

Kiama Municipal Council

Annual Surface and Groundwater Monitoring Report (EPL) Gerroa Waste Disposal Depot

Report E2W-025 R001

24 May 2015

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Project: Annual Surface and Groundwater Monitoring Report Gerroa Waste Disposal Depot

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Report: 24 May 2015
Reference: E2W-025 Gerroa R001 (V2)

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1 INTRODUCTION

Earth2Water Pty Ltd (E2W) was engaged by Kiama Municipal Council (Council) to provide an annual groundwater and surface water monitoring report for the Gerroa Waste Disposal Depot (GWDD). The GWDD Environment Protection Licence (EPL) was revoked in May 2008, and altered the previous reporting periods from August-July, to 1 April 2008 - 31 March 2009. The EPL reporting periods and monitoring periods have changed since 2009 (i.e. 2009-2010 monitoring report included results from five monitoring events including February 2009, May 2009, August 2009, November 2009 and February 2010. The 2010-2011 monitoring report included results from four monitoring events including May 2010, August 2010, November 2010 and February 2011. The 2011-2012 annual report includes results from five monitoring events including May 2011, August 2011, November 2011, February 2012 and May 2012. The 2012-2013 and 2013-2014 annual reports include results from four regular monitoring events (May, August, November 2013/2014, and February 2013/2014).

This annual EPL report (2014-2015) by E2W includes an assessment of four monitoring events (May 2014, August 2014, November 2014 and February 2015) and is based on Council's project brief (Ref H24/11, August 2004), ALS Environmental Pty Ltd laboratory results and E2W previous reports. This EPL report (2014-2015) is the eleventh[1] provided by E2W to the NSWEPA on behalf of Council, and meets the conditions outlined in the EPL (Lic No: 5959, R1.10).

1.1 BACKGROUND AND REMEDIATION ACTIVITIES

Council has owned and operated the GWDD since the 1960's. It was previously licensed as a Solid Waste Class 1 Landfill, operating under the EPL No. 5959. The site also functioned as a night soil depot for liquid pump out sullage. Land filling operations at the GWDD were discontinued in October 2003.

From July 2004 to February 2005, the landfill was rehabilitated to eliminate, or at least minimise the potential for landfill leachate generation. The waste mound was reshaped, capped with a 0.5 m thick clay barrier and 0.3 m thick combined drainage/re-vegetation layer. The former night soil trench was also remediated in August 2004 (i.e. approximately 300 tonnes of bio-solid sludge were excavated and placed underneath the clay cap).

In February 2005, an irrigation system was installed to assist with the re-vegetation of the landfill mound using a combination of native and annual grasses. A groundwater holding dam (30 x 30 m) was also constructed next to the two existing evaporation ponds to contain and supply water for the irrigation system. A spear point (yield ~2 L/sec) was installed on the north-west corner of the landfill mound to allow groundwater (and landfill leachate) to fill the holding dam as well as supply water for the irrigation system.

The sludge pond (southern lined dam) at Gerroa Landfill has not been used since Council ceased undertaking the septic clean-outs. Waste Processing Solutions Pty Ltd was engaged by KMC in September 2009 to de-water the sludge in the lined pond, and subsequently taken to a Soilco Pty Ltd owned site. Removal of the pond liner (HDPE) was undertaken in October 2011 by Council and

[1] First annual report for the period 2003 - 2004 was submitted in October 2004.

disposed to Shellharbour landfill (note: spillage of residual sludge may have occurred during removal of the liner).

Up until November 2008, Ecowise Pty Ltd (now ALS) performed the quarterly surface and groundwater monitoring at the landfill site. E2W and Council undertook the monitoring in November 2008, and subsequently Council and/or ALS performing the quarterly monitoring rounds herein. Water samples are sent to ALS for laboratory analyses. The landfill is kept locked at all times.

1.2 OBJECTIVES

Similar to previous years, the objective of monitoring was to assess the potential impact of the GWDD on local surface and groundwater systems. This round of monitoring provides an assessment of water quality improvements associated with the landfill rehabilitation works completed in February 2005.

2 SCOPE OF WORK

E2W was commissioned by Council to collate and interpret surface and groundwater data from the GWDD on 6 May, 18 August, 17 November 2014, and 26 February 2015. Each monitoring event comprised the following:

- Sampling of onsite and offsite groundwater wells MW-1S, MW-1D, MW-3, MW-4, MW-5, MW-6S, MW-6D, MW-7S, MW-7D, MW-9, MW-10 and MW-11.
- Sampling of surface water at two locations along Blue Angle Creek (ML-2, and ML-5[2]). Only ML-2 and ML-5 locations were sampled during this reporting period (i.e. ML-1, ML-3 and ML-4 were inaccessible due to being located on private property belonging to Cleary Brothers).

Similar EPL reports were previously completed by E2W for the 2003-2004, 2004-2005, 2005-2006, 2006-2007 , 2007-2008, 2008-2009, 2009-2010，2010-2011, 2011-2012, 2012-2013, and 2013-2014 monitoring periods. E2W is required to conduct the following scope of work to satisfy Council's surface and groundwater monitoring program at GWDD:

- Assist Council to interpret quarterly sampling results and provide recommendations.
- Prepare this annual report for May 2014 to February 2015 to provide information in accordance with Section R1.10 of the EPL (No. 5959). The annual report is to include the following:

    1. Tabulation of the monitoring data obtained for the period.
    2. Graphical representation of the current and previous monitoring data (minimum - last three years). Statistically significant variations or anomalies will be highlighted.
    3. Analyses and interpretation of monitoring data.
    4. Analyses and response to any complaints received.
    5. Identification of any deficiencies in the environmental performance of the GWDD, as highlighted by the monitoring data, trends and/or accidents.
    6. Proposal of recommendations to address the above identified deficiencies.
    7. Recommendations on improving the overall environmental performance of the facility.

[2] November 2008 was the first time ML-5 had been sampled since October 2004.

3 LICENCE CRITERIA AND RELEVANT GUIDELINES

The EPL for the GWDD was revoked by the DECC in May 2008. The ongoing groundwater monitoring is undertaken to assess the effectiveness of the capping works and environmental status of the landfill post closure and rehabilitation. The revocation notice is subject to the following conditions:

- The licensee must maintain the landfill capping works.
- The licensee must undertake groundwater monitoring at groundwater wells MW-1S, MW-1D, MW-3, MW-4, MW-5, MW-6S, MW-6D, MW-7S, MW-7D, MW-9, MW-10 and MW-11 (in accordance with Table 3.1 below).
- Should the monitoring results indicate ammonia concentrations greater than 20% above ammonia concentrations reported in Table GW-1 of *Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007*, dated 17 August 2007, the licensee must notify the EPA within 7 days of receiving the results.
- The licensee must undertake surface water monitoring at surface water monitoring points ML-1, ML-2, ML-3, ML-4 and ML-5 (in accordance with Table 3.1 below).
- Should the monitoring results indicate ammonia concentrations greater than 10% above ammonia concentrations reported in Table SW-1 of *Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007*, dated 17 August 2007, the licensee must notify the EPA within 7 days of receiving the results (Appendix C).
- The licensee must dewater, clean out and cap the two HDPE lined liquid storage ponds
    - By 1 January 2009, or
    - When the ponds are no longer required, or
    - If the liner is breached (whichever is the earlier).

Table 3.1: Surface and Groundwater Monitoring Requirements

Parameters	Monitoring Frequency - Groundwater	Monitoring Frequency – Surface water
Alkalinity	Quarterly (#1)	Quarterly (#1)
pH	Quarterly (#1)	Quarterly (#1)
Conductivity	Quarterly (#1)	Quarterly (#1)
Total Dissolved Solids	Quarterly (#1)	Quarterly (#1)
Nitrogen (Ammonia)	Quarterly (#1)	Quarterly (#1)
Phosphorous (Total)	Quarterly (#1)	Quarterly (#1)
Nitrate	Quarterly (#1)	Quarterly (#1)
Nitrite	Quarterly (#1)	Quarterly (#1)
Total Kjeldahl Nitrogen	Quarterly (#1)	Quarterly (#1)
Calcium	Annual	Annual
Chloride	Annual	-
Fluoride	Annual	-
Magnesium	Annual	Annual
Sulphate	Annual	-
Sodium	Annual	Annual
Bicarbonate	Annual	Annual
Carbonate	Annual	Annual
Potassium	Annual	Annual

Dissolved Organic Carbon	Annual	-
Iron	Annual	Annual
Manganese	Annual	Annual
Redox Potential	Annual	Annual
Faecal Coliforms	-	Annual
Enterococci	-	Annual

Note: Bicarbonate/alkalinity was conducted on quarterly basis (only an annual requirement).
Quarterly (#1) = monitoring is conducted on quarterly basis by KMC, however EPL requires sampling only "twice a year".

The parameters listed in Table 3.1 were included in May, August, November 2014 and/or February 2015 (Table 6). Annual parameters were sampled during the August 2014 monitoring period. Ongoing monitoring with the same parameters is proposed for the future monitoring reports.

The DECC's *Contaminated Sites: Guidelines for Assessment and Management of Groundwater Contamination* (March 2007) outlines a best-practice framework for assessing and managing groundwater contamination. The guidelines are made under the *Contaminated Land Management Act (1997)* and recommend adopting the ANZECC (2000) chemical concentration trigger values for the protection of (fresh and marine) aquatic ecosystems.

The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) guidelines include risk-based trigger levels and indicative interim working levels (IIWLs). The IIWLs are of low reliability and used when insufficient data is available to calculate a trigger level. It should be noted that the ANZECC (2000) water quality guidelines are applicable to receiving water and not to groundwater. However, they form an appropriate basis for undertaking a screening level assessment of groundwater quality. The selection of the applicable guideline values should be based on an assessment of potential pathways by which human or environmental exposure might take place and the beneficial end use of the groundwater (i.e. ecosystem support).
The choice of a beneficial use classification for groundwater at the site depends on the quality of the water and its potential use in the long term. Although groundwater in the aquifer surrounding the waste disposal facility is likely to be of relatively good quality (depending on the presence of saline intrusions), there are no known groundwater extraction bores (agricultural or domestic) within the immediate vicinity. Therefore, the most appropriate beneficial use category of the groundwater is considered to be for the protection of aquatic ecosystems in the discharge zones of nearby Blue Angle Creek and Seven Mile Beach (fresh and marine water, respectively).

Based on the closest environmental receptors being both marine and fresh waters (i.e. Seven Mile Beach, Blue Angle Creek and Crooked River Estuary), the guidelines adopted for the site are based on the protection of both marine and fresh water aquatic ecosystems. These assessment guidelines are presented with the summarised analytical results (i.e. Tables GW-1, SW-1).

Exceedances of ANZECC (2000) trigger values for marine water ecosystems have been highlighted in Tables GW-1 and SW-1.

4 ENVIRONMENTAL SETTING

The GWDD is located approximately 1.5 km southwest of the Gerroa Road bridge crossing of Crooked River and near the northern end of Seven Mile Beach. Blue Angle Creek is located around 80 m to the northwest of Crooked River Road (Figure 1).

The facility covers an area of approximately 3.2 hectares. The location and general layout of the site is shown in Figures 1 and 2. Prior to the remediation of the site in February 2005, the GWDD comprised the following:

- An elevated landfill mound ranging from 4 m to ~15 m AHD,
- Two lined evaporation sludge ponds. These accepted septic sludge associated with Gerringong's upgraded sewerage system. These ponds are now lined and used to hold groundwater pumped from the site to enable irrigation on the landfill mound.
- A night soil deposit, which historically accepted night soil sludge; and
- A small recycling facility.

The former night soil depot was located adjacent to the north-western slope of the landfill mound (Figure 2). The former depot consisted of two excavated infiltration trenches which, up until August 2002, received pump-out wastewater from septics in the Gerringong/Gerroa region. The two trenches were approximately 100 m in length (5 m wide) and while operational, partially filled with untreated wastewater.

4.1 CLIMATE

Between 1895 and 2011, the average yearly rainfall at Gerringong Mayflower Village (Latitude 34.75° S, Longitude 150.82° E) is 1343.4 mm/year, with the heaviest rainfalls occurring in summer and autumn months.

However, rainfall data from Toolijooa (Nyora) Station is taken from July 2012 due to the closure of Mayflower Village Station. Climatic data indicates Gerringong/Gerroa received approximately 1559 mm of rain from February 2014 to February 2015[3] (Appendix B). The highest months of above average rainfall were recorded in March 2014 (427 mm), and February 2015 (276 mm).

4.2 TOPOGRAPHY

A general layout of the site topography is presented in Figure 1. The GWDD is located in an estuarine landscape consisting of dune ridges, swamps and lagoons. The vegetation surrounding the facility comprises scrub and a littoral rainforest. Local relief is less than 5 m AHD and slopes less than 5%. The landfill forms a mound, reaching ~12 m above the surrounding ground surface.

The reduced groundwater level (RL) of the landfill footprint area ranges from ~3.3 to 5.2 m AHD. The footprint area (23,000 m^2) and height of the rehabilitated landfill mound (15.9 m AHD, July 2005) is practically the same as pre-remediation conditions (i.e. October 2003).

[3] Information obtained from the Bureau of Meteorology website (www.bom.gov.au/climate).

4.3 GEOLOGY

The GWDD is located within the Seven Mile Soil Landscape as defined by Hazelton (1992). Coastal Plain Quaternary marine sands and Quaternary alluvium underlie the site.

Previous site investigations, as discussed in the URS report (2002), identified light brown fine-grained dune sands to a depth of 4 - 6 m below grade. The sands vary in thickness (between dune ridges and swales) and are largely contained above the groundwater table.

Beneath the dune sands, fine-grained grey beach sands containing shell fragments are present to a depth of approximately 14 m. The base of the sequence comprises estuarine silty and sandy clays. Further inland, the sedimentary sequence comprises estuarine clays closer to the surface, particularly in the vicinity of Blue Angle Creek where the ground surface is 2 - 3 m lower than the landfill area.

4.4 HYDROGEOLOGY

The GWDD is underlain by an unconfined and permeable sandy aquifer. Groundwater is encountered at a depth of approximately 3 - 4 m below ground level (i.e. ~1 m AHD) at the landfill area and becomes shallower towards Blue Angle Creek to the west and Seven Mile Beach to the east.

The groundwater quality varies from potable to saline, with electrical conductivities ranging from 0.3 to 60 mS/cm. The groundwater generally becomes more saline with depth and in the vicinity of tidal saline water bodies (i.e. Blue Angle Creek and Seven Mile Beach).

The hydraulic conductivity of the beach and dune sands at Gerroa has a geometric average of 10 m/day (Gerroa-Gerringong Sewerage Scheme EIS, 1999). It is noted that the organic silty sands between 0 - 0.15 mbgl have a lower permeability (approximately 0.1 m/day, E2W site investigations, March 2004).
In the area of the GWDD, groundwater gradients are controlled by topography, the Seven Mile Beach shoreline, Blue Angle Creek and Crooked River Estuary. It is interpreted that a natural groundwater divide runs through the landfill (URS 2003, E2W 2004), with groundwater to the west flowing towards Blue Angle Creek and groundwater to the east towards Seven Mile Beach. It is likely the natural groundwater divide is influenced by the coastal dunes and presence of the landfill mound (due to increased recharge). The position of the groundwater divide may change with the tide and seasons. During 2004/2005 (a drought period), the predominant flow direction was considered to be east towards Seven Mile Beach.

Groundwater discharge at Blue Angle Creek and Seven Mile Beach will be influenced by the presence of a fresh groundwater/salt water interface. The interface results from the density difference between the groundwater and sea water and is a dynamic and complex region with upward hydraulic gradients, tidal fluctuations, micro-biological processes, groundwater and surface interaction and substantial salinity variations. The groundwater/salt water interface can be associated with enhanced natural attenuation (biodegradation, dilution, sorption etc.), which acts to reduce the levels of contaminants prior to their discharge to marine ecosystems.

Groundwater is also interpreted to discharge as baseflow within Blue Angle Creek. Due to the action of tides, salt water is intermittently present in Blue Angle Creek with salinity governed by tide levels. The saline water intrusion at high tide extends approximately 2 km upstream of the confluence between Blue Angle Creek and Crooked River.

It is understood offsite migration of contaminants (nutrients, iron and some ammonia) has occurred in the local shallow and deep groundwater systems (URS 2002, 2003; E2W 2004, 2006). This groundwater contamination arises from nutrient enrichment, which is associated with the former landfilling operations at the GWDD.

The leachate plume identified in the well network arises from historical waste disposal at the site, which commenced in the 1960s. The landfill remediation (completed in February 2005) will reduce future landfill leachate generation, however shrinking/diminishing of the existing plume will depend on natural attenuation processes (i.e. dilution, adsorption, biodegradation dispersion etc.) over time (years).

The groundwater quality immediately outside the footprint area is subjected to increased dilution arising from runoff (1 ha) and groundwater recharge from the landfill mound. This dilution together with natural attenuation decreases the leachate levels in the aquifer.

4.5 HYDROLOGY

The hydrology of the area is dominated by Blue Angle Creek, Crooked River and Seven Mile Beach (Figure 2).

The closest environmental receptors of water running through the GWDD are Blue Angle Creek, Seven Mile Beach and Crooked River Estuary (Figure 1). Blue Angle Creek flows into the Crooked River Estuary at the northern end of Seven Mile Beach. The estuary discharges into the ocean when the mouth is open.
Previous Crooked River and Blue Angle Creek surface water quality investigations were discussed in the URS report (2002). The results indicate a considerable variation in water quality, particularly between dry and wet conditions, which may be associated with inputs from the wider catchment area.

When the entrance to Crooked River is open, the lower part of the river is well flushed with oceanic waters. This results in levels of nutrients, bacteria and toxicants that generally comply with guideline levels. Immediately following wet weather, water quality in the estuarine section of Crooked River generally deteriorates, with increased levels of particulate material, bacteria, sulphide, nutrients and metals (URS, 2003).

Of the four main tributaries that feed into the estuarine section of Crooked River, water quality in Blue Angle Creek was the most degraded with phosphorus, nitrogen, hydrogen sulphide, copper and zinc (URS, 2003).

All surface water runoff from the landfill mound is diffused into the surrounding sandy soils.

5 PREVIOUS MONITORING RESULTS

The primary conclusion from the monitoring report submitted by URS (2002-2003) prior to remediation in 2005 is summarised below:

- High concentrations of nutrients, in particular ammonia-nitrogen, continue to be detected under the site and migrating offsite. The levels recorded are well in excess of ANZECC (2000) guidelines for the protection of fresh and marine water ecosystems.

The following key points are also noted:

- High concentrations of ammonia-nitrogen and TKN were consistently detected in monitoring wells MW-1 and MW-5, which are located on the outer extent of the facility. This indicates the potential for migration of the nutrient plume in a south-easterly direction towards Seven Mile Beach. High concentrations of ammonia-nitrogen were also detected in monitoring wells MW-3 and MW-7, which are also located on the outer extent of the facility, indicating the potential for migration of the nutrient plume in a north-westerly direction towards Blue Angle Creek.
- Elevated concentrations of ammonia-nitrogen were detected in the shallow monitoring wells MW-9 to MW-11, adjacent to Blue Angle Creek.

6 SURFACE AND GROUNDWATER MONITORING

Surface and groundwater monitoring between May 2014 and February 2015 was undertaken by ALS Environmental. Sampling was carried out on the following dates:

- 6 May 2014
- 18 August 2014
- 17 November 2014
- 26 February 2015

The recommended procedure for sample collection, storage, handling and quality control generally employed by Ecowise (ALS) is outlined in the SGMP by AWT (1999a). E2W used the November 2008 sampling round to instruct Council staff on surface and groundwater sampling protocol. The samples were sent to ALS (Sydney) for laboratory analyses. E2W understand that ALS carry out the quarterly sampling at the GWDD and submit the samples to ALS (Sydney via the Wollongong office) for analyses.

6.1 MONITORING LOCATIONS

The following outlines the nature of the monitoring and analytical program at the site and the conditions at the time of sample collection from information provided by ALS and/or Council.

Groundwater was sampled from six monitoring wells (MW-3, MW-4, MW-5, MW-9, MW-10, MW-11), and three nested wells (i.e. MW-1S/MW-1D, MW-6S/MW-6D and MW-7S/MW-7D, where S = shallow, D = deep).

Surface water was sampled at two locations (ML-2 and ML-5) along Blue Angle Creek (Figure 2). Samples were not collected from ML-1, ML-3 or ML-4 due to restricted access to sample locations (private land owned by CB). Samples were not collected from Seven Mile Beach (BS-1 to BS-4), or the ocean (OS-1 to OS-4) during May 2012 to February 2013 (neither during 2014 to 2015). Previous results from these locations indicate that it is unlikely landfill leachate is impacting these areas.

Variable EC levels in surface water testing locations indicate that sampling may not have been undertaken during low tide (sampling at low tide provides a reflection of groundwater discharge).

6.1.1 Sampling Sites - Groundwater

The sampling sites are described below, while sampling depths for the bundled piezometers and conventional wells are summarised in Table 6.2.

- MW-1S (shallow - 6 m depth) and MW-1D (deep - 10.5 m depth)[4] - Located next to the previous multilevel piezometer MW-1 and approximately 40 m from the SE corner of the landfill perimeter. The well is situated down-gradient of the landfill mound and intended to intersect flow heading towards Seven Mile Beach.
- MW3 - Approximately 20 m to the north of the landfill clearing, fronting native bushland. This well is to establish background water quality conditions and determine offsite migration of groundwater in a northerly direction.
- MW4 - Located immediately adjacent to the night soil depot, which is a source of potential nutrient and bacterial contamination.
- MW5 - Approximately 30 m to north of the night soil depot. The well is within the extent of contamination arising from the depot and landfill-impacted groundwater.
- MW-6S (shallow - 6 m depth) and MW-6D (deep - 10.5 m depth) - Located next to multilevel piezometer MW-6 and approximately 50 m NW of landfill and night soil depot. The well is situated down-gradient of the landfill and night soil depot.
- MW-7S (shallow - 6 m depth) and MW-7D (deep - 10.5 m depth) - Located 15 m to the east of multilevel piezometer MW-7 and approximately 100 m NW of landfill and night soil depot. This well was installed to establish background water quality conditions and determine offsite migration of groundwater contaminants towards Blue Angle Creek.
- MW9 - Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.
  MW10 - Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.
  MW11 - Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.

[4] Nested shallow and deep wells are constructed with a 3 m well screen.

6.1.2 Sampling Sites - Surface Water

Blue Angle Creek

- ML-1 - Approximately 100 m upstream of the depot along Blue Angle Creek at the end of the tidal limit. This sampling location was chosen to establish upstream water quality and offsite conditions.
- ML-2 - Approximately 500 m downstream of the depot along Blue Angle Creek. This sampling location was chosen to establish offsite and downstream water quality and assess the potential for contamination associated with the depot.
- ML-4 - Approximately 100 m upstream of the flood gates along Blue Angle Creek. This sampling location was chosen to establish upstream water quality and offsite conditions.
- ML-5 - Approximately 400 m downstream of the flood gates along Blue Angle Creek, between MW-9 and MW-11. This midstream sampling location was chosen to establish offsite receptor water quality conditions.

The surface water and groundwater sample locations are illustrated in Figure 2, and Table 6.1.2.

Table 6.1.2: Monitoring Summary for May 2014 to February 2015

Sample ID	Screen Interval (m AHD) & Sample Location	6 May 2014	18 August 2014	17 November 2014	26 February 2015
MW-1S	Approx. 0 to -3	X	Dry	Dry	Dry
MW-1D	Approx. -4 to -7	X	X	X	X
MW-3	0 to 1.5	X	X	X	X
MW-4	0.79 to -0.71	X	X	X	X
MW-5	0.55 to -0.95	X	X	X	X
MW-6S	Approx 0 to -3	X	X	Dry	Dry
MW-6D	Approx -4 to -7	X	X	X	X
MW-7S	Approx 0 to -3	X	X	X	X
MW-7D	Approx -4 to -7	X	X	X	X
MW-9	-0.53 to -1.53	X	X	X	X
MW-10	-0.525 to -1.525	X	X	X	X
MW-11	0.095 to -0.905	X	X	X	X
ML-1	Upstream of landfill	No access	No access	No access	No access
ML-2	Downstream of landfill	X	X	X	X
ML-3	Upstream of landfill	No access	No access	No access	No access
ML-4	Upstream of landfill	No access	No access	No access	No access
ML-5	Opposite landfill	X	X	X	X

Notes:
X = Sample collected. MW = Monitoring well sample from landfill site. ML = Surface water sample from Blue Angle Creek. The 6 wells (MW-1S/MW-1D etc) are considered more reliable monitoring locations (compared to multilevel piezometers) as they were constructed with standalone 50 mm diameter PVC screens and not the 7 mm poly tubing (low flow system)

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6.2 SAMPLE COLLECTION AND LABORATORY ANALYSIS

The surface and groundwater analytical program from May 2014 to February 2015 is presented in Tables GW-1 and SW-1. The nested wells (MW-1S, MW-1D, MW-6S, MW-6D, MW-7S, MW-7D) installed in 2006 have replaced the bundled piezometers [5] (i.e. MW-1, MW-6, MW-7). The results from the nested wells are graphed separately for the water quality trend assessment.

7 MONITORING RESULTS

All groundwater and surface water analytical results from 2003 to 2015 are presented in Tables GW-1 and SW-1, with the most recent (4) monitoring data highlighted. The field records and laboratory reports are presented in Appendix A and Table 6 (summary of data set).

Compliances exceedances are noted in Appendix C (ML-5 and MW-5).

A summary of all available monitoring data (2003 to 2015) is presented in Graph-01 to Graph-07. The graphs illustrate ammonia and total phosphorous concentrations (key indicators of leachate impact) for the groundwater wells[6] and surface water sampling locations as well as the depth to groundwater (m AHD, 2001 to February 2015).
The graphs illustrate the ammonia concentrations in the shallow (Graph-01) and deep monitoring wells separately (Graph-02). Contaminant migration rates and flushing characteristics are different at shallow and deep levels of the aquifer.

The graphs highlight water quality trends with respect to seasonal and water level changes, as well as water quality improvements associated with the landfill rehabilitation completed in 2005.

7.1 GROUNDWATER DATA

Groundwater was collected from a network of twelve monitoring wells at onsite and offsite locations (Figure 2) in May, August, November 2014 and February 2015. The results of the groundwater results obtained are summarised in Table GW-1, Graph-01 to Graph-05 and the following subsections.

7.1.1 Groundwater Depth and Flow Regime

The depth to groundwater was measured prior to each sampling event (in conventional wells) using a water level probe. The depth to the groundwater below top of casing and relative to a common reference (i.e. Australian Height Datum, m AHD) is presented in Table GW-1. The inferred groundwater contours are presented in Figures 3A & 3B. Reduced groundwater levels (m AHD) between 2001 and 2015 are illustrated in Graph-05.

[5] The bundled wells were believed to provide spurious results due to the low purge volumes.
[6] Results from multilevel piezometers MW-1, MW-6 and MW-7 (Graph-01 & Graph-03) are considered anomalous.

A groundwater divide is interpreted to occur at the landfill mound (sand dune area) and inferred to be located midway between Crooked River and Seven Mile Beach. As the position of the groundwater divide is influenced by the surface water bodies, the prevailing climate and recharge through the waste mound, it is likely local groundwater flow characteristics have altered over recent years.

The reduced groundwater levels from the twelve wells indicate a relatively moderate water table elevation. Field sampling records show that the depth to groundwater between October 2003 and February 2012 is below 1.87 mAHD. The groundwater levels recorded from the 2011-2012-2013 and 2014-2015 monitoring round are slightly higher than the 2013-2014 monitoring periods, reflecting variable rainfall patterns and leachate movement over time.

The inferred groundwater contours for the site are presented in Figures 3A & 3B (reflecting dry and wet weather periods with corresponding shallow and deep water tables). The groundwater levels and degree of mounding is generally variable, indicating a dynamic groundwater environment dependent upon rainfall recharge (aquifer is unconfined and sandy soils are highly permeable at the site).

7.1.2 Field Parameters

The groundwater, field parameters measured during sampling are considered indicative only (small purge volumes). Insitu measurements (within borehole) are likely to provide a more accurate rendition of the field chemistry, especially with respect to dissolved oxygen.

7.1.2.1 pH (field) and Redox

The groundwater pH measured from the twelve wells ranges from pH 4 to 7.7 (MW-5/10, May 2013 and MW-7d, during Aug 2014, respectively). The pH in each well was generally stable over the four monitoring rounds (May 2014 to February 2015).

On its own, pH is not considered a reliable indicator of leachate contamination, as sediments and decomposing organic material associated with the creek bed also have a significant influence on pH.

Redox was not measured during the previous monitoring periods (2010 to 2011 and 2009- 2010) but was measured in August 2011 during 2011-2012 sampling round, and August 2012 during the 2012-2013 monitoring period. Similarly redox was only measured in August 2014 during the 2013-2014/2014-2015 sampling rounds, ranging from 318 to -147 mV. In each well redox is generally comparable to previous monitoring periods.

7.1.2.2 Total Dissolved Solids (TDS and EC)

The TDS levels in groundwater collected from the site range from 365 to 23,400 mg/L (fresh to brackish). The lowest and highest TDS levels were obtained from MW-7S and MW-9, respectively. The TDS level for MW-9 is related to the well's proximity to Blue Angle Creek and associated tide and estuary mouth closure influences.

Wells located within the vicinity of the landfill mound (MW-3 to MW-6) have lower TDS levels (<1000 mg/L) which is similar to previous monitoring rounds (2013-2014, 2012-2013, 2011-2012,

2010-2011, 2009-2010 and 2008-2009). The distribution of TDS levels reflects the location of rainfall recharge and fresh water near the groundwater divide (landfill area).

Salinity increases as groundwater flows towards Blue Angle Creek (MW-9 to MW-11). A decrease in salinity (TDS) occurs in several wells close the landfill perimeter (i.e. MW-3, MW-4, MW-5), which is interpreted to occur from dilution arising from an increase in stormwater runoff from the landfill mound post-capping (& decreased leachate generation).

7.1.2.3 Dissolved Oxygen (DO)

Field analyses from the twelve wells recorded dissolved oxygen (DO) concentrations ranging between 1.4 and 4.2 mg/L (MW-3 and MW-10). The concentrations of DO reported for the site from 2003 to 2015 are variable. However, measurements may reflect the instruments (imprecise) used and/or purging process.

Based on the distribution of DO in the groundwater at the site, it is inferred that landfill leachate caused a depletion of groundwater DO and is generally increasing due to decreasing nutrient concentrations. This phenomenon is seen on many landfill sites, where organic carbon and nutrients provide surplus electron acceptors, which react with and consume the available DO in the groundwater. It is likely the groundwater under the landfill mound is anaerobic due to the presence of the landfill leachate (DOC, ammonia etc.) and poor flushing due to the landfill capping.

7.1.3 Nutrients

7.1.3.1 Nitrogen

Groundwater collected from the monitoring wells at the GWDD were analysed for ammonia-nitrogen, total Kjeldahl nitrogen (TKN) and oxidised nitrogen (nitrate and nitrite). Discussions regarding potential impact to the environment will focus on ammonia-nitrogen, as it is the main indicator of groundwater contamination from leachate.

The guidelines for total ammonia-nitrogen for the protection of fresh water and marine ecosystems vary according to pH and temperature. Given the range of pH and temperature measured across the site and in Blue Angle Creek, the guidelines are 1.88 and 2.84 mg/L for fresh and marine waters, respectively (at a pH of 7.3).

At least one groundwater samples collected from MW-5, MW-6D, MW-7D exceeded the ANZECC (2000) trigger value for ammonia. These monitoring wells are located adjacent or west of the landfill mound, indicating leachate is migrating towards Blue Angle Creek. The ammonia (14.5 mg/L in February 2015) reported in MW-05 is suspected to be an anomaly and should be re-sampled for quality control.

Groundwater wells (MW-1, MW-3 and MW-4 pre-rehabilitation) initially reported the highest concentrations of ammonia. Following the landfill rehabilitation, ammonia levels have declined in the shallow groundwater system and are below ANZECC guidelines (Graph-01). The groundwater from

deep wells (MW-1D, MW-6D and MW-7D) show a clear declining trend, and now hovering at above/below the ANZECC guidelines.

The ammonia concentrations show a clear reduction in nutrient loading in the deep aquifer (ammonia generally below 10 mg/L in the 3 key deep wells) and water quality improvement at the site since landfill closure and rehabilitation.
Nitrate was analysed for all samples (May 2014 to February 2015) with MW-1D, MW-6S, MW-6D, MW-7D, MW-9, MW-10 generally only marginally exceeded the ANZECC (2000) guideline (fresh water trigger value, 0.7 mg/L) at least once in the 2014-2015 monitoring period. The result for MW-6S (August 2014= 8.33 mg/L) is considered anomalous as previous results were reported below 1 mg/L.

All groundwater samples analysed from all twelve wells in May, August, November 2014 and February 2015 exceeded ANZECC (2000) fresh and marine water TKN trigger values (0.5 and 0.12 mg/L, respectively). Monitoring wells located adjacent to Blue Angle Creek (i.e. MW-9, MW-10, MW-11) continue to report stable or decreasing concentrations of ammonia (Graph 1).

Table 7.1.3 (below) and Figure 4 provide an overview of groundwater ammonia trends from May 2014 to February 2015 reporting period.

Table 7.1.3: Groundwater Ammonia Trends - May 2014 to February 2015

Well ID	Ammonia Trend	Exceedance of ANZECC (2000) Ammonia	Trigger 20% exceedance (Ammonia)	Comment
MW-1S	Decreasing trend. Levels below 0.31 mg/L, below ANZECC	No exceedance	No exceedance	Shallow sample - east of landfill
MW-1D	Variable but decreasing trend below ANZECC	No exceedance	No exceedance	Deep sample - east of landfill
MW-3	Decreasing/stable trend. below ANZECC	No exceedance	No exceedance	North of landfill
MW-4	Decreasing/stabile trend. below ANZECC	No exceedance	No exceedance	West of landfill
MW-5	Stable to variable/anomalous results ? Levels above/below ANZECC	Exceedance	Exceedance	North of landfill. Re-sample of Feb 2015 required for validation
MW-6S	Stable trend below ANZECC	No Exceedance	No Exceedance	Shallow sample - down-gradient of night soil deposit
MW-6D	Stable/decreasing trend. levels above and below ANZECC	Exceedance	No Exceedance	Deep sample - down-gradient of night soil deposit
MW-7S	Decreasing/Stabilising trend. below ANZECC	No exceedance	No exceedance	Shallow sample - down-gradient and adjacent to Crooked River Road
MW-7D	Decreasing/Stabilising trend. levels below and above ANZECC (6/5/2014= 1.91 mg/L)	Exceedance	No Exceedance	Deep sample - down-gradient and adjacent to Crooked River Road
MW-9	Stable/decreasing trend. below ANZECC	No exceedance	No exceedance	Next to Blue Angle Creek

MW-10	Stable/decreasing trend. below ANZECC	No exceedance	No exceedance	As above
MW-11	Stable/decreasing trend. below ANZECC	No exceedance	No exceedance	As above

Note: Three wells (MW-9, 10, 11) are located on the creek bank, potentially affected by flood waters and vegetation. . ANZECC (2000) refers the marine trigger value (2.84 mg/L).

As outlined in the revocation notice, ammonia concentrations greater than 20% above ammonia concentrations reported in Table GW-1 of *Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007*, dated 17 August 2007 are to be highlighted (refer to Appendix C).

7.1.3.2 Total Phosphorus (TP)

The ANZECC (2000) TP guideline for fresh and marine ecosystems is 0.05 and 0.025 mg/L, respectively. Between May 2014 and February 2015, all groundwater sample results exceeded the ANZECC (2000) trigger values (Table GW-1 and Graphs 3 & 4).

MW-6D (located down gradient of the former night soil deposit and landfill) reported a maximum of 6.84 mg/L in the 2011-2012 monitoring period, however decreased to a maximum of 4.8 mg/L in the 2012-2013 monitoring period. In 2013-2014 and 2014 -2015 total phosphorous was a maximum of 9.07 mg/L and 3.93 mg/L, respectively indicating variability. MW-7D reported a maximum (TP =1.07 mg/L in February 2015) which is below previous years (TP =8.46 mg/L, November 2014). TP at MW-6D and MW-7D (near former night soil) shows variability (Graph-4) and may relate to the 2013 dewatering/sludge pond decommissioning (further monitoring required to verify impacts in the deep groundwater).

During the 2013-2014-2015 monitoring period, MW-6S (shallow nested well) initially showed a decreasing trend and a maximum of 0.8 mg/L (February 2014), comparable to the 2012-2013 maximum (0.63 mg/L) and significantly lower than the 2011-2012 maximum of 8.81 mg/L. TP at MW-4 (located south of the night soil deposit) indicate an elevated, variable and potentially stabilising trend (Graph 3). The August 2012 & 2014 monitoring event reported a maximum TP (4.29 mg/L and 1.81 mg/L) at MW-4, which is lower than the maximum TP in 2011-2012 (7.98 mg/L, the highest to date since sampling began in June 2003). The removal of the liner from the sludge pond in October 2011 may have impacted the 2011-2012 results (particularly MW-6S).

The concentrations of TP immediately east and north of the landfill (MW-3 and MW-5) and next to Blue Angle Creek (MW-9 to MW-11) are lower, indicating that the former night soil deposit is a likely source of TP.

In relation to the former night soil deposit (primary TP source), a localised TP plume is interpreted to potentially migrate towards Blue Angle Creek (MW-4/MW-6S to MW-7S, and to MW5 (TP= 2.08 mg/L in February 2015). The TP plume is also detected at MW-4 (south of the night soil deposit). Potentially increasing TP concentrations in the deep wells (10.5 m depth, MW-6D, MW-7D) show that the plume may have reached the deep aquifer, however further monitoring is required to determine trends. The TP concentrations of TP on the east/north (MW-3/MW1) are likely to originate from the landfill mound.

TP concentrations at MW-1S (eastern side of landfill) shows a variable trend; however further monitoring is required to verify the trend.

7.1.4 Hydrogeochemical Indicators

Concentrations of major ions (i.e. chloride, sulphate, calcium, magnesium, sodium, alkalinity and potassium) are presented in Table GW-1. The concentrations at all monitoring wells are within previously reported ranges and characterised by the ions sodium, chloride and bicarbonate (alkalinity).

The landfill is interpreted to contribute some concentrations of ions including calcium, potassium, magnesium and bicarbonate/alkalinity. Contribution of sodium and chloride is difficult to ascertain as these ions are common in the marine environments (e.g. salt spray, tidal influence) and abundant in wells close to Blue Angle Creek (MW-9, MW-10, MW-11) or in proximity to Seven Mile Beach (MW-1S, MW-1D).

7.1.5 Inorganic Contaminants (Iron, Manganese and Fluoride)

Iron concentrations were only analysed for samples collected in August 2014. Concentrations of iron (filtered at the laboratory) ranged between <0.05 and 15.0 mg/L (MW-7D and MW-3,respectively). Seven wells reported concentrations were above the ANZECC (2000) guideline for iron in fresh water ecosystems (0.3 mg/L). Multiple natural and landfill related sources of iron are likely to exist at the site and offsite area (lithology and landfill).

The ANZECC (2000) guideline for iron is an indicative interim working level (IIWL) and is of low reliability. No guideline is available for iron in marine water, which is more relevant for Blue Angle Creek and Crooked River receiving water bodies.

Manganese concentrations were analysed for samples collected in August 2014. Concentrations of manganese ranged between 0.006 (MW-9) and 0.424 mg/L (MW-4). No exceedance of the ANZECC (2000) fresh water guideline (1.9 mg/L).

The levels of filterable iron and manganese are generally similar to previous reporting periods. Variation in the concentrations may also reflect turbidity of water samples and filtering procedures.

Concentrations of fluoride (analysed in August 2014) ranged from <0.1 (MW-5, MW-7S) to 0.4mg/L (MW-6S, MW-6D), which are similar to previous reporting periods (2010-2014). No reliable ANZECC (2000) guideline exists for fluoride in fresh or marine waters.

7.1.6 Organic Contaminants

Dissolved organic carbon (DOC) concentrations were only analysed for samples collected on the 30 August 2013. The concentration of dissolved organic carbon (DOC) in samples from the twelve wells ranged from 7 mg/L (MW-7D) to 31 mg/L (MW-11). The results are generally comparable to previous

monitoring periods, with lower concentrations noted in this period. No recommended ANZECC (2000) guidelines exist for DOC, but can be used to indicate organic carbon related to landfill leachate.

7.1.7 Discussion and Trends - Groundwater

The key trends in groundwater levels and nutrient contamination from 2003 to 2015 are presented in Graph-01 to Graph-05. The monitoring data indicates that ammonia concentrations in the deep groundwater are close to ANZECC guidelines (i.e. results at above and below ANZECC as shown in Graph-02). Trends for the deep wells (MW-1D, MW-6D and MW-7D) show a clear declining trend since August 2009 (Graph-02).

Groundwater (ammonia) trends for the three wells (MW-09, 10, 11) located adjacent Blue Angle Creek show a declining trend (Graph-01). These three wells are influenced from tides and flooding (including estuary mouth closures).

Graph-01 indicates ammonia concentrations in the shallow wells have steadily decreased (generally below guidelines) since land-filling operations at the GWDD ceased in October 2003.

Prior to landfill rehabilitation, groundwater quality trends indicate landfill leachate generation may be related to rainfall recharge into buried waste and subsequent groundwater and contaminant migration. The results post-landfill rehabilitation indicates landfill leachate concentrations in the shallow groundwater are decreasing, becoming diluted from attenuation/rainfall via runoff from the landfill mound. The potential for landfill leachate generation was significantly reduced following remedial works, as the buried waste was capped with an impervious clay barrier.

The groundwater ammonia trends (ammonia being a key landfill leachate indicator) indicate shallow groundwater quality is improving. The three deep wells installed in 2006 indicate the leachate plume in the deep parts of the aquifer is also improving (Graph-02) more slowly as flushing is lower at deeper levels in the aquifer (i.e. below sea level and across the groundwater divide).

7.2 SURFACE WATER

Surface water sampling was undertaken in May, August, November 2014 and February 2015. Samples were collected from two locations (ML-2 and ML-5, permission for accessing other locations was denied by site owner) locations along Blue Angle Creek (Figure 2).

Samples were not collected from ML-1, ML-3 or ML-4 due to restricted access (i.e. land is owned by Cleary Bros- access denied for sampling); therefore upstream water quality is relatively unknown and may be degraded due to farming and areas of acid soils. Sample locations, ML-1 ML-2 (downstream) and ML-5 (midstream) are not considered appropriate to assess water quality impacts from the landfill and potential upstream sources. All analytical results for surface water monitoring points ML-2 and ML-5 are presented in Table SW-1.

It is not known if surface water sampling was performed during wet or dry periods (note: Based on rainfall records August 2014 was likely to be a wet monitoring event). Blue Angle Creek is tidally

influenced and has a marine water influence at all sample locations, as shown by the broad range of TDS/conductivity results (i.e. fresh to saline, Table SW-1).

The surface water monitoring data at upstream/downstream locations is variable and likely to reflect a combination of tidal sampling regimes and inputs from the broader catchment area (e.g. samples should be coordinated with the tide so that both creek samples are collected during a run-out tide when the maximum amount of groundwater (potential leachate) discharges into the creek).

7.2.1 Field Parameters

7.2.1.1 pH (field) and Redox

The pH was similar at ML-2 and ML-5, and ranged from pH 6.1 to 7.1. Sampling results indicate that pH is slightly more acidic at upstream areas with Blue Angle Creek and may relate to the acid soils in the area.

Redox was only measured in August 2014 during 2014-2015 monitoring period, at ML-2 (149 mV) and ML-5 (205 mV).

7.2.1.2 Total Dissolved Solids (TDS and EC)

Restricted access has limited the assessment of upstream and downstream locations. Previous monitoring period indicated that between August and November 2008, the concentrations of TDS at the Blue Angle Creek upstream location (ML-1) were less than those recorded downstream (ML-2). The TDS concentration upstream of the flood gates (ML-4) was less than those recorded downstream of the flood gates (ML-1 and ML-2).

Samples collected between May 2014 and February 2015 at the downstream location ML-2 were fresh to saline[7] (TDS = 423 to 32,600 mg/L), while samples from the midstream location ML-5 were slightly fresher (TDS = 281 to 21,400 mg/L). The surface water samples are located in an area of the creek that is known to be influenced by tides. The presence of mangroves and other aquatic plants also reflects the typically saline water in the lower section of Blue Angle Creek.

Groundwater samples collected from MW-9, MW-10 and MW-11 were less saline than surface water samples collected from Blue Angle Creek and more saline than samples from all other groundwater monitoring wells sampled between May 2014 and February 2015. This data indicates that tidal waters from Crooked River Estuary can influence water quality and salinity of the 3 wells (MW-9, MW-10 and MW-11). Higher salinity reduces (as more marine water) the possibility of detecting leachate derived from the landfill.

[7] Possibly reflecting collection of samples during high and low tide and stormwater runoff and rainfall

7.2.2 Nutrients

7.2.2.1 Nitrogen

Concentrations of ammonia in the surface waters collected from Blue Angle Creek have been, and continue to vary with time (Graph-06 and Table 7.2.2). The upstream catchment area of Blue Angle creek is improved pastures and grazing (i.e. agricultural sources of nutrients).

Table 7.2.2: Surface Water Ammonia Trends - May 2014 to February 2015

Sample ID	Minimum (mg/L)	Maximum (mg/L)	Trend	Comments & Trigger 10% Exceedance of Ammonia
ML-1	-	-	-	No site access
ML-2	0.09 (Feb 2015)	0.68 (Aug 2014)	Variable, generally decreasing	All below ANZECC guidelines
ML-3	-	-	-	No site access
ML-4	-	-	-	No site access
ML-5	0.07 (Feb 2015)	3.5 (Nov 2014)	Variable, generally decreasing	Below ANZECC guidelines, except for Nov 2014 (3.5 mg/L)

Note: ML-5 was sampled for the first time in four years in November 2008.

Samples collected from ML-2 reported ammonia concentrations between 0.09 and 0.68 mg/L (Table SW-1). ML-5, located midstream in Blue Angle Creek in proximity to groundwater monitoring wells MW-9, MW-10 and MW-11 ranged from 0.07 to 3.5 mg/L. Highest ammonia (3.5 mg/L) concentration is associated with high TKN (4.3 mg/L), saline water (TDS= 18500 mg/L) which is inferred to reflect background water quality.

Sampling at ML-5 (resumed in November 2008 but had not been sampled since October 2004) indicates that the water quality is variable (Table SW-1), indicating multiple pollutant sources and tidal influence.

Restricted access to upstream locations (ML-1, ML-3 and ML-4) limits conclusions regarding impacts due to the absence of upstream sample locations. Elevated ammonia in surface water compared to groundwater wells (& variable TKN concentrations) in proximity to the creek (MW-9, MW-10, and MW-11) indicates that sources of ammonia also occur from the upstream catchment area (agricultural land).

Concentrations of TKN exceeded the ANZECC (2000) guidelines for fresh and marine waters for all samples collected along Blue Angle Creek. The highest concentration was reported at the upstream location (ML-5, 4.3 mg/L in November 2014). Concentrations of TKN in groundwater are elevated and variable.

Increases in nitrogen from upstream and downstream of the landfill have been observed during previous monitoring periods. While these increases may be attributable to the discharge of ammonia-rich groundwater from the landfill, other sources (random) of nitrogen input such as runoff from sub-catchments and nutrients bound in sediments cannot be discounted. It is also possible that poor quality estuarine waters from Crooked River move up Blue Angle Creek during tidal cycles. Sewerage

discharges into sand dunes may also occur due to capacity issues at the Gerroa sewerage treatment plant.

Interpretation of the nutrients into surface water bodies from the landfill is complicated by the sampling regime (i.e. sampling at various tides) and other potential sources of nitrogen. The fluctuating flow regime near Blue Angle Creek and wet weather events may reduce the potential for landfill leachate to impact the creek.
Total organic carbon (TOC) was not measured during the 2014 to 2015 monitoring period.

As stipulated in the revocation notice, ammonia concentrations greater than 10% above ammonia concentrations reported in Table SW-1 of *Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007*, dated 17 August 2007 are to be highlighted (Appendix C). Exceedances greater than 10% above ammonia were not exceeded at ML-2 (trigger value = 1.38 mg/L), and ML-5 (trigger value = 2.38 mg/L) for November 2014 (3.5 mg/L). Based on the low ammonia results from monitoring wells (MW-9, MW-10, MW-11, Graph 1) in proximity to the creek, high ammonia concentrations in the surface water may be attributed to potential upstream sources (agriculture) or poor quality estuarine water (tidal or mouth closure).

7.2.2.2 Total Phosphorous (TP)

Concentrations of TP from Blue Angle Creek were analysed from all samples collected in May, August, November 2014, and February 2015 (Table SW-1).

Previous levels (2011-2012 monitoring period) reported an increase in TP concentrations, which exceeded the IIWL[8] ANZECC 2000, (fresh 0.05 mg/L, marine 0.025 mg/L) at ML-2 and ML-5 for all sampling rounds. The 2012-2013 monitoring period reported an variable increase in TP concentrations which exceeded the IIWL[8] ANZECC 2000, (fresh 0.05 mg/L, marine 0.025 mg/L) at ML-2 (0.05 mg/L, May 2012 and 0.13 mg/L, February 2013) and ML-5 (1.95 mg/L, February 2013). The 2013-2014 monitoring period reported two exceedences of the ANZECC 2000 guidelines for ML-2 in May 2013 & February 2014 (0.09 mg/L and 0.12 mg/L respectively) and one exceedence in ML-5 in 2013 (0.06 mg/L).

TP concentrations at ML-2 ranged from 0.05 mg/L (August 2014) to 0.6 mg/L (May 2014) and continue to show a variable trend. The trend may be associated with the dynamic nature of the surface water and surrounding environment.

ML-5 reported all TP concentrations ranged from 0.05 mg/L (August 2014) to 0.22 mg/L (May 2014) in the 2014-2015 reporting period, indicating variability over time (Graph-07). The variability is considered to reflect the dynamic nature of the environment.

[8] ANZECC (2000) Indicative Interim Working Levels (IIWLs).
[9] Laboratory Level of Reporting (LOR)

7.2.3 Bacteriological Contaminants

Surface water sample locations (ML-2 and ML-5) were analysed for thermotolerant (faecal) coliforms and enterococcus coliforms on 18 August 2014 (Table SW-1).

Both samples results in August 2014 for enterococcus were above ANZECC (2000) fresh and marine guidelines (35 CFU/100 mL), downstream sample ML-2 reported 160 CFU/100 mL and midstream sample ML-5 reported ~130 CFU/100 mL. Both locations are significantly lower than 2010-2011 monitoring period results (ML-2, 1300 CFU/100 mL and ML-5, 1200 CFU/100 mL, November 2010) but above the 2011-2012 (ML-2, 18 CFU/100 mL and ML-5, 8 CFU/100 mL) and 2012-2013 (ML-2, 4 CFU/100 mL and ML-5, 15 CFU/100 mL).

Surface water samples reported levels of thermotolerant (faecal) coliforms below ARMCANZ (2000) guidelines (150 CFU/100 mL) for marine and fresh water ecosystems at ML-2 (290 CFU/100 mL) and ML-5 (~220 CFU/100 mL).

Multiple sources of coliforms exist in the surface water system, with the capped landfill representing an insignificant contribution, due to it's distance from the creek (i.e. local fauna and flora, farms) and filtering in the aquifer.

7.2.4 Inorganic Contaminants

Dissolved organic carbon (DOC) concentrations were not analysed during the 2012-2015 monitoring periods.

Surface water samples from August 2014 reported elevated concentrations of iron (ML-5 =0.6 mg/L, ML-2 = 0.36 mg/L) above ANZECC 2000 guidelines (0.3 mg/L). However, the ANZECC (2000) guideline for iron in fresh water is a low reliability IIWL.

Manganese concentrations for ML-2 & 5 were reported below the ANZECC (2000) fresh water guidelines (low reliability IIWL).

7.2.5 Major Ions

Concentrations of major cations (sodium, potassium, alkalinity, magnesium, calcium) in the surface water (Blue Angle Creek) indicate domination of sodium (marine water influence), which is consistent with previous monitoring rounds.

7.2.6 Quality Assurance/Quality Control

Interpretive Quality Control Reports (QCI, Appendix A) provided by ALS (Sydney) of the surface and groundwater laboratory data were reviewed for the four sampling rounds (May, August, November 2014 and February 2015). No laboratory outliers or exceedances of holding times were noted during the 2014-2015 monitoring period.

8 LEACHATE PLUME AND LANDFILL REHABILITATION

The monitoring results have been used to assess potential impacts to fresh and marine aquatic ecosystems. The groundwater migrating from the former landfill discharges to Blue Angle Creek and Seven Mile Beach. The range of groundwater contaminants identified from the latest monitoring events indicates the GWDD is a source of leachate (mostly ammonia and TKN), total phosphorous and iron.

Ammonia is the primary landfill leachate indicator. However, the waste is also a source of dissolved salts, metals and organics associated with the dissolution of ions (predominantly calcium and bicarbonate).

Following the closure of the landfill in 2003 and remedial works completed by Council and E2W in February 2005, the generation and migration of ammonia has declined in the shallow and deep groundwater system (Graphs-01 & 02). Monitoring wells MW-3, MW-4 and MW-5 are considered to reflect the typical groundwater quality arising from the landfill rehabilitation (>80% decrease in ammonia over time).

The deep groundwater monitoring wells (MW-1D, MW-6D and MW-7D) installed in 2006 show water quality improvements but at a slower rate relative to the shallow groundwater. Deeper groundwater took longer to improve due to the slower groundwater flushing. However, since August 2009 the ammonia concentrations in deep wells show a clear decreasing trend (Graph-02).

The most significant contaminant is ammonia-nitrogen, with a remnant plume extending in both north-west and south-east directions reflecting flows either side of the groundwater divide. Prior to rehabilitation, leachate originating from the landfill and night soil depot infiltrated the shallow aquifer, as well as migrating under the predominant groundwater flow regime towards Seven Mile Beach and Blue Angle Creek, respectively.

E2W consider the leachate plume in the shallow/deep groundwater has shrunk due to a decrease in leachate generation as well as from natural attenuation processes (including dilution). The time series trends show that significant groundwater quality improvements occur after approximately 5 years.

Monitoring results indicate a clear improvement in water quality and aquifer restoration. Landfill rehabilitation is considered to have achieved a practical and successful outcome over a 10 year period.

Previous results (2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015) results from the three groundwater wells located along Blue Angle Creek (MW-9, MW-10 and MW-11) indicate ammonia concentrations below the ANZECC (2000) guidelines (with the exception of MW-11 in 2009-2010, Table GW-1). Recent 2013-2014/2014-2015 results continue to report a decrease in ammonia, which are below ANZECC (2000) guidelines.

The landfill rehabilitation conducted between July 2004 and February 2005 has resulted in a measurable improvement in the shallow groundwater quality at GWDD. While ammonia remains elevated but has began to fall below the ANZECC 2000 guidelines in the deep groundwater, E2W consider that water quality will continue to improve in shallow/deep aquifer due to reduced leachate generation and ongoing natural attenuation.

The surface water results from the 2014-2015 monitoring period reported one guideline exceedences for ML-5 in November 2014 (3.5 mg/L). The surface water environment is dynamic and influenced by tidal flushing and discharges (runoff, seepage, baseflow) from the surrounding catchment and aquifer.

8.1 ECOLOGICAL ISSUES

Groundwater migrating from the landfill to Seven Mile Beach is diluted by the dynamic processes operating in this environment. Contaminants contained within this discharge may be diluted and dispersed via biological, chemical and physical processes occurring at the groundwater/salt water interface. Plant uptake of excess nutrients in the groundwater may also occur as the depth to groundwater becomes shallower as it approaches the beach.

The effect of nutrient-impacted groundwater discharging to Blue Angle Creek and/or Crooked River Estuary is unclear and difficult to ascertain given the variability, dynamic environment, and multiple nutrient sources in the catchment area.

Potential impacts of landfill leachate to Blue Angle Creek would depend on the groundwater-surface water interaction, climate and the rehabilitation works. Results from MW-9, MW-10 and MW-11 (monitoring wells adjacent to the creek) indicate a reduction in ammonia (Graph-01). Previously, MW-11 had a history of variable ammonia concentrations; however since May 2010 ammonia has remained below ANZECC guidelines.

E2W interpreted that some nitrogen-impacted groundwater would discharge to the creek (and consequently to the estuary), however the extent of attenuation of the nitrogen plume prior to discharge is unclear. Attenuation is likely to occur through a combination of dilution, mixing of groundwater from the creek, flows and tidal movements within the creek and estuary and oxidation of the ammonia to nitrate/nitrite and generation of nitrogen gas.

9 CONCLUSIONS

Surface and groundwater monitoring was completed at the GWDD by ALS in May, August, November 2014 and February 2015 for the EPL (2015). The data has been assessed by E2W to identify potential impacts to the groundwater and surface water systems. The following conclusions are offered:

- The rehabilitation of the landfill mound and night soil depot (completed February 2005) has demonstrated a measurable improvement of the local groundwater quality. The improvement to local surface water quality is not clear, and impacts are not readily discernible from landfill or background sources (agricultural, tidal water quality etc).
- Groundwater at the landfill site is directed towards Blue Angle Creek (base-flow discharge) and Seven Mile Beach (via a groundwater salt water interface).
- The key landfill indicator (ammonia-nitrogen) shows a decreasing/stabilising trend in shallow and deep wells located next to the landfill mound and former night soil deposit. Some data anomalies exist for the 2014-2015 monitoring period (e.g. MW-05 ammonia= 14.5 mg/L in February 2015,

and ML-5 ammonia=3.5 mg/L in November 2014 and will be addressed with future monitoring rounds).

- Elevated concentrations (above ANZECC 2000) of nutrients, in particular ammonia, continue to be detected in the shallow (MW-5) and deep groundwater (MW-6D, MW-7D which report results above and also below the ANZECC (2000) guidelines.
- Catchment area characteristics, climate and tidal regime all influence water quality in Blue Angle Creek and the adjacent wells (MW-9, MW-10 and MW-11).
- Concentrations of total phosphorous (TP) in the shallow/deep groundwater is generally variable, with elevated and variable trends at MW-6D/MW-7D. Variable TP is interpreted at two shallow wells (MW-4, MW-5) in proximity to the former night soil deposit.
- Ammonia within surface water samples collected at downstream locations (Blue Angle Creek) are generally variable and similar to previous years. An exceedance (greater than 10% above ammonia values in Appendix C) was noted at ML-5 for November 2014 (3.5 mg/L). Based on the low (below guidelines) ammonia results from monitoring wells (MW-9, MW-10, MW-11, Graph 1) in proximity to the creek, ammonia in surface water may be attributed to potential upstream sources (agriculture) or poor quality estuarine water (tidal- and estuary mouth closures).
- Total phosphorus (TP) concentrations at ML-5 ranged from 0.01 to 0.12 mg/L in 2011-2012, however during 2012-2013, TP slightly increased and ranged from <0.01 to 1.95 mg/L. TP in the 2013-2014 monitoring round is comparable to that reported in 2011-2012 (0.01 mg/L to 0.06 mg/L), whilst TP ranges from 0.05 to 0.22 mg/L in 2014-2015. TP in surface water is generally variable due to the dynamic nature of the tidal creek. It is likely that water quality in Blue Angle Creek reflects other nutrient sources in the catchment as well as from the GWDD.
- All other water quality indicators were consistent with the previous monitoring results.
- Monitoring results indicate a clear improvement in water quality and aquifer restoration at Gerroa. Landfill rehabilitation is considered to have achieved a practical and successful outcome over a 10 year monitoring period.

The nutrient concentrations (particularly ammonia) in the shallow and deep groundwater are likely to continue to decrease over time (note: phosphorous may take longer to decline as it is likely to adsorb/retarded by the aquifer matrix). The landfill capping system reduces rainfall infiltration into the buried waste (reduces leachate generation) and diverts runoff from the 3 ha capped mound into the aquifer, causing dilution and attenuation of the residual leachate.

Monitoring of surface and groundwater conditions at the GWDD following the completion of landfill remediation has provided beneficial data regarding the effectiveness of the rehabilitation works. The "surface and shallow" groundwater quality is showing signs of more frequently meeting the ANZECC (2000) guidelines. More consistent water quality and meeting of the guidelines is expected in the near future.

Based on recent groundwater trends, it is interpreted that the deep groundwater quality is beginning to meet (on some sampling events) the ANZECC (2000) guidelines for ammonia (key landfill leachate indicator) and demonstrating the effectiveness of landfill rehabilitation.

9.1 RECOMMENDATIONS

In order to improve the quality of monitoring at the site, E2W recommends that the following be incorporated into subsequent sampling rounds:

- Obtain survey details for the 6 piezometer wells (MW-1S/D, MW-6S/D and MW-7S/D).
- Assess quality assurance and control from laboratory and perform re-analyses for unusually elevated results.
- Perform reactive phosphorus (total & reactive) analyses at key wells (e.g. MW-4).
- Review tidal charts and climate prior to surface water sampling. Sample collection should be co-ordinated with the tide so that both creek samples are collected during a low run-out tide when the maximum amount groundwater discharges into the creek.
- Further investigate alternate sample locations to allow assessment of upstream water quality and the downgradient impacts associated with the landfill (i.e. replacement of previous locations @ ML-1, ML-3 and ML-4. It is noted that alternate locations are within private land "Cleary Bros site" and access has been denied).
- The proposed groundwater and surface water monitoring program for the GWDD is summarised in Table 3.1. The sampling methods are presented in Tables 1 and 2 of the Revocation of Licence (DECC, 29 May 2008).
- Discontinue bacteriological monitoring of surface water samples (i.e. not an EPL requirement and unlikely to indicate leachate discharges).

10 LIMITATIONS

Earth2Water Pty Ltd has prepared this report for the use of Kiama Municipal Council in accordance with the standard terms and conditions of the consulting profession. This report is prepared in accordance with the scope of work and for the purpose outlined in the proposal. The methodology adopted and sources of information used by E2W are outlined in this report.

E2W has made no independent verification of this information beyond the agreed scope of works and E2W assumes no responsibility for any inaccuracies or omissions.

This report was prepared in April and May 2015 and is based on the information reviewed at the time of preparation. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

The precision with which conditions are indicated depends largely on the frequency and method of sampling and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, E2W should be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

11 REFERENCES

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Tables

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW1S	MW 1S	MW 1S	MW1S	MW1S	MW 1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1D	MW 1D	MW 1D	MW1D	MW1D	MW 1D	MW1D	MW1D	MW1D	MW1D	MW1D
Field Measurements	**Fresh**	**Marine**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**
Ground Level (m AHD)			NA												-	-	-						NA										
Depth to Groundwater (m AHD)			-												-	-	-																
Groundwater depth (m bTOC)			3.74	3.52	2.88	3.3	3.25	3.17	3.53	3.86	3.33	3.6	3.9	3.75	3.25	3.16	3.74	Dry - no sample	3.29				3.62	3.39	2.77	3.16	3.12	3.04	3.5	3.73	3.2	3.48	3.77
Height of Stick up (m)			0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65		0.65				0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Groundwater Depth (mbgl)			3.09	2.87	2.23	2.65	2.6	2.52	2.88	3.21	2.68	2.95	3.25	3.1	2.6	2.51	3.09		2.64				3	2.77	2.15	2.54	2.5	2.42	2.88	3.11	2.58	2.86	3.15
Field Parameters																																	
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.8	6.9	6.7	6.5	6.80	6.70	7.10	7.00	6.60	6.9	7.4	7	6.40	6.5	6.8						6.9	7.2	6.8	7	7.30	7.60	7.60	7.50	7.80	7.5	7.5
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-						-	-	-	-	-	-	-	-	-		
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.95	1.41	0.602	0.49	0.51	0.44	0.47	0.40	0.50	<1	0.464	1.1	0.41	0.42	0.548						2.4	2.43	2.22	1.95	1.72	11.00	1.26	0.99	0.59	<1	0.657
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-						-	-	-	-	-	-	-	-	-		
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	1.39	2.41	1.58	1.8	1.62	2.49	2.02	2.21	1.62	0.8	1.73	1.48	1.57	2.51	0.72	-	2.92				2.56	2.59	1.67	2.31	1.54	2.51	1.72	2.60	5.30	2.2	1.98
Dissolved Oxygen (%)			-	-	17.10	-	-	-	-	-	-	8.2			-	-	-						-	-	18.20	-	-	-	-	-	-	22.2	
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-						-	-	-	-	-	-	-	-	-		
Redox Potential (mV)			-	-	-	-	-	-52.2	-	-	-	<0.1			-	-57	-						-	-	-	-	-	-91.6	-	-	-	<0.1	
Comments			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc						nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Laboratory Analyses																																	
Major Ions (mg/L)																																	
Sodium			-	-	54	-	-	21	-	-	-	22			-	42	-						-	-	239	-	-	118	-	-	-	22	
Potassium			-	-	4	-	-	2	-	-	-	3			-	2	-						-	-	44	-	-	15	-	-	-	11	
Calcium			-	-	41	-	-	39	-	-	-	52			-	24	-						-	-	115	-	-	68	-	-	-	64	
Magnesium			-	-	19	-	-	10	-	-	-	9			-	8	-						-	-	64	-	-	27	-	-	-	23	
Chloride			-	-	113	-	-	38	-	-	-	34			-	51	-						-	-	488	-	-	146	-	-	-	12	
Alkalinity (as CaCO3)			386	291	142	176	150	126	165	147	164	159		362	100	128	163		164				611	494	231	345	297	316	322	363	279	288	293
Bicarbonate			386	291	142	176	150	126	165	147	164	159		362	100	128	163	-	164				611	494	231	345	297	316	322	363	259	288	293
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1		<1				<1	<1	<1	<1	<1	<1	<1	<1	21.00	<1	<1
Sulphate (SO4)			-	-	8	-	-	<1	-	-	-	6			-	3	-						-	-	160	-	-	34.00	-	-	-	6	
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-		6.4				-	-	-	-	-	-	-	-	-		
Total Dissolved Solids (TDS)			1300	982	430	416	436	386	350	250	390	346		640	362	309	442		516				1340	1330	1420	1160	940	700	772	580	340	264	418
Hardness (as CaCO3)			-	-	-	-	-	-	-	-	-				-	-	-						-	-	-	-	-	-	-	-	-		
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-						-	-	-	-	-	-	-	-	-		
Heavy Metals (mg/L)																																	
Iron (filtered)	0.3 (1)		-	-	**13.9**	-	-	**33.2**	-	-	-	**26.2**			-	**29.0**	-	-					-	-	**9.93**	-	-	0.10	-	-	-	<0.05	
Manganese	1.90		-	-	0.046	-	-	0.05	-	-	-	0.051			-	0.050	-						-	-	0.036	-	-	0.008	-	-	-	0.001	
Nutrients (mg/L)																																	
Nitrate (NO3 as N)	0.7 (7)		0.26	0.04	0.02	0.21	0.02	0.02	<0.01	<0.01	<0.01	0.12		<0.10	<0.01	<0.01	<0.01		<0.01				**1.36**	**4.91**	**0.86**	**0.76**	**1.55**	**2.39**	**1.79**	<0.01	**1.57**	**2**	**2.13**
Nitrite (NO2 as N)			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.10	<0.01	<0.01	<0.01		<0.01				0.06	0.09	0.12	0.02	0.08	0.01	0.06	<0.01	0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.27	<0.01	0.05	0.05	0.04	0.06	0.02	<0.01	0.05	<0.01		0.13	0.34	0.28	0.21		0.31				**22.6**	**32.4**	**25.7**	**6.67**	**2.56**	0.12	**2.15**	**3.16**	0.07	0.09	0.17
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**4.4**	**46.8**	**2.6**	**1.9**	**2.50**	**0.90**	**1.10**	**2.20**	**1.2**	**1.0**		**1.8**	**1.9**	**1.3**	**4.6**	-	**2.7**				**45.2**	**53.2**	**31.3**	**9.6**	**4.60**	**1.70**	**3.30**	**4.00**	**1.50**	**1.4**	**1.9**
Dissolved Organic Carbon			-	-	38	-	-	31	-	-	-	26			-	58	-						-	-	22	-	-	12	-	-	-	6	
Fluoride (Electrode)			-	-	0.3	-	-	0.2	-	-	-	0.3			-	0.2	-						-	-	<0.1	-	-	0.2	-	-	-	0.1	
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.61**	**49.8**	**0.32**	**0.88**	**0.31**	**0.38**	**0.5**	**0.66**	**0.33**	**0.52**		**0.72**	**0.38**	**0.31**	**0.86**		**0.44**				**0.12**	**8.87**	<0.01	**0.35**	**0.03**	**0.15**	**0.04**	**0.26**	**0.08**	**0.18**	**0.16**

Note:

Exceeds ANZECC (2000) guidelines **35**
marine/fresh water ecosystems
Focus of this monitoring report
nc = no comment NA = not available

Notes:
1. Trigger value is an indicative interim working level only (IIWL).
2. Ammonia trigger at pH = 8.0, for a 95% protection, corrected for average pH = 7.3.
3. Trigger value for oxides of Nitrogen (NOx) for lowland rivers in NSW.
4. Trigger value for oxides of Nitrogen (NOx) for marine ecosystems in NSW.
5. Trigger value for total Nitrogen in lowland rivers in NSW.
6. Trigger value for total Nitrogen in marine ecosystems in NSW.
7. Trigger value for a 95% proetction level.
8. Guidelinefor water quality and aesthetics: primary contact.
a. Reference only, not dirtectly applicable to groundwater.

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW3	MW 3	MW 3	MW3	MW3	MW 3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3
Field Measurements	**Fresh**	**Marine**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**
Ground Level (m AHD)				-	-	-	-					4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.00	4.00	4.00	4.00
Depth to Groundwater (m AHD)				-	-	-	-					0.37	0.59	1.18	0.83	0.87	0.95	0.48	0.25	0.79	0.49	0.25	0.40	0.88	0.97	0.35	0.12	0.83	0.35	0.30	0.42
Groundwater depth (m bTOC)			3.6	3.1	3	3.64	3.54	3.15	3.65	3.68	3.54	4.08	3.86	3.27	3.62	3.58	3.5	3.97	4.2	3.66	3.96	4.2	4.05	3.57	3.48	4.1	4.33	3.62	4.1	4.15	4.03
Height of Stick up (m)			0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Groundwater Depth (mbgl)			2.98	2.48	2.38	3.02	2.92	2.53	3.03	3.06	2.92	3.63	3.41	2.82	3.17	3.13	3.05	3.52	3.75	3.21	3.51	3.75	3.6	3.12	3.03	3.65	3.88	3.17	3.65	3.70	3.58
Field Parameters																															
pH (field)	6.5-8.0 (a)	8-8.4 (a)	7.5	7.30	7.5	7.5	7.5		7.6			7	7.1	7	7.2	7.50	7.50	7.80	7.40	7.50	7.3	7.5	7.4	7.20	7.6	7.4	7.4		7.1		
Temperature (T deg C)				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-				
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.695	0.63	0.624	0.624	0.59		0.467	0.622	0.636	0.74	0.74	0.754	0.48	0.56	0.70	0.47	0.46	0.39	<1	0.633	0.631	0.51	0.704	0.760	0.787		0.946	0.932	0.812
Salinity (ppt)				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-				
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.6	1.97	1.62	2.50	1.82	1.88	3.50	2.90	2.50	3	1.91	2.67	1.68	4.50	2.07	1.58	1.76	2.66	0.7	1.75	1.94	1.68	1.84	1.54	2.36	2.69	1.4	2	3.8
Dissolved Oxygen (%)				-	-	-	-		36.2			-	-	28.20	-	-	-	-	-	-	7			-	-	-	-		14.5		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)		-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-				
Redox Potential (mV)				-	-78		-		60			-	-	-	-	-	-81.6	-	-	-	<0.1			-	-137	-	-		-114		
Comments			nc	-	-	-	-					nc	nc	nc	nc	-	-	-	-	nc	nc	nc	nc	nc	nc	nc	nc				
Laboratory Analyses																															
Major Ions (mg/L)																															
Sodium				-	22	-	-		14			-	-	71	-	-	37	-	-	-	27			-	49	-	-		86		
Potassium				-	15	-	-		10			-	-	3	-	-	2	-	-	-	3			-	3	-	-		3		
Calcium				-	62	-	-		65			-	-	90	-	-	88	-	-	-	102			-	79	-	-		117		
Magnesium				-	24	-	-		20			-	-	6	-	-	8	-	-	-	9			-	8	-	-		12		
Chloride				-	20	-	-		21			-	-	127	-	-	53	-	-	-	130			-	92	-	-		205		
Alkalinity (as CaCO3)			292	284	316	298	254	283	225	280	296	329	274	215	171	125	259	193	235	165	183	295	270	238	227	216	194	292.00	211	245	236
Bicarbonate			292	284	316	298	254	283	225	280	296	329	274	215	171	125	259	193	235	157	183	295	270	238	227	216	194	292.00	211	245	236
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	8.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)				-	6	-	-					-	-	28	-	-	3	-	-	-	<1			-	6	-	-		11.00		
pH (lab)				-	-	-	-	7.20	7.60	6.40	7.20			-	-	-	-	-	-	-				-	-	-	-	7.2	7.1	6.2	6.8
Total Dissolved Solids (TDS)			320	372	328	328	309	272	334	397	355	384	436	484	318	390	414	322	340	238	496	432	268	298	363	494	443	387	729	585	485
Hardness (as CaCO3)				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-				
Total Suspended Solids (TSS)				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-				
Heavy Metals (mg/L)																															
Iron (filtered)	0.3 (1)			-	<0.05	-	-		<0.05			-	-	**14.3**	-	-	**7.55**	-	-	-	**9.44**			-	**6.86**	-	-		**15.0**		
Manganese	1.90			-	0.010	-	-		0.00			-	-	0.109	-	-	0.07	-	-	-	0.069			-	0.064	-	-		0.127		
Nutrients (mg/L)																															
Nitrate (NO3 as N)	0.7 (7)		**2.38**	**1.06**	**0.97**	0.03	0.11	0.17	**2.1**	**1.4**	0.35	0.1	0.02	0.04	0.21	0.07	0.02	<0.01	<0.01	0.02	0.09	**0.73**	**5.59**	0.6	<0.01	0.02	0.21	<0.01	<0.01	<0.01	0.06
Nitrite (NO2 as N)			<0.01	0.08	0.07	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.05	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.26	0.27	**2.88**	**4.13**	**2.9**	1.29	0.02	1.3	1.51	0.62	0.87	0.66	0.26	0.14	0.42	0.29	0.23	0.04	0.35	0.44	**7.78**	0.93	0.14	0.25	0.11	0.13	0.17	0.32	0.18
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**1.2**	**1.10**	**3.4**	**4.4**	**3.1**	**1.6**	**0.6**	**2.1**	**1.8**	**1.1**	**1.9**	**1.7**	**0.6**	**0.50**	**0.90**	**0.60**	**0.80**	**0.4**	**0.5**	**2.2**	**7.8**	**1.5**	**0.4**	**0.7**	**0.4**	**0.5**	**0.9**	**0.7**	**0.7**
Dissolved Organic Carbon				-	15	-	-		8			-	-	11	-	-	10	-	-	-	6			-	12	-	-		18		
Fluoride (Electrode)				-	0.2	-	-		0.10			-	-	<0.1	-	-	0.1	-	-	-	0.1			-	0.1	-	-		<0.1		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	0.02	0.03	0.02	**0.44**	**0.1**	**0.0**	**0.1**	**0.3**	**0.1**	**0.14**	**0.22**	**0.31**	**0.18**	**0.21**	**0.62**	**0.16**	**0.14**	**0.22**	**0.19**	**0.42**	**0.13**	**0.15**	**0.16**	**0.33**	**0.27**	**0.14**	**0.25**	**0.21**	**0.16**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW4	MW 4	MW 4	MW4	MW4	MW 4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW5	MW 5	MW 5	MW5	MW5	MW 5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5
Field Measurements	**Fresh**	**Marine**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**7/2/14**
Ground Level (m AHD)			4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55
Depth to Groundwater (m AHD)			0.88	1.08	1.69	0.99	1.31	1.41	0.98	0.76	1.23	0.99	1.04	1.04	1.1	1.43	0.58	0.37	1.04	0.54	0.56	0.69	0.6	0.81	1.32	1	1.03	1.11	0.72	0.5	0.96	0.85	0.73	0.95	1.24	1.27	0.76	0.56	0.56
Groundwater depth (m bTOC)			4.36	4.16	3.55	4.25	3.93	3.83	4.26	4.48	4.01	4.25	4.2	4.2	4.14	3.81	4.66	4.87	4.2	4.7	4.68	4.55	4.15	3.94	3.43	3.75	3.72	3.64	4.03	4.25	3.79	3.9	4.02	3.8	3.51	3.48	3.99	4.19	4.19
Height of Stick up (m)			0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Groundwater Depth (mbgl)			3.91	3.71	3.1	3.80	3.48	3.38	3.81	4.03	3.56	3.80	3.75	3.75	3.69	3.36	4.21	4.42	3.75	4.25	4.23	4.1	3.95	3.74	3.23	3.55	3.52	3.44	3.83	4.05	3.59	3.7	3.82	3.6	3.31	3.28	3.79	3.99	3.99
Field Parameters																																							
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.9	6.8	6.4	6.4	6.80	6.80	6.90	6.90	6.80	7	6.8	7	6.30	7	7.1	7		7.1			7.8	7.7	7.2	7.6	8	8	8	7.9	8.1	7.7	7.7	7	7	7.7	7	7.3	
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-	
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.75	0.81	0.468	0.47	0.73	0.68	0.72	0.70	0.58	<1	0.7	0.829	0.44	0.47	0.632	0.683		0.472			0.52	0.51	0.414	0.31	0.44	0.31	0.38	0.345	0.36	<1	0.477	0.297	0.13	0.427	0.395	0.425	
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-	
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.55	2.32	1.46	2.21	1.78	3.09	2.64	2.34	3.22	1.1	2.48	1.7	2.26	2.49	2.32	1.97	4.10	2.70	2.10	3.60	2.81	3.08	2.14	2.22	4.15	2.88	2.15	2.32	2.41	0.9	1.77	1.8	1.52	1.62	2.13	2.09	2.09
Dissolved Oxygen (%)			-	-	15.90	-	-	-	-	-	-	10.8			-	-	-	-					-	-	22.60	-	-	-	-	-	-	9.3			-	-	-	-	
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-	
Redox Potential (mV)			-	-	-	-	-	-41.5	-	-	-	<0.1			-	-34	-	-		-128			-	-	-	-	-	-25	-	-	-	<0.1			-	-147	-	-	
Comments			nc	nc	nc	nc	-	-	-	-	nc				-	-	-	-					nc	nc	nc	nc	-	-	-	-	nc				nc	nc	nc	nc	
Laboratory Analyses																																							
Major Ions (mg/L)																																							
Sodium			-	-	14.00	-	-	12	-	-	-	13			-	13	-	-		10			-	-	16	-	-	7	-	-	-	9			-	15	-	-	
Potassium			-	-	1.00	-	-	2	-	-	-	4			-	4	-	-		3			-	-	6	-	-	4	-	-	-	5			-	5	-	-	
Calcium			-	-	91.00	-	-	109	-	-	-	117			-	68	-	-		88			-	-	53	-	-	44	-	-	-	60			-	54	-	-	
Magnesium			-	-	7.00	-	-	7	-	-	-	6			-	6	-	-		5			-	-	10	-	-	6	-	-	-	8			-	7	-	-	
Chloride			-	-	23.00	-	-	25	-	-	-	14			-	13	-	-		11			-	-	30	-	-	13	-	-	-	15			-	34	-	-	
Alkalinity (as CaCO3)			274	303	234	151	248	282	251	296	293	323	315	227	137	215	276	284	250	220	258	231	142	144	142	120	177	128	147	144	126	179	198	112	172	170	158	155	155
Bicarbonate			274	303	234	151	248	282	251	296	293	323	315	227	137	215	276	284	250	220	258	231	142	144	142	120	177	128	147	144	121	179	198	112	172	170	158	155	155
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)			-	-	11.00	-	-	10.00	-	-	-	<1			-	10	-	-		7.00			-	-	14	-	-	4.00	-	-	-	7			-	4	-	-	
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-	6.8	7.1	6.2	6.3	-	-	-	-	-	-	-	-	-				-	-	-	-	
Total Dissolved Solids (TDS)			354	352	330	252	318	400	388	382	342	376	406	278	262	248	314	351	304	326	376	311	311	238	258	268	252	197	258	204	170	264	326	166	240	224	219	264	264
Hardness (as CaCO3)			-	-	-	-	-	-	-	-	-				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-	
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-	-					-	-	-	-	-	-	-	-	-				-	-	-	-	
Heavy Metals (mg/L)																																							
Iron (filtered)	0.3 (1)		-	-	21.40	-	-	**17.10**	-	-	-	**7.98**			-	**1.61**	-	-		**10.3**			-	-	<0.05	-	-	<0.05	-	-	-	<0.05			-	**3.22**	-	-	
Manganese	1.90		-	-	0.38	-	-	0.35	-	-	-	0.299			-	0.272	-	-		0.424			-	-	0.002	-	-	0.001	-	-	-	0.001			-	0.041	-	-	
Nutrients (mg/L)																																							
Nitrate (NO3 as N)	0.7 (7)		0.26	0.03	0.06	0.31	0.39	0.04	0.1	0.04	0.07	0.19	0.05	0.15	0.36	0.09	0.03	0.02	0.28	0.03	<0.01	0.19	**5.15**	**10.4**	**4.44**	**0.96**	0.44	0.14	0.02	**1.08**	**1**	**1.44**	0.03	**1.81**	<0.01	0.06	0.14	0.61	0.61
Nitrite (NO2 as N)			<0.01	<0.01	<0.01	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.88	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.22	0.21	0.14	0.15	<0.01	0.02	<0.01	0.12	0.18	0.1	0.08	0.03	0.01	0.01	<0.01	0.11	0.11
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.38	0.44	0.22	0.91	1.16	0.58	0.64	0.68	0.18	0.1	0.15	0.44	1.86	<0.01	0.37	0.22	0.28	0.09	0.35	0.09	0.08	<0.01	0.04	0.03	0.03	0.03	0.08	0.02	0.03	0.05	0.23	0.55	0.45	0.06	**5.88**	0.64	**0.64**
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**1.3**	**1.5**	**1.5**	**3.1**	**2.60**	**1.70**	**2.60**	**1.60**	**0.90**	**1.2**	**1.2**	**0.8**	**15.30**	**0.6**	**1.7**	**0.7**	**1.0**	**0.7**	**0.8**	**0.9**	**1.7**	**2.6**	**2.7**	**0.6**	**0.80**	**0.30**	**0.70**	**1.30**	**1**	**1.4**	**2**	**2.6**	**17**	**1.1**	**9**	**2.2**	**2.2**
Dissolved Organic Carbon			-	-	6	-	-	9	-	-	-	7			-	12	-	-		9			-	-	6	-	-	5	-	-	-	6			-	12	-	-	
Fluoride (Electrode)			-	-	0.20	-	-	0.2	-	-	-	0.2			-	0.2	-	-		0.2			-	-	0.1	-	-	0.20	-	-	-	0.2			-	0.1	-	-	
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**4.24**	**2.93**	**1.97**	**1.56**	**1.24**	**3.46**	**7.98**	**1.72**	**1.31**	**4.29**	**3.99**	**0.9**	**2.4**	**0.86**	**2.17**	**1.6**	**1.46**	**1.81**	**1.56**	**1.3**	**0.09**	**0.11**	<0.01	**0.12**	**0.1**	**0.13**	**0.1**	**0.08**	**0.03**	**0.13**	**0.22**	**0.74**	**1.23**	**0.33**	**1.83**	**1.07**	**1.07**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot																		
Sample ID	**ANZECC, 2000**		**MW5**	**MW5**	**MW5**	**MW5**	**MW6S**	**MW 6S**	**MW 6S**	**MW6S**	**MW6S**	**MW 6S**	**MW6S**	**MW6S**	**MW6S**	**MW6S**	**MW6S**	**MW6S**
Field Measurements	**Fresh**	**Marine**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**
Ground Level (m AHD)			4.55	4.55	4.55	4.55	NA											
Depth to Groundwater (m AHD)			1.23	0.75	0.77	0.86												
Groundwater depth (m bTOC)			3.52	4	3.98	3.89	4.69	4.57	4.45	4.48	4.43	4.39	4.71	4.88	4.5	4.7	4.66	4.43
Height of Stick up (m)			0.2	0.2	0.2	0.2	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Groundwater Depth (mbgl)			3.32	3.8	3.78	3.69	4.09	3.97	3.85	3.88	3.83	3.79	4.11	4.28	3.9	4.1	4.06	3.83
Field Parameters																		
pH (field)	6.5-8.0 (a)	8-8.4 (a)		6.9			7.5	7.3	6.8	6.9	7.2	7	7.6	7.3	7.5	7.4	7.6	6.9
Temperature (T deg C)							-	-	-	-	-	-	-	-	-			
Electrical Conductivity (mS/cm)	0.125-2.2 (a)			0.126			0.52	0.65	0.502	0.37	0.569	0.511	0.504	0.504	0.475	<1	0.396	1.06
Salinity (ppt)							-	-	-	-	-	-	-	-	-			
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.74	3.2	3.1	2.4	1.74	2.56	2.63	2.19	2.18	2.94	1.9	1.82	2.29	1.2	2.4	2.58
Dissolved Oxygen (%)				32.7			-	-	27.70	-	-	-	-	-	-	11.8		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)					-	-	-	-	-	-	-	-	-			
Redox Potential (mV)				75.5			-	-	-	-	-	-33.80	-	-	-	<0.1		
Comments							nc	nc	nc	nc	-	-	-	-	nc	nc	nc	nc
Laboratory Analyses																		
Major Ions (mg/L)																		
Sodium				9			-	-	8	-	-	44	-	-	-	14		
Potassium				10			-	-	6	-	-	8	-	-	-	8		
Calcium				16			-	-	80	-	-	41	-	-	-	75		
Magnesium				3			-	-	9	-	-	7	-	-	-	6		
Chloride				26			-	-	14	-	-	42	-	-	-	21		
Alkalinity (as CaCO3)			158	41	118	113	182	263	208	176	130	133	196	226	227	202	237	315
Bicarbonate			158	41	118	113	182	263	208	176	130	133	196	226	206	202	237	315
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	21	<1	<1	<1
Sulphate (SO4)				<10			-	-	26	-	-	40.00	-	-	-	18		
pH (lab)			7.20	6.90	6.70	6.40	-	-	-	-	-	-	-	-	-			
Total Dissolved Solids (TDS)			216	164	234	138	314	350	308	332	280	334	328	342	286	314	372	616
Hardness (as CaCO3)							-	-	-	-	-	-	-	-	-			
Total Suspended Solids (TSS)							-	-	-	-	-	-	-	-	-			
Heavy Metals (mg/L)																		
Iron (filtered)	0.3 (1)			0.25			-	-	**5.59**	-	-	**3.13**	-	-	-	<0.05		
Manganese	1.90			0.03			-	-	0.116	-	-	0.06	-	-	-	0.025		
Nutrients (mg/L)																		
Nitrate (NO3 as N)	0.7 (7)		<0.01	0.63	0.61	<0.01	0.37	**1.71**	0.01	**1.16**	**7.48**	0.04	<0.01	**0.8**	0.01	**0.76**	**3.54**	0.11
Nitrite (NO2 as N)			<0.01	0.03	0.09	<0.01	0.01	0.02	<0.01	<0.01	0.03	<0.01	<0.01	0.31	0.01	0.08	0.32	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	**4.47**	1.28	1.4	**14.5**	0.83	1.8	1.73	0.48	0.23	0.19	0.4	0.25	0.12	0.08	0.2	0.91
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**6.3**	**2.5**	**3.2**	**18.9**	**1.5**	**2.6**	**2.5**	**1**	**2.40**	**0.60**	**0.80**	**2.00**	**0.9**	**3.1**	**1**	**4.2**
Dissolved Organic Carbon				12			-	-	8	-	-	7	-	-	-	4		
Fluoride (Electrode)				<0.1			-	-	0.3	-	-	0.60	-	-	-	0.6		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**1.03**	**0.39**	**0.48**	**2.08**	**0.33**	**1.04**	**0.79**	**0.42**	**0.68**	**0.53**	**3.10**	**8.81**	**0.54**	**0.63**	**0.4**	**0.4**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW6S	MW6S	MW6S	MW6S	MW6S	MW6S	MW6S	MW6S	MW6S	MW6D	MW 6D	MW 6D	MW6D	MW6D	MW 6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D	MW6D
Field Measurements	**Fresh**	**Marine**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**
Ground Level (m AHD)			-	-	-	-						NA												-	-	-	-					
Depth to Groundwater (m AHD)			-	-	-	-																		-	-	-	-					
Groundwater depth (m bTOC)			4.35	4.4	4.77	4.94	4.94	4.37	4.77			4.95	4.82	4.19	4.73	4.7	4.65	4.97	5.12	4.77	4.94	4.91	4.69	4.62	4.65	5.04	5.2	5.2	4.64	5.03	5.01	4.94
Height of Stick up (m)			0.6	0.6	0.6	0.6	0.6	0.6	0.6			0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Groundwater Depth (mbgl)			3.75	3.8	4.17	4.34	4.34	3.77	4.17			4.25	4.12	3.49	4.03	4	3.95	4.27	4.42	4.07	4.24	4.21	3.99	3.92	3.95	4.34	4.5	4.5	3.94	4.33	4.31	4.24
Field Parameters																																
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.9	7.1	7.4	7.2			7.3			7	7	6.6	6.8	7.1	7.2	7.1	6.9	7	7.1	7.2	7.2	7.2	7.2	7.1	7.5			7.1		
Temperature (T deg C)			-	-	-	-						-	-	-	-	-	-	-	-	-				-	-	-	-					
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.432	0.474	0.679	0.662			0.659			1.07	1.02	0.868	0.95	0.996	0.943	1.06	0.994	0.875	<1	0.798	0.86	0.867	0.896	0.851	0.476			0.599		
Salinity (ppt)			-	-	-	-						-	-	-	-	-	-	-	-	-				-	-	-	-					
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	1.46	1.9	2.13	2.33	2.33	1.85	2			2.61	2.37	1.34	1.45	2.21	2.71	2.12	1.55	1.45	1	1.81	2.67	1.77	1.58	1.88	1.94	2.75	1.85	1.1	3.1	1.9
Dissolved Oxygen (%)			-	-	-	-			20.9			-	-	14.10	-	-	-	-	-	-	10.6			-	-	-	-			11.7		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-						-	-	-	-	-	-	-	-	-				-	-	-	-					
Redox Potential (mV)			-	-57	-	-			65			-	-	-	-	-	30.90	-	-	-	<0.1			-	13	-	-			43		
Comments			-	-	-	-						nc	nc	nc	nc	-	-	-	-	nc	nc	nc	nc	nc	nc	nc	nc					
Laboratory Analyses																																
Major Ions (mg/L)																																
Sodium			-	30	-	-			24			-	-	18	-	-	20	-	-	-	15			-	16	-	-			10		
Potassium			-	6	-	-			6			-	-	19	-	-	11	-	-	-	10			-	15	-	-			6		
Calcium			-	75	-	-			124			-	-	120	-	-	142	-	-	-	120			-	141	-	-			122		
Magnesium			-	7	-	-			10			-	-	14	-	-	16	-	-	-	11			-	10	-	-			8		
Chloride			-	34	-	-			30			-	-	24	-	-	31	-	-	-	21			-	14	-	-			12		
Alkalinity (as CaCO3)			62	217	273	248	<1	182	262			544	409	441	408	396	399	375	410	388	332	342	348	386	375	358	208	325	346	248	271	331
Bicarbonate			62	217	273	248	248	182	262			544	409	441	408	396	399	375	410	388	332	342	348	386	375	358	208	325	346	248	271	331
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)			-	34	-	-			60			-	-	8	-	-	27	-	-	-	33			-	107	-	-			71		
pH (lab)			-	-	-	-		7	7			-	-	-	-	-	-	-	-	-				-	-	-	-		6.8	7.1	6.7	6.6
Total Dissolved Solids (TDS)			286	309	364	356	356	280	504			473	504	496	542	534	586	694	636	460	484	508	436	454	496	475	280	438	418	514	497	514
Hardness (as CaCO3)			-	-	-	-						-	-	-	-	-	-	-	-	-				-	-	-	-					
Total Suspended Solids (TSS)			-	-	-	-						-	-	-	-	-	-	-	-	-				-	-	-	-					
Heavy Metals (mg/L)																																
Iron (filtered)	0.3 (1)		-	**1.17**	-	-			<0.05			-	-	**9.48**	-	-	<0.05	-	-	-	<0.05			-	0.07	-	-			<0.05		
Manganese	1.90		-	0.019	-	-			0.03			-	-	0.184	-	-	0.119	-	-	-	0.122			-	0.161	-	-			0.11		
Nutrients (mg/L)																																
Nitrate (NO3 as N)	0.7 (7)		<0.01	**1.05**	0.62	0.05	0.05	0.06	**8.3**			**1.99**	**9.29**	0.14	0.17	0.61	**5.61**	**2.93**	0.02	0.03	**1.29**	**3.14**	0.48	0.41	**0.96**	0.02	0.02	0.05	0.16	**2.92**	**1.79**	0.06
Nitrite (NO2 as N)			<0.01	0.92	0.1	0.04	0.04	<0.01	0.75			<0.01	0.09	<0.01	<0.01	0.02	0.04	0.32	<0.01	<0.01	0.08	0.17	0.21	0.03	0.06	0.04	<0.01	<0.01	0.01	0.08	0.12	0.03
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.04	0.29	0.04	0.04	0.04	0.03	0.02			**16.4**	**10.6**	**21.8**	**8.9**	**13.80**	**3.24**	**2.25**	**10.80**	**7.62**	**7.06**	**7.17**	**12.8**	**14.60**	**11.30**	**10.40**	**1.97**	**9.08**	**8.27**	1.79	**2.23**	**3.92**
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**1.9**	**1.1**	**1**	**0.6**	**0.6**	**1.5**	**2.0**			**22.5**	**17.5**	**26.4**	**16.1**	**15.20**	**6.70**	**9.20**	**12.40**	**11.6**	**9.4**	**12.4**	**14**	**16.5**	**11.2**	**10.8**	**2.2**	**9.4**	**8.4**	**2.8**	**2.9**	**4.3**
Dissolved Organic Carbon			-	9	-	-			10			-	-	15	-	-	11	-	-	-	11			-	21	-	-			11		
Fluoride (Electrode)			-	0.4	-	-			0			-	-	0.4	-	-	0.4	-	-	-	0.4			-	0.4	-	-			0.4		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.44**	**0.12**	**0.2**	**0.8**	**0.8**	**0.2**	**0.2**			**2.92**	**1**	**8.06**	**3.92**	**4.27**	**1.39**	**1.45**	**6.84**	**4.80**	**5.46**	**0.88**	**0.38**	**2.23**	**2.52**	**9.07**	**2.55**	**3.86**	**3.93**	**2.08**	**0.62**	**1.74**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot																																
Sample ID	**ANZECC, 2000**		**MW7S**	**MW 7S**	**MW 7S**	**MW7S**	**MW7S**	**MW 7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7S**	**MW7D**	**MW 7D**	**MW 7D**	**MW7D**	**MW7D**	**MW 7D**	**MW7D**	**MW7D**	**MW7D**	**MW7D**
Field Measurements	**Fresh**	**Marine**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**
Ground Level (m AHD)															-	-	-	-						NA				NA				
Depth to Groundwater (m AHD)															-	-	-	-														
Groundwater depth (m bTOC)			4.57	4.44	4.09	4.32	4.31	4.24	4.58	4.76	4.38	4.54	4.56	4.32	4.23	4.26	4.68	4.84	4.84	4.25	4.64	4.67	4.55	4.76	4.59	4.25	4.46	4.46	4.41	4.72	4.88	4.53	4.7
Height of Stick up (m)			0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Groundwater Depth (mbgl)			4.04	3.91	3.56	3.79	3.78	3.71	4.05	4.23	3.85	4.01	4.03	3.79	3.7	3.73	4.15	4.31	4.31	3.72	4.11	4.14	4.02	4.16	3.99	3.65	3.86	3.86	3.81	4.12	4.28	3.93	4.1
Field Parameters																																
pH (field)	6.5-8.0 (a)	8-8.4 (a)	7.5	7.6	7.2	7.4	7.8	7	7.9	7.6	7.9	7.7	7.9	7.5	7.4	7.4	7.8	7.8			7.4			7.4	7.4	6.9	7.1	7.5	7.4	7.5	7.4	7.5	7.2
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-						-	-	-	-	-	-	-	-	-	
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.9	1.01	0.836	0.55	0.604	0.392	0.702	0.584	0.522	<1	0.671	0.467	0.442	0.381	0.518	0.58			0.365			0.96	0.86	0.712	0.68	0.634	0.649	0.694	0.625	0.661	<1
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-						-	-	-	-	-	-	-	-	-	
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.9	2.99	1.36	2.38	2.33	2.83	1.52	2.57	1.81	1.4	2.07	1.65	2.12	1.77	2.03	1.97	1.97	2.15	1.5	2.3	2.7	1.79	2.59	1.71	2.08	2.53	2.4	1.67	1.61	1.75	0.8
Dissolved Oxygen (%)			-	-	14.30	-	-	-	-	-	-	13.9			-	-	-	-			15.3			-	-	18.00	-	-	-	-	-	-	7.9
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-						-	-	-	-	-	-	-	-	-	
Redox Potential (mV)			-	-	-	-	-	10.50	-	-	-	<0.1			-	-39	-	-			83			-	-	-	-	-	23.50	-	-	-	<0.1
Comments			nc	nc	nc	nc	-	-	-	-	nc				nc	nc	nc	nc						nc	nc	nc	nc	-	-	-	-	nc	nc
Laboratory Analyses																																
Major Ions (mg/L)																																
Sodium			-	-	109	-	-	34	-	-	-	44			-	40	-	-			33			-	-	24	-	-	14	-	-	-	16
Potassium			-	-	11	-	-	2	-	-	-	6			-	4	-	-			6			-	-	16	-	-	6	-	-	-	6
Calcium			-	-	67	-	-	31	-	-	-	56			-	24	-	-			56			-	-	90	-	-	95	-	-	-	98
Magnesium			-	-	9	-	-	6	-	-	-	7			-	5	-	-			7			-	-	10	-	-	9	-	-	-	9
Chloride			-	-	166	-	-	56	-	-	-	82			-	48	-	-			59			-	-	20	-	-	14	-	-	-	41
Alkalinity (as CaCO3)			200	177	204	151	154	85	166	172	147	152	180	132	141	109	153	143	143	143	144	144	159	299	348	307	250	226	251	246	262	231	247
Bicarbonate			200	177	204	151	154	85	166	172	136	152	180	132	141	109	153	143	143	143	144	144	159	299	348	307	250	226	251	246	262	212	247
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	11	<1	<1	<1	<1	<1	<1	<1	<1	143	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	19	<1
Sulphate (SO4)			-	-	39	-	-	10	-	-	-	14			-	9	-	-			8			-	-	15	-	-	44	-	-	-	24
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-		7	7.4	6.8	6.9	-	-	-	-	-	-	-	-	-	
Total Dissolved Solids (TDS)			538	528	530	362	256	238	418	328	274	334	398	240	238	201	282	312	312	198	330	399	433	449	358	408	408	276	402	432	352	364	402
Hardness (as CaCO3)			-	-	-	-	-	-	-	-	-				-	-	-	-						-	-	-	-	-	-	-	-	-	
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-	-						-	-	-	-	-	-	-	-	-	
Heavy Metals (mg/L)																																
Iron (filtered)	0.3 (1)		-	-	**0.16**	-	-	**1.22**	-	-	-	**0.4**			-	**0.66**	-	-			0.18			-	-	**5.8**	-	-	0.07	-	-	-	<0.05
Manganese	1.90		-	-	0.02	-	-	0.01	-	-	-	0.014			-	0.01	-	-			0.013			-	-	0.106	-	-	0.101	-	-	-	0.081
Nutrients (mg/L)																																
Nitrate (NO3 as N)	0.7 (7)		0.01	0.01	0.02	0.06	<0.01	0.04	<0.01	0.12	<0.01	0.11	<0.01	0.1	<0.01	0.16	<0.10	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	**3.5**	0.05	0.12	**1.06**	0.05	0.16	<0.01	0.06	0.06	0.47
Nitrite (NO2 as N)			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.10	0.02	0.02	<0.01	0.01	0.01	0.02	0.04	0.04	0.06	0.05	0.02	<0.01	<0.01	<0.01	<0.01	0.06
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.49	1.7	**2.56**	1.34	1.3	0.16	**1.93**	**2.03**	**2.25**	**2.34**	**2.74**	1.2	**1.91**	0.91	1.33	1.64	1.64	0.68	1.12	0.54	1.16	**21.9**	**28.6**	**21.7**	**10.2**	**7.99**	**4.38**	**4.17**	**1.98**	**2.61**	**1.94**
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**0.8**	**2.6**	**4.5**	**1.6**	**2.2**	**0.4**	**2**	**3.3**	**2.6**	**2.8**	**3.5**	**1.4**	**2.6**	**1.5**	**2**	**1.8**	**1.8**	**1.00**	**1.6**	**0.7**	**1.6**	**32.7**	**35.7**	**28.4**	**14.5**	**9.60**	**4.50**	**4.80**	**4.80**	**3.60**	**2.40**
Dissolved Organic Carbon			-	-	9	-	-	6	-	-	-	6			-	8	-	-			7			-	-	13	-	-	5	-	-	-	5
Fluoride (Electrode)			-	-	<0.1	-	-	0.1	-	-	-	0.1			-	<0.1	-	-			<0.1			-	-	0.1	-	-	0.3	-	-	-	0.2
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.25**	**0.21**	**0.5**	**0.74**	**0.83**	**0.57**	**0.32**	**0.24**	**0.58**	**0.32**	**0.18**	**0.19**	**0.16**	**0.96**	**0.67**	**0.22**	**0.22**	**0.33**	**0.23**	**0.08**	**0.52**	**0.33**	**0.5**	**1.52**	**0.44**	**0.26**	**0.61**	**5.74**	**3.36**	**1**	**0.96**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW9	MW 9	MW 9	MW9	MW9	MW 9	MW9
Field Measurements	**Fresh**	**Marine**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**
Ground Level (m AHD)					-	-	-	-					1.37	1.37	1.37	1.37	1.37	1.37	1.37
Depth to Groundwater (m AHD)					-	-	-	-					0.53	0.55	0.95	0.63	0.52	0.48	0.47
Groundwater depth (m bTOC)			4.67	4.46	4.38	4.4	4.8	4.98	4.39	4.78	4.79	4.69	1.79	1.77	1.37	1.69	1.8	1.84	1.85
Height of Stick up (m)			0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Groundwater Depth (mbgl)			4.07	3.86	3.78	3.8	4.2	4.38	3.79	4.18	4.19	4.09	0.84	0.82	0.42	0.74	0.85	0.89	0.9
Field Parameters																			
pH (field)	6.5-8.0 (a)	8-8.4 (a)	7.4	7.5	7.4	7.4	7.4	7.5		7.7			5.9	6	6.3	6.5	6.7	6.8	6.8
Temperature (T deg C)					-	-	-	-					-	-	-	-	-	-	-
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.645	0.622	0.526	0.528	0.547	0.476		0.435			21.7	16.6	1.4	8.66	7.39	4.91	6.23
Salinity (ppt)					-	-	-	-					-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.92	2.89	1.54	1.56	2.2	1.94	1.44	1.9	2.9	3.6	4.74	5.42	3.36	8.68	2.24	2.89	2.14
Dissolved Oxygen (%)					-	-	-	-		19.2			-	-	35.60	-	-	-	-
Turbidity (NTU)	6-50 (a)	0.5-10 (a)			-	-	-	-					-	-	-	-	-	-	-
Redox Potential (mV)					-	-28	-	-		73.5			-	-	-	-	-	101	-
Comments			nc	nc	nc	nc	nc	nc					nc	nc	nc	nc	-	-	-
Laboratory Analyses																			
Major Ions (mg/L)																			
Sodium					-	17	-	-		12			-	-	759	-	-	904	-
Potassium					-	6	-	-		4			-	-	33	-	-	37	-
Calcium					-	76	-	-		70			-	-	34	-	-	31	-
Magnesium					-	7	-	-		6			-	-	67	-	-	77	-
Chloride					-	16	-	-		8			-	-	912	-	-	1410	-
Alkalinity (as CaCO3)			247	228	203	250	265	208	220	178	212	209	85	61	288	129	118	147	116
Bicarbonate			247	228	203	250	265	208	220	178	212	209	85	61	288	129	118	147	116
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)					-	18	-	-		8			-	-	33	-	-	258	-
pH (lab)					-	-	-	-	7.2	7.7	5.9	6.5	-	-	-	-	-	-	-
Total Dissolved Solids (TDS)			406	346	338	298	307	280	238	280	292	237	15600	10900	3270	6560	3900	2920	3660
Hardness (as CaCO3)					-	-	-	-					-	-	-	-	-	-	-
Total Suspended Solids (TSS)					-	-	-	-					-	-	-	-	-	-	-
Heavy Metals (mg/L)																			
Iron (filtered)	0.3 (1)				-	0.09	-	-		<0.05			-	-	**4.64**	-	-	**0.57**	-
Manganese	1.90				-	0.064	-	-		0.034			-	-	0.015	-	-	0.002	-
Nutrients (mg/L)																			
Nitrate (NO3 as N)	0.7 (7)		**0.97**	0.46	0.16	0.49	<0.10	0.02	<0.01	**1.19**	0.25	<0.01	0.4	**1.98**	**6.83**	0.52	0.19	0.17	<0.01
Nitrite (NO2 as N)			0.01	0.01	0.01	0.1	<0.10	<0.01	<0.01	0.04	0.01	0.02	<0.01	<0.01	<0.50	0.02	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	1.67	**1.93**	**2.82**	**2.43**	**2.09**	**1.97**	**1.91**	0.2	1.36	1.48	<0.10	<0.10	0.84	0.06	0.05	<0.01	1
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**2**	**2.2**	**3.90**	**2.60**	**3**	**2**	**2.10**	**0.60**	**1.60**	**1.60**	**0.8**	**2.7**	**94.1**	**1.6**	**2.40**	**1.70**	**2.60**
Dissolved Organic Carbon					-	13	-	-		7			-	-	430	-	-	51	-
Fluoride (Electrode)					-	0.2	-	-		0.2			-	-	0.5	-	-	0.4	-
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.08**	**0.17**	**1**	**1.66**	**8.46**	**2.55**	**0.89**	**0.37**	**0.30**	**1.07**	<0.01	**0.83**	**<2.00**	**0.07**	**0.12**	**0.07**	**0.22**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems — **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9
Field Measurements	**Fresh**	**Marine**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**
Ground Level (m AHD)			1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37
Depth to Groundwater (m AHD)			0.39	0.52	0.47	0.88	1.03	0.53	0.4	0.49	0.38	0.38	0.67	0.83	0.54	0.56
Groundwater depth (m bTOC)			1.93	1.8	1.85	1.44	1.29	1.79	1.92	1.83	1.94	1.94	1.65	1.49	1.78	1.76
Height of Stick up (m)			0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Groundwater Depth (mbgl)			0.98	0.85	0.9	0.49	0.34	0.84	0.97	0.88	0.99	0.99	0.7	0.54	0.83	0.81
Field Parameters																
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.3	6.7	6.3	6.5	6.7	6.4	6.2	6.4	6.2			5.7		
Temperature (T deg C)			-	-				-	-	-	-					
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		13	6.41	11	9.32	12.7	6.39	1.08	10.2	18.9			23.4		
Salinity (ppt)			-	-				-	-	-	-					
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.89	3.31	1.2	1.73	1.68	3.71	1.97	2.14	1.9	1.9	3.69	4.1	2.2	3.3
Dissolved Oxygen (%)			-	-	12.5			-	-	-	-			45.9		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-				-	-	-	-					
Redox Potential (mV)			-	-	<0.1			-	38	-	-			243		
Comments			-	nc	nc	nc	nc	nc	nc	nc	nc					
Laboratory Analyses																
Major Ions (mg/L)																
Sodium			-	-	2330			-	190	-	-			5370		
Potassium			-	-	101			-	13	-	-			175		
Calcium			-	-	147			-	6	-	-			382		
Magnesium			-	-	392			-	14	-	-			772		
Chloride			-	-	4620			-	275	-	-			8360		
Alkalinity (as CaCO3)			78	174	79	194	191	125	53	130	86	86	97	39	146	135
Bicarbonate			78	174	79	194	191	125	53	130	86	86	97	39	146	135
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)			-	-	679			-	37	-	-			1450		
pH (lab)			-	-				-	-	-	-		6.1	5.7	6.1	6.3
Total Dissolved Solids (TDS)			9530	4000	7670	6540	8220	3320	671	7530	13100	13100	6240	20900	8190	6730
Hardness (as CaCO3)			-	-				-	-	-	-					
Total Suspended Solids (TSS)			-	-				-	-	-	-					
Heavy Metals (mg/L)																
Iron (filtered)	0.3 (1)		-	-	0.11			-	**0.68**	-	-			0.08		
Manganese	1.90		-	-	0.005			-	0.004	-	-			0.006		
Nutrients (mg/L)																
Nitrate (NO3 as N)	0.7 (7)		<0.01	0.06	0.11	<0.10	0.02	<0.01	<0.10	<0.01	0.01	0.01	0.13	**1.60**	<0.01	<0.01
Nitrite (NO2 as N)			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	<0.10	0.03	0.04	0.23	1.08	<0.01	0.02	0.32	0.24	0.24	<0.01	<0.01	0.34	0.21
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**1.00**	**1.9**	**1.8**	**2.4**	**2.8**	**3.1**	**3.1**	**1.6**	**1.1**	**1.10**	**0.40**	**1.00**	**2.10**	**2.60**
Dissolved Organic Carbon			-	-	17			-	64	-	-			14		
Fluoride (Electrode)			-	-	0.2			-	0.2	-	-			0.2		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.08**	**0.14**	**0.05**	**0.17**	**0.23**	**0.34**	**0.24**	**0.09**	**0.06**	**0.06**	**0.05**	**0.07**	**0.22**	**0.20**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		MW10	MW 10	MW 10	MW10	MW10	MW 10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10
Field Measurements	**Fresh**	**Marine**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**
Ground Level (m AHD)			1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475
Depth to Groundwater (m AHD)			0.295	0.295	0.785	0.395	0.295	NA	0.185	0.035	0.275	0.225	0.605	0.765	0.365	0.195	0.235	0.105	0.415	0.475	0.355	0.305
Groundwater depth (m bTOC)			2.14	2.14	1.65	2.04	2.14	-	2.25	2.4	2.16	2.21	1.83	1.67	2.07	2.24	2.2	2.33	2.02	1.96	2.08	2.13
Height of Stick up (m)			0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Groundwater Depth (mbgl)			1.18	1.18	0.69	1.08	1.18	NA	1.29	1.44	1.2	1.25	0.87	0.71	1.11	1.28	1.24	1.37	1.06	1	1.12	1.17
Field Parameters																						
pH (field)	6.5-8.0 (a)	8-8.4 (a)	4	4.1	5.8	5	5.4	-	5.3	4.9	5.2	4.7	5	5.1	5	5.4	5.3	5.1		4.2		
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		29	6.45	3.06	8.94	5.12	-	5.7	14.8	6.3	12	15.2	13.1	6.64	6.72	14.4	28.2		22.7		
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	4.69	4.93	4.7	9.61	6.1	-	4.16	3.05	3.26	2.4	2.03	3.43	2.01	3.02	2.38	3.89	3.06	2.7	3.5	4.2
Dissolved Oxygen (%)			-	-	50.30	-	-	-	-	-	-	24.9			-	-	-	-		30.3		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-				
Redox Potential (mV)			-	-	-	-	-	-	-	-	-	<0.1			-	161	-	-		318		
Comments			nc	nc	nc	nc	-	-	-	-	nc				nc	nc	nc	nc				
Laboratory Analyses																						
Major Ions (mg/L)																						
Sodium			-	-	406	-	-	-	-	-	-	2390			-	1100	-	-		5060		
Potassium			-	-	20	-	-	-	-	-	-	102			-	48	-	-		156		
Calcium			-	-	7	-	-	-	-	-	-	114			-	44	-	-		265		
Magnesium			-	-	13	-	-	-	-	-	-	336			-	136	-	-		699		
Chloride			-	-	449	-	-	-	-	-	-	4730			-	1760	-	-		7760		
Alkalinity (as CaCO3)			<1	<1	28	3	10	-	6	2	6	4	1	<1	5	9	10	4	<1	<1	2	3
Bicarbonate			<1	<1	28	3	10	-	6	2	6	4	1	<1	5	9	10	4	<1	<1	2	3
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)			-	-	42	-	-	-	-	-	-	642			-	304	-	-		1410		
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-	5.20	4.20	5.10	5.10
Total Dissolved Solids (TDS)			20500	10100	1810	5740	2700	-	3440	10500	3980	8280	10700	7550	3870	3760	10800	19400	7970	16900	12200	8070
Hardness (as CaCO3)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Heavy Metals (mg/L)																						
Iron (filtered)	0.3 (1)		-	-	**10.4**	-	-	-	-	-	-	0.28			-	**0.54**	-	-		0.27		
Manganese	1.90		-	-	0.003	-	-	-	-	-	-	0.015			-	0.014	-	-		0.02		
Nutrients (mg/L)																						
Nitrate (NO3 as N)	0.7 (7)		0.2	0.3	**1.36**	0.44	0.05	-	0.15	<0.01	0.03	0.25	<0.01	0.01	<0.01	0.04	0.02	0.16	<0.01	**0.72**	0.07	0.02
Nitrite (NO2 as N)			<0.01	<0.01	<0.50	0.02	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	<0.10	<0.10	<0.10	<0.10	0.03	-	0.02	<0.10	0.02	0.02	<0.10	0.58	0.05	0.06	0.3	0.09	0.08	<0.01	0.13	0.15
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**2.2**	**6.2**	**59.3**	**1.2**	**2.6**	-	**5.2**	**8**	**1.5**	**10**	**1.4**	**1.4**	**3.1**	**6.1**	**0.3**	**<0.2**	**1.00**	**2.2**	**11.4**	**17.3**
Dissolved Organic Carbon			-	-	430	-	-	-	-	-	-	12			-	24	-	-		14		
Fluoride (Electrode)			-	-	<0.1	-	-	-	-	-	-	0.2			-	<0.1	-	-		0.30		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.15**	**0.52**	**<1.00**	**0.03**	**0.14**	-	**0.46**	**0.8**	**0.3**	**0.94**	**0.03**	**0.04**	**0.21**	**0.45**	<0.01	<0.02	**0.09**	**0.16**	**1.08**	**1.67**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems **35**

Focus of this monitoring report

nc = no comment NA = not available

Gerroa Waste Disposal Depot																						
Sample ID	**ANZECC, 2000**		**MW11**	**MW 11**	**MW 11**	**MW11**	**MW11**	**MW 11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**	**MW11**
Field Measurements	**Fresh**	**Marine**	**21/5/10**	**17/8/10**	**30/11/10**	**23/2/11**	**24/5/11**	**24/8/11**	**3/11/11**	**1/2/12**	**31/5/12**	**10/8/12**	**21/11/12**	**18/2/13**	**31/5/13**	**30/8/13**	**27/11/13**	**7/2/14**	**6/5/14**	**1/8/14**	**17/11/14**	**26/2/15**
Ground Level (m AHD)			1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695	1.695
Depth to Groundwater (m AHD)			0.405	0.485	0.955	0.495	0.405	0.375	0.345	0.265	0.375	0.385	0.785	0.965	0.505	0.315	0.375	0.265	0.635	0.705	0.445	0.515
Groundwater depth (m bTOC)			2.25	2.17	1.7	2.16	2.25	2.28	2.31	2.39	2.28	2.27	1.87	1.69	2.15	2.34	2.28	2.39	2.02	1.95	2.21	2.14
Height of Stick up (m)			0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Groundwater Depth (mbgl)			1.29	1.21	0.74	1.2	1.29	1.32	1.35	1.43	1.32	1.31	0.91	0.73	1.19	1.38	1.32	1.43	1.06	0.99	1.25	1.18
Field Parameters																						
pH (field)	6.5-8.0 (a)	8-8.4 (a)	5.1	5.2	5.7	6.1	6.2	6.3	6.4	6	6.1	5.4	5.7	6.2	5.5	6.2	5.7	5.6		5.2		
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		18.6	16.2	0.178	6.12	4.05	1.67	3.83	6.26	3.4	8	12.1	7.05	7.3	1080	4.73	8.28		15.5	4.62	7.85
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-				
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.41	3.32	5.13	9.66	2.66	1.56	6.61	2.58	2.16	1.2	1.8	1.63	2.05	1.97	2.25	2.15		3.1		
Dissolved Oxygen (%)			-	-	53.30	-	-	-	-	-	-	12.4			-	-	-	-		33.5		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-				
Redox Potential (mV)			-	-	-	-	-	111	-	-	-	<0.1			-	38	-	-		206		
Comments			nc	nc	nc	nc	-	-	-	-	nc	nc	nc	nc	nc	nc	nc	nc				
Laboratory Analyses																						
Major Ions (mg/L)																						
Sodium			-	-	368	-	-	298	-	-	-	1900			-	190	-	-		3710		
Potassium			-	-	16	-	-	10	-	-	-	67			-	13	-	-		99		
Calcium			-	-	10	-	-	31	-	-	-	100			-	6	-	-		218		
Magnesium			-	-	15	-	-	40	-	-	-	249			-	14	-	-		582		
Chloride			-	-	400	-	-	493	-	-	-	3690			-	275	-	-		6060		
Alkalinity (as CaCO3)			24	24	51	103	102	93	60	64	79	28	23	87	28	53	32	26	75	7	40	28
Bicarbonate			24	24	51	103	102	93	60	64	79	28	23	87	28	53	32	26	75	7	40	28
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)			-	-	30	-	-	121	-	-	-	471			-	37	-	-		1060		
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-	6	5	6	6
Total Dissolved Solids (TDS)			12800	10700	1530	3710	2260	1330	2370	3570	1990	6370	8300	4310	3950	671	2900	5480	1760	13800	2810	4840
Hardness (as CaCO3)			-	-	-	-	-	-	-	-	-					-	-	-				
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-					-	-	-				
Heavy Metals (mg/L)																						
Iron (filtered)	0.3 (1)		-	-	**6.2**	-	-	**2.57**	-	-	-	**1.69**			-	**0.68**	-	-		2.98		
Manganese	1.90		-	-	0.005	-	-	0.01	-	-	-	0.028			-	0.004	-	-		0.03		
Nutrients (mg/L)																						
Nitrate (NO3 as N)	0.7 (7)		0.06	0.17	**0.93**	0.48	<0.01	0.04	<0.01	<0.01	<0.01	0.08	<0.01	**0.81**	<0.01	<0.10	<0.01	<0.01	<0.01	0.09	<0.01	<0.01
Nitrite (NO2 as N)			<0.01	<0.01	<0.50	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	<0.10	<0.10	<0.10	0.13	0.06	0.03	0.03	0.01	0.03	0.05	<0.10	0.42	0.07	0.02	0.01	<0.01	0.06	<0.01	0.19	0.13
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	**2.8**	**3.9**	**67.7**	**3.2**	**4.30**	**4.70**	**2.60**	**3.40**	**3**	**5**	**2.7**	**2.3**	**6**	**3**	**1.2**	**5.0**	**2.5**	**2.6**	**3.7**	**4.9**
Dissolved Organic Carbon			-	-	440	-	-	145	-	-	-	48			-	64	-	-		31		
Fluoride (Electrode)			-	-	0.1	-	-	0.2	-	-	-	0.2			-	0.2	-	-		0		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.11**	**0.52**	**<1.00**	**0.31**	**0.25**	**0.44**	**0.25**	**0.12**	**0.07**	**0.3**	**0.06**	**0.06**	**0.32**	**0.2**	**0.07**	**0.47**	**0.14**	**0.16**	**0.29**	**0.32**

Note:

Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems — **35**

Focus of this monitoring report

nc = no comment NA = not available

Table SW-1: Summary Analytical Results for Surface Water Locations (2003 to 2015)

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-3	ML-3	ML-3	ML-3	ML-3
Field Measurements	Fresh	Marine	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	18/8/14	17/11/14	26/2/15	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.8	6.9	7	7.2	7	7.3	7.4	6.5	7	7.2	6.9	7.1	7	7	6.5	7.63	7.42	7.65	7.26	4.25
Temperature										-	-	-	-					20.5	21.34	13.03	13.16	18.75
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.41	6.73	19	15.7	20	46.9	19.6	5.13	6.88	13.6	40	38200	21000	36600	553	13.1	5.3	3.1	8.5	0.4
Eh (ORP) (mV)										-	-	-	-		149			nm	nm	nm	nm	nm
Salinity (ppt)										-	-	-	-					7.53	2.85	1.62	4.72	0.21
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	6.05	6.68	6.25	5.66	3.2	6.03	5.39	4.61	4.97	11.1	5.22	6.66	6.2	5.8	4.1	4.6	4.5	2.2	0.8	1.2
Dissolved Oxygen (%)							33.2			-	-	-	-		67.3			52.9	41.1	24	7.6	12.2
Turbidity (NTU)	6-50 (a)	0.5-10 (a)								-	-	-	-					30.1	27.1	21.5	20.6	15.1
Laboratory Analyses																						
Sodium (ICP)			189				7180			-	1200	-	-		5400			-	-	-	-	-
Potassium (ICP)			10				272			-	52	-	-		246			-	-	-	-	-
Calcium (ICP)			32				255			-	79	-	-		241			-	-	-	-	-
Magnesium (ICP)			29				701			-	140	-	-		614			-	-	-	-	-
Chloride										-	-	-	-					-	-	-	-	-
Alkalinity (as CaCO3)			50	66	128		121	128	117	43	160	127	115	124	92	111	17	-	-	-	-	-
Sulphate (SO4)										-	-	-	-					-	-	-	-	-
pH										-	-	-	-					-	-	-	-	-
Redox Potential (mV)			73.5				<0.1			-	58	-	-					-	-	-	-	-
Total Dissolved Solids (TDS)			846	6730	13700	11800	18100	34600	12900	2950	4260	9920	28800	32600	18600	24400	423	-	-	-	-	-
Total Suspended Solids (TSS)										-	-	-	-					-	-	-	-	-
Metals (mg/L)																						
Iron (ICP)	0.3 (1)		0.89				<0.50			-	1.45	-	-		**0.36**			-	-	-	-	-
Manganese (ICP)	1.90		0.12				0.031			-	0.052	-	-		0.025			-	-	-	-	-
Nutrients (mg/L)																						
Nitrate (NO3 as N)	0.7 (7)		0.08	0.12	0.07	0.24	0.18	<0.01	0.23	0.02	0.15	0.06	0.01	0.03	0.15	<0.01	0.05	-	-	-	-	-
Nitrite (NO2 as N)			<0.01	0.02	0.09	0.06	0.02	<0.01	<0.01	0.02	0.02	0.06	0.05	0.02	0.04	0.04	<0.01	-	-	-	-	-
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	1.69	1.03	1.7	1.8	1.09	<0.10	<0.10	0.75	**3.19**	1	0.44	0.33	0.68	0.36	0.09	0.08	0.04	0.08	0.07	0.03
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	**2**	**1.6**	**2.4**	**2.9**	**1.3**	**0.2**	**1**	**2**	**3.6**	**2.2**	**1**	<0.5	**1.2**	**0.9**	**1.4**	-	-	-	-	-
Total Organic Carbon (TOC)										-	-	-	-					-	-	-	-	-
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	**0.1**	**0.03**	**0.06**	**0.05**	<0.01	<0.01	**0.13**	**0.09**	0.04	0.01	**0.12**	**0.6**	**0.05**	**0.09**	**0.21**	-	-	-	-	-
Biological (CFU/100 ml)																						
Enterococcus	35 (8)	35 (8)	~18				4			-	20	-	-		**160**			10	**390**	**72**	**60**	**140**
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	~17				2			-	24	-	-		**290**			16	32 (app)	50	18 (app)	**220**

Exceeds ANZECC (2000) guidelines **0.054**

Focus of this monitoring report

nm = not measured (app) = approximately NR = no result

1. Trigger value is an indicative interim working level only (IIWL).
2. Ammonia trigger value at pH =8, 95% protection,corrected ave pH=7.3.
3. Trigger value for oxides of Nitrogen (NOx) for lowland rivers in NSW.
4. Trigger value for oxides of Nitrogen (NOx) for marine ecosystems in NSW.
5. Trigger value for total Nitrogen in lowland rivers in NSW.
6. Trigger value for total Nitrogen in marine ecosystems in NSW.
7. Trigger value for a 95% proetction level.
8. Guidelinefor water qualiity and aesthetics: primary contact

a. Reference only, not dirtectly applicable to groundwater

Table SW-1: Summary Analytical Results for Surface Water Locations (2003 to 2015)

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		ML-3	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4
Field Measurements	Fresh	Marine		10/07/03	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04	16/02/05	29/06/05	30/08/05	23/11/05	27/02/06	31/05/06	31/08/06	28/11/06	27/02/07	23/05/07	22/08/07	21/11/07	22/02/08
pH (field)	6.5-8.0 (a)	8-8.4 (a)	No access (Cleary Bros. Land) - no samples taken 31/05/2013; 30/08/2013; 27/11/2013 an	6.99	7.66	7.77	7.7	17.24	4.26	7.33	6.48	7.22	7.67	7.43	6.58	6.42	6.04	6.76	7.6	5.86	7.19	6.94
Temperature				12.7	19.99	21.72	12.68	12.43	18.66	19	13.77	16.62	18.86	22.14	12.58	15.36	20.6	22.61	14.2	13.56	23.26	20.85
Electrical Conductivity (mS/cm)	0.125-2.2 (a)			1.2	13.3	5.4	3.2	8.1	0.4	2.7	4.4	1.98	5.547	10.24	15.62	5.126	13.68	10.9	24.37	1.381	9.749	1.825
Eh (ORP) (mV)				-67	nm	nm	nm	nm	nm	nm	-172	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Salinity (ppt)				0.63	7.63	2.93	1.7	4.48	0.21	1.44	2.33	1.01	3.01	5.79	9.15	2.77	7.92	6.19	14.84	0.7	5.49	1.01
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)		5.1	4	4.1	2.5	0.6	0.5	4.6	7.4	9.48	8.26	5.06	6.3	14.45	7.36	5.02	4.71	8.19	5.31	4.88
Dissolved Oxygen (%)				46.5	46.1	47.6	23.3	6.6	4.9	50.3	71.6	97.9	90.4	60	62.7	146.8	85.8	58.3	46.2	79	64.2	54.9
Turbidity (NTU)	6-50 (a)	0.5-10 (a)		17.3	28.8	28.4	22.7	20.4	14.7	26	32.8	10.5	1	3.2	20.2	31.6	2.8	14.4	5.6	4.7	0	30.5
Laboratory Analyses																						
Sodium (ICP)				152	2612	1080	584	1589	40	461	677	219	907	3600	2500	670	3	1700	3600	150	1500	230
Potassium (ICP)				8	103	48	26	57	9.3	23	33	13	38	230	130	39	0.75	75	160	10	70	14
Calcium (ICP)				34	121	62	50	90	13	38	47	39	66	180	67	59	160	66	120	29	70	36
Magnesium (ICP)				28	-	119	76	174	9.2	61	95	34	122	450	290	85	0.008	210	500	32	210	36
Chloride				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity (as CaCO3)				282	93	108	83	95	14	60	11.5	71	49	119	15	63	83	52	100	-	90	97
Sulphate (SO4)				-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-
pH				6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redox Potential (mV)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (TDS)				744	8944	3480	1892	5176	160	1532	2496	1232	4236	13124	9400	3100	17000	6700	17400	602	6400	1000
Total Suspended Solids (TSS)				-	48	-	2	7	40	15	36	8	12	9	56	18	43	16	13	15	-	-
Metals (mg/L)																						
Iron (ICP)	0.3 (1)			0.23	**2.9**	**0.39**	0.27	0.2	**3.4**	0.095	0.1	0.05	0.28	0.05	**3.2**	**2.4**	<0.04	0.06	**0.36**	**0.4**	0.22	**2.9**
Manganese (ICP)	1.90			0.15	0.096	0.007	0.04	0.032	0.48	<0.001	0.29	<0.01	0.06	0.053	0.1	0.1	0.03	0.05	0.06	0.16	0.017	0.12
Nutrients (mg/L)																						
Nitrate (NO3 as N)	0.7 (7)			0.04	0.03	0.12	<0.02	0.08	0.04	0.02	0.075	<0.04	<0.04	<0.04	1.4	<0.04	190	0.16	0.09	0.1	0.05	<0.04
Nitrite (NO2 as N)				<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	0.019	0.01	0.003	0.008	0.016	0.003	4600	0.012	0.007	0.02	0.011	0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)		0.04	0.02	<0.02	<0.02	0.06	<0.02	0.21	<0.02	<0.10	0.05	0.55	0.29	0.37	<0.1	0.09	1.5	0.37	<0.02	1.7
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)		**0.37**	**0.15**	**0.75**	**0.48**	**0.7**	**2.1**	**0.8**	**0.66**	**0.62**	**0.42**	**1.3**	**2**	**1.4**	**0.75**	**0.83**	**2.3**	**0.44**	**0.49**	**2.9**
Total Organic Carbon (TOC)				7	5	3	8	6	28	10	9	10	6	2	NR	10	3	6		8	11	16
Total Phosphorus (TP)	0.05 (7)	0.025 (7)		<0.002	**0.049**	**0.036**	<0.002	<0.002	**0.3**	0.021	**0.04**	<0.002	<0.005	**0.029**	**0.098**	0.01	0.017	**0.036**	0.008	**0.44**	**0.019**	0.05
Biological (CFU/100 ml)																						
Enterococcus	35 (8)	35 (8)		<1	10	**320**	**60**	**72**	**100**	**180**	<1	**52**	**160**	**100**	**80**	**60**	30 (app)	**1800(ap)**	**230**	<2	32	**70**
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)		<1	15	28 (app)	44	20 (app)	**240**	24 (app)	<1	64	25	60	112	30 (app)	14 (app)	**2000**	12 (app)	<2	16 (app)	16 (app)

Exceeds ANZECC (2000) guidelines **0.054**

Focus of this monitoring report

nm = not measured (app) = approximately NR = no result

Table SW-1: Summary Analytical Results for Surface Water Locations (2003 to 2015)

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		ML-4	ML-4	ML-4	ML-4	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML5	ML-5	ML-5	ML-5	ML-5	ML-5
Field Measurements	Fresh	Marine	29/05/08	25/08/08	19/11/08		10/07/03	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04	19/11/08	18/02/09	19/05/09	27/08/09	27/11/09	26/2/10	21/05/10	17/08/10	30/11/10
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.64	6.8	7.07	No access (Cleary Bros. Land) - no samples taken 31/05/2013; 30/08/2013; 27/11/2013 an	7.26	7.97	7.54	7.51	7.51	6.6	7.23	6.9	6.7	5.9	6.3	6.8	6.7	6.7	5.8
Temperature			14.86	14.3	20		13.6	22.51	23.47	16.41	14.26	19.03	20.2	-	-	-	-	-	-	-	-
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.533	1.7	5.49		3	40.3	19.7	36.1	14.6	0.7	16.67	13	27	31	19	9.6	21.3	5.1	0.294
Eh (ORP) (mV)			nm	nm	89		-63	nm	nm	nm	nm	nm	88	-	-	-	-	-	-	-	-
Salinity (ppt)			0.97	1.1	nm		1.58	25.7	11.7	22.78	8.48	0.34	nm	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	5.11	8.2	nm		4.3	5.9	3	1.6	0.5	1	nm	8.1	6.4	5.4	4.9	5.2	6.36	9.44	5.18
Dissolved Oxygen (%)			63.2	81	46		41.8	79	37	18.2	4.8	11.3	67	-	-	62	-	-	-	-	54.00
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	1.1	4.6	nm		15.4	33.3	26.8	26.1	32.3	14.1	nm	-	-	-	-	-	-	-	-
Laboratory Analyses																					
Sodium (ICP)			440	200	740		-	-	-	-	-	-	2100	2100	-	6300	-	-	-	-	21
Potassium (ICP)			20	11	30		-	-	-	-	-	-	84	88	-	310	-	-	-	-	3
Calcium (ICP)			100	40	67		-	-	-	-	-	-	90	110	-	200	-	-	-	-	7
Magnesium (ICP)			64	34	96		-	-	-	-	-	-	240	260	-	820	-	-	-	-	5
Chloride			-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity (as CaCO3)			<2	61	80		-	-	-	-	-	-	110	110	110	120	100	106	103	55	6
Sulphate (SO4)			-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH			-	-	7.2		-	-	-	-	-	-	7	-	-	-	-	-	-	-	-
Redox Potential (mV)			-	-	170		-	-	-	-	-	-	190	-4	-	82	-	-	-	-	-
Total Dissolved Solids (TDS)			1100	990	3100		-	-	-	-	-	-	1200	8800	24000	24000	12000	6380	15400	3060	146
Total Suspended Solids (TSS)			-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals (mg/L)																					
Iron (ICP)	0.3 (1)		**0.68**	**0.43**	**1.3**		-	-	-	-	-	-	**0.57**	**0.66**	-	0.11	-	-	-	-	**0.98**
Manganese (ICP)	1.90		0.04	0.09	0.08		-	-	-	-	-	-	0.06	0.26	-	<0.01	-	-	-	-	0.062
Nutrients (mg/L)																					
Nitrate (NO3 as N)	0.7 (7)		-	-	0.05		-	-	-	-	-	-	0.08	**1.4**	0.1	0.2	0.13	0.19	0.16	0.08	0.03
Nitrite (NO2 as N)			-	-	<0.01		-	-	-	-	-	-	0.02	0.43	0.02	0.09	0.04	0.02	0.1	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	<0.10	0.27	<1		**1.9**	1.2	**4.1**	1.4	**4.2**	0.2	1.6	**2**	1.2	**2.8**	**3**	**2.17**	1.52	0.94	0.04
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	**0.53**	**0.76**	**0.8**		-	-	-	-	-	-	**2.4**	**2.1**	**1.2**	**2.9**	**3.6**	**4.6**	**1.7**	**1.6**	**1.5**
Total Organic Carbon (TOC)			10	10	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	<0.005	<0.005	<0.05		-	-	-	-	-	-	<0.05	<0.005	0.01	**0.04**	<0.05	**1.78**	<0.01	<0.01	<0.01
Biological (CFU/100 ml)																					
Enterococcus	35 (8)	35 (8)	18	8 (app)	14 (app)		2	4	**600**	**36 (app)**	**40**	**80**	**116 (app)**	**180**	-	-	-	-	-	-	**~1200**
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	15	13	16 (app)		<1	16	44	12 (app)	12 (app)	**160**	58	64	-	6	-	-	-	-	**~9100**

Exceeds ANZECC (2000) guidelines **0.054**

Focus of this monitoring report

nm = not measured (app) = approximately NR = no result

Table SW-1: Summary Analytical Results for Surface Water Locations (2003 to 2015)

Gerroa Waste Disposal Depot

Sample ID	ANZECC, 2000		ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5
Field Measurements	Fresh	Marine	23/02/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	18/8/14	17/11/14	26/2/15
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.8	7	6.8	6.9	7	7.2	6.9	7	7.3	6.4	7	7.2		6.5	6.7	6.4	6.1
Temperature			-									-	-	-	-				
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		16.6	8	9.19	2.89	9.59	5.08	5	45.9	18.9	1.26	1.81	4.26		26800	12900	26800	357
Eh (ORP) (mV)			-									-	-	-	-		208		
Salinity (ppt)			-									-	-	-	-				
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	6.24	5.38	6.39	6.86	6.68	7.37	3.6	6.82	4.5	5.22	3.91	6.65		5.55	6.2	5.6	5.3
Dissolved Oxygen (%)			-						33.7			-	-	-	-		63.3		
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-									-	-	-	-				
Laboratory Analyses																			
Sodium (ICP)			-		102				1030			-	274	-	-		2980		
Potassium (ICP)			-		7				43			-	16	-	-		138		
Calcium (ICP)			-		31				74			-	48	-	-		154		
Magnesium (ICP)			-		21				122			-	36	-	-		363		
Chloride			-									-	-	-	-				
Alkalinity (as CaCO3)			129	112	45	52	148	132	111	117	114	37	148	112		138	105	157	15
Sulphate (SO4)			-									-	-	-	-				
pH			-									-	-	-	-				
Redox Potential (mV)			-		72.6				<0.1			-	62	-	-				
Total Dissolved Solids (TDS)			10800	4450	538	1660	6530	2880	3890	29700	12700	692	936	2510		21400	8160	18500	281
Total Suspended Solids (TSS)			-									-	-	-	-				
Metals (mg/L)																			
Iron (ICP)	0.3 (1)		-		**0.89**				**0.94**			-	**1.99**	-	-		**0.6**		
Manganese (ICP)	1.90		-		0.139				0.042			-	0.083	-	-		0.04		
Nutrients (mg/L)																			
Nitrate (NO3 as N)	0.7 (7)		0.36	0.1	0.05	0.05	0.11	0.13	0.38	0.02	0.16	0.03	0.06	0.05	0.02	0.01	0.15	0.03	0.05
Nitrite (NO2 as N)			0.1	0.03	<0.01	<0.01	0.12	0.02	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.15	0.1	0.04	0.24	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	1.83	**3.12**	1.6	0.85	**3.07**	1.73	1.73	<0.10	<0.10	0.81	**2.6**	0.52	**2.6**	1.73	0.68	**3.5**	0.07
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	**3.3**	**4.2**	**2**	**1.2**	**4.1**	**2.5**	**1.9**	**0.2**	**1.7**	**1.7**	**3.1**	**0.6**	**2.7**	**2**	**1.2**	**4.3**	**1.6**
Total Organic Carbon (TOC)			-									-	-	-	-				
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	<0.01	**0.03**	**0.12**	**0.03**	**0.03**	<0.01	0.02	<0.01	**1.95**	**0.06**	0.03	0.01	0.03	**0.22**	**0.05**	**0.09**	**0.2**
Biological (CFU/100 ml)																			
Enterococcus	35 (8)	35 (8)	-		~8				12			-	~16	-	-		**130**		
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	-		<2				4			-	~6	-	-		**220**		

Exceeds ANZECC (2000) guidelines **0.054**

Focus of this monitoring report

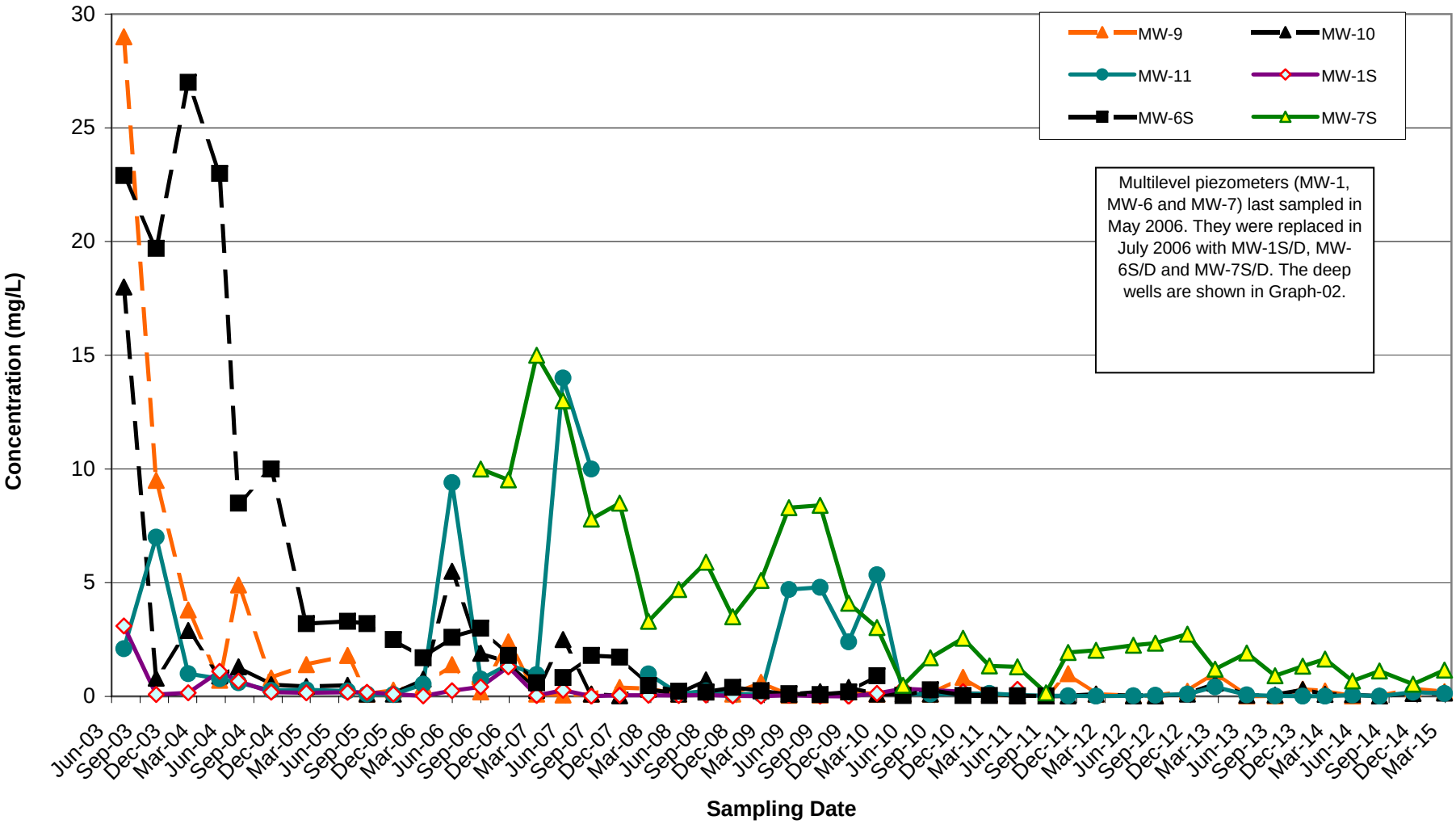
nm = not measured (app) = approximately NR = no result

Table 6: Groundwater and Surface Water Monitoring - 2014 to 2015

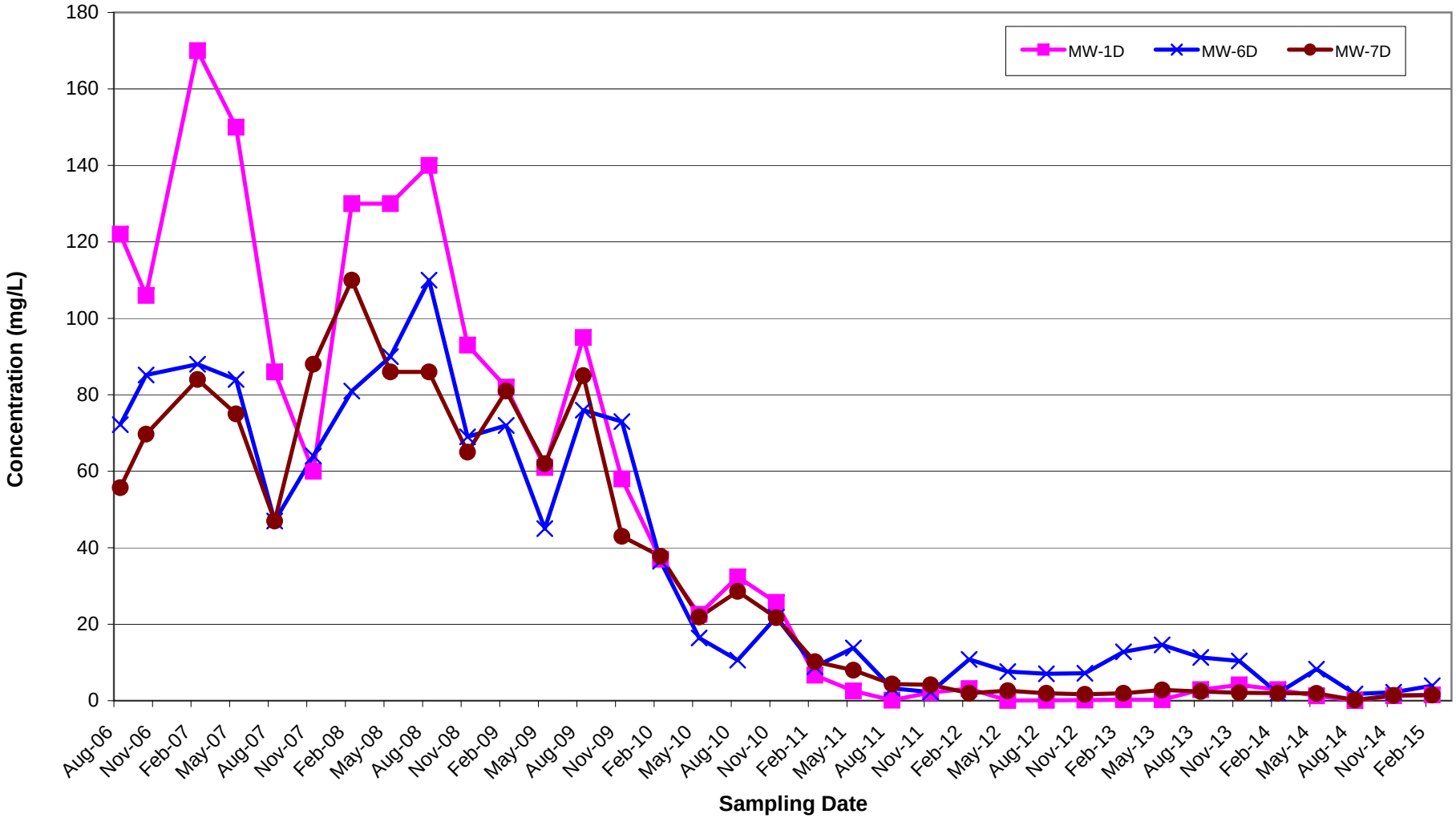
Analytes	Groundwater				Blue Angle Creek				Detection Limit	Method Reference
	6/05/14	18/08/14	17/11/14	26/02/15	6/05/14	18/08/14	17/11/14	26/02/15		
Physical Properties										
pH	X	X	X	X	X	X	X	X	0.01 pH unit	pH meter and probe/APHA4500-HB
Electrical Conductivity	X	X	X	X	X	X	X	X	0.01 mS/cm	Conductivity meter and probe
Dissolved Oxygen	X	X	X	X	X	X	X	X	0.0001	DO meter and probe
Redox (Orp)		X				X			1 mV	Platinum electrode probe
Temperature									1 °C	Temperature meter and probe
Total Dissolved Solids	X	X	X	X	X	X	X	X	5 mg/L	Determined gravimetrically by drying (APHA 2540 C)
Suspended Solids									2 mg/L	APHA2540D
Turbidity									1 NTU	Turbidmeter
Nutrients										
Ammonia-nitrogen	X	X	X	X	X	X	X	X	0.01 mg/L	FIA
Total Phosphorus	X	X	X	X	X	X	X	X	2 µg/L	FIA
Nitrate-nitrogen	X	X	X	X	X	X	X	X	10 µg/L	FIA
Nitrite-nitrogen	X	X	X	X	X	X	X	X	1 µg/L	FIA
Total Kjeldhal Nitrogen	X	X	X	X	X	X	X	X	50 µg/L	FIA
Hydro-chemical										
Calcium		X				X			0.5 mg/L	USEPA 6010 A
Chloride		X							0.5 mg/L	Titrated with mercuric nitrate using diphenol-carbazonel/xylene cyanol FF indicator
Fluoride		X							0. 1 mg/L	APHA4500-FC
Magnesium		X				X			0.02 mg/L	USEPA 6010 A
Sulphate		X							1 mg/L	ICID/MS
Sodium		X				X			0.05 mg/L	USEPA 6010 A
Bicarbonate/Alkalinity	X	X	X	X	X	X	X	X	0.5 mg/L	APHA2340C
Potassium		X				X			0.05 mg/L	USEPA 6010 A
Organic Contaminants										
Dissolved Organic Carbon		X							0.50 mg/L	APHA 5310C
Total Organic Carbon									0.1 mg/L	APHA 5310C
Inorganic Contaminants										
Iron		X				X			1 µg/L	USEPA 6010 A
Manganese		X				X			1 µg/L	USEPA 6010
Biological Contaminants										
Thermotolerant (Faecal) coliforms MF						X			1cfu/100 ml	WMM 009 (~AS 4276.7 - 1995)
Enterococcus MF						X			1cfu/100 ml	WMM 013 (~AS 4276.9 - 1995)

Graphs

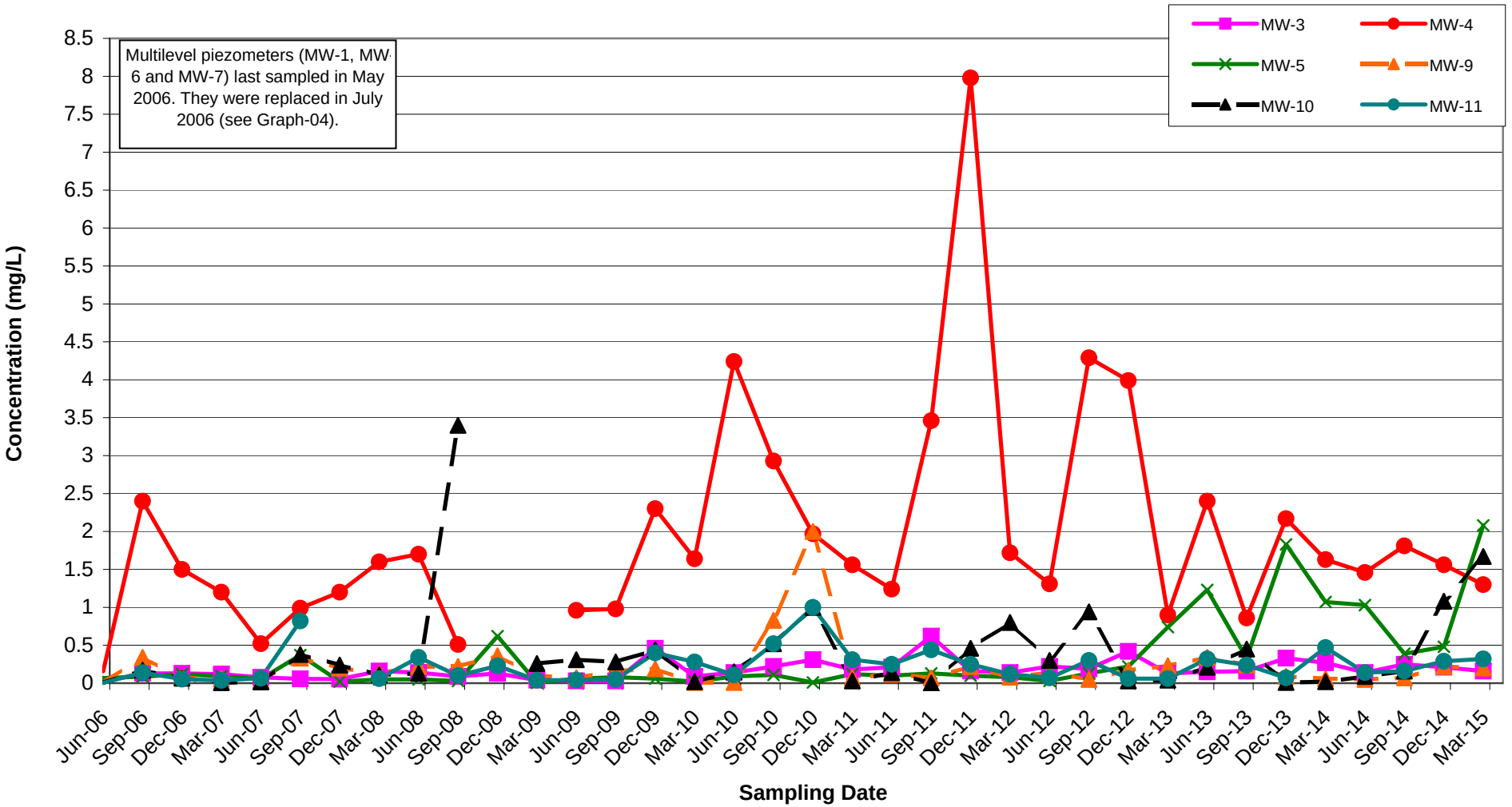
Graph-01: Groundwater Ammonia Time-Series Trends - Shallow & Creek Wells



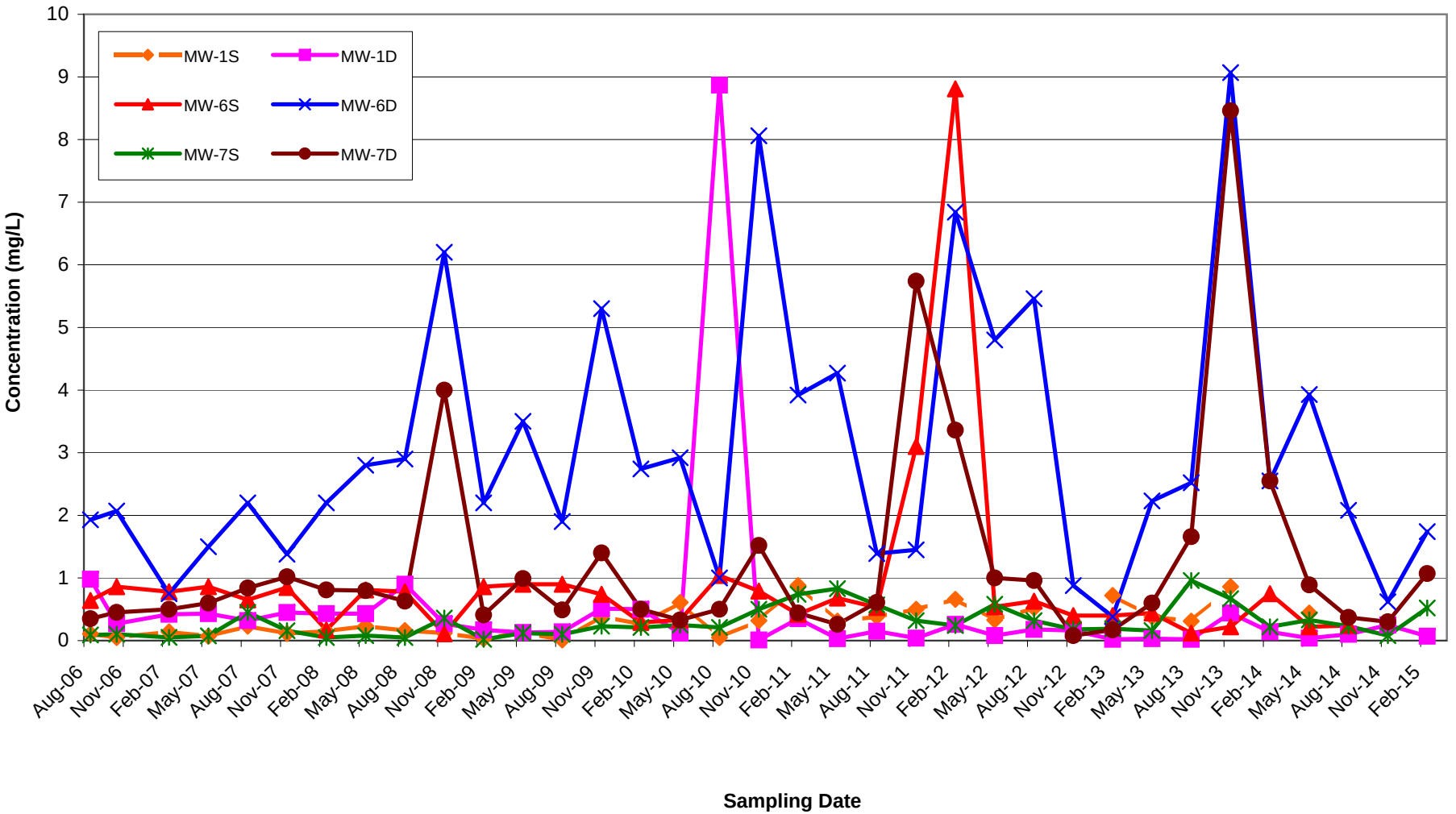
Graph -02: Groundwater Ammonia Time-Series Trends - Deep Wells



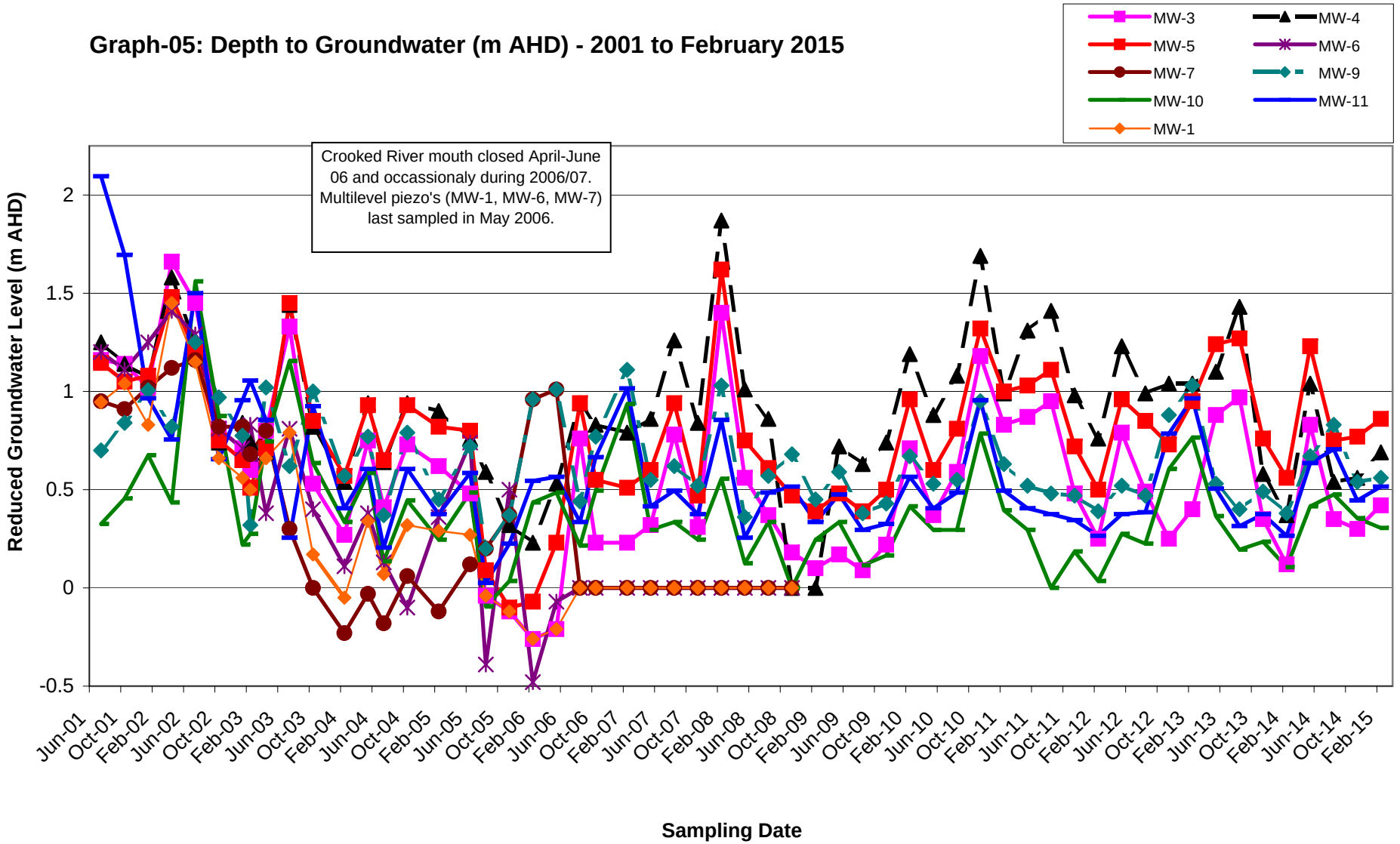
Graph-03: Groundwater Total Phosphorous Time-Series Trends - Standard Wells



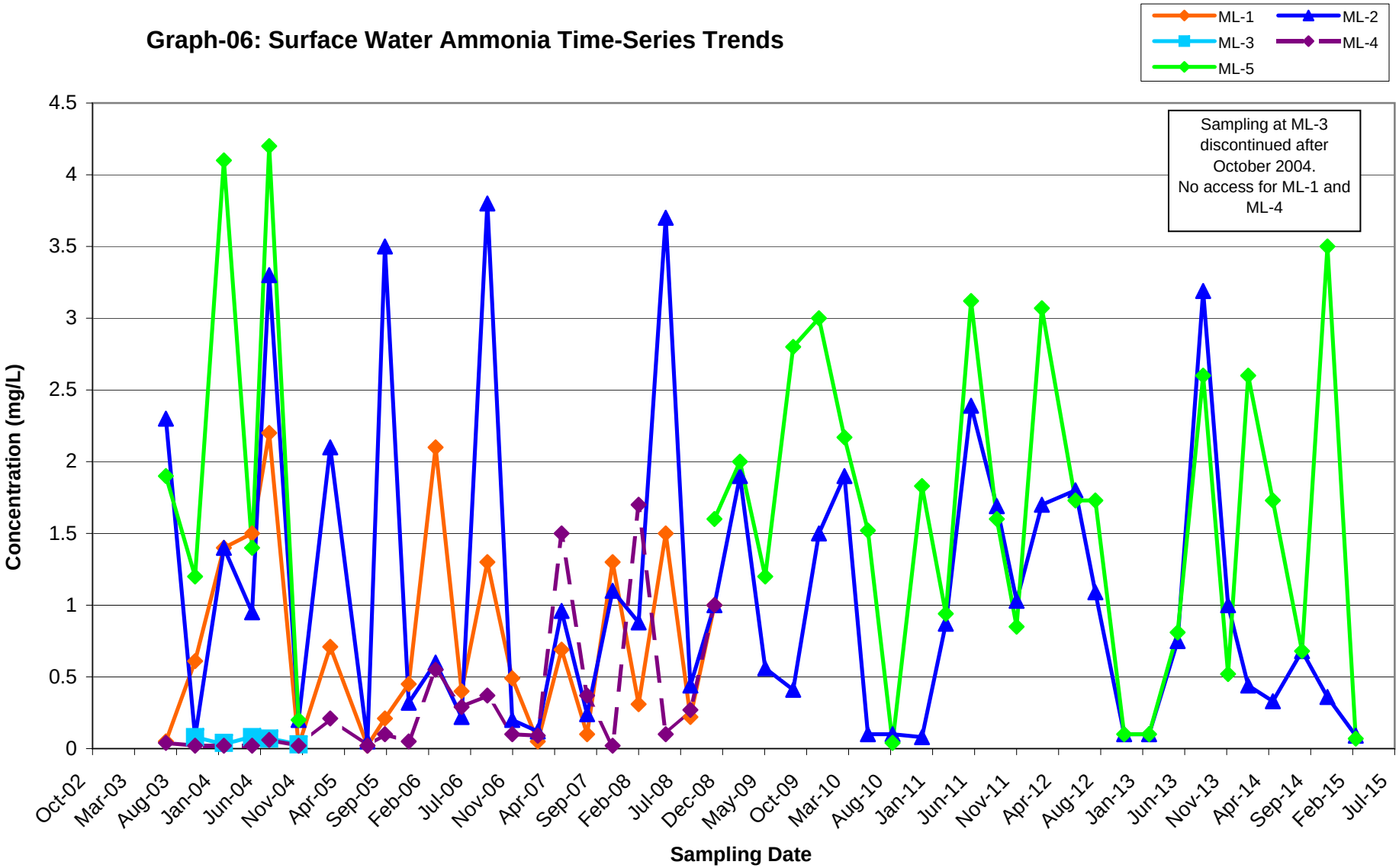
Graph-04: Groundwater Total Phosphorous Time-Series Trends - New Shallow and Deep Wells



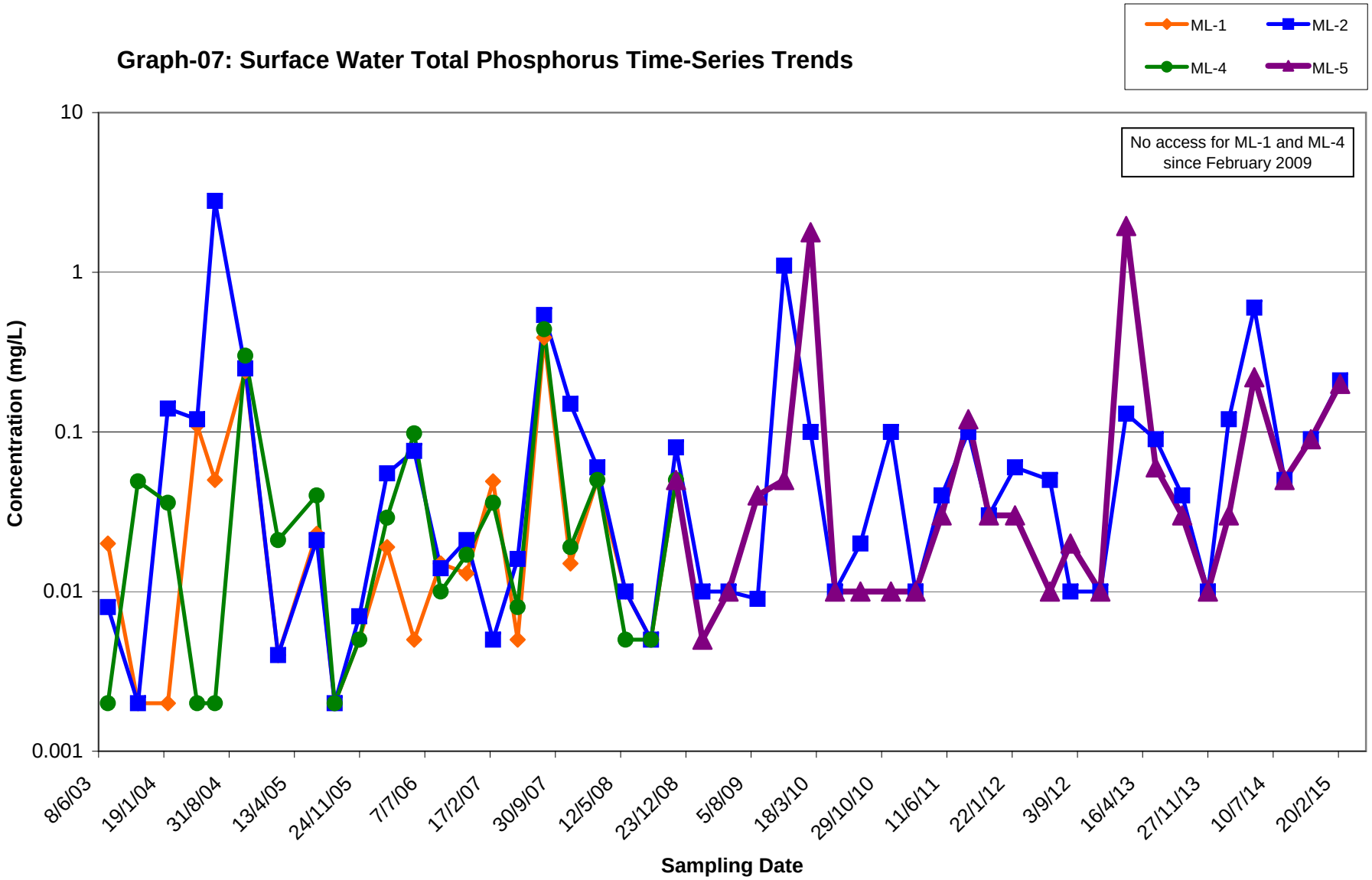
Graph-05: Depth to Groundwater (m AHD) - 2001 to February 2015



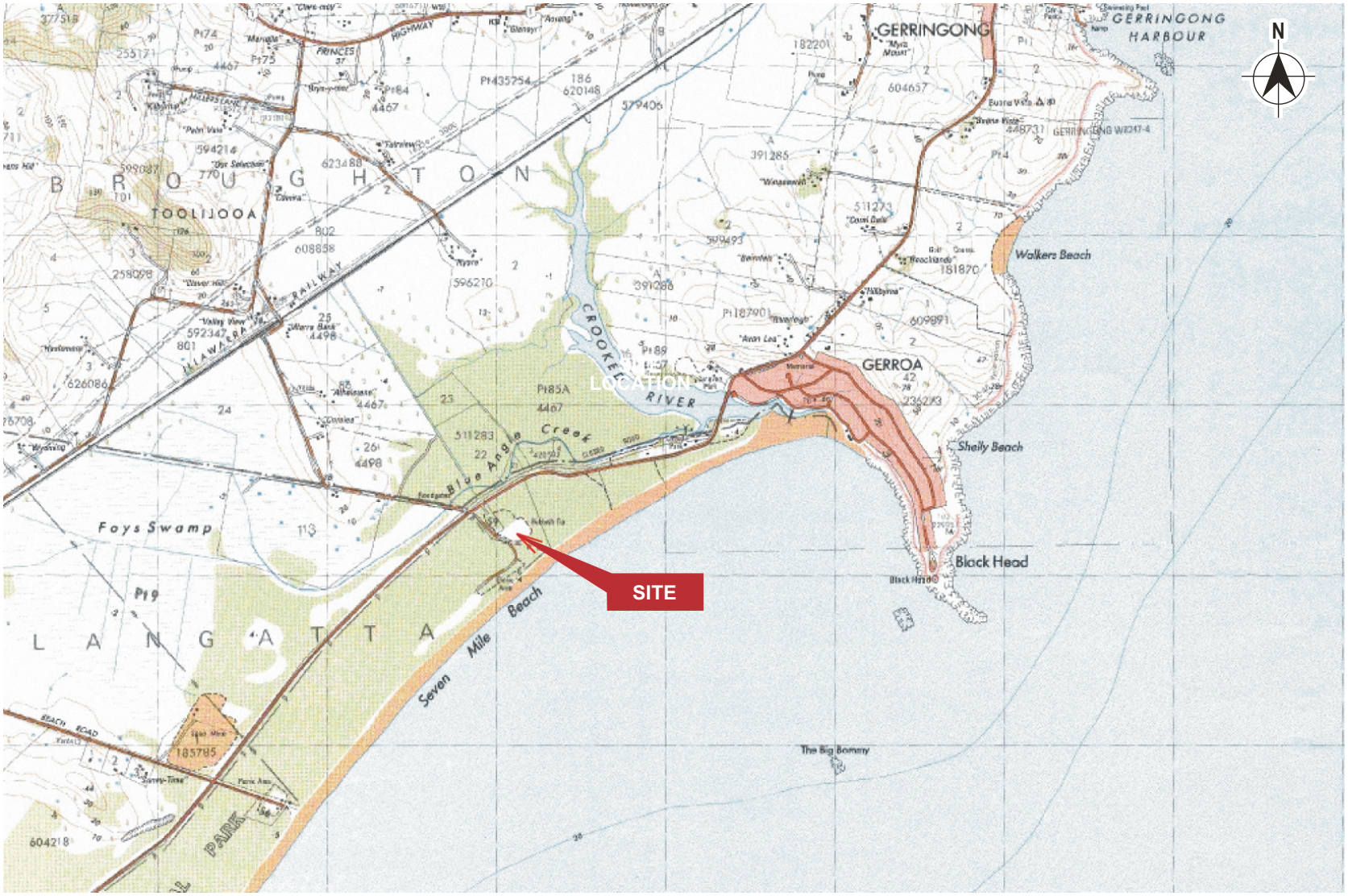
Graph-06: Surface Water Ammonia Time-Series Trends



Graph-07: Surface Water Total Phosphorus Time-Series Trends



Figures



Source: *Neil Charters Pty Ltd*

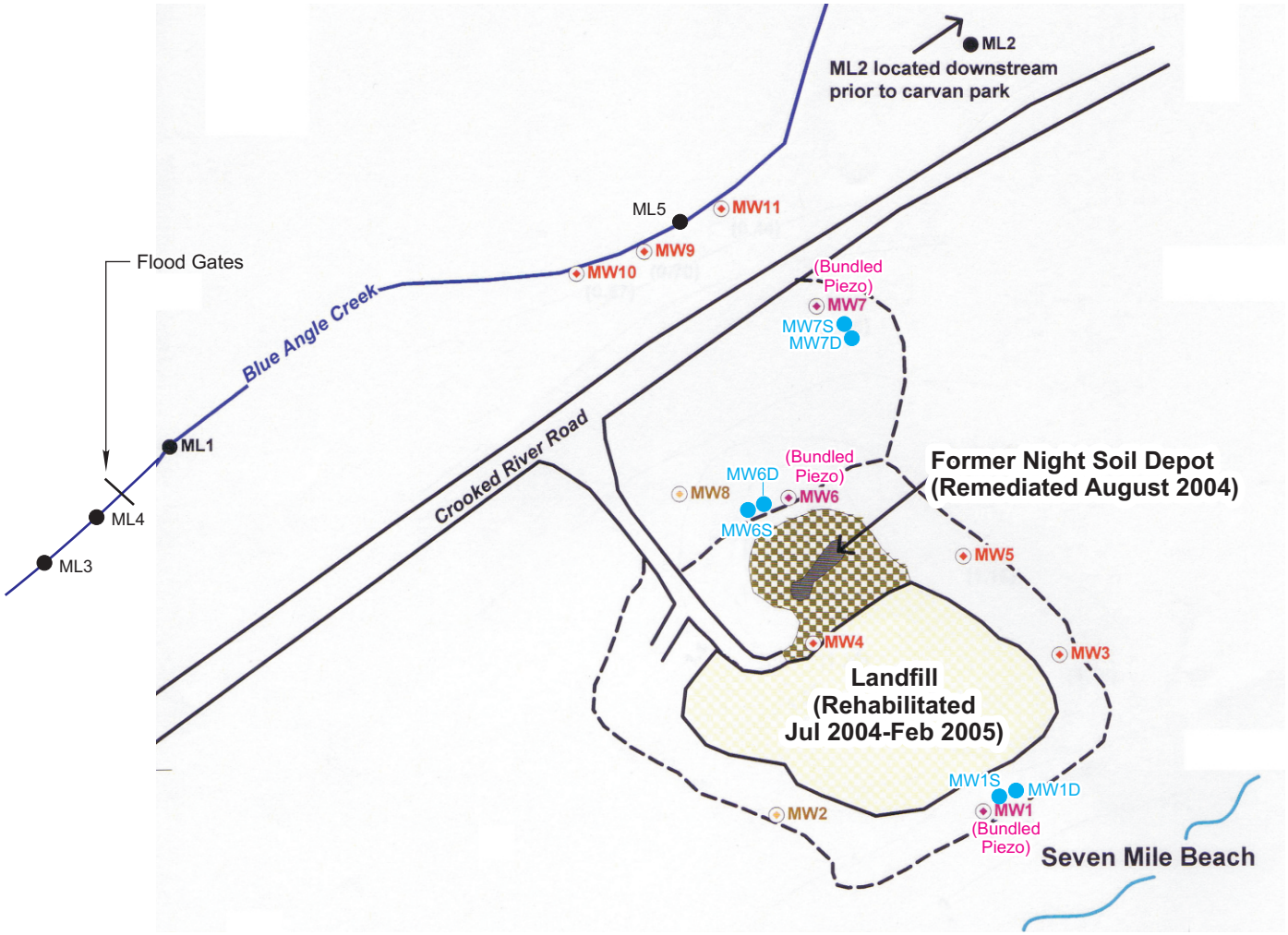
SITE LOCATION

GERROA ANNUAL MONITORING REPORT (2014-2015)

Date: *Feb 2015*

Reference: *E2W-025_55.cdr*

Figure 1



KEY

MW1S ● Monitoring Well - Shallow, August 2006

MW1D ● Monitoring Well - Deep, August 2006

MW1 ◉ Standard Monitoring Well

ML1 ● Surface Water Monitoring

Note: Bundled Piezometers MW1,6,7 - not sampled
MI3 no longer sampled, ML-2 and ML-4 no access

0 50 100m
Approximate Scale

Source: *URS Australia Pty Ltd*

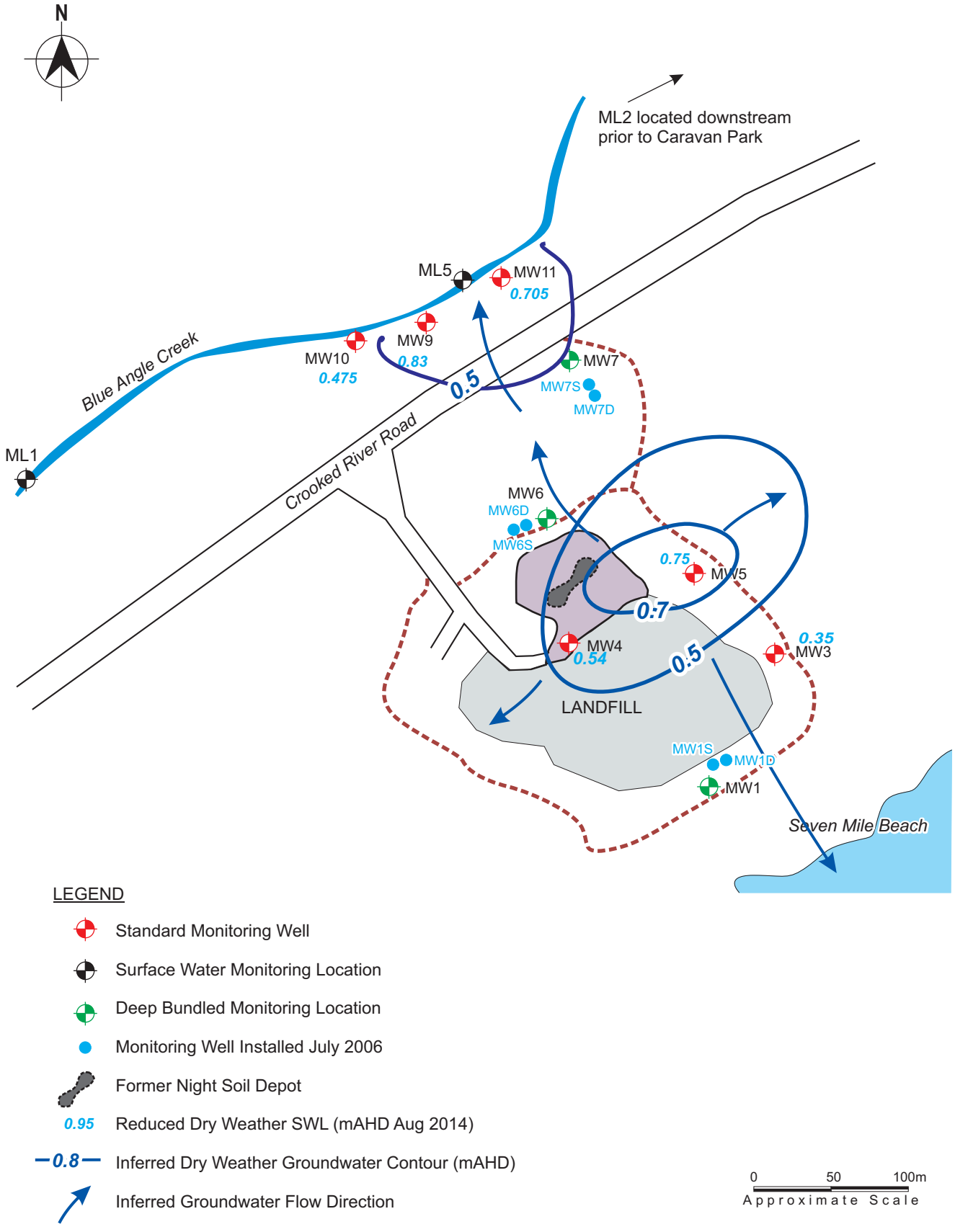
Date: *21 February 2015*

Reference: *E2W-025_01.cdr*

SITE LAYOUT & WELL LOCATIONS

GERROA ANNUAL MONITORING REPORT (2014-2015)

Figure 2



Source: *URS Australia Pty Ltd- baseplan*

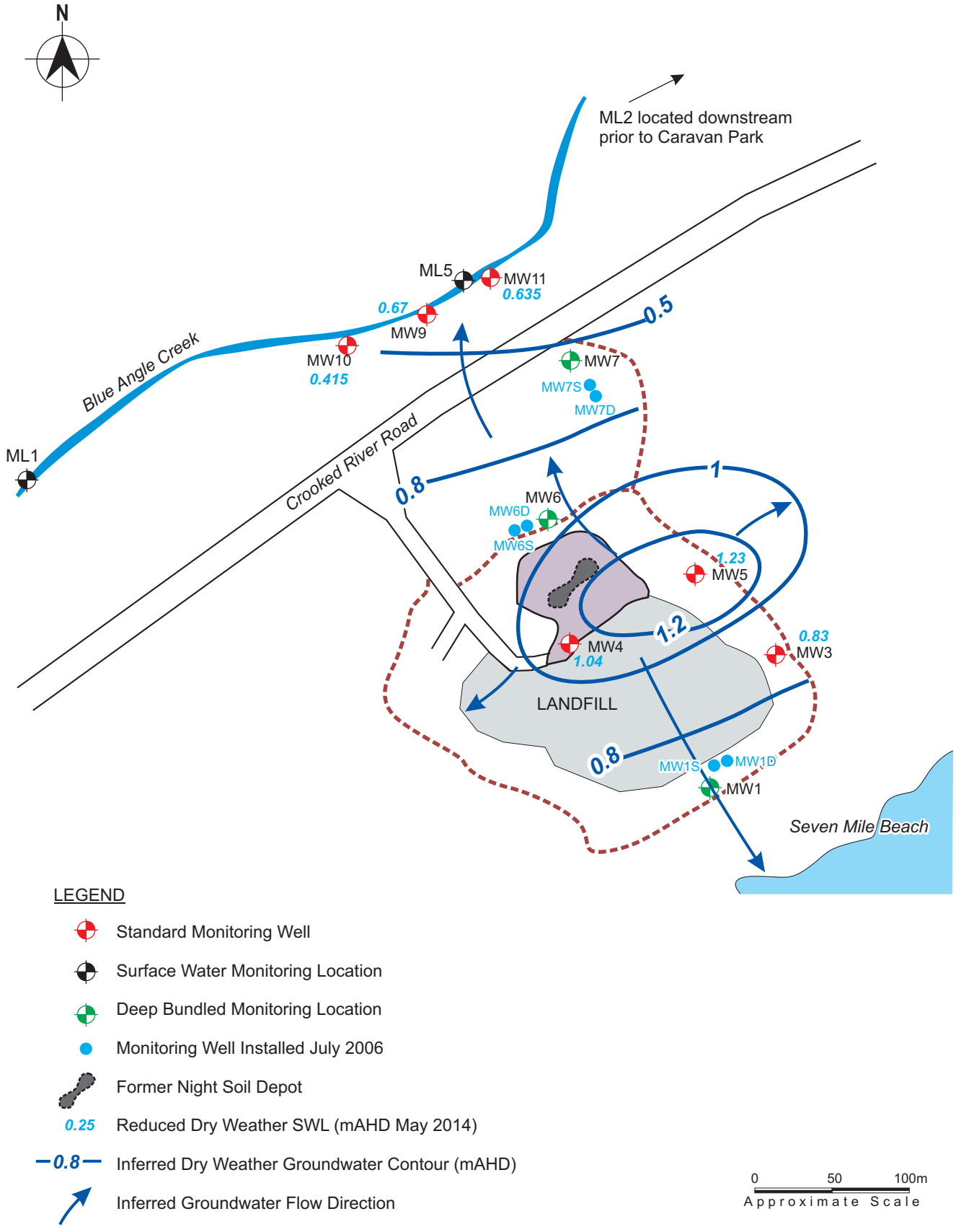
INFERRED GROUNDWATER FLOW REGIME (Wet, Aug 2014)

GERROA ANNUAL MONITORING REPORT (2014-2015)

Date: *Aug 2014*

Reference: *E2W-025_59.cdr*

Figure 3A



Source: *URS Australia Pty Ltd- baseplan*

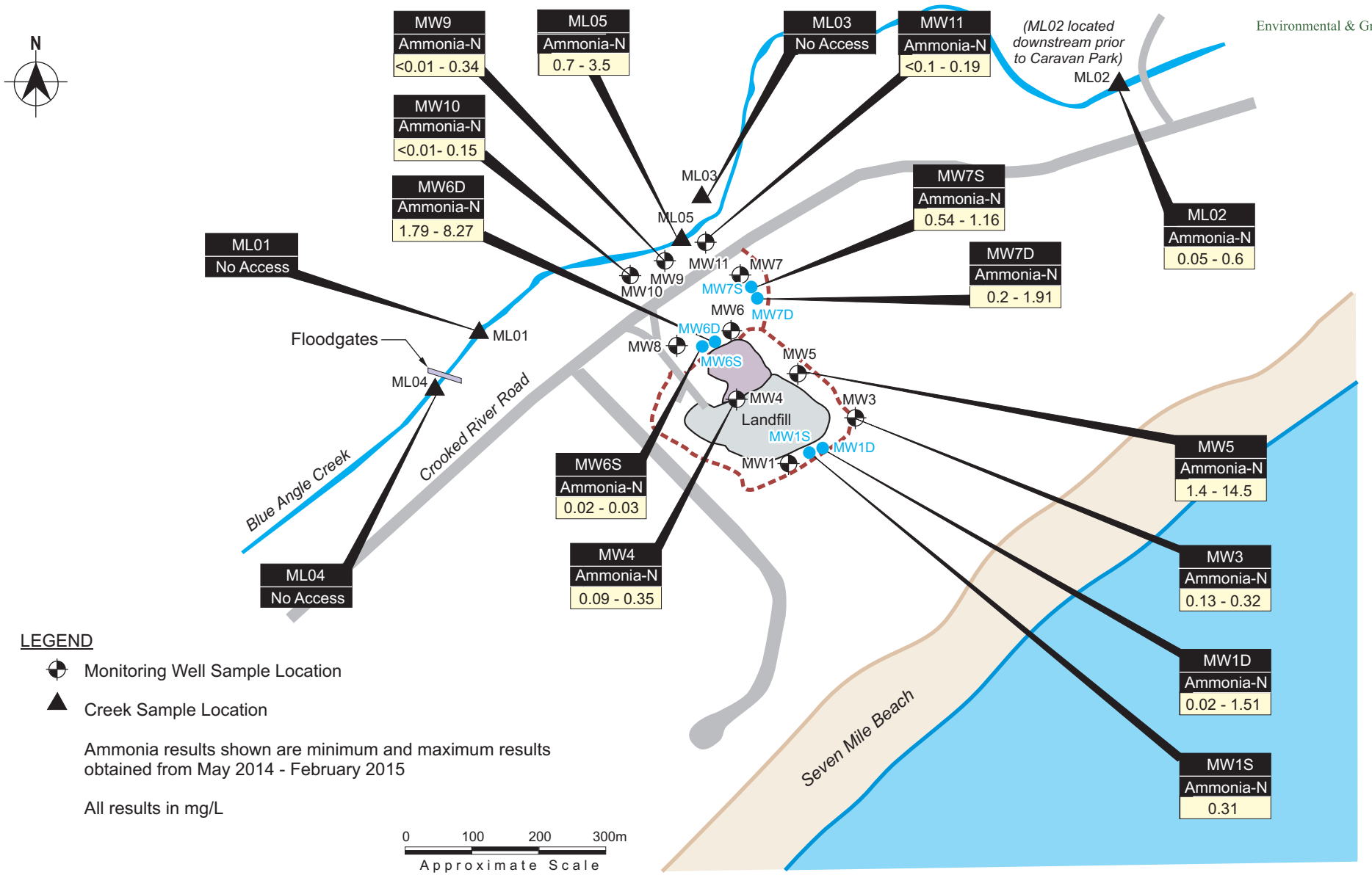
INFERRED GROUNDWATER FLOW REGIME (Dry, May 2014)

GERROA ANNUAL MONITORING REPORT (2014-2015)

Date: *February 2015*

Reference: *E2W-025_59.cdr*

Figure 3B



Source: *Base Plan, URS Australia Pty Ltd*

AMMONIA RESULTS (mg/L) 2014-2015

GERROA ANNUAL MONITORING REPORT (2014-2015)

Date: *February 2015*

Reference: *E2W_025_58.cdr*

Figure 4

Appendix A

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1401340**	Page	: 1 of 6
Client	: **KIAMA COUNCIL**	Laboratory	: Environmental Division NSW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies
Address	: 11 MANNING STREET KIAMA NSW, AUSTRALIA 2533	Address	: 99 Kenny Street, Wollongong 2500 Unit 4 / 13 Geary Place, PO Box 3105, North Nowra 2541 AUSTRALIA
E-mail	: paulc@kiama.nsw.gov.au	E-mail	: glenn.davies@alsglobal.com
Telephone	: +61 02 4232 0444	Telephone	: 02 4225 3125
Facsimile	: +61 02 4232 0555	Facsimile	: 02 4225 3128
Project	: Gerroa Landfill Quarterly	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 06-MAY-2014
Sampler	: Craig Wilson	Issue Date	: 14-MAY-2014
Site	: ----		
		No. of samples received	: 17
Quote number	: Gerroa Landfill WL/083/11	No. of samples analysed	: 17

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK062G: LOR raised for TKN and TN on sample ID(ML-2) due to sample matrix .**
- **Sampling and sample data supplied by ALS Wollongong.**
- **Sites - ML1, ML-3 & ML-4 No access at time of sampling.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW1D	MW1S	MW3	MW4	MW5
				Client sampling date / time	06-MAY-2014 13:18	06-MAY-2014 13:15	06-MAY-2014 13:10	06-MAY-2014 12:30	06-MAY-2014 13:05
					EW1401340-001	EW1401340-002	EW1401340-003	EW1401340-004	EW1401340-005
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**272**	**516**	**387**	**304**	**216**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**283**	**164**	**292**	**250**	**158**
Total Alkalinity as CaCO3	----	1	mg/L		**283**	**164**	**292**	**250**	**158**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.29**	**0.31**	**0.13**	**0.28**	**4.47**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.03**	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.17**	<0.01	<0.01	**0.28**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.20**	<0.01	<0.01	**0.28**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.6**	**2.7**	**0.5**	**1.0**	**6.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.8**	**2.7**	**0.5**	**1.3**	**6.3**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.04**	**0.44**	**0.14**	**1.46**	**1.03**
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		**7.2**	**6.4**	**7.2**	**6.8**	**7.2**
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**515**	**598**	**708**	**521**	**385**
Dissolved Oxygen	----	0.01	mg/L		**1.88**	**2.92**	**2.69**	**4.10**	**2.74**
Depth	----	0.01	m		**3.15**	**3.29**	**3.62**	**4.20**	**3.52**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW6D	MW6S	MW7D	MW7S	MW9
				Client sampling date / time	06-MAY-2014 12:45	06-MAY-2014 12:35	06-MAY-2014 13:00	06-MAY-2014 12:55	06-MAY-2014 13:45
					EW1401340-006	EW1401340-007	EW1401340-008	EW1401340-009	EW1401340-010
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**418**	**280**	**238**	**198**	**6240**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**346**	**182**	**220**	**143**	**97**
Total Alkalinity as CaCO3	----	1	mg/L		**346**	**182**	**220**	**143**	**97**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**8.27**	**0.03**	**1.91**	**0.68**	<0.01
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.01**	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.16**	**0.06**	<0.01	<0.01	**0.13**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.17**	**0.06**	<0.01	<0.01	**0.13**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**8.4**	**1.5**	**2.1**	**1.0**	**0.4**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**8.6**	**1.6**	**2.1**	**1.0**	**0.5**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**3.93**	**0.22**	**0.89**	**0.33**	**0.05**
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		**6.8**	**6.9**	**7.2**	**7.0**	**6.1**
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**692**	**442**	**393**	**284**	**9030**
Dissolved Oxygen	----	0.01	mg/L		**1.85**	**1.85**	**1.44**	**2.15**	**3.69**
Depth	----	0.01	m		**4.64**	**4.37**	**4.39**	**4.25**	**1.65**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: MW10	MW11	ML-1	ML-2	ML-3
				Client sampling date / time: 06-MAY-2014 13:25	06-MAY-2014 13:55	06-MAY-2014 14:10	06-MAY-2014 14:05	06-MAY-2014 14:15
				EW1401340-011	EW1401340-012	EW1401340-013	EW1401340-014	EW1401340-015
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	1	mg/L	**7970**	**1760**	----	**32600**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**75**	----	**124**	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	**75**	----	**124**	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.08**	**0.06**	----	**0.33**	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	**0.02**	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	----	**0.03**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	----	**0.05**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	**2.5**	----	<0.5	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**1.0**	**2.5**	----	<0.5	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.09**	**0.14**	----	**0.60**	----
EN67 PK: Field Tests								
pH	----	0.1	pH Unit	**5.2**	**6.1**	----	**7.1**	----
Electrical Conductivity (Non Compensated)	----	1	µS/cm	**1170**	**3330**	----	**38200**	----
Dissolved Oxygen	----	0.01	mg/L	**3.06**	**3.83**	----	**6.66**	----
Depth	----	0.01	m	**2.02**	**2.02**	----	----	----
Field Observations	----	0.01	--	----	----	**NO ACCESS**	----	**NO ACCESS**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ML-4	ML-5	----	----	----
				Client sampling date / time	06-MAY-2014 14:20	06-MAY-2014 13:50	----	----	----
Compound	CAS Number	LOR	Unit		EW1401340-016	EW1401340-017	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		----	21400	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	138	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	138	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	1.73	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	0.10	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	0.11	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	2.0	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		----	2.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	0.22	----	----	----
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		----	6.5	----	----	----
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	26800	----	----	----
Dissolved Oxygen	----	0.01	mg/L		----	5.55	----	----	----
Field Observations	----	0.01	--		NO ACCESS	----	----	----	----

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1402491**	Page	: 1 of 10
Amendment	: **1**		
Client	: **KIAMA COUNCIL**	Laboratory	: Environmental Division NSW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies
Address	: 11 MANNING STREET KIAMA NSW, AUSTRALIA 2533	Address	: 99 Kenny Street, Wollongong 2500 Unit 4 / 13 Geary Place, PO Box 3105, North Nowra 2541 AUSTRALIA
E-mail	: paulc@kiama.nsw.gov.au	E-mail	: glenn.davies@alsglobal.com
Telephone	: +61 02 4232 0444	Telephone	: 02 4225 3125
Facsimile	: +61 02 4232 0555	Facsimile	: 02 4225 3128
Project	: Minnamurra Landfill	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-AUG-2014
Sampler	: ----	Issue Date	: 28-AUG-2014
Site	: ----		
		No. of samples received	: 19
Quote number	: Minnamurra Landfill WL/083/11	No. of samples analysed	: 19

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dian Dao		Sydney Inorganics
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ED041G:LOR raised for Sulfate analysis on sample ID(MD 9C & MD 10B) due to sample matrix.**
- **EG020: LOR's have been raised due to matrix interference (High Total Dissolved Solids)**
- **EP002: It has been noted that DOC is greater than TOC for various samples, however this difference is within the limits of experimental variation.**
- **Ionic Balance out of acceptable limits due to analytes not quantified in this report.**
- **Sites MD 1B & Rocklow Down - No Access at time of sampling.**
- **Sites MD2A, MD4A, MD6A, MD9A and MD10A - Dry at time of sampling.**
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MD 1B	MD 2A	MD 2B	MD 2C	MD 4A
				Client sampling date / time	18-AUG-2014 10:25	18-AUG-2014 08:41	18-AUG-2014 08:47	18-AUG-2014 08:54	18-AUG-2014 09:02
					EW1402491-001	EW1402491-002	EW1402491-003	EW1402491-004	EW1402491-005
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	----	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	----	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	----	**580**	**439**	----
Total Alkalinity as CaCO3	----	1	mg/L		----	----	**580**	**439**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	----	**1260**	**2420**	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	----	**7500**	**13500**	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	----	**342**	**421**	----
Magnesium	7439-95-4	1	mg/L		----	----	**532**	**1020**	----
Sodium	7440-23-5	1	mg/L		----	----	**4380**	**8870**	----
Potassium	7440-09-7	1	mg/L		----	----	**240**	**363**	----
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		----	----	**0.010**	<0.010	----
Iron	7439-89-6	0.05	mg/L		----	----	<0.50	<0.50	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		----	----	**0.7**	**0.7**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	----	**0.41**	**0.11**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	----	**0.15**	**0.02**	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	**7.20**	**1.39**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	**7.35**	**1.41**	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		----	----	**249**	**440**	----
Total Cations	----	0.01	meq/L		----	----	**258**	**500**	----
Ionic Balance	----	0.01	%		----	----	**1.59**	**6.38**	----
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		----	----	**7.4**	**7.3**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 1B	MD 2A	MD 2B	MD 2C	MD 4A
				Client sampling date / time	18-AUG-2014 10:25	18-AUG-2014 08:41	18-AUG-2014 08:47	18-AUG-2014 08:54	18-AUG-2014 09:02
Compound	CAS Number	LOR	Unit		EW1402491-001	EW1402491-002	EW1402491-003	EW1402491-004	EW1402491-005
EN67 PK: Field Tests - Continued									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	----	19500	34300	----
Dissolved Oxygen	----	0.01	mg/L		----	----	3.10	2.90	----
Dissolved Oxygen - % Saturation	----	0.1	% saturation		----	----	33.2	33.8	----
Temperature	----	0.1	°C		----	----	14.1	14.2	----
Salinity	----	0.2	g/L		----	----	15.0	27.9	----
Depth	----	0.01	m		----	----	0.45	0.50	----
Field Observations	----	0.01	--		NO ACCESS	DRY	----	----	DRY
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		----	----	39	19	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		----	----	37	19	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		----	----	<0.05	<0.05	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MD 4B	MD 4C	MD 6A	MD 6B	MD 6C
				Client sampling date / time	18-AUG-2014 09:06	18-AUG-2014 09:13	18-AUG-2014 08:15	18-AUG-2014 08:19	18-AUG-2014 08:27
					EW1402491-006	EW1402491-007	EW1402491-008	EW1402491-009	EW1402491-010
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**700**	**547**	----	**718**	**306**
Total Alkalinity as CaCO3	----	1	mg/L		**700**	**547**	----	**718**	**306**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**473**	**1590**	----	**97**	**1360**
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**2940**	**9620**	----	**142**	**7920**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**382**	**345**	----	**156**	**346**
Magnesium	7439-95-4	1	mg/L		**222**	**712**	----	**66**	**582**
Sodium	7440-23-5	1	mg/L		**1570**	**6710**	----	**168**	**5240**
Potassium	7440-09-7	1	mg/L		**156**	**276**	----	**61**	**186**
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		**0.072**	<0.010	----	**0.133**	**0.035**
Iron	7439-89-6	0.05	mg/L		**0.16**	<0.50	----	**0.12**	<0.50
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	**0.6**	----	**0.4**	**0.4**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**27.9**	**0.06**	----	**21.8**	**24.4**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.55**	<0.01	----	**0.14**	**0.09**
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**8.13**	**0.40**	----	**1.27**	**3.30**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**8.68**	**0.40**	----	**1.41**	**3.39**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**107**	**315**	----	**20.4**	**258**
Total Cations	----	0.01	meq/L		**110**	**375**	----	**22.1**	**298**
Ionic Balance	----	0.01	%		**1.31**	**8.58**	----	**4.03**	**7.19**
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		**7.3**	**7.8**	----	**7.1**	**7.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 4B	MD 4C	MD 6A	MD 6B	MD 6C
				Client sampling date / time	18-AUG-2014 09:06	18-AUG-2014 09:13	18-AUG-2014 08:15	18-AUG-2014 08:19	18-AUG-2014 08:27
Compound	CAS Number	LOR	Unit		EW1402491-006	EW1402491-007	EW1402491-008	EW1402491-009	EW1402491-010
EN67 PK: Field Tests - Continued									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		8430	25600	----	1640	21400
Dissolved Oxygen	----	0.01	mg/L		2.10	5.00	----	3.30	2.40
Dissolved Oxygen - % Saturation	----	0.1	% saturation		21.4	55.3	----	33.7	26.2
Temperature	----	0.1	°C		14.8	14.6	----	15.9	16.0
Salinity	----	0.2	g/L		5.9	20.0	----	1.0	15.8
Depth	----	0.01	m		0.86	0.89	----	1.01	1.14
Field Observations	----	0.01	--		----	----	DRY	----	----
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		44	26	----	43	12
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		43	26	----	43	10
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	<0.05	<0.05

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MD 9A	MD 9B	MD 9C	MD 10A	MD 10B
				Client sampling date / time	18-AUG-2014 09:55	18-AUG-2014 10:00	18-AUG-2014 10:05	18-AUG-2014 09:30	18-AUG-2014 09:36
					EW1402491-011	EW1402491-012	EW1402491-013	EW1402491-014	EW1402491-015
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	<1	----	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	<1	----	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	**939**	**1200**	----	**745**
Total Alkalinity as CaCO3	----	1	mg/L		----	**939**	**1200**	----	**745**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	**25**	<10	----	<10
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	**346**	**512**	----	**208**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	**176**	**178**	----	**111**
Magnesium	7439-95-4	1	mg/L		----	**99**	**88**	----	**45**
Sodium	7440-23-5	1	mg/L		----	**298**	**398**	----	**156**
Potassium	7440-09-7	1	mg/L		----	**76**	**140**	----	**112**
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		----	**0.113**	**0.398**	----	**0.459**
Iron	7439-89-6	0.05	mg/L		----	**0.36**	**2.27**	----	**0.67**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		----	**0.5**	**0.4**	----	**0.7**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	**21.9**	**112**	----	**87.2**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	**0.02**	<0.01	----	**0.01**
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	**0.01**	<0.01	----	**0.01**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	**0.03**	<0.01	----	**0.02**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		----	**29.0**	**38.4**	----	**20.8**
Total Cations	----	0.01	meq/L		----	**31.8**	**37.0**	----	**18.9**
Ionic Balance	----	0.01	%		----	**4.58**	**1.86**	----	**4.69**
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		----	**7.1**	**7.1**	----	**7.4**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MD 9A	MD 9B	MD 9C	MD 10A	MD 10B
				Client sampling date / time	18-AUG-2014 09:55	18-AUG-2014 10:00	18-AUG-2014 10:05	18-AUG-2014 09:30	18-AUG-2014 09:36
Compound	CAS Number	LOR	Unit		EW1402491-011	EW1402491-012	EW1402491-013	EW1402491-014	EW1402491-015
EN67 PK: Field Tests - Continued									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	2320	3180	----	1850
Dissolved Oxygen	----	0.01	mg/L		----	3.10	2.10	----	3.20
Dissolved Oxygen - % Saturation	----	0.1	% saturation		----	30.4	20.5	----	31.5
Temperature	----	0.1	°C		----	14.7	14.7	----	15.1
Salinity	----	0.2	g/L		----	1.5	2.1	----	1.2
Depth	----	0.01	m		----	0.62	0.63	----	0.55
Field Observations	----	0.01	--		DRY	----	----	DRY	----
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		----	51	98	----	58
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		----	52	122	----	64
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		----	<0.05	<0.05	----	<0.05

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	Rocklow Down	Rocklow Middle	Rocklow Up	Blank	----
				Client sampling date / time	18-AUG-2014 10:20	18-AUG-2014 09:46	18-AUG-2014 08:05	18-AUG-2014 08:07	----
					EW1402491-016	EW1402491-017	EW1402491-018	EW1402491-019	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	**65**	**113**	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	**65**	**113**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	**484**	**906**	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	**2860**	**5540**	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	----	----	<1	----
Magnesium	7439-95-4	1	mg/L		----	----	----	<1	----
Sodium	7440-23-5	1	mg/L		----	----	----	<1	----
Potassium	7440-09-7	1	mg/L		----	----	----	<1	----
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L		----	**87**	**199**	----	----
Magnesium	7439-95-4	1	mg/L		----	**194**	**425**	----	----
Sodium	7440-23-5	1	mg/L		----	**1740**	**3880**	----	----
Potassium	7440-09-7	1	mg/L		----	**93**	**184**	----	----
EG020F: Dissolved Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		----	----	----	<0.001	----
Iron	7439-89-6	0.05	mg/L		----	----	----	<0.05	----
EG020T: Total Metals by ICP-MS									
Manganese	7439-96-5	0.001	mg/L		----	**0.079**	**0.170**	----	----
Iron	7439-89-6	0.05	mg/L		----	**0.82**	**0.53**	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		----	**0.4**	**0.5**	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	**0.14**	**0.14**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	**0.01**	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	**0.40**	**0.08**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Rocklow Down	Rocklow Middle	Rocklow Up	Blank	----
				Client sampling date / time	18-AUG-2014 10:20	18-AUG-2014 09:46	18-AUG-2014 08:05	18-AUG-2014 08:07	----
Compound	CAS Number	LOR	Unit		EW1402491-016	EW1402491-017	EW1402491-018	EW1402491-019	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N	----	0.01	mg/L		----	**0.41**	**0.08**	----	----
EN67 PK: Field Tests									
pH	----	0.1	pH Unit		----	**7.3**	**7.1**	----	----
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	**7340**	**13800**	----	----
Dissolved Oxygen	----	0.01	mg/L		----	**7.00**	**7.50**	----	----
Dissolved Oxygen - % Saturation	----	0.1	% saturation		----	**69.4**	**77.1**	----	----
Temperature	----	0.1	°C		----	**13.1**	**13.6**	----	----
Salinity	----	0.2	g/L		<0.2	**5.4**	**10.4**	----	----
Field Observations	----	0.01	--		**No Access**	----	----	----	----
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		----	**10**	**8**	<1	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		----	**12**	**8**	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		----	<0.05	<0.05	----	----

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1403461**	Page	: 1 of 6
Client	: **KIAMA COUNCIL**	Laboratory	: Environmental Division NSW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies
Address	: 11 MANNING STREET KIAMA NSW, AUSTRALIA 2533	Address	: 99 Kenny Street, Wollongong 2500 Unit 4 / 13 Geary Place, PO Box 3105, North Nowra 2541 AUSTRALIA
E-mail	: paulc@kiama.nsw.gov.au	E-mail	: glenn.davies@alsglobal.com
Telephone	: +61 02 4232 0444	Telephone	: 02 4225 3125
Facsimile	: +61 02 4232 0555	Facsimile	: 02 4225 3128
Project	: Gerroa Landfill Quarterly	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2014
Sampler	: Craig Wilson	Issue Date	: 25-NOV-2014
Site	: ----		
		No. of samples received	: 17
Quote number	: Gerroa Landfill WL/083/11	No. of samples analysed	: 17

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Field tests completed on day of sampling/receipt.**
- **It has been noted that Nitrite is greater than NOx for sample ID (ML-2), however this difference is within the limits of experimental variation.**
- **Sampling and sample data supplied by ALS Wollongong.**
- **Sampling completed as per FWI-EN001 Groundwater Sampling.**
- **Sampling completed as per FWI-EN002 Surface Water Sampling.**
- **Sites - ML1, ML-3 & ML-4 No access at time of sampling.**
- **Sites MW1S & MW6S - Dry at time of sampling.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW1D	MW1S	MW3	MW4	MW5
				Client sampling date / time	17-NOV-2014 11:44	17-NOV-2014 11:47	17-NOV-2014 11:36	17-NOV-2014 11:54	17-NOV-2014 11:25
					EW1403461-001	EW1403461-002	EW1403461-003	EW1403461-004	EW1403461-005
EA005FD: Field pH									
pH	----	0.1	pH Unit		**6.4**	----	**6.2**	**6.2**	**6.7**
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**622**	----	**932**	**480**	**312**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**397**	----	**585**	**376**	**234**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**280**	----	**245**	**258**	**118**
Total Alkalinity as CaCO3	----	1	mg/L		**280**	----	**245**	**258**	**118**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.30**	----	**0.32**	**0.35**	**1.40**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	----	<0.01	<0.01	**0.09**
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**1.37**	----	<0.01	<0.01	**0.61**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**1.37**	----	<0.01	<0.01	**0.70**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**2.1**	----	**0.7**	**0.8**	**3.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**3.5**	----	**0.7**	**0.8**	**3.9**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.25**	----	**0.21**	**1.56**	**0.48**
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	**DRY**	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**2.90**	----	**2.00**	**2.10**	**3.10**
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**3.68**	----	**4.15**	**4.68**	**3.98**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW6D	MW6S	MW7D	MW7S	MW9
				Client sampling date / time	17-NOV-2014 11:15	17-NOV-2014 11:10	17-NOV-2014 10:59	17-NOV-2014 10:52	17-NOV-2014 12:19
					EW1403461-006	EW1403461-007	EW1403461-008	EW1403461-009	EW1403461-010
EA005FD: Field pH									
pH	----	0.1	pH Unit		**6.7**	----	**5.9**	**6.8**	**6.1**
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**696**	----	**431**	**615**	**11600**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		----	----	----	----	**8190**
Total Dissolved Solids @180°C	----	1	mg/L		**497**	----	**292**	**399**	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**271**	----	**212**	**144**	**146**
Total Alkalinity as CaCO3	----	1	mg/L		**271**	----	**212**	**144**	**146**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**2.23**	----	**1.36**	**0.54**	**0.34**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.12**	----	**0.01**	**0.01**	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**1.79**	----	**0.25**	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**1.91**	----	**0.26**	**0.01**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**2.9**	----	**1.6**	**0.7**	**2.1**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**4.8**	----	**1.9**	**0.7**	**2.1**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.62**	----	**0.30**	**0.08**	**0.22**
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	**DRY**	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**3.10**	----	**2.90**	**2.30**	**2.20**
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**5.01**	----	**4.79**	**4.67**	**1.78**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW10	MW11	ML-1	ML-2	ML-3
				Client sampling date / time	17-NOV-2014 12:10	17-NOV-2014 12:33	17-NOV-2014 12:50	17-NOV-2014 12:43	17-NOV-2014 12:55
					EW1403461-011	EW1403461-012	EW1403461-013	EW1403461-014	EW1403461-015
EA005FD: Field pH									
pH	----	0.1	pH Unit		**5.1**	**6.1**	----	**7.0**	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**16700**	**4620**	----	**36600**	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**12200**	**2810**	----	**24400**	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**2**	**40**	----	**111**	----
Total Alkalinity as CaCO3	----	1	mg/L		**2**	**40**	----	**111**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.13**	**0.19**	----	**0.36**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	----	**0.04**	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.07**	<0.01	----	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.07**	<0.01	----	**0.03**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**11.4**	**3.7**	----	**0.9**	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**11.5**	**3.7**	----	**0.9**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**1.08**	**0.29**	----	**0.09**	----
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	----	**NO ACCESS**	----	**NO ACCESS**
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**3.50**	**2.40**	----	**5.80**	----
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**2.08**	**2.21**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ML-4	ML-5	----	----	----
				Client sampling date / time	17-NOV-2014 13:00	17-NOV-2014 12:22	----	----	----
Compound	CAS Number	LOR	Unit		EW1403461-016	EW1403461-017	----	----	----
EA005FD: Field pH									
pH	----	0.1	pH Unit		----	6.4	----	----	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	26800	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		----	18500	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	157	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	157	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	3.50	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	0.24	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	0.03	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	0.27	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	4.3	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		----	4.6	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	0.09	----	----	----
EN67 PK: Field Tests									
Field Observations	----	0.01	--		NO ACCESS	----	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		----	5.60	----	----	----

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1500669**	Page	: 1 of 6
Client	: **KIAMA COUNCIL**	Laboratory	: Environmental Division NSW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies
Address	: 11 MANNING STREET KIAMA NSW, AUSTRALIA 2533	Address	: 99 Kenny Street, Wollongong 2500 Unit 4 / 13 Geary Place, PO Box 3105, North Nowra 2541 AUSTRALIA
E-mail	: paulc@kiama.nsw.gov.au	E-mail	: glenn.davies@alsglobal.com
Telephone	: +61 02 4232 0444	Telephone	: 02 4225 3125
Facsimile	: +61 02 4232 0555	Facsimile	: 02 4225 3128
Project	: Gerroa Landfill Quarterly	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-FEB-2015
Sampler	: Craig Wilson	Issue Date	: 05-MAR-2015
Site	: ----		
		No. of samples received	: 17
Quote number	: Gerroa Landfill WL/083/11	No. of samples analysed	: 17

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong

General Comments

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Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Field tests completed on day of sampling/receipt.**
- **It has been noted that Nitrite is greater than NOx for sample ID(MW7D MW7S), however this difference is within the limits of experimental variation.**
- **Sampling and sample data supplied by ALS Wollongong.**
- **Sampling completed as per FWI-EN001 Groundwater Sampling.**
- **Sampling completed as per FWI-EN002 Surface Water Sampling.**
- **Sites - ML1, ML-3 & ML-4 No access at time of sampling.**
- **Sites MW1S & MW6S - Dry at time of sampling.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW1D	MW1S	MW3	MW4	MW5
				Client sampling date / time	26-FEB-2015 11:44	26-FEB-2015 11:40	26-FEB-2015 11:32	26-FEB-2015 10:56	26-FEB-2015 11:23
					EW1500669-001	EW1500669-002	EW1500669-003	EW1500669-004	EW1500669-005
EA005FD: Field pH									
pH	----	0.1	pH Unit		**7.2**	----	**6.8**	**6.3**	**6.4**
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**636**	----	**812**	**491**	**258**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**355**	----	**485**	**311**	**138**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**296**	----	**236**	**231**	**113**
Total Alkalinity as CaCO3	----	1	mg/L		**296**	----	**236**	**231**	**113**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.51**	----	**0.18**	**0.09**	**14.5**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	----	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.35**	----	**0.06**	**0.19**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.35**	----	**0.06**	**0.19**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.8**	----	**0.7**	**0.9**	**18.9**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**2.2**	----	**0.8**	**1.1**	**18.9**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.07**	----	**0.16**	**1.30**	**2.08**
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	**DRY**	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**2.50**	----	**3.80**	**3.60**	**2.40**
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**3.54**	----	**4.03**	**4.55**	**3.89**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW6D	MW6S	MW7D	MW7S	MW9
				Client sampling date / time	26-FEB-2015 11:07	26-FEB-2015 11:04	26-FEB-2015 11:17	26-FEB-2015 11:14	26-FEB-2015 12:30
					EW1500669-006	EW1500669-007	EW1500669-008	EW1500669-009	EW1500669-010
EA005FD: Field pH									
pH	----	0.1	pH Unit		**6.6**	----	**6.5**	**6.9**	**6.3**
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**736**	----	**390**	**619**	**10800**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**514**	----	**237**	**433**	**6730**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**331**	----	**209**	**159**	**135**
Total Alkalinity as CaCO3	----	1	mg/L		**331**	----	**209**	**159**	**135**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**3.92**	----	**1.48**	**1.16**	**0.21**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.03**	----	**0.02**	**0.02**	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.06**	----	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.09**	----	<0.01	**0.01**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**4.3**	----	**1.6**	**1.6**	**2.6**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**4.4**	----	**1.6**	**1.6**	**2.6**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**1.74**	----	**1.07**	**0.52**	**0.20**
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	**DRY**	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**1.90**	----	**3.60**	**2.70**	**3.30**
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**4.94**	----	**4.69**	**4.55**	**1.76**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MW10	MW11	ML-1	ML-2	ML-3
				Client sampling date / time	26-FEB-2015 12:19	26-FEB-2015 12:39	26-FEB-2015 12:00	26-FEB-2015 12:47	26-FEB-2015 12:05
					EW1500669-011	EW1500669-012	EW1500669-013	EW1500669-014	EW1500669-015
EA005FD: Field pH									
pH	----	0.1	pH Unit		**5.1**	**5.6**	----	**6.5**	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		**12300**	**7850**	----	**553**	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		**8070**	**4840**	----	**423**	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**3**	**28**	----	**17**	----
Total Alkalinity as CaCO3	----	1	mg/L		**3**	**28**	----	**17**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.15**	**0.13**	----	**0.09**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	----	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	<0.01	----	**0.05**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	<0.01	----	**0.05**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**17.3**	**4.9**	----	**1.4**	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**17.3**	**4.9**	----	**1.4**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**1.67**	**0.32**	----	**0.21**	----
EN67 PK: Field Tests									
Field Observations	----	0.01	--		----	----	**NO ACCESS**	----	**NO ACCESS**
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		**4.20**	**3.00**	----	**4.10**	----
FWI-EN/001: Groundwater Sampling - Depth									
Depth	----	0.01	m		**2.13**	**2.14**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	ML-4	ML-5	----	----	----
				Client sampling date / time	26-FEB-2015 12:10	26-FEB-2015 12:27	----	----	----
Compound	CAS Number	LOR	Unit		EW1500669-016	EW1500669-017	----	----	----
EA005FD: Field pH									
pH	----	0.1	pH Unit		----	6.1	----	----	----
EA010FD: Field Conductivity									
Electrical Conductivity (Non Compensated)	----	1	µS/cm		----	357	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	1	mg/L		----	281	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	15	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		----	15	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	0.07	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	0.05	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	0.05	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	1.6	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		----	1.6	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	0.20	----	----	----
EN67 PK: Field Tests									
Field Observations	----	0.01	--		NO ACCESS	----	----	----	----
EP025FD: Field Dissolved Oxygen									
Dissolved Oxygen	----	0.01	mg/L		----	5.30	----	----	----

Appendix B

Rainfall from Gerringong Mayflower Village (2000- June 2012), Toolijooa (Nyora July 2012-2015)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	76.3	21.6	145		60.8	77.9	50.3	30.6	47.6	52.4	230	77.2	
2001	101	285		69.2	104	56	200	95.6		60.2	123	35.4	
2002	243	396	135	110	82.4	74.2	13.4	16	24.6	26.6	27.4	91.6	1240.8
2003	68.2	95.8	110	202	539	71.6	65.6	63	17.8	79	207	54	1573.6
2004	69.8	85.6	101	341	27.2	27.6	80.4	47	111	309	72.2	103	1375.8
2005	175		128	35	138	64.8	158	5.2	101	106		45.4	
2006	125	66.2	52	24.2	124	228	184	90	90.6	15.6	70.2	90.4	1160.6
2007	23.8	331	84	247	33.4	325	46	121	56.8	18.4	313	135	1734.2
2008	61.8	562	54.8	112	13.4	102	110	56.2	83.2	107	42.4	135	1439.2
2009	23.2	142	52.2	141	26.9	155	35.2	8.4	31	191	70.4	117	994.1
2010	80.8	322	172	55.2	88.2	99.6	103	74	239	160	348	180	1921.4
2011	190	59.4	391	112	120	*96.4*	*254*	*98*	*70.4*	*106*	*171*	*79.2*	1746.4
2012	*72.2*	*360*	*306*	*113*	*22.6*	*124*	*48.8*	*3.6*	*20.4*	*96.4*	*43.6*	*31*	1334.6
2013	*164*	207	99.8	274	113	309	63.2	15.6	106	16.8	151	109	1628
2014	40.6	59.6	427	98	18	58.4	4.2	*186*	*49*	*122*	*58.8*	*127*	1248.8
2015	*277*	*74.8*											

Feb/Feb **1559.8** 2014/2015

Rainfall data obtained from Bureau of Meteorology 2013, Station ID: Toolijooa (Nyora), Number – 68175, approximately 3.3 km from Gerroa (http://www.bom.gov.au/climate/data/index.shtml)

Appendix C:
Ammonia Trigger Values

Ammonia levels and 20% trigger factor for Groundwater and 10% trigger factor for Surface water at Gerroa Landfill

Date Sampled	MW1D	MW1S	MW3	MW4	MW5	MW6D	MW6S	MW7D	MW7S	MW9	MW10	MW11	ML-1	ML-2	ML-3	ML-4	ML-5
20% trigger level (mg/L)	164.4	1.32	39.24	21.8	7.07 Exceed Feb 2015 #14.5 mg/L	98.8	27.78	85.32	14.3	4.26	2.85	2.96					
10% trigger level (mg/L)													0.836	1.38	0.066	0.23	2.38 Exceed Nov 2014 #3.5 mg/L)

Legend:

LAST PAGE OF REPORT

Thank you for the opportunity to work with Council.

Feedback is welcomed.

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