Mr Daniel Keary
Director Infrastructure Projects
NSW Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Delta electricity

Your ref: S09/01810

22 June 2011

Dear Mr. Keary

Mt Piper Power Station
Ash Placement Project 09_0186
Submissions Report
Response to Departmental & Agency Issues

I refer to your letter of 3 May 2011 which set out the findings of the Department of Planning and Infrastructure (DPI) and other concerned agencies from your final review of Delta Electricity's (Delta) Submissions Report for this project. This review found that a number of key environmental issues were yet to be resolved and that further information was required.

This letter sets out Delta Electricity's response to each of the objections that were raised, specifically those of the Office of Environment and Heritage (OEH) and of the Sydney Catchment Authority (SCA). A detailed response to SCA's comments on the Submissions Report is provided in the attachment to this letter. A summary of this response is provided below.

Delta notes that the NSW Office of Water (NOW) was satisfied with the commitment that Delta made in the Submissions Report to adopt NOW's recommended project approval conditions. Delta also notes that, in parallel with their objections, both OEH and SCA stated their satisfaction with new information and additional commitments made by Delta in the Submissions Report.

OEH objections
OEH did not support the increase in project-specific noise levels for residential receivers in Blackmans Flat. OEH did not consider that the location used by SKM to develop the project specific noise levels reflected the average noise environment in Blackmans Flat because the property chosen is close to Centennial Coal's Lamberts Gully mine site.

Delta's response to OEH
The location was chosen because it is the Blackmans Flat residence that is closest to the proposed Lamberts North ash placement site. When the noise study was done the noise at this site was dominated by road noise (from the Castlereagh Highway), with little influence from the existing coal mining activity at Lamberts Gully. The site preferred by OEH, however, is further from the proposed ash placement sites and is much less influenced by noise from the road (due to distance and shielding): it therefore would not give a true indication of background noise in the area.

SCA objections
1. SCA did not accept the comparison of 90th percentile pre-ash placement groundwater quality data with 50th percentile post-ash placement data. Instead, SCA considered that 50th and 90th percentile pre-ash placement monitoring data should be compared with equivalent 50th and 90th percentile post-ash placement quality data for a valid comparison.

2. SCA's analysis of the most recent annual groundwater quality monitoring report indicated an increasing trend in chloride concentration over the last 10 years in groundwater bores located downstream of the ash placement areas when compared to upstream bores. This strongly suggested to SCA a clear association with brine-conditioned ash disposal. SCA therefore recommended that the UTS (2007) groundwater model be updated to include this increasing chloride trend in order to enable updated predictions of long-term behaviour, fate and impacts of ash placement.

   SCA noted the clearly increasing trend in chloride concentration found in groundwater quality monitoring data for the groundwater collection basin located downstream of the ash placement site and the ongoing co-placement of 25-35 ML/annum of brine having a chloride concentration of some 24,000 mg/L via ash conditioning. Based on this evidence SCA rejected Delta's assertion that the increase in chloride concentration in the groundwater collection basin is due to the effects of upstream mining activities rather than to ash placement.

Delta's response to SCA

1. This objection arises from a review by SCA of Delta's groundwater monitoring reports of 2009 and 2010. The 2009 report was referenced in the Environmental Assessment as follows:

   AURECON (2009). Water Quality Monitoring Annual Update Report February 2008 – January 2009. Mt Piper Power Station Brine Conditioned Flyash Co-Placement Water Management Plan. Delta Electricity, July 2009.

   The 2009 report states that the ANZECC (2000) guideline procedure for assessing changes from pre- to post placement was used. This involves comparing the median (50th percentile) of the post-ash placement data with the pre-ash placement 90th percentile data. Section 2.5 of this report states:

   "2.5 Guidelines
   The ANZECC (2000) guideline approach of estimating local guidelines using the 90th percentile baseline for naturally mineralised, highly disturbed groundwater and comparing with the 50th percentiles (median) in receiving waters was used in this report (Connell Wagner, 2007a). The environmental goals for the receiving waters, which are the G[roundwater] C[ollection] B[asin] and Neubecks Creek, were established by using the pre-placement 90th percentile for water quality characteristics. According to the ANZECC procedure, the 50th percentile of the post-placement water quality is then compared to the pre-placement 90th percentile. It should be noted that the 90th percentile of some pre-placement characteristics were lower than the ANZECC guidelines, so the default (95% protection) guidelines were used as the environmental goal for these elements (see Sections 2.5 and 2.6 and Table 2)."

   The protocol uses this approach so that when a change is shown by the concentration difference between the 50th minus the 90th, a measurable change is considered to have taken place and an investigation of the cause is required. This approach is described in Section 2.6.1 of the Aurecon report:

   "To allow for natural variability, in practice, the guidelines suggest that, if the environmental goals [pre-90th percentile or ANZECC trigger levels] were consistently exceeded [by the post-placement 50th], an investigation of causes and management action of the brine conditioned ash placement would be initiated."

   For further information on this ANZECC guideline protocol, Delta refers SCA to Chapter 7 "Monitoring and assessment" and Chapter 3 "Aquatic Ecosystems" via the following link:

   http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality

2. Delta responds below to SCA's objection 2. This response is a summary of a longer response (please refer attachment) to SCA's own detailed comments on the Submissions Report that were provided in an attachment to DoPI's letter S09/01810.

   The small increases in chloride in the groundwater collection basin (GCB) and Neubecks Creek have been shown by modelling to be due to increased groundwater flows from a naturally occurring salt deposit in the mine goaf area adjacent to the GCB. This flow may have been influenced by the groundwater level rise due to the larger water conditioned ash placement.

   The brine conditioned ash placement is designed to minimise brine leachates reaching the groundwater in the ash placement area.

   A bore hole in the deepest part of the ash placement area, to a depth of 30.45m that was drilled in the middle of the Stage 1 brine conditioned ash area in 2007, was found to be dry. This proves that no leachates were reaching the groundwater under the brine placement.

   Ongoing monitoring of chloride at down-gradient sites has shown a recent, rapid increase of chloride at bore D10, without a corresponding increase at bore D11 or in the GCB. This suggests a local source of chloride input the mine water sampled by bore D10. If brine leachates had reached the groundwater under the brine placement then the recent, rapid increase seen at bore DF10 would have occurred at the other monitoring sites as well.

Delta trusts that this response to the concerns of DoPI, OEH, and SCA over the Submissions Report is satisfactory and looks forward to meeting with you and agency representatives to further discuss these issues and their resolution.

Delta considers it unreasonable to require that the UTS (2007) groundwater model be updated prior to a determination on this project. Delta has committed to preparing a new and comprehensive groundwater model of the existing and proposed ash placement areas, and to sharing results from it with SCA and other concerned agencies as part of normal reporting under the power station's operating license.

If you have any queries or require any further information please do not hesitate to contact Mr Steven Cowgill on (02) 9285 2767 or mobile 0438 907 749.

Yours sincerely,

David Hogg 22/6/11

David Hogg
General Manager Fuel & Environment

Encl.
"Attachment to the SCA Letter to Department of Planning, 28th April 2011".

ATTACHMENT

Response to SCA Letter dated 28 April 2011

Summary

Response to the Sydney Catchment Authority's comments on the Mount Piper Ash Placement Project Submissions Report in a letter to Department of Planning dated 28th April, 2011.

The following responses by Delta to the Sydney Catchment Authority's comments are shown indented after each SCA comment. The responses are limited to the suggestion that the increases in chloride in Neubecks Creek and the groundwater collection basin (GCB) are due to leachates from the brine placement area.

The SKM Mt Piper Power Station Ash Placement Project Environmental Assessment (EA) quoted the Connell Wagner (2008) and Aurecon (2009) reports. These are referred to in the following responses.

The SCA's comments were mainly concerned that the recent increase in chloride levels at the Mt Piper ash placement area may be due to the brine conditioned ash placement. The following summary of the reasons why this is not the case is taken from the responses provided below:

- The small increase in chloride in the GCB and Neubecks Creek was shown by modelling to be due to increased groundwater flows from a naturally occurring salt deposit in the goaf mine area to the GCB. This effect may have been influenced by the water level rise due to the larger water conditioned ash placement;
- The brine conditioned ash placement is designed to minimise brine leachates reaching the groundwater in the ash placement area;
- A borehole in the deepest part of the ash placement, to a depth of 30.45m, was drilled in the middle of the Stage I brine conditioned ash area in 2007 and it was dry. This showed no leachates were reaching the groundwater under the brine placement;
- Ongoing monitoring of chloride at down-gradient sites has shown a recent, rapid increase of chloride at bore D10, without a corresponding increase at bore D11 or in the GCB. This suggests a local source of chloride input to the mine water sampled by bore D10. If brine leachates had reached the groundwater under the brine placement, the recent rapid increase seen at bore D10 would have occurred at the other monitoring sites as well.

Sydney Catchment Authority Letter to Department of Planning 28th April, 2011

MOUNT PIPER ASH PLACEMENT PROJECT - SUBMISSIONS REPORT APPLICATION NUMBER MP09_0186

I refer to your letter received 5 April 2011 providing a submissions report and inviting the Sydney Catchment Authority (SCA) to provide further and/or updated comments on the proposal or updated advice on recommended conditions of approval.

The SCA has reviewed this submissions report and its response to each issue and the recommended conditions of approval are provided in the attached document. The SCA is not satisfied with the response related to impacts of ash placement on groundwater quality as outlined below (for more detail please refer to the attached document):

2. The SCA is not satisfied by the assertion there are not nor will not be any impacts resulting from the ash placement areas. The SCA's analysis of the most recent annual groundwater quality monitoring report clearly indicates an increasing trend in chloride concentration over the last 10 years in groundwater bores located downstream of ash placement areas when compared to upstream bores. This strongly suggests a clear association with brine-conditioned ash disposal.

Delta: See responses below to the attachment to the SCA Letter to Department of Planning 28th April, 2011

The SCA consequently recommends an updating of the UTS (2007) groundwater model to incorporate these increasing chloride concentrations, which would enable updated predictions of the long term behaviour, fate and impacts of ash placement.

Delta: See responses below to the attachment to the SCA Letter to Department of Planning 28th April, 2011

Attachment to the SCA Letter to Department of Planning 28th April, 2011

Sydney Catchment Authority response to Submissions Report for Mount Piper Ash Placement Project Application Number MP 09_0186

This document contains the SCA's comments on the submissions report and the SCA's recommended conditions of approval.

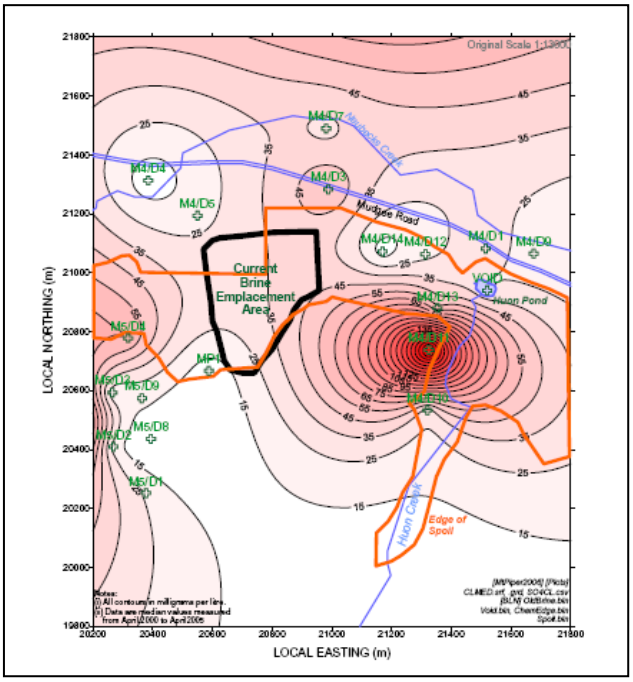
SCA Comments on the Submissions Report

Impacts of brine-conditioned ash on groundwater quality

2. The SCA acknowledges that the increasing trends in chloride concentration in Neubecks Creek and the groundwater collection basin, located downstream of the ash placement site, are minimal and well within ANZECC guidelines and may be due to drought conditions. However, the SCA **is not satisfied** that the increase in chloride concentration is most probably due to the effects of upstream mining activities and not related to ash placement.

Delta: There is a naturally occurring salt deposit in the goaf mine area near bore D11, which has a high chloride concentration (Figure 8 from the 2007 model report by Merrick, 2007 is reproduced below for reference). The small increase in chloride in the GCB and Neubecks Creek was suspected to be due to damage to or removal of part of the coal barrier between the goaf mine area and the GCB. Update of the model in 2007 showed this was a feasible explanation. Groundwater flows are from bore D11 to the GCB and the model predicted the increase in chloride would be expected with an increase in flows due to changes to the coal barrier. This, together with the recent water level rise due to water conditioned ash placement (see Figure 9 in the Aurecon, 2009 report) is most likely introducing low levels of chloride from the goaf to the GCB.

Figure 8 – Distribution of Concentrations of Chloride (mg/L) in Groundwater 2000-2005 (from Merrick, 2007)



The increase in chloride in the GCB and Neubecks Creek by October, 2009, due to this process, was shown to be small, as noted above in the response by SCA.

Delta's leachate detection system may not have detected full penetration of the ash repository

Delta: The vibrating wire piezometers (VWPs) were installed in the northern part of the ash placement area as a measure of surface water infiltration and as an indicator of potential long term water-related stability issues for the placed ash and batters. The vibrating wire piezometers shown in Figure 2 of the 2009 report were installed in boreholes drilled to the full depth of the ash. The tip of the VWP was placed about 1m above the base of the flyash in each borehole.

Bores MPGM4/D10 and D11 were installed in mine spoil downgradient of the ash placement and upgradient of the GCB for early detection of leachates from the brine placement area. Effects of the brine area leachate on groundwater chloride concentrations inside the placement area are expected to be detected by changes in both these bores.

however the groundwater water quality monitoring data of the groundwater collection basin clearly shows the increasing trend in chloride concentration which is highly likely due to ash placement activity

Delta: The claim that the chloride increase in the GCB is **highly likely** due to ash placement activity does not take into account the effects of the naturally occurring high chloride sampled by bore D11 and its movement to the GCB, as noted above.

In addition, Figure 7 in the Aurecon (2009) report shows little change in chloride concentrations in the GCB since January, 2008 while the concentration in bore D10 continued to increase. The SCA referred to the recent Aurecon (2010) report, which also showed little change in the GCB chloride to October, 2009 but the increase in bore D10 continued. These observations support the view that the small increase in the GCB is due to the nearby high chloride deposit and the water level rise due to the wider effect of ash placement.

because chloride is more an indicator of ash than the mining activity.

Delta: As shown in Figure 8, above, naturally occurring salt deposits occur in the mining area, so chloride is not just an indicator of ash placement.

Additionally when considering the annual quantity of brine used to condition ash (25-35ML/annum) and the chloride concentration in brine (some 24,000 mg/L based on 2003-2006 brine quality data), about 500 to 850 tonnes of chlorides are disposed of annually via ash placement activity.

Delta: The annual brine chloride production is stored in about 200,000 tonnes of brine conditioned ash each year, which is placed on top of about 3 million tonnes of water conditioned ash. This placement design was used to minimise brine leachates reaching the groundwater in the ash placement area.

This also suggests that the chloride in the groundwater collection basin is highly likely related to brine conditioned ash placement.

Delta: The 2009 report stated that the VWP nearest the Stage I deposit, and in the initial Stage II placement area, has remained dry. This VWP was installed in a borehole drilled to the base of water conditioned ash and the VWP tip was placed about 1m above the base at a depth of 22.5 m below RL 946m. Three metres of brine conditioned ash had been placed on top of this ash by December 2008 as shown in Figure 2 of the 2009 report. Confirmation of no leachates reaching the groundwater under the brine placement was obtained by drilling a borehole to a depth of 30.45m in the middle of the Stage I brine conditioned ash area. The bore log is attached and shows the bore was dry, as stated in the Connell Wagner (2008) report.

The current view that brine leachates have not yet reached the groundwater is supported by the relatively small increase of chloride at bore D11, compared to the rapid increase at bore D10 (shown in Figure 7 of the 2009 report and more clearly in Figure 6 of the 2010 report).

The SCA is aware that there are existing water quality issues in and around the existing and proposed ash placement areas particularly elevated levels of sulphate, boron, nickel, manganese and iron in Neubecks Creek catchment that are attributed to past coal mining. However, the SCA **is not satisfied** with the assertion that there will not be any impact on water quality from the ash placement activity.

Delta: We agree that it is not possible for there to be no effects on water quality from the ash placement activity.

Section 2.6.2 of the (Aurecon, 2010) report states “Groundwater modelling predicts that once seepage from the brine co-placement enters the groundwater table under the ash deposit, the salinity in the bores inside the ash placement area is expected to increase. Once this happens, the concentrations of some water quality characteristics may exceed the pre-placement baseline 90th percentile conditions in these bores. The only bores left inside the ash placement area are D10 and D11, so the trends over time for these bores are expected to show when the brine leachates reach the rubble drain under the ash deposit.”

The UTS model predicts that after 40 years of ash placement operations, with final capping of the brine and water conditioned ash placement at Mt Piper Power Station, the water quality in receiving waters (the GCB and Neubecks Creek) will still meet the ANZECC (2000) guidelines or local environmental goals shown in Table 1 of the 2008 report and in Table 2 of the 2009 and 2010 reports. Note that the ANZECC (2000) guideline trigger values for cadmium, chromium, copper, lead, nickel and zinc were adjusted for effects of hardness.

The SCA's analysis of groundwater monitoring quality data in the Water Quality Monitoring Update Report 2009 (Aurecon 2010), clearly shows an increasing trend in chloride concentration (an indicator of ash disposal) over the last 10 years in the downstream groundwater bores compared to bores located upstream of ash placement areas.

Delta: As noted above, chloride is also an indicator of naturally occurring salt deposits which occur in the underground mine workings in the area.

Section 3.1 of the 2010 report states “These bores, particularly D10, monitors changes due to non-Delta historical mining works, the predicted water level rises due to water conditioned ash placement and provide early warning of effects, if any, of the brine co-placement.”

The effects of the “non-Delta mining works” are discussed above in relation to movement of the chloride deposit near bore D11 to the GCB. The water level rises observed in the groundwater bores D10 and D11 are due to the mounding effects of placement of the large area of water conditioned ash placement, which was predicted by the model.

Section 3.1.1 stated “The rapid increase of chloride at bore D10 during 2009 (shown in Figure 5 of the 2010 report) suggests an increase in the source of chloride entering the groundwater. The increasing chloride concentrations are suggested to be investigated, with consideration of local mining activities, groundwater level rise and use of cooling tower blowdown water for dust suppression. In this regard, the strict management of storm water runoff from the brine and water conditioned ash areas should continue.”

As mentioned above, the increase of chloride at bore D10, without a corresponding recent, rapid increase at bore D11 (shown in Figure 6 of the 2010 report), suggests a

local source of chloride input to the mine water sampled by bore D10. As recommended in the Aurecon (2010) report, Delta Electricity is currently investigating the cause of the local inputs. However, whether the cause is a local mine input or the use of cooling tower blowdown for dust suppression and conditioning of the fresh ash, the localised nature of the changes suggests that the increase is not due to the brine conditioned ash placement. Brine leachates entering the local groundwater would be expected to cause a similar rise in chloride in all the down-gradient bores, as well as in the GCB.

The SCA nevertheless acknowledges that the three to five fold increase in chloride concentration are below ANZECC guidelines. Similarly, pre and post ash-placement water quality in a downstream groundwater bore also shows increasing trend in chloride levels from 22 to 50 mg/L.

Delta: Noted. These changes are the pre and post ash-placement averages for bore D10. As required by the Water Management Plan, the post ash-placement 50^{th} percentile at bore D10 exceeded the pre placement 90^{th} percentile, so an investigation of the causes was undertaken in 2007. As noted above, the continuing rise at bore D10 was the reason for the recommendation in the Aurecon (2010) report to investigate the causes.

Groundwater modelling predictions (UTS 2007) have assumed adsorption percentages of contaminants, including for chloride.

Delta: The adsorption tests were included in the model to simulate the uptake of trace metals from brine leachates as they flow through the mine spoil on the way to the receiving waters. The test showed the mine spoil could cause **uptake or release** of contaminants into the leachates. The chloride concentrations actually increased due to release from the local mine spoil. This is stated in the reports as a possible reason for the moderate increases in chloride noted in the bores as the local water levels rose due to the water conditioned ash placement.

The SCA recommends that the UTS model be reviewed and revised to reflect the latest monitoring data including the trend to increased chloride concentrations. The revised model would thus enable updated predictions of the long term behaviour, fate and impacts of ash placement.

Delta: The model will be updated with the Delta Electricity findings of the cause of the local chloride inputs to bore D10 and re-run to include the latest data.

Delta Electricity's annual reporting requirements require an update of the groundwater model if the results and analyses presented in the annual Environmental Monitoring Report, or any other information, may be reasonably interpreted as indicating significant impacts on the groundwater quality, in the vicinity of the Site, as a result of the placement of brine-conditioned flyash.

Although there is no evidence that the brine-conditioned flyash placement is the cause of the changes noted above at bore D10, it is necessary to define the cause of the increases so the likely effects on the receiving waters are understood and for implementation of controls, if the cause if due to the larger water conditioned ash placement. Accordingly, Delta Electricity will arrange for the model to be updated and the results will be presented in a Groundwater Modelling Report.

As the chloride increases noted in the annual Environmental Monitoring Reports are explained by the local groundwater conditions, and the low level effects of the brine placement predicted by modelling have not been seen yet, the approvals process for the Ash Placement Project should not be delayed by the proposal by Delta Electricity to re-run the Mt Piper brine placement groundwater model.

Updated model predictions would enable a revised risk assessment of ground and surface water quality impacts under a range of rainfall events of differing duration and intensities (including up to a 100 year ARI event).

Delta: The current model predicts the final outcome of effects on groundwater for average rainfall conditions over 40 years. Short-term rainfall events would not show effects of brine leachates on groundwater because it takes a long time (years) for the leachates to penetrate the 30m of water conditioned ash.

The suggested modelling of rainfall events of differing duration and intensities (including up to a 100 year ARI event) is more appropriate for surface runoff modelling. It is understood that the runoff detention system and size of the lined ponds in the brine areas are already based on the 100 year ARI event.

REPORT OF BOREHOLE: BH5/4

SHEET: 1 OF 4

CLIENT:	Clough E&M	COORDS: 224836 m E 6305394 m N 56 MGA94	DRILL RIG: Edson 3000
PROJECT:	Mt Piper Ash Dump	SURFACE RL: 960.50 m DATUM: AHD	DRILLER: Terratest
LOCATION:	Portland	INCLINATION: -90°	LOGGED: JKM DATE: 25/6/07
JOB NO:	06622138	HOLE DIA: 100 mm HOLE DEPTH: 30.45 m	CHECKED: DATE:

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	L-M	Groundwater not encountered	0	960.50					SILT, low plasticity, pale grey	M		Start drilling 11:45am Inferred Brine ASH
			6	6.00 954.50	SPT 6.00-6.45 m 2,2,2 N = 4				Silty SAND/ Sandy SILT, low plasticity, grey with dark grey, with some salt gravel	D-M		
			9	9.00 951.50	SPT 9.00-9.45 m 3,6,6 N = 12				SILT, low plasticity, pale grey, with a trace of sand and gravel			Fly ASH/ Brine ASH
			10									

REPORT OF BOREHOLE: BH5/4

SHEET: 2 OF 4

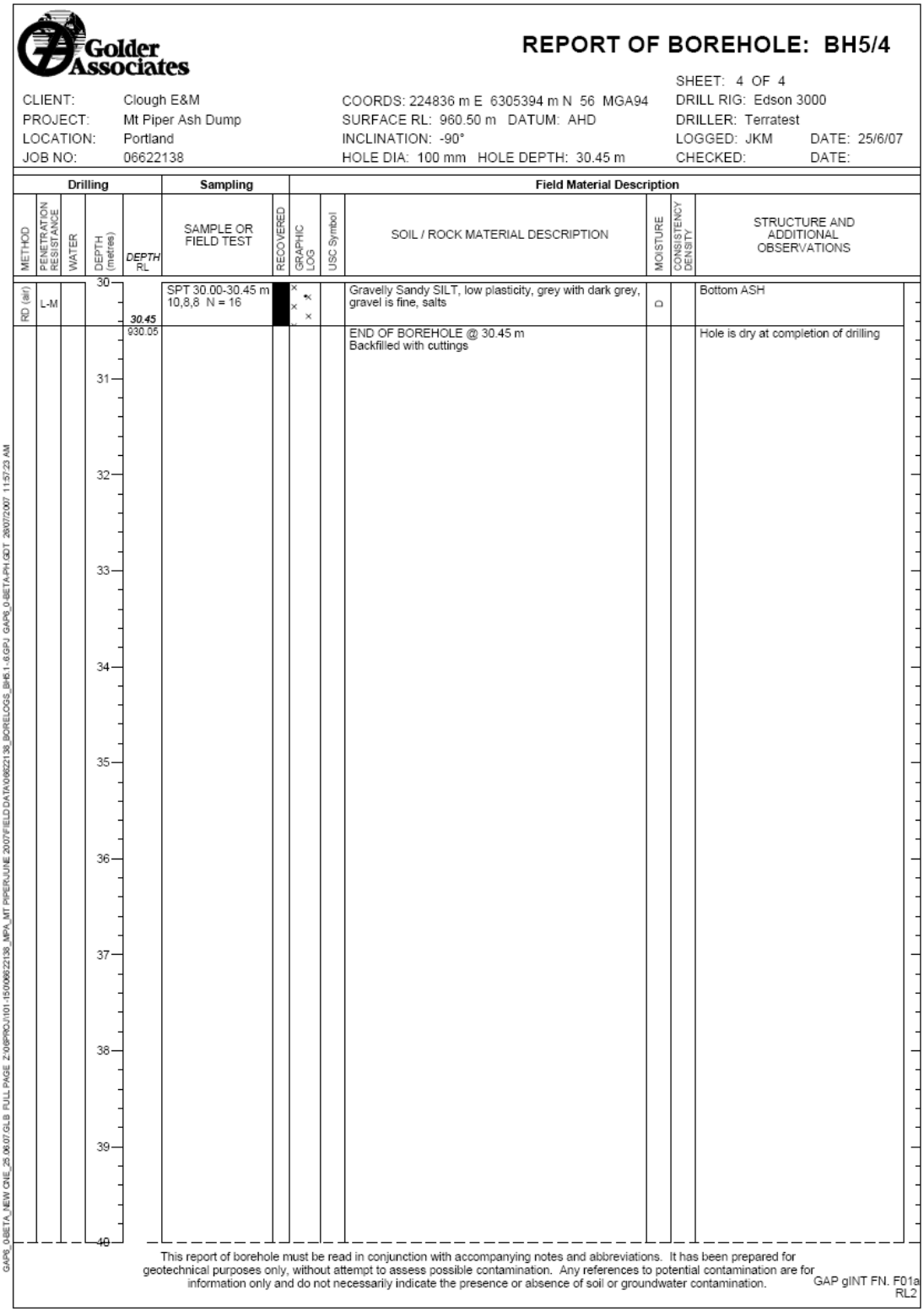
CLIENT:	Clough E&M	COORDS: 224836 m E 6305394 m N 56 MGA94	DRILL RIG: Edson 3000
PROJECT:	Mt Piper Ash Dump	SURFACE RL: 960.50 m DATUM: AHD	DRILLER: Terratest
LOCATION:	Portland	INCLINATION: -90°	LOGGED: JKM DATE: 25/6/07
JOB NO:	06622138	HOLE DIA: 100 mm HOLE DEPTH: 30.45 m	CHECKED: DATE:

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV	L-M		10						SILT, low plasticity, pale grey, with a trace of sand and gravel	D-M		Fly ASH/ Brine ASH
			11									
			12		SPT 12.00-12.45 m 5,7,9 N = 16							
			13									
			14	14.00 946.50					colour becoming very pale grey to white			
			15		SPT 15.00-15.45 m 2,3,3 N = 6							
RD (air)			16									
			17									
			18		SPT 18.00-18.45 m 12,20,HB N = HB							
			19									
			20									

REPORT OF BOREHOLE: BH5/4

CLIENT:	Clough E&M	COORDS: 224836 m E 6305394 m N 56 MGA94	SHEET: 3 OF 4
PROJECT:	Mt Piper Ash Dump	SURFACE RL: 960.50 m DATUM: AHD	DRILL RIG: Edson 3000
LOCATION:	Portland	INCLINATION: -90°	DRILLER: Terratest
JOB NO:	06622138	HOLE DIA: 100 mm HOLE DEPTH: 30.45 m	LOGGED: JKM DATE: 25/6/07
			CHECKED: DATE:

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RD (air)	L-M		20						SILT, low plasticity, pale grey, with a trace of sand and gravel	M		Fly ASH/ Brine ASH
			21		SPT 21.00-21.45 m 6,7,9 N = 16							
			22									Onsite 10am 25/6/07, hole has remained open
			23									
			24									
			25									
			26	26.10 934.40					Gravelly Sandy SILT, low plasticity, grey with dark grey, gravel is fine, salts	W		Bottom ASH
			27		U50 27.00-27.38 m					D		No cuttings returned beyond 27m difficulty pushing sample, driller assures no fall-in
			28									
			29									
			30									



REPORT OF BOREHOLE: BH5/4

SHEET: 4 OF 4

CLIENT:	Clough E&M	COORDS: 224836 m E 6305394 m N 56 MGA94	DRILL RIG: Edson 3000
PROJECT:	Mt Piper Ash Dump	SURFACE RL: 960.50 m DATUM: AHD	DRILLER: Terratest
LOCATION:	Portland	INCLINATION: -90°	LOGGED: JKM DATE: 25/6/07
JOB NO:	06622138	HOLE DIA: 100 mm HOLE DEPTH: 30.45 m	CHECKED: DATE:

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
RD (air)	L-M		30	30.45 930.05	SPT 30.00-30.45 m 10,8,8 N = 16				Gravelly Sandy SILT, low plasticity, grey with dark grey, gravel is fine, salts	D		Bottom ASH
									END OF BOREHOLE @ 30.45 m Backfilled with cuttings			Hole is dry at completion of drilling

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01a RL2

GAP8_0-BETA_NEW ONE_25.06.07.GLB FULL PAGE Z:\08PROJ\101-150\06622138_MPA_MT PIPER\JUNE 2007\FIELD DATA\06622138_BORELOGS_BH5.1-6.GPJ GAP8_0-BETA-PH.GDT 26/07/2007 11:57:23 AM

Golder Associates Pty Ltd, September 2007. DRAFT REPORT ON MOISTURE PROFILE ASSESSMENT AND BRINE ASH ANALYSIS MOUNT PIPER ASH EMPLACEMENT PORTLAND, NSW Submitted to: Clough Engineering and Maintenance Boulder Road Portland, NSW