

Hanson Construction Materials Pty Ltd



Wastewater Assessment:

Hanson's Bass Point Quarry Project

ENVIRONMENTAL



WATER



WASTEWATER



GEOTECHNICAL



CIVIL



PROJECT
MANAGEMENT



P0902486JR03V02
January 2010

Copyright Statement

Martens & Associates Pty Ltd (Publisher) is the owner of the copyright subsisting in this publication. Other than as permitted by the Copyright Act and as outlined in the Terms of Engagement, no part of this report may be reprinted or reproduced or used in any form, copied or transmitted, by any electronic, mechanical, or by other means, now known or hereafter invented (including microcopying, photocopying, recording, recording tape or through electronic information storage and retrieval systems or otherwise), without the prior written permission of Martens & Associates Pty Ltd. Legal action will be taken against any breach of its copyright. This report is available only as book form unless specifically distributed by Martens & Associates in electronic form. No part of it is authorised to be copied, sold, distributed or offered in any other form.

The document may only be used for the purposes for which it was commissioned. Unauthorised use of this document in any form whatsoever is prohibited. Martens & Associates Pty Ltd assumes no responsibility where the document is used for purposes other than those for which it was commissioned.

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to prepare a Stage 1 Contamination Assessment in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Hanson Construction Materials Pty Ltd (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy or completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client etc. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

© January 2010
 Copyright Martens & Associates Pty Ltd
 All Rights Reserved

Head Office
 6/37 Leighton Place
 Hornsby, NSW 2077, Australia
 ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
 Fax: +61-2-9476-8767
 Email: mail@martens.com.au
 Web: www.martens.com.au

Document and Distribution Status								
Author(s)			Reviewer(s)		Project Manager		Signature	
Megan Bowling			Andrew Norris		Andrew Norris			
Revision No.	Status	Release Date	Document Location					
			File Copy	MA Library	Hanson	Void	Void	Void
1	Draft	17.12.2009	1E, 1P,1H	-	1P			
2	Final	04.01.2010	1E, 1P,1H	1H	1P			

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.

Executive Summary

Overview

This report describes the findings of an on-site Wastewater Assessment conducted in order to support the proposed development at Bass Point Quarry (BPQ), Bass Point Quarry Road, Shellharbour, NSW.

Design Wastewater Load

Based on site occupancy data (58 full time staff anticipated) and AS/NZS 1547 (2000) guidelines, the site's wastewater management system is to be designed to manage a wastewater load of 2900 L/day.

Land Capability

The north eastern corner of the site, currently occupied by the processing plant, will be the best area for future effluent disposal. Given this areas current usage and the high level of disturbance, there is little to no soil for effluent disposal. The future use of this area for effluent disposal therefore will necessitate suitable soil material to be imported. Provided suitable soil material is brought into this area, the proposed effluent irrigation field would be considered to be suitable.

Required Effluent Irrigation Area

We recommend a minimum area of 1323 m² be provided for effluent irrigation in order to assimilate the applied hydraulic and nutrient loads. Such an area is easily accommodated within the identified area.

The irrigation area is sustainable based on nutrient and hydraulic loading assessments.

Executive Summary

Contents

1 OVERVIEW	6
1.1 Background and Scope	6
1.2 Proposed Development	6
2 SITE DESCRIPTION	7
2.1 Location	7
2.2 Topography and Drainage	7
2.3 Soils and Geology	8
2.4 Groundwater	8
2.5 Site Investigations	8
3 ON-SITE WASTEWATER MANAGEMENT	9
3.1 Existing Wastewater Management System	9
3.2 Site Population	9
3.3 Design Wastewater Load	9
3.4 Land Capability for Application of Effluent	10
3.5 Available Irrigation Area	11
3.6 Hydraulic Design - AS/NZS 1547	11
3.7 Nutrient Modelling	12
3.8 Required Effluent Irrigation Area and Imported Material	13
3.9 Specific Irrigation Requirements	13
3.10 Inspections and System Maintenance	14
4 REFERENCES.....	15
5 ATTACHMENT A – SITE PLAN	16
6 ATTACHMENT B – BORELOGS	19
7 ATTACHMENT C – NUTRIENT MODELLING RESULTS	25

1 Overview

1.1 Background and Scope

This report describes the findings of an on-site Wastewater Assessment conducted in order to support the proposed development at Bass Point Quarry (BPQ), Bass Point Quarry Road, Shellharbour, NSW (hereafter known as the "site"). The report is written to support an Environmental Assessment (EA) to accompany an application for project approval under Part 3A of the *Environmental Planning and Assessment Act* (1979).

1.2 Proposed Development

Proposed development at the site is comprised of the following:

1. Decommissioning of the existing processing plant and replacement with a new processing plant.
2. Relocation of the existing concrete plant, office, workshop and amenities.
3. An upgrade of the existing septic wastewater management system.
4. Deepening of the western extraction area from the approved level to -40 mAHD.
5. Reconfiguration of a bund approved by Shellharbour City Council under D947/2002.
6. Deepening of the eastern extraction area from the approved level to -40 mAHD.

2 Site Description

2.1 Location

The site (Lot 22 DP1010797) is located at Bass Point Quarry Road, Shellharbour, NSW and is within the Shellharbour Local Government Area. The site is located approximately 8 km north north east of Kiama and 2 km south east of Shellharbour on Bass Point. The site is border by Bass Point Reserve to the east, Killalea State Park to the west, the ocean to the south and Shell Cove (residential subdivision and boat harbour precinct) to the north (Figure 1).



Figure 1: Aerial photograph of the site and surrounding environment (Google Earth, 2006).

2.2 Topography and Drainage

The site currently has two quarry pits (east pit and west pit). Stormwater either flows into these two quarry pits or flows off-site. Off-site flows ultimately discharge to either the ocean, Killalea Lagoon or land to the north west of the site. Based on review of the most recent site survey (03.08.08) the site's elevation varies from approximately 53.5 mAHD on a knoll in the south of the site to 10.2 mAHD in the east pit.

2.3 Soils and Geology

Review of site borehole data indicates that the site is underlain by variable depth clays of the order of 2 to 13 m deep.

The Kiama 1: 250,000 geological series sheet SI 56-9 (NSW Dept Mines, 1966) indicates that the site is underlain by Bumbo Latite. Review of site borehole data (Attachment B) confirms this.

2.4 Groundwater

Groundwater is present beneath the site. Analysis of average groundwater levels within the site's 17 monitoring bores indicates that groundwater levels at the site typically vary from approximately 1 to 19 mAHD.

2.5 Site Investigations

Walkover site inspections were conducted on September 1 and 23, 2009. On-site testing was undertaken on November 24, 2009 and included the following:

- Excavation of four (4) boreholes to approximately 1.0 – 2.0 m or bedrock depth using a hydraulic auger to allow for the characterisation of underlying soils and geology; and
- Five (5) Dynamic Cone Penetrometer (DCP) tests to determine the engineering properties and depth of sub-surface material.

The borelogs are provided in Attachment B.

3 On-Site Wastewater Management

3.1 Existing Wastewater Management System

The existing on-site wastewater management system consists of two (2) septic tanks and an absorption trench of unknown size which treats wastewater coming from the administration building/office blocks and amenities area. The tanks and trench are located adjacent to the site's northern boundary, as shown approximately on the site plan (Attachment A).

3.2 Site Population

According to site occupancy data provided by the client, a total maximum of 58 people shall be employed on a 'full time' basis at the site. This includes:

- 41 persons in the quarry;
- 8 persons in the concrete plant;
- 3 persons in the laboratory; and
- 6 persons in the administration/office block.

Although the site also has 13 staff drivers and permanent contractors associated with it, these employees are generally working off-site and so are not included in this assessment

3.3 Design Wastewater Load

Based on site occupancy data and AS/NZS 1547 (2000) guidelines, the site's wastewater management system is to be designed to manage a wastewater load of 2900 L/day (Table 1).

Table 1: Design wastewater load for the site.

Design Site Occupants ¹	Recommended Wastewater Flow Allowance ²	Design Wastewater Load
58	50 L/person/day	2900 L/day

Notes: ¹ Based on site occupancy data provided by the client. ² Based on 'rural factories' with a reticulated water supply (AS/NZS 1547, 2000).

3.4 Land Capability for Application of Effluent

The client has indicated that the north eastern corner of the site, currently occupied by the processing plant, will be the best area for future effluent disposal. Site and soil suitability for effluent irrigation within this area has been assessed according to Tables 2.1 and 2.2 of DECC (2004) guidelines (Table 2).

Table 2: Site and soil suitability, according to NSW DECC. (2004).

Soil Feature	Site Details	Limitation Rating
Slope	<1%	Nil or Slight
Flooding	None or Rare	Nil or Slight
Landform	Plain	Nil or Slight
Surface rock outcrop	>5%	Severe
Exchangeable sodium ¹	0 – 0.2 %	Nil or Slight
Salinity measured as Electrical Conductivity ¹	Non-Saline	Nil or Slight
Depth to water table	> 3m	Nil or Slight
Depth to bedrock	0.5-1.0m	Moderate
Saturated Hydraulic Conductivity ¹	- ²	
Available Water Capacity ¹	- ²	
pH ¹	5.1 – 5.5	Moderate
Effective cation exchange capacity (CeC) ¹	> 15	Nil or Slight
Emerson aggregate test ¹	- ²	
(P)sorption ¹	Very High	Nil or Slight

Notes: ¹ Assumed using the Kiama 1:100 000 Soil Landscapes Sheet ² No information available

Given this areas current usage and the high level of disturbance, there is little to no soil for effluent disposal (Figure 2). The future use of this area for effluent disposal therefore will necessitate suitable soil material to be imported.

Assessment indicates that, provided suitable soil material is brought into this area, the proposed effluent irrigation field would have minor limiting factors and therefore be considered to be suitable.



Figure 2: Photograph of the existing processing plant area to be rehabilitated and used for effluent disposal (24/11/2009).

3.5 Available Irrigation Area

Review of the existing site and the proposed layout indicates that there is approximately 1.3 Ha of area available (Attachment A).

3.6 Hydraulic Design - AS/NZS 1547

3.6.1 Design Effluent Irrigation Rates

We recommend a minimum of 0.7m of imported "sub-soil" (clay loam or similar) be imported to the site; with a further 300mm of "top-soil" being a loam or sandy loam, to be overlain. Recommended soil properties and their corresponding design irrigation rates (DIR's) according to AS/NZS 1547 (2000) are given in Table 3. Based on this information, a minimum sub-surface design irrigation rate (DIR) of 4 mm/day (28mm / week) is recommended.

Table 3: Recommended soil types and corresponding Design Irrigation Rates (DIR) for effluent irrigation according to AS/NZS 1547 (2000).

Texture	DIR (mm/day)
Sandy Loam	5.0
Loams	4.0

3.6.2 Effluent Irrigation Area

Given a maximum design wastewater load of 2900 L/day (Table) and a DIR of 4.0 mm/day (Section 0), an irrigation area of 725 m² is required according to AS/NZS 1547 (2000).

Such an area is easily accommodated by the existing plant area, which is well outside of appropriate buffers, as shown on the site plan (Attachment A).

3.7 Nutrient Modelling

Design effluent quality used in the nutrient balance assessment is based on secondary effluent standards (Table 4).

Table 4: Effluent quality input parameters for the nutrient balance modelling.

Parameter	Design Criteria
BOD ₅ (mg/L)	20
Suspended Solids (mg/L)	30
Total Phosphorous (mg/L)	10
Total Nitrogen (mg/L)	25

Modelling has been undertaken to determine the sustainability of the recommended design effluent quality for the site (secondary treatment standard), and to ascertain minimum sustainable irrigation areas. All modelling has been conducted assuming continuous irrigation of effluent (i.e. no wet weather storage) and design soil depth of 0.5 m (1.0m of appropriate material to be imported to the site). Modelling results are summarised below, with detailed modelling assessment provided in Attachment C.

Table 4: Area required for sustainable irrigation of treated effluent based on various parameters.

Parameter	Area Required (m ²)
Nitrogen Leaching ¹	1323
Phosphorus Saturation ²	1040
AS/NZS 1547:2000 ³	725
Available Area	13 000
Design	1323

Note: ¹ Acceptable nitrogen budget: consumed - generated = 0. ² Phosphorus saturation modelled for 50 years, based on average 0.5 m soil depth, wastewater TP 10mg/L and P-sorption capacity of 500 mg/kg assumed. ³AS/NZS 1547 (2000) value based on loam DIR of 4 mm/day (28 mm / week) and peak average daily flow of 2900 L/day.

3.8 Required Effluent Irrigation Area and Imported Material

As shown by Table 4, nitrogen leaching is the limiting factor in this assessment. We therefore recommend a minimum area of 1323 m² be provided for effluent irrigation in order to assimilate the applied hydraulic and nutrient loads. Such an area is easily accommodated within the identified area on the site plan (Attachment A).

As previously discussed, in order to irrigate in this area, a minimum of 1m of soil material is to be imported to the site and placed in this area. Assuming a total soil profile depth of 1m, approximately 1323 m³ of material (preferably a clay loam or similar) is required to be imported and appropriately compacted, with at least 397 m³ of which being a loam or sandy loam as per Table 3.

Imported sub-soil may be site sourced top soil. Should local top soil be used to form the "imported" topsoil, it should first be mixed with 20% by volume of coarse sand size (0.2 – 2.0 mm) material to improve infiltration.

3.9 Specific Irrigation Requirements

The irrigation field is to be constructed in general accordance with AS/NZS 1547 (2000) and the following minimum specifications:

○

Spray Irrigation

- Irrigation system to use low aerosol sprinkler heads.
- Irrigation field to be fenced

Sub-Surface

- A 25mm reticulated flushing main with shut off valve is to be constructed for system flushing. Water from flushed lines is to be sent back to the AWTS
- Effluent is to be distributed via a series of irrigation lines buried at approximately 100 mm depth parallel to site contours and maximum 1 m apart (centres).
- Pressure compensating irrigation line such as “Netafim”, “Amiad PC” or “Wasteflow” is to be used. These products have been specifically designed for the distribution of secondary treated effluent and allow for the even distribution of flows along and between irrigation lines

General

- The effluent distribution pump and delivery mains are to be sized to provide adequate flow through the proposed irrigation system.
- The effluent distribution main, distribution manifolds and flushing manifold are to be fixed in place by burial to a depth of no less than 100 mm.
- Vegetation cover is to be maintained over the irrigation field.
- Irrigation areas are not to be accessed by vehicles, other than for the purposes of mowing.

3.10 Inspections and System Maintenance

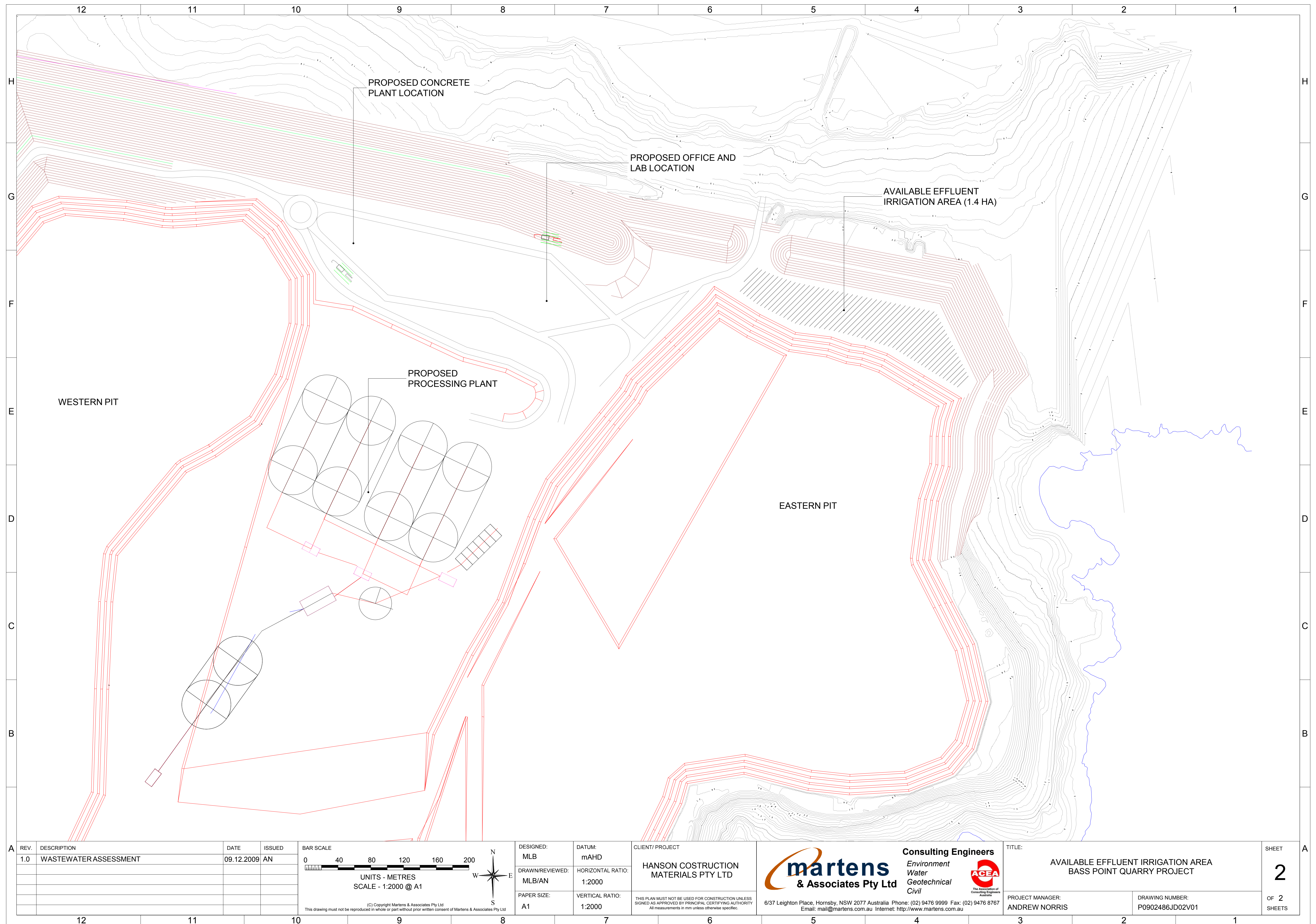
The wastewater management system shall be maintained quarterly (i.e. every three months) by a qualified contractor. As part of system maintenance any sub-surface irrigation systems are to be flushed and any filters removed and cleaned/replaced.

4 **References**

Australian / New Zealand Standard 1547 (2000), *On-site domestic wastewater management*.

Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998), *Environment and Health Protection Guidelines, On-site Sewage Management for Single Households*.

5 Attachment A – Site Plan



6 Attachment B – Borelogs

CLIENT		Hanson Construction Materials		COMMENCED		24.11.2009		COMPLETED		24.11.2009		REF		BH1	
PROJECT		Geotechnical Assessment		LOGGED		BR		CHECKED		AN		Sheet		1 of 1	
SITE		Bass Point Hard Rock Quarry		GEOLOGY		Latite		VEGETATION		Grass		PROJECT NO.		P0902486	
EQUIPMENT		AUGER		EASTING		-		RL SURFACE		-					
EXCAVATION DIMENSIONS		Ø 90mm X 750mm depth		NORTHING		-		ASPECT		N - NE		SLOPE		5-10%	

EXCAVATION DATA					MATERIAL DATA				SAMPLING & TESTING				
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS
A	Nil	N	D	0.1			OL	ORGANIC SILT - Brown (typical top soil).	-				
A	Nil	N	D	0.5			CL	CLAY - Brown, moisture increasing with depth.	-		B	0.5	2486/1/ 0.5
A	Nil	N	D	0.75			GC	CLAYEY GRAVEL - Clay is brown, gravels (2-10mm, 30%). Borehole refused on latite or coarse gravels at 0.75m.	-		B	0.75	2486/1/0.75
				1.0									
				1.5									
				2.0									
				2.25									

EQUIPMENT / METHOD		SUPPORT		WATER		MOISTURE		PENETRATION		CONSISTENCY		DENSITY		SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION	
N	Natural exposure	SH	Shoring	N	None observed	D	Dry	L	Low	VS	Very Soft	VL	Very Loose	A	Auger sample	pp	Pocket penetrometer
X	Existing excavation	SC	Shotcrete	X	Not measured	M	Moist	M	Moderate	S	Soft	L	Loose	B	Bulk sample	S	Standard penetration test
BH	Backhoe bucket	RB	Rock Bolts	W	Water level	W	Wet	H	High	F	Firm	MD	Medium Dense	U	Undisturbed sample	VS	Vane shear
E	Excavator	Nil	No support	Wp	Plastic limit	Wp	Plastic limit	R	Refusal	St	Stiff	D	Dense	D	Disturbed sample	DCP	Dynamic cone penetrometer
HA	Hand auger			WI	Liquid limit	WI	Liquid limit			VSt	Very Stiff	VD	Very Dense	M	Moisture content	FD	Field density
S	Hand spade									H	Hard			Ux	Tube sample (x mm)	WS	Water sample
PT	Push tube									F	Friable						
A	Auger																
CC	Concrete Corer																

(C) Copyright Martens & Associates Pty. Ltd . 2009

MARTENS & ASSOCIATES PTY LTD
6/37 Leighton Place
Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

**Engineering Log -
Borehole**

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

CLIENT		Hanson Construction Materials		COMMENCED		24.11.2009		COMPLETED		24.11.2009		REF		BH2					
PROJECT		Geotechnical Assessment		LOGGED		BR		CHECKED		AN		Sheet 1 of 1							
SITE		Bass Point Hard Rock Quarry		GEOLOGY		Latite		VEGETATION		Grass		PROJECT NO. P0902486							
EQUIPMENT				AUGER				EASTING		-		RL SURFACE				-			
EXCAVATION DIMENSIONS				Ø 90mm X 2000mm depth				NORTHING		-		ASPECT		N - NE		SLOPE		5-10%	
EXCAVATION DATA						MATERIAL DATA						SAMPLING & TESTING							
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.				CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS			
A	Nil	N	D	0.1			OL	ORGANIC SILT - Brown (typical top soil).				-							
A	Nil	N	M	0.5			CL	CLAY - Brown, gravels (5-10mm, 20%), gravels are red.				-		B	0.4	2486/2/ 0.4			
A	Nil	N	M	1.0			CL	CLAY - Light brown/yellow.				-		B	1.0	2486/2/ 1.0			
A	Nil	N	M	1.5			CL	CLAY - Grey to light brown.				-		B	1.5	2486/2/ 1.5			
A	Nil	N	D	2.0			EW	EXTREMELY WEATHERED LATITE.								2.0			
				2.25				Borehole terminated in extremely weathered latite at 2.0m.								2.25			
EQUIPMENT / METHOD		SUPPORT		WATER		MOISTURE		PENETRATION		CONSISTENCY		DENSITY		SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION			
N Natural exposure		SH Shoring		N None observed		D Dry		L Low		VS Very Soft		VL Very Loose		A Auger sample		pp Pocket penetrometer			
X Existing excavation		SC Shotcrete		X Not measured		M Moist		M Moderate		S Soft		L Loose		B Bulk sample		S Standard penetration test			
BH Backhoe bucket		RB Rock Bolts		Water level		W Wet		H High		F Firm		MD Medium Dense		U Undisturbed sample		VS Vane shear			
E Excavator		Nil No support		Water outflow		Wp Plastic limit		R Refusal		St Stiff		D Dense		D Disturbed sample		DCP Dynamic cone penetrometer			
HA Hand auger				Water inflow		WL Liquid limit				VSt Very Stiff		VD Very Dense		M Moisture content		FD Field density			
S Hand spade										H Hard				Ux Tube sample (x mm)		WS Water sample			
PT Push tube										F Friable									
A Auger																			
CC Concrete Corer																			
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																			
						MARTENS & ASSOCIATES PTY LTD 6/37 Leighton Place Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au						Engineering Log - Borehole							

CLIENT	Hanson Construction Materials			COMMENCED	24.11.2009	COMPLETED	24.11.2009	REF BH3																							
PROJECT	Geotechnical Assessment			LOGGED	BR	CHECKED	AN	Sheet 1 of 1																							
SITE	Bass Point Hard Rock Quarry			GEOLOGY	Latite	VEGETATION	Grass	PROJECT NO. P0902486																							
EQUIPMENT		AUGER			EASTING	-		RL SURFACE -																							
EXCAVATION DIMENSIONS		Ø 90mm X 1500mm depth			NORTHING	-		ASPECT	N - NE																						
								SLOPE	5-10%																						
EXCAVATION DATA					MATERIAL DATA				SAMPLING & TESTING																						
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS																		
A	Nil	N	D	0.1			OL	ORGANIC SILT - Brown (typical top soil).	-																						
A	Nil	N	M	0.5			CL	CLAY - Dark brown.	-																						
A	Nil	N	M	1.0			CL	CLAY - Light brown.	-																						
A	Nil	N	M	1.5			CL	CLAY - Light brown.	-																						
				2.0				Borehole terminated on extremely weathered latite at 1.5m.																							
				2.25																											
EQUIPMENT / METHOD N Natural exposure X Existing excavation BH Backhoe bucket E Excavator HA Hand auger S Hand spade PT Push tube A Auger CC Concrete Corer														SUPPORT SH Shoring SC Shotcrete RB Rock Bolts Nil No support		WATER N None observed X Not measured Water level Water outflow Water inflow		MOISTURE D Dry M Moist W Wet Wp Plastic limit WL Liquid limit		PENETRATION L Low M Moderate H High R Refusal		CONSISTENCY VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard F Friable		DENSITY VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense		SAMPLING & TESTING A Auger sample B Bulk sample U Undisturbed sample D Disturbed sample M Moisture content Ux Tube sample (x mm)		pp Pocket penetrometer S Standard penetration test VS Vane shear DCP Dynamic cone penetrometer FD Field density WS Water sample		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION Y USCS N Agricultural	
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																															
 Martens & Associates Pty Ltd 6/37 Leighton Place Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au												Engineering Log - Borehole																			

CLIENT	Hanson Construction Materials			COMMENCED	24.11.2009	COMPLETED	24.11.2009	REF BH4									
PROJECT	Geotechnical Assessment			LOGGED	BR	CHECKED	AN	Sheet 1 of 1									
SITE	Bass Point Hard Rock Quarry			GEOLOGY	Latite	VEGETATION	Grass	PROJECT NO. P0902486									
EQUIPMENT		AUGER			EASTING	-		RL SURFACE -									
EXCAVATION DIMENSIONS		Ø 90mm X 900mm depth			NORTHING	-		ASPECT	N - NE								
								SLOPE	5-10%								
EXCAVATION DATA				MATERIAL DATA				SAMPLING & TESTING									
METHOD	SUPPORT	WATER	MOISTURE	DEPTH (M)	PENETRATION RESISTANCE	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION OF STRATA Soil type, texture, structure, mottling, colour, plasticity, rocks, oxidation, particle characteristics, organics, secondary and minor components, fill, contamination, odour.	CONSISTENCY	DENSITY INDEX	TYPE	DEPTH (M)	RESULTS AND ADDITIONAL OBSERVATIONS				
A	Nil	N	D	0.3			OL	ORGANIC SILT - Brown (typical top soil).	-								
A	Nil	N	M	0.5			CL	CLAY - Chocolate brown.	-								
				0.9													
				1.0				Borehole refused on extremely weathered latite at 0.9m.									
				1.5													
				2.0													
				2.25													
EQUIPMENT / METHOD		SUPPORT	WATER	MOISTURE	PENETRATION	CONSISTENCY	DENSITY	SAMPLING & TESTING		CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION							
N	Natural exposure	SH	Shoring	N	None observed	D	Dry	VS	Very Soft	VL	Very Loose	A	Auger sample	pp	Pocket penetrometer	Y USCS	
X	Existing excavation	SC	Shotcrete	X	Not measured	M	Moist	S	Soft	L	Loose	B	Bulk sample	S	Standard penetration test		N Agricultural
BH	Backhoe bucket	RB	Rock Bolts	W	Water level	H	High	F	Firm	MD	Medium Dense	U	Undisturbed sample	VS	Vane shear		
E	Excavator	Nil	No support	Wp	Plastic limit	R	Refusal	St	Stiff	D	Dense	D	Disturbed sample	DCP	Dynamic cone penetrometer		
HA	Hand auger			WI	Liquid limit			VSt	Very Stiff	VD	Very Dense	M	Moisture content	FD	Field density		
S	Hand spade					H	Hard		Hard			Ux	Tube sample (x mm)	WS	Water sample		
PT	Push tube					F	Friable										
A	Auger																
CC	Concrete Corer																
EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS																	
				MARTENS & ASSOCIATES PTY LTD 6/37 Leighton Place Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 mail@martens.com.au WEB: http://www.martens.com.au				Engineering Log - Borehole									

7 Attachment C – Nutrient Modelling Results

Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007



6/37 Leighton Place, Hornsby, NSW 2077, Ph: (02) 9476 9999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	Bass Point Quarry - Wastewater Assessment			Ref. No.	P0902486JS06V01
Author	MLB	Reviewed	AN	Date Created	09.12.2009

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit
Treatment System	AWTS	-
Effluent flow rate	2900	L/day
Effluent N	25.0	mg/L
Effluent P	10.0	mg/L
Design soil depth	0.50	m
Soil P-sorption	500.0	mg/kg
Plant N uptake	200.0	kg/ha/year
Plant P uptake	20.0	kg/ha/year

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD		
N generated	26.46	kg/year
N consumed	26.46	kg/year
N balance	0.00	kg/year
Min Area	1323	m ²
PHOSPHORUS BUDGET FOR RE-USE FIELD		
P generated	10.59	kg/year
P consumed	2.08	kg/year
P balance	8.51	kg/year
P sorption	429.0	kg P/design soil depth
Field life (for P)	50.4	Years
Min Area	1040	m ²
MINIMUM NUTRIENT ASSIMILATION AREA		
Minimum Area	1323	m ²

