
4. Groundwater salinity was 6,400 mg/L.

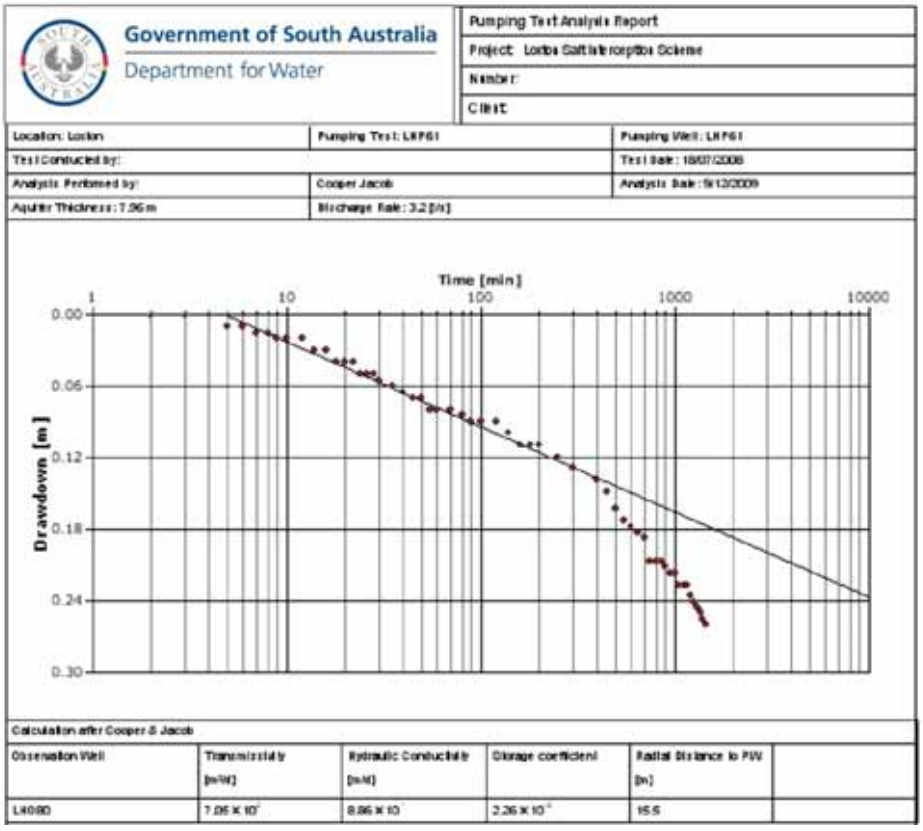


Figure 56. LHP61 Constant rate discharge test analysis (Cooper Jacob LHO80)

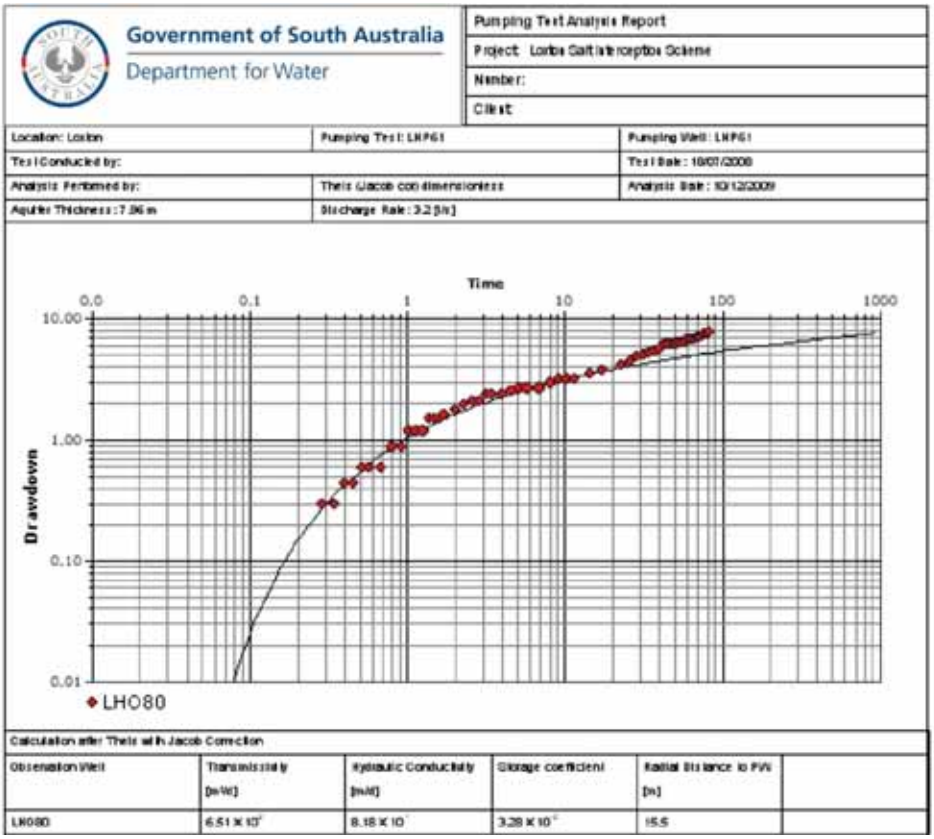


Figure 57. LHP61 Constant rate discharge test analysis (Theis LHO80)

Production well LHP62

The constant rate discharge test conducted on production well LHP62 was at a pumping rate of 3.5 L/s for a duration of 2,880 minutes. The data from the key observation well, LHO79 at r = 27.35 m, was analysed using the Cooper-Jacob method (Fig. 58) and the early time data using the Theis method (Fig. 59). The data was not amenable to Neuman analysis.

The following general comments can be made:

1. The Loxton Sands exhibited drawdown signatures at the observation well consistent with an unconfined aquifer. There was evidence of low permeability material at some distance from production well.
2. A drawdown of 0.19 m developed in observation well LHO79.
3. The Loxton Sands had a transmissivity range between 810 and 1,100 m^2/d and hydraulic conductivity range of 70 to 100 m/d. The specific yield could not be adequately determined from the test.
4. Groundwater salinity was 4,100 mg/L.

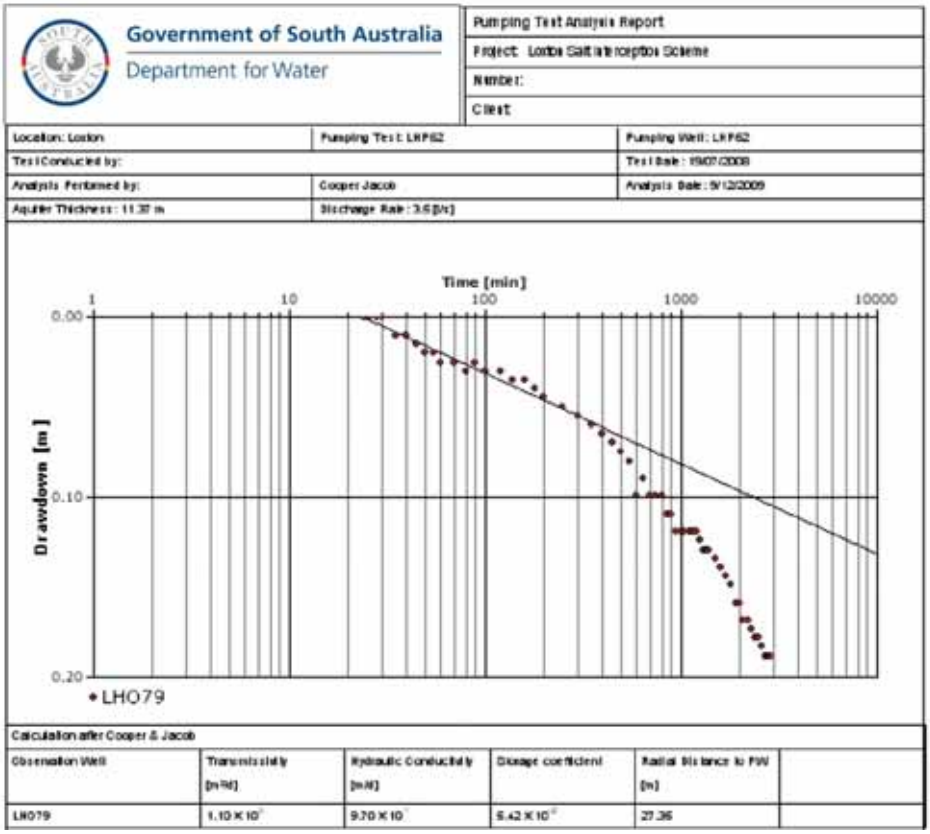


Figure 58. LHP62 Constant rate discharge test analysis (Cooper Jacob LHO79)

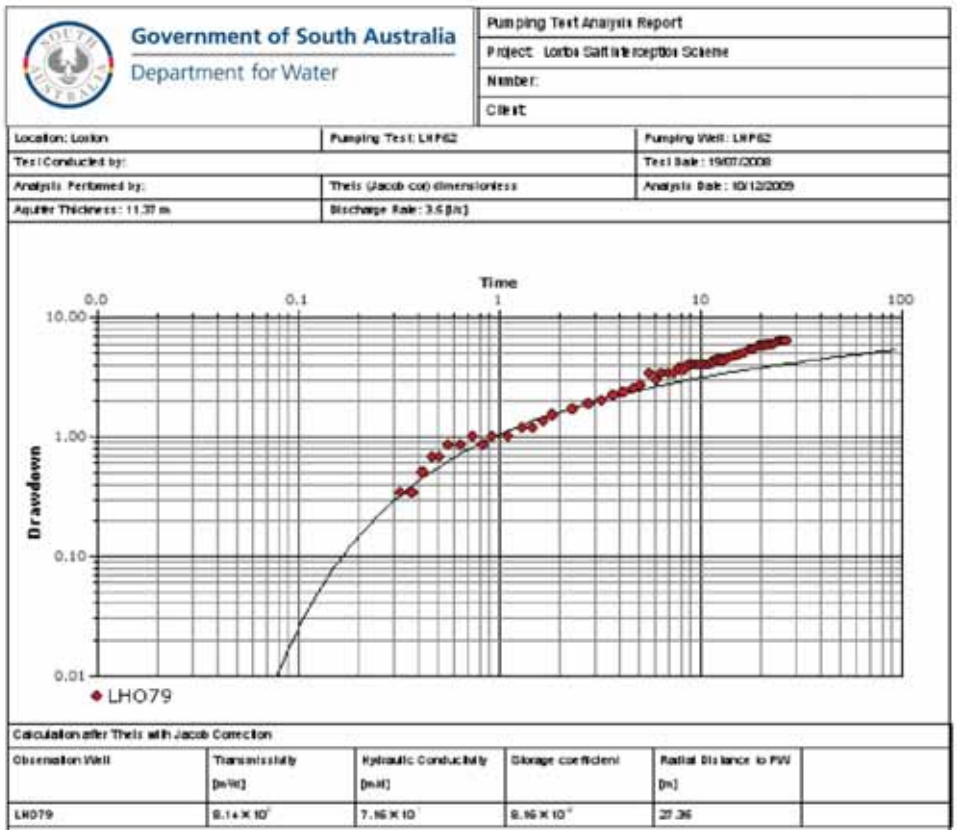


Figure 59. LHP62 Constant rate discharge test analysis (Theis LHO79)

4.6. PATA FORMATION CONSTANT RATE DISCHARGE TEST

DFW Groundwater Technical Services conducted a single constant rate discharge test on a Pata Formation production well completed in the well drilling program in June 2008. Test details and results are given in Appendix D. Data was analysed using the Schlumberger Water Services software package AquiferTestProV4.2.

The objective of the constant rate discharge test was to determine the aquifer (Pata Formation) and aquitard (Lower Loxton Clay and Shells and Bookpurnong Formation) hydraulic parameters, the potential for leakage, hydraulic boundaries and the hydraulic relationship between the aquifers.

Production well LHP56P

The constant rate discharge test conducted on the production well LHP56P (at the centre of the trial wellfield) was at a pumping rate of 0.5 L/s for a duration of 10,000 minutes. The data from two key observation wells, LHO73P at r = 31.54 m and LHO77P at r = 76.99 m, was analysed using the Cooper-Jacob method (Fig. 60) and Hantush method (Fig. 61 and Fig. 62).

The following general comments can be made:

1. The Pata Formation exhibited drawdown signatures at the observation consistent with a confined aquifer however there was evidence of slight inter-aquifer leakage.
2. The Pata Formation had a transmissivity range between 2 and 5 m^2/d and storage coefficient range of 8.11E-5 to 1.12E-4.
3. The aquitard (Lower Loxton Clay and Shells and Bookpurnong Formation) had a hydraulic resistance range of 13,403 to 42,153 days. This test was the longest test conducted on the Pata Formation in the Loxton region. The hydraulic resistance values derived from the test were considerably higher than those obtained previously and indicated the Pata Formation had a greater degree of confinement at the test site when compared to sites previously tested (Howles and Smith, 2005) when values between 826 and 3,708 days were obtained.
4. It was assumed that all leakage occurred through the overlying Lower Loxton Clay and Shells and Bookpurnong Formation. Assuming (a thickness of 8.5 m), a working range for the vertical hydraulic conductivity of between 2E-4 and 6E-4 m/d was calculated.
5. The absence of an observation well completed in the underlying Glenforslan Formation precluded any comment regarding possibly leakage through the underlying aquitard (the Winnambool Formation).
6. No drawdown developed in the Loxton Sands observation well LHO74 at a radial distance of 30.46 m from the production well (Fig. 63).
7. Groundwater level elevations recorded during the test are given in Fig. 64 which indicate that at the end of the test:
    a. A groundwater level elevation of 2 m AHD developed in production well LHP56P.
    b. A groundwater level elevation of 9.4 m AHD developed at observation well LHO73P at a radial distance of 31.54 m from the production well.
    c. A groundwater level elevation of 12 m AHD developed at observation well LH77P at a radial distance of 76.99 m from the production well.
    d. The potentiometric surface could be readily drawn down to river pool level of 9.8 m AHD in observation wells at some distance from the production well.

8. No hydraulic boundaries (except for inter-aquifer leakage) were evident during the test.
9. Production well LHP56P was nearly fully penetrating and completed open hole.
10. Groundwater salinity was 29,000 mg/L.

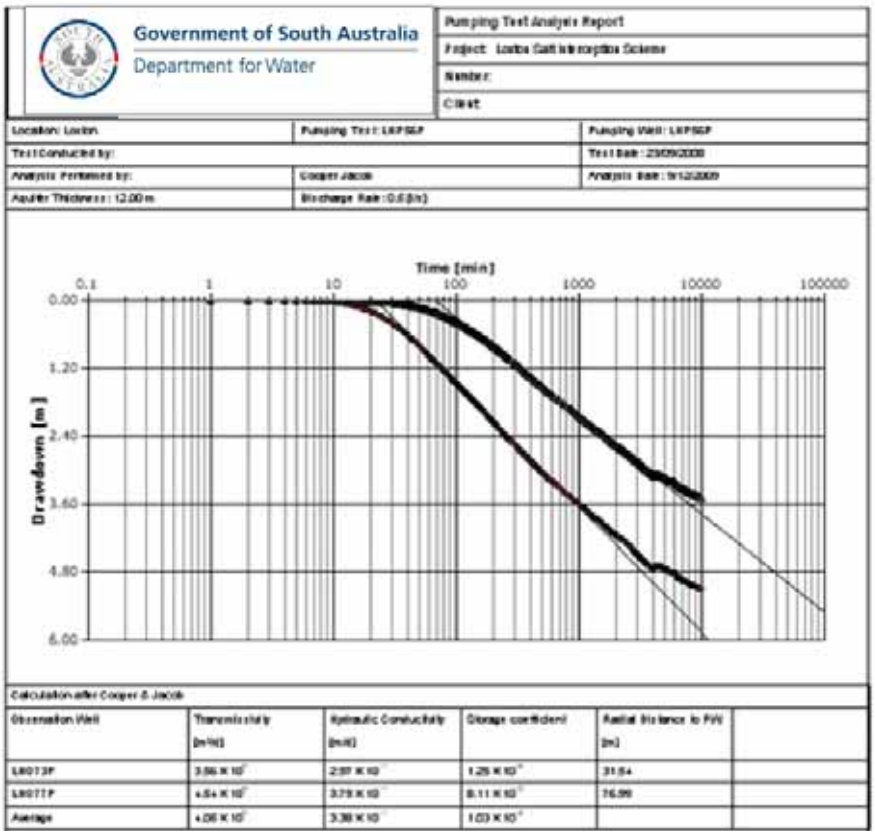


Figure 60. LHP56P Constant rate discharge test analysis (Cooper Jacob LHO73P, LHO77P)

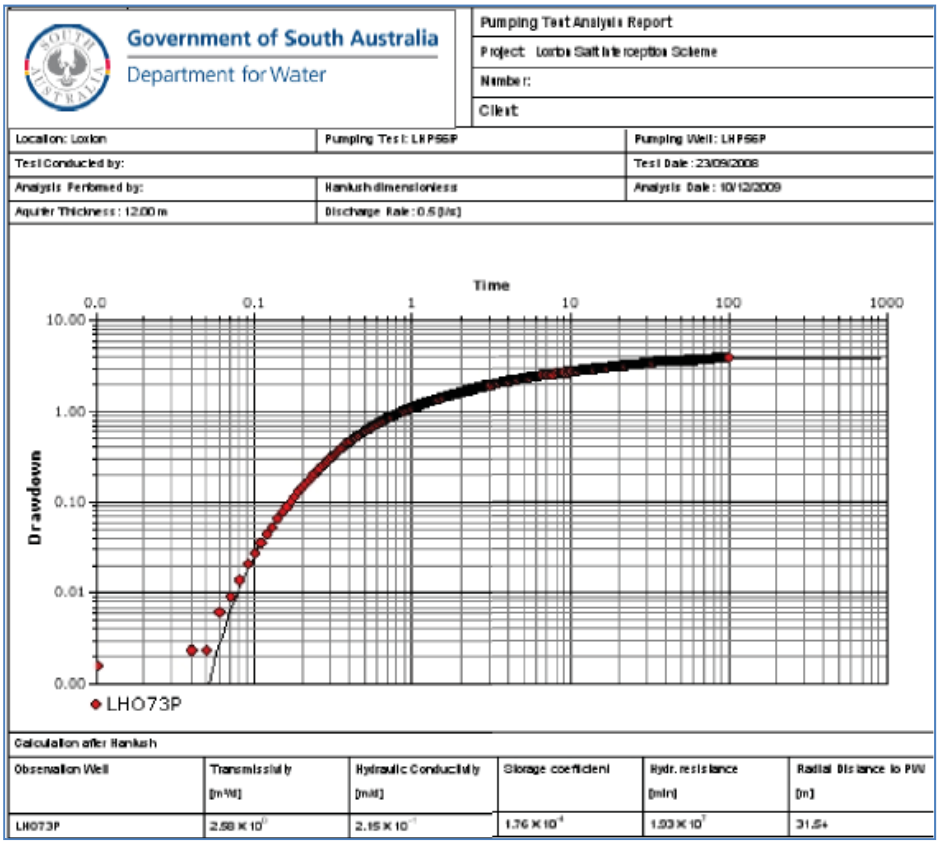


Figure 61. LHP56P Constant rate discharge test analysis (Hantush LHO73)

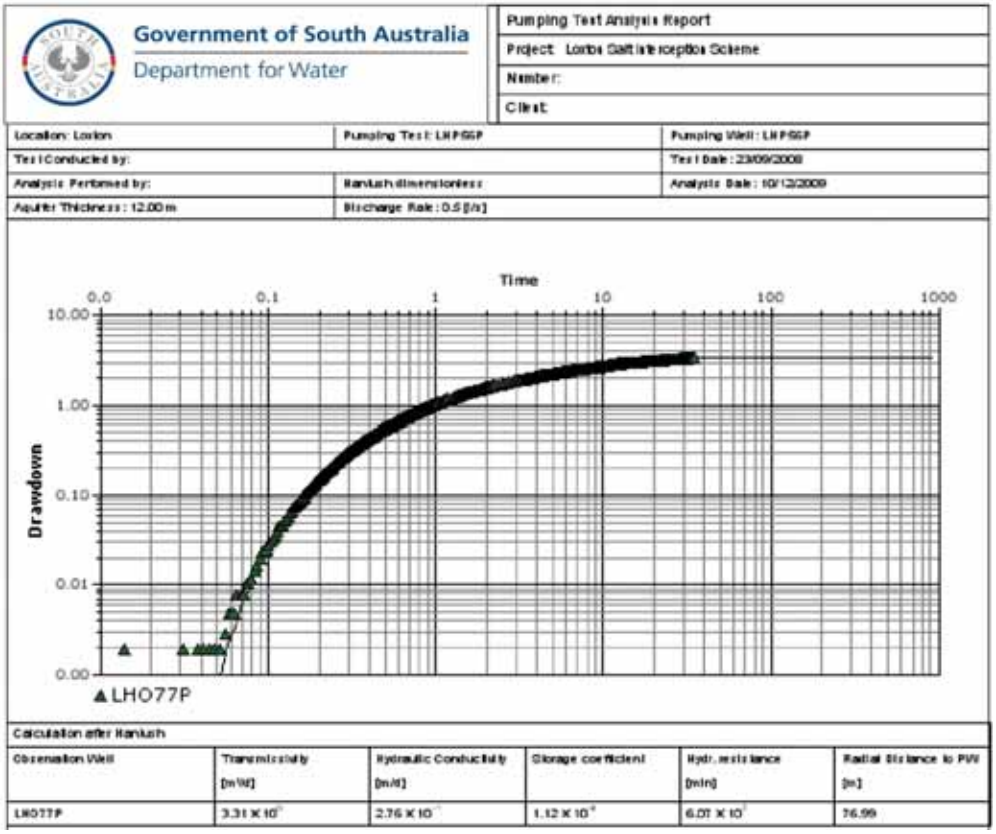


Figure 62. LHP56P Constant rate discharge test analysis (Hantush LHO77)

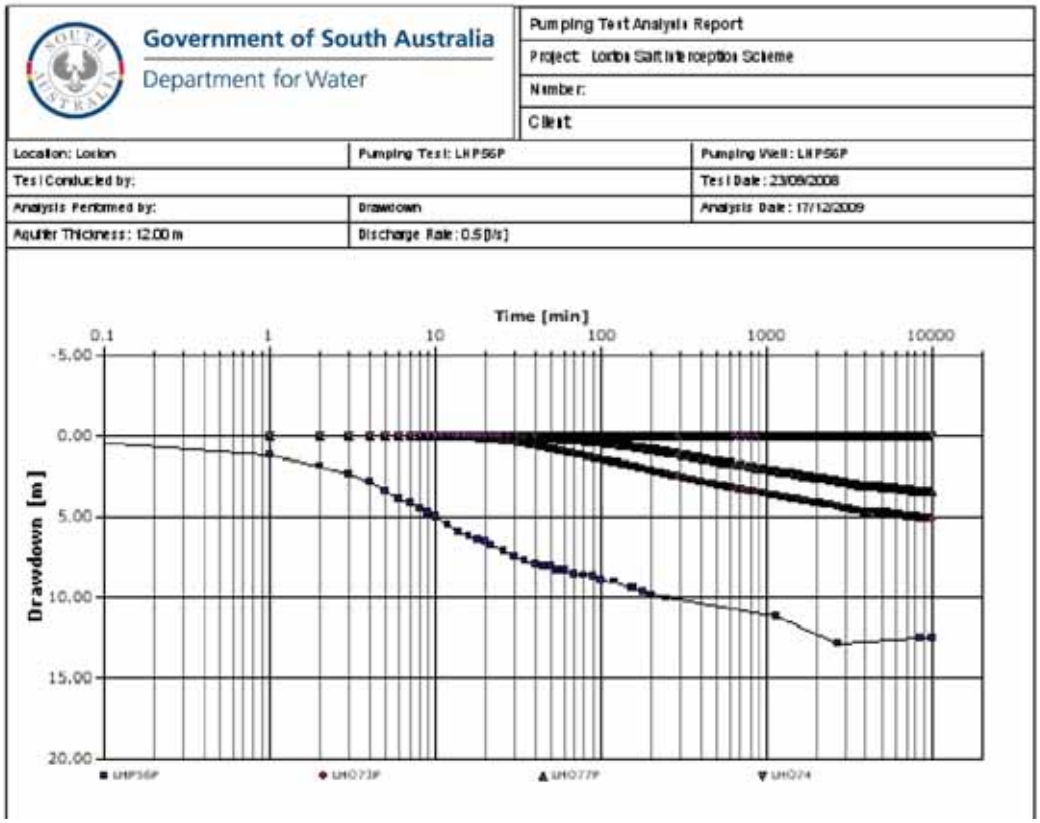


Figure 63. LHP56P Constant rate discharge test drawdown observations

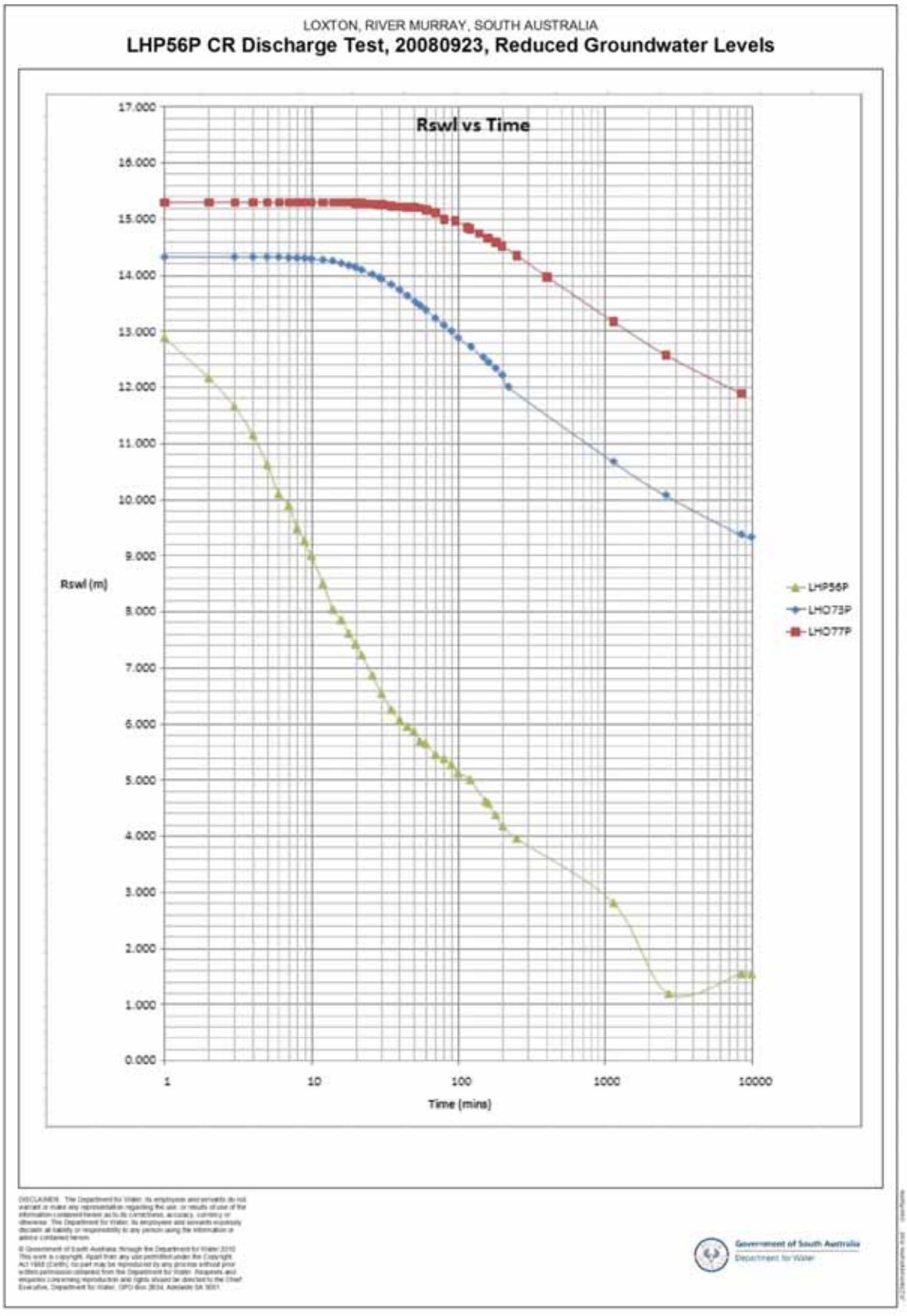


Figure 64. LHP56P Constant rate discharge test groundwater level elevations

4.7. IN-RIVER INVESTIGATIONS

During February 2008 cross-sectional salinity and velocity surveys were undertaken in the Loxton reach between river kms 492 and 495. The objective of the surveys was to use the data to quantify salt loads entering the river. Data was collected at various depths to ensure adequate representation of the variation in river salinity and velocity. While there was confirmation of salt tonnages indicated by the regional groundwater model for the reach between river kms 492 and 493.6 of 13 t/d, it was clear that the technique required refinement and additional runs would be required to assess the impact of the Loxton Pumping Station before accurate calculations could be attempted for the reach between river kms 494 and 495. This work was not progressed here or in the other areas of interest.

5. SITE-2 - TRIAL WELLFIELDS PUMPING TESTS

5.1. PATA FORMATION TRIAL WELLFIELD PUMPING TEST

In order to investigate the ability of the Site-2 Pata Formation trial wellfield (production wells LHP50P, LHP52P, LHP54P, LHP56P, LHP58P and LHP60P) to lower groundwater levels and intercept the groundwater flux and salt load discharging to the river from the overlying Loxton Sands aquifer, a long-term pumping test was conducted.

The objectives of the long-term pumping test conducted on the Pata Formation trial wellfield were:

1. Determine the hydraulic behaviour of the aquifer system to pumping from the wellfield and the effectiveness of the wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands by testing:
    a. The capacity of the wellfield to reduce the potentiometric head of the Pata Formation to river pool level of 9.8 m AHD at the mid-point observation wells.
    b. The capacity of the wellfield to reduce the watertable (by inducing vertical leakage) in the Loxton Sands to river pool level at the mid-point observation wells.
2. Determine the hydraulic connectivity of the Pata Formation and Loxton Sands through the response of the aquifer system (including extent of pumping influence) to pumping from the wellfield.
3. Determine the long-term pumping rate of the wellfield.
4. Determine possible mechanical / bio-geochemical clogging of the production wells.
5. Determine the optimum production well spacing for a more extensive wellfield.

The test commenced on 23 September 2008 and continued for a period of 194,585 minutes (135 days). The test commenced at 0.5 L/s per production well, with a total wellfield extraction of 3 L/s. The configuration of the wellfield is given in Fig. 23, with a cross-section presented in Fig. 65. The results obtained from the testing were used to determine the Pata Formation trial wellfield interception efficiency by site-specific groundwater modelling.

5.1.1. GROUNDWATER LEVEL MONITORING

Groundwater levels were monitored both manually and by pressure transducer during the long-term pumping test in seven Pata Formation observation wells (LHO71P, LHO72P, LHO73P, LHO76P, LHO77P, LHO83P and LHO84P) and in eight Loxton Sands observation wells (LHP51, LHP53, LHP55, LHP57, LHP59, LHO74, LHO75 and LHO82). Well locations are given in Fig. 66.

DFW installed an automated groundwater level logging system to monitor the bulk of the Pata Formation and Loxton Sands observation wells. These observation wells were fitted with Greenspan PS700, 0 to 20 m pressure transducers wired to a common data-logging unit programmed to record 1 minute readings for the first 6 hours, 10 minute readings for a further 6 hours and 30 minute readings thereafter. The remaining outlying observation wells (LHO82, LHO83P and LHO84P) were fitted with independent pressure transducers. Manual observations of groundwater levels were made to verify the accuracy of the pressure transducer data and to backup to the automated system.

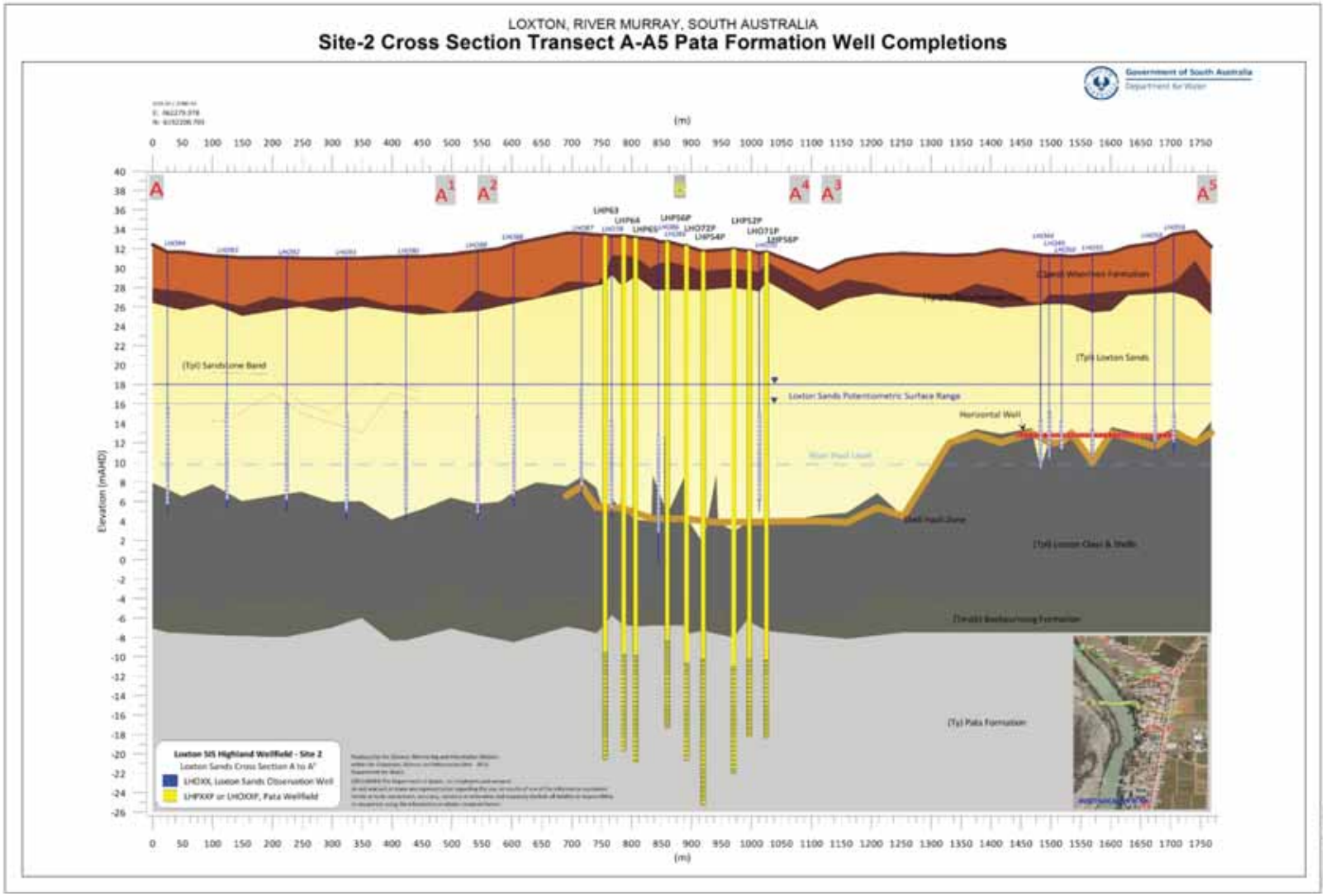


Figure 65. Site-2 Cross section of Pata Formation trial wellfield

Figure 66. Site-2 Pata Formation trial wellfield observation well location plan

5.1.2. PUMPS, METERS AND DISPOSAL

SA Water installed downhole submersible pumps in the six Pata Formation production wells within the production zone. The pump installation included variable speed drives to assist in flow control as well as magnetic Flow (Magflow) meters to measure individual production well pumping rates. The pumping rates were monitored and adjusted manually. Sampling taps were installed on the surface pipe-work to allow collection of groundwater samples. Groundwater pumped during the test was directed into the Central Irrigation Trust pipeline with discharge to the Katarapko Island Disposal Basin.

5.1.3. CONDUCT OF TEST

The following points are important in regard to the conduct of the long-term pumping test:

1. All pumps were set at an initial pumping rate of 0.50 L/s resulting in total wellfield extraction of 3 L/s and adjusted manually as necessary during the test. The pumping rates for production wells LHP54P and LHP56P were subsequently reduced to between 0.35 and 0.4 L/s
2. Pumping rates were adjusted to maintain groundwater levels within the production well casing providing a maximum drawdown of 25 m. The data indicates there were periods where the groundwater level was drawn into the production zone.
3. Several pump stoppages occurred as a result of power failures which can be seen as recovery events in groundwater level data recorded in Pata Formation observation wells. These stoppages went unnoticed as there was no pump failure alarm system and because weekly site visits occurred. The pre-existing drawdown regime was quickly re-established upon re-commencement of pumping.
4. Logger failure occurred between 74,000 and 83,400 minutes.
5. The pump in production well LHP54P failed after 73,000 minutes and was not replaced.
6. The pump in production well LHP58P failed after 132,000 minutes and was not replaced.
7. The pressure transducer data for observation well LHO75 was rejected as it did not match manual observations.
8. Following a review of the results, a decision was made to terminate the test as drawdown was not developing at a sufficient rate in the Loxton Sands.

5.1.4. HYDRAULIC RESPONSE TO PUMPING STRESS

The long-term pumping test conducted on the Pata Formation trial wellfield indicated the hydraulic behaviour of the wellfield and hydraulic response of the aquifer system to pumping stress. The pressure transducer drawdown recorded during the long-term pumping test is presented in Fig. 67 and the groundwater level elevations are presented in Fig. 68.

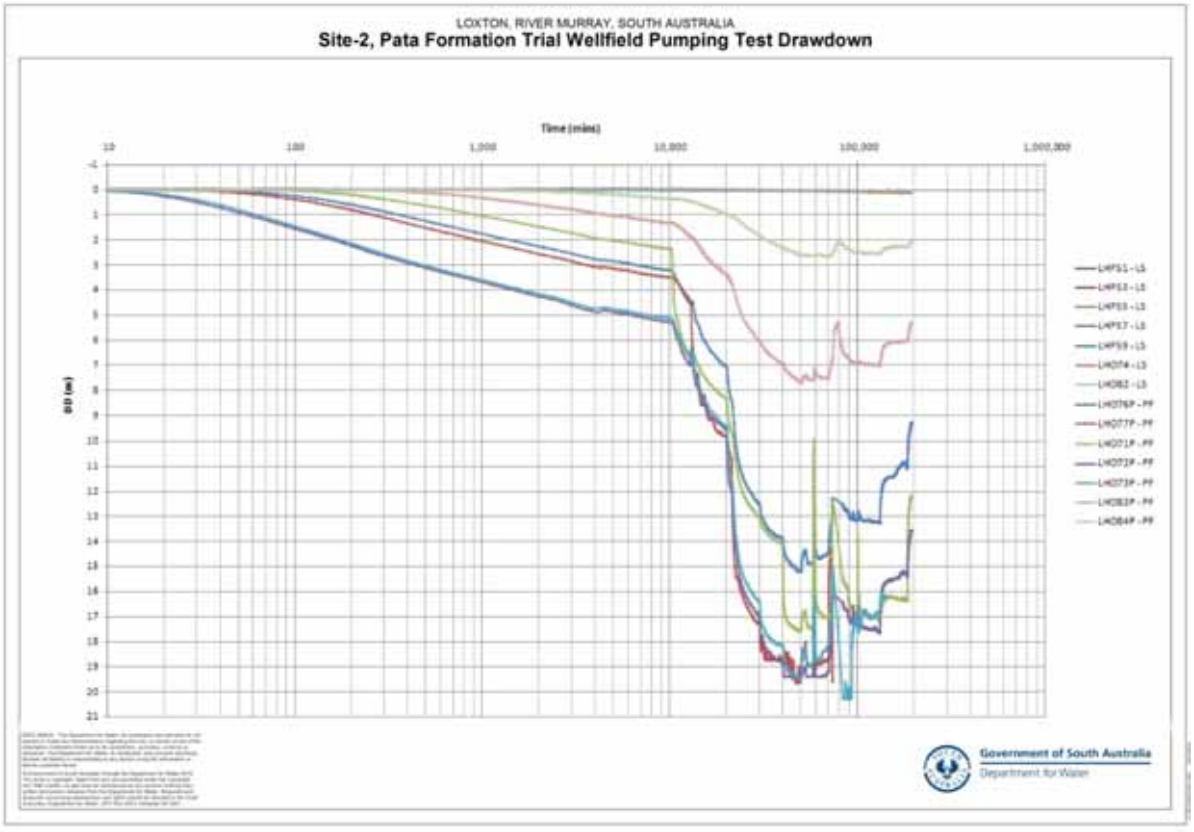


Figure 67. Site-2 Pata Formation trial wellfield pumping test drawdown levels

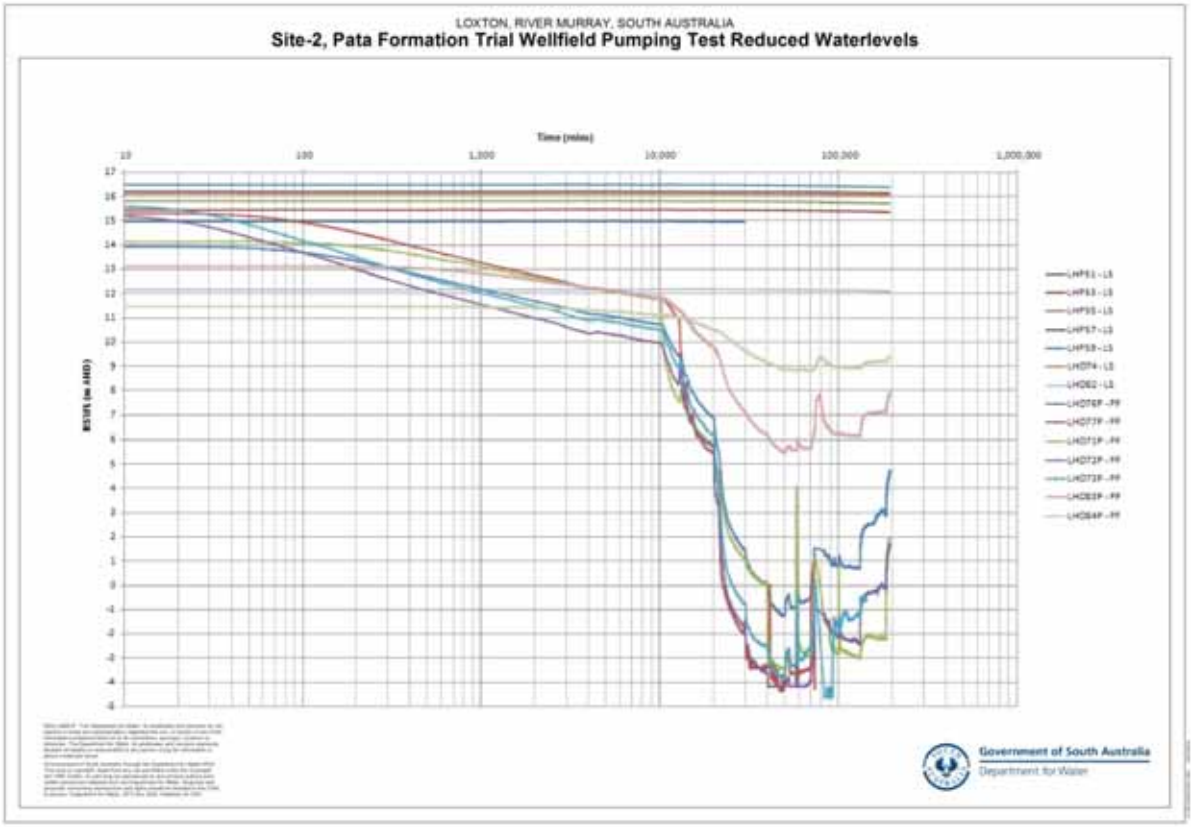


Figure 68. Site-2 Pata Formation trial wellfield pumping test groundwater level elevations

The following general comments can be made regarding the test results at 194,585 minutes (135 days):

1. Drawdown of up to 19.5 m rapidly developed in the Pata Formation mid-point observation wells along the entire wellfield by 30,000 minutes.
2. A long-term drawdown of 7.5 m developed at observation well LHO83P at a distance of 200 m from the wellfield transect.
3. A long-term drawdown of 2.5 m developed in observation well LHO84P positioned at a distance of 450 m from the wellfield transect.
4. A long-term drawdown of 0.14 m developed in the Loxton Sands mid-point observation wells.

5.1.5. CONCLUSIONS

The following general comments can be made regarding the test results:

1. Drawdown of up to 19.5 m rapidly developed in the Pata Formation mid-point observation wells along the entire wellfield corresponding to a groundwater level elevation of 4 m AHD, well below the river pool level of 9.8 m AHD. However, this drawdown was not translated into the Loxton Sands.
2. The 50 m spacing for the Pata Formation production wells was highly conservative. The three wells LHP50P, LHP56P and LHP60P, spaced at 100 m, exerted sufficient control to develop mid-point drawdown to river pool level.
3. Long-term production well pumping rates (>50,000 minutes) ranged between 0.3 and 0.5 L/s.
4. No mechanical / bio-geochemical clogging problems presented in production wells during the test.
5. A long-term drawdown of only 0.14 m (140 mm) developed in the overlying Loxton Sands mid-point observation wells separated from the production aquifer by 5 m of low permeability silts and clay. Up to 20 mm of this was attributed to the regional decline in groundwater levels observed prior to the commencement of the test which was believed to be due to the on-going drought and reduced irrigation.
6. In order for the wellfield to effectively intercept the groundwater flux discharging to the river from the Loxton Sands, a drawdown of 6 m was required to develop at the mid-point Loxton Sands observation wells. The test results indicated that there was minimal leakage through the aquitard in response to pumping from the Pata Formation.
7. It was evident that pumping from the Pata Formation was not a valid method for dewatering the overlying Loxton Sands. This was confirmed by the site-specific groundwater modelling.

5.2. LOXTON SANDS TRIAL WELLFIELD PUMPING TEST

In order to investigate the ability of the Site-2 Loxton Sands trial wellfield (production wells LHP51, LHP53, LHP55, LHP57 and LHP59) to lower groundwater levels and intercept the groundwater flux and salt load discharging to the river from the Loxton Sands aquifer, a long-term pumping test was conducted.

The objectives of the long-term pumping test conducted on the Loxton Sands trial wellfield were to:

1. Determine the hydraulic behaviour of the aquifer system to pumping from the wellfield and the effectiveness of the wellfield at intercepting the groundwater flux discharging to the river from the Loxton Sands by testing the capacity of the wellfield to reduce the watertable in the Loxton Sands to the river pool level of 9.8 m AHD at the mid-point observation wells.

2. Determine the long-term pumping rate of the wellfield.
3. Determine the optimum production well spacing for a more extensive wellfield.

The test commenced on 25 February 2009 and continued for a period of 580,000 minutes (403 days). The test commenced at 1 L/s per production well with a total wellfield extraction of 5.0 L/s. The configuration of the wellfield is given in Fig. 24, with a cross-section presented in Fig. 69 which includes the hydrostratigraphy and elevations of the major hydrogeological units along cross-section transect A-A5. The results obtained from the testing were used to determine the Loxton Sands trial wellfield interception efficiency by site-specific groundwater modelling.

5.2.1. GROUNDWATER LEVEL MONITORING

Groundwater levels were monitored both manually and by pressure transducer during the long-term pumping test in seven Loxton Sands observation wells (LHO70, LHO74, LHO75, LHO78, LHO82, LHO85 and LHO86), locations given in Fig. 24 (drawdown was also monitored in production wells LHP53 and LHP55). All observation wells were fitted with downhole pressure transducers as for the Pata Formation trial wellfield. Manual observations of groundwater levels were made to verify the accuracy of the pressure transducer data and to backup the automated system.

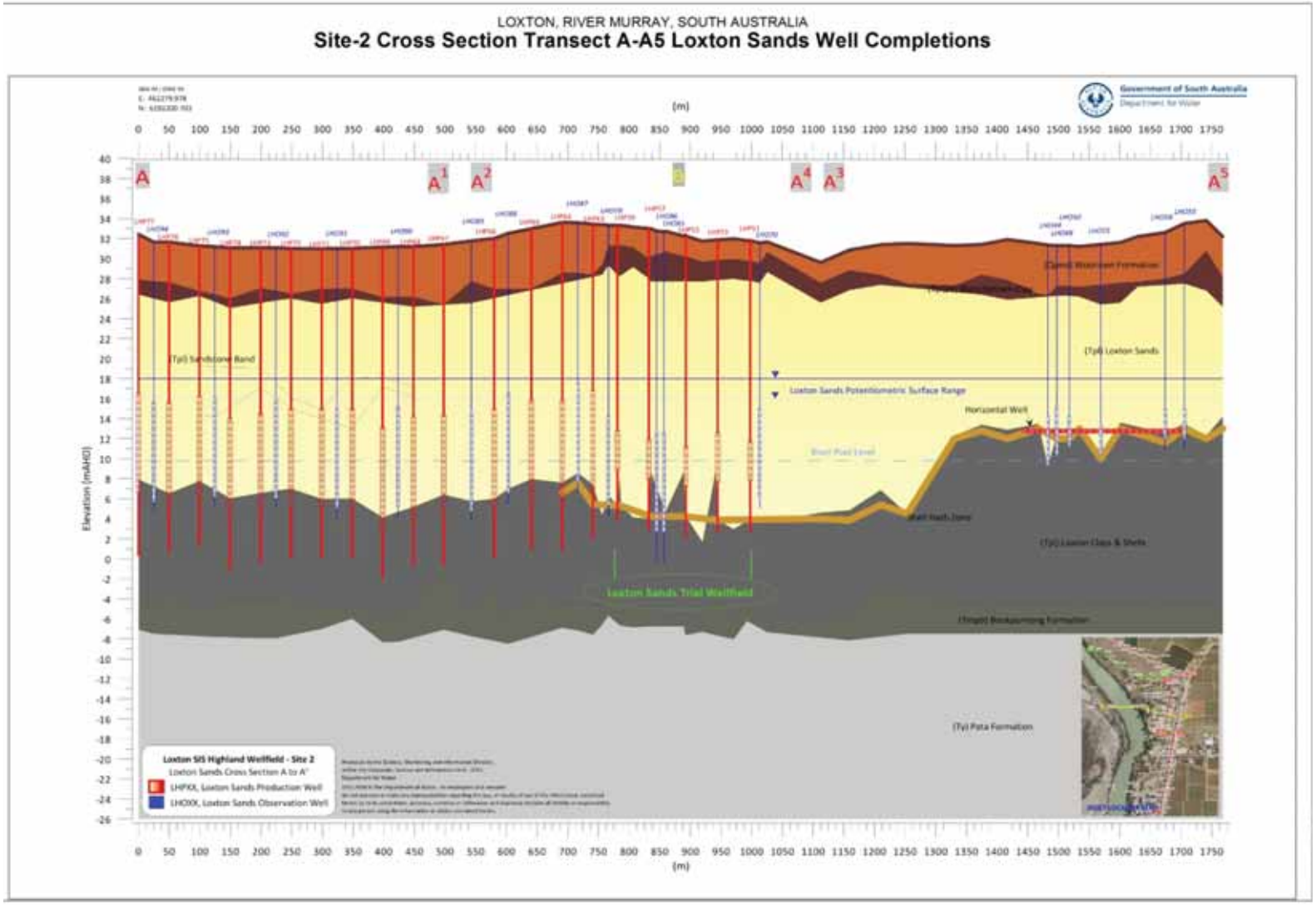


Figure 69. Site-2 Cross section of Loxton Sands trial wellfield

5.2.2. PUMPS, METERS AND DISPOSAL

SA Water installed downhole submersible pumps in the five Loxton Sands production wells within the production zone. The pump installation included variable speed drives to assist in flow control as well as magnetic flow meters to measure individual production well pumping rates. The pumping rates were monitored and adjusted manually. Sampling taps were installed on the surface pipe-work to allow collection of groundwater samples. Groundwater pumped during the test was directed into the Central Irrigation Trust main with discharge to the Katarapko Island Disposal Basin.

5.2.3. CONDUCT OF TEST

The following points are important in regard to the conduct of the long-term pumping test:

1. All pumps were set at an initial pumping rate of 1.0 L/s resulting in a total wellfield extraction of 5 L/s.
2. Pumping rates were adjusted to obtain the maximum drawdown. At 43,000 minutes, several pumps were replaced with higher capacity units. Production well LHP53 was pumped at up to 2.1 L/s and LHP57 was pumped at up to 2.3 L/s.
3. Several pump stoppages occurred as a result of power failures which can be seen as recovery events in the groundwater level data recorded in production wells LHP53 and LHP55. These stoppages went unnoticed as there was no pump failure alarm system and because weekly site visits occurred. Upon re-commencement of pumping, the pre-existing drawdown regime was quickly re-established.
4. The test was terminated earlier than expected due to electrical failure caused by peripheral infrastructure.

5.2.4. HYDRAULIC RESPONSE TO PUMPING STRESS

The long-term pumping test conducted on the Loxton Sands trial wellfield indicated the hydraulic behaviour of the wellfield and hydraulic response of the aquifer system to pumping stress. The pressure transducer drawdown recorded during the long-term pumping test is presented in Fig. 70 and the groundwater level elevations are presented in Fig. 71.

The following general comments can be made regarding the test results at 580,000 minutes (403 days):

1. Drawdown developed very slowly in the Loxton Sands mid-point observation wells with only 0.5 m recorded at the key mid-wellfield observation well LHO85 after 10,000 minutes.
    a. Between 10,000 and 100,000 minutes, drawdown continued to develop, with 2.2 m recorded after 260,000 minutes.
    b. A drawdown of 3.05 m developed after 580,000 minutes.
2. A long-term drawdown of 1.8 m developed at observation well LHO78 at the northern end of the wellfield and a long-term drawdown of 2.2 m developed at LHO70 at the southern end of the wellfield.
3. A long-term drawdown of 2.2 m developed at observation well LHO75 at a distance of 75 m from the wellfield, on the observation well transect towards the river.
4. A long-term drawdown of 0.55 m developed in observation well LHO82 positioned at a distance of 200 m from the wellfield, on the observation well transect towards the river and 30 m from the river.

5. The watertable in Loxton Sands production wells LHP53 and LHP55 was drawn down to an elevation of 8.5 and 8.0 m AHD respectively (i.e. below river pool level of 9.8 m AHD).
6. Drawdown may have developed further if pump stoppages had not occurred.

5.2.5. CONCLUSIONS

The following general comments can be made regarding the tests results:

1. Drawdown of up to 3 m slowly developed in the Loxton Sands mid-point observation wells along the wellfield (elevation of 12 m AHD) after 580,000 minutes, still 2.4 m above river pool level of 9.8 m AHD.
2. The 50 m spacing for the Loxton Sands production wells would result in a significant period of time before drawdown at the mid-point observation wells would reach the river pool level.
3. Long-term (>50,000 minutes) production well pumping rates ranged between 1 and 3 L/s.
4. No mechanical / bio-geochemical clogging problems occurred in production wells during the test.
5. Site-specific groundwater modelling of the test indicated that a wellfield with production wells at 50 m spacing was capable of an interception efficiency of up to 65%. A Loxton Sands wellfield was considered to be a realistic option for the partial interception of the groundwater flux discharging to the river from the Loxton Sands. Closing up the well spacing in the model to 35 m resulted in a 5% increase in interception efficiency.

Despite the hydrogeological difficulties associated with the site, the response of the aquifer system to the long-term pumping test was considered satisfactory and the trial wellfield was incorporated into the operational highland wellfield.

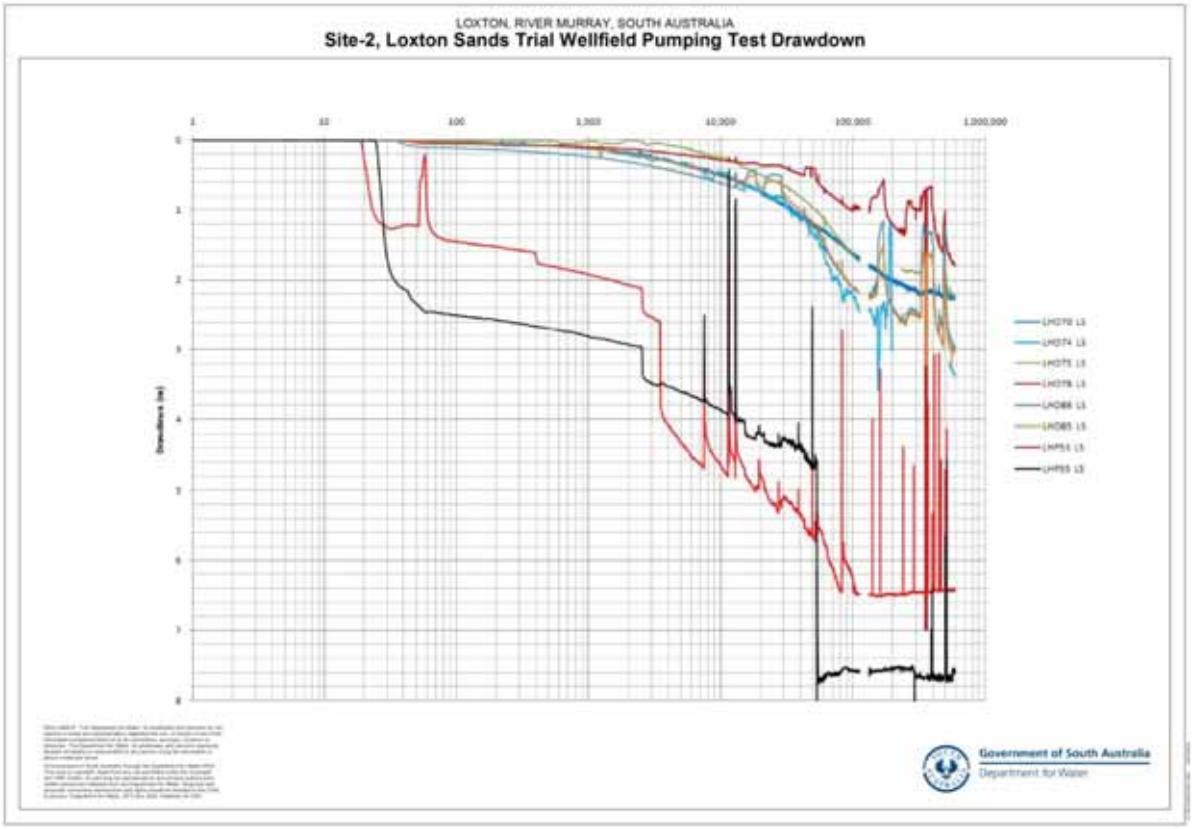


Figure 70. Site-2 Loxton Sands trial wellfield pumping test drawdown levels

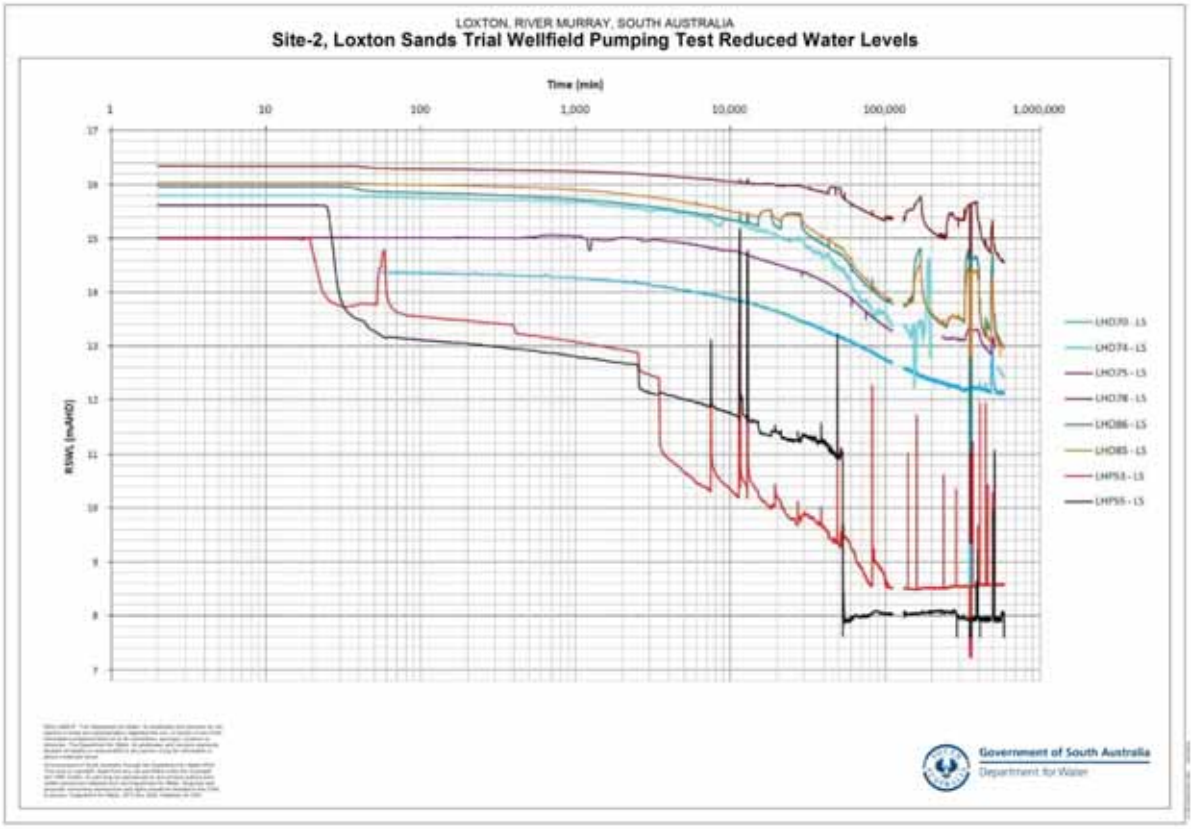


Figure 71. **Site-2 Loxton Sands trial wellfield pumping test groundwater level elevations**

6. SITE-2 TRIAL WELLFIELD INTERCEPTION EFFICIENCY MODELLING

Numerical groundwater flow models enable complex three-dimensional simulations of an aquifer system and its response to imposed stresses. Groundwater modelling was considered an appropriate method to determine the interception efficiency, of both the Pata Formation trial wellfield and the Loxton Sands trial wellfield in the Site-2 investigation area, in relation to the groundwater flux discharging to the river from the Loxton Sands aquifer. The development of the site-specific groundwater model was undertaken by Lisdon Associates (Armstrong 2009) in the first half of 2009. Subsequently, the Loxton-Bookpurnong regional groundwater model 2005 was used to determine salt load benefits of the SIS infrastructure. The following sections summarise the results of the modelling work. The reader is referred to Armstrong 2009 for more detail.

The following points should be noted in relation to this modelling exercise:

1. The MODFLOW model utilised groundwater zone budgets to determine groundwater fluxes.
2. Groundwater modelling at a simplified local scale had limited value in providing accurate steady state or transient estimates of groundwater flux discharging to the river.
3. Wellfield interception efficiency was expressed as percentage interception, rather than a volume of groundwater or tonnage of salt.

The objectives of the modelling included:

1. Develop a simple site specific groundwater model taking into consideration the aquifer geometry obtained from the drilling program and aquifer parameters obtained from pumping tests conducted on the Pata Formation trial wellfield and Loxton Sands trial wellfield.
2. Calibrate the model to:
    a. The observed hydraulic gradients and flow direction.
    b. The Pata Formation wellfield long-term pumping test.
    c. The Loxton Sands wellfield long-term pumping test.
3. Predict the performance of the Pata Formation trial wellfield, including:
    a. The long-term drawdown in the Pata Formation and Loxton Sands.
    b. The capacity for the wellfield to reduce groundwater levels in the Loxton Sands to river pool level of 9.8 m AHD.
    c. Wellfield interception efficiency in relation to the groundwater flux discharging to the river from the Loxton Sands.
4. Predict the performance of the Loxton Sands trial wellfield, including:
    a. The long-term drawdown in the Loxton Sands.
    b. The capacity for the wellfield to reduce groundwater levels in the Loxton Sands to river pool level of 9.8 m AHD.
    c. Wellfield interception efficiency in relation to the groundwater flux discharging to the river from the Loxton Sands.

6.1. MODEL CONSTRUCTION

The geological section (Fig. 30) indicates the relative position of the target aquifers.

The model was constructed incorporating:

1. East-west extent 5,578 m and north-south extent 4,590 m (Fig. 72).
2. Grid 467 rows x 496 columns.
3. Cell size ranging from 5 x 5 m to 10 x 100 m (east end) with the majority of cells 10 x 10 m.
4. Four layers for the Loxton Sands, Loxton Shells and Clay, Bookpurnong Formation and Pata Formation.
5. Recharge on irrigation areas set at 100 mm/y.
6. Initial model potentiometric heads given in Fig. 72 applied to all layers are.

The hydraulic parameters applied in the model are given in Table 2. The hydraulic conductivity of the Loxton Sands are within the range obtained from the pumping tests of between 22 and 100 m/d.

Table 2. Model Hydraulic Parameters

Layer No	Hydrogeological Unit	Kh (m/d)	Kv (m/d)	Sy / Ss
1	Loxton Sands	6 - 35 (6 near river)	2.7	0.125 (generally)
2	Loxton Shells and Clay	0.001	0.0001	0.1 / 0.00001
3	Bookpurnong Formation	0.00001	0.0001	0.1 / 0.00001
4	Pata Formation	0.25	0.001	0.15 / 0.000008

6.2. PATA FORMATION TRIAL WELLFIELD SIMULATION

The site-specific groundwater model was run to determine the aquifer hydraulic response to pumping from the confined Pata Formation trial wellfield (production wells LHP50P, LHP52P, LHP54P, LHP56P, LHP58P and LHP60P) to compare the results with those obtained from the long-term pumping test. Individual well pumping rates were set at 0.5 L/s.

The modelled drawdown in the Loxton Sands observation wells (LHP51, LHP53, LHP55, LHP57 and LHP59) after four months of pumping was less that 0.1 m. This result implied that there would be negligible interception of the groundwater flux discharging to the river from the Loxton Sands.

6.3. PATA FORMATION TRIAL WELLFIELD FORWARD PREDICTION

The Pata Formation trial wellfield was simulated with all production wells pumping at 0.5 L/s and both 100 mm/y recharge and zero recharge until a quasi steady state was achieved.

With 100 mm/y recharge (equivalent to ‘normal’ irrigation), the modelled drawdown in the Loxton Sands observation wells stabilised after one year at 0.0225 m (22.5 mm) (Fig. 73). When zero recharge was applied, modelled drawdown in the Loxton Sands observation wells increased to 0.6 m, stabilising after four years (Fig. 74).

Figure 72. Model extent and initial model heads

The following general comments summarise the model results:

1. The drawdown developed in the Loxton Sands in response to pumping from the Pata Formation trial wellfield was very small (even with the inclusion of the regional declining trend in Loxton Sands groundwater levels).
2. Model predictions for the zero recharge case produced a quasi steady state drawdown of 0.6 m in the Loxton Sands. This was considered insignificant in comparison to the five or more metres required to reduce groundwater levels to river pool level and effectively intercept the majority of groundwater flux discharging to the river.

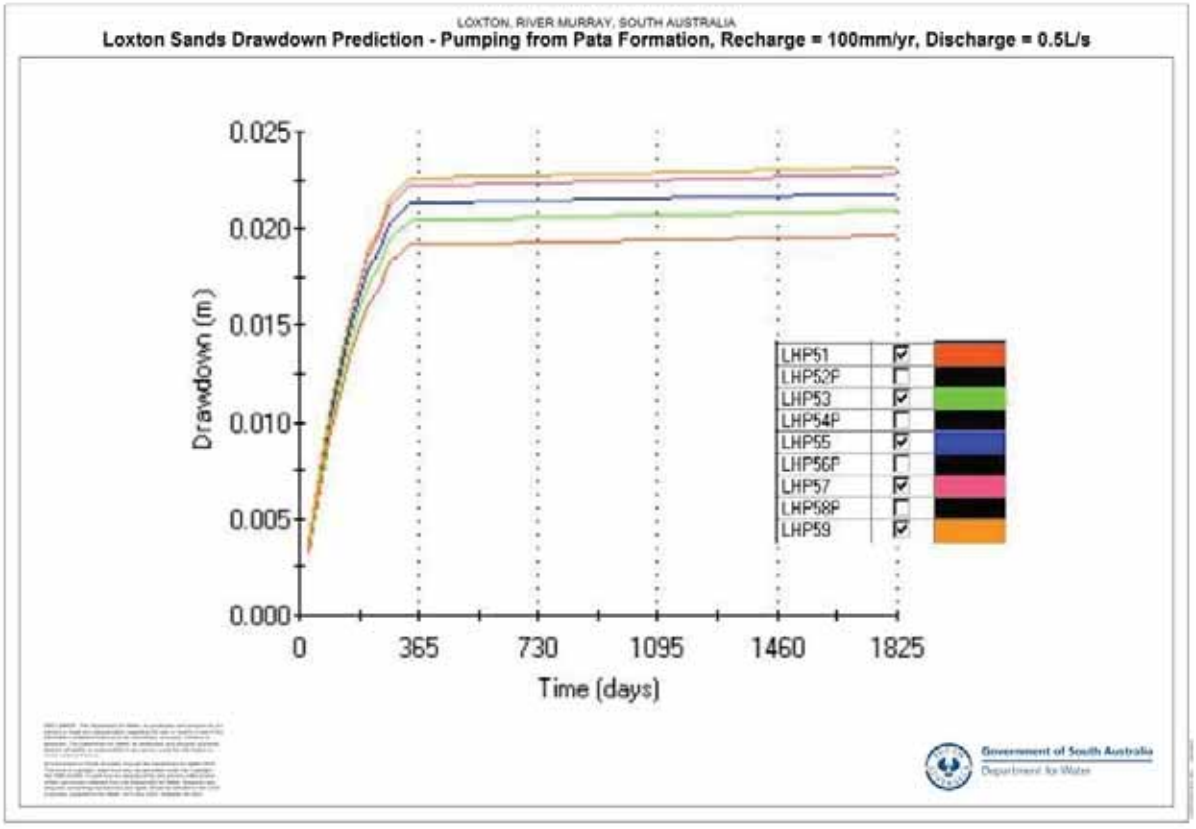


Figure 73. Modelled Loxton Sand drawdown with irrigation recharge

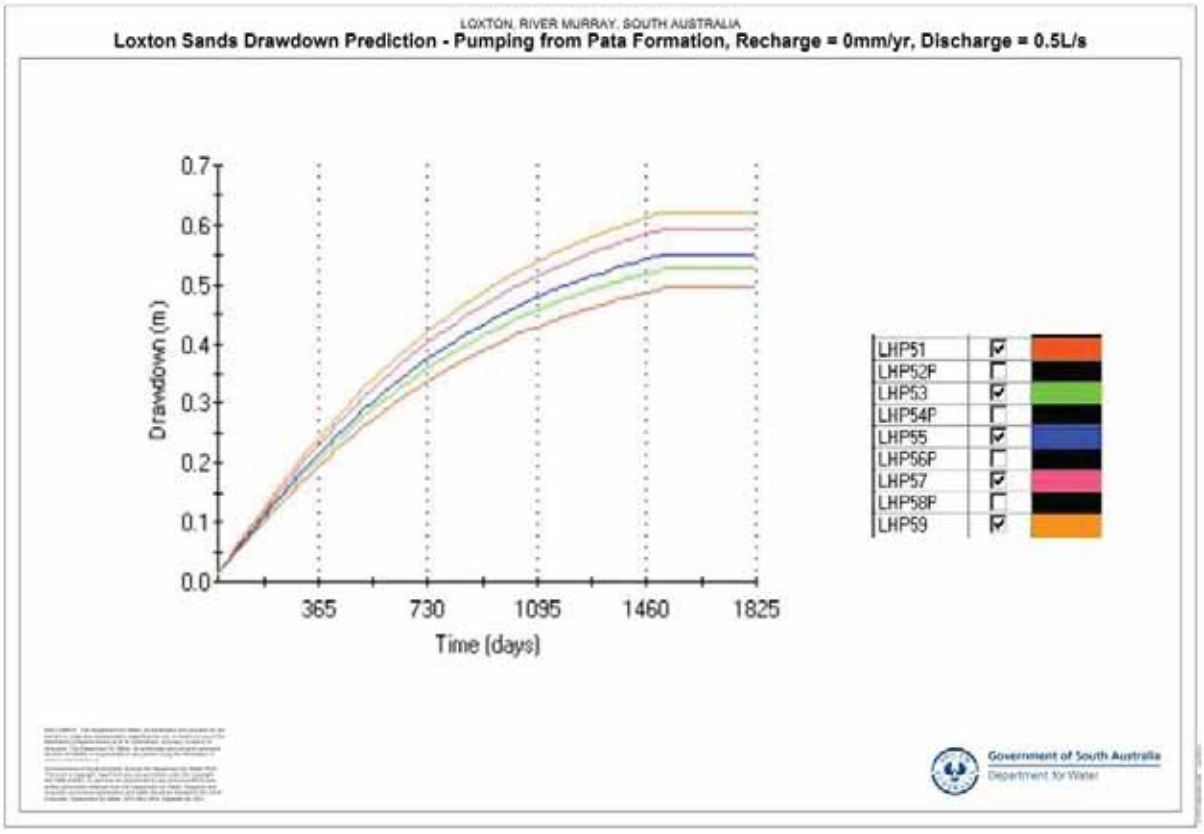


Figure 74. Modelled Loxton Sand drawdown with no recharge

6.4. LOXTON SANDS TRIAL WELLFIELD SIMULATION

The site-specific groundwater model was run to determine the aquifer hydraulic response to pumping from the unconfined Loxton Sands trial wellfield (production wells utilised were LHP51, LHP53, LHP55, LHP57 and LHP509) to compare the results with those obtained from the long-term pumping test. Individual well pumping rates varied between 1 and 2.5 L/s.

Calibration against the drawdown recorded during the long-term pumping test required considerable trial and error adjustment of aquifer parameters in the Loxton Sands. Model runs were made with recharge values ranging from zero to 100 mm/y, but the results reported are for 50 mm/y. This value was selected because it was believed to be more representative of future conditions in which irrigation may be limited by water availability. The resulting calibration was excellent, as indicated by the close agreement between modelled and recorded drawdown in the Loxton Sands observation wells (e.g. observation well LHO85 given in Fig. 75). The scatter diagram given in Fig. 76 indicates a very high degree of correlation between modelled and recorded drawdown. The line sloping at 45 degrees represents a perfect fit and the variance of 2.969E-3 m is considered to be highly satisfactory.

6.5. LOXTON SANDS TRIAL WELLFIELD FORWARD PREDICTION

The Loxton Sands trial wellfield was simulated for a 10 years of wellfield operation with a total wellfield extraction of 10.12 L/s (874.4 m^3/d) and recharge set at 50 mm/y. The individual pumping rates were slightly higher than those reported, but were necessary to obtain the drawdown recorded in the Loxton Sands observation wells. The modelled drawdown distribution in the Loxton Sands after 10 years of pumping is given in Fig. 77. The predicted drawdown at observation well LHO85 is given in Fig. 78. The drawdown stabilised at 3.9 m after four years pumping due to the quasi steady state supported by the 50 mm/y recharge.

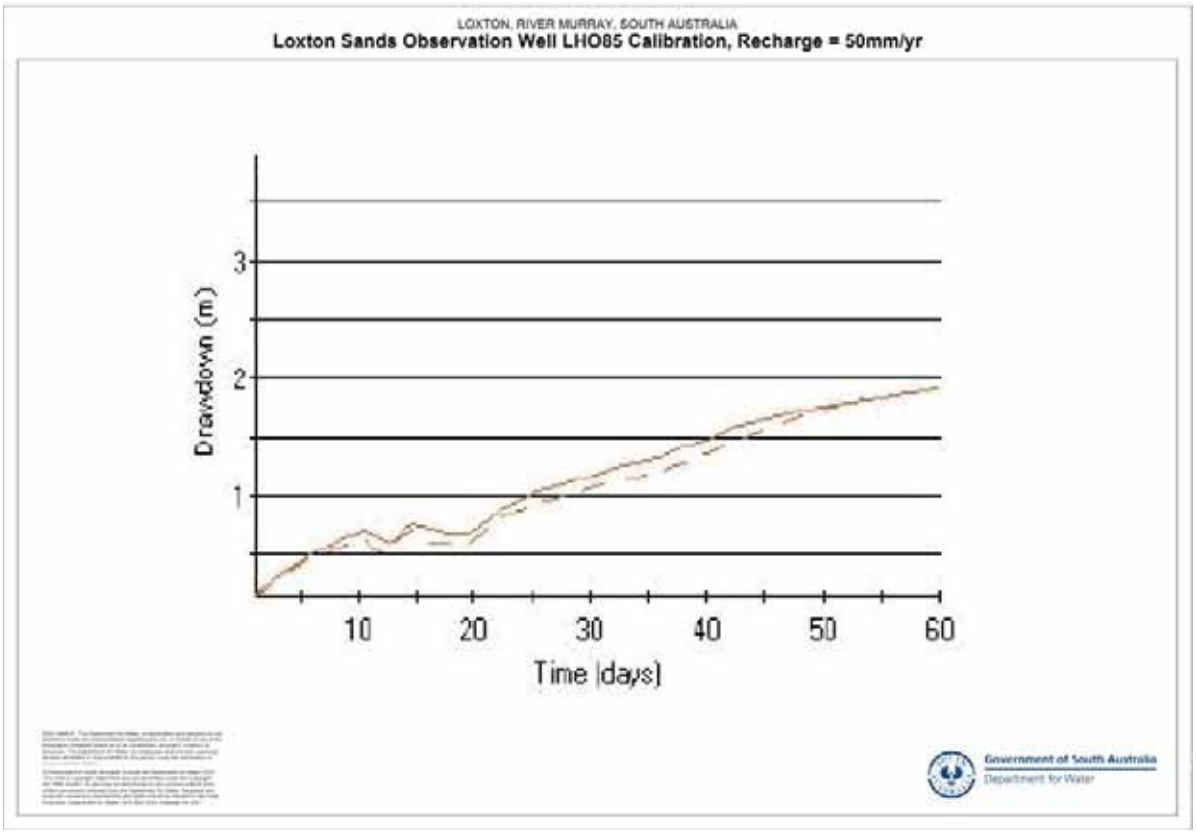


Figure 75. Modelled and recorded in the Loxton Sands observation well LHO85

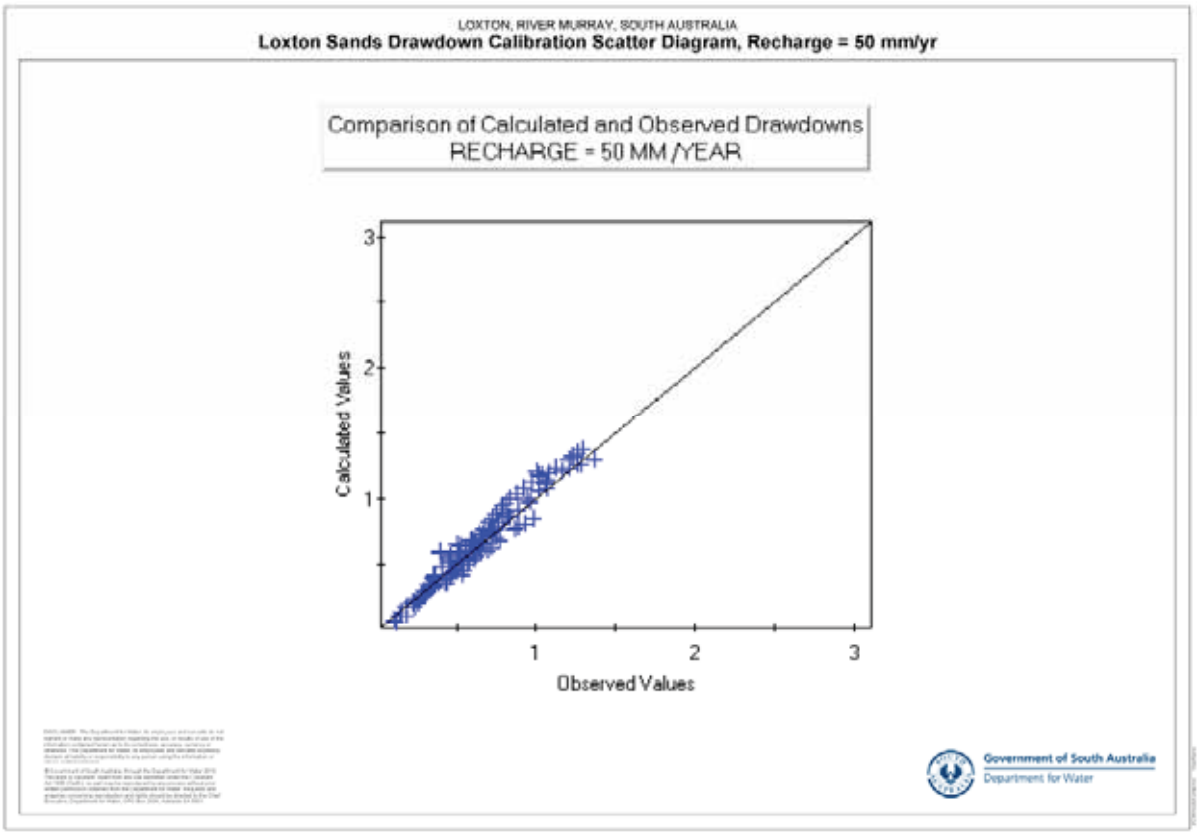


Figure 76. Correlation between modelled and recorded drawdown

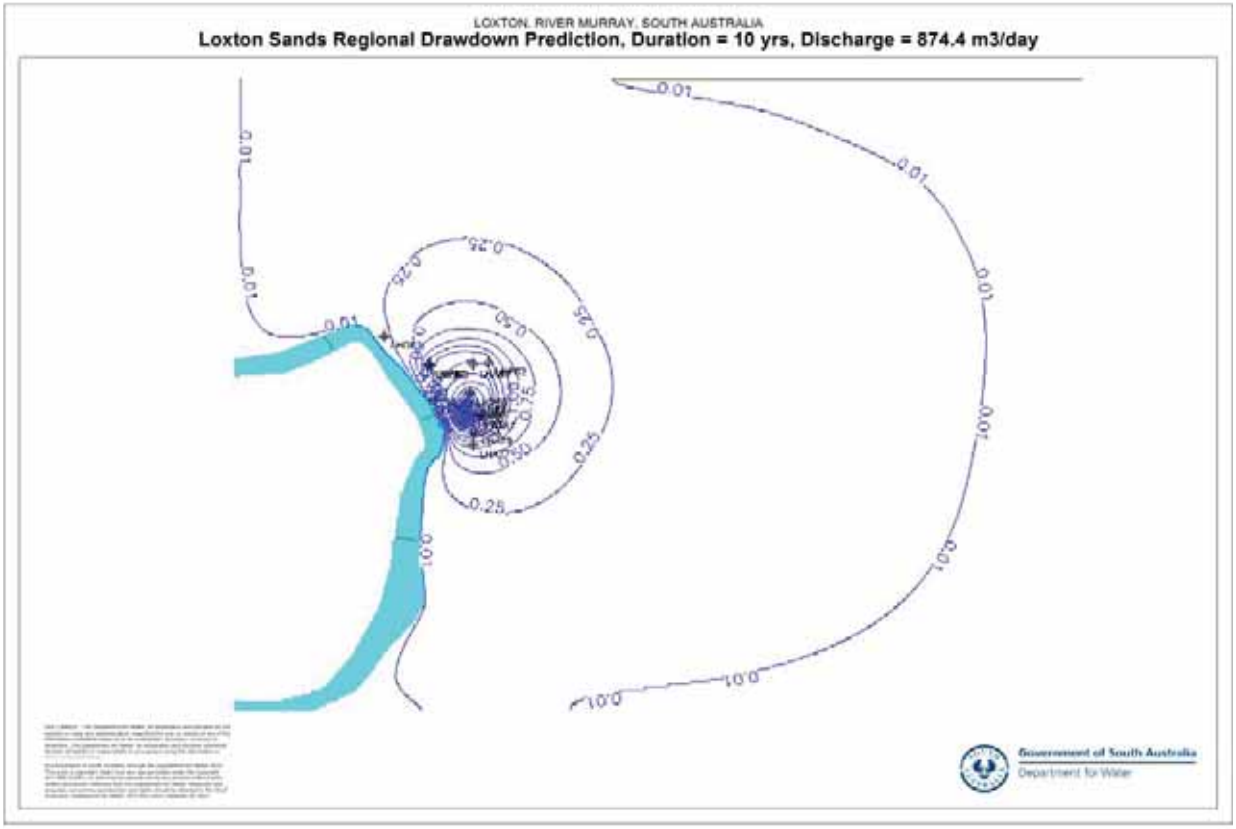


Figure 77. Loxton Sands regional drawdown prediction after 10 years

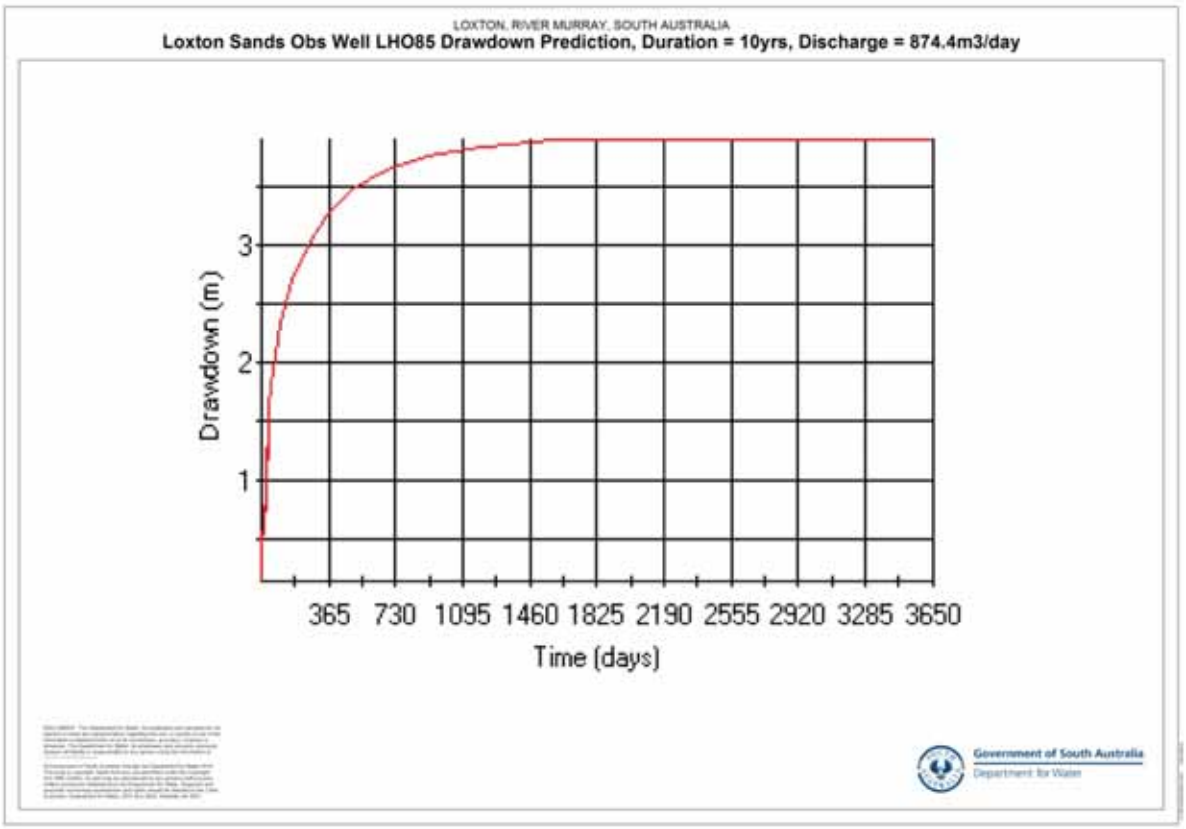


Figure 78. Loxton Sands drawdown prediction in observation well LHO85 after 10 years

6.6. LOXTON SANDS TRIAL WELLFIELD INTERCEPTION EFFICIENCY

In order to quantify the Loxton Sands trial wellfield interception efficiency, a model water budget zone 300 m wide (slightly wider than the trial wellfield with a length of 250 m) and extending parallel to flow from the river to the eastern model boundary was set in the model (Fig. 79).

The model water balance and in particular the groundwater flux discharging to the river from the Loxton Sands was then determined by running the model in steady state mode with different recharge conditions (including 100 mm/y, 50 mm/y and zero recharge); and in transient mode for ten years with the Loxton Sands trial wellfield extracting a total of 10.12 L/s (874.4 m^3/d) combined with the varying recharge conditions.

Model scenarios and results are given in Table 3. The results indicated that under the scenario of 50 mm/y recharge, a wellfield interception efficiency of 65% was achieved. The magnitude of values obtained for groundwater flux from the site-specific model compared favourably with those obtained from the original regional groundwater modelling considering the different model construction.

The model was then run with theoretical production wells set at 35 m spacing to determine the increase in the interception efficiency. The results indicated a small increase in efficiency of only 5%, suggesting that the increased costs associated with the additional SIS infrastructure may not be warranted.

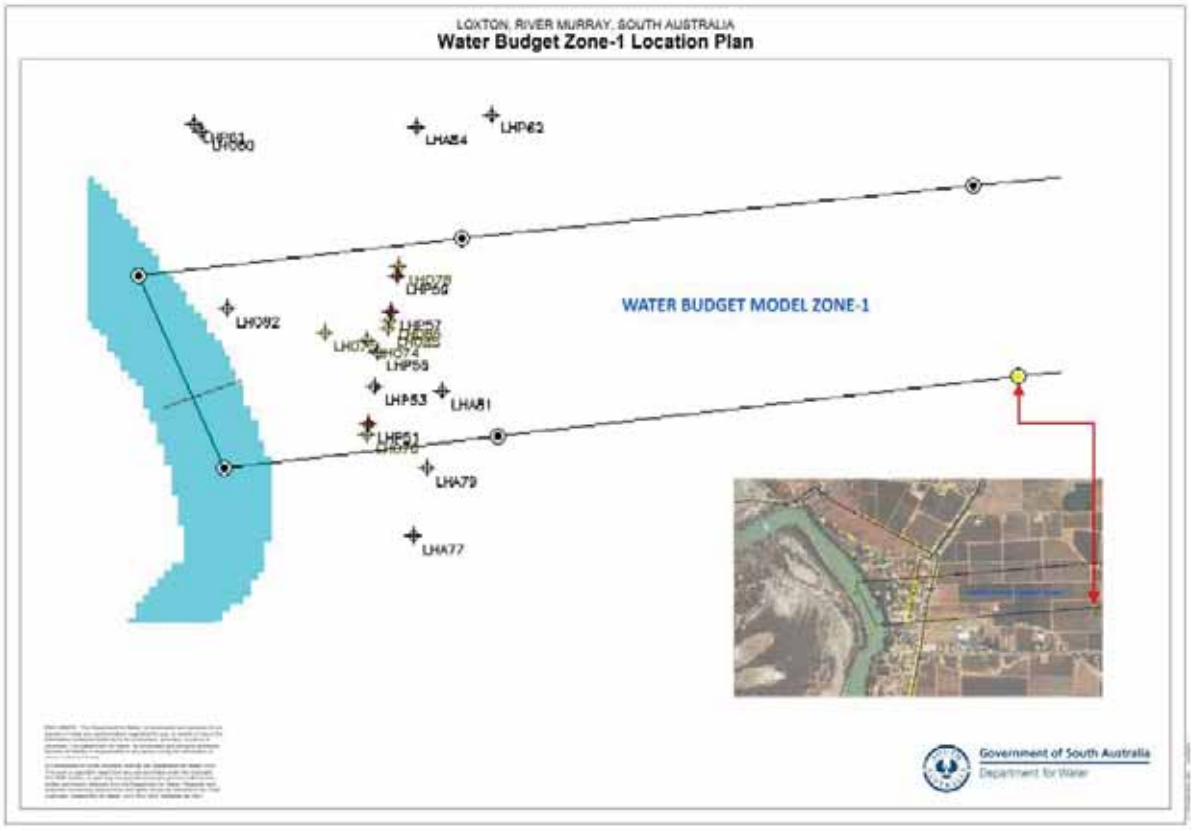


Figure 79. Model water budget zone location diagram

Table 3. Loxton Sands Trial Wellfield Interception Efficiency Scenarios and Results

Scenario	Conditions	Groundwater flux discharging to river		Interception efficiency
		(m^3/d)	(L/s)	
S-1	Steady-state Recharge 100 mm/y No pumping	654.8	7.6	N / A
S-1a	Transient pumping 10 yrs @ 10.12 L/s Recharge 100 mm/y	324.4	3.8	51%
S-2	Steady-state Recharge 50 mm/y No pumping	537.5	6.2	N / A
S-2a	Transient pumping 10 yrs @ 10.12 L/s Recharge 50 mm/y	189.9	2.2	65%
S-3	Steady-state Recharge zero No pumping	451.7	5.2	N / A
S-3a	Transient pumping 10 yrs @ 10.12 L/s Recharge zero	151.7	1.8	66%

6.7. COMPARISON WITH HORIZONTAL DRAINAGE WELL

The Loxton horizontal drainage well (Smith and Howles 2008) was drilled around one kilometre south of the Loxton Sands trial wellfield in an area where the base of the aquifer occurred at an elevation of between 12 and 13 m AHD, i.e. above river pool level of 9.8 m AHD.

Long-term pumping tests conducted on the horizontal drainage well indicated that 2 m of drawdown developed within a period of 80,000 minutes in observation wells laterally offset from the horizontal well by two and three metres. The resultant groundwater level was then 0.5 m above the top of the horizontal well.

The hydraulic behaviour of the horizontal drainage well was simulated by site-specific groundwater modelling. This modelling predicted the horizontal well interception efficiency, in relation to the groundwater flux passing an imaginary 250 m long plane parallel to the well, over three decades of pumping. The model positioned the 250 m long horizontal well at its correct elevation within a 1,300 m long aquifer strip adjacent the river with low permeability boundaries at the north and south. The model predicted the horizontal well was capable of intercepting 83% of the original groundwater flux passing the well after one year. Further modelling indicated that a horizontal well constructed so that the production zone was below river pool level had an interception efficiency of 100%.

6.8. CONCLUSIONS

The site-specific groundwater modelling provided a clear indication of the Loxton Sands trial wellfield interception efficiency in relation to the groundwater flux discharging to the river from the Loxton Sands.

The following general comments summarise the modelling results:

1. A Pata Formation wellfield was not a viable method for intercepting the flux of groundwater discharging to the river from the Loxton Sands.
2. A Loxton Sands wellfield with production wells at 50 m spacing was capable of varying degrees of interception of the flux of groundwater discharging to the river from the Loxton Sands, depending upon the annual recharge rate. Under the scenario of 50 mm/y recharge (considered to best

represent future conditions), modelling indicated a wellfield interception efficiency of 65%. Reducing the well spacing to 35 m resulted in an increase in efficiency of only 5%.

7. SITE-3 INVESTIGATIONS

A number of investigation, production and observation wells were drilled during previous investigations and the during the rollout of the floodplain wellfield in the Site-3 (Northern Thiele's floodplain) investigation area between river kms 492.5 and 493, however significant data gaps existed and further drilling was required.

This investigation targeted the Monoman Formation to gain a better understanding of the hydrostratigraphy, the magnitude of groundwater flux and salt load discharging to the river and assist SA Water in the positioning of a possible interception trench to address an outstanding salt issue at the northern end of the Thiele's Floodplain wellfield. A reference base map indicating key features is given in Fig. 80.

The objectives of the investigation program originally were to:

1. Determine the source of and magnitude of groundwater flux discharging to the river from the left bank floodplain.
    a. Characterise the Coonambidgal Formation / Monoman Formation:
        - Determine the areal extent, thickness, nature and lithology of the Coonambidgal Formation / Monoman Formation.
        - Determine the spatial and vertical salinity distribution of the Coonambidgal Formation / Monoman Formation.
        - Characterise the underlying Bookpurnong Formation, where encountered.
    b. Determine the magnitude of the groundwater flux discharging to the river from the Monoman Formation / Coonambidgal Formation and correlate with the in-river work if possible. Following the results obtained from the Site-2 investigations this component was not pursued. Salt load benefits derived from the regional groundwater model are reported.
    c. Determine, using in-river methods, locations where saline groundwater was likely to be discharging to the river (and the magnitude of the flux if possible). Following the results obtained from the Site-2 investigations this component was not pursued.
2. Provide recommendations for the SIS infrastructure option.
    a. Confirm the potential of an interception trench for effective interception of the groundwater flux discharging to the river from the Monoman Formation.
    b. Make recommendations regarding the interval over which the interception trench should extend.

During the course of the investigations the interception trench option was abandoned and two additional observation / production wells were added to the Thiele's Floodplain wellfield.

Figure 80. Site-3 Pre-2008 floodplain investigation drillholes location plan

7.1. REVERSE AIR CIRCULATION INVESTIGATION DRILLING

An RAC investigation drilling program was undertaken to further delineate the extent of the Monoman Formation throughout the investigation area, in particular north of the existing Thiele's Floodplain wellfield where a significant data gap existed. Drilling defined the base and extent of the Coonambidgal, Monoman and Bookpurnong Formations by targeting the underlying Pata Formation. Investigation drillholes (referred to as Master RAC Drillhole in Appendix B) were strategically positioned north of the existing production wells to assist with well design, the conceptual hydrogeological model and determination of the watertable in the Monoman Formation. At the time of drilling, it was anticipated that an extension to the existing wellfield by either interception trench or production wells would occur. The correspondence between the Drillhole Name, Unit Number and Permit Numbers is given in Appendix B.

7.1.1. DECEMBER 2008 AND OCTOBER 2009 DRILLING PROGRAM

Underdale Drillers undertook the RAC investigation drilling program under DFW supervision in early December 2008. Drillhole specifications are given in Appendix B with geological logs presented in Appendix C. Drillholes that fully penetrated the Bookpurnong Formation were grouted across the aquitard to ensure hydraulic separation of the aquifers.

The December 2008 program (Fig. 81) included:

1. Four investigation drillholes at 50 m spacing, commencing 50 m north of existing observation well LOW19 and 30m east of the river bank.
2. Three investigation drillholes at 50 m spacing at a distance greater than 50 m east of the river bank at the highland interface.

The October 2009 program (Fig. 82) included:

1. One investigation drillhole to delineate the extent of the Monoman Formation with the intent that if a sufficient aquifer thickness was encountered, an additional production well would be constructed.

7.2. PRODUCTION AND OBSERVATION WELLS

7.2.1. APRIL AND DECEMBER 2009 DRILLING PROGRAM

Underdale Drillers undertook mud rotary well drilling of two Monoman Sands production / observation wells under DFW supervision; well LPW19 on 15 April 2009 and well LPW19a on 16 December 2010. This work was undertaken to augment the existing Thiele's Floodplain wellfield in response to identifying the presence of the Monoman Formation at depth during the RAC investigation drilling program. The location of the wells are given in Fig. 82. Well specifications are given in Appendix B with geological logs are presented in Appendix C.

Well LPW19 was drilled at the site of investigation drillhole LFA40 and was positioned to act as an observation well for the SIS. Well LPW19a was positioned as close to LFA43 as possible. These wells were drilled to production well specifications to allow for future fitting of pumps.

7.2.2. PRODUCTION WELL SPECIFICATIONS

The drilling and construction of both Monoman Sands production / observation wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Biovis and CR650. Bentonite was not used due to concern regarding its effect on development.
2. Drilling was undertaken using a 13” (355 mm) diameter rotary blade.
3. Wells were cased with IPLEX 200 mm ID Class 12 UPVC.
4. Wells were completed with 200 mm ID Class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5%. Wells were completed with the production zone set over the entire aquifer thickness, where possible.
5. Well LPW19 was constructed with a 1 m 200 mm ID UPVC sump and LPW19a was constructed with a 5 m, 200 mm ID UPVC sump (providing for future fitting of an Airwell pump).
6. The annulus between the drillhole and the slotted casing was filled with 8:16 gravel pack emplaced by gravity to a minimum of 1.5 m above the production zone.
7. The annulus between the drillhole and the casing was grouted to surface using a 5% bentonite to cement mix and allowed to cure.
8. Wells were developed by airlifting until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
9. Following development and sampling, the wells were sterilised by dosing with a hypochlorite solution which was agitated by pumping for 15 minutes.

A survey of the groundwater levels conducted at the time of drilling indicated that at production well LPW19 the groundwater level elevation was approximately 11 m AHD, or 1 m above river pool level. At well LPW19a, the groundwater level elevation was 11.9 m AHD, or 2 m above river pool level. All wells were surveyed by the SA Water Survey and Land Management Group and the results are included in Appendix B.

7.2.3. GROUNDWATER SALINITY

Groundwater samples were submitted to the DFW laboratory for EC determination. Results from samples collected from production wells during development are given in Appendix B.

Figure 81. Site-3 Investigation drillhole location plan

Figure 82. Site-3 Well location plan

7.3. AQUIFER AND AQUITARD CHARACTERISATION

The location of the single cross-section transect G - G1 (north-south) is given in Fig. 83. The cross-section indicates the elevations and relationship of the major hydrogeological units, the potentiometric surface of the Monoman Sands and river pool level, together with well construction details.

7.3.1. TRANSECT G - G1

The hydrostratigraphy and elevations of the major hydrogeological units along transect G - G1 are presented in Fig. 84. The cross-section indicates the elevations and relationship of the major hydrogeological units, the potentiometric surface of the Monoman Sands and river pool level, together with well construction details. The cross-section can be summarised as follows:

Coonambidgal Formation

The ground surface (top of Coonambidgal Clay and recent Aeolian deposits) occurred between 12 and 14 m AHD. These units were identified across the entire transect length. The base of the unit occurred at 4 m AHD between LPWA18 and the inferred highland interface. North of LPW19, the base of the clays inclined to 8 m AHD.

Monoman Formation

The Monoman Formation overlies the Bookpurnong Formation and was observed in investigation drillholes LPWA18, LFA40 and observation well LOW19. Between these drillholes, the formation occurred as a thinning layer between 2 and 3 m thick. North of LFA40, the Monoman Formation was not intercepted, except at LFA43 where an isolated 2 m thick lens of re-worked sands and calcrete occurred at an elevation of between 5.5 and 8 m AHD.

Lower Loxton Clay and Shells

Clays were identified north of investigation drillhole LFA41 between 1 and 7 m AHD. This was interpreted as a reworking of the Lower Loxton Clay and Shells and may be open to further classification. This clay sequence continued north to the end of transect.

Bookpurnong Formation

The base of the Bookpurnong Formation occurred at -2 m AHD and it was 2.5 m thick.

Upper Murray Group Pata Formation

The Pata Formation was identified in investigation drillhole LFA46 (not shown on this cross-section). It consisted of a grey, friable, low permeability, silty fossiliferous limestone. No drillholes fully penetrated the entire thickness of the unit.

Figure 83. Site-3 Location of cross section

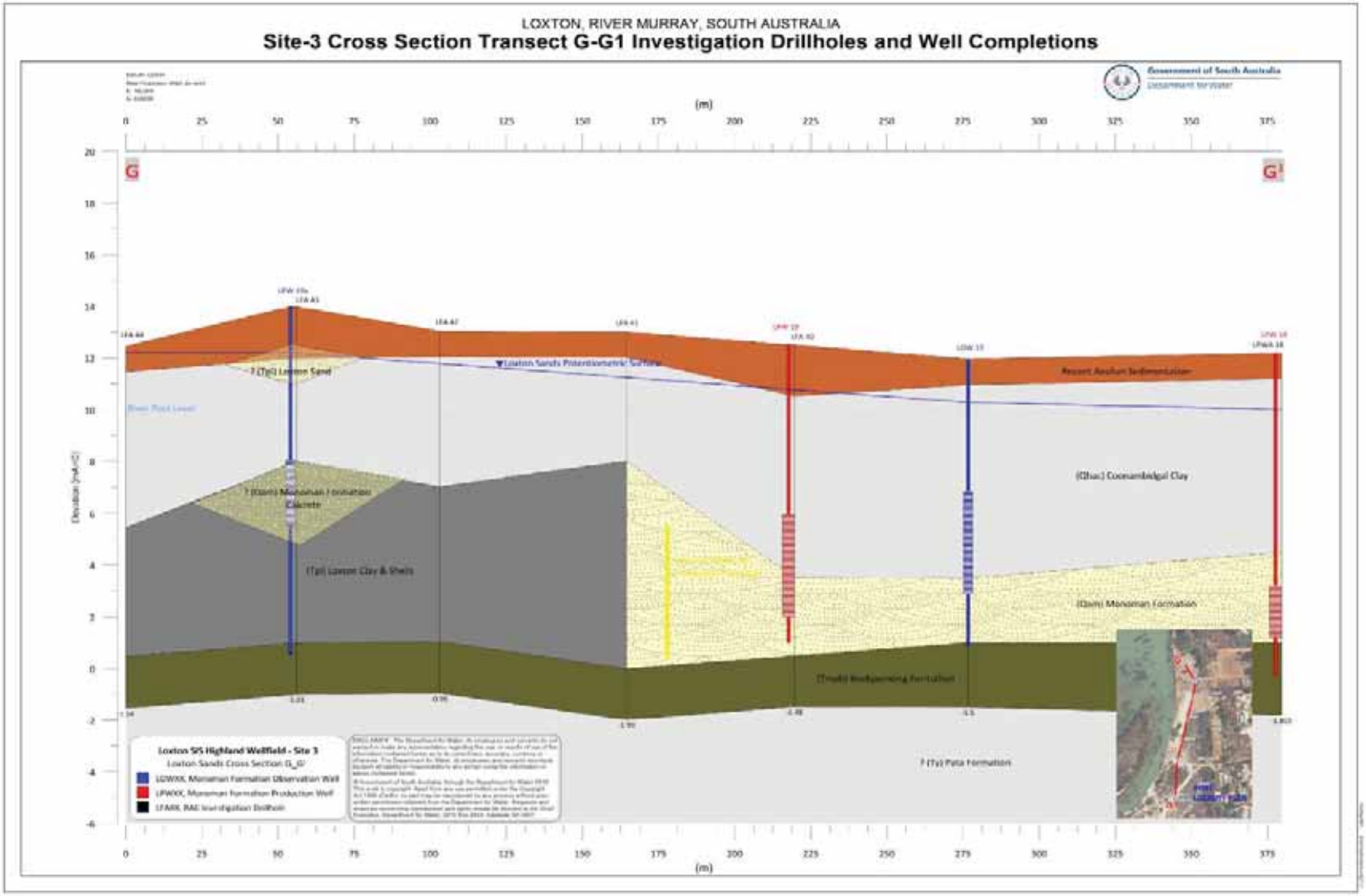


Figure 84. Site-3 Transect G - G1

8. PRELIMINARY MODELLED IN-RIVER SALT LOAD BENEFITS

The development of a regional groundwater model of the Loxton-Bookpurnong area was undertaken by DFW as part of the investigation phase for Loxton and Bookpurnong Salt Interception Schemes. The model was subsequently accredited by the MBDA. Extensive documentation of the groundwater modelling is provided in Yan *et al*.2004 and 2005.

This impact assessment regional groundwater model can be used to estimate the current groundwater flux discharging to the river from the entire aquifer system and to predict the future groundwater flux under different irrigation and development scenarios until 2104. When the modelled flux is combined with groundwater salinity, the salt load can be calculated. This figure can then be applied in the MDBA River Murray Model (BIGMOD) to determine in-river EC benefits.

The calibrated model includes a number of flow budget zones for which the lateral and vertical groundwater flux discharging to the river were determined using an assigned groundwater salinity values (Table 4) thus resulting in salt load values. Fig. 1 brings together the model flow budget zones, groundwater salinity values used in the original modelling, calculated salt loads (at 2002), potentiometric surface of the unconfined aquifers observed in May 2004 and results of the nanoTEM.

Fig. 1 indicates the location of the investigation areas in relation to the model zones and that:

- Site-1 (between river kms 501 and 502) lies within model Zone-21
- Site-2 (between river kms 494 and 495) spans model Zone-25 and Zone-26
- Site-3 (between river kms 492.5 and 493) lies within model Zone-27

Table 4. Loxton Area Modelled Groundwater Fluxes and Salt Loads Discharging to River

Flow budget zone	Floodplain/ highland	Modelled groundwater fluxes (m^3/d)			Ground-water salinity (mg/L)	Modelled salt load (t/d)		
		Lateral	Vertical	Total		Lateral	Vertical	Total
Zone-21	Highland	476	34	510	25,807	12.3	1.1	13.4
Zone-22	Floodplain	212	8	220	29,055	6.1	0.2	6.3
Zone-23	Floodplain	0	5	5	30,760	0	0.2	0.2
Zone-24	Floodplain	182	10	192	39,978	7.3	0.3	7.6
Zone-25	Highland	385	5	390	18,716	7.2	0.2	7.4
Zone-26	Highland	789	9	798	4,240	3.3	0.3	3.6
Zone-27	Highland	1 580	18	1 598	7,710	12.2	0.5	12.7
Zone-28	Floodplain	765	20	785	35,935	27.5	0.2	27.7
Zone-29	Highland	285	13	298	29,140	8.3	0.1	8.4
Zone-30	Floodplain	238	14	252	24,080	5.7	0	5.7
Zone-31	Highland	209	7	216	5,620	1.2	0	1.2
Totals	**N/A**	**5 121**	**143**	**5 264**	**N/A**	**91.1**	**3.1**	**94.2**

The potentiometric surface indicated that groundwater discharged directly from the highland to the river where there is no floodplain. The model indicated that, prior to the construction of any SIS infrastructure, groundwater discharged to the river from five highland zones:- Zone-21, Zone-25, Zone-26, Zone-27 and Zone-29, with lateral salt loads of 12.3; 7.2; 3.3; 12.2 and 8.3 t/d respectively. The highland salt loads were confirmed by low resistivity nanoTEM data between river kms 489 and 490, 492 and 495 and 500 and 502 (however slightly higher resistivity occurred between river kms 501 and 502).

8.1. MODELLING OBJECTIVES

The objectives of the regional groundwater modelling undertaken in October 2008 were to run the model and predict the in-river salt load benefit of the proposed (at that time) infrastructure at Site-1 (Rilli's Cliffs), Site-2 (Loxton Pumping Station to Thiele's Homestead) and Site-3 (Northern Thiele's Floodplain).

The modelling involved running Scenario-8 with the following variations:

1. Existing floodplain wellfield only (horizontal drainage well and cliff-toe drain not represented).
2. Existing floodplain wellfield plus highland wellfield infrastructure at Site-1.
3. Existing floodplain wellfield plus highland wellfield infrastructure at Site-2.
4. Existing floodplain wellfield plus floodplain wellfield infrastructure at Site-3.

The model was adjusted as follows:

1. Drainage cells (Fig. 85) representing existing and proposed production wells were applied in the model (simulated to match actual pumping rates and a mid-point target drawdown of river pool level) at a spacing required to result in drawdown to the river pool level of 9.8 m AHD, therefore representing the maximum possible interception (which may or may not be achieved on ground).
2. The target drawdown level was set at a river pool level.
3. Drain conductance was adjusted to simulate realistic pumping rates.

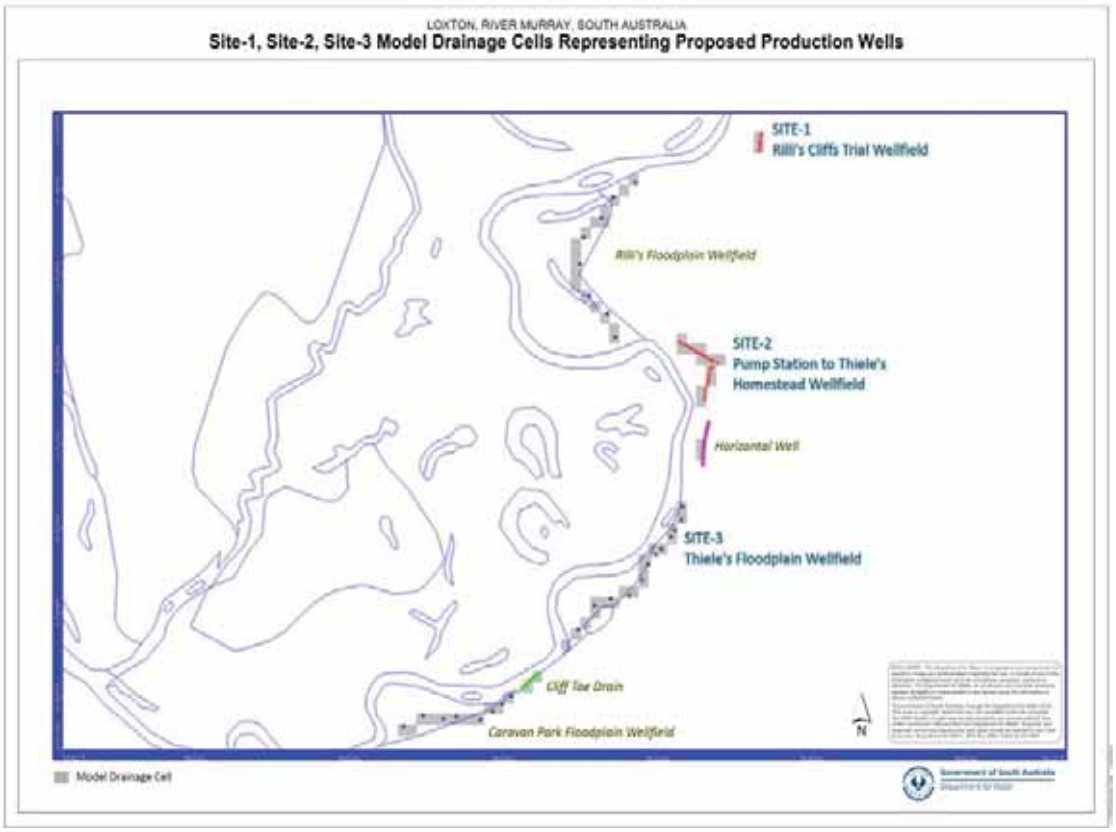


Figure 85. Model design indicating drainage cells and production wells

8.2. MODEL RESULTS

The predicted (modelled) in-river salt load benefits resulting from the proposed highland and floodplain wellfield infrastructure are given in Table 5.

8.2.1. HIGHLAND

Modelling of Site-1 and Site-2 infrastructure predicted a total in-river salt load benefit of 14 t/d after three years, increasing to 17 t/d at 100 years. The salt load benefit from the regional groundwater model was qualified with the application of the 65% efficiency obtained from the site-specific modelling of the Loxton Sands wellfield trial, due to the fact that the modelling assumed drawdown development to river pool level. This resulted in a salt load benefit of 9.1 t/d after three years, increasing to 11.1 t/d at 100 years.

8.2.2. FLOODPLAIN

Modelling of the Site-3 infrastructure predicted an in-river salt load benefit of 0.6 t/d remaining constant over 100 years. An estimated 75% interception efficiency was applied, which resulted in a salt load benefit of 0.45 t/d.

Table 5. Predicted In-River Salt Load Benefit Resulting from Proposed Infrastructure

Site	Area	Predicted in-river salt load benefit (t/d)		65% of predicted salt load benefit (t/d)	
		At 3 yrs	At 100 yrs	At 3 yrs	At 100 yrs
Site-1	Rilli's Cliffs	8	10	5.2	6.5
Site-2	Loxton Pumping Stn to Thiele's Homestead	6	7	3.9	4.6
	Total highland salt load benefit	**14**	**17**	**9.1**	**11.1**
				75% of predicted salt load benefit (t/d)	
Site-3	Northern Thiele's Floodplain	0.6	0.6	0.45	0.45

8.3. BENEFIT / COST RATIO

SA Water undertook an economic analysis of the proposed SIS infrastructure options for Site-1, Site-2 and Site-3 using the predicted salt load benefits. The results of the analysis are given in Table 6. In each case the proposed infrastructure exceeded '1' (the break-even point).

Table 6. Benefit / Cost Ratio of SIS Infrastructure

Option	Interception Efficiency	Benefit / Cost Ratio
Site-1, Rillis Cliff's wellfield	65%	1.34
Site-2, Loxton Pumping Stn - Thiele's Homestead wellfield	65%	1.19
Site-3, Northern Thiele's Floodplain wellfield	75%	3.61

9. SITE-2 WELLFIELD CONSTRUCTION

Following the completion of investigations in the Site-2 area, which included the final phase of RAC investigation drilling in October 2009, recommendations for the highland wellfield were provided to SA Water. It was agreed that a wellfield comprising closely spaced conventional vertical production wells be constructed.

The following risks in the design of the highland wellfield had been previously discussed and acknowledged by SA Water:

1. Transferring the Site-2 Loxton Sands trial wellfield design (with production wells spaced at 50 m) throughout the Site-2 investigation area (where less detailed hydrogeological information was available and for which site-specific groundwater modelling had not been undertaken) may result in the need for future retrofitting with additional production wells to bring the well spacing down to 25 m.
2. The development of drawdown and thus wellfield interception efficiency may take a long period of time, perhaps up to 20 years. This response time was considered acceptable, as similar periods of time were required to achieve the full benefits in some other schemes.

It was recommended that the highland wellfield be operated for at least five years prior to any augmentation, in terms of adding additional production wells to result in a 25 m spaced wellfield.

9.1. WELLFIELD DESIGN

The results of investigations indicated that the majority of the flux of saline groundwater (and salt load) discharging to the river from the highland in the Loxton reach was likely to occur in the Site-2 investigation area between river kms 494 and 495 (and also the Site-1 investigation area between river kms 501 and 502). Where the highland is in direct hydraulic connection with the river, the groundwater flux discharging to the river can only be controlled from the highland.

Interception of the flux of saline groundwater discharging to the river from the Loxton Sands aquifer could be achieved by the construction of a curtain of closely spaced production wells on the highland. Interception is achieved when the potentiometric surface at the mid-point observation wells is drawn down to the river pool level of 9.8 m AHD. In practical application, a drawdown of 3 m was recorded during the Loxton Sands trial wellfield long-term pumping test (still between 2 and 3 m above river pool level depending on the initial groundwater level) and a long-term drawdown of 4 m was modelled.

The design process for the highland wellfield involved:

1. Investigations to characterise the Loxton Sands (including the Lower Loxton Clay and Shells), Bookpurnong Formation and Pata Formation and the hydraulic connection between the Loxton Sands and the Pata Formation and their hydraulic connection with the river.
2. Drilling and construction of a Pata Formation trial wellfield and a Loxton Sands trial wellfield and long-term pumping tests.
3. Groundwater modelling to determine the magnitude of the groundwater flux and salt load discharging to the river and the efficiency of the Pata Formation trial wellfield and Loxton Sands trial wellfield.
4. Groundwater modelling to determine the in-river salt load benefits of the highland wellfield configuration with production wells at 50 m spacing.

The location of the Site-2 production wells corresponded closely with investigation drillholes LHA108 through LHA125 (Fig. 21). The approximate length of the wellfield was 750 m which was positioned as near to the existing Rilli's Floodplain SIS disposal main as reasonably possible. The final length of the wellfield, including the Site-2 Loxton Sands trial wellfield, was in excess of 1,000 m.

9.2. WELLFIELD CONSTRUCTION

The drilling and construction of production and observation wells was undertaken to implement the highland wellfield in the Site-2 investigation area. Underdale Drillers undertook the mud rotary well drilling program under DFW supervision in November to December 2009. The location of the Loxton Sands wells is given in Fig. 86. Well specifications are given in Appendix B with geological logs in Appendix C. The highland wellfield construction program included:

1. Fifteen 200 mm ID Loxton Sands production wells at 50 m spacing, LHP63 through LHP77.
2. Eight 80 mm ID Loxton Sands mid-point observation wells at 100 m spacing, LHO87 through LHO94.

9.2.1. PRODUCTION WELL DRILLING AND CONSTRUCTION DETAILS

The drilling and construction of the Loxton Sands production wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Australian Mud Company Biovis and CR650. Bentonite was not used due to concerns regarding its effect on development.
2. Drilling fluids were controlled in two 4,000 L mud tanks instead of open pits. This was decided as the best method to control mud weights, safety and in the best interest of any local Aboriginal Heritage. Mud tanks are particularly useful in situations where high concentrations of underground service occur in residential settings preclude the use of open (excavated) mud pits.
3. Wells were drilled using a 14" (355 mm) diameter rotary blade bit.
4. Wells were cased with IPLEX 200 mm ID, class 12 UPVC.
5. The base of the production zone was set 1 m below the base of the Loxton Sands, i.e. 1 m penetrating the Lower Loxton Clays and Shells in order to maximise drawdown during long-term pumping.
6. Production wells were completed with 10 metres of 200 mm ID, class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5%. Wells were competed with a 5 m sump to allow for the maximum development of drawdown to the base of the Loxton Sands using Airwell pumps if installed in future (as used in the Site-1 Loxton Sands trial wellfield).
7. The annulus between the drillhole and the slotted casing was filled with gravel pack of 8:16 grade emplaced by gravity up to 2.0 m above the top of the production zone.
8. The annulus between the drillhole and casing was sealed with 1 m (40 L) of bentonite pellets above the gravel pack.
9. The annulus between the drillhole and the casing was further grouted to surface by a tremie line with a 5% bentonite to cement mix. No accelerants were used in the cement mixture.

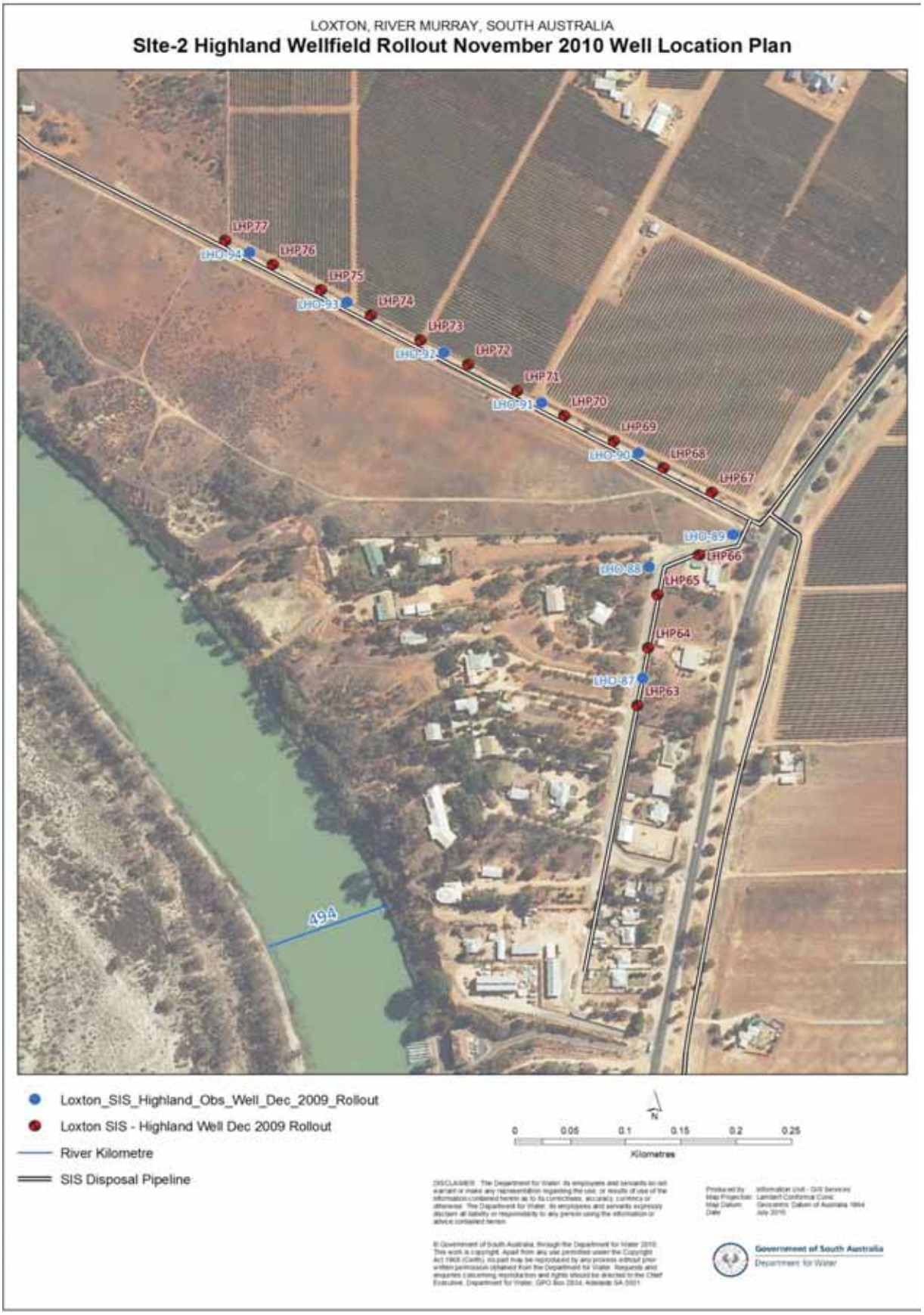


Figure 86. Site-2 Well location plan November 2010

1. Development commenced after a minimum grout setting time of 24 hours. Wells were developed by:
    a. Airlift surging at 690 KPa for one hour in the production zone with a jetting tool until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
    b. Injecting 500 L of water and 2 Kg (min) of Boreclean through the drill string and jetting tool into the production zone.
    c. Airlift surging after a minimum waiting time of one hour, for a period of one hour with a jetting tool until the groundwater was clear of drilling fluids and free of, or contained only minor amounts of suspended solids.
2. Groundwater samples from production wells LHP63 through LHP77 were submitted to the DFW laboratory for EC determination.
3. Wells were sterilised by dosing with a hypochlorite solution which was agitated for 15 minutes. The wells were purged after 24 hours to remove any residual chlorine.
4. The well head was completed above ground level with a Table E flange and 2 x bolts, painted with yellow and red paint for visual safety and fitted with an aluminium tag giving Permit No and Drillhole Name.
5. Initial surveying was conducted by SA Water Berri Staff.
6. Final surveying was conducted on well head boxes, completed near to the natural surface.

9.2.2. OBSERVATION WELL DRILLING AND CONSTRUCTION DETAILS

The drilling and construction of the Loxton Sands observation wells occurred in accordance with the following specifications:

1. Drilling was undertaken using polymers including Australian Mud Company products Biovis and CR650. Bentonite was not used due to concerns regarding its effect on development.
2. Drilling fluids were controlled in two 4,000 L mud tanks instead of open pits.
3. Wells were drilled using an 8” (178 mm) diameter rotary blade bit.
4. Wells were cased with IPLEX 80 mm ID, class 12 UPVC.
5. Observation wells were completed with 10 m of 80 mm ID, class 12 UPVC radial slotted casing in-line screens (1 mm aperture) with an open area of 5%. Wells were completed with a 1 m sump.
6. Wells were completed in the Loxton Sands with a 10 m production zone to enable EC profiling to be conducted.
7. The base of the production zone was set 1 m below the base of the Loxton Sands, i.e. 1 m penetrating the Lower Loxton Clays and Shells and in order to maximise observations from drawdown developed in response to pumping from the production wells.
8. The annulus between the drillhole and the slotted casing / casing was filled with gravel pack of 8:16 grade emplaced by gravity up to 2.0 m above the top of the production zone.
9. The annulus between the drillhole and casing was sealed with 1 m (20 L) of bentonite pellets above the gravel pack.
10. The annulus between the drillhole and the casing was further grouted to surface by tremie line with a 5% bentonite to cement mix. No accelerants were used in the cement mixture.

11. Development commenced after a minimum grout setting time of 24 hours. Airlift surging occurred for a minimum of one hour within the production zone with a jetting tool lowered by a 32 mm diameter blue line tremie until the groundwater was clear of drilling fluids and free of, or contained minor suspended solids.
12. A groundwater sample was collected during development and submitted to DFW laboratory for EC determination.
13. Wells were sterilised by dosing with a hypochlorite solution which was agitated by pumping for 15 minutes.
14. The well head was finished at ground level with a concrete gattic cover, painted with yellow and red paint for visual safety and fitted with an aluminium tag giving Permit No and Drillhole Name..
15. Surveying was conducted by SA Water Berri Staff.

9.3. WELLFIELD VALIDATION

The construction of the highland wellfield occurred following extensive investigations which included the drilling and long-term testing of the Loxton Sands trial wellfield and numerical groundwater modelling. No further testing was undertaken following the rollout of the wellfield.

9.4. WELLFIELD FLUX

A long-term flux from the operational highland wellfield comprising 27 production wells was predicted by the groundwater modelling to be 12 L/s. It should be noted that step drawdown tests conducted on a number of individual production wells during the investigations indicated an average value of 2.2 L/s. Wellfield optimisation will be required once commissioning has occurred. The final pumping rates for the production wells will only be determined once the wellfield has been in operation for some time.

10. MODELLED LOXTON SIS IN-RIVER SALT LOAD BENEFITS

The original objective of the Loxton SIS was to intercept between 80 and 85% of the total long-term flux of saline groundwater (and therefore the salt load) discharging to the river in the Loxton reach. Final modelling of the salt load benefits of the Loxton SIS infrastructure using the Loxton-Bookpurnong regional groundwater model 2005 was requested by SA Water in July 2010.

The objectives of the regional groundwater modelling were to run the regional groundwater model and predict the in-river salt load benefit of the as constructed SIS infrastructure with a start year of 2006. The modelling involved running Scenario-8 (as constructed SIS) with the following variations:

1. Existing floodplain wellfield.
2. Existing floodplain wellfield plus highland wellfield infrastructure at Site-1.
3. Existing floodplain wellfield plus highland wellfield infrastructure at Site-2.
4. Existing floodplain wellfield plus horizontal drainage well.
5. Existing floodplain wellfield plus cliff-toe drain.

Model Scenario-8 was adjusted as follows:

1. Floodplain production wells were simulated to match minimum actual pumping rates and a mid-point target drawdown level of 9.5 m AHD (at which the floodplain wellfield was mostly being operated at in 2010, which is less than river pool level.
2. Highland production wells were simulated to match minimum actual pumping rates and a mid-point drawdown level of 12 m AHD which was demonstrated during the Site-2 Loxton Sands trial wellfield long-term pumping test.
3. The horizontal drainage well was simulated using model drain cells to match the actual pumping rate of 3 L/s.
4. The cliff-toe drain was simulated using model drain cells to match the actual pumping rate of 1.5 L/s.

10.1. MODEL RESULTS

The regional groundwater model was based on the best knowledge and information available at the time the model was developed in 2004. The regional groundwater model may be updated when new information and knowledge becomes available. Future modelling results may therefore be different to those presented here. The numbers should not be treated as absolute values.

It was assumed that the long-term salt load discharging to the river is 98 t/d. The predicted in-river salt load benefits from the Loxton SIS are presented in Table 7 which indicated the following:

1. The floodplain wellfield (excluding the cliff-toe drain) was predicted to provide a salt load benefit of 45.5 t/d after three years, increasing to 46.3 t/d at 100 years.
2. The highland wellfield (excluding the horizontal drainage well) was predicted to provide a salt load benefit of 8.6 t/d after three years, increasing to 10.7 t/d at 100 years.
    a. The Loxton Pumping Station to Thiele's Homestead wellfield was predicted to provide a salt load benefit of 7.2 t/d at 100 years, greater than the preliminary modelled value of 4.6 t/d.

b. The Rilli's Cliffs wellfield was predicted to provide a salt load benefit of 3.5 t/d at 100 years, less than the preliminary modelled value of 6.5 t/d.

3. The highland wellfield (including the horizontal drainage well) was predicted to provide a salt load benefit of 11.4 t/d after three years, increasing to 13.6 t/d at 100 years.
4. By summation, all of the components of the Loxton SIS operating in concert (floodplain wellfield, highland wellfield, horizontal drainage well and cliff-toe drain) were predicted to provide a salt load benefit of 60.7 t/d after three years increasing to 63.9 t/d at 100 years.
5. The provision of salt load benefits for the MDBA Salinity Register requires all the individual components of the scheme to be modelled together in operation, rather than summation of individual component results. The predicted in-river salt load benefits were then 53.8 t/d after three years, increasing to 60.4 t/d at 100 years.
6. A long-term (100 year) reduction in salt load of 60.4 t/d represents a 62% reduction from the long-term average salt load of 98 t/d. This was less than the original objective of 80% due to the potential inefficiencies associated with the highland wellfield which were incorporated in predictive modelling and also due to the fact that the highland scheme requires augmentation in the future as recommended at the end of this report.

Table 7. Predicted In-River Salt Load Benefit Resulting from Loxton SIS Infrastructure

Site	Area	Predicted Salt Load Benefit (t/d)			
		At 3 yrs	At 30 yrs	At 50 yrs	At 100 yrs
Components of Loxton SIS operating in isolation					
	Caravan Park Wellfield	7.1	7.1	7.4	8
	Thiele's Floodplain Wellfield	27.8	25.7	26.5	28.1
	Rilli's Floodplain Wellfield	10.6	9.5	9.8	10.2
	Total Floodplain (Exc. Cliff-Toe drain)	**45.5**	**42.3**	**43.6**	**46.3**
	Cliff-Toe Drain	3.8	3.5	3.6	3.9
	Horizontal Drainage Well	2.8	2.5	2.7	2.9
Site-1	Rilli's Cliffs Wellfield	2.6	2.9	3.2	3.5
Site-2	Loxton Pumping Stn to Thiele's Homestead	6	6.3	6.6	7.2
	Total Highland (Exc. Horizontal drainage well)	**8.6**	**9.2**	**9.8**	**10.7**
	Summation of Total SIS	**60.7**	**57.5**	**59.7**	**63.9**
All components of Loxton SIS operating in concert					
		53.8			**60.4**

11. CONCLUSIONS AND RECOMMENDATIONS

11.1. WELLFIELD

The highland wellfield has been implemented in the Site-2 investigation area (Fig. 87) and a partial highland wellfield has been implemented in the Site-1 investigation area. The hydrogeological model and interception strategy are regarded as robust. It is only the detail of the actual wellfield, in terms of the numbers of production wells that are required (and spacing) that perhaps has some uncertainly associated with it.

The operational highland wellfield includes the Site-2 Loxton Sands trial wellfield and the Site-1 Loxton Sands trial wellfield. The final well specifications are given in Appendix B. The location of the entire Loxton SIS highland wellfield (production and observation wells), floodplain wellfield (production and observation wells), horizontal drainage well and cliff-toe drain are given in Fig. 88.

In addition to monitoring of groundwater levels at the mid-point observation wells, groundwater levels should also be recorded at a number of surrounding (regional) existing Loxton Sands observation wells. It is recommended that monitoring be conducted monthly for the first year of operation extending to quarterly readings thereafter. This data will assist with determining the deflation of the groundwater mound between the highland wellfield and the river. A wellfield and regional observation wells monitoring plan can be developed by SA Water in conjunction with DFW.

The existing floodplain wellfield in the Site-3 investigation area was augmented with two Monoman Formation observation / production wells (LPW19, LPW19a).

11.2. RECOMMENDATIONS

The Loxton SIS is an interception curtain comprising a series of floodplain and highland wellfields including 100 production and observation wells and also the innovative horizontal drainage well and cliff-toe drain.

Interception of the flux of saline groundwater discharging to the river from the Loxton Sands aquifer is achieved when the potentiometric surface at the highland wellfield mid-point observation wells is drawn down to, or close to, the river pool level of 9.8 m AHD. Monitoring groundwater levels in the mid-point observation wells is required at sufficient frequency to ensure satisfactory wellfield operation.

1. The effectiveness of the highland wellfield is dependent on the capacity of the production wells to generate adequate long-term drawdown at the mid-point observation wells. The performance of the wellfield should be assessed over a timeframe of five years.
2. The following issues are relevant to the operation of the highland wellfield:
    a. All alterations and additions to the wellfield should be documented.
    b. At the five-year review, the recorded in-river salt load benefits of the entire Loxton SIS should be compared with the predicted performance of the wellfield. The revised Loxton-Bookpurnong regional groundwater model should be re-run incorporating the operational drawdown.
    c. The wellfield effectiveness / performance must be determined and infrastructure augmented if it becomes evident that the wellfield is not performing to a satisfactory degree.

3. In the Site-2 investigation area, a 300 m long gap occurs in the interception curtain between the northern end of the horizontal drainage well and the southern end of the Loxton Sands trial wellfield. It is recommended that consideration be given to installing an additional seven production wells (and associated observation wells) at 50 m spacing, subject to the performance of the existing 50 m spaced wellfield.
4. The Site-1 Loxton Sands trial wellfield is located in regional groundwater model Zone-21 which contributes 13.4 t/d of salt to the river. Modelling predicted that the trial wellfield provided a salt load benefit of 3.5 t/d at 100 years. It is recommended that consideration be given to extension of the wellfield with between 11 and 21 production wells (and associated observation wells) at 50 m spacing, subject to the performance of the existing 50 m spaced limited wellfield south of production well LHP82, running for a distance of between 550 and 1,000 m. Modelling of the additional production wells should be undertaken to confirm the salt load benefits.

Figure 87. Site-2 highland wellfield location plan November 2010

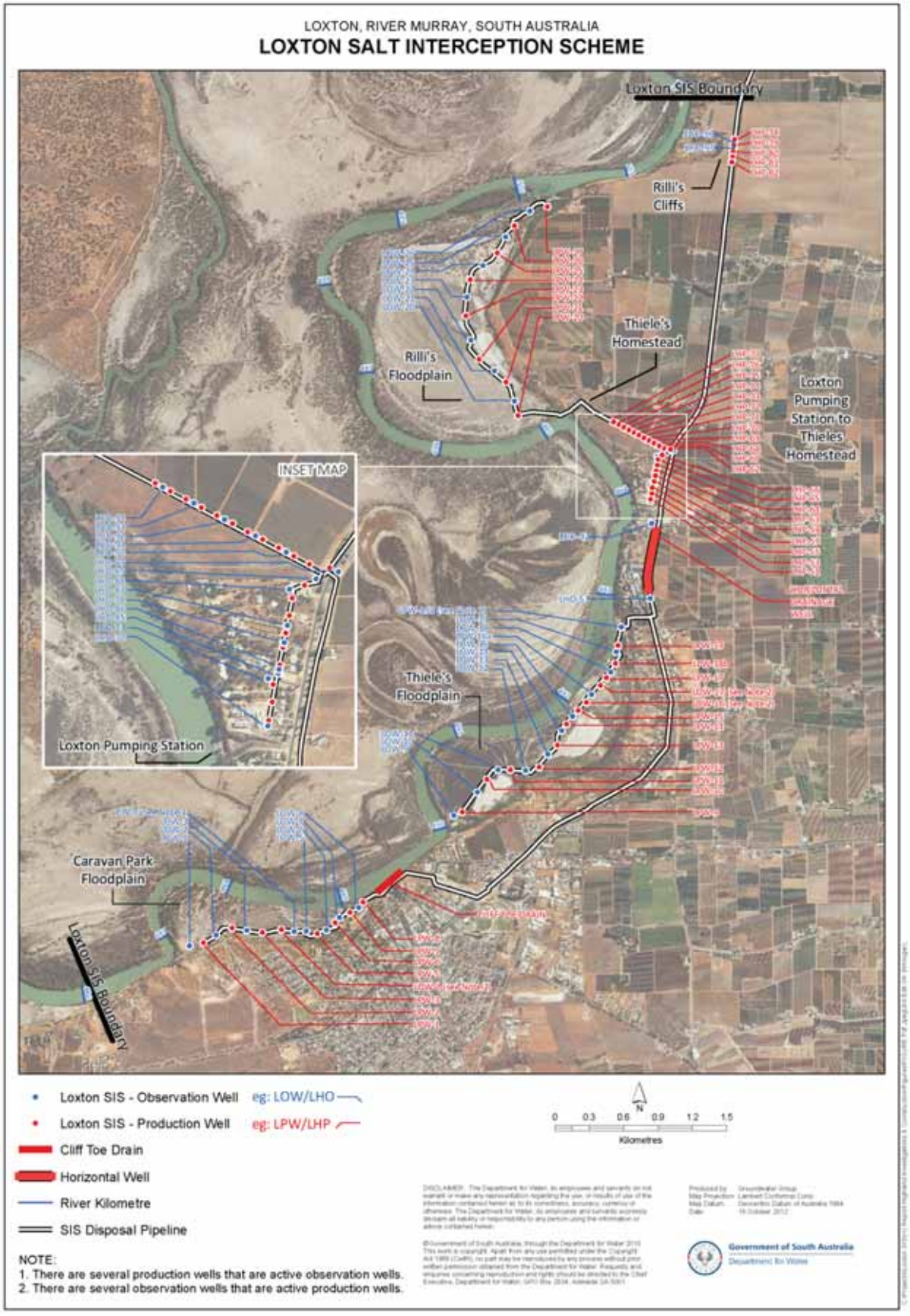


Figure 88. Loxton SIS infrastructure location plan January 2012

APPENDICES

A. CHRONOLOGY OF EVENTS

Due to the length and complexity of the investigations discussed in this report a chronology of important events is given.

1 November 2007

The status and future direction of the highland wellfield was discussed at a meeting chaired by MDBA and involving SA Water and DLWBC. The key discussion points included:

1. In-river EC data obtained by DFW late in 2006 indicated possible high salinity zones in the river between the Loxton Pumping Station and Thiele's homestead (referred to as Site-2 in this report, between river kms 494 and 495).
2. SA Water discussed evidence that had become available due to the current drought conditions indicating (in SA Water's opinion) the highland contribution to the in-river salt load may be considerably greater than had been previously believed.
3. SA Water discussed the results of a 35 day duration Pata Formation pumping test that it had conducted (independent of DFW), which possibly indicated drawdown in the Loxton Sands and expressed interest in a Pata Formation wellfield trial.
4. A full highland investigation program and scheme was unlikely due to time and budget constraints and it was recommended to target an area that, based on existing investigation data and knowledge, was likely to have a high groundwater flux and salt load discharging to the river.
5. Further investigations should be conducted on the Loxton highlands with the aim of implementing SIS infrastructure.

It was agreed to concentrate investigations on the Site-2 investigation area based on the following evidence:

1. Existing in-river EC surveys conducted by DFW indicated saline water (hot spots) close to the eastern (left) river bank.
2. Discharge of saline groundwater was observed from the cliff base, particularly closer to Thiele's homestead.
3. A steep hydraulic gradient was evident in the watertable contours of the unconfined aquifer which would result in a high groundwater flux if the aquifer permeability was high. This is the case in the area of the horizontal drainage well and similar conditions were assumed to extend through the highland areas of interest.

SA Water requested that DFW prepare a Project Brief and Scope of Works for an investigation program targeting the Site-2 investigation area with the following over-arching objectives:

1. Determine the magnitude of the groundwater flux and salt load discharging to the river.
2. Determine a Pata Formation trial wellfield interception efficiency in relation to the groundwater flux and salt load discharging to the river from the Loxton Sands.
3. Acquire knowledge of the area to allow selection of appropriate SIS infrastructure.

It is important to note that evidence at that time had indicated the Pata Formation would not be a viable target aquifer for salt interception in the Loxton region. DFW recognised there was benefit in conducting a long-term pumping test on a Pata Formation trial wellfield but stressed that such a trial was unlikely to indicate the benefits of pumping from the Pata Formation.

28 November 2007

Discussion at the Loxton SIS Project Team meeting on 28 November 2007 in relation to Site-2 investigations included:

1. The need for extensive close spaced RAC investigation drilling.
2. The configuration of the Pata Formation trial wellfield including five to six production wells. It was agreed that several of the Loxton Sands mid-point observation wells be completed as production wells thus allowing flexibility in relation to undertaking a Loxton Sands wellfield trial, pending the results of the Pata Formation wellfield trial.

5 December 2007

Submission of Project Brief and Scope of Works for Site-2 investigations to SA Water. The investigation aimed to build on existing knowledge through further in-river and hydrogeological investigations to increase the current understanding of the area and to enable appropriate scheme design and implementation. Significant data gaps in the proposed target area included:

1. In-river EC data obtained by DFW indicated possible hot spots in the target area however a more detailed in-river survey, combined with analysis and interpretation of the data, was required in the reach between the Loxton Pumping Station and Thiele's homestead.
2. Aquifer geometry, permeability and connectivity. A number of investigation drillholes existed in the Site-2 investigation area however further drilling and pumping tests were required to allow accurate definition of the aquifer geometry, permeability and hydraulic connectivity between the Loxton Sands and the Pata Formation.

The over-arching objectives of the Site-2 investigations were to:

1. Determine the source and magnitude of groundwater flux and salt load discharging to the river from the Loxton Sands from the left bank (the highland) between river kms 494 and 495. It was assumed that groundwater discharged from the Loxton Sands.
2. Determine the effectiveness of a Pata Formation trial wellfield at intercepting the groundwater flux and salt load discharging to the river from the Loxton Sands.
3. Provide recommendations for the highland wellfield infrastructure option.

21 January 2008

SA Water acceptance of Project Brief and Scope of Works for the Site-2 investigations.

SA Water also requested that DFW undertake a Loxton Sands wellfield trial at Site-2 which resulted in the need to drill additional production and observation wells completed in the Loxton Sands. The over-arching objective of this additional investigation was to:

- Determine the effectiveness of a Loxton Sands trial wellfield at intercepting the groundwater flux and salt load discharging to the river from the Loxton Sands.

30 January 2008

Opening of the Tender for drilling and construction of wells at Site-2.

15 February 2008

Close of the Tender for drilling and construction of wells at Site-2.

20 March 2008

Award of Contract for drilling and construction of wells at Site-2 to Underdale Drillers Pty Ltd.

27 March 2008 to 4 June 2008

Drilling program undertaken in the Site-2 area.

21 June 2008 to 19 July 2008

Pumping tests conducted at Site-2 by DFW Groundwater Technical Services.

20 August 2008

In the Loxton SIS Project Team meeting on 20 August 2008 SA Water requested that DFW prepare a Project Brief and Scope of Works to:

1. Extend the investigation program to include two additional areas:
    a. Rilli's Cliffs (referred to as Site-1 in this report, between river kms 501 and 502).
    b. Northern Thiele's Floodplain (referred to as Site-3 in this report, between river kms 492.5 and 493). A minor investigation to examine the potential for extending the floodplain wellfield in that area.
2. Run the Loxton-Bookpurnong regional groundwater model 2005 to provide estimates of the likely in-river salt load benefit of SIS infrastructure.

9 September 2008 to 23 September 2008

Pumping tests conducted on key Site-2 Pata Formation and Loxton Sands production wells, LHP56P and LHP55 respectively.

23 September 2008

Long-tem pumping test on Site-2 Pata Formation trial wellfield commenced.

13 November 2008

Submission of Project Brief and Scope of Works to SA Water extending the investigation program to include Site-1 and Site-3.

The over-arching objectives of the Site-1 investigations were to:

1. Determine (as far as practicable) the source and magnitude of the groundwater flux and salt load discharging to the river from the Loxton Sands between river kms 501 and 502.
2. Determine a Loxton Sands trial wellfield interception efficiency in relation to the groundwater flux and salt load discharging to the river from the Loxton Sands.
3. Provide recommendations for the highland wellfield infrastructure option.

The over-arching objectives of the Site-3 investigations were to:

1. Determine the source of saline groundwater and magnitude of the groundwater flux and salt load contributing to increasing river EC from the left bank (the floodplain) between river kms 492.5 and 493.
2. Provide recommendations for the SIS infrastructure option.

18 November 2008 to 20 November 2008

Two additional Loxton Sands observation wells were drilled at the Site-2 Loxton Sands trial wellfield to allow observation of drawdown at the midpoint between two Loxton Sands production wells.

3 December 2008

SA Water acceptance of Project Brief and Scope of Works for investigations at Site-1 and Site-3.

8 December 2008 to 6 January 2009

Drilling program undertaken at Site-1 and Site-3.

5 February 2009

Long-term pumping test on Site-2 Pata Formation trial wellfield completed.

25 February 2009

Long-term pumping test on Site-2 Loxton Sands trial wellfield commenced and the wellfield continues to be pumped as a part of the operational highland wellfield.

21 May 2009

In the Loxton SIS Project Team meeting on 21 May 2009, SA Water requested that DFW prepare a Project Brief and Scope of Works for the rollout of highland wellfield infrastructure at Site-2 and for further investigations at Site-1 including a Loxton Sands wellfield trial. The following risks were acknowledged:

1. Transferring the Site-2 Loxton Sands trial wellfield design (with production wells spaced at 50 m) throughout Site-2 (where less detailed hydrogeological information was available and for which site-specific groundwater modelling had not been undertaken) may result in the need for future retrofitting with additional production wells to bring the well spacing down to 25 m.
2. The development of the drawdown and thus wellfield interception efficiency may take a long period of time, perhaps up to 20 years. This response time may be acceptable as similar periods of time have been required to achieve the full in-river salt load benefit in some other schemes.

4 August 2009

Submission of Project Brief and Scope of Works to SA Water for rollout of highland wellfield at Site-2 and for further investigations at Site-1 including a Loxton Sands trial wellfield.

5 August 2009

SA Water acceptance of Project Brief and Scope of Works for rollout of the highland wellfield at Site-2 and for further investigations at Site-1.

7 August 2009

Opening of the Tender for drilling and construction of wells at Site-1 and Site-2.

14 August 2009

Close of the Tender for drilling and construction of wells at Site-1 and Site-2.

24 September 2009

Award of Contract for drilling and construction of wells at Sites-1 and Site-2 to Underdale Drillers Pty Ltd.

8 October 2009 to 14 October 2009

Drilling program undertaken at Site-1, Site-2 and Site-3.

November to December 2009

Wellfield rollout drilling program undertaken at Site-1, Site-2 and Site-3.

28 October 2010

Long-term pumping test on Site-1 Loxton Sands trial wellfield commenced and the wellfield continues to be pumped as a part of the operational highland wellfield.

B. DRILLING SCHEDULE

PROJECT DRILLING SCHEDULE

The following tables present information on the purpose, location and the "as constructed" drilling schedule for all wells drilled as part of this investigation. The legend below explains the abbreviations used in the tables.

OW = Observation Well
PW = Production Well
INV= Investigation Drillhole

TF = Thiele's floodplain
PA = Proud Avenue
TE = Thiele's Easment
RC = Rilli's Cliffs

MON = Monoman Formation
PATA = Pata Formation
BOOK = Bookpurmong Formation
LLSC = Lower Loxton Sands/Clay
LOX = Loxton Sands

LF = Loxton Floodplain prefix
LH = Loxton Highland prefix

SC = Slotted Casing
WS = Wirewound Screen
OH = Open Hole

Drill Hole Name	Master RAC Drillhole Name	Purpose	Unit No	Permit No.	Zone	Location	Target Format.	GDAEast	GDANorth
LFA40	-	INV	7029-2425	156602	LF	-	MON	463315	6194465
LFA41	-	INV	7029-2426	156601	LF	-	MON	462318	6190248
LFA42	-	INV	7029-2427	156600	LF	-	MON	462355	6190409
LFA43	-	INV	7029-2428	156619	LF	-	MON	463315	6194465
LFA44	-	INV	7029-2429	156605	LF	-	MON	462318	6190248
LFA45	-	INV	7029-2444	156618	LF	-	MON	462355	6190409
LFA46	-	INV	7029-2431	156603	LF	-	MON	463315	6194465
LFA47	-	INV	7029-2529	181918	LF	-	MON	462318	6190248
LHA72	-	INV	7029-2340	141930	LH	-	BOOK	463315	6194465
LHA73	-	INV	7029-2339	141937	LH	-	PATA	462318	6190248
LHA74	-	INV	7029-2341	141938	LH	-	BOOK	462355	6190409
LHA75	-	INV	7029-2338	141946	LH	-	BOOK	463315	6194465
LHA76	-	INV	7029-2342	141951	LH	-	BOOK	462318	6190248
LHA77	-	INV	7029-2343	141952	LH	-	LLSC	462355	6190409
LHA78	-	INV	7029-2344	141953	LH	-	BOOK	463315	6194465
LHA79	-	INV	7029-2354	141954	LH	-	LLSC	462318	6190248
LHA80	-	INV	7029-2345	141955	LH	-	BOOK	462355	6190409
LHA81	-	INV	7029-2355	141956	LH	-	LLSC	463315	6194465
LHA82	-	INV	7029-2346	141957	LH	-	BOOK	462318	6190248
LHA83	-	INV	7029-2347	141958	LH	-	BOOK	462355	6190409
LHA84	-	INV	7029-2356	141960	LH	-	LLSC	463315	6194465
LHA85	-	INV	7029-2348	141963	LH	-	BOOK	462318	6190248
LHA86	-	INV	7029-2349	141964	LH	-	BOOK	462355	6190409
LHA87	-	INV	7029-2350	141965	LH	-	BOOK	463315	6194465
LHA88	-	INV	7029-2351	141966	LH	-	BOOK	462318	6190248
LHA89	-	INV	7029-2431	156583	LH	-	PATA	462355	6190409

LHA90	-	INV	7029-2432	156584	LH	-	PATA	463315	6194465
LHA91	-	INV	7029-2433	156598	LH	-	PATA	462318	6190248
LHA92	-	INV	7029-2434	156586	LH	-	PATA	462355	6190409
LHA93	-	INV	7029-2445	156587	LH	-	PATA	463315	6194465
LHA94	-	INV	7029-2451	156588	LH	-	PATA	462318	6190248
LHA95	-	INV	7029-2452	156589	LH	-	PATA	462355	6190409
LHA96	-	INV	7029-2453	156590	LH	-	PATA	463315	6194465
LHA97	-	INV	7029-2454	156591	LH	-	PATA	462318	6190248
LHA98	-	INV	7029-2435	156592	LH	-	PATA	462355	6190409
LHA99	-	INV	7029-2436	156575	LH	-	PATA	463315	6194465
LHA100	-	INV	7029-2437	156576	LH	-	PATA	462355	6190409
LHA101	-	INV	7029-2438	156578	LH	-	PATA	463315	6194465
LHA102	-	INV	7029-2439	156579	LH	-	PATA	462318	6190248
LHA103	-	INV	7029-2440	156580	LH	-	PATA	462355	6190409
LHA104	-	INV	7029-2441	156581	LH	-	PATA	463315	6194465
LHA105	-	INV	7029-2442	156582	LH	-	PATA	462318	6190248
LHA106	-	INV	7029-2443	156593	LH	-	PATA	462355	6190409
LHA107	-	INV	7029-2455	156595	LH	-	PATA	463315	6194465
LHA108	-	INV	7029-2509	182586	LH	-	PATA	462318	6190248
LHA109	-	INV	7029-2510	168608	LH	-	LLSC	462355	6190409
LHA110	-	INV	7029-2511	182587	LH	-	PATA	463315	6194465
LHA111	-	INV	7029-2512	168610	LH	-	LLSC	462318	6190248
LHA112	-	INV	7029-2513	182588	LH	-	PATA	462355	6190409
LHA113	-	INV	7029-2514	168612	LH	-	LLSC	463315	6194465
LHA114	-	INV	7029-2515	182589	LH	-	PATA	462318	6190248
LHA115	-	INV	7029-2516	182591	LH	-	LLSC	462355	6190409
LHA116	-	INV	7029-2517	168615	LH	-	LLSC	463315	6194465
LHA117	-	INV	7029-2518	182592	LH	-	PATA	462318	6190248
LHA118	-	INV	7029-2519	168617	LH	-	LLSC	462355	6190409
LHA119	-	INV	7029-2520	182593	LH	-	PATA	463315	6194465
LHA120	-	INV	7029-2521	168619	LH	-	LLSC	462318	6190248
LHA121	-	INV	7029-2522	182594	LH	-	PATA	462355	6190409
LHA122	-	INV	7029-2523	168621	LH	-	LLSC	463315	6194465
LHA123	-	INV	7029-2524	182595	LH	-	PATA	462318	6190248
LHA124	-	INV	7029-2525	168623	LH	-	LLSC	462355	6190409
LHA125	-	INV	7029-2526	168624	LH	-	PATA	463315	6194465
LHA127	-	INV	7029-2527	168663	LH	-	LLSC	462318	6190248
LHA128	-	INV	7029-2528	168664	LH	-	LLSC	462355	6190409
LHC1	-	INV	7029-2353	141929	LH	-	BOOK	462318	6190248
LHC2	-	INV	7029-2352	141947	LH	-	BOOK	462355	6190409
LHO70	-	OW	7029-2372	141936	LH	PA	LOX	463315	6194465
LHO71P	LHC1	OW	7029-2376	141933	LH	PA	PATA	462318	6190248
LHO72P	LHA73	OW	7029-2357	141941	LH	PA	PATA	462355	6190409
LHO73P	-	OW	7029-2380	143529	LH	PA	PATA	463315	6194465
LHO74	-	OW	7029-2366	143527	LH	PA	LOX	462318	6190248
LHO75	-	OW	7029-2365	143528	LH	PA	LOX	462355	6190409
LHO76P	-	OW	7029-2374	143530	LH	PA	PATA	463315	6194465
LHO77P	LHC2	OW	7029-2368	141950	LH	PA	PATA	462318	6190248
LHO78	-	OW	7029-2362	141945	LH	PA	LOX	462355	6190409

LHO79	-	OW	7029-2361	141959	LH	PA	LOX	463315	6194465
LHO80	-	OW	7029-2364	141962	LH	PA	LOX	462318	6190248
LHO81	-	OW	7029-2363	141968	LH	PA	LOX	462355	6190409
LHO82	-	OW	7029-2379	141969	LF	PA	LOX	463315	6194465
LHO83P	-	OW	7029-2375	141970	LF	PA	PATA	462318	6190248
LHO84P	-	OW	7029-2381	141971	KF	PA	PATA	462355	6190409
LHO85	-	OW	7029-2449	150609	LH	PA	LOX	463315	6194465
LHO86	-	OW	7029-2450	150610	LH	PA	LOX	462318	6190248
LHO87	LHA109	OW	7029-2553	168636	LH	PA	LOX	462355	6190409
LHO88	LHA112	OW	7029-2564	168647	LH	PA	LOX	463315	6194465
LHO89	LHA114	OW	7029-2555	168645	LH	PA	LOX	462318	6190248
LHO90	LHA116, 117	OW	7029-2556	168626	LH	TE	LOX	462355	6190409
LHO91	LHA118, 119	OW	7029-2557	168627	LH	TE	LOX	463315	6194465
LHO92	LHA120, 121	OW	7029-2558	168628	LH	TE	LOX	462318	6190248
LHO93	LHA122, 123	OW	7029-2559	168629	LH	TE	LOX	462355	6190409
LHO94	LHA124, 125	OW	7029-2560	168638	LH	TE	LOX	463315	6194465
LHO95	LHA103, 127	OW	7029-2561	168665	LH	RC	LOX	462318	6190248
LHO96	LHA127, 102	OW	7029-2562	159887	LH	RC	LOX	462355	6190409
LHP50P	-	PW	7029-2358	141931	LH	PA	PATA	463315	6194465
LHP51	LHC1	PW	7029-2377	141934	LH	PA	LOX	462318	6190248
LHP52P	-	PW	7029-2359	141932	LH	PA	PATA	462355	6190409
LHP53	LHA72	PW	7029-2384	141935	LH	PA	LOX	463315	6194465
LHP54P	-	PW	7029-2360	141939	LH	PA	PATA	462318	6190248
LHP55	LHA73	PW	7029-2378	141942	LH	PA	LOX	462355	6190409
LHP56P	-	PW	7029-2373	141940	LH	PA	PATA	463315	6194465
LHP57	LHA74	PW	7029-2383	141943	LH	PA	LOX	462318	6190248
LHP58P	-	PW	7029-2370	141948	LH	PA	PATA	462355	6190409
LHP59	LHC2	PW	7029-2382	141944	LH	PA	LOX	463315	6194465
LHP60P	-	PW	7029-2369	141949	LH	PA	PATA	462318	6190248
LHP61	-	PW	7029-2371	141961	LH	PA	LOX	462355	6190409
LHP62	-	PW	7029-2367	141967	LH	PA	LOX	463315	6194465
LHP63	LHA108	PW	7029-2563	168646	LH	PA	LOX	462318	6190248
LHP64	LHA110	PW	7029-2554	168647	LH	PA	LOX	462355	6190409
LHP65	LHA111	PW	7029-2565	168648	LH	PA	LOX	463315	6194465
LHP66	LHA113	PW	7029-2566	168635	LH	PA	LOX	462318	6190248
LHP67	LHA115	PW	7029-2567	168639	LH	TE	LOX	462355	6190409
LHP68	LHA116	PW	7029-2568	168640	LH	TE	LOX	463315	6194465
LHP69	LHA117	PW	7029-2569	168641	LH	TE	LOX	462318	6190248
LHP70	LHA118	PW	7029-2570	168642	LH	TE	LOX	462355	6190409
LHP71	LHA119	PW	7029-2571	168643	LH	TE	LOX	463315	6194465
LHP72	LHA120	PW	7029-2572	168644	LH	TE	LOX	462318	6190248
LHP73	LHA121	PW	7029-2573	168649	LH	TE	LOX	462355	6190409
LHP74	LHA122	PW	7029-2574	168650	LH	TE	LOX	463315	6194465
LHP75	LHA123	PW	7029-2575	168651	LH	TE	LOX	462318	6190248
LHP76	LHA124	PW	7029-2576	168652	LH	TE	LOX	462355	6190409
LHP77	LHA125	PW	7029-2577	168653	LH	TE	LOX	463315	6194465
LHP78	LHA102	PW	7029-2578	159888	LH	RC	LOX	462318	6190248
LHP79	LHA127	PW	7029-2579	159889	LH	RC	LOX	462355	6190409
LHP80	LHA103	PW	7029-2580	156599	LH	RC	LOX	463315	6194465

LHP81	LHA128	PW	7029-2581	156604	LH	RC	LOX	462318	6190248
LHP82	LHA104	PW	7029-2582	156607	LH	RC	LOX	462355	6190409
LPW19	LFA40	PW	7029-2457	162582	LF	TF	MON	463315	6194465
LPW19a	LFA42	OW	7029-2583	181918	LF	TF	MON	462318	6190248

Drillhole Name	Completion Date	Natural Surface Elevn m AHD	Ref. Elevation (m AHD)	Purpose	Total Depth (mBGL)	Class 12 UPVC casing (grouted by tremie line)		Production Zone							Sump Length (m)	*Equiv. DTW (m AHD)*	Salinity (mg/L)
						Depth (m)	*ID (mm)*	*Type*	*Top (m)*	*Base (m)*	*Screen ID (mm)*	*Screen aperture (mm)*	*Open Area (%)*	*Gravel pack*			
LHO70	23/05/2008	31.566	32.388	OW	26.5	16.50	79.0	SC	16.5	25.5	79.0	1.0	5.0%	8:16	1.00	12.44	13,175
LHO71P	20/05/2008	31.806	32.620	OW	50.0	42.00	100.0	OH	-	-	-	-	-	-	-	12.25	30,708
LHO72P	8/04/2008	32.360	33.233	OW	53.0	43.00	100.0	OH	-	-	-	-	-	-	-	14.85	28,670
LHO73P	10/05/2008	32.243	32.430	OW	50.0	43.00	203.5	OH	-	-	-	-	-	-	-	16.10	27,831
LHO74	21/04/2008	32.411	32.907	OW	27.5	17.50	79.0	SC	17.5	26.5	79.0	1.0	5.0%	8:16	1.00	16.88	14,036
LHO75	21/04/2008	32.220	32.788	OW	27.5	17.50	79.0	SC	17.5	26.5	79.0	1.0	5.0%	8:16	1.00	16.58	13,348
LHO76P	16/05/2008	32.025	32.700	OW	51.0	42.00	100.0	OH	-	-	-	-	-	-	-	16.50	28,798
LHO77P	3/06/2008	33.319	34.533	OW	53.0	43.00	100.0	OH	-	-	-	-	-	-	-	15.08	30,273
LHO78	20/04/2008	33.325	34.352	OW	29.0	19.00	79.0	SC	19	28	79.0	1.0	5.0%	8:16	1.00	16.89	16,177
LHO79	18/04/2008	31.188	32.310	OW	29.0	20.00	79.0	SC	20	28	79.0	1.0	5.0%	8:16	1.00	-	9,860
LHO80	22/04/2008	31.998	32.026	OW	27.0	17.00	79.0	SC	17	26	79.0	1.0	5.0%	8:16	1.00	-	11,910
LHO81	23/04/2008	31.127	31.196	OW	25.0	16.00	79.0	SC	16	24	79.0	1.0	5.0%	8:16	1.00	-	6,774
LHO82	16/05/2008	15.943	16.804	OW	15.0	5.00	79.0	SC	5	14	79.0	1.0	5.0%	8:16	1.00	16.20	7,815
LHO83P	16/05/2008	15.943	16.815	OW	31.0	24.50	100.0	OH	-	-	-	-	-	-	-	16.82	27,767
LHO84P	8/05/2008	14.001	14.474	OW	29.0	23.50	100.0	OH	-	-	-	-	-	-	-	11.68	28,927
LHO85	18/11/2008	32.656	33.001	OW	33.0	20.00	125.0	SC	20	30	125.0	1.0	5.0%	8:16	3.00	16.63	13,827
LHO86	18/11/2008	32.756	33.042	OW	33.0	20.00	125.0	SC	20	30	125.0	1.0	5.0%	8:16	3.00	16.62	16,902
LHO87	30/10/2009	33.535	33.543	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.54	11,765
LHO88	3/11/2009	32.517	32.605	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.21	11,121
LHO89	4/11/2009	31.723	31.780	OW	28.00	17.00	79.0	SC	17	27	79.0	1.0	5.0%	8:16	1.00	16.16	11,676
LHO90	6/11/2009	31.139	31.161	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	16.50	14,656
LHO91	7/11/2009	30.950	30.973	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.81	17,448
LHO92	9/11/2009	30.941	30.977	OW	26.00	15.00	79.0	SC	15	25	79.0	1.0	5.0%	8:16	1.00	15.76	21,440
LHO93	9/11/2009	31.106	31.131	OW	26.00	15.00	79.0	SC	15	25	79.0	1.0	5.0%	8:16	1.00	16.38	17,296
LHO94	10/11/2009	31.863	31.879	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	14.86	22,645

LHO95	3/12/2009	43.649	43.701	OW	37.00	26.00	79.0	SC	26	36	79.0	1.0	5.0%	8:16	1.00	17.80	23,637
LHO96	4/12/2009	42.862	42.959	OW	34.50	23.50	79.0	SC	23.5	33.5	79.0	1.0	5.0%	8:16	1.00	17.45	23,472
LHP50P	10/04/2008	31.657	32.310	PW	50.0	42.00	203.5	OH	-	-	-	-	-	-	-	10.94	30,773
LHP51	19/05/2008	31.787	32.141	PW	29.0	20.00	203.5	WS	20	24	203.5	1.0	20.0%	8:16	5.00	13.20	10,253
LHP52P	16/04/2008	31.983	32.334	PW	54.0	43.00	203.5	OH			-	-	-	-	-	12.99	28,927
LHP53	4/05/2008	31.864	32.226	PW	29.2	19.20	203.5	WS	19.2	24.2	203.5	1.0	20.0%	8:16	5.00	15.77	11,004
LHP54P	18/04/2008	31.739	32.238	PW	57.0	42.00	203.5	OH	-	-	-	-	-	-	-	15.11	30,643
LHP55	21/05/2008	32.238	32.599	PW	30.0	21.00	203.5	WS	21	25	203.5	1.0	20.0%	8:16	5.00	17.17	10,678
LHP56P	17/05/2008	32.725	33.063	PW	51.0	41.00	203.5	SC			-	-	-	-		15.48	28,670
LHP57	1/05/2008	32.989	33.309	PW	30.0	21.00	203.5	WS	21	25	203.5	1.0	20.0%	8:16	5.00	16.82	12,435
LHP58P	3/06/2008	33.150	33.385	PW	54.0	43.00	203.5	OH	-	-	-	-	-	-	-	15.15	29,295
LHP59	2/05/2008	33.319	33.720	PW	29.5	20.50	203.5	WS	20.5	24.5	203.5	1.0	20.0%	8:16	5.00	16.84	11,021
LHP60P	21/05/2008	33.386	33.748	PW	54.0	43.00	203.5	OH	-	-	-	-	-	-	-	15.49	29,102
LHP61	29/04/2008	31.730	31.862	PW	23.7	16.70	203.5	SC	16.7	22.7	203.5	1.0	5.0%	8:16	1.00	14.10	6,470
LHP62	3/05/2008	31.370	31.856	PW	23.5	16.50	203.5	SC	16.5	22.5	203.5	1.0	5.0%	8:16	1.00	18.04	4,111
LHP63	29/10/2009	33.372	33.709	PW	31.50	16.50	203.5	SC	16.5	26.5	203.5	1.0	5.0%	8:16	5.00	14.67	9,160
LHP64	1/11/2009	33.588	34.195	PW	32.70	17.70	203.5	SC	17.7	27.7	203.5	1.0	5.0%	8:16	5.00	15.89	8,673
LHP65	2/11/2009	32.932	33.313	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.43	9,428
LHP66	5/11/2009	32.039	32.414	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.54	10,831
LHP67	28/11/2009	31.381	31.698	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.56	7,771
LHP68	28/11/2009	31.302	31.711	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.75	10,019
LHP69	25/11/2009	31.157	31.487	PW	33.00	18.00	203.5	SC	18	28	203.5	1.0	5.0%	8:16	5.00	16.09	13,508
LHP70	24/11/2009	31.011	31.334	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.86	15,457
LHP71	23/11/2009	30.892	31.338	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.89	16,238
LHP72	20/11/2009	30.860	31.225	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.76	12,328
LHP73	18/11/2009	30.922	31.384	PW	31.50	16.50	203.5	SC	16.5	26.5	203.5	1.0	5.0%	8:16	5.00	15.55	12,920
LHP74	18/11/2009	31.022	31.314	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	15.49	10,719
LHP75	17/11/2009	31.272	31.662	PW	30.00	15.00	203.5	SC	15	25	203.5	1.0	5.0%	8:16	5.00	15.32	9,166
LHP76	16/11/2009	31.513	31.948	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.00	17,967
LHP77	12/11/2009	32.332	32.892	PW	32.00	15.80	203.5	SC	15.8	25.8	203.5	1.0	5.0%	8:16	5.00	14.78	13,301

LHP78	7/12/2009	42.316	42.709	PW	38.00	21.00	203.5	SC	21	33	203.5	1.0	5.0%	8:16	5.00	16.99	24,178
LHP79	5/12/2009	43.241	43.533	PW	39.00	22.00	203.5	SC	22	34	203.5	1.0	5.0%	8:16	5.00	17.41	21,440
LHP80	10/12/2009	43.772	44.275	PW	42.00	25.00	203.5	SC	25	37	203.5	1.0	5.0%	8:16	5.00	17.97	15,310
LHP81	11/12/2009	42.752	43.235	PW	38.00	21.00	203.5	SC	21	33	203.5	1.0	5.0%	8:16	5.00	17.78	18,119
LHP82	14/12/2009	42.820	43.331	PW	40.00	23.00	203.5	SC	23	35	203.5	1.0	5.0%	8:16	5.00	17.98	8,147
LPW19	15/04/2009	13.980	-	PW	13.0	8.00	203.5	SC	8	12	203.5	1.0	5.0%	8:16	1.00	12.50	40,950
LPW19a	16/12/2009	14.044	14.298	OW	13.50	6.00	203.5	SC	6	8.5	203.5	1.0	5.0%	8:16	5.00	12.20	14,271

FINAL HIGHLAND OPERATIONAL WELLFIELD AS CONSTRUCTED DRILLING SCHEDULE

Drillhole Name	Completion Date	Natural Surface Elevn m AHD	Ref. Elevation (m AHD)	Purpose	Total Depth (mBGL)	Class 12 UPVC casing (grouted by tremie line)		Production Zone							Sump Length (m)	Equiv. DTW (m AHD)	Salinity (mg/L)
						Depth (m)	*ID (mm)*	*Type*	*Top (m)*	*Base (m)*	*Screen ID (mm)*	*Screen aperture (mm)*	*Open Area (%)*	*Gravel pack*			
LHO70	23/05/2008	31.566	32.388	OW	26.5	16.50	79.0	SC	16.5	25.5	79.0	1.0	5.0%	8:16	1.00	12.44	13,175
LHO74	21/04/2008	32.411	32.907	OW	27.5	17.50	79.0	SC	17.5	26.5	79.0	1.0	5.0%	8:16	1.00	16.88	14,036
LHO75	21/04/2008	32.220	32.788	OW	27.5	17.50	79.0	SC	17.5	26.5	79.0	1.0	5.0%	8:16	1.00	16.58	13,348
LHO78	20/04/2008	33.325	34.352	OW	29.0	19.00	79.0	SC	19	28	79.0	1.0	5.0%	8:16	1.00	16.89	16,177
LHO79	18/04/2008	31.188	32.310	OW	29.0	20.00	79.0	SC	20	28	79.0	1.0	5.0%	8:16	1.00	-	9,860
LHO80	22/04/2008	31.998	32.026	OW	27.0	17.00	79.0	SC	17	26	79.0	1.0	5.0%	8:16	1.00	-	11,910
LHO81	23/04/2008	31.127	31.196	OW	25.0	16.00	79.0	SC	16	24	79.0	1.0	5.0%	8:16	1.00	-	6,774
LHO82	16/05/2008	15.943	16.804	OW	15.0	5.00	79.0	SC	5	14	79.0	1.0	5.0%	8:16	1.00	16.20	7,815
LHO85	18/11/2008	32.656	33.001	OW	33.0	20.00	125.0	SC	20	30	125.0	1.0	5.0%	8:16	3.00	16.63	13,827
LHO86	18/11/2008	32.756	33.042	OW	33.0	20.00	125.0	SC	20	30	125.0	1.0	5.0%	8:16	3.00	16.62	16,902
LHO87	30/10/2009	33.535	33.543	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.54	11,765
LHO88	3/11/2009	32.517	32.605	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.21	11,121
LHO89	4/11/2009	31.723	31.780	OW	28.00	17.00	79.0	SC	17	27	79.0	1.0	5.0%	8:16	1.00	16.16	11,676
LHO90	6/11/2009	31.139	31.161	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	16.50	14,656
LHO91	7/11/2009	30.950	30.973	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	15.81	17,448
LHO92	9/11/2009	30.941	30.977	OW	26.00	15.00	79.0	SC	15	25	79.0	1.0	5.0%	8:16	1.00	15.76	21,440
LHO93	9/11/2009	31.106	31.131	OW	26.00	15.00	79.0	SC	15	25	79.0	1.0	5.0%	8:16	1.00	16.38	17,296
LHO94	10/11/2009	31.863	31.879	OW	27.00	16.00	79.0	SC	16	26	79.0	1.0	5.0%	8:16	1.00	14.86	22,645
LHO95	3/12/2009	43.649	43.701	OW	37.00	26.00	79.0	SC	26	36	79.0	1.0	5.0%	8:16	1.00	17.80	23,637
LHO96	4/12/2009	42.862	42.959	OW	34.50	23.50	79.0	SC	23.5	33.5	79.0	1.0	5.0%	8:16	1.00	17.45	23,472
LHP51	19/05/2008	31.787	32.141	PW	29.0	20.00	203.5	WS	20	24	203.5	1.0	20.0%	8:16	5.00	13.20	10,253
LHP53	4/05/2008	31.864	32.226	PW	29.2	19.20	203.5	WS	19.2	24.2	203.5	1.0	20.0%	8:16	5.00	15.77	11,004
LHP55	21/05/2008	32.238	32.599	PW	30.0	21.00	203.5	WS	21	25	203.5	1.0	20.0%	8:16	5.00	17.17	10,678
LHP57	1/05/2008	32.989	33.309	PW	30.0	21.00	203.5	WS	21	25	203.5	1.0	20.0%	8:16	5.00	16.82	12,435

LHP59	2/05/2008	33.319	33.720	PW	29.5	20.50	203.5	WS	20.5	24.5	203.5	1.0	20.0%	8:16	5.00	16.84	11,021
LHP62	3/05/2008	31.370	31.856	PW	23.5	16.50	203.5	SC	16.5	22.5	203.5	1.0	5.0%	8:16	1.00	18.04	4,111
LHP63	29/10/2009	33.372	33.709	PW	31.50	16.50	203.5	SC	16.5	26.5	203.5	1.0	5.0%	8:16	5.00	14.67	9,160
LHP64	1/11/2009	33.588	34.195	PW	32.70	17.70	203.5	SC	17.7	27.7	203.5	1.0	5.0%	8:16	5.00	15.89	8,673
LHP65	2/11/2009	32.932	33.313	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.43	9,428
LHP66	5/11/2009	32.039	32.414	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.54	10,831
LHP67	28/11/2009	31.381	31.698	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.56	7,771
LHP68	28/11/2009	31.302	31.711	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	16.75	10,019
LHP69	25/11/2009	31.157	31.487	PW	33.00	18.00	203.5	SC	18	28	203.5	1.0	5.0%	8:16	5.00	16.09	13,508
LHP70	24/11/2009	31.011	31.334	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.86	15,457
LHP71	23/11/2009	30.892	31.338	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.89	16,238
LHP72	20/11/2009	30.860	31.225	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.76	12,328
LHP73	18/11/2009	30.922	31.384	PW	31.50	16.50	203.5	SC	16.5	26.5	203.5	1.0	5.0%	8:16	5.00	15.55	12,920
LHP74	18/11/2009	31.022	31.314	PW	32.00	17.00	203.5	SC	17	27	203.5	1.0	5.0%	8:16	5.00	15.49	10,719
LHP75	17/11/2009	31.272	31.662	PW	30.00	15.00	203.5	SC	15	25	203.5	1.0	5.0%	8:16	5.00	15.32	9,166
LHP76	16/11/2009	31.513	31.948	PW	31.00	16.00	203.5	SC	16	26	203.5	1.0	5.0%	8:16	5.00	15.00	17,967
LHP77	12/11/2009	32.332	32.892	PW	32.00	15.80	203.5	SC	15.8	25.8	203.5	1.0	5.0%	8:16	5.00	14.78	13,301
LHP78	7/12/2009	42.316	42.709	PW	38.00	21.00	203.5	SC	21	33	203.5	1.0	5.0%	8:16	5.00	16.99	24,178
LHP79	5/12/2009	43.241	43.533	PW	39.00	22.00	203.5	SC	22	34	203.5	1.0	5.0%	8:16	5.00	17.41	21,440
LHP80	10/12/2009	43.772	44.275	PW	42.00	25.00	203.5	SC	25	37	203.5	1.0	5.0%	8:16	5.00	17.97	15,310
LHP81	11/12/2009	42.752	43.235	PW	38.00	21.00	203.5	SC	21	33	203.5	1.0	5.0%	8:16	5.00	17.78	18,119
LHP82	14/12/2009	42.820	43.331	PW	40.00	23.00	203.5	SC	23	35	203.5	1.0	5.0%	8:16	5.00	17.98	8,147

C. GEOLOGICAL LOGS

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2425 **Permit Number:** 156602 **Region:** Loxton

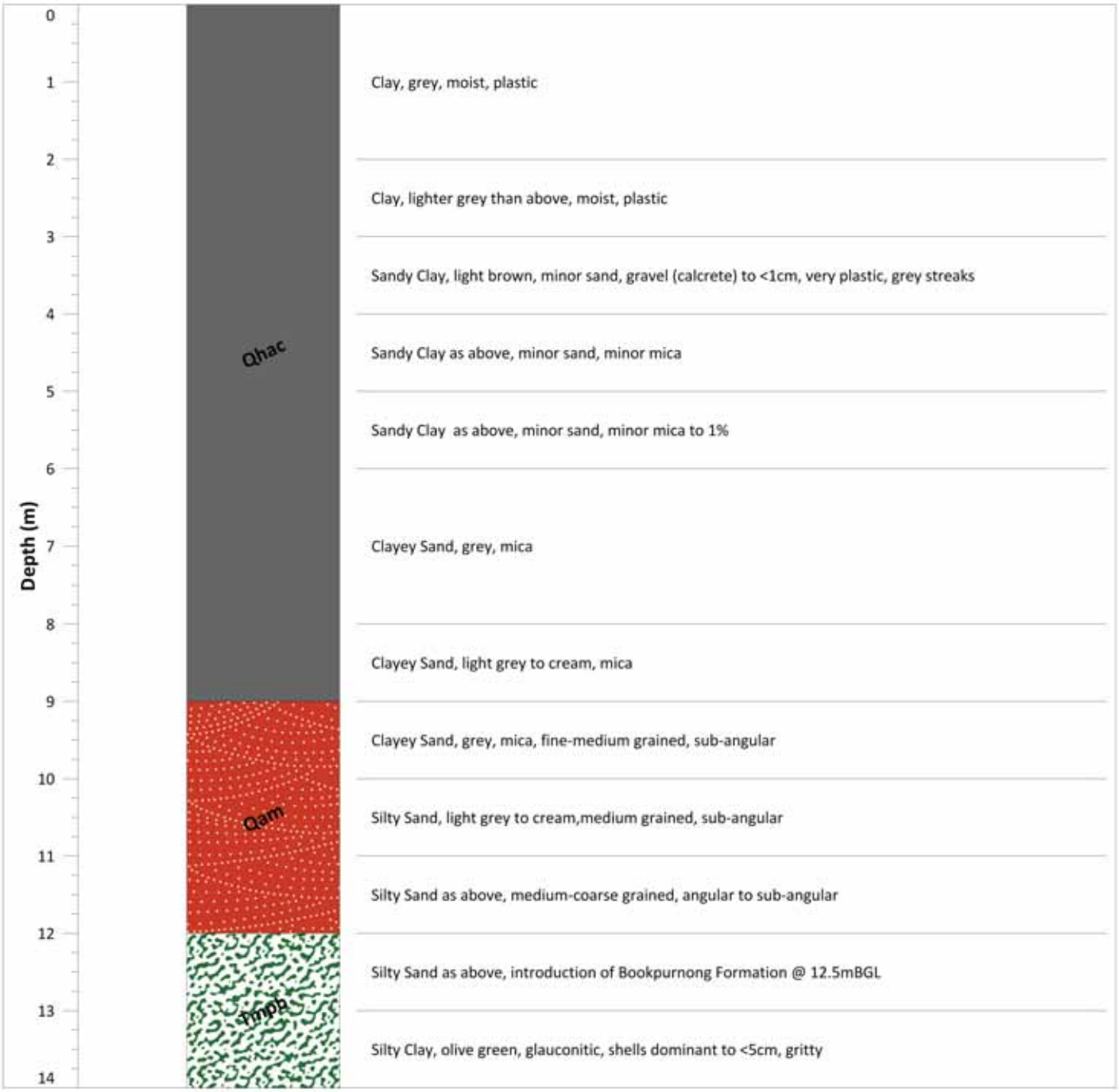
Completion Date: 12/08/08 **NS Elevation (mAHD):** 12.52 **Final Depth (m):** 14

Easting: 462314.223 **Zone:** 54 **Northing:** 6190250.337 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA40**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2426 **Permit Number:** 156601 **Region:** Loxton

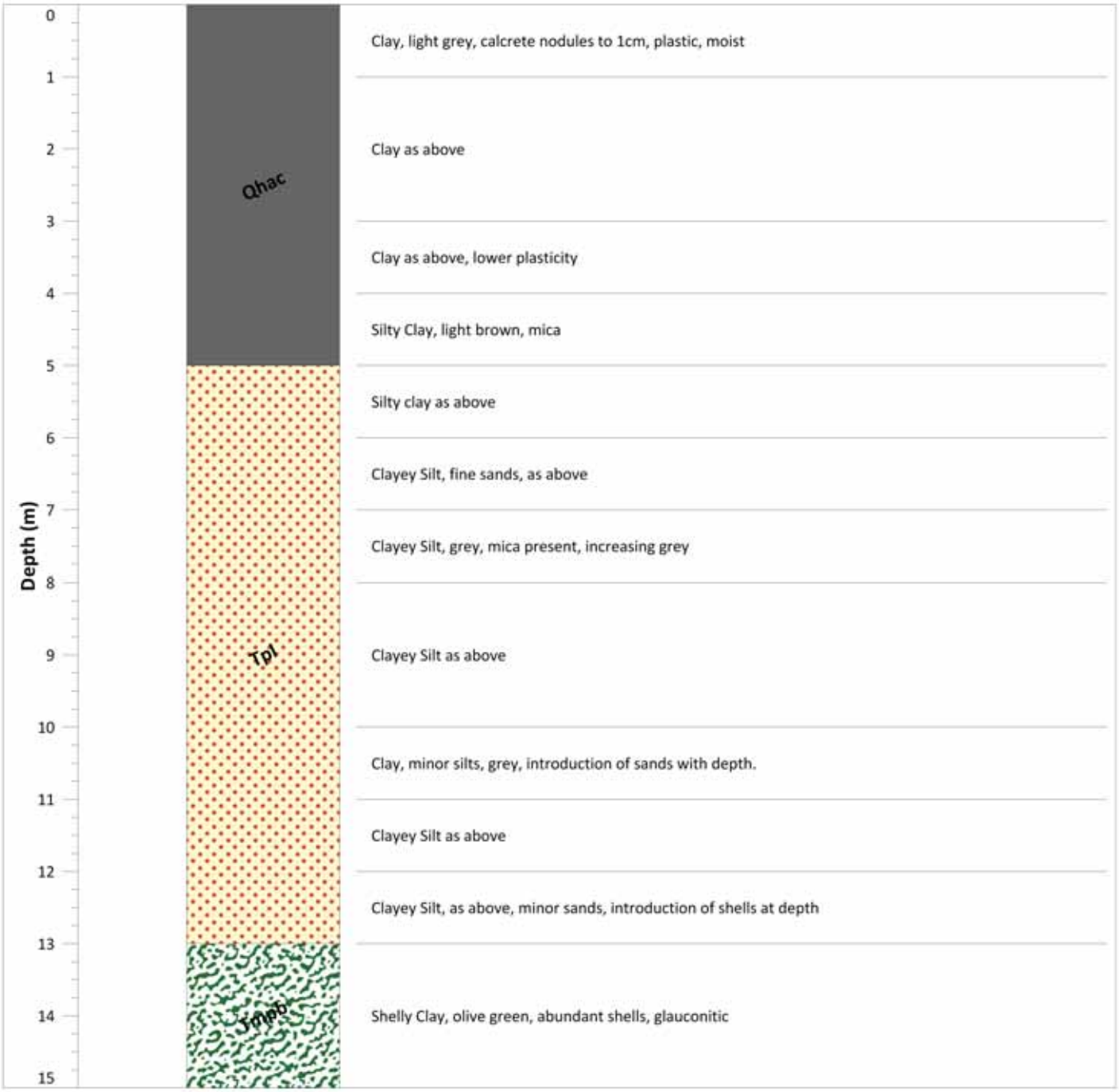
Completion Date: 12/08/08 **NS Elevation (mAHD):** 13.01 **Final Depth (m):** 15

Easting: 462331.135 **Zone:** 54 **Northing:** 6190307.642 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA41**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2427 **Permit Number:** 156600 **Region:** Loxton

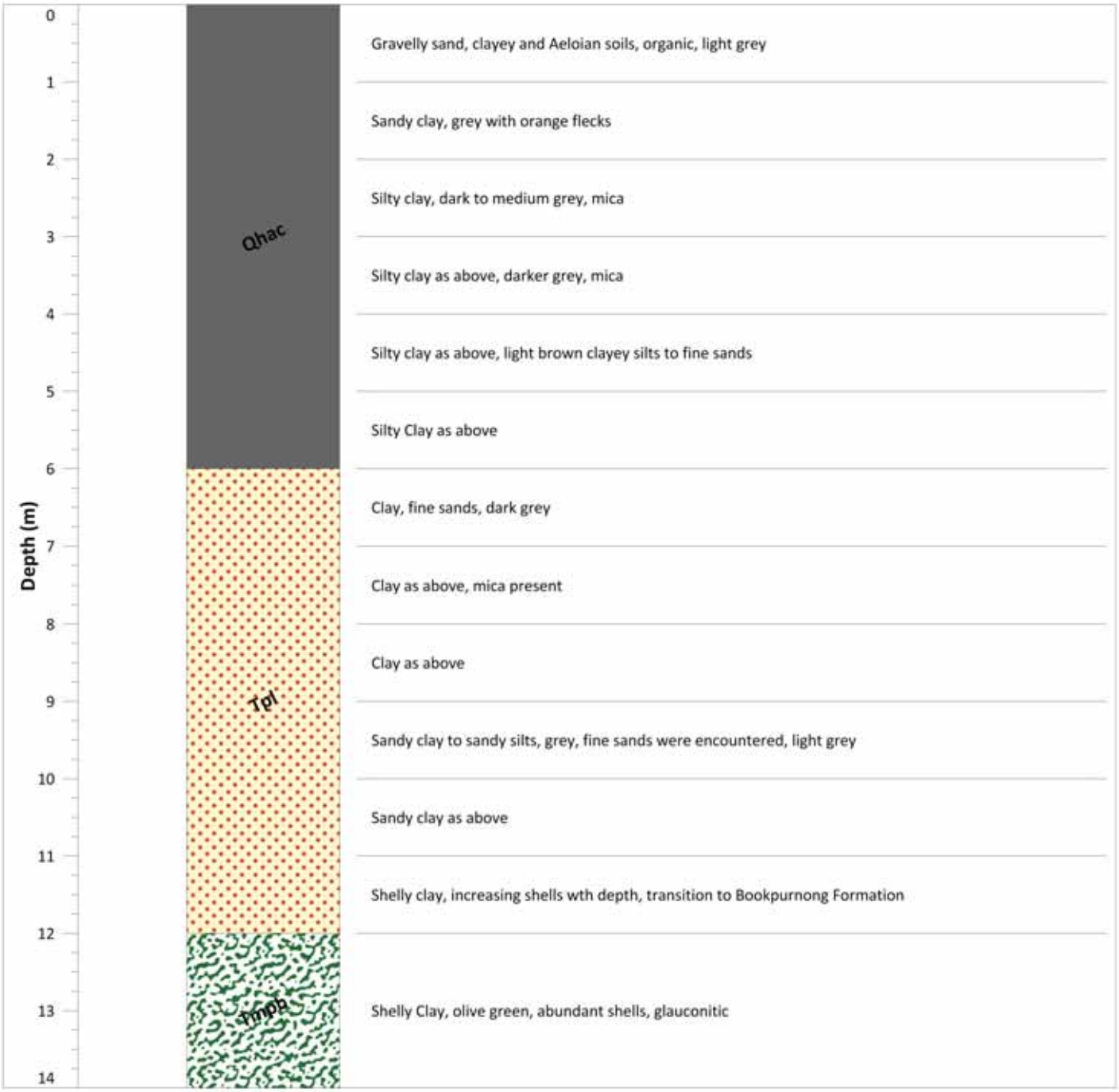
Completion Date: 12/08/08 **NS Elevation (mAHD):** 13.04 **Final Depth (m):** 14

Easting: 462344.32 **Zone:** 54 **Northing:** 6190364.362 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA42**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2428 **Permit Number:** 156619 **Region:** Loxton

Completion Date: 12/09/08 **NS Elevation (mAHD):** 13.99 **Final Depth (m):** 14

Easting: 462355.394 **Zone:** 54 **Northing:** 6190409.61 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA43**

mBGL	WELL CONSTRUCTION	HYDROSTRATIGRAPHIC LOG	LITHOLOGICAL DESCRIPTION
0			No Sample Obtained
1			Sandy Clay, dark grey, plastic, medium grained sands
2			Sand, light grey, medium to coarse, sub-rounded
3		Qhac	Clayey Sand, grey to quartz, calcrete to <5cm, low plasticity, overall grey to brown
4			Clayey Sand, decreasing sand content, decreasing calcrete, as bove
5			Silty sand to Silty clay as above, light grey to light brown
6			Sand, orange, very moist, fine to medium grained sands
7			Silty sand as above, introductio of dark grey clay, minor shells
8			Silty Clay to Silt, grey, grading to sands, orange streaks, minor shells
9		Tpl	Sandy Clay as above, light grey sands
10			Sandy Clay as above
11			Silty Clay minor sands, trending towards hard silty clay
12			Silty Clay as above, minor shells encountered
13		Tmpb	Shelly silty clay, dark olive green, shells
14			

Depth (m)

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2429 **Permit Number:** 156605 **Region:** Loxton

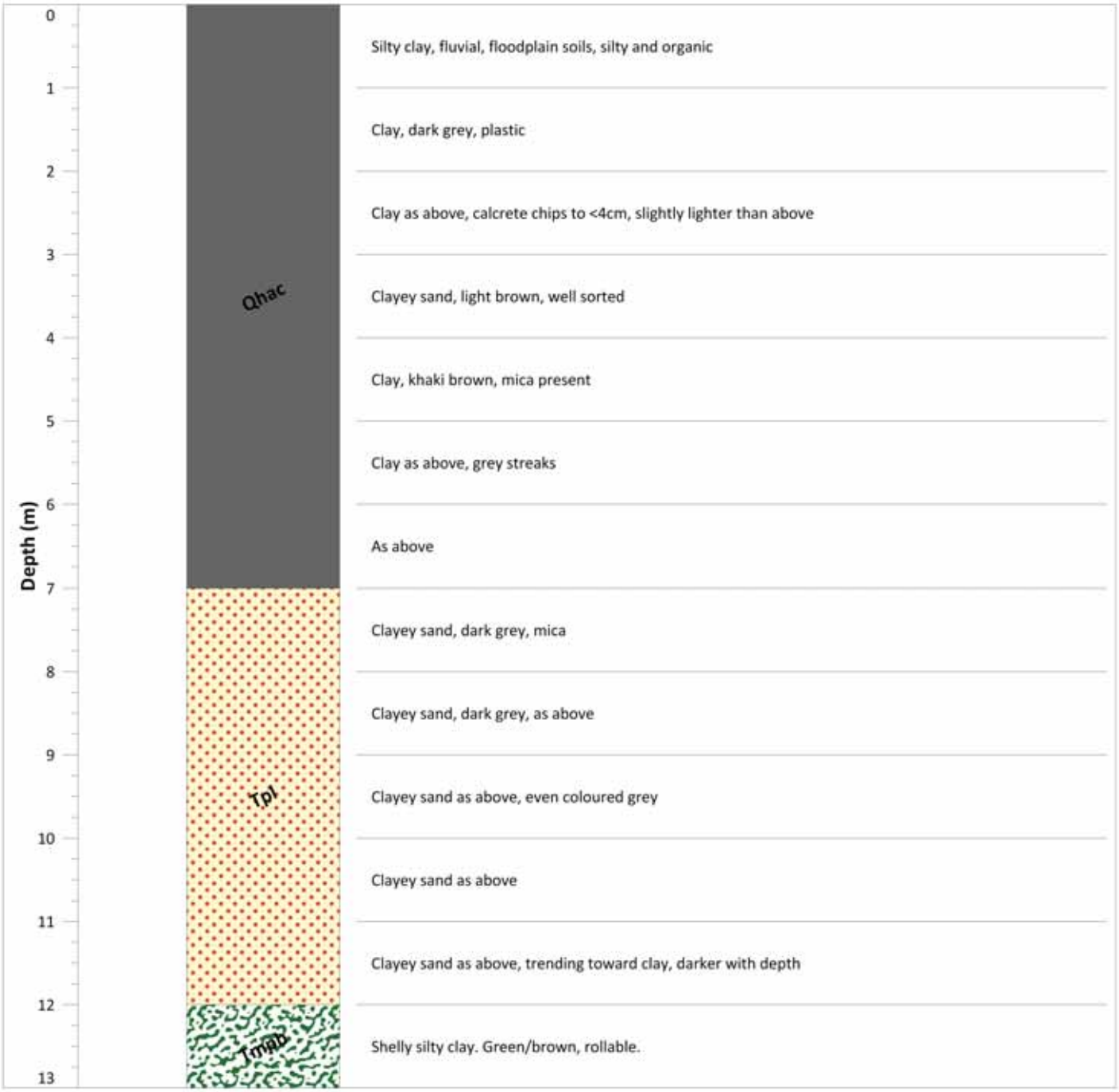
Completion Date: 12/09/08 **NS Elevation (mAHD):** 12.46 **Final Depth (m):** 13

Easting: 462326.386 **Zone:** 54 **Northing:** 6190459.112 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA44**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2444 **Permit Number:** 156618 **Region:** Loxton

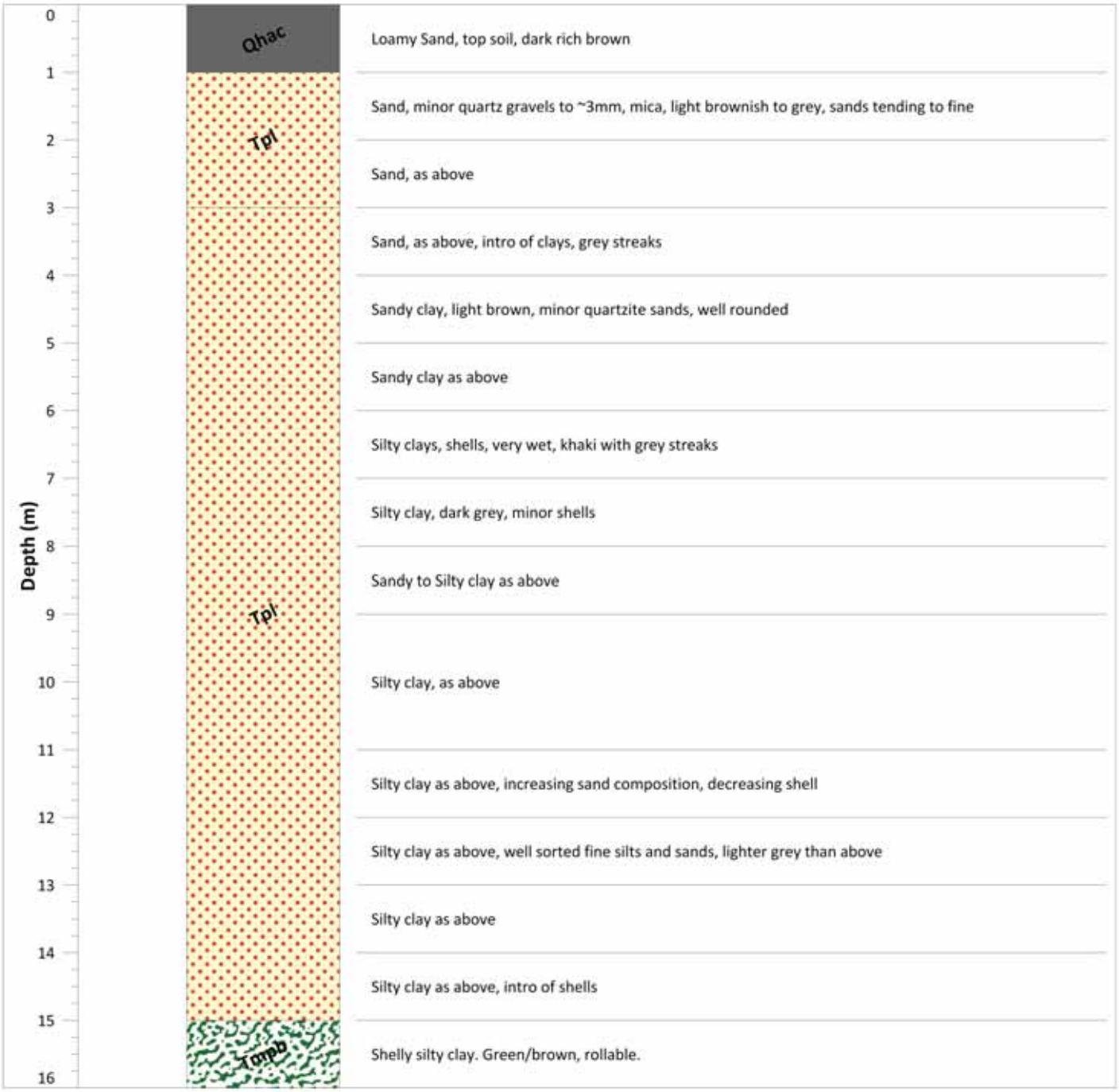
Completion Date: 12/09/08 **NS Elevation (mAHD):** 16.66 **Final Depth (m):** 16

Easting: 462387.963 **Zone:** 54 **Northing:** 6190453.574 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA45**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2431 **Permit Number:** 156603 **Region:** Loxton

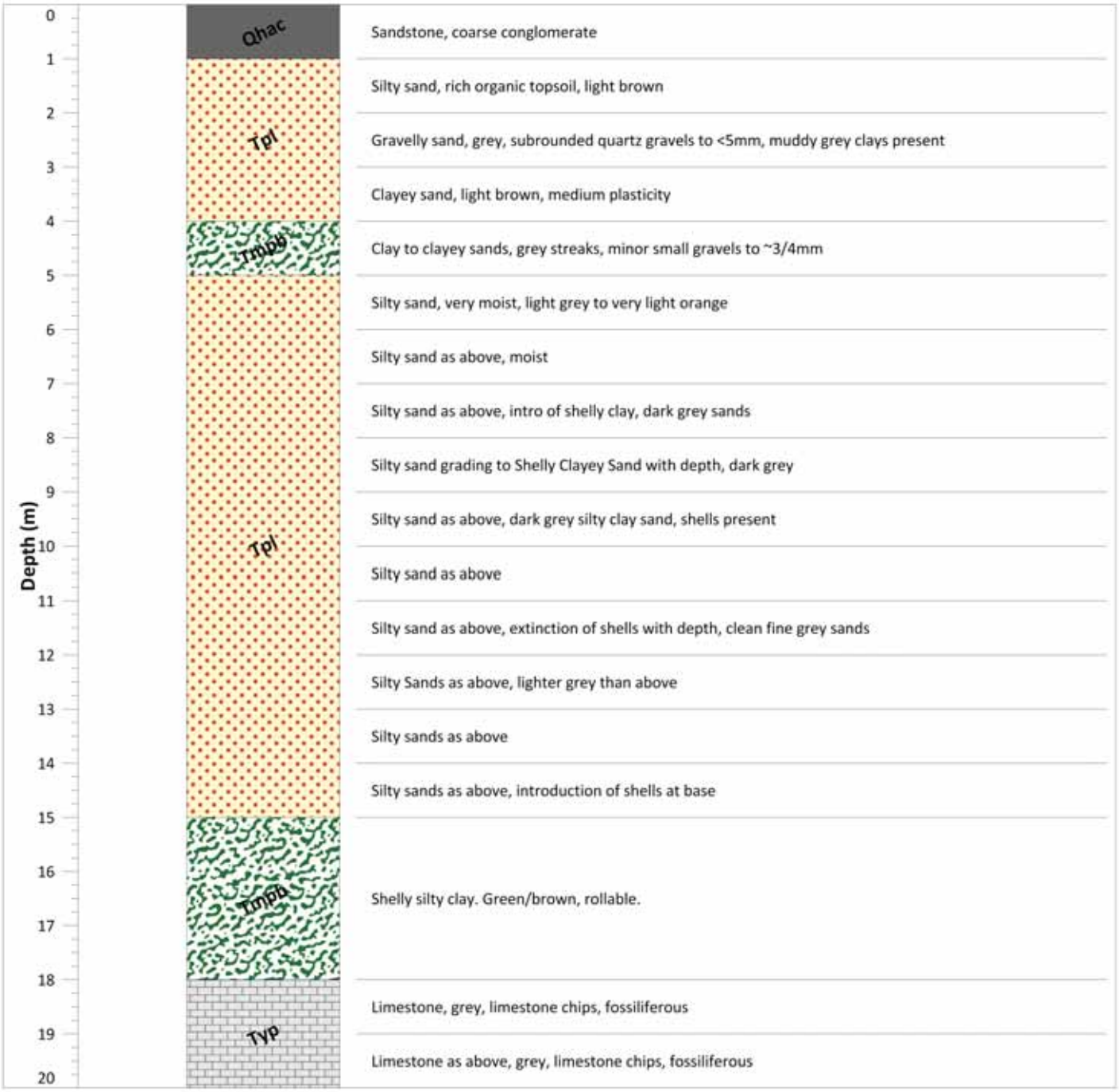
Completion Date: 12/09/08 **NS Elevation (mAHD):** 15.48 **Final Depth (m):** 20

Easting: 462388.938 **Zone:** 54 **Northing:** 6190372.076 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA46**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2529 **Permit Number:** 181918 **Region:** Loxton

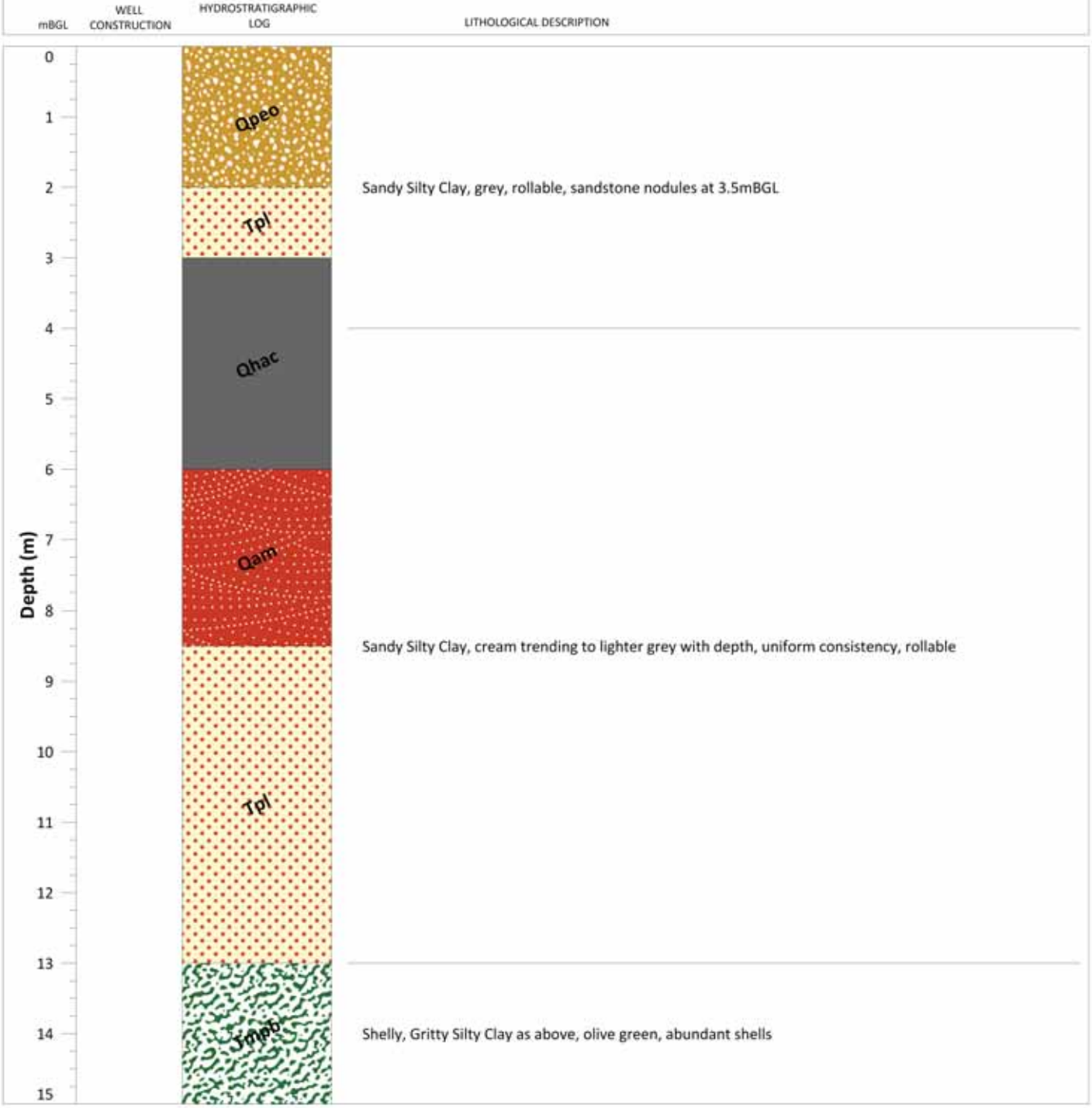
Completion Date: 10/15/09 **NS Elevation (mAHD):** 13.01 **Final Depth (m):** 15

Easting: 462360.77 **Zone:** 54 **Northing:** 6190331.39 **Site ID:** LF---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LFA47**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2340 **Permit Number:** 141930 **Region:** Loxton

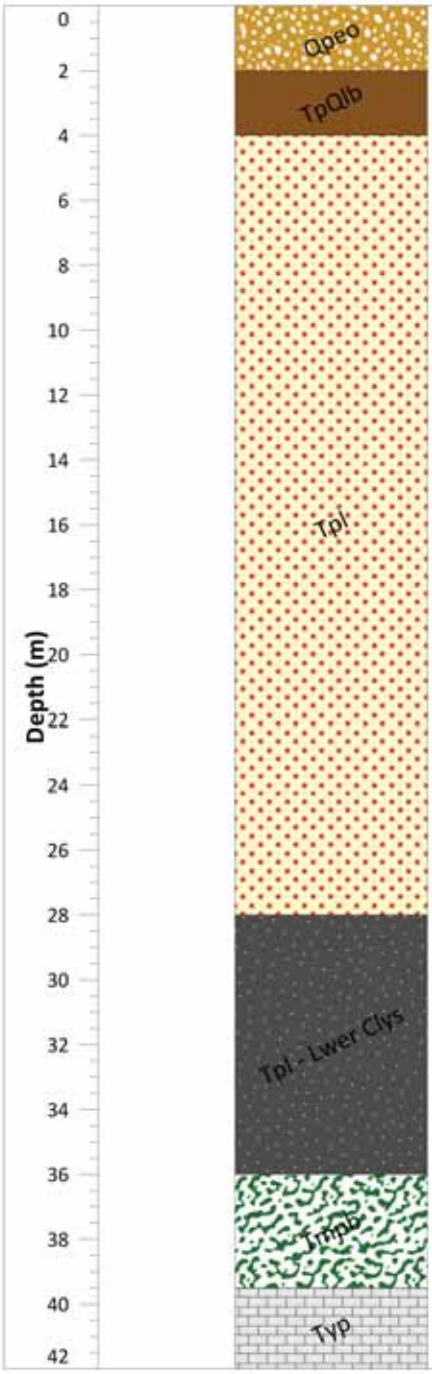
Completion Date: 3/28/08 **NS Elevation (mAHD):** 31.864 **Final Depth (m):** 42

Easting: 462613 **Zone:** 54 **Northing:** 6191579 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA72



LITHOLOGICAL DESCRIPTION

- Sand. Red/brown sand with significant (~50%) calcrete content.
- Sandy clay. Dense, rollable red/brown clay. Fine to medium sand becoming abundant towards end of sample.
- Gravely sand. Clear to yellow quartz sand and gravel to 3mm. Poor to moderately sorted, subrounded.
- Gravely sand as above with introduction of fine to medium orange quartz sand.
- Sand. Predominantly medium to coarse grained with minor gravel to 2.5mm. Poor to moderately sorted, subrounded, orange/yellow.
- Sand. Fine to medium grained orange/yellow sand with minor coarse sand to 2mm. Moderately sorted, subrounded.
- Sand. Fine to medium quartz sand to 0.5mm. Moderately sorted with clear to yellow/orange grains, subrounded, minor muscovite.
- Fine to medium sand as above. Minor opaques and muscovite. Minor gravel to 4mm.
- Sand. Fine grained quartz sand. Opaques and muscovite present. Moderate to well sorted. Thin hard calcrete layer ~19.5m.
- Silty sand. Predominately fine grained quartz sand to 0.2mm. Orange silt. Introduction of shell fragments ~22.5m,
- Shelly sand. Predominately medium to coarse quartz sand to 2mm. Poorly sorted with abundant fine sand and minor gravel to 3mm. Yellow/orange subrounded grains. Shell fragments.
- Sand. Fine quartz sand. Yellow/orange, subrounded, opaques present.
- Sand as above becoming silty.
- Silty sand. Fine grained sand, grey silt. Minor shell fragments and opaques.
- Silty sand as above becoming clayey.
- Silty, sandy clay. Low density, minor shell fragments.
- Silty clay. Medium density, pliable, rollable.
- Shelly silty clay. Green/brown, rollable.
- Clay. Grey, pliable, low density, shell fragments.
- Grey silty clay turning to Limestone. Friable limestone chips

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2339 **Permit Number:** 141937 **Region:** Loxton

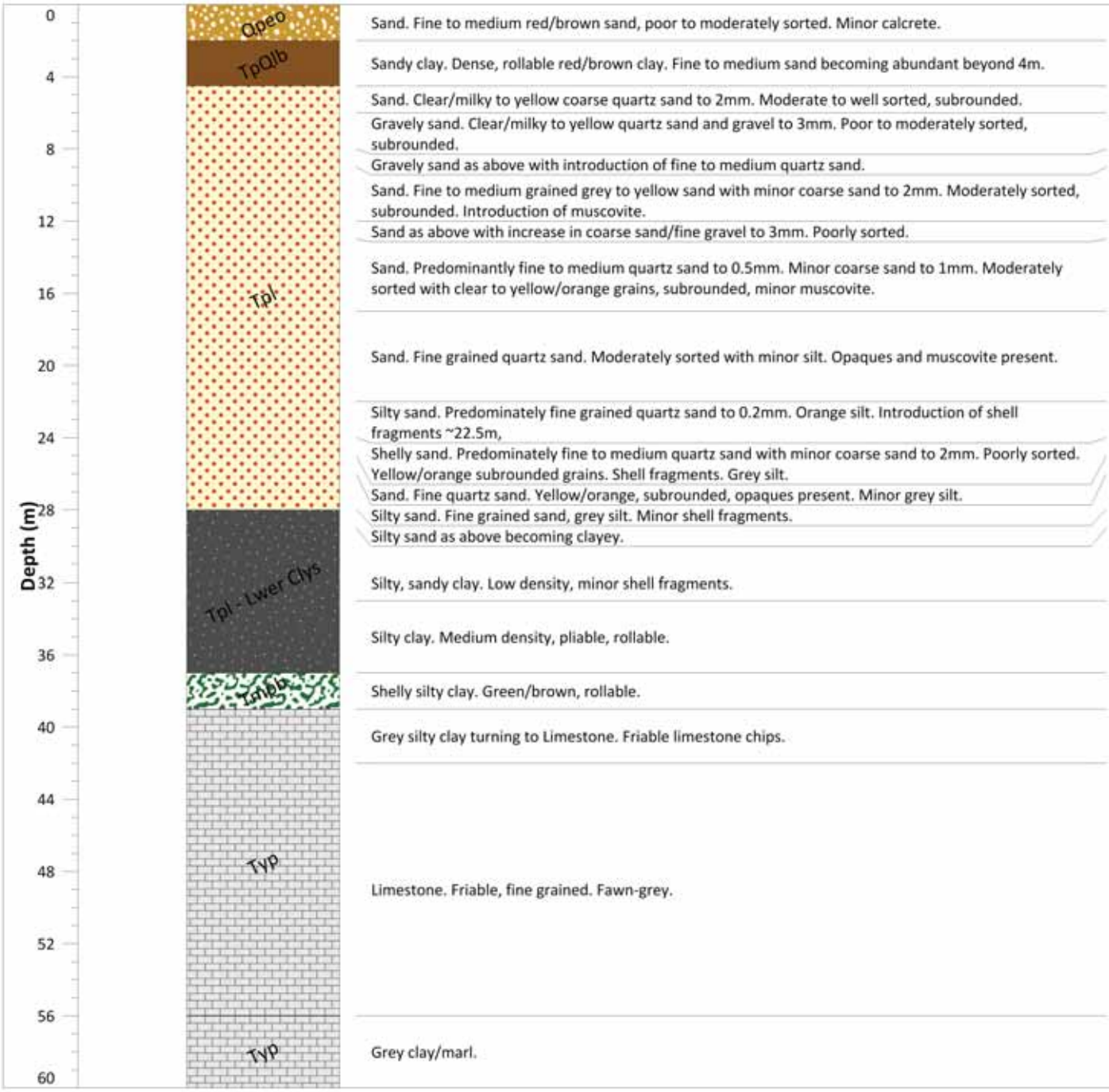
Completion Date: 3/27/08 **NS Elevation (mAHD):** 32.238 **Final Depth (m):** 60

Easting: 462617 **Zone:** 54 **Northing:** 6191628.549 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA73



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2341 **Permit Number:** 141938 **Region:** Loxton

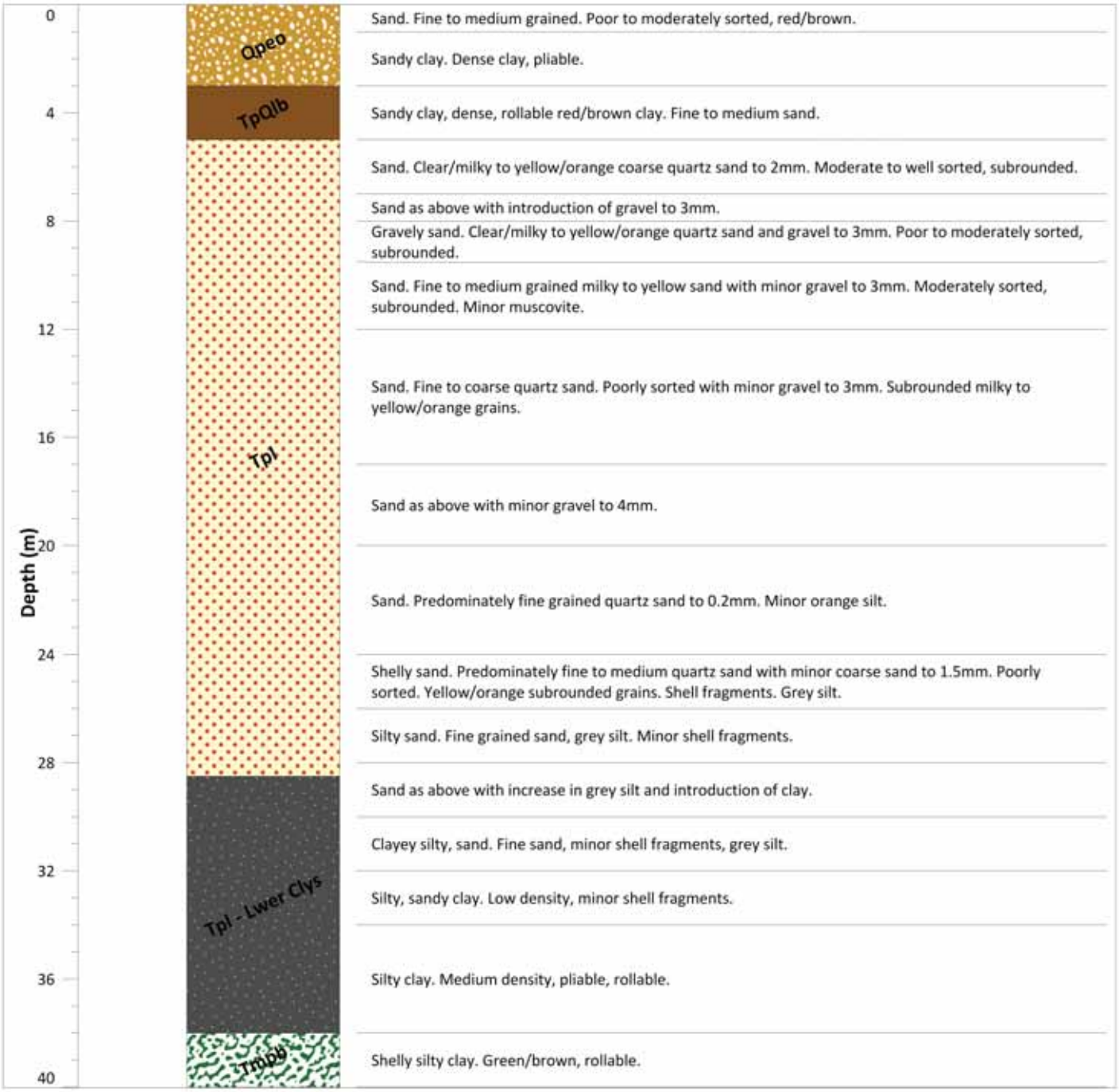
Completion Date: 3/28/08 **NS Elevation (mAHD):** 32.989 **Final Depth (m):** 42

Easting: 462635 **Zone:** 54 **Northing:** 6191679 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA74



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2338 **Permit Number:** 141946 **Region:** Loxton

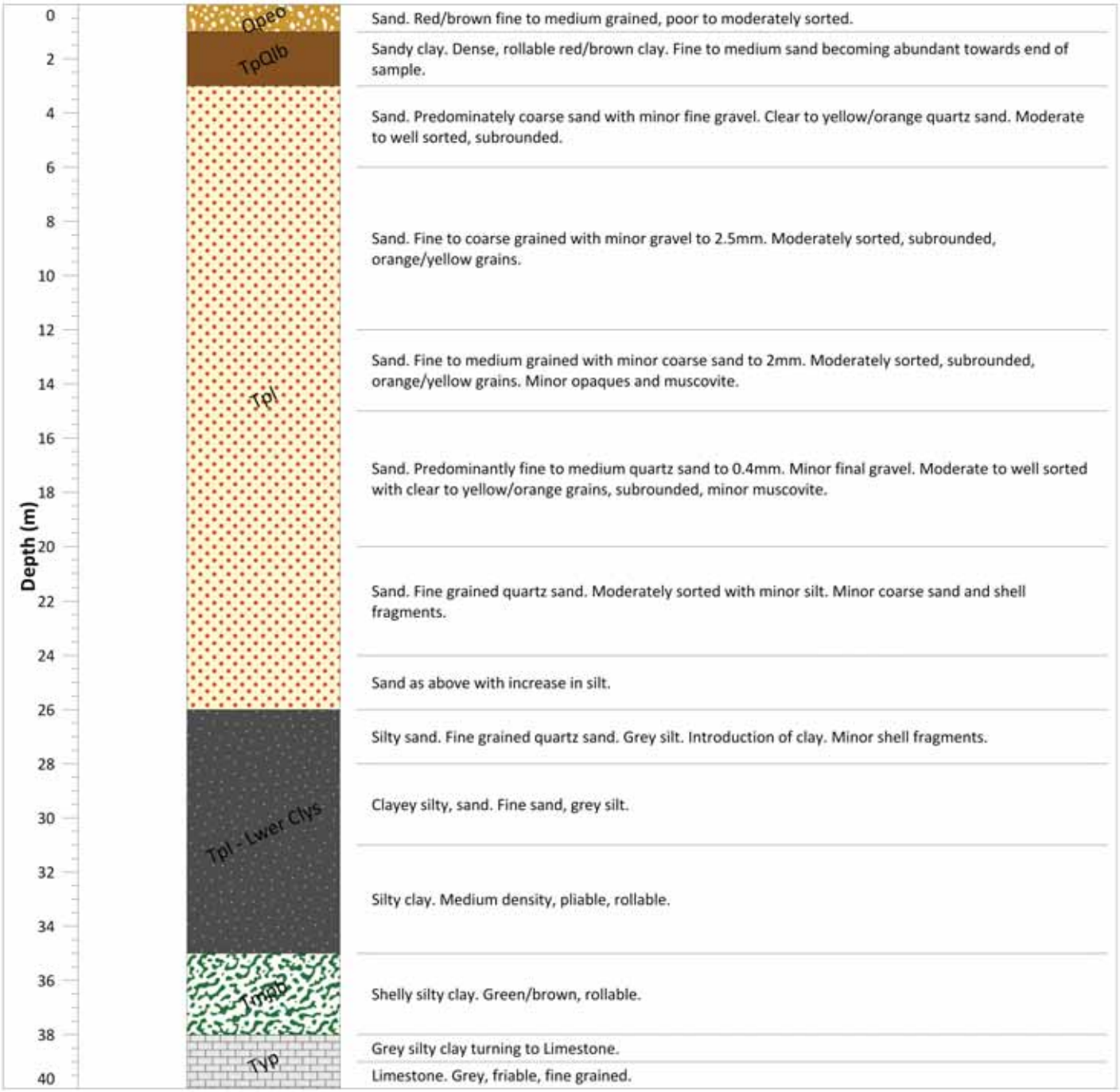
Completion Date: 3/27/08 **NS Elevation (mAHD):** 30.627 **Final Depth (m):** 40

Easting: 462558.451 **Zone:** 54 **Northing:** 6191628.689 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA75



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2342 **Permit Number:** 141951 **Region:** Loxton

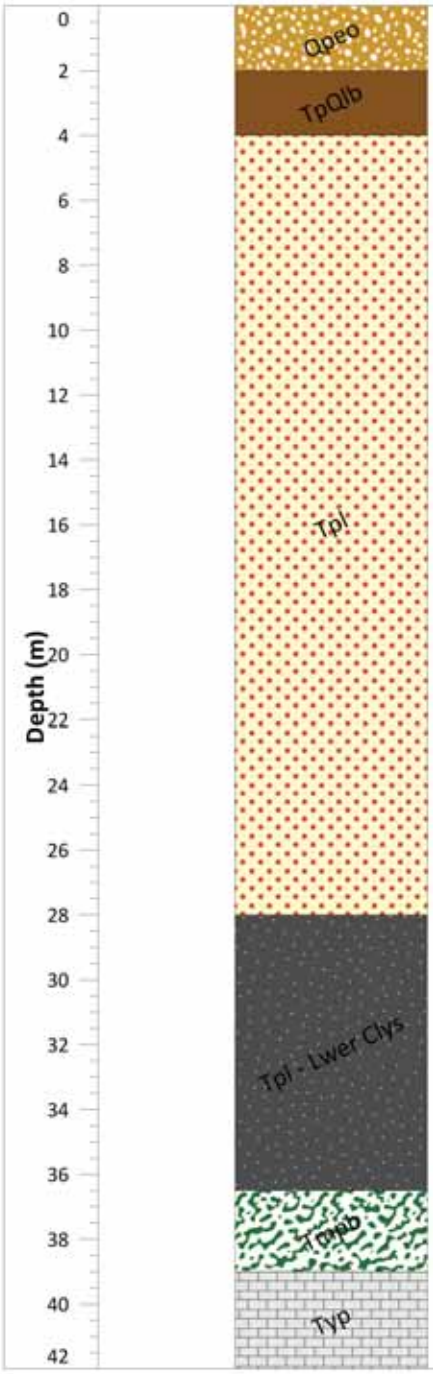
Completion Date: 3/28/08 **NS Elevation (mAHD):** 31.466 **Final Depth (m):** 42

Easting: 462666.094 **Zone:** 54 **Northing:** 6191324.017 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA76



LITHOLOGICAL DESCRIPTION
Sand. Fine to coarse quartz sand. Poorly sorted, subangular to subrounded. Calcrete fragments, rock fragments.
Sand. Fine to medium quartz sand. Red/brown silt. Minor calcrete and rock fragments.
Sand. Medium to coarse sand to 1.5mm. Clear to yellow/orange quartz sand. Moderate to well sorted, subrounded.
Sand as above with introduction of fine gravel to 3mm.
Gravely sand. Milky to yellow/orange quartz medium to coarse sand/gravel to 3mm. Moderately sorted, subrounded.
Sand. Fine to medium grained with minor coarse sand to 2mm. Moderately sorted, subrounded, orange/yellow grains. Minor opaques and muscovite.
Sand. Predominantly fine to medium quartz sand to 0.3mm. Moderate to well sorted with clear to yellow/orange grains, subrounded, minor muscovite.
Silty sand. Fine quartz sand to 0.2mm. Moderately sorted clear to yellow/orange grains, subrounded, minor muscovite. Grey silt.
Sand. Predominately fine to medium quartz sand with minor coarse sand to 1.2mm. Moderately sorted. Yellow/orange subrounded grains. Shell fragments reducing with depth. Grey silt.
Silty sand. Fine quartz sand to 0.2mm. Moderately sorted clear/yellow to grey grains, subrounded. Increasing grey silt. Minor shell fragments 25 to 27m.
Silty sand. Fine grained quartz sand. Grey silt. Introduction of clay.
Clayey silty, sand. Fine sand, grey silt.
Silty clay. Medium density, pliable, rollable.
Shelly silty clay. Green/brown, rollable.
Grey silty clay turning to limestone.
Limestone. Grey, friable, fine grained.

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2343 **Permit Number:** 141952 **Region:** Loxton

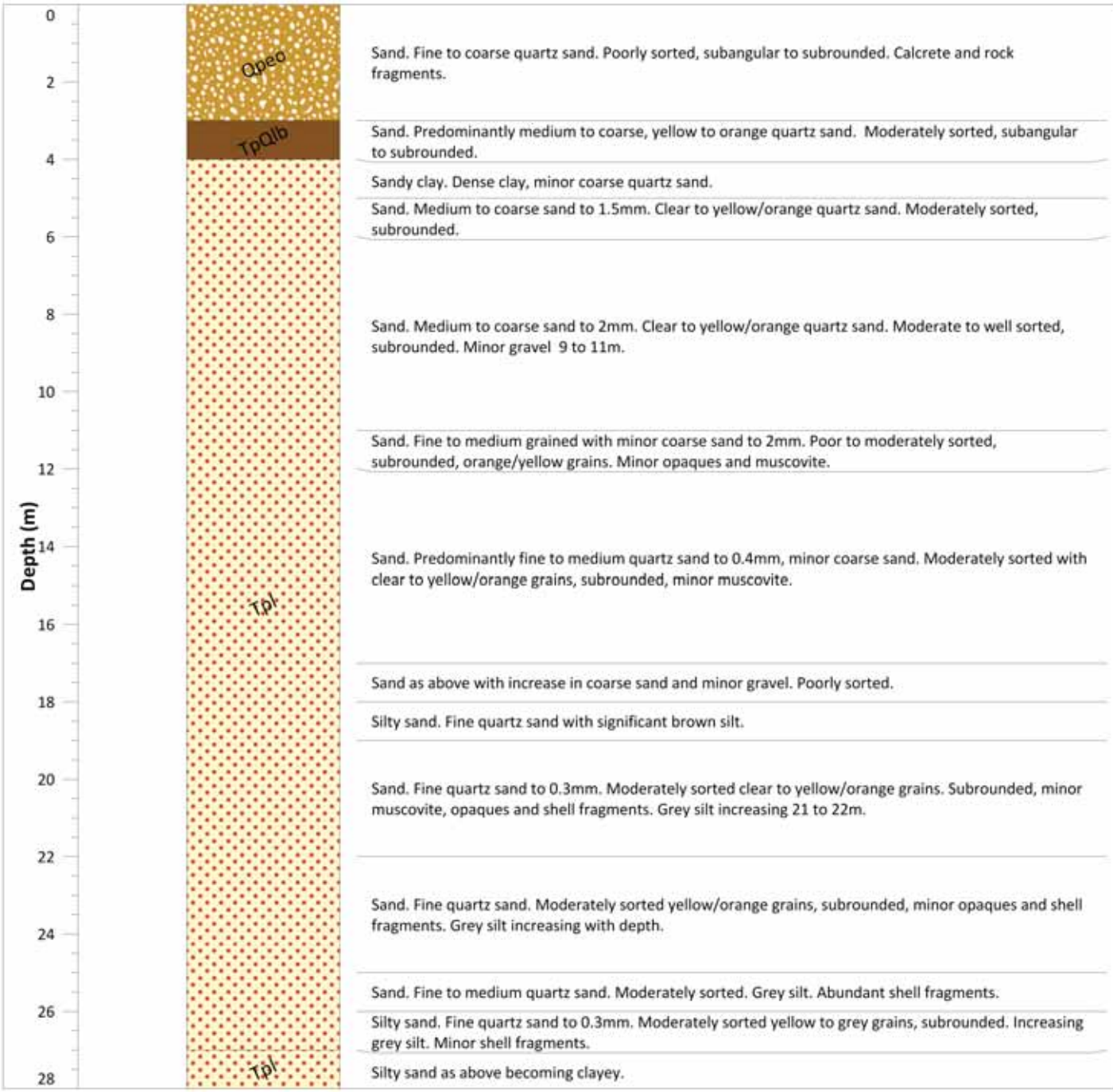
Completion Date: 3/29/08 **NS Elevation (mAHD):** 31.254 **Final Depth (m):** 28

Easting: 462668.649 **Zone:** 54 **Northing:** 6191367.669 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA77**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2344 **Permit Number:** 141953 **Region:** Loxton

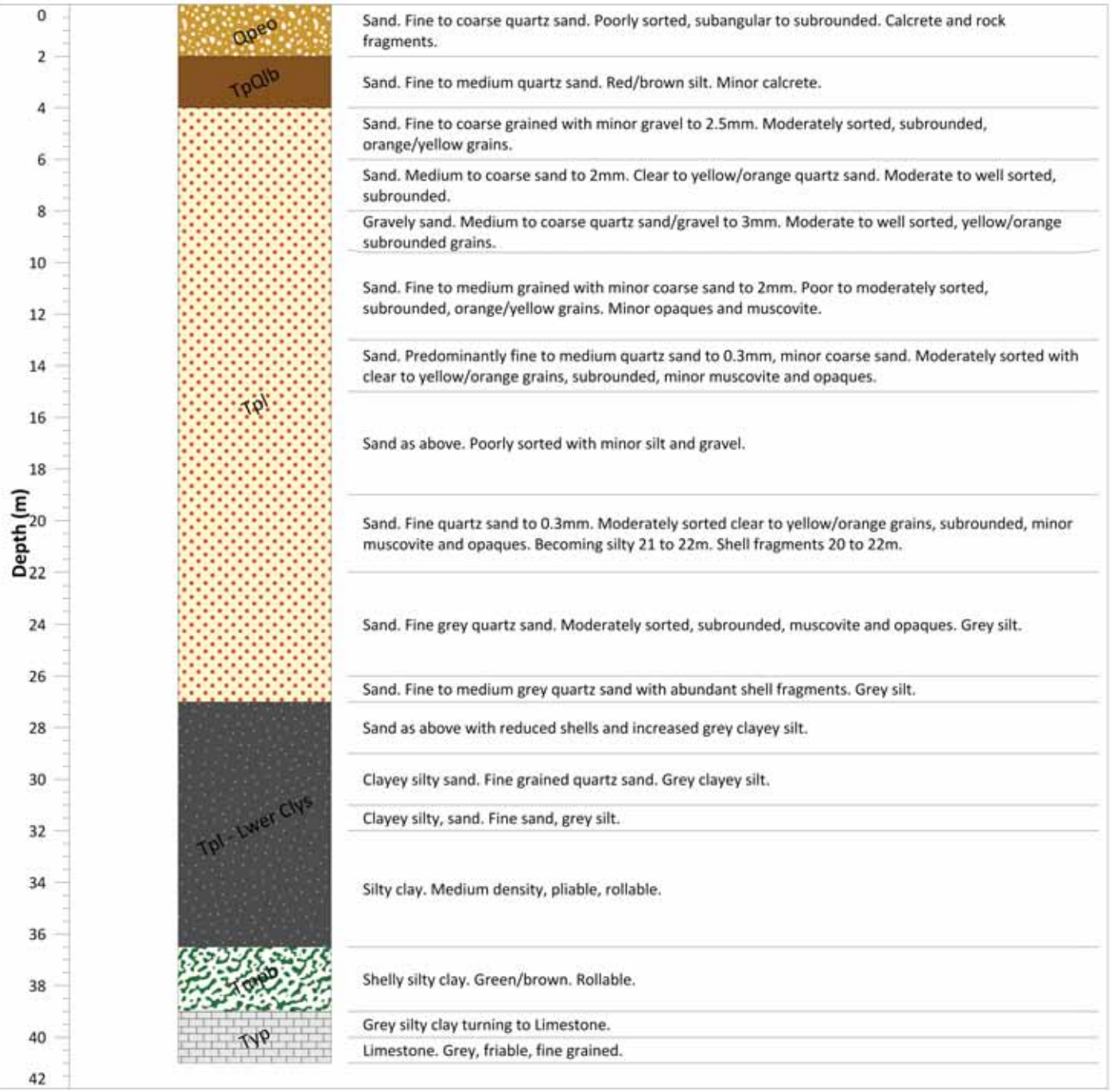
Completion Date: 3/29/08 **NS Elevation (mAHD):** 31.515 **Final Depth (m):** 41

Easting: 462677.849 **Zone:** 54 **Northing:** 6191417.781 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA78



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2354 **Permit Number:** 141954 **Region:** Loxton

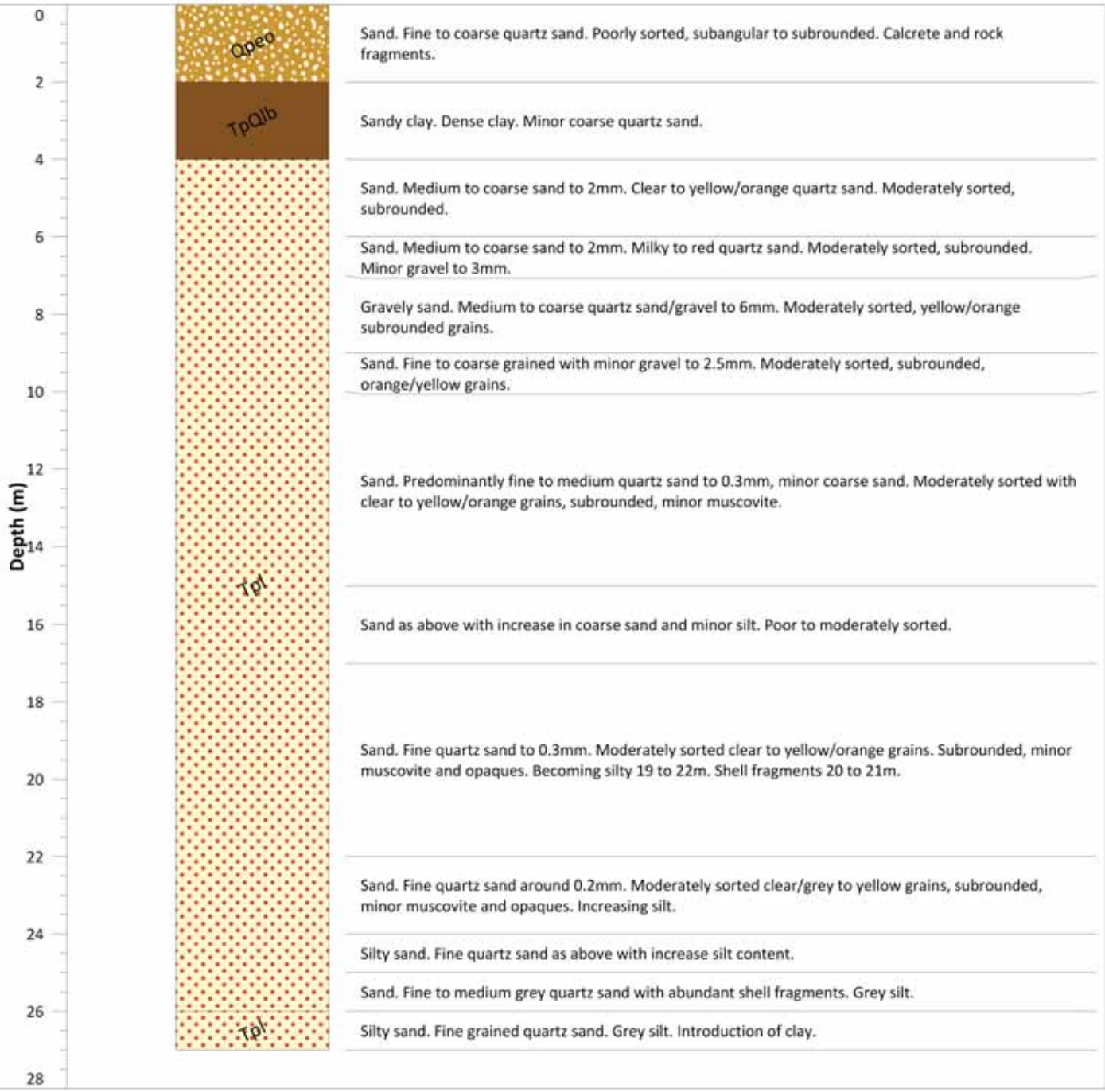
Completion Date: 4/1/08 **NS Elevation (mAHD):** 31.424 **Final Depth (m):** 27

Easting: 462685.995 **Zone:** 54 **Northing:** 6191463.038 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA79**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2345 **Permit Number:** 141955 **Region:** Loxton

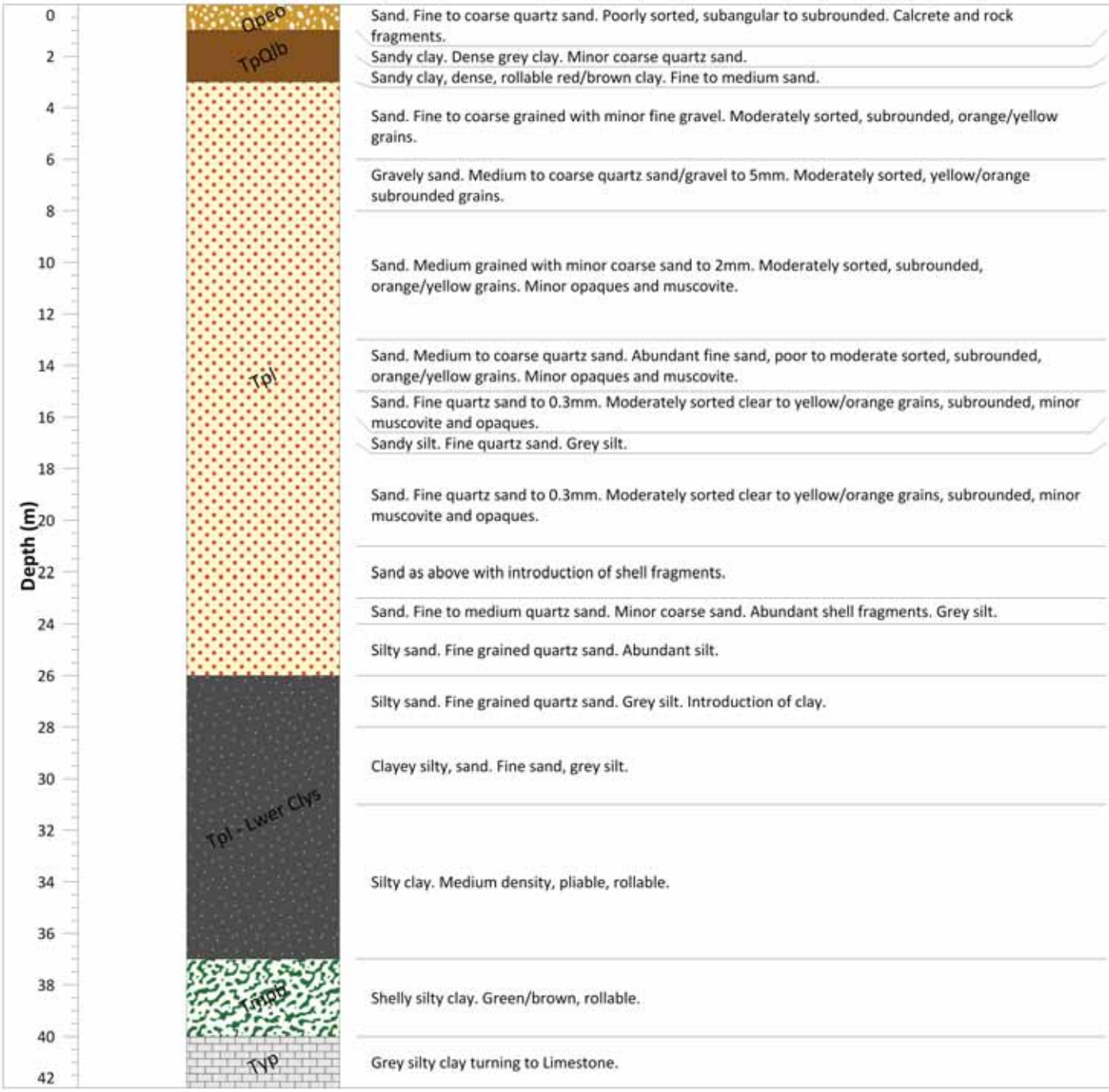
Completion Date: 3/29/08 **NS Elevation (mAHD):** 30.964 **Final Depth (m):** 42

Easting: 462698.441 **Zone:** 54 **Northing:** 6191523.008 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA80



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2355 **Permit Number:** 141956 **Region:** Loxton

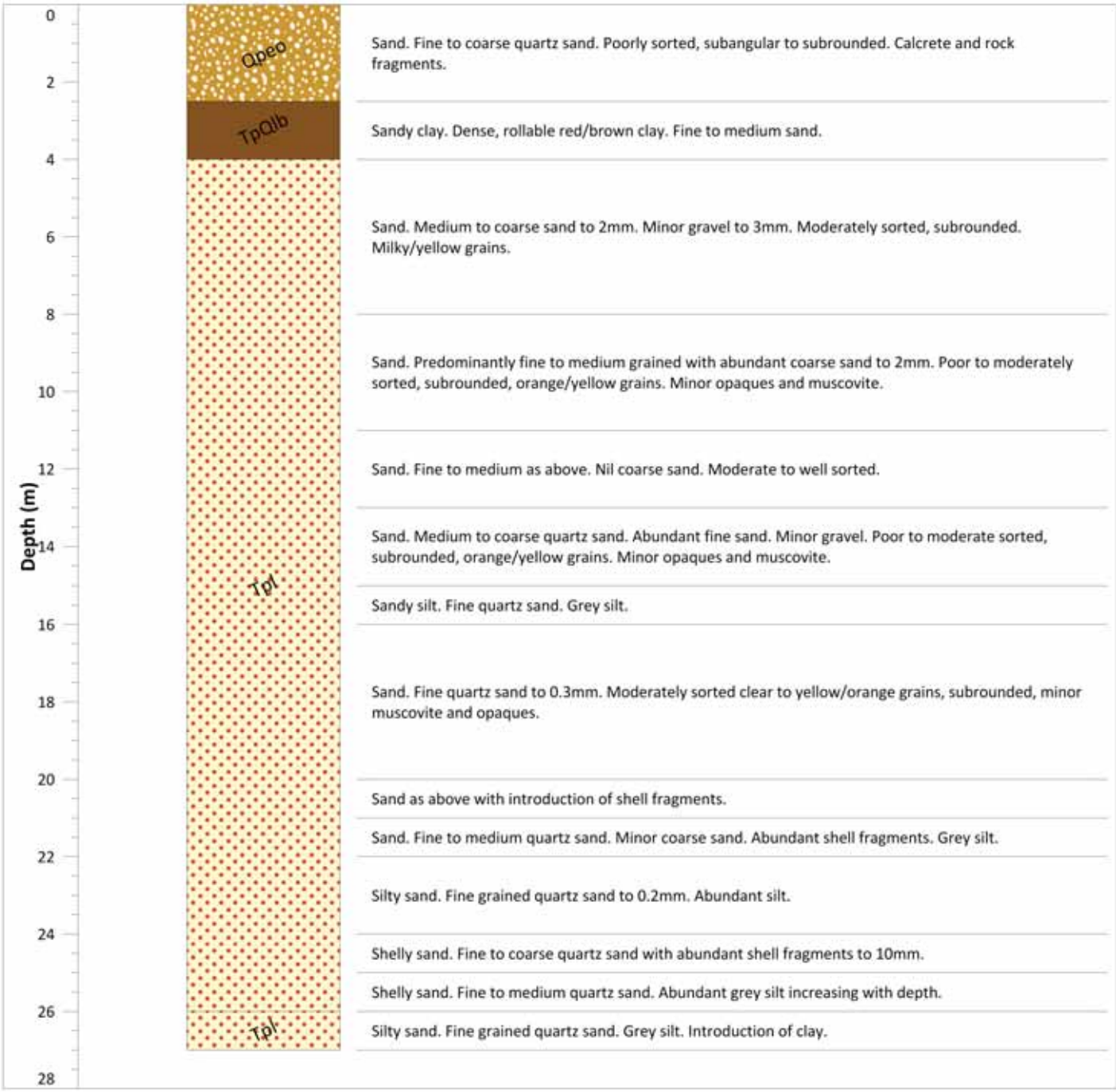
Completion Date: 4/23/08 **NS Elevation (mAHD):** 30.892 **Final Depth (m):** 27

Easting: 462708.513 **Zone:** 54 **Northing:** 6191570.124 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA81**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2346 **Permit Number:** 141957 **Region:** Loxton

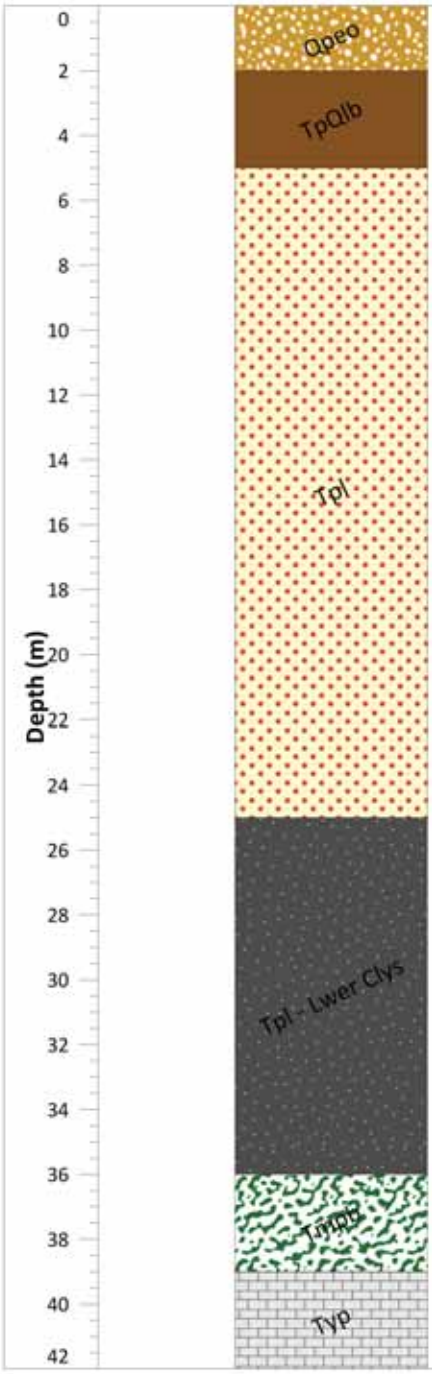
Completion Date: 3/29/08 **NS Elevation (mAHD):** 31.729 **Final Depth (m):** 42

Easting: 462738.329 **Zone:** 54 **Northing:** 6191732.163 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA82



LITHOLOGICAL DESCRIPTION

- Sand. Fine to coarse quartz sand. Poorly sorted, subangular to subrounded. Calcrete and rock fragments.
- Sandy clay. Dense, rollable red/brown clay. Fine to medium sand.
- Gravely sand. Medium to coarse quartz sand/gravel to 3mm. Moderate to well sorted, clear to grey subangular to subrounded grains.
- Sand. Fine to coarse quartz sand. Minor fine gravel. Moderately sorted, subrounded, clear to orange/yellow grains.
- Sand. Fine to medium grained. Moderate to well sorted, subrounded, clear to orange/yellow grains. Minor opaques and muscovite.
- Sand. Predominantly fine to medium grained with abundant coarse sand to 2mm. Poor to moderately sorted, subrounded, clear to orange/yellow grains. Minor opaques and muscovite.
- Sand. Medium to coarse quartz sand. Abundant fine sand. Minor gravel. Poor to moderate sorted, subrounded, orange/yellow grains. Minor opaques and muscovite.
- Gravely sand. Fine to coarse quartz sand/gravel to 4mm. Poorly sorted, grey to yellow/orange subrounded grains. Minor opaques and muscovite.
- Sand. Fine to coarse quartz sand. Poorly sorted, yellow/orange subrounded grains. Orange silt.
- Sand. Fine to coarse quartz sand. Poorly sorted, yellow/orange subrounded grains. Abundant shell fragments.
- Silty sand. Fine grained quartz sand to 0.3mm. Abundant brown silt.
- Sand. Fine to medium quartz sand. Minor coarse sand. Abundant shell fragments. Grey silt increasing with depth.
- Silty sand. Fine grained quartz sand. Grey silt. Introduction of clay. Minor shell fragments.
- Clayey silty, sand. Fine sand, grey silt.
- Silty clay. Medium density, pliable, rollable.
- Shelly silty clay. Green/brown, rollable.
- Grey silty clay turning to Limestone.
- Limestone. Grey, friable, fine grained.

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2347 **Permit Number:** 141958 **Region:** Loxton

Completion Date: 3/30/08 **NS Elevation (mAHD):** 31.588 **Final Depth (m):** 42

Easting: 462761.616 **Zone:** 54 **Northing:** 6191844.309 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA83**

mBGL	WELL CONSTRUCTION	HYDROSTRATIGRAPHIC LOG	LITHOLOGICAL DESCRIPTION
0		Qpeo	Sand. Fine to medium sand. Calcrete and rock fragments, organic matter.
2			Sand. Fine to medium quartz sand. Poorly sorted, subangular to subrounded. Calcrete fragments, rock fragments.
4		TpQlb	Sandy clay, dense, rollable red/brown clay. Fine to medium sand.
6			Gravely sand. Medium to coarse quartz sand with minor gravel to 3mm. Moderately sorted, clear to yellow subangular to subrounded grains.
8			
10			Sand. Predominantly fine to medium grained with minor coarse sand/fine gravel. Well sorted, subrounded, clear to orange/yellow grains. Minor opaques and muscovite.
12			Gravely sand. Fine to coarse quartz sand/gravel to 4mm. Poorly sorted, grey to yellow/orange subrounded grains. Minor opaques and muscovite.
14		Tpl	
16			Sand. Medium to coarse quartz sand. Abundant fine sand. Minor fine gravel. Poor to moderate sorted, subrounded, orange/yellow grains. Minor opaques and muscovite.
18			Sandy silt. Fine sand, grey silt.
20			Gravely sand. Fine to coarse quartz sand/gravel to 4mm. Poorly sorted, clear to yellow subrounded grains. Abundant grey silt.
22			As above with reduced coarse sand/gravel and increase in grey silt.
24			Sand. Fine to coarse quartz sand. Poor to moderately sorted, clear to yellow subrounded grains. Abundant shell fragments.
26			Silty sand. Fine grained quartz sand. Grey/brown silt increasing with depth.
28		Tpl - Lwer Clys	Silty sand. Fine grained quartz sand. Grey silt. Introduction of clay. Minor shell fragments.
30			
32			Clayey silty, sand. Fine sand, grey clayey silt increasing with depth.
34			Silty clay. Medium density, pliable, rollable.
36			
38		Tmpb	Shelly silty clay. Green/brown. Rollable. Abundant shell fragments to 20mm.
40		Typ	Grey silty clay turning to Limestone.
42			Limestone. Grey, friable, fine grained.

Depth (m)

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2356 **Permit Number:** 141960 **Region:** Loxton

Completion Date: 4/1/08 **NS Elevation (mAHD):** 31.752 **Final Depth (m):** 26

Easting: 462672.03 **Zone:** 54 **Northing:** 6191941.5 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA84**

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2348 **Permit Number:** 141963 **Region:** Loxton

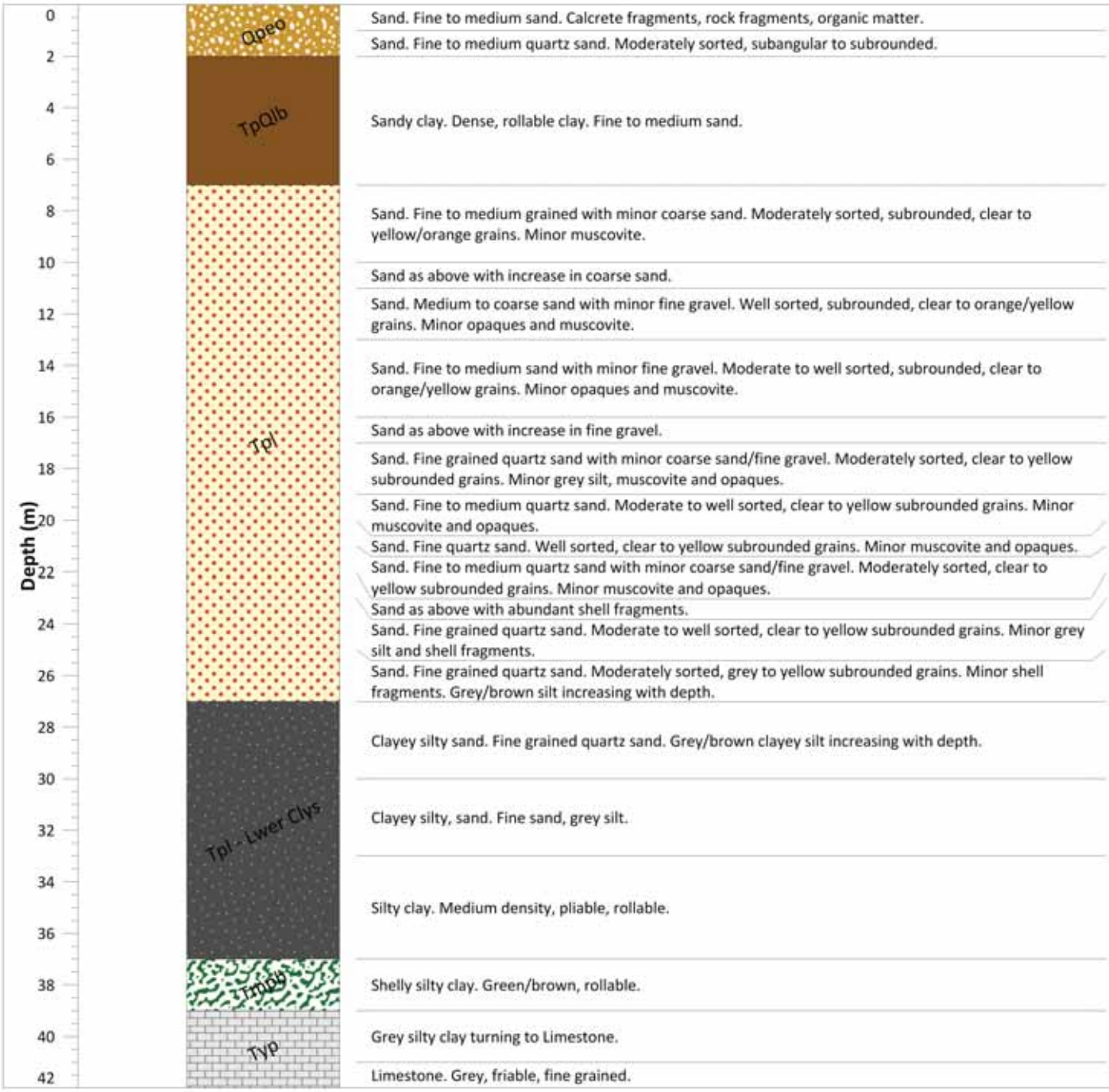
Completion Date: 3/30/08 **NS Elevation (mAHD):** 32.335 **Final Depth (m):** 42

Easting: 462575.587 **Zone:** 54 **Northing:** 6191939.266 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA85



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2349 **Permit Number:** 141964 **Region:** Loxton

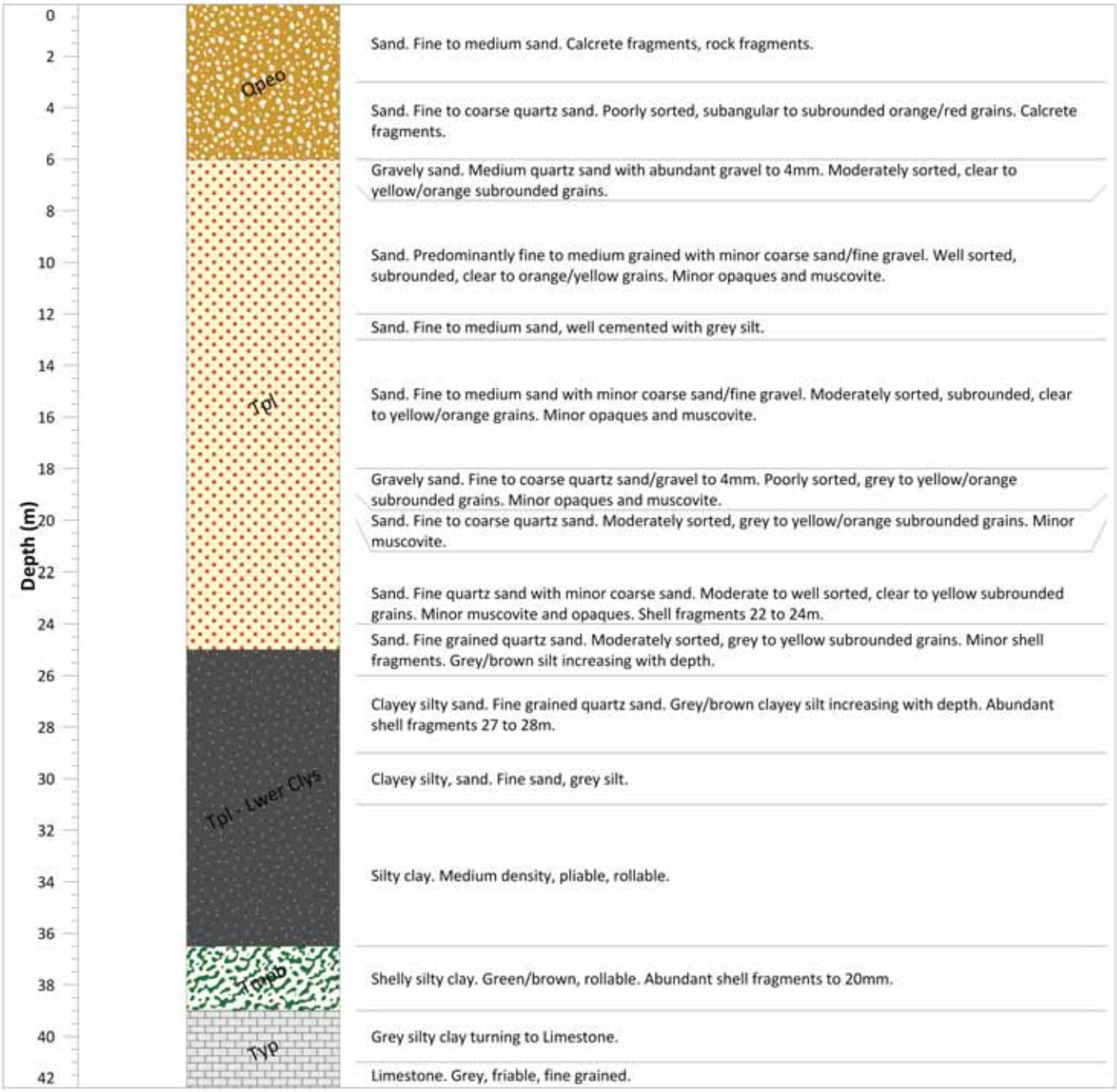
Completion Date: 3/30/08 **NS Elevation (mAHD):** 32.673 **Final Depth (m):** 42

Easting: 462319.926 **Zone:** 54 **Northing:** 6191979.877 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA86**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2350 **Permit Number:** 141965 **Region:** Loxton

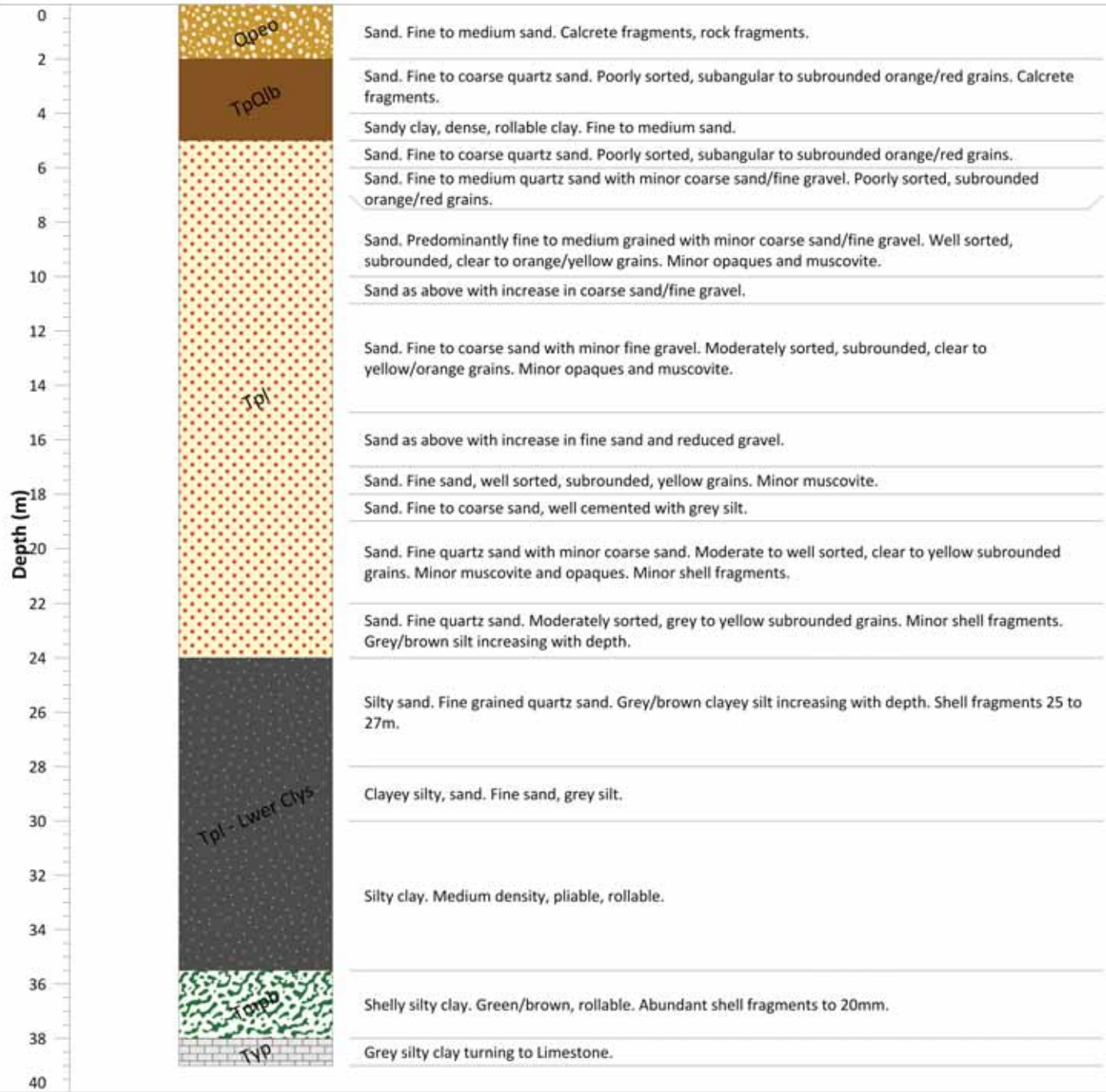
Completion Date: 3/31/08 **NS Elevation (mAHD):** 31.727 **Final Depth (m):** 39

Easting: 462162.708 **Zone:** 54 **Northing:** 6192088.875 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA87



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2351 **Permit Number:** 141966 **Region:** Loxton

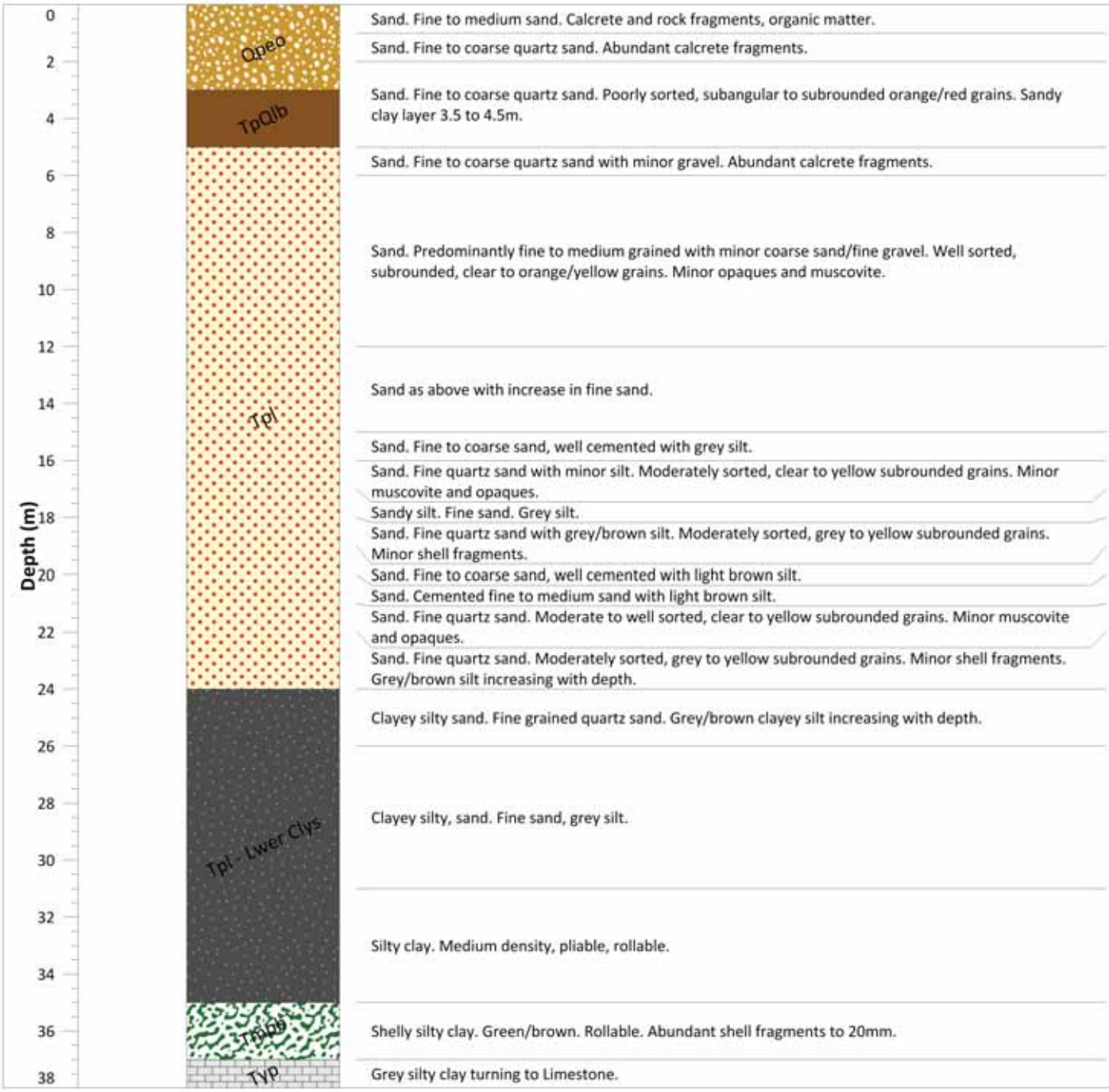
Completion Date: 3/31/08 **NS Elevation (mAHD):** 31.266 **Final Depth (m):** 38

Easting: 462048.173 **Zone:** 54 **Northing:** 6192163.91 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA88**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2431 **Permit Number:** 156583 **Region:** Loxton

Completion Date: 12/19/08 **NS Elevation (mAHD):** 36.89 **Final Depth (m):** 41.5

Easting: 462333.974 **Zone:** 54 **Northing:** 6194295.297 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA89

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2432 **Permit Number:** 156584 **Region:** Loxton

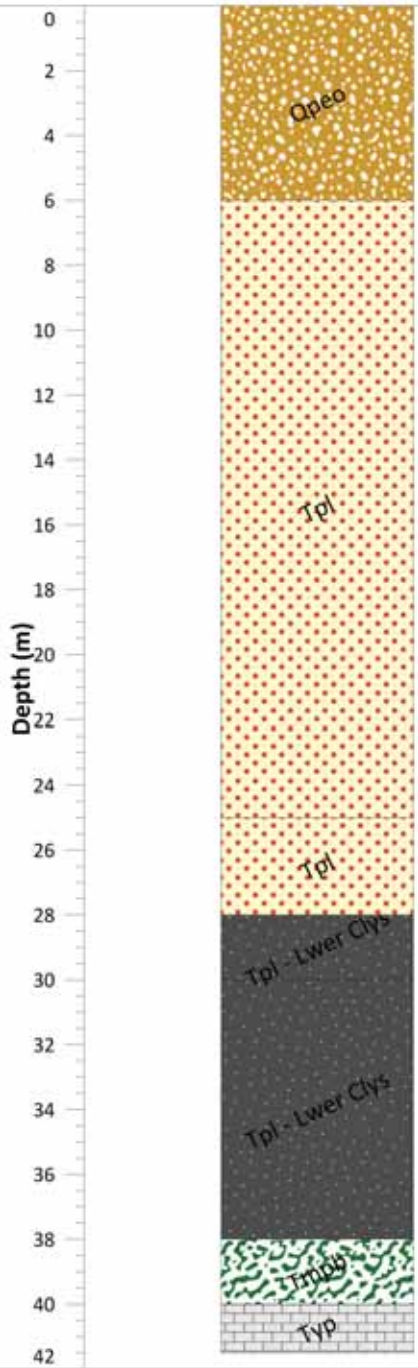
Completion Date: 12/19/08 **NS Elevation (mAHD):** 36.086 **Final Depth (m):** 41.5

Easting: 462494.019 **Zone:** 54 **Northing:** 6194319.332 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA90



LITHOLOGICAL DESCRIPTION
Sand, red, fine grained, organic
Sand as above, light red, rock fragments
Calcrete, hard drilling, light red sand, fine to medium grained
Sand, light red, fine to medium grained
Calcrete, hard drilling, as 2-3m
Sand, light red, fine to medium grained, calcrete fragments
Sand, consolidated, hard layer, calcrete capping
Calcrete, hard, hard drilling, light grey
Calcrete as above
Calcrete as above, introduction of fine to medium brown sands at depth
Sand, brown, fine to medium grained, minor coarse grains
Sand, light orange/ brown, poorly sorted fine to coarse grained, minor cemented rock pieces
Sandstone, light orange/ yellow,
Sandstone as above
Sand, light grey, fine, mica abundant
Sand, light grey, fine, minor gravels to 3mm
Sand, brown/ orange, fine grained, minor gravel
Sand, brown, fine grained, minor gravel, rock fragments
Sand, light orange/ grey, fine grained
Sand as above
Sand, brown, fine grained, becoming silty with depth
Sand as above
Sandy Clayey Silt, light brown, low density, sticky
Silty Sand, brown, unrollable
Silty Sand as above, becoming clayey with depth, barely rollable
Sandy Clay Silt to Silty Clay, gre/ brown, rollable
Sandy Clayey Silt to Silty Clay as above, introduction of lighter Clayey Silt with depth
Sandy Clayey Silt, grey, not rollable
Sandy Silty Clay, grey, rollable
Sandy Silty Clay as above
Sandy Silty Clay as above, minor shell fragments
Sandy Silty Clay as above
Shelly, Gritty Silty Clay, olive green
Silty Clay, significantly reduced shells, green/ grey
Clayey Silt, grey, fossiliferous
Clayey Silt as above, limestone fragments, fossiliferous

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2433 **Permit Number:** 156598 **Region:** Loxton

Completion Date: 12/20/08 **NS Elevation (mAHD):** 36.149 **Final Depth (m):** 42

Easting: 462582.751 **Zone:** 54 **Northing:** 6194341.468 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA91**

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2434 **Permit Number:** 156586 **Region:** Loxton

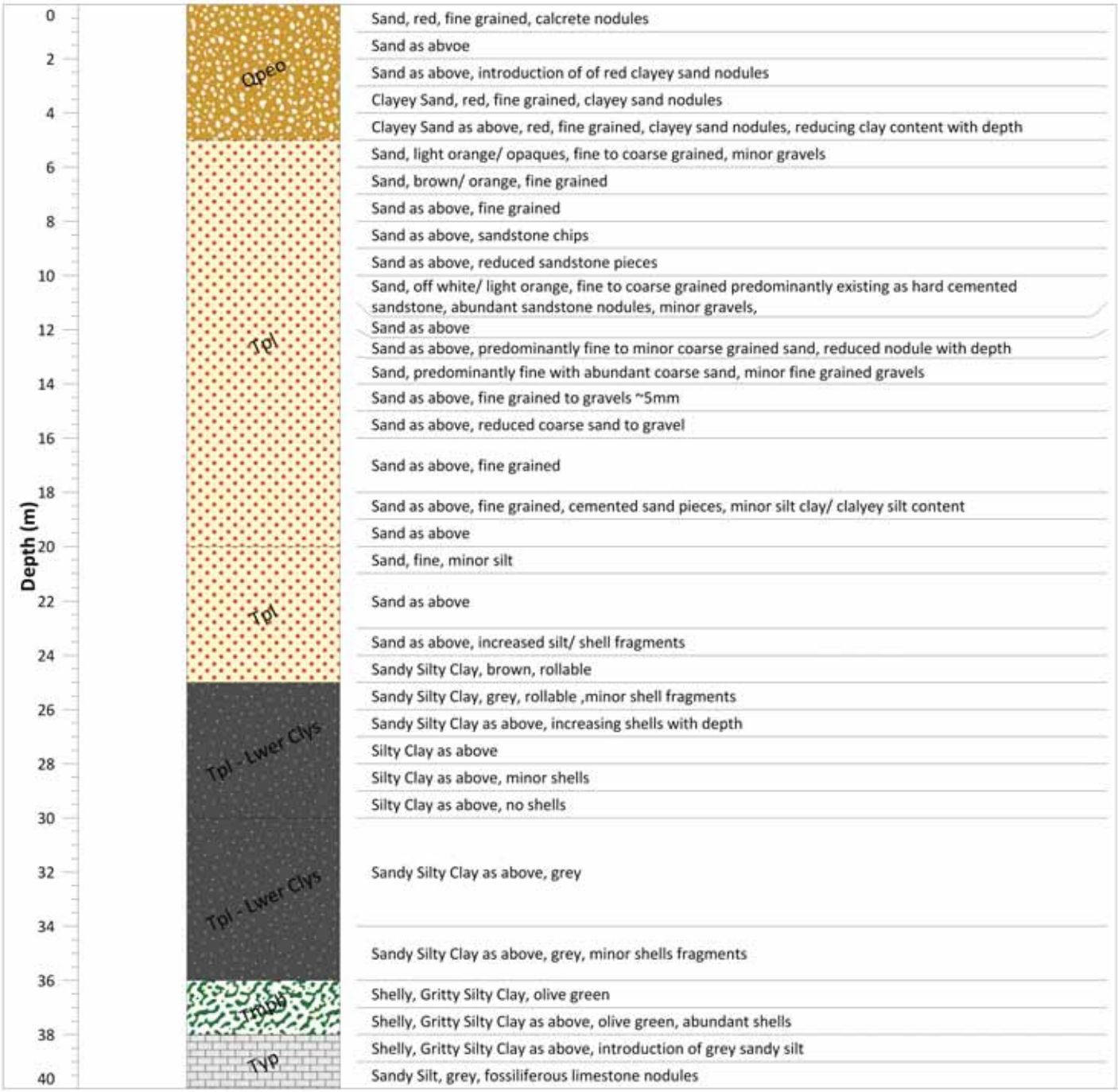
Completion Date: 12/20/08 **NS Elevation (mAHD):** 33.921 **Final Depth (m):** 40

Easting: 462645.934 **Zone:** 54 **Northing:** 6194369.588 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA92**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2445 **Permit Number:** 156587 **Region:** Loxton

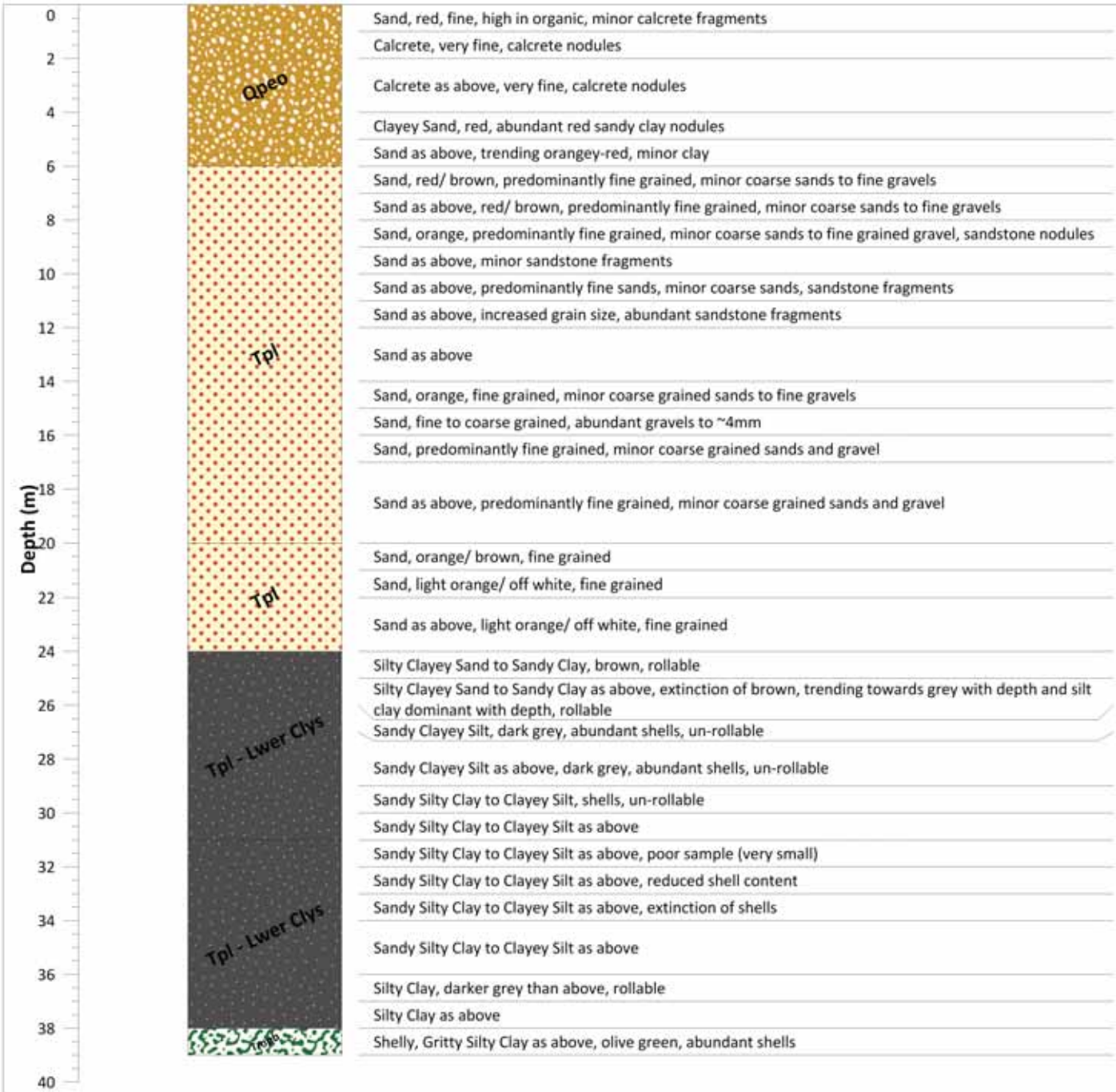
Completion Date: 12/20/08 **NS Elevation (mAHD):** 34.759 **Final Depth (m):** 39

Easting: 462752.607 **Zone:** 54 **Northing:** 6194426.794 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA93**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2451 **Permit Number:** 156588 **Region:** Loxton

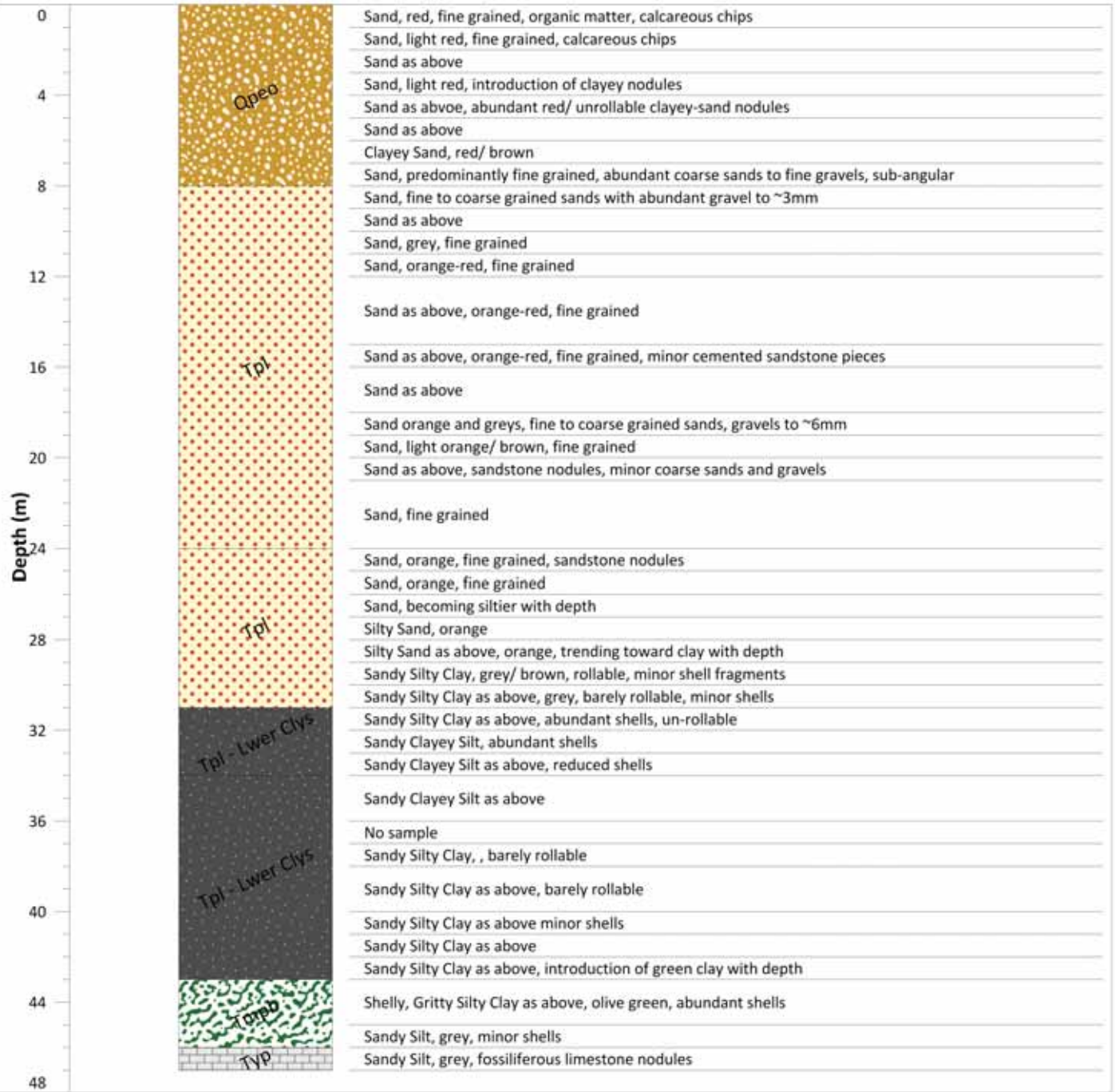
Completion Date: 12/21/08 **NS Elevation (mAHD):** 39.294 **Final Depth (m):** 47

Easting: 462984.093 **Zone:** 54 **Northing:** 6194461.177 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA94



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2452 **Permit Number:** 156589 **Region:** Loxton

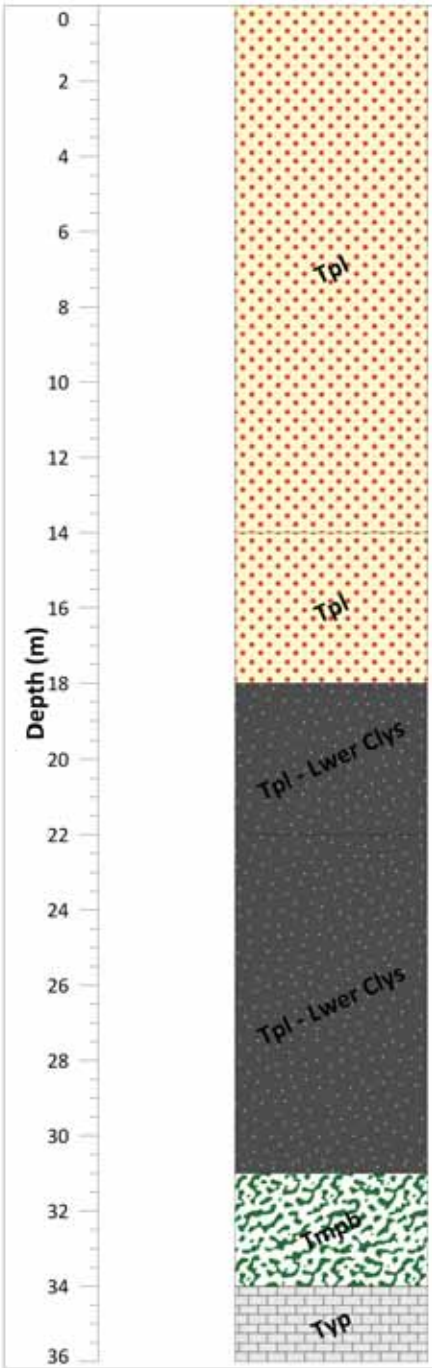
Completion Date: 1/5/09 **NS Elevation (mAHD):** 28.437 **Final Depth (m):** 36

Easting: 463037.097 **Zone:** 54 **Northing:** 6194602.698 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA95



LITHOLOGICAL DESCRIPTION

- Sand, orange, fine to medium grained, mica
- Sand as above, orange to light red with depth, coarse grained, fine gravels to ~3mm,
- Sand as above, orange/ brown, slightly smaller grain-size than above, sub-angular to angular grains, well sorted size distribution
- Sand as above, orange/ brown, sub-angular to angular grains, well sorted size distribution
- Sand as above, medium grained, coarse sands to fine gravels,
- Sand as above, red sands, medium grained, minor coarse sands and fine gravels
- Sand as above
- Sand, light reddish-orange, medium grained, coarse sands and fine gravels present, unsorted
- Sand to Fine Gravels, orange opaque sub-rounded gravels to ~4mm
- Sand, light orange/brown, fine to medium grained well sorted, mica
- Sand as above
- Sand, as above, increasing clay content
- Sand as above
- Sand as above, introduction of grey clays with depth
- Shelly Clayey Sand, grey
- Shelly Clayey Sand as above, grey
- Shelly Clayey Sand as above, grey, extinction of shells with depth
- Sandy Silty Clay as above, grey, barely rollable, minor shells
- Sandy Silty Clay as above, grey
- Sandy Silty Clay as above, introduction of green clay with depth
- Shelly, Gritty Silty Clay as above, olive green, abundant shells
- Shelly, Gritty Silty Clay as above, introduction of grey sandy silt/ limeston/ fossiliferous
- Sandy Silt, grey, fossiliferous limestone nodules

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2453 **Permit Number:** 156590 **Region:** Loxton

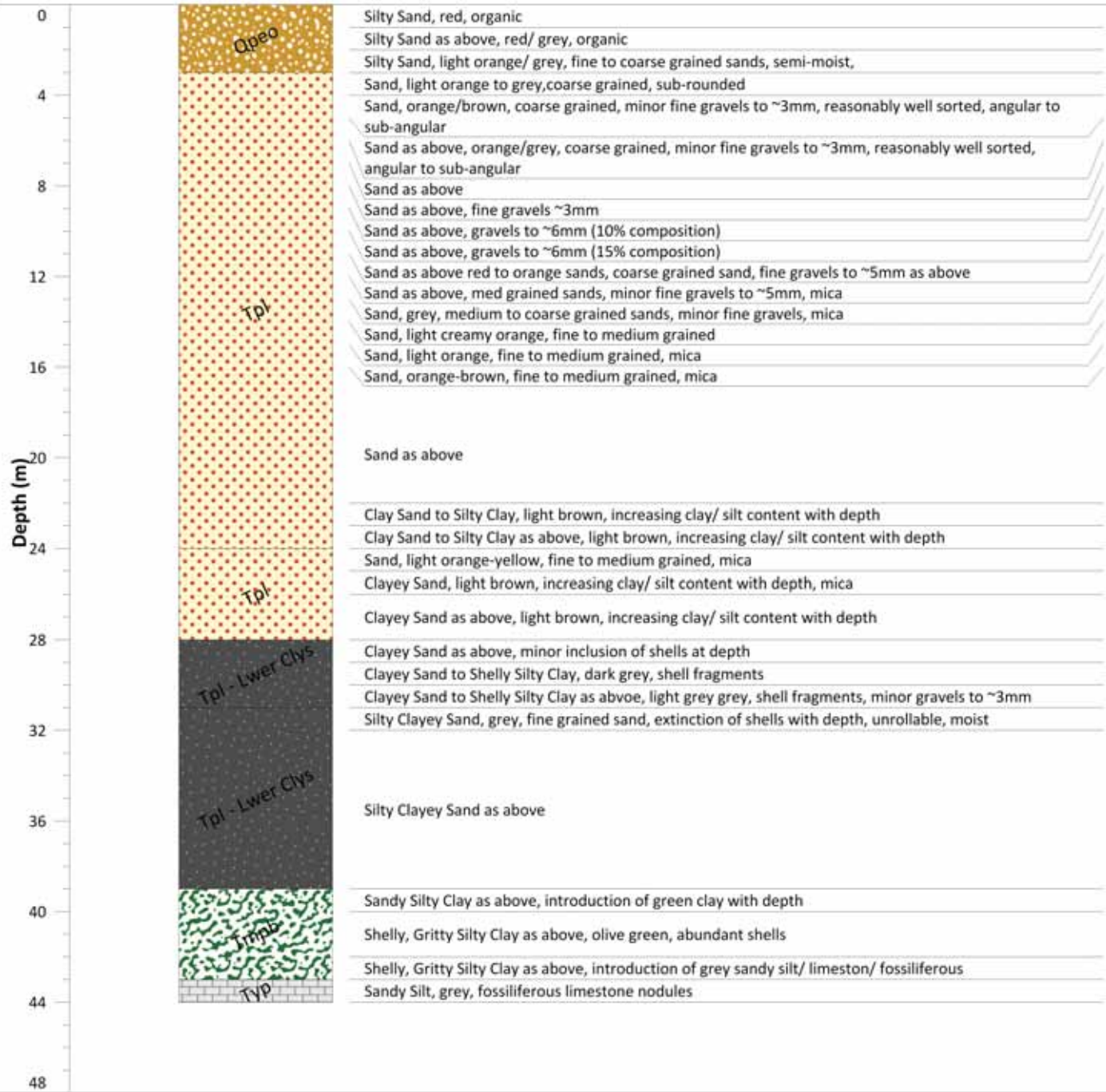
Completion Date: 1/6/09 **NS Elevation (mAHD):** 36.629 **Final Depth (m):** 44

Easting: 463048.565 **Zone:** 54 **Northing:** 6194749.638 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA96



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2454 **Permit Number:** 156591 **Region:** Loxton

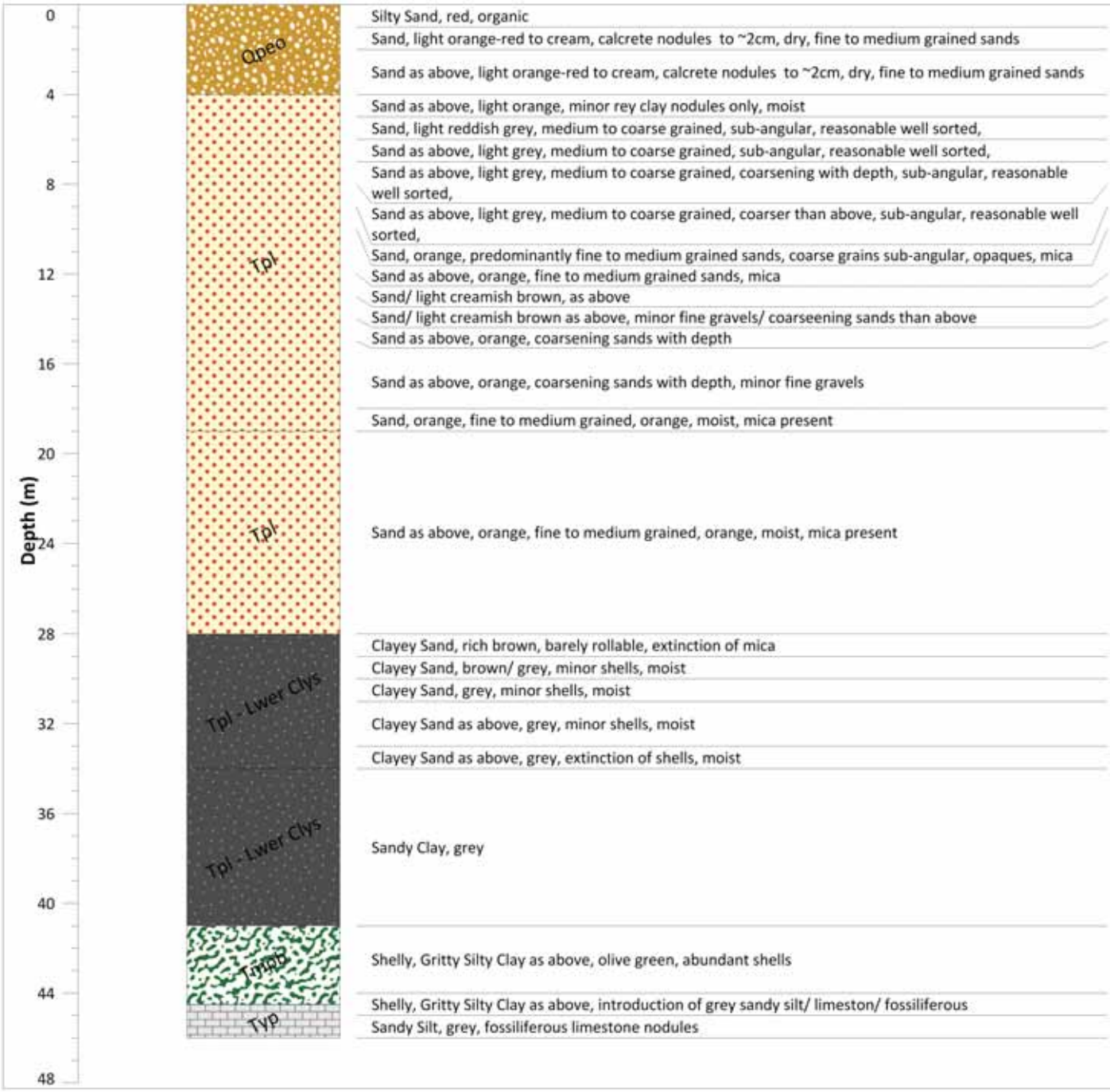
Completion Date: 1/6/09 **NS Elevation (mAHD):** 38.062 **Final Depth (m):** 46

Easting: 463070.79 **Zone:** 54 **Northing:** 6194876.383 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHA97**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2435 **Permit Number:** 156592 **Region:** Loxton

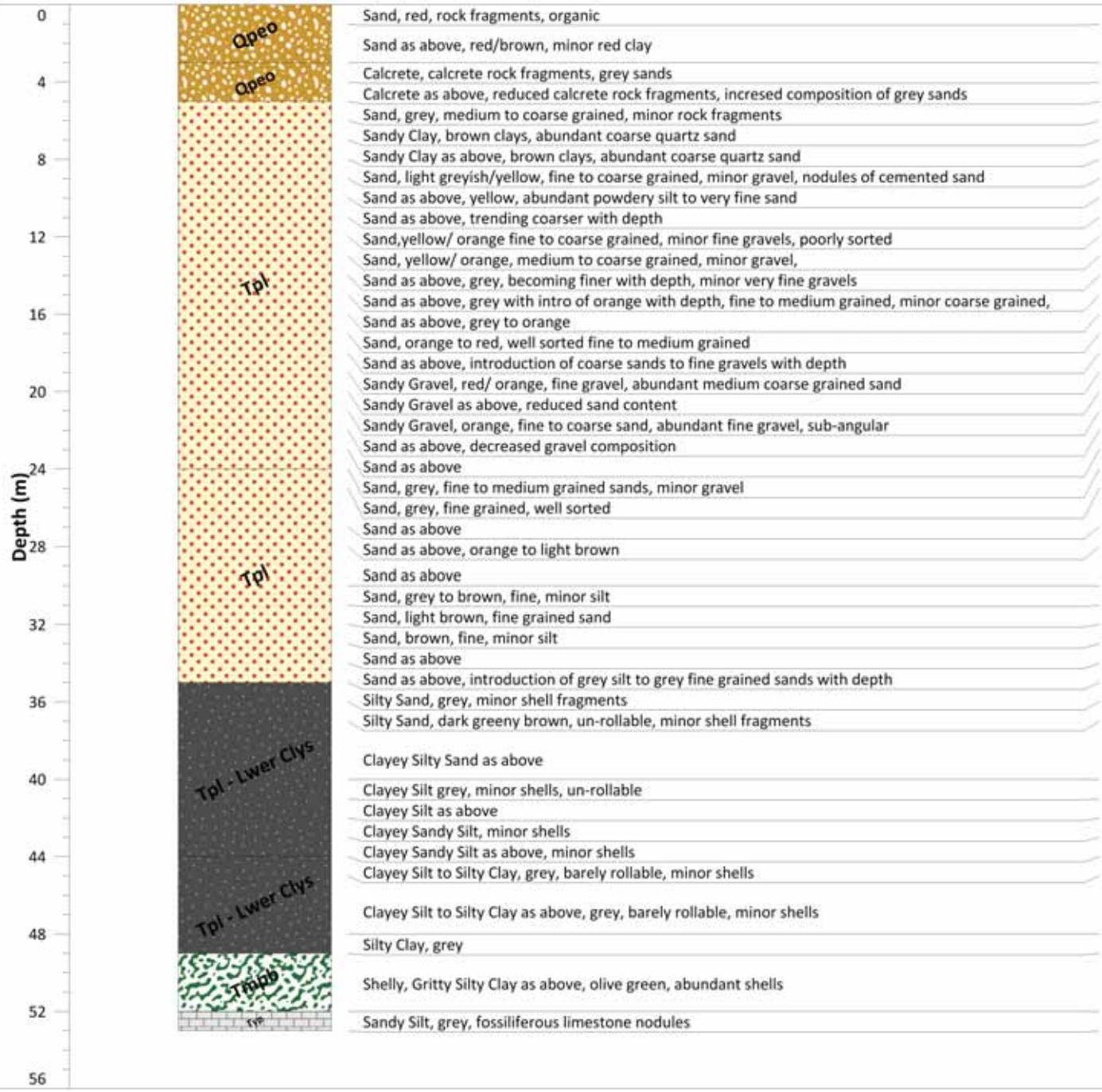
Completion Date: 12/18/08 **NS Elevation (mAHD):** 43.74 **Final Depth (m):** 53

Easting: 463447.522 **Zone:** 54 **Northing:** 6195162.457 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA98



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2436 **Permit Number:** 156575 **Region:** Loxton

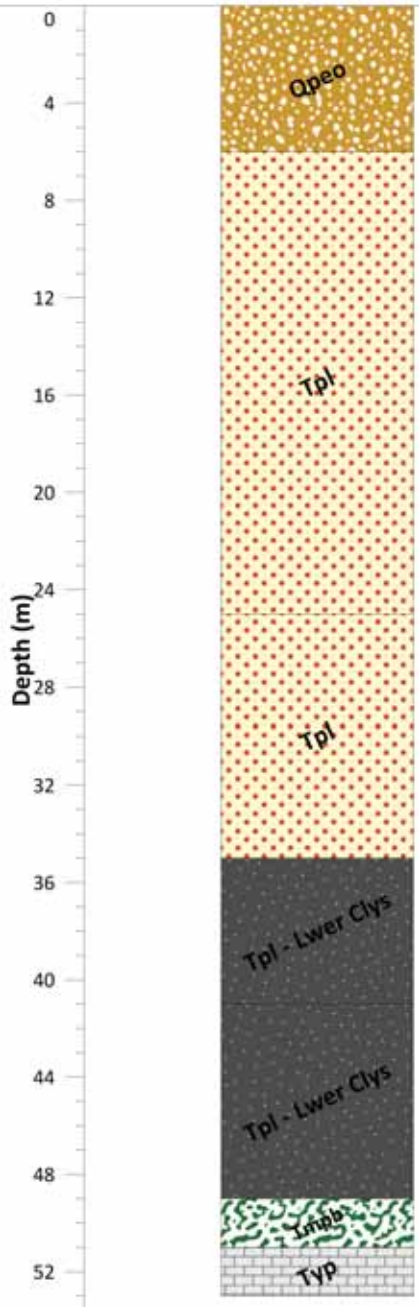
Completion Date: 12/17/08 **NS Elevation (mAHD):** 43.259 **Final Depth (m):** 53

Easting: 463407.934 **Zone:** 54 **Northing:** 6195062.695 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA99



LITHOLOGICAL DESCRIPTION

- Sand, orange, fine to medium grained, organic, rock fragments
- Sand, red/ brown, fine to coarse, poorly sorted
- Sand as above, light red/ brown, medium grained
- Clayey Sand, red, clayey sand clumps, calcrete chips
- Clayey Sand, red, fine to coarse grained
- Sand, light red, fine to coarse grained, poorly to moderately well sorted
- Sand, light red/ brown, moderately sorted, medium to coarse grained
- Sand as above, lighter red than above
- Sand as above
- Sand as above, light brown, higher %age of fine sands than above
- Sand as above, reduced fine sands
- Sand as abovelight grey/ brown, medium to coarse grained, minor gravel ~3mm, becoming coarser with depth
- Gravelly Sand, light greys/ opaquesmedium to coarse grained sands, minor gravels to ~5mm, poorly sorted
- Sand, light red/ orange, fine to medium grained, minor coarse sand s to fine gravels
- Sand as above, orange
- Gravelly Sand, orange, predominantly medium to coarse grained sand, abundant gravel to ~4mm,
- Gravelly Sand as above, red/ orange grains
- Sandy Gravel, brown, medium to coarse grained sand, gravels to ~5mm
- Sandy Gravel as above, orange, turning to fine/ medium grained with depth
- Sand, orange, fine to medium grained sand, minor coarse sands, minor fine gravels
- Sand, orange, medium grained, abunmdant coarse grained sands and fine gravels to ~4mm
- Sand, orange, fine to medium grained, abundant gravels, numerous nodules of fine grained sandstone
- Sand as above, orange to grey with depth, fine and coarse grained sands, increasing %age of coarse sand to fine gravels, extinction of cemented sandstone nodules,
- Sand, light brown/ yellow, fine to medium grained sands, sandstone nodules, mica
- Sand as above, extinction of cemented nodules
- Sand as above
- Sand as above, reduced fine sands
- Sand as above
- Sand, light orange/ yellow, fine to medium grained well sorted
- Sand as above
- Sand as above, introductio of brown silts with depth
- Sand as above, introduction of grey, fine to medium sands with depth
- Sand, grey, fine grained, grey silt
- Clayey Silty Sand, grey, unrollable
- Clayey Silty Sand, abundant shells
- Clayey Silty Sand as above
- Clayey Silty Sand as above, minor shells
- Sandy Silt, grey, fine grained, minor shell fragments
- Sandy Silt, grey as above, becoming clayey with depth
- Silty Clay, grey, sticky
- Sandy Clayey Silt, grey, fine grained, minor shells, unrollable
- Sandy Clayey Silt as above
- Silty Clay to Clayey Silt, grey, barely rollable
- Silty Clay to Clayey Silt as above
- Silty Clay, grey, introduction of green silty clay with depth
- Shelly Clayey Silt to Silty Clay, olive green
- Clayey Silt, grey
- Clayey Silt as above, abundant fossiliferous limestone fragments

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2437 **Permit Number:** 156576 **Region:** Loxton

Completion Date: 12/16/08 **NS Elevation (mAHD):** 40.025 **Final Depth (m):** 46.5

Easting: 463372.642 **Zone:** 54 **Northing:** 6194986.134 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA100

Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2438 **Permit Number:** 156578 **Region:** Loxton

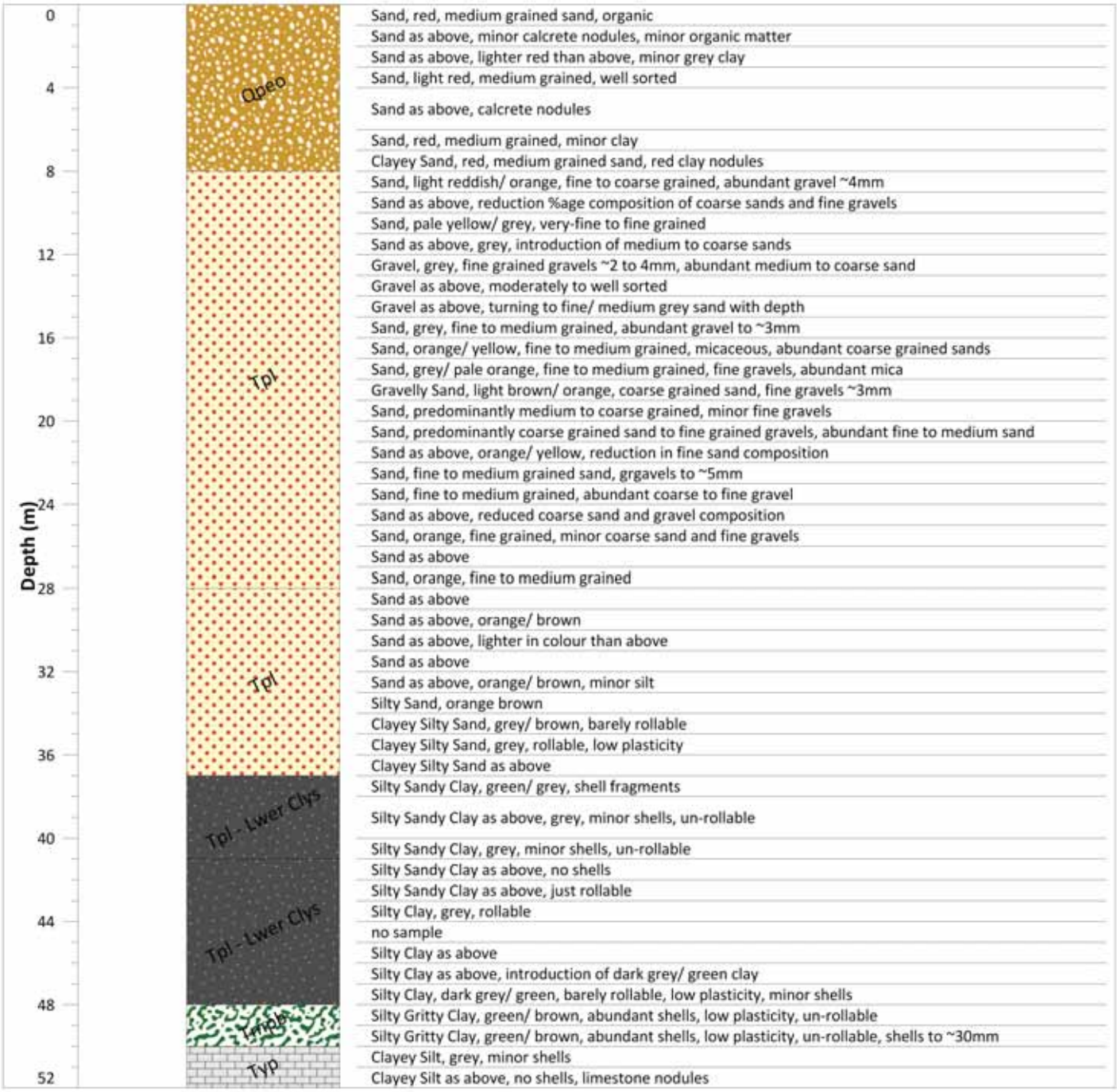
Completion Date: 12/15/08 **NS Elevation (mAHD):** 44.298 **Final Depth (m):** 52

Easting: 463344.051 **Zone:** 54 **Northing:** 6194772.453 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA101



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2439 **Permit Number:** 156579 **Region:** Loxton

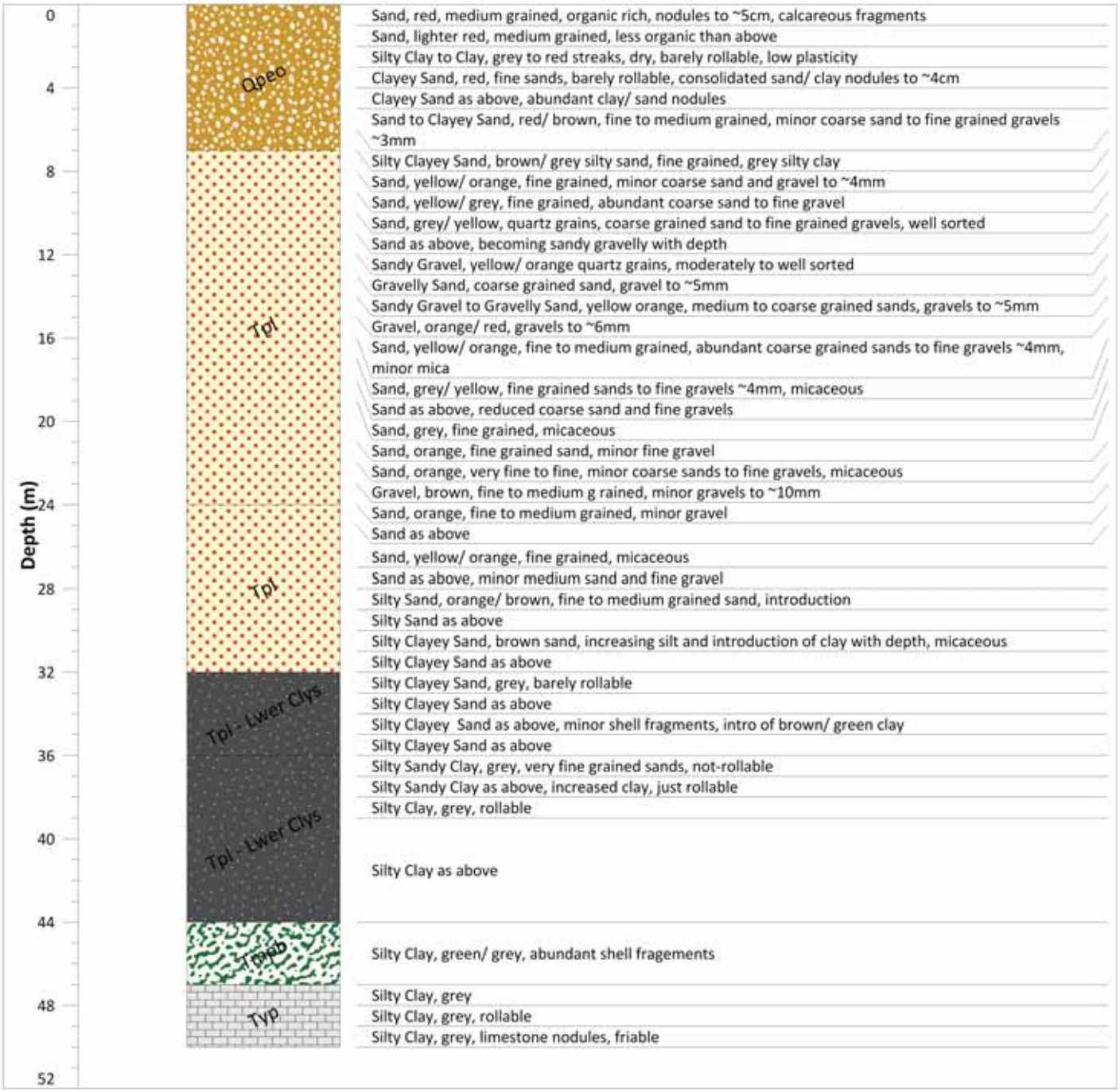
Completion Date: 12/15/08 **NS Elevation (mAHD):** 42.009 **Final Depth (m):** 50

Easting: 463333.9 **Zone:** 54 **Northing:** 6194660.439 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA102



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2440 **Permit Number:** 156580 **Region:** Loxton

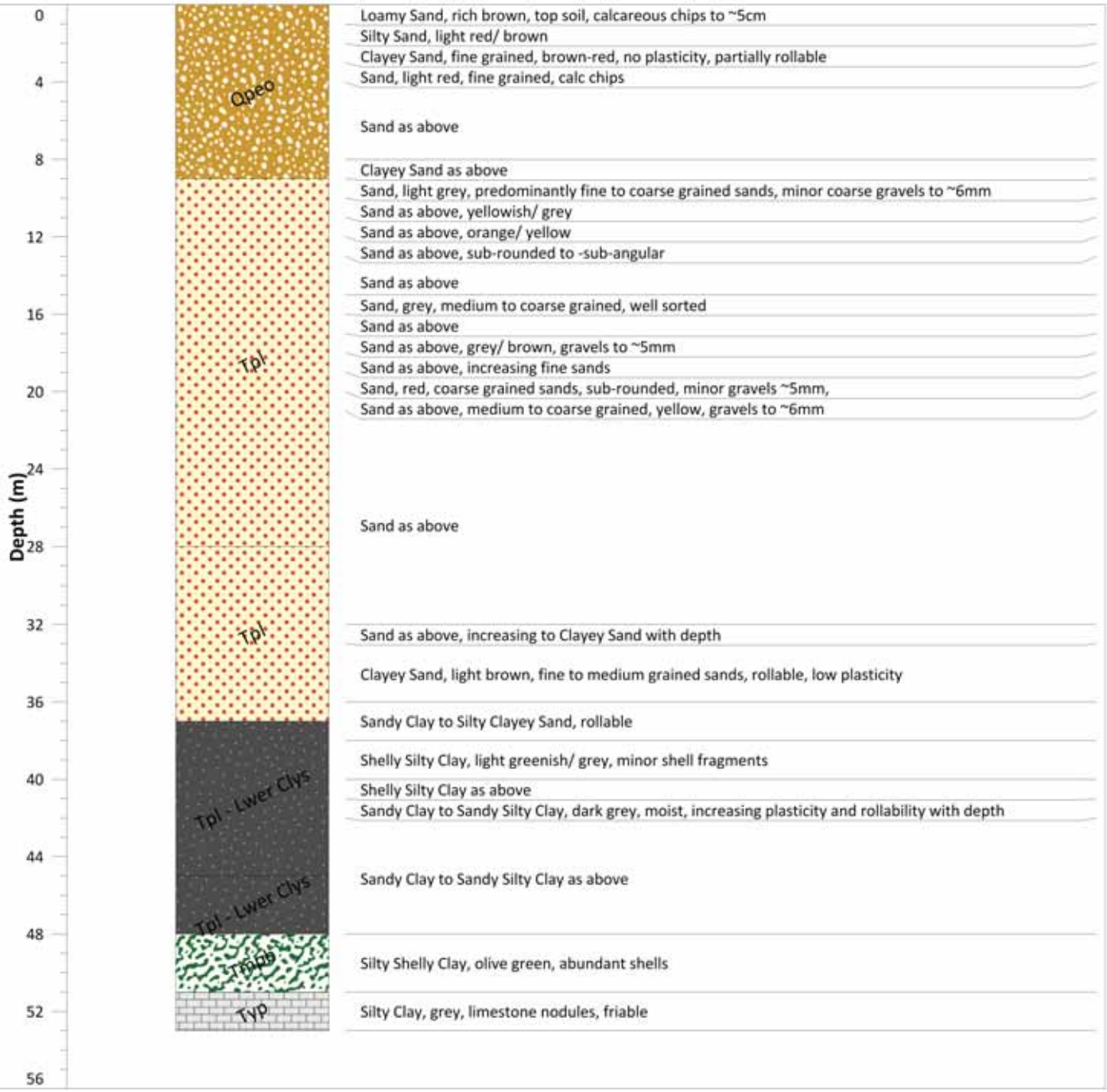
Completion Date: 12/13/08 **NS Elevation (mAHD):** 44.293 **Final Depth (m):** 53

Easting: 463320.021 **Zone:** 54 **Northing:** 6194562.353 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA103



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2441 **Permit Number:** 156581 **Region:** Loxton

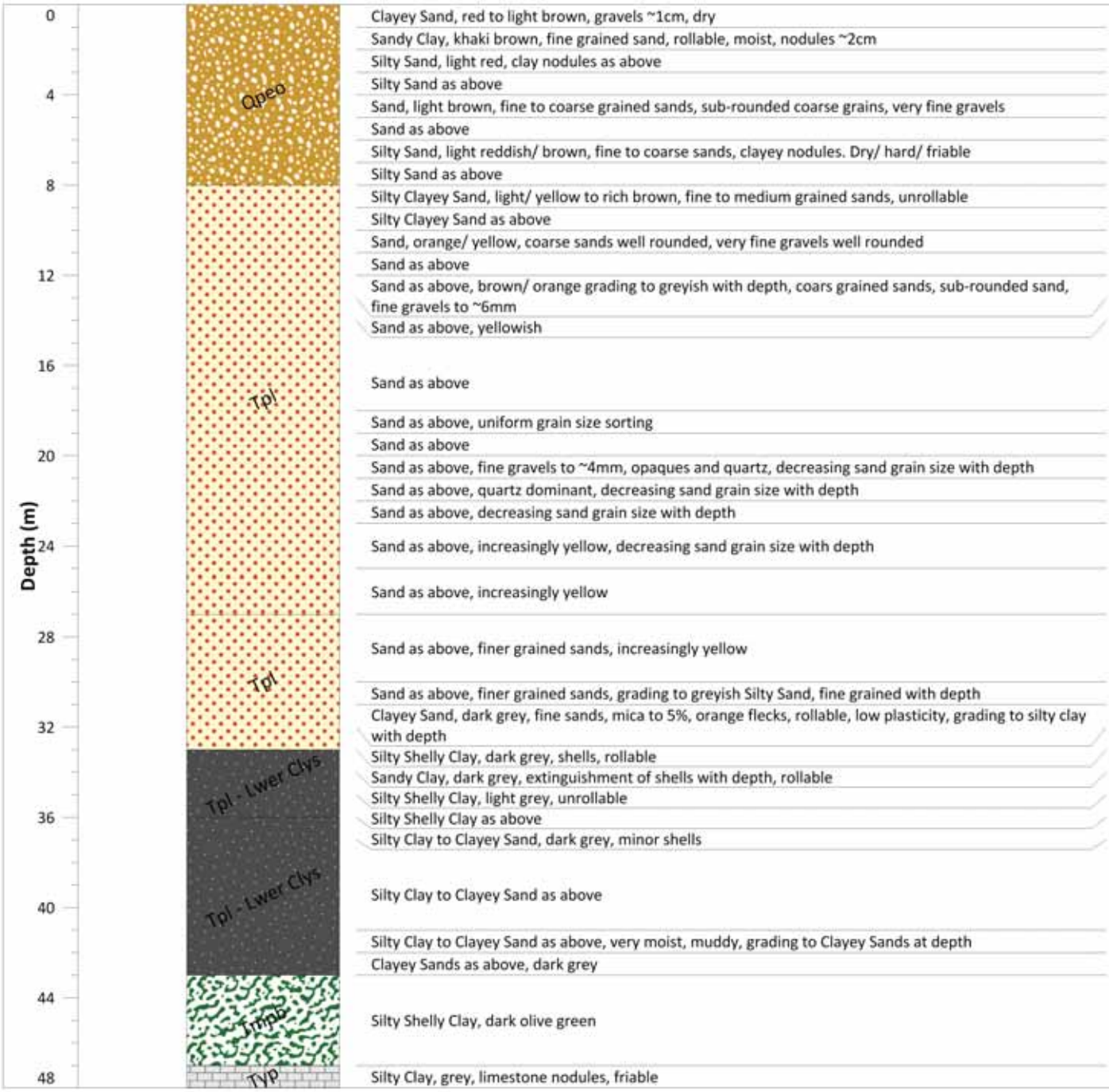
Completion Date: 12/13/08 **NS Elevation (mAHD):** 41.61 **Final Depth (m):** 48

Easting: 463309.991 **Zone:** 54 **Northing:** 6194465.651 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA104



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2442 **Permit Number:** 156582 **Region:** Loxton

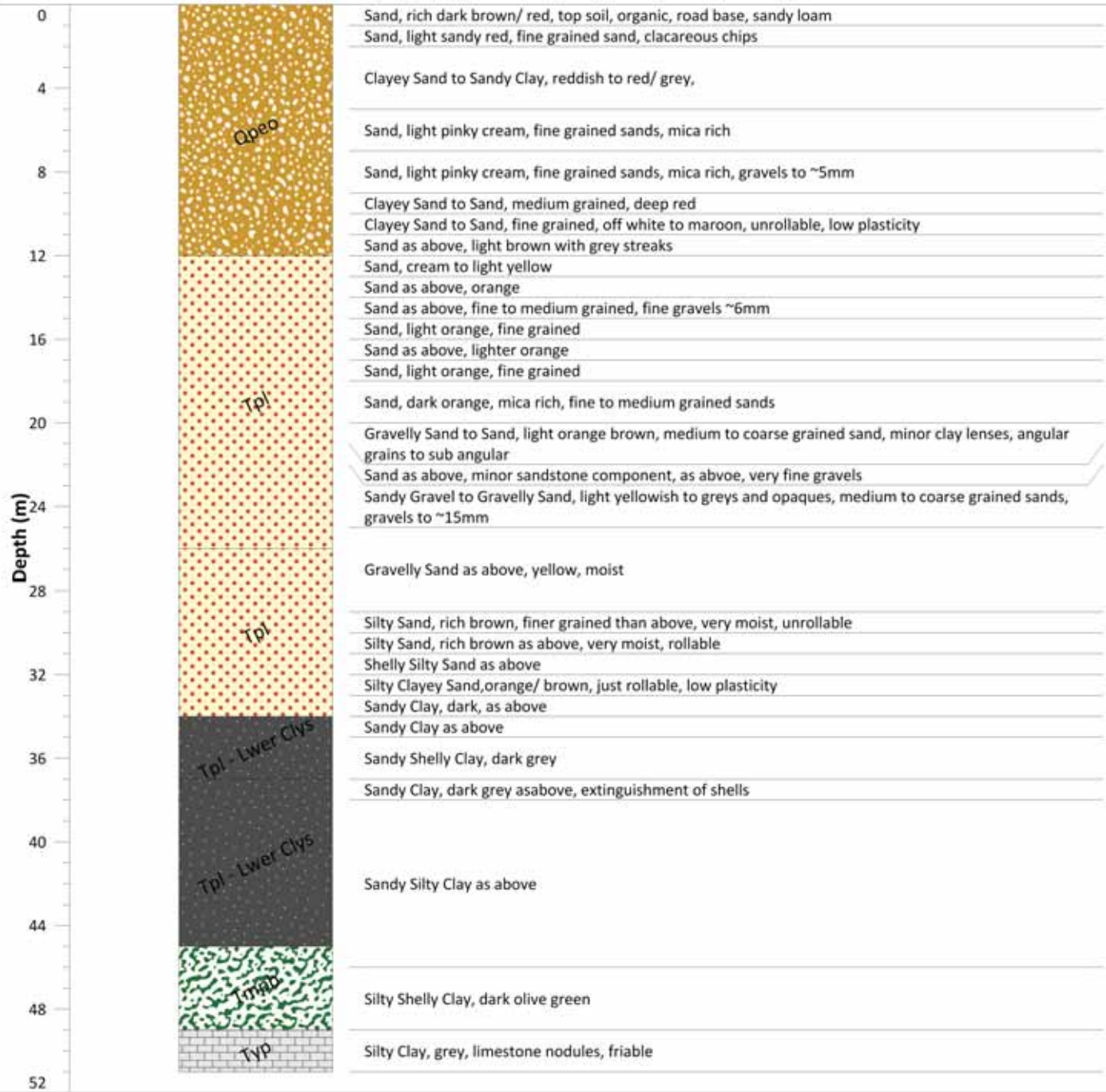
Completion Date: 12/11/08 **NS Elevation (mAHD):** 44.178 **Final Depth (m):** 51

Easting: 463289.438 **Zone:** 54 **Northing:** 6194351.991 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA105



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2443 **Permit Number:** 156593 **Region:** Loxton

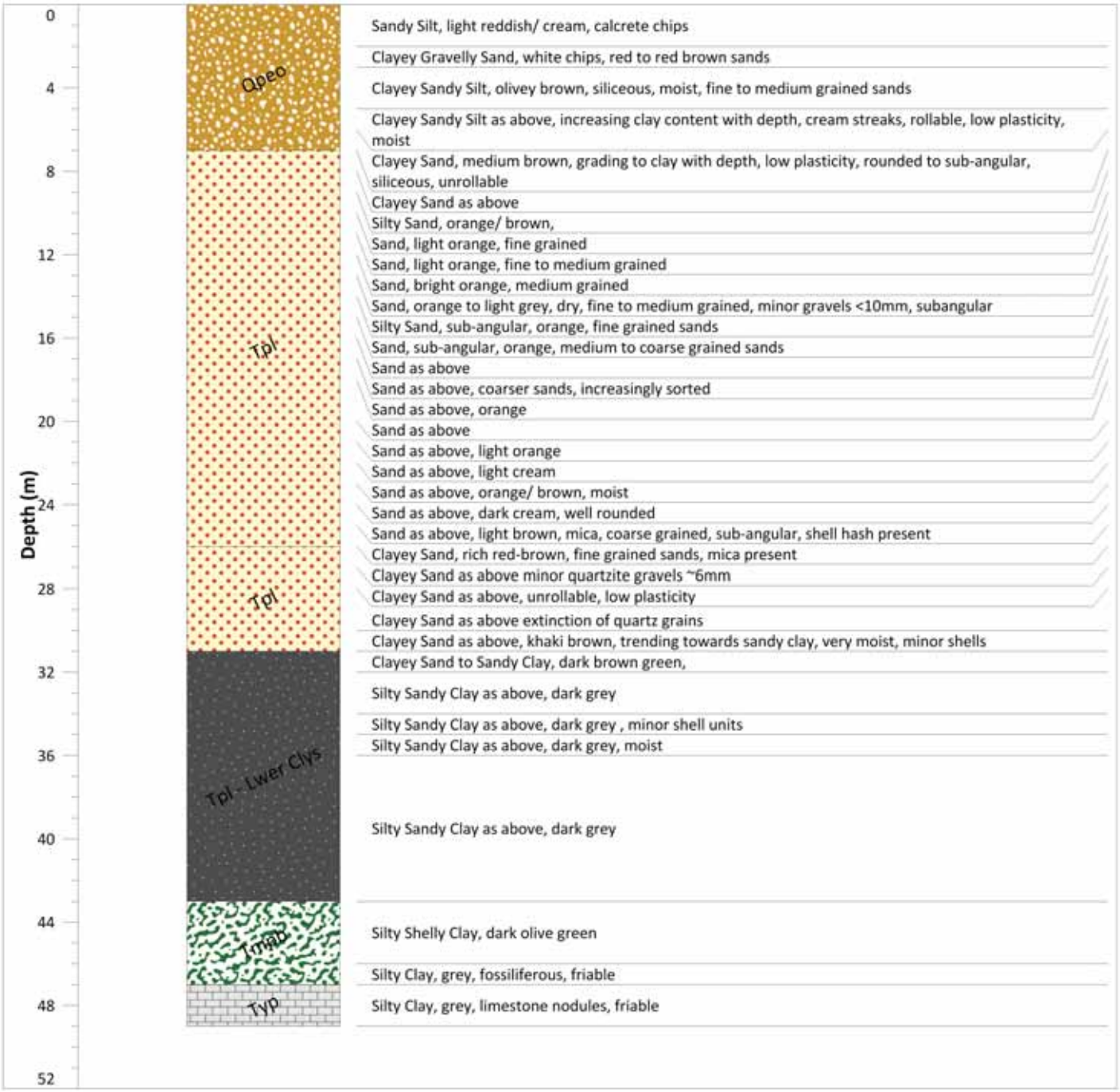
Completion Date: 12/11/08 **NS Elevation (mAHD):** 40.519 **Final Depth (m):** 49

Easting: 463276.084 **Zone:** 54 **Northing:** 6194179.562 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA106



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2455 **Permit Number:** 156595 **Region:** Loxton

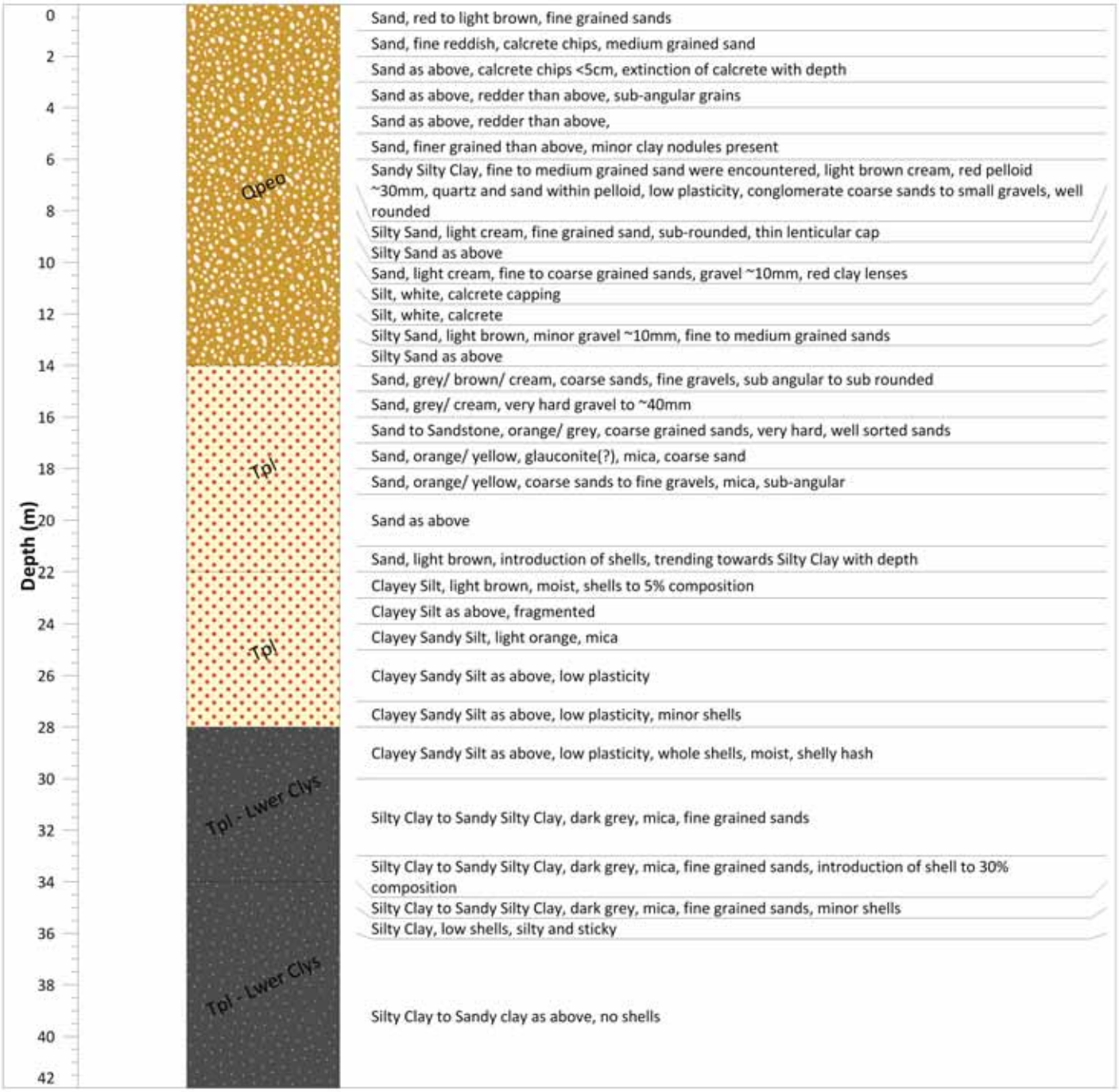
Completion Date: 12/10/08 **NS Elevation (mAHD):** 39.7 **Final Depth (m):** 42

Easting: 463261.401 **Zone:** 54 **Northing:** 6194054.087 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA107



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2509 **Permit Number:** 182586 **Region:** Loxton

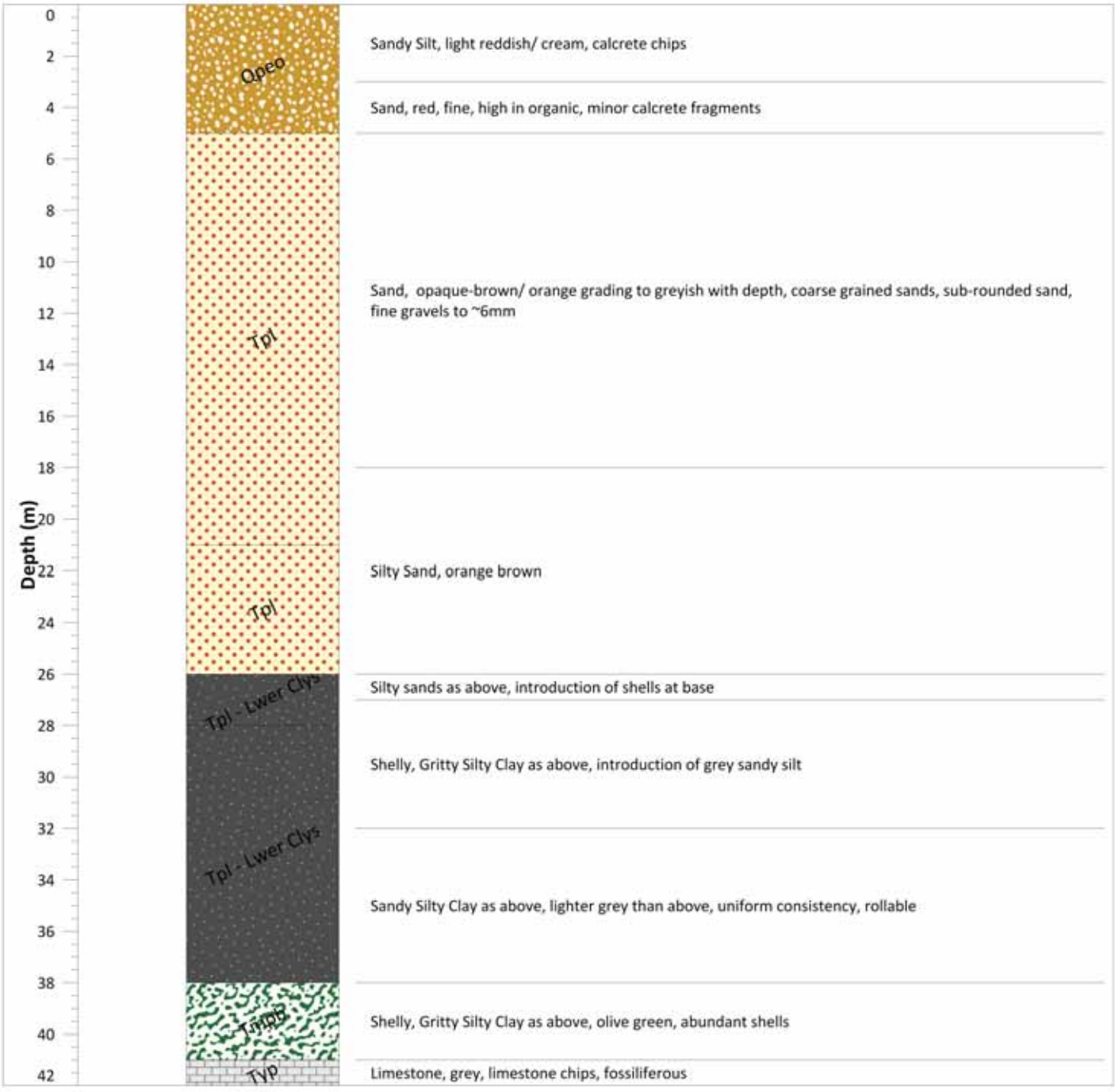
Completion Date: 10/08/09 **NS Elevation (mAHD):** 33.42 **Final Depth (m):** 42

Easting: 462653.13 **Zone:** 54 **Northing:** 6191770.3 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA108



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2510 **Permit Number:** 168608 **Region:** Loxton

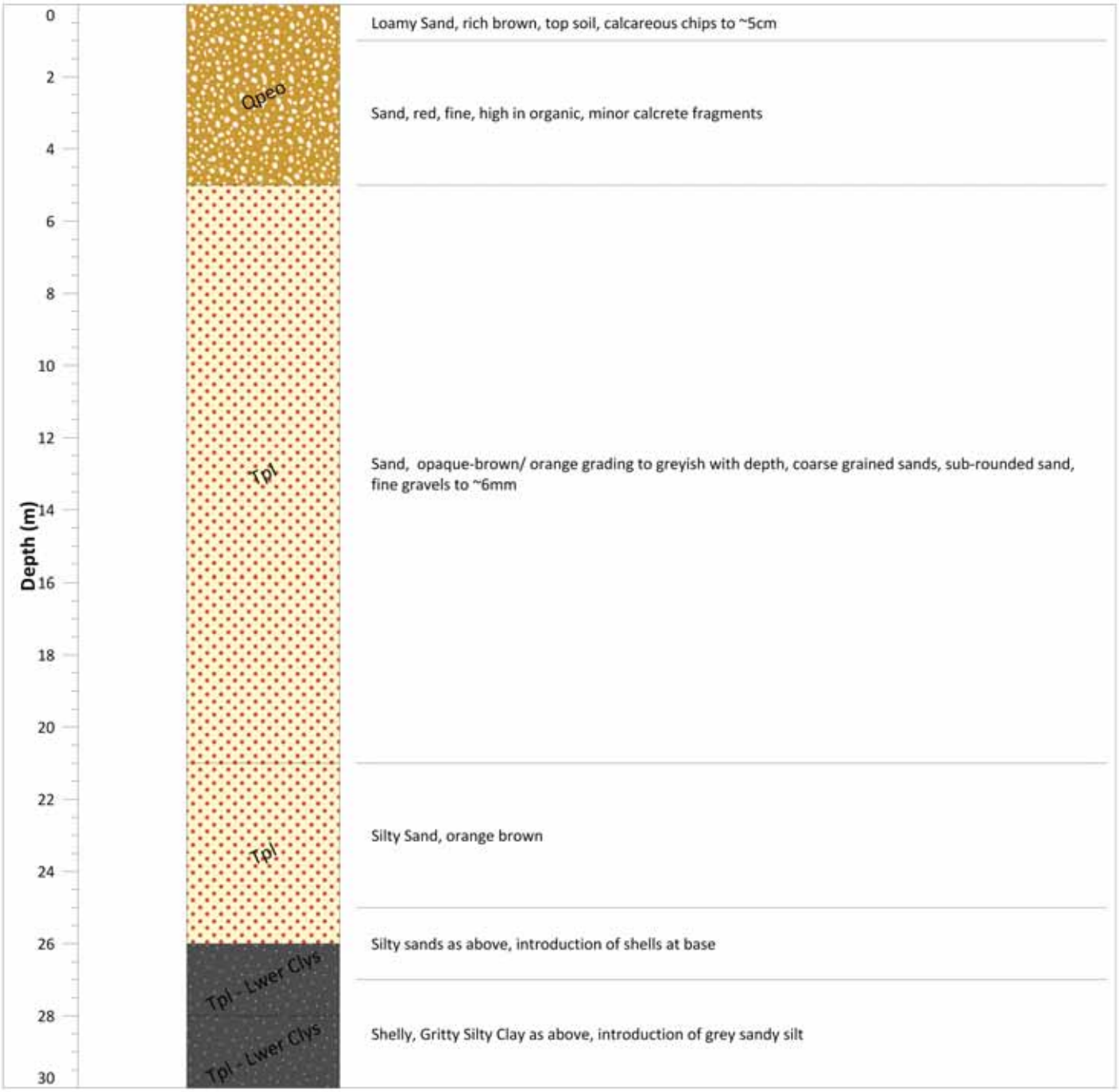
Completion Date: 10/08/09 **NS Elevation (mAHD):** 33.58 **Final Depth (m):** 30

Easting: 462657.76 **Zone:** 54 **Northing:** 6191794.65 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA109



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2511 **Permit Number:** 182587 **Region:** Loxton

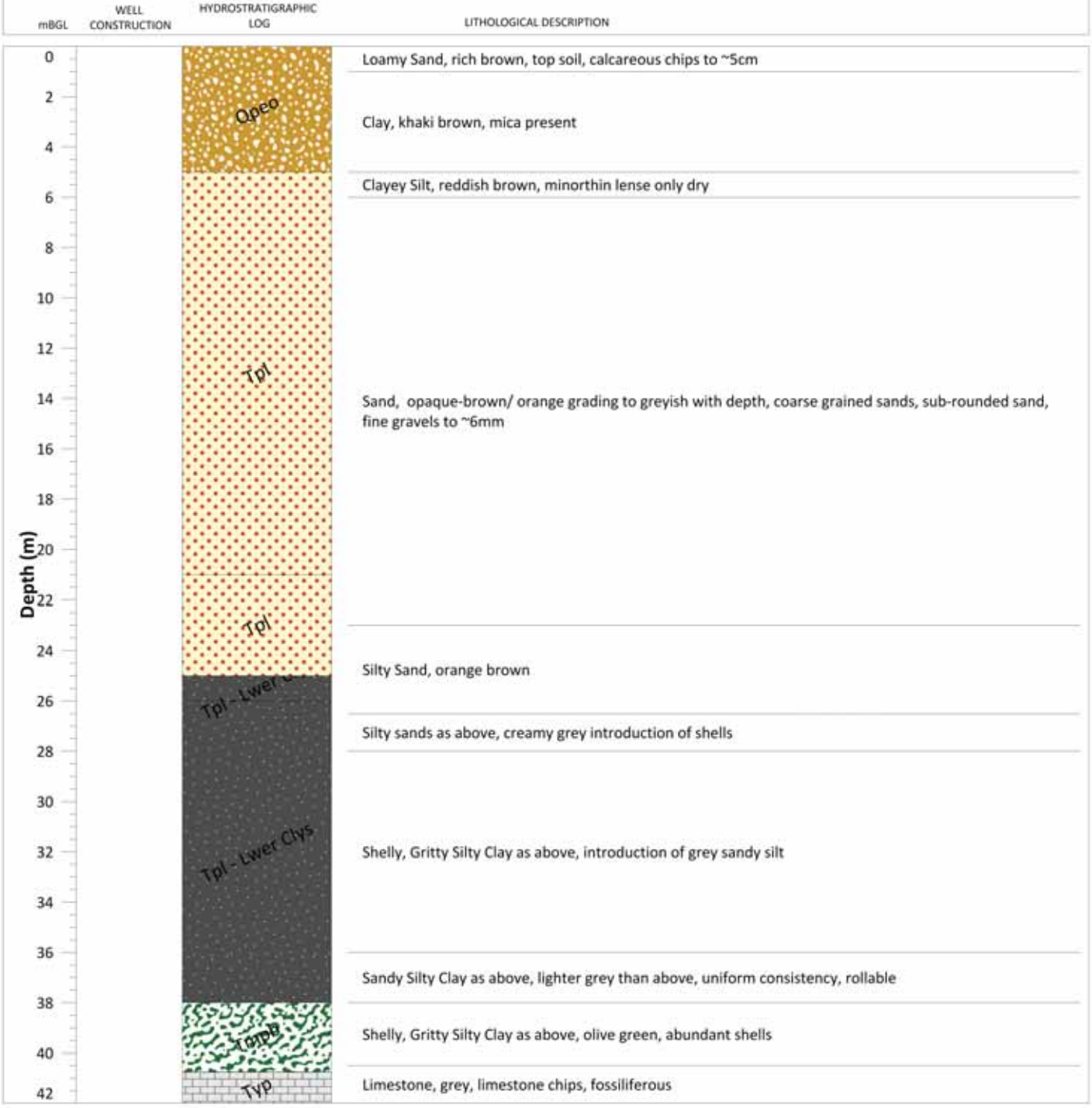
Completion Date: 10/08/09 **NS Elevation (mAHD):** 33.61 **Final Depth (m):** 42

Easting: 462662.62 **Zone:** 54 **Northing:** 6191819.43 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA110



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2512 **Permit Number:** 168610 **Region:** Loxton

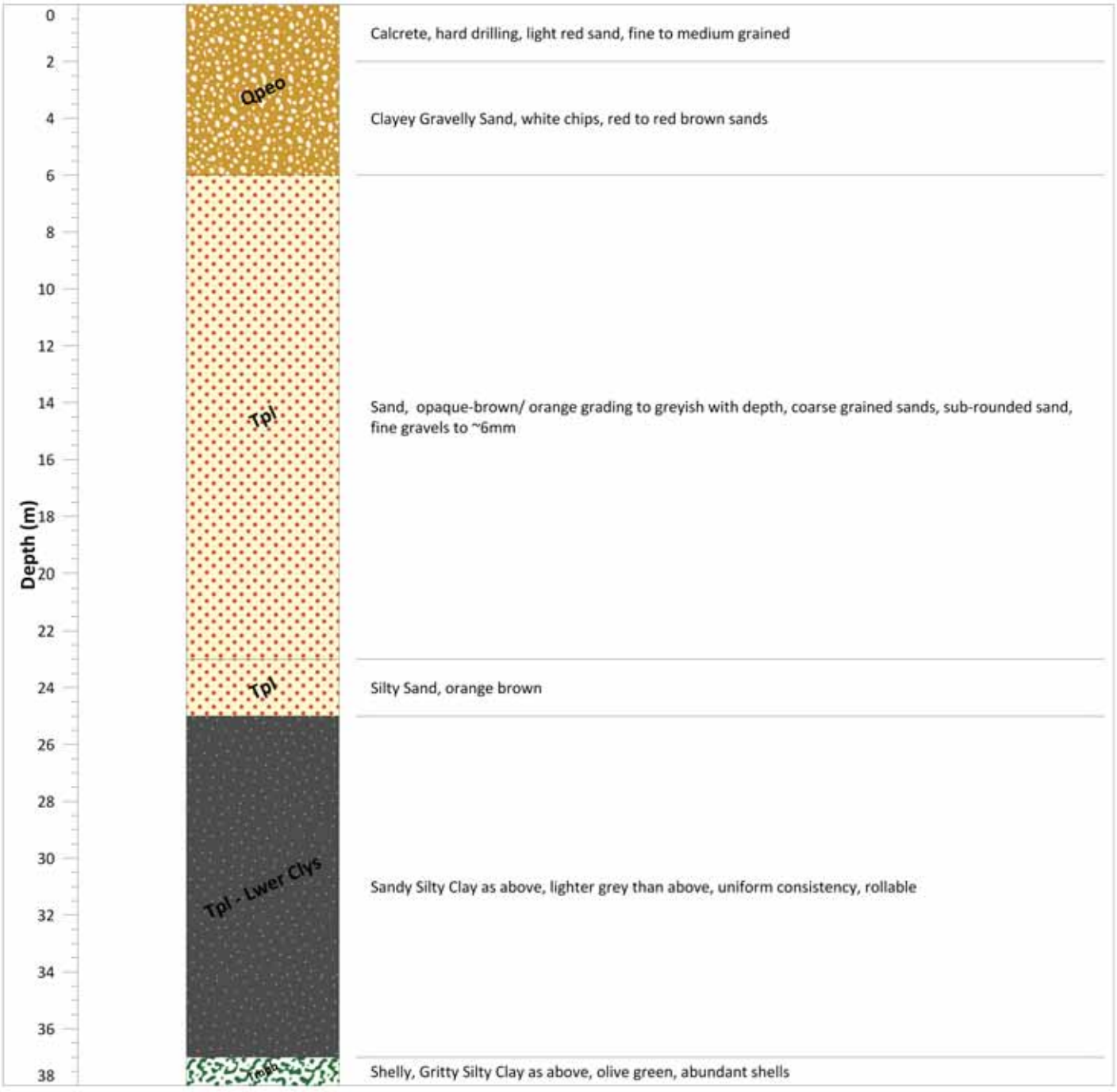
Completion Date: 10/09/09 **NS Elevation (mAHD):** 32.98 **Final Depth (m):** 38

Easting: 462671.43 **Zone:** 54 **Northing:** 6191868.89 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA111



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2513 **Permit Number:** 182588 **Region:** Loxton

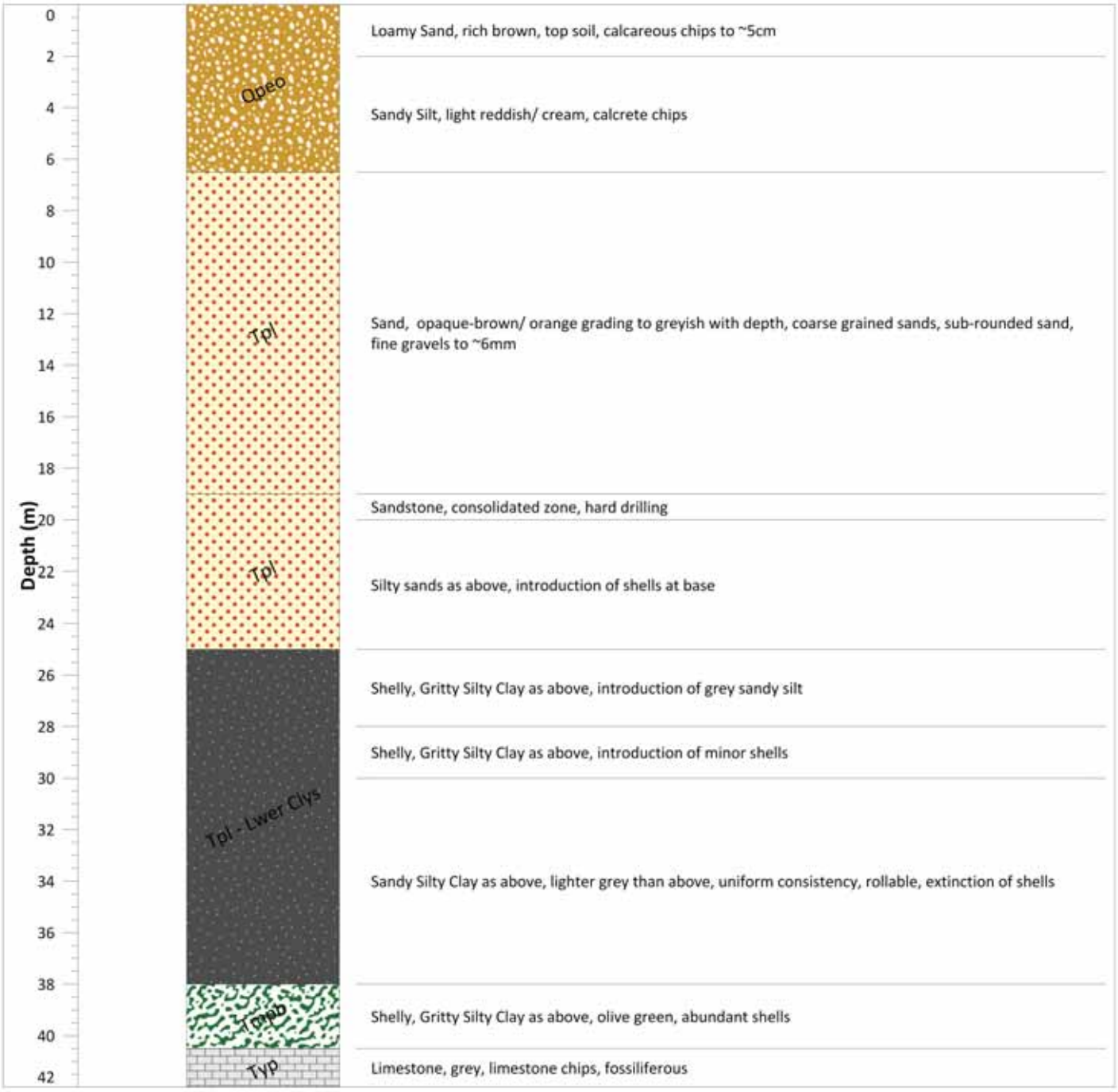
Completion Date: 10/09/09 **NS Elevation (mAHD):** 32.495 **Final Depth (m):** 42

Easting: 462663.111 **Zone:** 54 **Northing:** 6191897.922 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA112



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2514 **Permit Number:** 168612 **Region:** Loxton

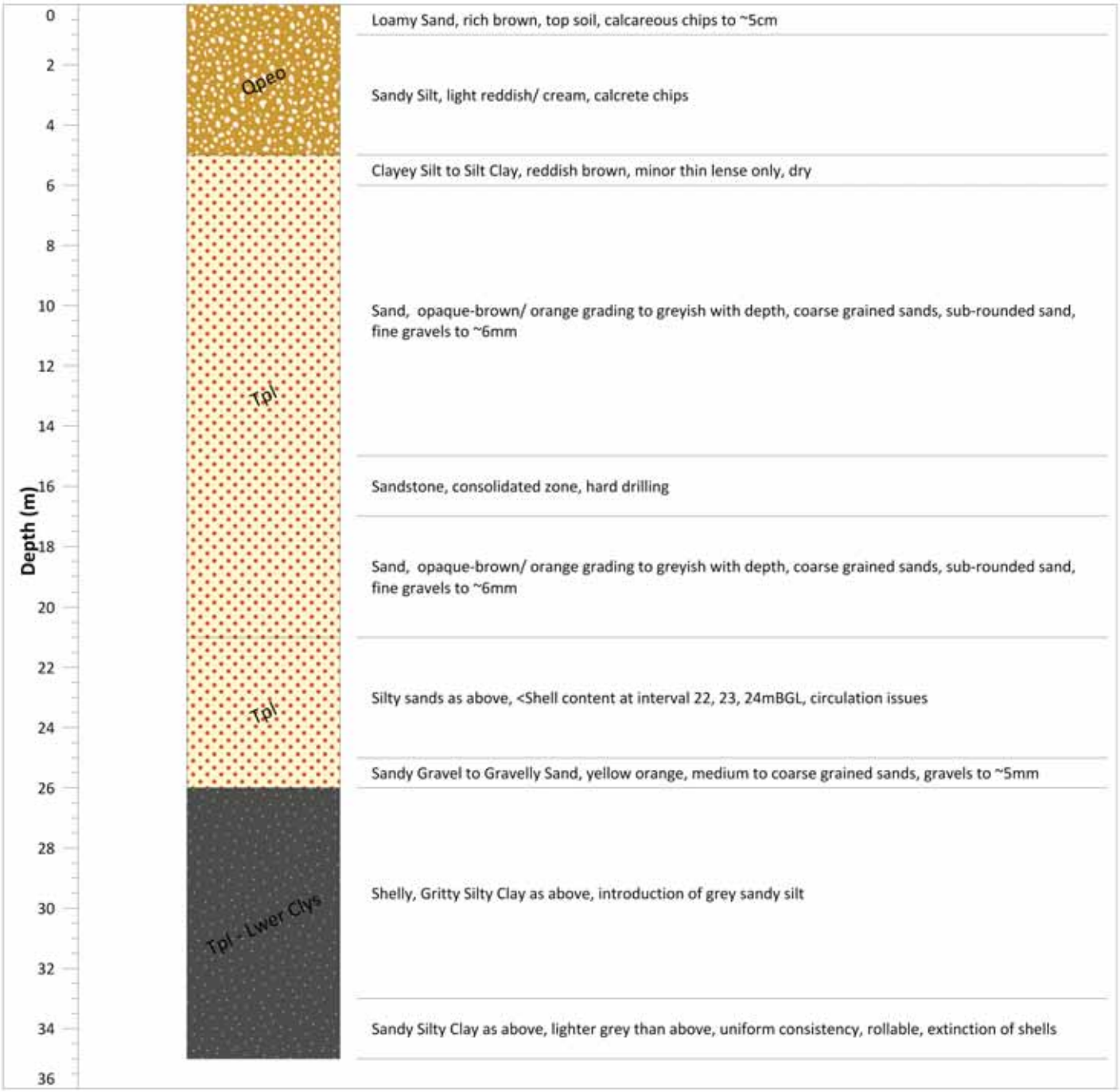
Completion Date: 10/09/09 **NS Elevation (mAHD):** 32.01 **Final Depth (m):** 35

Easting: 462738.98 **Zone:** 54 **Northing:** 6191924.58 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA113



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2515 **Permit Number:** 182589 **Region:** Loxton

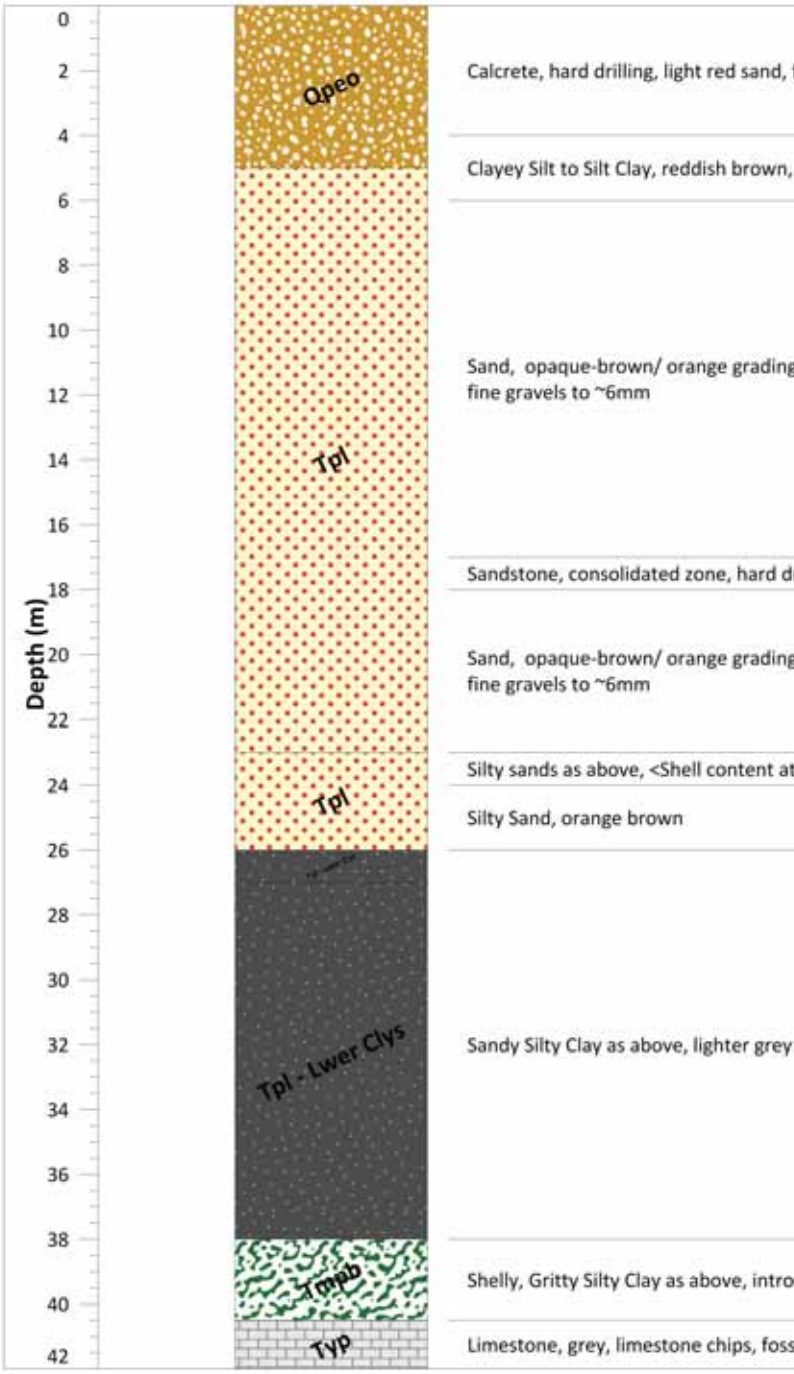
Completion Date: 10/10/09 **NS Elevation (mAHD):** 31.76 **Final Depth (m):** 42

Easting: 462738.98 **Zone:** 54 **Northing:** 6191924.58 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA114



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2516 **Permit Number:** 182591 **Region:** Loxton

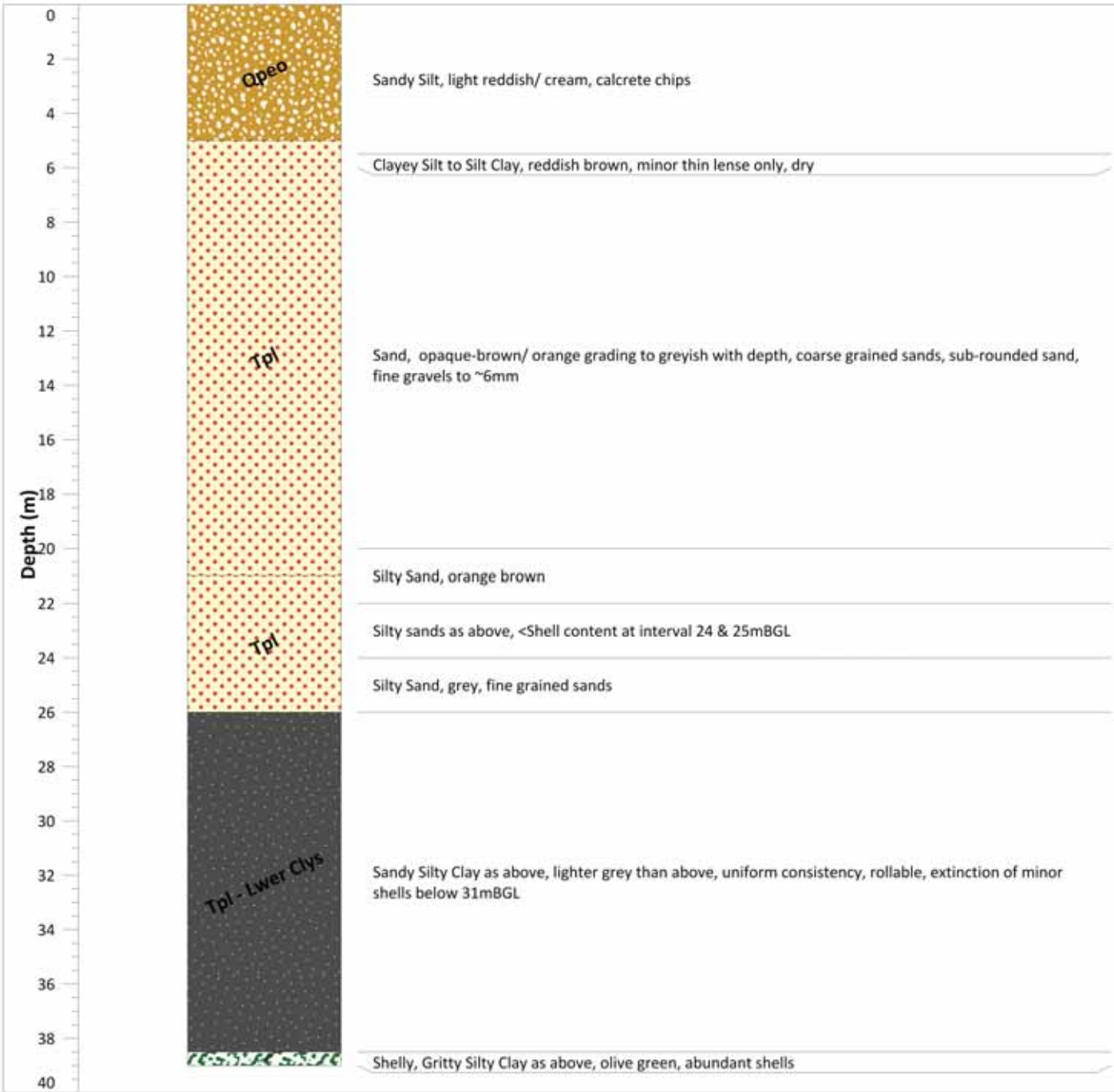
Completion Date: 10/10/09 **NS Elevation (mAHD):** 31.41 **Final Depth (m):** 39

Easting: 462719.61 **Zone:** 54 **Northing:** 6191965.03 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA115



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2517 **Permit Number:** 168615 **Region:** Loxton

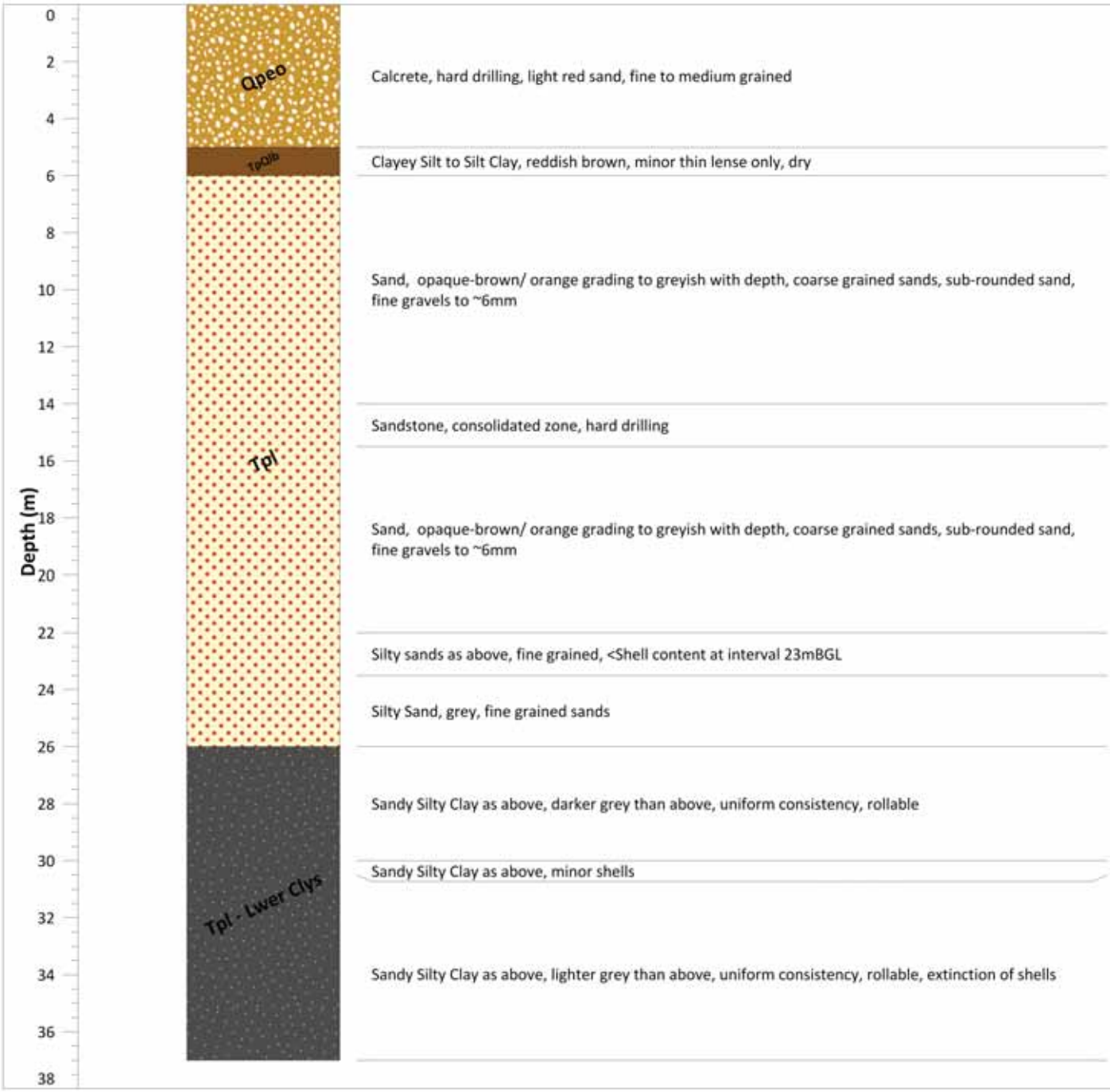
Completion Date: 10/10/09 **NS Elevation (mAHD):** 31.19 **Final Depth (m):** 37

Easting: 462675.75 **Zone:** 54 **Northing:** 6191988.21 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA116



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2518 **Permit Number:** 182592 **Region:** Loxton

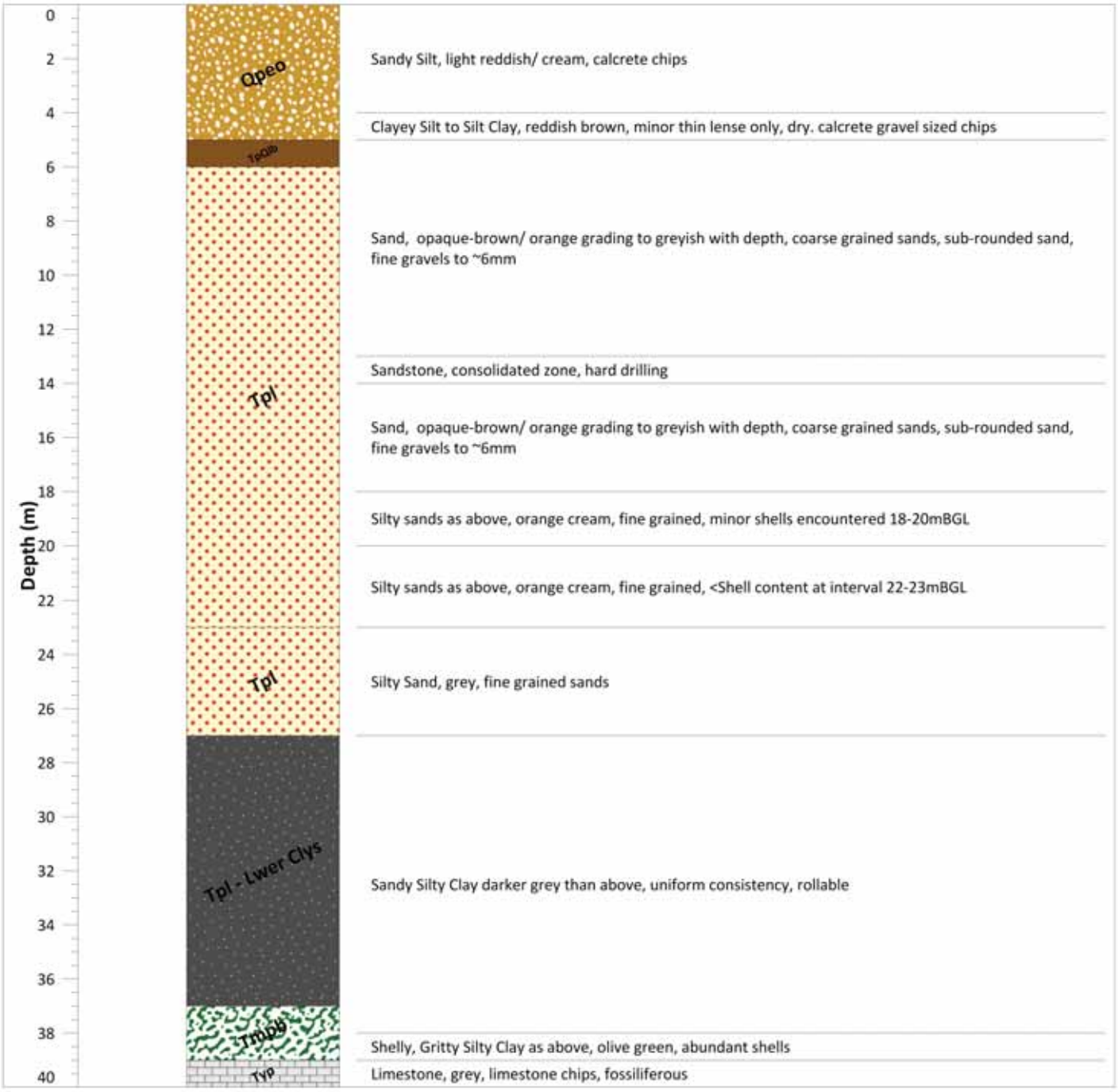
Completion Date: 10/11/09 **NS Elevation (mAHD):** 31.15 **Final Depth (m):** 40

Easting: 462631.48 **Zone:** 54 **Northing:** 6192011.58 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA117



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2519 **Permit Number:** 168617 **Region:** Loxton

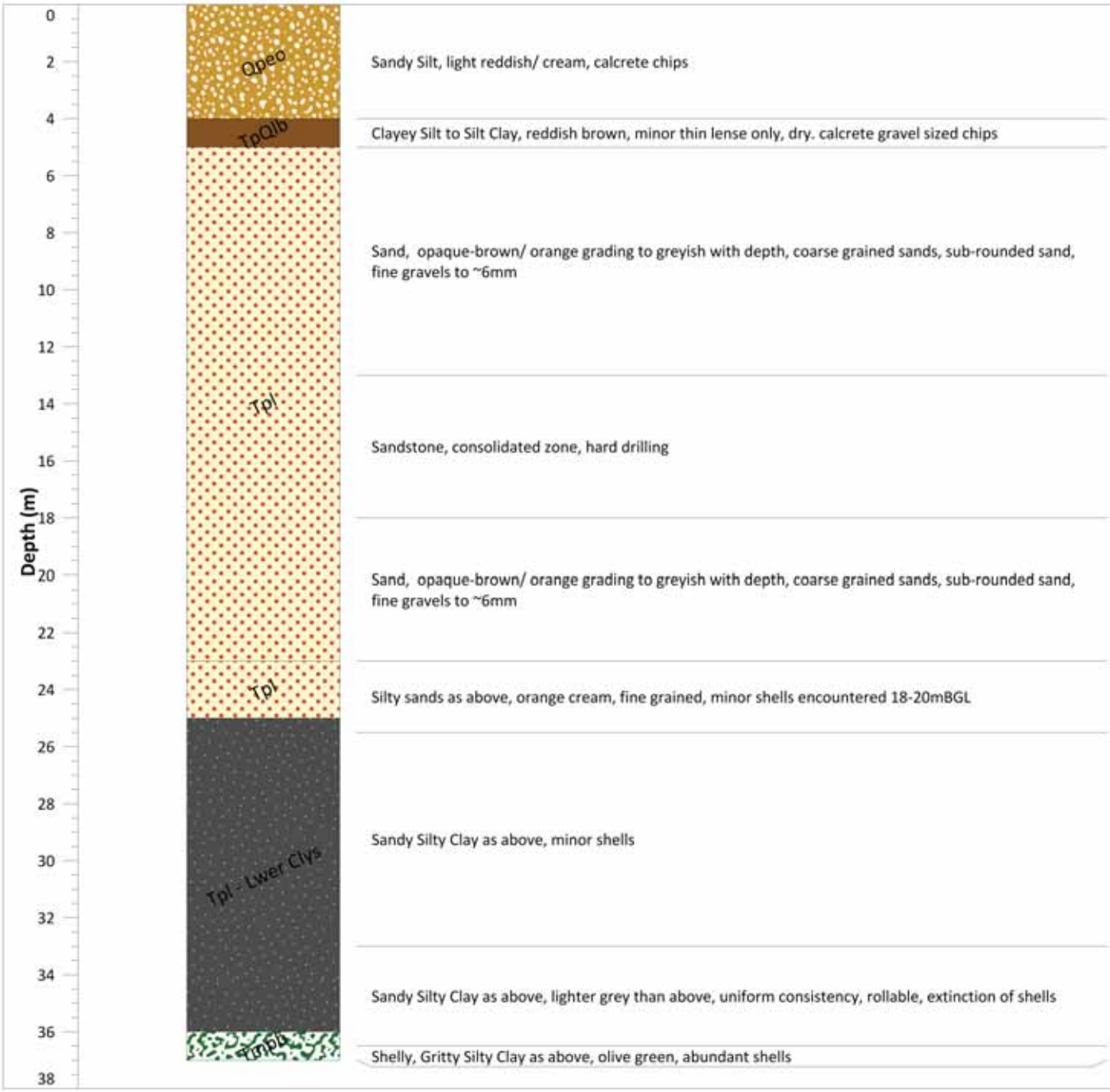
Completion Date: 10/11/09 **NS Elevation (mAHD):** 31.02 **Final Depth (m):** 37

Easting: 462587.59 **Zone:** 54 **Northing:** 6192034.76 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA118



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2520 **Permit Number:** 182593 **Region:** Loxton

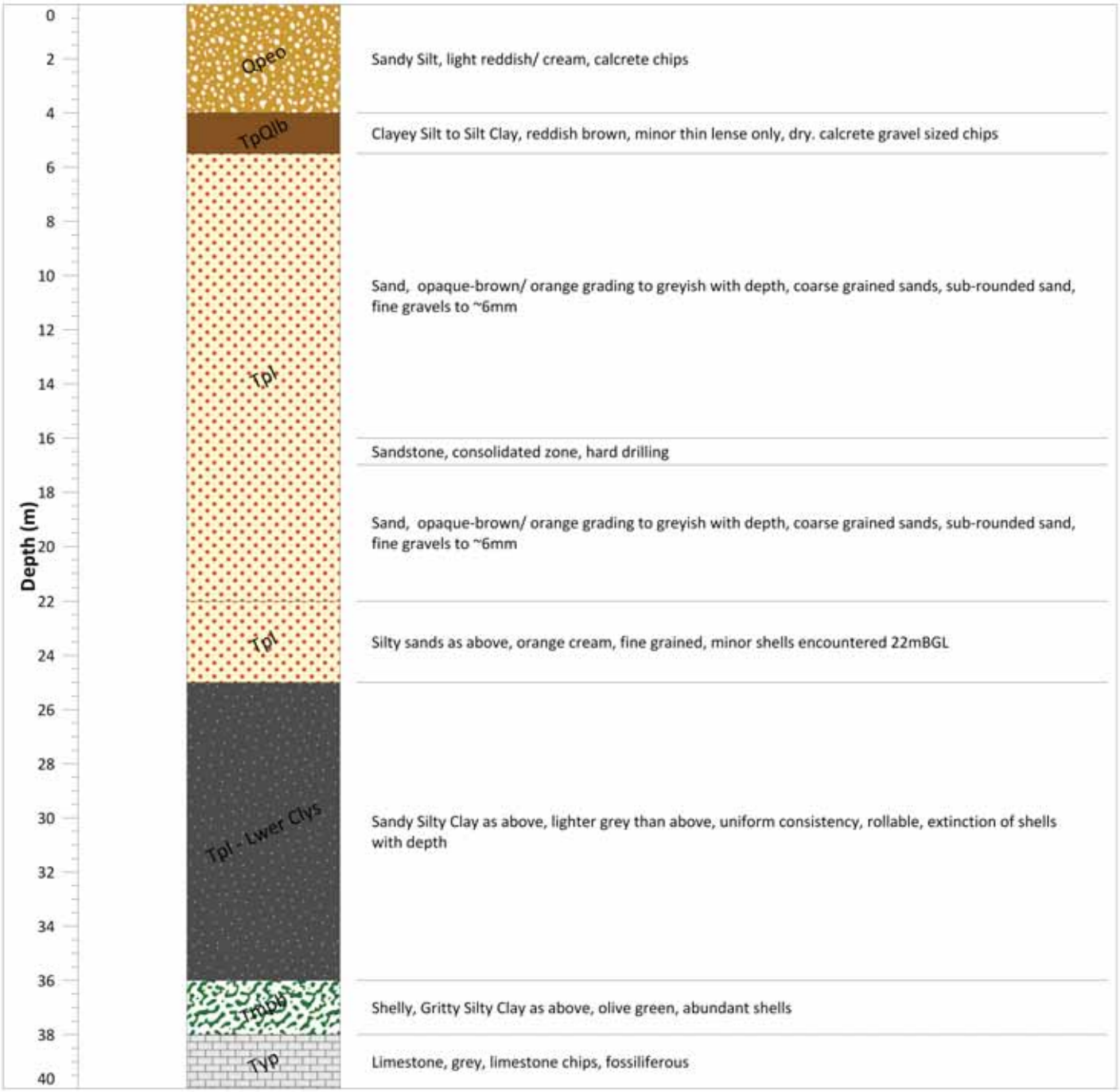
Completion Date: 10/12/09 **NS Elevation (mAHD):** 30.99 **Final Depth (m):** 40

Easting: 462543.6 **Zone:** 54 **Northing:** 6192057.85 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA119



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2521 **Permit Number:** 168619 **Region:** Loxton

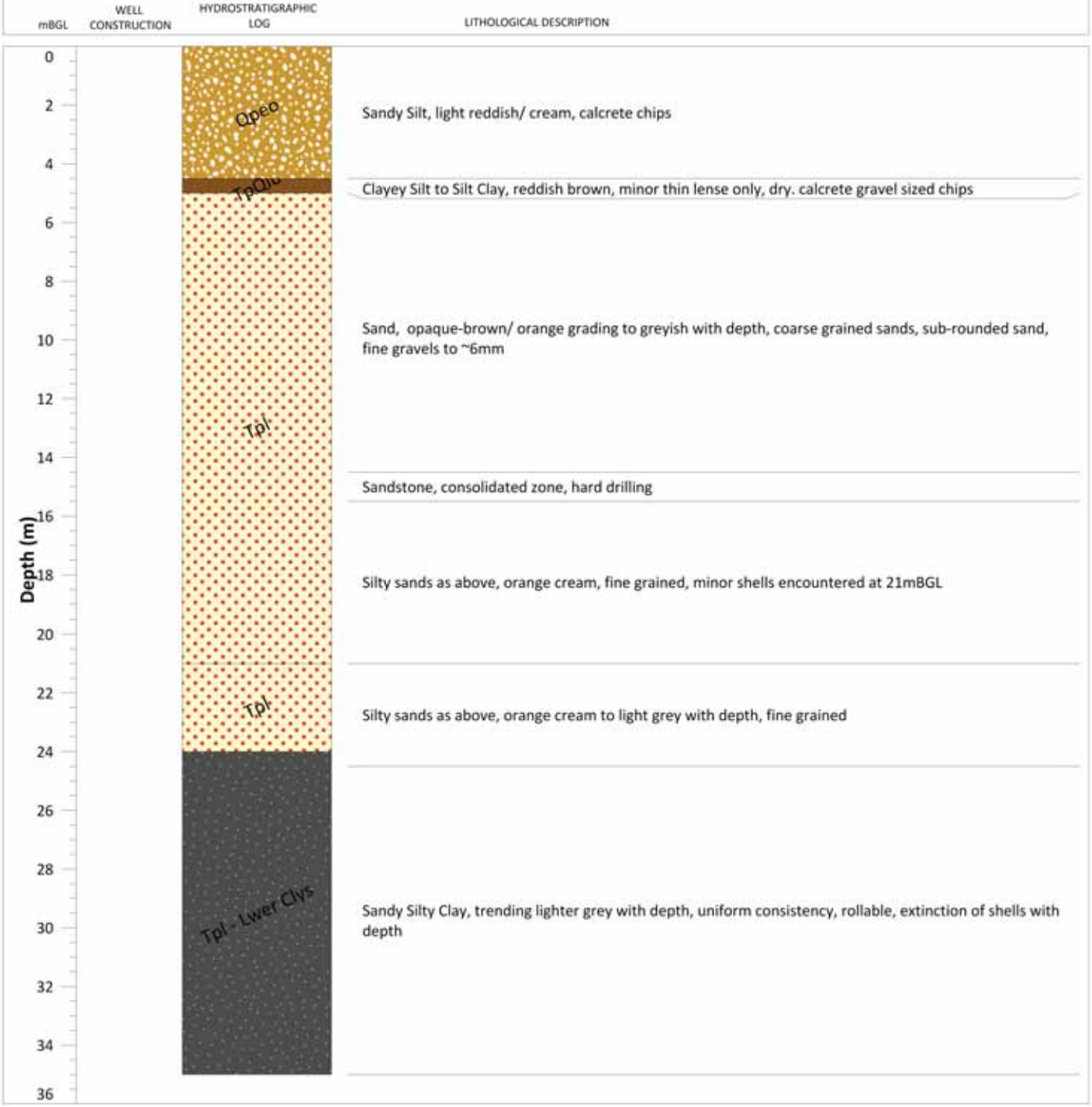
Completion Date: 10/12/09 **NS Elevation (mAHD):** 31.01 **Final Depth (m):** 35

Easting: 462499.61 **Zone:** 54 **Northing:** 6192080.98 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA120



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2522 **Permit Number:** 182594 **Region:** Loxton

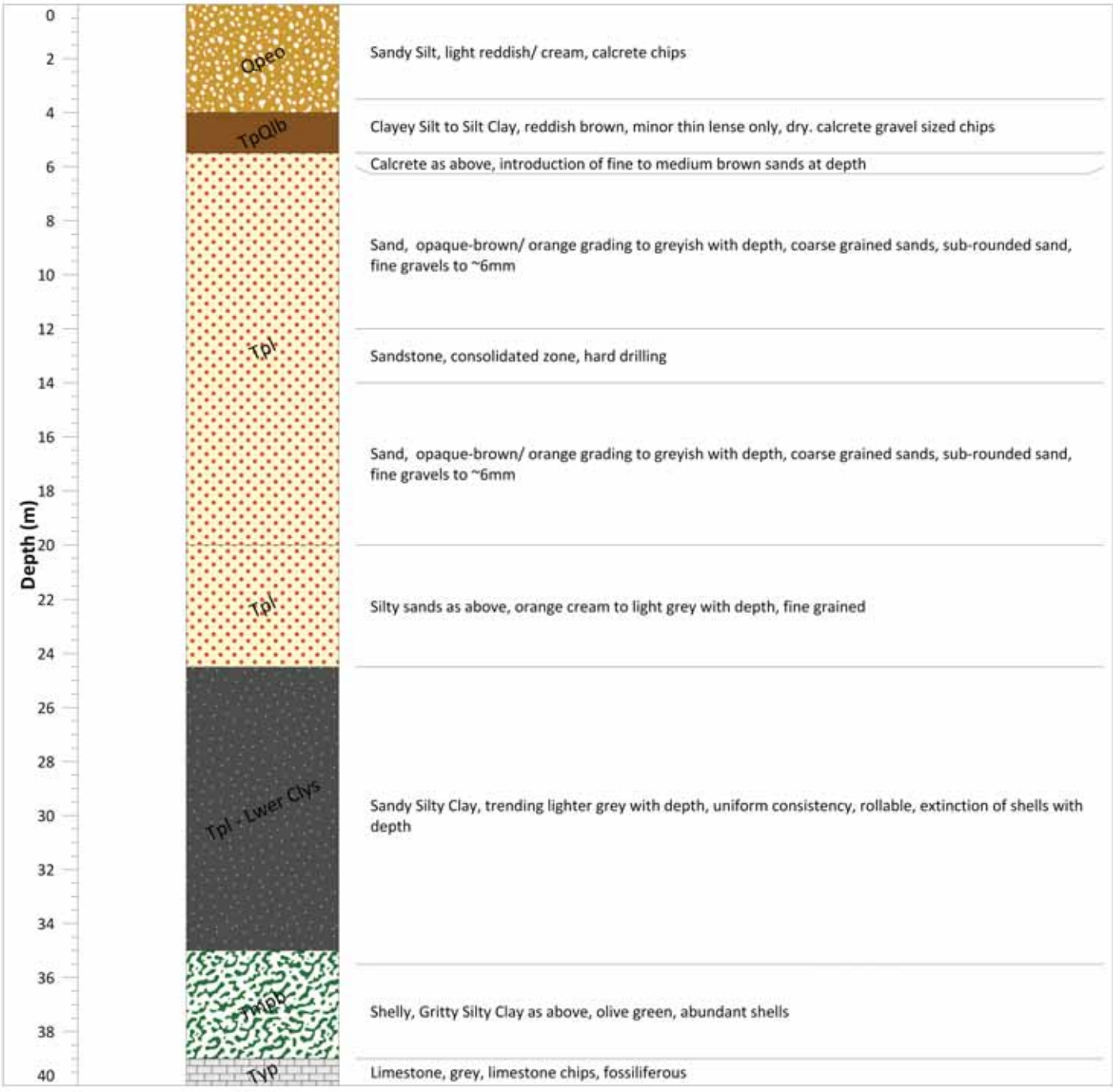
Completion Date: 10/12/09 **NS Elevation (mAHD):** 31.07 **Final Depth (m):** 40

Easting: 462455.6 **Zone:** 54 **Northing:** 6192104.25 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA121



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2523 **Permit Number:** 168621 **Region:** Loxton

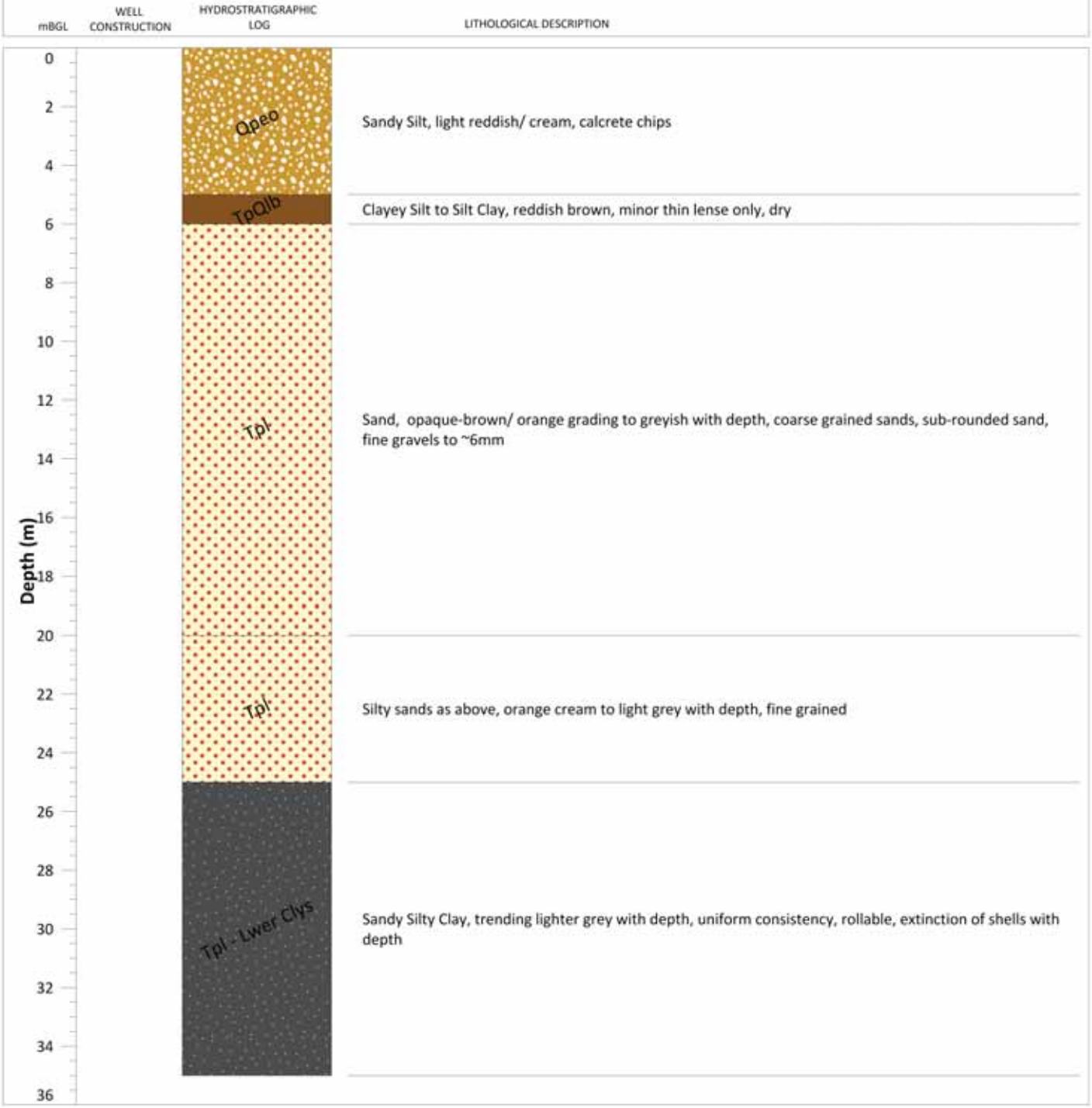
Completion Date: 10/12/09 **NS Elevation (mAHD):** 31.06 **Final Depth (m):** 35

Easting: 462411.51 **Zone:** 54 **Northing:** 6192127.43 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA122



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2524 **Permit Number:** 182595 **Region:** Loxton

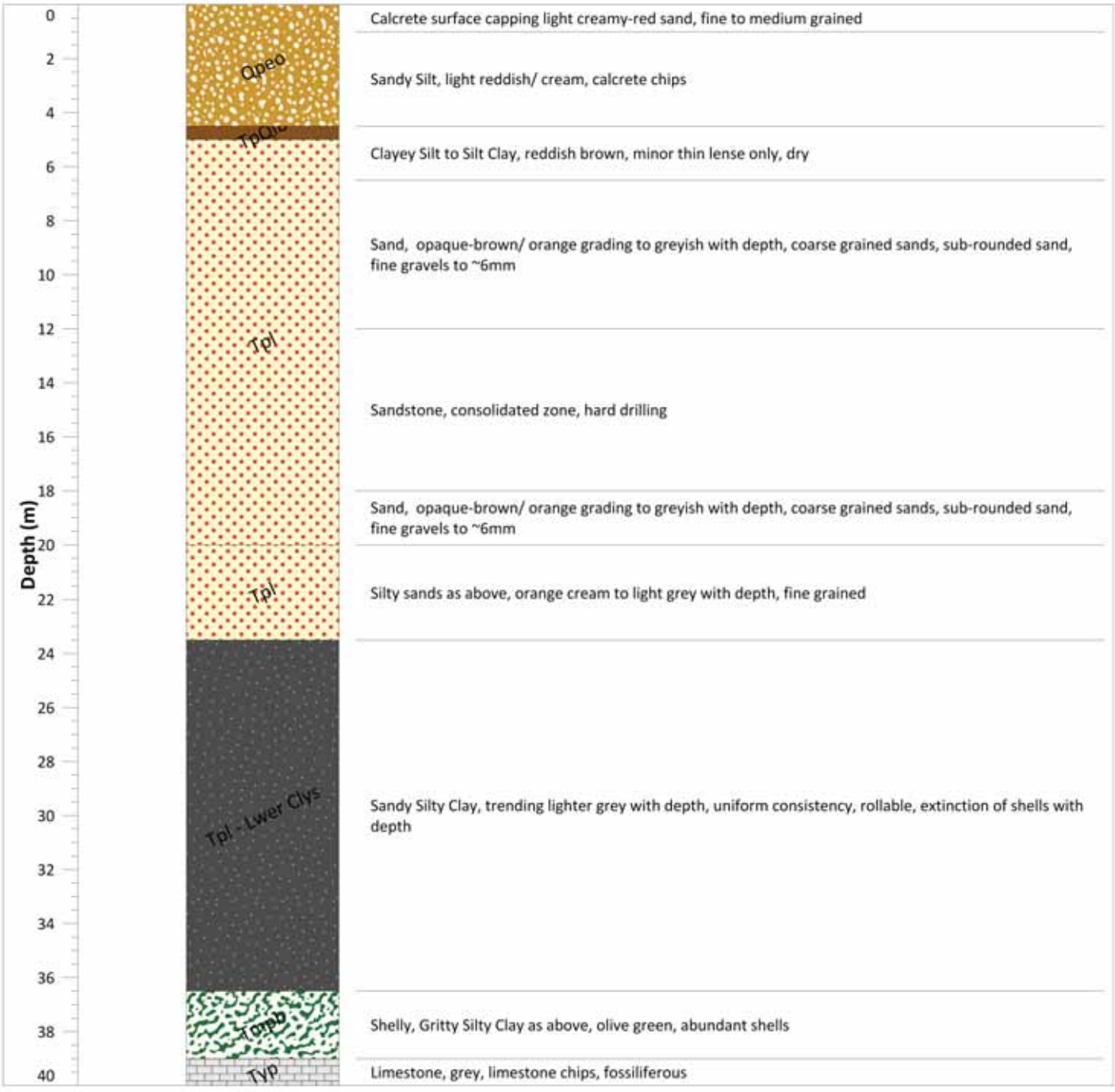
Completion Date: 10/13/09 **NS Elevation (mAHD):** 31.27 **Final Depth (m):** 40

Easting: 462367.63 **Zone:** 54 **Northing:** 6192150.66 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA123



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2525 **Permit Number:** 168623 **Region:** Loxton

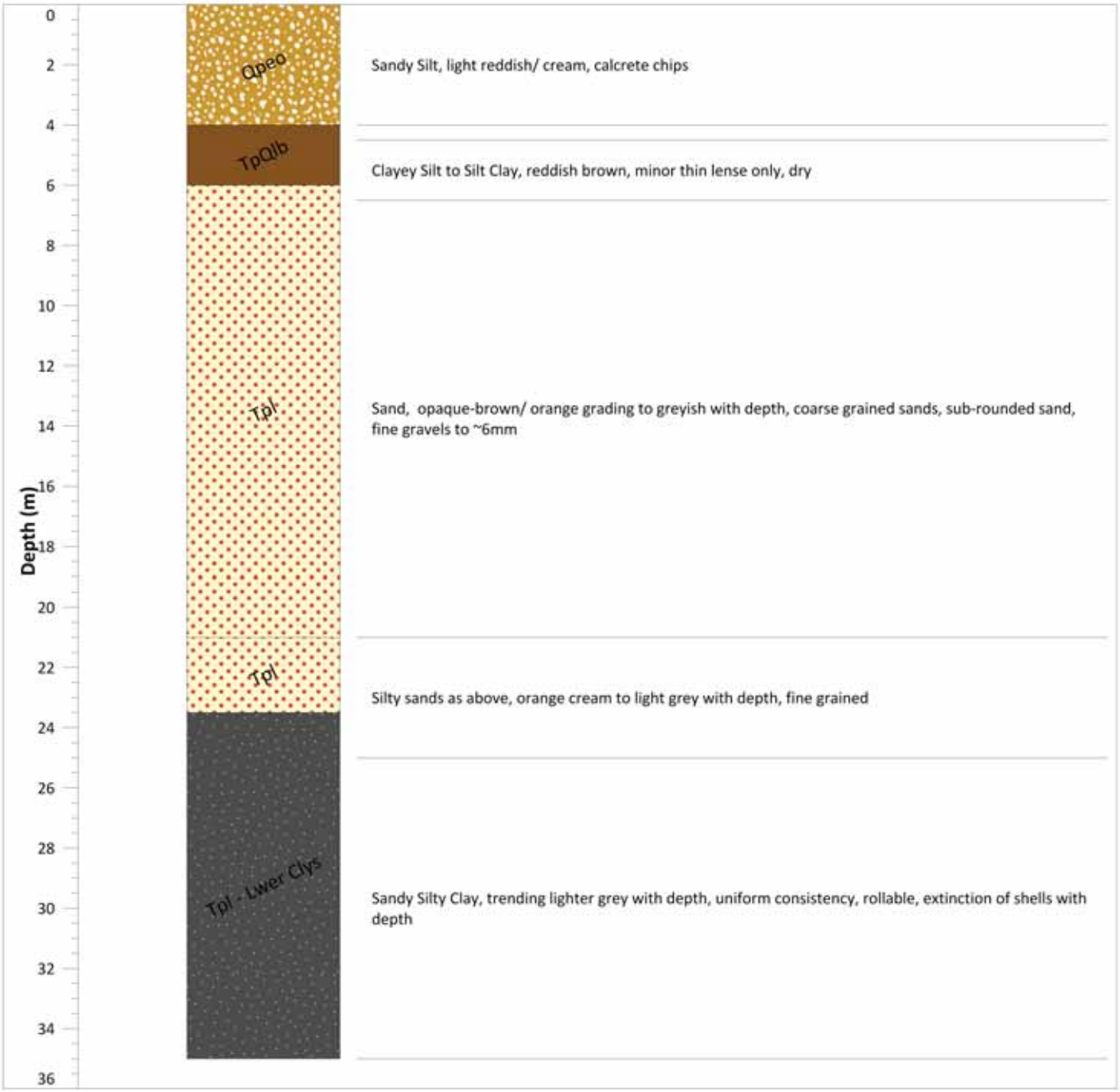
Completion Date: 10/13/09 **NS Elevation (mAHD):** 31.65 **Final Depth (m):** 35

Easting: 462323.8 **Zone:** 54 **Northing:** 6192173.67 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA124



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2526 **Permit Number:** 168624 **Region:** Loxton

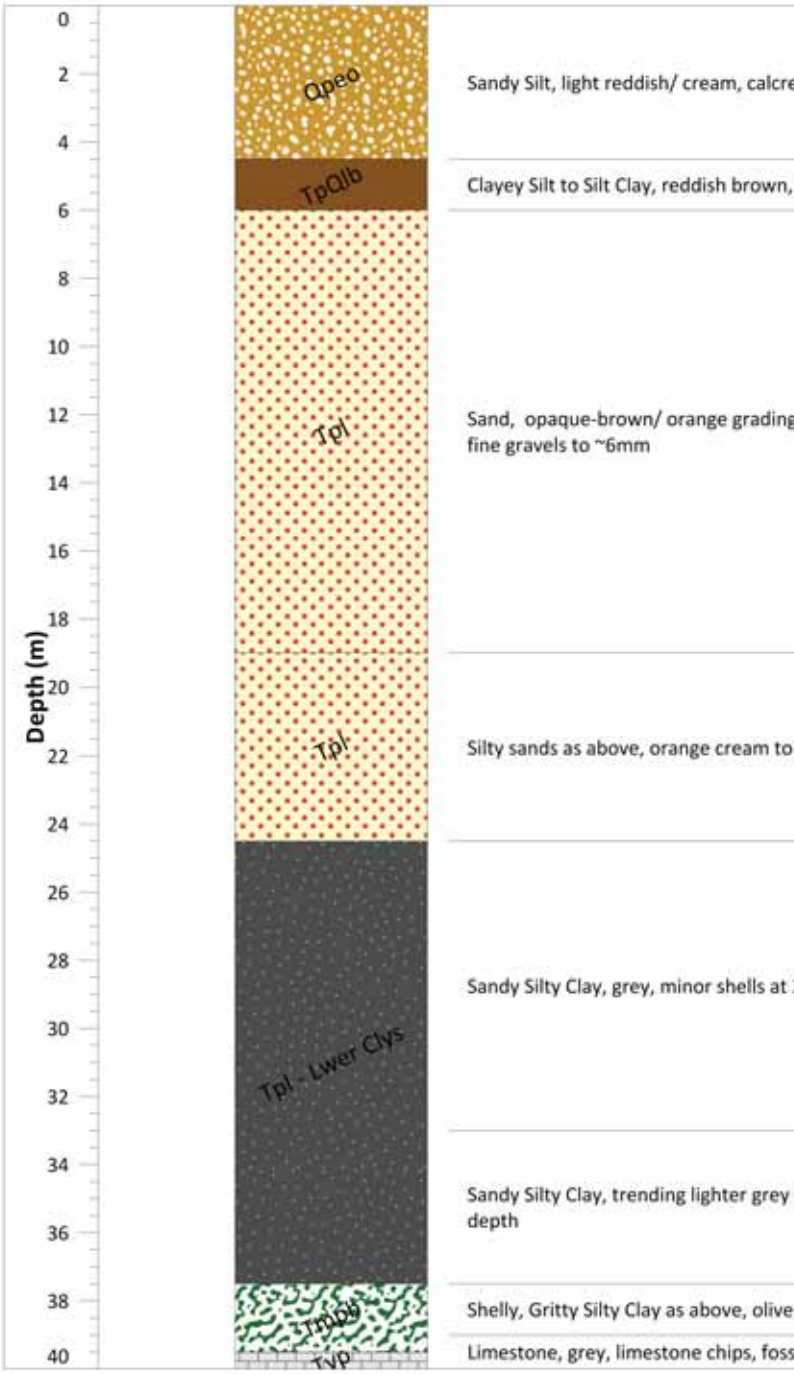
Completion Date: 10/13/09 **NS Elevation (mAHD):** 32.42 **Final Depth (m):** 40

Easting: 462279.68 **Zone:** 54 **Northing:** 6192196.88 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA125



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2527 **Permit Number:** 168663 **Region:** Loxton

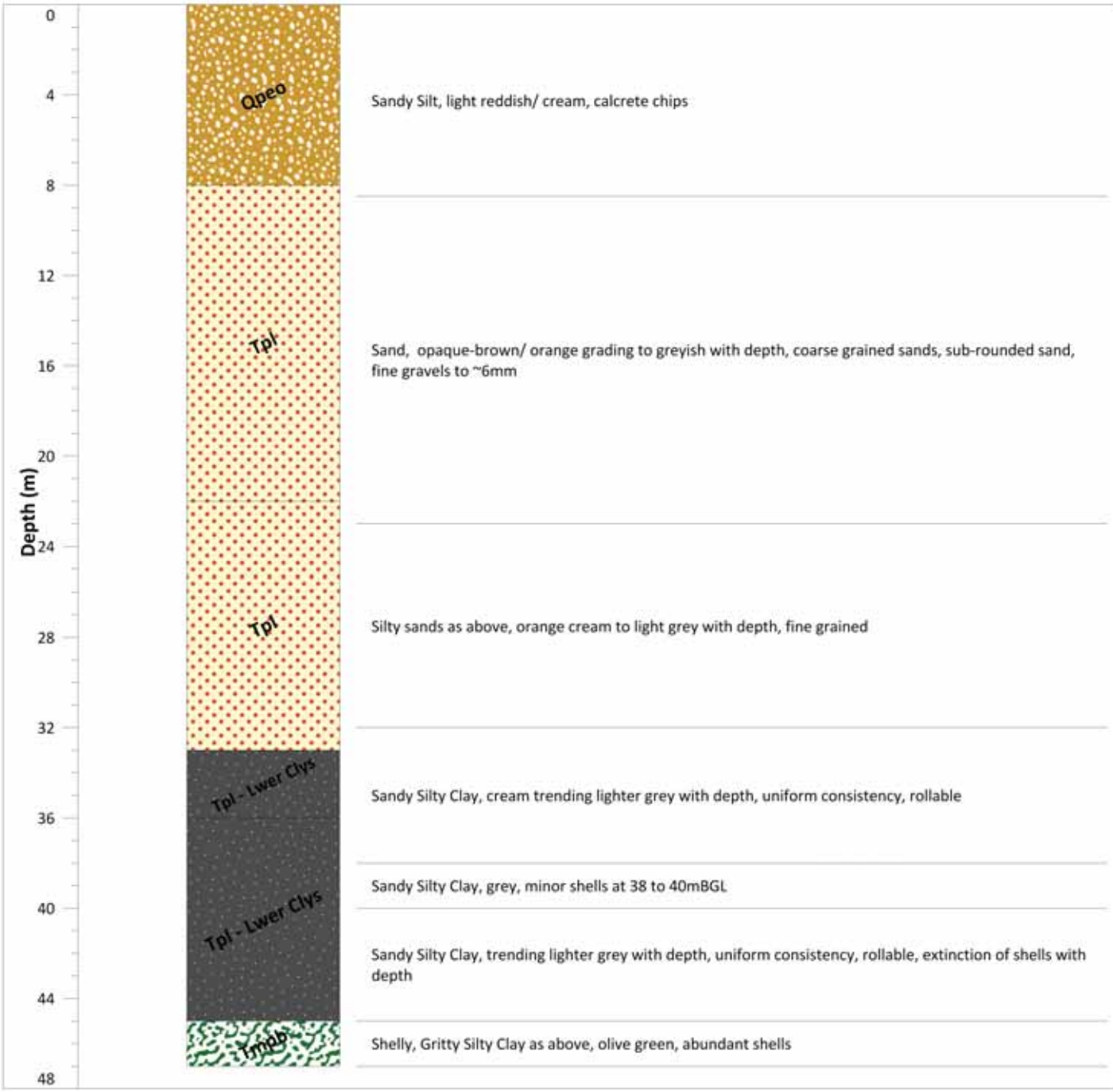
Completion Date: 10/14/09 **NS Elevation (mAHD):** 43.11 **Final Depth (m):** 47

Easting: 463332.23 **Zone:** 54 **Northing:** 6194612.305 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA127



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2528 **Permit Number:** 168664 **Region:** Loxton

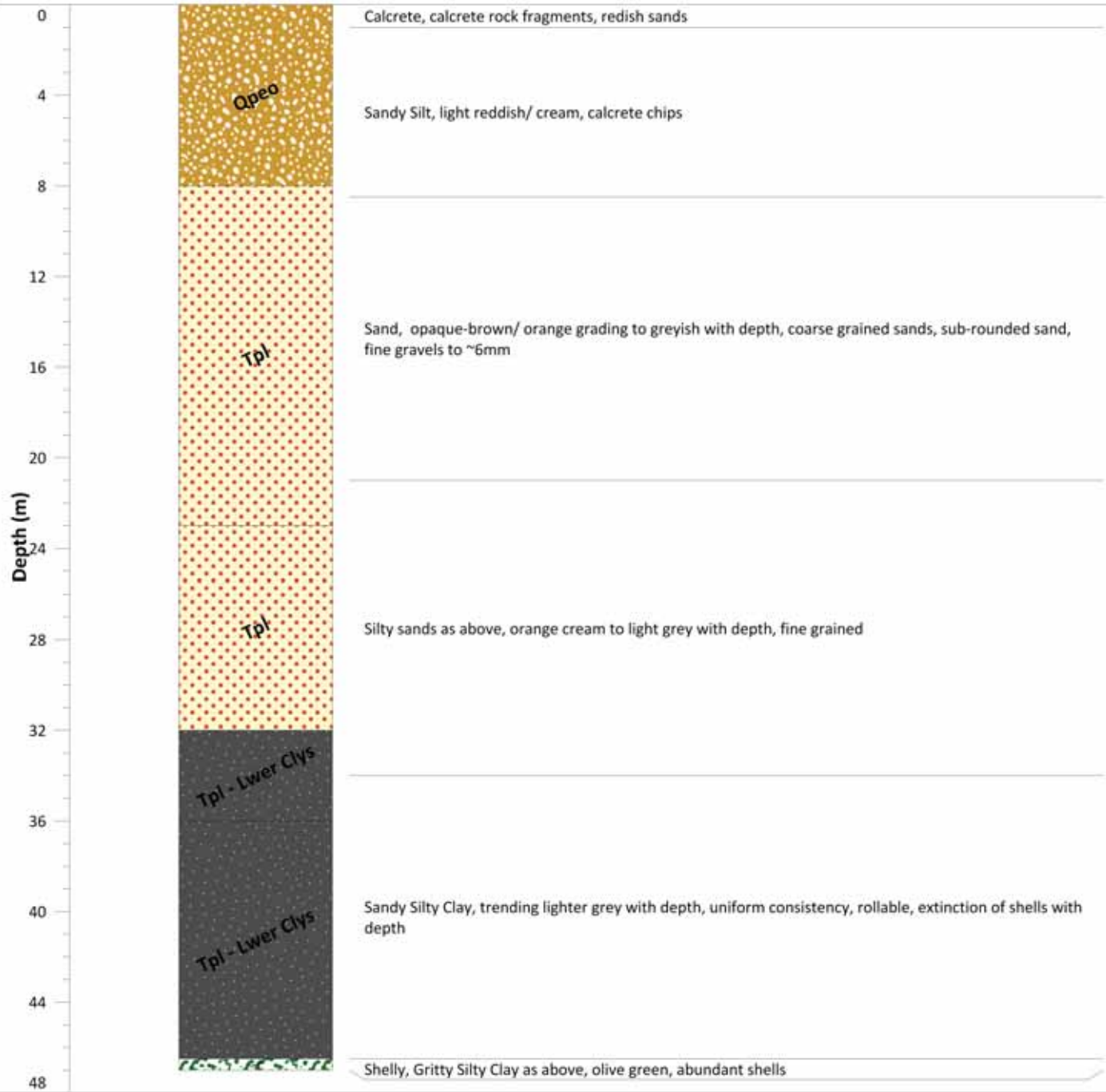
Completion Date: 10/14/09 **NS Elevation (mAHD):** 42.64 **Final Depth (m):** 47

Easting: 463320.383 **Zone:** 54 **Northing:** 6194511.52 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHA128



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2353 **Permit Number:** 141929 **Region:** Loxton

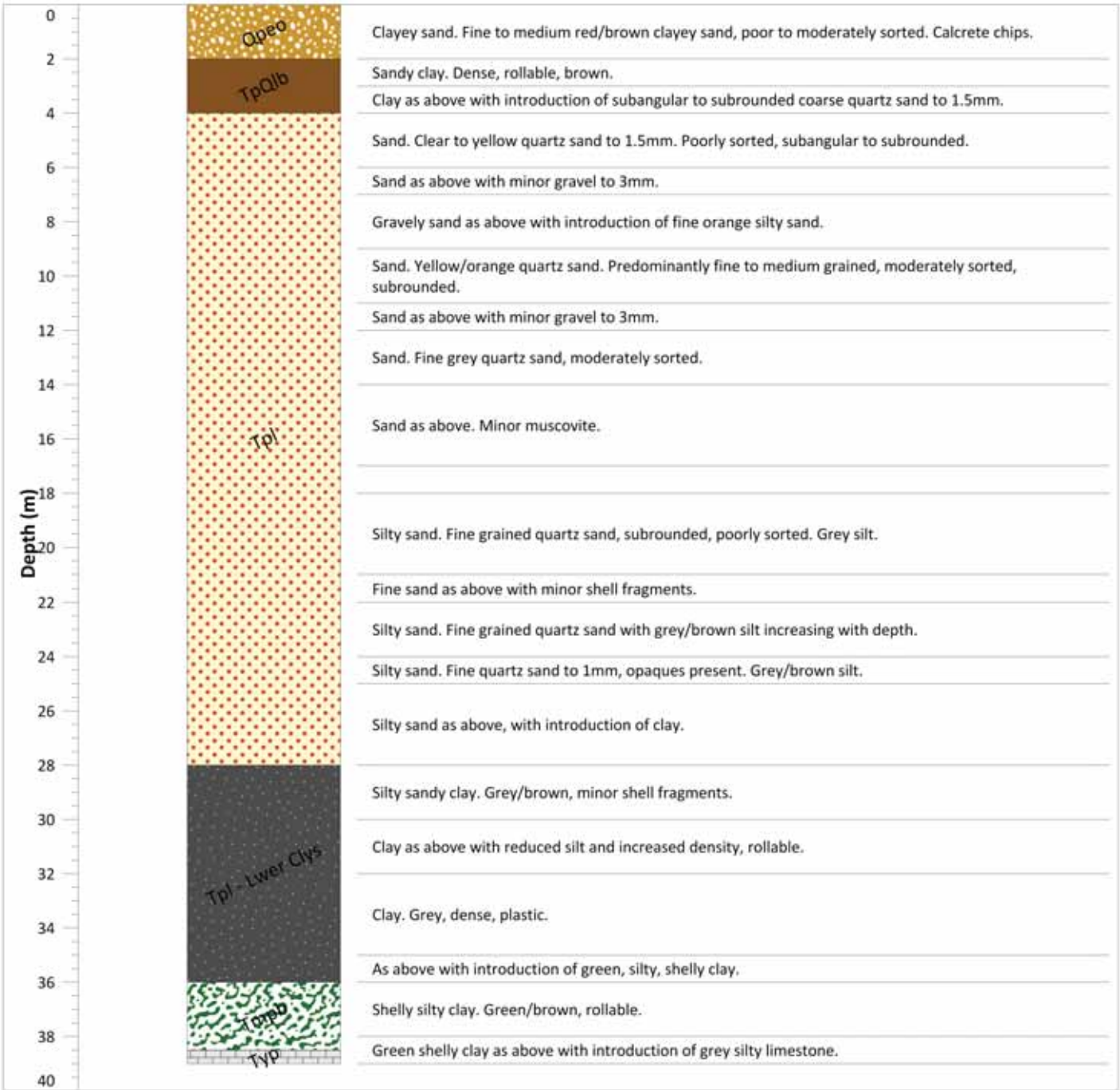
Completion Date: 3/31/08 **NS Elevation (mAHD):** 31.787 **Final Depth (m):** 39

Easting: 462605 **Zone:** 54 **Northing:** 6191529 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHC1**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2352 **Permit Number:** 141947 **Region:** Loxton

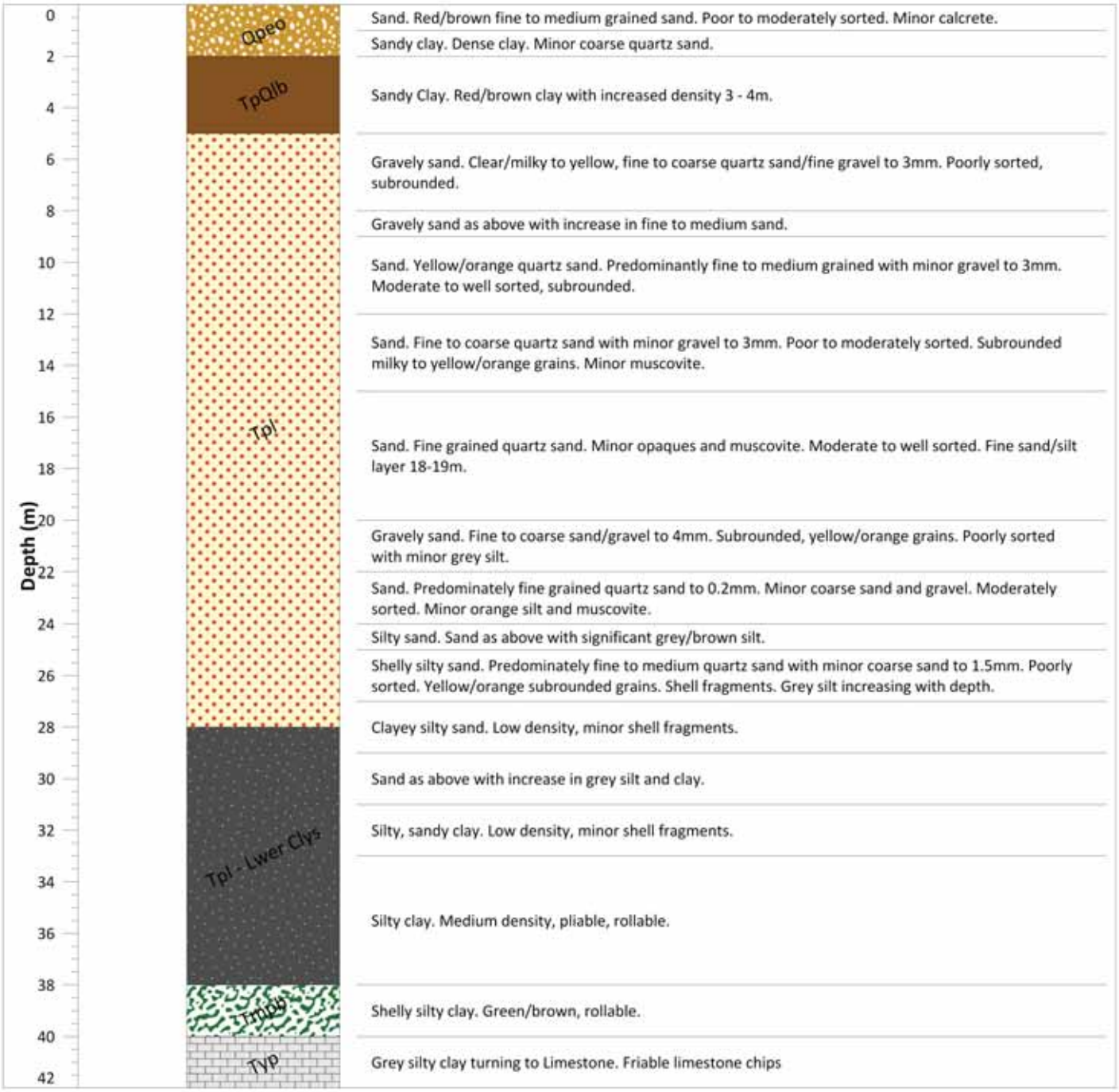
Completion Date: 3/31/08 **NS Elevation (mAHD):** 33.319 **Final Depth (m):** 42

Easting: 462645 **Zone:** 54 **Northing:** 6191728 **Site ID:** LH---INV

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHC2**



Casing Details

Details	ID	Interval	Pressure Cement

Production Zone Details

Type	Interval	Diam

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2372 **Permit Number:** 141936 **Region:** Loxton

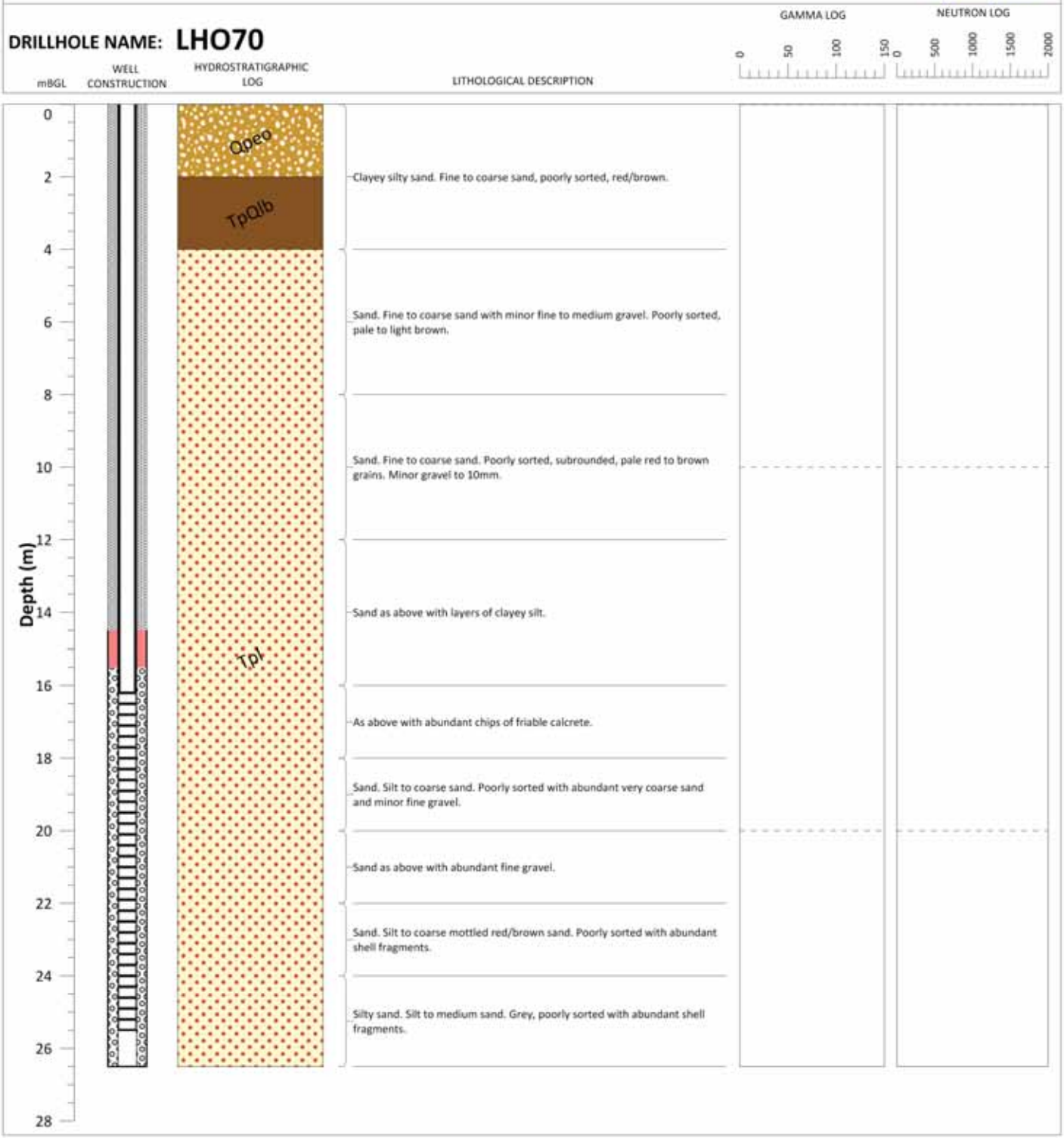
Completion Date: 5/23/08 **NS Elevation (mAHD):** 31.566 **Final Depth (m):** 26.5

Easting: 462601.709 **Zone:** 54 **Northing:** 6191508.501 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO70



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16.5 mBGL	0 to 14.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16.5 to 25.5 mBGL	79 mm
Sump	25.5 to 26.5 mBGL	79 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2376 **Permit Number:** 141933 **Region:** Loxton

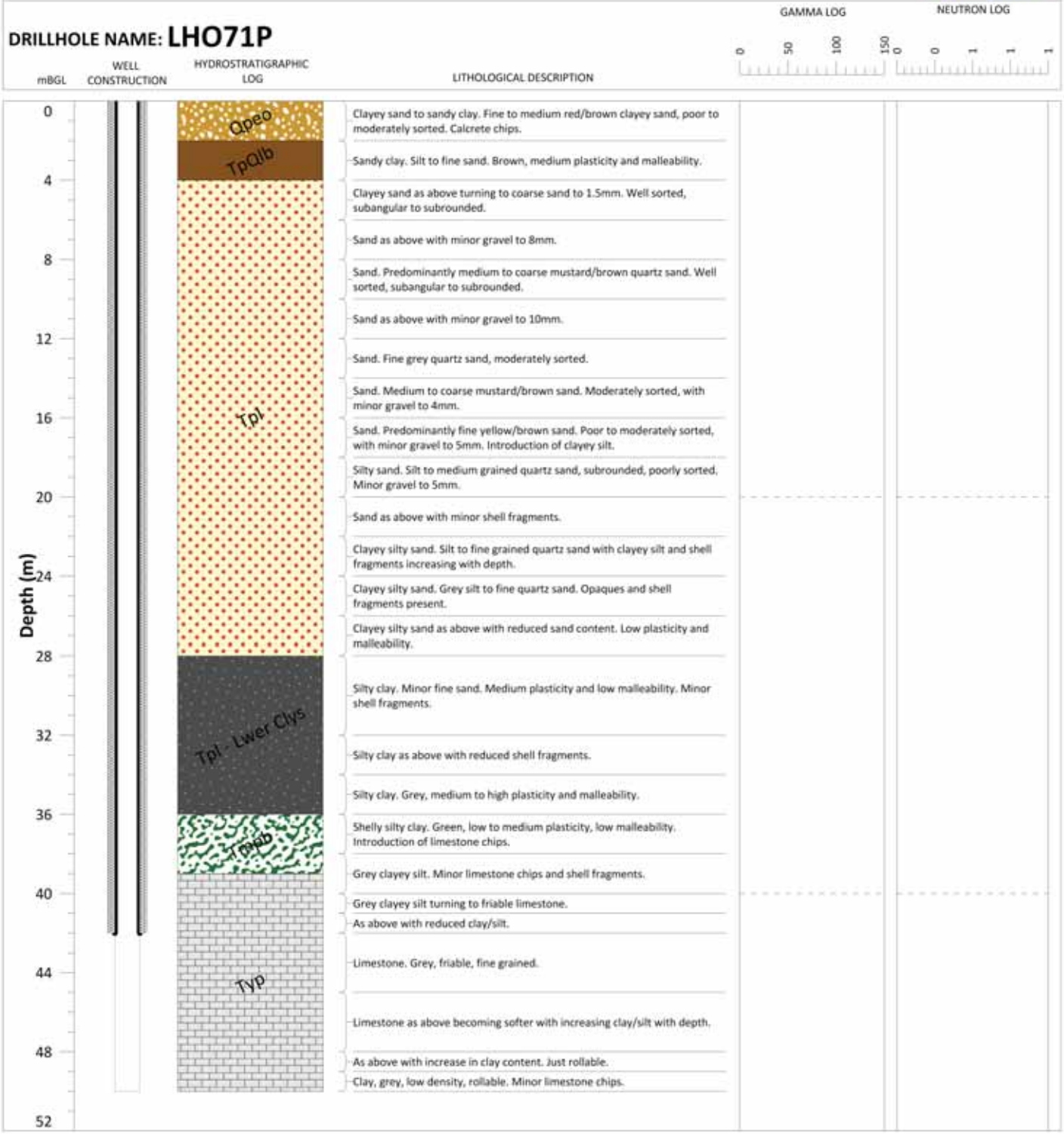
Completion Date: 5/20/08 **NS Elevation (mAHD):** 31.806 **Final Depth (m):** 50

Easting: 462604.773 **Zone:** 54 **Northing:** 6191524.592 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO71P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 42 mBGL	0 to 42 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	42 to 50 mBGL	100 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2357 **Permit Number:** 141941 **Region:** Loxton

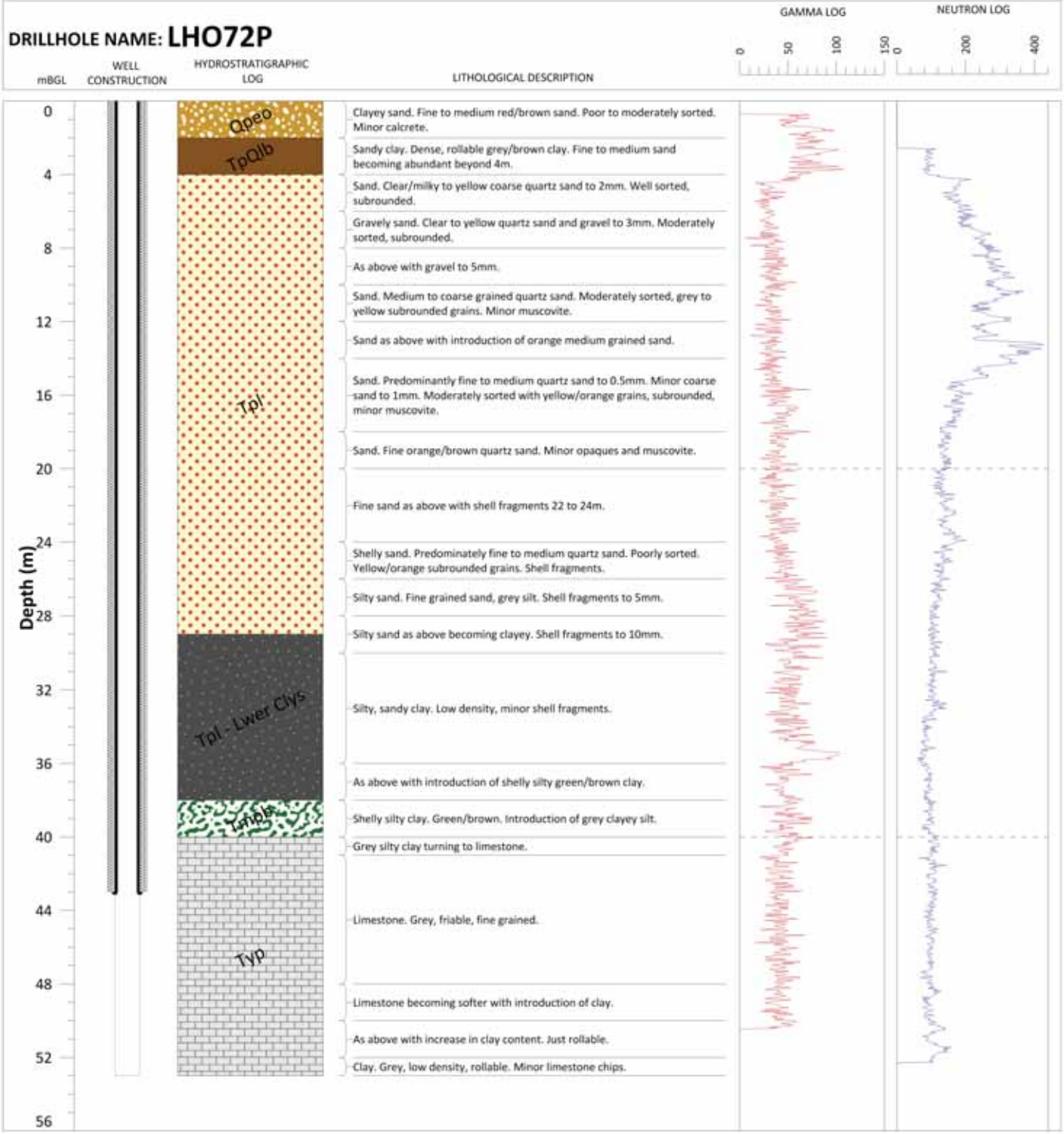
Completion Date: 4/8/08 **NS Elevation (mAHD):** 32.36 **Final Depth (m):** 53

Easting: 462615.257 **Zone:** 54 **Northing:** 6191628.359 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO72P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 53 mBGL	100 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2380 **Permit Number:** 143529 **Region:** Loxton

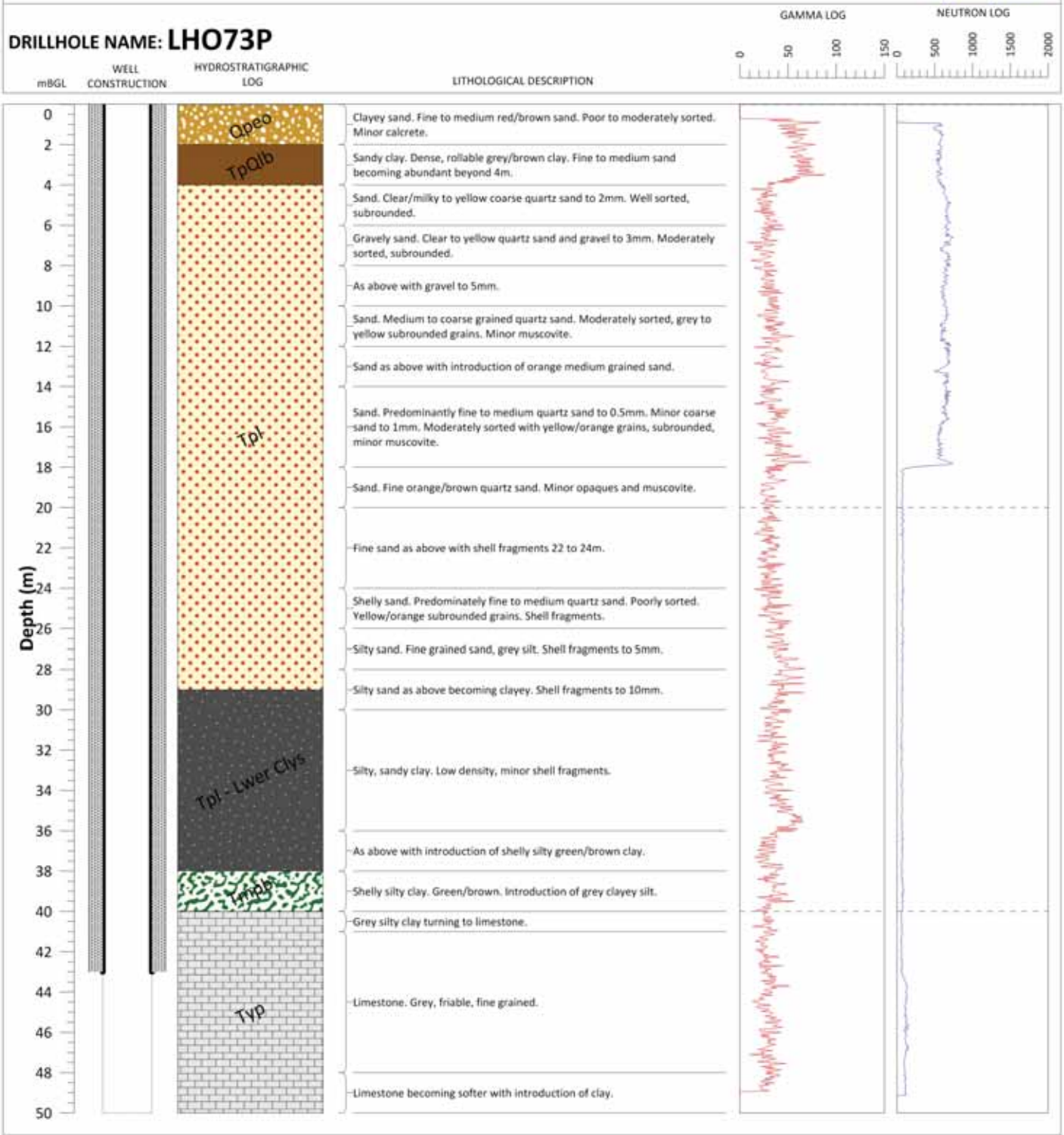
Completion Date: 5/10/08 **NS Elevation (mAHD):** 32.243 **Final Depth (m):** 50

Easting: 462602.215 **Zone:** 54 **Northing:** 6191640.953 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO73P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 50 mBGL	203.5 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2366 **Permit Number:** 143527 **Region:** Loxton

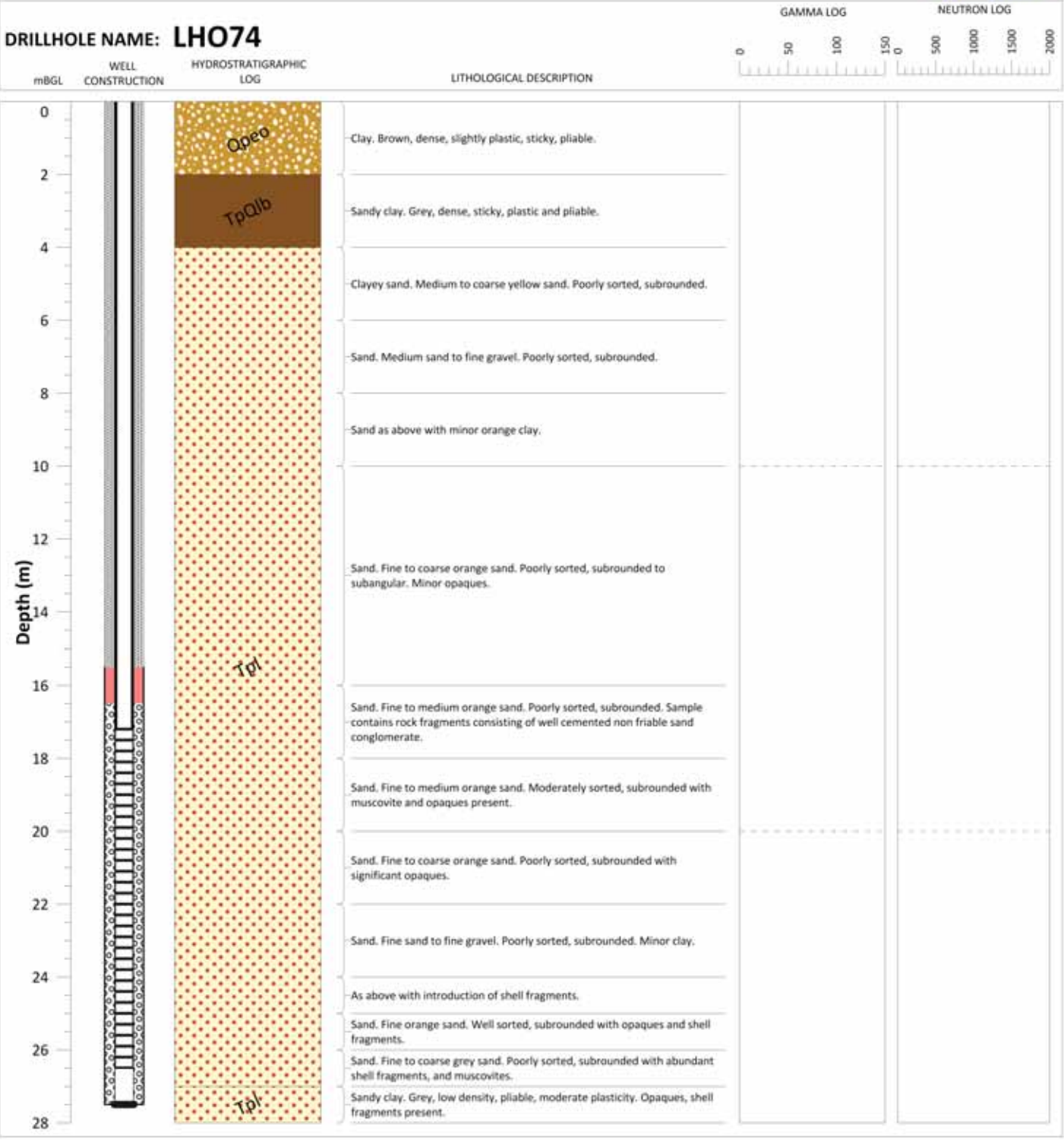
Completion Date: 4/21/08 **NS Elevation (mAHD):** 32.411 **Final Depth (m):** 27.5

Easting: 462602.658 **Zone:** 54 **Northing:** 6191642.934 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO74



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 17.5 mBGL	0 to 15.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17.5 to 26.5 mBGL	79 mm
Sump	26.5 to 27.5 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2365 **Permit Number:** 143528 **Region:** Loxton

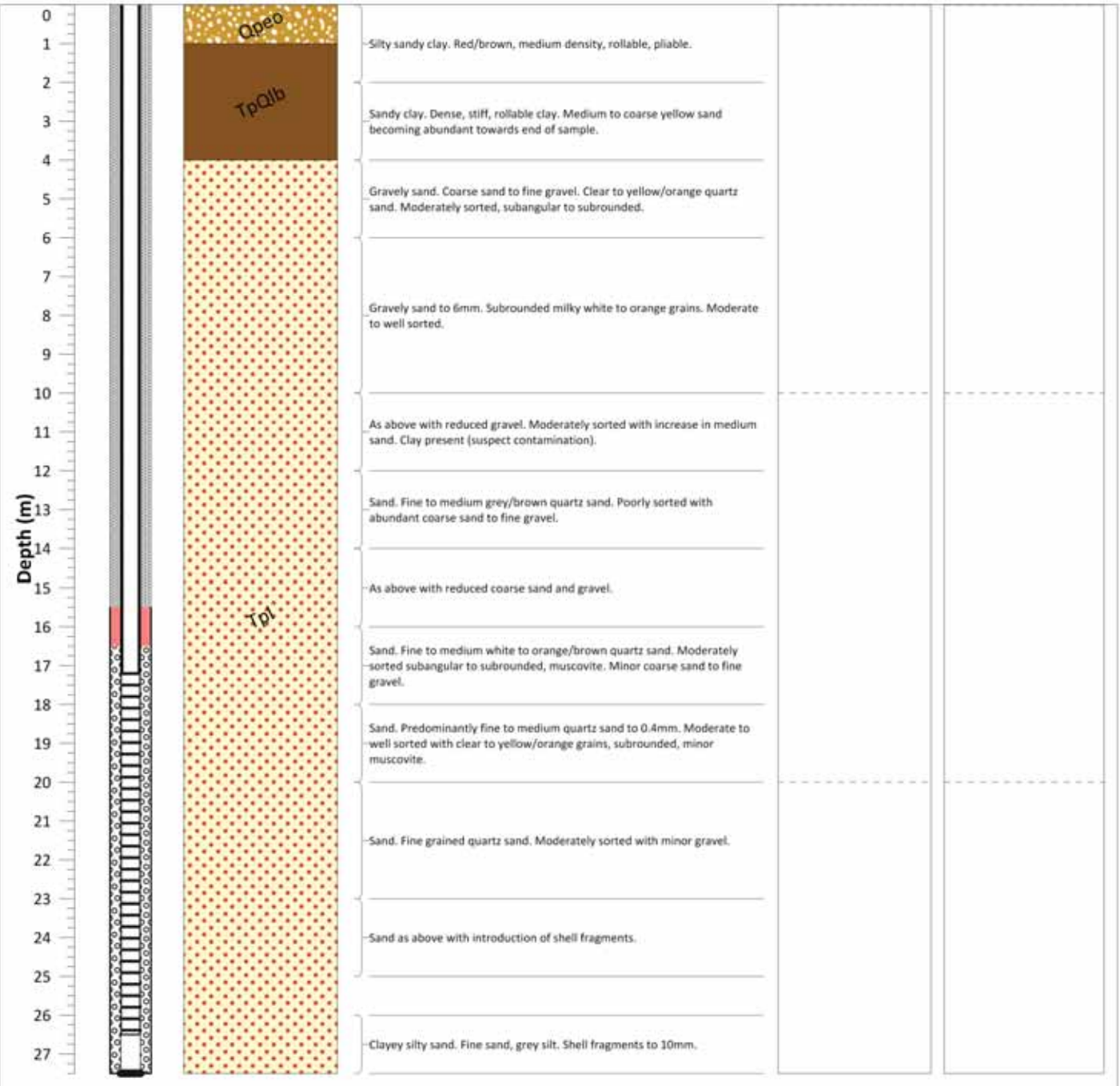
Completion Date: 4/21/08 **NS Elevation (mAHD):** 32.22 **Final Depth (m):** 27.5

Easting: 462543.646 **Zone:** 54 **Northing:** 6191652.322 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO75



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 17.5 mBGL	0 to 15.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17.5 to 26.5 mBGL	79 mm
Sump	26.5 to 27.5 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2374 **Permit Number:** 143530 **Region:** Loxton

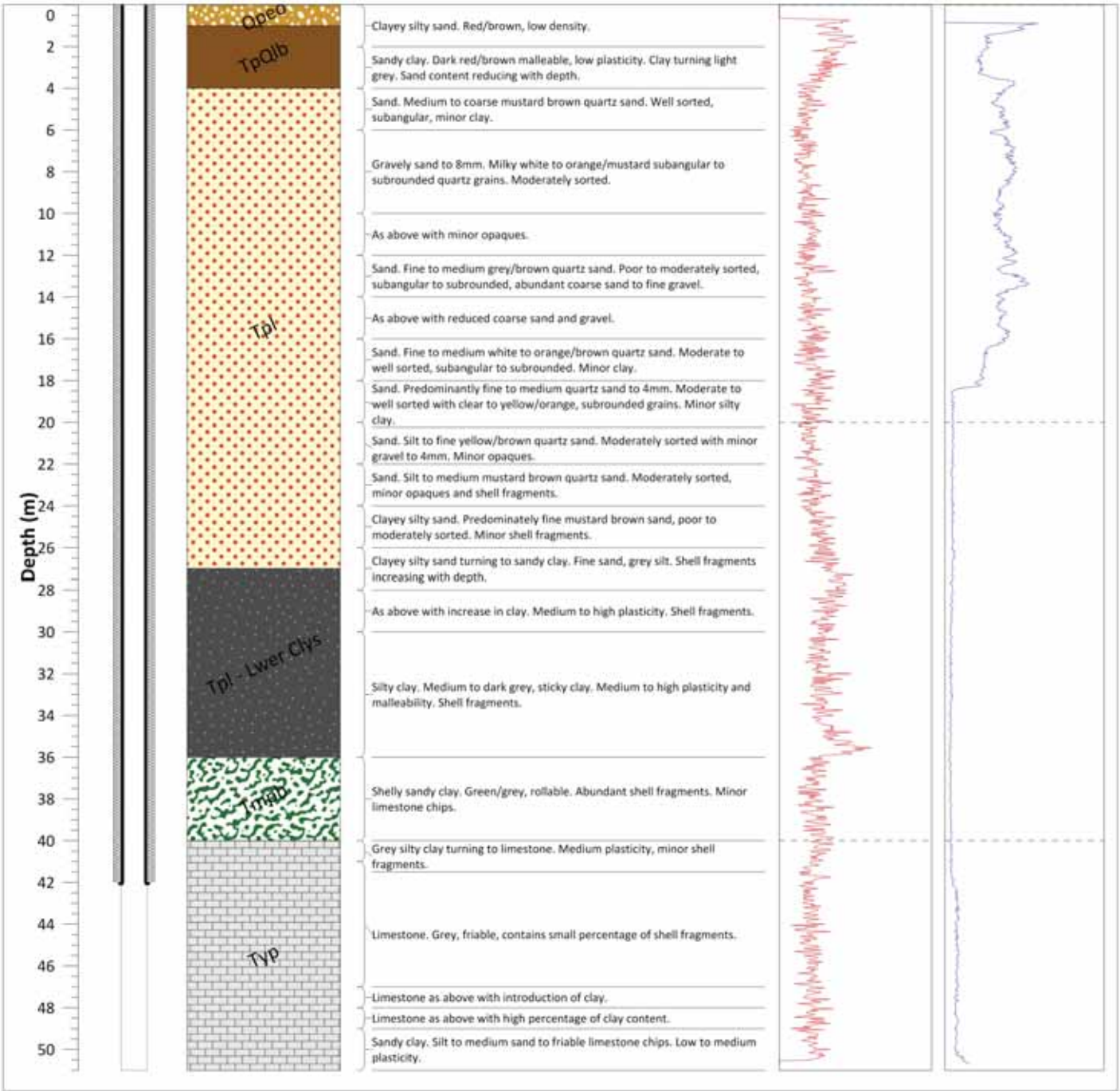
Completion Date: 5/16/08 **NS Elevation (mAHD):** 32.025 **Final Depth (m):** 51

Easting: 462543.449 **Zone:** 54 **Northing:** 6191650.138 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO76P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 42 mBGL	0 to 42 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	42 to 51 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2368 **Permit Number:** 141950 **Region:** Loxton

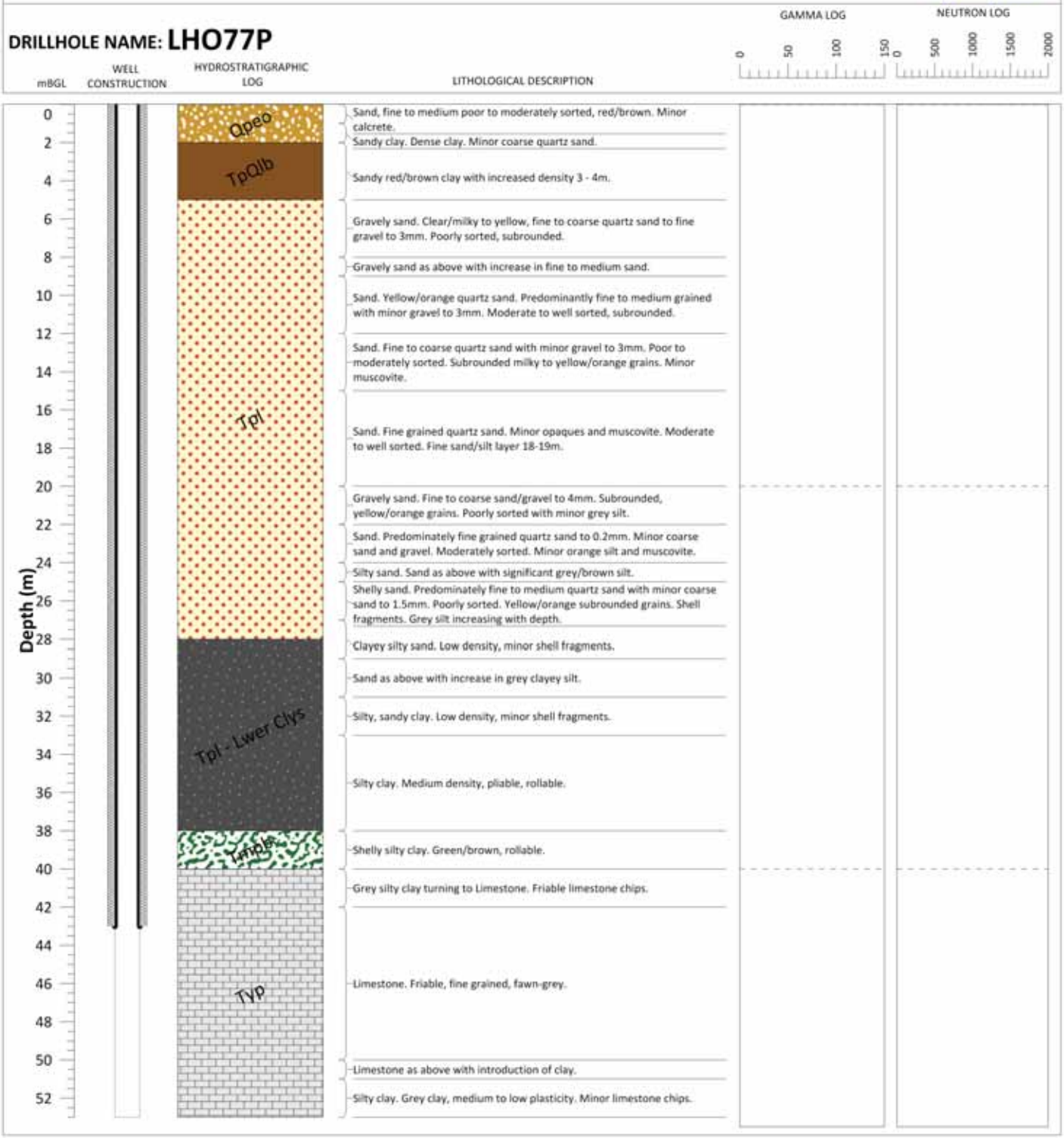
Completion Date: 6/3/08 **NS Elevation (mAHD):** 33.319 **Final Depth (m):** 53

Easting: 462644.63 **Zone:** 54 **Northing:** 6191730.58 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO77P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 53 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2362 **Permit Number:** 141945 **Region:** Loxton

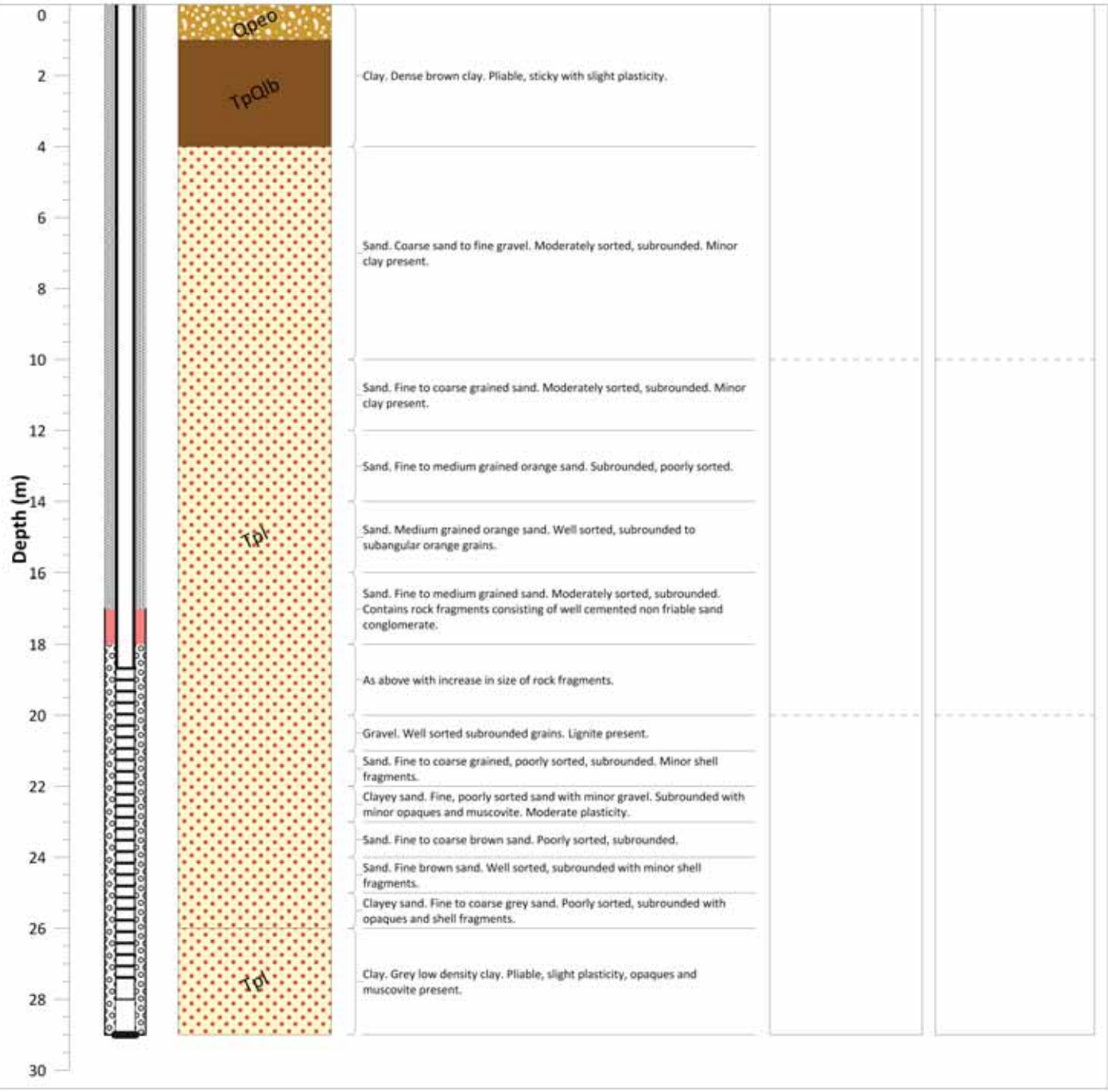
Completion Date: 4/20/08 **NS Elevation (mAHD):** 33.325 **Final Depth (m):** 29

Easting: 462647.774 **Zone:** 54 **Northing:** 6191746.026 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO78



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 19 mBGL	0 to 17 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	19 to 28 mBGL	79 mm
Sump	28 to 29 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2361 **Permit Number:** 141959 **Region:** Loxton

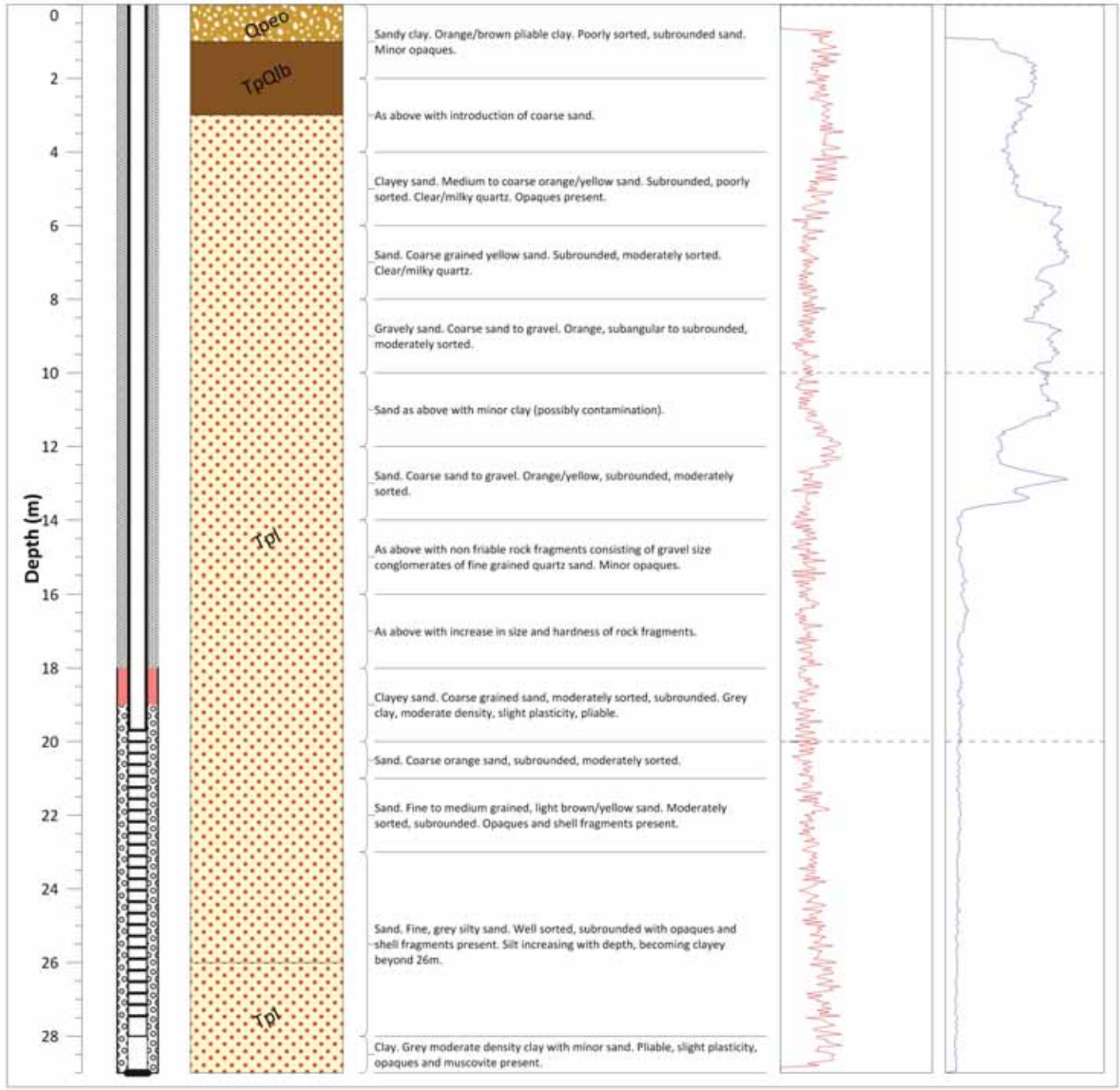
Completion Date: 4/18/08 **NS Elevation (mAHD):** 31.188 **Final Depth (m):** 29

Easting: 462802.527 **Zone:** 54 **Northing:** 6191947.931 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO79



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 20 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	20 to 29 mBGL	79 mm
Sump	29 to 30 mBGL	79 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2364 **Permit Number:** 141962 **Region:** Loxton

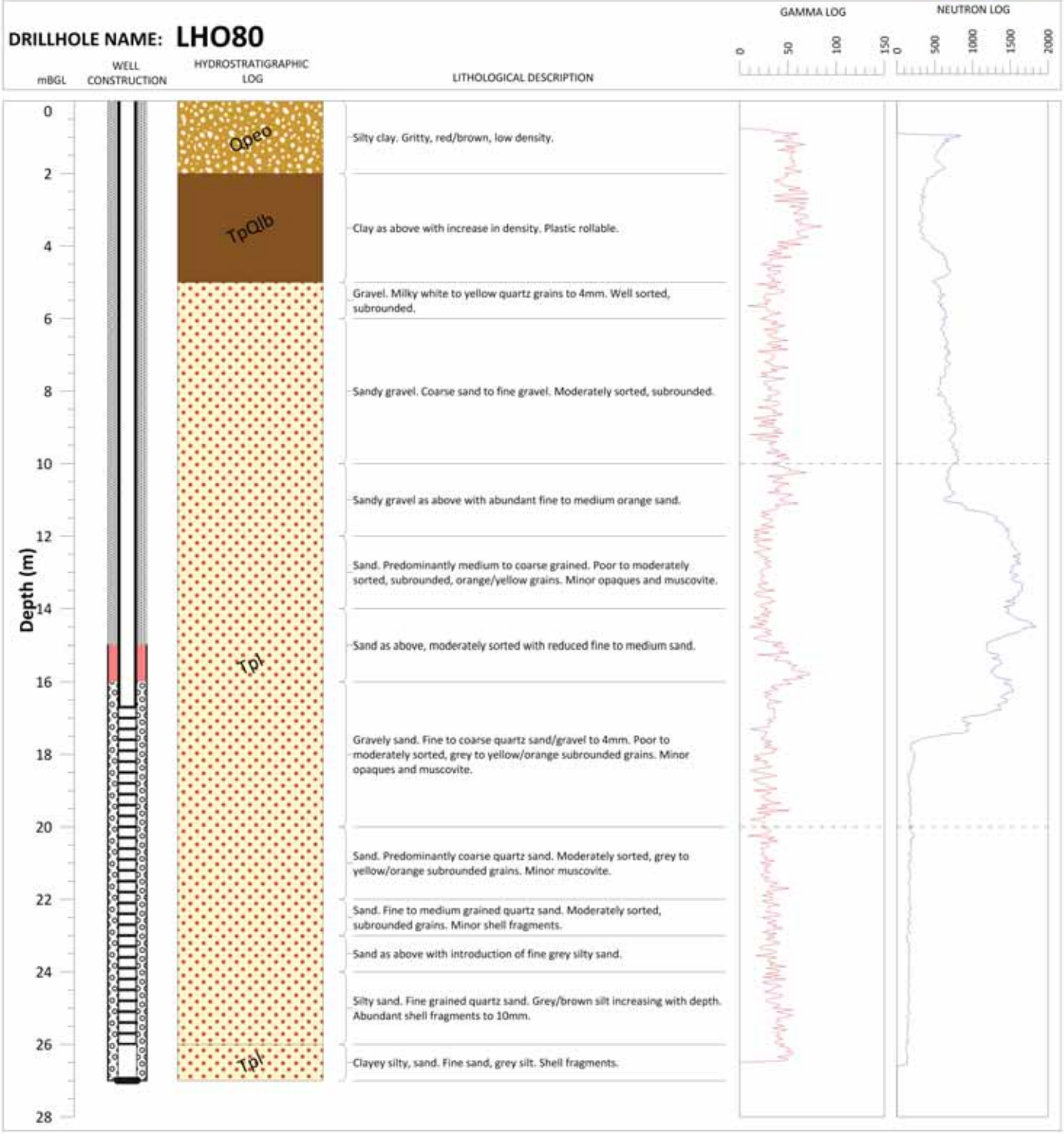
Completion Date: 4/22/08 **NS Elevation (mAHD):** 31.998 **Final Depth (m):** 27

Easting: 462372.082 **Zone:** 54 **Northing:** 6191935.14 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO80



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 17 mBGL	0 to 15 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2363 **Permit Number:** 141968 **Region:** Loxton

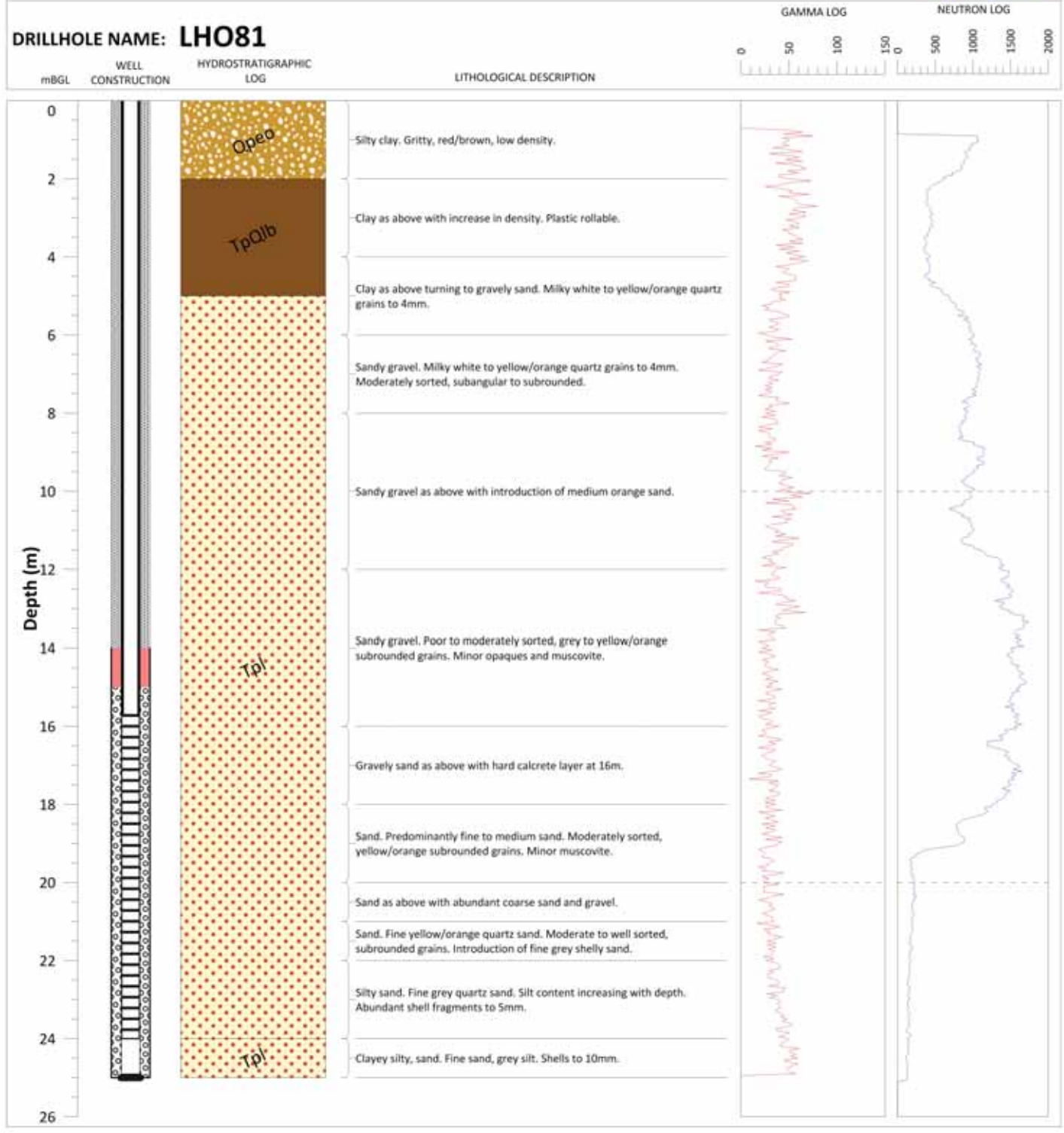
Completion Date: 4/23/08 **NS Elevation (mAHD):** 31.127 **Final Depth (m):** 25

Easting: 462056.201 **Zone:** 54 **Northing:** 6192150.434 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO81



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 24 mBGL	79 mm
Sump	24 to 25 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2379 **Permit Number:** 141969 **Region:** Loxton

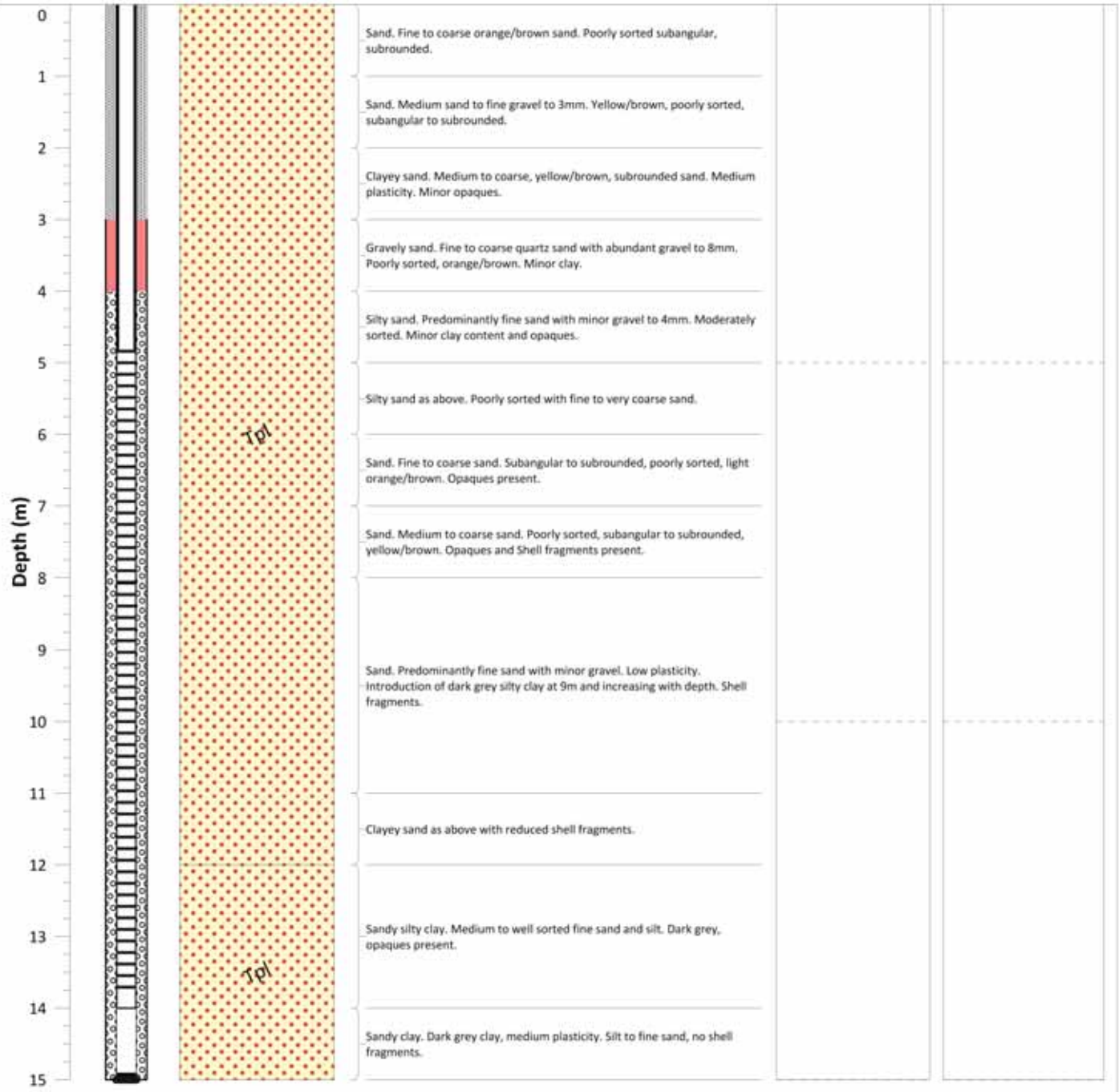
Completion Date: 5/16/08 **NS Elevation (mAHD):** 15.943 **Final Depth (m):** 15

Easting: 462407 **Zone:** 54 **Northing:** 6191687 **Site ID:** LF-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO82



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 5 mBGL	0 to 3 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	5 to 14 mBGL	79 mm
Sump	14 to 15 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2375 **Permit Number:** 141970 **Region:** Loxton

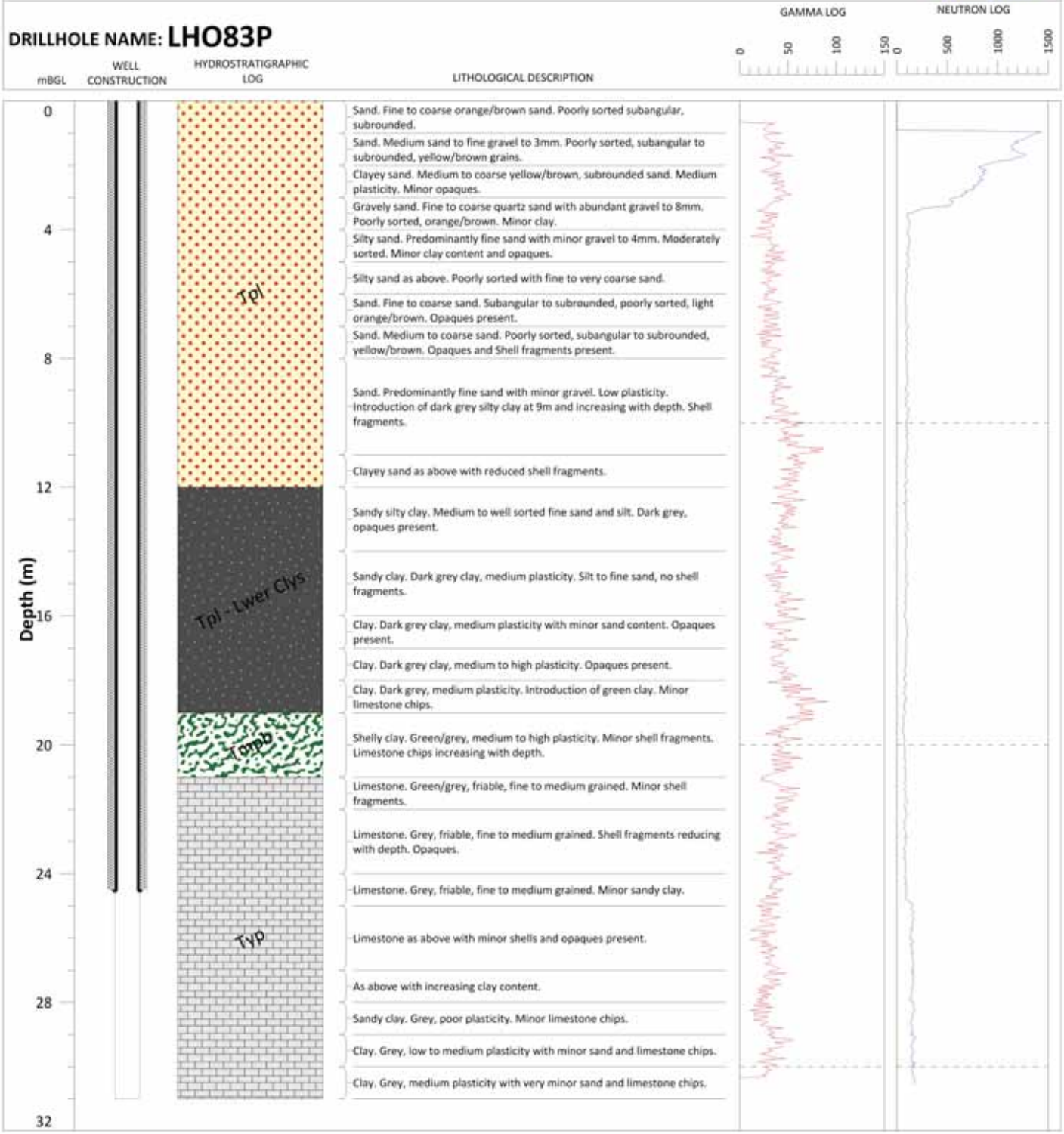
Completion Date: 5/16/08 **NS Elevation (mAHD):** 15.943 **Final Depth (m):** 31

Easting: 462406.5 **Zone:** 54 **Northing:** 6191687.7 **Site ID:** LF-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO83P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 24.5 mBGL	0 to 24.5 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	24.5 to 31 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

Notes:

Loxton Salt Interception

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2381 **Permit Number:** 141971 **Region:** Loxton

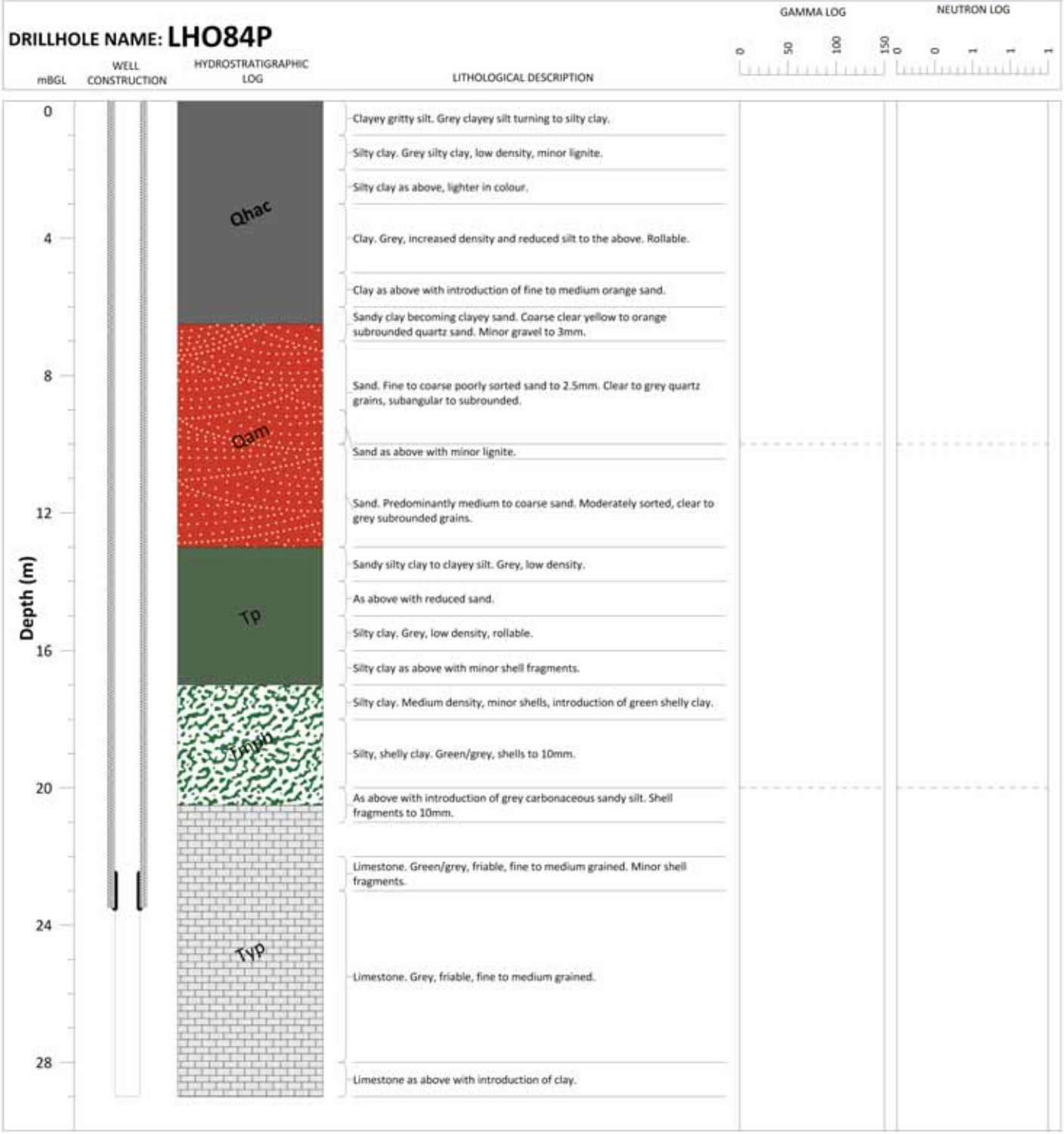
Completion Date: 5/8/08 **NS Elevation (mAHD):** 14.001 **Final Depth (m):** 29

Easting: 462151 **Zone:** 54 **Northing:** 6191691 **Site ID:** LF-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO84P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	100 mm	0 to 23.5 mBGL	0 to 23.5 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	23.5 to 29 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2449 **Permit Number:** 150609 **Region:** Loxton

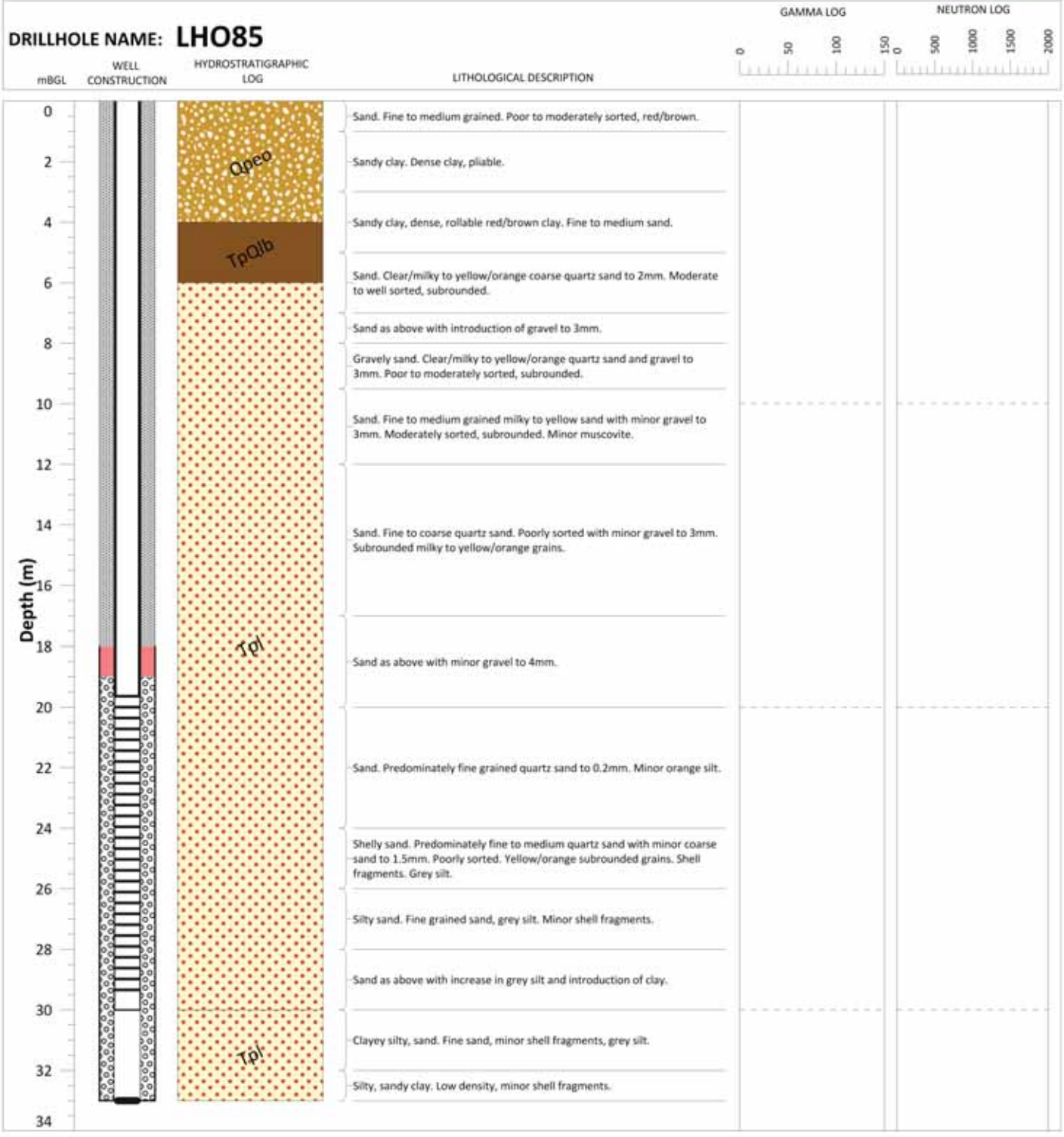
Completion Date: 11/18/08 **NS Elevation (mAHD):** 32.656 **Final Depth (m):** 33

Easting: 462631.212 **Zone:** 54 **Northing:** 6191657.876 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO85



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	125 mm	0 to 20 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	20 to 30 mBGL	125 mm
Sump	30 to 33 mBGL	125 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2450 **Permit Number:** 150610 **Region:** Loxton

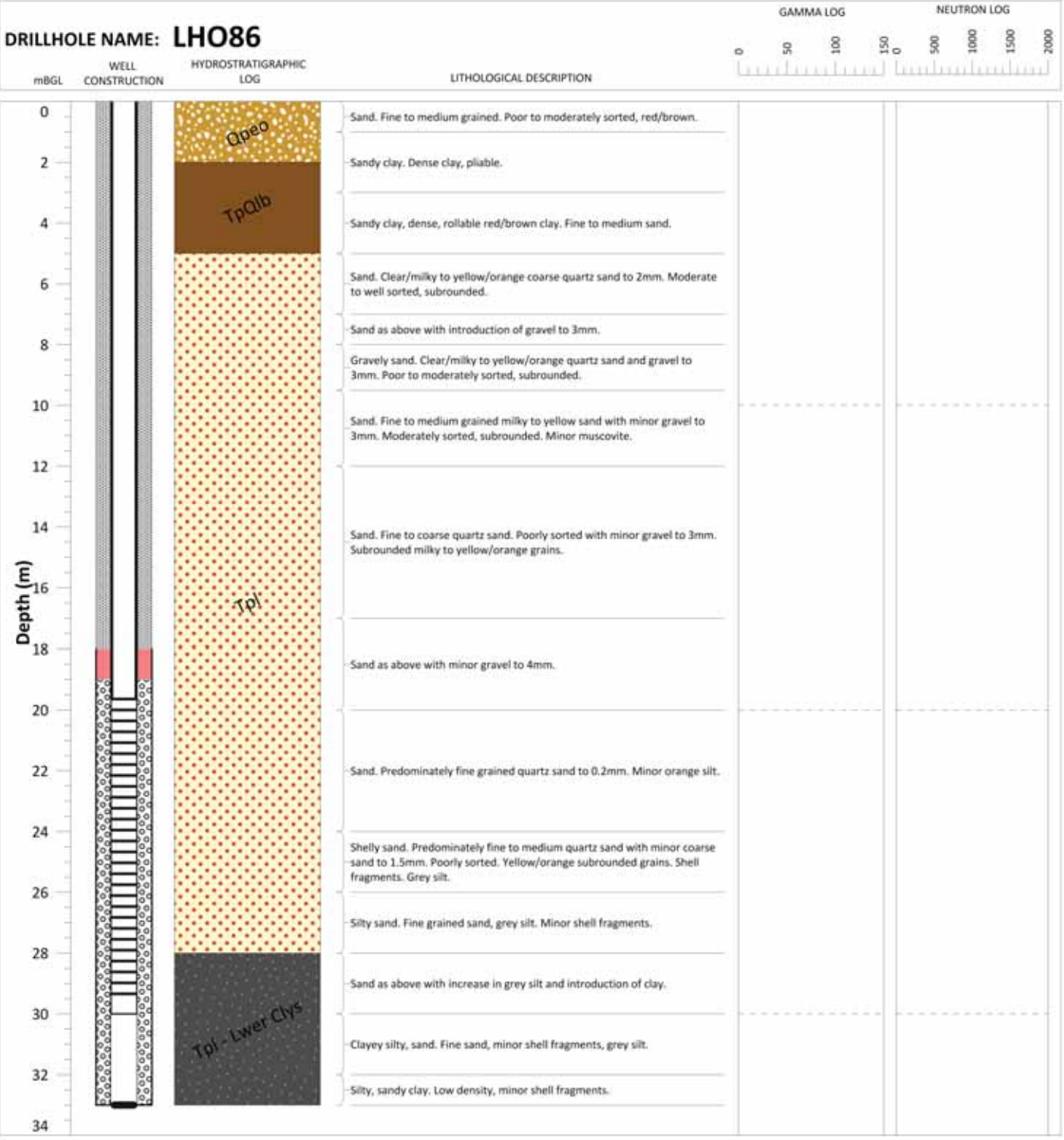
Completion Date: 11/18/08 **NS Elevation (mAHD):** 32.756 **Final Depth (m):** 33

Easting: 462633.518 **Zone:** 54 **Northing:** 6191669.518 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO86



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	125 mm	0 to 20 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	20 to 30 mBGL	125 mm
Sump	30 to 33 mBGL	125 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2553 **Permit Number:** 168636 **Region:** Loxton

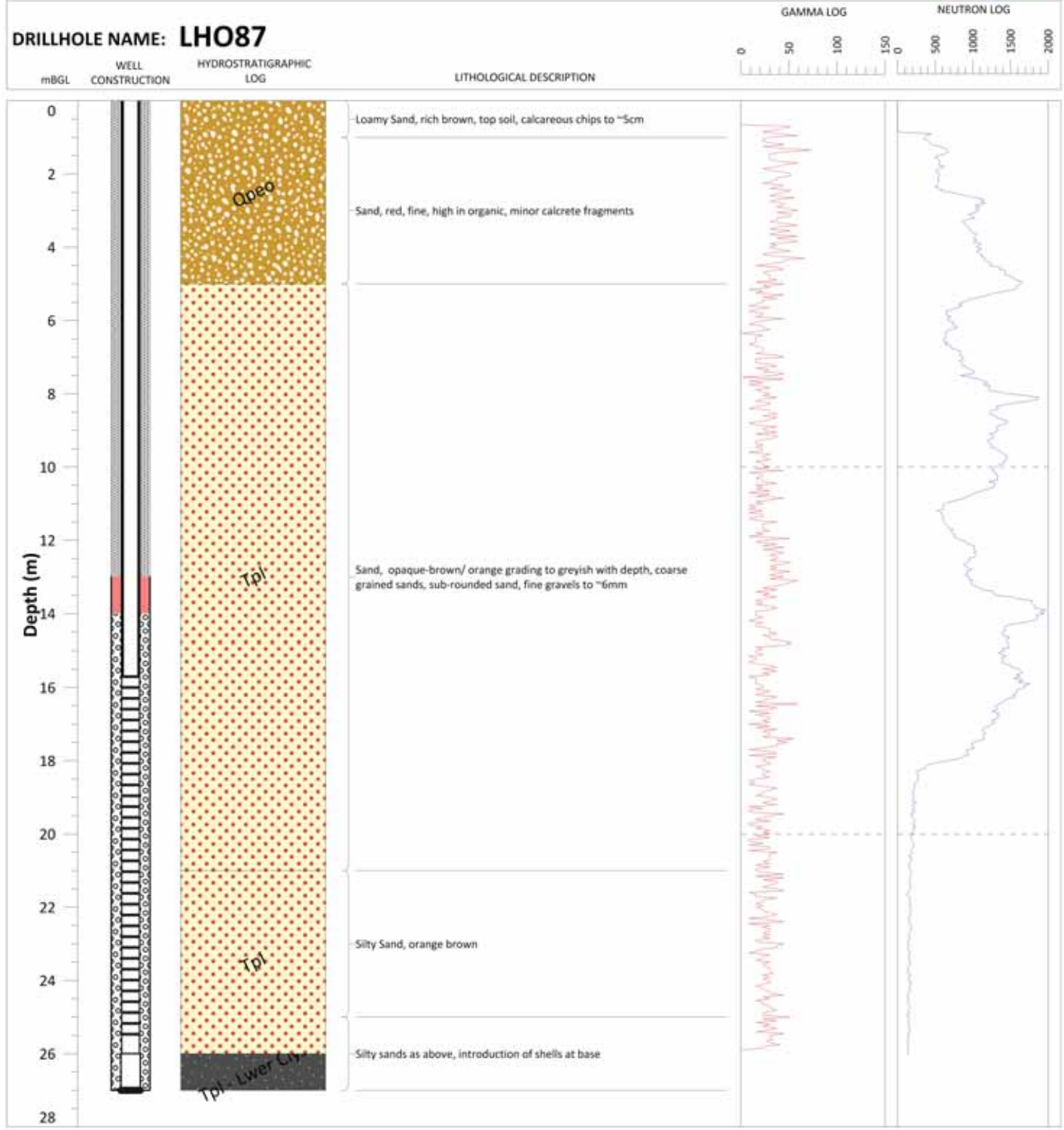
Completion Date: 10/30/09 **NS Elevation (mAHD):** 33.535 **Final Depth (m):** 27

Easting: 462657.288 **Zone:** 54 **Northing:** 6191794.965 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO87



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2564 **Permit Number:** 168647 **Region:** Loxton

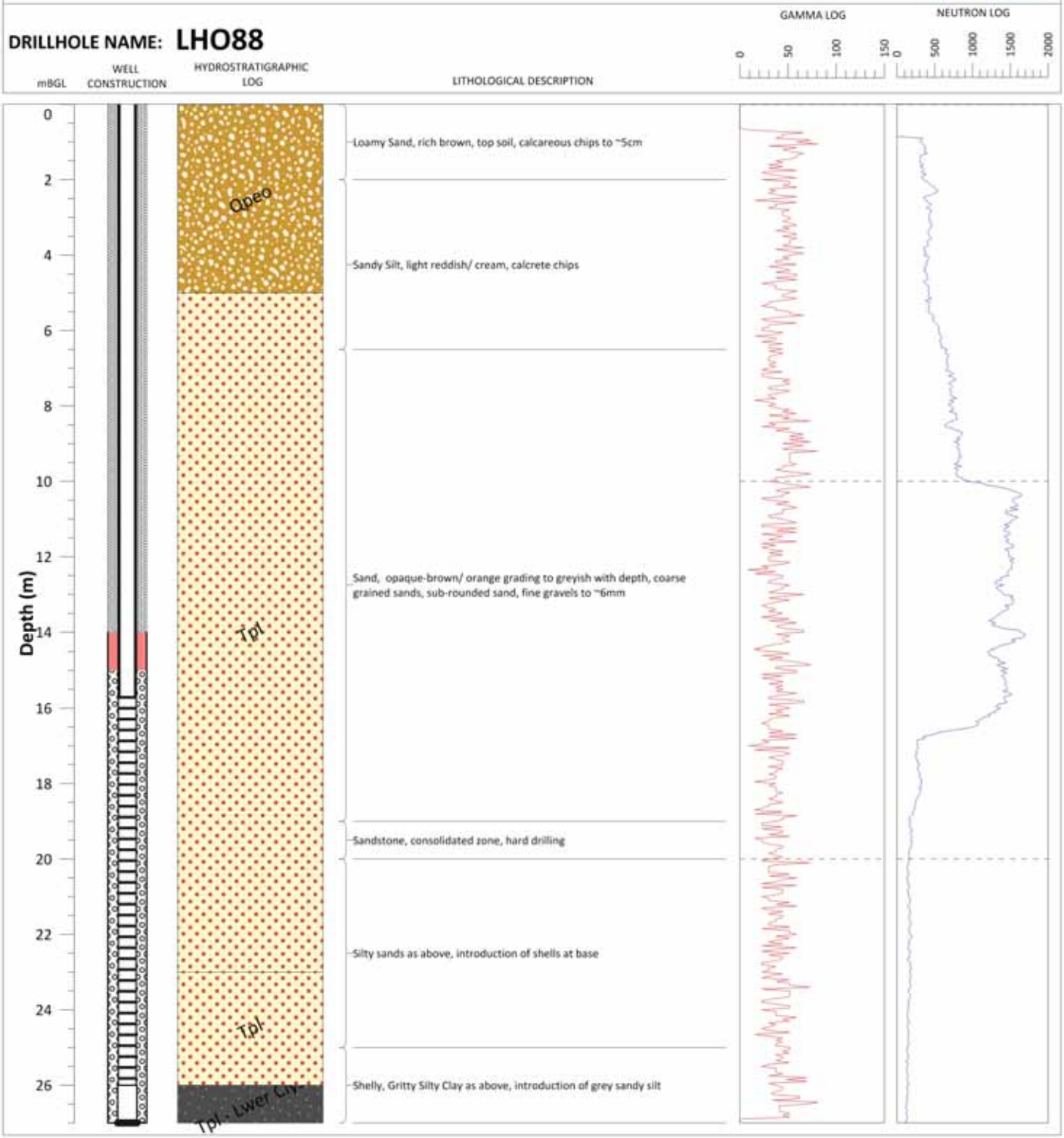
Completion Date: 11/03/09 **NS Elevation (mAHD):** 32.517 **Final Depth (m):** 27

Easting: 462663.111 **Zone:** 54 **Northing:** 6191897.922 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO88



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2555 **Permit Number:** 168645 **Region:** Loxton

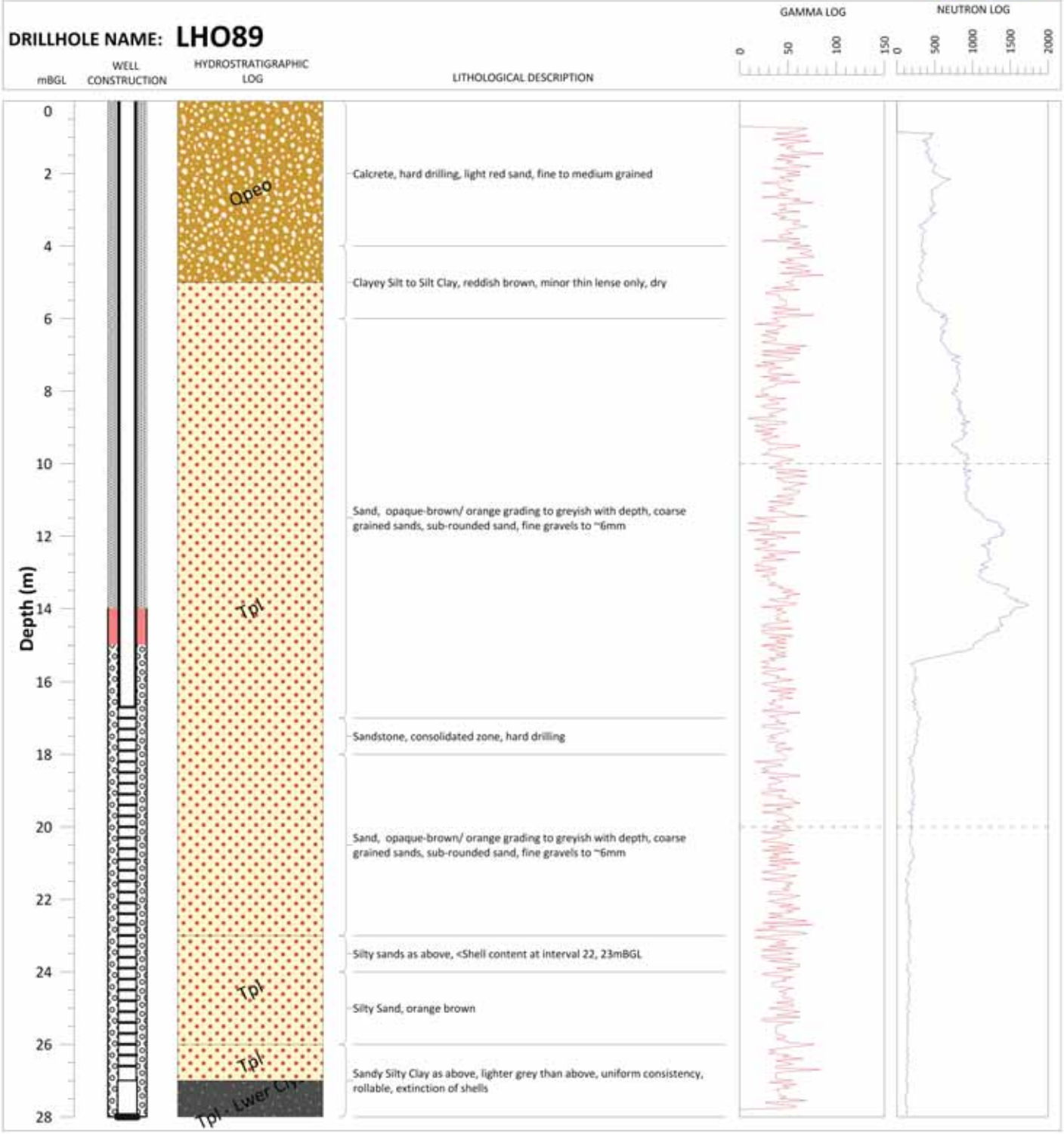
Completion Date: 11/04/09 **NS Elevation (mAHD):** 31.723 **Final Depth (m):** 28

Easting: 462738.716 **Zone:** 54 **Northing:** 6191927.799 **Site ID:** LH-PA-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO89



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	79 mm
Sump	27 to 28 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2556 **Permit Number:** 168626 **Region:** Loxton

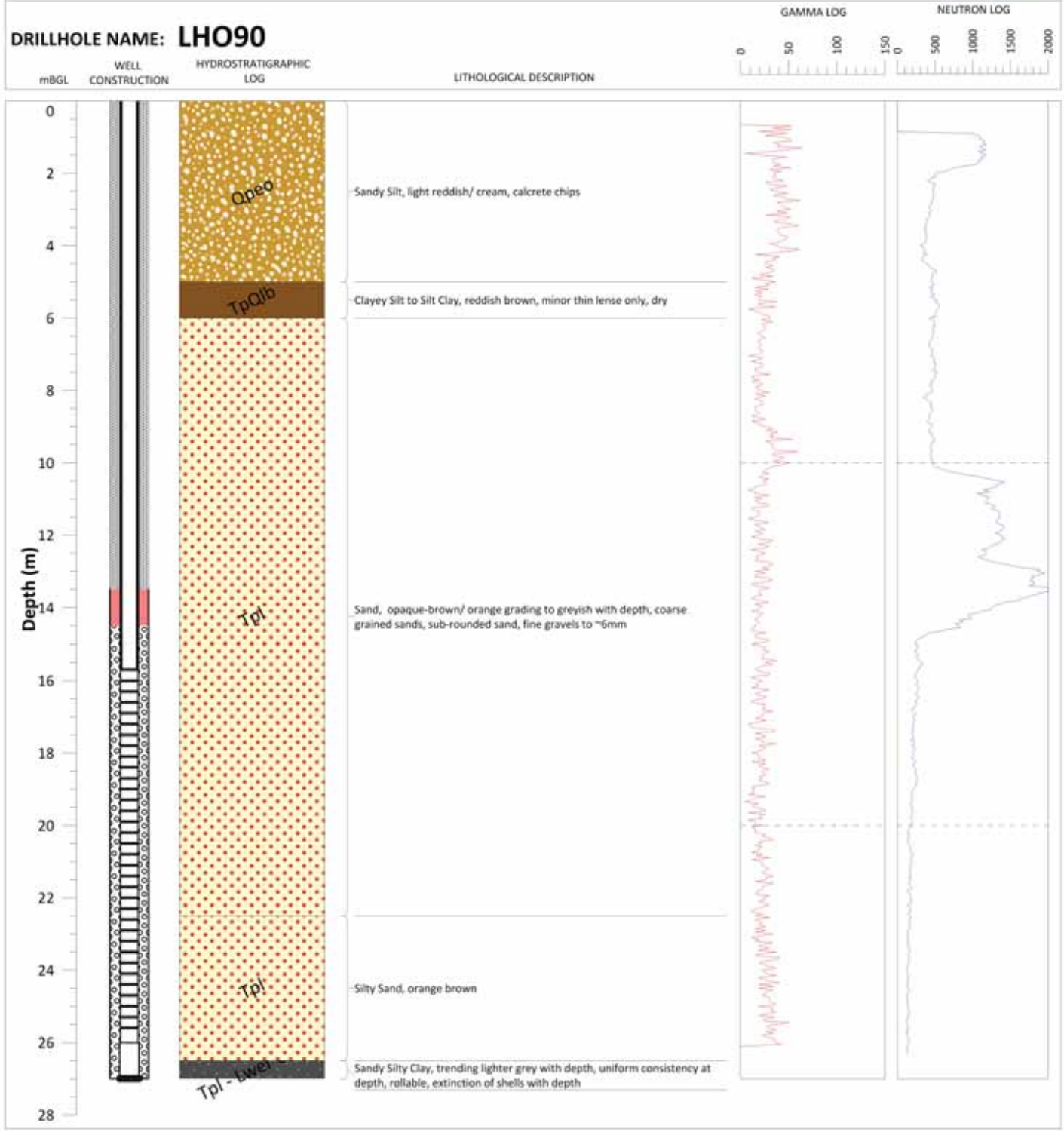
Completion Date: 11/06/09 **NS Elevation (mAHD):** 31.139 **Final Depth (m):** 27

Easting: 462653.461 **Zone:** 54 **Northing:** 6192003.527 **Site ID:** LH-TE-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO90



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 13.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2557 **Permit Number:** 168627 **Region:** Loxton

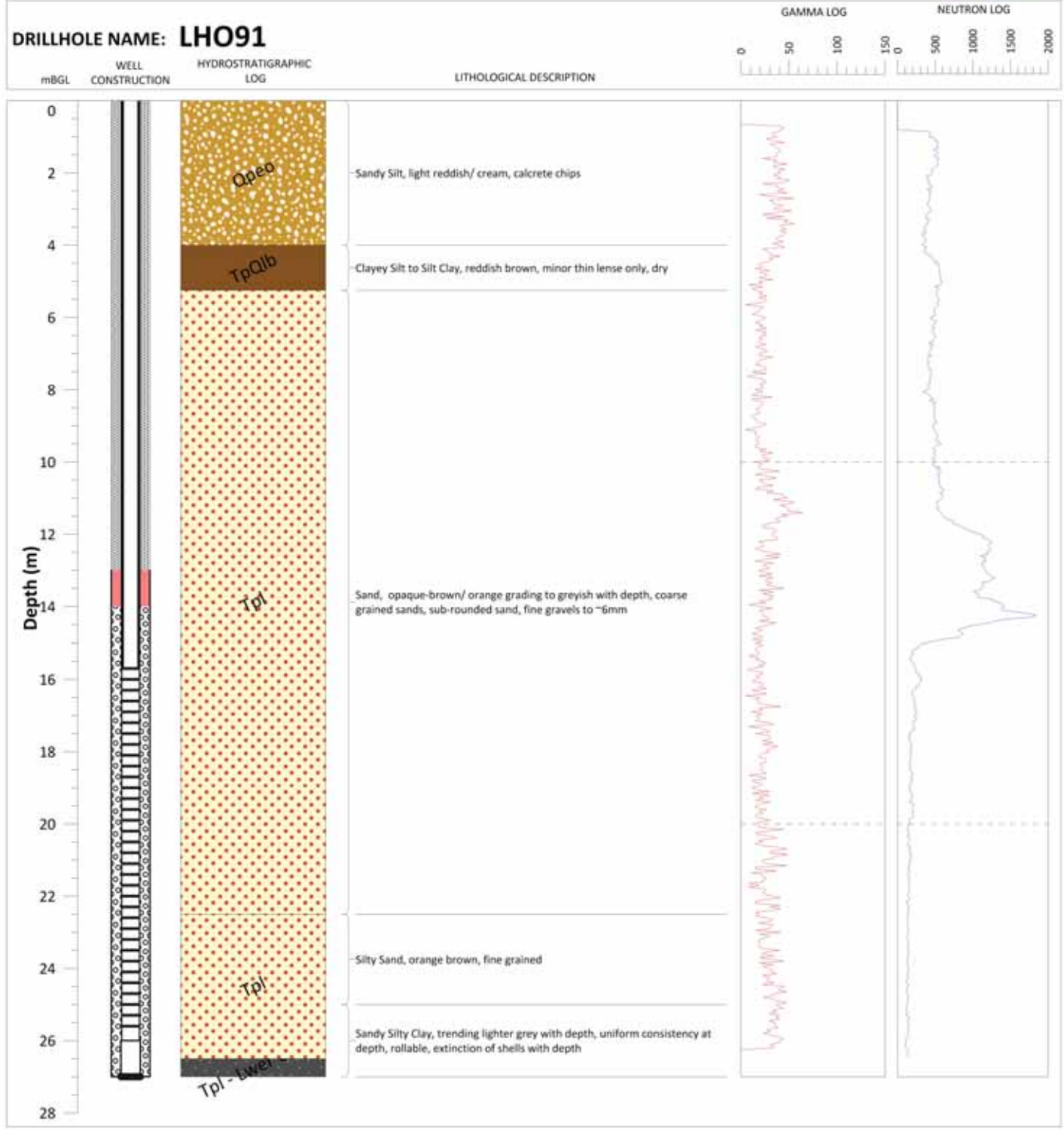
Completion Date: 11/07/09 **NS Elevation (mAHD):** 30.95 **Final Depth (m):** 27

Easting: 462565.818 **Zone:** 54 **Northing:** 6192050.354 **Site ID:** LH-TE-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO91



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2558 **Permit Number:** 168628 **Region:** Loxton

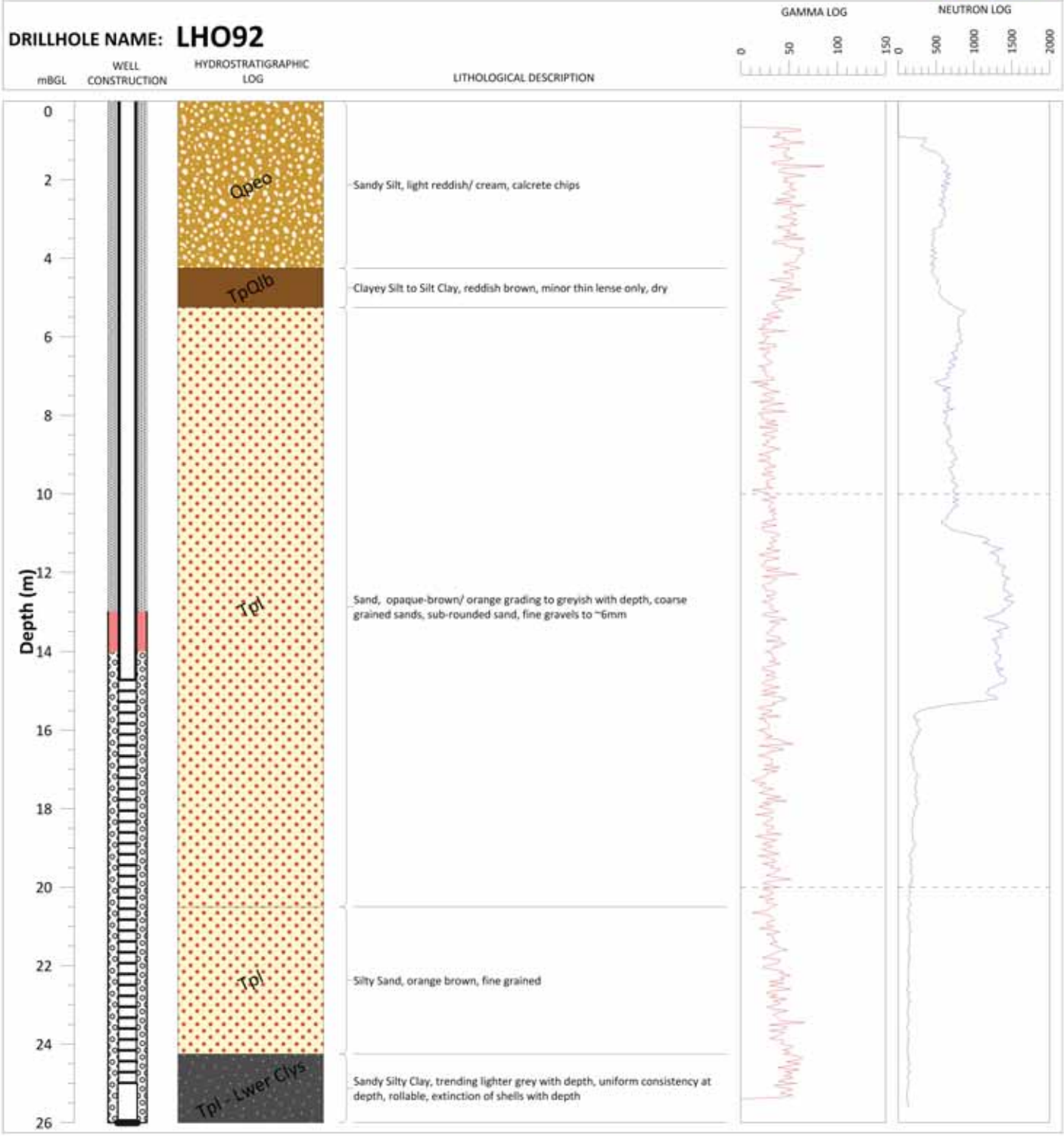
Completion Date: 11/09/09 **NS Elevation (mAHD):** 30.941 **Final Depth (m):** 26

Easting: 462477.728 **Zone:** 54 **Northing:** 6192096.686 **Site ID:** LH-TE-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO92



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 15 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	15 to 25 mBGL	79 mm
Sump	25 to 26 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2559 **Permit Number:** 168629 **Region:** Loxton

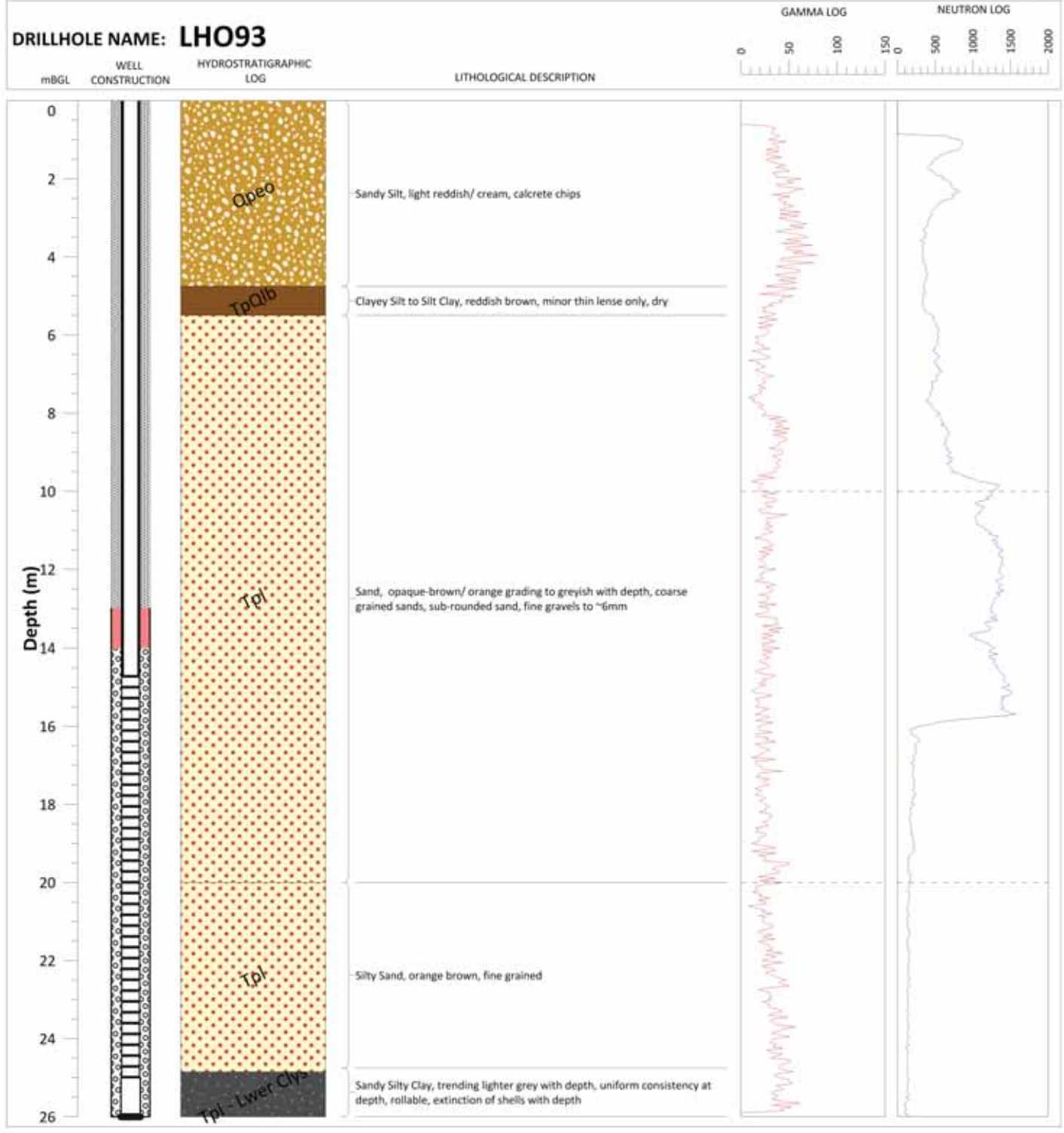
Completion Date: 11/09/09 **NS Elevation (mAHD):** 31.106 **Final Depth (m):** 26

Easting: 462389.804 **Zone:** 54 **Northing:** 6192143.121 **Site ID:** LH-TE-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHO93**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 15 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	15 to 25 mBGL	79 mm
Sump	25 to 26 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2560 **Permit Number:** 168638 **Region:** Loxton

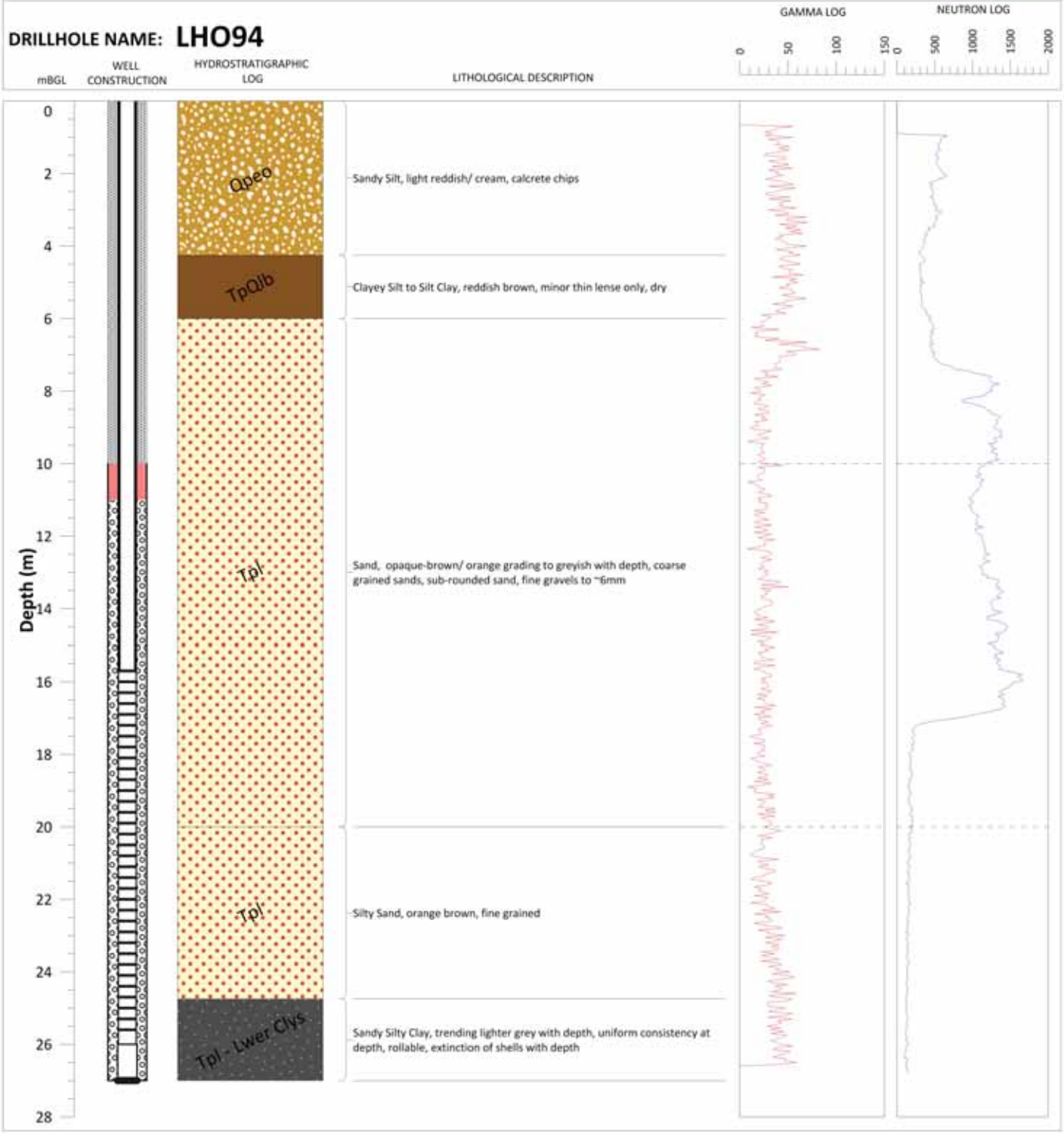
Completion Date: 11/10/09 **NS Elevation (mAHD):** 31.863 **Final Depth (m):** 27

Easting: 462302.095 **Zone:** 54 **Northing:** 6192189.227 **Site ID:** LH-TE-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHO94



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 16 mBGL	0 to 10 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	79 mm
Sump	26 to 27 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2561 **Permit Number:** 168665 **Region:** Loxton

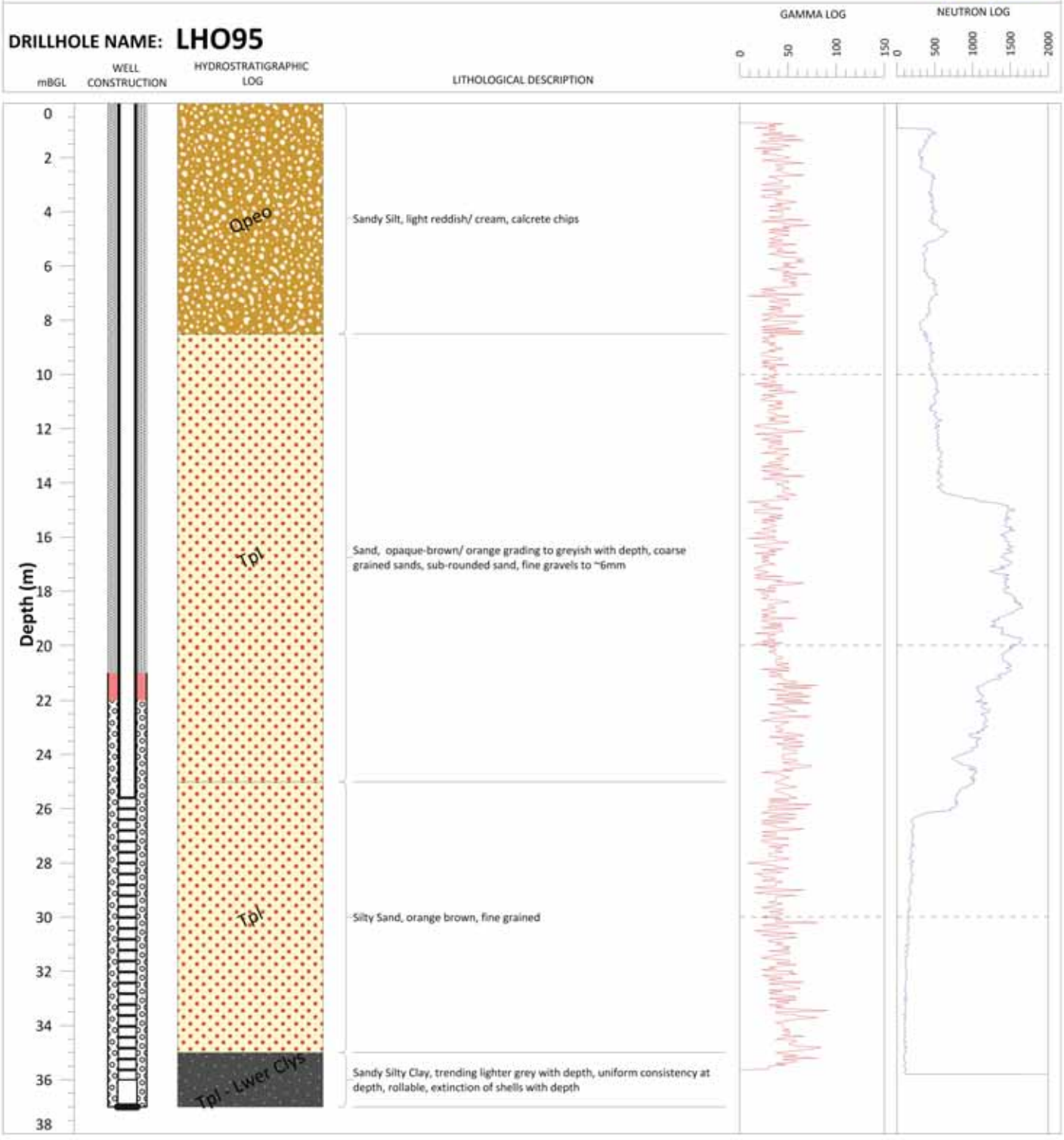
Completion Date: 12/03/09 **NS Elevation (mAHD):** 43.649 **Final Depth (m):** 37

Easting: 463329.229 **Zone:** 54 **Northing:** 6194587.266 **Site ID:** LH-RC-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHO95**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 26 mBGL	0 to 21 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	26 to 36 mBGL	79 mm
Sump	36 to 37 mBGL	79 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2562 **Permit Number:** 159887 **Region:** Loxton

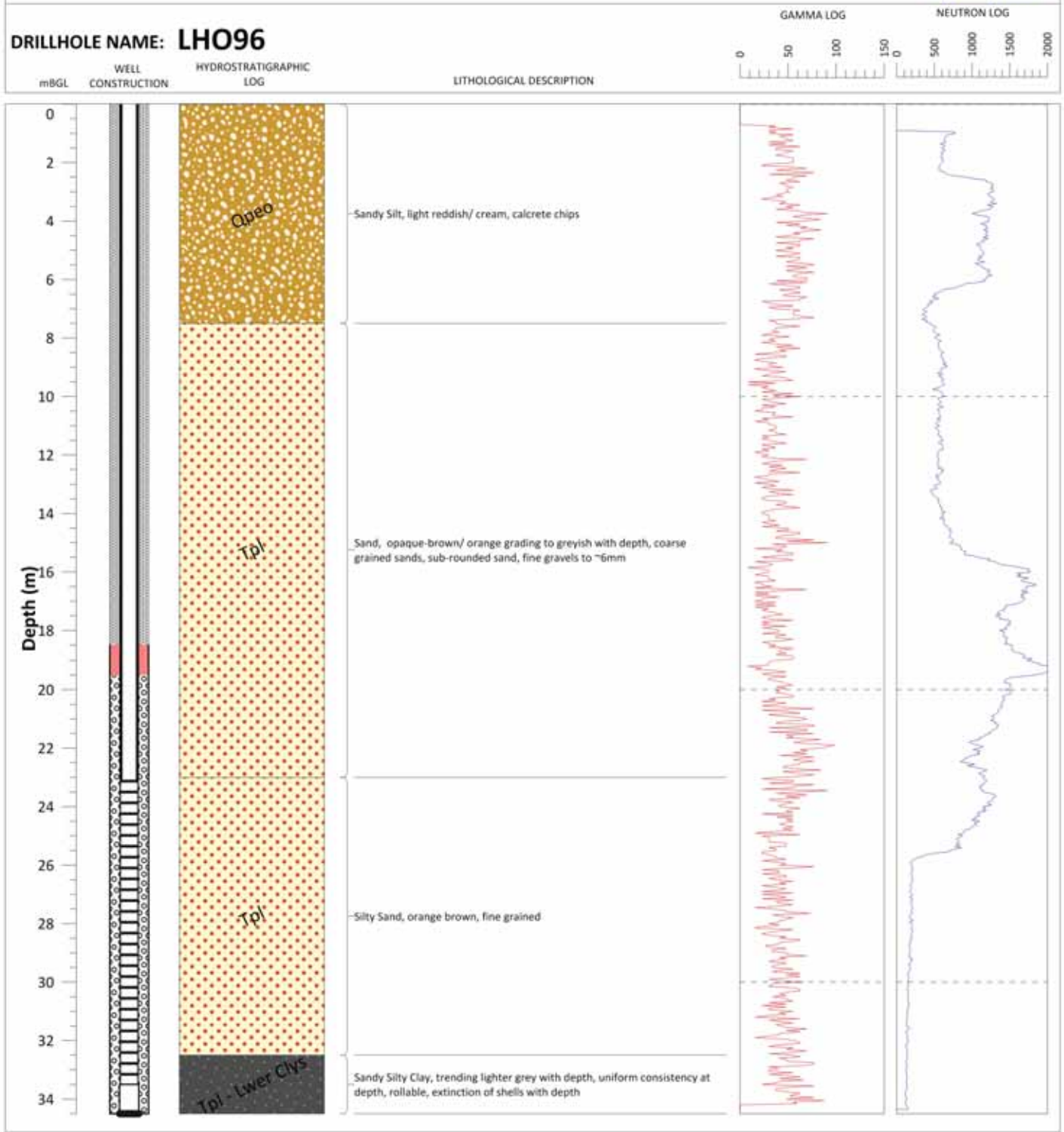
Completion Date: 12/04/09 **NS Elevation (mAHD):** 42.862 **Final Depth (m):** 34.5

Easting: 463335.638 **Zone:** 54 **Northing:** 6194637.17 **Site ID:** LH-RC-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHO96**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	79 mm	0 to 23.5 mBGL	0 to 18.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	23.5 to 33.5 mBGL	79 mm
Sump	33.5 to 34.5 mBGL	79 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2358 **Permit Number:** 141931 **Region:** Loxton

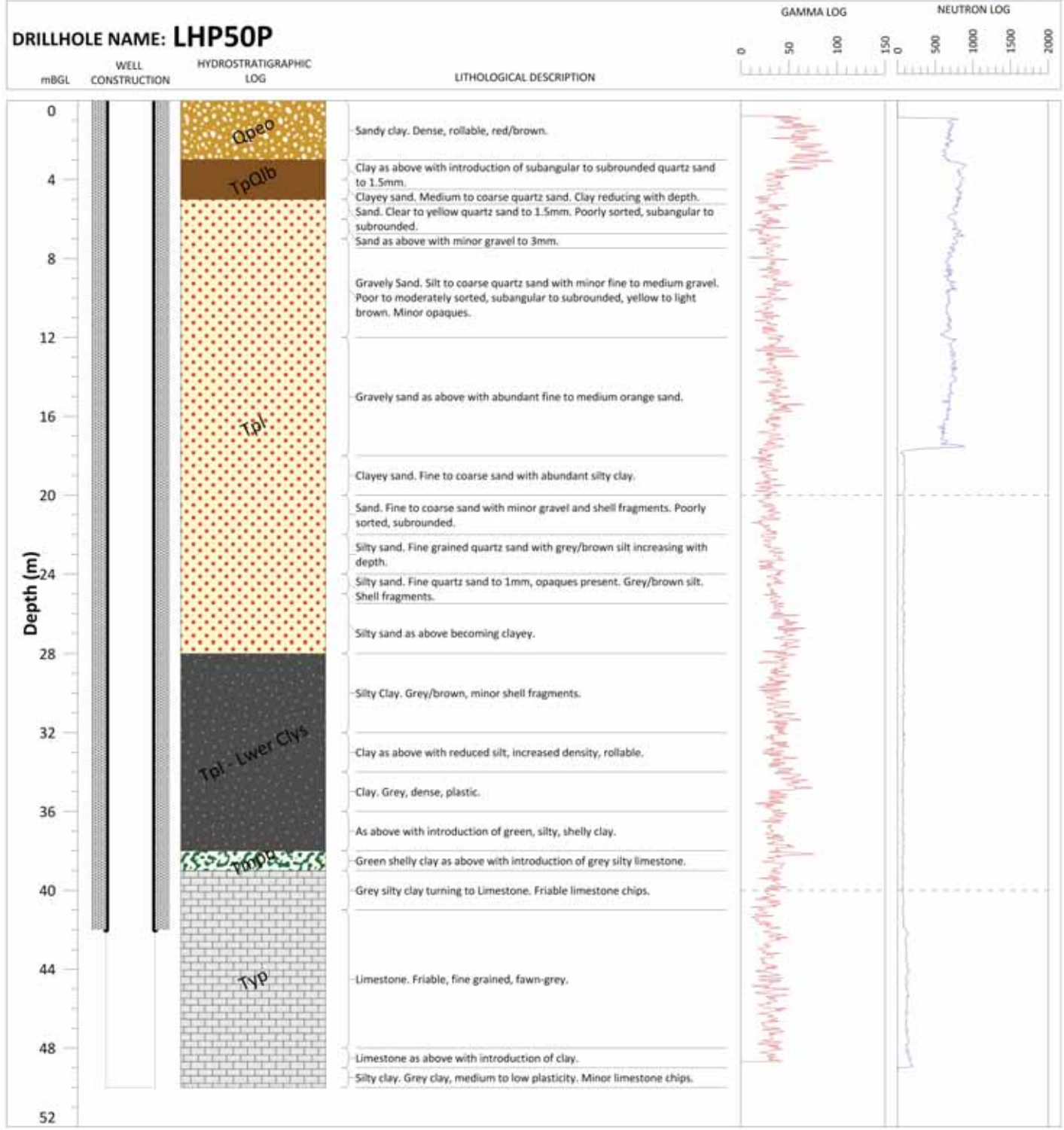
Completion Date: 4/10/08 **NS Elevation (mAHD):** 31.657 **Final Depth (m):** 50

Easting: 462606.322 **Zone:** 54 **Northing:** 6191497.358 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP50P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 42 mBGL	0 to 42 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	42 to 50 mBGL	203.5 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

Notes:

Loxton Salt Interception

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2377 **Permit Number:** 141934 **Region:** Loxton

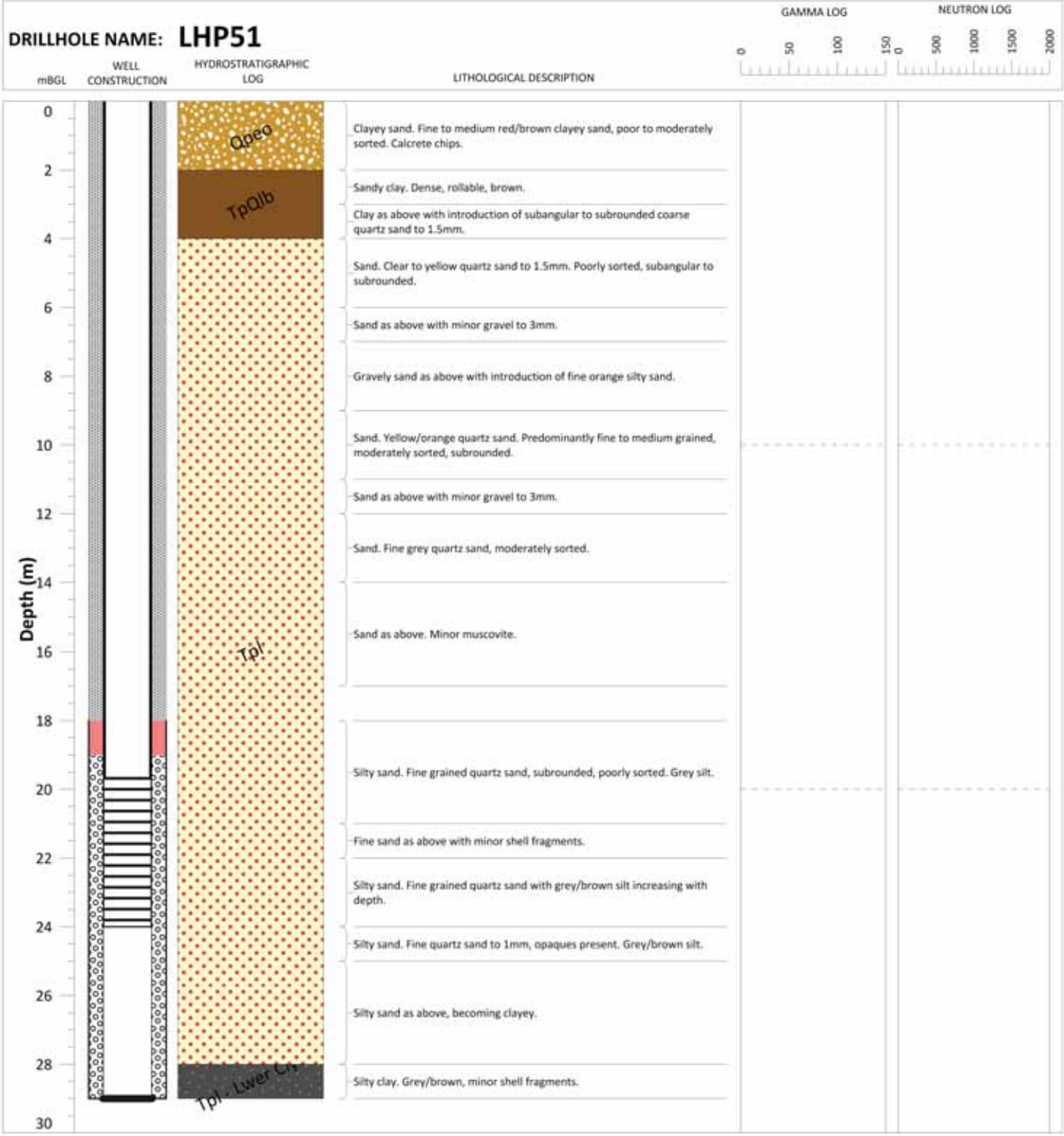
Completion Date: 5/19/08 **NS Elevation (mAHD):** 31.787 **Final Depth (m):** 29

Easting: 462604.326 **Zone:** 54 **Northing:** 6191523.654 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP51



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 20 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
W/Wound S/Steel	20 to 24 mBGL	203.5 mm
Sump	24 to 29 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2359 **Permit Number:** 141932 **Region:** Loxton

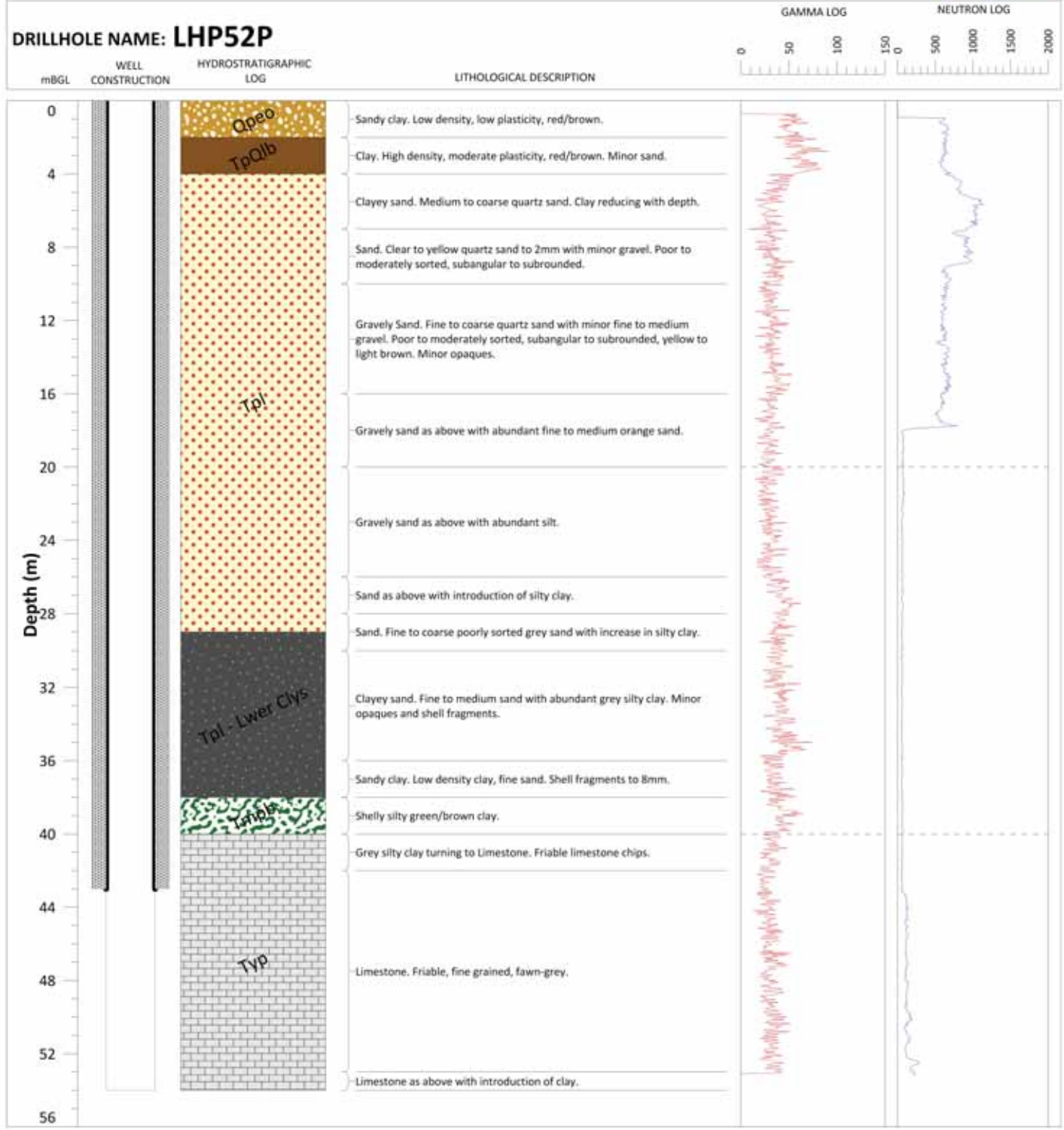
Completion Date: 4/16/08 **NS Elevation (mAHD):** 31.983 **Final Depth (m):** 54

Easting: 462609.59 **Zone:** 54 **Northing:** 6191549.879 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP52P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 54 mBGL	203.5 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2384 **Permit Number:** 141935 **Region:** Loxton

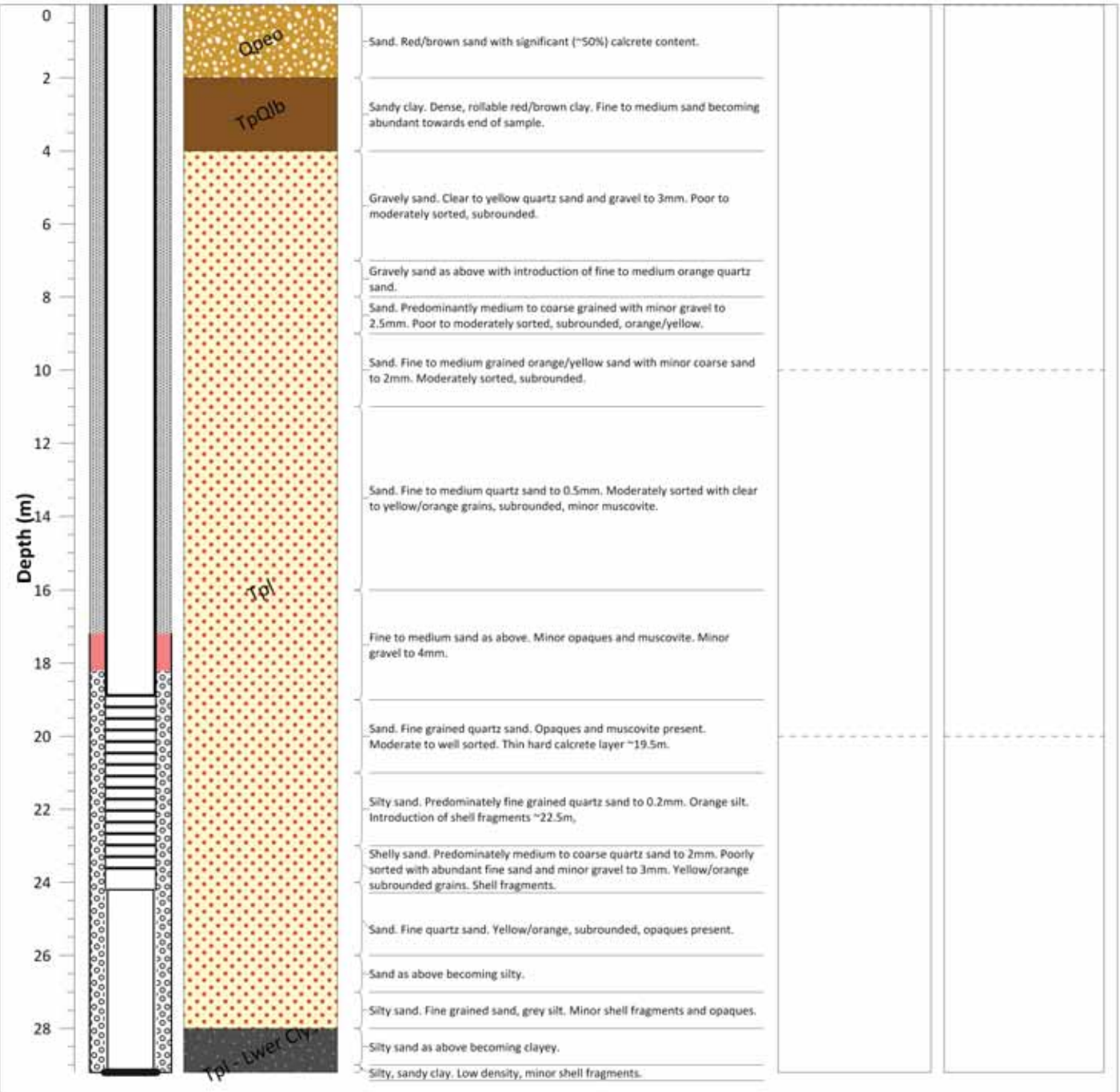
Completion Date: 5/4/08 **NS Elevation (mAHD):** 31.864 **Final Depth (m):** 29.2

Easting: 462613.933 **Zone:** 54 **Northing:** 6191575.834 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP53



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 19.2 mBGL	0 to 17.2 mBGL

Production Zone Details

Type	Interval	Diam
W/Wound S/Steel	19.2 to 24.2 mBGL	203.5 mm
Sump	24.2 to 29.2 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2360 **Permit Number:** 141939 **Region:** Loxton

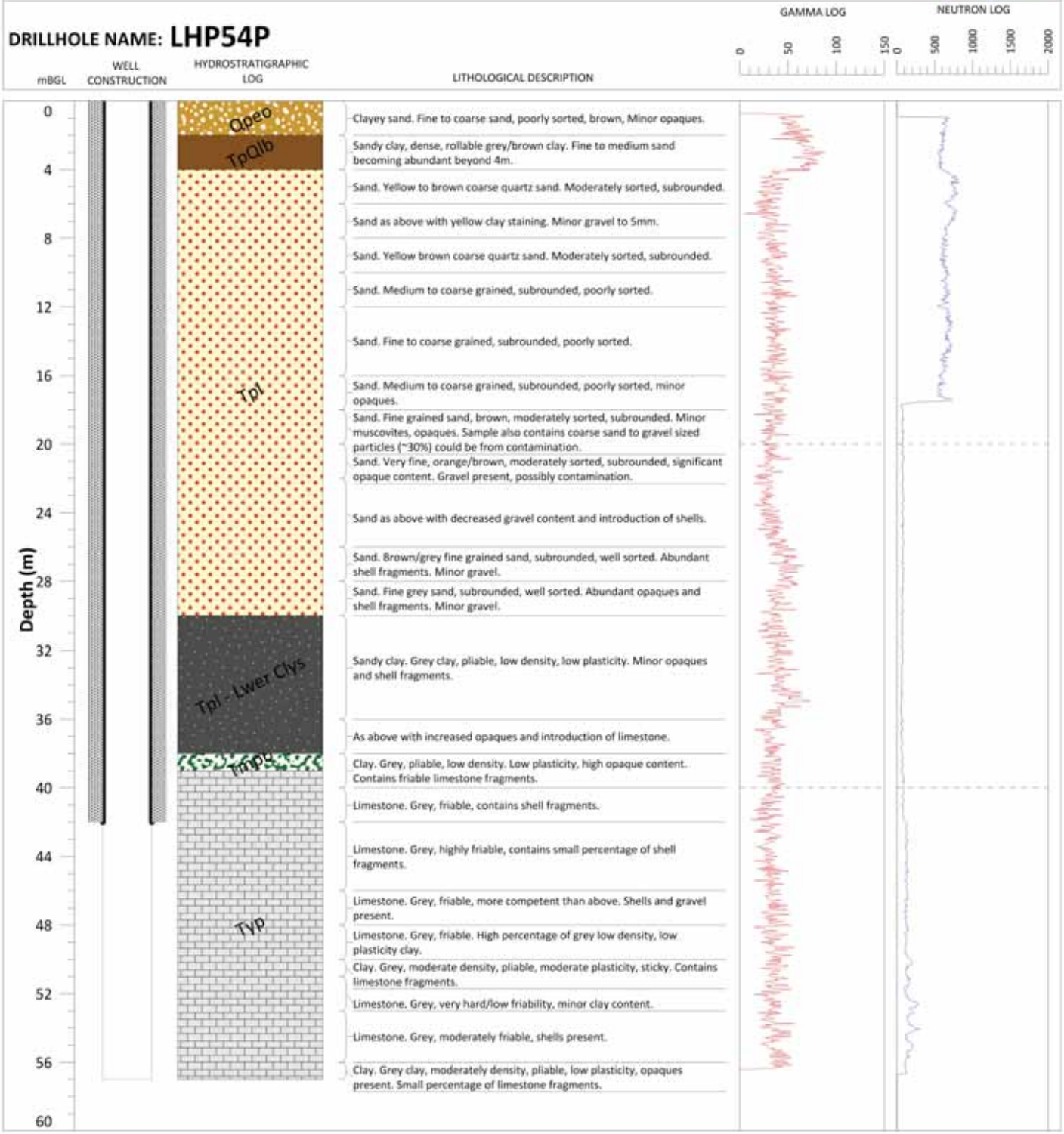
Completion Date: 4/18/08 **NS Elevation (mAHD):** 31.739 **Final Depth (m):** 57

Easting: 462609.775 **Zone:** 54 **Northing:** 6191600.349 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP54P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 42 mBGL	0 to 42 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	42 to 57 mBGL	203.5 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

Bentonite, Casing, Production Zone, Open hole, Casing end cap, Cement, Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2378 **Permit Number:** 141942 **Region:** Loxton

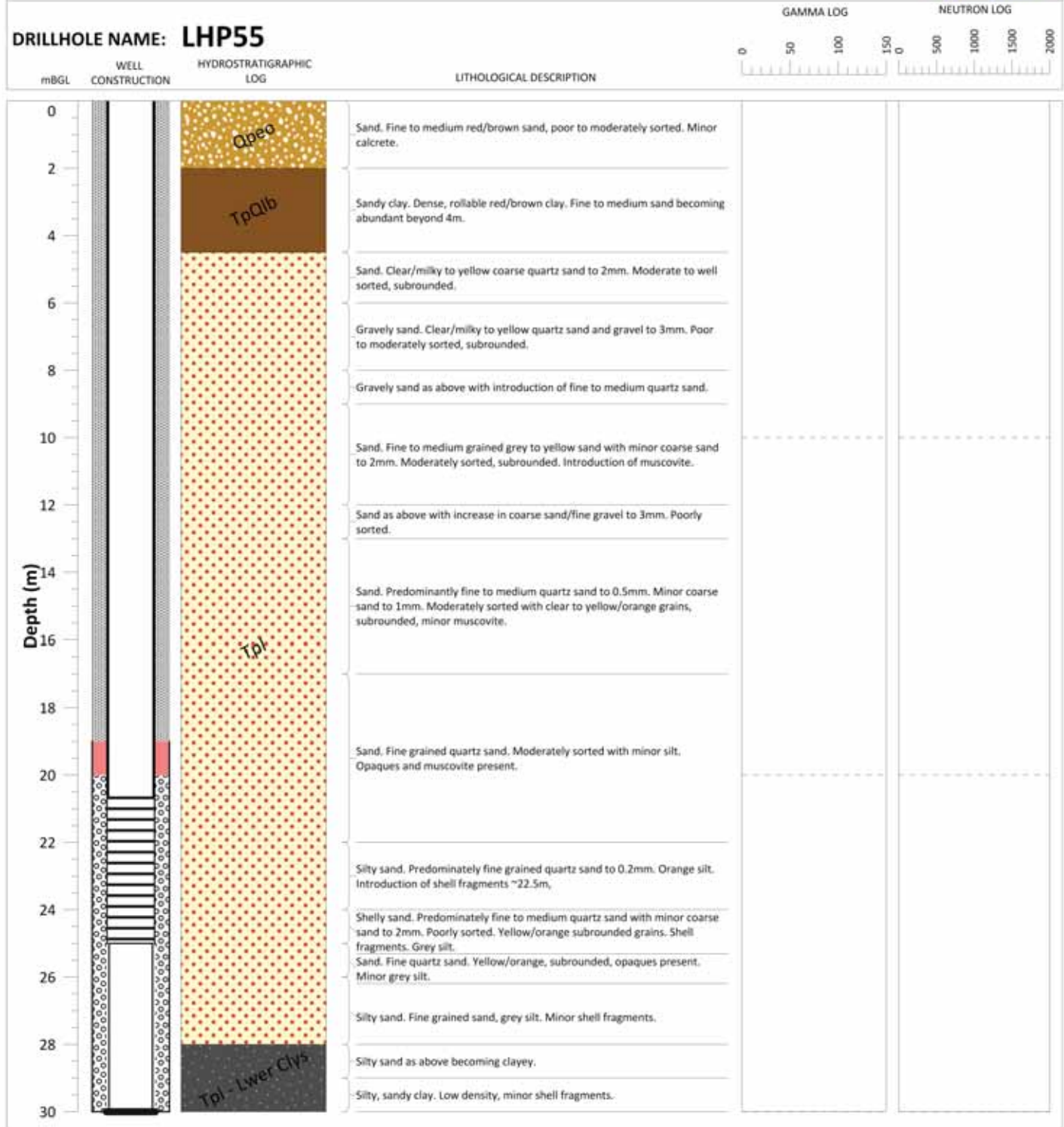
Completion Date: 5/21/08 **NS Elevation (mAHD):** 32.238 **Final Depth (m):** 30

Easting: 462616.745 **Zone:** 54 **Northing:** 6191626.491 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP55



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 21 mBGL	0 to 19 mBGL

Production Zone Details

Type	Interval	Diam
W/Wound S/Steel	21 to 25 mBGL	203.5 mm
Sump	25 to 30 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2373 **Permit Number:** 141940 **Region:** Loxton

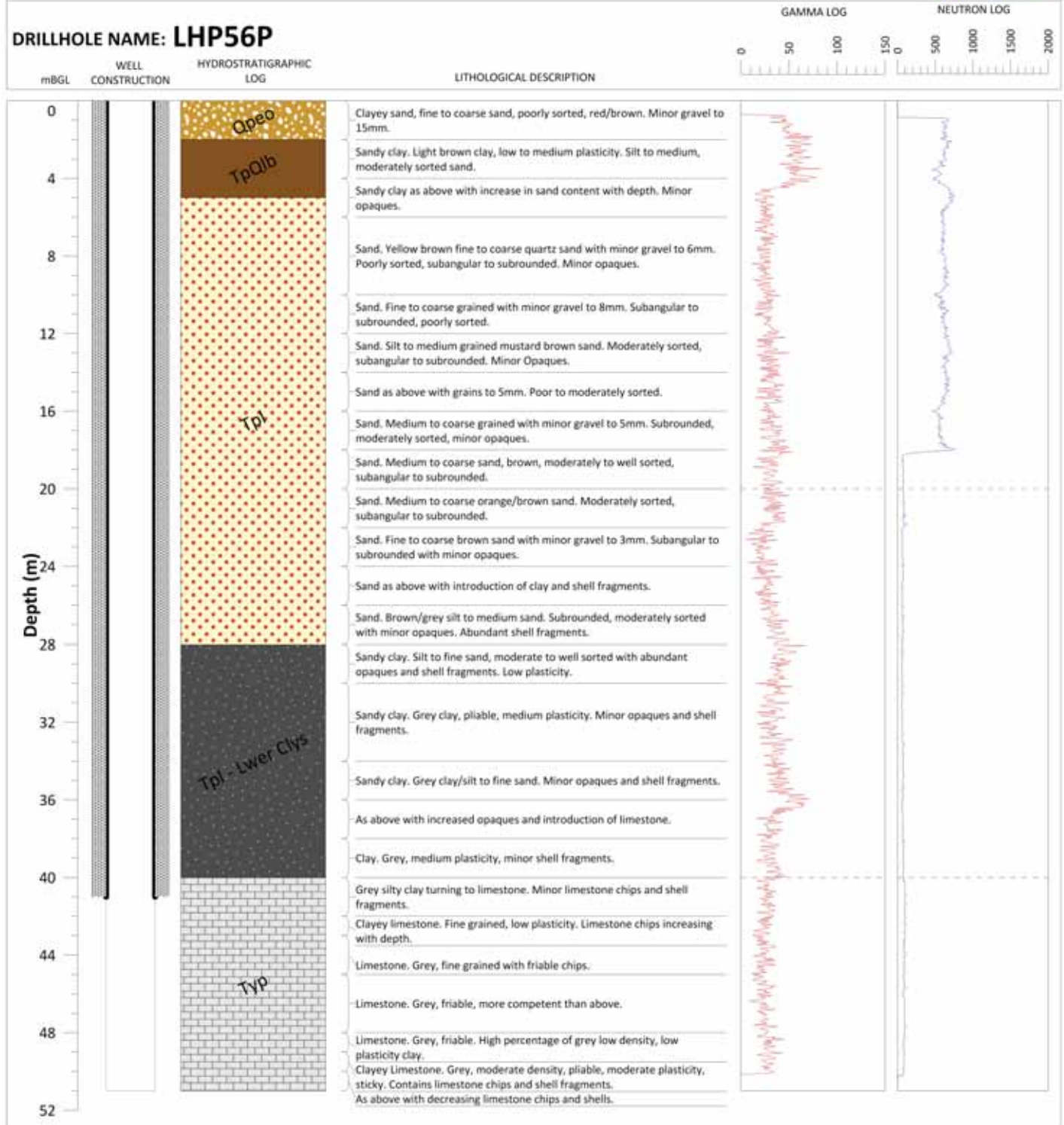
Completion Date: 5/17/08 **NS Elevation (mAHD):** 32.725 **Final Depth (m):** 51

Easting: 462630.501 **Zone:** 54 **Northing:** 6191654.924 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP56P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 41 mBGL	0 to 41 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	41 to 51 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

Notes:

Loxton Salt Interception

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2383 **Permit Number:** 141943 **Region:** Loxton

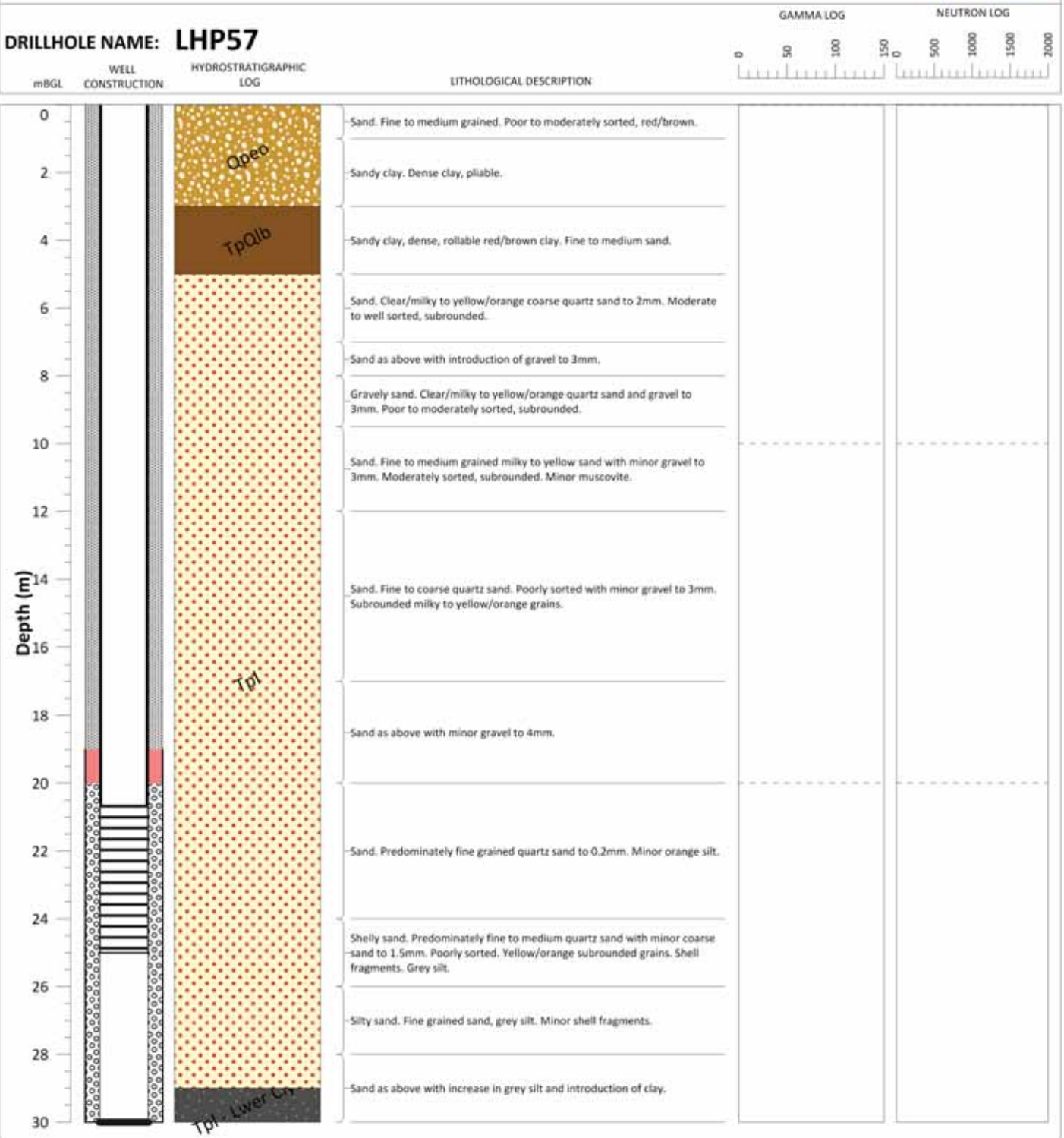
Completion Date: 5/1/08 **NS Elevation (mAHD):** 32.989 **Final Depth (m):** 30

Easting: 462635.583 **Zone:** 54 **Northing:** 6191681.625 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP57



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 21 mBGL	0 to 19 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	21 to 25 mBGL	203.5 mm
Sump	25 to 30 mBGL	203.5 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2370 **Permit Number:** 141948 **Region:** Loxton

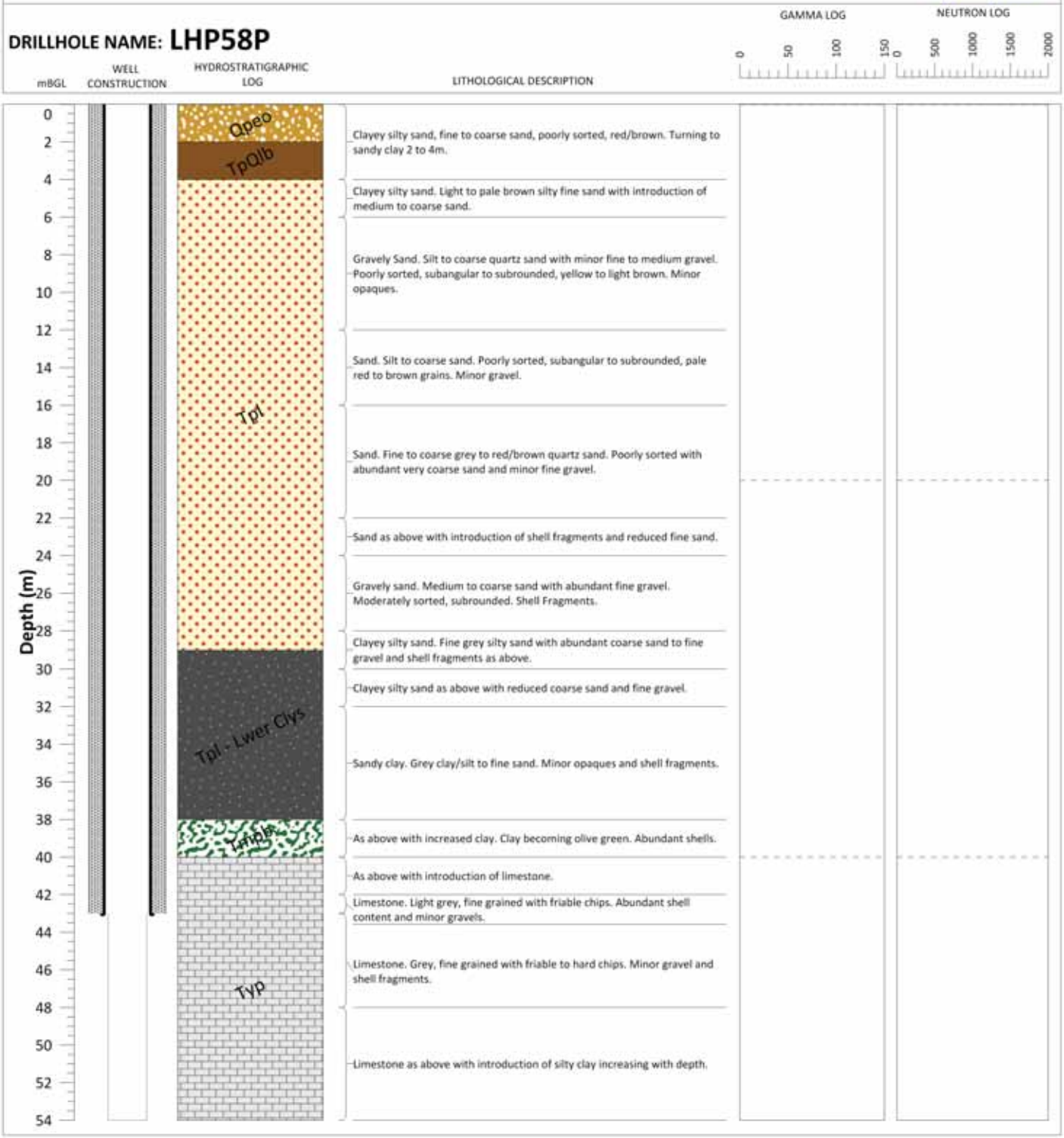
Completion Date: 6/3/08 **NS Elevation (mAHD):** 33.15 **Final Depth (m):** 54

Easting: 462641.26 **Zone:** 54 **Northing:** 6191706.45 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP58P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 54 mBGL	100 mm

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Notes:

Loxton Salt Interception

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2382 **Permit Number:** 141944 **Region:** Loxton

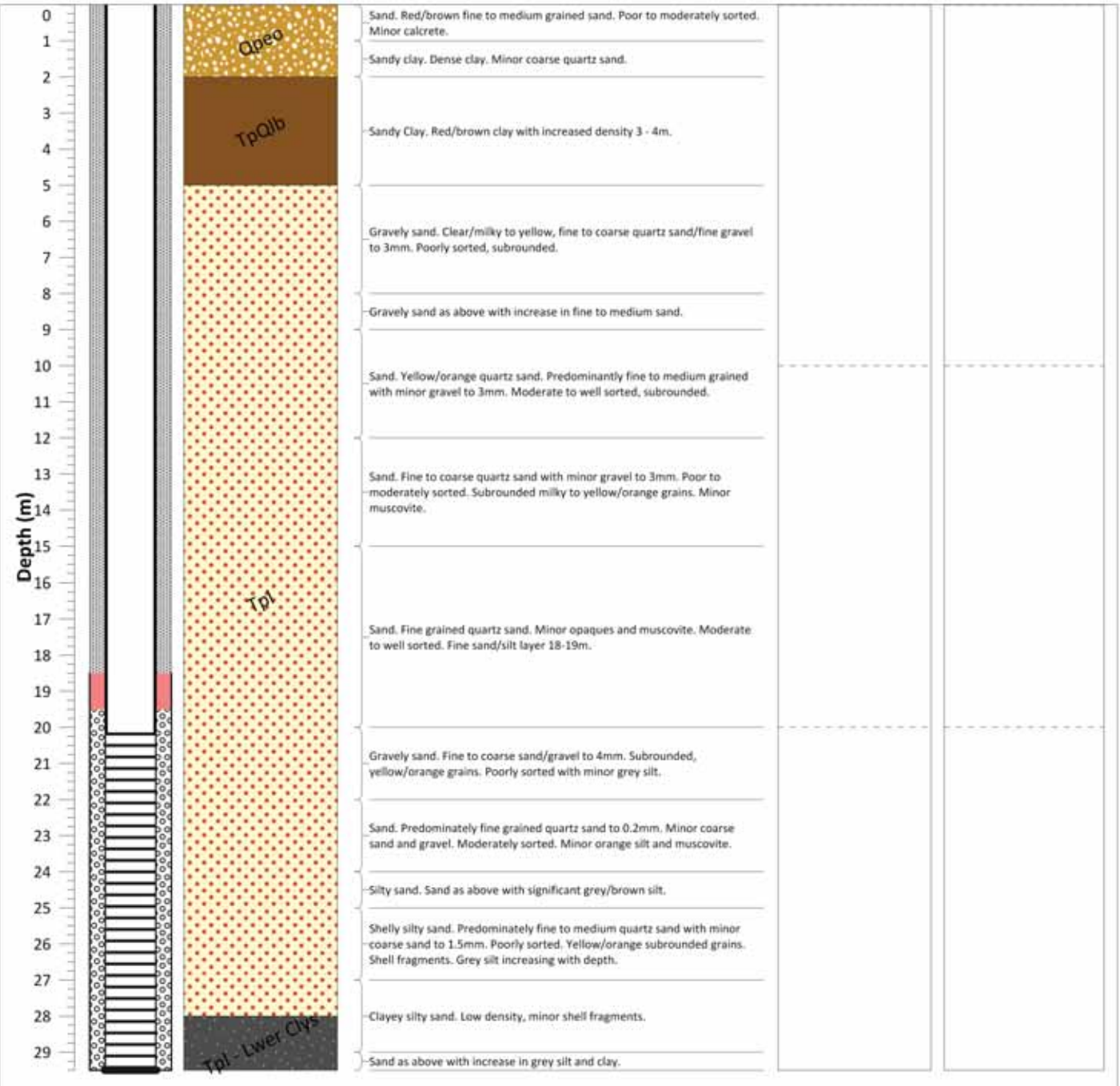
Completion Date: 5/2/08 **NS Elevation (mAHD):** 33.319 **Final Depth (m):** 29.5

Easting: 462644.771 **Zone:** 54 **Northing:** 6191731.436 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP59



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 20.5 mBGL	0 to 18.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	20.5 to 24.5 mBGL	203.5 mm
Sump	24.5 to 29.5 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2369 **Permit Number:** 141949 **Region:** Loxton

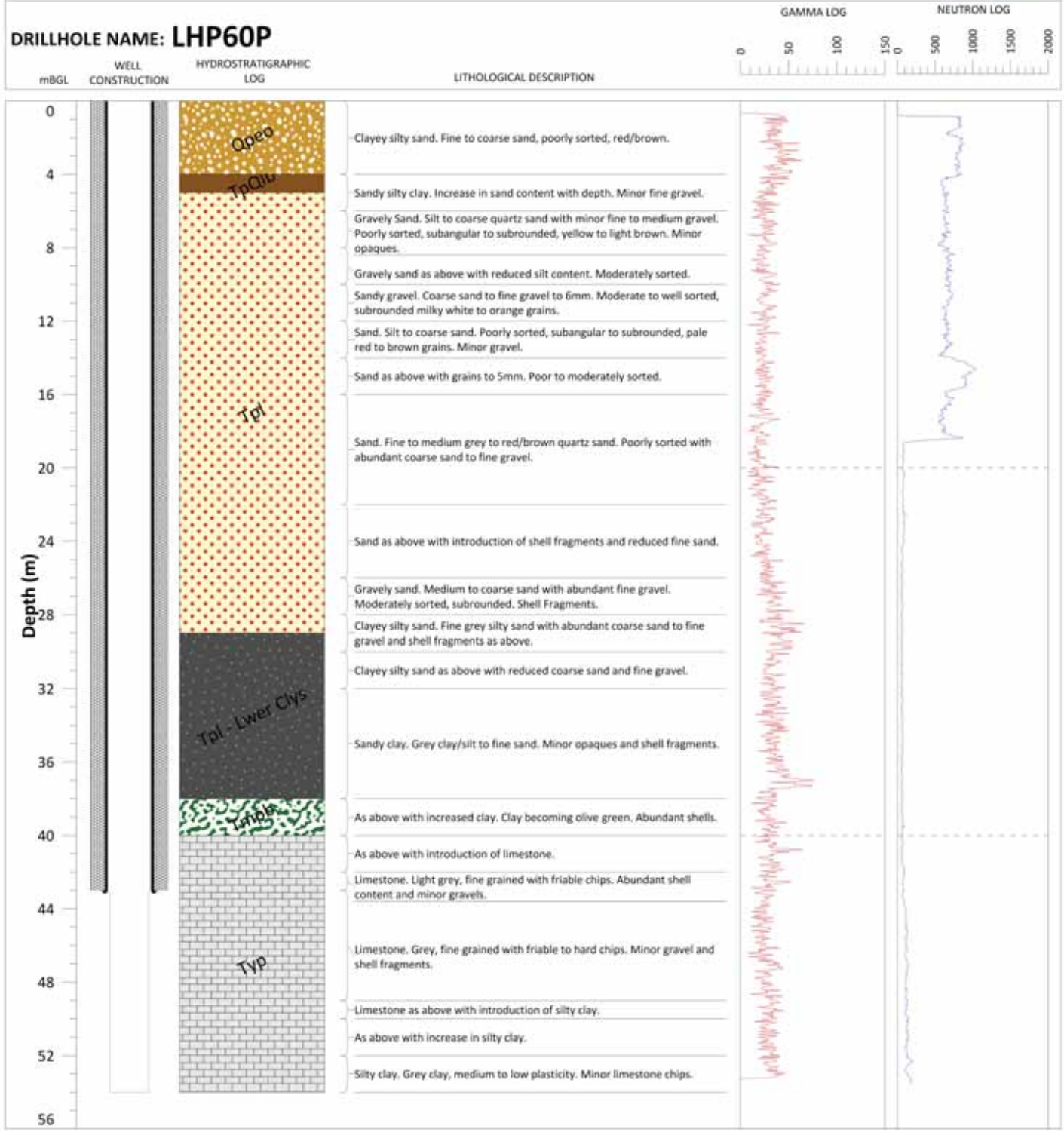
Completion Date: 5/21/08 **NS Elevation (mAHD):** 33.386 **Final Depth (m):** 54

Easting: 462649.498 **Zone:** 54 **Northing:** 6191756.385 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP60P



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 43 mBGL	0 to 43 mBGL

Production Zone Details

Type	Interval	Diam
Open Hole	43 to 54 mBGL	100 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2371 **Permit Number:** 141961 **Region:** Loxton

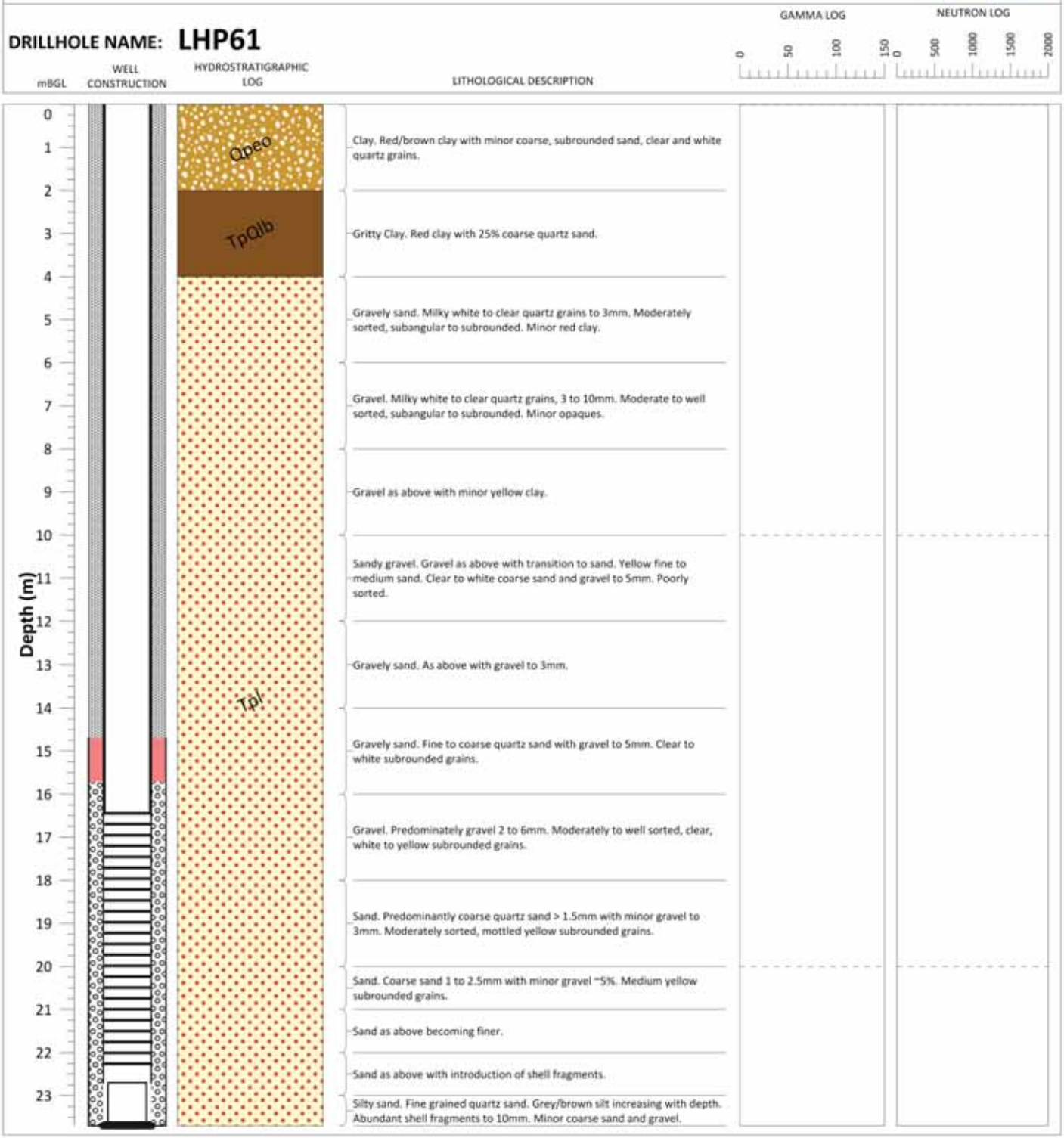
Completion Date: 4/29/08 **NS Elevation (mAHD):** 31.73 **Final Depth (m):** 23.7

Easting: 462359.846 **Zone:** 54 **Northing:** 6191944.915 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP61



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16.7 mBGL	0 to 14.7 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16.7 to 22.7 mBGL	203.5 mm
Sump	22.7 to 23.7 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2367 **Permit Number:** 141967 **Region:** Loxton

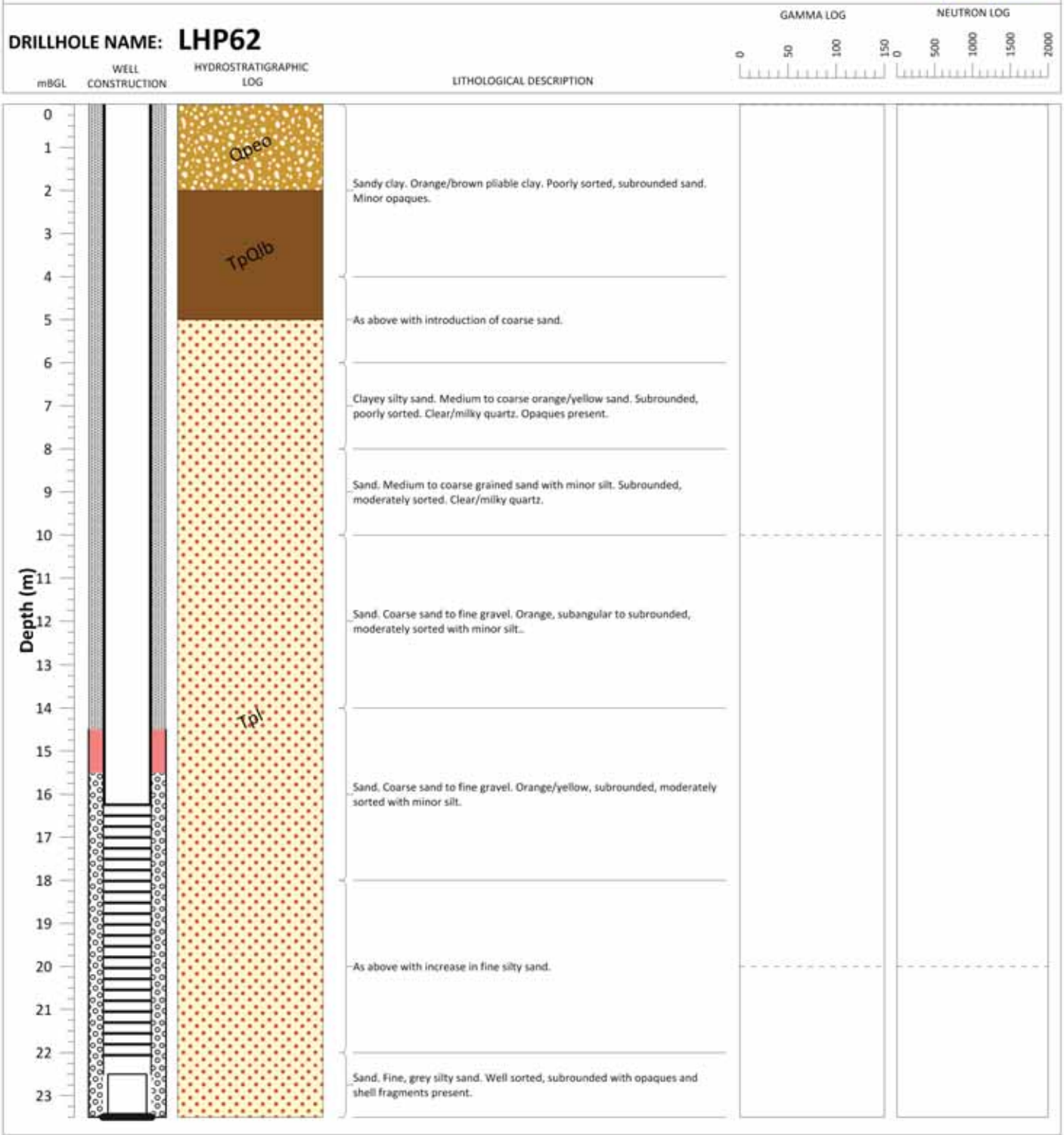
Completion Date: 5/3/08 **NS Elevation (mAHD):** 31.37 **Final Depth (m):** 23.5

Easting: 462777.418 **Zone:** 54 **Northing:** 6191958.773 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP62



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16.5 mBGL	0 to 14.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16.5 to 22.5 mBGL	203.5 mm
Sump	22.5 to 23.5 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2563 **Permit Number:** 168646 **Region:** Loxton

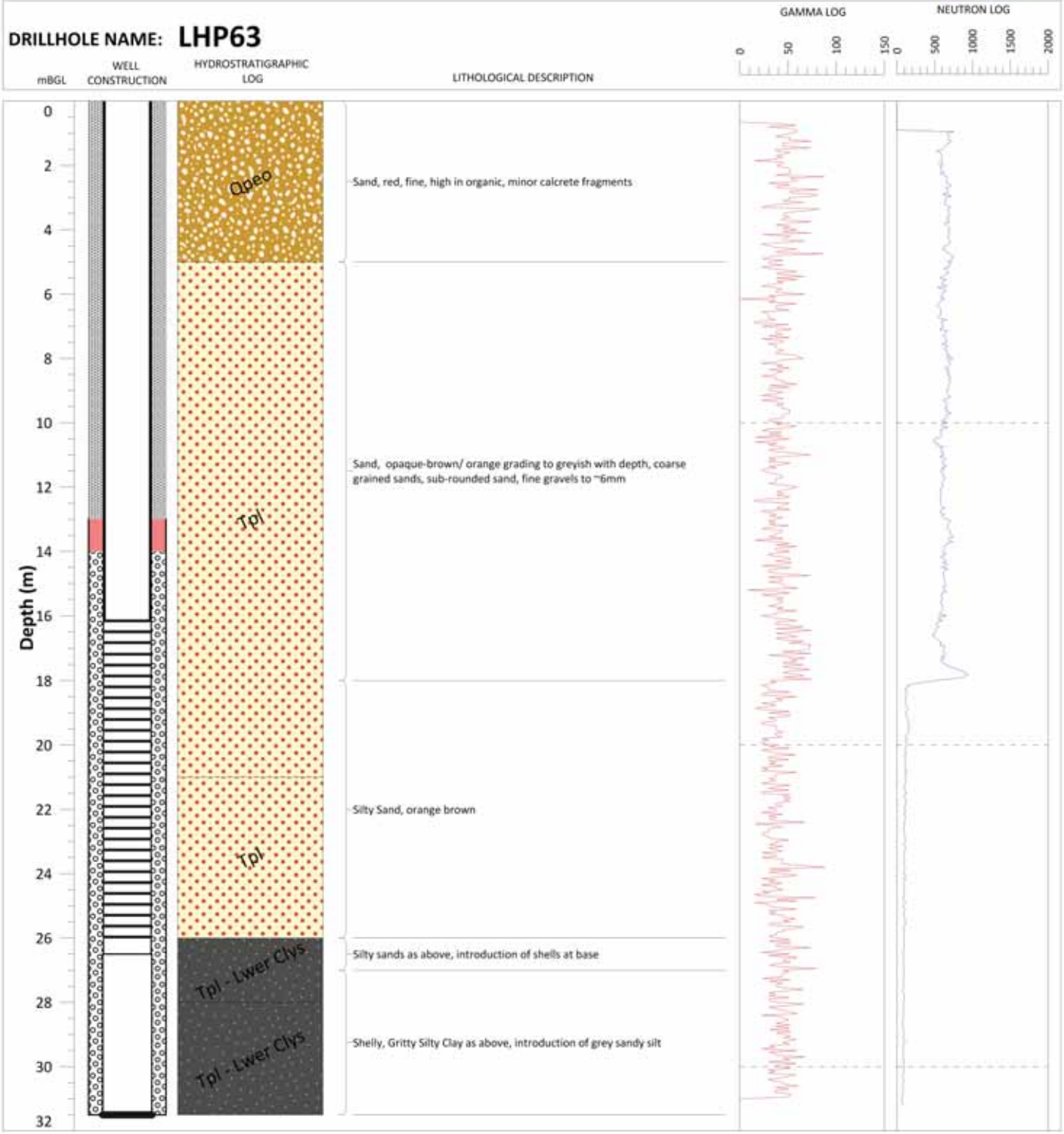
Completion Date: 10/29/09 **NS Elevation (mAHD):** 33.372 **Final Depth (m):** 31.5

Easting: 462653.014 **Zone:** 54 **Northing:** 6191773.388 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP63**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16.5 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16.5 to 26.5 mBGL	203.5 mm
Sump	26.5 to 31.5 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2574 **Permit Number:** 168650 **Region:** Loxton

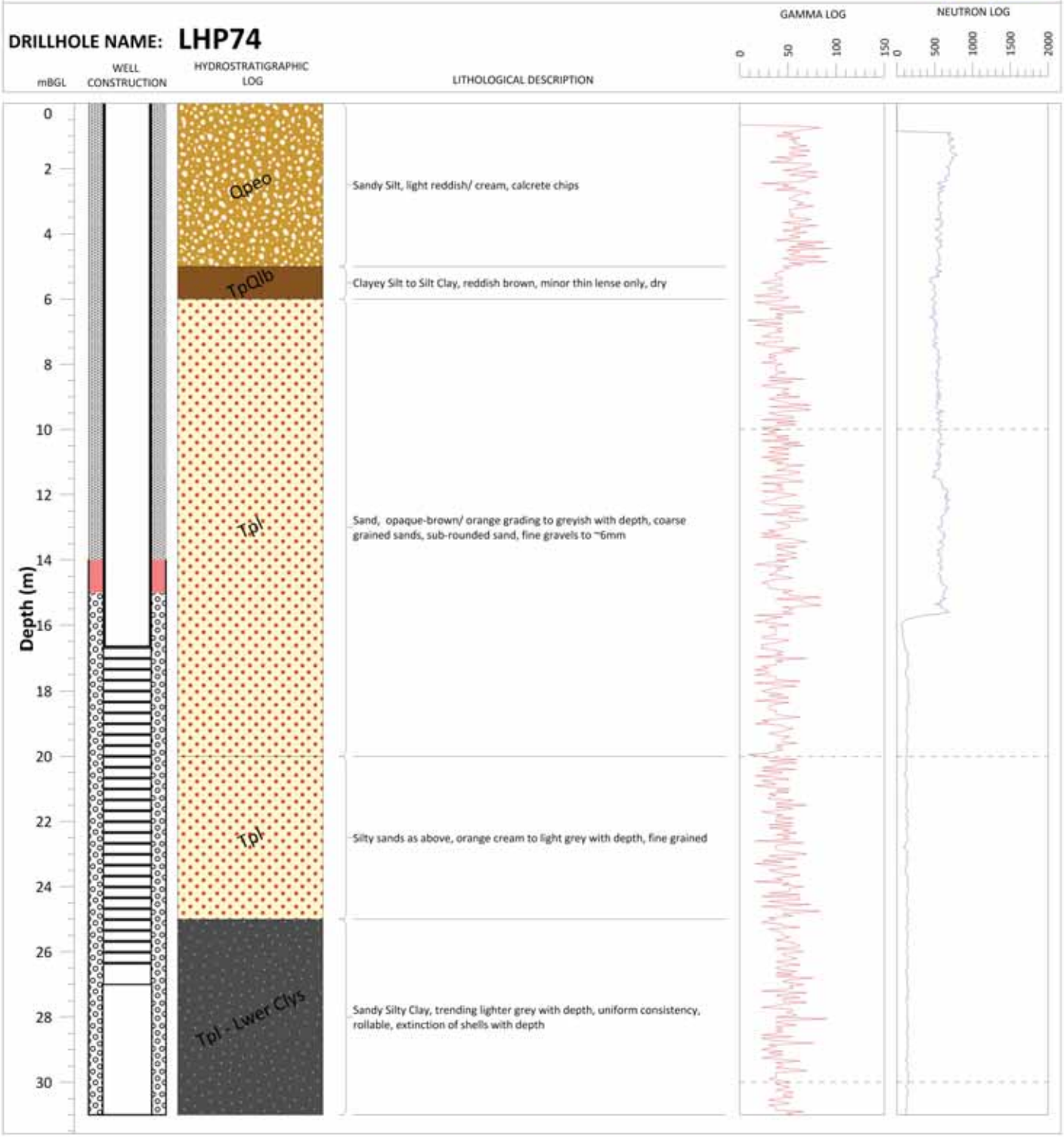
Completion Date: 11/18/09 **NS Elevation (mAHD):** 31.022 **Final Depth (m):** 32

Easting: 462412.007 **Zone:** 54 **Northing:** 6192131.25 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP74**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2565 **Permit Number:** 168648 **Region:** Loxton

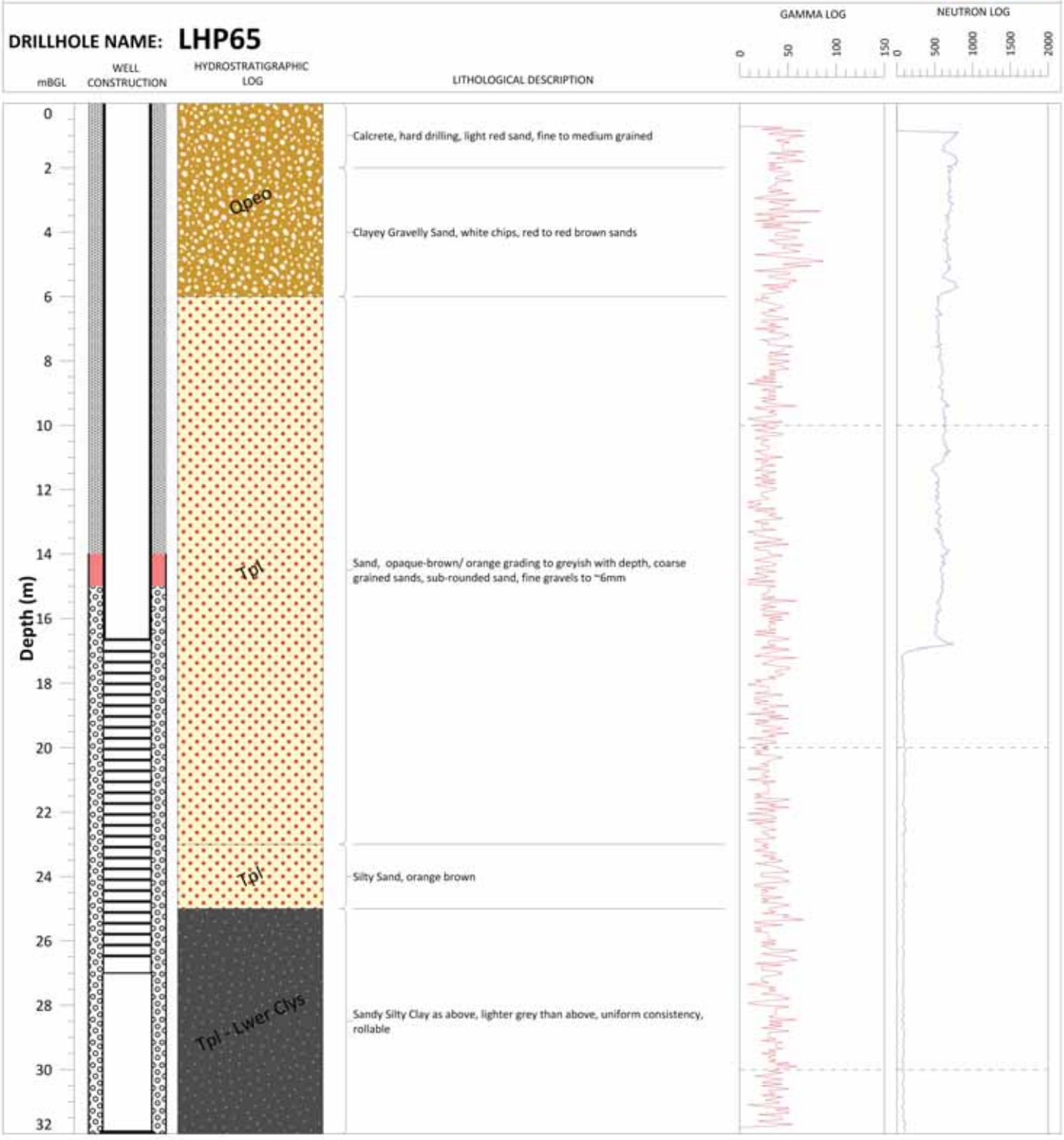
Completion Date: 11/02/09 **NS Elevation (mAHD):** 32.932 **Final Depth (m):** 32

Easting: 462671.417 **Zone:** 54 **Northing:** 6191872.829 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP65



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2566 **Permit Number:** 168635 **Region:** Loxton

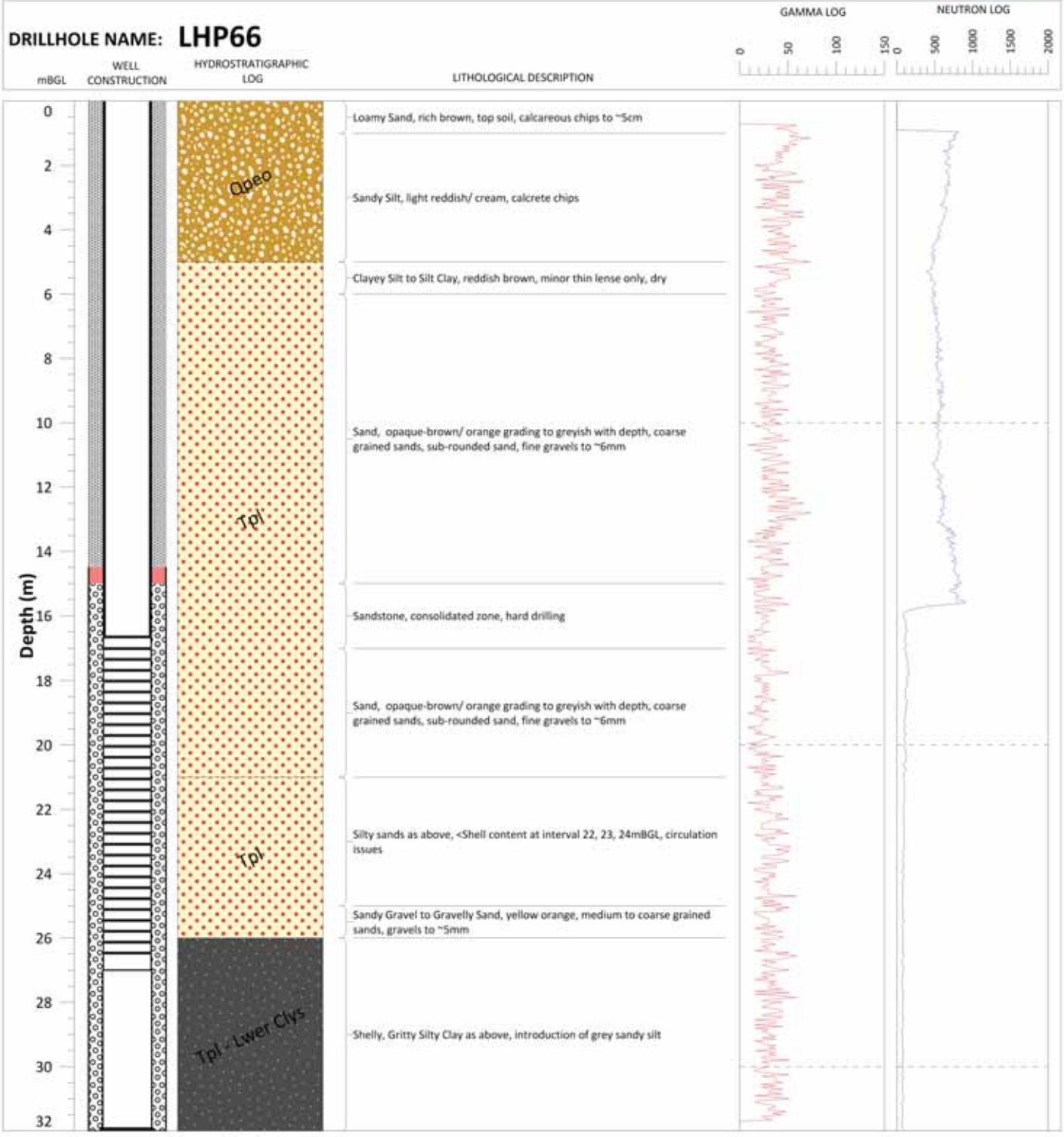
Completion Date: 11/05/09 **NS Elevation (mAHD):** 32.039 **Final Depth (m):** 32

Easting: 462706.531 **Zone:** 54 **Northing:** 6191909.607 **Site ID:** LH-PA-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP66**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14.5 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2567 **Permit Number:** 168639 **Region:** Loxton

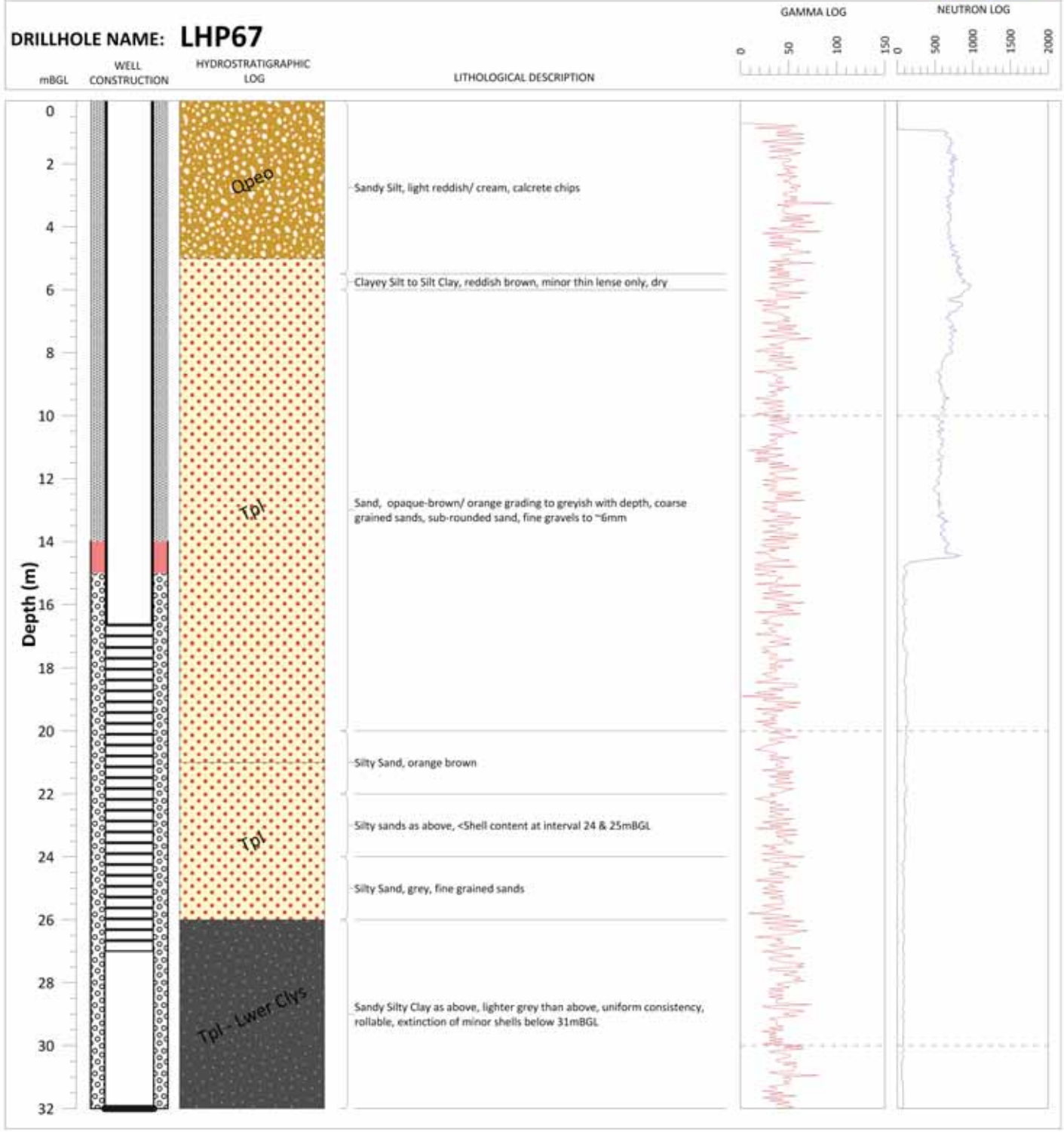
Completion Date: 11/28/09 **NS Elevation (mAHD):** 31.381 **Final Depth (m):** 32

Easting: 462719.51 **Zone:** 54 **Northing:** 6191969.397 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP67**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2568 **Permit Number:** 168640 **Region:** Loxton

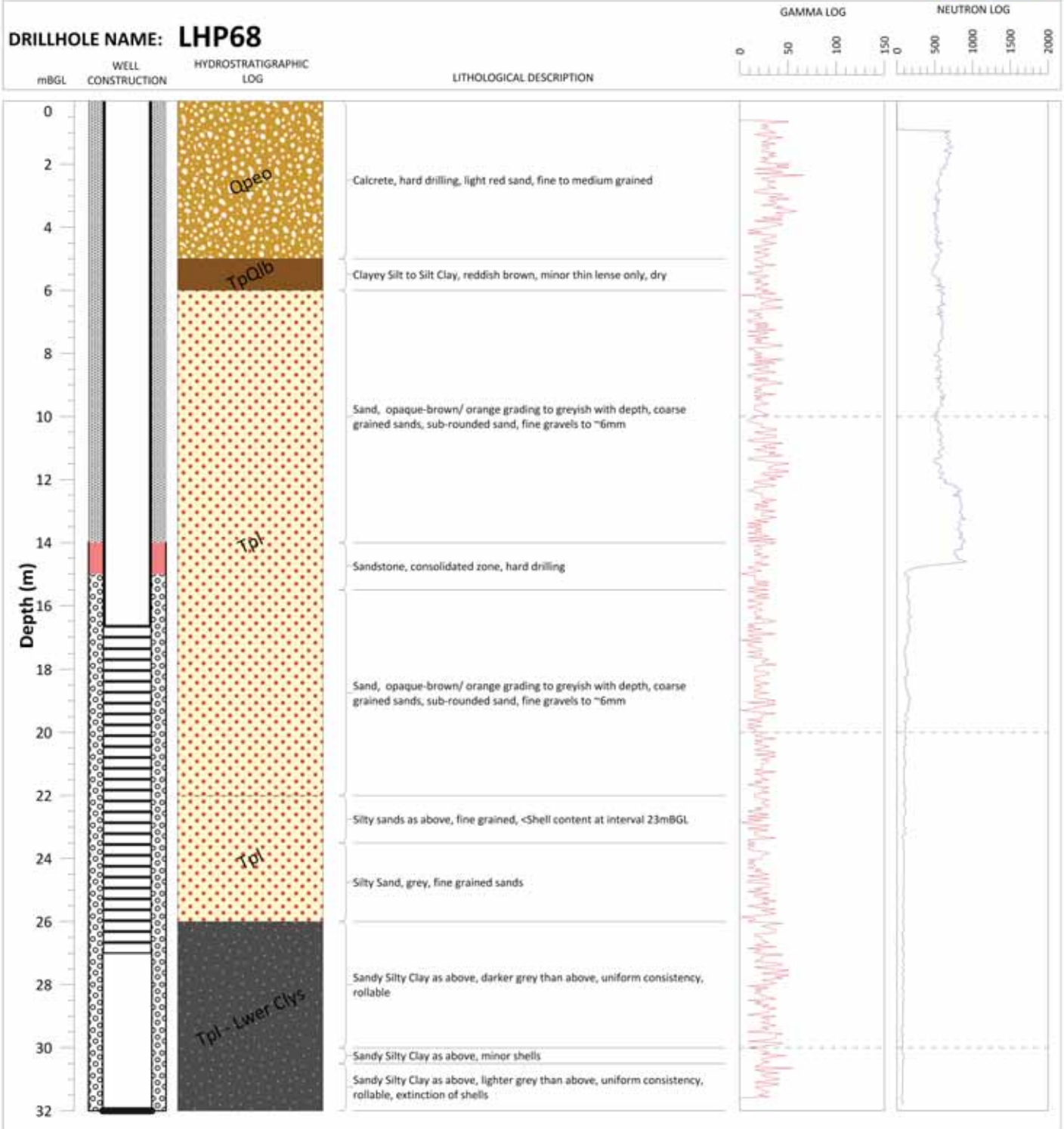
Completion Date: 11/28/09 **NS Elevation (mAHD):** 31.302 **Final Depth (m):** 32

Easting: 462675.802 **Zone:** 54 **Northing:** 6191992.544 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP68**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2569 **Permit Number:** 168641 **Region:** Loxton

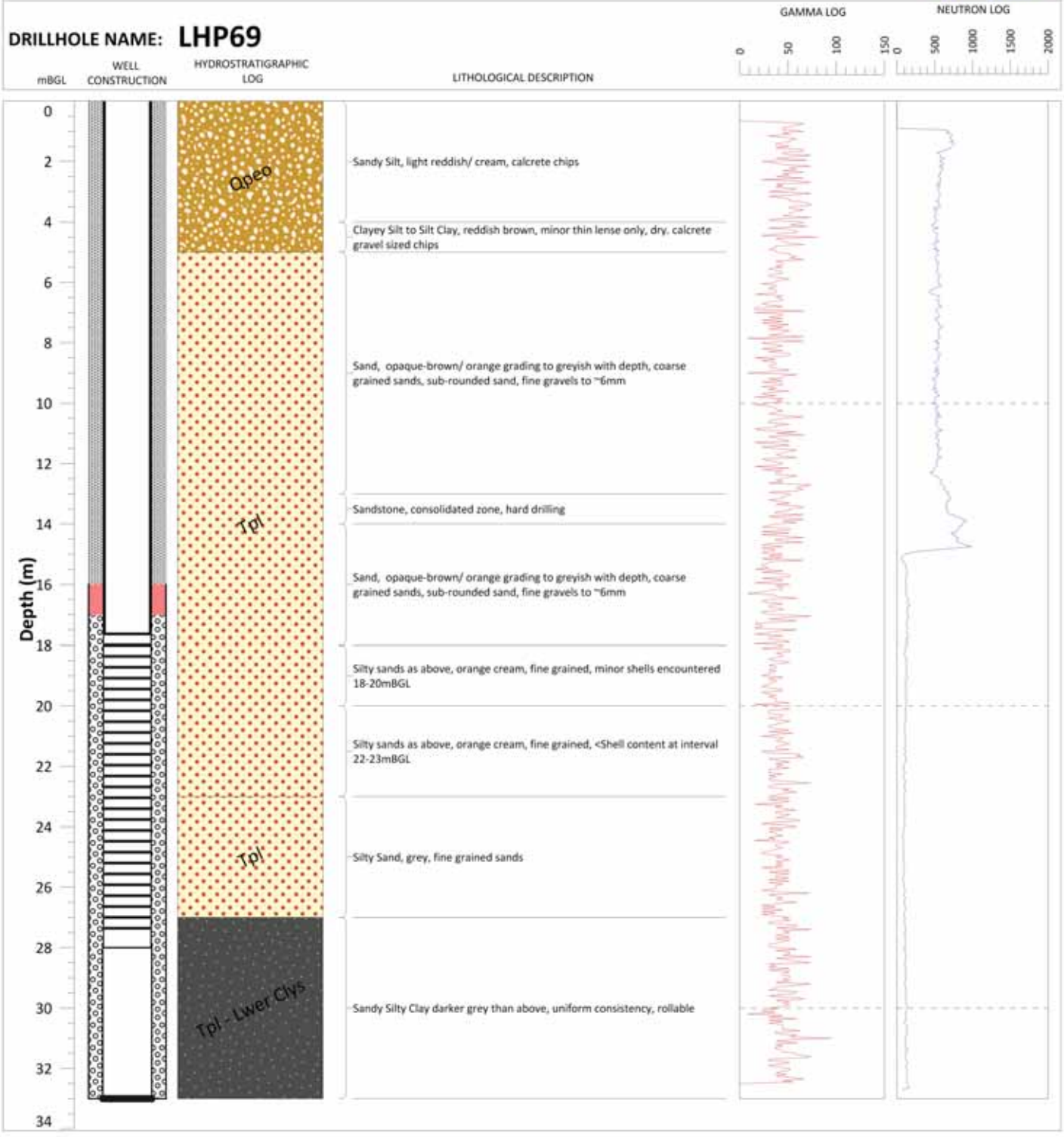
Completion Date: 11/25/09 **NS Elevation (mAHD):** 31.157 **Final Depth (m):** 33

Easting: 462632.119 **Zone:** 54 **Northing:** 6192015.628 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP69



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 18 mBGL	0 to 16 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	18 to 28 mBGL	203.5 mm
Sump	28 to 33 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2570 **Permit Number:** 168642 **Region:** Loxton

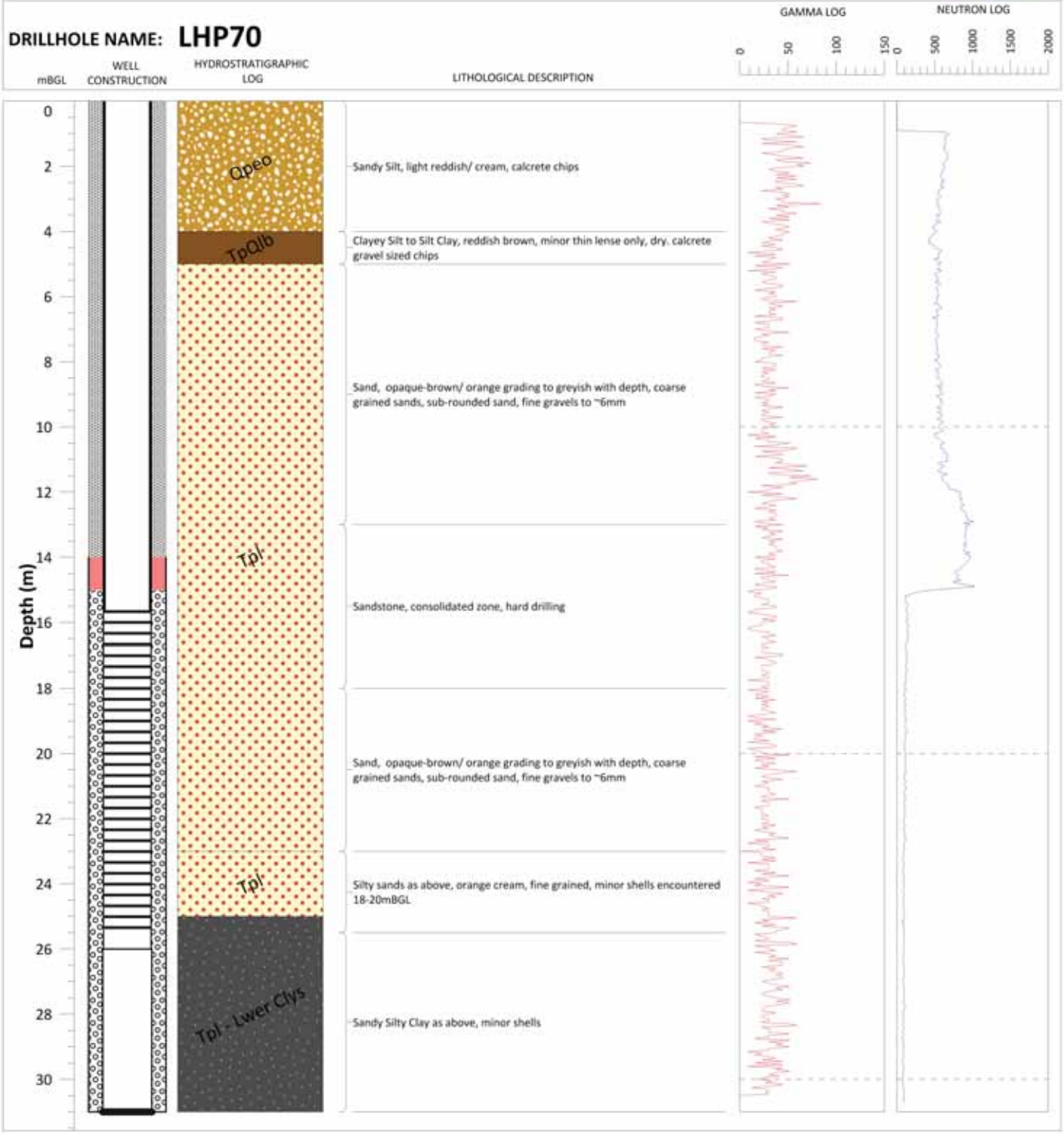
Completion Date: 11/24/09 **NS Elevation (mAHD):** 31.011 **Final Depth (m):** 31

Easting: 462586.704 **Zone:** 54 **Northing:** 6192039.415 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP70**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	203.5 mm
Sump	26 to 31 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2571 **Permit Number:** 168643 **Region:** Loxton

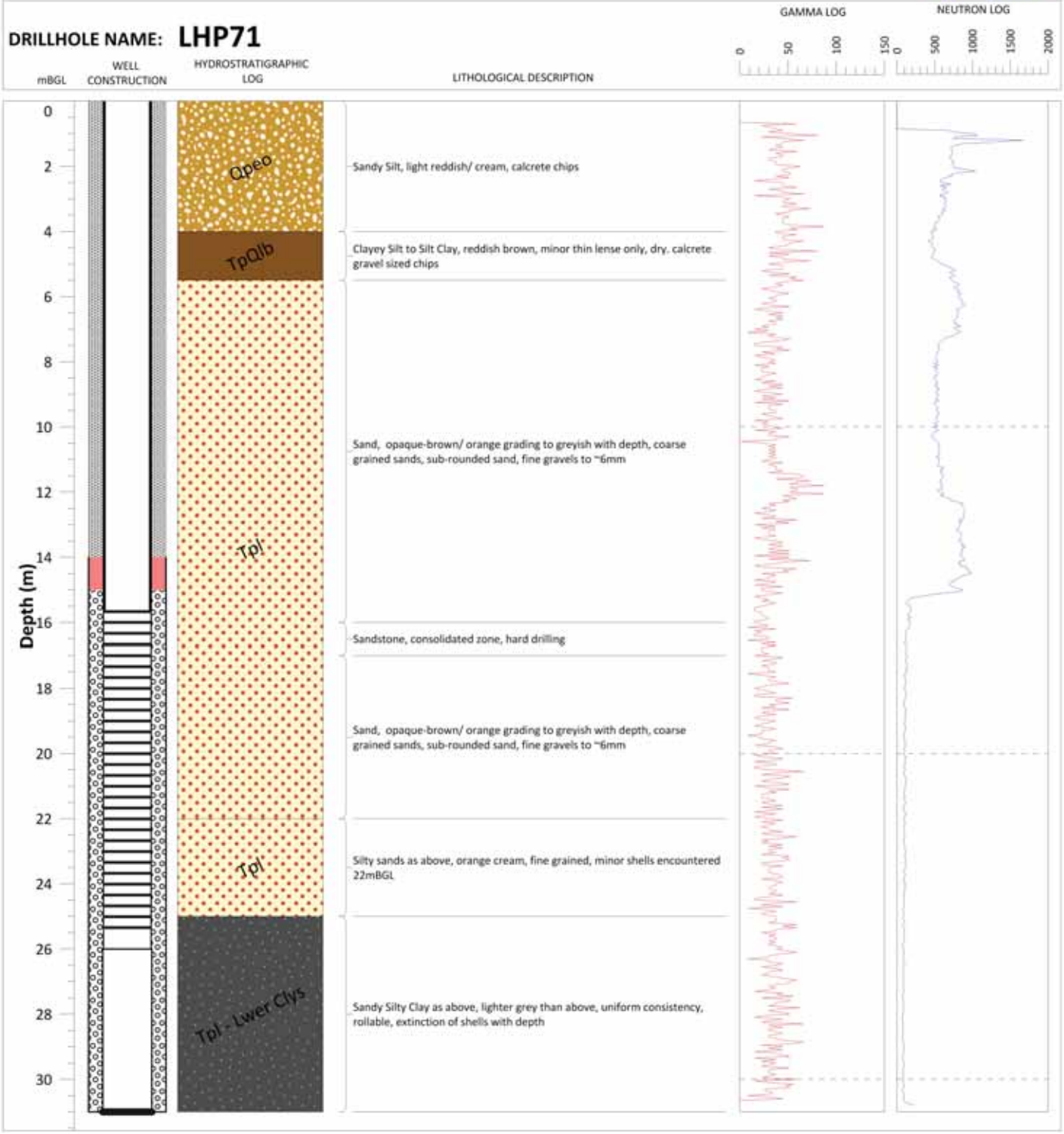
Completion Date: 11/23/09 **NS Elevation (mAHD):** 30.892 **Final Depth (m):** 31

Easting: 462544.027 **Zone:** 54 **Northing:** 6192061.822 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP71



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	203.5 mm
Sump	26 to 31 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2572 **Permit Number:** 168644 **Region:** Loxton

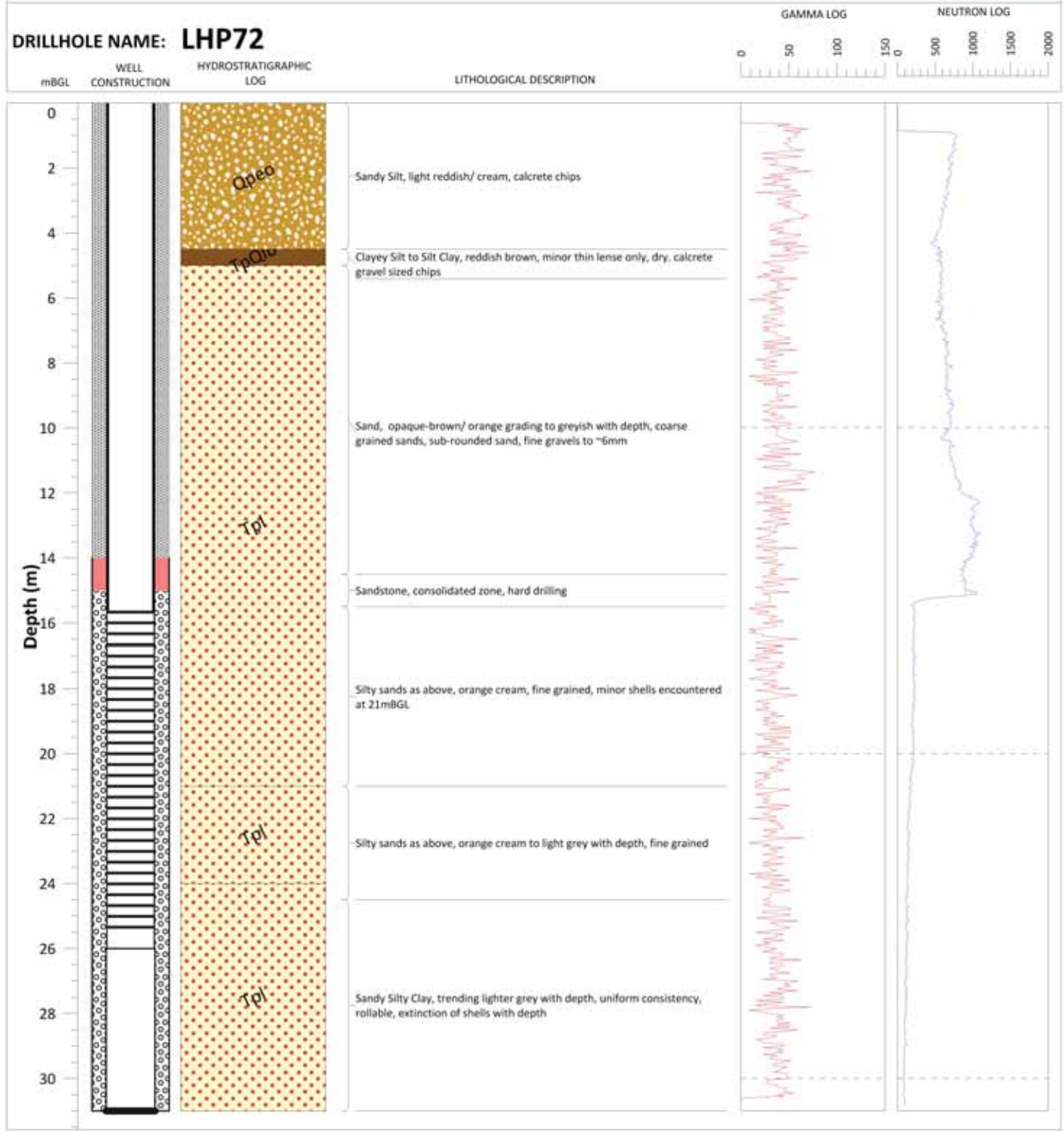
Completion Date: 11/20/09 **NS Elevation (mAHD):** 30.86 **Final Depth (m):** 31

Easting: 462499.947 **Zone:** 54 **Northing:** 6192084.969 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP72



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	203.5 mm
Sump	26 to 31 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2573 **Permit Number:** 168649 **Region:** Loxton

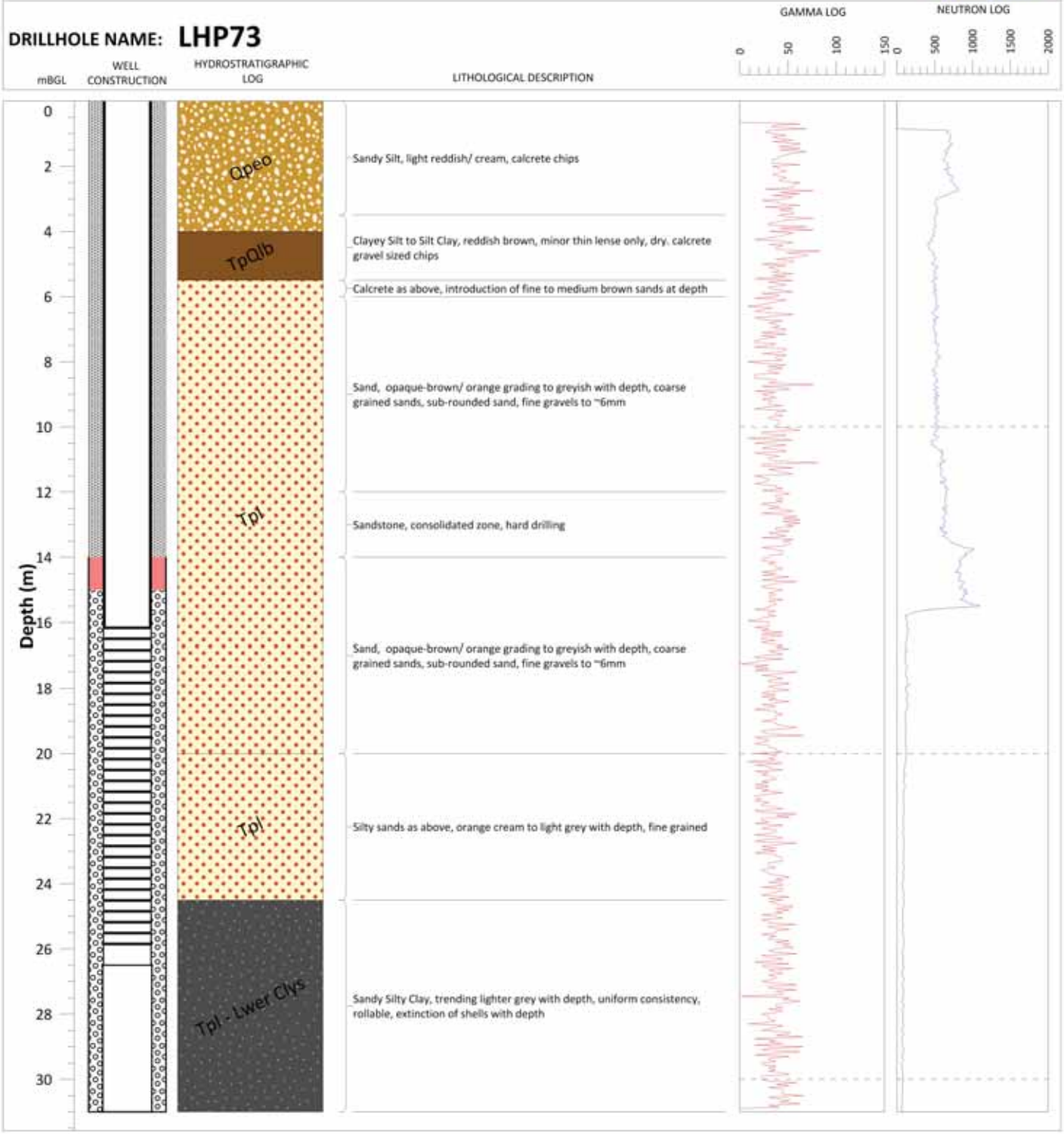
Completion Date: 11/18/09 **NS Elevation (mAHD):** 30.922 **Final Depth (m):** 31.5

Easting: 462456.26 **Zone:** 54 **Northing:** 6192108.24 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP73**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16.5 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16.5 to 26.5 mBGL	203.5 mm
Sump	26.5 to 31.5 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2574 **Permit Number:** 168650 **Region:** Loxton

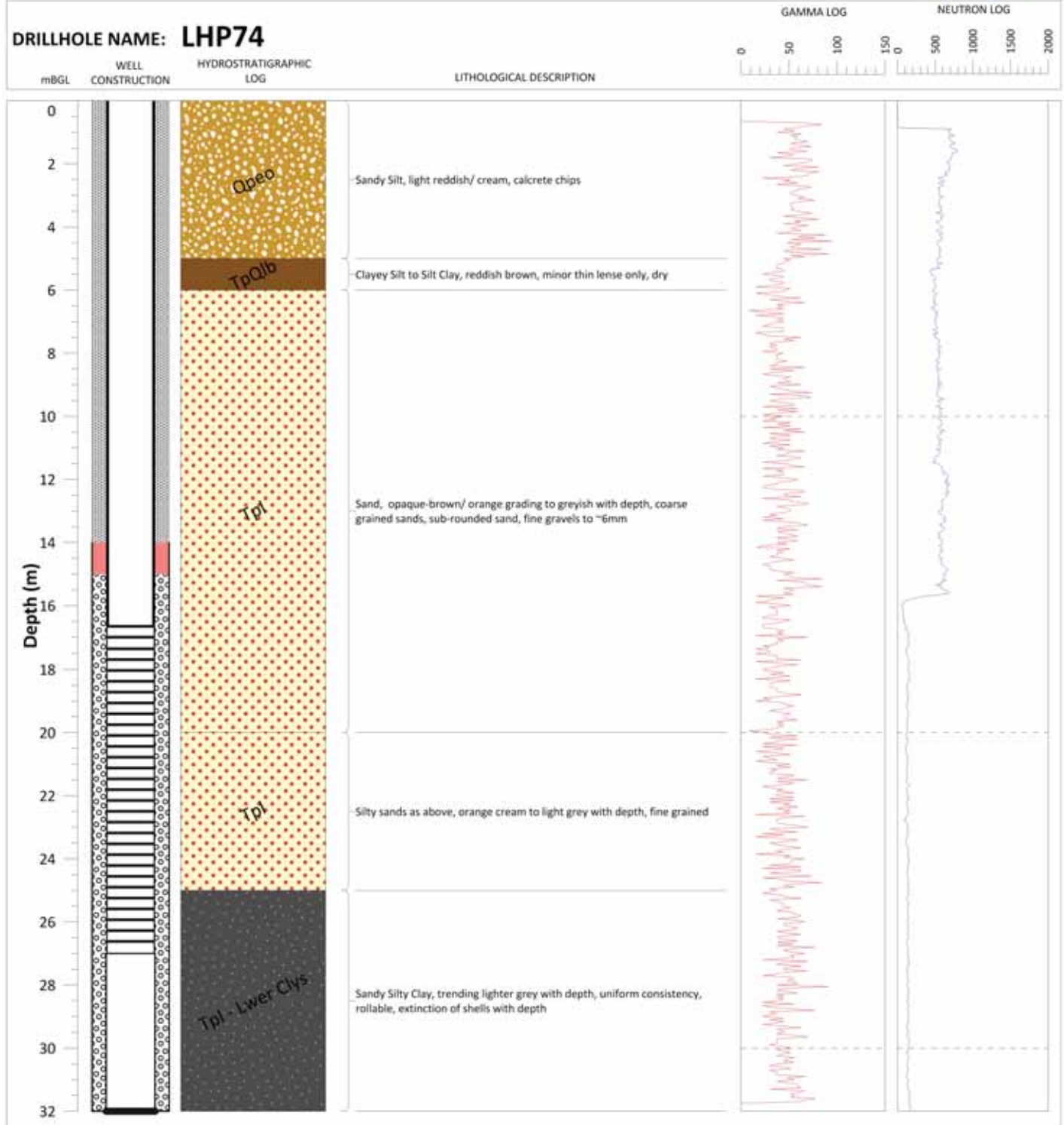
Completion Date: 11/18/09 **NS Elevation (mAHD):** 31.022 **Final Depth (m):** 32

Easting: 462412.007 **Zone:** 54 **Northing:** 6192131.25 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP74**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 17 mBGL	0 to 14 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	17 to 27 mBGL	203.5 mm
Sump	27 to 32 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2575 **Permit Number:** 168651 **Region:** Loxton

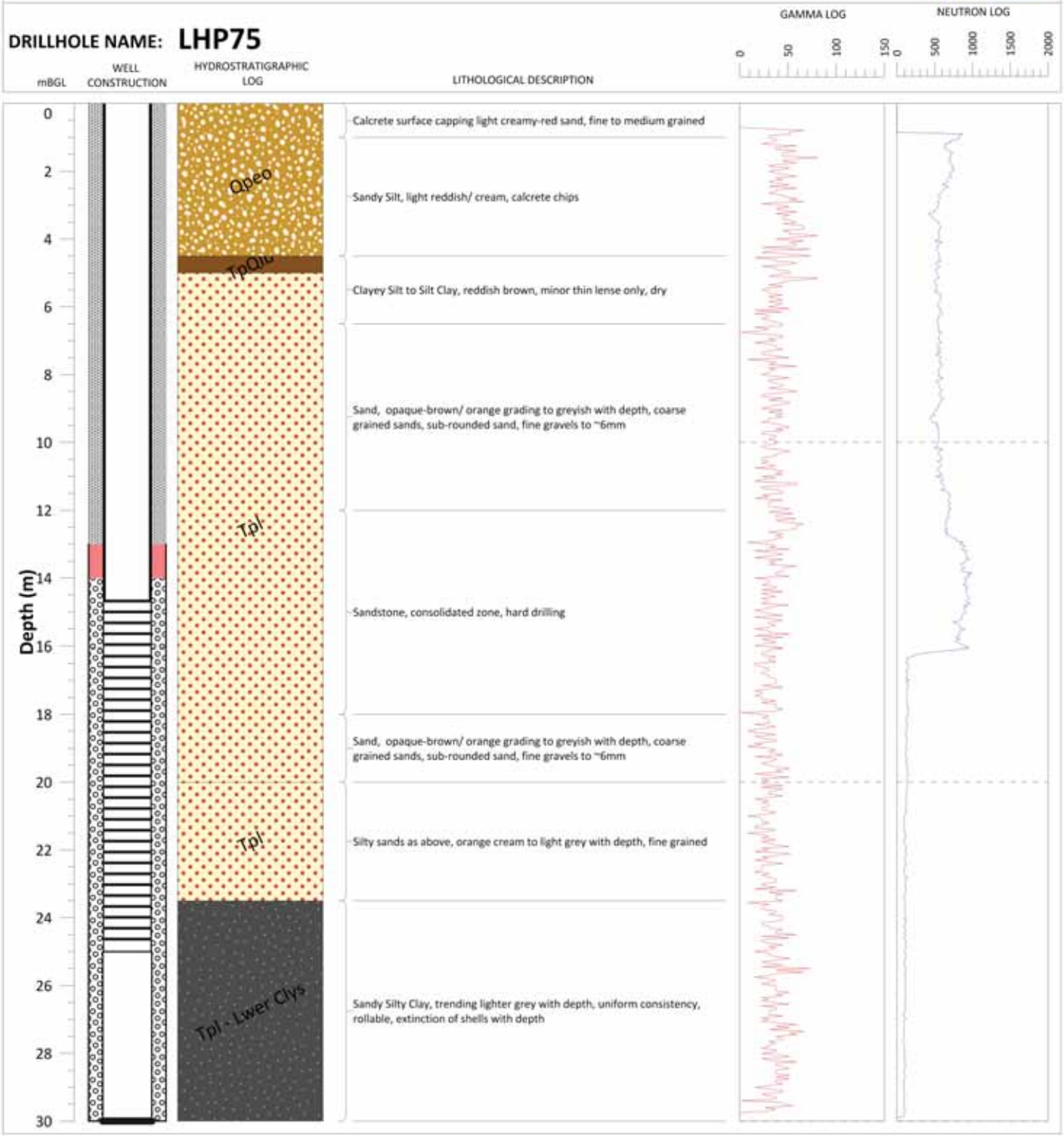
Completion Date: 11/17/09 **NS Elevation (mAHD):** 31.272 **Final Depth (m):** 30

Easting: 462367.499 **Zone:** 54 **Northing:** 6192154.834 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP75**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 15 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	15 to 25 mBGL	203.5 mm
Sump	25 to 30 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2576 **Permit Number:** 168652 **Region:** Loxton

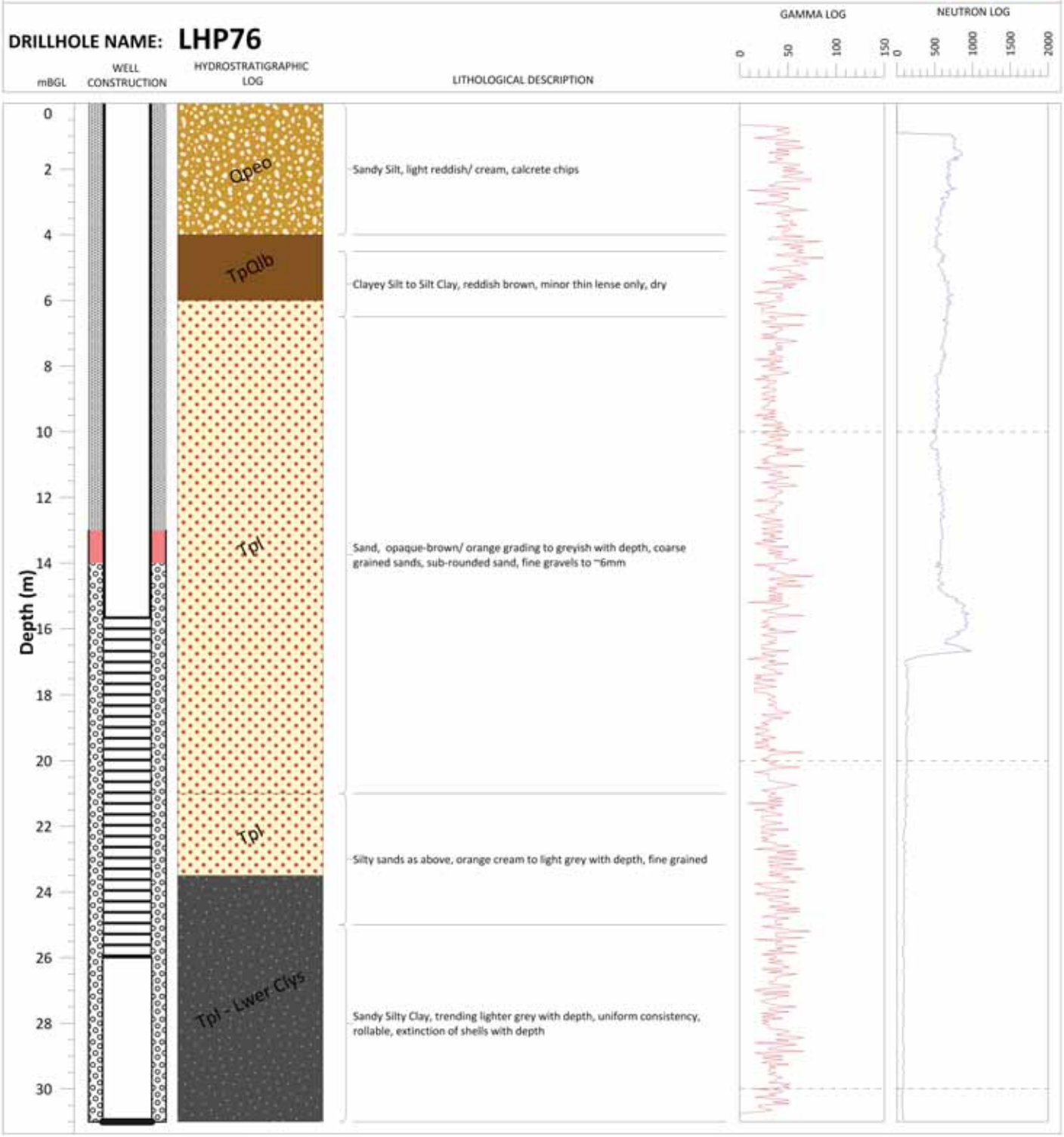
Completion Date: 11/16/09 **NS Elevation (mAHD):** 31.513 **Final Depth (m):** 31

Easting: 462323.562 **Zone:** 54 **Northing:** 6192177.693 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP76**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 16 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	16 to 26 mBGL	203.5 mm
Sump	26 to 31 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2577 **Permit Number:** 168653 **Region:** Loxton

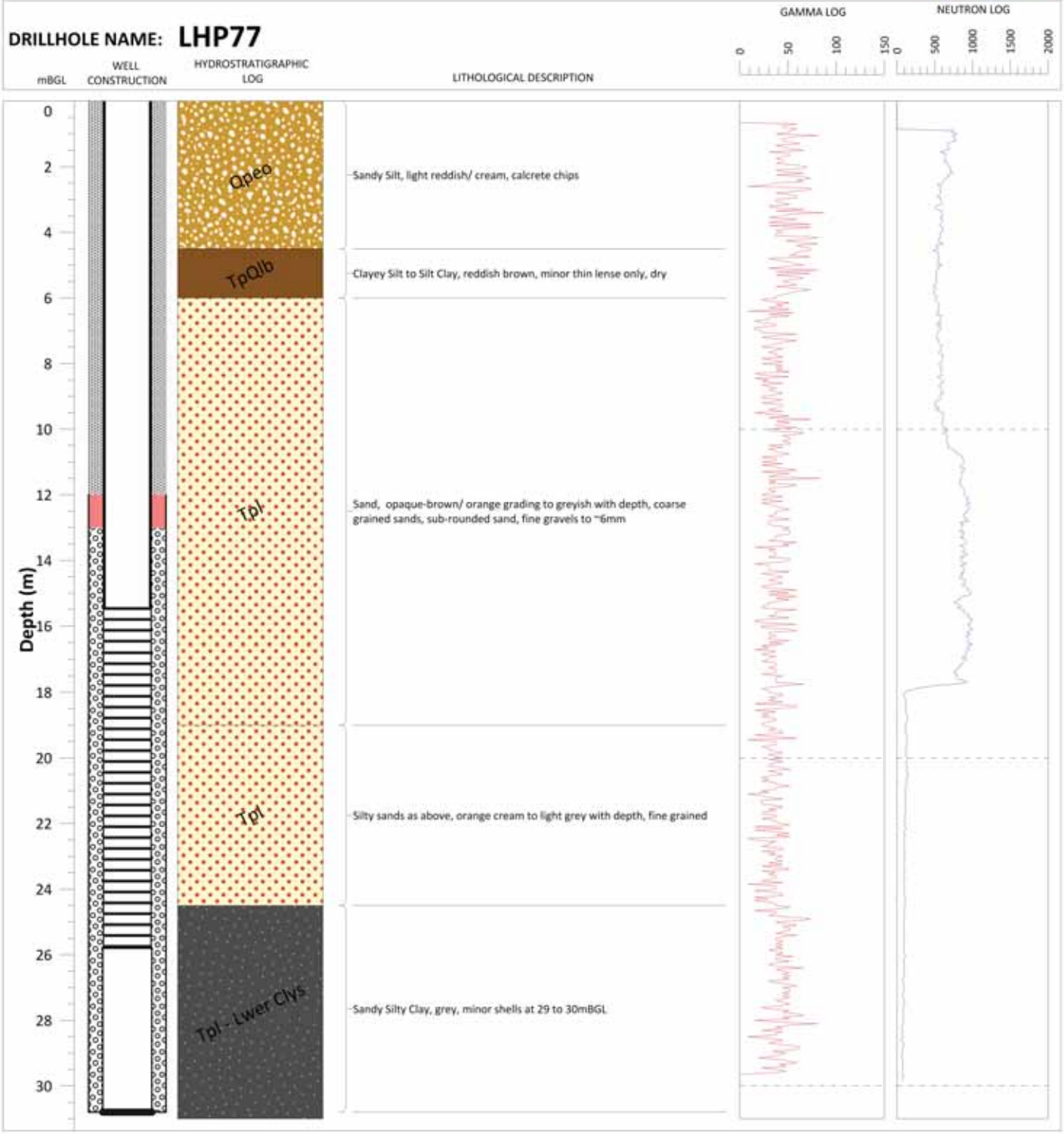
Completion Date: 11/12/09 **NS Elevation (mAHD):** 32.332 **Final Depth (m):** 30.8

Easting: 462279.978 **Zone:** 54 **Northing:** 6192200.703 **Site ID:** LH-TE-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP77**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 15.8 mBGL	0 to 12 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	15.8 to 25.8 mBGL	203.5 mm
Sump	25.8 to 30.8 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2578 **Permit Number:** 159888 **Region:** Loxton

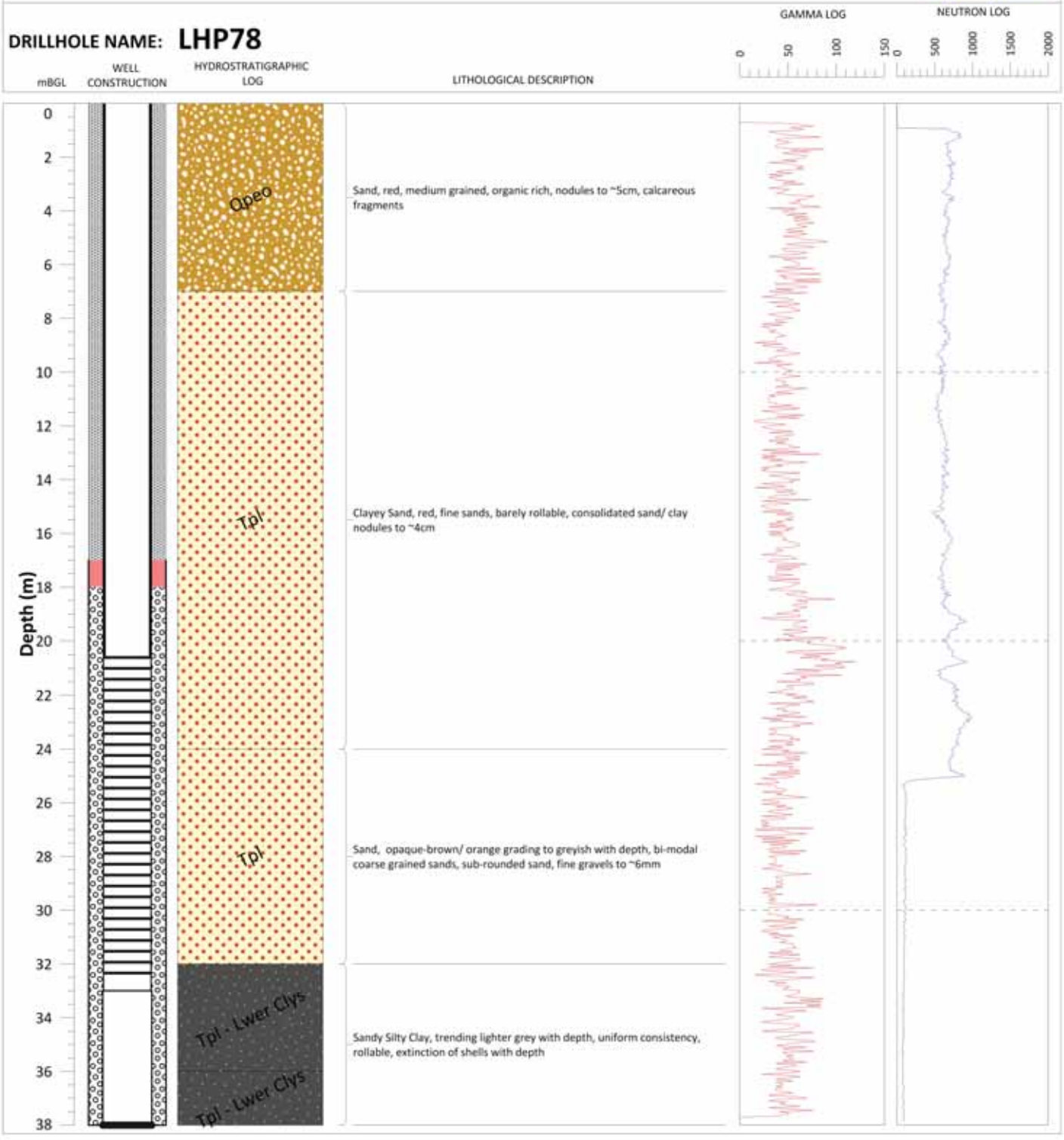
Completion Date: 12/07/09 **NS Elevation (mAHD):** 42.316 **Final Depth (m):** 38

Easting: 463338.667 **Zone:** 54 **Northing:** 6194661.918 **Site ID:** LH-RC-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP78**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 21 mBGL	0 to 17 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	21 to 33 mBGL	203.5 mm
Sump	33 to 38 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2579 **Permit Number:** 159889 **Region:** Loxton

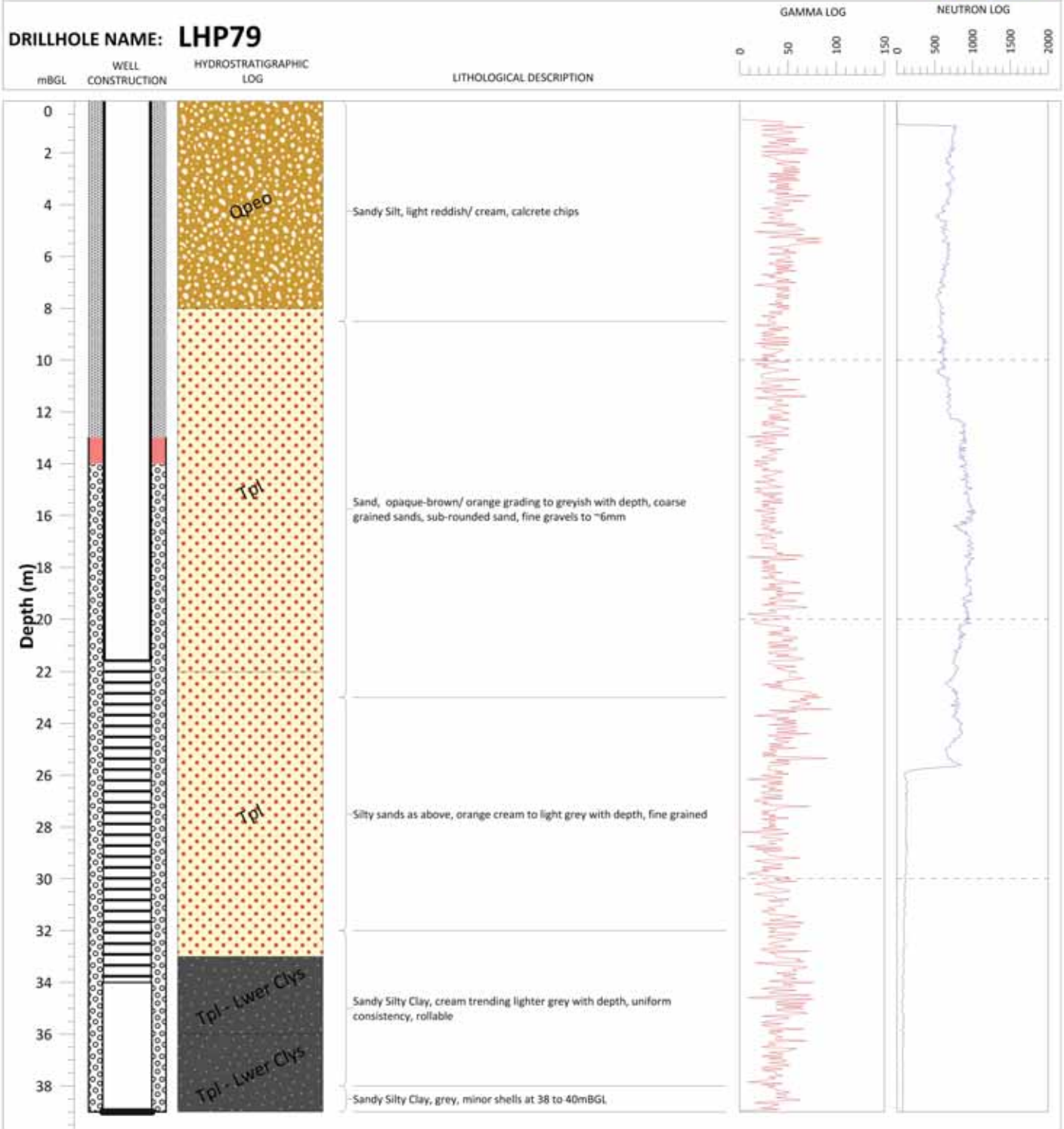
Completion Date: 12/05/09 **NS Elevation (mAHD):** 43.241 **Final Depth (m):** 39

Easting: 463332.23 **Zone:** 54 **Northing:** 6194612.305 **Site ID:** LH-RC-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP79**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 22 mBGL	0 to 13 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	22 to 34 mBGL	203.5 mm
Sump	34 to 39 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2580 **Permit Number:** 156599 **Region:** Loxton

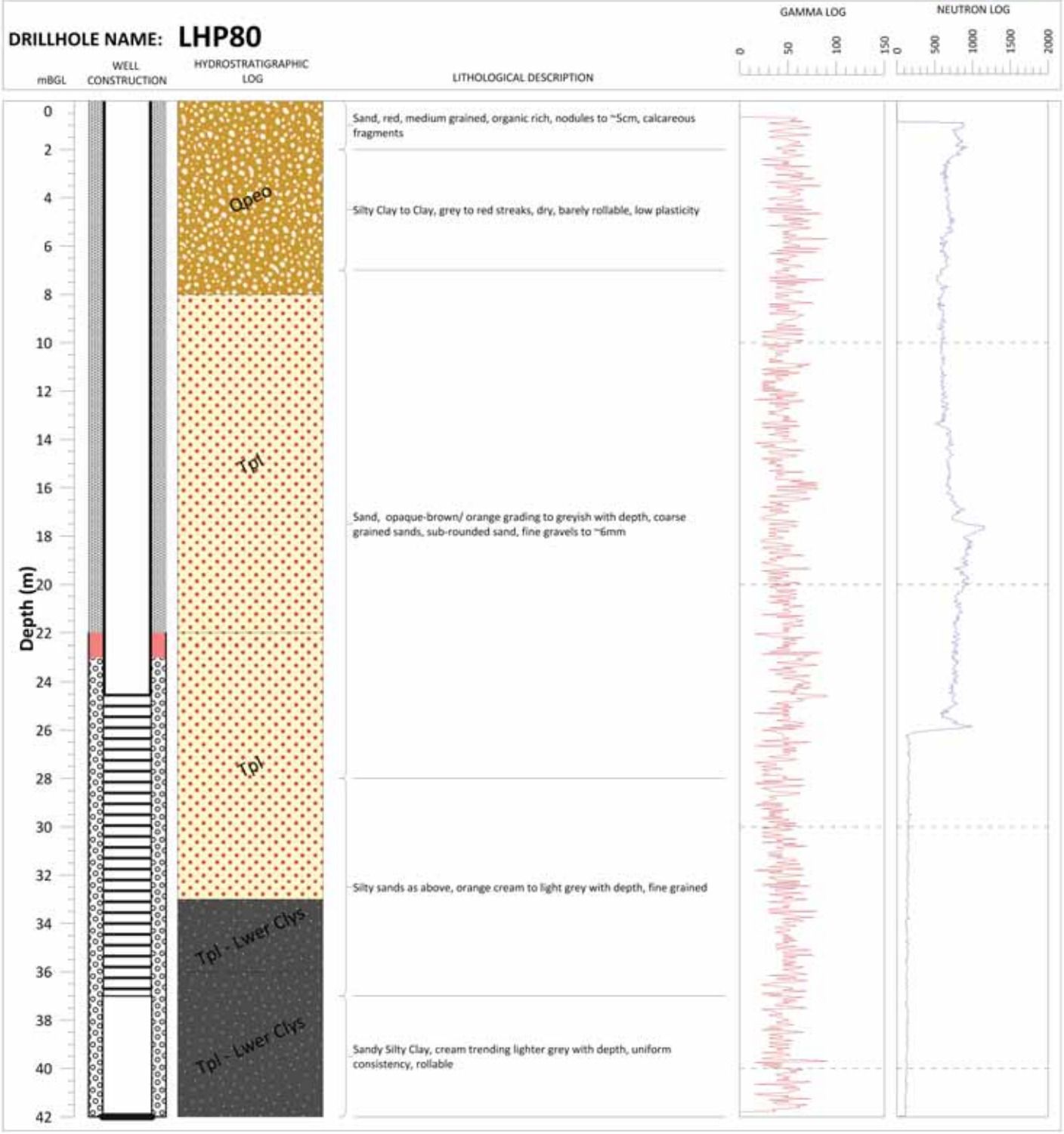
Completion Date: 12/10/09 **NS Elevation (mAHD):** 43.772 **Final Depth (m):** 42

Easting: 463324.834 **Zone:** 54 **Northing:** 6194554.525 **Site ID:** LH-RC-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP80



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 25 mBGL	0 to 22 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	25 to 37 mBGL	203.5 mm
Sump	37 to 42 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2581 **Permit Number:** 156604 **Region:** Loxton

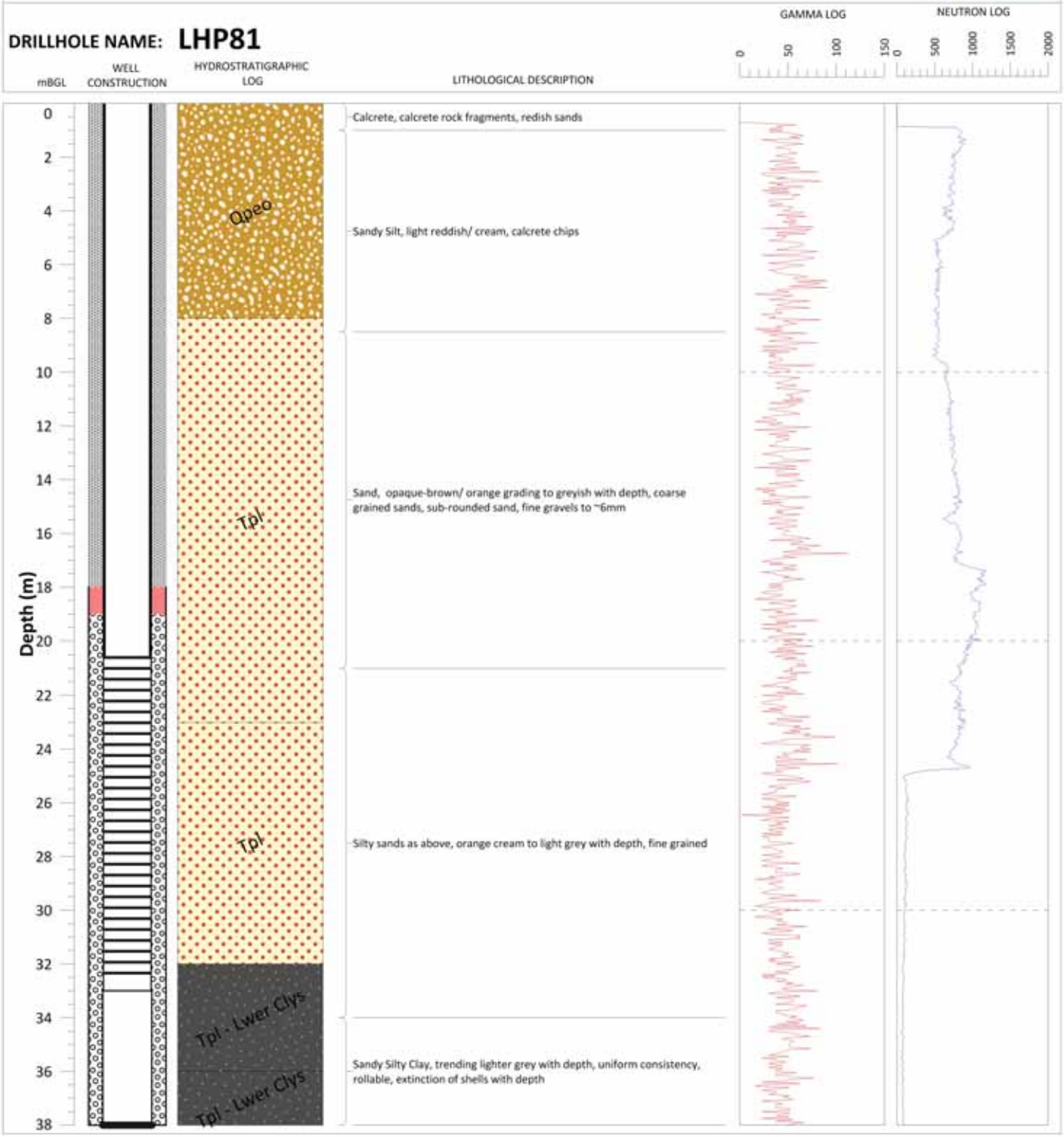
Completion Date: 12/11/09 **NS Elevation (mAHD):** 42.752 **Final Depth (m):** 38

Easting: 463320.383 **Zone:** 54 **Northing:** 6194511.52 **Site ID:** LH-RC-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: **LHP81**



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 21 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	21 to 33 mBGL	203.5 mm
Sump	33 to 38 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2582 **Permit Number:** 156607 **Region:** Loxton

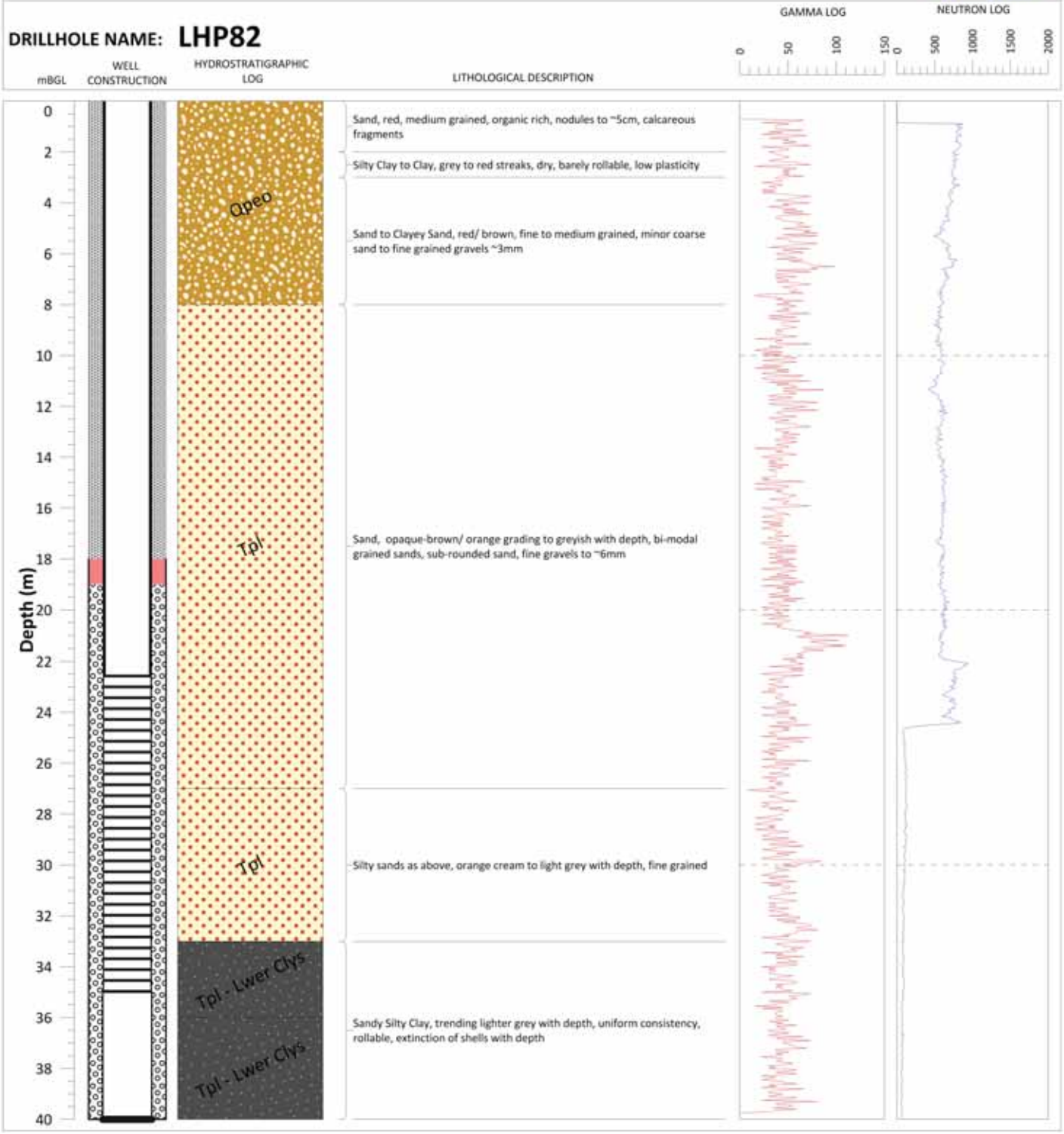
Completion Date: 12/14/09 **NS Elevation (mAHD):** 42.82 **Final Depth (m):** 40

Easting: 463314.777 **Zone:** 54 **Northing:** 6194464.608 **Site ID:** LH-RC-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LHP82



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 23 mBGL	0 to 18 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	23 to 35 mBGL	203.5 mm
Sump	35 to 40 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2457 **Permit Number:** 162582 **Region:** Loxton

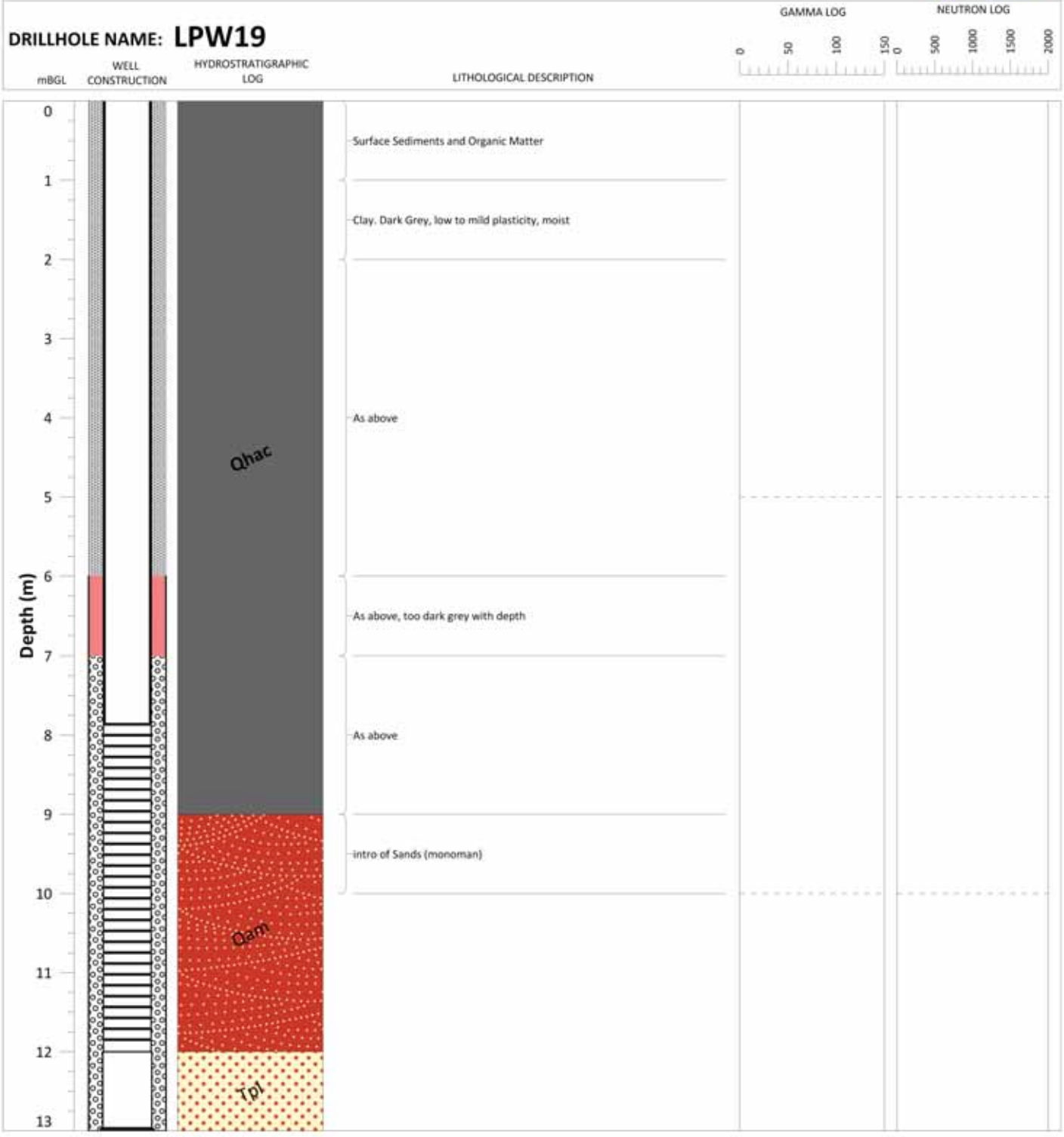
Completion Date: 4/15/09 **NS Elevation (mAHD):** 13.98 **Final Depth (m):** 13

Easting: 462318 **Zone:** 54 **Northing:** 6190248 **Site ID:** LF-TF-PW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LPW19



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 8 mBGL	to mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	8 to 12 mBGL	203.5 mm
Sump	12 to 13 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

LOXTON SALT INTERCEPTION SCHEME - Well Schematic Diagram

Unit Number: 7029-2583 **Permit Number:** 181918 **Region:** Loxton

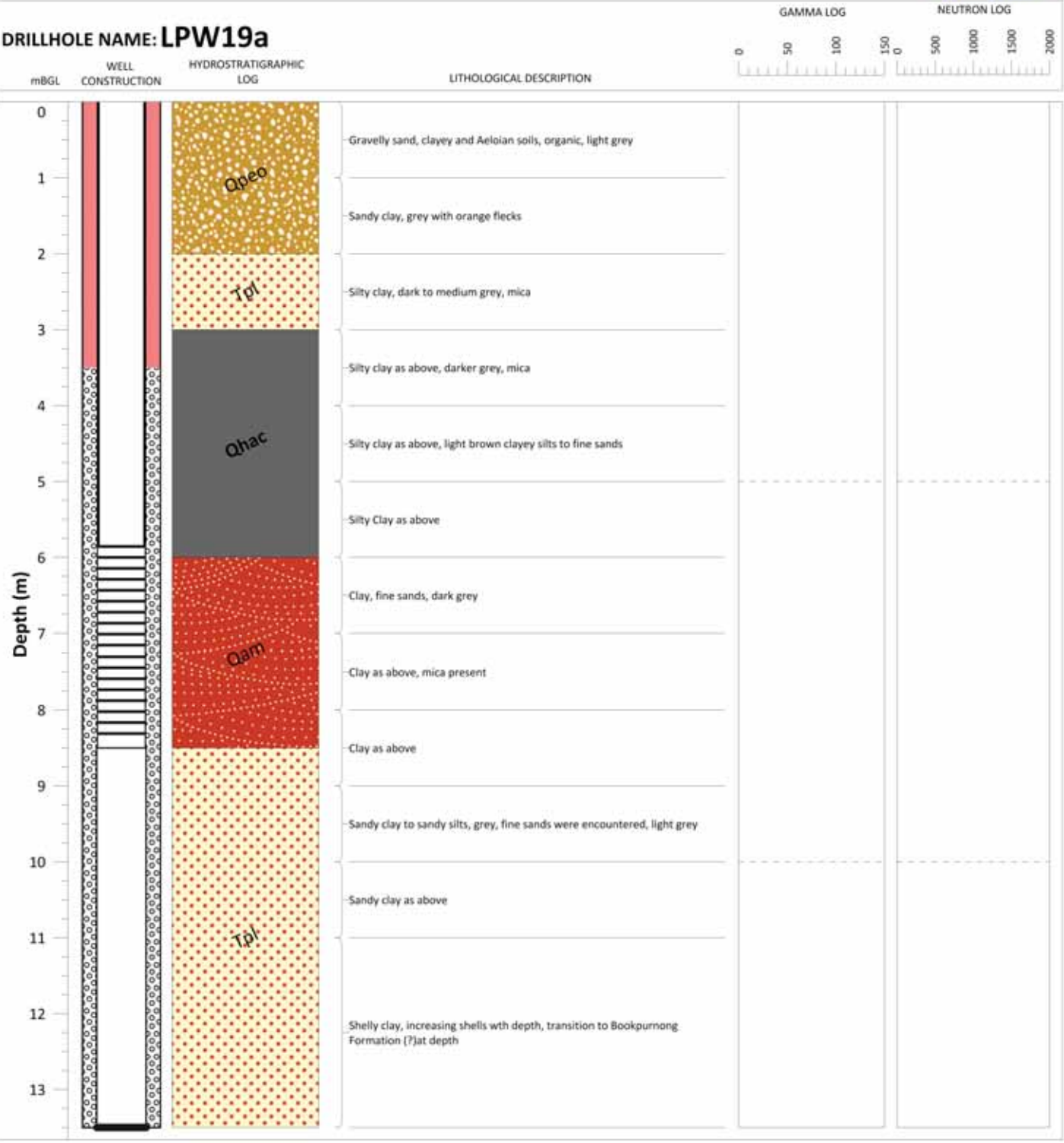
Completion Date: 12/16/09 **NS Elevation (mAHD):** 14.044 **Final Depth (m):** 13.5

Easting: 462355 **Zone:** 54 **Northing:** 6190409 **Site ID:** LF-TF-OW

Government of South Australia
Department for Water

Current at: 5/Mar/2012

DRILLHOLE NAME: LPW19a



Casing Details

Details	ID	Interval	Pressure Cement
IPLEX Class 12 UPVC	203.5 mm	0 to 6 mBGL	0 to 6 mBGL

Production Zone Details

Type	Interval	Diam
UPVC Slotted Casing	6 to 8.5 mBGL	203.5 mm
Sump	8.5 to 13.5 mBGL	203.5 mm

Notes:

Loxton Salt Interception

Hydro-Stratigraphic Symbols

- Qhac - Coonambidgal Clay
- Qam - Monoman Formation
- Tmpb - Bookpurnong Beds
- Tpl - Loxton Sands
- Qpeo - Woorinen Formation
- TpQlb - Blanchetown Clay
- Typ - Pata Formation
- Tpl Lwer Clys - Lower Loxton Shells and Clays

Well Construction Symbols

- Bentonite
- Casing
- Production Zone
- Open hole
- Casing end cap
- Cement
- Gravel Pack

APPENDICES

D. PUMPING TEST RESULTS

PUMPING TEST DETAILS

Project No.	Aquifer	Test date	Test	Step	Duration (min)	Q (L/s)
LHP51	Loxton Sands	21/06/2008	Step drawdown	1	100	0.30
				2	100	0.60
				3	100	0.90
		23/06/2008	Constant rate discharge	1	1,440	0.90
LHP53	Loxton Sands	20/06/2008	Step drawdown	1	60	0.30
				2	60	0.60
				3	60	0.90
LHP55	Loxton Sands	17/06/2008	Step drawdown	1	60	0.30
				2	60	0.60
				3	60	0.90
		9/09/2008	Constant rate discharge	1	10,000	0.85
LHP57	Loxton Sands	25/06/2008	Step drawdown	1	60	0.50
				2	60	1.00
				3	60	1.50
LHP59	Loxton Sands	18/06/2008	Step drawdown	1	100	0.40
				2	100	0.80
				3	100	1.20
		22/06/2008	Constant rate discharge	1	1,440	1.30
LHP61	Loxton Sands	16/07/2008	Step drawdown	1	60	1.30
				2	60	2.60
				3	60	3.90
		18/07/2008	Constant rate discharge	1	1,440	3.20
LHP62	Loxton Sands	17/07/2008	Step drawdown	1	100	1.00
				2	100	2.00
				3	100	3.00
		19/07/2008	Constant rate discharge	1	2,880	3.50
LHP80	Loxton Sands	18/03/2010	Step drawdown	1	100	0.20
				2	100	0.25
				3	100	0.30
		20/03/2010	Constant rate discharge	1	2,880	3.5
LHP82	Loxton Sands	22/03/2010	Step drawdown	1	100	0.50
				2	100	0.80
				3	100	1.00
LHP50P	Pata Formatn	19/06/2008	Step drawdown	1	60	0.30
				2	60	0.60
				3	60	0.90
LHP52P	Pata Formatn	26/06/2008	Step drawdown	1	60	0.20
				2	60	0.40
				3	60	0.60
LHP54P	Pata Formatn	18/06/2008	Step drawdown	1	60	0.30
				2	60	0.60
				3	60	0.90
LHP56P	Pata Formatn	20/06/2008	Step drawdown	1	100	0.20
				2	100	0.40
				3	100	0.60
		23/09/2008	Constant rate discharge	1	10,000	0.50

LHP58P	Pata Formatn	26/06/2008	Step drawdown	1	60	0.30
				2	60	0.60
				3	60	0.90
LHP60P	Pata Formatn	17/06/2008	Step drawdown	1	60	0.20
				2	60	0.40
				3	60	0.60

STEP DRAWDOWN TEST RESULTS

Project No.	Aquifer	Test date	'a'	'b'	'c'	At t = 1,000,000 mins					Screen Type
						Q (L/s)	Specific Capacity ([L/s]/m)	Aquifer loss (m)	Well Loss (m)	Well Efficiency %	
LHP51	Loxton Sands	21/06/2008	38.7	4.9	16.6	1.0	0.24	1.78	2.38	43	WS
LHP53	Loxton Sands	20/06/2008	24.7	6.4	32.1	1.0	0.26	2.29	1.60	59	WS
LHP55	Loxton Sands	17/06/2008	30.3	14.0	13.4	1.0	0.15	5.02	1.86	73	WS
LHP57	Loxton Sands	25/06/2008	16.7	8.3	22.9	1.0	0.25	2.99	1.08	73	WS
LHP59	Loxton Sands	18/06/2008	24.1	3.4	36.3	1.0	0.36	1.23	1.57	44	WS
LHP61	Loxton Sands	16/07/2008	3.1	1.7	31.7	1.0	1.09	0.62	0.30	67	SC
LHP62	Loxton Sands	17/07/2008	15.0	0.5	8.2	1.0	0.91	0.16	0.93	15	SC
LHP80	Loxton Sands	18/03/2010	-2.1	48.5	2,920	n/a	n/a	n/a	n/a	n/a	SC
LHP82	Loxton Sands	26/03/2010	23.1	10.1	183.5	1.0	0.18	3.63	2.05	64	SC
LHP50P	Pata Formation	19/06/2008	106.6	140.4	509.9	0.5	0.02	25,28	3.66	87	OH
LHP52P	Pata Formation	26/06/2008	100.2	167.5	59.0	0.5	0.02	30.15	3.06	91	OH
LHP54P	Pata Formation	18/06/2008	71.7	186.4	139.5	0.5	0.01	33.54	2.28	94	OH
LHP56P	Pata Formation	20/06/2008	162.5	113.4	347.1	0.5	0.02	20.42	5.19	80	SC
LHP58P	Pata Formation	26/06/2008	61.1	179.0	93.5	0.5	0.01	32.22	1.92	94	OH
LHP60P	Pata Formation	17/06/2008	89.9	231.9	1,039	0.5	0.01	41.75	3.63	92	OH

SC = Slotted Casing

WS = Wirewound Screen

OH = Open Hole

CONSTANT RATE DISCHARGE TEST RESULTS

Project No.	Aquifer	Test Date	Obs Wells	r (m)	Analysis Method	T (m^2/day)	D (m)	K (m/day)	S(-)	c (days)	Kv (m/day)	SY(-)
LHP51	Loxton Sands	23/06/2008	LHO70	15.00	Cooper-Jacob	254	10.65	23.8	6.31E-03	n/a	n/a	n/a
					Theis with Jacob Correction	235	10.65	22.1	8.43E-03	n/a	n/a	n/a
					Neuman	229	10.65	21.5	n/a	n/a	n/a	0.008
LHP55	Loxton Sands	9/09/2008	LHO74	21.65	Cooper-Jacob	368	11.26	32.7	1.49E-02	n/a	n/a	n/a
					Theis with Jacob Correction	338	11.26	30.0	1.63E-02	n/a	n/a	n/a
					Neuman	n/a	11.26	n/a	n/a	n/a	n/a	n/a
LHP59	Loxton Sands	22/06/2008	LHO78	14.90	Cooper-Jacob	677	10.23	66.2	7.07E-03	n/a	n/a	n/a
					Theis with Jacob Correction	314	10.23	30.7	1.40E-02	n/a	n/a	n/a
					Neuman	650	10.23	63.5	n/a	n/a	n/a	0.008
LHP61	Loxton Sands	18/07/2008	LHO80	15.50	Cooper-Jacob	705	7.96	88.6	2.26E-02	n/a	n/a	n/a
					Theis with Jacob Correction	651	7.96	81.8	3.28E-02	n/a	n/a	n/a
					Neuman	n/a	7.96	n/a	n/a	n/a	n/a	n/a
LHP62	Loxton Sands	19/07/2008	LHO79	27.35	Cooper-Jacob	1,100	11.37	96.7	5.42E-02	n/a	n/a	n/a
					Theis with Jacob Correction	814	11.37	71.6	8.16E-02	n/a	n/a	n/a
					Neuman	n/a	11.37	n/a	n/a	n/a	n/a	n/a
LHP80	Loxton Sands	20/03/2010	LHO95	33.00	Cooper-Jacob	n/a	n/a	n/a	n/a	n/a	n/a	n/a
LHP56P	Pata Fm.	23/09/2008	LHO73P	31.54	Cooper-Jacob	3.56	12.00	0.30	1.25E-04	n/a	n/a	n/a
					Theis	2.17	12.00	0.18	1.67E-04	n/a	n/a	n/a
					Hantush	2.58	12.00	0.22	1.76E-04	13,403	6.34E-04	n/a
			LHO77P	76.99	Cooper-Jacob	4.54	12.00	0.38	8.11E-05	n/a	n/a	n/a
					Theis	3.62	12.00	0.30	1.18E-04	n/a	n/a	n/a
					Hantush	3.31	12.00	0.28	1.12E-04	42,153	2.02E-04	n/a

R = Radial distance from production well
T = Transmissivity
K = Hydraulic conductivity
Kv = Vertical hydraulic conductivity
D = Thickness of the aquifer
c = Hydraulic resistance
S = Storage Coefficient
SY = Specific Yield

STEP DRAWDOWN TEST DATA

LHP51:- 2008/06/21 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
21/06/2008	10:20	1	100	0.30
		2	100	0.60
		3	100	0.90

LHP51 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.800	0.000	14.970		
1	20.080	2.280	12.690	0.30	0.13
2	19.270	1.470	13.500	0.30	0.20
3	18.890	1.090	13.880	0.30	0.28
4	18.750	0.950	14.020	0.30	0.32
5	18.700	0.900	14.070	0.30	0.33
6	18.640	0.840	14.130	0.30	0.36
7	18.630	0.830	14.140	0.30	0.36
8	18.610	0.810	14.160	0.30	0.37
9	18.600	0.800	14.170	0.30	0.38
10	18.590	0.790	14.180	0.30	0.38
12	18.605	0.805	14.165	0.30	0.37
14	18.625	0.825	14.145	0.30	0.36
16	18.620	0.820	14.150	0.30	0.37
18	18.640	0.840	14.130	0.30	0.36
20	18.640	0.840	14.130	0.30	0.36
22	18.640	0.840	14.130	0.30	0.36
24	18.650	0.850	14.120	0.30	0.35
26	18.645	0.845	14.125	0.30	0.36
28	18.650	0.850	14.120	0.30	0.35
30	18.650	0.850	14.120	0.30	0.35
35	18.655	0.855	14.115	0.30	0.35
40	18.655	0.855	14.115	0.30	0.35
45	18.655	0.855	14.115	0.30	0.35
50	18.660	0.860	14.110	0.30	0.35
55	18.660	0.860	14.110	0.30	0.35
60	18.670	0.870	14.100	0.30	0.34
70	18.670	0.870	14.100	0.30	0.34
80	18.680	0.880	14.090	0.30	0.34
90	18.680	0.880	14.090	0.30	0.34
100	18.700	0.900	14.070	0.30	0.33
101	19.080	1.280	13.690	0.60	0.47
102	19.220	1.420	13.550	0.60	0.42
103	19.310	1.510	13.460	0.60	0.40
104	19.360	1.560	13.410	0.60	0.38
105	19.380	1.580	13.390	0.60	0.38
106	19.410	1.610	13.360	0.60	0.37
107	19.430	1.630	13.340	0.60	0.37
108	19.445	1.645	13.325	0.60	0.36
109	19.460	1.660	13.310	0.60	0.36

110	19.470	1.670	13.300	0.60	0.36
112	19.480	1.680	13.290	0.60	0.36
114	19.500	1.700	13.270	0.60	0.35
116	19.510	1.710	13.260	0.60	0.35
118	19.520	1.720	13.250	0.60	0.35
120	19.520	1.720	13.250	0.60	0.35
122	19.525	1.725	13.245	0.60	0.35
124	19.530	1.730	13.240	0.60	0.35
126	19.530	1.730	13.240	0.60	0.35
128	19.520	1.720	13.250	0.60	0.35
130	19.535	1.735	13.235	0.60	0.35
135	19.530	1.730	13.240	0.60	0.35
140	19.520	1.720	13.250	0.60	0.35
145	19.530	1.730	13.240	0.60	0.35
150	19.530	1.730	13.240	0.60	0.35
155	19.530	1.730	13.240	0.60	0.35
160	19.510	1.710	13.260	0.60	0.35
170	19.550	1.750	13.220	0.60	0.34
180	19.560	1.760	13.210	0.60	0.34
190	19.580	1.780	13.190	0.60	0.34
200	19.570	1.770	13.200	0.60	0.34
201	19.970	2.170	12.800	0.90	0.41
202	20.200	2.400	12.570	0.90	0.38
203	20.250	2.450	12.520	0.90	0.37
204	20.300	2.500	12.470	0.90	0.36
205	20.360	2.560	12.410	0.90	0.35
206	20.380	2.580	12.390	0.90	0.35
207	20.390	2.590	12.380	0.90	0.35
208	20.420	2.620	12.350	0.90	0.34
209	20.425	2.625	12.345	0.90	0.34
210	20.440	2.640	12.330	0.90	0.34
212	20.460	2.660	12.310	0.90	0.34
214	20.460	2.660	12.310	0.90	0.34
216	20.470	2.670	12.300	0.90	0.34
218	20.480	2.680	12.290	0.90	0.34
220	20.490	2.690	12.280	0.90	0.33
222	20.480	2.680	12.290	0.90	0.34
224	20.480	2.680	12.290	0.90	0.34
226	20.500	2.700	12.270	0.90	0.33
228	20.500	2.700	12.270	0.90	0.33
230	20.500	2.700	12.270	0.90	0.33
235	20.520	2.720	12.250	0.90	0.33
240	20.500	2.700	12.270	0.90	0.33
245	20.510	2.710	12.260	0.90	0.33
250	20.520	2.720	12.250	0.90	0.33
255	20.500	2.700	12.270	0.90	0.33
260	20.470	2.670	12.300	0.90	0.34
270	20.500	2.700	12.270	0.90	0.33
280	20.450	2.650	12.320	0.90	0.34
290	20.490	2.690	12.280	0.90	0.33
300	20.500	2.700	12.270	0.90	0.33

LHP53:- 2008/06/20 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
20/06/2008	14:00	1	60	0.30
		2	60	0.60
		3	60	0.90

LHP53 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.400	0.000	15.460		
1	18.820	1.420	14.040	0.30	0.21
2	18.400	1.000	14.460	0.30	0.30
3	18.430	1.030	14.430	0.30	0.29
4	18.450	1.050	14.410	0.30	0.29
5	18.480	1.080	14.380	0.30	0.28
6	18.530	1.130	14.330	0.30	0.27
7	18.530	1.130	14.330	0.30	0.27
8	18.560	1.160	14.300	0.30	0.26
9	18.580	1.180	14.280	0.30	0.25
10	18.630	1.230	14.230	0.30	0.24
12	18.400	1.000	14.460	0.30	0.30
14	18.200	0.800	14.660	0.30	0.38
16	18.130	0.730	14.730	0.30	0.41
18	18.090	0.690	14.770	0.30	0.43
20	18.070	0.670	14.790	0.30	0.45
22	18.060	0.660	14.800	0.30	0.45
24	18.080	0.680	14.780	0.30	0.44
26	18.080	0.680	14.780	0.30	0.44
28	18.100	0.700	14.760	0.30	0.43
30	18.100	0.700	14.760	0.30	0.43
35	18.100	0.700	14.760	0.30	0.43
40	18.100	0.700	14.760	0.30	0.43
45	18.100	0.700	14.760	0.30	0.43
50	18.100	0.700	14.760	0.30	0.43
55	18.080	0.680	14.780	0.30	0.44
60	18.095	0.695	14.765	0.30	0.43
61	18.400	1.000	14.460	0.60	0.60
62	18.510	1.110	14.350	0.60	0.54
63	18.535	1.135	14.325	0.60	0.53
64	18.550	1.150	14.310	0.60	0.52
65	18.580	1.180	14.280	0.60	0.51
66	18.590	1.190	14.270	0.60	0.50
67	18.590	1.190	14.270	0.60	0.50
68	18.610	1.210	14.250	0.60	0.50
69	18.620	1.220	14.240	0.60	0.49
70	18.630	1.230	14.230	0.60	0.49
72	18.640	1.240	14.220	0.60	0.48
74	18.660	1.260	14.200	0.60	0.48
76	18.665	1.265	14.195	0.60	0.47
78	18.660	1.260	14.200	0.60	0.48
80	18.680	1.280	14.180	0.60	0.47

82	18.690	1.290	14.170	0.60	0.47
84	18.690	1.290	14.170	0.60	0.47
86	18.680	1.280	14.180	0.60	0.47
88	18.690	1.290	14.170	0.60	0.47
90	18.690	1.290	14.170	0.60	0.47
95	18.710	1.310	14.150	0.60	0.46
100	18.710	1.310	14.150	0.60	0.46
105	18.710	1.310	14.150	0.60	0.46
110	18.710	1.310	14.150	0.60	0.46
115	18.710	1.310	14.150	0.60	0.46
120	18.720	1.320	14.140	0.60	0.45
121	19.020	1.620	13.840	0.90	0.56
122	19.160	1.760	13.700	0.90	0.51
123	19.220	1.820	13.640	0.90	0.49
124	19.260	1.860	13.600	0.90	0.48
125	19.290	1.890	13.570	0.90	0.48
126	19.310	1.910	13.550	0.90	0.47
127	19.350	1.950	13.510	0.90	0.46
128	19.360	1.960	13.500	0.90	0.46
129	19.370	1.970	13.490	0.90	0.46
130	19.380	1.980	13.480	0.90	0.45
132	19.400	2.000	13.460	0.90	0.45
134	19.410	2.010	13.450	0.90	0.45
136	19.430	2.030	13.430	0.90	0.44
138	19.435	2.035	13.425	0.90	0.44
140	19.490	2.090	13.370	0.90	0.43
142	19.450	2.050	13.410	0.90	0.44
144	19.450	2.050	13.410	0.90	0.44
146	19.460	2.060	13.400	0.90	0.44
148	19.460	2.060	13.400	0.90	0.44
150	19.460	2.060	13.400	0.90	0.44
155	19.470	2.070	13.390	0.90	0.43
160	19.470	2.070	13.390	0.90	0.43
165	19.530	2.130	13.330	0.90	0.42
170	19.500	2.100	13.360	0.90	0.43
175	19.500	2.100	13.360	0.90	0.43
180	19.520	2.120	13.340	0.90	0.42

LHP55:- 2008/06/17 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
17/06/2008	12:40	1	60	0.30
		2	60	0.60
		3	60	0.90

LHP55 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.410	0.000	15.830		
1	19.640	2.230	13.600	0.30	0.13
2	18.880	1.470	14.360	0.30	0.20
3	18.580	1.170	14.660	0.30	0.26
4	18.460	1.050	14.780	0.30	0.29
5	18.550	1.140	14.690	0.30	0.26
6	18.530	1.120	14.710	0.30	0.27
7	18.590	1.180	14.650	0.30	0.25
8	18.660	1.250	14.580	0.30	0.24
9	18.550	1.140	14.690	0.30	0.26
10	18.460	1.050	14.780	0.30	0.29
12	18.450	1.040	14.790	0.30	0.29
14	18.400	0.990	14.840	0.30	0.30
16	18.390	0.980	14.850	0.30	0.31
18	18.370	0.960	14.870	0.30	0.31
20	18.370	0.960	14.870	0.30	0.31
22	18.360	0.950	14.880	0.30	0.32
24	18.365	0.955	14.875	0.30	0.31
26	18.360	0.950	14.880	0.30	0.32
28	18.350	0.940	14.890	0.30	0.32
30	18.350	0.940	14.890	0.30	0.32
35	18.350	0.940	14.890	0.30	0.32
40	18.350	0.940	14.890	0.30	0.32
45	18.390	0.980	14.850	0.30	0.31
50	18.385	0.975	14.855	0.30	0.31
55	18.390	0.980	14.850	0.30	0.31
60	18.400	0.990	14.840	0.30	0.30
61	18.770	1.360	14.470	0.60	0.44
62	18.870	1.460	14.370	0.60	0.41
63	18.980	1.570	14.260	0.60	0.38
64	19.030	1.620	14.210	0.60	0.37
65	19.090	1.680	14.150	0.60	0.36
66	19.120	1.710	14.120	0.60	0.35
67	19.150	1.740	14.090	0.60	0.34
68	19.170	1.760	14.070	0.60	0.34
69	19.170	1.760	14.070	0.60	0.34
70	19.200	1.790	14.040	0.60	0.34
72	19.240	1.830	14.000	0.60	0.33
74	19.255	1.845	13.985	0.60	0.33
76	19.280	1.870	13.960	0.60	0.32
78	19.290	1.880	13.950	0.60	0.32
80	19.300	1.890	13.940	0.60	0.32

82	19.310	1.900	13.930	0.60	0.32
84	19.310	1.900	13.930	0.60	0.32
86	19.330	1.920	13.910	0.60	0.31
88	19.340	1.930	13.900	0.60	0.31
90	19.350	1.940	13.890	0.60	0.31
95	19.370	1.960	13.870	0.60	0.31
100	19.355	1.945	13.885	0.60	0.31
105	19.365	1.955	13.875	0.60	0.31
110	19.360	1.950	13.880	0.60	0.31
115	19.365	1.955	13.875	0.60	0.31
120	19.400	1.990	13.840	0.60	0.30
121	19.740	2.330	13.500	0.90	0.39
122	19.950	2.540	13.290	0.90	0.35
123	20.080	2.670	13.160	0.90	0.34
124	20.120	2.710	13.120	0.90	0.33
125	20.190	2.780	13.050	0.90	0.32
126	20.230	2.820	13.010	0.90	0.32
127	20.260	2.850	12.980	0.90	0.32
128	20.290	2.880	12.950	0.90	0.31
129	20.310	2.900	12.930	0.90	0.31
130	20.330	2.920	12.910	0.90	0.31
132	20.355	2.945	12.885	0.90	0.31
134	20.390	2.980	12.850	0.90	0.30
136	20.420	3.010	12.820	0.90	0.30
138	20.450	3.040	12.790	0.90	0.30
140	20.460	3.050	12.780	0.90	0.30
142	20.460	3.050	12.780	0.90	0.30
144	20.480	3.070	12.760	0.90	0.29
146	20.500	3.090	12.740	0.90	0.29
148	20.530	3.120	12.710	0.90	0.29
150	20.530	3.120	12.710	0.90	0.29
155	20.510	3.100	12.730	0.90	0.29
160	20.530	3.120	12.710	0.90	0.29
165	20.540	3.130	12.700	0.90	0.29
170	20.560	3.150	12.680	0.90	0.29
175	20.570	3.160	12.670	0.90	0.28
180	20.580	3.170	12.660	0.90	0.28

LHP57:- 2008/06/25 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
25/06/2008	09:30	1	60	0.50
		2	60	1.00
		3	60	1.50

LHP57 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.660	0.000	16.330		
1	19.780	2.120	14.210	0.50	0.24
2	18.930	1.270	15.060	0.50	0.39
3	18.490	0.830	15.500	0.50	0.60
4	18.490	0.830	15.500	0.50	0.60
5	18.530	0.870	15.460	0.50	0.57
6	18.540	0.880	15.450	0.50	0.57
7	18.540	0.880	15.450	0.50	0.57
8	18.540	0.880	15.450	0.50	0.57
9	18.540	0.880	15.450	0.50	0.57
10	18.540	0.880	15.450	0.50	0.57
12	18.570	0.910	15.420	0.50	0.55
14	18.580	0.920	15.410	0.50	0.54
16	18.590	0.930	15.400	0.50	0.54
18	18.580	0.920	15.410	0.50	0.54
20	18.580	0.920	15.410	0.50	0.54
22	18.580	0.920	15.410	0.50	0.54
24	18.580	0.920	15.410	0.50	0.54
26	18.575	0.915	15.415	0.50	0.55
28	18.580	0.920	15.410	0.50	0.54
30	18.575	0.915	15.415	0.50	0.55
35	18.580	0.920	15.410	0.50	0.54
40	18.580	0.920	15.410	0.50	0.54
45	18.585	0.925	15.405	0.50	0.54
50	18.580	0.920	15.410	0.50	0.54
55	18.590	0.930	15.400	0.50	0.54
60	18.590	0.930	15.400	0.50	0.54
61	19.040	1.380	14.950	1.00	0.72
62	19.210	1.550	14.780	1.00	0.65
63	19.350	1.690	14.640	1.00	0.59
64	19.410	1.750	14.580	1.00	0.57
65	19.410	1.750	14.580	1.00	0.57
66	19.410	1.750	14.580	1.00	0.57
67	19.405	1.745	14.585	1.00	0.57
68	19.420	1.760	14.570	1.00	0.57
69	19.420	1.760	14.570	1.00	0.57
70	19.420	1.760	14.570	1.00	0.57
72	19.410	1.750	14.580	1.00	0.57
74	19.415	1.755	14.575	1.00	0.57
76	19.350	1.690	14.640	1.00	0.59
78	19.320	1.660	14.670	1.00	0.60
80	19.340	1.680	14.650	1.00	0.60

82	19.350	1.690	14.640	1.00	0.59
84	19.360	1.700	14.630	1.00	0.59
86	19.360	1.700	14.630	1.00	0.59
88	19.410	1.750	14.580	1.00	0.57
90	19.440	1.780	14.550	1.00	0.56
95	19.410	1.750	14.580	1.00	0.57
100	19.440	1.780	14.550	1.00	0.56
105	19.500	1.840	14.490	1.00	0.54
110	19.500	1.840	14.490	1.00	0.54
115	19.520	1.860	14.470	1.00	0.54
120	19.460	1.800	14.530	1.00	0.56
121	19.920	2.260	14.070	1.50	0.66
122	20.090	2.430	13.900	1.50	0.62
123	20.180	2.520	13.810	1.50	0.60
124	20.200	2.540	13.790	1.50	0.59
125	20.270	2.610	13.720	1.50	0.57
126	20.350	2.690	13.640	1.50	0.56
127	20.430	2.770	13.560	1.50	0.54
128	20.470	2.810	13.520	1.50	0.53
129	20.520	2.860	13.470	1.50	0.52
130	20.550	2.890	13.440	1.50	0.52
132	20.650	2.990	13.340	1.50	0.50
134	20.660	3.000	13.330	1.50	0.50
136	20.610	2.950	13.380	1.50	0.51
138	20.610	2.950	13.380	1.50	0.51
140	20.610	2.950	13.380	1.50	0.51
142	20.630	2.970	13.360	1.50	0.51
144	20.620	2.960	13.370	1.50	0.51
146	20.670	3.010	13.320	1.50	0.50
148	20.710	3.050	13.280	1.50	0.49
150	20.730	3.070	13.260	1.50	0.49
155	20.760	3.100	13.230	1.50	0.48
160	20.780	3.120	13.210	1.50	0.48
165	20.840	3.180	13.150	1.50	0.47
170	20.860	3.200	13.130	1.50	0.47
175	20.870	3.210	13.120	1.50	0.47
180	20.900	3.240	13.090	1.50	0.46

LHP59:- 2008/06/18 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
18/06/2008	08:20	1	100	0.40
		2	100	0.80
		3	100	1.20

LHP59 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.780	0.000	16.540		
1	19.370	1.590	14.950	0.40	0.25
2	18.770	0.990	15.550	0.40	0.40
3	18.580	0.800	15.740	0.40	0.50
4	18.530	0.750	15.790	0.40	0.53
5	18.510	0.730	15.810	0.40	0.55
6	18.510	0.730	15.810	0.40	0.55
7	18.500	0.720	15.820	0.40	0.56
8	18.500	0.720	15.820	0.40	0.56
9	18.500	0.720	15.820	0.40	0.56
10	18.480	0.700	15.840	0.40	0.57
12	18.510	0.730	15.810	0.40	0.55
14	18.500	0.720	15.820	0.40	0.56
16	18.500	0.720	15.820	0.40	0.56
18	18.500	0.720	15.820	0.40	0.56
20	18.500	0.720	15.820	0.40	0.56
22	18.490	0.710	15.830	0.40	0.56
24	18.510	0.730	15.810	0.40	0.55
26	18.480	0.700	15.840	0.40	0.57
28	18.500	0.720	15.820	0.40	0.56
30	18.500	0.720	15.820	0.40	0.56
35	18.510	0.730	15.810	0.40	0.55
40	18.510	0.730	15.810	0.40	0.55
45	18.515	0.735	15.805	0.40	0.54
50	18.500	0.720	15.820	0.40	0.56
55	18.505	0.725	15.815	0.40	0.55
60	18.510	0.730	15.810	0.40	0.55
70	18.515	0.735	15.805	0.40	0.54
80	18.520	0.740	15.800	0.40	0.54
90	18.515	0.735	15.805	0.40	0.54
100	18.530	0.750	15.790	0.40	0.53
101	18.870	1.090	15.450	0.80	0.73
102	19.030	1.250	15.290	0.80	0.64
103	19.100	1.320	15.220	0.80	0.61
104	19.150	1.370	15.170	0.80	0.58
105	19.170	1.390	15.150	0.80	0.58
106	19.200	1.420	15.120	0.80	0.56
107	19.210	1.430	15.110	0.80	0.56
108	19.220	1.440	15.100	0.80	0.56
109	19.235	1.455	15.085	0.80	0.55
110	19.250	1.470	15.070	0.80	0.54
112	19.260	1.480	15.060	0.80	0.54

114	19.270	1.490	15.050	0.80	0.54
116	19.290	1.510	15.030	0.80	0.53
118	19.290	1.510	15.030	0.80	0.53
120	19.290	1.510	15.030	0.80	0.53
122	19.300	1.520	15.020	0.80	0.53
124	19.300	1.520	15.020	0.80	0.53
126	19.310	1.530	15.010	0.80	0.52
128	19.310	1.530	15.010	0.80	0.52
130	19.310	1.530	15.010	0.80	0.52
135	19.300	1.520	15.020	0.80	0.53
140	19.320	1.540	15.000	0.80	0.52
145	19.320	1.540	15.000	0.80	0.52
150	19.320	1.540	15.000	0.80	0.52
155	19.310	1.530	15.010	0.80	0.52
160	19.330	1.550	14.990	0.80	0.52
170	19.330	1.550	14.990	0.80	0.52
180	19.340	1.560	14.980	0.80	0.51
190	19.360	1.580	14.960	0.80	0.51
200	19.370	1.590	14.950	0.80	0.50
201	19.770	1.990	14.550	1.20	0.60
202	19.900	2.120	14.420	1.20	0.57
203	19.960	2.180	14.360	1.20	0.55
204	20.000	2.220	14.320	1.20	0.54
205	20.040	2.260	14.280	1.20	0.53
206	20.080	2.300	14.240	1.20	0.52
207	20.100	2.320	14.220	1.20	0.52
208	20.110	2.330	14.210	1.20	0.52
209	20.120	2.340	14.200	1.20	0.51
210	20.135	2.355	14.185	1.20	0.51
212	20.150	2.370	14.170	1.20	0.51
214	20.160	2.380	14.160	1.20	0.50
216	20.160	2.380	14.160	1.20	0.50
218	20.170	2.390	14.150	1.20	0.50
220	20.170	2.390	14.150	1.20	0.50
222	20.160	2.380	14.160	1.20	0.50
224	20.180	2.400	14.140	1.20	0.50
226	20.200	2.420	14.120	1.20	0.50
228	20.210	2.430	14.110	1.20	0.49
230	20.210	2.430	14.110	1.20	0.49
235	20.210	2.430	14.110	1.20	0.49
240	20.220	2.440	14.100	1.20	0.49
245	20.220	2.440	14.100	1.20	0.49
250	20.220	2.440	14.100	1.20	0.49
255	20.225	2.445	14.095	1.20	0.49
260	20.230	2.450	14.090	1.20	0.49
270	20.240	2.460	14.080	1.20	0.49
280	20.260	2.480	14.060	1.20	0.48
290	20.270	2.490	14.050	1.20	0.48
300	20.270	2.490	14.050	1.20	0.48

LHP61:- 2008/07/16 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
16/07/2008	14:20	1	60	1.30
		2	60	2.60
		3	60	3.90

LHP61 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.050	0.000	14.620		
1	18.640	0.590	14.030	1.30	2.20
2	18.640	0.590	14.030	1.30	2.20
3	18.620	0.570	14.050	1.30	2.28
4	18.640	0.590	14.030	1.30	2.20
5	18.660	0.610	14.010	1.30	2.13
6	18.650	0.600	14.020	1.30	2.17
7	18.650	0.600	14.020	1.30	2.17
8	18.650	0.600	14.020	1.30	2.17
9	18.630	0.580	14.040	1.30	2.24
10	18.650	0.600	14.020	1.30	2.17
12	18.670	0.620	14.000	1.30	2.10
14	18.660	0.610	14.010	1.30	2.13
16	18.670	0.620	14.000	1.30	2.10
18	18.680	0.630	13.990	1.30	2.06
20	18.700	0.650	13.970	1.30	2.00
22	18.700	0.650	13.970	1.30	2.00
24	18.680	0.630	13.990	1.30	2.06
26	18.680	0.630	13.990	1.30	2.06
28	18.680	0.630	13.990	1.30	2.06
30	18.690	0.640	13.980	1.30	2.03
35	18.710	0.660	13.960	1.30	1.97
40	18.710	0.660	13.960	1.30	1.97
45	18.710	0.660	13.960	1.30	1.97
50	18.710	0.660	13.960	1.30	1.97
55	18.710	0.660	13.960	1.30	1.97
60	18.710	0.660	13.960	1.30	1.97
61	19.520	1.470	13.150	2.60	1.77
62	19.530	1.480	13.140	2.60	1.76
63	19.540	1.490	13.130	2.60	1.74
64	19.550	1.500	13.120	2.60	1.73
65	19.560	1.510	13.110	2.60	1.72
66	19.570	1.520	13.100	2.60	1.71
67	19.580	1.530	13.090	2.60	1.70
68	19.580	1.530	13.090	2.60	1.70
69	19.580	1.530	13.090	2.60	1.70
70	19.585	1.535	13.085	2.60	1.69
72	19.590	1.540	13.080	2.60	1.69
74	19.590	1.540	13.080	2.60	1.69
76	19.590	1.540	13.080	2.60	1.69
78	19.600	1.550	13.070	2.60	1.68
80	19.600	1.550	13.070	2.60	1.68

82	19.600	1.550	13.070	2.60	1.68
84	19.600	1.550	13.070	2.60	1.68
86	19.610	1.560	13.060	2.60	1.67
88	19.610	1.560	13.060	2.60	1.67
90	19.615	1.565	13.055	2.60	1.66
95	19.620	1.570	13.050	2.60	1.66
100	19.620	1.570	13.050	2.60	1.66
105	19.630	1.580	13.040	2.60	1.65
110	19.640	1.590	13.030	2.60	1.64
115	19.640	1.590	13.030	2.60	1.64
120	19.640	1.590	13.030	2.60	1.64
121	20.790	2.740	11.880	3.90	1.42
122	21.010	2.960	11.660	3.90	1.32
123	21.060	3.010	11.610	3.90	1.30
124	21.070	3.020	11.600	3.90	1.29
125	21.090	3.040	11.580	3.90	1.28
126	21.110	3.060	11.560	3.90	1.27
127	21.120	3.070	11.550	3.90	1.27
128	21.130	3.080	11.540	3.90	1.27
129	21.140	3.090	11.530	3.90	1.26
130	21.150	3.100	11.520	3.90	1.26
132	21.170	3.120	11.500	3.90	1.25
134	21.180	3.130	11.490	3.90	1.25
136	21.190	3.140	11.480	3.90	1.24
138	21.200	3.150	11.470	3.90	1.24
140	21.210	3.160	11.460	3.90	1.23
142	21.220	3.170	11.450	3.90	1.23
144	21.220	3.170	11.450	3.90	1.23
146	21.240	3.190	11.430	3.90	1.22
148	21.245	3.195	11.425	3.90	1.22
150	21.260	3.210	11.410	3.90	1.21
155	21.280	3.230	11.390	3.90	1.21
160	21.300	3.250	11.370	3.90	1.20
165	21.320	3.270	11.350	3.90	1.19
170	21.340	3.290	11.330	3.90	1.19
175	21.360	3.310	11.310	3.90	1.18
180	21.380	3.330	11.290	3.90	1.17

LHP62:- 2008/07/17 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
17/07/2008	10:00	1	100	1.00
		2	100	2.00
		3	100	3.00

LHP62 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	14.650	0.000	17.720		
1	16.050	1.400	16.320	1.00	0.71
2	15.690	1.040	16.680	1.00	0.96
3	15.600	0.950	16.770	1.00	1.05
4	15.590	0.940	16.780	1.00	1.06
5	15.610	0.960	16.760	1.00	1.04
6	15.610	0.960	16.760	1.00	1.04
7	15.610	0.960	16.760	1.00	1.04
8	15.620	0.970	16.750	1.00	1.03
9	15.620	0.970	16.750	1.00	1.03
10	15.620	0.970	16.750	1.00	1.03
12	15.610	0.960	16.760	1.00	1.04
14	15.600	0.950	16.770	1.00	1.05
16	15.605	0.955	16.765	1.00	1.05
18	15.610	0.960	16.760	1.00	1.04
20	15.600	0.950	16.770	1.00	1.05
22	15.620	0.970	16.750	1.00	1.03
24	15.620	0.970	16.750	1.00	1.03
26	15.620	0.970	16.750	1.00	1.03
28	15.610	0.960	16.760	1.00	1.04
30	15.620	0.970	16.750	1.00	1.03
35	15.620	0.970	16.750	1.00	1.03
40	15.630	0.980	16.740	1.00	1.02
45	15.630	0.980	16.740	1.00	1.02
50	15.630	0.980	16.740	1.00	1.02
55	15.610	0.960	16.760	1.00	1.04
60	15.620	0.970	16.750	1.00	1.03
70	15.590	0.940	16.780	1.00	1.06
80	15.600	0.950	16.770	1.00	1.05
90	15.590	0.940	16.780	1.00	1.06
100	15.580	0.930	16.790	1.00	1.08
101	16.520	1.870	15.850	2.00	1.07
102	16.590	1.940	15.780	2.00	1.03
103	16.600	1.950	15.770	2.00	1.03
104	16.610	1.960	15.760	2.00	1.02
105	16.620	1.970	15.750	2.00	1.02
106	16.640	1.990	15.730	2.00	1.01
107	16.630	1.980	15.740	2.00	1.01
108	16.640	1.990	15.730	2.00	1.01
109	16.640	1.990	15.730	2.00	1.01
110	16.640	1.990	15.730	2.00	1.01
112	16.650	2.000	15.720	2.00	1.00

114	16.640	1.990	15.730	2.00	1.01
116	16.640	1.990	15.730	2.00	1.01
118	16.630	1.980	15.740	2.00	1.01
120	16.610	1.960	15.760	2.00	1.02
122	16.630	1.980	15.740	2.00	1.01
124	16.620	1.970	15.750	2.00	1.02
126	16.620	1.970	15.750	2.00	1.02
128	16.620	1.970	15.750	2.00	1.02
130	16.620	1.970	15.750	2.00	1.02
135	16.610	1.960	15.760	2.00	1.02
140	16.610	1.960	15.760	2.00	1.02
145	16.610	1.960	15.760	2.00	1.02
150	16.610	1.960	15.760	2.00	1.02
155	16.620	1.970	15.750	2.00	1.02
160	16.620	1.970	15.750	2.00	1.02
170	16.620	1.970	15.750	2.00	1.02
180	16.610	1.960	15.760	2.00	1.02
190	16.610	1.960	15.760	2.00	1.02
200	16.610	1.960	15.760	2.00	1.02
201	17.640	2.990	14.730	3.00	1.00
202	17.720	3.070	14.650	3.00	0.98
203	17.730	3.080	14.640	3.00	0.97
204	17.745	3.095	14.625	3.00	0.97
205	17.760	3.110	14.610	3.00	0.96
206	17.760	3.110	14.610	3.00	0.96
207	17.770	3.120	14.600	3.00	0.96
208	17.760	3.110	14.610	3.00	0.96
209	17.760	3.110	14.610	3.00	0.96
210	17.770	3.120	14.600	3.00	0.96
212	17.770	3.120	14.600	3.00	0.96
214	17.775	3.125	14.595	3.00	0.96
216	17.780	3.130	14.590	3.00	0.96
218	17.770	3.120	14.600	3.00	0.96
220	17.770	3.120	14.600	3.00	0.96
222	17.775	3.125	14.595	3.00	0.96
224	17.770	3.120	14.600	3.00	0.96
226	17.770	3.120	14.600	3.00	0.96
228	17.775	3.125	14.595	3.00	0.96
230	17.775	3.125	14.595	3.00	0.96
235	17.770	3.120	14.600	3.00	0.96
240	17.770	3.120	14.600	3.00	0.96
245	17.780	3.130	14.590	3.00	0.96
250	17.780	3.130	14.590	3.00	0.96
255	17.780	3.130	14.590	3.00	0.96
260	17.790	3.140	14.580	3.00	0.96
270	17.790	3.140	14.580	3.00	0.96
280	17.790	3.140	14.580	3.00	0.96
290	17.800	3.150	14.570	3.00	0.95
300	17.810	3.160	14.560	3.00	0.95

LHP80:- 2010/03/18 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
18/03/2010	09:30	1	100	0.20
		2	100	0.25
		3	100	0.30

LHP80 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	26.570	8.770	6.200	0.20	
1	27.020	9.220	5.750	0.20	0.02
2	27.780	9.980	4.990	0.20	0.02
3	27.650	9.850	5.120	0.20	0.02
4	27.590	9.790	5.180	0.20	0.02
5	27.590	9.790	5.180	0.20	0.02
6	27.560	9.760	5.210	0.20	0.02
7	27.590	9.790	5.180	0.20	0.02
8	27.590	9.790	5.180	0.20	0.02
9	27.580	9.780	5.190	0.20	0.02
10	27.610	9.810	5.160	0.20	0.02
12	27.670	9.870	5.100	0.20	0.02
14	27.675	9.875	5.095	0.20	0.02
16	27.660	9.860	5.110	0.20	0.02
18	27.680	9.880	5.090	0.20	0.02
20	27.740	9.940	5.030	0.20	0.02
22	27.775	9.975	4.995	0.20	0.02
24	27.800	10.000	4.970	0.20	0.02
26	27.840	10.040	4.930	0.20	0.02
28	27.820	10.020	4.950	0.20	0.02
30	27.840	10.040	4.930	0.20	0.02
35	27.870	10.070	4.900	0.20	0.02
40	27.890	10.090	4.880	0.20	0.02
45	27.920	10.120	4.850	0.20	0.02
50	27.930	10.130	4.840	0.20	0.02
55	27.960	10.160	4.810	0.20	0.02
60	27.940	10.140	4.830	0.20	0.02
70	28.020	10.220	4.750	0.20	0.02
80	28.000	10.200	4.770	0.20	0.02
90	27.990	10.190	4.780	0.20	0.02
100	28.050	10.250	4.720	0.20	0.02
101	28.130	10.330	4.640	0.25	0.02
102	28.190	10.390	4.580	0.25	0.02
103	28.250	10.450	4.520	0.25	0.02
104	28.270	10.470	4.500	0.25	0.02
105	28.290	10.490	4.480	0.25	0.02
106	28.340	10.540	4.430	0.25	0.02
107	28.330	10.530	4.440	0.25	0.02
108	28.370	10.570	4.400	0.25	0.02
109	28.400	10.600	4.370	0.25	0.02
110	28.410	10.610	4.360	0.25	0.02
112	28.410	10.610	4.360	0.25	0.02

114	28.440	10.640	4.330	0.25	0.02
116	28.440	10.640	4.330	0.25	0.02
118	28.450	10.650	4.320	0.25	0.02
120	28.470	10.670	4.300	0.25	0.02
122	28.480	10.680	4.290	0.25	0.02
124	28.490	10.690	4.280	0.25	0.02
126	28.500	10.700	4.270	0.25	0.02
128	28.500	10.700	4.270	0.25	0.02
130	28.480	10.680	4.290	0.25	0.02
135	28.510	10.710	4.260	0.25	0.02
140	28.530	10.730	4.240	0.25	0.02
145	28.520	10.720	4.250	0.25	0.02
150	28.540	10.740	4.230	0.25	0.02
155	28.570	10.770	4.200	0.25	0.02
160	28.570	10.770	4.200	0.25	0.02
170	28.620	10.820	4.150	0.25	0.02
180	28.570	10.770	4.200	0.25	0.02
190	28.630	10.830	4.140	0.25	0.02
200	28.740	10.940	4.030	0.25	0.02
201	28.820	11.020	3.950	0.30	0.03
202	28.890	11.090	3.880	0.30	0.03
203	28.960	11.160	3.810	0.30	0.03
204	28.990	11.190	3.780	0.30	0.03
205	29.020	11.220	3.750	0.30	0.03
206	29.050	11.250	3.720	0.30	0.03
207	29.110	11.310	3.660	0.30	0.03
208	29.110	11.310	3.660	0.30	0.03
209	29.160	11.360	3.610	0.30	0.03
210	29.160	11.360	3.610	0.30	0.03
212	29.240	11.440	3.530	0.30	0.03
214	29.260	11.460	3.510	0.30	0.03
216	29.300	11.500	3.470	0.30	0.03
218	29.330	11.530	3.440	0.30	0.03
220	29.330	11.530	3.440	0.30	0.03
222	29.360	11.560	3.410	0.30	0.03
224	29.390	11.590	3.380	0.30	0.03
226	29.400	11.600	3.370	0.30	0.03
228	29.420	11.620	3.350	0.30	0.03
230	29.420	11.620	3.350	0.30	0.03
235	29.400	11.600	3.370	0.30	0.03
240	29.440	11.640	3.330	0.30	0.03
245	29.470	11.670	3.300	0.30	0.03
250	29.490	11.690	3.280	0.30	0.03
255	29.490	11.690	3.280	0.30	0.03
260	29.500	11.700	3.270	0.30	0.03
270	29.450	11.650	3.320	0.30	0.03
280	29.450	11.650	3.320	0.30	0.03
290	29.500	11.700	3.270	0.30	0.03
300	29.550	11.750	3.220	0.30	0.03

LHP82:- 2010/03/22 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
22/03/2010	09:00	1	100	0.50
		2	100	0.80
		3	100	1.00

LHP82 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	25.430	7.630	7.340	0.50	
1	26.310	8.510	6.460	0.50	0.06
2	26.820	9.020	5.950	0.50	0.06
3	26.750	8.950	6.020	0.50	0.06
4	26.660	8.860	6.110	0.50	0.06
5	26.630	8.830	6.140	0.50	0.06
6	26.650	8.850	6.120	0.50	0.06
7	26.670	8.870	6.100	0.50	0.06
8	26.670	8.870	6.100	0.50	0.06
9	26.690	8.890	6.080	0.50	0.06
10	26.700	8.900	6.070	0.50	0.06
12	26.710	8.910	6.060	0.50	0.06
14	26.710	8.910	6.060	0.50	0.06
16	26.710	8.910	6.060	0.50	0.06
18	26.720	8.920	6.050	0.50	0.06
20	26.730	8.930	6.040	0.50	0.06
22	26.730	8.930	6.040	0.50	0.06
24	26.740	8.940	6.030	0.50	0.06
26	26.740	8.940	6.030	0.50	0.06
28	26.730	8.930	6.040	0.50	0.06
30	26.720	8.920	6.050	0.50	0.06
35	26.720	8.920	6.050	0.50	0.06
40	26.730	8.930	6.040	0.50	0.06
45	26.750	8.950	6.020	0.50	0.06
50	26.750	8.950	6.020	0.50	0.06
55	26.750	8.950	6.020	0.50	0.06
60	26.750	8.950	6.020	0.50	0.06
70	26.810	9.010	5.960	0.50	0.06
80	26.820	9.020	5.950	0.50	0.06
90	26.830	9.030	5.940	0.50	0.06
100	26.820	9.020	5.950	0.50	0.06
101	27.140	9.340	5.630	0.80	0.09
102	27.240	9.440	5.530	0.80	0.08
103	27.330	9.530	5.440	0.80	0.08
104	27.450	9.650	5.320	0.80	0.08
105	27.500	9.700	5.270	0.80	0.08
106	27.530	9.730	5.240	0.80	0.08
107	27.530	9.730	5.240	0.80	0.08
108	27.560	9.760	5.210	0.80	0.08
109	27.570	9.770	5.200	0.80	0.08
110	27.570	9.770	5.200	0.80	0.08
112	27.610	9.810	5.160	0.80	0.08

114	27.630	9.830	5.140	0.80	0.08
116	27.650	9.850	5.120	0.80	0.08
118	27.650	9.850	5.120	0.80	0.08
120	27.660	9.860	5.110	0.80	0.08
122	27.670	9.870	5.100	0.80	0.08
124	27.680	9.880	5.090	0.80	0.08
126	27.680	9.880	5.090	0.80	0.08
128	27.680	9.880	5.090	0.80	0.08
130	27.680	9.880	5.090	0.80	0.08
135	27.690	9.890	5.080	0.80	0.08
140	27.700	9.900	5.070	0.80	0.08
145	27.710	9.910	5.060	0.80	0.08
150	27.710	9.910	5.060	0.80	0.08
155	27.720	9.920	5.050	0.80	0.08
160	27.800	10.000	4.970	0.80	0.08
170	27.760	9.960	5.010	0.80	0.08
180	27.740	9.940	5.030	0.80	0.08
190	27.750	9.950	5.020	0.80	0.08
200	27.730	9.930	5.040	0.80	0.08
201	28.050	10.250	4.720	1.00	0.10
202	28.160	10.360	4.610	1.00	0.10
203	28.260	10.460	4.510	1.00	0.10
204	28.360	10.560	4.410	1.00	0.09
205	28.430	10.630	4.340	1.00	0.09
206	28.450	10.650	4.320	1.00	0.09
207	28.470	10.670	4.300	1.00	0.09
208	28.500	10.700	4.270	1.00	0.09
209	28.530	10.730	4.240	1.00	0.09
210	28.550	10.750	4.220	1.00	0.09
212	28.610	10.810	4.160	1.00	0.09
214	28.640	10.840	4.130	1.00	0.09
216	28.670	10.870	4.100	1.00	0.09
218	28.680	10.880	4.090	1.00	0.09
220	28.670	10.870	4.100	1.00	0.09
222	28.700	10.900	4.070	1.00	0.09
224	28.740	10.940	4.030	1.00	0.09
226	28.750	10.950	4.020	1.00	0.09
228	28.760	10.960	4.010	1.00	0.09
230	28.770	10.970	4.000	1.00	0.09
235	28.800	11.000	3.970	1.00	0.09
240	28.820	11.020	3.950	1.00	0.09
245	28.830	11.030	3.940	1.00	0.09
250	28.830	11.030	3.940	1.00	0.09
255	28.840	11.040	3.930	1.00	0.09
260	28.850	11.050	3.920	1.00	0.09
270	28.870	11.070	3.900	1.00	0.09
280	28.900	11.100	3.870	1.00	0.09
290	28.930	11.130	3.840	1.00	0.09
300	28.960	11.160	3.810	1.00	0.09

LHP50P:- 2008/06/19 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
19/06/2008	14:00	1	60	0.30
		2	60	0.60
		3	60	0.90

LHP50P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.540	0.000	14.120		
1	23.750	5.210	8.910	0.30	0.06
2	23.950	5.410	8.710	0.30	0.06
3	24.030	5.490	8.630	0.30	0.05
4	24.080	5.540	8.580	0.30	0.05
5	24.130	5.590	8.530	0.30	0.05
6	24.190	5.650	8.470	0.30	0.05
7	24.240	5.700	8.420	0.30	0.05
8	24.300	5.760	8.360	0.30	0.05
9	24.350	5.810	8.310	0.30	0.05
10	24.390	5.850	8.270	0.30	0.05
12	24.520	5.980	8.140	0.30	0.05
14	24.590	6.050	8.070	0.30	0.05
16	24.680	6.140	7.980	0.30	0.05
18	24.750	6.210	7.910	0.30	0.05
20	24.800	6.260	7.860	0.30	0.05
22	24.860	6.320	7.800	0.30	0.05
24	24.900	6.360	7.760	0.30	0.05
26	24.940	6.400	7.720	0.30	0.05
28	24.990	6.450	7.670	0.30	0.05
30	25.040	6.500	7.620	0.30	0.05
35	25.160	6.620	7.500	0.30	0.05
40	25.210	6.670	7.450	0.30	0.04
45	25.280	6.740	7.380	0.30	0.04
50	25.350	6.810	7.310	0.30	0.04
55	25.390	6.850	7.270	0.30	0.04
60	25.510	6.970	7.150	0.30	0.04
61	26.140	7.600	6.520	0.60	0.08
62	26.790	8.250	5.870	0.60	0.07
63	27.220	8.680	5.440	0.60	0.07
64	27.650	9.110	5.010	0.60	0.07
65	28.070	9.530	4.590	0.60	0.06
66	28.400	9.860	4.260	0.60	0.06
67	28.740	10.200	3.920	0.60	0.06
68	29.010	10.470	3.650	0.60	0.06
69	29.250	10.710	3.410	0.60	0.06
70	29.530	10.990	3.130	0.60	0.05
72	29.940	11.400	2.720	0.60	0.05
74	30.360	11.820	2.300	0.60	0.05
76	30.570	12.030	2.090	0.60	0.05
78	30.860	12.320	1.800	0.60	0.05
80	31.100	12.560	1.560	0.60	0.05

82	31.270	12.730	1.390	0.60	0.05
84	31.400	12.860	1.260	0.60	0.05
86	31.530	12.990	1.130	0.60	0.05
88	31.650	13.110	1.010	0.60	0.05
90	31.710	13.170	0.950	0.60	0.05
95	32.030	13.490	0.630	0.60	0.04
100	32.250	13.710	0.410	0.60	0.04
105	32.400	13.860	0.260	0.60	0.04
110	32.510	13.970	0.150	0.60	0.04
115	32.700	14.160	-0.040	0.60	0.04
120	32.840	14.300	-0.180	0.60	0.04
121	33.510	14.970	-0.850	0.90	0.06
122	34.040	15.500	-1.380	0.90	0.06
123	34.550	16.010	-1.890	0.90	0.06
124	35.030	16.490	-2.370	0.90	0.05
125	35.390	16.850	-2.730	0.90	0.05
126	35.830	17.290	-3.170	0.90	0.05
127	36.160	17.620	-3.500	0.90	0.05
128	36.460	17.920	-3.800	0.90	0.05
129	36.750	18.210	-4.090	0.90	0.05
130	37.010	18.470	-4.350	0.90	0.05
132	37.390	18.850	-4.730	0.90	0.05
134	37.800	19.260	-5.140	0.90	0.05
136	38.150	19.610	-5.490	0.90	0.05
138	38.430	19.890	-5.770	0.90	0.05
140	38.650	20.110	-5.990	0.90	0.04
142	38.880	20.340	-6.220	0.90	0.04
144	39.060	20.520	-6.400	0.90	0.04
146	39.250	20.710	-6.590	0.90	0.04
148	39.390	20.850	-6.730	0.90	0.04
150	39.540	21.000	-6.880	0.90	0.04
155	39.810	21.270	-7.150	0.90	0.04
160	40.000	21.460	-7.340	0.90	0.04
165	40.140	21.600	-7.480	0.90	0.04
170	40.250	21.710	-7.590	0.90	0.04
175	40.370	21.830	-7.710	0.90	0.04
180	40.520	21.980	-7.860	0.90	0.04

LHP52P:- 2008/06/26 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
26/06/2008	09:30	1	60	0.20
		2	60	0.40
		3	60	0.60

LHP52P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.480	0.000	14.500		
1	22.080	3.600	10.900	0.20	0.06
2	22.100	3.620	10.880	0.20	0.06
3	22.140	3.660	10.840	0.20	0.05
4	22.210	3.730	10.770	0.20	0.05
5	22.280	3.800	10.700	0.20	0.05
6	22.360	3.880	10.620	0.20	0.05
7	22.380	3.900	10.600	0.20	0.05
8	22.440	3.960	10.540	0.20	0.05
9	22.500	4.020	10.480	0.20	0.05
10	22.550	4.070	10.430	0.20	0.05
12	22.640	4.160	10.340	0.20	0.05
14	22.710	4.230	10.270	0.20	0.05
16	22.760	4.280	10.220	0.20	0.05
18	22.830	4.350	10.150	0.20	0.05
20	22.900	4.420	10.080	0.20	0.05
22	22.960	4.480	10.020	0.20	0.04
24	23.030	4.550	9.950	0.20	0.04
26	23.080	4.600	9.900	0.20	0.04
28	23.110	4.630	9.870	0.20	0.04
30	23.150	4.670	9.830	0.20	0.04
35	23.250	4.770	9.730	0.20	0.04
40	23.290	4.810	9.690	0.20	0.04
45	23.340	4.860	9.640	0.20	0.04
50	23.370	4.890	9.610	0.20	0.04
55	23.420	4.940	9.560	0.20	0.04
60	23.480	5.000	9.500	0.20	0.04
61	24.100	5.620	8.880	0.40	0.07
62	24.290	5.810	8.690	0.40	0.07
63	24.610	6.130	8.370	0.40	0.07
64	24.950	6.470	8.030	0.40	0.06
65	25.140	6.660	7.840	0.40	0.06
66	25.370	6.890	7.610	0.40	0.06
67	25.560	7.080	7.420	0.40	0.06
68	25.750	7.270	7.230	0.40	0.06
69	25.910	7.430	7.070	0.40	0.05
70	26.080	7.600	6.900	0.40	0.05
72	26.380	7.900	6.600	0.40	0.05
74	26.500	8.020	6.480	0.40	0.05
76	26.830	8.350	6.150	0.40	0.05
78	27.040	8.560	5.940	0.40	0.05
80	27.250	8.770	5.730	0.40	0.05

82	27.380	8.900	5.600	0.40	0.04
84	27.480	9.000	5.500	0.40	0.04
86	27.620	9.140	5.360	0.40	0.04
88	27.710	9.230	5.270	0.40	0.04
90	27.800	9.320	5.180	0.40	0.04
95	27.980	9.500	5.000	0.40	0.04
100	28.190	9.710	4.790	0.40	0.04
105	28.330	9.850	4.650	0.40	0.04
110	28.480	10.000	4.500	0.40	0.04
115	28.580	10.100	4.400	0.40	0.04
120	28.640	10.160	4.340	0.40	0.04
121	29.770	11.290	3.210	0.60	0.05
122	29.840	11.360	3.140	0.60	0.05
123	30.090	11.610	2.890	0.60	0.05
124	30.490	12.010	2.490	0.60	0.05
125	30.690	12.210	2.290	0.60	0.05
126	30.960	12.480	2.020	0.60	0.05
127	31.150	12.670	1.830	0.60	0.05
128	31.390	12.910	1.590	0.60	0.05
129	31.590	13.110	1.390	0.60	0.05
130	31.720	13.240	1.260	0.60	0.05
132	31.980	13.500	1.000	0.60	0.04
134	32.280	13.800	0.700	0.60	0.04
136	32.500	14.020	0.480	0.60	0.04
138	32.690	14.210	0.290	0.60	0.04
140	32.850	14.370	0.130	0.60	0.04
142	32.970	14.490	0.010	0.60	0.04
144	33.070	14.590	-0.090	0.60	0.04
146	33.160	14.680	-0.180	0.60	0.04
148	33.330	14.850	-0.350	0.60	0.04
150	33.470	14.990	-0.490	0.60	0.04
155	33.720	15.240	-0.740	0.60	0.04
160	33.880	15.400	-0.900	0.60	0.04
165	34.000	15.520	-1.020	0.60	0.04
170	34.080	15.600	-1.100	0.60	0.04
175	34.150	15.670	-1.170	0.60	0.04
180	34.270	15.790	-1.290	0.60	0.04

LHP54P:- 2008/06/18 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
18/06/2008	14:00	1	60	0.30
		2	60	0.60
		3	60	0.90

LHP54P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	17.260	0.000	15.480		
1	21.250	3.990	11.490	0.30	0.08
2	21.470	4.210	11.270	0.30	0.07
3	21.750	4.490	10.990	0.30	0.07
4	22.070	4.810	10.670	0.30	0.06
5	22.350	5.090	10.390	0.30	0.06
6	22.450	5.190	10.290	0.30	0.06
7	22.650	5.390	10.090	0.30	0.06
8	22.800	5.540	9.940	0.30	0.05
9	22.980	5.720	9.760	0.30	0.05
10	23.090	5.830	9.650	0.30	0.05
12	23.480	6.220	9.260	0.30	0.05
14	23.650	6.390	9.090	0.30	0.05
16	23.820	6.560	8.920	0.30	0.05
18	23.975	6.715	8.765	0.30	0.04
20	24.100	6.840	8.640	0.30	0.04
22	24.280	7.020	8.460	0.30	0.04
24	24.470	7.210	8.270	0.30	0.04
26	24.590	7.330	8.150	0.30	0.04
28	24.730	7.470	8.010	0.30	0.04
30	24.800	7.540	7.940	0.30	0.04
35	25.070	7.810	7.670	0.30	0.04
40	25.170	7.910	7.570	0.30	0.04
45	25.270	8.010	7.470	0.30	0.04
50	25.340	8.080	7.400	0.30	0.04
55	25.440	8.180	7.300	0.30	0.04
60	25.550	8.290	7.190	0.30	0.04
61	26.220	8.960	6.520	0.60	0.07
62	26.790	9.530	5.950	0.60	0.06
63	27.190	9.930	5.550	0.60	0.06
64	27.690	10.430	5.050	0.60	0.06
65	28.140	10.880	4.600	0.60	0.06
66	28.490	11.230	4.250	0.60	0.05
67	28.760	11.500	3.980	0.60	0.05
68	28.980	11.720	3.760	0.60	0.05
69	29.330	12.070	3.410	0.60	0.05
70	29.540	12.280	3.200	0.60	0.05
72	29.960	12.700	2.780	0.60	0.05
74	30.350	13.090	2.390	0.60	0.05
76	30.620	13.360	2.120	0.60	0.04
78	30.880	13.620	1.860	0.60	0.04
80	31.180	13.920	1.560	0.60	0.04

82	31.350	14.090	1.390	0.60	0.04
84	31.540	14.280	1.200	0.60	0.04
86	31.720	14.460	1.020	0.60	0.04
88	31.860	14.600	0.880	0.60	0.04
90	32.020	14.760	0.720	0.60	0.04
95	32.200	14.940	0.540	0.60	0.04
100	32.320	15.060	0.420	0.60	0.04
105	32.440	15.180	0.300	0.60	0.04
110	32.680	15.420	0.060	0.60	0.04
115	32.850	15.590	-0.110	0.60	0.04
120	33.000	15.740	-0.260	0.60	0.04
121	33.640	16.380	-0.900	0.90	0.05
122	34.230	16.970	-1.490	0.90	0.05
123	34.710	17.450	-1.970	0.90	0.05
124	35.170	17.910	-2.430	0.90	0.05
125	35.600	18.340	-2.860	0.90	0.05
126	35.940	18.680	-3.200	0.90	0.05
127	36.260	19.000	-3.520	0.90	0.05
128	36.640	19.380	-3.900	0.90	0.05
129	36.910	19.650	-4.170	0.90	0.05
130	37.090	19.830	-4.350	0.90	0.05
132	37.560	20.300	-4.820	0.90	0.04
134	37.980	20.720	-5.240	0.90	0.04
136	38.340	21.080	-5.600	0.90	0.04
138	38.540	21.280	-5.800	0.90	0.04
140	38.790	21.530	-6.050	0.90	0.04
142	38.980	21.720	-6.240	0.90	0.04
144	39.150	21.890	-6.410	0.90	0.04
146	39.250	21.990	-6.510	0.90	0.04
148	39.410	22.150	-6.670	0.90	0.04
150	39.630	22.370	-6.890	0.90	0.04
155	39.930	22.670	-7.190	0.90	0.04
160	40.120	22.860	-7.380	0.90	0.04
165	40.280	23.020	-7.540	0.90	0.04
170	40.500	23.240	-7.760	0.90	0.04
175	40.650	23.390	-7.910	0.90	0.04
180	40.800	23.540	-8.060	0.90	0.04

LHP56P:- 2008/06/20 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
20/06/2008	08:00	1	100	0.20
		2	100	0.40
		3	100	0.60

LHP56P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.840	0.000	14.890		
1	22.700	3.860	11.030	0.20	0.05
2	22.710	3.870	11.020	0.20	0.05
3	22.720	3.880	11.010	0.20	0.05
4	22.720	3.880	11.010	0.20	0.05
5	22.730	3.890	11.000	0.20	0.05
6	22.770	3.930	10.960	0.20	0.05
7	22.780	3.940	10.950	0.20	0.05
8	22.810	3.970	10.920	0.20	0.05
9	22.830	3.990	10.900	0.20	0.05
10	22.850	4.010	10.880	0.20	0.05
12	22.930	4.090	10.800	0.20	0.05
14	22.990	4.150	10.740	0.20	0.05
16	23.020	4.180	10.710	0.20	0.05
18	23.060	4.220	10.670	0.20	0.05
20	23.090	4.250	10.640	0.20	0.05
22	23.100	4.260	10.630	0.20	0.05
24	23.135	4.295	10.595	0.20	0.05
26	23.170	4.330	10.560	0.20	0.05
28	23.190	4.350	10.540	0.20	0.05
30	23.240	4.400	10.490	0.20	0.05
35	23.310	4.470	10.420	0.20	0.04
40	23.350	4.510	10.380	0.20	0.04
45	23.400	4.560	10.330	0.20	0.04
50	23.430	4.590	10.300	0.20	0.04
55	23.460	4.620	10.270	0.20	0.04
60	23.500	4.660	10.230	0.20	0.04
70	23.590	4.750	10.140	0.20	0.04
80	23.620	4.780	10.110	0.20	0.04
90	23.685	4.845	10.045	0.20	0.04
100	23.780	4.940	9.950	0.20	0.04
101	24.170	5.330	9.560	0.40	0.08
102	24.530	5.690	9.200	0.40	0.07
103	24.910	6.070	8.820	0.40	0.07
104	25.220	6.380	8.510	0.40	0.06
105	25.480	6.640	8.250	0.40	0.06
106	25.700	6.860	8.030	0.40	0.06
107	25.940	7.100	7.790	0.40	0.06
108	26.130	7.290	7.600	0.40	0.05
109	26.340	7.500	7.390	0.40	0.05
110	26.520	7.680	7.210	0.40	0.05
112	26.760	7.920	6.970	0.40	0.05

114	26.960	8.120	6.770	0.40	0.05
116	27.140	8.300	6.590	0.40	0.05
118	27.280	8.440	6.450	0.40	0.05
120	27.400	8.560	6.330	0.40	0.05
122	27.500	8.660	6.230	0.40	0.05
124	27.600	8.760	6.130	0.40	0.05
126	27.630	8.790	6.100	0.40	0.05
128	27.710	8.870	6.020	0.40	0.05
130	27.760	8.920	5.970	0.40	0.04
135	27.910	9.070	5.820	0.40	0.04
140	27.990	9.150	5.740	0.40	0.04
145	28.140	9.300	5.590	0.40	0.04
150	28.210	9.370	5.520	0.40	0.04
155	28.280	9.440	5.450	0.40	0.04
160	28.330	9.490	5.400	0.40	0.04
170	28.470	9.630	5.260	0.40	0.04
180	28.530	9.690	5.200	0.40	0.04
190	28.620	9.780	5.110	0.40	0.04
200	28.600	9.760	5.130	0.40	0.04
201	29.250	10.410	4.480	0.60	0.06
202	29.680	10.840	4.050	0.60	0.06
203	29.960	11.120	3.770	0.60	0.05
204	30.230	11.390	3.500	0.60	0.05
205	30.440	11.600	3.290	0.60	0.05
206	30.630	11.790	3.100	0.60	0.05
207	30.800	11.960	2.930	0.60	0.05
208	31.000	12.160	2.730	0.60	0.05
209	31.120	12.280	2.610	0.60	0.05
210	31.220	12.380	2.510	0.60	0.05
212	31.500	12.660	2.230	0.60	0.05
214	31.770	12.930	1.960	0.60	0.05
216	31.990	13.150	1.740	0.60	0.05
218	32.380	13.540	1.350	0.60	0.04
220	32.560	13.720	1.170	0.60	0.04
222	32.620	13.780	1.110	0.60	0.04
224	32.620	13.780	1.110	0.60	0.04
226	32.690	13.850	1.040	0.60	0.04
228	32.76	13.920	0.970	0.60	0.04
230	32.82	13.980	0.910	0.60	0.04
235	32.96	14.120	0.770	0.60	0.04
240	33.17	14.330	0.560	0.60	0.04
245	33.3	14.460	0.430	0.60	0.04
250	33.38	14.540	0.350	0.60	0.04
255	33.46	14.620	0.270	0.60	0.04
260	33.63	14.790	0.100	0.60	0.04
270	33.79	14.950	-0.060	0.60	0.04
280	33.85	15.010	-0.120	0.60	0.04
290	33.89	15.050	-0.160	0.60	0.04
300	34.19	15.350	-0.460	0.60	0.04

LHP58P:- 2008/06/26 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
26/06/2008	13:50	1	60	0.30
		2	60	0.60
		3	60	0.90

LHP58P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.900	0.000	15.250		
1	22.490	3.590	11.660	0.30	0.08
2	23.600	4.700	10.550	0.30	0.06
3	23.780	4.880	10.370	0.30	0.06
4	23.810	4.910	10.340	0.30	0.06
5	23.980	5.080	10.170	0.30	0.06
6	24.110	5.210	10.040	0.30	0.06
7	24.250	5.350	9.900	0.30	0.06
8	24.400	5.500	9.750	0.30	0.05
9	24.520	5.620	9.630	0.30	0.05
10	24.640	5.740	9.510	0.30	0.05
12	24.870	5.970	9.280	0.30	0.05
14	25.050	6.150	9.100	0.30	0.05
16	25.200	6.300	8.950	0.30	0.05
18	25.320	6.420	8.830	0.30	0.05
20	25.440	6.540	8.710	0.30	0.05
22	25.540	6.640	8.610	0.30	0.05
24	25.650	6.750	8.500	0.30	0.04
26	25.710	6.810	8.440	0.30	0.04
28	25.780	6.880	8.370	0.30	0.04
30	25.870	6.970	8.280	0.30	0.04
35	26.030	7.130	8.120	0.30	0.04
40	26.120	7.220	8.030	0.30	0.04
45	26.210	7.310	7.940	0.30	0.04
50	26.280	7.380	7.870	0.30	0.04
55	26.360	7.460	7.790	0.30	0.04
60	26.400	7.500	7.750	0.30	0.04
61	26.990	8.090	7.160	0.60	0.07
62	27.540	8.640	6.610	0.60	0.07
63	28.070	9.170	6.080	0.60	0.07
64	28.550	9.650	5.600	0.60	0.06
65	28.900	10.000	5.250	0.60	0.06
66	29.270	10.370	4.880	0.60	0.06
67	29.570	10.670	4.580	0.60	0.06
68	29.900	11.000	4.250	0.60	0.05
69	30.130	11.230	4.020	0.60	0.05
70	30.370	11.470	3.780	0.60	0.05
72	30.830	11.930	3.320	0.60	0.05
74	31.170	12.270	2.980	0.60	0.05
76	31.450	12.550	2.700	0.60	0.05
78	31.690	12.790	2.460	0.60	0.05
80	31.900	13.000	2.250	0.60	0.05

82	32.060	13.160	2.090	0.60	0.05
84	32.200	13.300	1.950	0.60	0.05
86	32.350	13.450	1.800	0.60	0.04
88	32.550	13.650	1.600	0.60	0.04
90	32.660	13.760	1.490	0.60	0.04
95	32.980	14.080	1.170	0.60	0.04
100	33.180	14.280	0.970	0.60	0.04
105	33.350	14.450	0.800	0.60	0.04
110	33.470	14.570	0.680	0.60	0.04
115	33.590	14.690	0.560	0.60	0.04
120	33.700	14.800	0.450	0.60	0.04
121	34.380	15.480	-0.230	0.90	0.06
122	35.050	16.150	-0.900	0.90	0.06
123	35.480	16.580	-1.330	0.90	0.05
124	35.930	17.030	-1.780	0.90	0.05
125	36.330	17.430	-2.180	0.90	0.05
126	36.730	17.830	-2.580	0.90	0.05
127	37.060	18.160	-2.910	0.90	0.05
128	37.350	18.450	-3.200	0.90	0.05
129	37.620	18.720	-3.470	0.90	0.05
130	37.890	18.990	-3.740	0.90	0.05
132	38.310	19.410	-4.160	0.90	0.05
134	38.680	19.780	-4.530	0.90	0.05
136	39.020	20.120	-4.870	0.90	0.04
138	39.400	20.500	-5.250	0.90	0.04
140	39.630	20.730	-5.480	0.90	0.04
142	39.840	20.940	-5.690	0.90	0.04
144	40.090	21.190	-5.940	0.90	0.04
146	40.160	21.260	-6.010	0.90	0.04
148	40.310	21.410	-6.160	0.90	0.04
150	40.420	21.520	-6.270	0.90	0.04
155	40.770	21.870	-6.620	0.90	0.04
160	40.950	22.050	-6.800	0.90	0.04
165	41.150	22.250	-7.000	0.90	0.04
170	41.320	22.420	-7.170	0.90	0.04
175	41.430	22.530	-7.280	0.90	0.04
180	41.560	22.660	-7.410	0.90	0.04

LHP60P:- 2008/06/17 STEP DRAWDOWN TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
17/06/2008	08:30	1	60	0.20
		2	60	0.40
		3	60	0.60

LHP60P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (m AHD)	Q (L/s)	SC ((L/s)/m)
0	18.490	0.000	15.900		
1	24.000	5.510	10.390	0.20	0.04
2	24.430	5.940	9.960	0.20	0.03
3	24.430	5.940	9.960	0.20	0.03
4	24.460	5.970	9.930	0.20	0.03
5	24.480	5.990	9.910	0.20	0.03
6	24.510	6.020	9.880	0.20	0.03
7	24.580	6.090	9.810	0.20	0.03
8	24.610	6.120	9.780	0.20	0.03
9	24.660	6.170	9.730	0.20	0.03
10	24.710	6.220	9.680	0.20	0.03
12	24.830	6.340	9.560	0.20	0.03
14	24.880	6.390	9.510	0.20	0.03
16	24.970	6.480	9.420	0.20	0.03
18	25.025	6.535	9.365	0.20	0.03
20	25.090	6.600	9.300	0.20	0.03
22	25.130	6.640	9.260	0.20	0.03
24	25.170	6.680	9.220	0.20	0.03
26	25.240	6.750	9.150	0.20	0.03
28	25.290	6.800	9.100	0.20	0.03
30	25.315	6.825	9.075	0.20	0.03
35	25.440	6.950	8.950	0.20	0.03
40	25.530	7.040	8.860	0.20	0.03
45	25.620	7.130	8.770	0.20	0.03
50	25.710	7.220	8.680	0.20	0.03
55	25.860	7.370	8.530	0.20	0.03
60	26.040	7.550	8.350	0.20	0.03
61	26.420	7.930	7.970	0.40	0.05
62	26.830	8.340	7.560	0.40	0.05
63	27.150	8.660	7.240	0.40	0.05
64	27.430	8.940	6.960	0.40	0.04
65	27.770	9.280	6.620	0.40	0.04
66	27.930	9.440	6.460	0.40	0.04
67	28.170	9.680	6.220	0.40	0.04
68	28.360	9.870	6.030	0.40	0.04
69	28.610	10.120	5.780	0.40	0.04
70	28.810	10.320	5.580	0.40	0.04
72	29.140	10.650	5.250	0.40	0.04
74	29.420	10.930	4.970	0.40	0.04
76	29.690	11.200	4.700	0.40	0.04
78	29.920	11.430	4.470	0.40	0.03
80	30.130	11.640	4.260	0.40	0.03

82	30.350	11.860	4.040	0.40	0.03
84	30.520	12.030	3.870	0.40	0.03
86	30.640	12.150	3.750	0.40	0.03
88	30.790	12.300	3.600	0.40	0.03
90	30.920	12.430	3.470	0.40	0.03
95	31.210	12.720	3.180	0.40	0.03
100	31.450	12.960	2.940	0.40	0.03
105	31.690	13.200	2.700	0.40	0.03
110	31.810	13.320	2.580	0.40	0.03
115	31.940	13.450	2.450	0.40	0.03
120	32.100	13.610	2.290	0.40	0.03
121	32.540	14.050	1.850	0.60	0.04
122	32.900	14.410	1.490	0.60	0.04
123	33.260	14.770	1.130	0.60	0.04
124	33.600	15.110	0.790	0.60	0.04
125	33.880	15.390	0.510	0.60	0.04
126	34.250	15.760	0.140	0.60	0.04
127	34.490	16.000	-0.100	0.60	0.04
128	34.700	16.210	-0.310	0.60	0.04
129	34.960	16.470	-0.570	0.60	0.04
130	35.190	16.700	-0.800	0.60	0.04
132	35.600	17.110	-1.210	0.60	0.04
134	35.860	17.370	-1.470	0.60	0.03
136	36.100	17.610	-1.710	0.60	0.03
138	36.350	17.860	-1.960	0.60	0.03
140	36.530	18.040	-2.140	0.60	0.03
142	36.800	18.310	-2.410	0.60	0.03
144	37.000	18.510	-2.610	0.60	0.03
146	37.210	18.720	-2.820	0.60	0.03
148	37.400	18.910	-3.010	0.60	0.03
150	37.560	19.070	-3.170	0.60	0.03
155	37.960	19.470	-3.570	0.60	0.03
160	38.330	19.840	-3.940	0.60	0.03
165	38.550	20.060	-4.160	0.60	0.03
170	38.810	20.320	-4.420	0.60	0.03
175	38.970	20.480	-4.580	0.60	0.03
180	39.120	20.630	-4.730	0.60	0.03

CONSTANT RATE DISCHARGE TEST DATA

LHP51:- 2008/06/23 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
23/06/2008	13:30	1	1440	0.90
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP51	Production	0	Loxton Sands	32.790
LHO71P	Observation	2	Pata Formation	32.620
LHO70	Observation	15	Loxton Sands	32.390
LHP53	Observation	53	Loxton Sands	32.230
Note: Ref Elev may differ to final well details due to modification of well head				

LHP51 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	17.735	0.000	15.055		
1	21.500	3.765	11.290	0.90	0.24
2	21.130	3.395	11.660	0.90	0.27
3	20.440	2.705	12.350	0.90	0.33
4	20.170	2.435	12.620	0.90	0.37
5	20.090	2.355	12.700	0.90	0.38
6	20.100	2.365	12.690	0.90	0.38
7	20.120	2.385	12.670	0.90	0.38
8	20.150	2.415	12.640	0.90	0.37
9	20.170	2.435	12.620	0.90	0.37
10	20.190	2.455	12.600	0.90	0.37
12	20.210	2.475	12.580	0.90	0.36
14	20.240	2.505	12.550	0.90	0.36
16	20.250	2.515	12.540	0.90	0.36
18	20.280	2.545	12.510	0.90	0.35
20	20.320	2.585	12.470	0.90	0.35
22	20.280	2.545	12.510	0.90	0.35
24	20.290	2.555	12.500	0.90	0.35
26	20.280	2.545	12.510	0.90	0.35
28	20.320	2.585	12.470	0.90	0.35
30	20.315	2.580	12.475	0.90	0.35
35	20.280	2.545	12.510	0.90	0.35
40	20.285	2.550	12.505	0.90	0.35
45	20.310	2.575	12.480	0.90	0.35
50	20.330	2.595	12.460	0.90	0.35
55	20.330	2.595	12.460	0.90	0.35
60	20.330	2.595	12.460	0.90	0.35
70	20.325	2.590	12.465	0.90	0.35
80	20.335	2.600	12.455	0.90	0.35
90	20.320	2.585	12.470	0.90	0.35
100	20.340	2.605	12.450	0.90	0.35
120	20.330	2.595	12.460	0.90	0.35
140	20.290	2.555	12.500	0.90	0.35
160	20.240	2.505	12.550	0.90	0.36
180	20.220	2.485	12.570	0.90	0.36
200	20.350	2.615	12.440	0.90	0.34

250	20.360	2.625	12.430	0.90	0.34
300	20.250	2.515	12.540	0.90	0.36
350	20.450	2.715	12.340	0.90	0.33
400	20.390	2.655	12.400	0.90	0.34
450	20.200	2.465	12.590	0.90	0.37
500	20.150	2.415	12.640	0.90	0.37
550	20.210	2.475	12.580	0.90	0.36
600	20.340	2.605	12.450	0.90	0.35
650	20.400	2.665	12.390	0.90	0.34
700	20.560	2.825	12.230	0.90	0.32
750	20.540	2.805	12.250	0.90	0.32
800	20.550	2.815	12.240	0.90	0.32
850	20.390	2.655	12.400	0.90	0.34
900	20.450	2.715	12.340	0.90	0.33
950	20.540	2.805	12.250	0.90	0.32
1000	20.570	2.835	12.220	0.90	0.32
1050	20.560	2.825	12.230	0.90	0.32
1100	20.460	2.725	12.330	0.90	0.33
1150	20.380	2.645	12.410	0.90	0.34
1200	20.410	2.675	12.380	0.90	0.34
1250	20.350	2.615	12.440	0.90	0.34
1300	20.360	2.625	12.430	0.90	0.34
1350	20.340	2.605	12.450	0.90	0.35
1400	20.345	2.610	12.445	0.90	0.34
1440	20.400	2.665	12.390	0.90	0.34

LHO71P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	18.540	0.000	14.080
11	18.535	-0.005	14.085
21	18.535	-0.005	14.085
31	18.535	-0.005	14.085
41	18.535	-0.005	14.085
51	18.530	-0.010	14.090
61	18.535	-0.005	14.085
71	18.535	-0.005	14.085
80	18.530	-0.010	14.090
90	18.535	-0.005	14.085
100	18.530	-0.010	14.090
120	18.530	-0.010	14.090
140	18.530	-0.010	14.090
160	18.530	-0.010	14.090
180	18.530	-0.010	14.090
200	18.530	-0.010	14.090
250	18.530	-0.010	14.090
300	18.525	-0.015	14.095
350	18.525	-0.015	14.095
400	18.530	-0.010	14.090
450	18.510	-0.030	14.110

500	18.530	-0.010	14.090
550	18.530	-0.010	14.090
600	18.530	-0.010	14.090
650	18.520	-0.020	14.100
700	18.520	-0.020	14.100
750	18.520	-0.020	14.100
800	18.530	-0.010	14.090
850	18.520	-0.020	14.100
900	18.520	-0.020	14.100
950	18.530	-0.010	14.090
1000	18.520	-0.020	14.100
1050	18.520	-0.020	14.100
1100	18.510	-0.030	14.110
1150	18.510	-0.030	14.110
1200	18.510	-0.030	14.110
1250	18.510	-0.030	14.110
1300	18.505	-0.035	14.115
1350	18.500	-0.040	14.120
1400	18.500	-0.040	14.120
1440	18.500	-0.040	14.120

LHO70 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.495	0.000	14.895
1	17.495	0.000	14.895
2	17.495	0.000	14.895
3	17.500	0.005	14.890
4	17.510	0.015	14.880
5	17.510	0.015	14.880
6	17.515	0.020	14.875
7	17.515	0.020	14.875
8	17.515	0.020	14.875
9	17.520	0.025	14.870
10	17.520	0.025	14.870
12	17.525	0.030	14.865
14	17.525	0.030	14.865
16	17.530	0.035	14.860
18	17.530	0.035	14.860
20	17.535	0.040	14.855
22	17.535	0.040	14.855
24	17.540	0.045	14.850
26	17.540	0.045	14.850
28	17.540	0.045	14.850
30	17.545	0.050	14.845
35	17.545	0.050	14.845

40	17.550	0.055	14.840
45	17.555	0.060	14.835
50	17.560	0.065	14.830
55	17.565	0.070	14.825
60	17.565	0.070	14.825
70	17.570	0.075	14.820
80	17.570	0.075	14.820
90	17.570	0.075	14.820
100	17.580	0.085	14.810
120	17.580	0.085	14.810
140	17.580	0.085	14.810
160	17.585	0.090	14.805
180	17.585	0.090	14.805
200	17.590	0.095	14.800
250	17.590	0.095	14.800
301	17.595	0.100	14.795
350	17.600	0.105	14.790
400	17.605	0.110	14.785
450	17.610	0.115	14.780
500	17.600	0.105	14.790
550	17.610	0.115	14.780
600	17.610	0.115	14.780
650	17.620	0.125	14.770
700	17.625	0.130	14.765
750	17.615	0.120	14.775
800	17.630	0.135	14.760
850	17.630	0.135	14.760
900	17.635	0.140	14.755
950	17.640	0.145	14.750
1000	17.635	0.140	14.755
1050	17.645	0.150	14.745
1100	17.645	0.150	14.745
1151	17.640	0.145	14.750
1201	17.650	0.155	14.740
1251	17.650	0.155	14.740
1300	17.650	0.155	14.740
1351	17.645	0.150	14.745
1400	17.650	0.155	14.740
1440	17.650	0.155	14.740

LHP55:- 2008/09/09 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
9/09/2008	13:30	1	10000	0.85
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP55	Production	0	Loxton Sands	32.599
LHO74	Observation	21.65	Loxton Sands	32.907
LHP53	Observation	50.74	Loxton Sands	32.226
Note: Ref Elev may differ to final well details due to modification of well head				

LHP55 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	16.740	0.000	15.859		
1	17.840	1.100	14.759	0.85	0.77
2	18.100	1.360	14.499	0.85	0.62
3	18.180	1.440	14.419	0.85	0.59
6	18.270	1.530	14.329	0.85	0.56
7	18.320	1.580	14.279	0.85	0.54
10	18.400	1.660	14.199	0.85	0.51
11	18.420	1.680	14.179	0.85	0.51
12	18.450	1.710	14.149	0.85	0.50
14	18.480	1.740	14.119	0.85	0.49
18	18.520	1.780	14.079	0.85	0.48
20	18.520	1.780	14.079	0.85	0.48
22	18.540	1.800	14.059	0.85	0.47
26	18.530	1.790	14.069	0.85	0.47
28	18.550	1.810	14.049	0.85	0.47
30	18.565	1.825	14.034	0.85	0.47
35	18.600	1.860	13.999	0.85	0.46
40	18.620	1.880	13.979	0.85	0.45
45	18.620	1.880	13.979	0.85	0.45
50	18.640	1.900	13.959	0.85	0.45
55	18.640	1.900	13.959	0.85	0.45
60	18.670	1.930	13.929	0.85	0.44
72	18.680	1.940	13.919	0.85	0.44
84	18.720	1.980	13.879	0.85	0.43
94	18.740	2.000	13.859	0.85	0.43
103	18.740	2.000	13.859	0.85	0.43
121	18.770	2.030	13.829	0.85	0.42
142	18.790	2.050	13.809	0.85	0.41
162	18.790	2.050	13.809	0.85	0.41
181	18.810	2.070	13.789	0.85	0.41
200	18.820	2.080	13.779	0.85	0.41
220	18.815	2.075	13.784	0.85	0.41
270	18.835	2.095	13.764	0.85	0.41
460	18.890	2.150	13.709	0.85	0.40
1080	19.070	2.330	13.529	0.85	0.36
1500	19.100	2.360	13.499	0.85	0.36

Test extended to 10,000 minutes, logger data available to 8,668 minutes

LHO74 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.11	0.000	15.797
1	17.12	0.010	15.787
2	17.12	0.010	15.787
3	17.12	0.010	15.787
4	17.12	0.010	15.787
5	17.12	0.010	15.787
6	17.12	0.010	15.787
7	17.12	0.010	15.787
8	17.12	0.010	15.787
9	17.12	0.010	15.787
10	17.12	0.010	15.787
12	17.12	0.010	15.787
14	17.128	0.018	15.779
16	17.128	0.018	15.779
18	17.128	0.018	15.779
20	17.132	0.022	15.775
22	17.132	0.022	15.775
24	17.132	0.022	15.775
26	17.132	0.022	15.775
28	17.132	0.022	15.775
30	17.132	0.022	15.775
35	17.135	0.025	15.772
40	17.14	0.030	15.767
45	17.14	0.030	15.767
50	17.145	0.035	15.762
55	17.145	0.035	15.762
60	17.145	0.035	15.762
80	17.145	0.035	15.762
100	17.15	0.040	15.757
120	17.155	0.045	15.752
139	17.16	0.050	15.747
160	17.16	0.050	15.747
179	17.165	0.055	15.742
201	17.17	0.060	15.737
220	17.17	0.060	15.737
270	17.17	0.060	15.737
460	17.18	0.070	15.727
1080	17.195	0.085	15.712
1500	17.205	0.095	15.702

Test extended to 10,000 minutes, logger data available to 8,668 minutes

LHP53 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	16.780	0.000	15.446
15	16.770	-0.010	15.456
23	16.770	-0.010	15.456
32	16.770	-0.010	15.456
42	16.775	-0.005	15.451
52	16.770	-0.010	15.456
67	16.770	-0.010	15.456
82	16.770	-0.010	15.456
97	16.770	-0.010	15.456
120	16.778	-0.002	15.448
141	16.780	0.000	15.446
161	16.780	0.000	15.446
181	16.780	0.000	15.446
203	16.780	0.000	15.446
460	16.770	-0.010	15.456
1080	16.800	0.020	15.426
1500	16.800	0.020	15.426

Test extended to 10,000 minutes, logger data available to 8,668 minutes

LHP59:- 2008/06/22 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
22/06/2008	9:40	1	1440	1.30
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP59	Production	0	Loxton Sands	34.320
LHO77P	Observation	2	Pata Formation	34.530
LHO78	Observation	14.9	Loxton Sands	34.350
LHP57	Observation	50.65	Loxton Sands	33.310
Note: Ref Elev may differ to final well details due to modification of well head				

LHP59 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	17.770	0.000	16.550		
1	19.630	1.860	14.690	1.30	0.70
2	19.550	1.780	14.770	1.30	0.73
3	19.780	2.010	14.540	1.30	0.65
4	19.920	2.150	14.400	1.30	0.60
5	19.850	2.080	14.470	1.30	0.62
6	19.980	2.210	14.340	1.30	0.59
7	20.060	2.290	14.260	1.30	0.57
8	20.100	2.330	14.220	1.30	0.56
9	20.150	2.380	14.170	1.30	0.55
10	20.070	2.300	14.250	1.30	0.57
12	20.150	2.380	14.170	1.30	0.55
14	20.200	2.430	14.120	1.30	0.53
16	20.220	2.450	14.100	1.30	0.53
18	20.250	2.480	14.070	1.30	0.52
20	20.260	2.490	14.060	1.30	0.52
22	20.290	2.520	14.030	1.30	0.52
24	20.250	2.480	14.070	1.30	0.52
26	20.240	2.470	14.080	1.30	0.53
28	20.250	2.480	14.070	1.30	0.52
30	20.240	2.470	14.080	1.30	0.53
35	20.280	2.510	14.040	1.30	0.52
40	20.310	2.540	14.010	1.30	0.51
45	20.320	2.550	14.000	1.30	0.51
50	20.340	2.570	13.980	1.30	0.51
55	20.350	2.580	13.970	1.30	0.50
60	20.350	2.580	13.970	1.30	0.50
70	20.370	2.600	13.950	1.30	0.50
80	20.370	2.600	13.950	1.30	0.50
90	20.370	2.600	13.950	1.30	0.50
100	20.370	2.600	13.950	1.30	0.50
120	20.370	2.600	13.950	1.30	0.50
140	20.400	2.630	13.920	1.30	0.49
160	20.405	2.635	13.915	1.30	0.49
180	20.425	2.655	13.895	1.30	0.49
200	20.460	2.690	13.860	1.30	0.48
250	20.470	2.700	13.850	1.30	0.48
300	20.500	2.730	13.820	1.30	0.48

350	20.530	2.760	13.790	1.30	0.47
400	20.540	2.770	13.780	1.30	0.47
450	20.520	2.750	13.800	1.30	0.47
500	20.560	2.790	13.760	1.30	0.47
550	20.560	2.790	13.760	1.30	0.47
600	20.560	2.790	13.760	1.30	0.47
650	20.560	2.790	13.760	1.30	0.47
700	20.570	2.800	13.750	1.30	0.46
750	20.590	2.820	13.730	1.30	0.46
800	20.600	2.830	13.720	1.30	0.46
850	20.600	2.830	13.720	1.30	0.46
900	20.610	2.840	13.710	1.30	0.46
950	20.620	2.850	13.700	1.30	0.46
1000	20.620	2.850	13.700	1.30	0.46
1050	20.620	2.850	13.700	1.30	0.46
1100	20.620	2.850	13.700	1.30	0.46
1150	20.610	2.840	13.710	1.30	0.46
1200	20.620	2.850	13.700	1.30	0.46
1250	20.620	2.850	13.700	1.30	0.46
1300	20.660	2.890	13.660	1.30	0.45
1350	20.630	2.860	13.690	1.30	0.45
1400	20.645	2.875	13.675	1.30	0.45
1440	20.650	2.880	13.670	1.30	0.45

LHO77P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	19.370	0.000	15.160
11	19.370	0.000	15.160
21	19.370	0.000	15.160
31	19.370	0.000	15.160
41	19.365	-0.005	15.165
51	19.365	-0.005	15.165
61	19.365	-0.005	15.165
71	19.365	-0.005	15.165
81	19.365	-0.005	15.165
91	19.365	-0.005	15.165
121	19.360	-0.010	15.170
141	19.360	-0.010	15.170
161	19.360	-0.010	15.170
181	19.360	-0.010	15.170
201	19.355	-0.015	15.175
251	19.350	-0.020	15.180
300	19.350	-0.020	15.180
350	19.350	-0.020	15.180
400	19.350	-0.020	15.180
450	19.340	-0.030	15.190
500	19.340	-0.030	15.190
550	19.340	-0.030	15.190

600	19.340	-0.030	15.190
650	19.340	-0.030	15.190
700	19.330	-0.040	15.200
750	19.330	-0.040	15.200
800	19.330	-0.040	15.200
850	19.330	-0.040	15.200
900	19.330	-0.040	15.200
950	19.330	-0.040	15.200
1000	19.330	-0.040	15.200
1050	19.330	-0.040	15.200
1100	19.320	-0.050	15.210
1150	19.315	-0.055	15.215
1200	19.310	-0.060	15.220
1250	19.330	-0.040	15.200
1300	19.310	-0.060	15.220
1350	19.310	-0.060	15.220
1400	19.305	-0.065	15.225
1440	19.305	-0.065	15.225

LHO 78 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.770	0.000	16.580
1	17.770	0.000	16.580
2	17.770	0.000	16.580
3	17.770	0.000	16.580
4	17.780	0.010	16.570
5	17.780	0.010	16.570
6	17.780	0.010	16.570
7	17.790	0.020	16.560
8	17.790	0.020	16.560
9	17.790	0.020	16.560
10	17.800	0.030	16.550
12	17.800	0.030	16.550
14	17.800	0.030	16.550
16	17.800	0.030	16.550
18	17.810	0.040	16.540
20	17.810	0.040	16.540
22	17.810	0.040	16.540
24	17.810	0.040	16.540
26	17.810	0.040	16.540
28	17.815	0.045	16.535
30	17.815	0.045	16.535
35	17.820	0.050	16.530
40	17.820	0.050	16.530
45	17.820	0.050	16.530

50	17.820	0.050	16.530
55	17.820	0.050	16.530
60	17.820	0.050	16.530
70	17.825	0.055	16.525
80	17.825	0.055	16.525
90	17.825	0.055	16.525
100	17.825	0.055	16.525
120	17.820	0.050	16.530
140	17.820	0.050	16.530
160	17.820	0.050	16.530
180	17.825	0.055	16.525
200	17.825	0.055	16.525
252	17.830	0.060	16.520
301	17.835	0.065	16.515
351	17.840	0.070	16.510
401	17.840	0.070	16.510
451	17.840	0.070	16.510
501	17.845	0.075	16.505
551	17.850	0.080	16.500
601	17.850	0.080	16.500
651	17.850	0.080	16.500
701	17.845	0.075	16.505
751	17.850	0.080	16.500
801	17.855	0.085	16.495
851	17.855	0.085	16.495
901	17.850	0.080	16.500
950	17.850	0.080	16.500
1001	17.850	0.080	16.500
1051	17.850	0.080	16.500
1101	17.870	0.100	16.480
1151	17.860	0.090	16.490
1201	17.860	0.090	16.490
1251	17.860	0.090	16.490
1301	17.870	0.100	16.480
1351	17.870	0.100	16.480
1401	17.870	0.100	16.480
1440	17.870	0.100	16.480

LHP57 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.040	0.000	16.270
19	17.040	0.000	16.270
29	17.040	0.000	16.270
39	17.040	0.000	16.270
49	17.040	0.000	16.270

59	17.040	0.000	16.270
79	17.040	0.000	16.270
123	17.040	0.000	16.270
142	17.040	0.000	16.270
162	17.040	0.000	16.270
182	17.040	0.000	16.270
202	17.040	0.000	16.270
253	17.040	0.000	16.270
302	17.040	0.000	16.270
352	17.040	0.000	16.270
452	17.040	0.000	16.270
402	17.040	0.000	16.270
602	17.040	0.000	16.270
702	17.040	0.000	16.270
802	17.040	0.000	16.270
902	17.040	0.000	16.270
1002	17.040	0.000	16.270
1102	17.040	0.000	16.270
1202	17.040	0.000	16.270
1302	17.060	0.020	16.250
1402	17.070	0.030	16.240
1440	17.070	0.030	16.240

LHP61:- 2008/07/18 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
18/07/2008	09:00	1	1440	3.20
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP61	Production	0	Loxton Sands	32.670
LHO80	Observation	15.5	Loxton Sands	32.026
Note: Ref Elev may differ to final well details due to modification of well head				

LHP61 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	18.040	0.000	14.630		
1	19.480	1.440	13.190	3.20	2.22
2	19.670	1.630	13.000	3.20	1.96
3	19.830	1.790	12.840	3.20	1.79
4	19.960	1.920	12.710	3.20	1.67
5	19.910	1.870	12.760	3.20	1.71
6	19.900	1.860	12.770	3.20	1.72
7	19.910	1.870	12.760	3.20	1.71
8	19.910	1.870	12.760	3.20	1.71
9	19.920	1.880	12.750	3.20	1.70
10	19.940	1.900	12.730	3.20	1.68
12	19.950	1.910	12.720	3.20	1.68
14	19.970	1.930	12.700	3.20	1.66
16	19.990	1.950	12.680	3.20	1.64
18	20.000	1.960	12.670	3.20	1.63
20	20.020	1.980	12.650	3.20	1.62
22	20.040	2.000	12.630	3.20	1.60
24	20.050	2.010	12.620	3.20	1.59
26	20.050	2.010	12.620	3.20	1.59
28	20.060	2.020	12.610	3.20	1.58
30	20.050	2.010	12.620	3.20	1.59
35	20.080	2.040	12.590	3.20	1.57
40	20.100	2.060	12.570	3.20	1.55
45	20.120	2.080	12.550	3.20	1.54
50	20.140	2.100	12.530	3.20	1.52
55	20.150	2.110	12.520	3.20	1.52
60	20.160	2.120	12.510	3.20	1.51
70	20.180	2.140	12.490	3.20	1.50
80	20.200	2.160	12.470	3.20	1.48
90	20.230	2.190	12.440	3.20	1.46
100	20.250	2.210	12.420	3.20	1.45
120	20.270	2.230	12.400	3.20	1.43
140	20.280	2.240	12.390	3.20	1.43
160	20.300	2.260	12.370	3.20	1.42
180	20.330	2.290	12.340	3.20	1.40
200	20.350	2.310	12.320	3.20	1.39
250	20.400	2.360	12.270	3.20	1.36
300	20.440	2.400	12.230	3.20	1.33
350	20.500	2.460	12.170	3.20	1.30
400	20.540	2.500	12.130	3.20	1.28

450	20.570	2.530	12.100	3.20	1.26
500	20.620	2.580	12.050	3.20	1.24
550	20.640	2.600	12.030	3.20	1.23
600	20.690	2.650	11.980	3.20	1.21
650	20.730	2.690	11.940	3.20	1.19
700	20.750	2.710	11.920	3.20	1.18
750	20.780	2.740	11.890	3.20	1.17
800	20.820	2.780	11.850	3.20	1.15
850	20.850	2.810	11.820	3.20	1.14
900	20.880	2.840	11.790	3.20	1.13
950	20.900	2.860	11.770	3.20	1.12
1000	20.940	2.900	11.730	3.20	1.10
1050	20.940	2.900	11.730	3.20	1.10
1100	21.010	2.970	11.660	3.20	1.08
1150	21.020	2.980	11.650	3.20	1.07
1200	21.060	3.020	11.610	3.20	1.06
1250	21.100	3.060	11.570	3.20	1.05
1300	21.100	3.060	11.570	3.20	1.05
1350	21.120	3.080	11.550	3.20	1.04
1400	21.150	3.110	11.520	3.20	1.03
1440	21.160	3.120	11.510	3.20	1.03

LHO80 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.380	0.000	14.646
1	17.380	0.000	14.646
2	17.380	0.000	14.646
3	17.380	0.000	14.646
4	17.380	0.000	14.646
5	17.390	0.010	14.636
6	17.390	0.010	14.636
7	17.395	0.015	14.631
8	17.395	0.015	14.631
9	17.400	0.020	14.626
10	17.400	0.020	14.626
12	17.400	0.020	14.626
14	17.410	0.030	14.616
16	17.410	0.030	14.616
18	17.420	0.040	14.606
20	17.420	0.040	14.606
22	17.420	0.040	14.606
24	17.430	0.050	14.596
26	17.430	0.050	14.596
28	17.430	0.050	14.596
30	17.435	0.055	14.591
35	17.440	0.060	14.586
40	17.445	0.065	14.581
45	17.450	0.070	14.576

50	17.450	0.070	14.576
55	17.460	0.080	14.566
60	17.460	0.080	14.566
70	17.460	0.080	14.566
80	17.465	0.085	14.561
90	17.470	0.090	14.556
100	17.470	0.090	14.556
120	17.470	0.090	14.556
140	17.480	0.100	14.546
160	17.490	0.110	14.536
180	17.490	0.110	14.536
200	17.490	0.110	14.536
250	17.500	0.120	14.526
300	17.510	0.130	14.516
400	17.520	0.140	14.506
450	17.530	0.150	14.496
500	17.545	0.165	14.481
550	17.555	0.175	14.471
600	17.560	0.180	14.466
650	17.565	0.185	14.461
700	17.570	0.190	14.456
750	17.590	0.210	14.436
800	17.590	0.210	14.436
850	17.590	0.210	14.436
900	17.595	0.215	14.431
950	17.600	0.220	14.426
1000	17.600	0.220	14.426
1050	17.610	0.230	14.416
1100	17.610	0.230	14.416
1150	17.610	0.230	14.416
1200	17.620	0.240	14.406
1250	17.625	0.245	14.401
1300	17.630	0.250	14.396
1350	17.635	0.255	14.391
1400	17.640	0.260	14.386
1440	17.645	0.265	14.381

LHP62:- 2008/07/19 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
19/07/2008	10:00	1	2880	3.50
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP62	Production	0	Loxton Sands	32.370
LHO79	Observation	27.35	Loxton Sands	32.310
Note: Ref Elev may differ to final well details due to modification of well head				

LHP62 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	14.630	0.000	17.740		
1	17.620	2.990	14.750	3.50	1.17
2	18.150	3.520	14.220	3.50	0.99
3	18.280	3.650	14.090	3.50	0.96
4	18.180	3.550	14.190	3.50	0.99
5	18.140	3.510	14.230	3.50	1.00
6	18.140	3.510	14.230	3.50	1.00
7	18.120	3.490	14.250	3.50	1.00
8	18.130	3.500	14.240	3.50	1.00
9	18.140	3.510	14.230	3.50	1.00
10	18.140	3.510	14.230	3.50	1.00
12	18.150	3.520	14.220	3.50	0.99
14	18.160	3.530	14.210	3.50	0.99
16	18.170	3.540	14.200	3.50	0.99
18	18.160	3.530	14.210	3.50	0.99
20	18.170	3.540	14.200	3.50	0.99
22	18.165	3.535	14.205	3.50	0.99
24	18.190	3.560	14.180	3.50	0.98
26	18.200	3.570	14.170	3.50	0.98
28	18.200	3.570	14.170	3.50	0.98
30	18.200	3.570	14.170	3.50	0.98
35	18.200	3.570	14.170	3.50	0.98
40	18.180	3.550	14.190	3.50	0.99
45	18.200	3.570	14.170	3.50	0.98
50	18.210	3.580	14.160	3.50	0.98
55	18.200	3.570	14.170	3.50	0.98
60	18.210	3.580	14.160	3.50	0.98
70	18.190	3.560	14.180	3.50	0.98
80	18.200	3.570	14.170	3.50	0.98
90	18.210	3.580	14.160	3.50	0.98
100	18.210	3.580	14.160	3.50	0.98
120	18.210	3.580	14.160	3.50	0.98
140	18.210	3.580	14.160	3.50	0.98
160	18.215	3.585	14.155	3.50	0.98
180	18.220	3.590	14.150	3.50	0.97
200	18.220	3.590	14.150	3.50	0.97
250	18.220	3.590	14.150	3.50	0.97
300	18.240	3.610	14.130	3.50	0.97
350	18.260	3.630	14.110	3.50	0.96
400	18.270	3.640	14.100	3.50	0.96

450	18.280	3.650	14.090	3.50	0.96
500	18.250	3.620	14.120	3.50	0.97
550	18.250	3.620	14.120	3.50	0.97
600	18.260	3.630	14.110	3.50	0.96
650	18.270	3.640	14.100	3.50	0.96
700	18.270	3.640	14.100	3.50	0.96
750	18.280	3.650	14.090	3.50	0.96
800	18.290	3.660	14.080	3.50	0.96
850	18.270	3.640	14.100	3.50	0.96
900	18.280	3.650	14.090	3.50	0.96
950	18.290	3.660	14.080	3.50	0.96
1000	18.290	3.660	14.080	3.50	0.96
1050	18.290	3.660	14.080	3.50	0.96
1100	18.290	3.660	14.080	3.50	0.96
1150	18.280	3.650	14.090	3.50	0.96
1200	18.290	3.660	14.080	3.50	0.96
1250	18.300	3.670	14.070	3.50	0.95
1300	18.300	3.670	14.070	3.50	0.95
1350	18.290	3.660	14.080	3.50	0.96
1400	18.310	3.680	14.060	3.50	0.95
1450	18.320	3.690	14.050	3.50	0.95
1500	18.32	3.690	14.050	3.50	0.95
1550	18.32	3.690	14.050	3.50	0.95
1600	18.31	3.680	14.060	3.50	0.95
1650	18.29	3.660	14.080	3.50	0.96
1700	18.34	3.710	14.030	3.50	0.94
1750	18.34	3.710	14.030	3.50	0.94
1800	18.34	3.710	14.030	3.50	0.94
1850	18.34	3.710	14.030	3.50	0.94
1900	18.33	3.700	14.040	3.50	0.95
1950	18.35	3.720	14.020	3.50	0.94
2000	18.35	3.720	14.020	3.50	0.94
2050	18.33	3.700	14.040	3.50	0.95
2100	18.33	3.700	14.040	3.50	0.95
2150	18.33	3.700	14.040	3.50	0.95
2200	18.33	3.700	14.040	3.50	0.95
2250	18.34	3.710	14.030	3.50	0.94
2300	18.34	3.710	14.030	3.50	0.94
2350	18.36	3.730	14.010	3.50	0.94
2400	18.35	3.720	14.020	3.50	0.94
2450	18.35	3.720	14.020	3.50	0.94
2500	18.35	3.720	14.020	3.50	0.94
2550	18.35	3.720	14.020	3.50	0.94
2600	18.35	3.720	14.020	3.50	0.94
2650	18.35	3.720	14.020	3.50	0.94
2700	18.35	3.720	14.020	3.50	0.94
2750	18.35	3.720	14.020	3.50	0.94
2800	18.36	3.730	14.010	3.50	0.94
2850	18.36	3.730	14.010	3.50	0.94
2880	18.36	3.730	14.010	3.50	0.94

LHO79 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	14.650	0.000	17.660
1	14.535	-0.115	17.775
2	14.570	-0.080	17.740
3	14.580	-0.070	17.730
4	14.590	-0.060	17.720
5	14.600	-0.050	17.710
6	14.605	-0.045	17.705
7	14.610	-0.040	17.700
8	14.615	-0.035	17.695
9	14.620	-0.030	17.690
10	14.620	-0.030	17.690
12	14.625	-0.025	17.685
14	14.630	-0.020	17.680
16	14.635	-0.015	17.675
18	14.640	-0.010	17.670
20	14.640	-0.010	17.670
22	14.645	-0.005	17.665
24	14.650	0.000	17.660
26	14.650	0.000	17.660
28	14.650	0.000	17.660
30	14.650	0.000	17.660
35	14.660	0.010	17.650
40	14.660	0.010	17.650
45	14.665	0.015	17.645
50	14.670	0.020	17.640
55	14.670	0.020	17.640
60	14.675	0.025	17.635
70	14.675	0.025	17.635
80	14.680	0.030	17.630
90	14.675	0.025	17.635
100	14.680	0.030	17.630
120	14.680	0.030	17.630
140	14.685	0.035	17.625
160	14.685	0.035	17.625
180	14.690	0.040	17.620
200	14.695	0.045	17.615
250	14.700	0.050	17.610
300	14.705	0.055	17.605
350	14.710	0.060	17.600
400	14.715	0.065	17.595
450	14.720	0.070	17.590
500	14.725	0.075	17.585
550	14.730	0.080	17.580
600	14.750	0.100	17.560
650	14.740	0.090	17.570

700	14.750	0.100	17.560
750	14.750	0.100	17.560
800	14.750	0.100	17.560
850	14.760	0.110	17.550
900	14.760	0.110	17.550
950	14.770	0.120	17.540
1000	14.770	0.120	17.540
1050	14.770	0.120	17.540
1100	14.770	0.120	17.540
1150	14.770	0.120	17.540
1200	14.770	0.120	17.540
1250	14.775	0.125	17.535
1300	14.780	0.130	17.530
1350	14.780	0.130	17.530
1400	14.780	0.130	17.530
1500	14.785	0.135	17.525
1600	14.790	0.140	17.520
1700	14.795	0.145	17.515
1800	14.800	0.150	17.510
1900	14.810	0.160	17.500
2000	14.810	0.160	17.500
2100	14.820	0.170	17.490
2200	14.820	0.170	17.490
2300	14.825	0.175	17.485
2400	14.830	0.180	17.480
2500	14.830	0.180	17.480
2600	14.835	0.185	17.475
2700	14.840	0.190	17.470
2800	14.840	0.190	17.470
2880	14.840	0.190	17.470

LHP80:- 2010/03/20 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
20/03/2010	09:00	1	2880	0.30
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP80	Production	0	Loxton Sands	44.472
LHO95	Observation	27.35	Loxton Sands	43.701
Note: Ref Elev may differ to final well details due to modification of well head				

LHP62 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	26.64	0.000	17.832		
1	28.12	1.480	16.352	0.30	0.20
2	28.07	1.430	16.402	0.30	0.21
3	27.99	1.350	16.482	0.30	0.22
4	28.06	1.420	16.412	0.30	0.21
5	28.09	1.450	16.382	0.30	0.21
6	28.13	1.490	16.342	0.30	0.20
7	28.18	1.540	16.292	0.30	0.19
8	28.23	1.590	16.242	0.30	0.19
9	28.24	1.600	16.232	0.30	0.19
10	28.27	1.630	16.202	0.30	0.18
12	28.34	1.700	16.132	0.30	0.18
14	28.42	1.780	16.052	0.30	0.17
16	28.46	1.820	16.012	0.30	0.16
18	28.5	1.860	15.972	0.30	0.16
20	28.55	1.910	15.922	0.30	0.16
22	28.55	1.910	15.922	0.30	0.16
24	28.55	1.910	15.922	0.30	0.16
26	28.6	1.960	15.872	0.30	0.15
28	28.66	2.020	15.812	0.30	0.15
30	28.72	2.080	15.752	0.30	0.14
35	28.82	2.180	15.652	0.30	0.14
40	28.9	2.260	15.572	0.30	0.13
45	29.01	2.370	15.462	0.30	0.13
50	29.1	2.460	15.372	0.30	0.12
55	29.18	2.540	15.292	0.30	0.12
60	29.21	2.570	15.262	0.30	0.12
70	29.3	2.660	15.172	0.30	0.11
80	29.4	2.760	15.072	0.30	0.11
90	29.43	2.790	15.042	0.30	0.11
100	29.58	2.940	14.892	0.30	0.10
120	29.67	3.030	14.802	0.30	0.10
140	29.8	3.160	14.672	0.30	0.09
160	29.84	3.200	14.632	0.30	0.09
180	29.81	3.170	14.662	0.30	0.09
200	29.83	3.190	14.642	0.30	0.09
250	29.96	3.320	14.512	0.30	0.09
300	30.08	3.440	14.392	0.30	0.09
350	30.4	3.760	14.072	0.30	0.08
400	30.49	3.850	13.982	0.30	0.08

450	30.62	3.980	13.852	0.30	0.08
500	30.7	4.060	13.772	0.30	0.07
550	30.65	4.010	13.822	0.30	0.07
600	30.67	4.030	13.802	0.30	0.07
650	30.77	4.130	13.702	0.30	0.07
700	30.83	4.190	13.642	0.30	0.07
750	30.8	4.160	13.672	0.30	0.07
800	30.75	4.110	13.722	0.30	0.07
850	30.72	4.080	13.752	0.30	0.07
900	30.76	4.120	13.712	0.30	0.07
950	31.06	4.420	13.412	0.30	0.07
1000	31.01	4.370	13.462	0.30	0.07
1100	31.23	4.590	13.242	0.30	0.07
1200	31.22	4.580	13.252	0.30	0.07
1300	31.48	4.840	12.992	0.30	0.06
1400	32.3	5.660	12.172	0.30	0.05
1500	32.68	6.040	11.792	0.30	0.05
1600	32.77	6.130	11.702	0.30	0.05
1700	32.58	5.940	11.892	0.30	0.05
1800	32.01	5.370	12.462	0.30	0.06
1900	32	5.360	12.472	0.30	0.06
2000	32.23	5.590	12.242	0.30	0.05
2100	32.16	5.520	12.312	0.30	0.05
2200	32.44	5.800	12.032	0.30	0.05
2300	32.55	5.910	11.922	0.30	0.05
2400	32.82	6.180	11.652	0.30	0.05
2500	32.69	6.050	11.782	0.30	0.05
2600	32.78	6.140	11.692	0.30	0.05
2700	32.78	6.140	11.692	0.30	0.05
2800	32.8	6.160	11.672	0.30	0.05
2880	32.82	6.180	11.652	0.30	0.05

LHO95 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	25.94	0.000	17.761
9	25.94	0.000	17.761
22	25.94	0.000	17.761
56	25.94	0.000	17.761
82	25.94	0.000	17.761
181	25.94	0.000	17.761
301	25.93	-0.010	17.771
401	25.92	-0.020	17.781
601	25.93	-0.010	17.771
652	25.93	-0.010	17.771
751	25.95	0.010	17.751
852	25.92	-0.020	17.781
951	25.92	-0.020	17.781
1101	25.94	0.000	17.761
1201	25.95	0.010	17.751
1301	25.95	0.010	17.751
1403	25.96	0.020	17.741
1503	25.96	0.020	17.741
1603	25.94	0.000	17.761

1702	25.93	-0.010	17.771
1802	25.93	-0.010	17.771
1902	25.93	-0.010	17.771
2002	25.94	0.000	17.761
2101	25.95	0.010	17.751
2201	25.95	0.010	17.751
2301	25.96	0.020	17.741
2401	25.95	0.010	17.751
2501	25.96	0.020	17.741
2601	25.95	0.010	17.751
2701	25.95	0.010	17.751
2801	25.96	0.020	17.741
2881	25.96	0.020	17.741

LHP56P:- 2008/09/23 CONSTANT RATE DISCHARGE TEST

Start date	Start time	Step	Duration (minutes)	Q (L/s)
23/09/2008	12:50	1	10,000	0.50
Project No	Well Type	r (m)	Aquifer	Ref Elev. (mAHD)
LHP56P	Production	0	Pata Formation	32.310
LHO74	Observation	30.46	Loxton Sands	32.907
LHO73P	Observation	31.54	Pata Formation	32.430
LHO77P	Observation	76.99	Pata Formation	34.533
LHO76P	Observation	87.18	Pata Formation	32.700
LHO71P	Observation	132.82	Pata Formation	32.620
LHO83P	Observation	226.54	Pata Formation	16.815
LHO84P	Observation	226.5	Pata Formation	14.474
Note: Ref Elev may differ to final well details due to modification of well head				

LHP56P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)	Q (L/s)	SC ((L/s)/m)
0	18.292	0.000	14.018		
1	19.420	1.128	12.890	0.50	0.44
2	20.140	1.848	12.170	0.50	0.27
3	20.650	2.358	11.660	0.50	0.21
4	21.160	2.868	11.150	0.50	0.17
5	21.690	3.398	10.620	0.50	0.15
6	22.210	3.918	10.100	0.50	0.13
7	22.410	4.118	9.900	0.50	0.12
8	22.820	4.528	9.490	0.50	0.11
9	23.050	4.758	9.260	0.50	0.11
10	23.310	5.018	9.000	0.50	0.10
12	23.804	5.512	8.506	0.50	0.09
14	24.266	5.974	8.044	0.50	0.08
16	24.452	6.160	7.858	0.50	0.08
18	24.696	6.404	7.614	0.50	0.08
20	24.882	6.590	7.428	0.50	0.08
22	25.082	6.790	7.228	0.50	0.07
26	25.440	7.148	6.870	0.50	0.07
30	25.762	7.470	6.548	0.50	0.07
35	26.050	7.758	6.260	0.50	0.06
40	26.242	7.950	6.068	0.50	0.06
45	26.350	8.058	5.960	0.50	0.06
50	26.440	8.148	5.870	0.50	0.06
55	26.620	8.328	5.690	0.50	0.06
60	26.660	8.368	5.650	0.50	0.06
70	26.850	8.558	5.460	0.50	0.06
80	26.930	8.638	5.380	0.50	0.06
90	27.030	8.738	5.280	0.50	0.06
100	27.180	8.888	5.130	0.50	0.06
120	27.300	9.008	5.010	0.50	0.06
153	27.680	9.388	4.630	0.50	0.05
160	27.720	9.428	4.590	0.50	0.05
180	27.930	9.638	4.380	0.50	0.05
201	28.130	9.838	4.180	0.50	0.05

250	28.350	10.058	3.960	0.50	0.05
1140	29.500	11.208	2.810	0.50	0.04
2710	31.118	12.826	1.192	0.50	0.04
8470	30.760	12.468	1.550	0.50	0.04
9910	30.770	12.478	1.540	0.50	0.04

LHO74 MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	17.140	0.000	15.767
3	17.145	0.005	15.762
5	17.145	0.005	15.762
7	17.145	0.005	15.762
9	17.145	0.005	15.762
10	17.145	0.005	15.762
12	17.145	0.005	15.762
14	17.140	0.000	15.767
17	17.140	0.000	15.767
19	17.142	0.002	15.765
22	17.142	0.002	15.765
26	17.142	0.002	15.765
30	17.142	0.002	15.765
35	17.142	0.002	15.765
40	17.142	0.002	15.765
45	17.144	0.004	15.763
52	17.145	0.005	15.762
57	17.145	0.005	15.762
60	17.145	0.005	15.762
70	17.145	0.005	15.762
80	17.143	0.003	15.764
90	17.143	0.003	15.764
100	17.143	0.003	15.764
121	17.143	0.003	15.764
147	17.142	0.002	15.765
162	17.144	0.004	15.763
180	17.145	0.005	15.762
200	17.145	0.005	15.762
220	17.142	0.002	15.765
400	17.140	0.000	15.767
1140	17.140	0.000	15.767
2590	17.125	-0.015	15.782
8455	17.110	-0.030	15.797
9895	17.130	-0.010	15.777

LHO73P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)

0	18.090	0.000	14.340
1	18.100	0.010	14.330
3	18.100	0.010	14.330
4	18.100	0.010	14.330
5	18.100	0.010	14.330
6	18.100	0.010	14.330
7	18.110	0.020	14.320
8	18.115	0.025	14.315
9	18.120	0.030	14.310
10	18.130	0.040	14.300
12	18.150	0.060	14.280
14	18.170	0.080	14.260
16	18.210	0.120	14.220
18	18.250	0.160	14.180
20	18.285	0.195	14.145
22	18.330	0.240	14.100
26	18.410	0.320	14.020
29	18.470	0.380	13.960
30	18.490	0.400	13.940
35	18.590	0.500	13.840
40	18.690	0.600	13.740
45	18.790	0.700	13.640
51	18.900	0.810	13.530
55	18.965	0.875	13.465
60	19.040	0.950	13.390
70	19.190	1.100	13.240
80	19.320	1.230	13.110
90	19.420	1.330	13.010
100	19.540	1.450	12.890
122	19.700	1.610	12.730
148	19.890	1.800	12.540
161	19.980	1.890	12.450
180	20.085	1.995	12.345
200	20.205	2.115	12.225
220	20.420	2.330	12.010
1140	21.750	3.660	10.680
2590	22.350	4.260	10.080
8455	23.050	4.960	9.380
9895	23.100	5.010	9.330

LHO77P MANUAL DATA

Minutes	WL (m)	St (m)	Rwl (mAHD)
0	19.230	0.000	15.303
1	19.240	0.010	15.293
2	19.240	0.010	15.293
3	19.240	0.010	15.293

4	19.240	0.010	15.293
5	19.235	0.005	15.298
6	19.235	0.005	15.298
7	19.235	0.005	15.298
8	19.235	0.005	15.298
9	19.235	0.005	15.298
10	19.235	0.005	15.298
12	19.235	0.005	15.298
14	19.240	0.010	15.293
16	19.240	0.010	15.293
18	19.240	0.010	15.293
20	19.250	0.020	15.283
22	19.250	0.020	15.283
24	19.260	0.030	15.273
26	19.260	0.030	15.273
28	19.270	0.040	15.263
30	19.270	0.040	15.263
35	19.290	0.060	15.243
40	19.310	0.080	15.223
45	19.320	0.090	15.213
50	19.320	0.090	15.213
55	19.330	0.100	15.203
60	19.370	0.140	15.163
70	19.420	0.190	15.113
80	19.530	0.300	15.003
95	19.560	0.330	14.973
115	19.680	0.450	14.853
119	19.700	0.470	14.833
139	19.790	0.560	14.743
159	19.870	0.640	14.663
179	19.940	0.710	14.593
198	20.020	0.790	14.513
250	20.180	0.950	14.353
400	20.560	1.330	13.973
1140	21.360	2.130	13.173
2590	21.950	2.720	12.583
8455	22.640	3.410	11.893

E. GEOPHYSICAL LOGGING

Drillhole name	Geophysics			Televiewer	Caliper	HydroLab		
	Gamma	Neutron	Induction			Conductivity	Temp	pH
LHO70	-	-	-	-	Y	Y	Y	Y
LHO71P	-	-	-	-	-	-	-	-
LHO72P	-	-	-	-	-	-	-	-
LHO73P	Y	Y	-	-	-	-	-	-
LHO74	-	-	-	-	-	Y	Y	Y
LHO75	-	-	-	-	-	Y	Y	Y
LHO76P	Y	Y	-	-	-	-	-	-
LHO77P	-	-	-	-	-	-	-	-
LHO78	Y	Y	Y	-	-	Y	Y	Y
LHO79	Y	Y	Y	-	-	Y	Y	Y
LHO80	Y	Y	Y	-	-	Y	Y	Y
LHO81	Y	Y	Y	-	-	Y	Y	Y
LHO82	Y	Y	Y	-	-	Y	Y	Y
LHO83P	Y	Y	-	-	-	-	-	-
LHO84P	-	-	-	-	-	-	-	-
LHO85	-	-	-	-	-	-	-	-
LHO86	-	-	-	-	-	-	-	-
LHO87	Y	Y	-	-	-	-	-	-
LHO88	Y	Y	-	-	-	-	-	-
LHO89	Y	Y	-	-	-	-	-	-
LHO90	Y	Y	-	-	-	-	-	-
LHO91	Y	Y	-	-	-	-	-	-
LHO92	Y	Y	-	-	-	-	-	-
LHO93	Y	Y	-	-	-	-	-	-
LHO94	Y	Y	-	-	-	-	-	-
LHO95	Y	Y	Y	-	-	-	-	-
LHO96	Y	Y	Y	-	-	-	-	-
LHP50P	Y	Y	-	-	Y	-	-	-
LHP51	-	-	-	-	-	-	-	-
LHP52P	Y	Y	-	-	Y	-	-	-
LHP53	-	-	-	-	-	-	-	-
LHP54P	Y	Y	-	-	Y	Y	Y	Y

LHP55	-	-	-	-	-	-	-	-
LHP56P	**Y**	**Y**	-	-	**Y**	-	-	-
LHP57	-	-	-	-	-	-	-	-
LHP58P	**Y**	**Y**	-	-	**Y**	-	-	-
LHP59	-	-	-	-	-	-	-	-
LHP60P	**Y**	**Y**	-	-	**Y**	-	-	-
LHP61	-	-	-	-	-	-	-	-
LHP62	-	-	-	-	-	-	-	-
LHP63	**Y**	**Y**	-	**Y**	-	**Y**	**Y**	**Y**
LHP64	**Y**	**Y**	-	**Y**	-	**Y**	**Y**	**Y**
LHP65	**Y**	**Y**	-	**Y**	-	**Y**	**Y**	**Y**
LHP66	**Y**	**Y**	-	**Y**	-	**Y**	**Y**	**Y**
LHP67	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP68	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP69	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP70	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP71	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP72	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP73	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP74	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP75	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP76	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP77	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP78	**Y**	**Y**	-	**Y**	-	**Y**	**Y**	**Y**
LHP79	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP80	**Y**	**Y**	**Y**	**Y**	-	**Y**	**Y**	**Y**
LHP81	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LHP82	**Y**	**Y**	-	-	-	**Y**	**Y**	**Y**
LPW19	-	-	-	-	-	-	-	-
LPW19a	-	-	-	-	-	-	-	-

UNITS OF MEASUREMENT

Units of measurement commonly used (SI and non-SI Australian legal)

Name of unit	Symbol	Definition in terms of other metric units	Quantity
day	d	24 h	time interval
gigalitre	GL	10^6 m^3	volume
gram	g	10^{-3} kg	mass
hectare	ha	10^4 m^2	area
hour	h	60 min	time interval
kilogram	kg	base unit	mass
kilolitre	kL	1 m^3	volume
kilometre	km	10^3 m	length
litre	L	10^{-3} m^3	volume
megalitre	ML	10^3 m^3	volume
metre	m	base unit	length
microgram	µg	10^{-6} g	mass
microlitre	µL	10^{-9} m^3	volume
milligram	mg	10^{-3} g	mass
millilitre	mL	10^{-6} m^3	volume
millimetre	mm	10^{-3} m	length
minute	min	60 s	time interval
second	s	base unit	time interval
tonne	t	1000 kg	mass
year	y	365 or 366 days	time interval

Shortened forms

~	approximately equal to
bgs	below ground surface
EC	electrical conductivity (µS/cm)
K	hydraulic conductivity (m/d)
pH	acidity
pMC	percent of modern carbon
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
w/v	weight in volume
w/w	weight in weight

GLOSSARY

Aquiclude — In hydrologic terms, a formation that contains water but cannot transmit it rapidly enough to furnish a significant supply to a well or spring

Aquifer — An underground layer of rock or sediment that holds water and allows water to percolate through

Aquifer, confined — Aquifer in which the upper surface is impervious (see 'confining layer') and the water is held at greater than atmospheric pressure; water in a penetrating well will rise above the surface of the aquifer

Aquifer test — A hydrological test performed on a well, aimed to increase the understanding of the aquifer properties, including any interference between wells, and to more accurately estimate the sustainable use of the water resources available for development from the well

Aquifer, unconfined — Aquifer in which the upper surface has free connection to the ground surface and the water surface is at atmospheric pressure

Aquitard — A layer in the geological profile that separates two aquifers and restricts the flow between them

Confining layer — A rock unit impervious to water, which forms the upper bound of a confined aquifer; a body of impermeable material adjacent to an aquifer; see also 'aquifer, confined'

DFW — Department for Water (Government of South Australia)

DWLBC — Department of Water, Land and Biodiversity Conservation (Government of South Australia)

EC — Electrical conductivity; 1 EC unit = 1 micro-Siemen per centimetre (µS/cm) measured at 25°C; commonly used as a measure of water salinity as it is quicker and easier than measurement by TDS

Floodplain — Of a watercourse means: (1) floodplain (if any) of the watercourse identified in a catchment water management plan or a local water management plan; adopted under the Act; or (2) where (1) does not apply — the floodplain (if any) of the watercourse identified in a development plan under the *Development (SA) Act 1993*; or (3) where neither (1) nor (2) applies — the land adjoining the watercourse that is periodically subject to flooding from the watercourse

Fully-penetrating well — In theory this is a wellhole that is screened throughout the full thickness of the target aquifer; in practice, any screen that is open to at least the mid 80% of a confined aquifer is regarded as fully-penetrating

Groundwater — Water occurring naturally below ground level or water pumped, diverted and released into a well for storage underground; see also 'underground water'

Hydraulic conductivity (K) — A measure of the ease of flow through aquifer material: high K indicates low resistance, or high flow conditions; measured in metres per day

Hydrogeology — The study of groundwater, which includes its occurrence, recharge and discharge processes, and the properties of aquifers; see also 'hydrology'

Monitoring — (1) The repeated measurement of parameters to assess the current status and changes over time of the parameters measured (2) Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals, and other living things

Permeability — A measure of the ease with which water flows through an aquifer or aquitard, measured in m^2/d

Piezometer — A narrow tube, pipe or well; used for measuring moisture in soil, water levels in an aquifer, or pressure head in a tank, pipeline, etc

Potentiometric head — The potentiometric head or surface is the level to which water rises in a well due to water pressure in the aquifer, measured in metres (m); also known as piezometric surface

Production well — The pumped well in an aquifer test, as opposed to observation wells; a wide-hole well, fully developed and screened for water supply, drilled on the basis of previous exploration wells

GLOSSARY

SA Geodata — A collection of linked databases storing geological and hydrogeological data, which the public can access through the offices of PIRSA. Custodianship of data related to minerals and petroleum, and groundwater, is vested in PIRSA and DWLBC, respectively. DWLBC should be contacted for database extracts related to groundwater

SA Water — South Australian Water Corporation (Government of South Australia)

Specific storage (S_s) — Specific storativity; the amount of stored water realised from a unit volume of aquifer per unit decline in head; it is dimensionless

Specific yield (S_y) — The volume ratio of water that drains by gravity, to that of total volume of the porous medium. It is dimensionless

Well — (1) An opening in the ground excavated for the purpose of obtaining access to underground water. (2) An opening in the ground excavated for some other purpose but that gives access to underground water. (3) A natural opening in the ground that gives access to underground water

REFERENCES

Armstrong, D 2009, Numerical modeling of Loxton Highland Interception trials - Pata Formation pumping and Loxton Sands pumping. Lisdon Associates unpublished report, Adelaide.

Campbell R & Waterhouse J (2007), Design Review Loxton Groundwater Interception Scheme Murray-Darling Basin South Australia, Golder Associates.

Howles S & Smith A 2005, Loxton Salt Interception Scheme Aquifer Testing and Well Hydraulics, DWLBC Report 2005/20, Government of South Australia, through Department for Water, Adelaide.

Howles S, Smith A, Stadter M, Yan W & Hill, A 2007, Loxton Salt Interception Scheme Wellfield Design and Construction Report - Floodplain Component. DWLBC Report 2007/06, Government of South Australia, through Department for Water, Adelaide.

Smith A, Howles S 2008, Loxton Salt Interception Scheme Trial Horizontal Drainage Well: Well and Aquifer Response to Pumping, and Effectiveness in Intercepting Groundwater Flux Discharging to the River Murray. DWLBC Report 2008/06, Government of South Australia, through Department for Water, Adelaide.

Yan W, Howles S & Hill A 2004, Loxton Numerical Groundwater Model 2004. DWLBC Report 2005/16, Government of South Australia, through Department for Water, Adelaide.

Yan W, Howles S, Howe B, & Hill A 2005, Loxton-Bookpurnong Numerical Groundwater Model 2005. DWLBC Report 2005/17, Government of South Australia, through Department for Water, Adelaide.