Australasian
Groundwater & Environmental
Consultants Pty Ltd

REPORT on

HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT

AIRPORT LINK PROJECT

prepared for
SKM-CW JOINT VENTURE

Project Number G1312/C
May 2006

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REPORT ON

HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT

AIRPORT LINK PROJECT

1.0 INTRODUCTION

One aspect of the Queensland Government's South East Queensland Infrastructure Plan and Program and Brisbane City Council's Transport Plan and Trans Apex is construction of a road to connect the northern Brisbane arterial roads with the Inner City Bypass (ICB) and the proposed North South Bypass Tunnel (NSBT). The project is termed Airport Link (APL) and is referred to in this document as the "Project". Phase 1 of the project feasibility study was completed in October 2005 and identified a preferred study corridor with the southern portion being aligned on Lutwyche Road and with northern connections to Gympie Road near Kedron Brook and the East-West Arterial Road at Toombul. The majority of the roadway is proposed to be through tunnels however some sections of viaduct are possible. A locality plan showing the study area is presented in Drawing No. 1.

Construction of the Project has the potential to impact the hydrogeological regime of the area in that groundwater levels may be permanently lowered from their existing levels in areas where the Project tunnel is untanked (unlined). The lowering of the groundwater levels may lead to settlement in areas of compressive soils, mobilisation of contaminated groundwater towards the tunnel, and reduction in available water for groundwater dependent ecosystems. Groundwater flowing into the tunnel will also need to be pumped with potential environmental impacts dependent upon the groundwater quality and disposal method. This report describes the existing state of knowledge of the hydrogeological regime of the area along the study corridor and assesses the potential hydrogeologically based environmental impacts resulting from the construction of the Project. The assessment has been based on historical and BCC data, which were evaluated to develop an appreciation of the groundwater regime prior to significant development and the impacts of development leading to the current status of the groundwater regime, and the study corridor as at May 2006.

This report was prepared by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) at the request of the SKM-CW Joint Venture on behalf of their client, Brisbane City Council.

2.0 TERMS OF REFERENCE

The Terms of Reference (TOR) for the APL Environment Impact Statement (EIS) were finalised by the Queensland Co-ordinator General in March 2006. Section 5.2 of the TOR covers groundwater related issues and is as follows:

5.2 Groundwater Quality

5.2.1 Description of Existing Environment

The EIS should review the significance of groundwater in the Project area, including current authorised users, together with groundwater use in neighbouring areas. The depth to groundwater and flow direction should be identified. All groundwater facilities within the influence of the Project should be recorded.

The groundwater assessment should take into account the findings of the acid sulfate soils assessments as per Section 5.1.2.

The environmental values of the groundwater should be described in terms of:

- *values identified in the Environmental Protection (Water) Policy;*
- *sustainability, including both quality and quantity; and*
- *physical integrity, fluvial processes and morphology of groundwater resources.*

5.2.2 Potential Impacts and Mitigation Measures

The EIS should include an assessment of the potential for environmental impact to be caused by the Project to any affected groundwater resources.

The impact assessment should consider the impacts of the Project on groundwater resources, define the extent of the potential area within which groundwater resources are likely to be affected, and the significance of the Project to groundwater depletion or recharge. The assessment should take into account the potential impact of the Project on any affected groundwater regime caused by the altered porosity and permeability of any land disturbance. The assessment should also identify any groundwater-dependent ecosystems. Management options available to monitor and mitigate these effects should be provided.

Investigations of the potential for draw-down on known and potentially contaminated groundwater and, if relevant, the identification of measures to manage significant contaminant migration to adjacent previously uncontaminated sites generated by identified draw-down should be carried out.

This report serves to address Sections 5.2.1 and 5.2.2 of the EIS TOR providing the description of the existing hydrogeological environment, an assessment of the potential impacts and provision of appropriate mitigation measures

These requirements are addressed in this report using data obtained from historical sources, previous tunnelling work in Brisbane, the geotechnical drilling undertaken for the Project as well as

data obtained through review of the Queensland Department of Natural Resources, Mines and Water (NRMW) reports and records.

3.0 DESCRIPTION OF EXISTING ENVIRONMENT

The following description of the existing hydrogeological environment is based upon factual data obtained from public sources including:

- Brisbane City Council (BCC);
- Queensland Department of Natural Resources, Mines and Water; and
- Bureau of Meteorology (BoM).

The review of the hydrogeological aspects of the study corridor encompasses the following facets:

- site physiography;
- historical factors;
- aquifers (distribution, hydraulic parameters, water levels);
- water quality;
- groundwater users;
- groundwater contaminant sources.

3.1 Site Physiography

3.1.1 Drainage and Topography

The area traversed by the APL is situated in the inner northern suburbs of Brisbane, in particular, Windsor, Lutwyche and Wooloowin. The topography of the area consists of generally undulating terrain with minor surface catchments between hills which comprise parts of the main catchments of Enoggera Creek and Kedron Brook. The topography of the area is shown on Drawing No. 2 and described below.

- the southern end of the study corridor is within the catchment of Enoggera Creek and, in the area of the Project, drains most of Windsor and the southern parts of Lutwyche and Wooloowin. The topographic catchment divide is the ridge line corresponding approximately to Maygar Street, Windsor and Chalk Street, Wooloowin.

- the northern catchment encompasses the majority of Lutwyche and Wooloowin as well as the northern parts of Clayfield and drains to Kedron Brook. The locality of Kalinga, part of Wooloowin is contained within this catchment. The study corridor intersects Kedron Brook in the area of Gympie Road, however, is south of the creek through the Wooloowin/Clayfield area until the connection with the East-West Arterial Road.

3.1.2 Rainfall and Evaporation

The Brisbane area is characterised by a sub-tropical climate. Rainfall can be received in any month; however, there is a predominance of rainfall throughout the summer months. Monthly rainfall and pan evaporation data are presented in Table 1. Mean annual rainfall is 1146.4mm (145 years) and mean pan evaporation is 4.2mm/day or 1533mm/annum.

Table 1: CLIMATE DATA – BRISBANE REGIONAL OFFICE STATION 040214

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
Average Monthly Rainfall (mm)	159.6	158.3	140.7	92.5	73.7	67.8	56.5	45.9	45.7	75.4	97.0	133.3	1146
Average Daily Pan Evaporation (mm)	5.6	5.0	4.5	3.7	2.6	2.3	2.3	3.2	4.2	4.8	5.5	6.3	1533

3.2 Historical Impacts on the Groundwater Regime

Development of the inner northern suburbs of Brisbane in the later portion of the 19th century was limited to relatively large, and at the time, rural blocks. It is beyond the scope of this report to discuss the urban development of Brisbane; however, it appears from a review of historical maps that development in the form of subdivision of the initial large lots spread slowly north of Enoggera Creek and was initially centred upon major roads such as Gympie Road and the railway stations of the area. By the early part of the 20th century most of the area contained within the study corridor, that is, bounded to the north by Kedron Brook and to the south by Enoggera Creek was reasonably heavily populated.

Unlike the central area of Brisbane, few surface water drainage pathways appear to have existed and required filling or lining with stormwater drains. Within the study corridor there appears to be only two areas where this has occurred. The first, and relatively minor, drainage system that was filled/lined is associated with the small valley that drains the Windsor area through Somerset Street to Enoggera Creek. A small creek in this area was filled and lined with a brick drain.

The major drainage works in the area were undertaken to line and cover a creek that originated in the vicinity of Kent Road and Kedron Park Road and meandered, via a series of water holes, to a swampy area north of Junction Road before discharging to Kedron Brook near Sandgate Road. The location of this creek is evident in Department of Public Roads maps published in 1907 (Drawing No. 3). At present this creek is an open drain from Melrose Park in Wooloowin to Kedron Brook and it is believed that lining of the creek was undertaken in the mid 1920's. This conclusion is based on a very poor reproduction of engineering drawings for the proposed works dated 19 August 1922 (BCC Plans C_7_276 and C_7_276/2) which show the route of the drain upstream of Melrose Park and the profile of the open drain below the pipe outfall. The drain itself ranges in diameter up to 2.6m (8' 6") and has a number of branches draining the area bounded by Chalk Street, the North-Coast railway line and Lutwyche Road.

It is without doubt, that although the construction of drains and the lining of this watercourse have been undertaken as a surface water control measure, that the shallow groundwaters contained within the alluvium of the creek will also have been impacted. It is unknown if the creek was perennial, however, based on the Department of Public Lands map (Drawing No. 3) of the area, it

appears likely that this was the case. Flow in the creek would have been maintained by spring discharge most likely associated with discharge from the adjacent Brisbane Tuff.

The springs which maintained flow in the creek are groundwater discharge points generally associated with water emanating from joints, fractures, unconformities or other rock defects, and were sustained by a hydraulic head of water associated with groundwater mounds that formed under the topographically higher ridgeline areas. Recharge to the system occurred by direct infiltration of rainfall assisted by trees where decayed roots form pipes for infiltrating water. The clearing of tree cover in the catchment and the construction of buildings, pavements, roadways and stormwater drains as discussed above, will have significantly reduced recharge resulting in a lowering of the water table, and as a result groundwater discharge to the watercourse or drain will have diminished or ceased.

In addition to the probable zone of spring discharge discussed above, NRMW records indicate a possible spring-fed pond on the grounds of the current Holy Cross School at Chalk Street in Wooloowin. NRMW files dating from 1958 have records of a site inspection by a departmental hydrogeologist at the suggestion of the local MP. The inspecting departmental officer noted the presence of an excavation with built-up banks and a standing water level approximately equal to ground surface. It was concluded that, due the position of the site relative to the Brisbane Tuff to the west (on Lutwyche Road) and the indications that the pond was spring fed from the tuff through the overlying Ipswich Coal Measures (cf Aspley Formation) that the prospects of a viable production bore were good. A bore depth of approximately 30m (~100') was recommended, however, it is unknown if drilling of the bore was ever undertaken.

The NRMW files and existing groundwater users are discussed in more detail in Section 3.6; however, reference is made on occasion to the presence of a number of bores tapping the alluvial sand and gravels of the Kalinga area. A well known drilling contractor (Mr. Schells) was based in Wooloowin in the period from the 1950's and is likely to have drilled bores in the area.

Although only limited data are available, it appears that some degree of impact on the groundwater resources of the area has occurred, either though construction of drains or through small scale groundwater extraction. There is unlikely to be significant groundwater extraction (if at all any) occurring in the area of the study corridor and as such at present the current level of impact is considered to be limited to the construction of drains etc and the reduction in recharge and hence groundwater levels resulting from urbanisation.

3.3 Aquifers

3.3.1 Overview

The hydrogeological regime of the APL study corridor comprises two broad aquifer types, viz:

- a fractured rock aquifer system of either the Brisbane Tuff, Neranleigh-Fernvale Beds, Tingalpa Formation or Aspley Formation;
- isolated Quaternary alluvial systems associated with the valleys of Enoggera Creek and Kedron Brook.

A portion of the current Brisbane 1:100,000 scale geological map covering the study corridor is presented in Drawing No. 4. As a further reference the earlier geological map published in 1965 is shown on Drawing No. 5. The geology of the area is not well understood and there are areas in

which the geological boundaries, particularly between the Tingalpa/Aspley Formations and the Brisbane Tuff are uncertain. This is due to the fact that there are a very limited number of exposures of either Tingalpa or the Aspley Formations to assist with field mapping. The geological maps presented in Drawing Nos. 4 and 5 should thus be taken as indicative, to be improved during the geotechnical drilling program being undertaken for the project.

A number of geotechnical boreholes have been drilled within the study corridor and immediate area either directly for the APL project or for the previous, broader TransApex study[1, 2]. These boreholes are supplemented by 10 boreholes drilled in the study corridor adjacent to Enoggera Creek as part of the NSBT investigation. From a groundwater perspective, the NSBT geotechnical investigation incorporated a rigorous hydrogeological component comprising packer testing, monitoring bore construction, water level measurement and groundwater sampling. These data, although from outside study corridor, can be used to supplement the information obtained from the boreholes drilled specifically for APL.

The boreholes have been drilled to obtain geotechnical information, however, in the majority of boreholes, in-situ permeability testing in the form of packer or lugeon tests, were undertaken. Standpipe monitoring bores or vibrating wire piezometers have been installed in most holes and on occasion at multiple levels at the same site in order to provide groundwater levels within each geological unit. These tests and data provide valuable information on the variability of the permeability of each rock unit present along the alignment.

A summary of the geotechnical drilling and hydrogeologically focussed testing program undertaken for the APL project and the portion of the TransApex project with the area is presented in Appendix A, and the locations of these boreholes relative to the position of the APL study corridor are shown on Drawing No. 6. This drawing also shows the location of the NSBT boreholes within the corridor.

With the exception of the alluvium, the geological units through which the Project tunnels will be excavated may be regarded as typical fractured rock aquifers and contain essentially no primary porosity. Groundwater flow is through secondary features such as joints and fractures and along bedding planes. On a localised scale, permeability will depend upon the number and aperture of fractures/ joints and can vary over a number of orders of magnitude. There has been debate as to how hydraulic conductivity in fractured rock aquifers varies with the scale of investigation. Cook (2003)[3] provides the following insight into the issue of scale and hydraulic conductivity with regards to fractured rock aquifers:

> *"Consider a system of evenly spaced, identical fractures. Clearly, at very small scales the hydraulic conductivity varies between that of the matrix, K_m, and that of the fractures, K_f. However, when measurements are made at scales much larger than the fracture spacing, then the variability of hydraulic conductivity will be greatly reduced. At these scales, each measurement will return a value equal to the aquifer hydraulic conductivity. The scale beyond which the hydraulic conductivity approaches a constant value is referred to as the representative elementary volume (REV). However, when fractures are*

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[1] Brisbane City Business, (Nov. 2004), *"Major Projects Infrastructure Office, TransApex Project, Preliminary Geotechnical Investigation, Airport Link,"* Ref. CD/T3-G1/041863-PR003Act.

[2] Brisbane City Business, (Nov. 2005), *"Major Projects Infrastructure Office, Airport Link, Stage 2 Geotechnical Investigation, Geotechnical Data Report,",* Ref. CD/G1-060012-PR0013Act.

[3] Peter G. Cook, CSIRO Land and Water, Glen Osmond, Australia *"A Guide to Regional Groundwater Flow in Fractured Rock Aquifers" (2003)*

not evenly spaced and identical, then it is no longer clear that an REV exists. A number of people have argued that the hydraulic conductivity continues to increase as the scale of investigation increases because the probability of intersecting larger fractures increases. The basis of this proposition is that aquifers comprise a large number of very small fractures and a small number of large fractures. However, others have argued that above a certain scale of measurement, permeability begins to decrease with increasing scale, as fracture connectivity is reduced. This proposed decrease in conductivity at large scales is a consequence of fractures having finite lengths. The maximum hydraulic conductivity occurs at the scale that is just great enough for a single large cluster of fractures to form that spans the entire network (Renshaw, 1998)."

The issue of scale and the overall hydraulic conductivity needs to be taken into account when assessing the potential hydraulic conductivity for each of the geological units within the study corridor. An indication of the potential variability in permeability can be obtained through review of the hydraulic conductivity testing undertaken for this and nearby projects. Varying degrees of hydraulic testing has been undertaken in each aquifer unit and these are discussed in detail in the following sections.

Each of the geological units along the study corridor is described below in terms of their hydrogeological characteristics.

3.3.2 Neranleigh-Fernvale Beds

The Devonian – Carboniferous Age Neranleigh-Fernvale Beds underlie the entire study corridor. In their treatise of the geology of Brisbane, Willmott and Stevens (1992)[4] describe the unit as "hard chiefly meta-sedimentary rocks, now folded and steeply inclined".

Within the study corridor, the Neranleigh-Fernvale Beds only outcrop on the western boundary and it is possible that interaction with the Project tunnels will only be minor. The Neranleigh-Fernvale Beds can be described as an aquifer of very low to low permeability. Packer (Lugeon) testing[5] during previous geotechnical investigations yielded mixed results, however, the majority of tests suggested that the rock is of very low permeability. A summary of the results obtained from successful tests undertaken during the S1 Sewer Tunnel, NSBT and APL geotechnical investigations is presented below in Table 2. The specific details relating to each test are presented in Appendix A.

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[4] Warwick Willmott and Neville Stevens, (1992), *"Rocks and Landscapes of Brisbane and Ipswich".*

[5] Packer or lugeon testing is a geotechnical engineering method of determining the transmissivity or permeability of rock during drilling operations. The tests are undertaken by isolating a length of the drill hole (usually about 6m) and measuring the volume of water accepted by the test section at a number of different pressures. The test results are reported in lugeon units which are defined as the number of litres lost to the formation per minute per metre length of test section at an effective pressure of 1000kPa. One lugeon is approximately equivalent to a mass permeability of 1 x 10^{-7}m/s. As rock is almost permeable, the test results represent the number of openings and continuity of rock defects. In general terms, the results can be readily evaluated as:

Lugeon Value	Permeability
<1	low
1 to 5	moderate
5 to 20	high
20 to 50	very high
>50	extremely high

Table 2: NERANLEIGH-FERNVALE BEDS PACKER TEST RESULTS						
Project	**Number of Tests**	**Lugeon Permeability (uL)**				
		uL<1	*1< uL <5*	*5<uL<20*	*20<uL<50*	*uL>50*
S1 Sewer Tunnel	50	21	16	9	3	1
NSBT	71	52	12	5	2	0
APL	13	10	1	2	0	0

It can be seen that despite the majority of the results reporting a lugeon permeability of <5uL, there are isolated areas of higher permeability. It is likely that these higher permeability zones are associated with areas of localised fracturing rather than being indicative of broad areas of high permeability. For further evidence of the potential for high permeability, notice should be taken of the results from the in-situ no-fines concrete test work undertaken as part of the NSBT investigations[6]. In this test, a water bore was drilled into the Neranleigh-Fernvale Beds beneath the Storey Bridge and groundwater drawn through a core of no-fines concrete for a period of approximately 75 days in an attempt to assess the interactions between the concrete and groundwater. The test site was selected somewhat at random yet yielded a pumping rate of about $20m^3$/day. Whilst this flow is low from a water supply perspective, it may be regarded as being quite high from a geological unit that is not regarded as an aquifer.

Testing undertaken throughout the APL investigations have supported the conclusion that the Neranleigh-Fernvale Beds are of low hydraulic conductivity with most of the tests recording negligible water loss.

3.3.3 Brisbane Tuff

The Brisbane Tuff originated as high velocity, very hot ash flows emanating from volcanic events to the north of Brisbane. Upon cessation of flow, the ash was still of sufficient temperature that its own weight compacted and "welded" it to a very hard rock, termed welded tuff or ignimbrite. The tuff is most evident in outcrop at the Kangaroo Point cliffs where significant historical quarrying has been undertaken.

Willmot and Stevens (1992)[4] describe the welded tuff or ignimbrite as:

> *"cream, pink, mauve or green, hard, very fine-grained rock, with visible crystals of clear quartz and white feldspar. Can be confused with a rhyolite lava, but contains flattened fragments of pumice, angular pieces of older rocks such as Bunya Phyllite and greenstone, and rare fragments of wood from overwhelmed trees (now converted to charcoal or replaced by silica). The varied colours are probably caused by traces or iron and manganese compounds; most become brown on exposure due to oxidation in the air.*
>
> *The ignimbrite has been used as a building stone around Brisbane under the old name "porphyry", which means any fine-grained rock containing larger crystals. There are also some thin beds of soft air-fall tuff and shale within the unit".*

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[6] Australasian Groundwater and Environmental Consultants Pty Ltd, (Nov. 2005), *"Report on In-Situ No-Fines Concrete Testing, North-South Bypass Tunnel",* prepared for Brisbane City Council, Project No. G1300/A.

A brecciated zone is also generally present at the unconformity between the welded tuff and Neranleigh-Fernvale Beds. Conjecture exists as to the mode of formation of the breccia however inspection of drill core samples indicates that it is comprised of fragments of Neranleigh-Fernvale rocks in a welded tuff matrix. Hydrogeologically, the brecciated zone appears to be very similar in nature to the overlying welded tuff.

Packer testing in the tuff was undertaken as part of the S1 Sewer Tunnel investigation (23 tests) and a further 61 tests have been undertaken for the NSBT geotechnical study. The packer test data indicates the variably permeable nature of the rock with test results ranging from negligible water loss (41 tests) to instances in which water losses were so great that no test could be completed. Of interest is borehole BCC125 drilled near the Valley Municipal Baths which recorded a permeability value of 125 lugeon units. The drill core shows a 20mm joint within the test interval and it is assumed that this was the reason for the high water losses. A zone of high permeability tuff was intersected in borehole NST34 which was drilled at the corner of Water and Miserton Streets in Fortitude Valley. Difficulty in maintaining pump pressure was experienced in three tests undertaken in this hole, suggesting a significant zone of fracturing and high permeability.

It appears from the packer testing that the bulk permeability of the deeper tuff may be at least twice that of the Neranleigh-Fernvale Beds. This conclusion is based on somewhat limited data, however, the variability apparent in this data suggests that there is a high probability of intersecting a permeable joint/fracture in the tuff during tunnelling. On the positive front, volumes of groundwater actually stored within an intersected joint system are considered to be low and groundwater inflows from individual joints would be expected to diminish relatively quickly as the groundwater held in storage is drained.

As for the Neranleigh-Fernvale Beds, inspection of the core in rock and in outcrop indicates that the rock has effectively no primary porosity and any groundwater movement will be through secondary features such as joints or fractures.

Packer testing in the tuff has also been undertaken for the APL geotechnical investigation. The results of the packer testing undertaken for the three projects are summarised below in Table 3.

Table 3: BRISBANE TUFF PACKER TEST RESULTS

Project	Number of Tests	Lugeon Permeability (uL)				
		uL<1	*1< uL <5*	*5<uL<20*	*20<uL<50*	*uL>50*
S1 Sewer Tunnel	23	8	6	3	2	4
NSBT	61	33	11	5	5	7
APL	24	14	4	3	0	3

For the tests have been undertaken in the Tuff within the study corridor, it is clear that a similar level of variability is evident within this area to that observed on the NSBT or S1 alignments, although it appears that in places the rock has the occasional large fractures with a resultant “extremely high” permeability without the intermediate “high” permeability range.

A detailed summary of the packer testing results from each investigation is presented in Appendix A.

3.3.4 Aspley and Tingalpa Formations

The Aspley Formation unconformably overlies the Brisbane Tuff and Neranleigh-Fernvale Beds east of the study corridor and the majority of the portion north-east of about Kedron Park Road (Drawing No. 4). The position of the unconformity is of great importance to the tunnel engineers and has been investigated as part of the geotechnical drilling program.

The unit is of Triassic age and consists of sandstone, conglomerate and minor shale. Drilling undertaken as part of the APL geotechnical investigation indicates that the unit is reasonably massive conglomerate and sandstone with occasional fractured zones. As discussed above, the primary porosity is considered to be essentially zero and the permeability of the rock will be governed by the number of fractures and the degree to which fracture zones are interconnected.

The Tingalpa Formation is the youngest of the consolidated geological units within the study corridor. Its extent within the corridor is limited to the eastern portions of the study corridor. It conformably overlies the Aspley Formation and comprises variable siltstones, shales and thin coal seams indicative of a more mature depositional environment. The conformity between the two geological units is generally easily identified in drill holes by the change in lithology from fine grained to coarse grained sedimentary rocks.

A small coal mine was established on the northern side of Kedron Brook in the very early 1900's following identification of a 1.2m (4') coal seam outcropping in the creek bank. Historical reports held by NRMW provide valuable details on the geological aspects of the area; however, do not contain any references to groundwater related issues. There are no reports of excessive groundwater inflows to the workings suggesting that groundwater inflow was low and the rocks (including the coal seam) are of low permeability. The Nundah Coal Mine is reported in a number of NRMW (then Mines Department) publications however, the most complete description of the mine was written in 1930 by A.K. Denmead[7], some 21 years after extraction of coal ceased. Relevant extractions of this report are prescribed below:

> *<u>Situation:</u> The property lies in portion 349, Parish of Nundah, at a distance of one quarter of a mile westerly from the Toombul railway station, 4 miles from Brisbane.*
>
> *<u>Historical:</u> In the first few years of this century a 4 ft. seam of coal outcropping on the left bank of Kedron Brook, not far from Nundah, attracted considerable attention, not so much because of the quality of the coal (the seam having several dirty bands) but rather on account of its proximity to the metropolis and because it pointed to the possibility of further seams occurring in the vicinity. A company was formed and a tunnel was driven on the outcrop for a distance of 800 ft. Later a second tunnel was opened up not far from the first.*
>
> *In 1907, according to the Annual Report of the Under Secretary for Mines, 100 tons of coal valued at £30 were raised. In the following year the Company produced 1,500 tones valued at £375. The output for 1909 was 133 tons (£40). Work ceased in this year due to the low price received for the coal (5s. to 6s. per ton) combined with the high cost of working the faulted seam.*
>
> *Two prospecting bores were sunk in the vicinity. The former according to E.O. Marks (Annual Report Mines Department 1910, p.191) put down in portion 355, about half a mile north-east of the outcrop, passed through 69 ft. of basalt between 41 ft. and 110 ft. At 223 ft. the strata were highly inclined and boring was discontinued.*

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[7] Denmead, A.K., (1930), *"Nundah Coal, Clay and Gravel Property with Plan and Section".*

The second bore was sunk in portion 353, quarter of a mile north of the outcrop, to a depth of 377 ft. At 145 ft. a 4 ft, 9 inch seam of coal was passed through lying immediately beneath 8 ft. of gravel. Between 164 ft. and 262 ft. several small unworkable seams were met with. Below 262 ft. no coal was recorded. The bore, which in some respects were unsatisfactory, at least showed that in this vicinity only one workable seam, viz. that which outcrops in portion 349, occurs reasonably close to the surface.*

Recently the owner of the property, Mr. Gardner has let the seam on tribute to a small party. It is proposed to crosscut on the seam from just inside the entrance of No. 2 tunnel. Work has already commenced and several tons of coal have been raised. A measured section on the working face showed three feet, ten inches of coal including three dirty bands each about one inch thick as well as a very thin band of "splint".

Geological Note: The clays, gravels, sandstones &c. outcropping on the property belong to the Ipswich freshwater Series.

The fossils recorded by Dr. A.B. Walkom from the property are Equisetites rotiferum (?), Tenison Woods; Stachyopitys annularioides, Shirley; Thinnfeldia odontopteroides (Morris); Taeniopteris tension-woodsi, Etheridge Jr.; Taeniopteris carruthersi, Tenison-Woods.

The general strike is about 100° east of north and the dip is N. 10° E. at about 8°. Both strike and dip suffer dislocation owing to the faulting which is rather prevalent at this locality. The faults which have been observed on the quarry face strike obliquely to the strike of the beds, but with one exception their direction cannot be measured. Their downthrow is in every case to the north-north-west, thus constituting a series of step faults. A study of the Brisbane City Council's quarry a short distance up the creek shows a continuation of these conditions. Generally the faults are vertical or nearly so. Those which are not vertical strike to the north-north-west. The smallest fault observed has a throw of 4 ft. and the greatest (in the Council quarry) of 30 ft.

E.O. Marks who had access to the workings noted eight faults along No. 2 tunnel. These had a strike direction east-north-east and west-south-west, with a downthrow to the north-north-west.

The beds lie on the south-western limit of a syncline. They disappear to the north-east under more recent formations (Tertiary basalts, alluvium, &c.) and appear again at Sandgate, where they are rather disturbed and have a general dip to the south-west. Thus a very considerable area to the north and north-east of Nundah is possibly coal-bearing and as Marks (op.cit.) mentioned in 1910 "it is remarkable that further effort has not been made to prospect measures so advantageously situated for shipping purposes".

Eighteen packer tests have been undertaken within the Tingalpa and Aspley Formations within the study corridor, although one test failed. The results of the tests undertaken are summarised below in Table 4 and specific details of each test are presented in Appendix A.

Table 4: TINGALPA/ASPLEY FORMATIONS PACKER TEST RESULTS

Project	Number of Tests	Lugeon Permeability (uL)				
		uL<1	1< uL <5	5<uL<20	20<uL<50	uL>50

APL	17	11	4	2	0	0

The results of the testing indicate that the Formations are generally of low permeability. Two tests yielded results greater than 5uL however these results are considered possibly anomalous and may not be representative of the Formations.

3.3.5 Quaternary Alluvium

There are two main areas of alluvium along the study corridor and are associated with Enoggera Creek and Kedron Brook respectively. A small area of alluvium is also present in the vicinity of Somerset Street in Windsor as part of the lower portions of the drainage of the Windsor area. Drilling data indicate that the alluvium is variable, containing deposits of clay, silt, sand and gravel.

The alluvium associated with the major creeks is expected to be quite thick in the central portions of the respective creek alignments, thinning rapidly as the ground surface rises away from the creeks. Drilling at NST61, located on the northern side of Enoggera Creek intersected 21.5m of alluvium over Brisbane Tuff, indicating that the valley is deeply incised. Groundwater levels in a monitoring bore established in this hole range between 1.17mAHD and 1.43mAHD, suggesting that the alluvial groundwater in that area is in hydraulic connection with the tidal creek.

The APL study corridor splits just south of Kedron Brook to accommodate one roadway linking with Gympie Road at or near to the Stafford Road intersection and the second roadway heading eastwards to the East-West Arterial Road at Toombul. There is thus potential for the Quaternary alluvium to interact with the roadway/tunnel in two portions of Kedron Brook. The first being in the Gympie Road area and the second as the Project tunnels are aligned sub-parallel with the creek in the area from Gympie Road to the East-West Arterial Road.

A number of boreholes have been drilled in this area to assess the nature and thickness of the alluvium and the properties of the underlying rock. Borehole NST2-13, intersected 9m of predominately sand and gravel alluvium and NST2-15 intersected approximately 6.8m of similar material whilst NST2-16 terminated at 4.07m depth in extremely weathered tuff. Borehole APL07 located west of the above TransApex holes intersected a similar alluvial profile to that observed at NST2-16 which is overlying Brisbane Tuff at a depth of 4m.

The alluvium appears to extend to the east to the intersection with the East-West Arterial Road and the presence of quite thick sequences of sand and gravel appear to be pervasive. Each borehole intersected a significant thickness of alluvium and at each it comprised a proportion of sand and gravel. A summary of the geotechnical boreholes in relation to the thickness and type of alluvium intersected is presented in Table 5. The locations of the boreholes are presented on Drawing No. 6.

Table 5: DETAILS OF ALLUVIUM - KEDRON BROOK AREA

Borehole	Easting (BCSG02)	Northing (BCGS02)	Collar Level (mAHD)	Total Depth (m)	Base of Alluvium (mbGL)	Alluvium Details
NST2-11	55450.00	165302.00	4.20	30.07	11.3	very soft to firm clays and loose to medium basal gravels

NST2-11A	55188.00	165312.00	9.00	28.67	21.5	loose to dense sands and gravels, firm to very stiff clays
NST2-12	55814.00	165272.00	5.00	8.63	6.2	dense to very dense gravelly sand and clayey gravel
NST2-13	53953.00	165175.00	9.80	14.95	8.8	loose sands over loose to medium gravels
NST2-15	53711.00	165100.00	7.20	13.00	6.8	loose sands and gravels
NST2-16	53785.00	165200.00	7.00	4.07	2.0	firm to stiff clay
NST2-17	53304.00	165057.00	16.50	16.50	13.5	medium dense to dense sands and gravels
NST2-19	56079.00	165163.00	4.00	11.79	11.2	medium dense sands and very stiff sandy and gravelly clays
NST2-20	56266.00	165127.00	4.00	23.50	16.1	medium to dense sands and gravels and very stiff clays
APL04	55376.12	165282.27	4.18	31.93	10.5	silty clay, clay and gravelly clay
APL05	55575.16	165324.24	4.17	23.70	11.2	very soft to firm clays and loose to medium basal gravels
APL06	53921.72	164763.64	14.87	41.20	4.1	clay and silty sand
APL07	53533.87	164941.53	7.81	35.66	4.1	loose sands and gravels
APL16	53142.22	162861.50	6.84	53.51	8.0	sandy clay and silty clay, some sand and gravel bands
APL24	53434.74	164998.27	13.75	15.02	10.8	sands and gravels, some clayey sand
APL25D	53825.68	164932.95	10.61	18.99	15.5	clayey sand and gravel
APL28	54098.97	165234.18	14.06	41.43	17.3	silty clay, sandy clay and clay
APL29	54160.24	165399.00	13.60	20.00	16.9	clay and clayey sand with clayey sandy gravel at depth
APL30	54309.65	165286.35	12.92	54.00	15.6	sandy clay/clayey sand with some gravel bands
APL31	54537.59	165352.17	11.83	40.00	23.6	gravelly sand and sandy clay
APL32D	54614.38	165471.27	12.28	20.00	23.7	sandy clay/clay sand with thick intervals of clayey gravel
APL33	54789.08	165332.39	10.40	53.38	12.8	clay with sand, gravel and silt
APL34	55014.05	165406.85	10.53	30.00	17.85	clayey sand and clayey gravel
APL40	53648.42	164845.66	12.00	14.78	19.9	sandy/silty clay underlain by clayey sand and gravel

This sequence supports information obtained from a drilling program undertaken in the early 1950's for the North Kedron Brook Sewer Tunnel which traverses the area. Two Department of Mines (now NRMW) memorandums dated 20 May 1954 and 23 October 1956 described the history of the tunnel excavation including aspects of the geology and engineering geology. Copies of these memoranda are presented in Appendix B and include a portion of the geological long section of the sewer tunnel route which shows regular intersections of water bearing sands and gravels. The salient points of each memoranda in relation to groundwater occurrence within the Kedron Brook/Kalinga area are:

- the alluvium grades from clay at surface to gravel at depth;
- test bore No. 24 in Kalinga Park intersected 15.7m (51' 6") of alluvium;
- work on the tunnel shafts in Kalinga Park suggested a hydraulic connection with Kedron Brook;
- at Shaft 43, situated in Kalinga Park, groundwater inflow was measured at 68m^3/day (15,000gpd);

- the most difficult section of tunnelling was beneath Shultz Canal, Kedron Brook and Kalinga Park and eventually tunnelling in this area was abandoned in favour of open-cut methods;
- the behaviour of the alluvium during tunnelling was variable with clays below the water table acting as “squeezing ground” with the greatest difficulty experienced with water bearing sand and gravel horizons.

In terms of the APL Project tunnel construction and potential impacts, these deep sections of water bearing alluvium have a number of potential implications, viz:

- geotechnical issues related to the stability of any excavation;
- the potential for settlement of unconsolidated sediments as a result of dewatering of the alluvial gravels/sands;
- reduction in baseflow in Kedron Brook due to temporary or permanent groundwater extraction from the tunnel;
- migration of contaminated groundwater to the tunnel excavation;
- reduction in available water to groundwater dependent plants as a result of temporary/ permanent lowering of the groundwater table.

3.4 Groundwater Levels

Groundwater level data within the study corridor are available from standpipe monitoring bores and vibrating wire piezometers (VWP) installed in geotechnical bores drilled for the APL Project and in the northern parts of the NSBT project area. The locations of these facilities are presented in Drawing No. 6 and the details regarding each are contained in the geotechnical summary table included in Appendix A.

Groundwater monitoring has been undertaken on a monthly basis since October 2005. A total of 7 rounds of water levels measurements have been undertaken since October 2005 as follows:

Round 1	-	24-26 October 2005
Round 2	-	25 November 2005
Round 3	-	22 December 2005
Round 4	-	19-20 January 2006
Round 5	-	15-16 & 24 February 2006
Round 6	-	30 March 2006
Round 7	-	8 May 2006

The groundwater monitoring network has gradually expanded since monitoring commenced as the geotechnical drilling program has progressed. Since February 2006, the monthly monitoring has included measurement of groundwater levels in a total of 16 standpipe monitoring bores, 8 open uncased boreholes and 7 boreholes equipped with VWP. Installation of standpipes in the open uncased boreholes is pending.

The vibrating wire piezometers are designed to measure pore pressures and are grouted into the boreholes with a cement/bentonite mix. The vibrating wire sensors use un-vented cables and therefore measure barometric pressure as well as water pressure.

Data loggers for continual electronic measurement of groundwater levels were installed in 4 of the seven bores equipped with VWP (APL03, APL05, APL08, APL28). Since installation, an accumulation of condensation in the humid summer months has resulted in the failure of the electronics in APL03 and APL08. Silica gel has been installed in the remaining data loggers in an attempt to remove excess moisture.

At eight locations (APL04, APL05, APL07, APL08, APL 25, APL28, APL32 and APL34) twin facilities have been installed in order to assess both the variability in water quality and/or hydraulic head in different geological units.

The results of the water level monitoring undertaken between October 2004 and May 2005 are presented Appendix C. Hydrographs for selected monitoring bores are also included in Appendix C.

The groundwater level data indicates that the potentiometric surface is a subdued reflection of the surface topography. Groundwater flows from areas of higher elevation down-gradient towards the creeks and drainage channels which are discharge zones. In the southern areas of the study corridor, groundwater flows from elevated areas in Windsor/Lutwyche, in a generally southerly direction and discharges into Breakfast Creek which is tidal. In the northern areas of the study corridor, groundwater flows from hills in elevated areas of Windsor/Lutwyche and Hamilton, in a generally northerly direction and discharges into Kedron Brook. On the northern side of Kedron Brook groundwater flows is in a southerly direction into the creek.

As the network of monitoring bores installed as part of the geotechnical investigation follow the proposed alignment of the tunnel, and are not evenly spread across the topographic catchments it is difficult to draw groundwater contours. However groundwater contours produced by numerical modelling are presented in Section 5.1.1 and Drawing No. 15.

The boreholes of most interest are those in which water level data have been collected from two geological units. At sites APL04, APL05, APL07 and APL25 the piezometric levels in the underlying formations are greater than those in the shallow strata which indicates that upward groundwater flow is occurring. These sites are located on the alluvial plain of Kalinga/Wooloowin and it may thus be expected that the upward flow of groundwater is recharging the alluvial sediments and contributing to the baseflow in Kedron Brook. The monitoring bore installed at site APL07D is artesian and the water level has been measured as being between 0.3m and 0.5m above ground level.

At elevated areas such as at APL03 and APL08 the processes governing the groundwater flow are not as clear. The groundwater level monitoring at site APL03 consists of two VWP's installed in the Aspley Formation and underlying Brisbane Tuff. At this site the data indicates that groundwater flow is upwards from the tuff to the Aspley Formation which is consistent with the presence of springs thought to exist in the area (Section 3.3.5). The reverse situation exists at the site of APL08 where the groundwater flow direction is apparently from the shallower Tingalpa Formation to the Brisbane Tuff. The piezometric level recorded in the Brisbane Tuff at APL08D of approximately 12.4mAHD is some 6.5m below that at the nearby APL03D monitoring site and this difference is somewhat concerning as it is expected that the respective piezometric levels should be similar. It is considered that there may be some other factor influencing the observed behaviour at APL08D such as malfunctioning equipment or a nearby (unknown) bore.

3.5 Groundwater Quality

Groundwater quality data within the study corridor are limited to samples collected as part of the on-going geotechnical investigation for the project. As discussed above, five stages of geotechnical drilling have been undertaken to date, being the TransApex drilling program and Stages 1 to 4 of the APL investigation.

A total of sixteen (16) standpipe monitoring bores have been installed at thirteen (13) sites for the purpose of obtaining groundwater samples from the Quaternary alluvium or underlying rock. The standpipes are supplemented by standpipes constructed in the Enoggera Creek alluvium as part of the NSBT geotechnical investigation.

Collection of groundwater samples has been undertaken progressively as the monitoring bore network expands. To date two, or in some case three samples have been collected from each monitoring bore. Installation of casing in several boreholes drilled during the Stage 3 geotechnical program is still pending and therefore collection of groundwater quality samples from these boreholes is yet to be undertaken.

Sampling at each site has been undertaken in a similar manner with each monitoring bore developed with a pneumatic pump until a hydraulic connection was established and fresh groundwater was being extracted. Stabilisation of the field parameters of electrical conductivity and pH was used to determine when fresh groundwater was being extracted. Following development, the groundwater in each of the monitoring bores was allowed to stabilise for a period of up to 24 hours before samples were collected using a discrete interval sampling device. This device was used to collect groundwater samples from the lower portions of the boreholes in order to provide data relating to the corrosion potential of the groundwaters. The samples were collected in laboratory supplied bottles and submitted to the BCC Scientific Services laboratory for analysis. Prior to collection, the samples for metal analyses were filtered with a 45μm filter before acidification. Each sample was analysed for a standard suite of cations/anions and metals as well as for volatile and semi-volatile organic compounds (VOCs/SVOCs). When the VOCs/SVOCs analyses reported concentrations below the level of laboratory detection, they were omitted from the analysis suite for subsequent rounds of testing.

The results of the water sampling are summarised in Appendix D with the laboratory certificates presented in Appendix D.

As the bores were completed in a variety of geological units, there is a marked difference in water quality within the study corridor. Electrical conductivity (EC), which is a measure of salinity, is probably the most appropriate and readily understood method of assessing the water quality variability within the area. Drawing No. 8 which shows the tunnel corridor on a basemap of the 1:100,000 geological map, presents the EC measured in each standpipe monitoring bore. Table 6 presents a summary of the available pH and Total Dissolved Solids (TDS) data for each geological formation.

Table 6: SUMMARY OF APL GROUNDWATER QUALITY

Aquifer	No Monitoring Bores	pH		Total Dissolved Solids (TDS) mg/L	
		Range	Median	Range	Median
Alluvial	6	5.89 - 7.90	6.63	540 - 3819	1063
Brisbane Tuff	5	4.34 – 7.14	6.76	293 - 1717	805

Neranleigh Fernvale Beds	1	6.49 - 7.98	6.90	334 - 368	354
Tingalpa Formation	4	5.91 – 7.89	7.00	161 - 1042	480

It can be seen from the available data that water quality within the study corridor is quite variable. In terms of water quality from specific geological units at present there is only a single monitoring bore constructed in the Neranleigh-Fernvale Beds and the data should therefore not be taken as being representative of this unit.

The data indicates that groundwater quality in the alluvial aquifer is the most variable with TDS data indicating fresh (540mg/L – APL25S) to brackish (3819mg/L – APL02) quality. The observed water quality in the alluvial monitoring bores adjacent to Kedron Brook, that is, APL04S, APL05S and APL07S show that the salinity of the alluvium groundwater in the area is between 747mg/L and 2652mg/L. It is expected that this water quality results from mixing of recharge rainfall and upwelling groundwater from underlying aquifers. This supposition is supported by upward hydraulic gradients in the area of Kedron Brook (refer Section 3.4).

Groundwater in the Brisbane Tuff is fresh to slightly brackish ranging from 293mg/L to 1717mg/L. The TDS data for monitoring bores installed in the Tingalpa formation indicates a generally fresh water quality.

Concentrations of iron are variable in the data set. The highest concentrations were detected in the alluvial aquifer at 31.84mg/L with slightly lower maximum concentrations recorded in the Tingalpa Formation (16.96mg/L) and Brisbane Tuff (3.08mg/L).

As discussed, a number of boreholes drilled as part of the NSBT geotechnical investigation are located within the defined project area and are shown on Drawing No. 6. Standpipe monitoring bores have been constructed in three of the boreholes located in the Enoggera Creek alluvium. Groundwater samples were collected from these monitoring bores in August 2005 and the results are summarised below in Table 7.

Table 7: NSBT AREA GROUNDWATER QUALITY

Bore ID		NST57	NST59	NST61
Aquifer		Alluvium	Alluvium	Alluvium
Sampling Date		22/8/05	18/8/05	18/8/05
pH		7.6	7.7	7.8
Electrical Conductivity	(μS/cm)	9700	1300	5700
Total Dissolved Solids	(mg/L)	6730	780	3620
Calcium	(mg/L)	200	20	40
Magnesium	(mg/L)	140	8.6	79
Sodium	(mg/L)	1400	270	1000
Potassium	(mg/L)	30	5.3	59
Chloride	(mg/L)	3200	42	1200
Sulphate	(mg/L)	34	230	33
Total Alkalinity	(mg/L)	860	360	1400
Bicarbonate	(mg/L)	860	360	1400
Carbonate Alkalinity	(mg/L)	3	2	8
Free CO_2	(mg/L)	45	14	46
Aggressive CO_2	(mg/L)	<1.0	<1.0	<1.0
Dissolved sulfide	(mg/L)	<0.1	<0.1	<0.1
Ammonia	(mg/L)	2.7	0.3	14

Table 7: NSBT AREA GROUNDWATER QUALITY				
Nitrate	(mg/L)	0.018	<0.01	0.015
Ortho Phosphorus	(mg/L)	0.011	0.038	0.18
Aluminium	(mg/L)	0.02	0.031	0.018
Barium	(mg/L)	0.34	0.032	0.053
Cadmium	(mg/L)	<0.001	<0.001	<0.001
Chromium	(mg/L)	<0.001	<0.001	0.002
Copper	(mg/L)	<0.002	0.002	<0.002
Iron	(mg/L)	2.4	1.3	3.8
Manganese	(mg/L)	3.7	0.049	0.76
Nickel	(mg/L)	0.016	0.015	0.006
Lead	(mg/L)	<0.005	<0.005	<0.005
Zinc	(mg/L)	0.039	0.04	0.055

In addition to the above data, an extensive program of groundwater sampling has been undertaken for the NSBT investigations at monitoring bores constructed in alluvium. The Tingalpa Formation, Brisbane Tuff and Neranleigh-Fernvale Beds, whilst not within the APL corridor provide a further basis for defining the expected groundwater quality within the APL project area. As discussed, electrical conductivity is a readily useable method of assessing the various qualities. The ranges observed to date, within the NSBT project area are:

Alluvium	:	230μS/cm - 9700μS/cm	Typically ~3000μS/cm
Tingalpa Formation	:	3460μS/cm – 6000μS/cm	
Brisbane Tuff	:	320μS/cm – 10,700μS/cm	Typically ~3500μS/cm
Neranleigh Fernvale Beds	:	1300μS/cm – 44,660μS/cm	

Only a small number of standpipes were constructed in the Neranleigh-Fernvale Beds and the majority of these were at sites adjacent to the Brisbane River and as such the observed water quality reflects this river water quality. A typical EC for groundwater derived Neranleigh-Fernvale Beds is in the 5000μS/cm range.

The corrosion potential of the groundwater within the study corridor has been assessed by Professor Brian Cherry of Monash University and the results presented below in Table 8. An analysis of groundwater quality data for additional monitoring bores has been undertaken by Professor Brian Cherry and will be presented in future reports.

Table 8: CORROSION ANALYSIS												
Borehole	**APL01**	**APL01**	**APL02**	**APL02**	**APL04D**	**APL04S**	**APL05S**	**APL06**	**APL07D**	**APL07S**	**APL09**	**NST2-17**
Sample Date	18/08/2005	26/10/2005	18/08/2005	26/10/2005	26/10/2005	26/10/2005	26/10/2005	27/10/2005	26/10/2005	26/10/2005	26/10/2005	27/10/2005
Aquifer	Neranleigh-Fernvale Beds	Neranleigh-Fernvale Beds	Tuff	Tuff	Tingalpa Formation	Alluvium	Alluvium	Tuff	Tuff	Alluvium	Tuff	Tuff
pH	8.0	6.5	7.9	7.3	5.9	6.8	6.7	7.8	6.8	6.6	6.8	6.6
TDS	368	354	3,520	3,820	430	810	1,170	1,040	1,050	893	757	1,600
Ca^{2+} (mg/L)	5.2	8.7	110.0	90.0	18	4.6	30.0	45	50	42	27	13
Total Alk (mg/L $CaCO_3$)	131.0	100.0	370.0	360.0	140	310	480.0	260	180	150	140	160
pHs	**8.8**	**8.7**	**7.0**	**7.1**	**8.2**	**8.4**	**7.4**	**7.5**	**7.6**	**7.8**	**8.0**	**8.3**
Cl-(mg/L)	110	130	2,200	2,200	61	69	62	500	510	460	410	840
SO4--(mg/L)	31	28	270	240	18	11	360	10	44	40	23	47
$[Cl^-] + [2SO_4^{2-}]$ (mol/m^3)	**4**	**4**	**68**	**67**	**2**	**2**	**9**	**14**	**15**	**14**	**12**	**25**
L.S.I	**-0.8**	**-2.2**	**0.9**	**0.2**	**-2.3**	**-1.6**	**-0.7**	**0.3**	**-0.8**	**-1.2**	**-1.2**	**-1.7**
Aggressivity to concrete	Mild	V. Strong	Depositing	Depositing	V. Strong	Strong	Mild	Depositing	Mild	Strong	Strong	Strong
Aggressivity to steel	Low	Low	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Medium

The tendency for the groundwater to attack steel or concrete structures is expressed in terms of Langlier Saturation Index (LSI) which is a calculation based on the relative concentrations of calcium, chloride and sulphate ions and the alkalinity of the water. An LSI value of less than 0 indicates that the water has potential to attack concrete whilst a value greater than 0 suggests that the groundwater will precipitate calcium carbonate and potentially clog concrete drainage systems.

3.6 Groundwater Users

A review of the NRMW groundwater database was undertaken to ascertain the nature and number of registered groundwater facilities within an area likely to be impacted by the Project. Groundwater facilities include such constructions as water bores, wells and groundwater interception trenches, and generally encompass any infrastructure constructed to allow extraction of groundwater. The search encompassed the area bounded by 153° 00' 00"E, 27° 24' 00"S and 153° 05' 00"E, 27° 28' 00"S. The search found fourteen registered sites, all bores, within the above area. The locations of these sites are shown on Drawing No. 9. It can be seen that only one bore (RN73993) is located within the study corridor.

The lack of registered groundwater facilities is not at all unexpected. From a water supply perspective, the study area and the surrounding area may be regarded as possessing very low groundwater resource potential and hence the number of bores or wells historically constructed would have been low.

Prior to commencement of the current legislation governing groundwater licences, that is, the Water Act (2000), reporting requirements for groundwater facilities was limited to "declared" or "proclaimed" groundwater areas. These encompassed parts of Queensland in which groundwater was considered as a valuable or important resource and by way of example, included North Stradbroke Island and the Great Artesian Basin. In these areas, facility owners were required to report specific factual details of each facility such as location, stratigraphy, construction details, water quality etc. This requirement was for all facilities including domestic or stock water supplies as well as for industrial usage such as feedlots. This depended to some extent on the hydrogeology etc. of the area, as many areas only required the major users to be licensed. The majority of Brisbane is generally regarded as possessing low groundwater potential and as such the area was not declared and reporting requirements were not mandatory. In the undeclared groundwater areas, drilling contractors must now record all data relating to a bore and submit a copy of the information to NRMW within 30 days. In time this will greatly expand the groundwater knowledge base within Queensland, particularly in areas that were not previously declared.

A summary of the fourteen bores within the general area of the Project is presented below in Table 9. Details of bore RN73993 and the majority of the remaining bores in the search area are presented in Appendix E. For some bores data was not collected and therefore information on the NRMW database is limited to locations. The general lack of data associated with bores in the Brisbane area is evident in the fact that information relating to lithology and bore construction is sparse.

Table 9: NRMW REGISTERED BORES							
Registered Number	**Easting (BCSG02)**	**Northing (BCSG02)**	**Lot**	**Plan**	**Field Location**	**Owner**	**Bore Details**
11	57525	163593	2	RP33616	Eagle Farm Racecourse	Eagle Farm Racecourse	Drilled: 1889, Depth: 544.38m, abandoned
73990	54696	162670	1	RP33562	5/1034 Crosby Road, Albion	Brothers Rugby Club	no details
73992	55520	163963	3	RP75060	40 Liverpool Rd, Clayfield		EC: 648uS/cm (1962)
73993	55604	165071	9	RP33852	1 Nellie Street, Clayfield		EC: 14,770uS/cm (1961)
79064	55960	163716	2	RP146544	24 Palm Avenue, Ascot		Drilled: 1958, Depth: 32.0m
79069	57525	163623	2	RP33616	32 Hampden Street, Ascot	Doomben Racecourse	Depth: 543.2, possibly same hole as RN11
79233	55603	162578	8	RP47013	122 Crescent Road, Hamilton		EC: 950uS/cm (1989)
79236	52582	166457	25	RP41460	7 East Street, Kedron		EC: 3900uS/cm (1989)
120457	53735	162455	4	RP152644	71 Legeyt Street, Windsor	Neilsers Concrete Pty Ltd	Drilled: 2003, Depth: 29.0m, EC: 15000uS/cm
120559	57170	165655	130	SP139826	Nudgee Road, Hendra		Drilled: 2004, Depth: 2.6m, Landfill Monitoring Bore
120560	57307	165624	134	SP139826	Nudgee Road, Hendra		Drilled: 2004, Depth: 3.5m, Landfill Monitoring Bore
120561	57142	165717	36	SL5077	574 Nudgee Road, Hendra		Drilled: 2004, Depth: 8.0m, Landfill Monitoring Bore
120593	56235	163409	6	RP866929	230 Lancaster Road, Ascot		Drilled: 2003, Depth: 22.5m, EC: 220uS/cm
120594	56235	163439	6	RP866929	230 Lancaster Road, Ascot		Drilled: 2003, Depth: 25.0m, EC: 220uS/cm

Despite the previous absence of a regulatory requirement for drilling contractors or landholders to submit details of bores to NRMW, the Department regularly provided extension services to people desiring to construct a bore on their property. A review of NRMW files was undertaken as part of this assessment and showed that in the period since the late 1940's numerous requests were made to NRMW officers by residents of the inner northern suburbs regarding the groundwater potential in their area. In general the advice was negative citing potentially low bore yields and elevated salinities and recommending that drilling not be attempted. As discussed above, there was no requirement to report results of drilling and in most cases it is unknown if the proposed bore was constructed and used. On occasions the files contain water quality results and these have been used to assign a bore identification number (registered number) to a particular bore which has enabled the hole to be included in the NRMW Groundwater Database.

The most interesting borehole in the area is the well known bore at the Eagle Farm Racecourse (RN11) which was drilled in 1889 to a depth of 543m (1781') and produced a flow of 0.43L/s (8232gsd). The bore interested shales and sandstones before penetrating 24m (80') of Tuff and terminated in schist. A 1.5m (5') section of coal was intersected between 241.1m and 242.6m (791' to 796') below ground level. The salinity of the water in the bore was measured as 113.4 grains per gallon which equates to 1944mg/L, and is in the range observed elsewhere in the area. The NRMW bore card presented in Appendix E reports that the casing was withdrawn upon completion of drilling and the bore collapsed.

A drained or unlined tunnel constructed below the water table has the potential to intercept and hence remove groundwater and by strict definition could be regarded as a groundwater facility. On this basis, discussions were held with Mr Russ Robson (Principal Policy Officer – Water Management) of NRMW with regards the implications of the APL and Northern Busway tunnels in relation to the Water Act (2000) and the current moratorium on groundwater extraction in the Moreton area. A written advice summarising the discussions was received in an email from Mr Robson on 20 January 2006 and is as follows:

Thanks for your clarification that the tunnels are likely to be substantially unlined. I can confirm that this does not change the Department's position.

From a practical perspective, I guess that it could be speculated that the absence of lining or similar would indicate the likelihood that viable aquifers were not intersected in any event; but regardless, the fundamental point from the Department's perspective is that the infrastructure falls outside the jurisdictional scope of Water Act because its primary purpose is not to take water or to interfere with water for a consumptive purpose.

As I mentioned previously, the Department has no regulatory regime presently in place in relation to sub-artesian water in the area - apart from the Moratorium Notice for the Moreton Area - under which it could exercise a jurisdiction in any event. Whether or not subartesian water in the area is regulated in future will be determined by the water resource planning process that has commenced, but this would not change the Department's primary position as above.

I have also mentioned previously that the tunnel infrastructure would not be a 'water bore' for the purposes of the Act. This is an important observation for two reasons -

- *because of the nexus between 'water bores' and the requirement under the Act for a person constructing a 'water bore' to be a licensed water bore driller and to adhere to certain bore construction standards (neither of which requirements would be workable for tunnel construction); and*
- *because the Moratorium Notice, in context, affects 'works' and 'subartesian bores' as defined under the Act (meaning that the Moratorium Notice does not catch infrastructure that is not 'works or a 'subartesian bore' = 'water bore' under the Act.*

Accordingly, in relation to your query about the effect of the Moratorium Notice on the tunnel construction, I can confirm both on the Department's primary position and on the latter reasoning above, that the Notice will not have effect.

In conclusion, I would reiterate that, regardless of the current or future regulatory circumstances, the Department's position concerning the infrastructure does not diminish its custodial interest in to the water resource that might be impacted. However, as I mentioned in my previous advice, the Department will continue to exercise this custodial interest through input to the broader project approval process - i.e. through input to EIS, EMP etc content.

The advice for Mr Robson indicates that in the view of NRMW, the APL Project falls outside of the intent of the Water Act (2000) and the current Moratorium Notice for the Moreton Area.

3.7 Groundwater Contamination

The study corridor passes under the area of Lutwyche Road/Gympie Road which historically has been the main northern route within Brisbane. As would be expected there have been a variety of land users in the area ranging from service stations/petroleum storage to quarrying of the Brisbane Tuff at two locations in Windsor. The industries with petroleum storage tanks are considered to have the greatest potential for possessing mobile contaminants and these have been highlighted on Drawing No. 10 which also shows the other potentially contaminated sites in the area.

The drilling programs undertaken to date have been focussed on providing geotechnical data with collection of groundwater and contamination related information an ancillary consideration. Analyses for potential contaminants has included trace metals (arsenic, aluminium, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc), nutrients (ammonia, nitrate, nitrite, ortho phosphorus), Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs).

The concentrations of the trace metals arsenic, cadmium, copper, chromium, nickel and lead were typically at or below the laboratory level of detection in all geological formations.

Concentration of the nutrients ammonia and nitrate were highest in the alluvial aquifer at 4.8mg/L and 1.32mg/L respectively. Maximum concentrations of ammonia and nitrate in the Brisbane Tuff, Neranleigh-Fernvale Beds and the Tingalpa Formation were all below 0.5mg/L.

Selected Semi-Volatile Organic Compounds were detected in samples collected from monitoring NST2-17, APL07S, APL20 and APL25D.

APL07S reported 587µg/L 3- & 4- methylphenol in a sample collected on 26 October 2005. Two subsequent samples collected from APL07S did not detect 3- & 4- methylphenol above the level of laboratory detection.

NST2-17 reported a concentration of 6µg/L of naphthalene, slightly above the level of detection at 2µg/L on 27 October 2005. A subsequent sample collected on 16 February 2006 did not report naphthalene above levels of detection. As samples collected from NST2-17 reported a weathered hydrocarbon odour, a sample was also analysed for the presence of Total Petroleum Hydrocarbons (TPH). The concentrations of TPH fractions were below the level of laboratory detection suggesting the odour is of non-hydrocarbon origin.

Samples collected from APL20 exhibited a hydrocarbon odour and reported 5750µg/L of TPH in the C_6-C_9 fraction suggesting contamination from the former service station adjacent to the monitoring bore.

The compound bis (2-ethylhexyl) phthalate was detected in samples collected from monitoring bores APL25D (80µg/L) and APL25S (60µg/L) on 15 February 2006. The source of the bis (2-ethylhexyl) phthalate is uncertain and may be an artefact of the sampling and analysis processes. Further analyses for these bores are required.

Volatile and Semi-volatile Organic Compounds were below the level of detection in all other monitoring bores.

4.0 ENVIRONMENTAL VALUES

The Environmental Protection (Water) Policy (1997) serves to protect Queensland's environment while allowing for ecologically sustainable development. This is achieved through the policy by providing a framework for:

(a) identifying environmental values for Queensland waters; and

(b) deciding and stating water quality guidelines and objectives to enhance or protect the environmental values; and

(c) making consistent and equitable decisions about Queensland waters that promote efficient use of resources and best practice environmental management; and

(d) involving the community through consultation and education, and promoting community responsibility.

Section 7 of the policy defines environmental values as:

Environmental values to be enhanced or protected

7. (1) *The* ***"environmental values"*** *of waters to be enhanced or protected under this policy are—*

(a) for a water in schedule, column 1—the environmental values stated in the document opposite the water in schedule 1, column 2; or

(b) for another water—the qualities in subsection (2).

(2) *The qualities are—*
(a) if the water—

(i) is a pristine water—biological integrity of a pristine aquatic ecosystem; or

(ii) is not a pristine water—biological integrity of a modified aquatic ecosystem; and

(b) suitability for recreational use; and

(c) suitability for minimal treatment before supplying as drinking water; and

(d) suitability for agricultural use; and

(e) Suitability for industrial use.

(3) *However, if a natural property of the water precludes enhancement or protection of a particular environmental value, subsection (1)(b) does not apply to the value.*

(4) *For subsection (1)(a), a document is taken to state environmental values for a water if it states 1 or more values (however described) that are equivalent to a quality or qualities in subsection (2).*

The water defined in Schedule 1, Column 1 of the policy refers to Trinity Inlet near Cairns and is not relevant to this assessment.

In terms of the policy, the relevant qualities of the groundwater of the study corridor are discussed below.

4.1 Aquatic Ecosystems

Regardless of whether the groundwater is considered a pristine or non-pristine water, it is considered that any aquatic ecosystems dependent upon groundwater within the study corridor will be limited to those within Kedron Brook. It is considered that any ecosystems established at the edge of the Enoggera Creek will be dependent upon the tidal creek flows and the saline water quality rather than the relatively small groundwater fluxes discharging to the creek from the surrounding rocks. Any ecosystems developed along the historical alluvial creek beds will have been grossly impacted by development within the area such as the construction of stormwater drainages and paving of roads.

4.2 Recreational Use

This category of environmental values is considered irrelevant in relation to groundwater.

4.3 Drinking Water

The water quality data obtained from the standpipe monitoring bores installed as part of this project indicate that in general, the water is unsuitable for human consumption. This is due to elevated levels of salinity which are difficult to treat. Issues of contamination and the ease of obtaining a mains water supply are also factors which preclude the usage and potential for usage of the groundwater as a drinking water source.

4.4 Agricultural Use

The permeability of the alluvium in the Wooloowin area suggests that viable bore yields may be readily obtained and it is possible that a number of residences have established bores to supply water for lawns and gardens. Water quality in the area ranges from 820μS/cm to 1500μS/cm. It is possibly marginal for irrigation and it is considered that widespread extraction at high rates is unlikely.

In the remaining areas of the study corridor, land use and elevated salinity will preclude the use of the groundwater for irrigation purposes.

4.5 Industrial Use

It is believed that there are no industrial users of the groundwater within the study corridor. The potential for industrial usage of the water is considered to be greater than that for either agricultural or drinking water usage. Industrial users generally have the capital required to drill and equip bores and if necessary appropriately treat the water before use. On the negative side, industrial users tend to require large volumes of water which will be difficult to obtain from bores in the area. The reliability and ease of obtaining a mains supply of water is considered to be a

dominating factor, and as such, the likelihood of any industrial water users within the study corridor, drilling, constructing and equipping a bore, is low.

5.0 IMPACT ASSESSMENT

The EIS TOR requires that the potential for environmental impact to be caused by the Project to any affected groundwater resources must be assessed. Specific points to be addressed, as defined by the TOR, are:

- define the extent of the potential area within which groundwater resources are likely to be affected;
- significance of the Project to groundwater depletion or recharge;
- potential impact of the Project on any affected groundwater regime caused by the altered porosity and permeability of any land disturbance;
- identification of groundwater-dependent ecosystems;
- provision of management options available to monitor and mitigate these effects;
- investigations of the potential for drawdown on known and potentially contaminated groundwater and if relevant, the identification of measures to manage significant contaminant migration to adjacent previously uncontaminated sites generated by identified drawdown.

A numerical groundwater flow model incorporating the hydrogeological characteristics of the site and the Project tunnel alignments was formulated to assist in undertaking the impact assessment by simulating the groundwater drawdown and the extent of the area of influence upon groundwater levels. The results of the modelling, collected data and hydrogeological judgement, can be used to complete the environmental impact assessment.

5.1 Groundwater Modelling

5.1.1 Modelling Strategy

The application of a computer based numerical model to problem solving in groundwater engineering provides a powerful tool for the prediction of flow in a complex spatially and temporally varying environment. The modelling process is a technique for simulating flow in the aquifer using a system of mathematical equations based on Darcy's Law for flow of water through porous media. Darcy's Law can be also applied to simulate groundwater flow in fractured aquifers providing the ratio of the fracture density to the volume of the simulated aquifer cell is sufficient to approximate porous conditions. The process requires definition of the aquifer in respect of some or all of the following:

- aquifer geometry, including lateral and vertical extent;
- aquifer hydraulic properties; transmissivity, storativity, porosity, leakage etc;
- regional groundwater pressure distribution, fluxes, recharge and discharge processes.

These parameters were defined in developing the conceptual model of the groundwater regime described in Section 3.3.

The use of a computer numerical model can overcome the difficulties inherent in the assessment of hydrogeological systems using classical analytical methods. These mostly assume aquifer homogeneity and are more applicable to the interpretation of localised aquifer response.

With a computer numerical model, it is possible to simulate complex conditions by introducing variations in aquifer transmissivity or hydraulic loads. This is accomplished by discretising the modelled area into a number of blocks each representing a volume of aquifer with constant hydraulic parameters. The accuracy of model predictions depends on the knowledge of all parameters having an impact on the groundwater regime, both in the area of interest as well as in more distant areas.

The development of a model also facilitates sensitivity analyses which provide a means of understanding the dominant parameters and mechanisms operating within a hydrogeological system.

The objective of the modelling was to simulate the impact of the Project on the hydrogeological regime of the area and in particular to undertaken predictive modelling in order to assess:

- the extent and amount of water level drawdown in the surrounding area as a result of inflow to the construction sites;
- the potential groundwater inflow volumes to the Project tunnels.

The groundwater modelling was undertaken using the finite-element simulation package FEFLOW (2005)[8]. FEFLOW is a high-end groundwater flow software package, capable of simulating two and three-dimensional groundwater flow, contaminant mass transport and heat transport in saturated and unsaturated media within the same code. Since its creation in 1979, FEFLOW has been continuously improved. The FEFLOW source code is written in ANSI C/C++ and contains more than 1,300,000 lines. FEFLOW is used in Australia and worldwide as a high-end groundwater modelling tool at universities, research institutes, water suppliers, government offices and engineering companies. The advantage of using a finite element simulation package rather than the more commonly used finite difference technique lies in the fact that complex natural engineering structures like tunnels can be accurately implemented into the model. However the higher accuracy comes with a higher numerical effort and therefore longer simulation times.

Modelling was undertaken in a number of stages, viz:

- steady state conditions, that is, before commencement of tunnelling;
- transient predictive modelling for two scenarios:
  - impact of construction of the tunnels from 2008 to 2012 and impact of operation of the Project for 100 years or until steady-state conditions are realised ,
  - cumulative impact of the Northern Busway tunnels from 2008 to 2026 and impact of operation of both projects for 100 years or until steady-state conditions are realised.

[8] H.-J. G. Diersch (2005), FEFLOW – Finite Element Subsurface Flow and Transport Simulation System, Reference Manual, WASY Ltd., Berlin.

5.1.2 Model Design

The model is based upon the hydrologic catchments in which the Project is situated. The northern boundary of the model is defined by Downfall Creek, north of Kedron Brook. Kedron Brook itself has not been chosen as a model border to allow for the possibility that groundwater drawdown caused by the Project may extend beyond Kedron Brook. In the south, the model boundary follows Breakfast/Enoggera Creek and the Brisbane River. Towards the east, the model extents almost to the Brisbane Airport with some sections of this boundary defined by major stormwater drains. In the west, the model is confined by the hilly area of the suburbs of Ashgrove, Mitchelton and Enoggera.

The vertical discretisation of the model represents the local geology in four layers. The top layer represents the alluvial and tidal deposits along the creeks and near the shore, and the hardrock outcrops, that is Brisbane Tuff, Neranleigh-Fernvale beds/ Bunya Phyllite and Tingalpa Formation (see Drawing No. 12). The second layer represents the subsurface geology as interpreted from the available bore logs (see Drawing No. 13). Model layer three has been introduced to simulate areas of Brisbane Tuff that underlay the younger Tingalpa/Aspley Formation (see Drawing No. 14). The bottom layer of the model represents the underlying Neranleigh-Fernvale Beds with a modelled floor elevation of -80mAHD, which is a sufficient thickness to allow for the modelling of the impact of the deep tunnel sections.

The boundary conditions used to develop the model were based upon the hydrologic boundaries forming the extents of the model, (Drawing No. 11). Where sections of the model boundaries did not coincide with hydrologic features, especially along the eastern and western model border, no-flow” boundaries were assigned. "No flow” boundaries are boundary condition whereby no water is permitted to leave or enter the model domain. It is assumed that in the west, as the geology consists of very low permeable Neranleigh-Fernvale Beds and Bunya Phyllites, the groundwater inflow through this area is negligible. Along the eastern border, the outflowing or discharging groundwater is collected by drains.

Along the southern model border, the Brisbane River and Breakfast/Enoggera Creek were represented as a “constant head” boundary with a specific hydraulic head (water level) of 0mAHD for the Brisbane River and up to 7.8mAHD for Enoggera Creek. This boundary condition results in the Brisbane River and Breakfast/Enoggera Creek being an infinite source of water, which for the purposes of this work, is a valid assumption.

Along the northern border, Downfall Creek has the function of a groundwater drain, thus "drainage boundary conditions" have been set. The drainage boundary condition consists of a constant head boundary condition with an additional constraint condition that only allows for groundwater outflow into the creek. The amount of groundwater outflow is computed by the gradient between the assigned surface water level in the creek and the computed groundwater table elevation in the model.

Kedron Brook is an important internal hydrologic feature. Most parts of Kedron Brook are modelled as constant head boundary conditions, thus allowing for groundwater outflow and inflow. Only the most upstream sections are modelled as drains.

Additional internal drainage areas corresponding to the smaller creeks, channels and surface water drainage features were simulated by applying drainage boundary conditions as explained above for Downhill Creek.

All surface water levels have been interpreted from topographic elevation data provided by BCC. As a rule, the measured topographic elevation at a watercourse has been reduced by 0.5m to represent the water surface.

5.1.3 Hydraulic Parameters

The model domain was divided into five hydraulic conductivity zones representing the different hydrogeological units, namely the Brisbane Tuff, the Neranleigh-Fernvale Beds/Bunya Phyllite, the Tingalpa/Aspley Formation and the recent and older Alluvium. The basis for the zonation was the Brisbane 1:100,000 geological map and the Brisbane 1:100,000 soils map. The geological mapping has been updated during the geotechnical investigations of the Project and the information received from the lithological bore logs of the monitoring and geotechnical bores.

The packer test data discussed above in Section 3.0 and presented in Appendix A was used as the basis for determining an appropriate value of hydraulic conductivity for each hardrock aquifer unit. Analysis of the data suggests that a median value of hydraulic conductivity for the Brisbane Tuff and Neranleigh-Fernvale Beds is 1uL (1 x 10^{-7}m/s) and 0.3uL (0.3 x 10^{-7}m/s) respectively. The Tingalpa/Aspley Formation shows a higher value of 2.6uL (2.6 x 10^{-7}m/s).

Packer tests provide a value for the horizontal hydraulic conductivity of the surrounding rock. The vertical hydraulic conductivity is assumed to be lower than the horizontal hydraulic conductivity due to the occurrence of clayey layers within the rocks. Therefore the vertical hydraulic conductivity has been reduced to a third of the horizontal hydraulic conductivity.

For the purpose of the modelling, it was generally assumed that these median values represent a valid bulk hydraulic conductivity for each of the rock units. It should be noted that the variability in the water pressure testing indicates that significant heterogeneity exists within each rock unit. This is to be expected and implies that the results of the groundwater modelling should be interpreted on a broad scale. The spatial location and number of individual high permeability fractures intersected during tunnelling will govern the degree of water level drawdown adjacent to particular portions of the tunnel and the volume of groundwater inflow at those sites.

For the quantification of the hydraulic conductivity of the alluvial deposits, no direct field measurements have been carried out. Thus assumptions have been made based on the lithological descriptions available and the results of initial simulation runs. For the recent alluvium covering mostly the Kedron Brook and Enoggera Creek area, a value of 2.7m/day (3.16 x 10^{-5}m/s) has been estimated while for the more clayey older alluvium this value has been reduced to 0.75m/day (8.67 x 10^{-6}m/s). Tidal deposits along the western border of the model are assumed to possess a similar low hydraulic conductivity.

For transient predictive simulations, a value for specific yield must be assumed. For the hardrock aquifers the same values have been chosen as for the groundwater modelling of the North-South Bypass Tunnel, that is, 2%. The alluvium is assumed to show a higher specific yield of 5%.

Recharge of the fractured rock aquifers is dependent upon a number of environmental factors; however, from a modelling perspective, recharge is closely correlated to the permeability adopted for each geological unit. A recharge rate of 3% of the annual Brisbane rainfall (1146.4mm) was used in previous modelling and yielded good results. As the additional drilling undertaken for this project has provided better estimates of hydraulic conductivity values, the recharge flux for each unit has been adjusted accordingly. The recharge fluxes adopted are presented below and maintain the same permeability/recharge flux ratios as used previously.

The recharge rate for the alluvium is assumed to be the same as for the more permeable hardrock, the clay layers within the alluvium reducing the recharge capacity in the same manner as clayey layers within the hard rock.

Recent Alluvium	11 x $10^{-5}m^3/d/m^2$ (40mm/yr or 3.5% of 1146.4mm)
Older Alluvium	11 x $10^{-5}m^3/d/m^2$ (40mm/yr or 3.5% of 1146.4mm)
Tingalpa/Aspley Formation	11 x $10^{-5}m^3/d/m^2$ (40mm/yr or 3.5% of 1146.4mm)
Brisbane Tuff	11 x $10^{-5}m^3/d/m^2$ (40mm/yr or 3.5% of 1146.4mm)
Neranleigh-Fernvale Beds	1.5 x $10^{-5}m^3/d/m^2$ (5.5mm/yr or 0.48% of 1146.4mm)

5.1.4 Simulation of Major Influences on the Groundwater Regime

In addition to the Brisbane River, Breakfast/Enoggera Creek and alluvial drainage channels, the major features governing groundwater flow in the study corridor are man-made. Specifically there are the numerous stormwater drains constructed in now in-filled creek beds (see Drawing No. 11). Where the observed water levels indicate a control of the groundwater surface by these structures, the stormwater drains have been implemented into the model as drainage boundary conditions.

The transient predictive simulation of the hydrogeological impact of the Project comprises two scenarios. The base scenario analyses the impact of the construction and operation of the Project. An additional cumulative scenario analyses the cumulative impact of the Project and the Northern Busway Project.

Base Scenario - Airport Link Project
The Project alignment used for the modelling is that of March 2006 (Option 9B). Information on the alignment and construction methodology has been received from the Concept Design Report - Volume 1 (Draft Final Revision A). It comprises various portions of tanked (lined) earth pressure balance machine (EPBM) driven sections, untanked (unlined) road header sections, untanked cut and cover tunnels and untanked access ramps.

The north-south driven tunnels are untanked road header sections and will act as groundwater drains throughout construction and tunnel operation.

The east-west driven tunnel is proposed to be constructed by using an EPBM and is fully tanked during construction and operation. For modelling purposes, this tanked tunnel is assumed to have no impact on the groundwater regime and hence is not explicitly represented in the model.

To model the drainage activity of the driven tunnels correctly, an additional layer has been implemented into the model with an elevation corresponding to that of the planned tunnel floors. Inclusion of this layer has divided the layer three of the model into two layers, without modifying the hydraulic properties.

Cut and cover tunnels are planned at Gympie Road and at the Sandgate Road connection. At construction sites within the alluvium it is assumed that the cut and cover tunnels are built by using diaphragm walls that fully penetrate the alluvial sediments.

Access ramps are planned at various locations along the Project alignment. They consist of a combination of cut and cover tunnel sections and transition structures. Transition structures are

open trough excavations, constructed in a similar manner as the cut and cover tunnels, only without a roof.

For the simulation of the dewatering, drainage boundary conditions representing the cut and cover tunnels and access ramps are assigned on the top layer of the model.

The various sections of tunnels to be untanked and tanked are summarised below in Table 10. The estimated start of construction refers to the early start date indicated on the *APL Construction Programmes based on Concept Design - 3 Lane Option* dated 6th April 2006 (see Table 11 below). For the purpose of this modelling task, only the start date is of interest for the construction sequence. All structures that are untanked and lie below the groundwater table remain active drains (groundwater sinks) throughout the Project construction and operation period.

Table 10: TUNNEL CONSTRUCTION PROGRAM AIRPORT LINK

Location	Construction			
Detail	**Approx. Length**	**Description**	**Lining**	**Start**
NSBT connection to Airport Link				
	60m	Transition structure	untanked	7/07/2008
	155m	Cut&Cover Tunnel	untanked	5/05/2008
North-south driven tunnels				
	520m	driven tunnel, road header	untanked	3/04/2008
North-south to east-west connection				
	945m	Cut&Cover Tunnel	untanked	7/07/2008
Airport Link connection to Gympie Road				
Access Ramp Northbound	100m	Cut&Cover tunnels and transition structure	untanked	7/07/2008
Access Ramp Southbound	120m	Cut&Cover tunnels and transition structure	untanked	7/07/2008
East-west connection				
Access Ramp Northbound	290m	Cut&Cover Tunnel and transition structure	untanked	7/07/2008
Access Ramp Southbound	350m	Cut&Cover Tunnel and transition structure	untanked	7/07/2008
East-west driven tunnels				
EPBM	1480m	Driven Tunnel	tanked	10/02/2009
Airport Link connection to East-West Arterial				
	450m	Cut&Cover Tunnel	untanked	3/07/2008
	190m	Transition structure	untanked	11/03/2009
Airport Link connection to Sandgate Road				
Access Ramp Eastbound	300m	Cut&Cover Tunnel and transition structure	untanked	3/07/2008
Access Ramp Westbound	240m	Cut&Cover Tunnel and transition structure	untanked	3/07/2008

It is assumed that the north-south driven tunnel will be excavated simultaneously from the northern and southern portals towards the centre. Thus, within the groundwater flow model, the tunnel has been divided in northern, central and southern sections. The northern and southern sections will be excavated first, followed by the central section. Similarly the cut and cover tunnel at the north-south to east-west connection has been divided into three sections within the groundwater flow model. The model simulates a consecutive excavation sequence from south to north.

During simulation, the different tunnel sections become active drains with the starting date of construction as listed in Table 10. Generally, the drainage level coincides with the tunnel floor elevation. If the construction site is within alluvium, the drainage level is lowered by one metre to provide for a dry floor within the excavation site. By draining immediately down to the final floor elevation, a high groundwater inflow derived from release of groundwater from aquifer storage will be generated. With time, the groundwater inflow rate is reduced to a steady-state level.

Cumulative Impact - Northern Busway Project

The Interim Stage of the Northern Busway construction takes place contemporaneously with the construction of the Airport Link Project, The Northern Busway comprises a series of tunnel and transition structures which are constructed directly above the north-south section of the APL Project (see Table 11below). At the Gympie Road connection, the Northern Busway deviates towards the north-west. The Ultimate Stage of the Northern Busway Project is proposed to be completed by additional construction works in the years 2025 and 2026. At the time of the groundwater modelling works, no detailed construction programme was available. It is assumed that during the Interim Stage works will be carried out simultaneously with the Airport Link construction. All Northern Busway structures are untanked.

The Northern Busway tunnels are at a more shallow level than the APL tunnels. Within the model the driven tunnels are assigned as drainage boundary conditions on overlying layers. The near-surface structures such as cut and cover tunnels and transition structures are assigned on the top layer. Where the near-surface structures intersect, the deeper one, that is the APL Project structure, is modelled.

Table 11: ESTIMATED TUNNEL CONSTRUCTION PROGRAM NORTHERN BUSWAY

Location	Construction			
Detail	**Approx. length**	**Description**	**Lining**	**Start**
Interim Stage - Section 4 and Section 5 (Stoneleigh Street to Sadlier Street)				
Pop's Fig Tunnel - Approaches				
Southern Approach	90m	Transient structure	untanked	13/06/2009
	35m	Cut and cover tunnel	untanked	13/06/2009
Pop's Fig Tunnel	390m	Driven tunnel	untanked	13/06/2009
Northern Approach	70m	Cut and cover tunnel	untanked	3/04/2008
Lutwyche Busway Station				
	130m	Busway Station	untanked	3/04/2008
Lutwyche North Cut and Cover Tunnel				

Table 11: ESTIMATED TUNNEL CONSTRUCTION PROGRAM NORTHERN BUSWAY				
Location	**Construction**			
Detail	**Approx. length**	**Description**	**Lining**	**Start**
	295m	Cut and cover tunnel	untanked	3/04/2008
Lamington Avenue Access Ramp Cut and Cover Tunnel	90m	Cut and cover tunnel	untanked	3/04/2008
Gympie Road Cut and Cover Tunnels - Approaches				
Southern Approach	75m	Transient structure	untanked	29/09/2009
Dual Busway Carriageway	190m	Cut and cover tunnel	untanked	29/09/2009
Northbound Sadlier Road	390m	Cut and cover tunnel	untanked	29/09/2009
Southbound - Leckie Road	120m	Cut and cover tunnel	untanked	29/09/2009
Ultimate Stage - Section 2 and Section 3 (Northey Street to Stoneleigh Street)				
Lutwyche South Tunnel - Approaches				
Southern Approach	120m	Cut and cover tunnel	untanked	1/1/2025
Lutwyche South Tunnel	510m	Driven tunnel	untanked	1/1/2025
Northern Approach	60m	Cut and cover tunnel	untanked	1/1/2025
Windsor Busway Station				
	115m	Busway station	untanked	1/1/2025
Roblane Street Tunnel - Approaches				
Southern Approach	150m	Cut and cover tunnel	untanked	1/1/2025
Roblane Street Tunnel	215m	Driven tunnel	untanked	1/1/2025
Northern Approach	95m	Cut and cover tunnel	untanked	1/1/2025
Albion Road Busway Station				
	65m	Busway station	untanked	1/1/2025
Truro Street Tunnel - Approaches				
Southern Approach	60m	Cut and cover tunnel	untanked	1/1/2025
Truro Street Tunnel	80m	Driven tunnel	untanked	1/1/2025
Northern Approach	20m	Cut and cover tunnel	untanked	1/1/2025
	50m	Transient structure	untanked	1/1/2025

5.1.5 Modelling Results

Steady-State Conditions Pre-Construction

The simulated groundwater table for steady-state conditions is shown on Drawing No. 15. An appreciation of the appropriateness of the model formulation and calibration can be achieved by comparison of the predicted and observed water levels at each of the standpipe monitoring bores and vibrating wire piezometers. A summary of this data corresponding to the average water level in the period October 2005 to March 2006 is presented below in Table 12 and shows that in general, there is a good correlation between simulated and observed groundwater levels. At monitoring bores APL17 and APL18 predicted water levels are much lower than observed water levels, however as these are both open holes that have not been developed, their reliability is considered low.

Table 12: MODELLED WATER LEVELS

Borehole	Observed Water Level (mAHD)	Predicted Water Level (mAHD)	Difference Predicted to Observed Water Level (m)
APL01	12.87	9.66	-3.21
APL02	2.46	1.50	-0.96
APL03D	18.4	15.09	-3.31
APL03S	16.35	15.70	-0.65
APL04D	2.69	1.97	-0.72
APL04S	2.49	1.96	-0.53
APL05D	2.4	1.30	-1.10
APL05S	0.99	1.24	0.25
APL06	10.29	9.41	-0.88
APL07D	8.31	5.79	-2.52
APL07S	6.37	5.61	-0.76
APL08D	12.53	14.39	1.86
APL08S	14.56	15.13	0.57
APL09	10.21	10.49	0.28
APL11	1.47	3.92	2.45
APL12	0.57	5.03	4.46
APL13	9.45	8.97	-0.49
APL16	6.47	1.96	-4.51
APL17	23.23	15.25	-7.98
APL18	23.01	18.48	-4.53
APL19	14.22	16.69	2.47
APL20	17.68	15.53	-2.14
APL22	12.87	11.08	-1.78
APL23	12.77	9.86	-2.91
APL25D	2.50	6.02	3.52
APL25S	2.45	5.82	3.37
APL28D	4.36	4.88	0.52
APL28S	2.26	4.89	2.63
APL30	3.21	4.71	1.50
NST2-17	7.24	7.54	0.30

Predictive Transient Modelling - Base Scenario

The results of the modelling are shown on Drawing Nos. 16 to 23. The drawings show the predicted water levels at various stages before during and after the tunnel construction and are presented as contours and at three strategically located cross-sections. The water level drawdown induced by the tunnel is also presented, and was calculated as the difference between the modelled water level before the start of the construction of Project, and the modelled water level

resulting from Project construction. Two time stages were analysed, the impact one year after completion of the Project construction and the long-term impact after more than 50 years post construction.

As the drawings show, the maximum extent of the drawdown is almost reached one year after the end of construction for those sections of the Project that are going to be constructed within the alluvium. On the other hand, for the north-south driven tunnels, the drawdown continues to extend towards the west over the following decades. West of the north-south driven tunnels where very low permeable hardrock is present, correspondingly low groundwater recharge occurs and no active drains have been identified. Thus, the relevant area of influence of the deep draining tunnel is quite large and needs some time to reach its final extents.

The groundwater model was used to predict groundwater inflows to various segments of the tunnels for steady state conditions. The predicted inflows are presented in Drawing No. 23. Peak inflows shown in this plot are a function of the modelling methodology adopted and should not be regarded as flows expected during construction. Construction inflow will be dependent upon the number, permeability and position of individual fractures intersected. The modelled long-term inflow rate for the tunnel is approximately 8L/s.

Cumulative Impact with Northern Busway

As stated previously, the construction of the Project occurs simultaneously with the Northern Busway. The results of the cumulative impact modelling are shown on Drawing Nos. 24 to 27.

The Northern Busway runs almost along the same alignment as the Project from Enoggera Creek to Stafford Road. At Stafford Road, the Northern Busway crosses Kedron Brook in a north-western direction. Generally the tunnel structures of the Northern Busway are overlaying the Project tunnels, requiring less dewatering depth than the APL structures. Hence, an additional significant impact on the regional groundwater drawdown does not take place.

In fact, assuming that simultaneous progress of the construction programmes for APL and Northern Busway occurs, the modelling results suggest that dewatering requirements during construction of the Northern Busway tunnels are quite low due to the contemporaneous groundwater drawdown caused by the APL Project construction (see Drawing No. 27).

Additional groundwater drawdown is only expected north-west of Kedron Brook, where the model predicts a local drawdown of less than 3m as the result of the construction of a cut and cover tunnel. The drawdown reaches a quasi-steady state condition rapidly and does not extend significantly in the long-term (Drawing Nos. 25 and 27). This additional drawdown may have an impact on the transport of contaminants within the groundwater body as explained below. The inflow rate at the Gympie Road cut and cover tunnel is around 0.5L/s in the long-term. Thus the cumulative total inflow to the tunnels of the Project and Northern Busway is approximately 8.5L/s.

Sensitivity Analysis

A sensitivity analysis was also undertaken based on the cumulative impact scenario in order to assess the significance that variations in hydraulic conductivity (permeability) and specific yield have on the area of water level drawdown and predicted groundwater inflows.

The sensitivity analysis on the impacts of rock mass permeability was undertaken by doubling the hydraulic conductivity of all aquifers for the cumulative impact scenario. In order to maintain the equivalent hydraulic conductivity to recharge ratio, the value of recharge flux was also doubled. The predicted drawdown is presented in Drawing No. 28. It can be seen that the extent of the groundwater drawdown is essentially the same as for the base case scenario. Long-term predicted

groundwater inflows are of the order of 18L/s, that is, around double that for the cumulative impact scenario.

The sensitivity analysis for specific yield, presented in Drawing No. 29 shows very little variation from the cumulative impact scenario as the drawdown contours for the end of the Project construction confirm. This similarity indicates that in this environment, quasi-steady state conditions are reached very rapidly for most part of the Project. An exception is the area west of the north-south driven tunnel, where the drawdown extends more rapidly than for the base scenario.

5.2 Extent of Area Impacted

The results of the modelling discussed above can be used to assess the areal extent and level of drawdown as a result of the Project. The simulation of the cumulative impact scenario has not shown significant changes in respect to the base scenario, which only analysed the APL Project. Therefore in the following section the base scenario is discussed by default. Where the cumulative impact analysis has shown different results, this is stated within the text.

The key outcomes of the modelling in relation to the area of impact are as follows:

- water level drawdown occurs predominantly at the untanked (unlined) road header sections, cut and cover tunnels and deeper transition structures of the Project;
- water level drawdown as a result of the Project is aligned about the Project axis and is greatest at the deeper parts of the Project, that is, at the north-south bound driven tunnels, where a drawdown of up to 45m is predicted (Drawing No. 19);
- the transient predictive modelling, including that of the sensitivity analysis, shows that a quasi-steady-state drawdown condition is achieved within about 20 years of construction of the Project. Generally, within the alluvial aquifers, steady-state conditions are reached faster than in the hardrock aquifers (Drawing No. 19).
- the cumulative impact assessment shows only additional local drawdown of around 2m at the Gympie Road cut and cover tunnel of the Northern Busway, north-west of the APL Project (Drawing Nos. 25 and 27).

5.3 Groundwater Depletion or Recharge

The results of the modelling discussed above can be used to quantify the groundwater depletion and recharge as a result of the tunnels. The simulation of the cumulative impact scenario has not shown significant changes in respect to the APL Project base scenario. As for the above discussion on the area of impact, the base scenario is discussed by default. Where the cumulative impact analysis has shown different results, it is stated within the text.

The results of the simulation runs indicate the following regarding groundwater depletion and recharge:

- total long-term groundwater inflow to the tunnel was modelled as approximately 8L/s for the base scenario and 8.5L/s for the cumulative impact scenario;

- the modelling also indicated that quasi-steady state conditions are reached after a period of 20 years post construction (Drawing No. 26);
- surface water inflow from Kedron Brook at the east-west connection and Sandgate Road connection may occur as a result of the groundwater table drawdown during construction and operation of the cut and cover tunnels. The simulation of the Project works computed long-term inflow rates of around 0.9L/s at the east-west connection and at 1.4L/s at Sandgate Road connection.
- no inflow is derived from the Brisbane River or Breakfast/Enoggera Creek. Thus the long-term groundwater inflow to the tunnel is met mainly by infiltration of rainfall over the remainder of the area.
- the only area, where a deeper untanked tunnel section of the Project crosses the alluvium is between Newmarket Road and Granton Street. The groundwater modelling results indicate that the alluvial aquifer directly above the tunnel will be locally depleted. However experience with similar projects suggests that the alluvial aquifer will not dry out totally. A more likely scenario will be the development of a perched shallow aquifer. Thus the direct hydraulic connection between the alluvial aquifer and the deeper fractured rock aquifers will be interrupted.

5.4 Impacts of Land Disturbance

Land disturbance as a result of the Project construction will be limited to the open trough structures and cut and cover tunnels.

High rainfall events that coincide with the presence of open cut and cover areas or open troughs may temporarily flood workings and lead to a short period of localised increase in recharge. In the event that this does occur, the impacts are considered minor, localised and of short duration. No impact on any groundwater regime is anticipated.

The possibility exists for stress relief fracturing of rock to occur during excavation of the Project. It is beyond the scope of this report and our expertise to speculate on how much or to what extent fracturing may occur. Any stress relief fracturing will likely be limited to the immediate area of any excavation and may temporarily increase inflows during construction. The inflows are expected to dissipate quickly and should create no additional impact on the groundwater system.

Within the alluvial aquifers, the groundwater drawdown caused during Project construction and operation may lead to compaction of the dewatered soil column and to land subsidence in the immediate surroundings of the Project construction site.

5.5 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems exist in the following areas (see table 3 pages 1-14 and 1-15, Ecology Report):

- Kalinga Park;
- Melrose Park, Wooloowin;
- Kedron Brook, adjacent to Gympie Road;
- Downey Park, Enoggera Creek and Northey Street plantings.

The results of the modelling discussed above can be used to assess the impact on the groundwater dependent ecosystems as a result of the Project. The simulation of the cumulative impact scenario has not shown significant changes in respect to the base scenario, which only analysed the APL Project. Where the cumulative impact analysis has shown different results to the base scenario, it is stated within the text.

- the cut and cover tunnel for the Project to the East-West Arterial connection lies within Kalinga Park and the groundwater modelling predicts a long-term drawdown of more than 3m in the alluvium in the vicinity of the construction site (see Drawing No. 22), with a maximum drawdown of 7m directly at the deepest section of the excavation site;

- Melrose Park is situated south of the tanked EPBM driven tunnel. No significant long-term drawdown in this area is predicted (Drawing No. 19);

- the modelling results indicate that the vegetated areas of Kedron Brook along Gympie Road will experience a long-term drawdown of less than 1m for most areas. Around the construction site for the cut and cover tunnel of the east-west to north-south connection, a drawdown of more than 3m is predicted in the area of the alluvium (Drawing No. 19);

- along Downey Park, Enoggera Creek and Northey Street planting a drawdown of less than 1m is predicted (Drawing No. 19);

- recharge of the groundwater resources will be induced by surface water infiltration from Kedron Brook, as discussed above. It is assumed from field observations that the alluvial aquifer is already now recharged by surface water temporarily during flood events, thus the groundwater quality is already influenced by the surface water. To assess the scale of the impact of the infiltration on the groundwater dependant environment along the sections of Kedron Brook, more in-depth analysis of the hydrogeological properties of the alluvial aquifer and flow rates and water level changes over time within the Kedron Brook is recommended. However, data analysis of surface water sampled near the shallow groundwater monitoring bore, APL05S, indicates that groundwater quality may improve by additional recharge from Kedron Brook. In relation to salinity, a surface water measurement carried out on May 23rd 2006 at Kedron Brook near monitoring bore APL05S showed brackish water quality with 5500μS/cm. This level of salinity is likely to be a result of the tidal nature of Kedron Brook in this vicinity. The potential thus exists for the current fresh to slightly brackish aquifer to be adversely impacted at this location.

5.6 Management Options

On the basis of the assessment undertaken, the major environmental issue is considered to be:

- drawdown and depletion of groundwater within the alluvial aquifer systems;
- change of groundwater quality caused by induced recharge from Kedron Brook.

Monitoring of the water level drawdown of groundwater within the alluvial systems can be undertaken through the use of standpipe monitoring bores or vibrating wire piezometers. A suitable network of alluvial monitoring bores has been established through the geotechnical drilling program. The boreholes that constructed within the alluvium, and possibly within the reach of drawdown caused by an untanked tunnel segment, are listed in Table 13 below.

Table 13: MONITORING BORES NEAR UNTANKED TUNNEL SECTIONS	
Borehole	**Location**
NST2-17	Stafford Rd and Gympie Rd
APL04S	Lewis St
APL05S	Kalinga Park
APL06	Park Rd
APL07S	Kedron Brook near Gympie Road
APL10	Byrne St
APL15	Newmarket Rd
APL16	Granston St
APL24	Lamington Ave
APL25S	Chelmsford Ave
APL26	Colton Ave
APL28	Gorman St

A regular water level monitoring has been instigated and has been undertaken to date by BCC City Design. The water level monitoring will be continued until commencement of the Project construction in order to provide baseline water level data from the alluvial systems. Insufficient data is available at present to discern any seasonal trends or relationships between water levels and rainfall.

Once construction commences, water level monitoring will be continued and if necessary the frequency of monitoring increased. Deviations from seasonal baseline water levels will be assessed and if necessary mitigation options formulated. It is envisaged that mitigation of any impacts will be dependent upon the location of the increased drawdown. Strategies may range from “do nothing”, to an assessment of the extent of the impact and the establishment of surface irrigation networks to maintain root zone moisture content levels.

For the areas, where the simulation results indicate a significant degree of depletion of the alluvial aquifer (Gympie Road connection and Sandgate Road connection) the tanking of the respective tunnel segment may be an option. However during construction, the cut and cover tunnels may not be tanked in any case. Mitigation measures during construction to manage larger groundwater drawdowns especially in areas of potential Acid Sulfate Soil hazard or groundwater dependent ecosystems (see Sections 5.5 and 5.8) may consist of wetting of the soil by sprinklers or re-infiltration of the discharged groundwater using infiltration galleries. These actions would reduce the groundwater table drawdown and with it the induced low-quality water infiltration from nearby creeks.

During operation, the tanking of the cut and cover tunnels within the alluvial aquifers will create hydraulic barriers, inhibiting the natural groundwater flow towards groundwater discharge zones. Without mitigation, water levels will rise upstream of the tunnels and will be lowered directly downstream. A mitigation option can be the installation of cross-drains, consisting of pipes which channel the natural groundwater flow from the upstream wall of the tunnel to the downstream side.

Before these remediation strategies are planned in detail, field tests should be carried out to verify the estimated hydrogeological properties of the alluvium. A pumping test in the alluvium at Kalinga Park is recommended and is planned as part of the geotechnical investigations.

5.7 Groundwater Contamination

An area of environmental impact or risk relates to the potential for mobilisation of contaminated groundwater towards the Project. The untanked portions of any construction below the water table will always act as a groundwater sink and will draw in water within the groundwater capture zone.

Contaminated Sites

An assessment of land contamination has been carried out as part of the Project. Sites on the Project route that are listed with the Environmental Management Register and Contaminated Land Register (EMR/CLR) as potentially contaminated are shown on Drawing No. 30. A total of 135 properties within 1km of the Project alignment were listed on the EMR/CLR. Additionally, 10 properties have been identified within the Study corridor from historical aerial photographs, where a potential exists for a notifiable activity.

It is considered unlikely that the identified sites comprise all the contaminated or potentially contaminated sites within the study corridor. A number of the sites are petroleum storage areas or service stations which are considered to have the greatest probability of possessing mobile contaminants. A vehicular inspection produced further 58 properties of interest within the study corridor that may be contaminated.

Detected Groundwater Contamination

Groundwater contamination has been detected at two boreholes (refer Appendix D). At monitoring bore APL20 the contamination consists of BTEX, the nearest registered EMR/CLR sites are service stations, an activity that can cause BTEX contamination in groundwater. At monitoring bore APL07S semi-volatile compounds have been detected on one occasion. On a second sampling campaign the presence of this contamination could not be confirmed. Monitoring bore APL07S lies between a registered landfill and Kedron Brook. At monitoring bore APL25, semi-volatile compounds (phthalate) have been detected. At NST2-17, near Stafford Road, no contamination has been detected, however the area is suspected to be contaminated by a known groundwater contamination from a nearby service station.

Impact of the Project

In the longer term, as the extent of groundwater drawdown created by the tunnel becomes greater, the potential area in which contaminants may be “captured” becomes progressively larger. Drawing No. 30 shows the location and type of the identified potential contaminated sites together and the area of steady-state drawdown caused by the cumulative impact of the Project and Northern Busway construction activities and operation.

All mobile groundwater contaminants within this capture zone may be expected to ultimately report to the Project tunnel. Contaminant travel times will depend upon the contaminant itself, distance from the tunnels and the magnitude of the hydraulic gradient towards the tunnels. As groundwater inflows are expected to be low, contaminant fluxes will also be correspondingly low.

The migration of contaminated groundwater towards or through adjacent, previously uncontaminated sites is an issue that warrants further discussion. Dissolved phase contamination, that is contaminated groundwater, migrates under the influence of a hydraulic gradient. All things being equal, the steeper the hydraulic gradient, the faster the rate of groundwater flow and hence contaminant movement. It is rare in Brisbane for contamination sources to be in direct contact with groundwater, exceptions to this generalisation are buried contaminant sources, such as

underground fuel storage tanks, located in alluvial valleys. Contamination of groundwater occurs when uncontaminated water, either in the form of infiltrating rain or irrigation water or groundwater comes in contact with a source of contamination. If the contaminant is soluble, a percentage of the source dissolves and a groundwater plume is created as the groundwater moves naturally away from the source. Processes such as dispersion and diffusion, which are aquifer and contaminant dependent, serve to reduce the concentration of contaminant around the margins of the plume and the effect becomes greater the further the plume travels from the source.

Migration of the contaminant occurs until the groundwater discharges as surface water, either in the river or as baseflow in an alluvial stream.

The issue in relation to the Project is what happens to the contaminant plume when the direction and magnitude of the hydraulic gradient changes due to the construction of the tunnel. It is without doubt that any contaminant plume within the fractured rock aquifers and in the “capture zone” of untanked tunnel sections will alter direction in response to the reversal or modification of the natural hydraulic gradient.

Contaminant plumes contained within the alluvium will probably be impacted by the Project at Kedron Brook near the north-south to east-west connection, where contamination has been detected at the monitoring bores APL07 and APL25, and near the connection to the East-West Arterial. In all cases, untanked, shallow cut and cover tunnels will act as groundwater sinks and deviate the natural groundwater flow direction, from the natural water course towards the Project alignment. As discussed above, in the alluvial area between Newmarket Road and Granton Street within the alluvium, a perched water table may be formed by the impact of the north-south driven tunnel. Contamination contained within the alluvium may seep from the perched aquifer towards the driven tunnel or flow to the shallow excavations of Northern Busway for the Windsor busway station and the approaches of the Roblane Street tunnel. In terms of the cumulative impact with the Northern Busway, contaminant plumes contained within the alluvium will probably be impacted by the Northern Busway Project at the Gympie Road cut and cover tunnel near monitoring bore NST2-17.

The modification in groundwater flow direction and, by inference, the movement of any contaminated groundwater will result in contamination moving under properties that otherwise would not be on the contaminant plume flowpath. It has been established that the possibility of industry or domestic residents attempting to secure a groundwater supply is remote. Groundwater in the non alluvial areas of the tunnel alignment is generally well below root zone level and will become deeper as the tunnel is constructed. On this basis the environmental impact of such an event is considered negligible. Within the alluvium, the environmental impact may be significant, if a contaminant plume migrates towards a formerly non contaminated zone and groundwater consumption by domestic residents or by groundwater dependent ecosystems occurs.

Remedial activities or contaminant management strategies for the alluvium may be considered if additional investigations at the potentially impacted sites indicate the presence of mobile contaminants within the groundwater system. In the areas where contamination has been already detected, further investigations should be carried out to assess the scale of the contamination. If remedial activities are deemed necessary, they should be coordinated with already ongoing remediation projects and should also consider the impact of the tanking of the cut and cover tunnels as a mitigation measure against the groundwater drawdown.

As stated above, the untanked portions of the various tunnels and excavations that occur below the water table will be permanent groundwater sinks and will act to capture contaminated groundwater within the area of influence. The chemistry of the groundwater inflow will be

dominated by the natural groundwater; however, in all probability the groundwater will also contain contamination. It is understood that this water will be treated prior to disposal and as such construction of the respective projects will serve to intercept and treat contaminated groundwater that would otherwise discharge to the creeks and alluvial channels. Thus the capturing of contaminated groundwater will have a positive impact on the groundwater system.

5.8 Management of Acid Sulfate Soils

According to the Acid Sulfate Soils (ASS) map provided by the BCC, ASS with different levels of hazard risk are present within the alluvial aquifers. The predicted long-term drawdown of the groundwater table caused by construction and operation in the vicinity of the tunnel section in most areas is up to three metres (see Drawing No. 31). In the immediate vicinity of the cut and cover tunnel at the Sandgate Road connection, the drawdown as computed by the groundwater model can reach more than 7m if the cut and cover tunnel is not tanked.

It is understood that management plans will be put in place to contain and neutralise any acid sulfate soils encountered and disturbed during excavations. These management strategies will serve to minimise the potential impacts on the alluvial groundwaters of Enoggera Creek and Kedron Brook.

AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD

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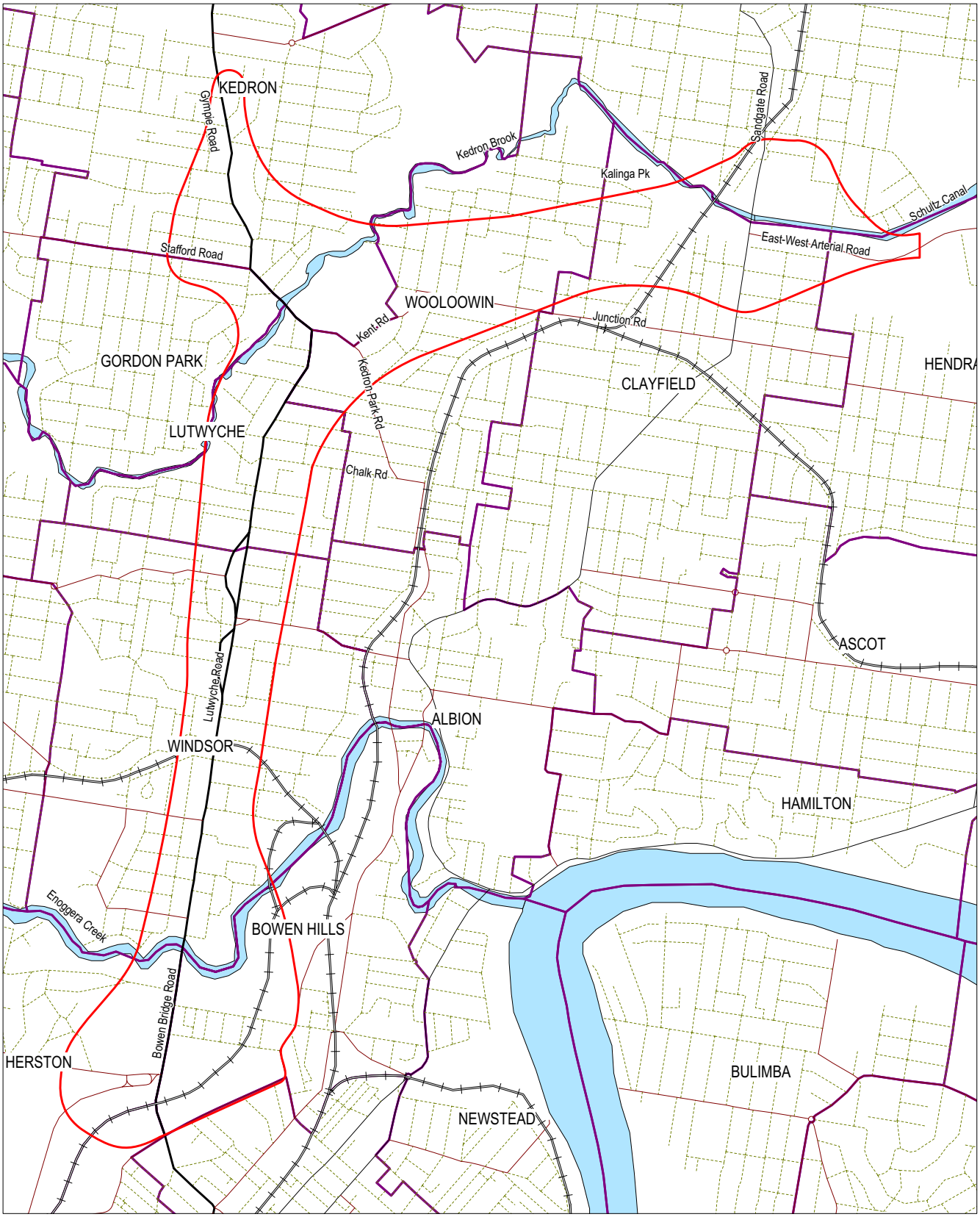


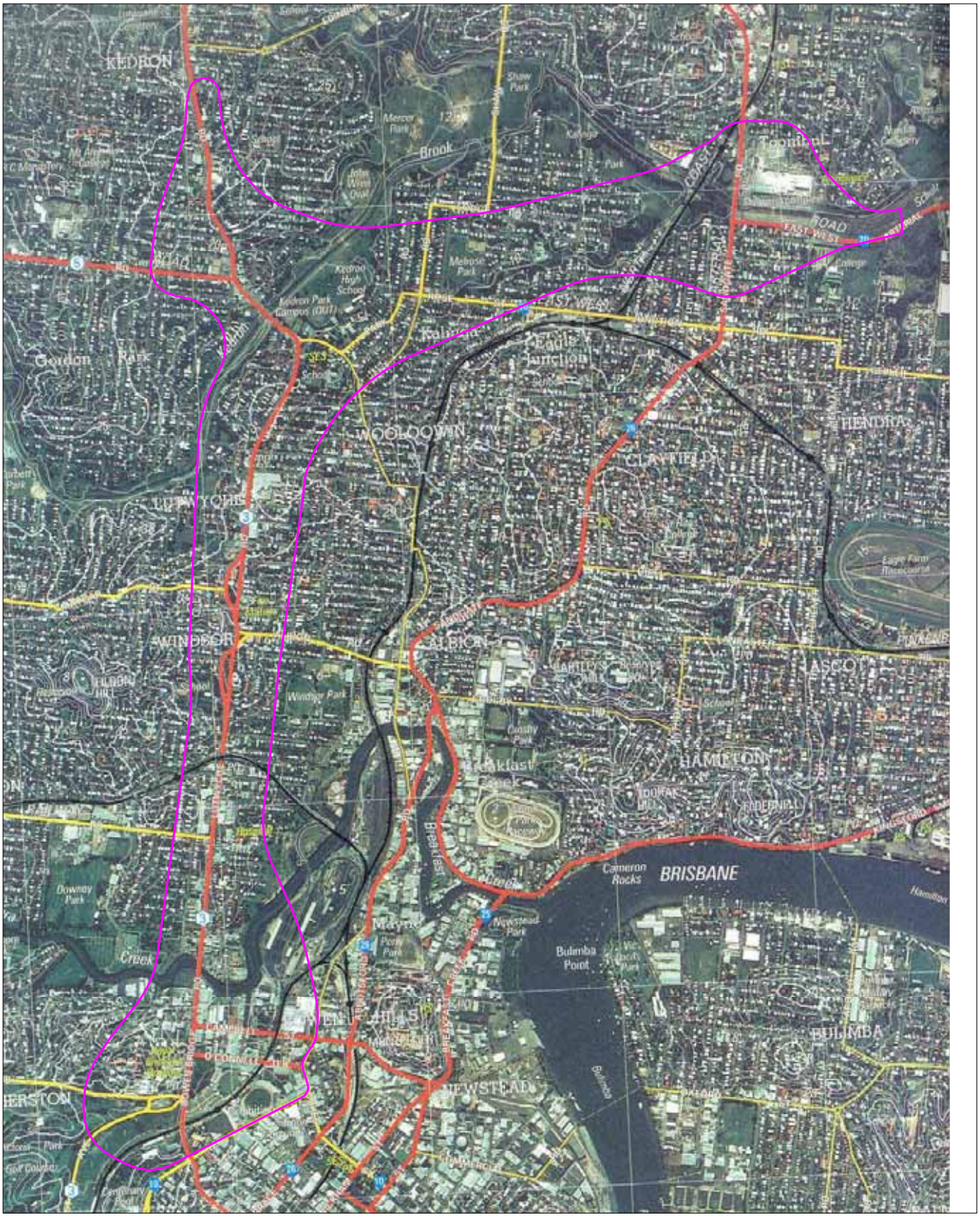
- LEGEND -

Project Corridor

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
LOCATION PLAN

CLIENT: SKM-CW Joint Venture
OFFICE: Brisbane
DRAWN BY: IPC
SCALE: 1:20,000 (A3)
PROJECT No: G1312/C
DRAWING No: 1
APPROVED BY:
DATE: December 2005



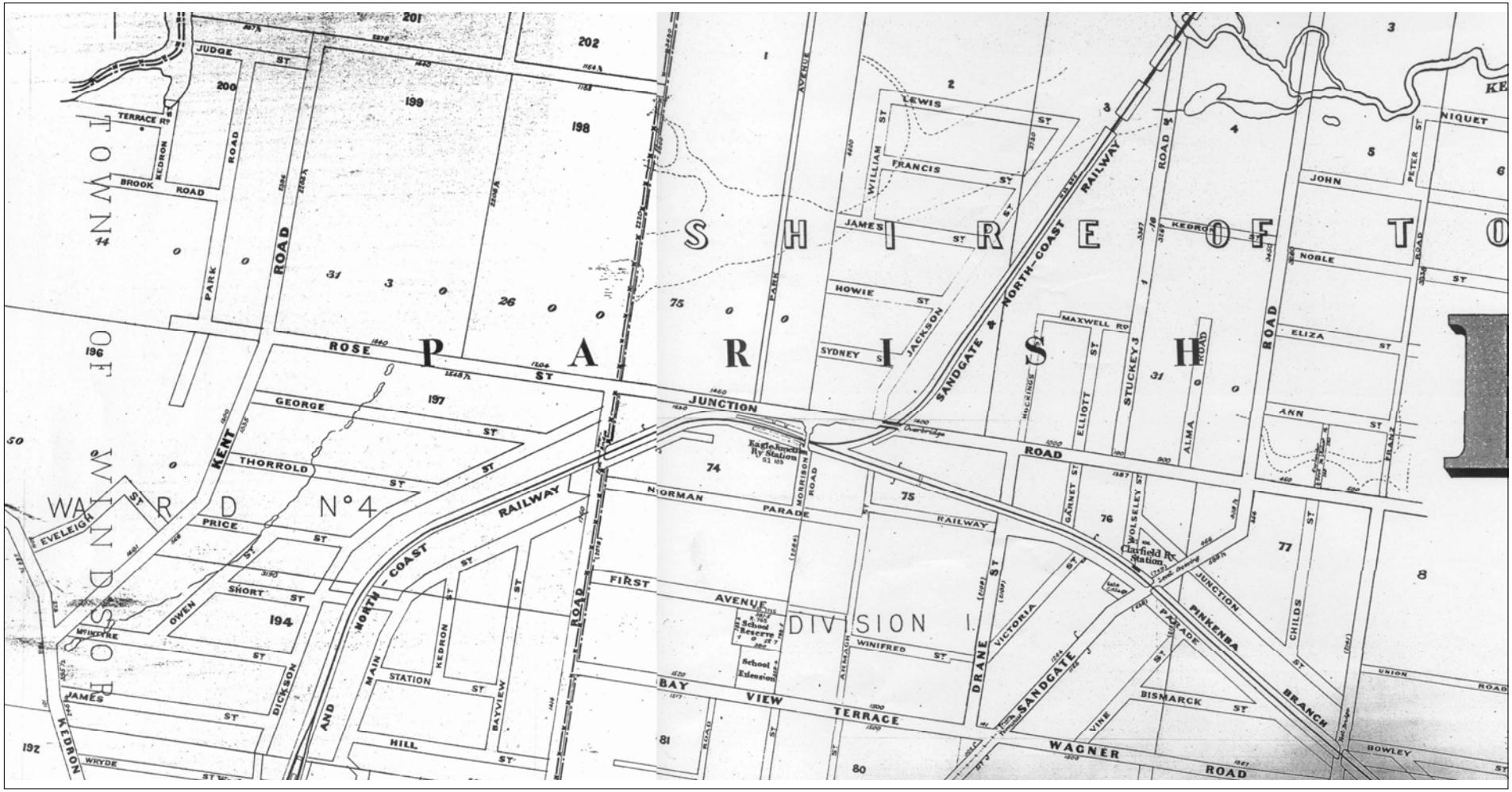
- LEGEND -

Project Corridor

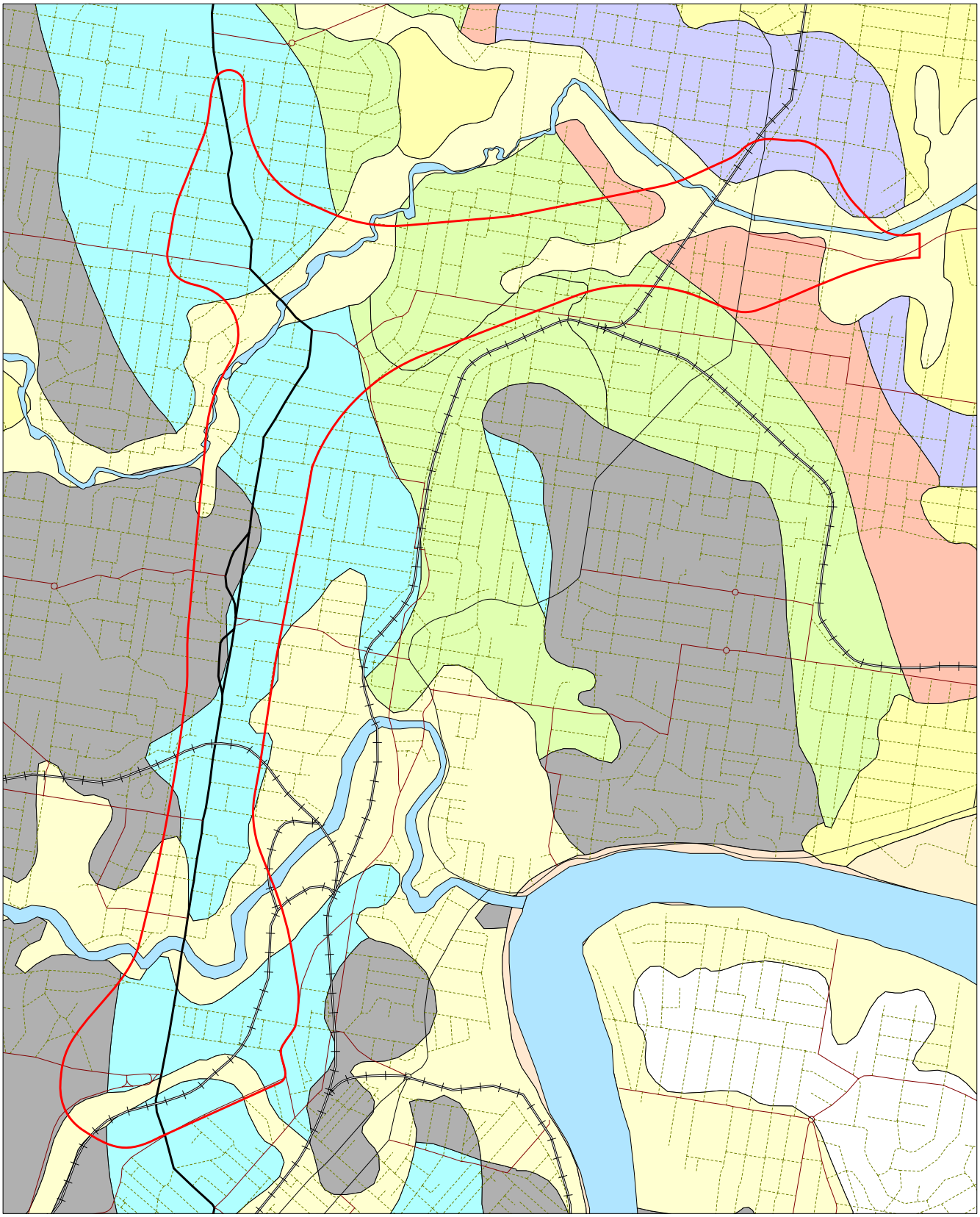
AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
TOPOGRAPHY

CLIENT: SKM - CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: 1:20,000 (A3)	PROJECT No: G1312/C	DRAWING No: 2
APPROVED BY:		DATE: May 2006	



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD 36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA			
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT AIRPORT LINK TUNNEL WOOLOOWIN AREA - 1907			
CLIENT: SKM - CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: As Shown	PROJECT No: G1312/C	DRAWING No: 3
APPROVED BY:		DATE: May 2006	



- LEGEND -

	Qhe	Estuarine Deposits
	Qhct	Tidal Flats
	Qa	Quaternary Alluvium
	Qpa	Older Alluvium
	RJbw	Woogaroo Subgroup
	Rip	Aspley Formation
	Rin	Tingalpa Formation
	Rif	Brisbane Tuff
	DCf	Neranleigh-Fernvale Beds
		Project Corridor

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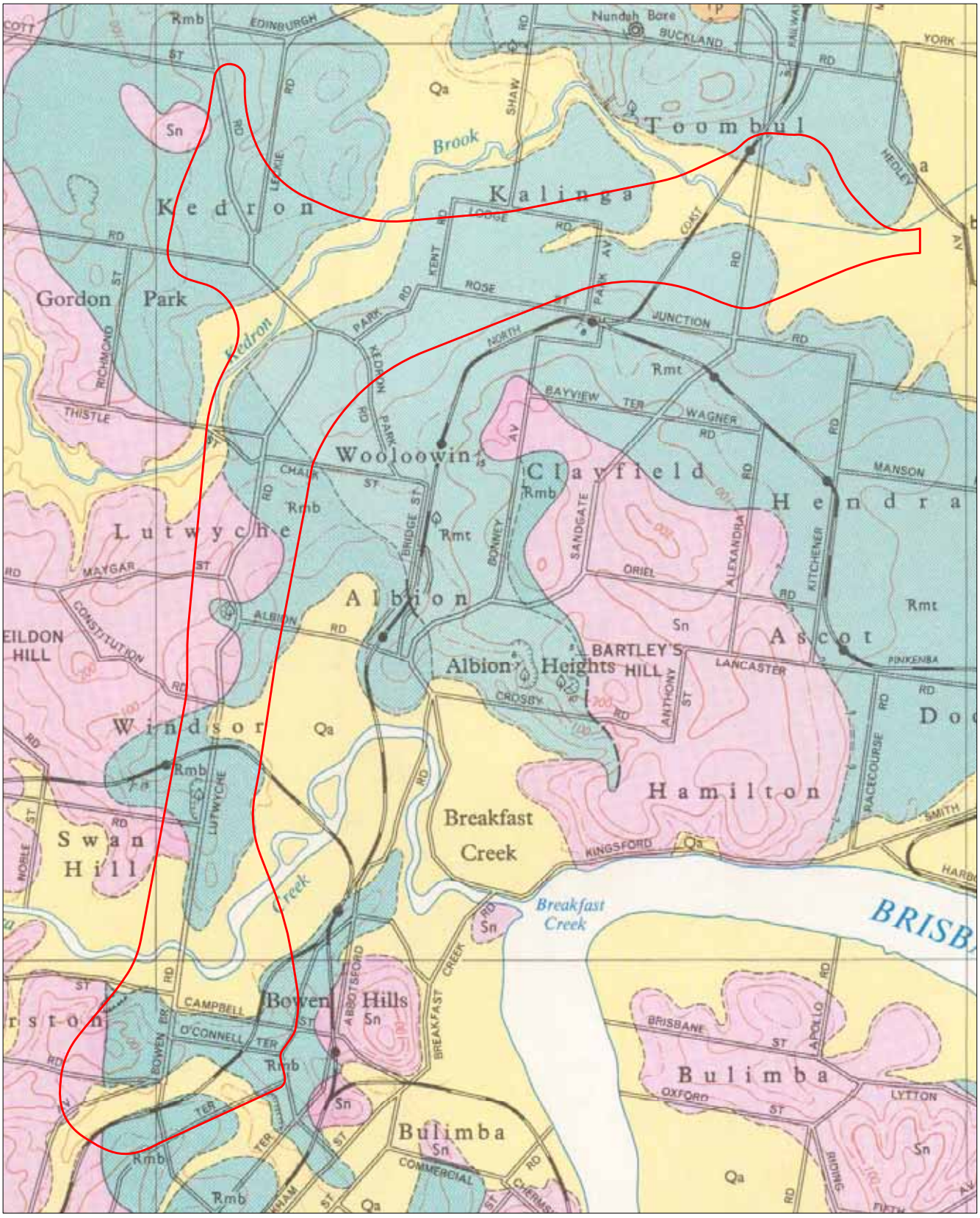
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
ALIGNMENT GEOLOGY

CLIENT: SKM-CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: 1:20,000 (A3)	PROJECT No: G1312/C	DRAWING No: 4
APPROVED BY:		DATE: May 2006	



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	Qa	Quaternary Alluvium
	Rmt	Tingalpa Formation
	Rmb	Brisbane Tuff
	Sn	Neranleigh-Fernvale Beds
		Project Corridor

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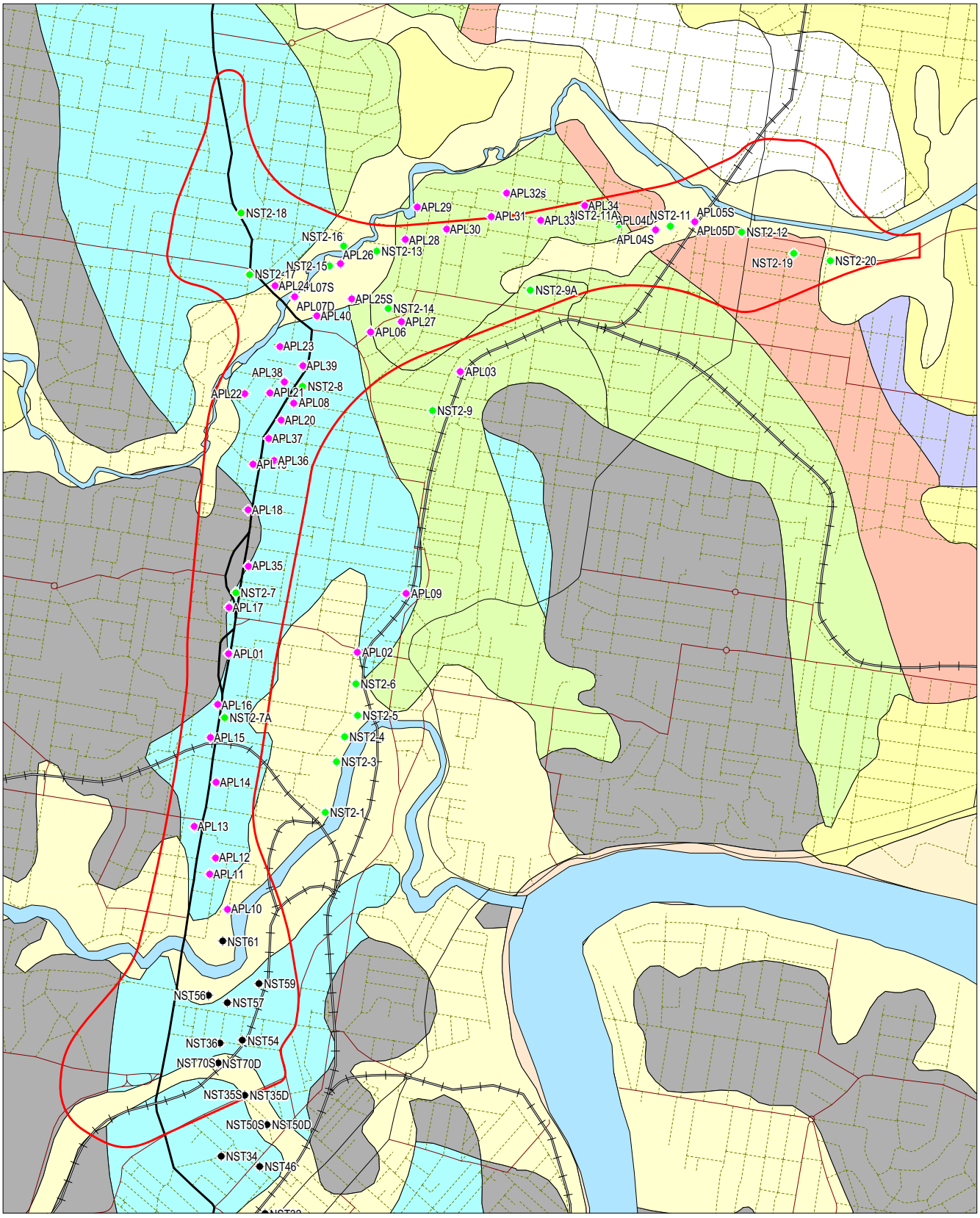
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
BRISBANE GEOLOGY - 1965

CLIENT: SKM-CW Joint Venture | OFFICE: Brisbane

DRAWN BY: IPC | SCALE: 1:20,000 (A3) | PROJECT No: G1312/C | DRAWING No: 5

APPROVED BY: | DATE: May 2005



- LEGEND -

	Qhe	Estuarine Deposits
	Qhct	Tidal Flats
	Qa	Quaternary Alluvium
	Qpa	Older Alluvium
	RJbw	Woogaroo Subgroup
	Rip	Aspley Formation
	Rin	Tingalpa Formation
	Rif	Brisbane Tuff
	DCf	Neranleigh-Fernvale Beds
		Project Corridor
APL01		Airport Link Boreholes
NST2-3		TransApex Boreholes
NST36		NSBT Boreholes

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
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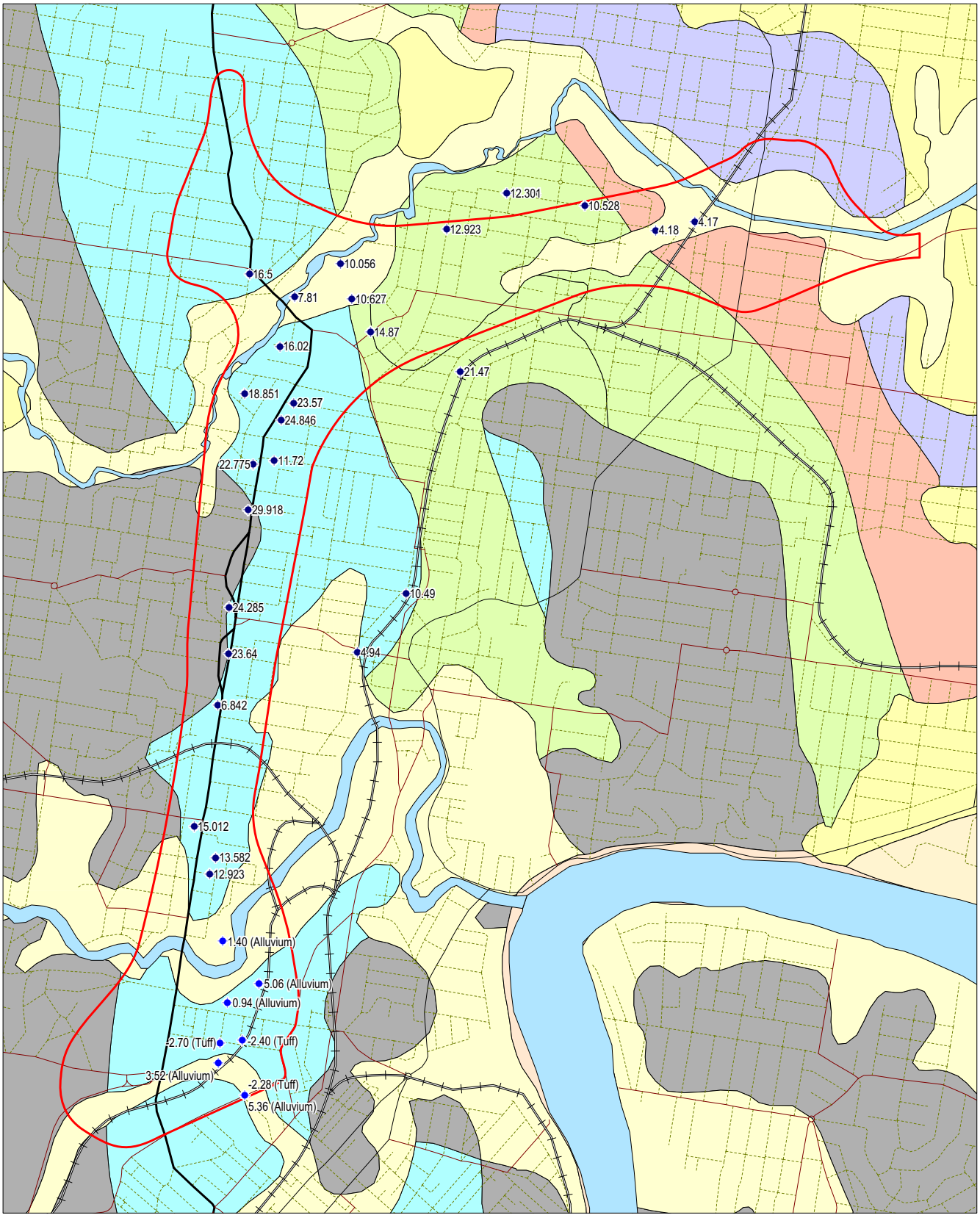
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
GEOTECHNICAL BOREHOLES

CLIENT: SKM-CW Joint Venture | OFFICE: Brisbane

DRAWN BY: IPC | SCALE: 1:20,000 (A3) | PROJECT No: G1312/C | DRAWING No: 6

APPROVED BY: | DATE: May 2006



- LEGEND -

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	Rip	Aspley Formation
	Rin	Tingalpa Formation
	Rif	Brisbane Tuff
	DCf	Neranleigh-Fernvale Beds
		Project Corridor
23.64	◆	Water Level (mAHD) - May 2006

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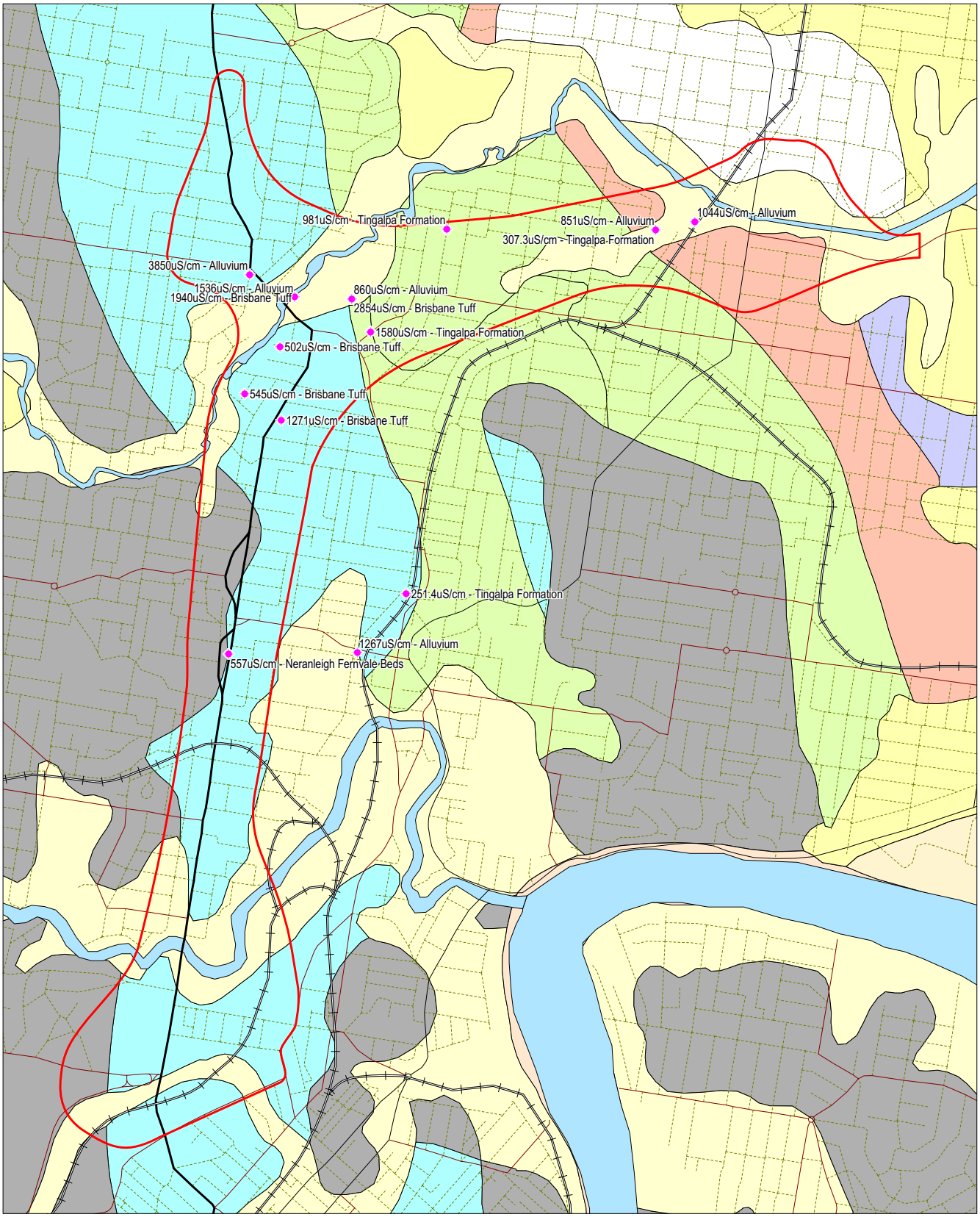
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
OBSERVED GROUNDWATER LEVELS - MAY 2006

CLIENT: SKM-CW Joint Venture | OFFICE: Brisbane
DRAWN BY: IPC | SCALE: 1:20,000 (A3) | PROJECT No: G1312/C | DRAWING No: 7
APPROVED BY: | DATE: May 2006



- LEGEND -

	Qhe	Estuarine Deposits
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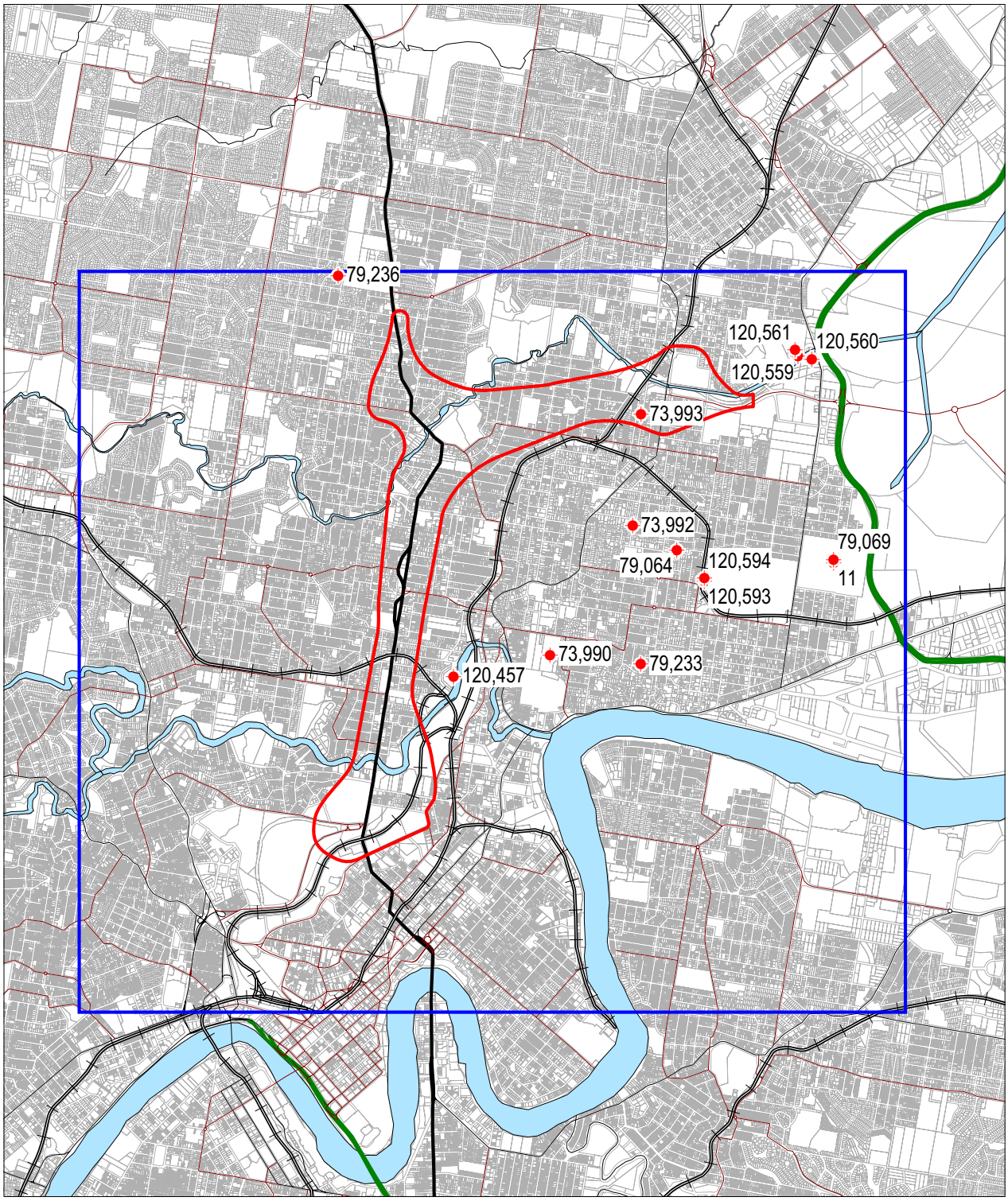
	Rin	Tingalpa Formation
	Rif	Brisbane Tuff
	DCf	Neranleigh-Fernvale Beds
		Project Corridor
557	◆	Electrical Conductivity (uS/cm)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
GROUNDWATER ELECTRICAL CONDUCTIVITY

CLIENT: SKM-CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: 1:20,000 (A3)	PROJECT No: G1312/C	DRAWING No: 8
APPROVED BY:		DATE: May 2006	



- LEGEND -

Project Corridor

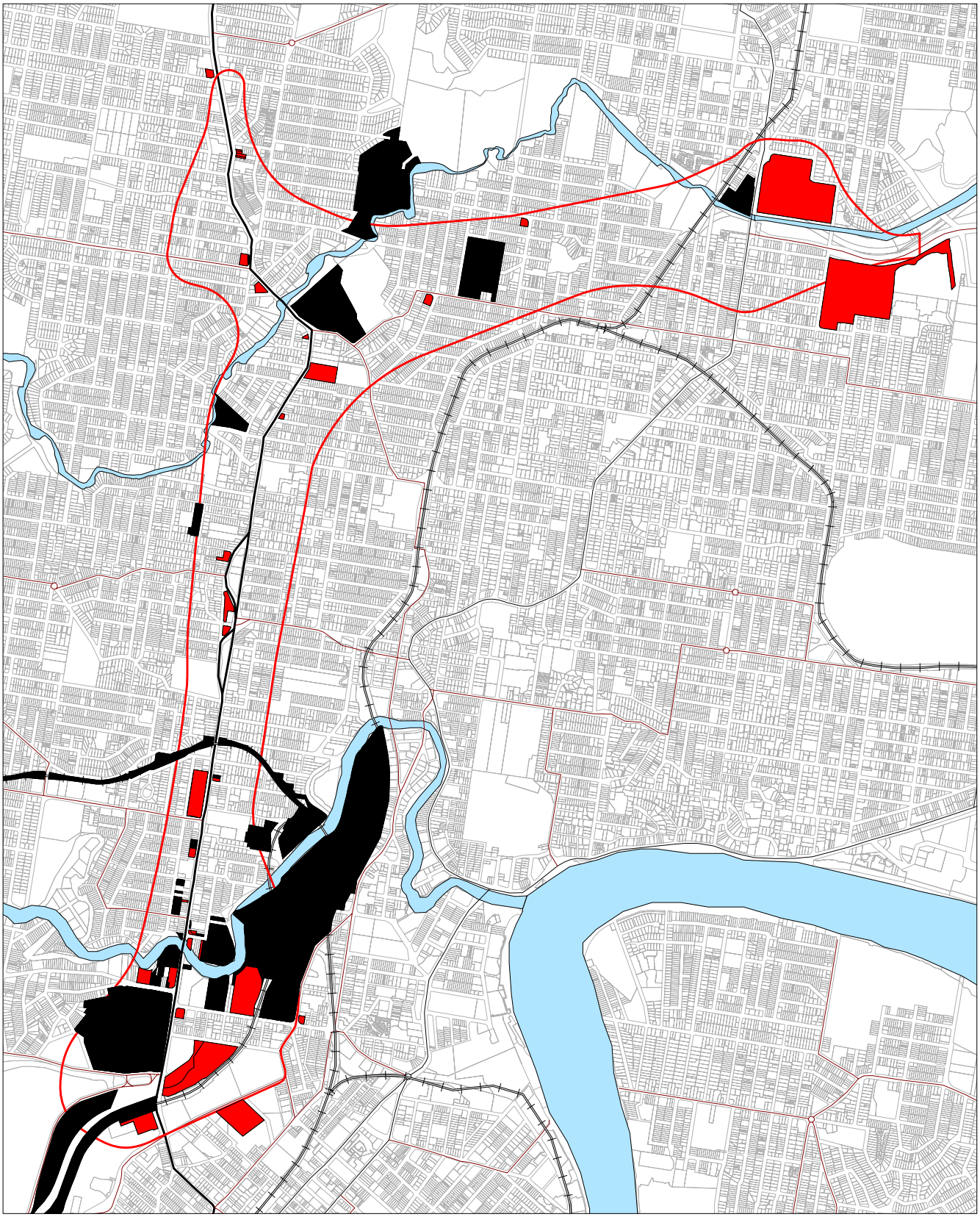
Bounds of NRM Database Search

NRM Registered Bore

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
NRMW REGISTERED BORES

CLIENT: SKM - CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: 1:60,000 (A4)	PROJECT No: G1312/C	DRAWING No: 9
APPROVED BY:		DATE: May 2006	



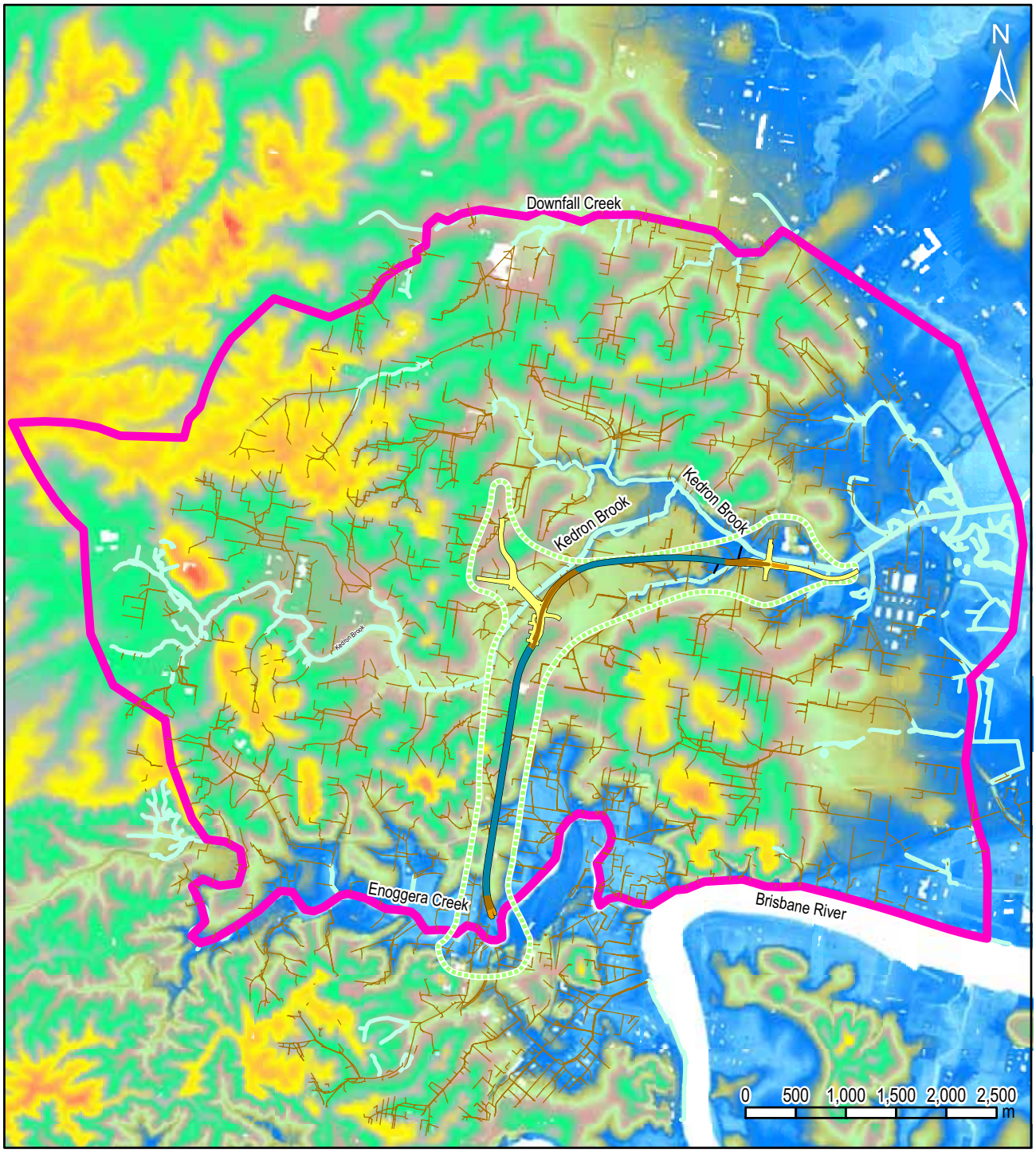
- LEGEND -

- Project Corridor
- Potentially Contaminated Site (non-hydrocarbon)
- Potentially Contaminated Site (hydrocarbon)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
EPA AND HISTORICAL CONTAMINATED SITES

CLIENT: SKM - CW Joint Venture			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: 1:20,000 (A3)	PROJECT No: G1312/C	DRAWING No: 10
APPROVED BY:		DATE: May 2006	



- LEGEND -

Topographical Elevation (mAHD)

- 0 - 0.01m
- 0.01 - 5m
- 5 - 10m
- 10 - 15m
- 15 - 20m
- 20 - 30m
- 30 - 40m
- 40 - 50m
- 50 - 75m
- 75 - 100m
- 100 - 150m
- 150 - 200m

APL Alignment

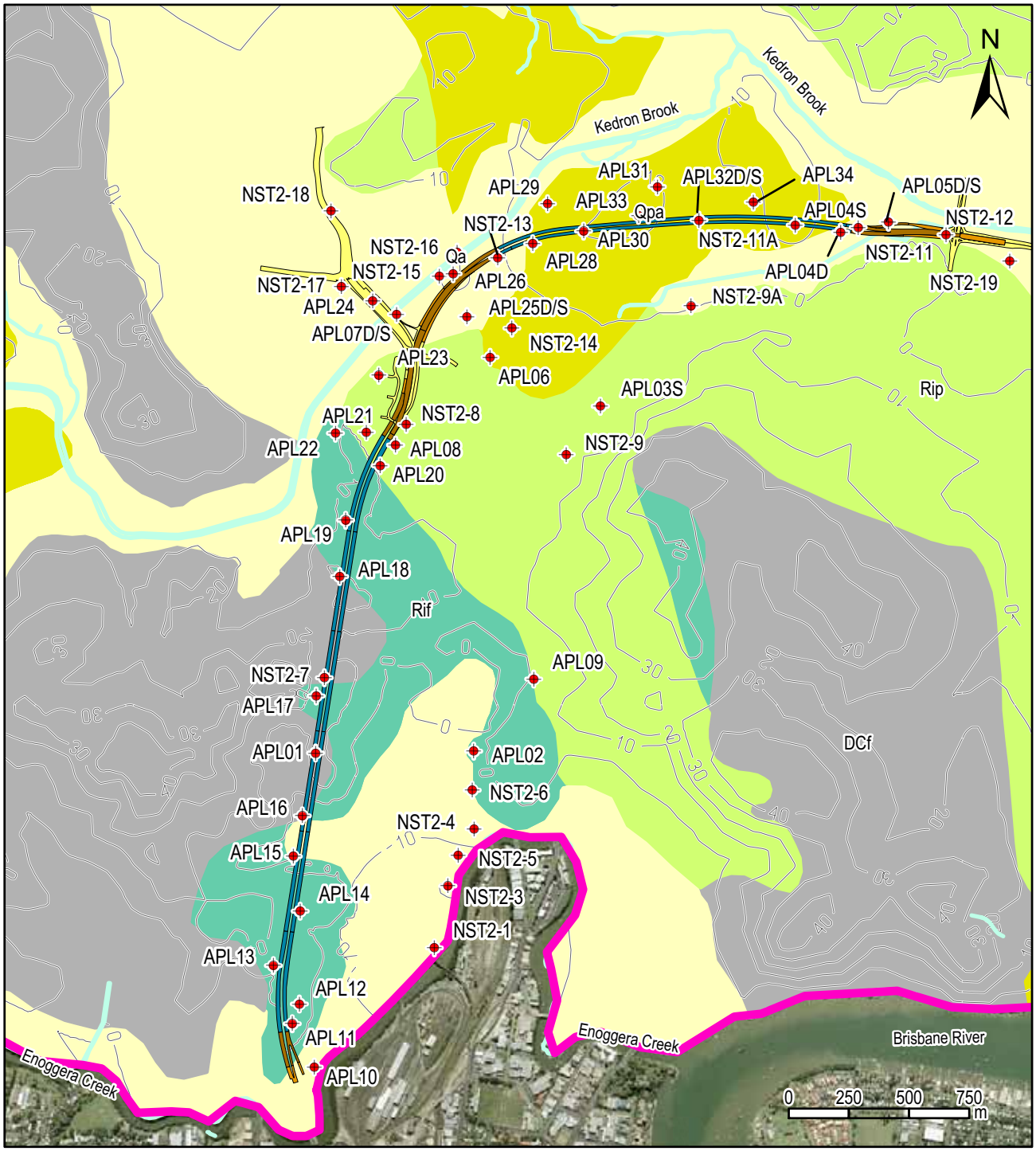
- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

- Waterway
- Stormwater Drainage
- Model Domain
- Project Corridor

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODEL DOMAIN - TOPOGRAPHY

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 11
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Hydrogeological Units

- Qa Recent Alluvium
- Qpa Old Alluvium
- Rip Tingalpa Formation
- Rif Brisbane Tuff
- DCf Neranvale Fernleigh Beds

APL Alignment

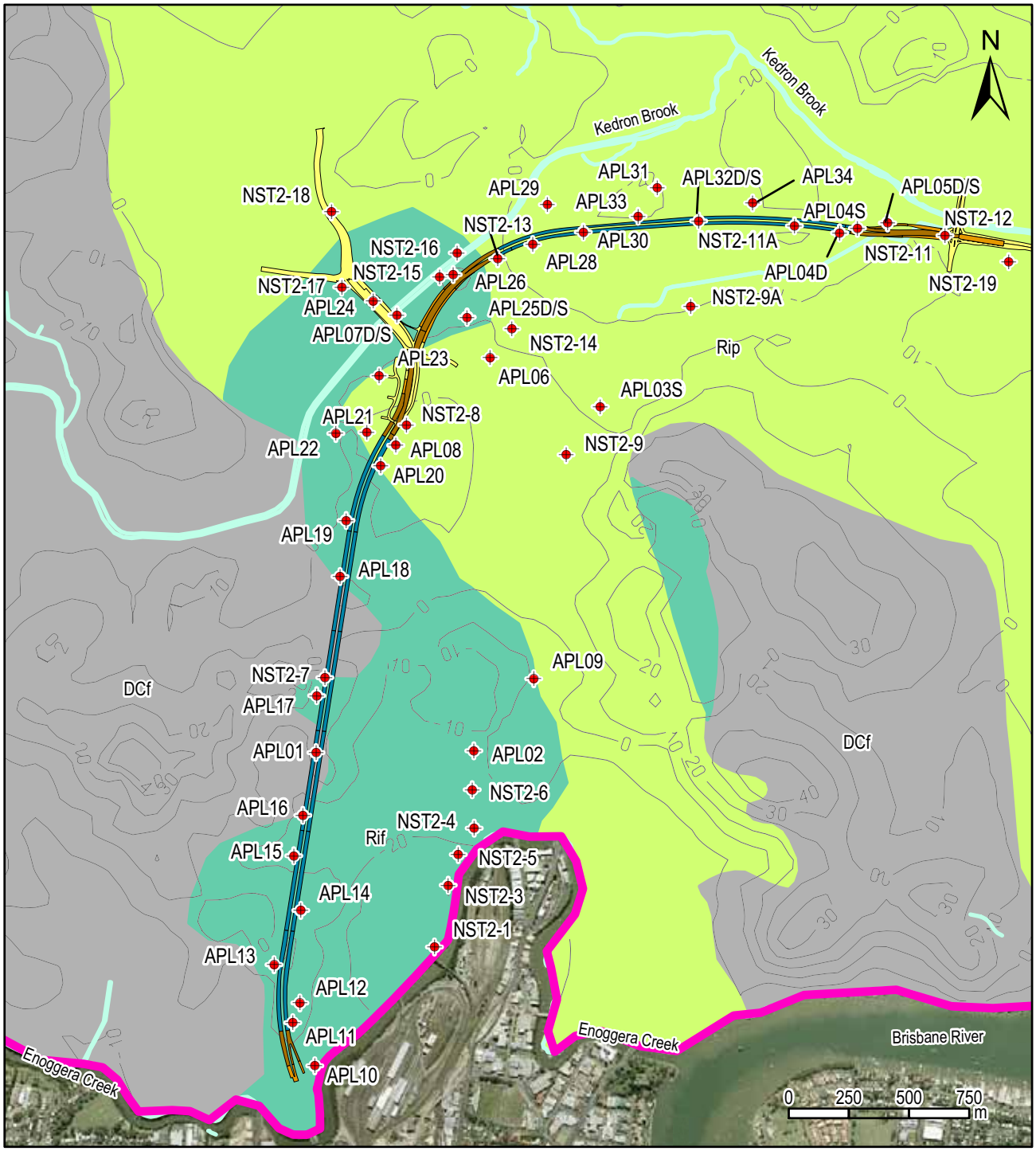
- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

- Waterway
- APL09 Modelled Monitoring Bore
- Layer Base (mAHD)
- Model Domain

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODEL LAYER 1 - HYDROGEOLOGICAL UNITS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 12
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Hydrogeological Units

- Rip Tingalpa/ Aspley Formation
- Rif Brisbane Tuff
- DCf Neranvale Fernleigh Beds

APL Alignment

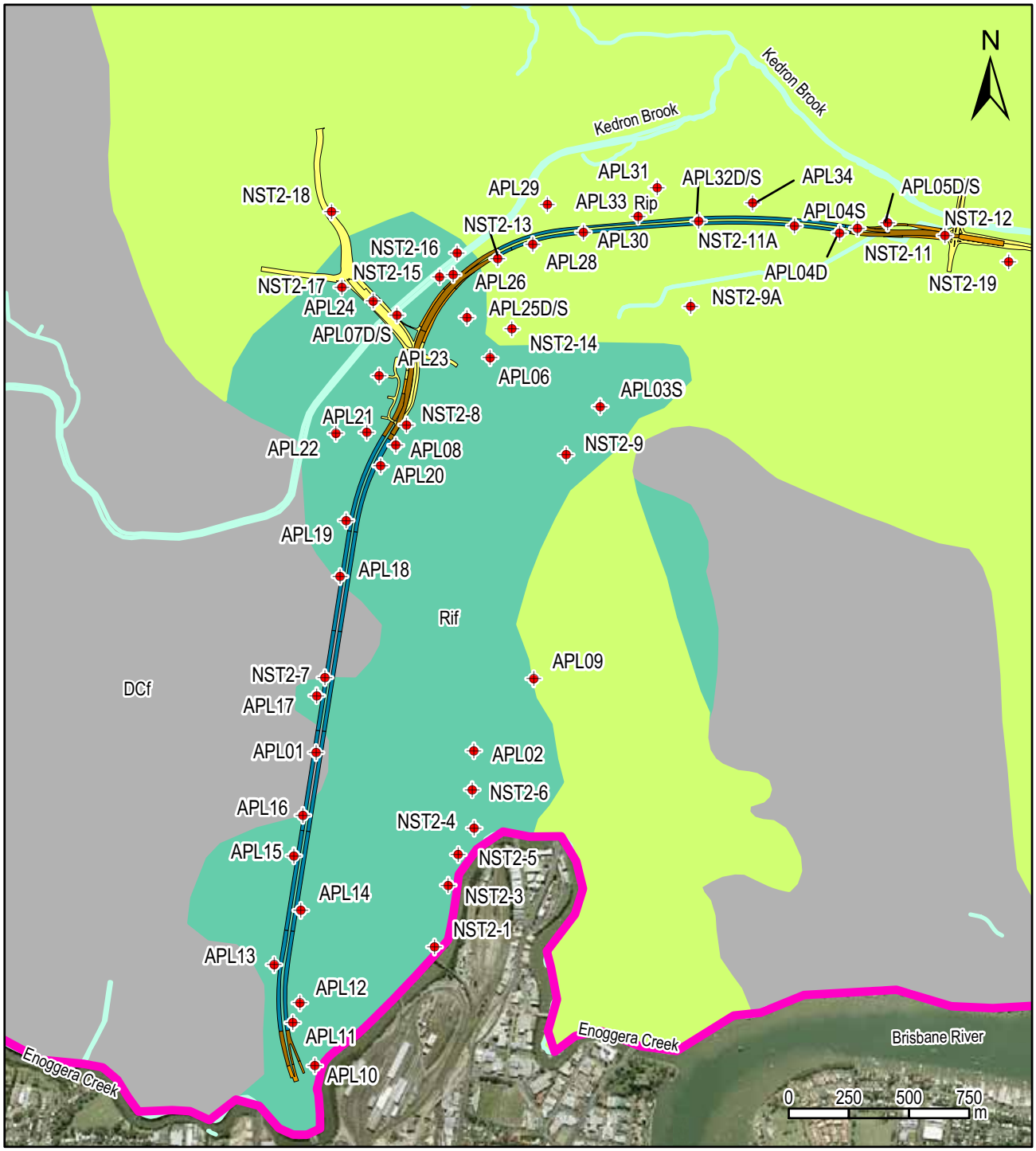
- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

- Waterway
- APL09 Modelled Monitoring Bore
- Layer Base (mAHD)
- Model Domain

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODEL LAYER 2 - HYDROGEOLOGICAL UNITS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 13
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Hydrogeological Units

- Rip Tingalpa/ Aspley Formation
- Rif Brisbane Tuff
- DCf Neranvale Fernleigh Beds

APL Alignment

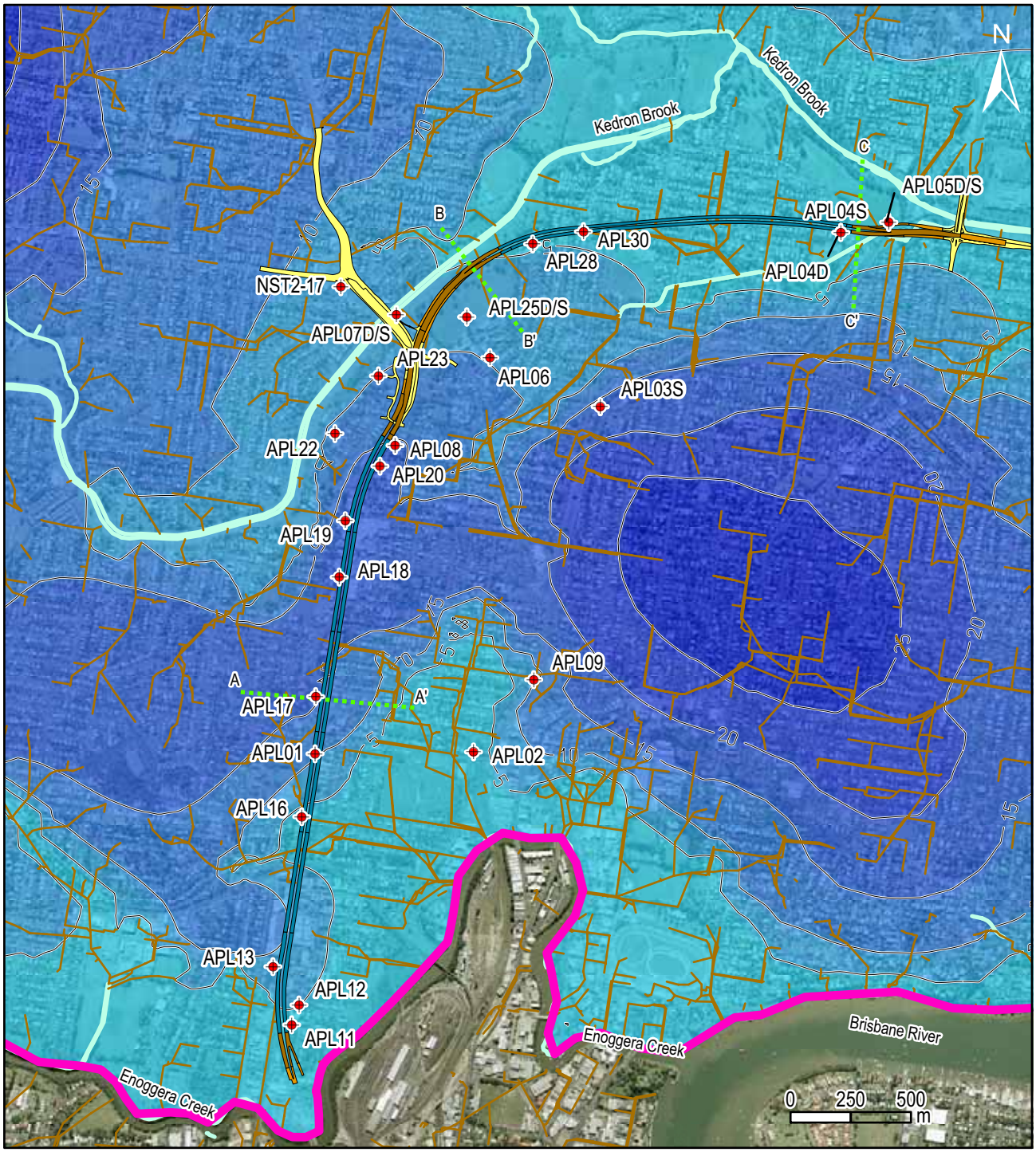
- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

- Waterway
- APL09 Modelled Monitoring Bore
- Model Domain
- Layer Base at -50mAHD

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODEL LAYER 3 - HYDROGEOLOGICAL UNITS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 14
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Water Table (mAHD)

- < -30
- -30 - -25
- -25 - -20
- -20 - -15
- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

APL Alignment

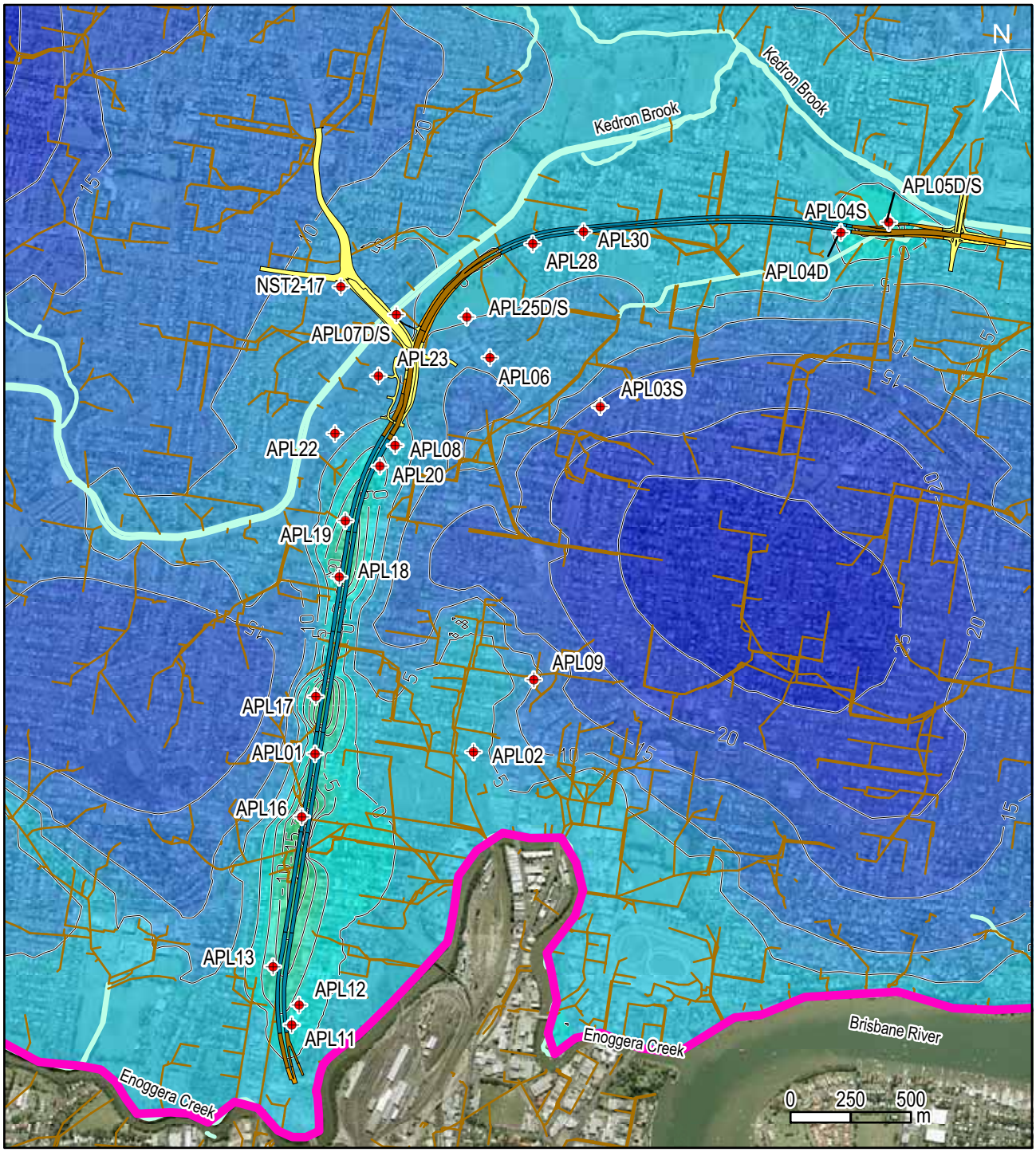
- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- 5m Water Level Contour (mAHD)
- Model Domain
- Cross Section

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODELLED WATER LEVELS - PRE CONSTRUCTION

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 15
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Water Table (mAHD)

- < -30
- -30 - -25
- -25 - -20
- -20 - -15
- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

APL Alignment

- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

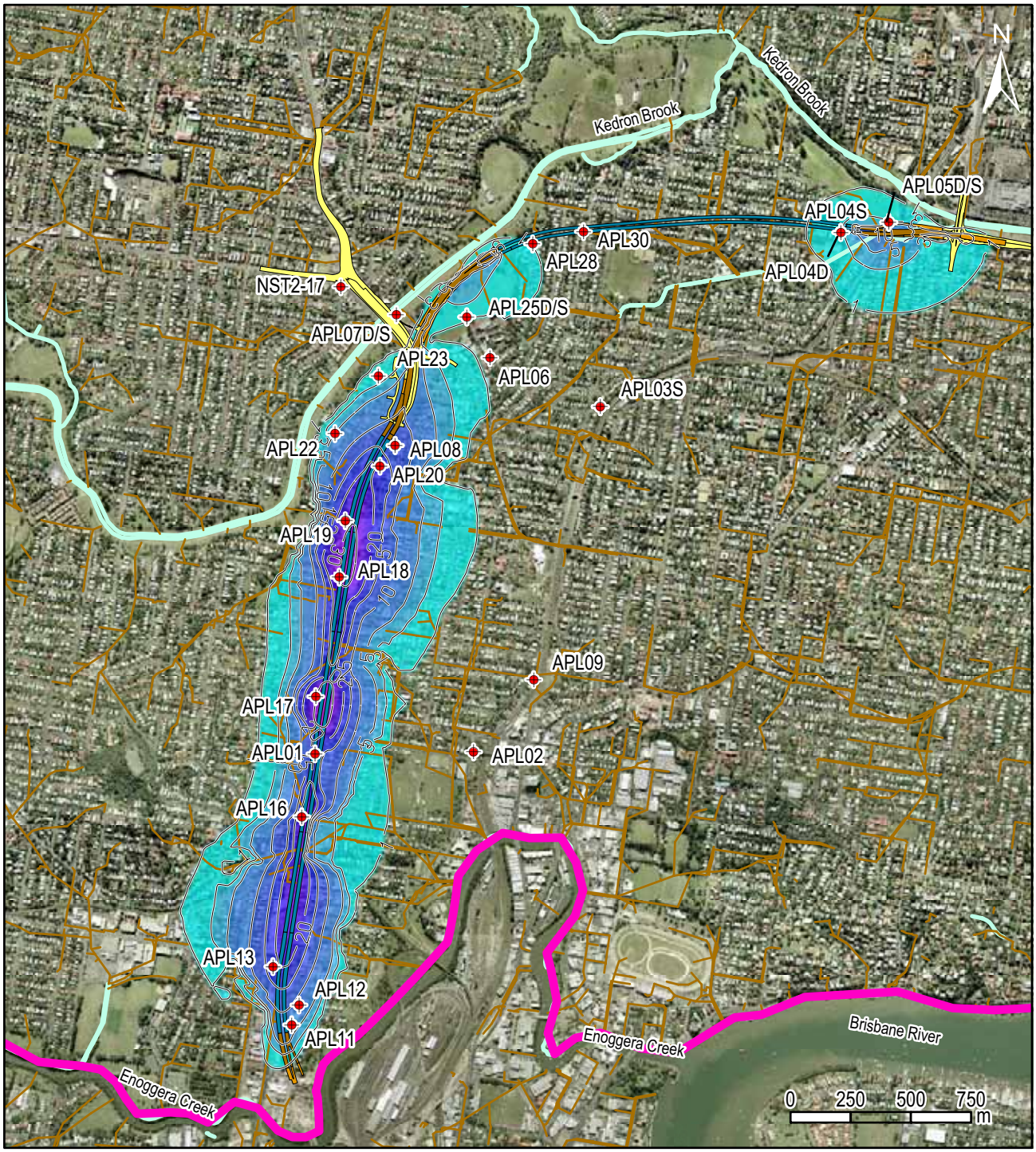
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- 5m Water Level Contour (mAHD)
- Model Domain

Post Construction (1year)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
BASE SCENARIO - MODELLED WATER LEVELS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 16
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

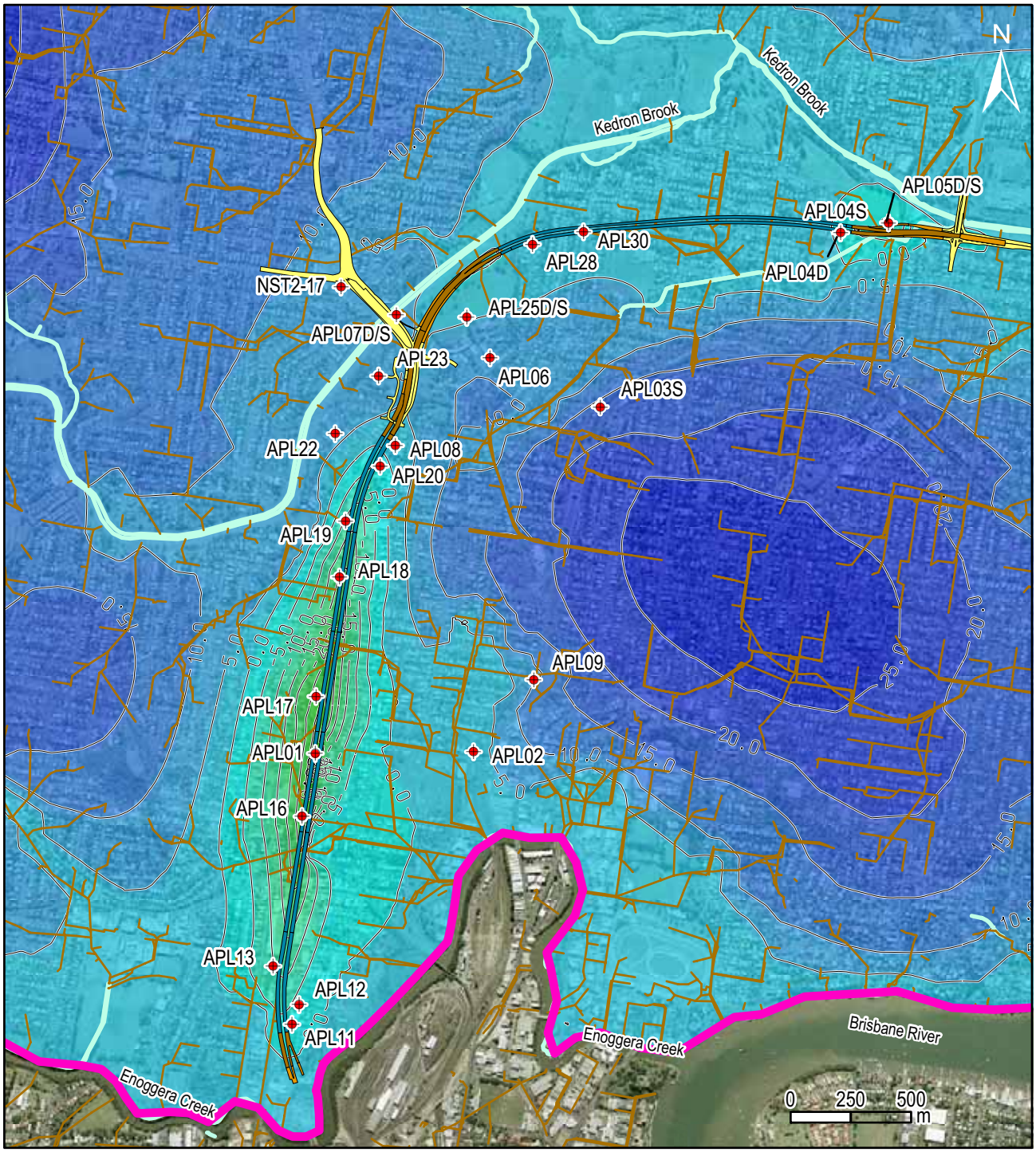
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post Construction (1 year)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
BASE SCENARIO - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 17
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Water Table (mAHD)

- < -30
- -30 - -25
- -25 - -20
- -20 - -15
- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

APL Alignment

- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

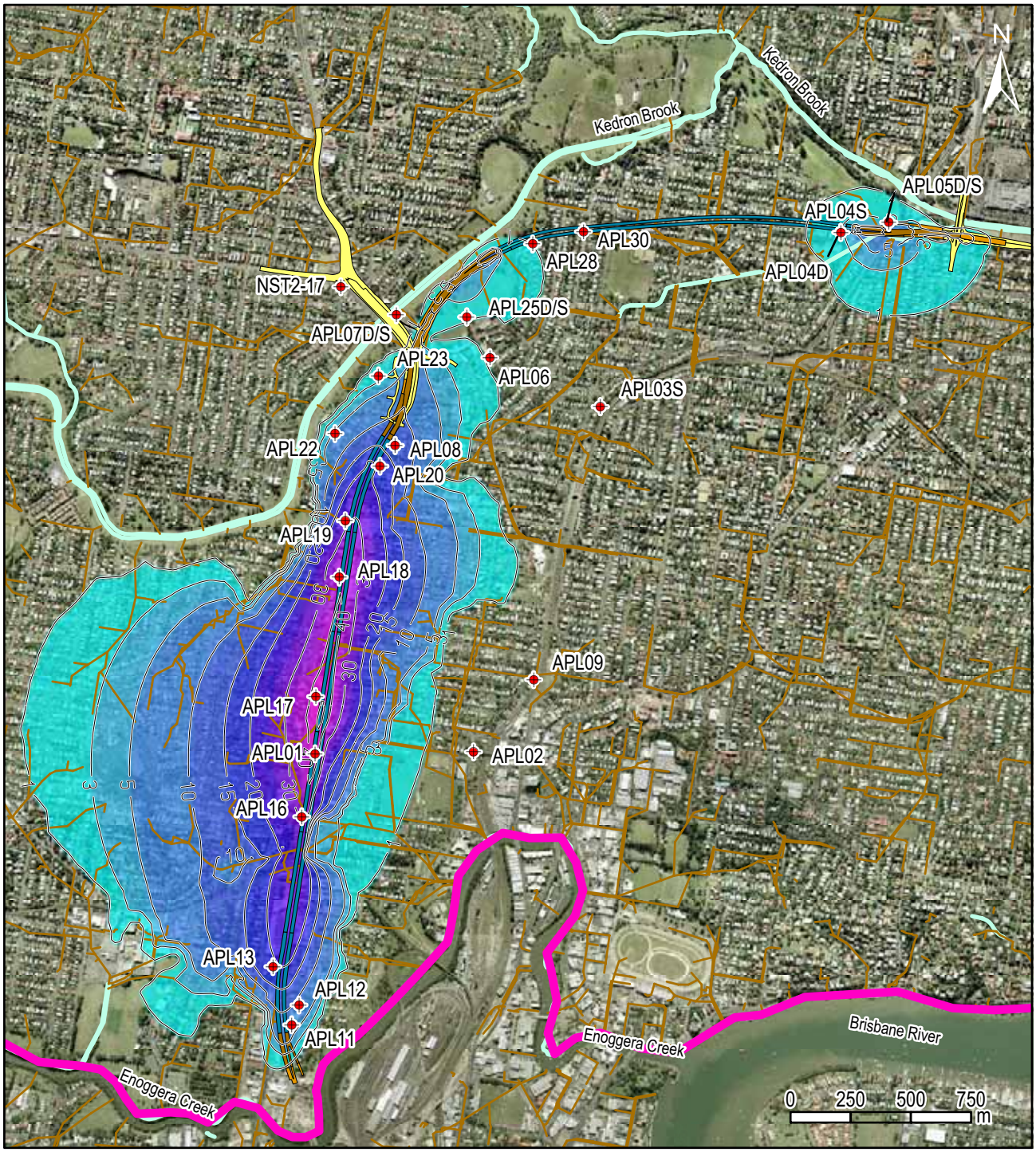
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- 5m Water Level Contour (mAHD)
- Model Domain

Post Construction Long-term (>50yrs)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
BASE SCENARIO - MODELLED WATER LEVELS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 18
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Surface Structures
- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure

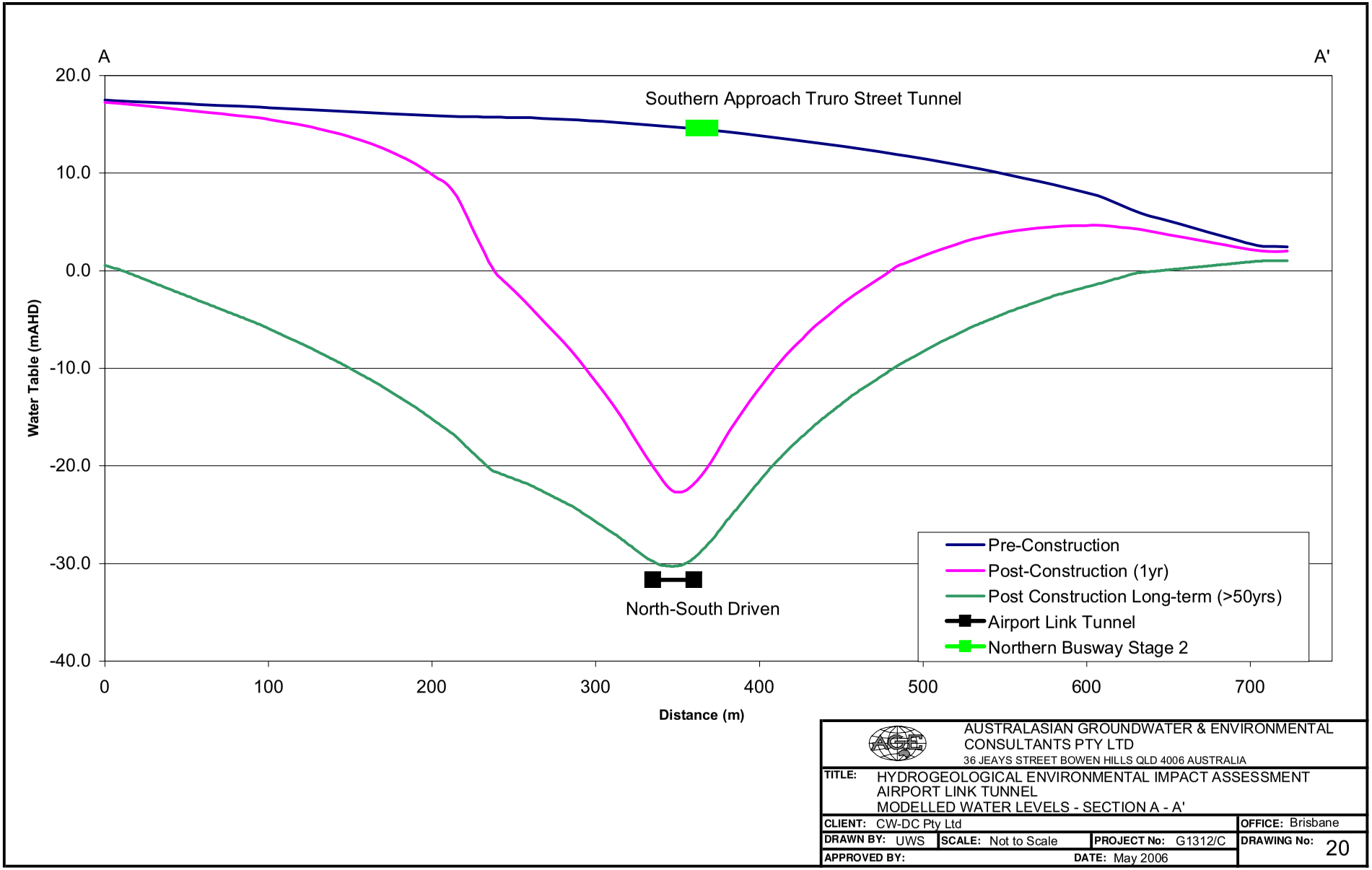
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post Construction Long-term (>50 yrs)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
BASE SCENARIO - MODELLED DRAWDOWN

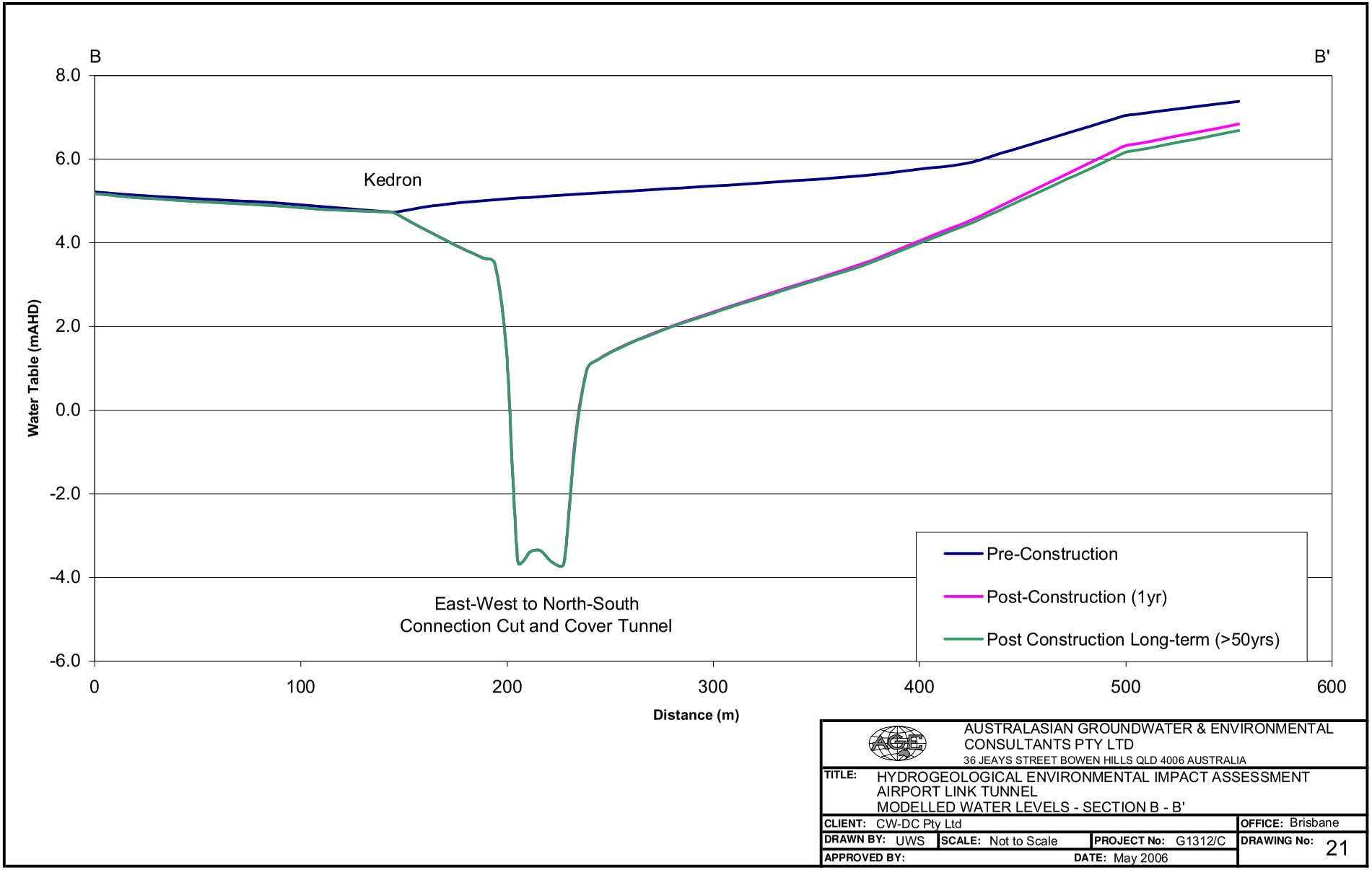
CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 19
APPROVED BY:		**DATE:** May 2006	



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODELLED WATER LEVELS - SECTION A - A'

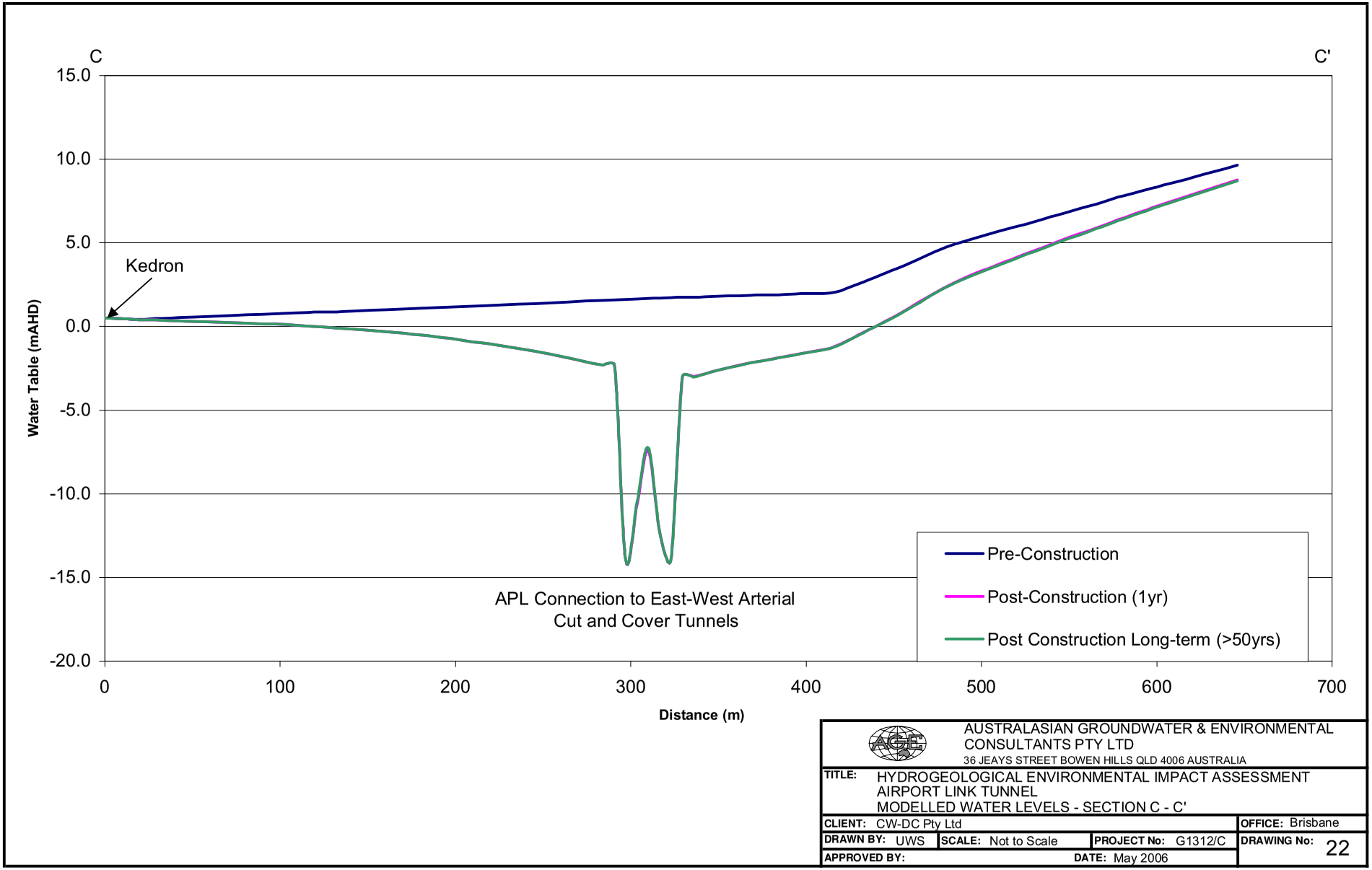
CLIENT: CW-DC Pty Ltd			OFFICE: Brisbane
DRAWN BY: UWS	SCALE: Not to Scale	PROJECT No: G1312/C	DRAWING No: 20
APPROVED BY:		DATE: May 2006	



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

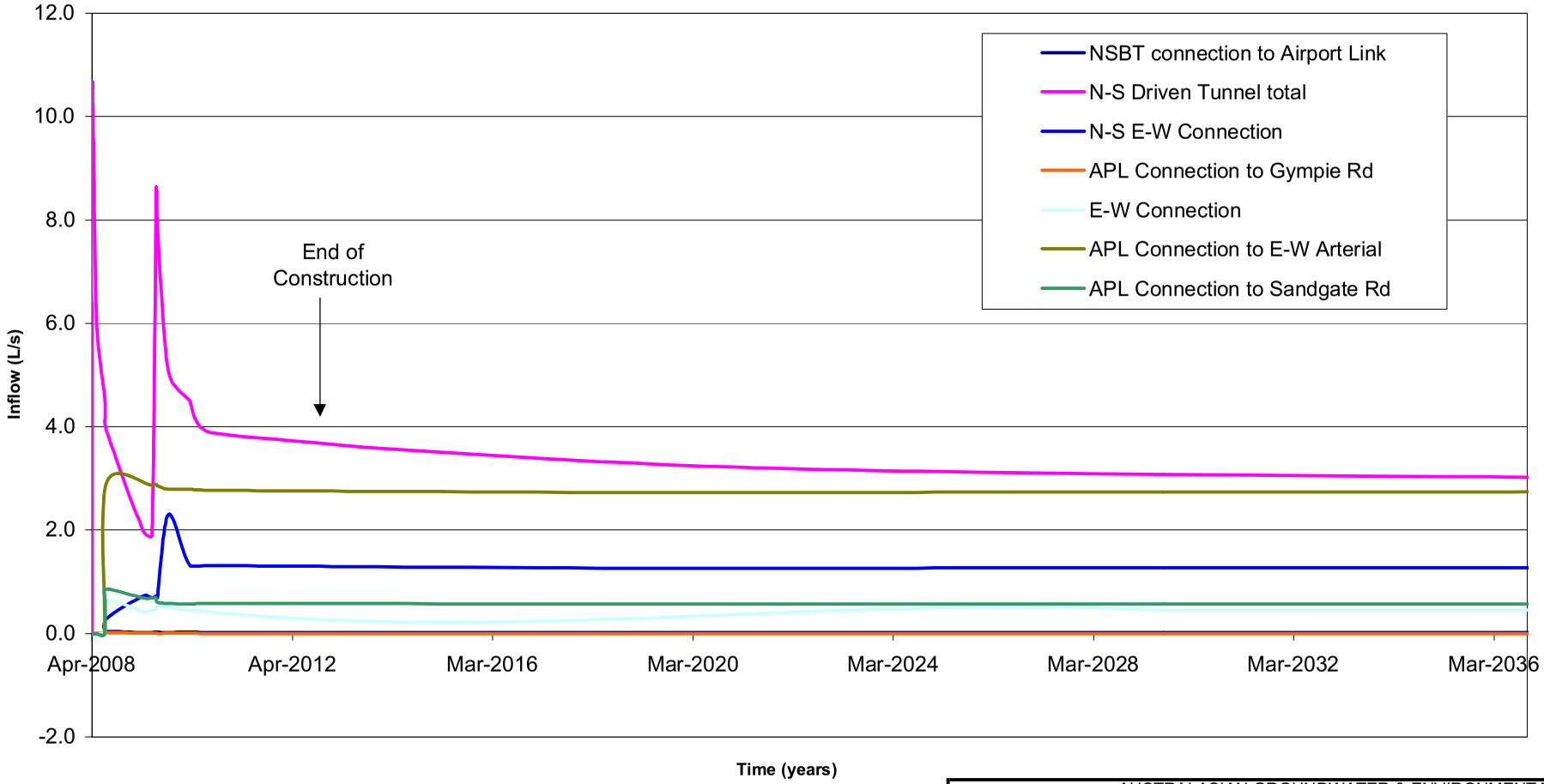
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODELLED WATER LEVELS - SECTION B - B'

CLIENT: CW-DC Pty Ltd			OFFICE: Brisbane
DRAWN BY: UWS	SCALE: Not to Scale	PROJECT No: G1312/C	DRAWING No: 21
APPROVED BY:		DATE: May 2006	



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

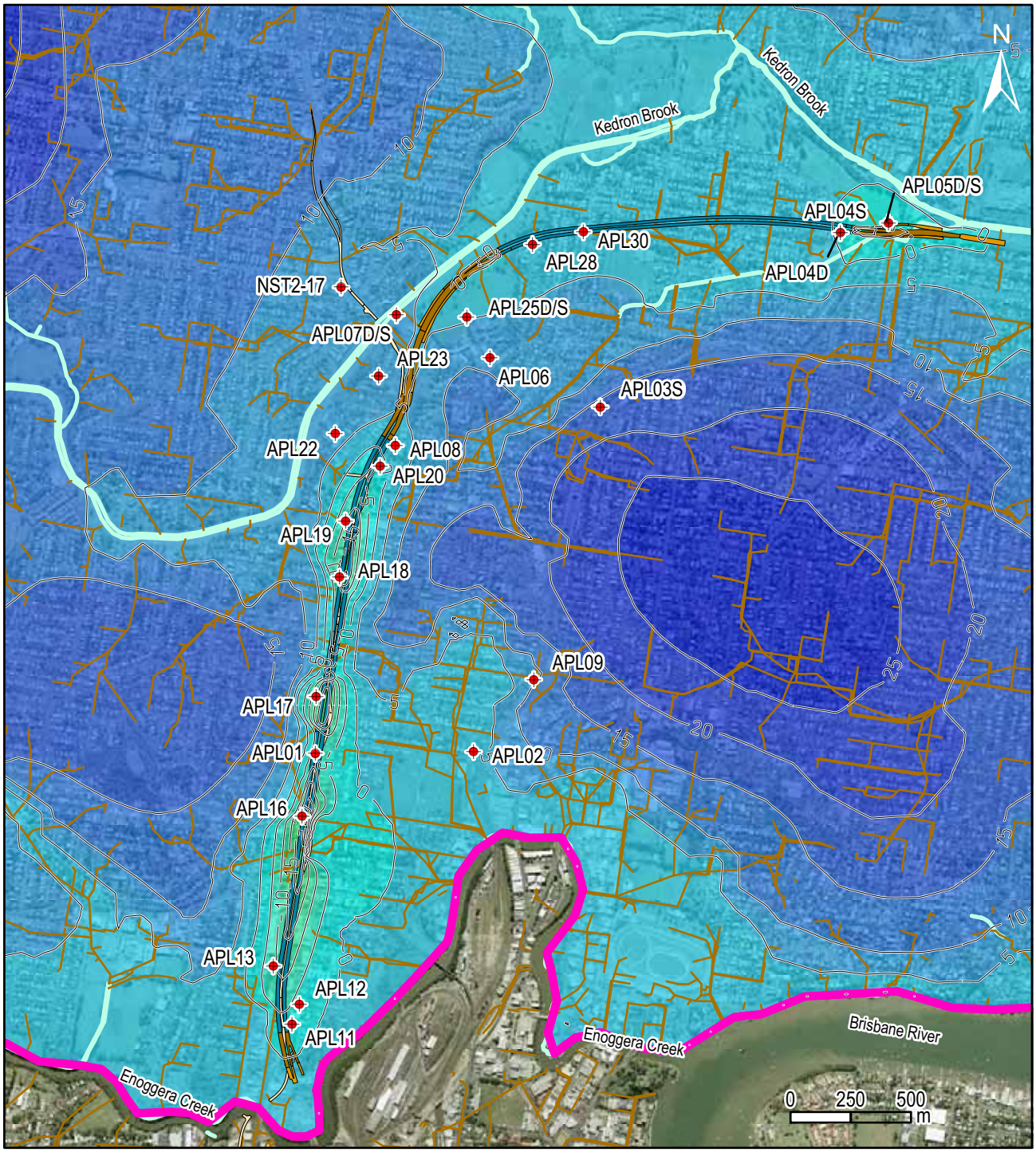
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT AIRPORT LINK TUNNEL MODELLED WATER LEVELS - SECTION C - C'				
CLIENT: CW-DC Pty Ltd				OFFICE: Brisbane
DRAWN BY: UWS	SCALE: Not to Scale		PROJECT No: G1312/C	DRAWING No: 22
APPROVED BY:		DATE: May 2006		



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
MODELLED INFLOW RATES

CLIENT: SKM - CW Joint Venture			OFFICE: Brisbane
DRAWN BY: UWS	SCALE: Not to Scale	PROJECT No: G1312/C	DRAWING No: 23
APPROVED BY:		DATE: May 2006	



- LEGEND -

Water Table (mAHD)

- < -30
- -30 - -25
- -25 - -20
- -20 - -15
- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

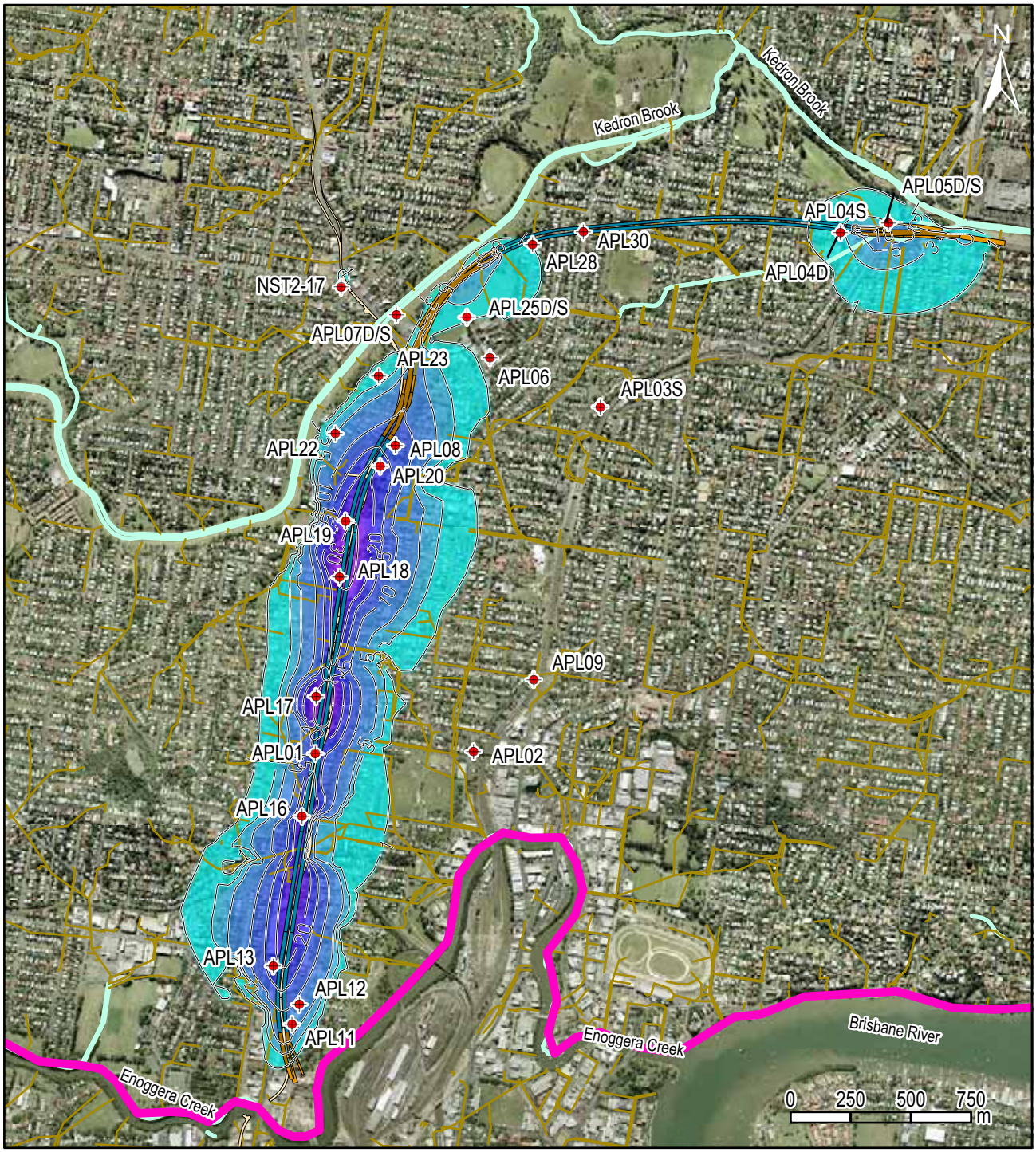
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- 5m Water Level Contour (mAHD)
- Model Domain

Post APL Construction (1 year)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
CUMULATIVE IMPACT - MODELLED WATER LEVELS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 24
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

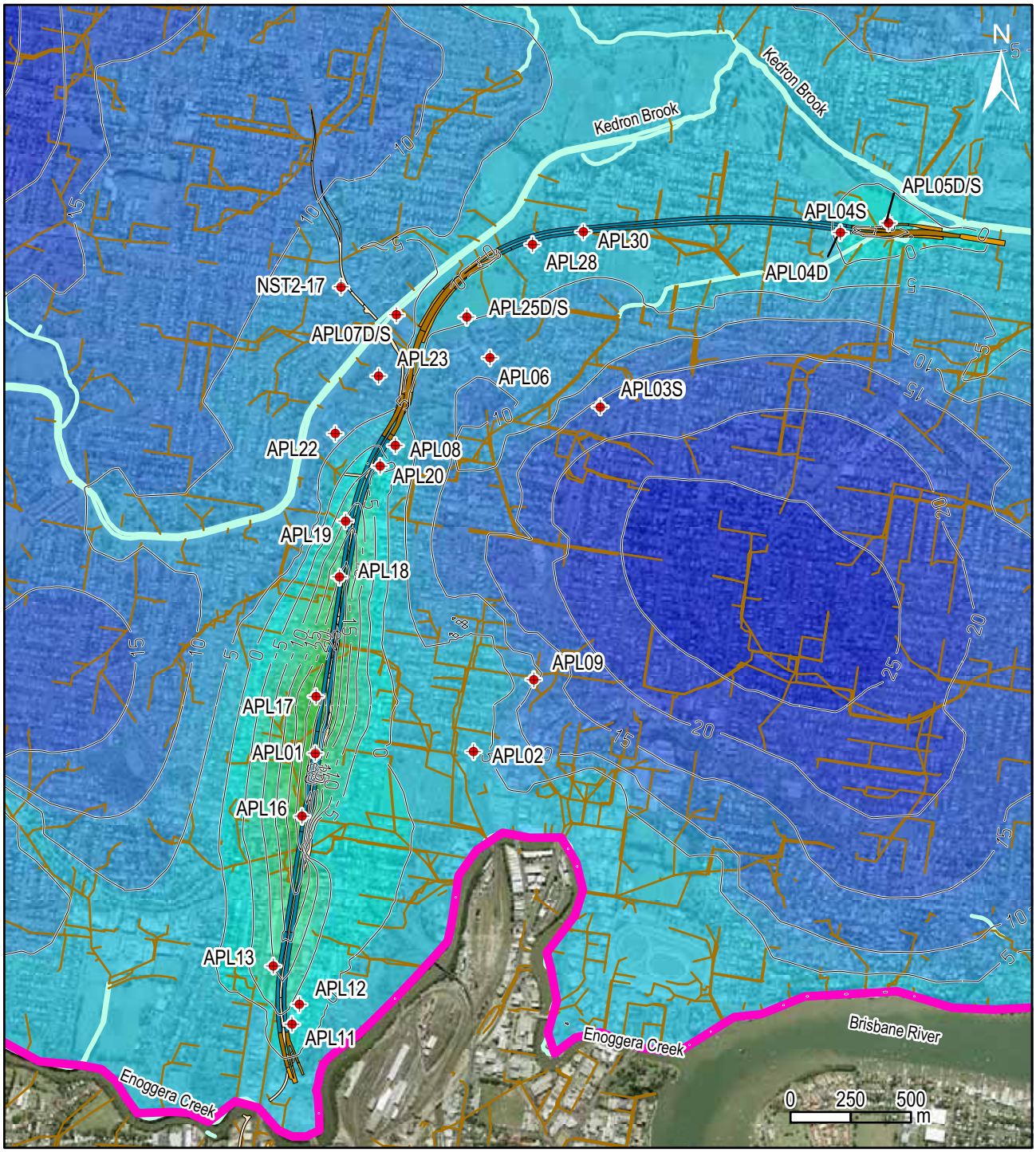
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post APL Construction (1 year)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
CUMULATIVE IMPACT - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 25
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Water Table (mAHD)

- < -30
- -30 - -25
- -25 - -20
- -20 - -15
- -15 - -10
- -10 - -5
- -5 - 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

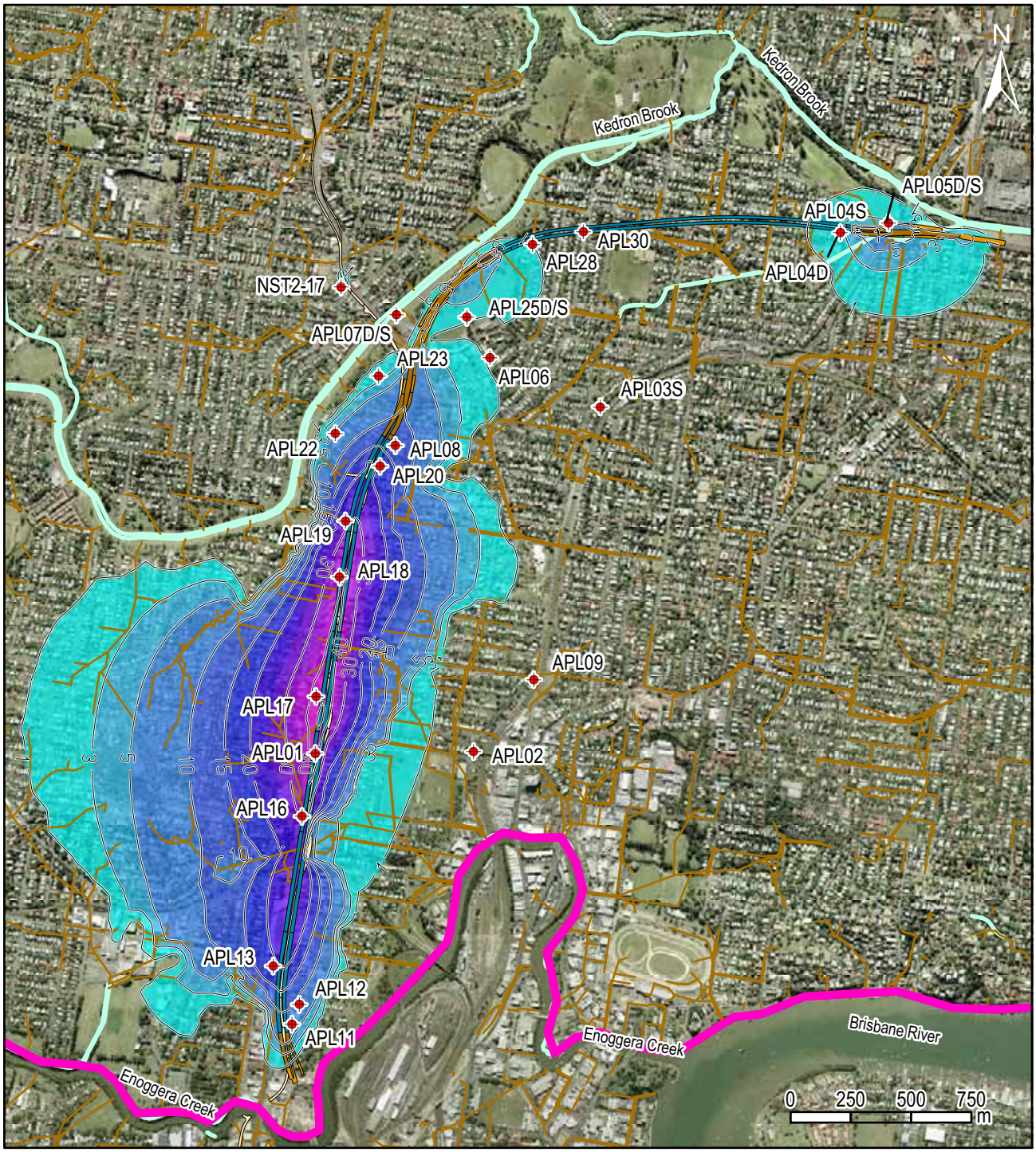
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- 5m Water Level Contour (mAHD)
- Model Domain

Post Construction Long-term (>50 years)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
CUMULATIVE IMPACT - MODELLED WATER LEVELS

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 26
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

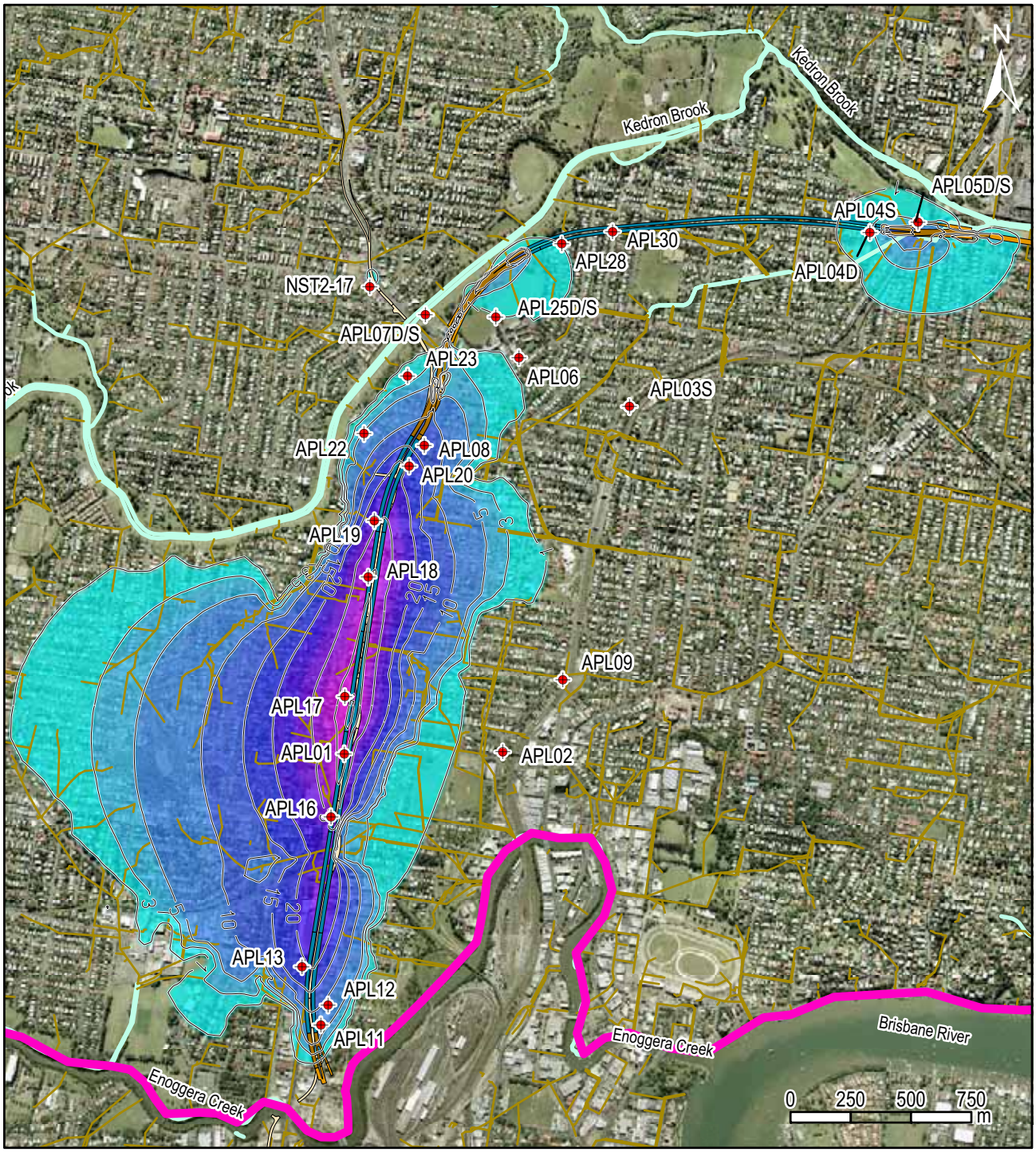
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post Construction Long-term (>50 yrs)

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
CUMULATIVE IMPACT - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 27
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

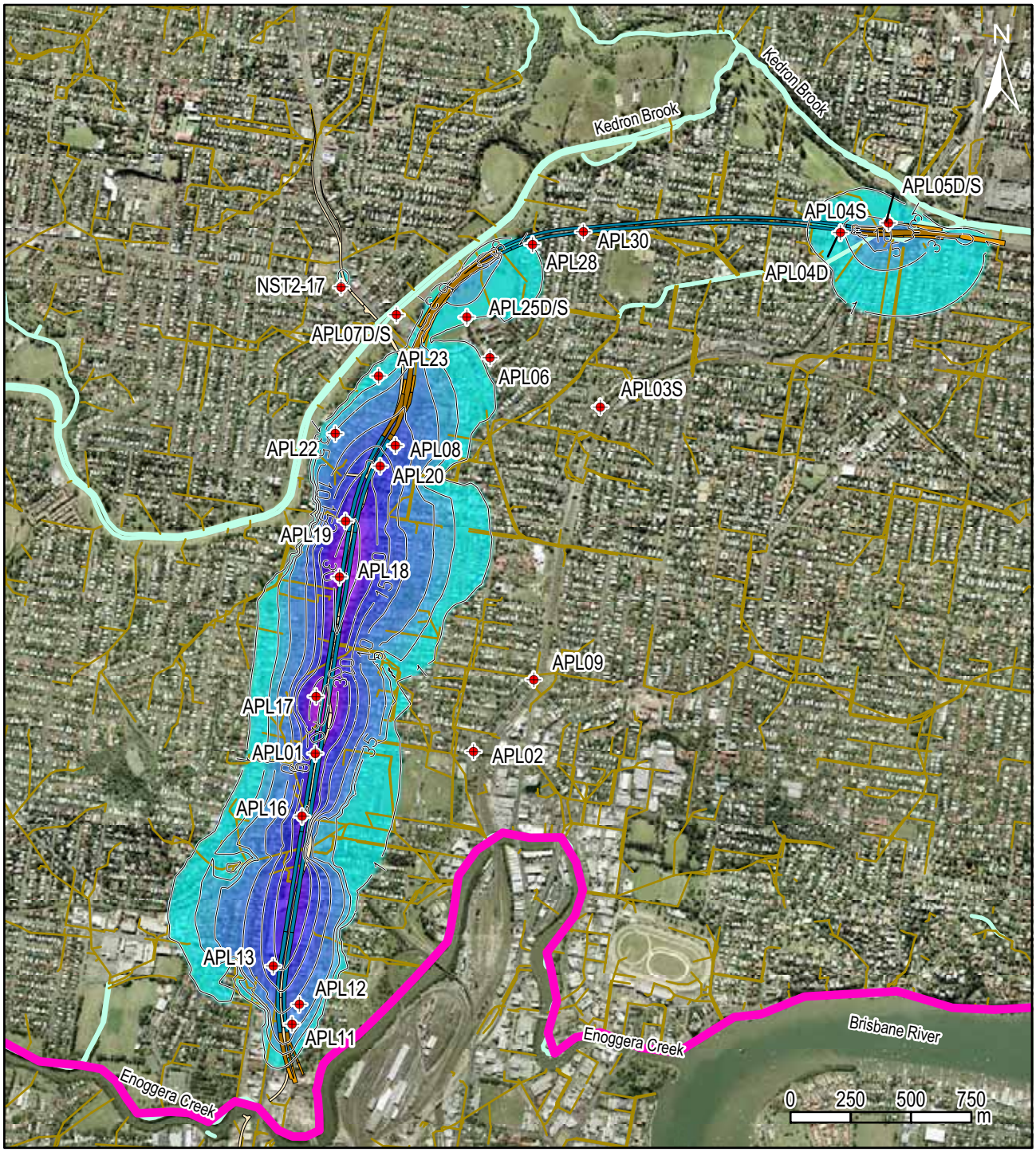
- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post Construction Longt-term (>50 years)
Cumulative Scenario
Permeability = 2 x Base Case Permeability

AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
PERMEABILITY SENSITIVITY ANALYSIS - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 28
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Post Construction APL (1 year)
Cumulative Scenario
Specific Yield = 0.5 x Base Case Specific Yield

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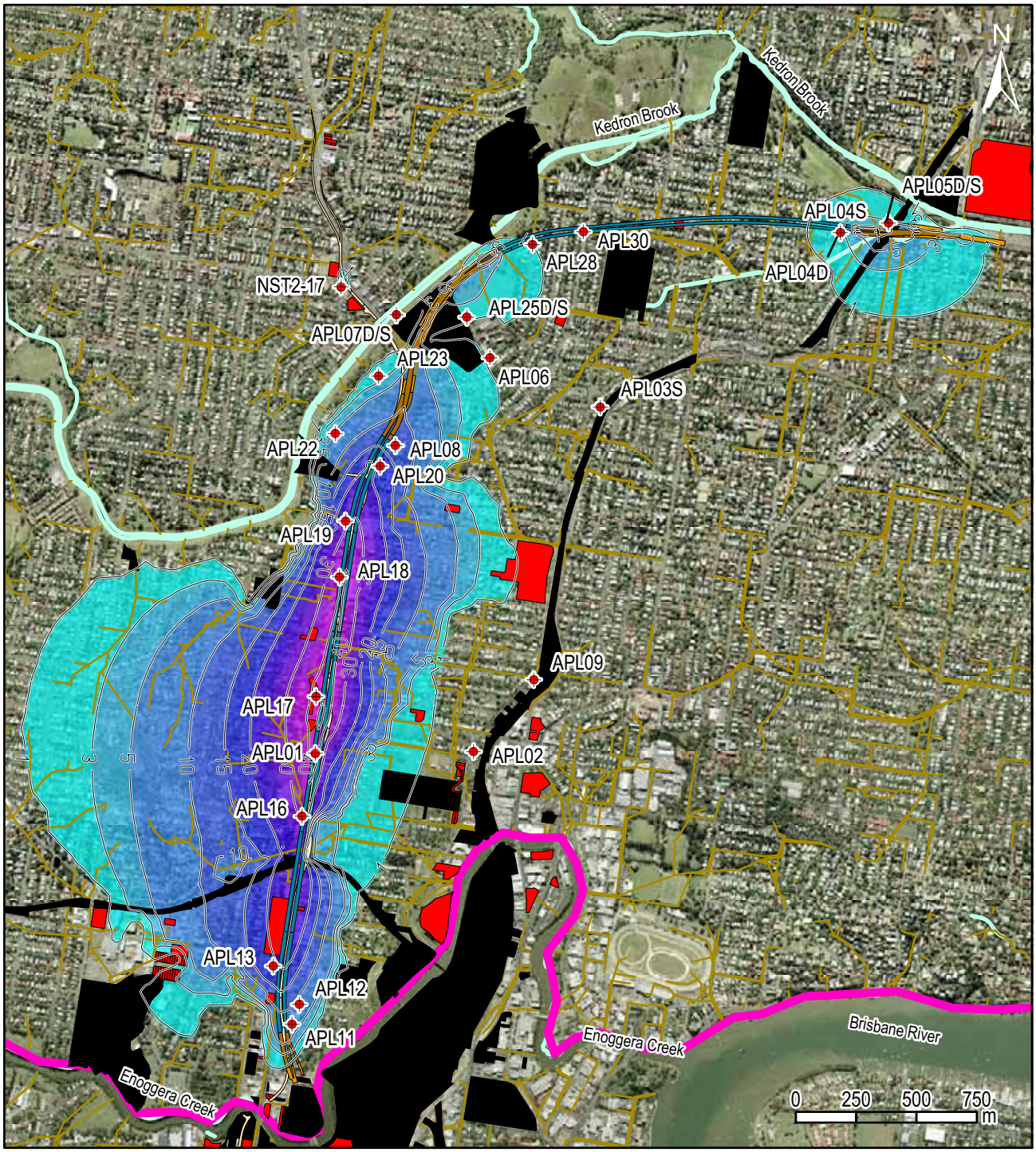
AIRPORT LINK TUNNEL
SPECIFIC YIELD SENSITIVITY ANALYSIS - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 29
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

- Potentially Contaminated Site (Non-hydrocarbon)
- Potentially Contaminated Site (Hydrocarbon)

Post Construction Longterm (>50years)

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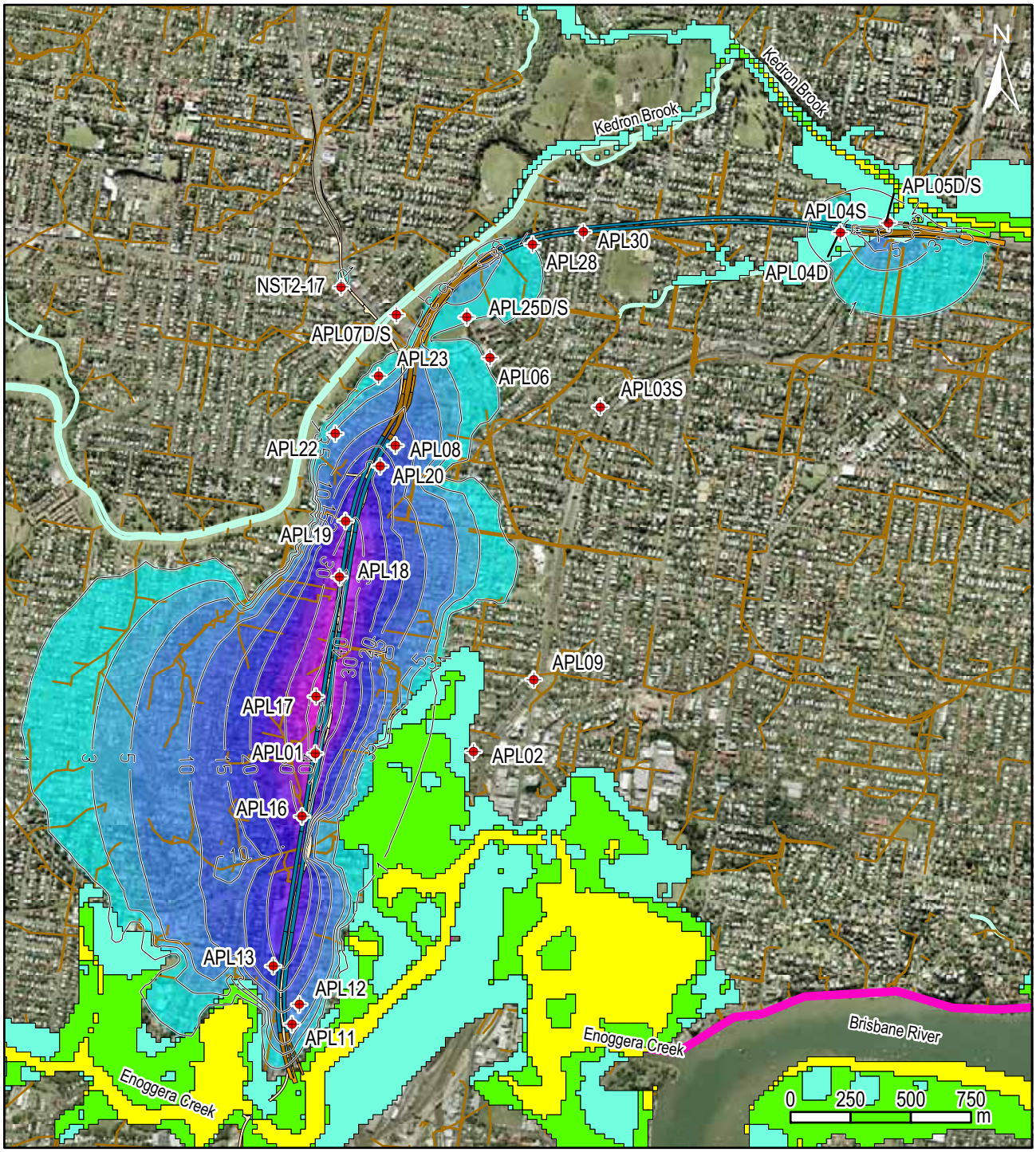
TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
POTENTIALLY CONTAMINATED SITES - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 30
APPROVED BY:		**DATE:** May 2006	



- LEGEND -

Post Construction Longterm (>50years)

Drawdown (m)

- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45

APL Alignment

- Cut and Cover Tunnel
- Driven Tunnel
- Transition Structure
- Northern Busway

- Waterway
- Stormwater Drainage
- APL09 Modelled Monitoring Bore
- Drawdown Contour (m)
- Model Domain

Acid Sulphate Soil

- AS2 - Hazard Rating Low
- AS3 - Hazard Rating Medium
- AS4 - Hazard Rating High
- AS5 - Hazard Rating Very High

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TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK TUNNEL
ASS HAZARD RISK - MODELLED DRAWDOWN

CLIENT: SKM - CW Joint Venture			**Office:** Brisbane
DRAWN BY: UWS	**SCALE:** 1:25,000 (A4)	**PROJECT No:** G1312/C	**DRAWING No:** 31
APPROVED BY:		**DATE:** May 2006	

Appendix A

GEOTECHNICAL DRILLING

Table A1: Airport Link Geotechnical Borehole Summary

Borehole	Easting (BCSG02)	Northing (BCSG02)	Easting (GDA94)	Northing (GDA94)	Collar (mAHD)	Location	Azimuth	Inclination	Total Depth (m)	Date Commenced	Date Completed	Approx APL Chainage	Approx APL Invert Level	Response Zone Geology	Completion Details	Construction Details
NST2-1	53690.00	162314.00	503689.00	6965087.00	1.80	Genon St Bikeway, Windsor	-	90.00	20.16	11/8/04				-	abandoned	
NST2-3	53747.00	162571.00	503746.00	6965344.00	1.70	Somerset St near McDonald Rd, Windsor	-	90.00	32.47	10/8/05				-	abandoned	
NST2-4	53789.00	162698.00	503788.00	6965471.00	2.20	Bowen St near McDonald Rd, Windsor	-	90.00	17.53	12/8/05				-	abandoned	
NST2-5	53855.00	162808.00	503854.00	6965581.00	2.50	Grafton St near McDonald Rd, Windsor	-	90.00	10.30	13/8/04	13/8/04			-	abandoned	
NST2-6	53847.00	162968.00	503845.00	6965741.00	2.80	Mill St near McDonald Rd, Windsor	-	90.00	8.30						WL 0.5mAHD	
NST2-7	53234.00	163434.00	503233.00	6966207.00	28.00	Lutwyche Rd near Fosbery St, Windsor	-	90.00	16.96	15/9/04				-	abandoned	
NST2-7A	53177.00	162797.00	503176.00	6965570.00	4.50	Bowen St near Lutwyche Rd, Windsor	-	90.00	8.54	17/9/04	17/9/04				WL 2.1mAHD	
NST2-8	53574.00	164485.00	503573.00	6967257.00	24.20	Norman St near Lutwyche Rd, Wooloowin	-	90.00	28.57	20/8/04	20/8/04			-	abandoned	
NST2-9	54238.00	164360.00	504236.00	6967133.00	18.70	Inwood and Dickson Sts, Wooloowin	-	90.00	20.65	16/9/04	16/9/04			-	abandoned	
NST2-9A	54756.00	164976.00	504734.00	6967748.00	12.00	Woombye St, Wooloowin	-	90.00	20.00	13/10/04	13/10/04			-	abandoned	
NST2-11	55450.00	165302.00	505448.00	6968074.00	4.20	Kalinga Park off Jackson St, Clayfield	-	90.00	30.07	8/9/04	8/9/04			-	abandoned	
NST2-11A	55188.00	165312.00	505186.00	6968084.00	9.00	Lewis St near Fitzroy St, Clayfield	-	90.00	28.67	29/9/04	29/9/04			-	abandoned	
NST2-12	55814.00	165272.00	505812.00	6968044.00	5.00	Ross Park near Sandgate Rd, Clayfield	-	90.00	8.63	21/9/04	21/9/04			-	abandoned	
NST2-13	53953.00	165175.00	503951.00	6967947.00	9.80	Kalinga Park off Brook Rd, Wooloowin	-	90.00	14.95	7/9/04	7/9/04			-	abandoned	
NST2-14	54012.00	164884.00	504010.00	6967656.00	14.20	Gorman St near Kedron Park Rd, Wooloowin	-	90.00	22.86	17/9/07	17/9/04			-	abandoned	
NST2-15	53711.00	165100.00	503710.00	6967872.00	7.20	Kedron Brook near Emergency Services	-	90.00	13.00	7/9/04	7/9/04				WL 5.7mAHD	
NST2-16	53785.00	165200.00	503783.00	6967972.00	7.00	Kedron Brook near Kedron HS	-	90.00	4.07	21/9/04	21/9/04			-	abandoned	
NST2-17	53304.00	165057.00	503303.00	6967829.00	16.50	cnr Stafford Rd and Gympie Rd, Kedron	-	90.00	16.50	1/9/04	1/9/04			Brisbane Tuff	Rock Standpipe	Screen 9.5-15.5m, Sand 8.5-15.5m, Bentonite 0.0-8.5m
NST2-18	53261.00	165370.00	503260.00	6968142.00	28.20	Gympie Rd near Broughton Rd, Kedton	-	90.00	19.50	21/9/04	21/9/04			-	abandoned	
NST2-19	56079.00	165163.00	506077.00	6967935.00	4.00	Wongara St near Franz Rd, Clayfield	-	90.00	11.79	20/9/04	20/9/04			-	abandoned	
NST2-20	56266.00	165127.00	506264.00	6967899.00	4.00	Widdop St near Wongara St, Clayfield	-	90.00	23.50	17/9/04	17/9/04			-	abandoned	
APL01	53197.19	163122.17			23.64	Windsor Memorial Park	-	90.00	40.39	26/7/05	28/7/05			Neranleigh Fernvale Beds	Rock Standpipe	Screen 24.00-30.00m, Sand 23.00-40.25m, Bentonite 0.00-23.00m
APL02	53853.85	163129.45			4.94	Off McDonald Rd at Albion Overpass	-	90.00	5.11	25/7/05	25/7/05			Brisbane Tuff	Rock Standpipe	Screen 3.61-5.11m, Sand 3.11-5.11m, Bentonite 0.00-3.11m
APL03	54379.42	164560.48			21.47	Ashbolt St off Dickson St, Wooloowin	-	90.00	42.45	1/8/05	4/8/05			Aspley Formation	VWP	VWP tip set at 22.00m, sensor: 82231T, minilogger: 24113
APL03	54379.42	164560.48			21.47	Ashbolt St off Dickson St, Wooloowin	-	90.00	42.45	1/8/05	4/8/05			Brisbane Tuff	VWP	VWP tip set at 40.00m, sensor: 82233T, minilogger: 24021
APL04D	55376.12	165282.27			4.18	Lewis St near Kalinga Park	-	90.00	31.93	30/8/05	1/9/05			Tingalpa Formation	Rock Standpipe	Screen 26.90-31.90m, Sand 25.90-31.90m, Bentonite 24.90-25.90m
APL04S	55376.12	165282.27			4.18	Lewis St near Kalinga Park	-	90.00	9.40					Alluvium	Alluvium Standpipe	Screen
APL05D	55575.16	165324.24			4.17	Kalinga Park off Jackson St	-	90.00	23.70	6/9/05	7/9/05			Tingalpa Formation	VWP	VWP tip set at 20.00m, sensor: 83128T, minilogger: 24117
APL05S	55575.16	165324.24			4.17	Kalinga Park off Jackson St	-	90.00	9.00	6/9/05	7/9/05			Alluvium	Alluvium Standpipe	Screen 6.00-9.00m, Sand 4.80-9.00m, Bentonite 3.80-4.80m
APL06	53921.72	164763.64			14.87	Outside High School at Park Rd, Kedron	-	90.00	41.20	12/9/05	14/9/05			Brisbane Tuff	Rock Standpipe	Screen 29.20-41.20m, Sand 25.00-41.20m, Bentonite 22.00-25.00m
APL07D	53533.87	164941.53			7.81	Kedron Brook near Gympie Road	-	90.00	35.66	19/9/05	20/9/05			Brisbane Tuff	Rock Standpipe	Screen 29.66-35.66m, Sand 21.66-35.66m, Bentonite 18.00-21.66m
APL07S	53533.87	164941.53			7.81	Kedron Brook near Gympie Road	-	90.00	4.00	19/9/05	20/9/05			Alluvium	Alluvium Standpipe	Screen 1.50-4.00m, Sand 1.00-4.00m, Bentonite 0.00-4.00m
APL08	53529.44	164399.47			23.57	Isedale St near Lutwyche Rd, Wooloowin	-	90.00	43.00	26/9/05	29/9/05			Tingalpa Formation	VWP	VWP tip set at 23.18m, sensor: 83129T, minilogger: 24119
APL08	53529.44	164399.47			23.57	Isedale St near Lutwyche Rd, Wooloowin	-	90.00	43.00	26/9/05	29/9/05			Brisbane Tuff	VWP	VWP tip set at 43.00m, sensor: 83133T, minilogger: 24120
APL09	54103.29	163429.05			10.49	Intxn Bridge and Grove Sts, Albion	-	90.00	25.00	8/9/05	9/9/05			Brisbane Tuff	Rock Standpipe	Screen 22.00-25.00m, Sand 19.00-25.00m, Bentonite 17.00-19.00m
APL10	53192.19	161819.64			2.37		-	90.00	11.73	23/1/06	25/1/06			-	abandoned	
APL11	53100.40	161999.02			12.92		-	90.00	23.45	30/1/06	30/1/06			Brisbane Tuff	open uncased	Surface casing only
APL12	53130.45	162081.10			13.58		-	90.00	30.10	23/1/06	25/1/06			Brisbane Tuff	open uncased - proposed standpipe	Surface casing only
APL13	53022.54	162240.28			15.01		-	90.00	38.16	23/1/06	25/1/06			Brisbane Tuff/Neranleigh Fernvale Beds	open uncased	Surface casing only
APL14	53133.68	162465.96			15.74		-	90.00	41.68	20/2/06	22/2/06			Brisbane Tuff	open uncased - proposed standpipe	Surface casing only
APL15	53105.00	162693.23			4.04		-	90.00	43.66	6/3/06	8/3/06			Brisbane Tuff/Neranleigh Fernvale Beds	VWP	VWP tip set at.....
APL16	53142.22	162861.50			6.84		315.00	60.00	53.51	16/2/06	18/2/06			Neranleigh Fernvale Beds	open uncased	Surface casing only
APL17	53200.02	163358.85			24.29		-	90.00	57.35	27/2/06	1/3/06			Brisbane Tuff/Neranleigh Fernvale Beds	VWP	
APL18	53297.33	163853.93			29.92		-	90.00	47.78	13/2/06	15/2/06			Brisbane Tuff/Neranleigh Fernvale Beds	open uncased - proposed standpipe	Surface casing only
APL19	53322.42	164087.40			22.78		-	90.00	41.65	21/2/06	23/2/06			Brisbane Tuff	open uncased	Surface casing only
APL20	53466.16	164313.59			24.85		-	90.00	17.00	15/12/05	17/12/05			Brisbane Tuff	open uncased - proposed standpipe	Surface casing only
APL21	53408.29	164453.73			25.88		202.50	60.00	45.40	12/12/05	14/12/05			-	abandoned	-
APL22	53279.78	164448.64			18.85		-	90.00	32.74	19/12/05	21/12/05			Brisbane Tuff	Rock Standpipe	Sand 27.00-32.74m, Screen 28.7-32.74m, Bentonite 26.00-27.00m
APL23	53459.69	164688.21			16.02		-	90.00	30.00	9/1/06	11/1/06			Brisbane Tuff	Rock Standpipe	Data pending
APL24	53434.74	164998.27			13.75		-	90.00	15.02	16/1/06	18/1/06			-	abandoned	-
APL25D	53825.68	164932.95			10.61		-	90.00	18.99	5/1/06	7/1/06			Brisbane Tuff	Rock Standpipe	Screen 16.00-19.00m, Sand 13.00-19.00m, Bentonite 11.00-13.00m
APL25S	53825.72	164931.38			10.63		-	90.00	9.00	5/1/06	7/1/06			Alluvium	Alluvium Standpipe	Screen 6.00-9.00m, Sand 5.00-9.00m, Bentonite 4.5-5.00m
APL26	53767.85	165109.95			10.06		-	90.00	16.00	3/1/06	4/1/06			Brisbane Tuff	VWP	VWP tip set at.....
APL27	54078.71	164815.27			13.76		-	90.00		10/2/06	12/2/06			BrisbaneTuff	open uncased	Surface casing only
APL28	54098.97	165234.18			14.06		-	90.00	41.43	9/1/06	11/1/06			Tingalpa Formation	2 X VWPs	VWP tips set t 14.31 & 34.64mbgl

Table A1: Airport Link Geotechnical Borehole Summary

Borehole	Easting (BCSG02)	Northing (BCSG02)	Easting (GDA94)	Northing (GDA94)	Collar (mAHD)	Location	Azimuth	Inclination	Total Depth (m)	Date Commenced	Date Completed	Approx APL Chainage	Approx APL Invert Level	Response Zone Geology	Completion Details	Construction Details
APL29	54160.24	165400.00			13.60		-	90.00	20.00	31/1/06	3/2/06			-	abandoned	-
APL30	54309.65	165286.35			12.92		-	90.00	54.00	6/2/06	8/2/06			Tingalpa Formation	Rock Standpipe	
APL31	54537.59	165352.17			11.83		-	90.00	40.00	9/1/06	11/1/06			-		
APL32D	54614.38	165471.27			12.28		-	90.00	20.00	30/1/06	3/2/06					
APL32S	54616.27	165470.92			12.30		-	90.00		30/1/06	30/1/06					
APL33	54789.08	165332.39			10.40		-	90.00	53.38							
APL34	55014.05	165406.85			10.53		-	90.00	30.00	16/1/06	18/1/06					
APL35	53298.29	163569.16	503297	6966342	19.00	Ada Street	-	90.00	58.20							
APL36	53429.34	164106.37	503428	6966879	19.70	Chalk Street	-	90.00	44.50							
APL37	53402.33	164219.42	503401	6966992	23.20	Bradshaw Street	-	90.00	41.77							
APL38	53482.36	164509.53	503481	6967282	25.80	Norman Avenue	-	90.00	28.51							
APL39	53576.40	164589.56	503575	6967362	23.00	Windsor Avenue	-	90.00	14.51							
APL40	53648.42	164845.66	503647	6967618	12.00	SES Depot	-	90.00	14.78							

Table A2: Airport Link Packer Test Results

Borehole	Easting (BCSG02)	Northing (BCSG02)	Easting (GDA94)	Northing (GDA94)	Collar (mAHD)	Azimuth	Inclination	Total Depth (m)	Test Interval				Test Section Length (m)	Permeability (Lugeons)	Geology
									Top (mbREF)	Bottom (mbREF)	Top (mAHD)	Bottom (mAHD)			
NST2-1	53690	162314	503689	6965087	1.8	-	90.00	20.16	no tests						
NST2-3	53747	162571	503746	6965344	1.7	-	90.00	32.47	no tests						
NST2-4	53789	162698	503788	6965471	2.2	-	90.00	17.53	no tests						
NST2-5	53855	162808	503854	6965581	2.5	-	90.00	10.30	no tests						
NST2-6	53847	162968	503845	6965741	2.8	-	90.00	8.30	no tests						
NST2-7	53234	163434	503233	6966207	28.0	-	90.00	16.96	no tests						
NST2-7A	53177	169797	503176	6965570	4.5	-	90.00	8.54	no tests						
NST2-8	53574	164485	503573	6967257	24.2	-	90.00	28.57	no tests						
NST2-9	54238	164360	504236	6967133	18.7	-	90.00	20.65	no tests						
NST2-9A	54756	164976	504734	6967748	12.0	-	90.00	20.00	no tests						
NST2-11	55450	165302	505448	6968074	4.2	-	90.00	30.07	no tests						
NST2-11A	55188	165312	505186	6968084	9.0	-	90.00	28.67	no tests						
NST2-12	55814	165272	505812	6968044	5.0	-	90.00	8.63	no tests						
NST2-13	53953	165175	503951	6967947	9.8	-	90.00	14.95	no tests						
NST2-14	54012	164884	504010	6967656	14.2	-	90.00	22.86	no tests						
NST2-15	53711	165100	503710	6967872	7.2	-	90.00	13.00	no tests						
NST2-16	53785	165200	503783	6967972	7.0	-	90.00	4.07	no tests						
NST2-17	53304	165057	503303	6967829	16.5	-	90.00	16.50	no tests						
NST2-18	53261	165370	503260	6968142	28.2	-	90.00	19.50	no tests						
NST2-19	56079	165163	506077	6967935	4.0	-	90.00	11.79	no tests						
NST2-20	56266	165127	506264	6967899	4.0	-	90.00	23.50	no tests						
APL01	53197.19	163122.17			23.64	-	90.00	40.39	21.00	27.62	2.64	-3.98	6.62	<0.1	Neranleigh-Fernvale Beds
									27.00	34.47	-3.36	-10.83	7.47	0.1	Neranleigh-Fernvale Beds
APL02	53853.85	163129.45			4.94	-	90.00	5.11	no tests						
APL03	54379.42	164560.48			21.47	-	90.00	42.45	12.20	18.75	9.27	2.72	6.55	5.3	Tingalpa Formation
									17.20	23.50	4.27	-2.03	6.30	9.6	Tingalpa/Aspley Formation
									22.50	29.48	-1.03	-8.01	6.98	2	Aspley Formation over Brisbane Tuff
									28.50	35.48	-7.03	-14.01	6.98	1.1	Brisbane Tuff
									34.50	40.54	-13.03	-19.07	6.04	9.5	Brisbane Tuff
APL04	55376.12	165282.27			4.18	-	90.00	31.93	no tests						
APL05	55575.16	165324.24			4.17	-	90.00	23.70	no tests						
APL06	53921.72	164763.64			14.87	-	90.00	41.20	11.00	17.66	3.87	-2.79	6.66	failed	Tingalpa/Aspley Formation over Brisbane Tuff
									18.80	23.70	-3.93	-8.83	4.90	1.8	Brisbane Tuff
									22.70	29.70	-7.83	-14.83	7.00	<0.1	Brisbane Tuff
									28.70	35.47	-13.83	-20.60	6.77	<0.1	Brisbane Tuff
									34.70	41.20	-19.83	-26.33	6.50	0.3	Brisbane Tuff
APL07	53533.87	164941.53			7.81	-	90.00	35.66	no tests						
APL08	53529.44	164399.47			23.57	-	90.00	43.00	19.60	26.59	3.97	-3.02	6.99	<0.1	Tingalpa/Aspley Formation
									25.60	32.46	-2.03	-8.89	6.86	1.3	Aspley Formation over Brisbane Tuff
									32.60	38.28	-9.03	-14.71	5.68	1.6	Brisbane Tuff
APL09	54103.29	163429.05			10.49	-	90.00	25.00	5.90	14.71	4.59	-4.22	8.81	10	Brisbane Tuff
									14.00	20.71	-3.51	-10.22	6.71	3.7	Brisbane Tuff
APL10	53192.19	161819.64			2.37	-	90.00	11.73	no tests						
APL11	53100.40	161999.02			12.92	-	90.00	23.45	8.30	14.38	4.62	-1.46	6.08	0	Brisbane Tuff
									13.00	20.45	-0.08	-7.53	7.54	0	Brisbane Tuff
APL12	53130.45	162081.10			13.58	-	90.00	30.10	12.00	18.00	1.58	-4.42	6.00	0	Brisbane Tuff
									17.00	24.05	-3.42	-10.47	7.05	0	Brisbane Tuff
APL13	53022.54	162240.28			15.01	-	90.00	38.16	20.50	26.16	-5.49	-11.15	5.66	0	Neranleigh-Fernvale Beds
									25.50	32.12	-10.49	-17.11	6.62	0	Neranleigh-Fernvale Beds
APL14	53133.68	162465.96			15.74	-	90.00	41.68	24.00	30.95	-8.26	-15.21	6.95	0.2	Brisbane Tuff
									30.00	36.00	-14.26	-20.26	6.00	<100	Brisbane Tuff
APL15	53105.00	162693.23			4.04	-	90.00	43.66	26.00	31.40	-21.96	-27.36	5.40	0	Neranleigh-Fernvale Beds
									30.60	38.62	-26.56	-34.58	8.02	0	Neranleigh-Fernvale Beds

Table A2: Airport Link Packer Test Results

Borehole	Easting (BCSG02)	Northing (BCSG02)	Easting (GDA94)	Northing (GDA94)	Collar (mAHD)	Azimuth	Inclination	Total Depth (m)	Test Interval				Test Section Length (m)	Permeability (Lugeons)	Geology
									Top (mbREF)	Bottom (mbREF)	Top (mAHD)	Bottom (mAHD)			
APL16	53142.22	162861.50			6.84	315.00	60.00	53.51	32.00	39.75	-20.87	-27.58	7.75	0	Neranleigh-Fernvale Beds
									38.00	45.15	-26.07	-32.26	7.15	0	Neranleigh-Fernvale Beds
APL17	53200.02	163358.85			24.29	-	90.00	57.35	34.00	39.92	-9.72	-15.64	5.92	0	Neranleigh-Fernvale Beds
									39.00	45.97	-14.71	-21.68	6.97	7.7	Neranleigh-Fernvale Beds
									45.00	51.85	-20.71	-27.56	6.85	0	Neranleigh-Fernvale Beds
APL18	53297.33	163853.93			29.92	-	90.00	47.78	30.00	35.10	-0.08	-5.18	5.10	4.2	Neranleigh-Fernvale Beds
									34.00	41.10	-4.08	-11.18	7.10	9.7	Neranleigh-Fernvale Beds
APL19	53322.42	164087.40			22.78	-	90.00	41.65	23.50	29.63	-0.73	-6.86	6.13	0	Brisbane Tuff
									27.00	35.62	-4.22	-12.84	6.62	75	Brisbane Tuff
APL20	53466.16	164313.59			24.85	-	90.00	17.00	no tests						
APL21	53408.29	164453.73			25.88	202.50	60.00	45.40	25.00	31.78	4.23	-1.64	6.78	0.3	Brisbane Tuff
									31.00	36.30	-0.97	-5.56	5.30	<0.1	Brisbane Tuff
APL22	53279.78	164448.64			18.85	-	90.00	32.74	17.50	23.76	1.35	-4.91	6.26	14	Brisbane Tuff
									23.76	29.68	-4.91	-10.83	5.92	>100	Brisbane Tuff
APL23	53459.69	164688.21			16.02	-	90.00	30.00	10.00	16.03	6.02	-0.01	6.03	0	Brisbane Tuff
									15.00	20.48	1.02	-4.46	5.48	0.1	Brisbane Tuff
APL24	53434.74	164998.27			13.75	-	90.00	15.02	no tests						
APL25D	53825.68	164932.95			10.61	-	90.00	18.99	no tests						
APL26	53767.85	165109.95			10.06	-	90.00	16.00	no tests						
APL27	54078.71	164815.27			13.76	-	90.00		26.00	32.15	-12.24	-18.39	6.15	0	Brisbane Tuff
APL28	54098.97	165234.18			14.06	-	90.00	41.43	29.00	35.45	-14.94	-21.39	6.45	0	Tingalpa Formation
									34.50	41.43	-20.44	-27.37	6.93	0	Tingalpa Formation
APL29	54160.24	165400.00			13.60	-	90.00	20.00	24.80	30.66	-11.20	-17.06	5.86	0	Tingalpa Formation
									29.80	37.00	-16.20	-23.40	7.20	1.7	Tingalpa Formation
APL30	54309.65	165286.35			12.92	-	90.00	54.00	38.00	43.38	-25.08	-30.46	5.38	0	Tingalpa Formation
									43.00	49.20	-30.08	-36.28	6.20	1.8	Tingalpa Formation
APL31	54537.59	165352.17			11.83	-	90.00	40.00	29.00	34.15	-17.17	-22.32	5.15	0	Tingalpa Formation
									33.50	40.10	-21.67	-28.27	6.60	0	Tingalpa Formation
APL32D	54614.38	165471.27			12.28	-	90.00	20.00	no tests						
APL33	54789.08	165332.39			10.40	-	90.00	53.38	37.50	44.34	-27.10	-33.94	6.84	0	Tingalpa Formation
									43.50	50.37	-33.10	-39.97	6.87	0.25	Tingalpa Formation
APL34	55014.05	165406.85			10.53	-	90.00	30.00	32.50	38.10	-21.97	-27.57	5.60	0.6	Tingalpa Formation
									36.50	44.80	-25.97	-34.27	8.30	0	Tingalpa Formation
APL35	53298.29	163569.16	503297	6966342	19.00	-	90.00	58.20	no tests						
APL36	53429.34	164106.37	503428	6966879	19.70	-	90.00	44.50	no tests						
APL37	53402.33	164219.42	503401	6966992	23.20	-	90.00	41.77	no tests						
APL38	53482.36	164509.53	503481	6967282	25.80	-	90.00	28.51	no tests						
APL39	53576.40	164589.56	503575	6967362	23.00	-	90.00	14.51	no tests						
APL40	53648.42	164845.66	503647	6967618	12.00	-	90.00	14.78	no tests						

Table A3: NSBT Geotechnical Investigation Packer Test Results

Borehole	Easting (BCGS02)	Northing (BCGS02)	Collar (mAHD)	Azimuth	Inclination	Total Depth (m)	Test Interval Details				Test Section Length (m)	Permeability (Lugeons)	Geology
							Top (mbRef)	Bottom (mbRef)	Top (mAHD)	Bottom (mAHD)			
NST01	53556.04	157564.86	11.60	0	70	65.00	14.00	20.60	-1.56	-4.34	6.60	1.8	Brisbane Tuff
							25.00	32.30	-11.89	-18.75	7.30	0.38	Brisbane Tuff
NST02	53574.39	156958.98	7.41	0	70	64.95	9.10	14.50	-1.14	-6.22	5.40	2.3	Brisbane Tuff
NST03	53511.26	159286.43	5.15	0	90	60.00	42.00	46.80	-36.85	-41.65	4.80	30	Neranleigh Fernvale Beds
							45.80	52.90	-40.65	-47.75	7.10	0	Neranleigh Fernvale Beds
							51.90	60.35	-46.75	-55.20	8.45	0.3	Neranleigh Fernvale Beds
NST04	53511.26	159286.43	5.15	0	90	59.70	34.50	41.40	-29.35	-36.25	6.90	1.8	Neranleigh Fernvale Beds
							40.60	47.53	-36.95	-43.88	6.93	0.3	Neranleigh Fernvale Beds
							46.50	53.66	-42.85	-50.01	7.16	0	Neranleigh Fernvale Beds
							52.60	59.69	-48.95	-56.04	7.09	0	Neranleigh Fernvale Beds
NST05	53499.31	159579.09	3.38	168	60	62.50	38.00	44.24	-29.53	-34.93	6.24	0.1	Neranleigh Fernvale Beds
							43.00	50.26	-33.86	-40.15	7.26	0.6	Neranleigh Fernvale Beds
							49.00	55.40	-39.06	-44.60	6.40	0	Neranleigh Fernvale Beds
							55.00	62.50	-44.25	-50.75	7.50	0	Neranleigh Fernvale Beds
NST06	53500.90	159609.38	3.56	346	60	61.50	38.00	43.60	-29.34	-34.19	5.60	0.1	Neranleigh Fernvale Beds
							42.00	49.63	-32.81	-39.42	7.63	0	Neranleigh Fernvale Beds
							48.00	55.60	-38.01	-44.59	7.60	0	Neranleigh Fernvale Beds
NST07	53494.84	159306.95	4.17	347	60	60.38	44.50	48.21	-34.37	-37.58	3.71	0.3	Neranleigh Fernvale Beds
							47.00	54.21	-36.53	-42.78	7.21	0.2	Neranleigh Fernvale Beds
							53.00	60.38	-41.73	-48.12	7.38	11	Neranleigh Fernvale Beds
NST08	53654.97	158150.02	25.40	0	90	44.67	15.00	20.66	10.40	4.74	5.66	0	Brisbane Tuff
							19.50	26.68	5.90	-1.28	7.18	1	Brisbane Tuff
							25.50	32.63	-0.10	-7.23	7.13	1.6	Brisbane Tuff
NST09	53538.39	158235.14	21.29	0	90	56.84	15.40	20.80	5.89	0.49	5.40	0	Brisbane Tuff
							19.50	26.83	1.79	-5.54	7.33	0	Brisbane Tuff
							25.50	32.86	-4.21	-11.57	7.36	0.4	Brisbane Tuff
NST10	53566.46	159280.34	5.22	359	58	68.92	51.00	56.83	-38.03	-42.97	5.83	1.3	Neranleigh Fernvale Beds
							55.70	60.55	-42.02	-46.13	4.85	1.1	Neranleigh Fernvale Beds
							62.00	68.92	-47.36	-53.23	6.92	1.2	Neranleigh Fernvale Beds
NST11	53495.63	159285.86	4.59	165	60	70.95	46.00	52.00	-35.25	-40.45	6.00	0.1	Neranleigh Fernvale Beds
							51.00	58.63	-39.58	-46.19	7.63	0.1	Neranleigh Fernvale Beds
							57.00	64.00	-44.78	-50.84	7.00	0.1	Neranleigh Fernvale Beds
NST12	53624.52	159574.34	3.31	178	60	70.27	47.00	53.40	-37.39	-42.93	6.40	3	Neranleigh Fernvale Beds
							52.50	58.95	-42.15	-47.74	6.45	0.3	Neranleigh Fernvale Beds
							58.00	70.27	-46.92	-57.54	12.27	<0.1	Neranleigh Fernvale Beds
NST13	53504.81	158633.83	18.27	0	90	48.00	19.50	25.45	-1.23	-7.18	5.95	0	Brisbane Tuff
							24.50	29.89	-6.23	-11.62	5.39	6	Brisbane Tuff
							29.00	35.96	-10.73	-17.69	6.96	>100	Brisbane Tuff
NST14	53520.35	159509.77	-18.41	0	90	46.67	22.00	28.64	-40.41	-47.05	6.64	<0.1	Neranleigh Fernvale Beds
							27.45	34.68	-45.86	-53.09	7.23	<0.1	Neranleigh Fernvale Beds
							33.25	40.67	-51.66	-59.08	7.42	0.43	Neranleigh Fernvale Beds
NST15	53489.32	159360.53	-1.21	0	90	64.28	39.50	46.14	-40.71	-47.35	6.64	0	Neranleigh Fernvale Beds
							44.95	52.21	-46.16	-53.42	7.26	<0.1	Neranleigh Fernvale Beds
							50.70	58.23	-51.91	-59.44	7.53	0.24	Neranleigh Fernvale Beds
NST16	53493.32	159395.17	-6.07	0	90	24.80	no tests					-	Neranleigh Fernvale Beds
NST17	53505.02	159421.22	-11.35	0	90	52.82	29.50	35.66	-40.85	-47.01	6.16	15	Neranleigh Fernvale Beds
							34.30	41.63	-45.65	-52.98	7.33	<0.1	Neranleigh Fernvale Beds
							40.30	46.82	-51.65	-58.17	6.52	<0.1	Neranleigh Fernvale Beds
NST18	53511.92	159442.92	-15.39	0	90	14.50	no tests					-	Neranleigh Fernvale Beds
NST19	53516.56	159461.15	-17.82	0	90	46.63	25.80	31.67	-43.62	-49.49	5.87	<0.1	Neranleigh Fernvale Beds
							31.00	37.69	-48.82	-55.51	6.69	0.1	Neranleigh Fernvale Beds
NST20	53511.36	159489.86	-18.65	0	90	44.70	no tests					-	Neranleigh Fernvale Beds
NST21	53514.58	159467.76	-18.05	0	90	46.16	22.80	29.37	-40.85	-47.42	6.57	4.3	Neranleigh Fernvale Beds
							32.50	40.85	-50.55	-58.90	8.35	0.7	Neranleigh Fernvale Beds
NST22	53510.27	159467.25	-18.97	0	90	45.15	no tests					-	Neranleigh Fernvale Beds

Table A3: NSBT Geotechnical Investigation Packer Test Results

Borehole	Easting (BCGS02)	Northing (BCGS02)	Collar (mAHD)	Azimuth	Inclination	Total Depth (m)	Test Interval Details				Test Section Length (m)	Permeability (Lugeons)	Geology
							Top (mbRef)	Bottom (mbRef)	Top (mAHD)	Bottom (mAHD)			
NST23	53516.60	159478.76	-17.09	0	90	47.32	no tests					-	Neranleigh Fernvale Beds
NST24	53318.50	156579.69	19.651	0	90	41.45	13.50	20.10	6.15	-0.45	6.60	160	Brisbane Tuff
							19.00	26.16	0.65	-6.51	7.16	13.5	Brisbane Tuff
NST25	53540.86	156641.82	11.31	0	60	28.50	12.50	19.41	0.48	-5.50	6.91	18	Tingalpa Formation/Brisbane Tuff
							18.50	25.52	-4.71	-10.79	7.02	<0.1	Brisbane Tuff
NST26	53480.23	156882.36	11.291	0	90	35.80	15.00	20.65	-3.71	-9.36	5.65	0.18	Brisbane Tuff
							21.00	26.65	-9.71	-15.36	5.65	<0.5	Brisbane Tuff
NST27	53785.57	156772.66	4.626	0	90	6.00	no tests					-	Alluvium
NST28	53841.65	158013.67	14.789	0	90	20.94	no tests					-	Brisbane Tuff
NST29	53506.25	158419.55	16.658	0	90	46.69	22.00	28.17	-5.34	-11.51	6.17	0	Brisbane Tuff
							27.00	34.37	-10.34	-17.71	7.37	1.1	Brisbane Tuff
NST30	53517.51	158787.96	13.91	259	60	65.20	40.00	46.67	-20.73	-26.51	6.67	0.3	Neranleigh Fernvale Beds
NST31	53402.95	159888.06	21.79	0	90	83.57	42.30	45.70	-20.51	-23.91	3.40	45	Brisbane Tuff
							48.80	52.67	-27.01	-30.88	3.87	0	Brisbane Tuff/Neranleigh Fernvale Beds
							59.00	65.05	-37.21	-43.26	6.05	0	Neranleigh Fernvale Beds
							64.00	71.25	-42.21	-49.46	7.25	0	Neranleigh Fernvale Beds
NST32	53383.61	160264.84	5.69	0	90	60.33	37.00	43.79	-31.31	-38.10	6.79	0	Brisbane Tuff
							43.00	49.48	-37.31	-43.79	6.48	0	Brisbane Tuff
NST33	53187.17	160077.75	10.13	18	55	73.80	26.50	32.37	-11.58	-16.38	5.87	0	Brisbane Tuff
NST34	53159.65	160559.02	10.41	32	60	60.64	23.40	29.65	-9.86	-15.27	6.25	230	Brisbane Tuff
							38.00	44.42	-22.50	-28.06	6.42	170	Brisbane Tuff
							43.00	50.50	-26.83	-33.33	7.50	230	Brisbane Tuff
NST35	53278.69	160869.50	6.42	0	90	35.00	13.00	19.41	-6.58	-12.99	6.41	2	Brisbane Tuff
							18.00	24.83	-11.58	-18.41	6.83	35	Brisbane Tuff
NST36	53153.64	161135.49	11.65	90	63	34.59	no tests					-	Brisbane Tuff
NST37	53874.74	157058.26	5.37	0	90	9.90	no tests					-	Tingalpa Formation?/Brisbane Tuff
NST38	53292.22	156448.70	17.14	0	90	50.48	no tests					-	Tingalpa Formation/Brisbane Tuff
NST39	53340.42	156247.41	15.53	0	90	38.92	no tests					-	Tingalpa Formation/Brisbane Tuff
NST40	53281.80	156333.32	10.95	0	90	18.66	12.00	18.66	-1.05	-7.71	6.66	3.3	Aspley Formation
NST41	53245.17	156516.39	13.97	0	90	30.55	14.50	20.43	-0.53	-6.46	5.93	no result	Brisbane Tuff
							20.50	26.54	-20.50	-12.57	6.04	<0.5	Brisbane Tuff
NST42	53305.43	156641.74	25.73	0	90	34.24	19.50	26.60	6.23	-0.87	7.10	12.5	Brisbane Tuff
							30.00	34.00	-30.00	-8.27	4.00	2.8	Neranleigh-Fernvale Group
NST43	53322.02	156713.23	24.46	0	90	38.50	21.00	26.55	3.46	-2.09	5.55	<0.1	Brisbane Tuff + Neranleigh-Fernvale Group
							26.00	31.70	-1.54	-7.24	5.70	0.7	Neranleigh-Fernvale Group
NST44	53368.88	156793.69	19.39	355	65	50.00	31.00	37.20	-10.52	-16.14	6.20	6.4	Neranleigh-Fernvale Group
							36.00	40.13	-15.05	-18.80	4.13	12.7	Neranleigh-Fernvale Group
NST45	53459.21	156826.31	13.21	360	60	37.00	20.50	25.60	-6.31	-10.73	5.10	<0.1	Brisbane Tuff + Neranleigh-Fernvale Group
							25.00	30.85	-10.21	-15.28	5.85	<0.1	Neranleigh-Fernvale Group
NST46	53356.11	160506.53	11.57	0	90	53.98	no tests						
NST47	53454.43	159699.96	28.22	0	90	92.48	no tests						
NST48	53500.87	159609.40	3.57	0	90	75.00	no tests						
NST49	53533.71	159595.29	3.57	120	63	74.70	42.26	46.53	-34.47	-38.28	4.27	30	Neranleigh-Fernvale Group
							60.00	65.70	-50.28	-55.36	5.70	1	Neranleigh-Fernvale Group
							64.00	68.68	-53.84	-58.01	4.68	<0.1	Neranleigh-Fernvale Group
NST50	53392.81	160720.68	5.36	0	90	41.00	22.50	30.40	-17.14	-25.04	7.90	1.5	Brisbane Tuff
							29.00	36.00	-23.64	-30.64	7.00	<0.1	Brisbane Tuff
NST51	53517.09	158956.43	6.85	0	90	52.50	37.00	43.45	-30.15	-36.60	6.45	<0.05	Neranleigh-Fernvale Group
							42.50	49.10	-35.65	-42.25	6.60	0.5	Neranleigh-Fernvale Group
NST52	53543.26	159089.70	4.93	0	90	58.00	no tests						
NST53	53524.57	158726.01	14.76	0	90	53.00	33.00	39.20	-18.24	-24.44	6.20	<0.5	Neranleigh-Fernvale Group
							38.70	45.30	-23.94	-30.54	6.60	0.5	Neranleigh-Fernvale Group
NST54	53267.36	161150.21	15.29	170	65	41.15	28.00	32.35	-11.52	-15.46	4.35	<0.1	Neranleigh-Fernvale Group
							31.00	38.00	-14.24	-20.58	7.00	4	Neranleigh-Fernvale Group
NST55	53549.66	158543.47	15.04	182	60	49.53	29.50	34.63	-12.52	-16.96	5.13	42	Brisbane Tuff

Table A3: NSBT Geotechnical Investigation Packer Test Results

Borehole	Easting (BCGS02)	Northing (BCGS02)	Collar (mAHD)	Azimuth	Inclination	Total Depth (m)	Test Interval Details				Test Section Length (m)	Permeability (Lugeons)	Geology
							Top (mbRef)	Bottom (mbRef)	Top (mAHD)	Bottom (mAHD)			
							33.50	40.49	-15.99	-22.04	6.99	27	Brisbane Tuff
NST56	53095.14	161379.67	3.02	0	90	22.00	no tests						
NST57	53191.31	161343.69	4.53	0	90	16.65	no tests						
NST58	53547.25	156775.59	10.72	170	60	34.60	no tests						
NST59	53352.37	161438.39	5.74	0	90	6.54	no tests						
NST60	53546.29	156712.34	11.91	0	90	37.00	no tests						
NST61	53167.16	161655.32	3.52	0	90	26.90	no tests						
NST62	53414.88	160170.98	8.98	0	90	61.00	43.00	48.55	-34.02	-39.57	5.55	2.5	Brisbane Tuff
							47.20	51.70	-38.22	-42.72	4.50	<0.1	Brisbane Tuff
NST63	53458.84	160072.77	14.27	0	90	78.90	52.50	58.55	-43.52	-49.57	6.05	62	Brisbane Tuff
							57.20	64.17	-57.20	-64.17	6.97	0.2	Brisbane Tuff
NST64	53546.20	156523.16	5.64	0	90	15.00							
NST65	53565.00	157404.45	15.14	0	90	39.00	21.70	26.20	-6.56	-11.06	4.50	<0.1	Brisbane Tuff
							25.20	35.15	-10.06	-20.01	9.95	<0.1	Brisbane Tuff
NST66	53527.64	157042.75	7.00	210	64	37.20	22.20	28.20	-13.66	-19.05	6.00	<0.1	Brisbane Tuff
							26.20	31.10	-17.26	-21.66	4.90	<0.1	Brisbane Tuff
NST67	53689.83	158076.68	19.50	0	90	17.50	10.70	17.50	8.80	2.00	6.80	<0.1	Brisbane Tuff
NST68	53635.83	156665.23	7.97	0	90	28.29	13.50	19.12	-5.53	-11.15	5.62	25	Brisbane Tuff
							18.00	25.20	-10.03	-17.23	7.20	17.5	Brisbane Tuff
NST69	53471.87	158330.67	20.32	0	90	47.50	19.20	25.63	1.12	-5.31	6.43	<0.1	Brisbane Tuff
NST70	53144.25	161033.60	7.09	0	90	21.50	11.20	18.47	-4.11	-11.38	7.27	3.1	Brisbane Tuff
NST71	53415.25	158661.08	6.40	0	90	59.55							
NST72	53427.38	156695.76	17.91	0	90	37.90	21.20	26.50	-3.29	-8.59	5.30	<0.1	Brisbane Tuff
							25.20	32.70	-7.29	-14.79	7.50	<0.1	Brisbane Tuff
NST73	53365.46	157557.50	21.21	0	90	50.70	33.20	38.80	-11.99	-17.59	5.60	<0.1	Brisbane Tuff
							36.20	44.80	-14.99	-23.59	8.60	<0.1	Brisbane Tuff
NST74	53505.59	157919.60	25.00	0	90	41.42	22.50	29.57	2.50	-4.57	7.07	<0.1	Brisbane Tuff
							28.50	35.34	-3.50	-10.34	6.84	<0.1	Brisbane Tuff
NST75	53397.18	156028.25	9.75	0	90	15.00	no tests						
NST76	53603.72	156479.10	4.62	0	90	5.50	no tests						
NST77	53818.44	156513.17	4.43	0	90	3.60	no tests						
NST78	53712.37	156831.18	6.42	0	90	11.60	no tests						
NST79	53958.43	157139.04	5.75	0	90	8.40	no tests						
NST80	53228.34	156595.97	22.79	0	90	34.70	16.52	23.30	6.27	-0.51	6.78	<0.1	Brisbane Tuff + Neranleigh-Fernvale Group
							22.50	29.85	0.29	-7.06	7.35	<0.1	Neranleigh-Fernvale Group
NST81	53328.14	156515.16	14.24	0	90	24.82	15.50	22.50	-1.26	-8.26	7.00	1.8	Brisbane Tuff
NST82	53378.55	156704.22	20.85	0	90	46.70	15.20	20.61	5.65	0.24	5.41	50	Brisbane Tuff
							21.20	26.68	-0.35	-5.83	5.48	no result	Brisbane Tuff
NST83	53396.77	159233.92	3.20	100	60	68.04	no tests						
NST84	53476.47	159395.54	-6.79	0	90	57.91	39.50	46.93	-46.29	-53.72	7.43	<0.1	Neranleigh-Fernvale Group
							45.20	52.88	-51.99	-59.67	7.68	<0.1	Neranleigh-Fernvale Group
NST85	53500.65	159445.67	-15.99	0	90	48.00	29.70	36.90	-45.69	-52.89	7.20	<0.1	Neranleigh-Fernvale Group
							35.75	42.93	-51.74	-58.92	7.18	<0.1	Neranleigh-Fernvale Group
NST86	53429.58	159463.99	-17.59	0	90	47.00	28.53	35.64	-46.12	-53.23	7.11	0.35	Neranleigh-Fernvale Group
							34.50	41.62	-52.09	-59.21	7.12	0.35	Neranleigh-Fernvale Group
NST87	53501.15	159503.87	-18.38	0	90	49.87	27.50	34.83	-45.88	-53.21	7.33	1.25	Neranleigh-Fernvale Group
							33.50	40.94	-51.88	-59.32	7.44	0.5	Neranleigh-Fernvale Group
NST88	53473.13	159499.23	-18.21	0	90	45.72	27.50	33.45	-45.71	-51.66	5.95	<0.1	Neranleigh-Fernvale Group
NST89	53454.74	159503.30	-18.21	0	90	46.30	33.20	40.60	-51.41	-58.81	7.40	8.5	Neranleigh-Fernvale Group
NST90	53478.10	159540.77	-9.21	0	90	55.95	36.25	44.30	-45.46	-53.51	8.05	2.5	Neranleigh-Fernvale Group
							43.30	50.80	-52.51	-60.01	7.50	2.2	Neranleigh-Fernvale Group
NST91	53438.54	159543.69	-8.83	0	90	54.40	37.15	42.17	-45.98	-51.00	5.02	<0.1	Neranleigh-Fernvale Group
							41.65	48.20	-50.48	-57.03	6.55	<0.1	Neranleigh-Fernvale Group

Table A4: S1 Sewer Tunnel Investigation Packer Test Results

Borehole	Approx Easting (BCGS02)	Approx Northing (BCGS02)	Approx Easting (GDA94)	Approx Northing (GDA94)	Approx Collar (mAHD)	Total Depth (m)	Test Interval				Test Section Length (m)	Permeability (Lugeons)	Geology
							Top (mbRef)	Bottom (mbREF)	Top (mAHD)	Bottom (mAHD)			
BCC110	54398	161792	504396	6964566	5		10.50	15.00	-5.50	-10.00	4.50	0	Neranleigh-Fernvale Beds
							13.50	17.08	-8.50	-12.08	3.58	<0.1	Neranleigh-Fernvale Beds
							16.00	20.00	-11.00	-15.00	4.00	6.8	Neranleigh-Fernvale Beds
BCC113	54202	161462	504200	6964236	4		9.00	13.26	-5.00	-9.26	4.26	26.1	Neranleigh-Fernvale Beds
							12.00	16.26	-8.00	-12.26	4.26	20.6	Neranleigh-Fernvale Beds
							15.00	19.00	-11.00	-15.00	4.00	1.6	Neranleigh-Fernvale Beds
BCC117	54119	160984	504117	6963758	2.9		10.00	13.10	-7.10	-10.20	3.10	2.2	Neranleigh-Fernvale Beds
							12.00	15.02	-9.10	-12.12	3.02	3.5	Neranleigh-Fernvale Beds
BCC118	54086	160976	504084	6963750	2.9		10.90	14.50	-8.00	-11.60	3.60	0	Neranleigh-Fernvale Beds
							12.80	17.00	-9.90	-14.10	4.20	<0.1	Neranleigh-Fernvale Beds
BCC121	53769	160604	503768.0	6963378.5	6.34	22.00	13.00	17.90	-6.66	-11.56	4.90	0	Neranleigh-Fernvale Beds
							16.00	22.00	-9.66	-15.66	6.00	0.8	Neranleigh-Fernvale Beds
BCC125	53649	160491	503648.0	6963264.8	5.50	20.10	9.00	13.00	-3.50	-7.50	4.00	<0.1	Brisbane Tuff
							12.00	15.97	-6.50	-10.47	3.97	125	Brisbane Tuff
							15.00	20.10	-9.50	-14.60	5.10	<0.1	Brisbane Tuff
BCC136	53123	159716	503122	6962490	18.3		10.00	14.05	8.30	4.25	4.05	1	Neranleigh-Fernvale Beds
							13.00	17.07	5.30	1.23	4.07	<0.1	Neranleigh-Fernvale Beds
							19.00	23.00	-0.70	-4.70	4.00	0	Neranleigh-Fernvale Beds
							25.00	29.00	-6.70	-10.70	4.00	<0.1	Neranleigh-Fernvale Beds
BCC139	52877	159538	502876	6962312	23.2		28.80	31.00	-5.60	-7.80	2.20	4.3	Neranleigh-Fernvale Beds
							30.20	33.00	-7.00	-9.80	2.80	0.1	Neranleigh-Fernvale Beds
BCC141	52802	159421	502801	6962195	25.2		16.00	20.90	9.20	4.30	4.90	0	Neranleigh-Fernvale Beds
							19.90	24.00	5.30	1.20	4.10	17.5	Neranleigh-Fernvale Beds
							22.90	27.00	2.30	-1.80	4.10	10.8	Neranleigh-Fernvale Beds
							25.90	30.10	-0.70	-4.90	4.20	1.5	Neranleigh-Fernvale Beds
							28.90	33.00	-3.70	-7.80	4.10	0.9	Neranleigh-Fernvale Beds
							31.90	36.00	-6.70	-10.80	4.10	7.8	Neranleigh-Fernvale Beds
BCC148	52315	158947	502314	6961722	9.8		10.00	14.30	-0.20	-4.50	4.30	<0.1	Neranleigh-Fernvale Beds
							12.50	16.85	-2.70	-7.05	4.35	7	Neranleigh-Fernvale Beds
							16.00	20.00	-6.20	-10.20	4.00	22	Neranleigh-Fernvale Beds
							19.50	23.00	-9.70	-13.20	3.50	69	Neranleigh-Fernvale Beds
BCC151	52107	158735	502106	6961510	9.1		10.00	14.00	-0.90	-4.90	4.00	5.4	Neranleigh-Fernvale Beds
							13.00	17.00	-3.90	-7.90	4.00	3.4	Neranleigh-Fernvale Beds
							16.00	20.05	-6.90	-10.95	4.05	4.8	Neranleigh-Fernvale Beds
							19.00	22.10	-9.90	-13.00	3.10	11.5	Neranleigh-Fernvale Beds
BCC173	52091	158855	502090.11	6961629.3	13.91		19.00	24.32	-5.09	-10.41	5.32	0.3	Neranleigh-Fernvale Beds
BCC174	52075	158841	502074.07	6961616	13.59		19.00	24.00	-5.41	-10.41	5.00	0.5	Neranleigh-Fernvale Beds
BCC175	53604	160455	503602.9	6963229.0	4.92	19.12	10.00	19.12	-5.08	-14.20	9.12	11.8	Brisbane Tuff
							16.00	19.12	-11.08	-14.20	3.12	40	Brisbane Tuff
BCC176	53629	160561	503628.0	6963335.0	7.08	24.37	6.00	24.38	1.08	-17.30	18.38	2.4	Brisbane Tuff
							12.00	24.38	-4.92	-17.30	12.38	1.5	Brisbane Tuff
BCC178	53691	160715	503689.1	6963489.4	5.39	21.80	14.00	21.80	-8.61	-16.41	7.80	2.8	Neranleigh-Fernvale Beds
BCC181	53634	160601	503632.3	6963375.4	7.83	25.00	16.50	25.00	-8.67	-17.17	8.50	3	Brisbane Tuff/Neranleigh-Fernvale Beds
							20.70	25.00	-12.87	-17.17	4.30	3.2	Neranleigh-Fernvale Beds
BCC182	53736	160860	503734.3	6963633.8	15.85	29.00	9.00	29.00	6.85	-13.15	20.00	0	Neranleigh-Fernvale Beds
BCC184	53779	160986	503778.0	6963759.4	6.26	20.90	14.20	20.90	-7.94	-14.64	6.70	2.5	Neranleigh-Fernvale Beds
BCC188	53815	161265	503813.3	6964038.4	21.40	37.16	20.00	37.16	1.40	-15.76	17.16	<0.1	Neranleigh-Fernvale Beds
BCC189	53896	161379	503894.4	6964152.7	27.48	41.15	16.00	41.15	11.48	-13.67	25.15	12.5	Neranleigh-Fernvale Beds
							27.40	41.15	0.08	-13.67	13.75	0	Neranleigh-Fernvale Beds
BCC190	53916	161494	503914.0	6964267.3	17.66	32.05	17.60	32.05	0.06	-14.39	14.45	packer failed	Neranleigh-Fernvale Beds
BCC191	53959	161577	503957.9	6964350.1	7.57	22.00	11.00	22.10	-3.43	-14.53	11.10	0.7	Brisbane Tuff/Neranleigh-Fernvale Beds
							15.50	22.10	-7.93	-14.53	6.60	1.1	Neranleigh-Fernvale Beds
BCC192	53986	161646	503984.7	6964419.5	3.28	17.80	12.00	17.80	-8.72	-14.52	5.80	10.6	Neranleigh-Fernvale Beds
							14.50	17.80	-11.22	-14.52	3.30	1.6	Neranleigh-Fernvale Beds
BCC193	54031	161733	504029.5	6964506.7	1.88	17.70	15.00	17.70	-13.12	-15.82	2.70	packer failed	Neranleigh-Fernvale Beds
BCC194	53987	161430	503985.4	6964203.4	30.84	44.57	35.80	44.60	-4.96	-13.76	8.80	<0.1	Neranleigh-Fernvale Beds
BCC195	53955	161487	503953.74	6964261.05	17.86	35.03	24.20	35.00	-6.34	-17.14	10.80	0	Neranleigh-Fernvale Beds
BCC196	54091	161544	504089.7	6964317.5	5.21	19.10	5.50	19.10	-0.29	-13.89	13.60	1.4	Neranleigh-Fernvale Beds
							12.50	19.10	-7.29	-13.89	6.60	0.3	Neranleigh-Fernvale Beds
BCC197	54159	161588	504157.02	6964361.39	2.77		11.50	18.00	-8.73	-15.23	6.50	1.9	Neranleigh-Fernvale Beds
BCC219	53770	161017	503768.54	6963791.27	4.72	17.00	13.00	17.00	-8.28	-12.28	4.00	packer failed	Neranleigh-Fernvale Beds
BCC235	54286	161395	504284.56	6964168.98	11.19		18.10	26.10	-6.91	-14.91	8.00	1.2	Neranleigh-Fernvale Beds
BCC238	53525	160762	503523.3	6963536.4	14.65	29.00	16.00	29.00	-1.35	-14.35	13.00	0.4	Brisbane Tuff

Table A4: S1 Sewer Tunnel Investigation Packer Test Results

Borehole	Approx Easting (BCGS02)	Approx Northing (BCGS02)	Approx Easting (GDA94)	Approx Northing (GDA94)	Approx Collar (mAHD)	Total Depth (m)	Test Interval				Test Section Length (m)	Permeability (Lugeons)	Geology
							Top (mbRef)	Bottom (mbREF)	Top (mAHD)	Bottom (mAHD)			
BCC239	53056	159774	503055.14	6962547.89	17.99	31.41	21.00	31.41	-3.01	-13.42	10.41	0.45	Brisbane Tuff
BCC242	53098	160054	503096.8	6962828.52	14.49	31.22	14.50	31.22	-0.01	-16.73	16.72	6.2	Brisbane Tuff
							21.15	31.22	-6.66	-16.73	10.07	1	Brisbane Tuff
BCC243	53113	160167	503111.96	6962941.38	16.13	16.13	18.00	29.87	-1.87	-13.74	11.87	2.8	Brisbane Tuff
BCC244	53205	160383	503203.3	6963157.4	18.06	31.45	21.00	31.45	-2.94	-13.39	10.45	>100	Brisbane Tuff
BCC245	53041	159941	503039.56	6962715.03	18.88	32.00	20.70	32.00	-1.82	-13.12	11.30	20.8	Brisbane Tuff
							25.60	32.00	-6.72	-13.12	6.40	19.6	Brisbane Tuff
BCC246	53298	160492	503297.0	6963266.3	13.67	28.18	18.00	28.18	-4.33	-14.51	10.18	0.9	Brisbane Tuff
BCC247	53501	160722	503500.0	6963496.1	11.60	28.00	17.75	28.00	-6.15	-16.40	10.25	100	Brisbane Tuff
							23.75	28.00	-12.15	-16.40	4.25	53	Brisbane Tuff
BCC249	53641	160872	503639.2	6963645.9	16.80	31.12	20.90	31.12	-4.10	-14.32	10.22	packer failed	Neranleigh-Fernvale Beds
							21.90	31.12	-5.10	-14.32	9.22	0	Brisbane Tuff
BCC250	53668	160967	503666.9	6963740.4	19.10	35.84	25.00	35.84	-5.90	-16.74	10.84	1.5	Brisbane Tuff
BCC251	53670	160933	503668.8	6963707.1	19.05	34.25	20.80	34.25	-1.75	-15.20	13.45	0.9	Brisbane Tuff

Appendix B

NORTH KEDRON BROOK SEWER

Information obtained from Mr. Cameron
Geol. Survey.

20th May, 1954.

(To accompany plan & sections.)

M. RANDUM -

The Chief Government Geologist,
BRISBANE.

NORTH KEDRON BROOK SEWER EXCAVATIONS, WHINSTAINES TO KALINGA, BRISBANE.

INTRODUCTION - When construction of the North Kedron Brook Sewer commenced late in 1951, representations were made by the company concerned - the French firm, Etudes et Entreprises - for advice on the geology of the tunnel line and on the problems likely to be encountered. The geological investigation of the project commenced with an examination of specimens from test bores on 20th November, 1951. The surface along the line of the proposed sewer was then examined and periodical inspections of the workings were made up to 21st April, 1954, the excavations being almost completed by that date.

Although the broad features of the geology of the project were clear at its commencement, the detailed geology proved to be very complicated and the periodical inspections permitted the prediction of zones where dangerous conditions could be expected.

LOCATION AND SPECIFICATIONS - The line of the sewer extends from the lower end at a point near the intersection of Eagle Farm Road and Bunya Street, Whinstanes in a general north-north-westerly direction to Schulz Canal, beside Hedley Avenue, thence in a westerly direction to Kalinga Park. The location of the sewer, with the shafts and test bores, is shown on the attached plan (Fig. 1).

The completed sewer will be 17,600 ft. long and will be concrete lined with an internal diameter of 63 in. for the lower 7,371 ft., and of 48 in. for the remainder. The depth from the surface to the top of the sewer excavation ranges from approximately 9 ft. beneath Kedron Brook, beside Kalinga Park, to approximately 60 ft. near Shaft No.30 at Toombul.

The project includes 44 shafts to the sewer, spaced at intervals ranging from 225 ft. to 590 ft. approximately. On 21/4/54 about 4,500 ft. of driving, mainly in the vicinity of Schulz Canal, Toombul Railway Station and Kalinga Park, and some shaft-sinking in Kalinga Park remained to be completed.

TOPOGRAPHY - The surface from the lower end of the sewer to Shaft 24 near Schulz Canal is almost flat, the reduced level ranging from 18 to 29 ft. An alluvial flat with a surface elevation of about 10 ft. extends on either side of the canal and includes the sites of Shafts 25 and 26.

From Shaft 27 to Shaft 40, beside Kedron Brook, the surface is undulating, the reduced level ranging from 17 to 48 ft. approximately. Beyond Shaft 40, to the upper end of the sewer, except for the channel of Kedron Brook, the surface is again flat with an elevation of about 22 ft.

TEST BORES - In connection with the sewer project, the Brisbane City Council during the period 31/10/50 to 17/4/51, drilled twenty-four percussion bores numbered 1 to 9, 11 to 19, and 21 to 26 ranging in depth from 40 to 68 ft. and spaced at intervals ranging from 255 ft. to 1,642 ft. along the line of the sewer. Driller's logs were supplied. Cores from the bores were logged after detailed examination.

GEOLOGY - As shown by the attached section of the tunnel line, basalt and possibly three sedimentary formations are involved in the excavations. These formations, in order of age, are as follows:-

(i) Ipswich Coal Measures: This Triassic formation outcrops from Shaft 27 to Shaft 30 and again in the vicinity of Shafts 37 and 38. At these localities, sandstone, shale and conglomerate dip easterly at a low angle. From the lower end, up to Shaft 5, the drive was in sandstone of the Coal Measures, which had a general dip of about 10 degrees in the direction N.7°E. A few minor faults were encountered, the throw generally being up to about 5 ft.

Coal lenticles and lenses of carbonaceous shale were encountered in the workings and in Shaft 37 specimens of Thinnfeldia were found. It is of interest to note that a small colliery was worked intermittently in the northern bank of Kedron Brook at a point some 12 chains upstream from Shaft 39, during the period 1906-1915. The seam was reported by E.O. Marks, Assistant Government Geologist (a) to have ranged from 3 ft. 6 in. to 4 ft. thick and to dip at 1 in 7 in the direction N. 5° E. Faults striking E.N.E. with the downthrow to the north were reported to have hindered mining operations.

(ii) Tertiary Sediments: Black, red and white clays were exposed, beneath Tertiary basalt between Shafts 6 and 7, and in the vicinity of Shaft 9. Although there is no palaeontological evidence as to their age, the clays are presumed to be Tertiary because of their occurrence beneath the basalt.

Unlike other clays in the excavations these clays possess swelling properties, the expansion taking place over a period of some months.

(iii) Basalt: Weathered basalt was penetrated by the drive from Shaft 7 to Shaft 8, from Shaft 9 to Shaft 16, and again from Shaft 18 to Shaft 22. It is completely covered by alluvium, the minimum thickness of cover being a reported 25 ft. in Shaft 19.

Although the nearest outcrops are along the coast to the south of the Brisbane River, basalt had been reported by E.O. Marks, Assistant Government Geologist (b) from a bore on portion 355, Toombul, approximately ¼ mile west of the Nundah Railway Station. The log of this bore is as follows:-

0 - 41 ft.	No core; probably alluvium
41 - 110 ft.	Basalt, upper 9 to 10 ft. weathered
110 - 223 ft.	Clay, shale and sandstone representing Ipswich Coal Measures and possibly Tertiary sediments.

In view of the widespread occurrence of Tertiary basalts in south-east Queensland, the basalt in the excavations is presumed to be Tertiary.

The rock is relatively coarse-grained with numerous felspar laths, together with augite and aggregates of chlorite, the latter apparently being deuteric in origin.

At least two superimposed flows of basalt were exposed in the workings. Except for a few "kernels" of unaltered rock between Shafts 7 and 8 and between Shafts 12 and 13, the basalt has weathered, the colour being shades of yellow, brown or red. Downstream from Shaft 8 the drive is partly in agglomerate, now weathered to clay.

The section shows the vertical irregularity of the basalt flows. The latter must have suffered considerable erosion before the deposition of the alluvium on them. The presence of pebbles of basalt, now altered to clay in the gravels above the basalt, e.g. between Shafts 16 and 17 and between Shafts 20 and 22 supports this.

(a) Q.G.M.J. Jan. 1910, p.20

(b) A.R.D.M. for 1910, p.191.

(iv) Alluvium: The surface from the lower end of the sewer to beyond Shaft 26, from Shaft 31 to Shaft 36 and again upstream from Shaft 39 is occupied by alluvium. In general the alluvium in Kalinga Park and in the vicinity of Schulz Canal is largely of dark clay, with woody fragments, and gravel of silicified phyllite pebbles. Elsewhere clays are usually lighter in colour and the alluvium ranges in composition from clay to coarse gravel, the latter sometimes being irregularly distributed. In general, however, the alluvium appears to grade from clay at the surface to gravel at depth.

A few minor faults intersect the unconformity between the basalt and the alluvium. In each case the throw is of the order of a few feet.

The elevation of the surface of the alluvium along the line of the sewer ranges up to 29 ft. above State Datum (at Shaft 20). A test bore, No.24, on the site of Shaft 41 (R.L. 23 ft.) in Kalinga Park on the flood plain of Kedron Brook, was reported to have penetrated 51 ft. 6 in. of alluvium before bottoming on rock (a boulder ?).

The bore shows that Kedron Brook occupies a drowned valley, and it is considered that the alluvium in the Whinstanes-Kalinga area was deposited, following the rise in sea level which took place at about the end of the Pleistocene Period(e). Subsequently, during the Recent Period, a depression in sea level terminated deposition and left the sediments as dry land.

ENGINEERING GEOLOGY - The Coal Measures and the weathered basalt provided the best working conditions in the sewer excavations. Where the alluvium was relatively dry clay, conditions were good but gravel, sand and sandy clay, particularly when wet, presented difficulties and in many cases face-boards were necessary. Cement grouting was attempted but with little success because of the presence of clay in the sand and gravel.

At the commencement of the Project the distribution of the Coal Measures and weathered basalt, which were concealed by the alluvium, was assessed from the information available. The greatest source of danger in driving in these rocks was the local thinning of the roof of hard material over the drive until it became too thin to support the weight of the overlying alluvium, with subsequent collapse. This danger was increased by the certainty that the upper surfaces of both the Coal Measures and the weathered basalt are very irregular. Similar danger existed in driving from Coal Measures or weathered basalt into alluvium.

This hazard was reduced by arranging for test boring above and ahead of the working faces and by drawing attention to indications of the thinning of rock in the roof - softening of the rock due to greater alteration, and a slight influx of water from the alluvium. In spite of this in some cases these indications were not interpreted correctly and some falls resulted at points shown on the section. In general a fall at a depth of about 50 ft. took some weeks to extend up to the surface.

In a few places, e.g. between Shafts 6 and 7 and between Shafts 8 and 10, slow expansion of the Tertiary clay beneath the basalt broke timbers and upset the alignment of the drive.

The most difficult sections of the drive, i.e. beneath Schulz Canal and beneath Kedron Brook and Kalinga Park, have yet to be completed. Here alluvium consists largely of black clay and water-bearing gravels. These gravels appear to be interconnected

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(e) Bryan & Jones, The Geological History of Queensland: Uni. Q'ld. Pub. Vol. II, No.12, 1945, p.79.

over a wide area and work on the shafts in Kalinga Park suggests that there may be an influx of water from Kedron Brook itself. The use of shields and other measures will probably be necessary in these sections.

Future movement along fault planes, particularly of Recent faults, could damage the sewer but under the circumstances little could be done to prevent possible damage.

CONCLUSION - Geological advice to the company, Etudes et Entreprises, who are excavating the North Kedron Brook Sewer in the Whinstanes-Kalinga area, a most difficult section of the metropolitan area, has facilitated operations and helped to avert many falls in tunnelling. In the course of this work a detailed geological section of the excavations has been prepared.

In the Doomben-Hendra area the excavations reveal the extension, hitherto unsuspected, of weathered basalt, presumably Tertiary, with Recent Alluvium above and what is probably Tertiary clay beneath. Light was also thrown on the distribution of the Ipswich Coal Measures beneath the alluvium in the Whinstanes-Doomben area and the work has added to the knowledge of the thickness and distribution of alluvium in the vicinity of Schulz Canal, Toombul and Kalinga.

(Sgd.) T.D.Dimmick.

Geologist.

MEMORANDUM: 23rd October, 56.

The Chief Government Geologist,
BRISBANE.

North Kedron Brook Sewer Excavations, Whinstaines to Kalinga, Brisbane.

Introduction: Mr. T.D.Dimmick (7th May, 1952) described the geological formations outcropping along the line of the proposed North Kedron Brook Sewer and commented on their likely behaviour during tunnelling. During the construction of the sewer, periodical inspections were made of the workings to map the subsurface geology. Up to April 1954, this work was carried out by Mr. Dimmick. His observations are recorded in a progress report dated 20th May, 1954. The information collected by the writer on subsequent visits is set out in this report.

Excavations: By April, 1954, some 4,400 ft. of tunnelling remained to be done. This footage was spread over eight different sections and comprised mainly difficult soft ground. Approximately 750 ft. of this work was subsequently done by opencut methods. In addition, two access shafts not in the original specifications, Nos. 26A and 42A, were sunk. All excavations were completed by the end of 1955.

Geology: During the final stages of construction, no new formations were penetrated. Ipswich Coal Measures were met with between Shafts Nos. 4 and 5 and Nos. 36 and 39. They consist of interbedded sandstones and shales - a lithology characteristic of these Triassic rocks. Alluvium was encountered in all the remaining driving.

This alluvium is composed essentially of light coloured sediments ranging in grain size from clay to gravel. The porous beds invariably carry large supplies of underground water. Some of these aquifers are undoubtedly of considerable areal extent; others are small lenticular bodies, erratically distributed.

In the two localities where the sewer line cuts Kedron Brook - from Shaft No.25 to Shaft No.26 and from Shaft No.39 to Shaft No.44 - the clays in the alluvium have a characteristic blue-black colour.

The sandy horizons, however, are of the normal type. Associated with this blue-black clay has been found much woody material, now partly carbonised. It is possible that a radiocarbon assay will be made of a sample of this material to determine its absolute age. A sub-fossil crustacean was also found in similar clay between Shafts Nos. 25 and 26. The specimen, determined by Mr. J.T.Woods of the Queensland Museum as Scylla serrata, the Mangrove or Mud Crab, occurred approximately 25 ft. below State Datum. Percussion boring at this point has shown that similar alluvium extends to at least 53 ft. below State Datum. These sediments were most likely deposited following the eustatic rise in sea level at the end of Pleistocene times.

Engineering Geology: Strata of the Ipswich Coal Measures provided excellent tunnelling conditions. In the early stages of construction considerable difficulty was experienced at the junction of these rocks and the alluvium. Serious falls, often extending to the surface, occurred at all of these points. However, similar sections between Shafts Nos. 36 and 37 and Nos. 38 and 39 were successfully negotiated during the final stages.

The behaviour of the alluvial material during tunnelling was very variable. Above the water table, clays gave firm ground conditions; below the water table, they acted as squeezing ground. Generally, however, clays provided satisfactory driving conditions. The greatest difficulty was experienced with sand and gravel horizons carrying water. These gave rise to flowing ground. These conditions were encountered between Shafts Nos. 17 and 18, Nos. 22 and 26A and Nos. 40 and 44. In the vicinity of Kedron Brook and Schulz Canal tunnelling was finally abandoned in favour of open-cut methods. However, between Shafts Nos. 17 and 18 underground driving was successfully completed by using compressed air under a pressure of 9 lb. per square inch. Despite the frequent loss of air from the tunnel due to exceptionally permeable horizons, no "blows" occurred.

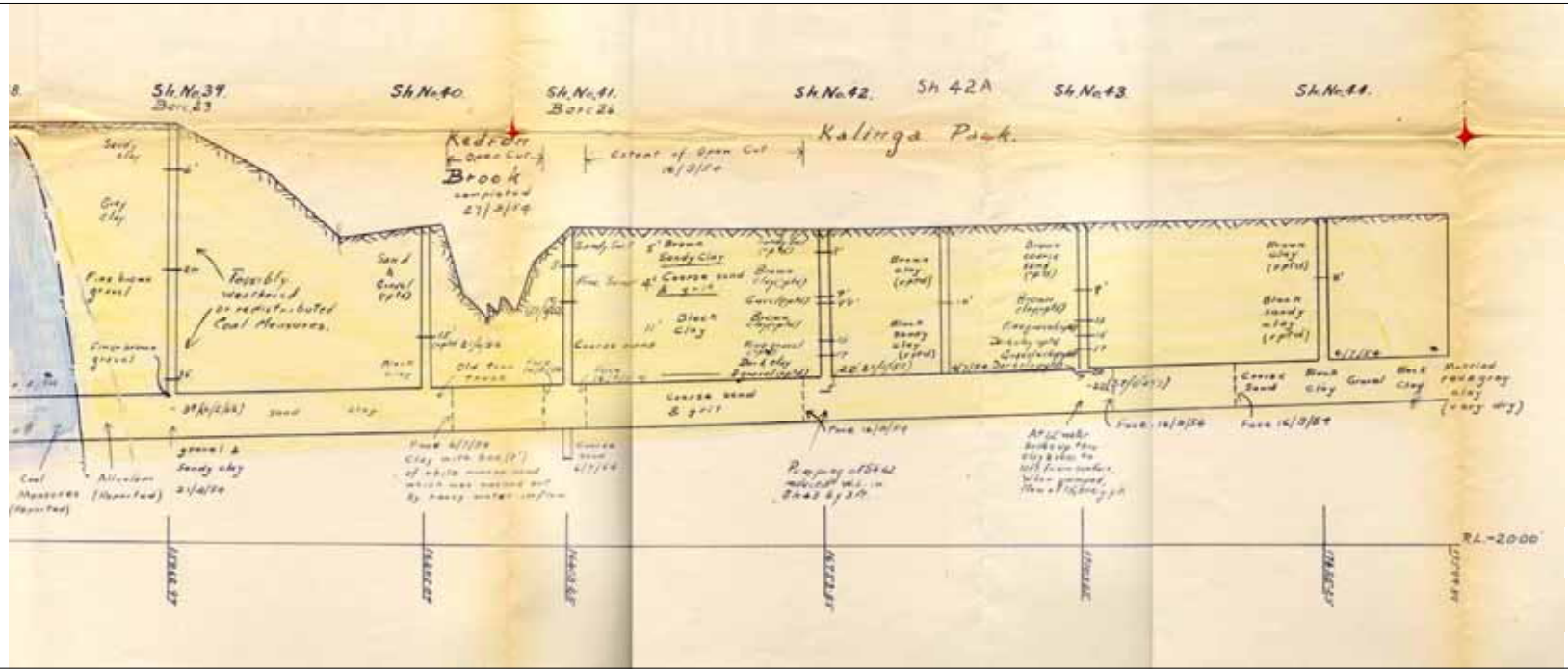
Conclusion:

Periodical inspections of the excavations for the North Kedron Brook Sewer from 1952 to 1955 have added greatly to our knowledge of the local geology, both pure and applied. The existence of Tertiary basalt and clay beneath the alluvium of the Toomben-Hendra area was

not previously realised. In addition, the lithology of the alluvium itself is now better understood. This aspect is particularly important from the engineering geology point of view for it was in this material that all the major problems were encountered during the construction of the sewer. Unfortunately, no attempt has been made to correlate the behaviour of the various types of alluvium during tunnelling with their mechanical properties as determined by the more common tests of soil mechanics. Our knowledge of the engineering properties of these sediments is at the moment, therefore, based on qualitative appraisal rather than quantitative methods.

J B Cameron

Geologist.



AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS PTY LTD
36 JEAYS STREET BOWEN HILLS QLD 4006 AUSTRALIA

TITLE: HYDROGEOLOGICAL ENVIRONMENTAL IMPACT ASSESSMENT
AIRPORT LINK PROJECT
GEOLOGICAL LONG SECTION - NORTH KEDRON BROOK SEWER

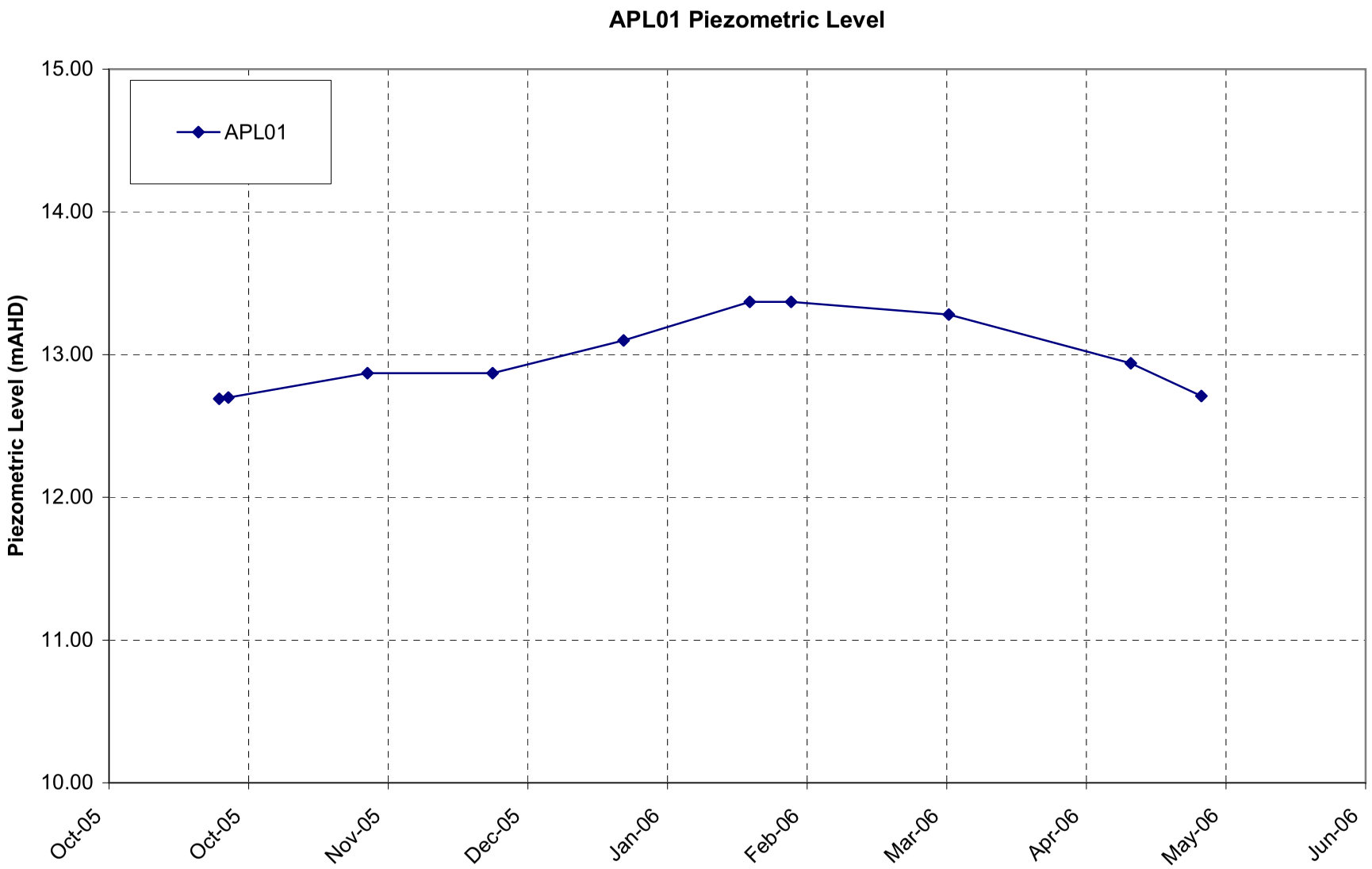
CLIENT: SKM - CW JOINT VENTURE			OFFICE: Brisbane
DRAWN BY: IPC	SCALE: As Shown	PROJECT No: G1312/C	DRAWING No: B1
APPROVED BY:		DATE: May 2006	

Appendix C

GROUNDWATER LEVEL DATA

Table C1. Groundwater Levels Monitoring Data

Borehole	Easting (BCSG02)	Northing (BCSG02)	Reference Level (mAHD)	Inclination	Geology	Completion Details	Water Levels (mAHD)															
							24/10/2005	25/10/2005	26/10/2005	27/10/2005	25/11/2005	22/12/2005	19/01/2006	20/01/2006	15/02/2006	16/02/2006	24/02/2006	26/02/2006	30/03/2006	8/05/2006	23/05/2006	24/05/2006
NST2-17	53304	165057	16.5	90	Brisbane Tuff	Rock Standpipe	7.15			7.14		7.33		7.24		7.26	7.24			7.14	7.20	
APL01	53197.19	163122.17	23.64	90	Neranleigh Fernvale Beds	Rock Standpipe	12.69		12.70		12.87	12.87	13.10		13.37		13.37		13.28	12.94	12.71	
APL02	53853.85	163129.45	4.94	90	Brisbane Tuff	Rock Standpipe		2.25	2.23		2.33	2.37	2.46				2.86		3.19	2.61	2.50	
APL03	54379.42	164560.48	21.47	90	Brisbane Tuff	VWP tip set at 40.00m					18.82								17.98	17.31		
APL03	54379.42	164560.48	21.47	90	Aspley Formation	VWP tip set at 22.00m					15.98						16.17		16.72	16.14		
APL04D	55376.12	165282.27	4.18	90	Tingalpa Formation	Rock Standpipe		2.62	2.61		2.65	2.68	2.70		2.73		2.71		2.70	2.61	2.59	
APL04S	55376.12	165282.27	4.18	90	Alluvium	Alluvium Standpipe		2.34	2.34		2.43	2.48	2.50		2.52		2.50		2.51	2.39	2.34	
APL05D	55575.16	165324.24	4.17	90	Tingalpa Formation	VWP tip set at 20.00m					2.40											
APL05S	55575.16	165324.24	4.17	90	Alluvium	Alluvium Standpipe		1.09			0.98	1.05	0.82		1.04		0.97		1.00		0.83	
APL06	53921.72	164763.64	14.87	90	Brisbane Tuff	Rock Standpipe	7.87				10.61	10.66		10.50	9.81		10.23		10.35		10.33	
APL07D	53533.87	164941.53	7.81	90	Brisbane Tuff	Rock Standpipe					8.31	8.31		8.40			8.33		8.29		8.11	
APL07S	53533.87	164941.53	7.81	90	Alluvium	Alluvium Standpipe		6.44	6.40		6.56	6.23	6.33		6.45		6.31		6.19		6.15	
APL08	53529.44	164399.47	23.57	90	Tingalpa Formation	VWP tip set at 23.18m					14.19								14.93			
APL08	53529.44	164399.47	23.57	90	Brisbane Tuff	VWP tip set at 43.00m					12.43								12.63			
APL09	54103.29	163429.05	10.49	90	Brisbane Tuff	Rock Standpipe	10.44		9.62		9.87	9.94	10.49		10.19		10.23		10.34	10.34	10.34	
APL11	53100.40	161999.02	12.92	90													1.73		1.21	1.13		1.08
APL12	53130.45	162081.10	13.58	90												0.55	0.57		0.61	0.55	0.52	
APL13	53022.54	162240.28	15.01	90													9.51		9.39	9.25		9.17
APL14	53133.68	162465.96	15.74	90																1.83		
APL15	53105.00	162693.23	4.04	90																		
APL16	53142.22	162861.50	6.84	60													6.84		6.19	6.12	6.11	
APL17	53200.02	163358.85	24.29	90															23.23	22.70	22.50	
APL18	53297.33	163853.93	29.92	90													23.14		22.88	22.47	22.23	
APL19	53322.42	164087.40	22.78	90													15.06		13.38	13.02	12.96	
APL20	53466.16	164313.59	24.85	90										17.84		17.69	17.67		17.67	17.81	17.82	
APL22	53279.78	164448.64	18.85	90										12.86	12.87		12.89		12.61	12.94	12.88	
APL23	53459.69	164688.21	16.02	90										12.62	12.76		12.78		12.85	12.66	12.56	
APL25D	53825.68	164932.95	10.61	90										2.52	2.49		2.50		2.50		2.46	
APL25S	53825.72	164931.38	10.63	90										2.45			2.46		2.47		2.41	
APL26	53767.85	165109.95	10.06	90																		
APL27	54078.71	164815.27	13.76	90																		
APL28	54098.97	165234.18	14.06	90																		
APL30	54309.65	165286.35	12.92	90												-0.42	3.25		3.16	3.11	3.11	
APL32D	54614.38	165471.27	12.28	90																		
APL32S	54616.27	165470.92	12.30	90																		
APL34	55014.05	165406.85	10.53	90																		
APL36	53429.34	164106.37	19.70	90																		
APL39	53576.40	164589.56	23.00	90																		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Feb-06
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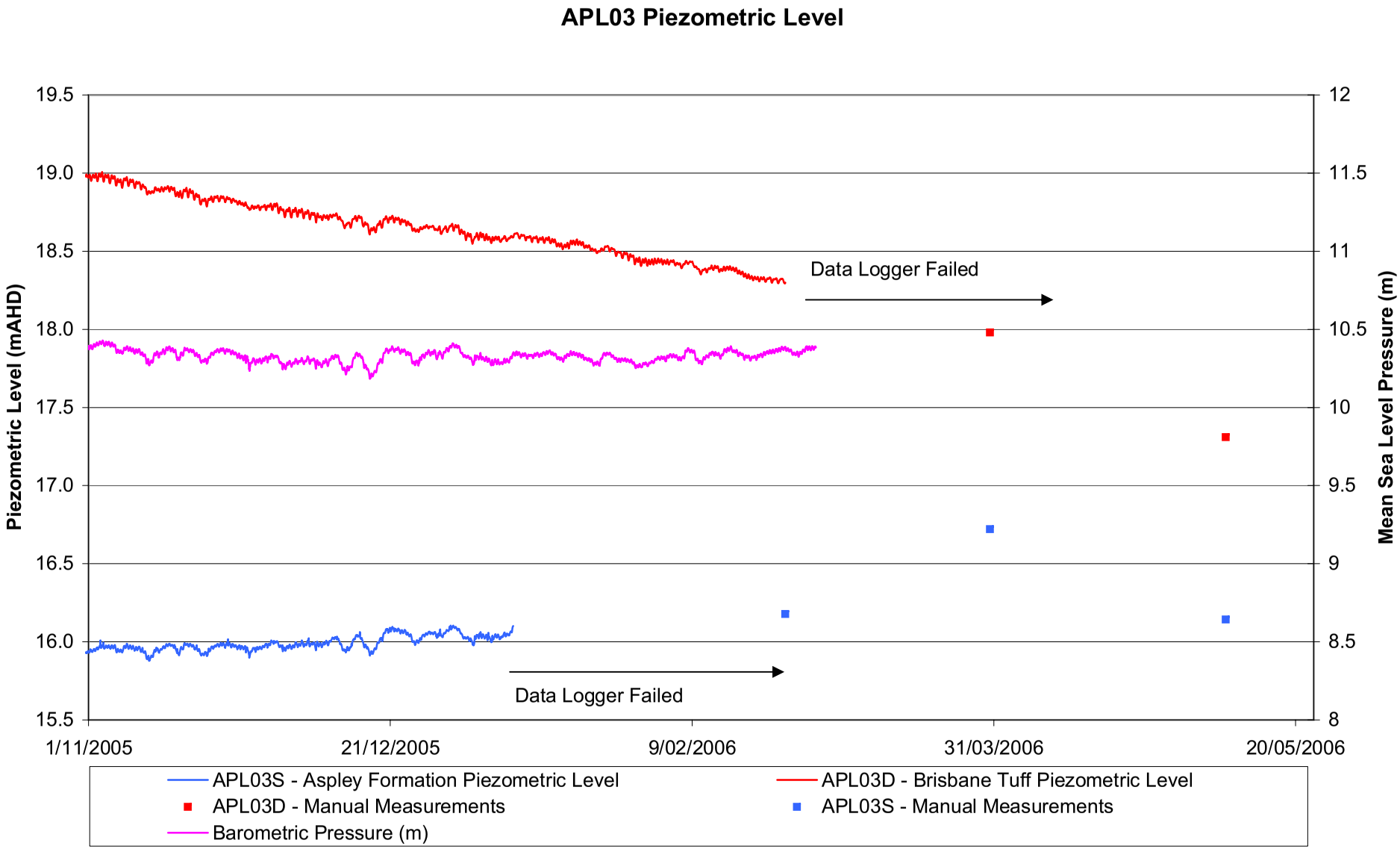
May-06
Jun-06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10
9.5
9
8.5
8
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21/12/2005
9/02/2006
31/03/2006
20/05/2006
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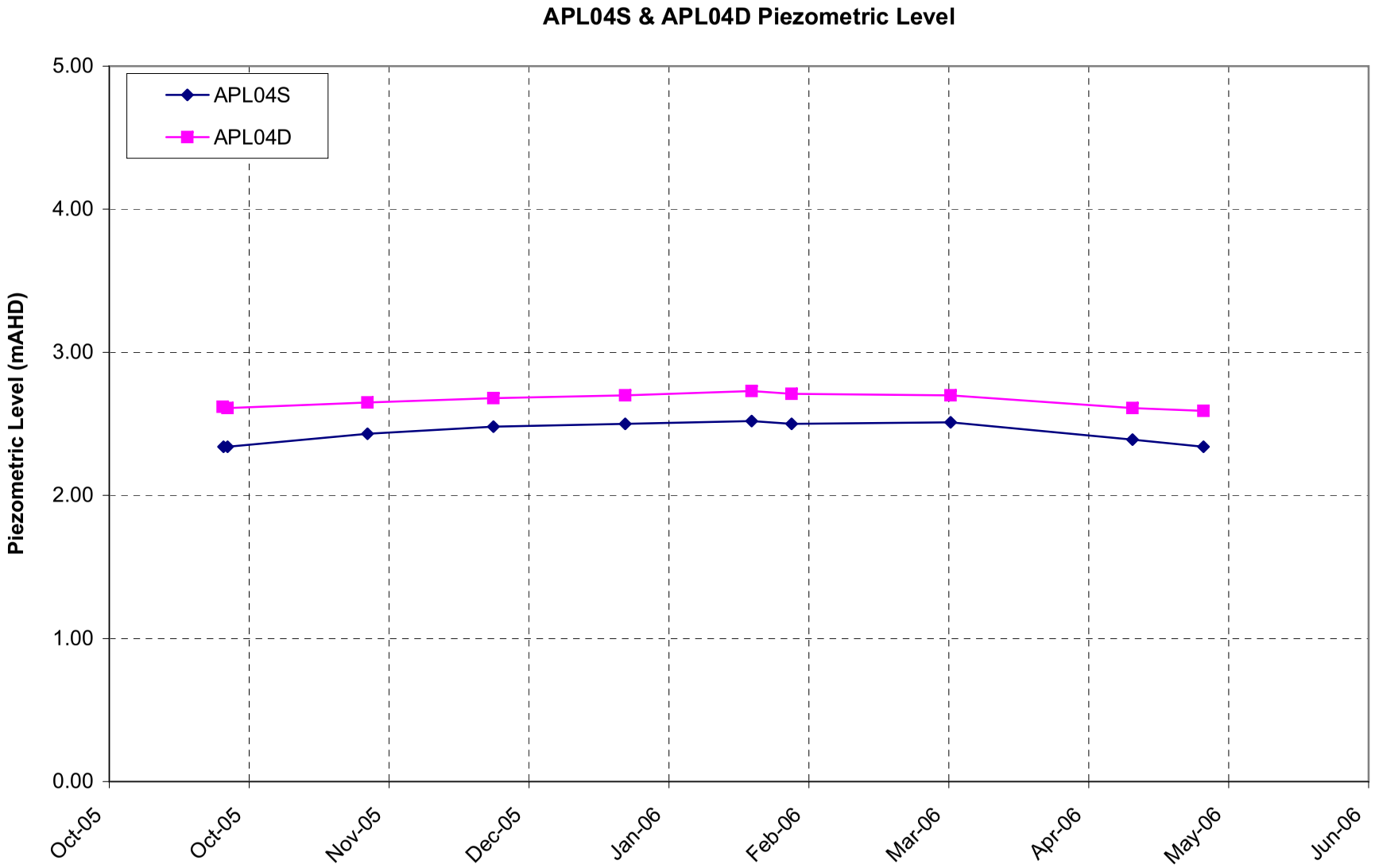
APL03D - Manual Measurements
APL03S - Manual Measurements
Barometric Pressure (m)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APL04D
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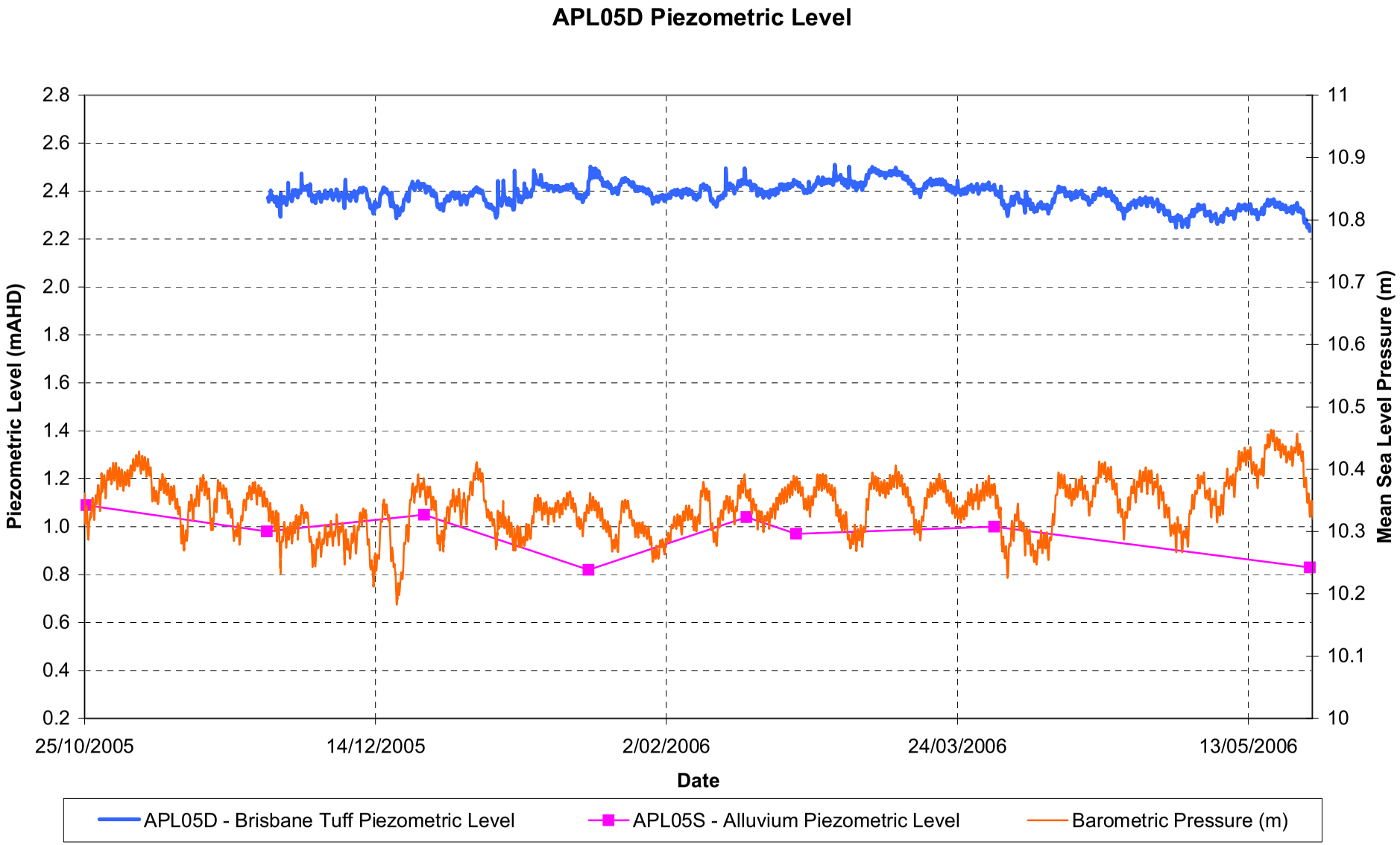
Jun-06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11
10.9
10.8
10.7
10.6
10.5
10.4
10.3
10.2
10.1
10
25/10/2005
14/12/2005
2/02/2006
24/03/2006
13/05/2006
Date
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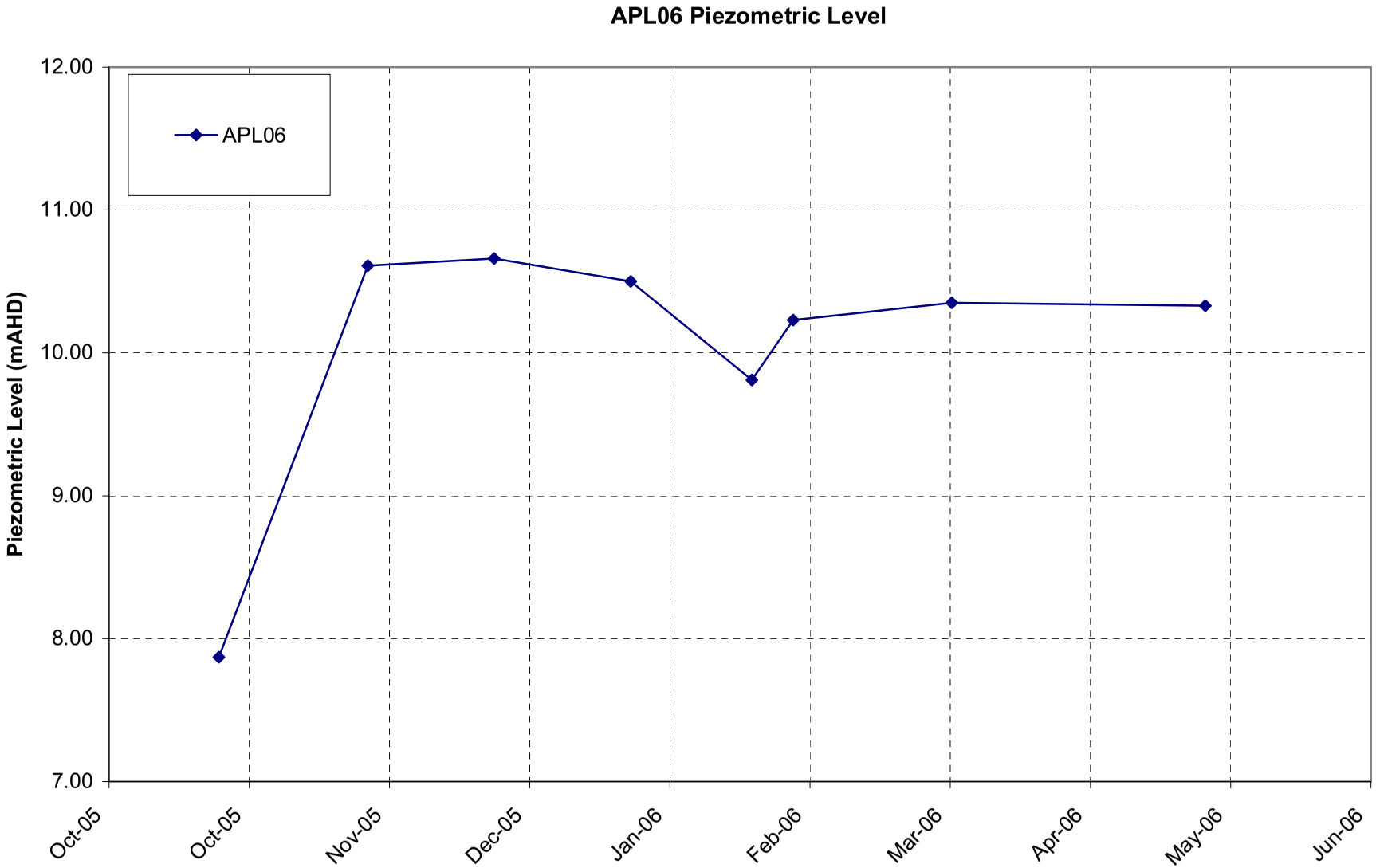
APL05S - Alluvium Piezometric Level
Barometric Pressure (m)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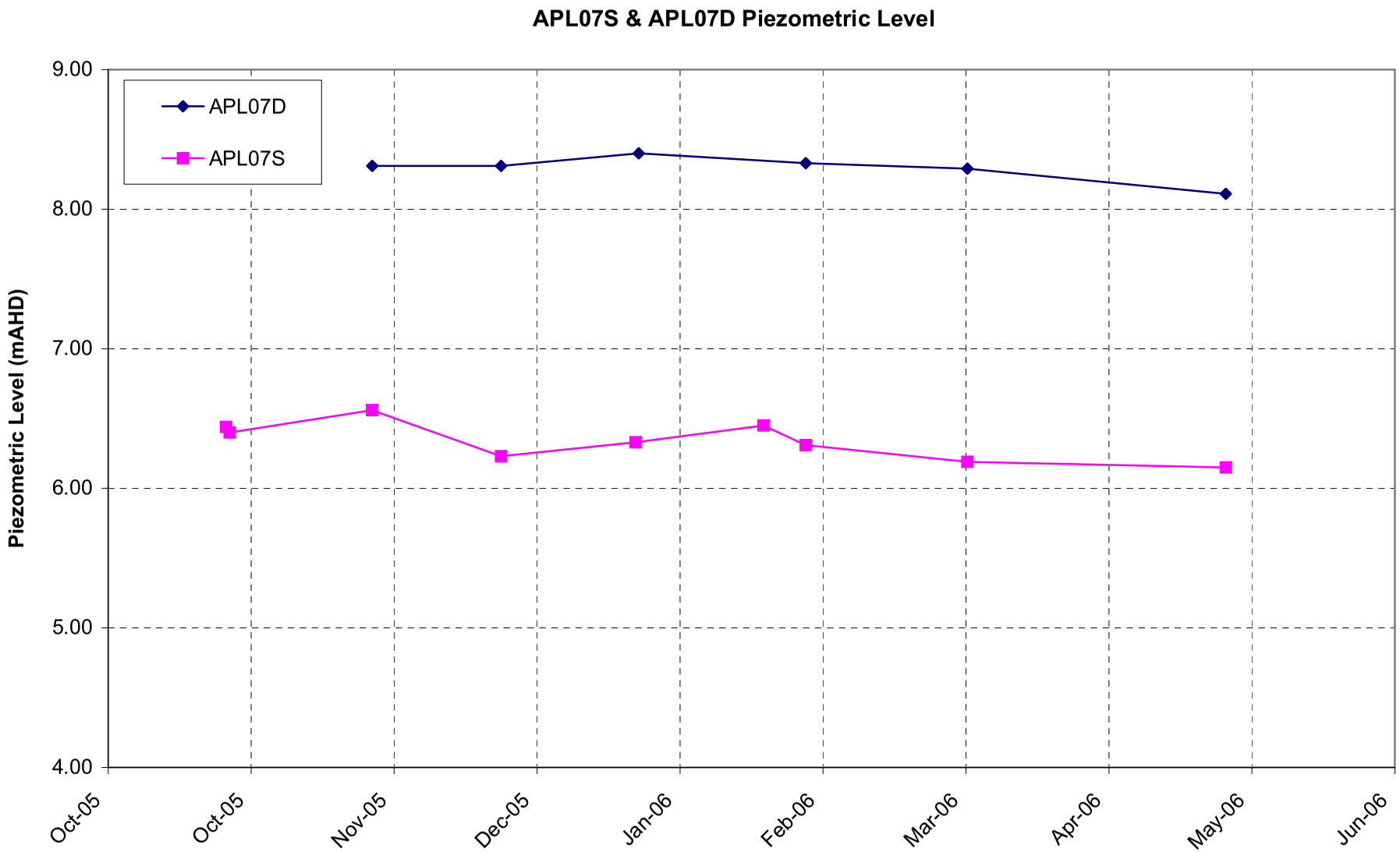
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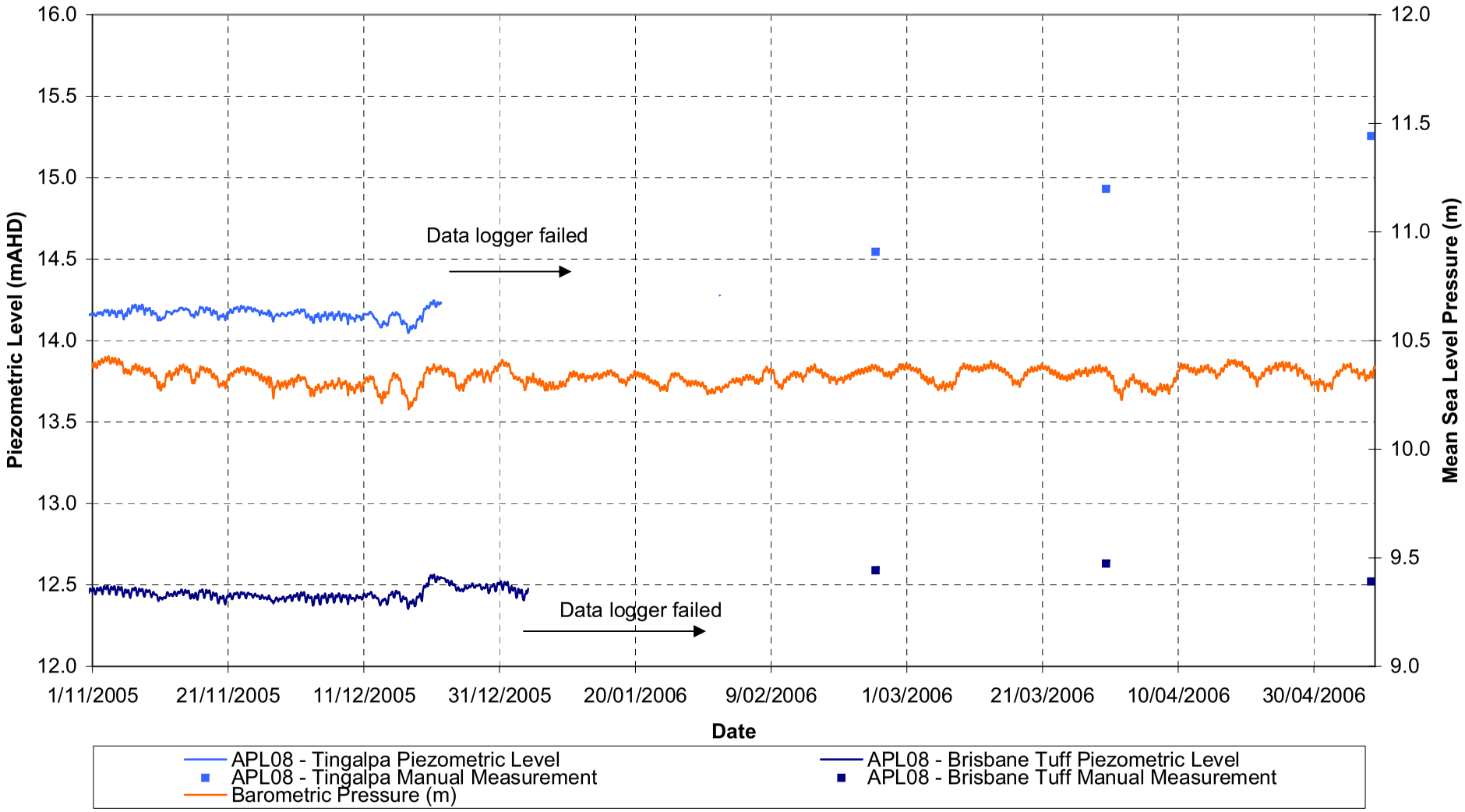

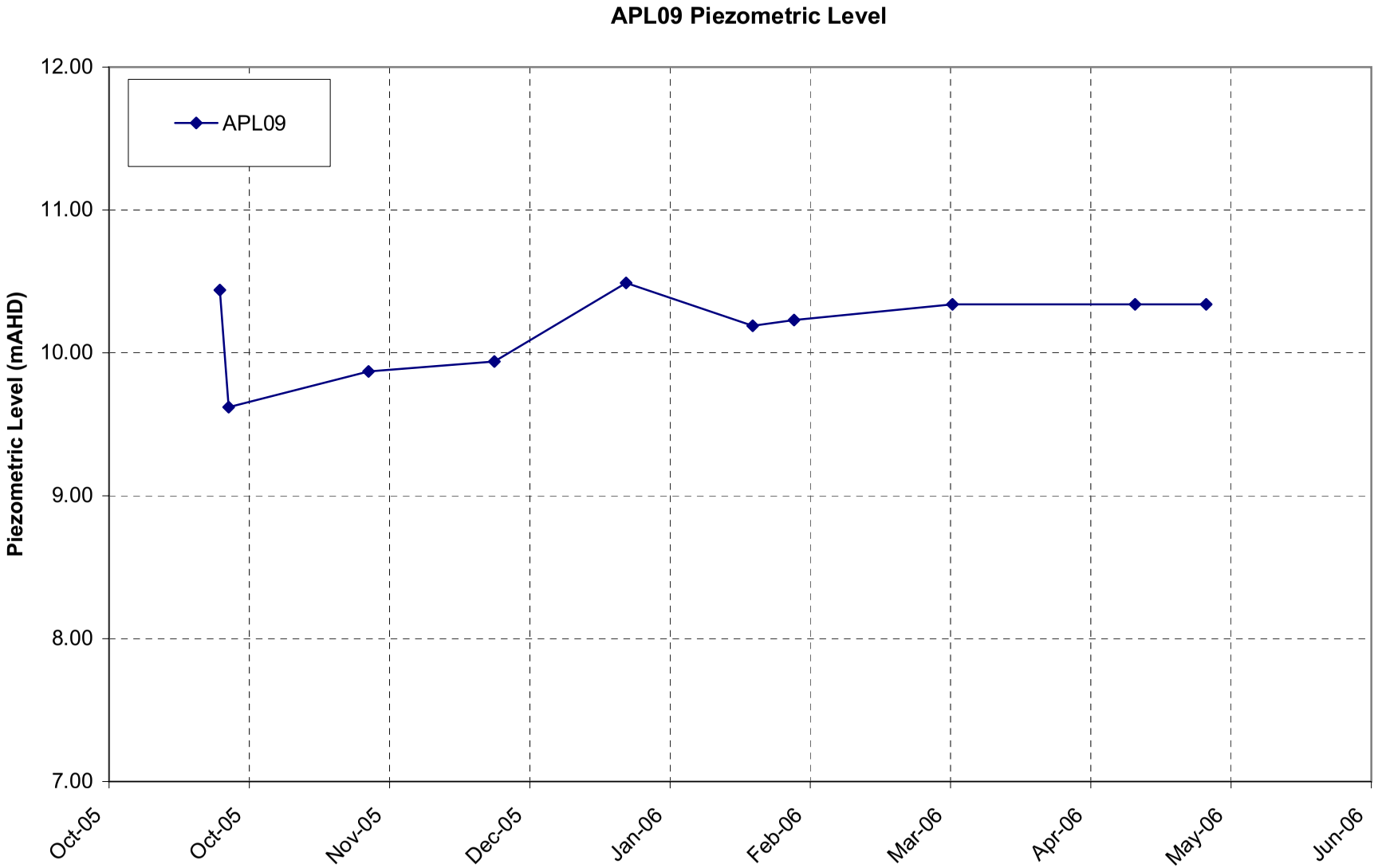
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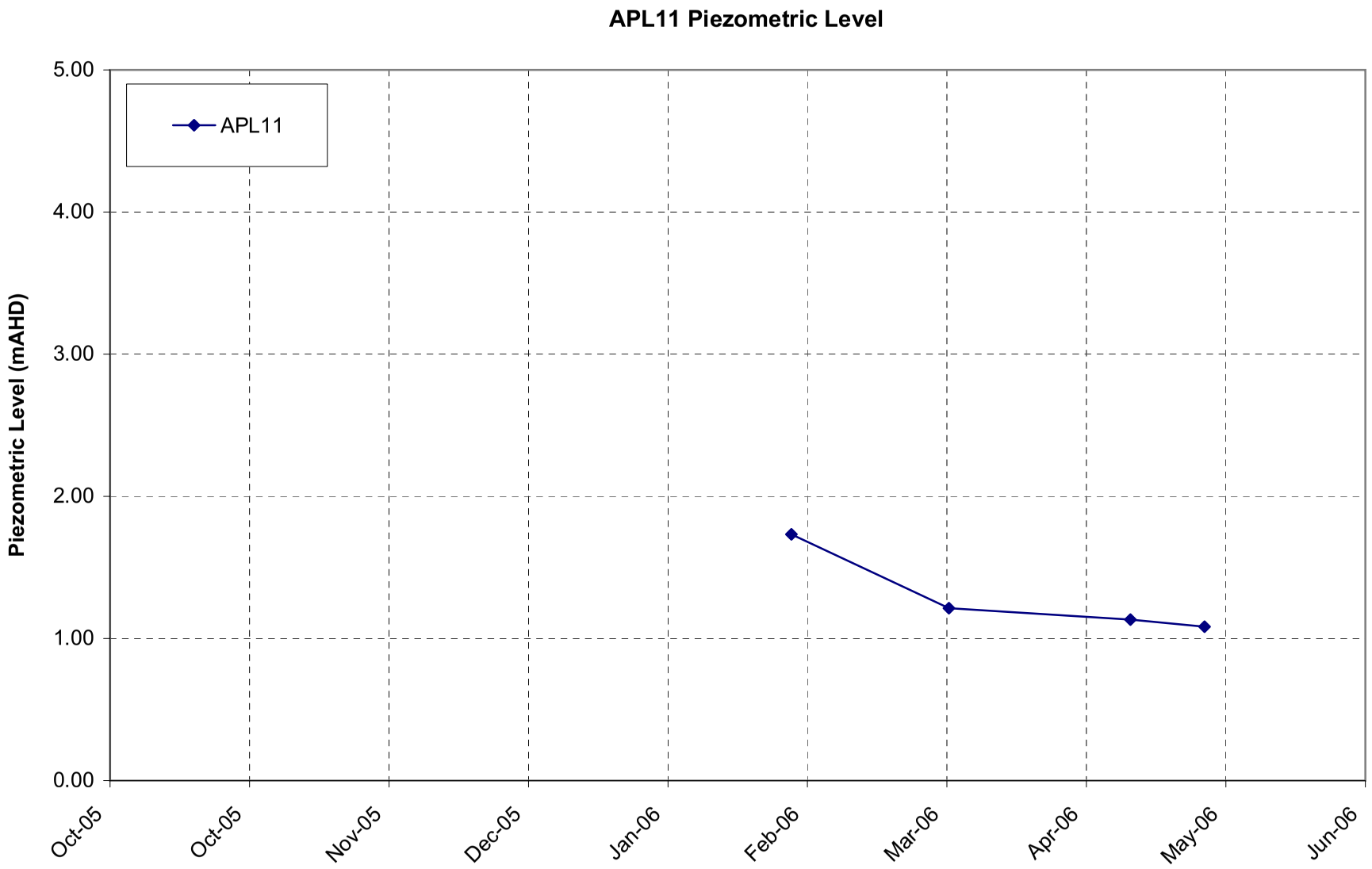
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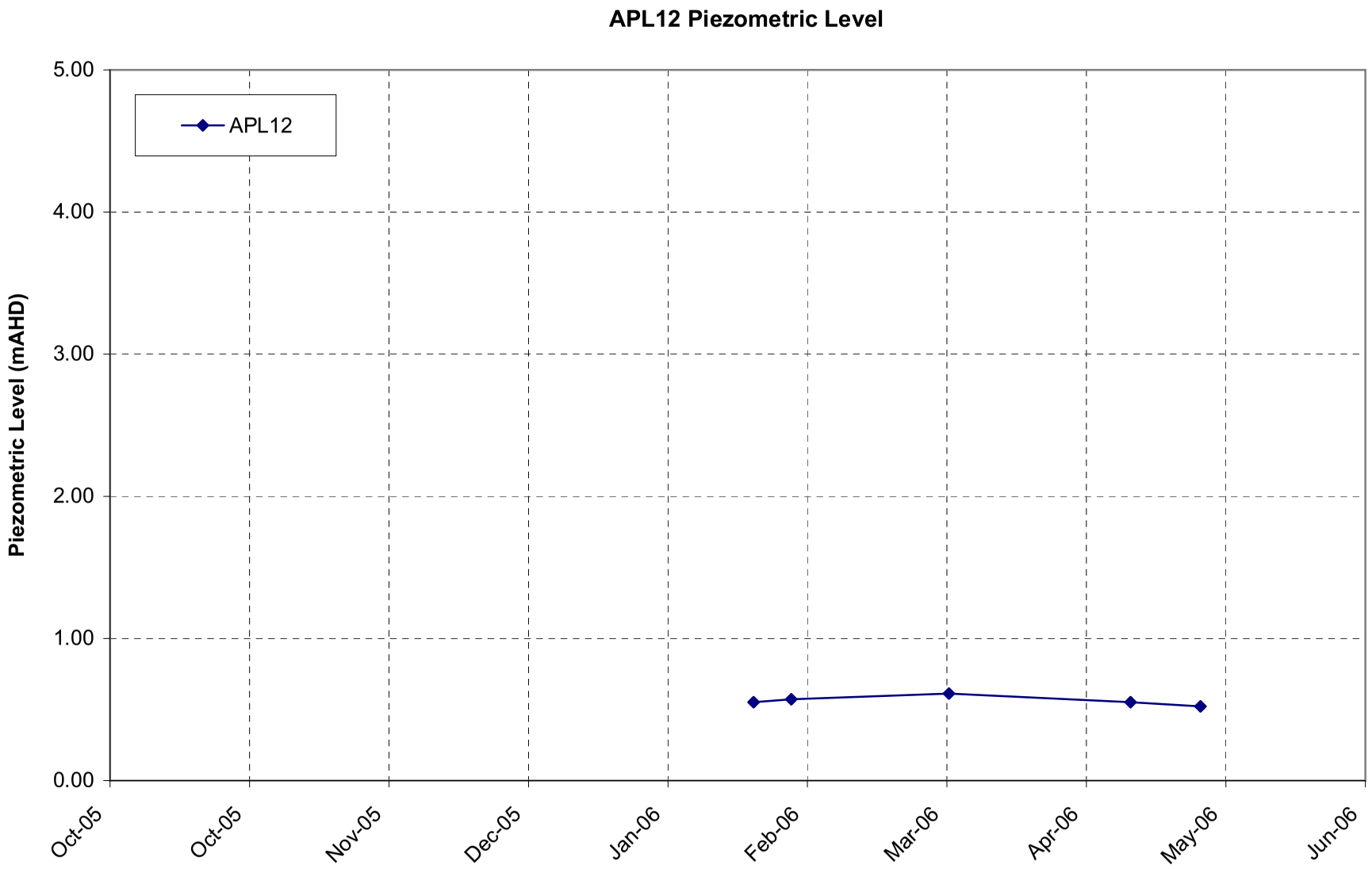
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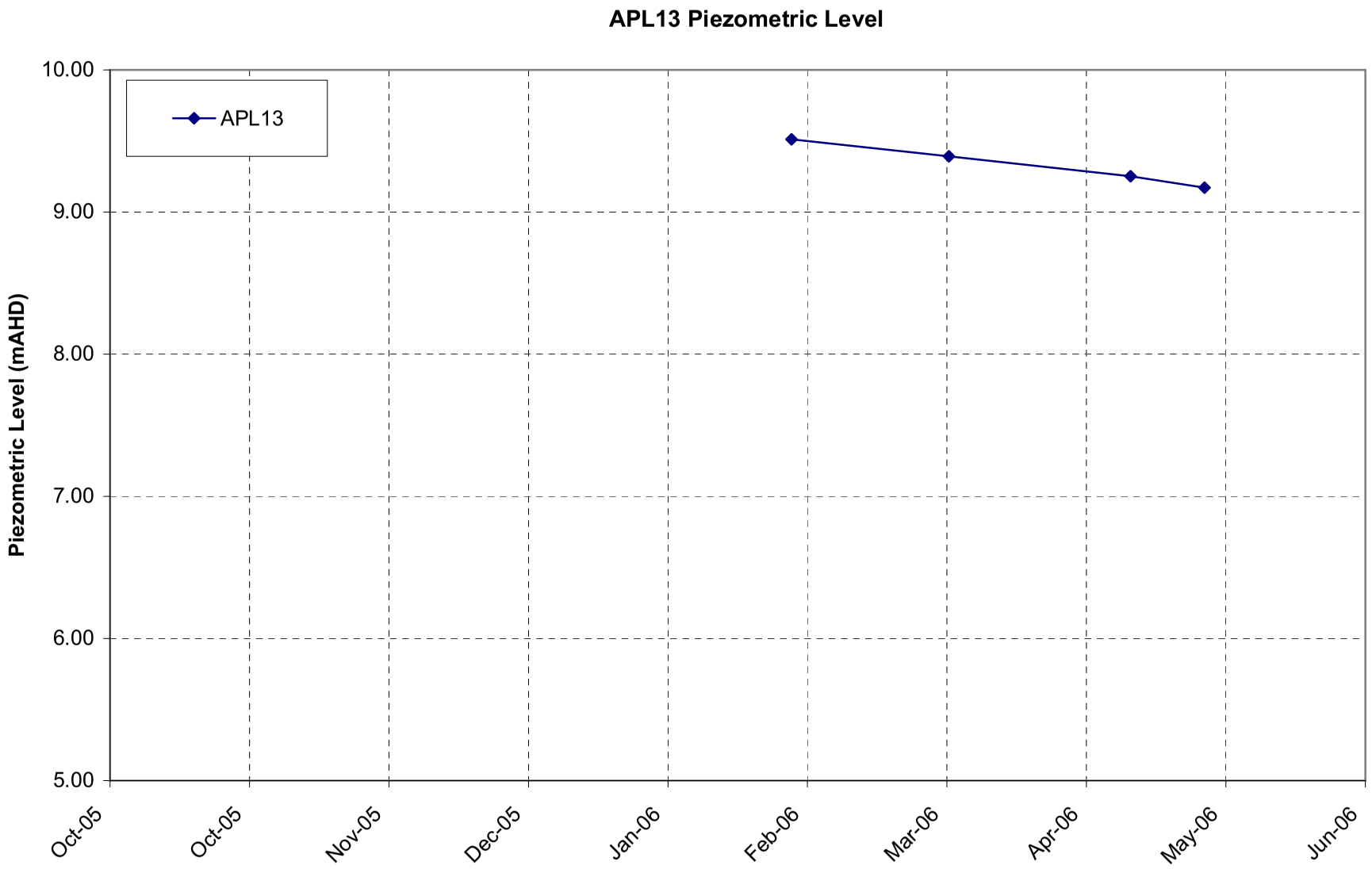
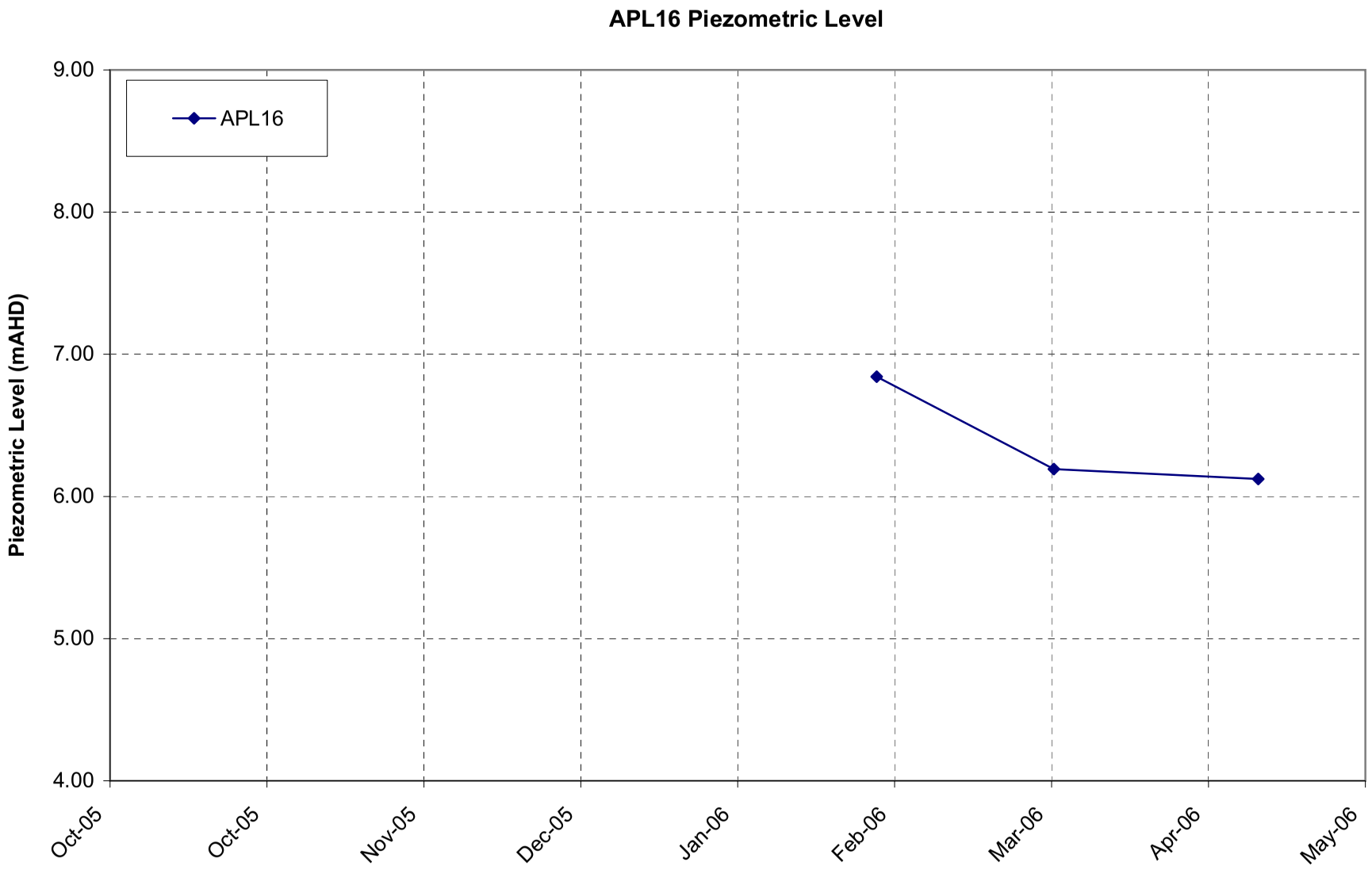
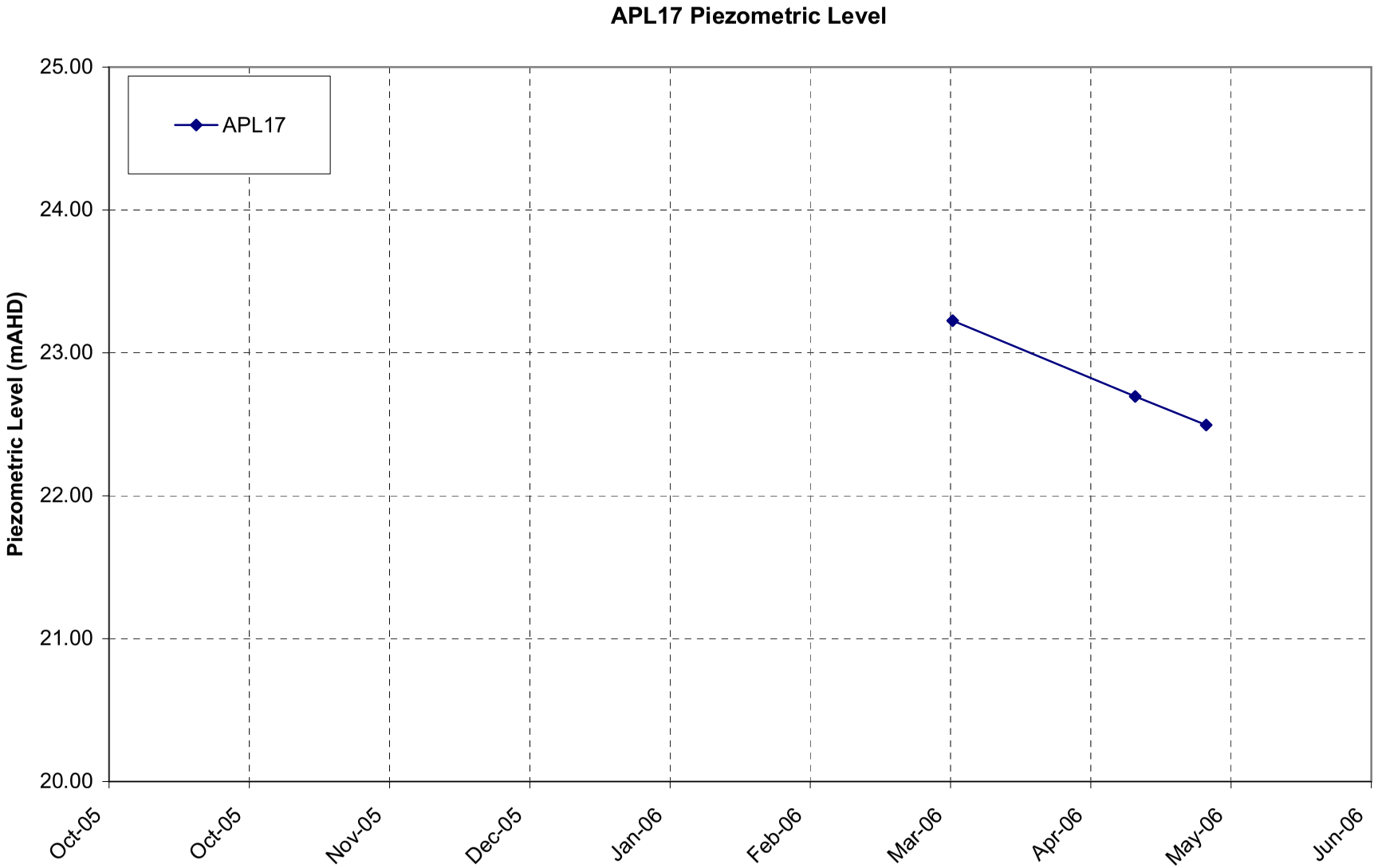
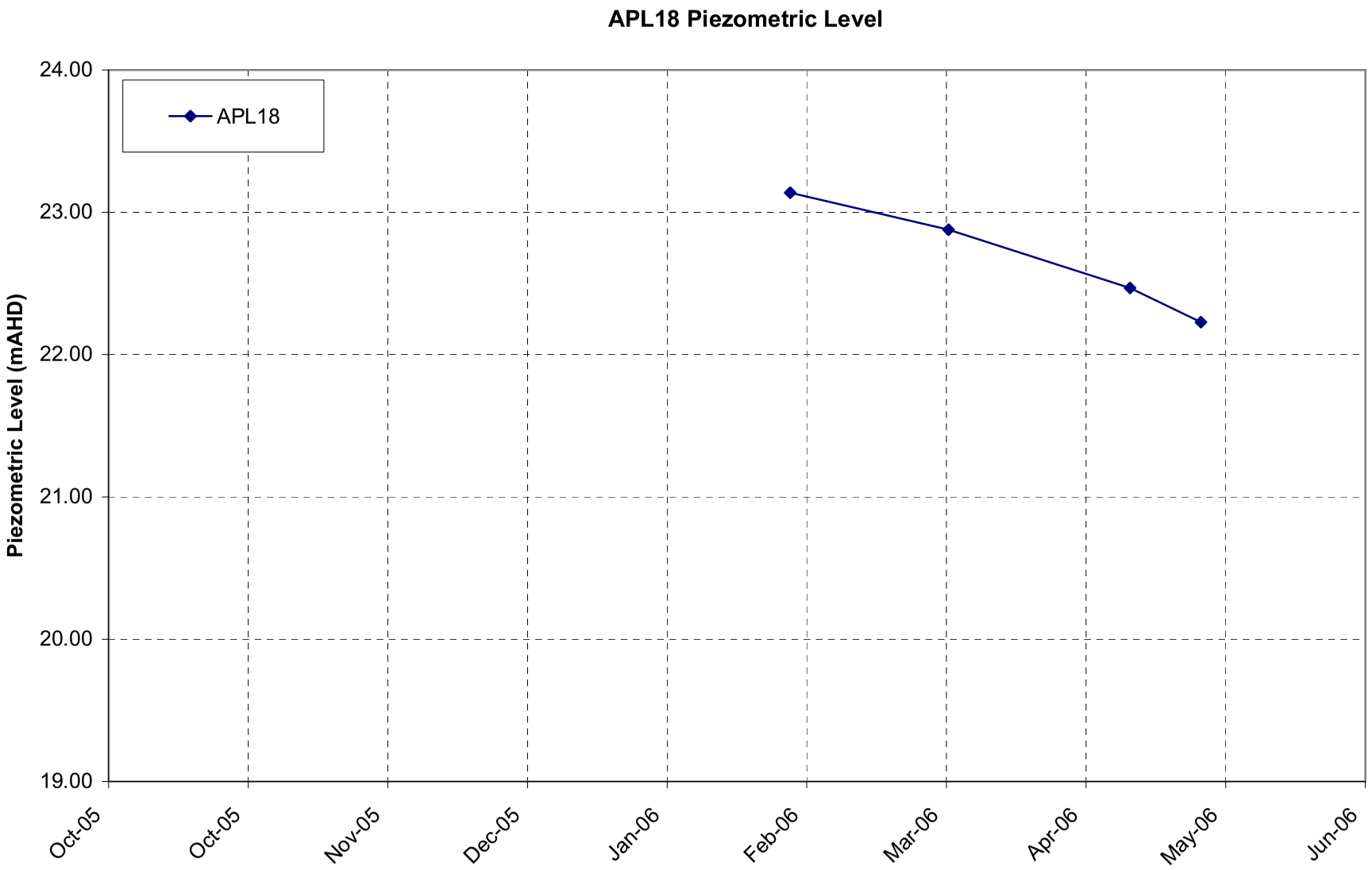
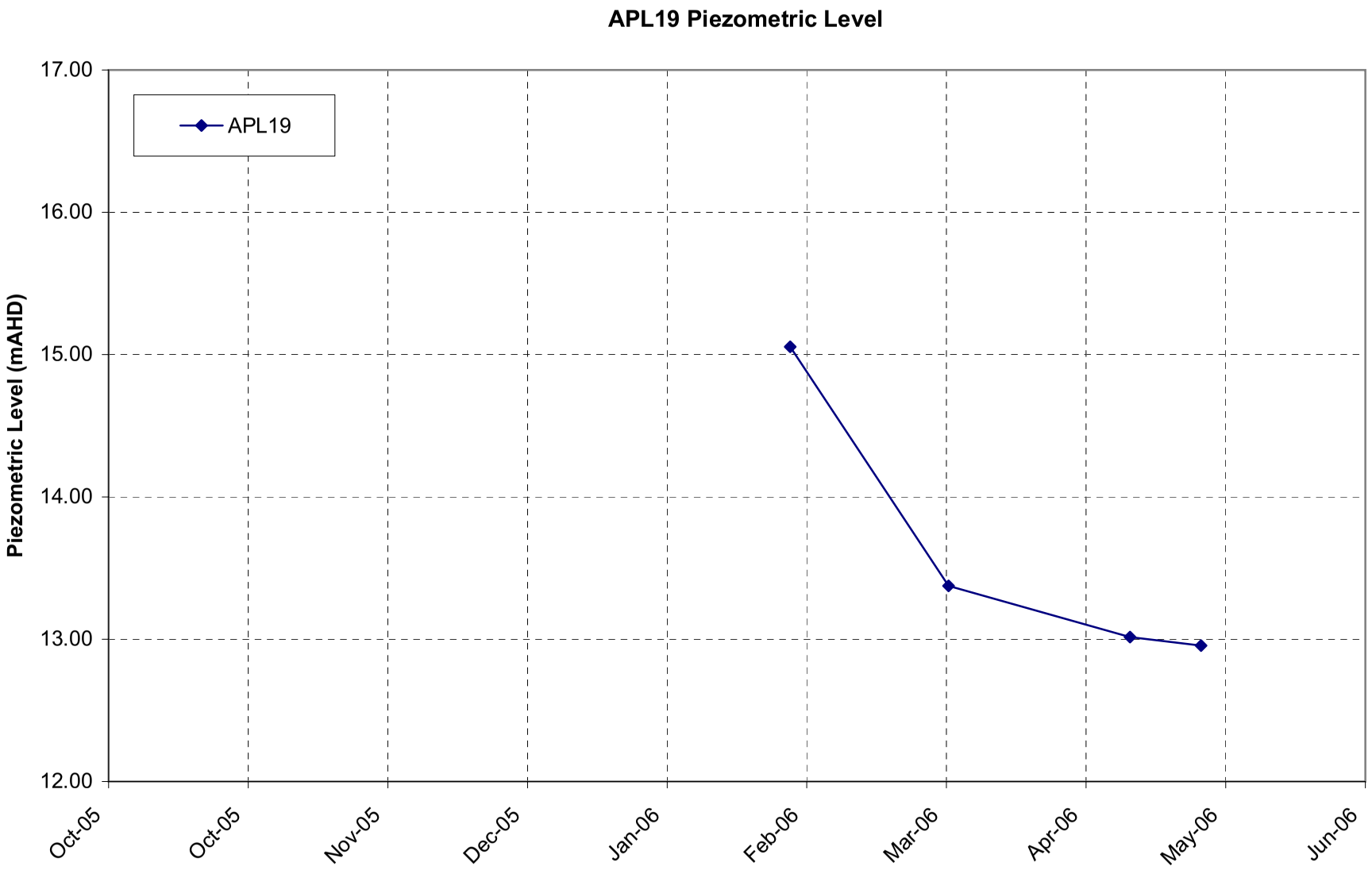
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL13 Piezometric Level
APL13
Piezometric Level (mAHD)
10.00
9.00
8.00
7.00
6.00
5.00
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL16 Piezometric Level
APL16
Piezometric Level (mAHD)
9.00
8.00
7.00
6.00
5.00
4.00
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06


APL17 Piezometric Level
APL17
Piezometric Level (mAHD)
25.00
24.00
23.00
22.00
21.00
20.00
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL18 Piezometric Level
APL18
Piezometric Level (mAHD)
24.00
23.00
22.00
21.00
20.00
19.00
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL19 Piezometric Level
APL19
Piezometric Level (mAHD)
17.00
16.00
15.00
14.00
13.00
12.00
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Oct-05
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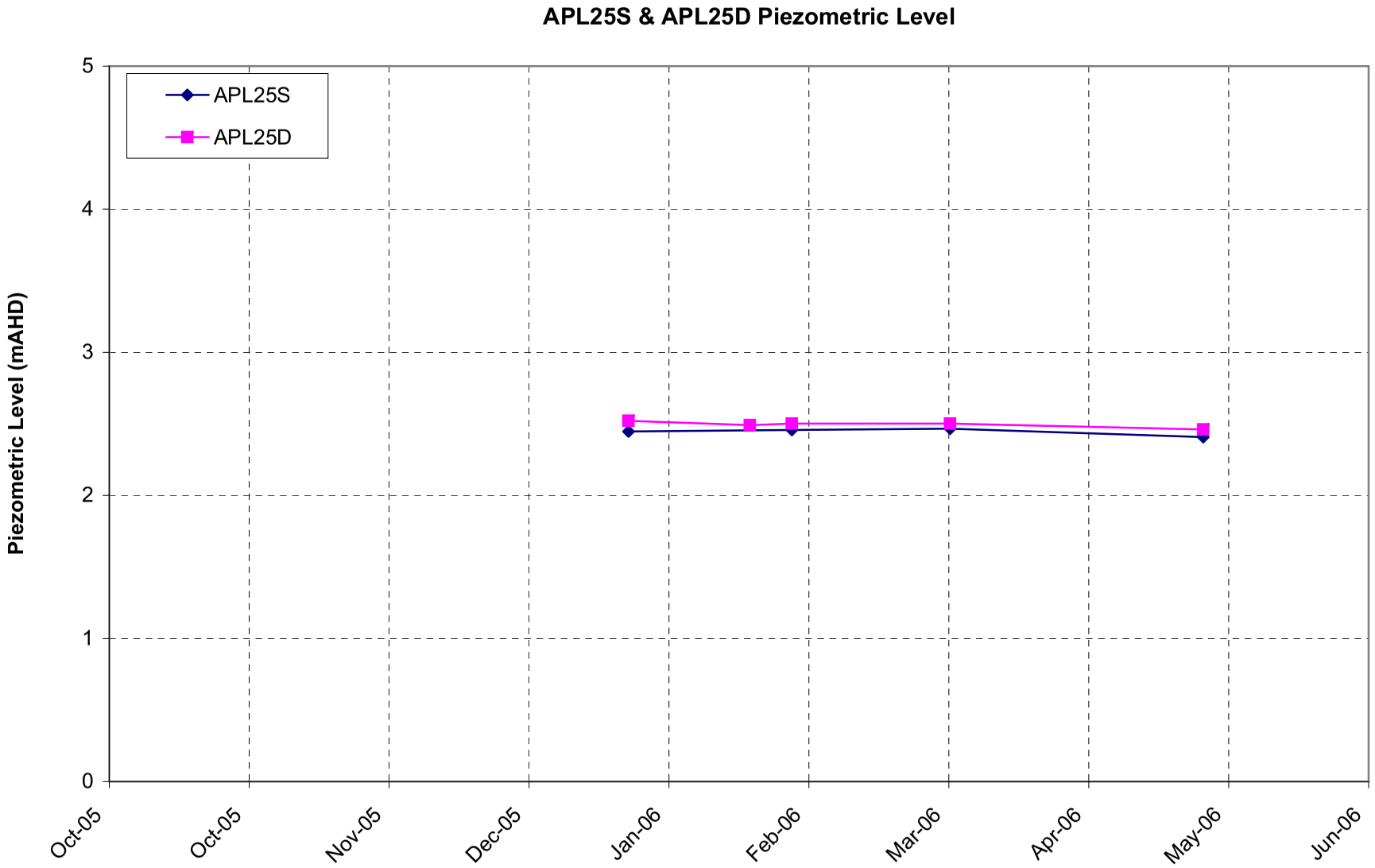
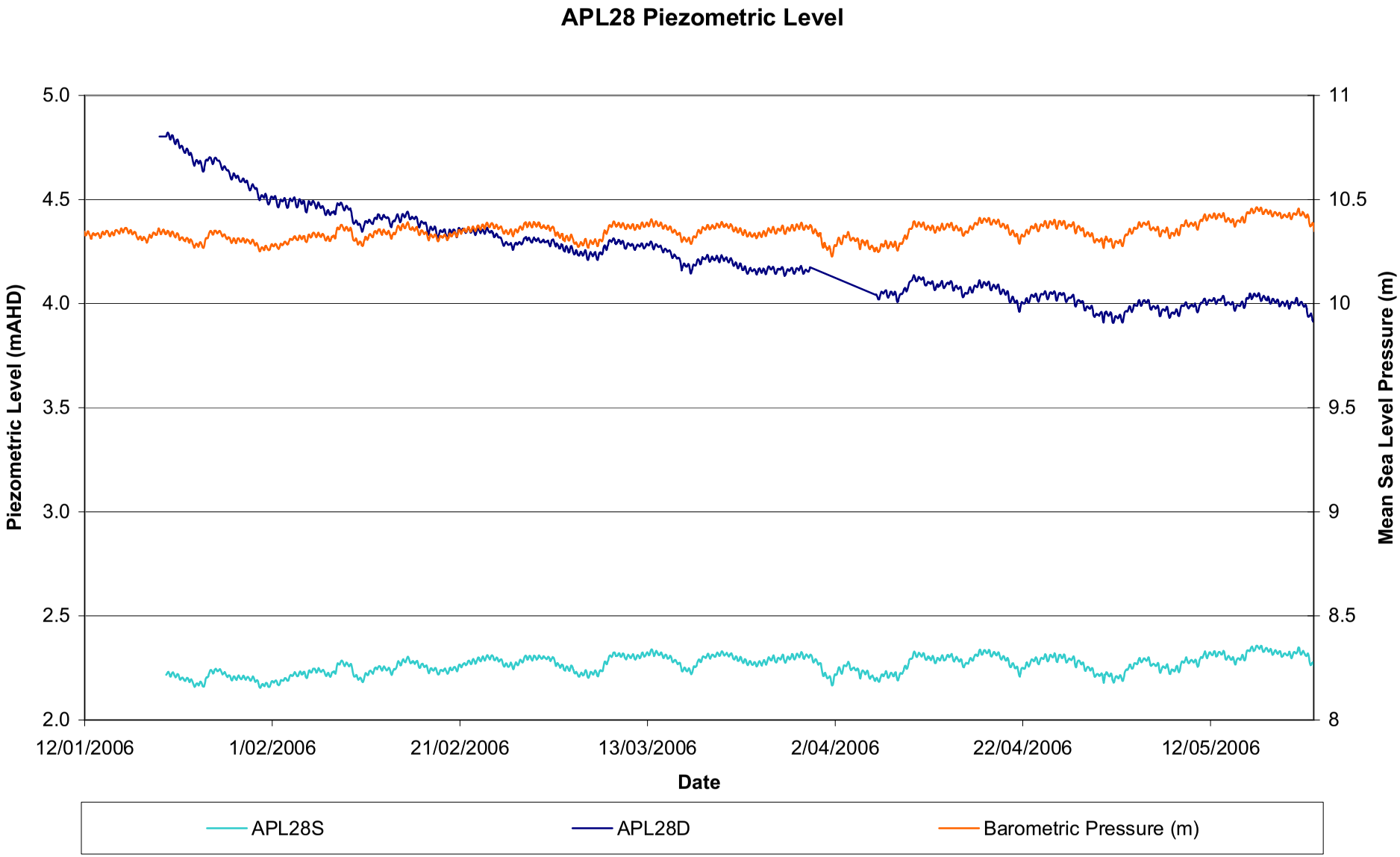
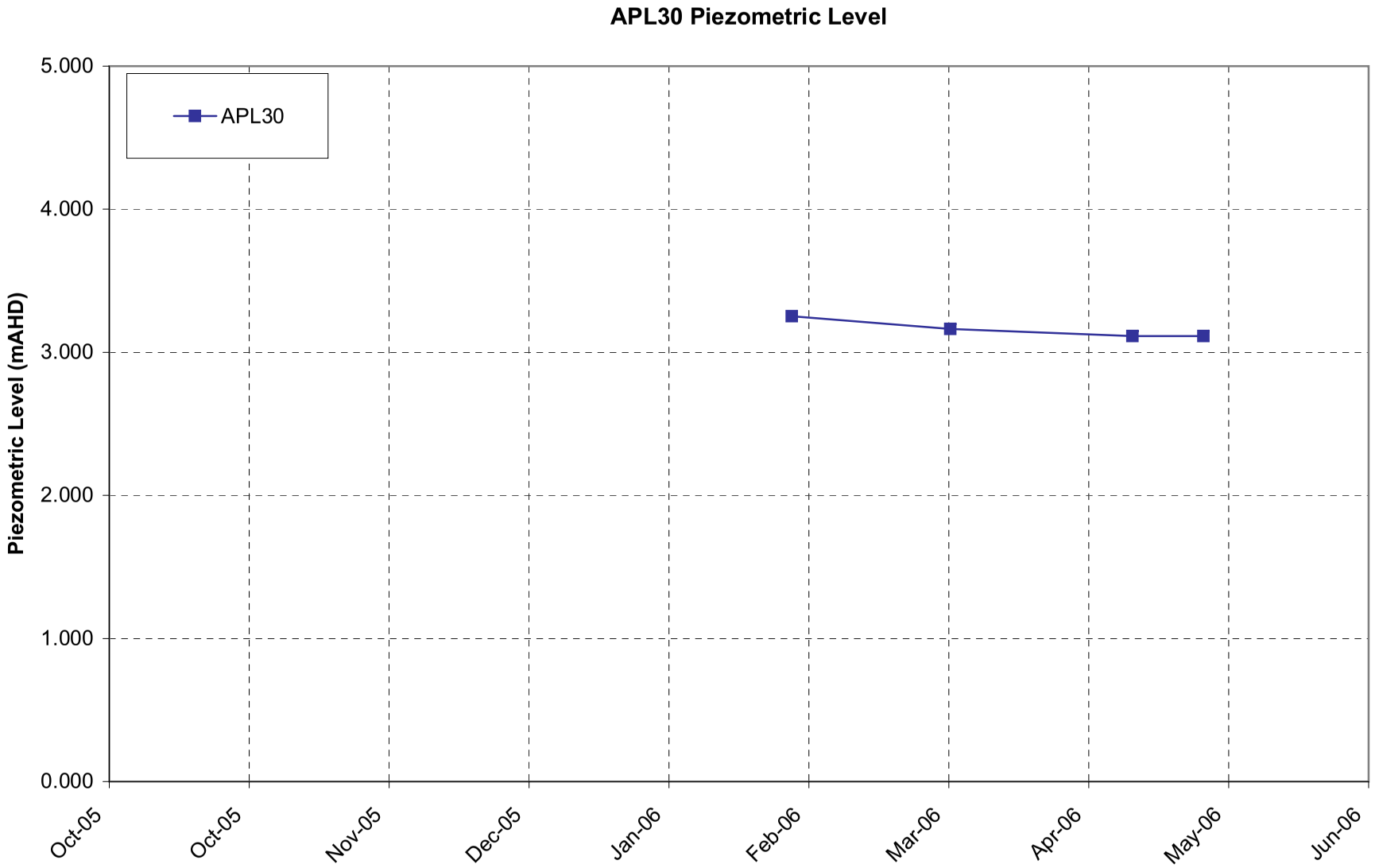
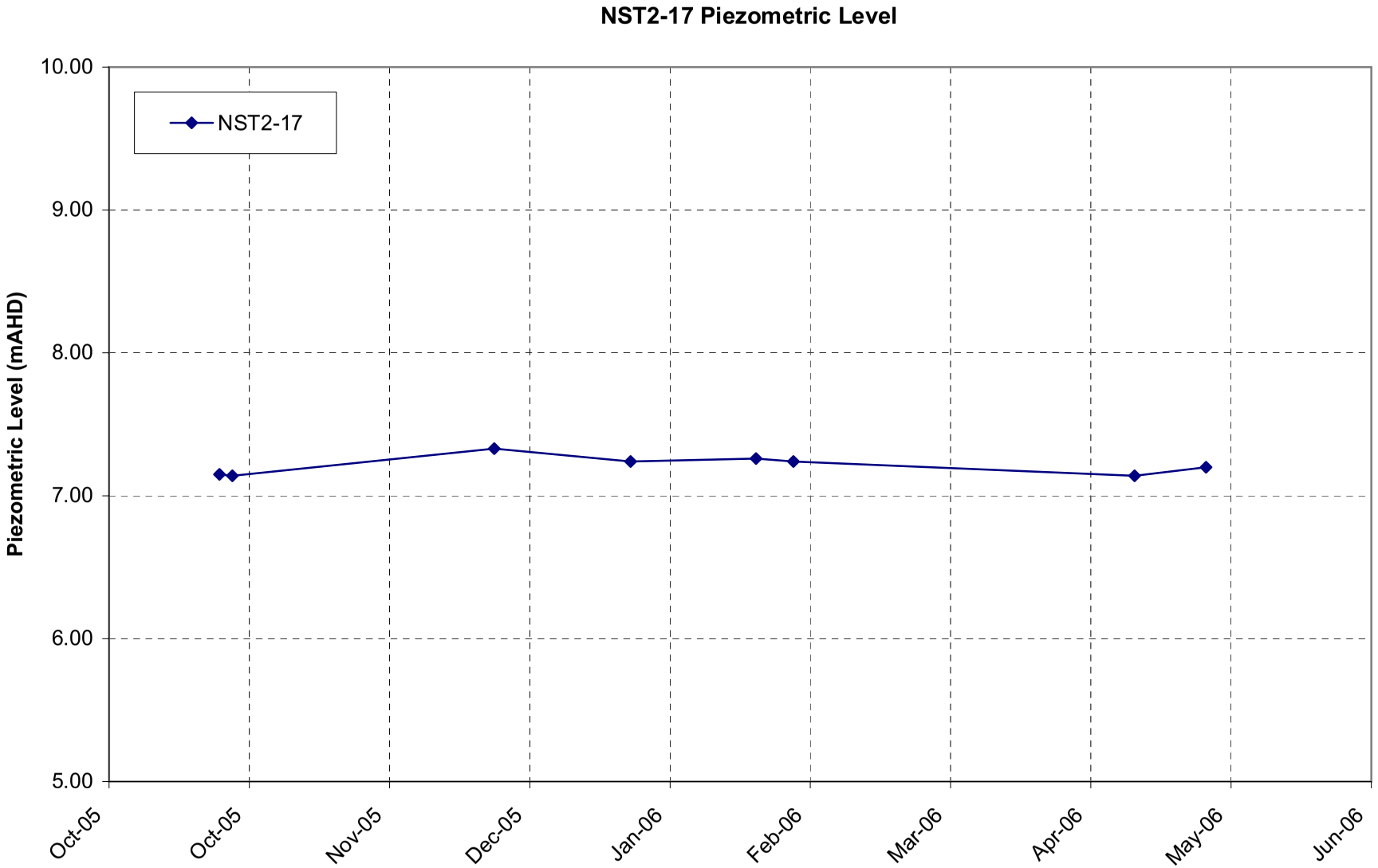
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL25S & APL25D Piezometric Level
APL25S
APL25D
Piezometric Level (mAHD)
5
4
3
2
1
0
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


APL28 Piezometric Level
Piezometric Level (mAHD)
Mean Sea Level Pressure (m)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
11
10.5
10
9.5
9
8.5
8
12/01/2006
1/02/2006
21/02/2006
13/03/2006
2/04/2006
22/04/2006
12/05/2006
Date
APL28S
APL28D
Barometric Pressure (m)


APL30 Piezometric Level
APL30
Piezometric Level (mAHD)
5.000
4.000
3.000
2.000
1.000
0.000
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06


NST2-17 Piezometric Level
NST2-17
Piezometric Level (mAHD)
10.00
9.00
8.00
7.00
6.00
5.00
Oct-05
Oct-05
Nov-05
Dec-05
Jan-06
Feb-06
Mar-06
Apr-06
May-06
Jun-06

Appendix D

WATER QUALITY ANALYSES

Table D1: Summary of Groundwater Quality Data

SampleID	SampleDate	Quality Indicators			Cations (mg/L)				Anions (mg/L)						Metals (mg/L)												Nutrients (mg/L)					Organics (ug/L)		
		pH	Conductivity uS/cm	Total Dissolved Solids (mg/L)	Calcium (Soluble)	Magnesium (Soluble)	Sodium (Soluble)	Potassium (Soluble)	Chloride	Sulphur as SO4	Dissolved Sulphide as S	Carbonate Alkalinity	Bicarbonate Alkalinity	Total Alkalinity as CaCO3	Arsenic	Aluminium	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc	Ammonia N	Nitrate N by FIA (Calc)	Nitrite for NO3 only Calc	NOX for NO3 only Calc	Ortho Phosphorus	Volatile Organic Compunds	Semi-Volatile Organic Compounds	Total Petroleum Hydrocarbons
Alluvial Bores																																	
APL02	18-Aug-05	7.90	6540	3516	111	183	1032	17	2209	268	<0.1	3	365	368		0.017	0.243	0.001	<0.001	0.013	0.016	<0.005	0.35		0.008	0.177	0.113	0.879	0.025	0.904	0.035	ND	ND	-
APL02	26-Oct-05	7.33	6370	3820	90	165	1030	13	2180	236	<0.1	1	356	357	<0.005	0.027	0.144	0.001	0.001	0.031	0.038	<0.005	0.144	<0.1	0.006	0.263	0.016	1.318	0.002	1.32	0.044	ND	ND	-
APL02	15-Feb-06	6.65	1267	883	9	14	277	5	295	54	<0.1	<1	131	131	<0.01	0.12	0.031	<0.001	0.001	0.013	0.86	<0.005	0.105	0.227	0.007	0.072	0.217	<0.01	<0.002	<0.002	0.045	-	-	-
APL07S	26-Oct-05	6.58	1461	893	42	27	256	6	465	40	<0.1	<1	148	148	<0.005	0.017	0.288	<0.001	<0.001	<0.002	6.675	<0.005	0.798	<0.1	<0.002	0.117	0.522	0.077	0.01	0.087	0.01	ND	598	-
APL07S	15-Feb-06	6.56	1536	954	33	27	270	5	384	31	<0.1	<1	200	201	<0.01	0.015	0.376	<0.001	<0.001	<0.002	31.839	<0.005	1.914	<0.1	<0.002	0.058	0.651	<0.01	<0.002	<0.002	0.003	ND	ND	-
APL07S	06-Apr-06	6.52	1715	1310	39	30	289	5	440	39	<0.1	<1	153	153	<0.01	0.033	0.315	<0.001	0.001	0.002	16.85	<0.005	1.11	<0.1	<0.002	0.06	0.354	0.038	<0.02	0.038	<0.02	ND	ND	ND
NST2-17	27-Oct-05	6.60	2500	1600	13	57	540	5	840	47	<0.1	<1	160	160	0.02	0.01	1.2	<0.001	<0.001	<0.002	17	<0.005	11	<0.1	0.005	0.34	0.34	0.027	<0.002	0.027	0.01	ND	6	-
NST2-17	15-Feb-06	6.38	3850	2375	18	58	549	5	791	61	<0.1	<1	91	91	0.019	<0.005	0.79	<0.001	<0.001	<0.002	13.317	<0.005	8.814	<0.1	0.008	0.465	0.136	<0.01	<0.002	0.007	<0.002	ND	ND	ND
APL04S	26-Oct-05	6.81	820	810	5	11	171	8	69	11	<0.1	<1	309	309	0.029	0.032	0.185	<0.001	<0.001	<0.002	1.658	<0.005	0.143	<0.1	<0.002	0.106	0.008	0.011	<0.002	0.011	0.006	ND	ND	-
APL04S	15-Feb-06	6.79	851	2652	5	13	183	9	30	<2	<0.1	<1	405	405	0.048	0.015	0.205	<0.001	<0.001	<0.002	4.486	<0.005	0.129	<0.1	<0.002	0.012	0.4	<0.01	<0.002	<0.002	0.004	-	-	-
APL05S	26-Oct-05	6.72	1476	1172	30	54	261	34	62	362	<0.1	<1	483	483	0.012	0.019	0.111	<0.001	<0.001	<0.002	10.454	<0.005	2.096	<0.1	0.007	0.109	4.8	<0.01	0.003	0.007	0.016	ND	ND	-
APL05S	15-Feb-06	7.12	1044	747	12	27	252	28	47	3	<0.1	1	579	580	0.017	0.021	0.033	<0.001	0.001	<0.002	2.553	<0.005	0.673	<0.1	<0.002	0.026	3.81	<0.01	<0.002	<0.002	0.047	-	-	-
APL25S	15-Feb-06	5.96	860	663	11	19	132	5	168	89	<0.1	<1	35	35	<0.01	0.023	0.078	<0.001	<0.001	0.015	0.264	<0.005	0.571	<0.1	0.008	0.115	0.012	0.135	0.005	0.14	0.009	ND	60	-
APL25S	06-Apr-06	5.89	1009	540	15	30	144	5	274	57	<0.1	<1	35	35	<0.01	0.021	0.105	<0.001	0.001	0.022	0.521	<0.005	0.691	<0.1	0.011	0.113	<0.06	0.088	<0.02	0.088	0.02	-	-	-
Neranleigh Fernvale Beds																																	
APL01	18-Aug-05	7.98	687	368	5	6	135	6	112	31	<0.1	1	133	134		0.028	0.019	<0.001	<0.001	<0.002	0.862	<0.005	0.318		0.004	0.043	0.072	<0.01	0.005	0.012	0.026	ND	ND	-
APL01	26-Oct-05	6.49	611	354	9	6	122	6	129	28	<0.1	<1	105	105	<0.005	0.039	0.052	<0.001	<0.001	0.037	0.134	<0.005	0.295	<0.1	0.005	0.183	<0.004	0.319	0.005	0.324	0.271	ND	ND	-
APL01	15-Feb-06	6.90	557	334	18	5	84	8	84	44	<0.1	<1	122	122	<0.01	0.048	0.035	<0.001	<0.001	0.03	0.783	<0.005	0.23	<0.1	0.003	0.118	<0.004	0.128	0.004	0.132	1.03	-	-	-
Tingalpa Formation																																	
APL04D	26-Oct-05	5.91	489	430	18	13	75	6	61	18	<0.1	<1	143	143	<0.005	0.088	0.067	<0.001	<0.001	<0.002	16.957	<0.005	0.935	<0.1	0.019	0.015	0.006	<0.01	<0.002	0.005	0.017	ND	ND	-
APL04D	15-Feb-06	6.39	307	188	4	4	62	1	43	<2	<0.1	<1	94	94	<0.01	0.018	0.017	<0.001	<0.001	<0.002	11.43	<0.005	0.471	<0.1	<0.002	0.05	0.095	<0.01	<0.002	<0.002	0.004	-	-	-
APL06	27-Oct-05	7.84	1746	1043	45	21	350	5	499	10	<0.1	2	258	260	0.005	0.027	0.426	<0.001	<0.001	<0.002	0.059	<0.005	0.121	<0.1	0.003	0.066	0.154	0.095	0.013	0.108	0.09	ND	ND	-
APL06	15-Feb-06	7.66	1580	961	38	14	262	5	403	13	<0.1	1	236	237	<0.01	0.07	0.602	<0.001	<0.001	<0.002	0.125	<0.005	0.059	<0.1	<0.002	0.02	0.239	0.082	0.002	0.084	0.005	-	-	-
APL09	26-Oct-05	6.84	1372	757	27	16	221	10	410	23	<0.1	<1	135	135	<0.005	0.023	0.362	<0.001	<0.001	0.011	1.35	<0.005	0.62	<0.1	0.004	0.307	0.039	0.079	<0.002	0.079	0.018	ND	ND	-
APL09	15-Feb-06	7.00	251	161	13	4	38	3	40	27	<0.1	<1	35	35	<0.01	0.1	0.032	<0.001	0.001	0.008	0.081	<0.005	0.025	<0.1	<0.002	0.028	0.036	0.233	0.011	0.244	0.009	-	-	-
APL30	06-Apr-06	7.89	981	480	32	18	249	5	220	9	<0.1	1	155	156	<0.01	0.113	0.212	<0.001	<0.001	0.006	0.084	<0.005	0.078	<0.1	<0.002	0.011	0.202	0.035	<0.02	0.035	0.021	ND	ND	-
Brisbane Tuff Bores																																	
APL07D	26-Oct-05	6.79	1742	1049	50	32	299	6	508	44	<0.1	<1	178	178	<0.005	0.024	0.104	<0.001	<0.001	<0.002	2.981	<0.005	0.294	<0.1	<0.002	0.082	0.065	0.041	<0.002	0.041	0.019	ND	ND	-
APL07D	15-Feb-06	6.73	1940	1211	52	33	319	5	285	44	<0.1	<1	176	176	<0.01	<0.005	0.112	<0.001	0.001	0.011	3.078	<0.005	0.3	<0.1	0.002	0.296	0.08	<0.01	<0.002	<0.002	0.004	-	-	-
APL20	16-Feb-06	4.34	1271	835	8	26	217	7	292	11	<0.1	<1	<1	<1	<0.01	1.091	0.32	<0.001	<0.001	0.162	0.898	0.045	0.585	<0.1	0.017	0.446	<0.004	<0.01	<0.002	0.006	0.018	3905	74	5750
APL20	06-Apr-06	4.39	1422	775	10	32	243	9	434	13	<0.1	<1	<1	<1	<0.01	1.699	0.378	0.001	0.001	0.405	1.195	0.109	0.68	<0.1	0.021	0.77	<0.06	<0.01	<0.02	<0.02	0.064	203	31	-
APL22	15-Feb-06	7.14	545	319	18	13	57	4	103	20	<0.1	<1	90	90	<0.01	0.014	0.064	<0.001	<0.001	0.01	0.135	<0.005	0.207	<0.1	0.003	0.155	0.038	0.07	0.067	0.137	0.003	ND	ND	-
APL22	06-Apr-06	6.88	657	416	18	13	61	5	140	20	<0.1	<1	96	96	<0.01	0.018	0.061	<0.001	<0.001	0.013	0.147	<0.005	0.137	<0.1	0.003	0.19	0.107	0.115	<0.02	0.115	0.028	-	-	-
APL23	15-Feb-06	6.40	502	375	5	4	101	2	105	12	<0.1	<1	78	78	<0.01	0.015	0.071	<0.001	<0.001	<0.002	0.393	<0.005	0.109	<0.1	<0.002	0.092	0.005	<0.01	<0.002	0.003	0.003	ND	ND	-
APL23	06-Apr-06	6.47	491	293	5	4	89	2	97	12	<0.1	<1	70	70	<0.01	0.02	0.055	<0.001	<0.001	0.017	0.048	<0.005	0.102	<0.1	0.002	0.157	0.068	0.058	<0.02	0.058	<0.02	-	-	-
APL25D	15-Feb-06	7.01	2854	1717	44	51	458	5	479	42	<0.1	<1	317	317	<0.01	0.051	0.147	<0.001	0.001	0.174	0.847	0.013	1.147	<0.1	0.015	0.606	0.05	<0.01	<0.002	0.008	0.007	ND	80	-
APL25D	06-Apr-06	7.07	2474	1567	44	50	476	6	605	42	<0.1	<1	269	269	<0.01	0.076	0.138	<0.001	0.002	0.11	0.6	<0.005	0.617	<0.1	0.005	0.225	0.078	0.121	<0.02	0.121	0.026	-	-	-

Notes: ND - analyte not detected; - sample not detected; VOCs and SVOCs are totals for multiple compounds - refer to lab reports for individual compounds

Brisbane Water

ABN 72 002 765 795

Scientific Analytical Services
240 Donaldson Road
Rocklea Brisbane Qld 4106

Telephone 07 3403 2611
Facsimile 07 3403 2646

A unit of Brisbane City Council

SCIENTIFIC ANALYTICAL SERVICES LABORATORY REPORT

Attention:	Dale Waters
Client:	City Design, Ground Engineering St Paul's Tce Fortitude Valley QLD
Job Name:	Airport Link - Analysis
Sampled By:	SAS Laboratory
Sampling Date:	18/08/2005
Sampling Method:	Grab
Sample Matrix:	Aqueous
Batch Number:	05/08228
Registration Date:	18 August 2005
Date of Report:	7 September 2005

Patti O'Shea
Supervising Chemist

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

Client: City Design, Ground Engineering **Batch Number:** 05/08228
Job Name: Airport Link - Analysis **Report Date:** 7/09/05

Method	Test Date sampled:	Units	05/08228/1 APL2 18/08/2005 13:05	05/08228/2 APL1 18/08/2005 13:45
5.304F	Calcium (Soluble) as Ca	mg/L	110	5.2
5.304F	Magnesium (Soluble) as Mg	mg/L	180	5.6
5.304F	Sodium (Soluble) as Na	mg/L	1,000	140
5.304F	Potassium (Soluble) as K	mg/L	17	5.6
FIA.109	Chloride	mg/L	2,200	110
5.304F	Sulphur as SO4 (Soluble)	mg/L	270	31
1.012	Total Alkalinity as $CaCO_3$	mg/L	370	130
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	360	130
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	3.0	1.0
1.002	pH		7.9	8.0
1.007	Conductivity @ 25^{o}C	uS/cm	6,500	690
Misc. *	Total Dissolved Solids	mg/L	3,520	368
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.11	0.072
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.88	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.035	0.026
External	ALS Batch No.	Text	EB0507400	EB0507400
5.304F	Aluminium (Soluble) as Al	mg/L	0.017	0.028
5.304F	Barium (Soluble) as Ba	mg/L	0.24	0.019
5.304F	Cadmium (Soluble) as Cd	mg/L	0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.013	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	0.016	0.86
5.304F	Manganese (Soluble) as Mn	mg/L	0.35	0.32
5.304F	Nickel (Soluble) as Ni	mg/L	0.008	0.004
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.18	0.043

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	:	**BRISBANE CITY COUNCIL**	**Laboratory**	:	ALS Environmental Brisbane	**Page**	: **1 of 9**
Contact	:	MS PATTI O`SHEA	**Contact**	:	Michael Heery		
Address	:	ANALYTICAL SERVICES SECTION 240 DONALDSON ROAD ROCKLEA QLD AUSTRALIA 4106	**Address**	:	32 Shand Street Stafford QLD Australia 4053	**Work order**	: **EB0507400**
Project	:	E1908-1	**Quote number**	:	EN 487 97	**Date received**	: 19 Aug 2005
Order number	:	- Not provided -				**Date issued**	: 5 Sep 2005
C-O-C number	:	- Not provided -					
Site	:	- Not provided -					
E-mail	:	Patti.O"Shea@brisbane.qld.gov.au	**E-mail**	:	Michael.Heery@alsenviro.com	**No. of samples**	
Telephone	:	07 3403 2622	**Telephone**	:	61-7-32437222	**Received**	: 4
Facsimile	:	07 3403 2646	**Facsimile**	:	61-7-32437259	**Analysed**	: 4

This final report for the ALSE work order reference EB0507400 supersedes any previous reports with this reference.
Results apply to the samples as submitted. All pages of this report have been checked and approved for release.
This report contains the following information:

- Analytical results for samples submitted
- Surrogate control limits

Work order specific comments

VOC analysis conducted by ALS Perth, NATA accreditation no. 825, site no. 15842.

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory - 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Mat Taylor	Organics - NATA 818 (Brisbane)
Shuk Hui Li	Perth Organics - NATA 15847 (Perth)

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits).
Abbreviations: ***CAS number*** = *Chemical Abstract Services number,* ***LOR*** = *Limit of Reporting.* ***# Indicates a raised LOR, * Indicates failed Surrogate Recoveries.***
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes.

Analytical Results

				Client Sample ID :	**05/8228/1 APL2**	**05/8228/2 APL1**	**05/8782/1 NST61**	**05/8782/2 NST59**	
				Sample Matrix Type / Description :	WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER	
				Sample Date / Time :	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	
				Laboratory Sample ID :	**EB0507400-001**	**EB0507400-002**	**EB0507400-003**	**EB0507400-004**	
Analyte	***CAS number***	***LOR***	***Units***						
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	5	µg/L		<5	<5	<5	<5	
Toluene	108-88-3	5	µg/L		<5	<5	<5	<5	
Ethylbenzene	100-41-4	5	µg/L		<5	<5	<5	<5	
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L		<5	<5	<5	<5	
Styrene	100-42-5	5	µg/L		<5	<5	<5	<5	
ortho-Xylene	95-47-6	5	µg/L		<5	<5	<5	<5	
Isopropylbenzene	98-82-8	5	µg/L		<5	<5	<5	<5	
n-Propylbenzene	103-65-1	5	µg/L		<5	<5	<5	<5	
1,3,5-Trimethylbenzene	108-67-8	5	µg/L		<5	<5	<5	<5	
sec-Butylbenzene	135-98-8	5	µg/L		<5	<5	<5	<5	
1,2,4-Trimethylbenzene	95-63-6	5	µg/L		<5	<5	<5	<5	
tert-Butylbenzene	98-06-6	5	µg/L		<5	<5	<5	<5	
p-Isopropyltoluene	99-87-6	5	µg/L		<5	<5	<5	<5	
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	<5	<5	
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	<50	<50	
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	<50	<50	
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	<50	<50	
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	<50	<50	
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	<5	<5	
EP074D: Fumigants									
2,2-Dichloropropane	594-20-7	5	µg/L		<5	<5	<5	<5	
1,2-Dichloropropane	78-87-5	5	µg/L		<5	<5	<5	<5	
cis-1,3-Dichloropropylene	10061-01-5	10	µg/L		<10	<10	<10	<10	
trans-1,3-Dichloropropylene	10061-02-6	10	µg/L		<10	<10	<10	<10	
1,2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	<5	
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	<50	
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	<50	
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	<50	
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	<50	

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Analytical Results

				Client Sample ID :	**05/8228/1 APL2**	**05/8228/2 APL1**	**05/8782/1 NST61**	**05/8782/2 NST59**	
				Sample Matrix Type / Description :	WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER	
				Sample Date / Time :	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	
				Laboratory Sample ID :					
Analyte	***CAS number***	***LOR***	***Units***		**EB0507400-001**	**EB0507400-002**	**EB0507400-003**	**EB0507400-004**	
EP074E: Halogenated Aliphatic Compounds									
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	<50	
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	<50	
1,1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	<5	
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	<5	
trans-1,2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	<5	
1,1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	<5	
cis-1,2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	<5	
1,1,1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	<5	
1,1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	<5	
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	<5	
1,2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	<5	
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	<5	
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	<5	
1,1,2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	<5	
1,3-Dichloropropane	142-28-9	5	µg/L		<5	<5	<5	<5	
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	<5	<5	
1,1,1,2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	<5	<5	
trans-1,4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	<5	<5	
cis-1,4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	<5	<5	
1,1,2,2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	<5	<5	
1,2,3-Trichloropropane	96-18-4	5	µg/L		<5	<5	<5	<5	
Pentachloroethane	76-01-7	5	µg/L		<5	<5	<5	<5	
1,2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	<5	<5	
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	<5	<5	
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	<5	<5	
Bromobenzene	108-86-1	5	µg/L		<5	<5	<5	<5	
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	<5	<5	
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	<5	<5	
1,3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5	<5	<5	
1,4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5	<5	<5	
1,2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5	<5	<5	
1,2,4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5	<5	<5	
1,2,3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	<5	<5	
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	<5	<5	

ALS Environmental

Analytical Results

				Client Sample ID :	05/8228/1 APL2	05/8228/2 APL1	05/8782/1 NST61	05/8782/2 NST59	
				Sample Matrix Type / Description :	WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER	
				Sample Date / Time :	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	
				Laboratory Sample ID :	EB0507400-001	EB0507400-002	EB0507400-003	EB0507400-004	
Analyte	*CAS number*	*LOR*	*Units*						
EP074G: Trihalomethanes									
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	<5	<5	
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	<5	<5	
Bromoform	75-25-2	5	µg/L		<5	<5	<5	<5	
EP074H: Naphthalene									
Naphthalene	91-20-3	7	µg/L		<7	<7	<7	<7	
EP075A: Phenolic Compounds									
Phenol	108-95-2	2	µg/L		<2	<2	<2	2	
2-Chlorophenol	95-57-8	2	µg/L		<2	<2	<2	<2	
2-Methylphenol	95-48-7	2	µg/L		<2	<2	<2	<2	
3- & 4-Methylphenol	1319-77-3	2	µg/L		<2	<2	<2	<2	
2-Nitrophenol	88-75-5	2	µg/L		<2	<2	<2	<2	
2,4-Dimethylphenol	105-67-9	2	µg/L		<2	<2	<2	<2	
2,4-Dichlorophenol	120-83-2	2	µg/L		<2	<2	<2	<2	
2,6-Dichlorophenol	87-65-0	2	µg/L		<2	<2	<2	<2	
4-Chloro-3-Methylphenol	59-50-7	2	µg/L		<2	<2	<2	<2	
2,4,6-Trichlorophenol	88-06-2	2	µg/L		<2	<2	<2	<2	
2,4,5-Trichlorophenol	95-95-4	2	µg/L		<2	<2	<2	<2	
Pentachlorophenol	87-86-5	4	µg/L		<4	<4	<4	<4	
EP075B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	2	µg/L		<2	<2	<2	<2	
2-Methylnaphthalene	91-57-6	2	µg/L		<2	<2	<2	<2	
2-Chloronaphthalene	91-58-7	2	µg/L		<2	<2	<2	<2	
Acenaphthylene	208-96-8	2	µg/L		<2	<2	<2	<2	
Acenaphthene	83-32-9	2	µg/L		<2	<2	<2	<2	
Fluorene	86-73-7	2	µg/L		<2	<2	<2	<2	
Phenanthrene	85-01-8	2	µg/L		<2	<2	<2	<2	
Anthracene	120-12-7	2	µg/L		<2	<2	<2	<2	
Fluoranthene	206-44-0	2	µg/L		<2	<2	4	<2	
Pyrene	129-00-0	2	µg/L		<2	<2	4	<2	
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L		<2	<2	<2	<2	
Benz(a)anthracene	56-55-3	2	µg/L		<2	<2	<2	<2	
Chrysene	218-01-9	2	µg/L		<2	<2	<2	<2	
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L		<4	<4	<4	<4	
7,12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L		<2	<2	<2	<2	
Benzo(a)pyrene	50-32-8	2	µg/L		<2	<2	<2	<2	
3-Methylcholanthrene	56-49-5	2	µg/L		<2	<2	<2	<2	

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Analytical Results

				Client Sample ID :	05/8228/1 APL2	05/8228/2 APL1	05/8782/1 NST61	05/8782/2 NST59	
				Sample Matrix Type / Description :	WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER	
				Sample Date / Time :	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	
				Laboratory Sample ID :	EB0507400-001	EB0507400-002	EB0507400-003	EB0507400-004	
Analyte	*CAS number*	*LOR*	*Units*						
EP075B: Polynuclear Aromatic Hydrocarbons									
Indeno(1,2,3,cd)pyrene	193-39-5	2	µg/L		<2	<2	<2	<2	
Dibenz(a,h)anthracene	53-70-3	2	µg/L		<2	<2	<2	<2	
Benzo(g,h,i)perylene	191-24-2	2	µg/L		<2	<2	<2	<2	
EP075C: Phthalate Esters									
Dimethyl phthalate	131-11-3	2	µg/L		<2	<2	<2	<2	
Diethyl phthalate	84-66-2	2	µg/L		<2	<2	<2	<2	
Di-n-butyl phthalate	84-74-2	2	µg/L		<2	<2	<2	<2	
Butyl benzyl phthalate	85-68-7	2	µg/L		<2	<2	<2	4	
bis(2-ethylhexyl) phthalate	117-81-7	20	µg/L		80	50	60	60	
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	<2	<2	
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	<2	<2	
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	<2	<2	
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	<4	<4	
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	<2	<2	
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	<2	<2	
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	<2	<2	
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	<2	<2	
N-Nitrosodiphenyl & Diphenylamine	86-30-6	4	µg/L		<4	<4	<4	<4	
Methapyrilene	91-80-5	2	µg/L		<2	<2	<2	<2	
EP075E: Nitroaromatics and Ketones									
2-Picoline	109-06-8	2	µg/L		<2	<2	<2	<2	
Acetophenone	98-86-2	2	µg/L		<2	<2	<2	<2	
Nitrobenzene	98-95-3	2	µg/L		<2	<2	<2	<2	
Isophorone	78-59-1	2	µg/L		<2	<2	<2	<2	
2,6-Dinitrotoluene	606-20-2	4	µg/L		<4	<4	<4	<4	
2,4-Dinitrotoluene	121-14-2	4	µg/L		<4	<4	<4	<4	
1-Naphthylamine	134-32-7	2	µg/L		<2	<2	<2	<2	
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L		<2	<2	<2	<2	
5-Nitro-o-toluidine	99-55-8	2	µg/L		<2	<2	<2	<2	
Azobenzene	103-33-3	2	µg/L		<2	<2	<2	<2	
1,3,5-Trinitrobenzene	99-35-4	2	µg/L		<2	<2	<2	<2	
Phenacetin	62-44-2	2	µg/L		<2	<2	<2	<2	
4-Aminobiphenyl	92-67-1	2	µg/L		<2	<2	<2	<2	
Pentachloronitrobenzene	82-68-8	2	µg/L		<2	<2	<2	<2	
Pronamide	23950-58-5	2	µg/L		<2	<2	<2	<2	

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 05/8228/1 APL2	05/8228/2 APL1	05/8782/1 NST61	05/8782/2 NST59
Sample Matrix Type / Description				WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER
Sample Date / Time				18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00
Laboratory Sample ID				EB0507400-001	EB0507400-002	EB0507400-003	EB0507400-004
EP075E: Nitroaromatics and Ketones							
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	<2	<2
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	<2	<2
EP075F: Haloethers							
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2	<2
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2	<2
EP075G: Chlorinated Hydrocarbons							
1,4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2	<2
1,3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2	<2
1,2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2	<2
Hexachloroethane	67-72-1	2	µg/L	<2	<2	<2	<2
1,2,4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	<4	<4
EP075H: Anilines and Benzidines							
Aniline	62-53-3	2	µg/L	<2	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L	<2	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L	<4	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L	<4	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L	<2	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L	<2	<2	<2	<2
Carbazole	86-74-8	2	µg/L	<2	<2	<2	<2
3,3'-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	<2	<2
EP075I: Organochlorine Pesticides							
alpha-BHC	319-84-6	2	µg/L	<2	<2	<2	<2
beta-BHC	319-85-7	2	µg/L	<2	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L	<2	<2	<2	<2
delta-BHC	319-86-8	2	µg/L	<2	<2	<2	<2
Heptachlor	76-44-8	2	µg/L	<2	<2	<2	<2
Aldrin	309-00-2	2	µg/L	<2	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 05/8228/1 APL2	05/8228/2 APL1	05/8782/1 NST61	05/8782/2 NST59
Sample Matrix Type / Description:				WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER
Sample Date / Time:				18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00
Laboratory Sample ID:				EB0507400-001	EB0507400-002	EB0507400-003	EB0507400-004
EP075I: Organochlorine Pesticides							
4,4'-DDE	72-55-9	2	µg/L	<2	<2	<2	<2
Dieldrin	60-57-1	2	µg/L	<2	<2	<2	<2
Endrin	72-20-8	2	µg/L	<2	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	<2	<2
4,4'-DDD	72-54-8	2	µg/L	<2	<2	<2	<2
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	<2	<2
4,4'-DDT	50-29-3	4	µg/L	<4	<4	<4	<4
EP075J: Organophosphorus Pesticides							
Dichlorvos	62-73-7	2	µg/L	<2	<2	<2	<2
Dimethoate	60-51-5	2	µg/L	<2	<2	<2	<2
Diazinon	333-41-5	2	µg/L	<2	<2	<2	<2
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	<2	<2
Malathion	121-75-5	2	µg/L	<2	<2	<2	<2
Fenthion	55-38-9	2	µg/L	<2	<2	<2	<2
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	<2	<2
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	<2	<2
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	<2	<2
Prothiofos	34643-46-4	2	µg/L	<2	<2	<2	<2
Ethion	563-12-2	2	µg/L	<2	<2	<2	<2
EP075K: Miscellaneous Compounds							
1,3,5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2	<2	<2
1,2,4,5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2	<2	<2
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2	<2	<2
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<2	<2	<2
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2	<2	<2
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2	<2	<2
Safrole	94-59-7	2	µg/L	<2	<2	<2	<2
Diallate	2303-16-4	2	µg/L	<2	<2	<2	<2
2,3,4,6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2	<2	<2
EP074S: VOC Surrogates							
1,2-Dichloroethane-D4	17060-07-0	0.1	%	98.8	102	99.6	98.8
Toluene-D8	2037-26-5	0.1	%	99.2	99.0	99.5	97.7
4-Bromofluorobenzene	460-00-4	0.1	%	96.2	98.3	98.2	94.6
EP075S: Acid Extractable Surrogates							
2-Fluorophenol	367-12-4	0.1	%	35.1	29.9	22.5	34.6
Phenol-d6	13127-88-3	0.1	%	23.8	20.6	16.9	24.7

ALS Environmental

Analytical Results

				Client Sample ID :	**05/8228/1 APL2**	**05/8228/2 APL1**	**05/8782/1 NST61**	**05/8782/2 NST59**	
				Sample Matrix Type / Description :	WATER / WATER	WATER / WATER	WATER / WATER	WATER / WATER	
				Sample Date / Time :	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	18 Aug 2005 15:00	
				Laboratory Sample ID :					
Analyte	***CAS number***	***LOR***	***Units***		**EB0507400-001**	**EB0507400-002**	**EB0507400-003**	**EB0507400-004**	
EP075S: Acid Extractable Surrogates									
2-Chlorophenol-D4	93951-73-6	0.1	%		66.6	49.0	53.9	65.1	
2,4,6-Tribromophenol	118-79-6	0.1	%		81.7	72.9	86.3	86.2	
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.1	%		64.9	52.4	72.6	67.0	
1,2-Dichlorobenzene-D4	2199-69-1	0.1	%		52.7	41.5	61.0	56.1	
2-Fluorobiphenyl	321-60-8	0.1	%		69.4	58.4	77.5	72.6	
Anthracene-d10	1719-06-8	0.1	%		64.9	61.6	79.0	75.5	
4-Terphenyl-d14	1718-51-0	0.1	%		72.6	66.3	83.0	82.2	

ALS Environmental

Surrogate Control Limits

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: WATER ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	70	130
	Toluene-D8	70	130
	4-Bromofluorobenzene	70	130
EP075: Semivolatile Organic Compounds			
EP075S: Acid Extractable Surrogates	2-Fluorophenol	21	100
	Phenol-d6	10	94
	2-Chlorophenol-D4	23	134
	2,4,6-Tribromophenol	10	123
EP075T: Base/Neutral Extractable Surrogates	Nitrobenzene-D5	35	114
	1,2-Dichlorobenzene-D4	32	129
	2-Fluorobiphenyl	43	116
	Anthracene-d10	27	133
	4-Terphenyl-d14	33	141

Scientific Analytical Services

ABN 72 002 765 795

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Rocklea Brisbane Qld 4106

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A unit of Brisbane City Council

SCIENTIFIC ANALYTICAL SERVICES LABORATORY REPORT

Attention:	Dale Waters
Client:	City Design, Ground Engineering St Paul's Tce Fortitude Valley QLD
Job Name:	Airport Link
Sampled By:	Client
Sampling Date:	27/11/2005
Sampling Method:	Grab
Sample Matrix:	Aqueous
Batch Number:	05/11056-B
Registration Date:	10 November 2005
Date of Report:	12 December 2005

Comment:
VOC/SVOC analysis on NST2-17 performed by ALS.

This report supersedes any previous report of the same batch number.

Patti O'Shea
Supervising Chemist

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

Client: City Design, Ground Engineering **Batch Number:** 05/11056-B
Job Name: Airport Link **Report Date:** 12/12/05

Method	Test Date sampled:	Units	05/11056-B/1 NST2-17 27/10/2005 08:45
1.002	pH		6.6
1.007	Conductivity @ 25^{o}C	uS/cm	2,500
Misc. *	Total Dissolved Solids	mg/L	1,600
5.304F	Calcium (Soluble) as Ca	mg/L	13
5.304F	Magnesium (Soluble) as Mg	mg/L	57
5.304F	Sodium (Soluble) as Na	mg/L	540
5.304F	Potassium (Soluble) as K	mg/L	5.0
FIA.109	Chloride	mg/L	840
5.304F	Sulphur as SO4 (Soluble)	mg/L	47
1.012	Total Alkalinity as $CaCO_3$	mg/L	160
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	160
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10
External	ALS Batch No.	Text	EB0509917
FIA.008	Ammonia N	mg/L	0.34
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.027
FIA.011A	Ortho Phosphorus as P	mg/L	0.010
5.304F	Aluminium (Soluble) as Al	mg/L	0.01
5.304F	Arsenic (Soluble) as As	mg/L	0.020
5.304F	Barium (Soluble) as Ba	mg/L	1.2
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	17
5.304F	Manganese (Soluble) as Mn	mg/L	11
5.304F	Nickel (Soluble) as Ni	mg/L	0.005
5.304F	Lead (Soluble) as Pb	mg/L	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.34
5.303F	Mercury (Soluble)	ug/L	<0.10

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BRISBANE CITY COUNCIL	Laboratory	: ALS Environmental Brisbane	Page	: 1 of 10
Contact	: MS PATTI O`SHEA	Contact	: Michael Heery	Work Order	: EB0511003
Address	: ANALYTICAL SERVICES SECTION 240 DONALDSON ROAD ROCKLEA QLD AUSTRALIA 4106	Address	: 32 Shand Street Stafford QLD Australia 4053		
E-mail	: Patti.O''Shea@brisbane.qld.gov.au	E-mail	: Michael.Heery@alsenviro.com		
Telephone	: 07 3403 2622	Telephone	: 61-7-32437222		
Facsimile	: 07 3403 2646	Facsimile	: 61-7-32437259		
Project	: E2810-3	Quote number	: ---	Date received	: 28 Oct 2005
Order number	: - Not provided -			Date issued	: 30 Nov 2005
C-O-C number	: - Not provided -			No. of samples	- Received : 1
Site	: - Not provided -				Analysed : 1

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Mat Taylor	Senior Instrument Chemist	Organics - NATA 818 (Brisbane)

ALS Environmental

Comments

This report for the ALSE reference EB0511003 supersedes any previous reports with this reference. Results apply to the sample as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical results for samples submitted**

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

- **Surrogate control limits**

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number	LOR	Units			
EP074A: Monocyclic Aromatic Hydrocarbons						
Benzene	71-43-2	5	µg/L	5		
Toluene	108-88-3	5	µg/L	<5		
Ethylbenzene	100-41-4	5	µg/L	<5		
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5		
Styrene	100-42-5	5	µg/L	<5		
ortho-Xylene	95-47-6	5	µg/L	<5		
Isopropylbenzene	98-82-8	5	µg/L	<5		
n-Propylbenzene	103-65-1	5	µg/L	<5		
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5		
sec-Butylbenzene	135-98-8	5	µg/L	<5		
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5		
tert-Butylbenzene	98-06-6	5	µg/L	<5		
p-Isopropyltoluene	99-87-6	5	µg/L	<5		
n-Butylbenzene	104-51-8	5	µg/L	<5		
EP074B: Oxygenated Compounds						
Vinyl Acetate	108-05-4	50	µg/L	<50		
2-Butanone (MEK)	78-93-3	50	µg/L	<50		
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50		
2-Hexanone (MBK)	591-78-6	50	µg/L	<50		
EP074C: Sulfonated Compounds						
Carbon disulfide	75-15-0	5	µg/L	<5		
EP074D: Fumigants						
2.2-Dichloropropane	594-20-7	5	µg/L	<5		
1.2-Dichloropropane	78-87-5	5	µg/L	<5		
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10		
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10		
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5		
EP074E: Halogenated Aliphatic Compounds						
Dichlorodifluoromethane	75-71-8	50	µg/L	<50		
Chloromethane	74-87-3	50	µg/L	<50		
Vinyl chloride	75-01-4	50	µg/L	<50		
Bromomethane	74-83-9	50	µg/L	<50		
Chloroethane	75-00-3	50	µg/L	<50		
Trichlorofluoromethane	75-69-4	50	µg/L	<50		
1.1-Dichloroethene	75-35-4	5	µg/L	<5		

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number / LOR / Units					
EP074E: Halogenated Aliphatic Compounds						
Iodomethane	74-88-4 / 5 / µg/L	<5				
trans-1.2-Dichloroethene	156-60-5 / 5 / µg/L	<5				
1.1-Dichloroethane	75-34-3 / 5 / µg/L	<5				
cis-1.2-Dichloroethene	156-59-2 / 5 / µg/L	<5				
1.1.1-Trichloroethane	71-55-6 / 5 / µg/L	<5				
1.1-Dichloropropylene	563-58-6 / 5 / µg/L	<5				
Carbon Tetrachloride	56-23-5 / 5 / µg/L	<5				
1.2-Dichloroethane	107-06-2 / 5 / µg/L	<5				
Trichloroethene	79-01-6 / 5 / µg/L	<5				
Dibromomethane	74-95-3 / 5 / µg/L	<5				
1.1.2-Trichloroethane	79-00-5 / 5 / µg/L	<5				
1.3-Dichloropropane	142-28-9 / 5 / µg/L	<5				
Tetrachloroethene	127-18-4 / 5 / µg/L	<5				
1.1.1.2-Tetrachloroethane	630-20-6 / 5 / µg/L	<5				
trans-1.4-Dichloro-2-butene	110-57-6 / 5 / µg/L	<5				
cis-1.4-Dichloro-2-butene	1476-11-5 / 5 / µg/L	<5				
1.1.2.2-Tetrachloroethane	79-34-5 / 5 / µg/L	<5				
1.2.3-Trichloropropane	96-18-4 / 5 / µg/L	<5				
Pentachloroethane	76-01-7 / 5 / µg/L	<5				
1.2-Dibromo-3-chloropropane	96-12-8 / 5 / µg/L	<5				
Hexachlorobutadiene	87-68-3 / 5 / µg/L	<5				
EP074F: Halogenated Aromatic Compounds						
Chlorobenzene	108-90-7 / 5 / µg/L	<5				
Bromobenzene	108-86-1 / 5 / µg/L	<5				
2-Chlorotoluene	95-49-8 / 5 / µg/L	<5				
4-Chlorotoluene	106-43-4 / 5 / µg/L	<5				
1.3-Dichlorobenzene	541-73-1 / 5 / µg/L	<5				
1.4-Dichlorobenzene	106-46-7 / 5 / µg/L	<5				
1.2-Dichlorobenzene	95-50-1 / 5 / µg/L	<5				
1.2.4-Trichlorobenzene	120-82-1 / 5 / µg/L	<5				
1.2.3-Trichlorobenzene	87-61-6 / 5 / µg/L	<5				
EP074G: Trihalomethanes						
Chloroform	67-66-3 / 5 / µg/L	<5				
Bromodichloromethane	75-27-4 / 5 / µg/L	<5				
Dibromochloromethane	124-48-1 / 5 / µg/L	<5				
Bromoform	75-25-2 / 5 / µg/L	<5				

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	*CAS number*	*LOR*	*Units*			
EP074H: Naphthalene						
Naphthalene	91-20-3	7	µg/L	<7		
EP075A: Phenolic Compounds						
Phenol	108-95-2	2	µg/L	<2		
2-Chlorophenol	95-57-8	2	µg/L	<2		
2-Methylphenol	95-48-7	2	µg/L	<2		
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2		
2-Nitrophenol	88-75-5	2	µg/L	<2		
2.4-Dimethylphenol	105-67-9	2	µg/L	<2		
2.4-Dichlorophenol	120-83-2	2	µg/L	<2		
2.6-Dichlorophenol	87-65-0	2	µg/L	<2		
4-Chloro-3-Methylphenol	59-50-7	2	µg/L	<2		
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2		
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2		
Pentachlorophenol	87-86-5	4	µg/L	<4		
EP075B: Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	2	µg/L	6		
2-Methylnaphthalene	91-57-6	2	µg/L	<2		
2-Chloronaphthalene	91-58-7	2	µg/L	<2		
Acenaphthylene	208-96-8	2	µg/L	<2		
Acenaphthene	83-32-9	2	µg/L	<2		
Fluorene	86-73-7	2	µg/L	<2		
Phenanthrene	85-01-8	2	µg/L	<2		
Anthracene	120-12-7	2	µg/L	<2		
Fluoranthene	206-44-0	2	µg/L	<2		
Pyrene	129-00-0	2	µg/L	<2		
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2		
Benz(a)anthracene	56-55-3	2	µg/L	<2		
Chrysene	218-01-9	2	µg/L	<2		
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4		
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2		
Benzo(a)pyrene	50-32-8	2	µg/L	<2		
3-Methylcholanthrene	56-49-5	2	µg/L	<2		
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2		
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2		
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2		

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number / LOR / Units					
EP075C: Phthalate Esters						
Dimethyl phthalate	131-11-3 / 2 / µg/L	<2				
Diethyl phthalate	84-66-2 / 2 / µg/L	<2				
Di-n-butyl phthalate	84-74-2 / 2 / µg/L	<2				
Butyl benzyl phthalate	85-68-7 / 2 / µg/L	<2				
bis(2-ethylhexyl) phthalate	117-81-7 / 20 / µg/L	<20				
Di-n-octylphthalate	117-84-0 / 2 / µg/L	<2				
EP075D: Nitrosamines						
N-Nitrosomethylethylamine	10595-95-6 / 2 / µg/L	<2				
N-Nitrosodiethylamine	55-18-5 / 2 / µg/L	<2				
N-Nitrosopyrrolidine	930-55-2 / 4 / µg/L	<4				
N-Nitrosomorpholine	59-89-2 / 2 / µg/L	<2				
N-Nitrosodi-n-propylamine	621-64-7 / 2 / µg/L	<2				
N-Nitrosopiperidine	100-75-4 / 2 / µg/L	<2				
N-Nitrosodibutylamine	924-16-3 / 2 / µg/L	<2				
N-Nitrosodiphenyl & Diphenylamine	86-30-6 / 4 / µg/L	<4				
Methapyrilene	91-80-5 / 2 / µg/L	<2				
EP075E: Nitroaromatics and Ketones						
2-Picoline	109-06-8 / 2 / µg/L	<2				
Acetophenone	98-86-2 / 2 / µg/L	<2				
Nitrobenzene	98-95-3 / 2 / µg/L	<2				
Isophorone	78-59-1 / 2 / µg/L	<2				
2.6-Dinitrotoluene	606-20-2 / 4 / µg/L	<4				
2.4-Dinitrotoluene	121-14-2 / 4 / µg/L	<4				
1-Naphthylamine	134-32-7 / 2 / µg/L	<2				
4-Nitroquinoline-N-oxide	56-57-5 / 2 / µg/L	<2				
5-Nitro-o-toluidine	99-55-8 / 2 / µg/L	<2				
Azobenzene	103-33-3 / 2 / µg/L	<2				
1.3.5-Trinitrobenzene	99-35-4 / 2 / µg/L	<2				
Phenacetin	62-44-2 / 2 / µg/L	<2				
4-Aminobiphenyl	92-67-1 / 2 / µg/L	<2				
Pentachloronitrobenzene	82-68-8 / 2 / µg/L	<2				
Pronamide	23950-58-5 / 2 / µg/L	<2				
Dimethylaminoazobenzene	60-11-7 / 2 / µg/L	<2				
Chlorobenzilate	510-15-6 / 2 / µg/L	<2				
EP075F: Haloethers						
Bis(2-chloroethyl) ether	111-44-4 / 2 / µg/L	<2				

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number / LOR / Units					
EP075F: Haloethers						
Bis(2-chloroethoxy) methane	111-91-1 / 2 / µg/L	<2				
4-Chlorophenyl phenyl ether	7005-72-3 / 2 / µg/L	<2				
4-Bromophenyl phenyl ether	101-55-3 / 2 / µg/L	<2				
EP075G: Chlorinated Hydrocarbons						
1.4-Dichlorobenzene	106-46-7 / 2 / µg/L	<2				
1.3-Dichlorobenzene	541-73-1 / 2 / µg/L	<2				
1.2-Dichlorobenzene	95-50-1 / 2 / µg/L	<2				
Hexachloroethane	67-72-1 / 2 / µg/L	<2				
1.2.4-Trichlorobenzene	120-82-1 / 2 / µg/L	<2				
Hexachloropropylene	1888-71-7 / 2 / µg/L	<2				
Hexachlorobutadiene	87-68-3 / 2 / µg/L	<2				
Hexachlorocyclopentadiene	77-47-4 / 10 / µg/L	<10				
Pentachlorobenzene	608-93-5 / 2 / µg/L	<2				
Hexachlorobenzene (HCB)	118-74-1 / 4 / µg/L	<4				
EP075H: Anilines and Benzidines						
Aniline	62-53-3 / 2 / µg/L	<2				
4-Chloroaniline	106-47-8 / 2 / µg/L	<2				
2-Nitroaniline	88-74-4 / 4 / µg/L	<4				
3-Nitroaniline	99-09-2 / 4 / µg/L	<4				
Dibenzofuran	132-64-9 / 2 / µg/L	<2				
4-Nitroaniline	100-01-6 / 2 / µg/L	<2				
Carbazole	86-74-8 / 2 / µg/L	<2				
3.3'-Dichlorobenzidine	91-94-1 / 2 / µg/L	<2				
EP075I: Organochlorine Pesticides						
alpha-BHC	319-84-6 / 2 / µg/L	<2				
beta-BHC	319-85-7 / 2 / µg/L	<2				
gamma-BHC	58-89-9 / 2 / µg/L	<2				
delta-BHC	319-86-8 / 2 / µg/L	<2				
Heptachlor	76-44-8 / 2 / µg/L	<2				
Aldrin	309-00-2 / 2 / µg/L	<2				
Heptachlor epoxide	1024-57-3 / 2 / µg/L	<2				
alpha-Endosulfan	959-98-8 / 2 / µg/L	<2				
4.4'-DDE	72-55-9 / 2 / µg/L	<2				
Dieldrin	60-57-1 / 2 / µg/L	<2				
Endrin	72-20-8 / 2 / µg/L	<2				
beta-Endosulfan	33213-65-9 / 2 / µg/L	<2				

ALS Environmental

Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number	LOR	Units			
EP075I: Organochlorine Pesticides						
4.4'-DDD	72-54-8	2	µg/L	<2		
Endosulfan sulfate	1031-07-8	2	µg/L	<2		
4.4'-DDT	50-29-3	4	µg/L	<4		
EP075J: Organophosphorus Pesticides						
Dichlorvos	62-73-7	2	µg/L	<2		
Dimethoate	60-51-5	2	µg/L	<2		
Diazinon	333-41-5	2	µg/L	<2		
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2		
Malathion	121-75-5	2	µg/L	<2		
Fenthion	55-38-9	2	µg/L	<2		
Chlorpyrifos	2921-88-2	2	µg/L	<2		
Pirimphos-ethyl	23505-41-1	2	µg/L	<2		
Chlorfenvinphos	470-90-6	2	µg/L	<2		
Prothiofos	34643-46-4	2	µg/L	<2		
Ethion	563-12-2	2	µg/L	<2		
EP075K: Miscellaneous Compounds						
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2		
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2		
Methanesulfonate methyl	66-27-3	2	µg/L	<2		
Methanesulfonate ethyl	62-50-0	2	µg/L	<2		
cis-Isosafrole	17627-76-8	2	µg/L	<2		
trans-Isosafrole	4043-71-4	2	µg/L	<2		
Safrole	94-59-7	2	µg/L	<2		
Diallate	2303-16-4	2	µg/L	<2		
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2		
EP074S: VOC Surrogates						
1.2-Dichloroethane-D4	17060-07-0	0.1	%	96.4		
Toluene-D8	2037-26-5	0.1	%	97.6		
4-Bromofluorobenzene	460-00-4	0.1	%	94.2		
EP075S: Acid Extractable Surrogates						
2-Fluorophenol	367-12-4	0.1	%	57.2		
Phenol-d6	13127-88-3	0.1	%	39.8		
2-Chlorophenol-D4	93951-73-6	0.1	%	88.5		
2.4.6-Tribromophenol	118-79-6	0.1	%	112		
EP075T: Base/Neutral Extractable Surrogates						
Nitrobenzene-D5	4165-60-0	0.1	%	109		

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Analytical Results

	Client Sample ID :	05/11056-B/1 NST2-17				
	Sample Matrix Type / Description :	WATER				
	Sample Date / Time :	27 Oct 2005 15:00				
	Laboratory Sample ID :	EB0511003-001				
Analyte	CAS number	LOR	Units			
EP075T: Base/Neutral Extractable Surrogates						
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%	33.4		
2-Fluorobiphenyl	321-60-8	0.1	%	69.7		
Anthracene-d10	1719-06-8	0.1	%	94.9		
4-Terphenyl-d14	1718-51-0	0.1	%	97.0		

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Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	80	120
	Toluene-D8	88	110
	4-Bromofluorobenzene	86	115
EP075: Semivolatile Organic Compounds			
EP075S: Acid Extractable Surrogates	2-Fluorophenol	21	100
	Phenol-d6	10	94
	2-Chlorophenol-D4	23	134
	2,4,6-Tribromophenol	10	123
EP075T: Base/Neutral Extractable Surrogates	Nitrobenzene-D5	35	114
	1,2-Dichlorobenzene-D4	32	129
	2-Fluorobiphenyl	43	116
	Anthracene-d10	27	133
	4-Terphenyl-d14	33	141

Scientific Analytical Services

ABN 72 002 765 795

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A unit of Brisbane City Council

SCIENTIFIC ANALYTICAL SERVICES LABORATORY REPORT

Attention:	Dale Waters
Client:	City Design, Ground Engineering St Paul's Tce Fortitude Valley QLD
Job Name:	Airport Link
Sampled By:	Client
Sampling Date:	
Sampling Method:	Grab
Sample Matrix:	Aqueous
Batch Number:	05/11057
Registration Date:	26 October 2005
Date of Report:	28 November 2005

Patti O'Shea
Supervising Chemist

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

Client: City Design, Ground Engineering **Batch Number:** 05/11057
Job Name: Airport Link **Report Date:** 28/11/05

Method	Test Date sampled:	Units	05/11057/1 APL04D 26/10/2005 08:15	05/11057/2 APL04S 26/10/2005 09:10	05/11057/3 APL05S 26/10/2005 10:00
1.002	pH		5.9	6.8	6.7
1.007	Conductivity @ 25^{o}C	uS/cm	490	820	1,500
Misc. *	Total Dissolved Solids	mg/L	430	810	1,170
5.304F	Calcium (Soluble) as Ca	mg/L	18	4.6	30
5.304F	Magnesium (Soluble) as Mg	mg/L	13	11	54
5.304F	Sodium (Soluble) as Na	mg/L	75	170	260
5.304F	Potassium (Soluble) as K	mg/L	6.3	8.0	34
FIA.109	Chloride	mg/L	61	69	62
5.304F	Sulphur as SO4 (Soluble)	mg/L	18	11	360
1.012	Total Alkalinity as $CaCO_3$	mg/L	140	310	480
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	140	310	480
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10
External	ALS Batch No.	Text	EB0509918	[NR]	[NR]
External	Semi-Volatile Organic_Scan	Text	Complete	Complete	Complete
External	Volatile Organic Scan	Text	Complete	Complete	Complete
FIA.008	Ammonia N	mg/L	0.006	0.008	4.8
FIA.010C	Nitrate N by FIA (Calc)	mg/L	<0.01	0.011	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.017	0.006	0.016
5.304F	Aluminium (Soluble) as Al	mg/L	0.088	0.032	0.019
5.304F	Arsenic (Soluble) as As	mg/L	<0.005	0.029	0.012
5.304F	Barium (Soluble) as Ba	mg/L	0.067	0.18	0.11
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	<0.002	<0.002	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	17	1.7	10
5.304F	Manganese (Soluble) as Mn	mg/L	0.94	0.14	2.1
5.304F	Nickel (Soluble) as Ni	mg/L	0.019	<0.002	0.007
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.015	0.11	0.11
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10

Client: City Design, Ground Engineering **Batch Number:** 05/11057
Job Name: Airport Link **Report Date:** 28/11/05

Method	Test Date sampled:	Units	05/11057/4 APL07S 26/10/2005 11:30	05/11057/5 APL07D 26/10/2005 11:00	05/11057/6 APL02 26/10/2005 12:20
1.002	pH		6.6	6.8	7.3
1.007	Conductivity @ 25^{o}C	uS/cm	1,500	1,700	6,400
Misc. *	Total Dissolved Solids	mg/L	893	1,050	3,820
5.304F	Calcium (Soluble) as Ca	mg/L	42	50	90
5.304F	Magnesium (Soluble) as Mg	mg/L	27	32	170
5.304F	Sodium (Soluble) as Na	mg/L	260	300	1,000
5.304F	Potassium (Soluble) as K	mg/L	5.6	5.6	13
FIA.109	Chloride	mg/L	460	510	2,200
5.304F	Sulphur as SO4 (Soluble)	mg/L	40	44	240
1.012	Total Alkalinity as $CaCO_3$	mg/L	150	180	360
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	150	180	360
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10
External	ALS Batch No.	Text	[NR]	[NR]	[NR]
External	Semi-Volatile Organic_Scan	Text	Complete	Complete	Complete
External	Volatile Organic Scan	Text	Complete	Complete	Complete
FIA.008	Ammonia N	mg/L	0.52	0.065	0.016
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.077	0.041	1.3
FIA.011A	Ortho Phosphorus as P	mg/L	0.010	0.019	0.044
5.304F	Aluminium (Soluble) as Al	mg/L	0.017	0.024	0.027
5.304F	Arsenic (Soluble) as As	mg/L	<0.005	<0.005	<0.005
5.304F	Barium (Soluble) as Ba	mg/L	0.29	0.10	0.14
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001	0.001
5.304F	Copper (Soluble) as Cu	mg/L	<0.002	<0.002	0.031
5.304F	Iron (Soluble) as Fe	mg/L	6.7	3.0	0.038
5.304F	Manganese (Soluble) as Mn	mg/L	0.80	0.29	0.14
5.304F	Nickel (Soluble) as Ni	mg/L	<0.002	<0.002	0.006
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.12	0.082	0.26
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10

Client: City Design, Ground Engineering **Batch Number:** 05/11057
Job Name: Airport Link **Report Date:** 28/11/05

Method	Test Date sampled:	Units	05/11057/7 APL09 26/10/2005 13:45	05/11057/8 APL01 26/10/2005 14:40	05/11057/9 APL06 27/10/2005 08:15
1.002	pH		6.8	6.5	7.8
1.007	Conductivity @ 25^{o}C	uS/cm	1,400	610	1,700
Misc. *	Total Dissolved Solids	mg/L	757	354	1,040
5.304F	Calcium (Soluble) as Ca	mg/L	27	8.7	45
5.304F	Magnesium (Soluble) as Mg	mg/L	16	6.5	21
5.304F	Sodium (Soluble) as Na	mg/L	220	120	350
5.304F	Potassium (Soluble) as K	mg/L	10	5.9	5.5
FIA.109	Chloride	mg/L	410	130	500
5.304F	Sulphur as SO4 (Soluble)	mg/L	23	28	9.5
1.012	Total Alkalinity as $CaCO_3$	mg/L	140	100	260
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	130	100	260
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	2.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10
External	ALS Batch No.	Text	[NR]	[NR]	[NR]
External	Semi-Volatile Organic_Scan	Text	Complete	Complete	Complete
External	Volatile Organic Scan	Text	Complete	Complete	Complete
FIA.008	Ammonia N	mg/L	0.039	<0.004	0.15
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.079	0.32	0.095
FIA.011A	Ortho Phosphorus as P	mg/L	0.018	0.27	0.090
5.304F	Aluminium (Soluble) as Al	mg/L	0.023	0.039	0.027
5.304F	Arsenic (Soluble) as As	mg/L	<0.005	<0.005	0.005
5.304F	Barium (Soluble) as Ba	mg/L	0.36	0.052	0.43
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.011	0.037	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	1.3	0.13	0.059
5.304F	Manganese (Soluble) as Mn	mg/L	0.62	0.29	0.12
5.304F	Nickel (Soluble) as Ni	mg/L	0.004	0.005	0.003
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.31	0.18	0.066
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BRISBANE CITY COUNCIL	Laboratory	: ALS Environmental Brisbane	Page	: 1 of 17
Contact	: MS PATTI O`SHEA	Contact	: Michael Heery	Work Order	: EB0509918
Address	: ANALYTICAL SERVICES SECTION 240 DONALDSON ROAD ROCKLEA QLD AUSTRALIA 4106	Address	: 32 Shand Street Stafford QLD Australia 4053	Amendment No.	: 1
E-mail	: Patti.O''Shea@brisbane.qld.gov.au	E-mail	: Michael.Heery@alsenviro.com		
Telephone	: 07 3403 2622	Telephone	: 61-7-32437222		
Facsimile	: 07 3403 2646	Facsimile	: 61-7-32437259		
Project	: E2810-2	Quote number	: EN 487 97	Date received	: 28 Oct 2005
Order number	: - Not provided -			Date issued	: 23 Nov 2005
C-O-C number	: - Not provided -			No. of samples	- Received : 9
Site	: - Not provided -				Analysed : 9

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This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Carsten Emrich		Organics - NATA 818 (Brisbane)

ALS Environmental

Comments

This report for the ALSE reference EB0509918 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical results for samples submitted**

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

- **Surrogate control limits**

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Specific comments for Work Order **EB0509918**

Particular samples required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
				Sample Matrix Type / Description : WATER	WATER	WATER	WATER	WATER
				Sample Date / Time : 26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
				Laboratory Sample ID : EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	5	µg/L	<5	<5	<5	<5	<5
Toluene	108-88-3	5	µg/L	<5	<5	<5	<5	<5
Ethylbenzene	100-41-4	5	µg/L	<5	<5	<5	<5	<5
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5	<5	<5	<5	<5
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5	<5
ortho-Xylene	95-47-6	5	µg/L	<5	<5	<5	<5	<5
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5	<5
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5	<5
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5	<5
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5	<5
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5	<5
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5	<5
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5	<5	<5
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50	<50	<50
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50	<50	<50
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50	<50	<50
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5	<5	<5
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	<10	<10	<10	<10
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	<10	<10	<10	<10
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L	<50	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L	<50	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L	<50	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L	<50	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	<50	<50	<50
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	<5	<5	<5

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
				Sample Matrix Type / Description : WATER	WATER	WATER	WATER	WATER
				Sample Date / Time : 26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
				Laboratory Sample ID : EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP074E: Halogenated Aliphatic Compounds								
Iodomethane	74-88-4	5	µg/L	<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	<5	<5	<5
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	<5	<5	<5
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	<5	<5	<5
Trichloroethene	79-01-6	5	µg/L	<5	<5	<5	<5	<5
Dibromomethane	74-95-3	5	µg/L	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5	<5	<5
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5	<5	<5
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5	<5	<5
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	<5	<5	<5
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5	<5	<5
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5	<5	<5
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	<5
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	<5
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5	<5	<5
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	<5
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	<5
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	<5

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP074H: Naphthalene								
Naphthalene	91-20-3	7	µg/L	<7	<7	<7	<7	<7
EP075A: Phenolic Compounds								
Phenol	108-95-2	2	µg/L	<2	<10	<2	11	<2
2-Chlorophenol	95-57-8	2	µg/L	<2	<10	<2	<2	<2
2-Methylphenol	95-48-7	2	µg/L	<2	<10	<2	<2	<2
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	<10	<2	587	<2
2-Nitrophenol	88-75-5	2	µg/L	<2	<10	<2	<2	<2
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<10	<2	<2	<2
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<10	<2	<2	<2
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<10	<2	<2	<2
4-Chloro-3-Methylphenol	59-50-7	2	µg/L	<2	<10	<2	<2	<2
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<10	<2	<2	<2
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<10	<2	<2	<2
Pentachlorophenol	87-86-5	4	µg/L	<4	<20	<4	<4	<4
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	<10	<2	<2	<2
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<10	<2	<2	<2
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<10	<2	<2	<2
Acenaphthylene	208-96-8	2	µg/L	<2	<10	<2	<2	<2
Acenaphthene	83-32-9	2	µg/L	<2	<10	<2	<2	<2
Fluorene	86-73-7	2	µg/L	<2	<10	<2	<2	<2
Phenanthrene	85-01-8	2	µg/L	<2	<10	<2	<2	<2
Anthracene	120-12-7	2	µg/L	<2	<10	<2	<2	<2
Fluoranthene	206-44-0	2	µg/L	<2	<10	<2	<2	<2
Pyrene	129-00-0	2	µg/L	<2	<10	<2	<2	<2
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<10	<2	<2	<2
Benz(a)anthracene	56-55-3	2	µg/L	<2	<10	<2	<2	<2
Chrysene	218-01-9	2	µg/L	<2	<10	<2	<2	<2
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<20	<4	<4	<4
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<10	<2	<2	<2
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<10	<2	<2	<2
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<10	<2	<2	<2
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<10	<2	<2	<2
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<10	<2	<2	<2
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<10	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
				Sample Matrix Type / Description : WATER	WATER	WATER	WATER	WATER
				Sample Date / Time : 26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
				Laboratory Sample ID : EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	2	µg/L	<2	<10	<2	<2	<2
Diethyl phthalate	84-66-2	2	µg/L	<2	<10	<2	<2	<2
Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<10	<2	<2	<2
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<10	<2	<2	<2
bis(2-ethylhexyl) phthalate	117-81-7	20	µg/L	<20	<100	<20	<20	<20
Di-n-octylphthalate	117-84-0	2	µg/L	<2	<10	<2	<2	<2
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<20	<4	<4	<4
N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<10	<2	<2	<2
N-Nitrosodiphenyl & Diphenylamine	86-30-6	4	µg/L	<4	<20	<4	<4	<4
Methapyrilene	91-80-5	2	µg/L	<2	<10	<2	<2	<2
EP075E: Nitroaromatics and Ketones								
Acetophenone	98-86-2	2	µg/L	<2	<10	<2	<2	<2
Nitrobenzene	98-95-3	2	µg/L	<2	<10	<2	<2	<2
Isophorone	78-59-1	2	µg/L	<2	<10	<2	<2	<2
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<20	<4	<4	<4
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<20	<4	<4	<4
1-Naphthylamine	134-32-7	2	µg/L	<2	<10	<2	<2	<2
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<10	<2	<2	<2
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<10	<2	<2	<2
Azobenzene	103-33-3	2	µg/L	<2	<10	<2	<2	<2
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<10	<2	<2	<2
Phenacetin	62-44-2	2	µg/L	<2	<10	<2	<2	<2
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<10	<2	<2	<2
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<10	<2	<2	<2
Pronamide	23950-58-5	2	µg/L	<2	<10	<2	<2	<2
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<10	<2	<2	<2
Chlorobenzilate	510-15-6	2	µg/L	<2	<10	<2	<2	<2
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<10	<2	<2	<2
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<10	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
				Sample Matrix Type / Description : WATER	WATER	WATER	WATER	WATER
				Sample Date / Time : 26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
				Laboratory Sample ID : EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP075F: Haloethers								
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<10	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<10	<2	<2	<2
EP075G: Chlorinated Hydrocarbons								
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<10	<2	<2	<2
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<10	<2	<2	<2
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<10	<2	<2	<2
Hexachloroethane	67-72-1	2	µg/L	<2	<10	<2	<2	<2
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<10	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L	<2	<10	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<10	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<50	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L	<2	<10	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<20	<4	<4	<4
EP075H: Anilines and Benzidines								
Aniline	62-53-3	2	µg/L	<2	<10	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L	<2	<10	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L	<4	<20	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L	<4	<20	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L	<2	<10	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L	<2	<10	<2	<2	<2
Carbazole	86-74-8	2	µg/L	<2	<10	<2	<2	<2
3.3'-Dichlorobenzidine	91-94-1	2	µg/L	<2	<10	<2	<2	<2
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	2	µg/L	<2	<10	<2	<2	<2
beta-BHC	319-85-7	2	µg/L	<2	<10	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L	<2	<10	<2	<2	<2
delta-BHC	319-86-8	2	µg/L	<2	<10	<2	<2	<2
Heptachlor	76-44-8	2	µg/L	<2	<10	<2	<2	<2
Aldrin	309-00-2	2	µg/L	<2	<10	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<10	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L	<2	<10	<2	<2	<2
4.4'-DDE	72-55-9	2	µg/L	<2	<10	<2	<2	<2
Dieldrin	60-57-1	2	µg/L	<2	<10	<2	<2	<2
Endrin	72-20-8	2	µg/L	<2	<10	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L	<2	<10	<2	<2	<2
4.4'-DDD	72-54-8	2	µg/L	<2	<10	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP075I: Organochlorine Pesticides								
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<10	<2	<2	<2
4.4'-DDT	50-29-3	4	µg/L	<4	<20	<4	<4	<4
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	2	µg/L	<2	<10	<2	<2	<2
Dimethoate	60-51-5	2	µg/L	<2	<10	<2	<2	<2
Diazinon	333-41-5	2	µg/L	<2	<10	<2	<2	<2
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<10	<2	<2	<2
Malathion	121-75-5	2	µg/L	<2	<10	<2	<2	<2
Fenthion	55-38-9	2	µg/L	<2	<10	<2	<2	<2
Chlorpyrifos	2921-88-2	2	µg/L	<2	<10	<2	<2	<2
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<10	<2	<2	<2
Chlorfenvinphos	470-90-6	2	µg/L	<2	<10	<2	<2	<2
Prothiofos	34643-46-4	2	µg/L	<2	<10	<2	<2	<2
Ethion	563-12-2	2	µg/L	<2	<10	<2	<2	<2
EP075K: Miscellaneous Compounds								
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<10	<2	<2	<2
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<10	<2	<2	<2
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<10	<2	<2	<2
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<10	<2	<2	<2
cis-Isosafrole	17627-76-8	2	µg/L	<2	<10	<2	<2	<2
trans-Isosafrole	4043-71-4	2	µg/L	<2	<10	<2	<2	<2
Safrole	94-59-7	2	µg/L	<2	<10	<2	<2	<2
Diallate	2303-16-4	2	µg/L	<2	<10	<2	<2	<2
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<10	<2	<2	<2
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	92.2	108	118	108	97.5
Toluene-D8	2037-26-5	0.1	%	93.3	88.5	91.7	89.6	88.0
4-Bromofluorobenzene	460-00-4	0.1	%	92.1	91.3	90.7	88.4	89.6
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.1	%	45.6	61.2	59.8	42.5	67.3
Phenol-d6	13127-88-3	0.1	%	39.6	54.8	40.1	36.5	40.4
2-Chlorophenol-D4	93951-73-6	0.1	%	78.5	79.7	89.6	82.3	96.7
2.4.6-Tribromophenol	118-79-6	0.1	%	103	94.8	112	115	113
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.1	%	88.0	95.1	109	96.0	109
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%	26.3	44.7	33.4	37.0	33.1

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/1 APL04D	05/11057/2 APL04S	05/11057/3 SAPL05S	05/11057/4 APL07S	05/11057/5 APL07D
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-001	EB0509918-002	EB0509918-003	EB0509918-004	EB0509918-005
EP075T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	53.4	68.4	68.7	71.5	60.4
Anthracene-d10	1719-06-8	0.1	%	85.5	95.7	107	94.8	106
4-Terphenyl-d14	1718-51-0	0.1	%	82.9	102	112	89.2	118

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009
EP074A: Monocyclic Aromatic Hydrocarbons							
Benzene	71-43-2	5	µg/L	<5	<5	<5	<5
Toluene	108-88-3	5	µg/L	<5	<5	<5	<5
Ethylbenzene	100-41-4	5	µg/L	<5	<5	<5	<5
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5	<5	<5	<5
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5
ortho-Xylene	95-47-6	5	µg/L	<5	<5	<5	<5
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5	<5
EP074B: Oxygenated Compounds							
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50	<50
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50	<50
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50	<50
EP074C: Sulfonated Compounds							
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5	<5
EP074D: Fumigants							
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5	<5
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5	<5
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	<10	<10	<10
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	<10	<10	<10
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds							
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	<50	<50
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	<5	<5

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06	
Sample Matrix Type / Description:				WATER	WATER	WATER	WATER	
Sample Date / Time:				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00	
Laboratory Sample ID:				EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009	
EP074E: Halogenated Aliphatic Compounds								
Iodomethane	74-88-4	5	µg/L	<5	<5	<5	<5	
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	<5	<5	
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	<5	<5	
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	<5	<5	
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	<5	<5	
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	<5	<5	
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	<5	<5	
1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	<5	<5	
Trichloroethene	79-01-6	5	µg/L	<5	<5	<5	<5	
Dibromomethane	74-95-3	5	µg/L	<5	<5	<5	<5	
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	<5	<5	
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5	<5	
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5	<5	
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5	<5	
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5	<5	
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5	<5	
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5	<5	
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5	<5	
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5	<5	
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5	<5	
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	<5	<5	
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5	<5	
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5	<5	
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5	<5	
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5	<5	
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5	<5	
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5	<5	
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5	<5	
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	

ALS Environmental

Analytical Results

	Client Sample ID :	05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06	
	Sample Matrix Type / Description :	WATER	WATER	WATER	WATER	
	Sample Date / Time :	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00	
	Laboratory Sample ID :	EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009	
Analyte	CAS number / LOR / Units					
EP074H: Naphthalene						
Naphthalene	91-20-3 / 7 / µg/L	<7	<7	<7	<7	
EP075A: Phenolic Compounds						
Phenol	108-95-2 / 2 / µg/L	<2	<2	<2	<2	
2-Chlorophenol	95-57-8 / 2 / µg/L	<2	<2	<2	<2	
2-Methylphenol	95-48-7 / 2 / µg/L	<2	<2	<2	<2	
3- & 4-Methylphenol	1319-77-3 / 2 / µg/L	<2	<2	<2	<2	
2-Nitrophenol	88-75-5 / 2 / µg/L	<2	<2	<2	<2	
2.4-Dimethylphenol	105-67-9 / 2 / µg/L	<2	<2	<2	<2	
2.4-Dichlorophenol	120-83-2 / 2 / µg/L	<2	<2	<2	<2	
2.6-Dichlorophenol	87-65-0 / 2 / µg/L	<2	<2	<2	<2	
4-Chloro-3-Methylphenol	59-50-7 / 2 / µg/L	<2	<2	<2	<2	
2.4.6-Trichlorophenol	88-06-2 / 2 / µg/L	<2	<2	<2	<2	
2.4.5-Trichlorophenol	95-95-4 / 2 / µg/L	<2	<2	<2	<2	
Pentachlorophenol	87-86-5 / 4 / µg/L	<4	<4	<4	<4	
EP075B: Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3 / 2 / µg/L	<2	<2	<2	<2	
2-Methylnaphthalene	91-57-6 / 2 / µg/L	<2	<2	<2	<2	
2-Chloronaphthalene	91-58-7 / 2 / µg/L	<2	<2	<2	<2	
Acenaphthylene	208-96-8 / 2 / µg/L	<2	<2	<2	<2	
Acenaphthene	83-32-9 / 2 / µg/L	<2	<2	<2	<2	
Fluorene	86-73-7 / 2 / µg/L	<2	<2	<2	<2	
Phenanthrene	85-01-8 / 2 / µg/L	<2	<2	<2	<2	
Anthracene	120-12-7 / 2 / µg/L	<2	<2	<2	<2	
Fluoranthene	206-44-0 / 2 / µg/L	<2	<2	<2	<2	
Pyrene	129-00-0 / 2 / µg/L	<2	<2	<2	<2	
N-2-Fluorenyl Acetamide	53-96-3 / 2 / µg/L	<2	<2	<2	<2	
Benz(a)anthracene	56-55-3 / 2 / µg/L	<2	<2	<2	<2	
Chrysene	218-01-9 / 2 / µg/L	<2	<2	<2	<2	
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9 / 4 / µg/L	<4	<4	<4	<4	
7.12-Dimethylbenz(a)anthracene	57-97-6 / 2 / µg/L	<2	<2	<2	<2	
Benzo(a)pyrene	50-32-8 / 2 / µg/L	<2	<2	<2	<2	
3-Methylcholanthrene	56-49-5 / 2 / µg/L	<2	<2	<2	<2	
Indeno(1.2.3.cd)pyrene	193-39-5 / 2 / µg/L	<2	<2	<2	<2	
Dibenz(a.h)anthracene	53-70-3 / 2 / µg/L	<2	<2	<2	<2	
Benzo(g.h.i)perylene	191-24-2 / 2 / µg/L	<2	<2	<2	<2	

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009
EP075C: Phthalate Esters							
Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	<2	<2
Diethyl phthalate	84-66-2	2	µg/L	<2	<2	<2	<2
Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2	<2	<2
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	<2	<2
bis(2-ethylhexyl) phthalate	117-81-7	20	µg/L	<20	<20	<20	<20
Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2	<2	<2
EP075D: Nitrosamines							
N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2	<2	<2
N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2	<2	<2
N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4	<4	<4
N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2	<2	<2
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2	<2	<2
N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2	<2	<2
N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2	<2	<2
N-Nitrosodiphenyl & Diphenylamine	86-30-6	4	µg/L	<4	<4	<4	<4
Methapyrilene	91-80-5	2	µg/L	<2	<2	<2	<2
EP075E: Nitroaromatics and Ketones							
Acetophenone	98-86-2	2	µg/L	<2	<2	<2	<2
Nitrobenzene	98-95-3	2	µg/L	<2	<2	<2	<2
Isophorone	78-59-1	2	µg/L	<2	<2	<2	<2
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	<4	<4
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	<4	<4
1-Naphthylamine	134-32-7	2	µg/L	<2	<2	<2	<2
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	<2	<2
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	<2	<2
Azobenzene	103-33-3	2	µg/L	<2	<2	<2	<2
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	<2	<2
Phenacetin	62-44-2	2	µg/L	<2	<2	<2	<2
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	<2	<2
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	<2	<2
Pronamide	23950-58-5	2	µg/L	<2	<2	<2	<2
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	<2	<2
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	<2	<2
EP075F: Haloethers							
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06
				Sample Matrix Type / Description : WATER	WATER	WATER	WATER
				Sample Date / Time : 26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00
				Laboratory Sample ID : EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009
EP075F: Haloethers							
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2	<2
EP075G: Chlorinated Hydrocarbons							
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2	<2
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2	<2
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2	<2
Hexachloroethane	67-72-1	2	µg/L	<2	<2	<2	<2
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	<4	<4
EP075H: Anilines and Benzidines							
Aniline	62-53-3	2	µg/L	<2	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L	<2	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L	<4	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L	<4	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L	<2	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L	<2	<2	<2	<2
Carbazole	86-74-8	2	µg/L	<2	<2	<2	<2
3.3'-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	<2	<2
EP075I: Organochlorine Pesticides							
alpha-BHC	319-84-6	2	µg/L	<2	<2	<2	<2
beta-BHC	319-85-7	2	µg/L	<2	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L	<2	<2	<2	<2
delta-BHC	319-86-8	2	µg/L	<2	<2	<2	<2
Heptachlor	76-44-8	2	µg/L	<2	<2	<2	<2
Aldrin	309-00-2	2	µg/L	<2	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	<2	<2
4.4'-DDE	72-55-9	2	µg/L	<2	<2	<2	<2
Dieldrin	60-57-1	2	µg/L	<2	<2	<2	<2
Endrin	72-20-8	2	µg/L	<2	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	<2	<2
4.4'-DDD	72-54-8	2	µg/L	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER
Sample Date / Time :				26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00
Laboratory Sample ID :				EB0509918-006	EB0509918-007	EB0509918-008	EB0509918-009
EP075I: Organochlorine Pesticides							
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	<2	<2
4.4'-DDT	50-29-3	4	µg/L	<4	<4	<4	<4
EP075J: Organophosphorus Pesticides							
Dichlorvos	62-73-7	2	µg/L	<2	<2	<2	<2
Dimethoate	60-51-5	2	µg/L	<2	<2	<2	<2
Diazinon	333-41-5	2	µg/L	<2	<2	<2	<2
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	<2	<2
Malathion	121-75-5	2	µg/L	<2	<2	<2	<2
Fenthion	55-38-9	2	µg/L	<2	<2	<2	<2
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	<2	<2
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	<2	<2
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	<2	<2
Prothiofos	34643-46-4	2	µg/L	<2	<2	<2	<2
Ethion	563-12-2	2	µg/L	<2	<2	<2	<2
EP075K: Miscellaneous Compounds							
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2	<2	<2
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2	<2	<2
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2	<2	<2
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<2	<2	<2
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2	<2	<2
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2	<2	<2
Safrole	94-59-7	2	µg/L	<2	<2	<2	<2
Diallate	2303-16-4	2	µg/L	<2	<2	<2	<2
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2	<2	<2
EP074S: VOC Surrogates							
1.2-Dichloroethane-D4	17060-07-0	0.1	%	106	113	99.0	90.1
Toluene-D8	2037-26-5	0.1	%	91.2	91.5	94.8	93.7
4-Bromofluorobenzene	460-00-4	0.1	%	93.7	88.7	95.1	90.6
EP075S: Acid Extractable Surrogates							
2-Fluorophenol	367-12-4	0.1	%	56.3	54.6	45.7	52.7
Phenol-d6	13127-88-3	0.1	%	36.9	37.1	32.7	37.0
2-Chlorophenol-D4	93951-73-6	0.1	%	89.7	83.1	66.9	81.4
2.4.6-Tribromophenol	118-79-6	0.1	%	108	105	85.0	105
EP075T: Base/Neutral Extractable Surrogates							
Nitrobenzene-D5	4165-60-0	0.1	%	104	97.5	78.2	83.5
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%	36.0	28.9	18.4	17.0

ALS Environmental

Analytical Results

	Client Sample ID :	05/11057/6 APL02	05/11057/7 APL09	05/11057/8 APL01	05/11057/9 APL06	
	Sample Matrix Type / Description :	WATER	WATER	WATER	WATER	
	Sample Date / Time :	26 Oct 2005 15:00	26 Oct 2005 15:00	26 Oct 2005 15:00	27 Oct 2005 15:00	
	Laboratory Sample ID :					
Analyte	*CAS number* / *LOR* / *Units*	**EB0509918-006**	**EB0509918-007**	**EB0509918-008**	**EB0509918-009**	
EP075T: Base/Neutral Extractable Surrogates						
2-Fluorobiphenyl	321-60-8 / 0.1 / %	66.8	59.5	43.8	25.0	
Anthracene-d10	1719-06-8 / 0.1 / %	102	98.8	73.6	72.3	
4-Terphenyl-d14	1718-51-0 / 0.1 / %	106	101	76.5	104	

ALS Environmental

Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	80	120
	Toluene-D8	88	110
	4-Bromofluorobenzene	86	115
EP075: Semivolatile Organic Compounds			
EP075S: Acid Extractable Surrogates	2-Fluorophenol	21	100
	Phenol-d6	10	94
	2-Chlorophenol-D4	23	134
	2,4,6-Tribromophenol	10	123
EP075T: Base/Neutral Extractable Surrogates	Nitrobenzene-D5	35	114
	1,2-Dichlorobenzene-D4	32	129
	2-Fluorobiphenyl	43	116
	Anthracene-d10	27	133
	4-Terphenyl-d14	33	141

Scientific Analytical Services

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A unit of Brisbane City Council

SCIENTIFIC ANALYTICAL SERVICES LABORATORY REPORT

Client:	Chris Thorley City Design, Ground Engineering St Paul's Tce Fortitude Valley QLD
Job Name:	Airport Link
	G1335
Sampled By:	Client
Sampling Date:	
Sampling Method:	Grab
Sample Matrix:	Aqueous
Batch Number:	06/01873
Registration Date:	16 February 2006
Date of Report:	29 March 2006

DO measured in the laboratory at 19.8 ^{o}C.

This report supersedes any previous report of the same batch number.

D. O'Shea

Patti O'Shea
Supervising Chemist

Client: City Design, Ground Engineering **Batch Number:** 06/01873
Job Name: Airport Link **Report Date:** 29/03/06

Method	Test	Units	06/01873/1 APL25D 15/02/2006 07:30	06/01873/2 APL25S 15/02/2006 08:15	06/01873/3 APL07D 15/02/2006 10:15	06/01873/4 APL07S 15/02/2006 12:00
1.002	pH	pH Unit	7.0	6.0	6.7	6.6
1.007	Conductivity @ 25°C	uS/cm	2,900	860	1,900	1,500
Misc. *	Total Dissolved Solids	mg/L	1,720	663	1,210	954
5.304F	Calcium (Soluble) as Ca	mg/L	44	11	52	33
5.304F	Magnesium (Soluble) as Mg	mg/L	51	19	33	27
5.304F	Sodium (Soluble) as Na	mg/L	460	130	320	270
5.304F	Potassium (Soluble) as K	mg/L	5.1	4.5	5.3	5.0
FIA.109	Chloride	mg/L	480	170	280	380
5.304F	Sulphur as SO4 (Soluble)	mg/L	42	89	44	31
1.012	Total Alkalinity as $CaCO_3$	mg/L	320	35	180	200
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	320	35	180	200
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.050	0.012	0.080	0.65
FIA.010C	Nitrate N by FIA (Calc)	mg/L	<0.01	0.14	<0.01	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.007	0.009	0.004	0.003
External	ALS Batch No.	Text	EB0601542&EB 0602258	[NR]	[NR]	[NR]
External	Hydrocarbon Banding (TPH)	Text	[NR]	[NR]	[NR]	Complete
5.304F	Aluminium (Soluble) as Al	mg/L	0.051	0.023	<0.005	0.015
5.304F	Arsenic (Soluble) as As	mg/L	<0.01	<0.01	<0.01	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.15	0.078	0.11	0.38
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	0.001	<0.001	0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.17	0.015	0.011	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	0.85	0.26	3.1	32
5.304F	Manganese (Soluble) as Mn	mg/L	1.1	0.57	0.30	1.9
5.304F	Nickel (Soluble) as Ni	mg/L	0.015	0.008	0.002	<0.002
5.304F	Lead (Soluble) as Pb	mg/L	0.013	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.61	0.12	0.30	0.058
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10	<0.10

Client: City Design, Ground Engineering **Batch Number:** 06/01873
Job Name: Airport Link **Report Date:** 29/03/06

Method	Test	Units	06/01873/5 APL06 15/02/2006 13:00	06/01873/6 APL23 15/02/2006 13:20	06/01873/7 APL22 15/02/2006 14:15	06/01873/8 APL01 15/02/2006 15:30
1.002	pH	pH Unit	7.7	6.4	7.1	6.9
1.007	Conductivity @ 25°C	uS/cm	1,600	500	540	560
Misc. *	Total Dissolved Solids	mg/L	961	375	319	334
5.304F	Calcium (Soluble) as Ca	mg/L	38	5.2	18	18
5.304F	Magnesium (Soluble) as Mg	mg/L	14	3.9	13	5.1
5.304F	Sodium (Soluble) as Na	mg/L	260	100	57	84
5.304F	Potassium (Soluble) as K	mg/L	4.9	2.0	4.3	8.1
FIA.109	Chloride	mg/L	400	100	100	84
5.304F	Sulphur as SO4 (Soluble)	mg/L	13	12	20	44
1.012	Total Alkalinity as $CaCO_3$	mg/L	240	78	90	120
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	240	78	90	120
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	1.0	<1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.24	0.005	0.038	<0.004
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.082	<0.01	0.070	0.13
FIA.011A	Ortho Phosphorus as P	mg/L	0.005	0.003	0.003	1.0
External	ALS Batch No.	Text	[NR]	[NR]	[NR]	[NR]
External	Hydrocarbon Banding (TPH)	Text	[NR]	[NR]	[NR]	[NR]
5.304F	Aluminium (Soluble) as Al	mg/L	0.070	0.015	0.014	0.048
5.304F	Arsenic (Soluble) as As	mg/L	<0.01	<0.01	<0.01	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.60	0.071	0.064	0.035
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	<0.002	<0.002	0.01	0.030
5.304F	Iron (Soluble) as Fe	mg/L	0.13	0.39	0.14	0.78
5.304F	Manganese (Soluble) as Mn	mg/L	0.059	0.11	0.21	0.23
5.304F	Nickel (Soluble) as Ni	mg/L	<0.002	<0.002	0.003	0.003
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.020	0.092	0.15	0.12
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10	<0.10

Client: City Design, Ground Engineering **Batch Number:** 06/01873
Job Name: Airport Link **Report Date:** 29/03/06

Method	Test	Units	06/01873/9 APL02 15/02/2006 16:00	06/01873/10 APL09 15/02/2006 16:30	06/01873/11 APL04S 15/02/2006 17:15	06/01873/12 APL04D 15/02/2006 17:00
1.002	pH	pH Unit	6.7	7.0	6.8	6.4
1.007	Conductivity @ 25°C	uS/cm	1,300	250	850	310
Misc. *	Total Dissolved Solids	mg/L	883	161	760	188
5.304F	Calcium (Soluble) as Ca	mg/L	9.0	13	5.0	4.5
5.304F	Magnesium (Soluble) as Mg	mg/L	14	4.0	13	3.5
5.304F	Sodium (Soluble) as Na	mg/L	280	38	180	62
5.304F	Potassium (Soluble) as K	mg/L	4.8	2.6	8.5	1.3
FIA.109	Chloride	mg/L	290	40	30	43
5.304F	Sulphur as SO4 (Soluble)	mg/L	54	27	<2	<2
1.012	Total Alkalinity as $CaCO_3$	mg/L	130	35	410	94
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	130	35	400	94
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.22	0.036	0.40	0.095
FIA.010C	Nitrate N by FIA (Calc)	mg/L	<0.01	0.23	<0.01	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.045	0.009	0.004	0.004
External	ALS Batch No.	Text	[NR]	[NR]	[NR]	[NR]
External	Hydrocarbon Banding (TPH)	Text	[NR]	[NR]	[NR]	[NR]
5.304F	Aluminium (Soluble) as Al	mg/L	0.12	0.10	0.015	0.018
5.304F	Arsenic (Soluble) as As	mg/L	<0.01	<0.01	0.048	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.031	0.032	0.20	0.017
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	0.001	0.001	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.013	0.008	<0.002	<0.002
5.304F	Iron (Soluble) as Fe	mg/L	0.86	0.081	4.5	11
5.304F	Manganese (Soluble) as Mn	mg/L	0.10	0.025	0.13	0.47
5.304F	Nickel (Soluble) as Ni	mg/L	0.007	<0.002	<0.002	<0.002
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.072	0.028	0.012	0.050
5.303F	Mercury (Soluble)	ug/L	0.23	<0.10	<0.10	<0.10

Client: City Design, Ground Engineering **Batch Number:** 06/01873
Job Name: Airport Link **Report Date:** 29/03/06

Method	Test	Units	06/01873/13 APL05S 15/02/2006 18:00	06/01873/14 NST2-17 16/02/2006 06:15	06/01873/15 APL20 16/02/2006 06:50
1.002	pH	pH Unit	7.1	6.4	4.3
1.007	Conductivity @ 25°C	uS/cm	1,000	3,800	1,300
Misc. *	Total Dissolved Solids	mg/L	747	2,370	835
5.304F	Calcium (Soluble) as Ca	mg/L	12	18	8.2
5.304F	Magnesium (Soluble) as Mg	mg/L	27	58	26
5.304F	Sodium (Soluble) as Na	mg/L	250	550	220
5.304F	Potassium (Soluble) as K	mg/L	28	5.2	7.4
FIA.109	Chloride	mg/L	47	790	290
5.304F	Sulphur as SO4 (Soluble)	mg/L	3.0	61	11
1.012	Total Alkalinity as $CaCO_3$	mg/L	580	91	<1.0
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	580	91	<1.0
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	3.8	0.14	<0.004
FIA.010C	Nitrate N by FIA (Calc)	mg/L	<0.01	<0.01	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.047	<0.002	0.018
External	ALS Batch No.	Text	[NR]	[NR]	[NR]
External	Hydrocarbon Banding (TPH)	Text	[NR]	Complete	Complete
5.304F	Aluminium (Soluble) as Al	mg/L	0.021	<0.005	1.1
5.304F	Arsenic (Soluble) as As	mg/L	0.017	0.019	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.033	0.79	0.32
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	0.001	<0.001	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	<0.002	<0.002	0.16
5.304F	Iron (Soluble) as Fe	mg/L	2.6	13	0.90
5.304F	Manganese (Soluble) as Mn	mg/L	0.67	8.8	0.58
5.304F	Nickel (Soluble) as Ni	mg/L	<0.002	0.008	0.017
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	0.045
5.304F	Zinc (Soluble) as Zn	mg/L	0.026	0.47	0.45
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

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CERTIFICATE OF ANALYSIS

Client	: **BRISBANE CITY COUNCIL**	*Laboratory*	: **ALS Environmental Brisbane**	*Page*	: **1 of 17**
Contact	: **MS PATTI O`SHEA**	*Contact*	: **Michael Heery**	*Work Order*	: **EB0601542**
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Project	: **E1602-3**	*Quote number*	: **BN/281a/05**	*Date received*	: **16 Feb 2006**
Order number	: **- Not provided -**			*Date issued*	: **7 Mar 2006**
C-O-C number	: **- Not provided -**			*No. of samples*	- *Received* : **7**
Site	: **- Not provided -**				*Analysed* : **7**

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This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	*Position*	*Department*
Carsten Emrich	**Senior Organic Chemist**	**Organics - NATA 818 (Brisbane)**

ALS Environmental

Comments

This report for the ALSE reference EB0601542 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical results for samples submitted**

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

- **Surrogate control limits**

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Specific comments for Work Order **EB0601542**

EP075: Poor surrogate recovery due to possible matrix interference. Insufficient sample for re-extraction.

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID :				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	5	µg/L	<5	<5	<5	<5	<5
Toluene	108-88-3	5	µg/L	<5	<5	<5	<5	<5
Ethylbenzene	100-41-4	5	µg/L	<5	<5	<5	<5	<5
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5	<5	<5	<5	<5
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5	<5
ortho-Xylene	95-47-6	5	µg/L	<5	<5	<5	<5	<5
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5	<5
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5	<5
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5	<5
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5	<5
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5	<5
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5	<5
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5	<5	<5
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50	<50	<50
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50	<50	<50
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50	<50	<50
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5	<5	<5
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	<10	<10	<10	<10
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	<10	<10	<10	<10
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L	<50	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L	<50	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L	<50	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L	<50	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	<50	<50	<50
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	<5	<5	<5

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description:				WATER	WATER	WATER	WATER	WATER
Sample Date / Time:				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID:				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP074E: Halogenated Aliphatic Compounds								
Iodomethane	74-88-4	5	µg/L	<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	<5	<5	<5
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	<5	<5	<5
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	<5	<5	<5
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	<5	<5	<5
Trichloroethene	79-01-6	5	µg/L	<5	<5	<5	<5	<5
Dibromomethane	74-95-3	5	µg/L	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5	<5	<5
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5	<5	<5
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5	<5	<5
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	<5	<5	<5
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5	<5	<5
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5	<5	<5
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	<5
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	<5
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5	<5	<5
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	5
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	9
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	<5

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID :				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP074H: Naphthalene								
Naphthalene	91-20-3	7	µg/L	<7	<7	<7	<7	<7
EP075A: Phenolic Compounds								
Phenol	108-95-2	2	µg/L	<2	<2	<2	<2	<2
2-Chlorophenol	95-57-8	2	µg/L	<2	<2	<2	<2	<2
2-Methylphenol	95-48-7	2	µg/L	<2	<2	<2	<2	<2
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	<2	<2	<2	<2
2-Nitrophenol	88-75-5	2	µg/L	<2	<2	<2	<2	<2
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	<2	<2	<2
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	<2	<2	<2
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	<2	<2	<2
4-Chloro-3-Methylphenol	59-50-7	2	µg/L	<2	<2	<2	<2	<2
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	<2	<2	<2
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	<2	<2	<2
Pentachlorophenol	87-86-5	4	µg/L	<4	<4	<4	<4	<4
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	<2	<2	<2	<2
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	<2	<2	<2
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	<2	<2	<2
Acenaphthylene	208-96-8	2	µg/L	<2	<2	<2	<2	<2
Acenaphthene	83-32-9	2	µg/L	<2	<2	<2	<2	<2
Fluorene	86-73-7	2	µg/L	<2	<2	<2	<2	<2
Phenanthrene	85-01-8	2	µg/L	<2	<2	<2	<2	<2
Anthracene	120-12-7	2	µg/L	<2	<2	<2	<2	<2
Fluoranthene	206-44-0	2	µg/L	<2	<2	<2	<2	<2
Pyrene	129-00-0	2	µg/L	<2	<2	<2	<2	<2
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	<2	<2	<2
Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	<2	<2	<2
Chrysene	218-01-9	2	µg/L	<2	<2	<2	<2	<2
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	<4	<4	<4
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	<2	<2	<2
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	<2	<2	<2
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	<2	<2	<2
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	<2	<2	<2
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID :				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	<2	<2	<2
Diethyl phthalate	84-66-2	2	µg/L	<2	<2	<2	<2	<2
Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2	<2	<2	<2
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	<2	<2	<2
bis(2-ethylhexyl) phthalate	117-81-7	20	µg/L	80	60	<20	<20	30
Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2	<2	<2	<2
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4	<4	<4	<4
N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2	<2	<2	<2
N-Nitrosodiphenyl & Diphenylamine	86-30-6	4	µg/L	<4	<4	<4	<4	<4
Methapyrilene	91-80-5	2	µg/L	<2	<2	<2	<2	<2
EP075E: Nitroaromatics and Ketones								
Acetophenone	98-86-2	2	µg/L	<2	<2	<2	<2	<2
Nitrobenzene	98-95-3	2	µg/L	<2	<2	<2	<2	<2
Isophorone	78-59-1	2	µg/L	<2	<2	<2	<2	<2
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4	<4	<4	<4
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4	<4	<4	<4
1-Naphthylamine	134-32-7	2	µg/L	<2	<2	<2	<2	<2
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2	<2	<2	<2
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2	<2	<2	<2
Azobenzene	103-33-3	2	µg/L	<2	<2	<2	<2	<2
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2	<2	<2	<2
Phenacetin	62-44-2	2	µg/L	<2	<2	<2	<2	<2
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2	<2	<2	<2
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2	<2	<2	<2
Pronamide	23950-58-5	2	µg/L	<2	<2	<2	<2	<2
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2	<2	<2	<2
Chlorobenzilate	510-15-6	2	µg/L	<2	<2	<2	<2	<2
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2	<2	<2	<2
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description :				WATER	WATER	WATER	WATER	WATER
Sample Date / Time :				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID :				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP075F: Haloethers								
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2	<2	<2
EP075G: Chlorinated Hydrocarbons								
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2	<2	<2
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2	<2	<2
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2	<2	<2
Hexachloroethane	67-72-1	2	µg/L	<2	<2	<2	<2	<2
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	<4	<4	<4
EP075H: Anilines and Benzidines								
Aniline	62-53-3	2	µg/L	<2	<2	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L	<2	<2	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L	<4	<4	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L	<4	<4	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L	<2	<2	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L	<2	<2	<2	<2	<2
Carbazole	86-74-8	2	µg/L	<2	<2	<2	<2	<2
3.3'-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	<2	<2	<2
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	2	µg/L	<2	<2	<2	<2	<2
beta-BHC	319-85-7	2	µg/L	<2	<2	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L	<2	<2	<2	<2	<2
delta-BHC	319-86-8	2	µg/L	<2	<2	<2	<2	<2
Heptachlor	76-44-8	2	µg/L	<2	<2	<2	<2	<2
Aldrin	309-00-2	2	µg/L	<2	<2	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	<2	<2	<2
4.4'-DDE	72-55-9	2	µg/L	<2	<2	<2	<2	<2
Dieldrin	60-57-1	2	µg/L	<2	<2	<2	<2	<2
Endrin	72-20-8	2	µg/L	<2	<2	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	<2	<2	<2
4.4'-DDD	72-54-8	2	µg/L	<2	<2	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
Sample Matrix Type / Description:				WATER	WATER	WATER	WATER	WATER
Sample Date / Time:				15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
Laboratory Sample ID:				EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005
EP075I: Organochlorine Pesticides								
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	<2	<2	<2
4.4'-DDT	50-29-3	4	µg/L	<4	<4	<4	<4	<4
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	2	µg/L	<2	<2	<2	<2	<2
Dimethoate	60-51-5	2	µg/L	<2	<2	<2	<2	<2
Diazinon	333-41-5	2	µg/L	<2	<2	<2	<2	<2
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	<2	<2	<2
Malathion	121-75-5	2	µg/L	<2	<2	<2	<2	<2
Fenthion	55-38-9	2	µg/L	<2	<2	<2	<2	<2
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	<2	<2	<2
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	<2	<2	<2
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	<2	<2	<2
Prothiofos	34643-46-4	2	µg/L	<2	<2	<2	<2	<2
Ethion	563-12-2	2	µg/L	<2	<2	<2	<2	<2
EP075K: Miscellaneous Compounds								
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2	<2	<2	<2
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2	<2	<2	<2
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2	<2	<2	<2
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<2	<2	<2	<2
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2	<2	<2	<2
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2	<2	<2	<2
Safrole	94-59-7	2	µg/L	<2	<2	<2	<2	<2
Diallate	2303-16-4	2	µg/L	<2	<2	<2	<2	<2
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2	<2	<2	<2
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	96.8	105	107	88.6	89.7
Toluene-D8	2037-26-5	0.1	%	108	105	109	103	99.2
4-Bromofluorobenzene	460-00-4	0.1	%	106	104	110	97.3	94.4
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.1	%	39.6	36.6	40.8	39.7	41.0
Phenol-d6	13127-88-3	0.1	%	28.4	28.5	29.2	25.8	24.7
2-Chlorophenol-D4	93951-73-6	0.1	%	62.8	54.9	65.0	47.3	59.2
2.4.6-Tribromophenol	118-79-6	0.1	%	72.8	71.8	63.8	34.7	56.0
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.1	%	52.3	41.0	63.9	38.7	60.2
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%	5.9	5.2	54.4	31.3	49.2

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Analytical Results

	Client Sample ID :	06/01873/1 APL25D	06/01873/2 APL25S	06/01873/4 APL07S	06/01873/6 APL23	06/01873/7 APL22
	Sample Matrix Type / Description :	WATER	WATER	WATER	WATER	WATER
	Sample Date / Time :	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00	15 Feb 2006 15:00
	Laboratory Sample ID :	EB0601542-001	EB0601542-002	EB0601542-003	EB0601542-004	EB0601542-005

Analyte	CAS number	LOR	Units					
EP075T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	13.9	7.2	68.9	35.9	58.5
Anthracene-d10	1719-06-8	0.1	%	75.4	68.8	62.8	38.2	60.6
4-Terphenyl-d14	1718-51-0	0.1	%	96.1	92.9	83.4	45.0	75.1

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 06/01873/14 NST2-17 Sample Matrix Type / Description: WATER Sample Date / Time: 16 Feb 2006 15:00 Laboratory Sample ID: EB0601542-006	Client Sample ID: 06/01873/15 APL20 Sample Matrix Type / Description: WATER Sample Date / Time: 16 Feb 2006 15:00 Laboratory Sample ID: EB0601542-007			
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	5	µg/L	<5	2580			
Toluene	108-88-3	5	µg/L	<5	59			
Ethylbenzene	100-41-4	5	µg/L	<5	175			
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5	268			
Styrene	100-42-5	5	µg/L	<5	<5			
ortho-Xylene	95-47-6	5	µg/L	<5	588			
Isopropylbenzene	98-82-8	5	µg/L	<5	25			
n-Propylbenzene	103-65-1	5	µg/L	<5	19			
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	59			
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5			
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	132			
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5			
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5			
n-Butylbenzene	104-51-8	5	µg/L	<5	<5			
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	<50			
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50			
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50			
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50			
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	<5			
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5			
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5			
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	<10			
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	<10			
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5			
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50			
Chloromethane	74-87-3	50	µg/L	<50	<50			
Vinyl chloride	75-01-4	50	µg/L	<50	<50			
Bromomethane	74-83-9	50	µg/L	<50	<50			
Chloroethane	75-00-3	50	µg/L	<50	<50			
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50			
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5			

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 06/01873/14 NST2-17	06/01873/15 APL20			
Sample Matrix Type / Description:				WATER	WATER			
Sample Date / Time:				16 Feb 2006 15:00	16 Feb 2006 15:00			
Laboratory Sample ID:				EB0601542-006	EB0601542-007			
EP074E: Halogenated Aliphatic Compounds								
Iodomethane	74-88-4	5	µg/L	<5	<5			
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5			
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5			
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5			
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5			
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5			
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5			
1.2-Dichloroethane	107-06-2	5	µg/L	<5	30			
Trichloroethene	79-01-6	5	µg/L	<5	<5			
Dibromomethane	74-95-3	5	µg/L	<5	<5			
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5			
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5			
Tetrachloroethene	127-18-4	5	µg/L	<5	<5			
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5			
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5			
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5			
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5			
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5			
Pentachloroethane	76-01-7	5	µg/L	<5	<5			
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5			
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5			
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5			
Bromobenzene	108-86-1	5	µg/L	<5	<5			
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5			
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5			
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5			
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5			
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5			
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5			
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5			
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5			
Bromodichloromethane	75-27-4	5	µg/L	<5	<5			
Dibromochloromethane	124-48-1	5	µg/L	<5	<5			
Bromoform	75-25-2	5	µg/L	<5	<5			

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/14 NST2-17	06/01873/15 APL20			
Sample Matrix Type / Description :				WATER	WATER			
Sample Date / Time :				16 Feb 2006 15:00	16 Feb 2006 15:00			
Laboratory Sample ID :				EB0601542-006	EB0601542-007			
EP074H: Naphthalene								
Naphthalene	91-20-3	7	µg/L	<7	42			
EP075A: Phenolic Compounds								
Phenol	108-95-2	2	µg/L	<2	18			
2-Chlorophenol	95-57-8	2	µg/L	<2	<2			
2-Methylphenol	95-48-7	2	µg/L	<2	<2			
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	<2			
2-Nitrophenol	88-75-5	2	µg/L	<2	<2			
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	4			
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2			
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2			
4-Chloro-3-Methylphenol	59-50-7	2	µg/L	<2	<2			
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2			
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2			
Pentachlorophenol	87-86-5	4	µg/L	<4	<4			
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	29			
2-Methylnaphthalene	91-57-6	2	µg/L	<2	2			
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2			
Acenaphthylene	208-96-8	2	µg/L	<2	<2			
Acenaphthene	83-32-9	2	µg/L	<2	<2			
Fluorene	86-73-7	2	µg/L	<2	<2			
Phenanthrene	85-01-8	2	µg/L	<2	<2			
Anthracene	120-12-7	2	µg/L	<2	<2			
Fluoranthene	206-44-0	2	µg/L	<2	<2			
Pyrene	129-00-0	2	µg/L	<2	<2			
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2			
Benz(a)anthracene	56-55-3	2	µg/L	<2	<2			
Chrysene	218-01-9	2	µg/L	<2	<2			
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4			
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2			
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2			
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2			
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2			
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2			
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2			

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/14 NST2-17	06/01873/15 APL20			
Sample Matrix Type / Description :				WATER	WATER			
Sample Date / Time :				16 Feb 2006 15:00	16 Feb 2006 15:00			
Laboratory Sample ID :				EB0601542-006	EB0601542-007			
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	2	µg/L	<2	<2			
Diethyl phthalate	84-66-2	2	µg/L	<2	<2			
Di-n-butyl phthalate	84-74-2	2	µg/L	<2	<2			
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2			
bis(2-ethylhexyl) phthalate	117-81-7	20	µg/L	<20	<20			
Di-n-octylphthalate	117-84-0	2	µg/L	<2	<2			
EP075D: Nitrosamines								
N-Nitrosomethylethylamine	10595-95-6	2	µg/L	<2	<2			
N-Nitrosodiethylamine	55-18-5	2	µg/L	<2	<2			
N-Nitrosopyrrolidine	930-55-2	4	µg/L	<4	<4			
N-Nitrosomorpholine	59-89-2	2	µg/L	<2	<2			
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L	<2	<2			
N-Nitrosopiperidine	100-75-4	2	µg/L	<2	<2			
N-Nitrosodibutylamine	924-16-3	2	µg/L	<2	<2			
N-Nitrosodiphenyl & Diphenylamine	86-30-6	4	µg/L	<4	<4			
Methapyrilene	91-80-5	2	µg/L	<2	<2			
EP075E: Nitroaromatics and Ketones								
Acetophenone	98-86-2	2	µg/L	<2	10			
Nitrobenzene	98-95-3	2	µg/L	<2	<2			
Isophorone	78-59-1	2	µg/L	<2	<2			
2.6-Dinitrotoluene	606-20-2	4	µg/L	<4	<4			
2.4-Dinitrotoluene	121-14-2	4	µg/L	<4	<4			
1-Naphthylamine	134-32-7	2	µg/L	<2	<2			
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L	<2	<2			
5-Nitro-o-toluidine	99-55-8	2	µg/L	<2	<2			
Azobenzene	103-33-3	2	µg/L	<2	<2			
1.3.5-Trinitrobenzene	99-35-4	2	µg/L	<2	<2			
Phenacetin	62-44-2	2	µg/L	<2	<2			
4-Aminobiphenyl	92-67-1	2	µg/L	<2	<2			
Pentachloronitrobenzene	82-68-8	2	µg/L	<2	<2			
Pronamide	23950-58-5	2	µg/L	<2	<2			
Dimethylaminoazobenzene	60-11-7	2	µg/L	<2	<2			
Chlorobenzilate	510-15-6	2	µg/L	<2	<2			
EP075F: Haloethers								
Bis(2-chloroethyl) ether	111-44-4	2	µg/L	<2	<2			
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2			

ALS Environmental

Analytical Results

	Client Sample ID :	06/01873/14 NST2-17	06/01873/15 APL20			
	Sample Matrix Type / Description :	WATER	WATER			
	Sample Date / Time :	16 Feb 2006 15:00	16 Feb 2006 15:00			
	Laboratory Sample ID :					
Analyte	CAS number / LOR / Units	EB0601542-006	EB0601542-007			
EP075F: Haloethers						
4-Chlorophenyl phenyl ether	7005-72-3 / 2 / µg/L	<2	<2			
4-Bromophenyl phenyl ether	101-55-3 / 2 / µg/L	<2	<2			
EP075G: Chlorinated Hydrocarbons						
1.4-Dichlorobenzene	106-46-7 / 2 / µg/L	<2	<2			
1.3-Dichlorobenzene	541-73-1 / 2 / µg/L	<2	<2			
1.2-Dichlorobenzene	95-50-1 / 2 / µg/L	<2	<2			
Hexachloroethane	67-72-1 / 2 / µg/L	<2	<2			
1.2.4-Trichlorobenzene	120-82-1 / 2 / µg/L	<2	<2			
Hexachloropropylene	1888-71-7 / 2 / µg/L	<2	<2			
Hexachlorobutadiene	87-68-3 / 2 / µg/L	<2	<2			
Hexachlorocyclopentadiene	77-47-4 / 10 / µg/L	<10	<10			
Pentachlorobenzene	608-93-5 / 2 / µg/L	<2	<2			
Hexachlorobenzene (HCB)	118-74-1 / 4 / µg/L	<4	<4			
EP075H: Anilines and Benzidines						
Aniline	62-53-3 / 2 / µg/L	<2	<2			
4-Chloroaniline	106-47-8 / 2 / µg/L	<2	<2			
2-Nitroaniline	88-74-4 / 4 / µg/L	<4	<4			
3-Nitroaniline	99-09-2 / 4 / µg/L	<4	<4			
Dibenzofuran	132-64-9 / 2 / µg/L	<2	<2			
4-Nitroaniline	100-01-6 / 2 / µg/L	<2	<2			
Carbazole	86-74-8 / 2 / µg/L	<2	<2			
3.3'-Dichlorobenzidine	91-94-1 / 2 / µg/L	<2	<2			
EP075I: Organochlorine Pesticides						
alpha-BHC	319-84-6 / 2 / µg/L	<2	<2			
beta-BHC	319-85-7 / 2 / µg/L	<2	<2			
gamma-BHC	58-89-9 / 2 / µg/L	<2	<2			
delta-BHC	319-86-8 / 2 / µg/L	<2	<2			
Heptachlor	76-44-8 / 2 / µg/L	<2	<2			
Aldrin	309-00-2 / 2 / µg/L	<2	<2			
Heptachlor epoxide	1024-57-3 / 2 / µg/L	<2	<2			
alpha-Endosulfan	959-98-8 / 2 / µg/L	<2	<2			
4.4'-DDE	72-55-9 / 2 / µg/L	<2	<2			
Dieldrin	60-57-1 / 2 / µg/L	<2	<2			
Endrin	72-20-8 / 2 / µg/L	<2	<2			
beta-Endosulfan	33213-65-9 / 2 / µg/L	<2	<2			
4.4'-DDD	72-54-8 / 2 / µg/L	<2	<2			

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/01873/14 NST2-17	06/01873/15 APL20			
Sample Matrix Type / Description :				WATER	WATER			
Sample Date / Time :				16 Feb 2006 15:00	16 Feb 2006 15:00			
Laboratory Sample ID :				EB0601542-006	EB0601542-007			
EP075I: Organochlorine Pesticides								
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2			
4.4'-DDT	50-29-3	4	µg/L	<4	<4			
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	2	µg/L	<2	<2			
Dimethoate	60-51-5	2	µg/L	<2	<2			
Diazinon	333-41-5	2	µg/L	<2	<2			
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2			
Malathion	121-75-5	2	µg/L	<2	<2			
Fenthion	55-38-9	2	µg/L	<2	<2			
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2			
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2			
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2			
Prothiofos	34643-46-4	2	µg/L	<2	<2			
Ethion	563-12-2	2	µg/L	<2	<2			
EP075K: Miscellaneous Compounds								
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2			
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2			
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2			
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<2			
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2			
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2			
Safrole	94-59-7	2	µg/L	<2	<2			
Diallate	2303-16-4	2	µg/L	<2	<2			
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2			
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	96.2	88.3			
Toluene-D8	2037-26-5	0.1	%	101	109			
4-Bromofluorobenzene	460-00-4	0.1	%	96.0	103			
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.1	%	48.7	61.2			
Phenol-d6	13127-88-3	0.1	%	30.4	60.8			
2-Chlorophenol-D4	93951-73-6	0.1	%	71.9	82.0			
2.4.6-Tribromophenol	118-79-6	0.1	%	76.3	85.9			
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.1	%	77.7	100			
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%	65.9	70.2			

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Analytical Results

	Client Sample ID :	06/01873/14 NST2-17	06/01873/15 APL20			
	Sample Matrix Type / Description :	WATER	WATER			
	Sample Date / Time :	16 Feb 2006 15:00	16 Feb 2006 15:00			
	Laboratory Sample ID :	EB0601542-006	EB0601542-007			
Analyte	*CAS number*	*LOR*	*Units*			
EP075T: Base/Neutral Extractable Surrogates						
2-Fluorobiphenyl	321-60-8	0.1	%	75.7	83.7	
Anthracene-d10	1719-06-8	0.1	%	79.0	84.4	
4-Terphenyl-d14	1718-51-0	0.1	%	98.9	102	

ALS Environmental

Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	80	120
	Toluene-D8	88	110
	4-Bromofluorobenzene	86	115
EP075: Semivolatile Organic Compounds			
EP075S: Acid Extractable Surrogates	2-Fluorophenol	21	100
	Phenol-d6	10	94
	2-Chlorophenol-D4	23	134
	2,4,6-Tribromophenol	10	123
EP075T: Base/Neutral Extractable Surrogates	Nitrobenzene-D5	35	114
	1,2-Dichlorobenzene-D4	32	129
	2-Fluorobiphenyl	43	116
	Anthracene-d10	27	133
	4-Terphenyl-d14	33	141

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BRISBANE CITY COUNCIL	Laboratory	: ALS Environmental Brisbane	Page	: 1 of 4
Contact	: MS PATTI O`SHEA	Contact	: Michael Heery	Work Order	: EB0602258
Address	: ANALYTICAL SERVICES SECTION 240 DONALDSON ROAD ROCKLEA QLD AUSTRALIA 4106	Address	: 32 Shand Street Stafford QLD Australia 4053		
E-mail	: Patti.O''Shea@brisbane.qld.gov.au	E-mail	: Michael.Heery@alsenviro.com		
Telephone	: 07 3403 2622	Telephone	: 61-7-32437222		
Facsimile	: 07 3403 2646	Facsimile	: 61-7-32437259		
Project	: - Not provided -	Quote number	: BN/281a/05	Date received	: 8 Mar 2006
Order number	: - Not provided -			Date issued	: 22 Mar 2006
C-O-C number	: - Not provided -			No. of samples	- Received : 3
Site	: - Not provided -				Analysed : 3

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Signatory	Position	Department
Carsten Emrich	Senior Organic Chemist	Organics - NATA 825 (818 - Brisbane)

ALS Environmental

Comments

This report for the ALSE reference EB0602258 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical results for samples submitted**

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

- **Surrogate control limits**

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

ALS Environmental

Analytical Results

	Client Sample ID :	06/01873/14	06/01873/15	06/01873/4		
	Sample Matrix Type / Description :	WATER	WATER	WATER		
	Sample Date / Time :	16 Feb 2006 15:00	16 Feb 2006 15:00	16 Feb 2006 15:00		
	Laboratory Sample ID :	EB0602258-001	EB0602258-002	EB0602258-003		
Analyte	CAS number	LOR	Units			
EP080/071: Total Petroleum Hydrocarbons						
C6 - C9 Fraction		20	µg/L	<20	5750	<20
C10 - C14 Fraction		50	µg/L	<50	<50	<50
C15 - C28 Fraction		100	µg/L	<100	<100	<100
C29 - C36 Fraction		50	µg/L	<50	<50	<50
EP080S: TPH(V)/BTEX Surrogates						
1.2-Dichloroethane-D4	17060-07-0	0.1	%	96.2	88.3	107
Toluene-D8	2037-26-5	0.1	%	101	109	109
4-Bromofluorobenzene	460-00-4	0.1	%	96.0	103	110

ALS Environmental

Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP080: TPH Volatiles/BTEX			
EP080S: TPH(V)/BTEX Surrogates	1,2-Dichloroethane-D4	80	120
	Toluene-D8	88	110
	4-Bromofluorobenzene	86	115

Scientific Analytical Services

ABN 72 002 765 795

240 Donaldson Road
Rocklea Brisbane Qld 4106

Telephone 07 3403 2611
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A unit of Brisbane City Council

SCIENTIFIC ANALYTICAL SERVICES LABORATORY REPORT

Client:	Chris Thorley City Design, Ground Engineering St Paul's Tce Fortitude Valley QLD
Job Name:	G1335 Airport Link
Sampled By:	Client
Sampling Date:	6/04/2006
Sampling Method:	Grab
Sample Matrix:	Aqueous
Batch Number:	06/03872
Registration Date:	6 April 2006
Date of Report:	28 April 2006

Patti O'Shea
Supervising Chemist

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

Client: City Design, Ground Engineering **Batch Number:** 06/03872
Job Name: G1335 **Report Date:** 28/04/06

Method	Test	Units	06/03872/1 APL 07S 6/04/2006 09:10	06/03872/2 APL 25S 6/04/2006 10:05	06/03872/3 APL 25D 6/04/2006 09:45	06/03872/4 APL 30 6/04/2006 10:45
1.002	pH	pH Unit	6.5	5.9	7.1	7.9
1.007	Conductivity @ 25°C	uS/cm	1,700	1,000	2,500	980
1.619*	Total Dissolved Solids	mg/L	1,310	540	1,570	480
5.304F	Calcium (Soluble) as Ca	mg/L	39	15	44	32
5.304F	Magnesium (Soluble) as Mg	mg/L	30	30	50	18
5.304F	Sodium (Soluble) as Na	mg/L	290	140	480	250
5.304F	Potassium (Soluble) as K	mg/L	5.4	5.4	5.7	5.4
FIA.109	Chloride	mg/L	440	270	600	220
5.304F	Sulphur as SO4 (Soluble)	mg/L	39	57	42	8.8
1.012	Total Alkalinity as $CaCO_3$	mg/L	150	35	270	160
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	150	35	270	150
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	<1.0	1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.35	<0.06	0.078	0.20
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.038	0.088	0.12	0.035
FIA.011A	Ortho Phosphorus as P	mg/L	<0.02	0.020	0.026	0.021
External	ALS Batch No.	Text	EB0603430	[NR]	[NR]	[NR]
5.304F	Aluminium (Soluble) as Al	mg/L	0.033	0.021	0.076	0.11
5.304F	Arsenic (Soluble) as As	mg/L	<0.01	<0.01	<0.01	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.32	0.11	0.14	0.21
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	<0.001	<0.001
5.304F	Chromium (Soluble) as Cr	mg/L	0.001	0.001	0.002	<0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.002	0.022	0.11	0.006
5.304F	Iron (Soluble) as Fe	mg/L	17	0.52	0.60	0.084
5.304F	Manganese (Soluble) as Mn	mg/L	1.1	0.69	0.62	0.078
5.304F	Nickel (Soluble) as Ni	mg/L	<0.002	0.011	0.005	<0.002
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	<0.005	<0.005
5.304F	Zinc (Soluble) as Zn	mg/L	0.060	0.11	0.23	0.011
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10	<0.10

Please note that for samples not collected by SAS Laboratory, the above results refer only to the samples tested, and not to the batches from which they were drawn.

Client: City Design, Ground Engineering **Batch Number:** 06/03872
Job Name: G1335 **Report Date:** 28/04/06

Method	Test	Units	06/03872/5 APL 22 6/04/2006 11:35	06/03872/6 APL 23 6/04/2006 12:05	06/03872/7 APL 20 6/04/2006 13:20
1.002	pH	pH Unit	6.9	6.5	4.4
1.007	Conductivity @ 25°C	uS/cm	660	490	1,400
1.619*	Total Dissolved Solids	mg/L	416	293	775
5.304F	Calcium (Soluble) as Ca	mg/L	18	5.2	9.7
5.304F	Magnesium (Soluble) as Mg	mg/L	13	3.6	32
5.304F	Sodium (Soluble) as Na	mg/L	61	89	240
5.304F	Potassium (Soluble) as K	mg/L	5.0	2.4	8.5
FIA.109	Chloride	mg/L	140	97	430
5.304F	Sulphur as SO4 (Soluble)	mg/L	20	12	13
1.012	Total Alkalinity as $CaCO_3$	mg/L	96	70	<1.0
5.012	Bicarbonate Alkalinity as $CaCO_3$	mg/L	96	70	<1.0
5.012	Carbonate Alkalinity as $CaCO_3$	mg/L	<1.0	<1.0	<1.0
1.609*	Diss. Sulphide as S	mg/L	<0.10	<0.10	<0.10
FIA.008	Ammonia N	mg/L	0.11	0.068	<0.06
FIA.010C	Nitrate N by FIA (Calc)	mg/L	0.12	0.058	<0.01
FIA.011A	Ortho Phosphorus as P	mg/L	0.028	<0.02	0.064
External	ALS Batch No.	Text	[NR]	[NR]	[NR]
5.304F	Aluminium (Soluble) as Al	mg/L	0.018	0.020	1.7
5.304F	Arsenic (Soluble) as As	mg/L	<0.01	<0.01	<0.01
5.304F	Barium (Soluble) as Ba	mg/L	0.061	0.055	0.38
5.304F	Cadmium (Soluble) as Cd	mg/L	<0.001	<0.001	0.001
5.304F	Chromium (Soluble) as Cr	mg/L	<0.001	<0.001	0.001
5.304F	Copper (Soluble) as Cu	mg/L	0.013	0.017	0.41
5.304F	Iron (Soluble) as Fe	mg/L	0.15	0.048	1.2
5.304F	Manganese (Soluble) as Mn	mg/L	0.14	0.10	0.68
5.304F	Nickel (Soluble) as Ni	mg/L	0.003	0.002	0.021
5.304F	Lead (Soluble) as Pb	mg/L	<0.005	<0.005	0.11
5.304F	Zinc (Soluble) as Zn	mg/L	0.19	0.16	0.77
5.303F	Mercury (Soluble)	ug/L	<0.10	<0.10	<0.10

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: BRISBANE CITY COUNCIL	Laboratory	: ALS Environmental Brisbane	Page	: 1 of 10
Contact	: MS PATTI O`SHEA	Contact	: Michael Heery	Work Order	: EB0603430
Address	: ANALYTICAL SERVICES SECTION 240 DONALDSON ROAD ROCKLEA QLD AUSTRALIA 4106	Address	: 32 Shand Street Stafford QLD Australia 4053		
E-mail	: Patti.O''Shea@brisbane.qld.gov.au	E-mail	: Michael.Heery@alsenviro.com		
Telephone	: 07 3403 2622	Telephone	: 61-7-32437222		
Facsimile	: 07 3403 2646	Facsimile	: 61-7-32437259		
Project	: E0704-2	Quote number	: BN/281a/05	Date received	: 7 Apr 2006
Order number	: - Not provided -			Date issued	: 27 Apr 2006
C-O-C number	: - Not provided -			No. of samples	- Received : 3
Site	: - Not provided -				Analysed : 3

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Signatory	Position	Department
Aaron Stott	Senior Organic Chemist	Organics - NATA 825 (13778 - Melbourne)

ALS Environmental

Comments

This report for the ALSE reference EB0603430 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical results for samples submitted**

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

- **Surrogate control limits**

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Specific comments for Work Order **EB0603430**

EP080 was conducted by ALS Melbourne, NATA accreditation no. 825, site no 13778

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
				Sample Matrix Type / Description : WATER	WATER	WATER		
				Sample Date / Time : 6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
				Laboratory Sample ID : EB0603430-001	EB0603430-002	EB0603430-003		
EP074A: Monocyclic Aromatic Hydrocarbons								
Benzene	71-43-2	5	µg/L	<5	<5	124		
Toluene	108-88-3	5	µg/L	<5	<5	<5		
Ethylbenzene	100-41-4	5	µg/L	<5	<5	10		
meta- & para-Xylene	108-38-3 106-42-3	5	µg/L	<5	<5	21		
Styrene	100-42-5	5	µg/L	<5	<5	<5		
ortho-Xylene	95-47-6	5	µg/L	<5	<5	42		
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5		
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5		
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5		
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5		
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	6		
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5		
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5		
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5		
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50		
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50		
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50		
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50		
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5		
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5		
1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5		
cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	<10	<10		
trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	<10	<10		
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	<5		
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	<50		
Chloromethane	74-87-3	50	µg/L	<50	<50	<50		
Vinyl chloride	75-01-4	50	µg/L	<50	<50	<50		
Bromomethane	74-83-9	50	µg/L	<50	<50	<50		
Chloroethane	75-00-3	50	µg/L	<50	<50	<50		
Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	<50		
1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	<5		

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
				Sample Matrix Type / Description : WATER	WATER	WATER		
				Sample Date / Time : 6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
				Laboratory Sample ID : EB0603430-001	EB0603430-002	EB0603430-003		
EP074E: Halogenated Aliphatic Compounds								
Iodomethane	74-88-4	5	µg/L	<5	<5	<5		
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	<5		
1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	<5		
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	<5		
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	<5		
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	<5		
Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	<5		
1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	<5		
Trichloroethene	79-01-6	5	µg/L	<5	<5	<5		
Dibromomethane	74-95-3	5	µg/L	<5	<5	<5		
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	<5		
1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	<5		
Tetrachloroethene	127-18-4	5	µg/L	<5	<5	<5		
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	<5		
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	<5		
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	<5		
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	<5		
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	<5		
Pentachloroethane	76-01-7	5	µg/L	<5	<5	<5		
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	<5		
Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	<5		
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	<5	<5		
Bromobenzene	108-86-1	5	µg/L	<5	<5	<5		
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5		
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5		
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5		
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5		
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5		
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5		
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5		
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	<5	<5		
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5		
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5		
Bromoform	75-25-2	5	µg/L	<5	<5	<5		

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Analytical Results

	Client Sample ID :	06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
	Sample Matrix Type / Description :	WATER	WATER	WATER		
	Sample Date / Time :	6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
	Laboratory Sample ID :	EB0603430-001	EB0603430-002	EB0603430-003		
Analyte	CAS number	LOR	Units			
EP074H: Naphthalene						
Naphthalene	91-20-3	7	µg/L	<7	<7	<7
EP075A: Phenolic Compounds						
Phenol	108-95-2	2	µg/L	<2	<2	14
2-Chlorophenol	95-57-8	2	µg/L	<2	<2	<2
2-Methylphenol	95-48-7	2	µg/L	<2	<2	<2
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2	<2	<2
2-Nitrophenol	88-75-5	2	µg/L	<2	<2	<2
2.4-Dimethylphenol	105-67-9	2	µg/L	<2	<2	8
2.4-Dichlorophenol	120-83-2	2	µg/L	<2	<2	<2
2.6-Dichlorophenol	87-65-0	2	µg/L	<2	<2	<2
4-Chloro-3-Methylphenol	59-50-7	2	µg/L	<2	<2	<2
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	<2
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	<2
Pentachlorophenol	87-86-5	4	µg/L	<4	<4	<4
EP075B: Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	2	µg/L	<2	<2	9
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	<2
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	<2
Acenaphthylene	208-96-8	2	µg/L	<2	<2	<2
Acenaphthene	83-32-9	2	µg/L	<2	<2	<2
Fluorene	86-73-7	2	µg/L	<2	<2	<2
Phenanthrene	85-01-8	2	µg/L	<2	<2	<2
Anthracene	120-12-7	2	µg/L	<2	<2	<2
Fluoranthene	206-44-0	2	µg/L	<2	<2	<2
Pyrene	129-00-0	2	µg/L	<2	<2	<2
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	<2
Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	<2
Chrysene	218-01-9	2	µg/L	<2	<2	<2
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	<4
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	<2
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	<2
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	<2
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	<2
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	<2
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	<2

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Analytical Results

	Client Sample ID :	06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
	Sample Matrix Type / Description :	WATER	WATER	WATER		
	Sample Date / Time :	6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
	Laboratory Sample ID :	EB0603430-001	EB0603430-002	EB0603430-003		
Analyte	CAS number / LOR / Units					
EP075C: Phthalate Esters						
Dimethyl phthalate	131-11-3 / 2 / µg/L	<2	<2	<2		
Diethyl phthalate	84-66-2 / 2 / µg/L	<2	<2	<2		
Di-n-butyl phthalate	84-74-2 / 2 / µg/L	<2	<2	<2		
Butyl benzyl phthalate	85-68-7 / 2 / µg/L	<2	<2	<2		
bis(2-ethylhexyl) phthalate	117-81-7 / 20 / µg/L	<20	<20	30		
Di-n-octylphthalate	117-84-0 / 2 / µg/L	<2	<2	<2		
EP075D: Nitrosamines						
N-Nitrosomethylethylamine	10595-95-6 / 2 / µg/L	<2	<2	<2		
N-Nitrosodiethylamine	55-18-5 / 2 / µg/L	<2	<2	<2		
N-Nitrosopyrrolidine	930-55-2 / 4 / µg/L	<4	<4	<4		
N-Nitrosomorpholine	59-89-2 / 2 / µg/L	<2	<2	<2		
N-Nitrosodi-n-propylamine	621-64-7 / 2 / µg/L	<2	<2	<2		
N-Nitrosopiperidine	100-75-4 / 2 / µg/L	<2	<2	<2		
N-Nitrosodibutylamine	924-16-3 / 2 / µg/L	<2	<2	<2		
N-Nitrosodiphenyl & Diphenylamine	86-30-6 / 4 / µg/L	<4	<4	<4		
Methapyrilene	91-80-5 / 2 / µg/L	<2	<2	<2		
EP075E: Nitroaromatics and Ketones						
2-Picoline	109-06-8 / 2 / µg/L	<2	<2	<2		
Acetophenone	98-86-2 / 2 / µg/L	<2	<2	4		
Nitrobenzene	98-95-3 / 2 / µg/L	<2	<2	<2		
Isophorone	78-59-1 / 2 / µg/L	<2	<2	<2		
2.6-Dinitrotoluene	606-20-2 / 4 / µg/L	<4	<4	<4		
2.4-Dinitrotoluene	121-14-2 / 4 / µg/L	<4	<4	<4		
1-Naphthylamine	134-32-7 / 2 / µg/L	<2	<2	<2		
4-Nitroquinoline-N-oxide	56-57-5 / 2 / µg/L	<2	<2	<2		
5-Nitro-o-toluidine	99-55-8 / 2 / µg/L	<2	<2	<2		
Azobenzene	103-33-3 / 2 / µg/L	<2	<2	<2		
1.3.5-Trinitrobenzene	99-35-4 / 2 / µg/L	<2	<2	<2		
Phenacetin	62-44-2 / 2 / µg/L	<2	<2	<2		
4-Aminobiphenyl	92-67-1 / 2 / µg/L	<2	<2	<2		
Pentachloronitrobenzene	82-68-8 / 2 / µg/L	<2	<2	<2		
Pronamide	23950-58-5 / 2 / µg/L	<2	<2	<2		
Dimethylaminoazobenzene	60-11-7 / 2 / µg/L	<2	<2	<2		
Chlorobenzilate	510-15-6 / 2 / µg/L	<2	<2	<2		
EP075F: Haloethers						
Bis(2-chloroethyl) ether	111-44-4 / 2 / µg/L	<2	<2	<2		

ALS Environmental

Analytical Results

	Client Sample ID :	06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
	Sample Matrix Type / Description :	WATER	WATER	WATER		
	Sample Date / Time :	6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
	Laboratory Sample ID :	EB0603430-001	EB0603430-002	EB0603430-003		
Analyte	CAS number	LOR	Units			
EP075F: Haloethers						
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L	<2	<2	<2
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L	<2	<2	<2
4-Bromophenyl phenyl ether	101-55-3	2	µg/L	<2	<2	<2
EP075G: Chlorinated Hydrocarbons						
1.4-Dichlorobenzene	106-46-7	2	µg/L	<2	<2	<2
1.3-Dichlorobenzene	541-73-1	2	µg/L	<2	<2	<2
1.2-Dichlorobenzene	95-50-1	2	µg/L	<2	<2	<2
Hexachloroethane	67-72-1	2	µg/L	<2	<2	<2
1.2.4-Trichlorobenzene	120-82-1	2	µg/L	<2	<2	<2
Hexachloropropylene	1888-71-7	2	µg/L	<2	<2	<2
Hexachlorobutadiene	87-68-3	2	µg/L	<2	<2	<2
Hexachlorocyclopentadiene	77-47-4	10	µg/L	<10	<10	<10
Pentachlorobenzene	608-93-5	2	µg/L	<2	<2	<2
Hexachlorobenzene (HCB)	118-74-1	4	µg/L	<4	<4	<4
EP075H: Anilines and Benzidines						
Aniline	62-53-3	2	µg/L	<2	<2	<2
4-Chloroaniline	106-47-8	2	µg/L	<2	<2	<2
2-Nitroaniline	88-74-4	4	µg/L	<4	<4	<4
3-Nitroaniline	99-09-2	4	µg/L	<4	<4	<4
Dibenzofuran	132-64-9	2	µg/L	<2	<2	<2
4-Nitroaniline	100-01-6	2	µg/L	<2	<2	<2
Carbazole	86-74-8	2	µg/L	<2	<2	<2
3.3'-Dichlorobenzidine	91-94-1	2	µg/L	<2	<2	<2
EP075I: Organochlorine Pesticides						
alpha-BHC	319-84-6	2	µg/L	<2	<2	<2
beta-BHC	319-85-7	2	µg/L	<2	<2	<2
gamma-BHC	58-89-9	2	µg/L	<2	<2	<2
delta-BHC	319-86-8	2	µg/L	<2	<2	<2
Heptachlor	76-44-8	2	µg/L	<2	<2	<2
Aldrin	309-00-2	2	µg/L	<2	<2	<2
Heptachlor epoxide	1024-57-3	2	µg/L	<2	<2	<2
alpha-Endosulfan	959-98-8	2	µg/L	<2	<2	<2
4.4'-DDE	72-55-9	2	µg/L	<2	<2	<2
Dieldrin	60-57-1	2	µg/L	<2	<2	<2
Endrin	72-20-8	2	µg/L	<2	<2	<2
beta-Endosulfan	33213-65-9	2	µg/L	<2	<2	<2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
Sample Matrix Type / Description :				WATER	WATER	WATER		
Sample Date / Time :				6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
Laboratory Sample ID :				EB0603430-001	EB0603430-002	EB0603430-003		
EP075I: Organochlorine Pesticides								
4.4'-DDD	72-54-8	2	µg/L	<2	<2	<2		
Endosulfan sulfate	1031-07-8	2	µg/L	<2	<2	<2		
4.4'-DDT	50-29-3	4	µg/L	<4	<4	<4		
EP075J: Organophosphorus Pesticides								
Dichlorvos	62-73-7	2	µg/L	<2	<2	<2		
Dimethoate	60-51-5	2	µg/L	<2	<2	<2		
Diazinon	333-41-5	2	µg/L	<2	<2	<2		
Chlorpyrifos-methyl	5598-13-0	2	µg/L	<2	<2	<2		
Malathion	121-75-5	2	µg/L	<2	<2	<2		
Fenthion	55-38-9	2	µg/L	<2	<2	<2		
Chlorpyrifos	2921-88-2	2	µg/L	<2	<2	<2		
Pirimphos-ethyl	23505-41-1	2	µg/L	<2	<2	<2		
Chlorfenvinphos	470-90-6	2	µg/L	<2	<2	<2		
Prothiofos	34643-46-4	2	µg/L	<2	<2	<2		
Ethion	563-12-2	2	µg/L	<2	<2	<2		
EP075K: Miscellaneous Compounds								
1.3.5-Trichlorobenzene	108-70-3	2	µg/L	<2	<2	<2		
1.2.4.5-Tetrachlorobenzene	95-94-3	2	µg/L	<2	<2	<2		
Methanesulfonate methyl	66-27-3	2	µg/L	<2	<2	<2		
Methanesulfonate ethyl	62-50-0	2	µg/L	<2	<2	<2		
cis-Isosafrole	17627-76-8	2	µg/L	<2	<2	<2		
trans-Isosafrole	4043-71-4	2	µg/L	<2	<2	<2		
Safrole	94-59-7	2	µg/L	<2	<2	<2		
Diallate	2303-16-4	2	µg/L	<2	<2	<2		
2.3.4.6-Tetrachlorophenol	58-90-2	2	µg/L	<2	<2	<2		
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	97.5	95.6	101		
Toluene-D8	2037-26-5	0.1	%	102	98.6	103		
4-Bromofluorobenzene	460-00-4	0.1	%	99.1	95.0	102		
EP075S: Acid Extractable Surrogates								
2-Fluorophenol	367-12-4	0.1	%	47.4	22.4	23.2		
Phenol-d6	13127-88-3	0.1	%	29.5	Not Determined	41.8		
2-Chlorophenol-D4	93951-73-6	0.1	%	61.8	37.2	70.9		
2.4.6-Tribromophenol	118-79-6	0.1	%	56.1	27.8	68.4		
EP075T: Base/Neutral Extractable Surrogates								
Nitrobenzene-D5	4165-60-0	0.1	%	76.8	39.2	103		

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Analytical Results

	Client Sample ID :	06/3872/1 APL 07S	06/3872/4 APL 30	06/3872/7 APL20		
	Sample Matrix Type / Description :	WATER	WATER	WATER		
	Sample Date / Time :	6 Apr 2006 15:00	6 Apr 2006 15:00	6 Apr 2006 15:00		
	Laboratory Sample ID :	EB0603430-001	EB0603430-002	EB0603430-003		
Analyte	*CAS number* / *LOR* / *Units*					
EP075T: Base/Neutral Extractable Surrogates						
1.2-Dichlorobenzene-D4	2199-69-1 / 0.1 / %	61.0	38.1	64.0		
2-Fluorobiphenyl	321-60-8 / 0.1 / %	75.6	44.0	74.0		
Anthracene-d10	1719-06-8 / 0.1 / %	61.3	49.5	59.6		
4-Terphenyl-d14	1718-51-0 / 0.1 / %	87.4	49.6	80.2		

ALS Environmental

Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits ***Surrogate Control Limits***

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	70	130
	Toluene-D8	70	130
	4-Bromofluorobenzene	70	130
EP075: Semivolatile Organic Compounds			
EP075S: Acid Extractable Surrogates	2-Fluorophenol		
	Phenol-d6		
	2-Chlorophenol-D4		
	2,4,6-Tribromophenol		
EP075T: Base/Neutral Extractable Surrogates	Nitrobenzene-D5		
	1,2-Dichlorobenzene-D4		
	2-Fluorobiphenyl		
	Anthracene-d10		
	4-Terphenyl-d14		

Appendix E

NRMW GROUNDWATER DATABASE

BORE CARD REPORT - PUBLISHABLE

REG NUMBER 11

REGISTRATION DETAILS

OFFICE	Brisbane	**BASIN**		**LATITUDE**	27-25-34	**MAP-SCALE**	104
DATE LOG RECD		**SUB-AREA**		**LONGITUDE**	153-04-34	**MAP-SERIES**	M
D/O FILE NO.		**SHIRE**	1000-BRISBANE C.	**EASTING**	507523	**MAP-NO**	9543
R/O FILE NO.		**LOT**		**NORTHING**	6966365	**MAP NAME**	BRISBANE
H/O FILE NO.	L6572B	**PLAN**		**ZONE**	56	**PROG SECTION**	
		ORIGINAL DESCRIPTION	EAGLE FARM RACECOURSE	**ACCURACY**		**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.42618112	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	EAGLE FARM RACECOURS
GIS LNG	153.0760652	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	N	**PROPERTY NAME**					
		FIELD LOCATION				**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	AF	**DATE DRILLED**				**DATA OWNER**	
STATUS	AD	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
1	0.00	18.29	CLAY
2	18.29	60.96	SANDSTONE
3	60.96	67.06	CLAY
4	67.06	88.39	SANDSTONE & CLAY
5	88.39	100.58	SHALE COAL SANDSTONE
6	100.58	118.87	SHALE
7	118.87	134.11	SANDSTONE SHALE COAL
8	134.11	192.02	SANDSTONE & SHALE
9	192.02	205.74	COAL SHALE SANDSTONE
10	205.74	219.46	SHALE
11	219.46	240.79	SANDSTONE & SHALE

REG NUMBER 11

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
12	240.79	254.51	SHALE & COAL
13	254.51	278.89	SANDSTONE
14	278.89	310.90	SHALE
15	310.90	335.28	SANDSTONE & CLAY
16	335.28	345.95	SANDSTONE & CLAY
17	345.95	380.70	SANDSTONE & SHALE
18	380.70	389.23	SHALE
19	389.23	475.49	SANDSTONE
20	475.49	512.06	SANDSTONE & CLAY
21	512.06	542.85	SCHIST
22	289.56	297.49	SHALE GREY & BLACK
23	297.49	310.90	SHALE GREY & BLACK
24	310.90	335.28	CLAY SANDSTONE
25	335.28	345.95	SHALE DARK
26	345.95	365.76	SHALE SANDSTONE
27	365.76	389.23	SHALE
28	389.23	400.21	SANDSTONE
29	400.21	512.07	SANDSTONE & CLAY
30	512.07	544.38	SCHIST CASING WITHDRAWN ABANDONED
31			WATER STRUCK 1347FT&1620FT 8232 GPD
32			88 F

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

REG NUMBER 11

PUMP TEST DETAILS PART 2

**** NO RECORDS FOUND ****

BORE CONDITION

DATE	DRAIN DETAILS TOT LEN (km)	MAX RUN (km)	C D N	HEADWORKS RET LEN (km)	C D N	C T L	LEAK	FLOW IRREGULARITY	PRECIPITATE	EST USE (ML/yr)	STOCK CATTLE	SHEEP	COMMENT
18/09/1889													Bore contains small quantities of carburetted Hydrogen, being unfit for domestic purposes. Casing withdrawn & bore collapsed. Coal approx 5' thick at 791'.

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD	ANALYST	QAN	DEPTH (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	22/02/1987	1	GCL	118407	20.00		GB	880	8.1	78	690.00	570.00	300	325	1.8	1.9	0.50

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	22/02/1987	1	76.0	0.6	64.0	34.0	0.03	390.0	0.02	3.6	85.0	0.30	0.7	35.0				

WATER LEVEL DETAILS

PIPE	DATE	MEASURE (m)	N/R	RMK	PIPE	DATE	MEASURE (m)	N/R	RMK	PIPE	DATE	MEASURE (m)	N/R	RMK
A	07/03/1989	0.00	R											

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	METH	SOURCE

REG NUMBER 11

PIPE	DATE	DEPTH (m)	COND (uS/cm)	pH	TEMP (C)	NO3 (mg/L)	DO (mg/L)	Eh (mV)	METH	SOURCE
A	18/09/1889				31.1					

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

REGDET	CASING	STRLOG	AQUIFR	PUMTES	ELVDET	WLVDET	FIELDQ
		Y 27/11/2000					

VALIDATION LOG - PART 2

WATANL	SAMPLE	STRTIG	WIRLOG	MULCND	BRCOND	FPREAD	GNOTES

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 73990

REGISTRATION DETAILS

		BASIN	1430	**LATITUDE**	27-26-04	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-02-51	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	504694	**MAP-NO**	
D/O FILE NO.		**LOT**	1	**NORTHING**	6965444	**MAP NAME**	
R/O FILE NO.	6236/2535	**PLAN**	RP33562	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	BROTHERS RUGBY CLUB CROSBY RD. ALBION	**ACCURACY**	UNKN	**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4343787737	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.0474192943	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	5/1034 CROSBY ROAD,ALBION (BRISBANE CITY)			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

****** NO RECORDS FOUND ******

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

REG NUMBER 73990

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

REGDET	CASING	STRLOG	AQUIFR	PUMTES	ELVDET	WLVDET	FIELDQ
Y 15/11/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991

VALIDATION LOG - PART 2

WATANL	SAMPLE	STRTIG	WIRLOG	MULCND	BRCOND	FPREAD	GNOTES
Y 15/11/1991		Y 25/12/1991		Y 25/12/1991			

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 73992

REGISTRATION DETAILS

		BASIN	1422	**LATITUDE**	27-25-22	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-03-21	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	505519	**MAP-NO**	
D/O FILE NO.		**LOT**	3	**NORTHING**	6966736	**MAP NAME**	
R/O FILE NO.	6236/2535	**PLAN**	RP75060	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	40 LIVERPOOL RD. CLAYFIELD	**ACCURACY**	UNKN	**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4226971175	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.0558797522	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	40 LIVERPOOL ROAD,CLAYFIELD			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

****** NO RECORDS FOUND ******

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

REG NUMBER 73992

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD	ANALYST	QAN	DEPTH (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	06/11/1962	1	GCL	25334	27.00		GB	648	6.8		362.90	325.79	25	60	0.1		0.70

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	06/11/1962	1	119.0		10.0			73.0			160.0	0.90						

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 73993

REGISTRATION DETAILS

		BASIN	1422	**LATITUDE**	27-24-46	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-03-24	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	505602	**MAP-NO**	
D/O FILE NO.		**LOT**	9	**NORTHING**	6967843	**MAP NAME**	
R/O FILE NO.	6236/2535	**PLAN**	RP33852	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	1 NELLIE ST. CLAYFIELD	**ACCURACY**		**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4126494136	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.0566954205	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	1 NELLIE STREET,CLAYFIELD			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

****** NO RECORDS FOUND ******

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

REG NUMBER 73993

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD	ANALYST	QAN	DEPTH (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	31/01/1961	1	GCL	23398	9.00		GB	14770	4.6		10493.40	10488.83	3627	7	0.5	22.3	

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	31/01/1961	1	3092.0		613.0	509.0		9.0			5525.0	0.40	745.0					

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 79064

REGISTRATION DETAILS

		BASIN	1430	**LATITUDE**	27-25-30	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-03-37	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	505958	**MAP-NO**	
D/O FILE NO.	6236/2532	**LOT**	2	**NORTHING**	6966489	**MAP NAME**	
R/O FILE NO.		**PLAN**	RP146544	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	A10 P1 (24 PALM AVE. ASCOT)	**ACCURACY**	UNKN	**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4250171818	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.0602115928	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	24 PALM AVENUE,ASCOT (BRISBANE CITY)			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**	01/JAN/58			**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
2	0.00	0.60	SOIL & SUB SOIL.
4	0.60	19.82	WEATHERED SHALE.
6	19.82	32.02	SANDSTONE.
8			STRUCK WATER 19.82 - 28.97.
10			S.W.L. 9.15

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

REG NUMBER 79064

PUMP TEST DETAILS PART 1

**** NO RECORDS FOUND ****

PUMP TEST DETAILS PART 2

**** NO RECORDS FOUND ****

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

**** NO RECORDS FOUND ****

WATER ANALYSIS PART 2

**** NO RECORDS FOUND ****

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

REGDET	CASING	STRLOG	AQUIFR	PUMTES	ELVDET	WLVDET	FIELDQ
Y 06/11/1991	Y 25/12/1991	Y 06/11/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991

VALIDATION LOG - PART 2

REG NUMBER 79064

WATANL	SAMPLE	STRTIG	WIRLOG	MULCND	BRCOND	FPREAD	GNOTES
Y 25/12/1991		Y 25/12/1991		Y 25/12/1991			

GENERAL NOTES

****** NO RECORDS FOUND ******

REG NUMBER 79069

REGISTRATION DETAILS

		BASIN	1422	**LATITUDE**	27-25-33	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-04-34	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	507523	**MAP-NO**	
D/O FILE NO.	6236/2532	**LOT**	2	**NORTHING**	6966396	**MAP NAME**	
R/O FILE NO.		**PLAN**	RP33616	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	DOOMBEN RACECOURSE	**ACCURACY**	UNKN	**PRES EQUIPMENT**	SP
				GPS ACC			
GIS LAT	-27.425830024	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.075936752	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	32 HAMPDEN STREET,ASCOT (BRISBANE CITY)			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
2	0.00	24.40	YELLOW CLAY.
4	24.40	61.00	SANDSTONE.
6	61.00	67.10	BLUE CLAY.
8	67.10	88.45	SANDSTONE & CLAY.
10	88.45	100.65	SHALE,SANDSTONE,COAL.
12	100.65	118.95	SHALE.
14	118.95	134.20	SHALE,SANDSTONE,COAL.
16	134.20	192.15	SHALE & SANDSTONE.
18	192.15	205.87	COAL,SHALE,SANDSTONE.
20	205.87	219.60	SHALE.
22	219.60	241.25	SHALE & SANDSTONE.

REG NUMBER 79069

RECORD NUMBER	STRATA TOP (m)	STRATA BOT (m)	STRATA DESCRIPTION
24	241.25	242.78	COAL.
26	242.78	254.67	SHALE & COAL.
28	254.67	279.07	SHALE,SANDSTONE,COAL.
30	279.07	311.10	SHALE.
32	311.10	335.50	CLAY,SANDSTONE.
34	335.50	346.17	SHALE.
36	346.17	400.46	SHALE,SANDSTONE.
38	400.46	410.83	CONGLOMERATE. WATER AT 410M.
40	410.83	436.45	SANDSTONE & CONGLOMERATE.
42	436.45	512.40	SANDSTONE.(MAY BE TUFF).WATER AT 491M
44	512.40	543.20	SCHIST.

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

BORE CONDITION

****** NO RECORDS FOUND ******

ELEVATION DETAILS

****** NO RECORDS FOUND ******

WATER ANALYSIS PART1

A	21/11/1997	1 GCL	A97078		680	6.9	484.41	362.93	161	196	0.9	2.8	0.69

REG NUMBER 79069

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	21/11/1997	1	82.0	2.9	38.0	16.1		239.0	0.17	0.0	98.0	0.14	0.2	7.9				

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

REGDET	CASING	STRLOG	AQUIFR	PUMTES	ELVDET	WLVDET	FIELDQ
Y 06/11/1991	Y 25/12/1991	Y 06/11/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991	Y 25/12/1991

VALIDATION LOG - PART 2

WATANL	SAMPLE	STRTIG	WIRLOG	MULCND	BRCOND	FPREAD	GNOTES
Y 25/12/1991		Y 25/12/1991		Y 25/12/1991			

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 79233

REGISTRATION DETAILS

		BASIN	1430	**LATITUDE**	27-26-07	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-03-24	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	505600	**MAP-NO**	
D/O FILE NO.	158/4	**LOT**	8	**NORTHING**	6965351	**MAP NAME**	
R/O FILE NO.		**PLAN**	RP47013	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	112 CRESCENT RD HAMILTON	**ACCURACY**	UNKN	**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4351410536	**PARISH NAME**	4634-TOOMBUL			**ORIGINAL BORE NO**	
GIS LNG	153.0565693538	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	112 CRESCENT ROAD,HAMILTON			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

****** NO RECORDS FOUND ******

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

REG NUMBER 79233

BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD	ANALYST	QAN	DEPTH (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	03/12/1989	1	GCL	131911			GB	950	8.4	32	689.54	500.43	276	369	1.5	2.2	1.86

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	03/12/1989	1	84.0	1.8	48.0	38.0	0.01	435.0	0.03	7.6	69.0	0.10	0.5	5.5				

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 2

**** NO RECORDS FOUND ****

GENERAL NOTES

**** NO RECORDS FOUND ****

REG NUMBER 79236

REGISTRATION DETAILS

		BASIN	1422	**LATITUDE**	27-24-01	**MAP-SCALE**	
OFFICE	Brisbane	**SUB-AREA**		**LONGITUDE**	153-01-34	**MAP-SERIES**	
DATE LOG RECD		**SHIRE**	1000-BRISBANE C.	**EASTING**	502581	**MAP-NO**	
D/O FILE NO.	158/4	**LOT**	25	**NORTHING**	6969229	**MAP NAME**	
R/O FILE NO.		**PLAN**	RP41460	**ZONE**	56	**PROG SECTION**	
H/O FILE NO.		**ORIGINAL DESCRIPTION**	7 EAST ST KEDRON	**ACCURACY**	UNKN	**PRES EQUIPMENT**	
				GPS ACC			
GIS LAT	-27.4003615138	**PARISH NAME**	2585-KEDRON			**ORIGINAL BORE NO**	
GIS LNG	153.0259887278	**COUNTY**	STANLEY			**BORE LINE**	-
CHECKED	Y	**PROPERTY NAME**					
		FIELD LOCATION	7 EAST STREET,KEDRON			**POLYGON**	
						RN OF BORE REPLACE	
FACILITY TYPE	SF	**DATE DRILLED**				**DATA OWNER**	
STATUS	EX	**DRILLERS NAME**				**CONFIDENTIAL**	
ROLES		**DRILL COMPANY**					
		METHOD OF CONST.					

CASING DETAILS

****** NO RECORDS FOUND ******

STRATA LOG DETAILS

****** NO RECORDS FOUND ******

STRATIGRAPHY DETAILS

****** NO RECORDS FOUND ******

AQUIFER DETAILS

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 1

****** NO RECORDS FOUND ******

PUMP TEST DETAILS PART 2

****** NO RECORDS FOUND ******

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BORE CONDITION

**** NO RECORDS FOUND ****

ELEVATION DETAILS

**** NO RECORDS FOUND ****

WATER ANALYSIS PART1

PIPE	DATE	RD	ANALYST	QAN	DEPTH (m)	RMK	SRC	COND (uS/cm)	pH	Si (mg/L)	TOTAL IONS (mg/L)	TOTAL SOLIDS (mg/L)	HARD	ALK	FIG. OF MERIT	SAR	RAH
A	01/08/1989	1	GCL	130673	19.00	PU	GB	3900	7.7	27	2457.27	2319.07	1111	270	1.2	5.5	

WATER ANALYSIS PART 2

PIPE	DATE	RD	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	01/08/1989	1	425.0	2.8	255.0	115.0	0.45	325.0	0.02	1.8	1100.0	0.30	1.9	230.0				

WATER LEVEL DETAILS

**** NO RECORDS FOUND ****

WIRE LINE LOG DETAILS

**** NO RECORDS FOUND ****

FIELD MEASUREMENTS

**** NO RECORDS FOUND ****

SPECIAL WATER ANALYSIS

**** NO RECORDS FOUND ****

VALIDATION LOG - PART 1

REGDET	CASING	STRLOG	AQUIFR	PUMTES	ELVDET	WLVDET	FIELDQ
Y 20/12/1991	Y 20/12/1991	Y 20/12/1991	Y 20/12/1991	Y 20/12/1991	Y 20/12/1991	Y 20/12/1991	Y 20/12/1991

VALIDATION LOG - PART 2

WATANL	SAMPLE	STRTIG	WIRLOG	MULCND	BRCOND	FPREAD	GNOTES
Y 20/12/1991		Y 20/12/1991		Y 20/12/1991			

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GENERAL NOTES

**** NO RECORDS FOUND ****

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**** End of Report ****