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REPORT ON

WATER QUALITY MONITORING STRATEGY
ELLA BAY INTEGRATED RESORT

Submitted to:

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DISTRIBUTION:

2 Copies - Ella Bay Development Pty Ltd (1 Bound, 1 CD)
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March, 2008 087673008 001 Rev1

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1.0 INTRODUCTION

White Beech Pty Ltd on behalf of Satori Resorts Ella Bay Pty Ltd commissioned Golder Associates Pty Ltd (Golder) to prepare this Water Quality Monitoring Strategy for the proposed Ella Bay Integrated Resort and an associated public road development/upgrade from Flying Fish Point to the development site (refer Figure 1, Site Location Plan).

Surface water and groundwater present within the Ella Bay Integrated Resort development site and access road alignment are located immediately adjacent to or within the following key environment protection areas (refer Figure 1):

- Ella Bay National Park containing rainforest and wetlands that are part of the Wet Tropics of Queensland World Heritage Area (WTQWHA).

- Ella Bay and associated back beach wetlands that front the off-shore boundary of the Great Barrier Reef World Heritage Area (GBRWHA).

This Water Quality Monitoring Strategy for the Ella Bay Integrated Resort provides the framework to:

- Establish existing surface water and groundwater quality conditions within and adjacent to the development site and access road alignment.

- Identify potential adverse impacts on water quality that may result from development construction and operation to enable implementation of appropriate mitigation measures.

- Prepare detailed water quality management plans for each specific component or stage of development construction works, including provision of draft procedures for water quality monitoring, reporting and impact mitigation.

2.0 BACKGROUND

2.1 General

Detailed descriptions of the Ella Bay Integrated Resort and access road alignment geology, topography, surface water and groundwater hydrology, ecology and other environmental values are provided within the Environment Impact Statement (EIS) and Supplementary Environment Impact Statement (SEIS) documents prepared for development approval. The key EIS/SEIS documents reviewed to prepare this Water Quality Monitoring Strategy comprised:

- '*Preliminary Environmental And Geotechnical Investigation, Ella Bay Development Far North Queensland*', Golder, 001-06673041-R1, November 2006 (Golder 2006).
- '*Water Quality Monitoring – Ella Bay*', Golder 002-077673018-R2, June 2007 (Golder 2007a).
- '*Concept Surface Water and Groundwater Hydrology Models, Ella Bay Integrated Resort*', Golder, 001-077673018-R3, July 2007 (Golder 2007b).
- '*Water Quality Management Strategy for Ella Bay Resort - Impacts on Fauna & Flora*', THG Resource Strategists and EcoWater Solutions, EWS07-18 / E4733, August 2007 (THG 2007).
- '*Water Quality Management Strategy for Ella Bay Resort – Access Road*', THG Resource Strategists, E4733, March 2008 (THG 2008).

Relevant background information is summarised in the following sections.

2.2 Proposed Development

The Master Plan for the Ella Bay Integrated Resort shown in Appendix A includes the following key elements:

- Low to medium density resorts, units and a day spa facility located along the eastern boundary adjacent to Ella Bay over a distance of approximately 1.7 km.
- A community recreation centre, sports academy and international school.
- An 18-hole golf course surrounded by residential house lots and 3 to 4 storey unit blocks.
- An on-site sewerage treatment plant.
- Construction of a new public access road to bypass Flying Fish Point and upgrading of the existing public roadway from Flying Fish Point to Ella Bay.

Freehold land remaining outside the development site that predominantly comprises remnant rainforest and wetlands is proposed to be protected by an environmental covenant (refer to '*Northern Freehold Area*', '*Eastern Freehold Area'* and '*Western Freehold Area*' shown on Figure 2).

2.3 Site Description

The Far North Queensland climate is dominated by a high rainfall, hot 'wet' seasons between December and April with average monthly rainfalls of approximately 500 mm up to maximums of approximately 1,500 mm and low rainfall, cooler 'dry' seasons between May and November with average monthly rainfalls of in the order of 100 mm to 200 mm.

The Seymour and Graham Ranges and located between Flying Fish Point and Russell Heads form a 35 km long continuous natural surface water and groundwater divide between a series of relatively minor coastal fringe catchments that include Flying Fish Point and Ella Bay Integrated Resort and the much larger catchment areas of:

- Johnstone River that discharges at Flying Fish Point
- Russell River and Mulgrave River that discharge at Russell Heads

Located between Flying Fish Point and Bramston Beach (refer Figure 1), Ella Bay is formed within the sea frontage of the Seymour Range, with localised alluvial plains and low-lying wetlands present between the range foothills and beachfront. The Ella Bay Integrated Resort is predominantly located within an alluvial plain area, with the access road alignment predominantly located within the range foothills.

Figure 2 (Development Layout Plan) shows the proposed development site, topography, regional soils, surface water catchments and drainage pathways, cleared land and associated remanent vegetation, and adjacent areas of rainforest, wetlands and beach frontage.

Figure 3 (Access Road Alignment Plan) shows the proposed access road alignment, Flying Fish Point township, surface water catchments, cleared land and associated remanent vegetation.

Catchment areas containing the proposed development site and access road alignment are shown on Figure 2 and Figure 3 and are summarised below.

Current Land Use	Catchment Discharge	Freehold Land/Access Road Proposed Development
'*Ella Bay Wetlands*' (Catchment B)		Total Catchment Area: 836 ha
• National Park (95% of total) • Uncleared Freehold (9%) • Cleared Farmland (5%)	Ella Bay Northern Beach Discharge	• Golf Course (2% of total) • Residential Housing (1%) • Low Density Eco-Resort (0.5%) • Access Roads (0.5%) • Rehabilitation/Conservation (10%)
'*Farm Creek*' (Catchment A)		Total Catchment Area: 886 ha
• National Park/Wetlands (61%) • Little Cove Development (2%) • Uncleared Freehold (11%) • Cleared Farmland (26%)	Ella Bay Southern Beach Discharge	• Golf Course (12%) • Residential Housing (5%) • Commercial/Service Areas (2%) • Beach Resorts (3%) • Access Roads (1%) • Rehabilitation/Conservation (15%)
'*Heath Point*' (Catchment C)		Total Catchment Area: 165 ha
• National Park/Wetlands (65%) • Little Cove Development (33%) • Public Road Reserve (2%)	Various Freshwater Creeks	• Access Road Upgrade (2%)
'*Flying Fish Point*' (Catchment D)		Total Catchment Area: 125 ha
• National Park (61%) • Uncleared (11%) • Aquiculture (6%) • Township (25%)	Various Creeks and Stormwater Pipelines	• Access Road Upgrade (1%) • New Access Road (2%)
'*Coconuts*' (Catchment E)		Total Catchment Area: 225 ha
• National Park (40%) • Wetlands (15%) • Uncleared (15%) • Farmland (20%) • Township (10%)	Various Wetlands and Creeks	• New Access Road (1%)

The Seymour Range that surrounds the development site and contains most of the access road alignment comprises interbedded sequences of schist, quartzite, arenite, phyllite, greenstone and gneiss (refer Figure 2, Mountainous, Mission, Galmara Soil Units).

Within the development site, the bedrock is generally overlain by alluvial deposits of silt, clay and sand (refer Figure 2, Tully Soil Unit) and the coastal frontage mapped as sand dune and beach ridge deposits (refer Figure 2, Hull Soil Unit).

North of the development site the sandy soils (Hull Soil Unit) located immediately behind the Ella Bay beach ridge changes to wet, low strength organic clays and peats associated with low-lying wetlands (refer Figure 2, Nind, Sumalea Soil Units).

The predominant groundwater flow influence within the coastal catchments is topography that results in a general west to east flow direction. There is generally no mechanism for northwards and southwards migration and/or interaction of groundwater within the coastal plain or wetland areas. It is considered that there is only minor and localised groundwater interchange between the development site and immediately adjacent sections of the '*Northern Freehold Area*'. Overall, groundwater forms only a minor component of the hydrology of undisturbed wetlands areas.

Beachfront wetland swales are considered to play an important role in maintaining a natural groundwater divide between seawater in Ella Bay and freshwater within on-shore shallow aquifers.

Localised interconnected groundwater aquifers are associated with each of the main soil and rock within the development site as indicated on Figure 4 and summarised below.

Groundwater/ Geology Unit	General Description	Groundwater Recharge Sources	Groundwater Flow Mechanisms
Unit A Metasediments (Mountainous)	Weathered to fresh fractured meta-sediment rock.	Rainfall on exposed elevated rock outcrops. Minor inflow from overlying groundwater units at depth.	Secondary flow within open rock fractures.
Unit B Residual Soils/ Colluvium (Mission/ Galmara)	Clays sourced from rock and slope-wash material directly overlying the lower extent of Unit A.	Rainfall on exposed surfaces located near the base of the steep ranges . Minor inflow from overlying/underlying groundwater units at depth.	Primary flow within pore spaces of clay soils, with some preferential flow along bands of broken rock.
Unit C Alluvial Clays (Tully)	Alluvial clays in low-lying areas below the steep ranges.	Rainfall on level exposed surfaces. Minor inflow from overlying/underlying groundwater units.	Primary flow within pore spaces of clay soils in an easterly direction.
Unit D Swamp Clays (Nind/Sumalea)	Wet, unconsolidated clay soils deposited within estuarine and coastal swamp conditions.	Rainfall and surface water flows within the wetland areas. Minor inflow from ground-water units at depth.	Primary flow within pore spaces of clay soils as dictated by the head of surface water present within the wetlands.
Unit E Beach Sands (Hull)	Unconsolidated sand soils deposited within coastal beach ridge environment.	Rainfall on relatively level exposed surfaces and interchange with surface water bodies such as creeks, the Farm Wetland Swale. Minor inflow from underlying ground-water units at depth.	Primary flow within pore spaces within the sand soils. Direction of flow would be dictated by the head of surface water present in the creeks, Farm Wetland Swale and adjacent tidal levels in Ella Bay.

2.4 Potential Impacts and Management Strategies

THG 2007 and THG 2008 provide comprehensive summaries of potential water quality impact sources (e.g. THG 2007, Table 4) and proposed mitigation strategies (e.g. THG 2007, Section 6) that will be implemented to protect water quality during and following construction works. Key water quality issues are summarised below:

- Soil erosion and transport
- Disturbance of acid sulfate soils
- Fertiliser run-off and on-site wastewater treatment
- Herbicides and Pesticide use
- Fuels, oils and road sediment
- Gross pollutants (litter, vegetation debris)

Appropriate selection and application of Water Sensitive Urban Design (WSUD) techniques have been adopted as a first tier approach to protect and improve water quality within catchment areas disturbed by the proposed development. These include:

- Water diversion and segregation
- Engineered control and treatment swales and wetlands
- Gross pollutant traps
- Tertiary wastewater treatment
- Minimisation of on-site fuel and chemical use and waste generation
- Off-site waste disposal

Secondary tier management and mitigation methods to protect water quality to be applied during construction works and as long term contingency measures include:

- Sediment and erosion control
- Leakage/spillage response plans
- Seasonal construction and maintenance planning
- Fertiliser and chemical use plans with staff and long term resident training

3.0 MONITORING PARAMETERS

3.1 Water Quality Guidelines

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) document an Australia-wide framework for identification and selection of aquatic ecosystems and provides a range of water quality guidelines values based upon three levels of ecosystem condition (i.e. high value, disturbed and highly disturbed).

It should be recognised, however, that '*For aquatic ecosystems, although the ANZECC 2000 Guidelines provide extensive default guideline values, they strongly emphasise the need to develop more locally relevant guidelines*'.

Queensland Water Quality Guidelines (QWQG 2006) have subsequently been prepared to:

- '*Provide guideline values (numbers) that are tailored to Queensland regions and water types*'.

- '*Providing a process/framework for deriving and applying local guidelines for waters in Queensland (i.e. more specific guidelines than those in the QWQG)*'.

3.2 Ecosystems Water Types and Conditions

QWQG 2006 places Ella Bay within the '*Wet Tropics*' Guideline Region adjacent to the boundary between the Mulgrave-Russell Catchment (No. 111) and Johnstone River Catchment (No. 112) River Basins (QWQG 2006, Figure 2.3.2).

Appendix B of QWQG 2006 provides objective criteria to define the water type for individual aquatic ecosystems on a regional basis from three broad categories and associated subcategories as summarised below.

Water Type Description	Brief Definition
Freshwaters	Above the tidal limit of Mean High Water Spring (MHWS)
• Upland	Moderate to fast flowing due to steep gradients
• Lowland	Slow moving and meandering with very slight gradients
• Lakes	Area exceeds 8 ha, less than 30 % vegetation cover
• Wetlands	Non-tidal, dominated by trees/shrubs and low salinity
Estuaries	Subject to tidal movements between MHWS and fully saline open marine waters.
• Upper Estuary	Not present within Wet Tropics Region
• Middle Estuary	Majority of the length of most estuaries (full salinity <20% of time)
• Lower Estuary	Enclosed coastal water subject to some residual freshwater inflow or downstream reaches with marine water exchanges on every tide

Water Type Description	Brief Definition
Marine Waters	Seawater not influenced by terrestrial freshwater flow
• Inshore • Offshore	Near coastal waters to 15 km except enclosed coastal waters Oceanic waters

Section 3.1 of ANZECC 2000 provides three levels of aquatic ecosystem condition as summarised below.

Ecosystem Condition	Brief Definition
• High value ecosystems	Effectively unmodified, with ecological integrity regarded as intact.
• Slightly to moderately disturbed ecosystems	Small impacts to aquatic biological diversity within moderately cleared catchments with reasonably intact riparian vegetation.
• Highly disturbed ecosystems	Measurably degraded ecosystems typically associated with shipping ports or urban catchments.

Based upon the definitions, water type an ecosystem condition have been assigned to each of the catchment areas to be disturbed by the Ella Bay Integrated Resort and access road alignment.

Catchment	Discharge	Water Type	Ecosystem Condition
'*Ella Bay Wetlands*' (Catchment B)			
• Farmland (B1 to B4)	Wetlands (B5)	Freshwater Wetlands	Slightly to Moderately Disturbed
• Rainforest & Wetlands (B5)	Beachfront Swale (B6)	Freshwater Wetlands	High value
• Beachfront Swale (B6)	Coral Sea	Middle Estuary	High value
'*Farm Creek*' (Catchment A)			
• Rainforest & Farmland (A1 to A4)	Beachfront Swale (A5)	Freshwater Upland	Slightly to Moderately Disturbed
• Beachfront Swale (A5)	Coral Sea	Middle Estuary	Slightly to Moderately Disturbed
'*Heath Point'* (Catchment C)			
• Rainforest-Above Road (C1)	Below Road (C1)	Freshwater Upland	High value
• Rainforest-Below Road (C2)	Coral Sea	Freshwater Upland	Slightly to Moderately Disturbed

Catchment	Discharge	Water Type	Ecosystem Condition
'*Flying Fish Point'* (Catchment D)			
• Rainforest-Above Road/Urban (D1) • Agriculture/Urban (D2)	Agriculture/ Urban (D2) Coral Sea	Freshwater Upland Freshwater Upland	High value Slightly to Moderately Disturbed
'*Coconuts'* (Catchment E)			
• Rainforest (E1) • Farmland/Urban (E2) • Coastal Wetlands (E3)	Coastal Wetlands (E3) Coastal Wetlands (E3) Coral Sea	Freshwater Upland Freshwater Upland Middle Estuary	High value Slightly to Moderately Disturbed Slightly to Moderately Disturbed

3.3 Parameter Selection and Guideline Values

ANZECC 2000 identified the following general water quality indicator groupings:

- Physio-chemical
- Toxicant
- Biological
- Habitat

A broad range of water quality guideline values were also provided in ANZECC 2000 for the physio-chemical and Toxicant groupings. For the Wet Tropics Region, the QWQG 2006 provides more relevant physio-chemical guideline values for the Estuary and Inshore Marine water types. Biological and habitat indicator groupings have not been included in the water quality monitoring strategy for the Ella Bay Integrated Resort.

It is noted that there are no suitable published guideline values for groundwater quality. It is common practice to adopt surface water guidelines, with assessment made for dilution, dispersion and attenuation within aquifers and groundwater discharge to surface water catchment areas.

Based upon the identified potential water quality issues discussed in Section 2.4, physio-chemical and chemical/toxicant parameters have been selected for development site and access road alignment water quality monitoring program. Where available, relevant ANZECC 2000 or QWQG 2006 guideline values are also provided.

Water Quality Parameter	Freshwater Upland		Freshwater Wetland		Middle Estuary	
	High Value	Disturbed	High Value	Disturbed	High Value	Disturbed
Physio-chemical – General						
pH	–	6.0 to 7.5[2]	–	6.0 to 8[2]	–	6.5 to 8.4[2]
Conductivity	–	–	–	–	–	–
Temperature	–	–	–	–	–	–
Dissolved Oxygen	–	90 to 100 %[2]	–	90 to 120 %[2]	–	80 to 105 %[2]
Suspended Solids	–	–	–	–	–	–
Turbidity	–	6 NTU	–	2-200 NTU	–	10 NTU
Physio-chemical – Nutrients						
Ammonia	–	6 ug/L[2]	–	10 ug/L[2]	–	15 ug/L[2]
Oxidised Nitrogen	–	30 ug/L[2]	–	10 ug/L[2]	–	30 ug/L[2]
Organic Nitrogen	–	125 ug/L[2]	–	330-1180 ug/L[2]	–	200 ug/L[2]
Total Nitrogen	–	150 ug/L[2]	–	350-1200 ug/L[2]	–	250 ug/L[2]
Filtered Phosphorous	–	5 ug/L[2]	–	5-25 ug/L[2]	–	5 ug/L[2]
Total Phosphorous	–	10 ug/L[2]	–	10-50 ug/L[2]	–	20 ug/L[2]
Toxicant – Metals						
Arsenic	1.8 ug/L[1]	37 ug/L[1]	1.8 ug/L[1]	37 ug/L[1]	–	–
Cadmium	0.06 ug/L[1]	0.2 ug/L[1]	0.06 ug/L[1]	0.2 ug/L[1]	0.7 ug/L[1]	5.5 ug/L[1]
Chromium	0.01 ug/L[1]	1.0 ug/L[1]	0.01 ug/L	1.0 ug/L[1]	7.8 ug/L[1]	31.8 ug/L[1]
Copper	1.0 ug/L[1]	1.4 ug/L[1]	1.0 ug/L[1]	1.4 ug/L[1]	0.3 ug/L[1]	1.3 ug/L[1]
Lead	1.0 ug/L[1]	3.4 ug/L[1]	1.0 ug/L[1]	3.4 ug/L[1]	2.2 ug/L[1]	4.4 ug/L[1]
Mercury	0.06 ug/L[1]	0.6 ug/L[1]	0.06 ug/L[1]	0.6 ug/L[1]	0.1 ug/L[1]	0.4 ug/L[1]
Nickel	8 ug/L[1]	11 ug/L[1]	8 ug/L[1]	11 ug/L[1]	7 ug/L[1]	70 ug/L[1]
Zinc	2.4 ug/L[1]	8 ug/L[1]	2.4 ug/L[1]	8 ug/L[1]	7 ug/L[1]	15 ug/L[1]
Aluminium	27 ug/L[1]	55 ug/L[1]	27 ug/L[1]	55 ug/L[1]	–	–
Iron	–	–	–	–	–	–
Toxicant – Fuels, Oils and Greases						
Oils and Greases	–	–	–	–	–	–
Petroleum Hydrocarbons	–	–	–	–	–	–
Benzene	600 ug/L[1]	950 ug/L[1]	600 ug/L[1]	950 ug/L[1]	500 ug/L[1]	700 ug/L[1]
Xylene	340 ug/L[1]	550 ug/L[1]	340 ug/L[1]	550 ug/L[1]	–	–
Toxicant – Pesticides and Herbicides (Development Site Only)[3]						
Organophosphates	–	–	–	–	–	–
- Azinphos methyl	0.01 ug/L[1]	0.02 ug/L[1]	0.01 ug/L[1]	0.02 ug/L[1]	–	–
- Clorpyrifos	0.00004 ug/L[1]	0.01 ug/L[1]	0.00004 ug/L[1]	0.01 ug/L[1]	0.00005 ug/L[1]	0.00005 ug/L[1]
- Diazinon	0.00003 ug/L[1]	0.01 ug/L[1]	0.00003 ug/L[1]	0.01 ug/L[1]	–	–
- Dimethoate	0.1 ug/L[1]	0.15 ug/L[1]	0.1 ug/L[1]	0.15 ug/L[1]	–	–
- Fenithrothion	0.1 ug/L[1]	0.2 ug/L[1]	0.1 ug/L[1]	0.2 ug/L[1]	–	–
- Malathion	0.002 ug/L[1]	0.05 ug/L[1]	0.002 ug/L[1]	0.05 ug/L[1]	–	–
- Parathion	0.0007 ug/L[1]	0.004 ug/L[1]	0.0007 ug/L[1]	0.004 ug/L[1]	–	–
- Temephos	–	–	–	–	0.0004 ug/L[1]	0.05 ug/L[1]
Pyrethroids	–	–	–	–	–	–
- Esfenvalerate	–	0.001 ug/L[1]	–	0.001 ug/L[1]	–	–
Phenoxy Acid	–	–	–	–	–	–
- 2,4-D	140 ug/L[1]	280 ug/L[1]	140 ug/L[1]	280 ug/L[1]	–	–
- 2.4,5-T	3 ug/L[1]	36 ug/L[1]	3 ug/L[1]	36 ug/L[1]	–	–
Gross Pollutants	–	–	–	–	–	–

Notes:

(1) QWQG 2006

(2) ANZECC 2000

(3) Potential pesticide and herbicide use will be limited to the development site only. In the absence of detailed information on proposed chemical use initial reference monitoring will be limited to an organophosphate pesticide screen. Water quality monitoring during construction and post construction stages will include actual pesticides and herbicides used on-site with the assumption that currently available chemicals would not be present within existing background conditions.

– No published guidelines

3.4 Local Water Quality Guidelines

ANZECC 2000 and QWQG 2006 identify that catchment specific guideline values should be derived over time based on local reference data. The EPA has established a network of water quality monitoring reference points along the Queensland Coastline (QWQG Appendix F). None of these reference points are directly relevant to the five minor coastal catchments that include the Ella Bay Integrated Resort site and access road alignment (Catchment A to Catchment E).

Table 1 summarises identified surface water and groundwater quality monitoring undertaken to date within and adjacent to the development site. It is noted that the limited existing water quality concentrations for one or more monitoring locations exceed the ANZECC 2000 and QWQG 2006 guideline values for a number of parameters (i.e. nitrogen, phosphorous, copper, zinc, aluminium). Given the presence of existing elevated water quality concentrations within the development site, the absence of published guideline values for a range of adopted parameters and the high ecological value of adjacent wetland and marine ecosystems, it is recommended that local guidelines be established for each of the five identified surface water catchment areas (Catchment A to Catchment E).

The procedure for deriving local water quality guidelines is established in Section 3 and Appendix A of the QWQG 2006, including:

1. Determine catchment areas
2. Determine water types
3. Establish reference sites
4. Define indicators of interest
5. Collect reference data
6. Establish guideline values

For the purposes of this Water Quality Monitoring Strategy, items 1, 2 and 4 have been completed in Section 2, Section 3.1 and Section 3.2, respectively of the management strategy. Table 3.4.2 of the QWQG 2006 recommends the at least 2 reference sites for each catchment area and water type and that at least 18 data samples are required over a minimum 12 month period or 12 data samples where three or more reference sites are used. Reference data is therefore required for the following common sub-catchment areas and water quality types.

Catchment	Water Type	Ecosystem Condition
'*Ella Bay Wetlands'* (Catchment B)		
1. Farmland/Wetlands (B1 to B4)	Freshwater Wetland	Slightly to Moderately Disturbed
'*Farm Creek'* (Catchment A)		
2. Farmland (A1 to A4)	Freshwater Upland	Slightly to Moderately Disturbed
3. Beachfront Swale (A5)	Middle Estuary	
'*Health Point'* (Catchment C), '*Flying Fish Point'* (Catchment D), '*Coconuts'* (Catchment E)		
4. Rainforest-Above Road/Urban (C1/D1/E1)	Freshwater Upland	High Value
5. Rainforest-Below Road (C2)	Freshwater Upland	Slightly to Moderately Disturbed
6. Agriculture/Urban (D2/E2)	Freshwater Upland	
7. Coastal Wetland (E3)	Middle Estuary	

3.5 Reference Data Monitoring Program

The reference data monitoring program is based upon collection of 12 data samples over a 12 month period from three reference points within each of the six overall catchment areas. The whole area of each of the seven reference catchments are considered to generally comply with the suitability criteria for reference points provided in Table 3.4.1 of the QWQG. The proposed water quality reference points are summarised below and shown on Figure 6 (Development Site) and Figure 6 (Access Road Alignment). Proposed locations use existing monitoring points, where appropriate.

Catchment	Surface Water	Groundwater
'*Ella Bay Wetlands'* (Catchment B)		
1. Farmland Catchments (B1 to B4)	B-SW01 to B-SW03	Not applicable
'*Farm Creek'* (Catchment A)		
2. Farmland Catchments (A1 to A4)	A-SW04 to A-SW06	A-MW1 to A-MW3
3. Beachfront Swale (A5)	A-SW07 to A-SW09	A-MW4 to A-MW6
'*Health Point'* (Catchment C), '*Flying Fish Point'* (Catchment D), '*Coconuts'* (Catchment E)		
4. Rainforest-Above Road/Urban (C1/D1/E1)	CDE-SW10 to CDE-SW12	Not applicable
5. Rainforest-Below Road (C2)	C-SW13 to CSW15	Not applicable
6. Agriculture/Urban (D2/E2)	D-SW16 to D-SW18	Not applicable
7. Coastal Wetland (E3)	E-SW19 to E-SW20	Not applicable

The Coastal Wetland catchment (E3) only includes two reference sample points, one for each estuarine creek discharge to the Johnstone River Mouth. Local water quality guidelines to based upon the reference data to be collected will be derived in accordance with the methods established in Appendix A of the QWQG 2006 and submitted to relevant regulatory authorities for approval prior to use for construction monitoring purposes.

3.6 Interim Monitoring Criteria

In the absence of documented and approved local water quality guidelines, the following interim criteria are recommend for any disturbance undertaken within the Ella Bay Integrated Resort site and access road alignment.

Water Quality Parameter	Freshwater Upland		Wetland	Middle Estuary
	High Value	Disturbed	Disturbed	Disturbed
Catchments	C, D1, E1	A1 to A4, D2, E2	B1 to B4	A5, E3
Physio-chemical – General				
pH	6.0 to 7.5[2]		6.0 to 8[2]	6.5 to 8.4[2]
Dissolved Oxygen	90 to 100 %[2]		90 to 120 %[2]	80 to 105 %[2]
Turbidity	6 NTU		200 NTU	10 NTU
Physio-chemical – Nutrients				
Ammonia	6 ug/L[2]		10 ug/L[2]	15 ug/L[2]
Oxidised Nitrogen	30 ug/L[2]		10 ug/L[2]	30 ug/L[2]
Organic Nitrogen	125 ug/L[2]		1180 ug/L[2]	200 ug/L[2]
Total Nitrogen	150 ug/L[2]		1200 ug/L[2]	250 ug/L[2]
Filtered Phosphorous	5 ug/L[2]		25 ug/L[2]	5 ug/L[2]
Total Phosphorous	10 ug/L[2]		50 ug/L[2]	20 ug/L[2]
Toxicant – Metals				
Arsenic	1.8 ug/L[1]	37 ug/L[1]	37 ug/L[1]	37 ug/L[1, 3]
Cadmium	0.06 ug/L[1]	0.2 ug/L[1]	0.2 ug/L[1]	5.5 ug/L[1]
Chromium	0.01 ug/L[1]	1.0 ug/L[1]	1.0 ug/L[1]	31.8 ug/L[1]
Copper	1.0 ug/L[1]	1.4 ug/L[1]	1.4 ug/L[1]	1.3 ug/L[1]
Lead	1.0 ug/L[1]	3.4 ug/L[1]	3.4 ug/L[1]	4.4 ug/L[1]
Mercury	0.06 ug/L[1]	0.6 ug/L[1]	0.6 ug/L[1]	0.4 ug/L[1]
Nickel	8 ug/L[1]	11 ug/L[1]	11 ug/L[1]	70 ug/L[1]
Zinc	2.4 ug/L[1]	8 ug/L[1]	8 ug/L[1]	15 ug/L[1]
Aluminium	27 ug/L[1]	55 ug/L[1]	55 ug/L[1]	55 ug/L[1, 3]
Toxicant – Fuels, Oils and Greases				
Oils and Greases	Not Greater than background sample from Catchment B5 (‘*Ella Bay Wetlands*’)			
Benzene	600 ug/L[1]	950 ug/L[1]	950 ug/L[1]	700 ug/L[1]
Xylene	340 ug/L[1]	550 ug/L[1]	550 ug/L[1]	550 ug/L[1, 3]
Toxicant – Pesticides and Herbicides (Development Site Ony)				
- Azinphos methyl	0.01 ug/L[1]	0.02 ug/L[1]	0.02 ug/L[1]	0.02 ug/L[1, 3]
- Clorpyrifos	0.00004 ug/L[1]	0.01 ug/L[1]	0.01 ug/L[1]	0.00005 ug/L[1]
- Diazinon	0.00003 ug/L[1]	0.01 ug/L[1]	0.01 ug/L[1]	0.00003 ug/L[1, 3]
- Dimethoate	0.1 ug/L[1]	0.15 ug/L[1]	0.15 ug/L[1]	0.15 ug/L[1, 3]
- Fenithrothion	0.1 ug/L[1]	0.2 ug/L[1]	0.2 ug/L[1]	0.2 ug/L[1, 3]
- Malathion	0.002 ug/L[1]	0.05 ug/L[1]	0.05 ug/L[1]	0.05 ug/L[1, 3]
- Parathion	0.0007 ug/L[1]	0.004 ug/L[1]	0.004 ug/L[1]	0.004 ug/L[1, 3]
- Temephos	0.05 ug/L[1, 3]	0.05 ug/L[1, 3]	0.05 ug/L[1, 3]	0.05 ug/L[1]
- Esfenvalerate	0.001 ug/L[1, 3]	0.001 ug/L[1]	0.001 ug/L[1]	0.001 ug/L[1, 3]
- 2,4-D	140 ug/L[1]	280 ug/L[1]	280 ug/L[1]	280 ug/L[1, 3]
- 2.4,5-T	3 ug/L[1]	36 ug/L[1]	36 ug/L[1]	36 ug/L[1, 3]
Gross Pollutants	No litter visible and vegetation less than background from Catchment C (‘*Health Point*’)			

Notes:

(1) QWQG 2006

(2) ANZECC 2000

(3) Lowest published guideline value for other water types with equivalent level of disturbance.

4.0 CONSTRUCTION MONITORING STRATEGY

4.1 Background

Given the proposed staged development approach for the Ella Bay Integrated Resort and access road alignment, it is not practical to prepare a single overall water quality monitoring plan for construction works and subsequent operation on the basis that:

- Project planning has only been completed to concept and feasibility stages. Detailed design for each stage of development works has not been undertaken at this time to comprehensively identify and address every potential water quality issue with appropriate mitigation measures.

- Staged construction within the development site and along the access road alignment is likely to be undertaken using a range of individual contractors. Methods of construction, potential risks to water quality and associated water quality management approaches to be adopted are likely to vary between each stage of construction and contractor.

In a similar approach that has been adopted for the Water Quality Management Strategies (THG 2007, THG 2008), the following sections outline the overall water quality monitoring strategies to be adopted to monitor for potential water quality impacts and provide a structure for the preparation of water quality monitoring plans (WQMP) that would be prepared for each stage of works and then approved by appropriate regulatory authorities in conjunction with obtaining individual Operational Works Approvals.

4.2 Responsibilities

For each stage of works the following key responsibilities shall be assigned:

Project Manager:

Responsible for ensuring that the requirements of the WQMP are met for the period of time from the commencement of construction works until the completion of the defects liability period. Specific responsibilities include:

- Inclusion of WQMP in Construction Contracts
- Regulatory Approval of WQMP
- Appointment of a suitably qualified and experienced Water Quality (WQ) Practitioner (internal employee or external consultant).
- Preparation of monitoring reports and submission to relevant regulatory authorities, including identification of Non-Conformances.
- Addressing any non-conformances and implementation of required corrective actions.

Contractor:
Responsible for ensuring that the requirements of the WQMP are met for the period of time from the commencement of construction works until the completion of the defects liability period. Specific responsibilities include: • Arrangement and documentation of training for understanding the requirements of the WQMP for relevant site personnel. • Water management, treatment and monitoring. • Notification of all project Non-Conformances to the Project Manager. • Implementation of Contingency Measures as required. • Preparation of progress reports to the Project manager on the above items.
WQ Practitioner
Responsible to the Project Manager for: • Provision of training to relevant site personnel on WQMP and provision of technical advice as required • Undertaking regular site inspections. • Undertaking routine water quality sampling monitoring and reporting. • Preparation of progress reports on site inspections and validation works including identification of Non-Conformances.

4.3 Water Management

For each stage of construction works it will be necessary to assess potential risks to water quality and then select one or more of the first tier water quality management strategies outlined in THG 2007/THG2008 to address the identified risks.

WQMP's prepared for each stage of construction works shall:

- Describe the first tier water quality management strategies to be adopted.

- Detail the second tier strategies to be implemented during the monitoring program to demonstrate the protection of water quality and respond to issues that may arise.

4.4 Monitoring Parameters

Construction water quality monitoring shall include each of the parameters identified in Section 3.3 as a minimum unless otherwise agreed with regulatory authorities on a stage by stage basis. Monitoring for additional toxicants may be required where identified during detailed design planning.

Assessment of water quality monitoring test results shall be carried out in accordance with Section 4 of the QWQG 2006, with monitoring results considered as follows (refer Figure 4.1.1 of the QWQG 2006:

- Physio-chemical parameters: Short term non-compliance
- Toxicant parameters: Medium term non-compliance

4.5 Monitoring Locations and Frequency

Water quality monitoring shall be undertaken during the construction period and subsequent defect liability period for each stage of works. For the purposes of water quality management, the defect liabilities period shall be at least two years from the completion of construction works, except where it can be demonstrated to regulatory authorities for specific stages of works that a shorter time period would be adequate to identify actual water quality impacts that may occur. Water quality monitoring to be undertaken for each stage of construction works shall generally comply with the following sampling frequency approach.

Monitoring Locations	Sampling Frequency
Development Site	
Surface Water:	
• Established Reference Locations (Catchment A & Catchment B)	• Construction Period o Weekly: Physio-chemical Parameters o Monthly: All Parameters • Defects Liability Period(2) o Bi-Monthly: All Parameters
• Construction/Disturbance Areas(1) o Each Local Discharge Location o Background/ Upgradient Location	• Construction Period – First Three Months o Daily: Physio-chemical Parameters o Weekly: All Parameters • Construction Period – 4 to 6 Months(2) o Bi-Daily: Physio-chemical Parameters o Bi-Weekly: All Parameters • Construction Period – 6+Months(2) o Twice Weekly: Physio-chemical Parameters o Monthly: All Parameters • Defects Liability Period(2) o Rainfall Event (>100 mm): Physio-chemical Parameters o Bi-Monthly: All Parameters

Monitoring Locations	Sampling Frequency
Development Site (continued)	
Groundwater:	
• Established Reference Locations	• Construction Period o Weekly: Physio-chemical Parameters/ Water Levels o Monthly: All Parameters/Water Levels • Defects Liability Period(2) o Bi-Monthly: All Parameters/ Water Levels
Access Road Alignment	
Surface Water:	
• Established Reference Locations (Catchment C to Catchment E)	• Construction Period o Weekly: Physio-chemical Parameters o Monthly: All Parameters • Defects Liability Period o Bi-Monthly: All Parameters
• Construction/Disturbance Areas(1) o Each Local Discharge Location o Background/ Upgradient Location	• Construction Period – First Three Months o Daily: Physio-chemical Parameters o Weekly: All Parameters • Construction Period – 4 to 6 Months(2) o Bi-Daily: Physio-chemical Parameters o Bi-Weekly: All Parameters • Construction Period – 6+Months(2) o Twice Weekly: Physio-chemical Parameters o Monthly: All Parameters • Defects Liability Period(2) o Rainfall Event (>100 mm): Physio-chemical Parameters • Bi-Monthly: All Parameters

Notes:

(1) The number and location of construction/disturbance specific surface water and groundwater monitoring locations required for each stage of construction works would be documented in each respective WQMP.

(2) Reduction in monitoring frequencies shall only occur where existing monitoring data is relatively consistent and does not identify environmental impacts are occurring.

4.6 Corrective Actions and Complaints

A non-conformance is a failure to meet specific performance indicators or deviation from the requirements of the WQMP. For management of this project, non-conformances shall be characterised as follows:

- Major Non-Conformance: Issues that could potentially have or have already had an adverse effect on the surrounding natural environment. Triggers include:
  - Aesthetic impact (i.e. turbidity)
  - Consistent physio-chemical non-compliance
  - Toxicant testing non-compliance
- Minor Non-Conformance Other deviations from the WQMP or single incidents where performance indicators are not met.

Responses to a Major Non-Conformance shall include:

- Ceasing relevant works
- Notification of relevant regulatory authorities (i.e. Council, Queensland EPA, DEWHA).
- Implement WQMP Corrective Actions. These would typically include:
  - Preventing further impacted water discharge
  - Implementation and/or rectification of approved water quality mitigation measures
  - Undertaking incident specific water treatment to remove identified impact
- Site inspection and specialist advice from a suitably qualified practitioner.
- Development of specific Corrective Actions and discussion/approval with relevant authorities (i.e. Council, Queensland EPA, DEWHA).

Responses to Minor Non-Conformances shall include:

- Notification of the Project Manager.
- Review of works practices and implementation of appropriate Corrective Actions.
- Seeking advice of a suitably qualified practitioner, as required.
- Monthly reporting of Minor Non-Conformances and Corrective Actions.

Concerns raised by the community (or other parties) will be directed to the Project Manager. The Project Manager will maintain a register to record the following information:

1. Contact details: Name, address and phone number of party raising concern.

2. Nature of concern: Details of issue/incident.

3. Action taken or required: Details of action proposed or undertaken to address the concern, including time and date.

4. Response to action: Was the party raising the concern satisfied with the outcome, if not, what else needs to be done, or is it outside the scope of the development works.

5. Prevention of re-occurrence: If the concern relates directly to an operational problem, what corrective action has been taken to ensure the problem will not occur again.

4.7 Auditing and Reporting

The Project Manager will be responsible for ensuring that an auditing program of the WQMP is implemented during construction works. The audit program shall aim to ensure that all parties comply with the WQMP and relevant statutory requirements.

During the construction works, the WQ Practitioner shall conduct regular auditing of activities and management measures. Given the expected construction period, a weekly auditing schedule is recommended. The frequency of these audits may gradually decrease if a high level of compliance with the WQMP is evident.

The audit shall take the form of a visual inspection of the site and associated control measures and a review of monitoring data. A written record of auditing undertaken shall be maintained, including details on the date of the audit, activities undertaken, observations made and any non-conformances identified. A copy of the audit report shall be forwarded to the Contractor within 2 days of the audit.

A Water Quality Monitoring (WQM) Report shall be prepared monthly by the WQ Practitioner that includes:

- Water quality monitoring results
- Routine auditing results
- Summary of non-compliance/complaints and corrective actions

Copies of the monthly WQM Report shall be provided to:

- Project Manager
- Contractor
- Relevant Regulatory Authorities (i.e. Council, Queensland EPA, DEWHA).

5.0 OPERATION MANAGEMENT STRATEGY

5.1 Access Road Alignment

Although the Ella Bay Integrated Resort will remain under an overall group title management system with limited responsibilities by the various levels of government, it is anticipated that following the completion of a defects liability period, the access road alignment located within public road reserves would result in the hand over to full local government control.

It is anticipated that no further routine monitoring would be undertaken for the access road unless an environmental incident occurred such as a fuel spillage. Management of such incidents would be the responsibility of government agencies using strategies development for similar public roads adjacent to coastal areas within the Wet Tropics Region.

5.2 Environmentally Relevant Activities

Within the development site there may be a number of Environmental Protection Act (1994) Environmentally Relevant Activities (ERA) or Water Act (2000) requirements that will trigger licensing and associated statutory water quality management and monitoring plans such as:

- On-site wastewater treatment plant discharge.
- Recycling of treated effluent within the golf course and other open space areas.
- Bulk fuel storage.
- Waste Recycling and Transfer Stations
- Groundwater extraction and aquifer recharge (water supply, air-conditioning, etc)

Preparation of water quality management and monitoring plans for each ERA or water supply would be undertaken in conjunction with obtaining appropriate approvals and licenses from regulatory authorities and have not been considered further for this strategy document.

5.3 Ella Bay Integrated Resort

Water quality monitoring undertaken within the development site during the defects liability period for each stage of construction works should provide for the identification and rectification of most potential ongoing water quality issues that may result from initial design and/or operational planning limitations. In the event that ongoing environmental impact is identified, the defect liability monitoring programs would be extended beyond the initial two year period until each water quality issue had been appropriately rectified.

Long term general water quality monitoring within the development site following the completion of the defects liability period would need to comprise the following elements:

- Surface water sampling at the boundaries between:
    - Farm Creek and Farm Creek Beachfront Swale.
    - Farm Creek Beachfront Swale and Ella Bay.
    - Each surface water discharge point into the Ella Bay Wetland Catchment.
- Shallow groundwater sampling at three locations adjacent to the Farm Creek Beachfront Swale.
- Collection of samples at quarterly intervals.
- Testing for at least the physio-chemical grouping, pesticides and herbicides..
- Yearly reporting to regulatory authorities.

It is anticipated that most of this long term monitoring programming would be required for licensing for ERA's and/or water use. The actual locations for long term monitoring would need to be determined based upon the detailed design and completed construction of the development site.

6.0 LIMITATIONS OF THIS REPORT

This report has been prepared in accordance with the agreement between White Beech Pty Ltd and Golder Associates Pty Ltd (Golder Associates). The services performed by Golder Associates have been conducted in a manner consistent with the level of quality and skill generally exercised by members of its profession and consulting practice. No warranty or guarantee of site conditions is intended.

This report is solely for the use of White Beech Pty Ltd, Ella Bay Developments Pty Ltd and relevant government assessment agencies and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses. This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Golder Associates.

The information in this report is considered to be accurate at the date of issue in accordance to the current conditions of the site. Subsurface conditions can vary across a particular site which cannot be explicitly defined by investigation. Therefore, it is unlikely that the results and estimations expressed in this report will represent the extremes of conditions within the site.

Attached as Appendix B is a document "Important Information About Your Geo-Environmental Report" which should be read in conjunction with this report. We would be pleased to answer any questions about this important information.

GOLDER ASSOCIATES PTY LTD

James Begg
Senior Environmental Engineer

Paul Scells
Principal

JSB/PKS/cps
J:\ENV\2008\087673008 - WATER QUALITY & MONITORING, ELLA BAY\CORRESPONDENCE OUT\087673008 001\087673008 001 R REV1 WATER QUALITY MONITORING STRATEGY.DOC

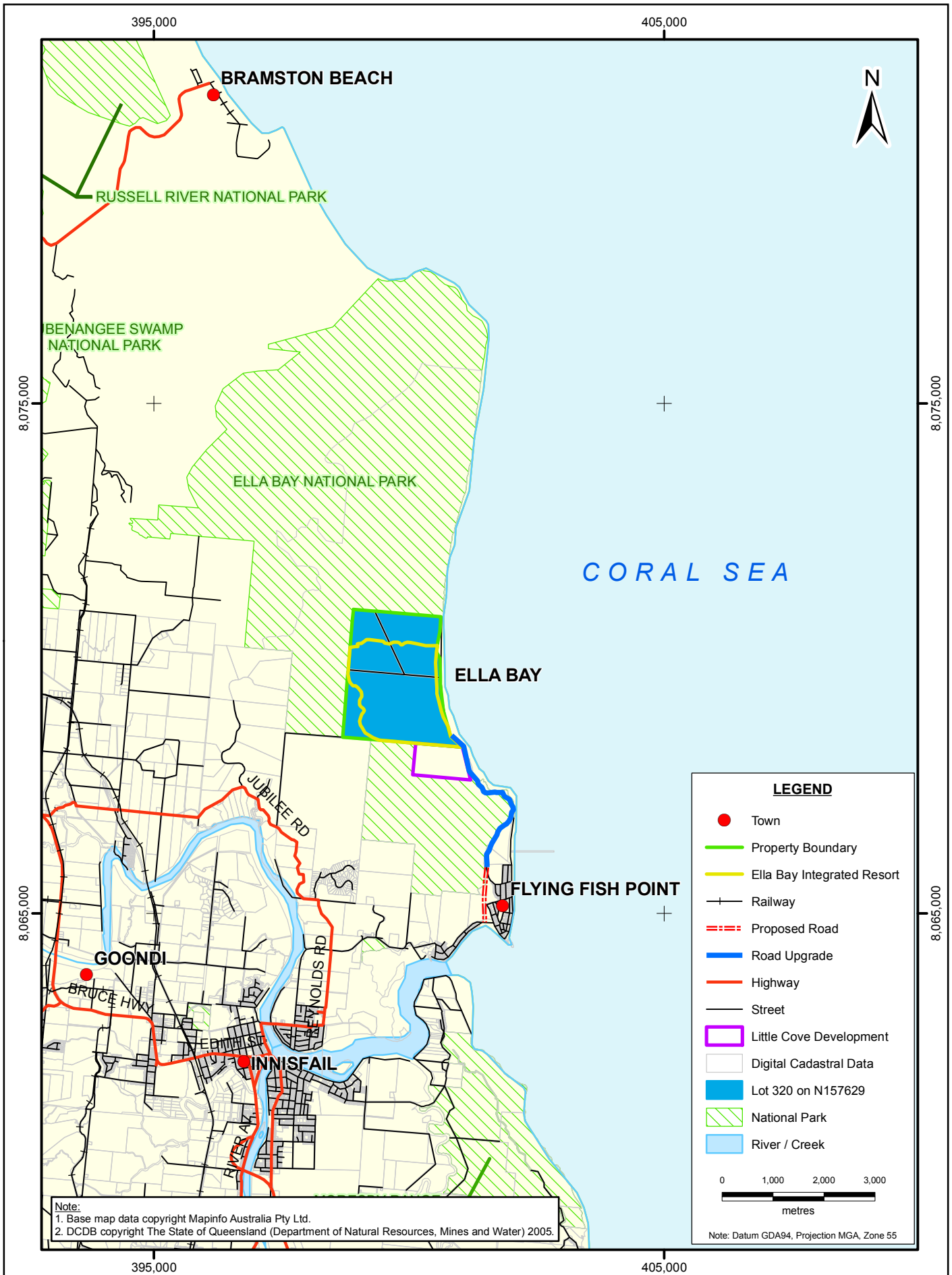
Station Name	Collect Date	Collect Season	pH* pH units	EC* µS/cm	Ammonia Nitrogen ug/L	Total Kjeldahl Nitrogen ug/L	Total Oxidised Nitrogen ** ug/L	Total Nitrogen ug/L	Total Phosphorus (as P)*** ug/L	Arsenic ug/L	Cadmium ug/L	Chromium ug/L	Copper ug/L	Lead ug/L	Nickel ug/L	Zinc ug/L	Mercury ug/L	Aluminium ug/L	Iron ug/L	Total Iron ug/l
A-SW1 (LCSW1)	13/11/2006	End of Dry	6.7	70	<50	120	<50	120	<20	<5	<0.2	<2	<1	<2	<2	5	<0.2	<50	490	1000
	22/05/2007	End of Wet	7.0	46	<50	140	**90**	**240**	<20	<5	<0.2	<50	<10	<2	<50	6	<0.2	**160**	220	300
A-SW2 (LCSW2)	13/11/2006	End of Dry	6.5	73	**50**	140	<50	140	<20	<5	<0.2	<2	<1	<2	<2	7	<0.2	<50	550	1000
	22/05/2007	End of Wet	6.9	42	<50	110	**70**	**180**	<20	<5	<0.2	<50	<10	<2	<50	<5	<0.2	**220**	190	300
A-SW3 (LCSW3)	13/11/2006	End of Dry	6.8	79	**70**	120	**150**	**270**	<20	<5	<0.2	<2	<1	<2	<2	**12**	<0.2	<50	<50	230
	22/05/2007	End of Wet	6.9	42	<50	120	**230**	**350**	<20	<5	<0.2	<50	<10	<2	<50	5	<0.2	**780**	<50	<50
A-MW1 (MW1)	14/11/2006	End of Dry	5.9	42	<50	160	**60**	**220**	**340**	<5	<0.2	<2	<1	<2	<2	6	<0.2	<50	<50	48000
	22/05/2007	End of Wet	5.8	35	<50	200	**50**	**250**	**170**	<5	<0.2	<50	<10	<2	<50	<5	<0.2	**350**	<50	<50
A-MW2 (MW2)	14/11/2006	End of Dry	5.6	91	<50	190	<50	**190**	**120**	<5	<0.2	<2	**3**	<2	<2	**12**	<0.2	<50	<50	9800
	22/05/2007	End of Wet	5.7	49	<50	730	<50	**730**	**270**	<5	<0.2	<50	<10	<2	<50	<5	<0.2	**210**	<50	<50
A-MW4 (MW3)	14/11/2006	End of Dry	5.3	86	**50**	270	<50	**270**	**490**	<5	<0.2	<2	<1	<2	<2	**62**	<0.2	<50	<50	11000
	22/05/2007	End of Wet	5.0	17	<50	510	<50	**510**	**390**	<5	<0.2	<50	<10	<2	<50	**11**	<0.2	**370**	1400	1000
Freshwater Upland - Slightly to Moderately Disturbed			**6.0-7.5**	-	**6**	-	**30**	**150**	**10**	**37**	**0.2**	**1**	**1.4**	**3.4**	**11**	**8**	**0.6**	**55**	-	-
Freshwater Wetland - Slightly to Moderately Disturbed			**6.0-8.0**	-	**10**	-	**10**	**350-1200**	**10-50**	**37**	**0.2**	**1**	**1.4**	**3.4**	**11**	**8**	**0.6**	***55***	-	-
Middle Estuary - Slightly to Moderately Disturbed			**6.5-8.4**	-	**15**	-	**30**	**250**	**20**	-	**5.5**	**31.8**	**1.3**	**4.4**	**70**	**15**	**0.4**	**-**	-	-

Note:

Golder Associates

TABLE 1
SUMMARY OF WATER TEST RESULTS
Ella Bay Developments Pty Ltd
Ella Bay Integrated Resort
Ella Bay

Input By: AOB
Date: 10/03/2008
Checked By: PKS
Date: 10/03/2008



Golder Associates	CLIENT: Satori Resorts Ella Bay Pty Ltd	PROJECT: ELLA BAY INTERGRATED RESORT WATER QUALITY MONITORING STRATEGY	
	DRAWN: JEH / DATE: 7/03/08	TITLE: **SITE LOCATION PLAN**	
	CHECKED: JSB* / DATE: 7/03/08		
	SCALE: 1:100,000	PROJECT No: 087673008-001	FIGURE No: 1 / REV No: R1 / A4

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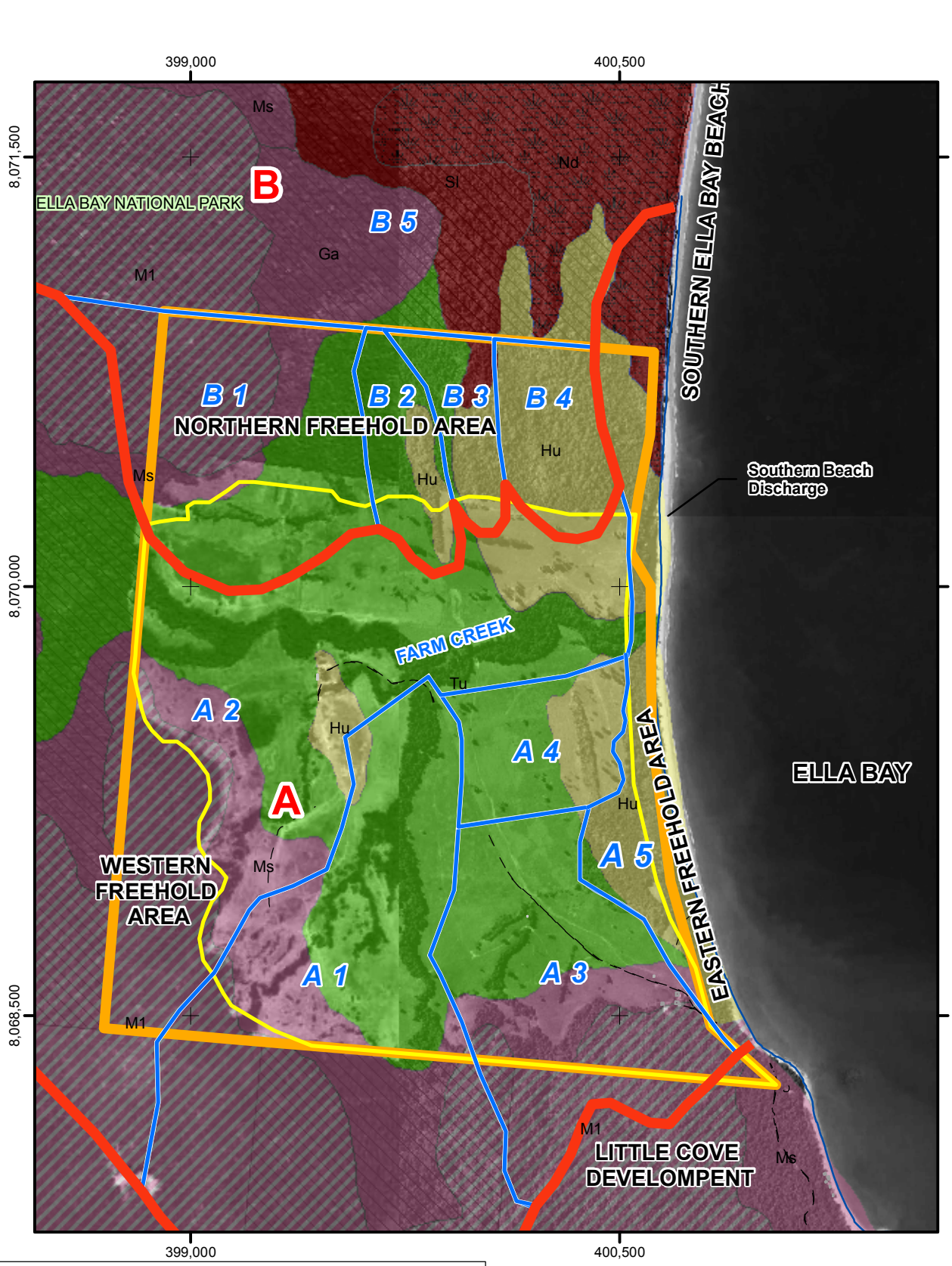
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.



LEGEND

- Catchment Area
- Property Boundary
- Site Boundary
- A1 Sub-Catchment Boundary
- National Park

Soils

- Ga Galmara
- Hu Hull
- M1 Mountainous
- Ms Mission
- Nd Nind
- Sl Sumalea
- Tu Tully

0 200 400 600 800 metres

Note: Datum GDA94, Projection MGA, Zone 55

Note:
1. Base map data copyright Mapinfo Australia Pty Ltd.
2. Aerial photography copyright The State of Queensland (Department of Natural Resources and Mines) 2002.

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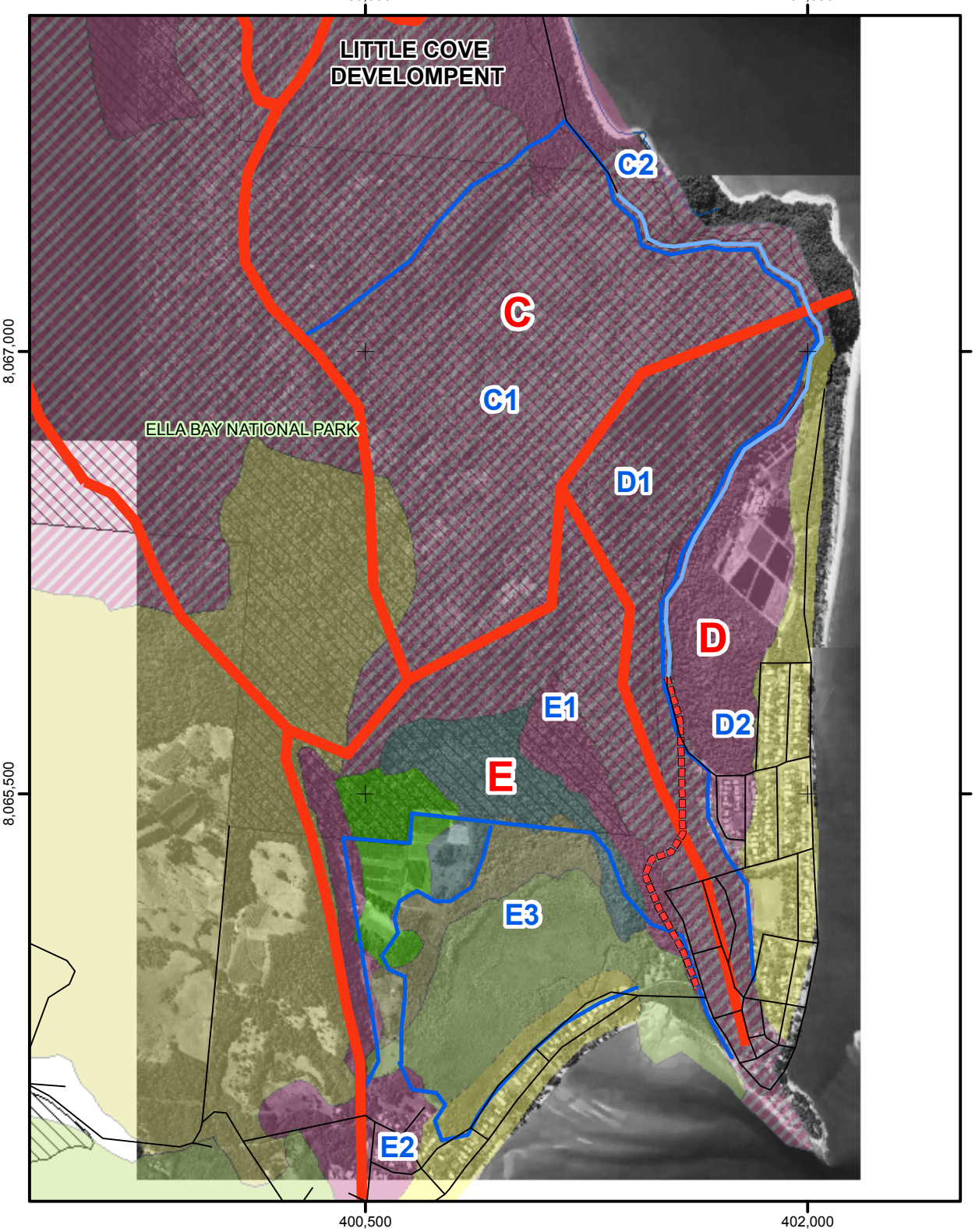
CLIENT	Satori Resorts Ella Bay Pty Ltd	PROJECT	Ella Bay Intergrated Resort Water Quality Monitoring Strategy
DRAWN	JEH/BAG	DATE	20/03/08
CHECKED	JSB*	DATE	7/03/08
TITLE	DEVELOPMENT LOCATION PLAN		
SCALE	1:20,000	PROJECT No	087673008-001
FIGURE No	2	REV No	R1
			A4

File Location: S:\GIS_Jobs\Cairns.08\3ENV08\087673008_EllaBay\GIS\Projects\087673008-001-SiteLocationPlan-Fig2Rev1-A4
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.



Legend

- Bi Bingil
- Co Coom
- He Hewitt
- Hu Hull
- M1 Mountainous
- Mg
- Mi Mission
- Tu Tully
- UpgradedRoads
- Street
- ProposedRoad
- Catchments
- D1 Subcatchment Boundaries

0 150 300 450 600 750
metres

Note: Datum GDA94, Projection MGA, Zone 55

Note:
1. Base map data copyright Mapinfo Australia Pty Ltd.
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CLIENT: Satori Resorts Ella Bay Pty Ltd		PROJECT: Ella Bay Integrated Resort Water Quality Monitoring Strategy	
DRAWN: JEH/BAG	DATE: 20/03/08	TITLE: ACCESS ROAD LOCATION PLAN	
CHECKED: JSB*	DATE: 20/03/08		
SCALE: 1:20,000		PROJECT No: 087673008-001	FIGURE No: 3 REV No: R1 A4

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Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.

LEGEND

Groundwater Units

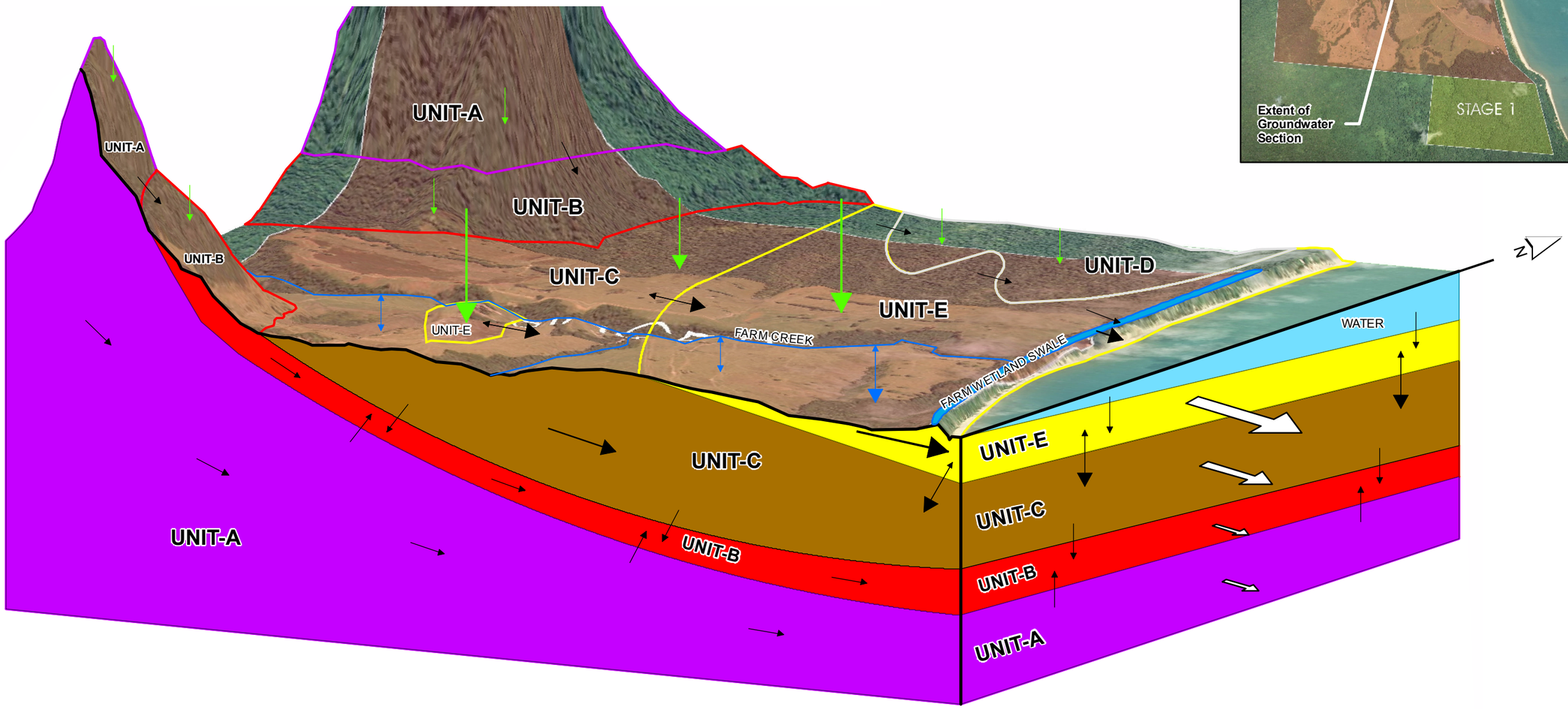
- Lake / Creek
- UNIT A: Meta-sediments
- UNIT B: Residual/Colluvium
- UNIT C: Alluvial Clays
- UNIT D: Swamp Clays
- UNIT E: Beach Sands
- Water

Flow Direction

- Groundwater
- Rainfall
- Surface water interchange
- Off-site discharge

Groundwater Volume

- High: >50% of total
- Moderate: <50% and >25% of total
- Low: <25% and >5% of total



CLIENT: Ella Bay Developments Pty Ltd		PROJECT: ELLA BAY INTEGRATED RESORT WATER QUALITY MONITORING	
DRAWN: AOB	DATE: 9/7/07	TITLE: **CONCEPTUAL GROUNDWATER MODEL**	
CHECKED: JSB*	DATE: 9/7/07		REV No
SCALE: Not To Scale		PROJECT No: 087673008	FIGURE No: 4 R0

Golder Associates

File Location: S:\GIS_Jobs\Cairns.07\3env07\077673018_EllaBay\GIS\Projects\ArcGIS\001-077673018-R-Fig05-GroundwaterSection-Rev0-A3.mxd

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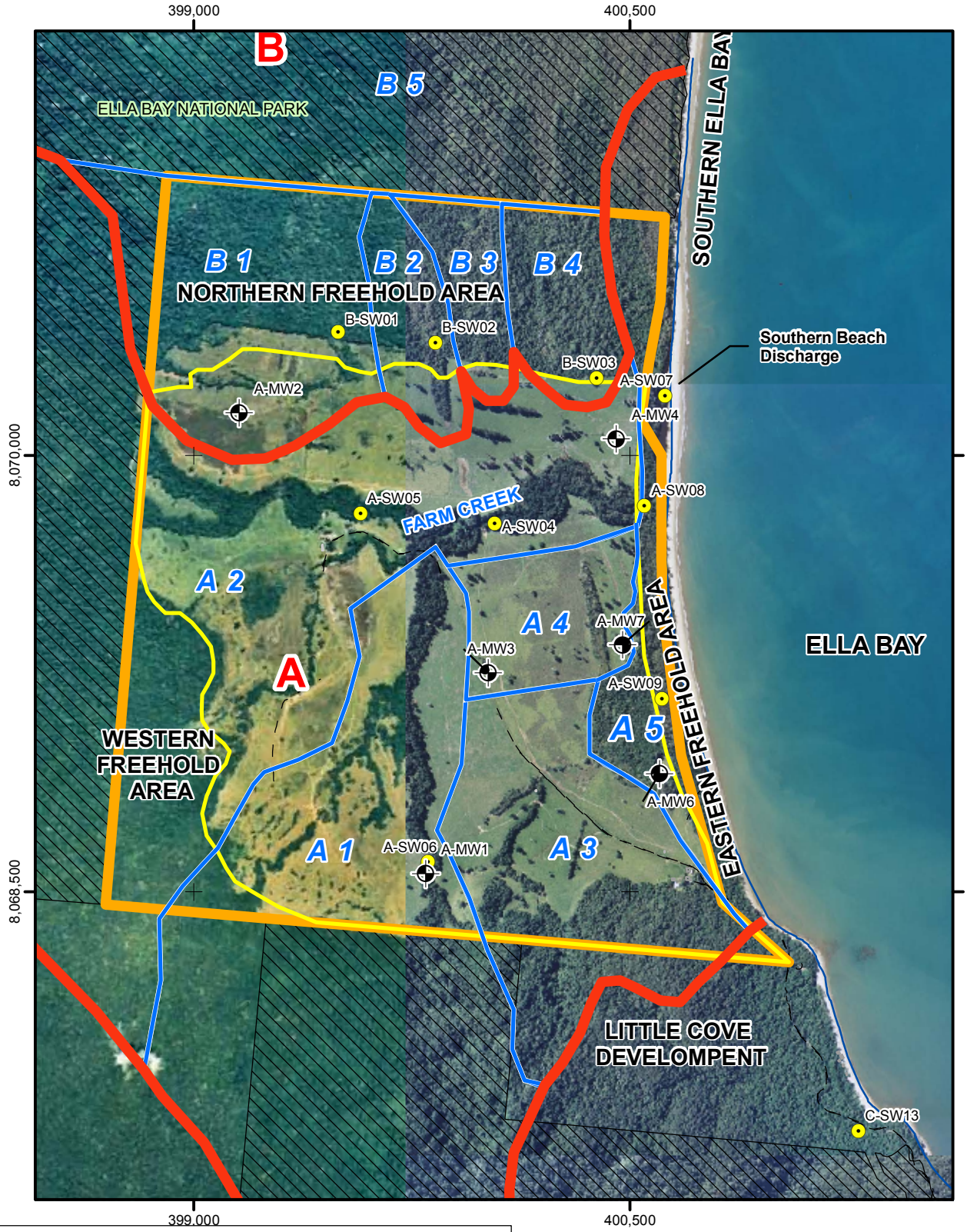

LEGEND

- Catchment Area
- A1 Sub-Catchment Boundary
- Property Boundary
- Site Boundary
- National Park
- Monitoring Well
- Surface Monitoring Location

0 200 400 600 800

metres

Note: Datum GDA94, Projection MGA, Zone 55

Note:
1. Base map data copyright Mapinfo Australia Pty Ltd.
2. Aerial photography copyright The State of Queensland (Department of Natural Resources and Mines) 2002.

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CLIENT	Satori Resorts Ella Bay Pty Ltd	PROJECT	Ella Bay Intergrated Resort Water Quality Monitoring Strategy
DRAWN	BAG	DATE	20/03/08
CHECKED	JSB*	DATE	20/03/08
SCALE	1:20,000	TITLE	DEVELOPMENT LOCATION PLAN
PROJECT No	087673008-001	FIGURE No	5
REV No	R1		A4

File Location: S:\GIS_Jobs\Cairns.08\3ENV08\087673008_EllaBay\GIS\Projects\087673008-001-SiteLocationPlan-Fig5Rev1-A4.mxd
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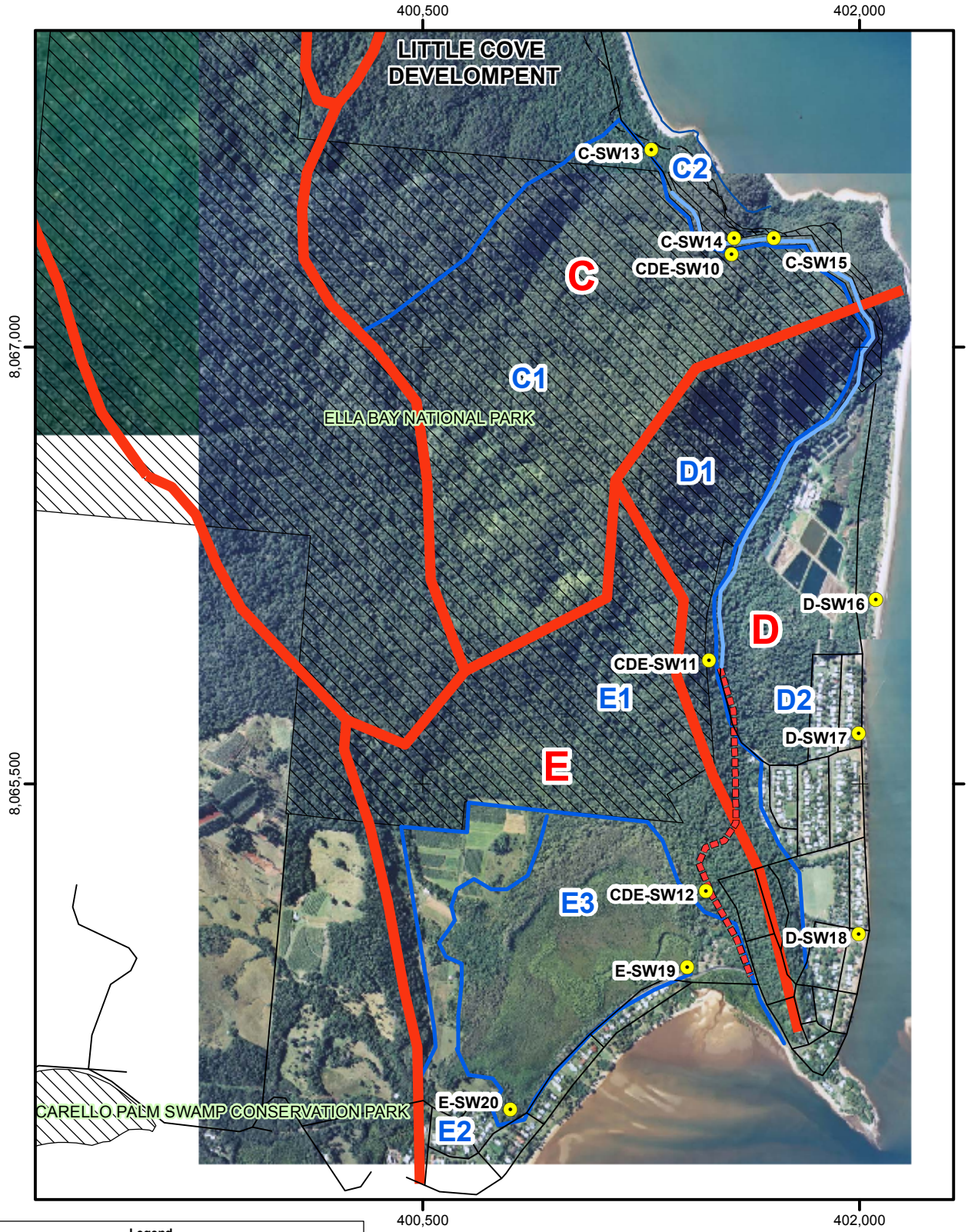


Note:
1. Base map data copyright Mapinfo Australia Pty Ltd.
2. Aerial photography copyright The State of Queensland (Department of Natural Resources and Mines) 2002.

Golder Associates

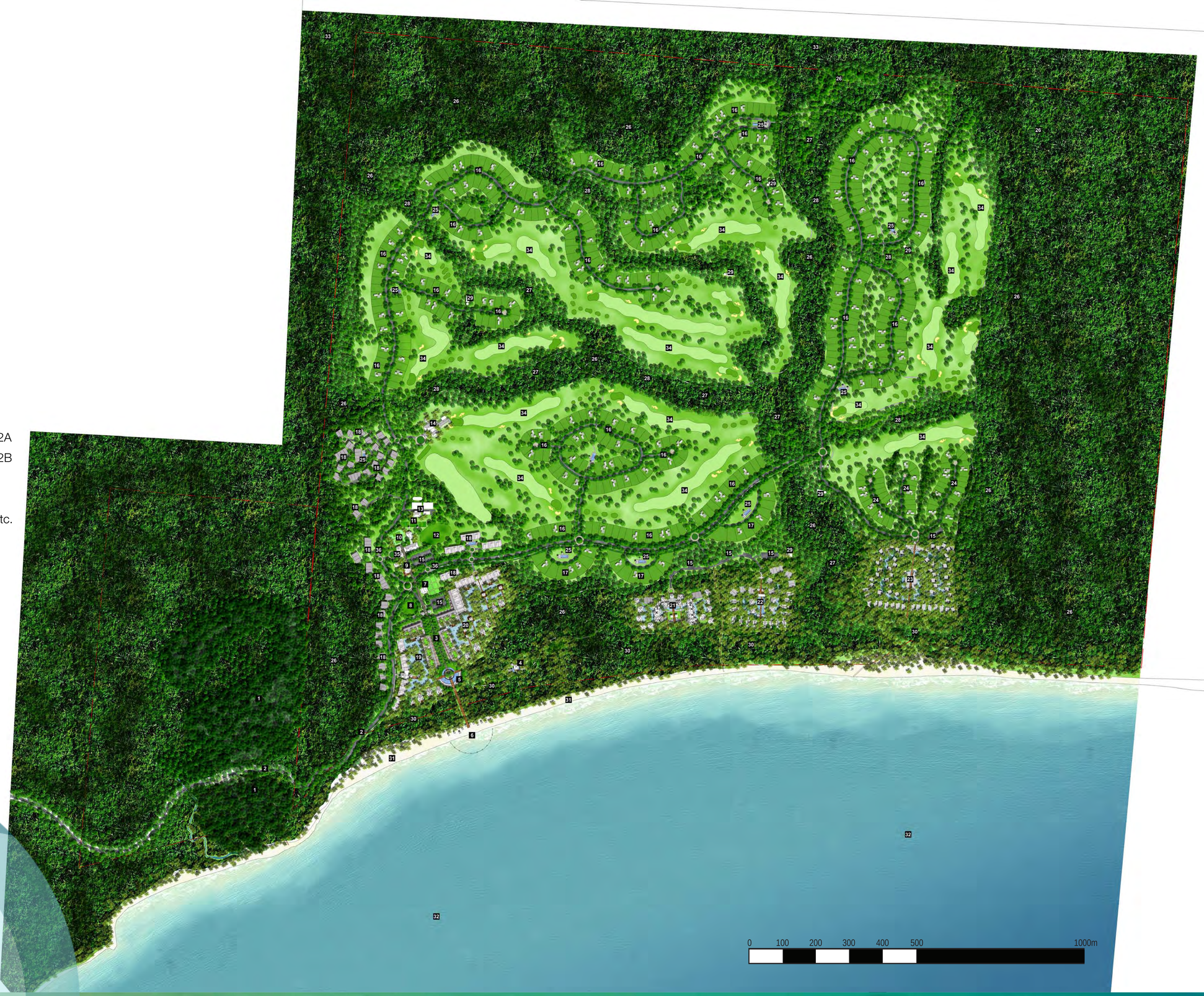
CLIENT	Satori Resorts Ella Bay Pty Ltd	PROJECT	Ella Bay Integrated Resort Water Quality Monitoring Strategy
DRAWN	JEH/BAG	DATE	20/03/08
CHECKED	JSB*	DATE	20/03/08
TITLE	ACCESS ROAD LOCATION PLAN		
SCALE	1:20,000	PROJECT No	087673008-001
FIGURE No	6	REV No	R1
			A4

File Location: S:\GIS_Jobs\Cairns.08\3ENV08\087673008_EllaBay\GIS\Projects\087673008-001-SiteLocationPlan-Fig6Rev0-A4.mxd
Note: The * beside the typed initials denotes the original drawing issue was signed or initialled by that respective person.

APPENDIX A

ELLA BAY INTEGRATED RESORT
CONCEPT MASTER PLAN

1. existing approved development
2. coastal access road
3. village centre - retail / commercial precinct / pedestrian plaza
4. eco day spa facilities
5. public pool facility
6. protected public swimming zone
7. community centre and garden plots
8. village green
9. welcome centre
10. education facility / institute of sustainability / private school
11. rainforest rehabilitation nursery
12. sports oval
13. core utilities site
14. 18 hole golf clubhouse
15. car parking
16. detached dwelling residential lots (min. 800m2)
17. special purpose residential apartment lots- 3 dwellings/lot
18. 3 storey residential units apartments blocks
19. beachfront resort development parcel R1A
20. beachfront resort development parcel R1B
21. medium density eco beachfront resort development parcel R2A
22. medium density eco beachfront resort development parcel R2B
23. low density eco beachfront resort development parcel R3
24. detached dwelling residential lots (min. 500m2)
25. neighbourhood recreation facility - pool, multipurpose room etc.
26. existing vegetation preserved
27. watercourses preserved, rehabilitated and/or enhanced
28. rehabilitated fauna corridor
29. infrastructure zone - including sewer
30. minimum 110m wide foreshore protection zone
31. ella bay beach
32. coral sea
33. world heritage listed national park
34. 18 hole championship golf course
35. community recycle centre
36. access control point



Ella Bay
masterplan report

Satori Resorts Ella Bay Pty Ltd
Concept Masterplan

February 2008
job no. 045800

ELLA BAY
satori resorts
DBI DESIGN

APPENDIX B

"IMPORTANT INFORMATION ABOUT YOUR GEO-ENVIRONMENTAL REPORT"

Important Information About Your

Geo-environmental Report

These notes have been prepared by Golder Associates Pty Ltd using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences, of which Golder Associates Pty Ltd is a member. They are offered to help you in the interpretation of your Geo-environmental Report.

Geo-environmental studies are commissioned to gain information about environmental conditions on and beneath the surface of a site. The more comprehensive the study, the more reliable the assessment is likely to be. But remember, any such assessment is to a greater or lesser extent based on professional opinions about conditions that cannot be seen or tested. Accordingly, no matter how much data is accumulated, risks created by unanticipated conditions will always remain. *Have realistic expectations.* Work with your Geo-environmental consultant to manage known and unknown risks. Part of that process should already have been accomplished, through the risk allocation provisions you and your Geo-environmental professional discussed and included in your contract's general terms and conditions. This document is intended to explain some of the concepts that may be included in your agreement, and to pass along information and suggestions to help you manage your risk.

Beware of Change; Keep Your Geo-environmental Professional Advised

The design of a Geo-environmental study considers a variety of factors that are subject to change. Changes can undermine the applicability of a report's findings, conclusions, and recommendations. *Advise your Geo-environmental professional about any changes you become aware of them.* Geo-environmental professionals cannot accept responsibility or liability for problems that occur because a report fails to consider conditions that did not exist when the study was designed. Ask your Geo-environmental professional about the types of changes you should be particularly alert to. Some of the most common include:

- modification of the proposed development or ownership group,
- sale or other property transfer,
- replacement of or additions to the financing entity,
- amendment of existing regulations or introduction of new ones, or
- changes in the use or condition of adjacent property

Should you become aware of any change, *do not rely on an existing Geo-environmental report.* Advise your Geo-environmental professional immediately; follow the professional's advice.

Recognize the Impact of Time

A Geo-environmental professional's findings, recommendations, and conclusions cannot remain valid indefinitely. The more time that passes, the more likely it is that important latent changes may occur. *Do not rely on a Geo-environmental report if too much time has elapsed since it was completed.* Ask your environmental professional to define "too much time." In the case of Phase I Environmental Site Assessments (ESAs), for example, more than 180 days after submission is generally considered "too much."

Prepare To Deal with Unanticipated Conditions

The findings. recommendations, and conclusions of a Phase I ESA report typically are based on a review of historical information, interviews, a site "walkover," and other forms of noninvasive research. When site subsurface conditions are not sampled in any way, the risk of unanticipated conditions is higher than it would otherwise be.

While borings, installation of monitoring wells, and similar invasive test methods can help reduce the risk of unanticipated conditions, *do not overvalue the effectiveness of testing.* Testing provides information about actual conditions only at the precise locations where samples are taken, and only when they are taken. Your Geo-environmental professional has applied that specific information to develop a general opinion about environmental conditions. *Actual conditions in areas not sampled may differ (sometimes sharply) from those predicted in a report.* For example, a site may contain an unregistered underground storage tank that shows no surface trace of its existence. *Even conditions in areas that were tested can change,* sometimes suddenly, due to any number of events, not the least of which include occurrences at adjacent sites. Recognize, too, that *even some conditions in tested areas may go undiscovered,* because the tests or analytical methods used were designed to detect only those conditions assumed to exist.

Manage your risks by retaining your Geo-environmental professional to work with you as the project proceeds. Establish a contingency fund or other means to enable your Geo-environmental professional to respond rapidly, in order to limit the impact of unforeseen conditions. To

help prevent any misunderstanding, identify those empowered to authorize changes and the administrative procedures that should be followed.

Do Not Permit Any Other Party To Rely on the Report

Geo-environmental professionals design their studies and prepare their reports to meet the specific needs of the clients who retain them, in light of the risk management methods that the client and Geo-environmental professional agree to, and the statutory, regulatory, or other requirements that apply. The study designed for a developer may differ sharply from one designed for a lender, insurer, public agency ... or even another developer. *Unless the report specifically states otherwise, it was developed for you and only you.* Do not unilaterally permit any other party to rely on it. The report and the study underlying it may not be adequate for another party's needs, and you could be held liable for shortcomings your Geo-environmental professional was powerless to prevent or anticipate. Inform your Geo-environmental professional when you know or expect that someone else - a third-party will want to use or rely on the report. *Do not permit third-party use or reliance until you first confer with the Geo-environmental professional who prepared the report.* Additional testing, analysis, or study may be required and, in any event, appropriate terms and conditions should be agreed to so both you and your Geo-environmental professional are protected from third-party risks. *Any party who relies on a Geo-environmental report without the express written permission of the professional who prepared it and the client for whom it was prepared may be solely liable for any problems that arise.*

Avoid Misinterpretation of the Report

Design professionals and other parties may want to rely on the report in developing plans and specifications. They need to be advised, in writing, that their needs may not have been considered when the study's scope was developed, and, even if their needs were considered, they might misinterpret Geo-environmental findings, conclusions, and recommendations. *Commission your Geo-environmental professional to explain pertinent elements of the report to others who are permitted to rely on it, and to review any plans, specifications or other instruments of professional service that incorporate any of the report's findings, conclusions, or recommendations.* Your Geo-environmental professional has the best understanding of the issues involved, including the fundamental assumptions that determined the study's scope.

Give Contractors Access to the Report

Reduce the risk of delays, claims, and disputes by giving contractors access to the full report, *providing that it is accompanied by a letter of transmittal that can protect you* by making it unquestionably clear that: 1) the study was not conducted and the report was not prepared for purposes of bid development, and 2) the findings, conclusions, and recommendations included in the report are based on a variety of opinions, inferences, and assumptions and are subject to interpretation. Use the letter to also advise contractors to consult with your Geo-environmental professional to obtain clarifications, interpretations, and guidance (a fee may be required for this service), and that-in any event-they should conduct additional studies to obtain the specific type and extent of information each prefers for preparing a bid or cost estimate. Providing access to the full report, with the appropriate caveats, helps prevent formation of adversarial attitudes and claims of concealed or differing conditions. If a contractor elects to ignore the warnings and advice in the letter of transmittal, it would do so at its own risk. Your Geo-environmental professional should be able to help you prepare an effective letter.

Do Not Separate Documentation from the Report

Geo-environmental reports often include supplementary documentation, such as maps and copies of regulatory files, permits, registrations, citations, and correspondence with regulatory agencies. If subsurface explorations were performed, the report may contain final boring logs and copies of laboratory data. If remediation activities occurred on site, the report may include: copies of daily field reports, waste manifests, and information about the disturbance of subsurface materials, the type and thickness of any fill placed on site, and fill placement practices, among other types of documentation. *Do not separate supplementary documentation from the report. Do not, and do not permit any other party to redraw or modify any of the supplementary documentation for incorporation into other professionals' instruments of service.*

Understand the Role of Standards

Unless they are incorporated into statutes or regulations, standard practices and standard guides developed by the American Society for Testing and Materials (ASTM) and other recognized standards-developing organizations (SDOs) are little more than aspirational methods agreed to by a consensus of a committee. The committees that develop standards may not comprise those best qualified to establish methods and, no matter what, no standard method can possibly consider the infinite client and project-specific variables that fly in the face of the theoretical "standard conditions" to which standard practices and standard guides apply. In fact, these variables can be so pronounced that Geo-environmental professionals who comply with every directive of an ASTM or other standard procedure could run foul of local custom and practice, thus violating the standard of care.

Accordingly, when Geo-environmental professionals indicate in their reports that they have performed a service "in general compliance" with one standard or another, it means they have applied professional judgement in creating and implementing a scope of service designed for the specific client and project involved, and which follows some of the general precepts

laid out in the referenced standard. To the extent that a report indicates "general compliance" with a standard, you may wish to speak with your Geo-environmental professional to learn more about what was and was not done. *Do not assume a given standard was followed to the letter.* Research indicates that that seldom is the case.

Realize That Recommendations May Not Be Final

The technical recommendations included in a Geo-environmental report are based on assumptions about actual conditions, and so are preliminary or tentative. Final recommendations can be prepared only by observing actual conditions as they are exposed. For that reason, you should retain your Geo-environmental professional to observe construction and/or remediation activities on site, to permit rapid response to unanticipated conditions. *The Geo-environmental professional who prepared the report cannot assume responsibility or liability for the report's recommendations if that professional is not retained to observe relevant site operations.*

Understand That Geotechnical Issues Have Not Been Addressed

Unless geotechnical engineering was specifically included in the scope of professional service, a report is not likely to relate any findings, conclusions, or recommendations about the suitability of subsurface materials for construction purposes, especially when site remediation has been accomplished through the removal, replacement, encapsulation, or chemical treatment of on-site soils. The equipment, techniques, and testing used by geotechnical engineers differ markedly from those used by Geo-environmental professionals; their education, training, and experience are also significantly different. If you plan to build on the subject site, but have not yet had a geotechnical engineering study conducted, your Geo-environmental professional should be able to provide guidance about the next steps you should take. The same firm may provide the services you need.

Read Responsibility Provisions Closely

Geo-environmental studies cannot be exact; they are based on professional judgement and opinion. Nonetheless, some clients, contractors, and others assume Geo-environmental reports are or certainly should be unerringly precise. Such assumptions have created unrealistic expectations that have led to wholly unwarranted claims and disputes. To help prevent such problems, Geo-environmental professionals have developed a number of report provisions and contract terms that explain who is responsible for what, and how risks are to be allocated. Some people mistake these for "exculpatory clauses," that is, provisions whose purpose is to transfer one party's rightful responsibilities and liabilities to someone else. Read the responsibility provisions included in a report and in the contract you and your Geo-environmental professional agreed to. They are important.

Rely on Your Geo-environmental Professional for Additional Assistance

Membership in ASFE exposes Geo-environmental professionals to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a Geo-environmental project. Confer with your ASFE-member Geo-environmental professional for more information.