

APPENDIX 1

SUPPLEMENTARY ABORIGINAL CULTURAL HERITAGE ASSESSMENT

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***Proposed Coffs Harbour Water Treatment Plant,
140 Upper Orara Road, Karangi, NSW mid-north coast***

Supplementary Aboriginal cultural heritage assessment

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Prepared on behalf of :

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1 INTRODUCTION

Coffs Harbour City Council (Council) proposes to construct and operate a Water Treatment Plant facility at 140 Upper Orara Road, Karangi (Lot 2 DP 1083920), 12 kilometres inland of Coffs Harbour on the NSW mid-north coast (Figure 1). This Aboriginal cultural heritage assessment supplements an earlier report (Collins 2007) that supported a recommendation for subsurface archaeological testing made by Coffs Harbour and District Local Aboriginal Land Council (CHLALC) and Gumbula Julipi Elders Aboriginal Corporation representatives following an inconclusive surface inspection of the subject property. The consultant was engaged by Council to undertake the subsurface investigation in conjunction with the CHLALC and Gumbula Julipi Elders, and the results of this investigation are presented here.

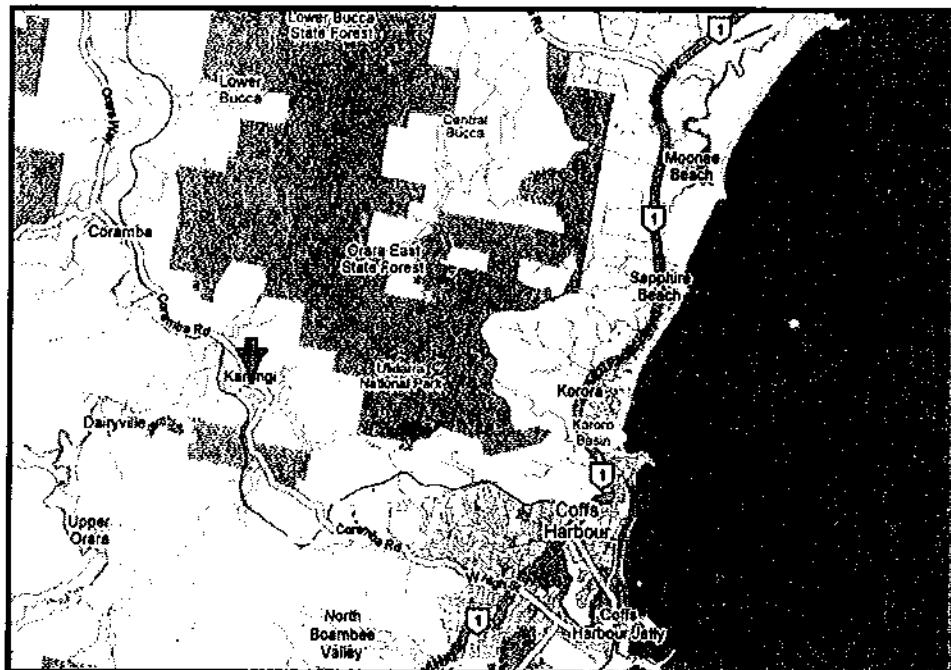


Figure 1. General location of Karangi on the NSW mid-north coast
(Source: Google map data, MapData Sciences Pty Ltd 2007)

1.1 Location of the study area

140 Upper Orara Road, Karangi ('the study area'), is located 1.25 kilometres west of Karangi, between Karangi Dam (750 metres south-west) and the Orara River (250 metres north). It is bounded to the south by Upper Orara Road, and by cleared farmland on the other sides. An

electricity sub-station has been constructed on the northern end of an easterly adjacent spur (Figure 2).

1.2 Project description

The proposed Coffs Harbour Water Treatment Plant would directly impact less than 2.5 hectares of land, and involve the construction of a range of facilities, including buildings, tanks, pumps and a lagoon, as well as connecting roadways. As illustrated in Figure 3, some of these facilities would be constructed on a level platform excavated into the eastern portion of the property.

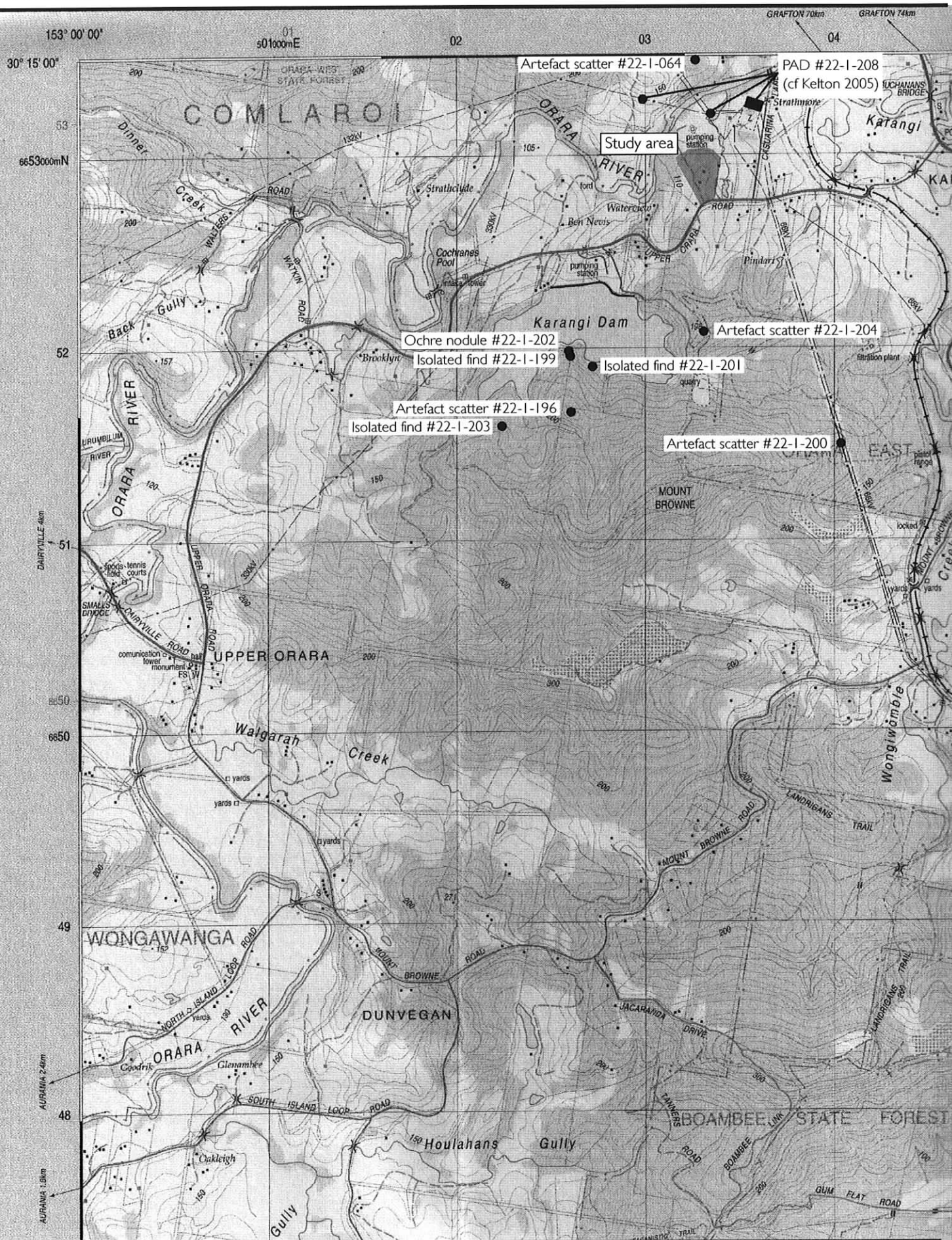
The Water Treatment Plant would initially be developed in a single stage, including its necessary connection to other existing water supply infrastructure in the local vicinity. Provision has also been made in the current design for areas that would allow for the future expansion of the plant's capacity, if required, via the addition of further process units.

1.3 Legislative background

The Coffs Harbour Water Treatment Plant proposal will be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), which provides an approval process specific to major projects.

Under the auspices of Part 3A, authorisations for an approved project, including permits and consents under Section 87 and Section 90 (Part 6) of the *National Parks and Wildlife Act 1974*, are not required for project-related works that may impact on Aboriginal cultural heritage. However, the NSW Department of Planning will take account of heritage issues and consult with the NSW Department of Environment and Climate Change (DECC) to ensure that any such issues are duly considered prior to granting project approval.

In the absence of the requirement for a Section 87 permit, the subsurface investigation described in Section 5 of this report was undertaken following receipt of verbal advice from the DECC to proceed. Council will need to manage Aboriginal cultural heritage issues in accordance with the specific conditions of approval imposed by the Minister for Planning. These may include the management recommendations presented in Section 10.



2 ENVIRONMENT AND LANDUSE EFFECTS

The study area lies within the escarpment ranges landsystem, where it comprises one of a series of small spurs that extend north from the foot of Mount Browne into the narrow valley of the upper Orara River. Mount Browne itself rises to an altitude of 350 metres AHD on a prominent peak 1.5 kilometres further south.

The study spur features a narrow, level to low-gradient crest elevated at 115 to 117 metres AHD, which broadens at its terminal end where a house is situated. The spur is defined to the east (beyond the study boundary) by a highly modified seasonal gully that separates it from a more substantial spur on which a TransGrid electricity sub-station has been built. Although surface contours are largely intact, the spur has been cleared of its original rainforest vegetation (cf Davies 2004) for past dairying and cultivation purposes, and is now dominated by grass cover. Further disturbance has been caused by the construction of a large shed and cattle yards on the spur crest, and dairy bails on the western slope.

The study area forms part of the Megan Soil Landscape unit, characterised by strongly acid, stony and highly erodible red and brown earths and podzolic soils that have developed on the late Carboniferous metasediments of the Coffs Harbour association (Milford 1999). This association includes greywacke, siliceous argillite, and some quartz, chert and jasper (Korsch 1980), all potential sources of raw material for the production of Aboriginal flaked stone tools. However, no rock outcrops or other possible stone sources (surface pebbles etc) occur in the study area itself, and the topsoil comprises a similar organic dark brown loam as identified on the adjacent easterly spur (Kelton 2005).

3 ABORIGINAL COMMUNITY BACKGROUND, INVOLVEMENT AND CONSULTATION

3.1 Cultural background

Karangi lies within the traditional country of Gumbaingirr-speaking people, who inhabited a wide area from the Clarence River to at least as far south as the Nambucca (Enright 1934; Smythe 1949; Eades 1979; Godwin 1990). At the time of first European contact, the Gumbaingirr comprised a number of distinct but interrelated groupings of people, each associated with a defined geographical area. These groups shared economic resources, trading and ceremonial

occasions, intermarried, and spoke a mutually intelligible language, even though differences of dialect or speech, of local territorial association, and some cultural practices varied from one group or locality to another. As stated by McDougall (1900:116), "each tribe kept its own belt of country, and separated into small camps, and only collected together on special occasions".

During the course of everyday life, resource exploitation seems to have been undertaken by family groups (cf Henderson 1851; Lane 1970:5.2) and often several families would co-operate to form a highly flexible 'band' that would gather or disperse as conditions demanded (Godwin 1990:97). Away from the coast, camps were shifted "about monthly as the game in the immediate vicinity became exhausted ... it took several months to give each ground in the locale its turn" (McFarlane 1934-5). Base camps were established in areas protected from the elements by dense vegetation (McFarlane 1935). According to Dawson (1935), "the middle of each day was spent around the fire where the venison or game was procured, and the remnant of the meal ... was carried back to camp for evening consumption". On the basis of this description it seems that base camps would have been situated in sheltered areas offering suitable conditions, with a large number of small resource-specific sites scattered between.

Early European sources indicate that most of the Aboriginal population centred on the coastline, coastal alluvial plains and major river corridors, despite the rapid appropriation of these landsystems by timber-getters and farmers. While Aboriginal people were undoubtedly present in the escarpment ranges (cf Hodgkinson in Hobson 1978:5), historic accounts suggest low population numbers in comparison to the coastal landsystems. Even so, a large camp was situated at Bagawa, near the confluence of the Orara River and Bucca Bucca Creek some 20 kilometres north of Karangi (Holder 1984:20). Bagawa is said to have provided a summer complement to the coast, used as a base for hunting excursions along the streams and up into the ranges (Holder 1984:20-22). In the Karangi area, there were apparently few Aboriginal residents (Kelly 1987), although many passed through "on their way to somewhere else" (Secomb 1986:46). According to Secomb, this movement was undertaken via long-established tracks.

Aboriginal landuse patterns were substantially modified in the decades following European incursion, as traditional lands were invaded and freedom to move through the country was progressively restricted. By the last decade of the 19th century the fertile flats along the Orara River had been taken up for dairying, corn and pig production, and gold mining was underway on the eastern slopes of Mount Browne little more than a kilometre south of the study area (England 1976). Aboriginal people were often employed in the area, primarily as timber 'spotters' (A. Hope pers comm.).

Despite a decline in population numbers and the massive changes brought about by European settlement, many local Gumbaingirr were able to maintain traditional knowledge of and associations with the landscape. In addition to important ceremonial and meeting places, information relating to such things as travelling routes, resource use and relationships to land has been handed down through the generations (Goulding 2001).

3.2 Compliance with DECC 'Interim Aboriginal Community Consultation Requirements'

The 'Interim Aboriginal Community Consultation Requirements' prescribe DECC requirements in relation to Part 3A (EP&A Act) approvals and the preparation of applications for permits and consents under Part 6 of the *National Parks and Wildlife Act 1974*. In summary, these requirements outline a number of steps that need to be taken to ensure that a transparent and informed Aboriginal consultation process is implemented prior to issue of the relevant approval/s.

Notification and registration of interests

In accordance with the Interim Requirements, notification of the development proposal and the consultant's intention to prepare an Aboriginal cultural heritage assessment report was mailed to the organisations listed below, inviting the registration of groups and/or individuals wishing to be involved in the assessment process.

- Coffs Harbour and District LALC
- Gumbula Julipi Elders Aboriginal Corporation
- Registrar of Aboriginal Owners, NSW Department of Aboriginal Affairs
- NSW Native Title Services
- The General Manager, Coffs Harbour City Council
- NSW Department of Environment and Climate Change (formerly the Department of Environment and Conservation)

On the 7th of October 2006, a newspaper notice was also published in the 'Coffs Harbour Advocate', inviting interested Aboriginal parties to contact Coffs Harbour City Council to formally register their interest in the project.

Responses were received from the Coffs Harbour and District LALC and the Gumbula Julipi Elders Corporation. The DECC advised that an additional opportunity to register interest should be extended to:

- The Garby Elders Corporation
- Yarrawarra Aboriginal Corporation
- The (former) Mudjay Elders

Phone contact was subsequently made with Tony Perkins, Chairperson of the Garby Elders, and Tim Cowan, Manager of the Jalumbo Cultural Heritage Research Unit, Yarrawarra Aboriginal Corporation, inviting involvement in the assessment process. Both advised that Karangi is not within their group's area of knowledge or interest, and that the Gumbula Julipi Elders are the most appropriate group to consult in relation to Karangi. In the absence of a phone contact, a letter inviting involvement and detailing the project and proposed assessment methodology was sent to Steven Hart, spokesperson for the Mudjay Elders, asking for a written or verbal (phone) response. No response was received.

As a result of the above process, the Coffs Harbour and District LALC and Gumbula Julipi Elders were formally endorsed as registered Stakeholders in relation to this assessment. These are the same two groups initially engaged by Council to inspect the Water Treatment Plant site, and who recommended the subsurface archaeological testing that gave rise to this report.

Assessment methodology

As required, the proposed assessment and subsurface testing methodology was mailed to the registered Stakeholders, seeking comments with a view to informing and refining this methodology. Given that it had been discussed and developed in the field with the direct involvement of Stakeholder representatives, the proposed methodology was accepted unmodified (no responses received).

Drafting, review and finalisation of this report

A draft copy of this report was supplied to the CHLALC and Gumbula Julipi Elders and comments/suggested revisions invited. However, the Stakeholders advised that no amendments were necessary. Correspondence received from Stakeholders is reproduced in Appendix C.

3.3 Aboriginal cultural heritage values of the Karangi locality

To assess traditional and contemporary Aboriginal cultural heritage values, consultation was undertaken with Elders and knowledge-holders identified by the registered Stakeholder groups as having any potential attachments to, or relevant information about, the wider Karangi/Mount Browne locality and/or the study area in particular.

These individuals included Gumbula Julipi Elders Ken Craig, Ken Nayda and Mark Flanders, local research historian Arlene Hope, and Dee Murphy, Project Officer for the Jalumbo Cultural Heritage Research Unit, Yarrawarra Aboriginal Corporation.

Consultation undertaken in conjunction with this assessment revealed Mount Coramba, a registered natural mythological site (#22-1-004) situated 4.5 kilometres north-east of the study area, to be the most culturally-significant site in the Coffs Harbour hinterland. The only other identified place of ceremonial, mythological or otherwise sacred significance is a women's site associated with pools at Bangalor Falls on the Urumbilum River (a tributary of the Orara), 10.75 kilometres south-west of the study area. Cochranes Pool, in the Orara River approximately two kilometres upstream of the study area, was also reportedly always spoken of by the old people, but the degree and nature of its traditional significance is unknown. In more recent times, Cochranes Pool was used as a 'washing place' by the Flanders family (cf Goulding 2001).

Upper Orara-Karangi is valued as a marchland area, which contained a network of traditional walking trails that followed the main ridgelines between the Bellinger and Clarence Rivers and connected the inland ranges with the coast at Bonville, Boambee and Coffs Harbour. Many of these trails were later used by bullock teams and some have since been developed as modern-day roads. None of the known transit routes are located in or near the study area.

A number of campsites used at the time of first European contact (and presumably long before) are known to have been situated close to waterways in the Upper Orara-Karangi locality. These include camps along Wongiwomble Creek at the eastern foot of Mount Browne, along Houlahans Gully south of Mount Browne, and on the site of the Karangi Public School, beside Karangi Creek 1.25 kilometres north-east of the study area.

Individuals and small family groups continued to occupy bush camps well into the 20th century, with many of the remembered camps dating from the 1940s, 50s and 60s. Both these camps and a range of other types of historic Aboriginal sites and attachments have been researched and mapped by Goulding (2001). An analysis of historic camp locations revealed the majority to have been situated on crown land reasonably close to the coastline. Camps further inland tended to be on public land in or near towns where there were accessible water supplies. A significant proportion of camps were established at a place of work or in walking distance of work, but others were used seasonally for recreation purposes, or in response to the availability of certain resources (Goulding 2001:64). Although none of the historic or otherwise significant sites mapped by Goulding occur in or close to the study area, the present consultation revealed the site of the Karangi timber mill, on the opposite side of Karangi Creek 200 metres north of the Public School, to have historical links with a known individual. This was a camping place used by the late Harry

Buchanan, a well-known and highly regarded Gumbaingirr identity, who worked as a timber-cutter in the area during the first half of the 20th century.

In the more immediate study locality, Aboriginal Stakeholders advised that the most significant features are the archaeological sites recorded in the vicinity of Karangi Dam. Further camping grounds and burials are believed to exist on the slopes of Mount Browne and all of these would be of Aboriginal cultural/social value as a physical link with the traditional and/or historic past.

Although of some general heritage value, Stakeholders assessed the low-density distribution of artefacts detected within the study area itself to have a low level of cultural/social significance, and recommend that the proposed Water Treatment Plant be developed as planned without further Aboriginal heritage constraints. Stakeholders advised that impacts on Aboriginal cultural/social values have been satisfactorily mitigated through the conduct of the subsurface investigation and the community education information that this investigation has provided. The results of both the present and other recent subsurface investigations in the Coffs Harbour area have allowed for a more comprehensive understanding of traditional landuse patterns than has been possible in the past (when subsurface investigations were rarely undertaken). Stakeholders intend to use the educational information generated by these investigations to assist with the identification of future development proposals that may impact on Aboriginal cultural/social values, and to direct their decisions with regard to the implementation of management strategies appropriate to the affected landforms.

4 ARCHAEOLOGICAL CONTEXT

4.1 Past archaeological work

A number of archaeological surveys/investigations have been conducted in response to past development proposals in the Karangi locality. These are reviewed in this section and provide an insight to the types, frequency and environmental context of sites that have been recorded. Numbers in brackets (#n) refer to DECC site identification codes.

Field surveys

In 1990, Navin and Officer surveyed a 60 metre wide transmission line easement between Karangi and Grafton. This easement runs down the spine of a major spur that extends north from Mount Browne west of Karangi Dam, crossing the Orara River just downstream of Cochran's Pool and continuing north across high timbered ridges and cleared valleys. Seventeen artefact scatters, one stone quarry and a scarred tree were recorded between Karangi and Glenreagh,

mostly on ridgelines and associated knolls and spurs. Closest to the present study area was a scatter of five artefacts (#22-1-049) on a ridgeline saddle 1.25 kilometres to the north-west.

In 1994, Navin surveyed approximately 35 hectares of moderate to steeply-graded ridge slopes surrounding Karangi Dam. One retouched chert artefact (#22-1-199) was detected in a re-deposited context on an excavated slope above the dam.

Also surveyed was a transmission line easement, which extends inland from Coffs Harbour and across the eastern slopes of Mount Browne to terminate at the TransGrid sub-station on the spur immediately east of the study area (Mills 1997). No Aboriginal sites were detected along this section of the easement, although the crest of a spur on the eastern side of Mount Browne was considered to have some further archaeological potential.

An 8-15 metre wide pipeline route between the site of the Shannon Creek Dam near Grafton and Karangi Dam was surveyed by Officer and Navin in 1998. In the southern section, this route traverses ridge slopes, spurs and valley flats from Glenreagh to the Orara River. It then skirts along the western edge of the study spur (beyond the western boundary) to reach Upper Orara Road and Karangi Dam beyond. Four scatters of between two and five artefacts, two isolated artefact finds, one scarred eucalypt tree and three PADs (potential archaeological deposits) were recorded south of Glenreagh. All of the known artefact sites occurred on the crests of spurs fringing the Orara River valley, while the identified PADs were associated with elevated banks adjacent to streamlines.

In 2004, a survey was undertaken by the CHLALC in response to the proposed maintenance and construction of access tracks/fire breaks within 138 hectares of forest on the northern slopes of Mount Browne, above Karangi Dam. This survey resulted in the recording of two artefact scatters (#22-1-196 containing seven artefacts; and #22-1-204 containing 19 artefacts), two isolated mudstone cores and an isolated nodule of red ochre, all on spurlines. A burial site was also pinpointed close to Karangi Dam, but the source of information relating to the whereabouts of this burial was not reported (CHLALC 2004:11 [map]).

The most wide-ranging survey work so far completed in the Coffs Harbour hinterland has been that done by Davies (1993) as part of the Environmental Impact Assessment for the Coffs Harbour-Urunga Forestry Management Areas. Davies divided the management areas into landsystems and conducted sample surveys in each. Some limited area inspection was undertaken, but Davies' survey was largely geared to locating open surface sites detectable on vehicle track exposures. Although targeting areas considered to have high archaeological potential, her survey strategy was explicit in its recording of a wide range of site/environmental

associations and provides valuable data on the distribution and density of stone artefact occurrences.

Across the management areas as a whole, artefact scatters and isolated artefacts were generally found on flat to gently-sloping ground, primarily on the crests of dry forested spurs. Site frequencies varied with inland distance, with most sites associated with the escarpment ranges west of the Orara River. Despite the higher frequency of artefact occurrences in the escarpment ranges, however, these tended to have fewer artefacts (most often only a single find) than sites closer to the coast (Davies 1993:58-59).

As designated by Davies, the Orara East State Forest, which takes in the eastern slopes of Mount Browne, falls within the 'coastal ranges' landsystem, where artefact occurrences were found to occur at a density of 0.37 per kilometre of linear survey route ('trajectory'), or 16.59 artefacts per hectare (Davies 1993:Table 10). In all, three isolated artefacts and four artefact scatters were recorded in the 'coastal ranges'. Of the artefact scatters, two comprised three artefacts, while the other two comprised 12 and 31 artefacts. Given the low density of material at these sites, Davies believes them to most likely represent transitory rather than base camps. During her survey Davies (1993) covered 19 kilometres of forestry trails in the 'coastal ranges', although none of these were within the Orara East State Forest.

Subsurface investigations

The results of archaeological test excavations conducted by Kelton (2005) on two proposed transmission line tower locations and the site of an extension to the TransGrid sub-station (PAD #22-1-208; see Figure 1), located on the shoulder and western edge of a similar but broader spur immediately east of the present study area, are of particular relevance to this assessment.

Kelton's subsurface testing was undertaken using a 60 centimetre diameter backhoe-mounted auger supplemented by hand shovelling where necessary. The surface ('A') soil horizon was removed as a single spit to an average depth of 10 centimetres. Excavated sediments were sieved through 10 and 2.5 millimetre mesh screens, and sieve residues examined for artefact materials. In all, four auger holes were excavated on each of the proposed tower locations, but these were sterile of archaeological evidence. A systematic grid of 107 auger holes was excavated across the most potentially sensitive (undisturbed and reasonably level) parts of the 130 metre by 100 metre sub-station extension. Seven of these yielded stone artefacts, resulting in the recovery of nine artefacts from the 22 square metres of surface area directly sampled (ie a density of one artefact per 2.44 square metres).

The recovered stone assemblage comprised seven unmodified flakes, one flake fragment and a multi-platform core made on tuff/chert and silcrete. Despite an absence of stone cortex on any of these artefacts, Kelton (2005:32) asserts that a local stream source for the raw stone materials cannot be discounted, and reports finding a nearby location in the Orara River bed that contains water-worn pebbles of these same materials.

Kelton concluded that the overall low density of artefacts detected on the proposed sub-station extension was probably reflective of an 'edge effect' associated with Aboriginal occupation of the spur crest proper. This crest had already been impacted by construction of the existing sub-station and Casuarina Lane, which extends the length of the spur between Upper Orara Road and the Orara River.

4.2 Registered sites

Table 1. DECC registered sites within five kilometres of the study area

Site #	Site name	Site type	No artefacts	Environmental context
21-3-014	CH-G 3	Artefact scatter	7	Ridge crest
21-3-154	Scrimshaw	Artefact scatter	?	Ridge upper slope
22-1-004	Mt Coramba	Natural myth	N/a	Prominent mountain
22-1-049	CH-G 1	Artefact scatter	5	Ridge crest
22-1-050	CH-G 2	Artefact scatter	3	Ridge crest
22-1-054	Coramba	Scarred tree	N/a	Ridge upper slope
22-1-064	Orara River 1	Artefact scatter	2	Spurline knoll crest
22-1-110	SKP A15	Artefact scatter	>5	Spur crest near river
22-1-112	SKP IF5	Isolated find	1	Spurline knoll
22-1-135	Rosebank 1	Scarred tree	N/a	Upper spur slope
22-1-159	Wilson property	Scarred tree	N/a	Spur mid-slope
22-1-196	Karangi Dam 1	Artefact scatter	7	Spurline knoll crest
22-1-199	Karangi Dam IF1	Isolated find	1	Spur mid-slope
22-1-200	Karangi TransGrid	PAD	?	Spur crest
22-1-201	Karangi Dam 2	Isolated find	1	Spur mid-slope
22-1-202	Karangi Dam 3	Isolated find	1	Spur mid-slope
22-1-203	Karangi Dam 4	Isolated find	1	Spur upper slope
22-1-204	Karangi Dam 5	Artefact scatter	19	Spur crest and upper slope
22-1-208	TransGrid PAD	Subsurface artefact scatter	9	Spur upper slope

DECC Aboriginal Heritage Information Management System

As listed in Table 1, 19 Aboriginal sites have been registered to date on the DECC Aboriginal Heritage Information Management System (AHIMS) within a five kilometre radius of the study area, including 10 artefact scatters, five isolated finds, three scarred trees and a natural mythological site. All of the registered artefact sites are associated with ridge and spur landforms, occurring on crests, knolls, upper slopes and mid-slopes (Table 1).

None of the registered sites are located within the study area itself, but as outlined in Section 4.1 above, nine stone artefacts were recovered during a subsurface investigation of PAD #22-1-208, on an adjacent spur above the Orara River.

Other heritage registers

Searches of the Australian Heritage Database maintained by the Department of Environment and Heritage, the NSW State Heritage Register, and Heritage Items of the North Coast Regional Environmental Plan (Schedule 2), and Coffs Harbour Local Environmental Plan (Schedule 5) revealed no listed Aboriginal sites or places in or close to the study area.

4.3 Surface inspection of the study area

A full surface inspection of the study area was completed by CHLALC senior sites officer (and Gumbula Julipi Elder) Mark Flanders and Gumbula Julipi Elder Ken Nayda on the 6th of September 2006. No archaeological materials were detected, but surface visibility was negligible due to extensive grass cover.

Given the well-known archaeological sensitivity of level spur crests, the recovery of artefacts on the adjacent spur (Kelton 2005), and the number of artefact occurrences so far recorded during limited surveys on the northern ridges, spurs and slopes of Mount Browne, it was concluded that the study area had the potential to contain subsurface evidence of Aboriginal occupation (particularly stone artefacts) of possible cultural, educational and scientific value. Subsurface testing was recommended to more reliably determine the area's archaeological context and overall level of significance.

To develop a mutually-agreeable methodology for the subsurface testing, the study area was re-inspected by the consultant and Mark Flanders on the 18th of September 2006. Surface visibility was still very low, and subsurface investigation was thus considered the only viable means of assessing cultural heritage/archaeological potential. It was agreed that the investigation aims could be best achieved through employment of the methodology outlined in Section 5.2 of this report.

5 ARCHAEOLOGICAL TEST EXCAVATIONS

The archaeological test excavations detailed in this section were undertaken by the consultant with the direct involvement of four representatives of the CHLALC and Gumbula Julipi Elders (the registered Stakeholder groups) on the 21st, 22nd and 23rd of May, 2007. During this period, Mr Dean Slaverio (Affordable Bobcat Hire), who has extensive mechanical archaeological excavation experience in the Coffs Harbour region and artefact detection capabilities, operated the excavating machine and assisted with sieving.

5.1 Justification and research design

Advice from Aboriginal Stakeholders and other key individuals consulted during the course of this assessment indicated that development of the proposed Water Treatment Plant would have no direct or indirect impact on any known sites or places of cultural heritage significance (cf Section 3.3). However, Stakeholders considered the study area to have the potential to contain undetected evidence of past Aboriginal occupation that may be significant in demonstrating traditional lifeways, providing a material link with Gumbaingirr ancestors. As advised by these Stakeholders, the existence and significance of any site within the study area could only be reliably assessed on the basis of the results of a subsurface archaeological investigation.

Following an analysis of all known site locations in the Coffs Harbour region, it was predicted that the highest density of artefact occurrences in the escarpment ranges would be associated with the level or gently-inclined crests of ridges and spurs, particularly those with open or east to north-east aspects supporting dry open forest (Collins 2001:76). The present study area comprises the level to low-gradient crest of a spur fringing the permanent channel of the Orara River. It has an open to northerly aspect, but is believed to have originally supported rainforest vegetation. The augering conducted by Kelton (2005; cf Section 4.1) represents the only controlled subsurface investigation so far undertaken in the Coffs Harbour escarpment country, and this investigation focused on the shoulder and western edge of a spur rather than a spur crest itself. Because some artefacts were recovered during augering, Kelton concluded that he had intercepted the periphery of a campsite centred on the spur crest, beyond the eastern margin of his designated investigation area.

In view of the above, the subsurface investigation offered the opportunity to provide data to support an informed assessment of the cultural/social and scientific/archaeological values of the Water Treatment Plant site. At the same time, the investigation offered a seminal opportunity to investigate the archaeological context of a once-rainforested spur crest in the escarpment ranges

that could be usefully extrapolated to other similar landforms in the Coffs Harbour region.

Specifically, the archaeological test excavations aimed to:

- Determine if stone artefacts and/or other Aboriginal cultural materials are present within the proposed development impact area.
- Characterise the nature of any archaeological deposits.
- Recover a representative sample of artefacts/cultural material.
- Inform the need for any further mitigation measures (eg artefact salvage, Aboriginal construction monitoring, amendments to the development layout, procedure and/or construction methodology to achieve site conservation) that may be warranted prior to commencement of development works.

5.2 Methodology

Rationale

Considering the past results reviewed in Section 4.1, it was resolved in consultation with Aboriginal Stakeholders that the subsurface investigation could be appropriately confined to the potentially sensitive spur crest/upper slopes, which cover a maximum area of 170 metres (north/south) by 100 metres (east/west).

Although existing site information suggested a reasonable chance of artefacts occurring in the study area, no surface evidence had been identified, and it was anticipated that any site that did occur would probably be of a low-density nature only. A small number of large test pits (rather than a larger number of small test pits) has been advocated as the most effective means of detecting low-density artefact distributions (ie less than five artefacts per square metre) (Kintigh 1988:702-3; Krakker *et al* 1983:479). The use of two square metre test pits at 15 metre spacings was thus considered amenable to assessing the study area's archaeological potential, and the systematic grid arrangement provided even coverage suitable for interpreting variable artefact densities.

Procedure

The subsurface investigation was confined to the apparently least disturbed sections of the spur crest and upper slopes falling within the proposed development impact area. Required test pit locations were measured, marked out and mapped prior to commencement of the investigation, and each given an alpha-numeric code to facilitate recording (Figure 4).

To achieve adequate and systematic coverage, a grid of 44 test pits, each two metres long and one metre wide (two square metres), was excavated at 15 metre intervals across the study area in the locations shown on Figure 4. Some gaps and re-alignments were necessary to avoid underground services, driveways/tracks, buildings, trees and fences.

All test pits were dug using a 3.1 ton rubber-tracked mechanical excavator mounted with a smooth-edged one metre wide bucket. Sediments were removed from each test pit in (approximate) 10 centimetre spits to the base of the surface soil (A) horizon, or deeper as necessary to determine the vertical artefact distribution. Each spit was dry sieved separately through a (mechanically agitated) six millimetre mesh screen. Sieve residues were carefully examined for Aboriginal cultural material, with each find individually bagged and labelled for later analysis. Recent European materials (glass and china shards, plastic, metal, brick and concrete fragments, imported gravel) were recovered, but these were discarded once their test pit and spit details had been recorded. Soil samples were taken from selected pits for Munsell determinations. Each test pit was then backfilled with its own sterile sieve spoil as the investigation progressed.

Artefact analysis

On completion of the investigation, a basic analysis of all recovered Aboriginal stone artefacts was conducted to a level concomitant with the small size and restricted information potential of the assemblage. This included raw material, size and spatial distribution, and any distinctive technological attributes. Stone artefact identification was based on the definition developed by Hiscock (1984:128), which maintains that an artefact is a fragment of stone that generally possesses one or more of the following characteristics-

- A positive or negative ring crack.
- A distinct positive or negative bulb of force.
- A definite erailure scar in position beneath a platform.
- Definite remnants of flake scars (ie dorsal scars and ridges).
- Ground facets indicative of human industry.

With the exception of ground artefacts, these traits indicate the application of an external force to a core, and are characteristic of the spalls removed by humans using direct percussion.

Following analysis, the recovered artefacts were returned to the CHLALC/Gumbula Julipi Elders for safekeeping at the Land Council office until they can be re-interred in an appropriately protected location within the study area.



Figure 4. Location and recording code of test excavation pits

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6 TEST EXCAVATION RESULTS

Forty stone artefacts were recovered during the investigation, demonstrating the existence of an Aboriginal site within the proposed Water Treatment Plant development impact area. Locations of the artefact-bearing test pits are mapped on Figure 5.

6.1 Stratigraphy

As outlined in Section 5.2, test pits were taken to the base of the surface soil (A) horizon, or deeper as necessary to determine the vertical artefact distribution. The investigation revealed a 10 to 30 centimetre thick topsoil layer of organic very dark brown loam (Munsell 10YR/2/2), overlying stiff dark yellowish brown (Munsell 10YR/3/4) or dark brown (Munsell 10YR/3/3) clay. Disintegrating quartz bedrock fragments were common within the basal clay. In contrast to the five recovered quartz artefacts, which had all been made on high flaking-quality milky (#4) or rose (#1) quartz, these natural fragments contained a close network of dark grey and red surface and incipient fracture planes.

All of the artefacts recovered during test pitting lay within the topsoil, the majority (60 percent) at or near its interface with the basal clay (Appendix A). No cultural stratification was evident. The incidence of introduced materials (glass, china, plastic, metal, brick and concrete fragments, imported gravel), mixed topsoil/clay sediments and/or plough marks in 29 test pits (66 percent), including 15 (65 percent) of the artefact-bearing pits, is indicative of reasonably widespread European disturbance. The abundance of earthworms in most of the pits suggested that artefacts had probably also worked their way down the topsoil profile as a result of natural bio-turbation processes.

6.2 The stone artefact assemblage

Details of the recovered stone artefact assemblage are given in Appendix B, and summarised in Table 2.

Artefacts are dominated by unmodified flakes and flake fragments (77.5 percent), followed by cores (17.5 percent) and flaked pieces (5.0 percent). No formal tools or retouched artefacts were recovered. The artefacts are made on a range of locally-available raw stone materials, primarily volcanics (35.0 percent) and metasediments (30.0 percent), with a minor representation of greywacke, quartz, siltstone and chert. Although ranging up to 62 millimetres in maximum

dimension, most of the artefacts are reasonably small, with a mean maximum dimension of 30.3 millimetres. However, despite use of a six millimetre sieve screen, no artefacts smaller than 13 millimetres maximum dimension were recovered, suggesting a general paucity (or absence) of the type of flaking debitage usually associated with on-site stone reduction. Whilst it is conceded that detection of flaked pieces may have been constrained to some extent by the presence of introduced gravel and disintegrating quartz bedrock, this notion is supported by the recovery of only two positively identified flaked pieces within the assemblage.

Table 2. Summary of raw material and artefact types

Raw material	Flake/ fragment	Flaked piece	Bipolar core	Multi-platform core	Single platform core	Total	%
Chert	1	0	0	0	0	1	2.5
Siltstone	3	0	0	0	0	3	7.5
Greywacke	5	0	0	0	0	5	12.5
Metasediment	8	1	2	0	1	12	30
Quartz	4	0	1	0	0	5	12.5
Volcanic	10	1	2	1	0	14	35
Total	31	2	5	1	1	40	100.0
%	77.5	5.0	12.5	2.5	2.5		

Table 3. Incidence of stone cortex per raw material and artefact type

Raw material	Flake/ fragment	Flaked piece	Bipolar core	Multi-platform core	Single platform core	Total	%
Chert	0	0	0	0	0	0	0.0
Siltstone	1	0	0	0	0	1	33.3
Greywacke	1	0	0	0	0	1	20.0
Metasediment	4	1	0	0	1	6	50.0
Quartz	0	0	0	0	0	0	0.0
Volcanic	3	0	1	0	0	4	28.6
Total	9	1	1	0	1	12	30.0
%	29.0	50.0	20.0	0.0	100.0		

Stone cortex identified on the recovered artefacts indicates raw stone material collection from both terrestrial and stream sources. Almost one third of the artefacts retained at least some cortex. Most of these artefacts were unmodified flakes and flake fragments made on volcanic and

metasedimentary materials. In general, the recovered cores had been well reduced, and some cortex remained on only two of the seven examples (Table 3).

6.3 Artefact density and distribution

The investigation revealed a low density of stone artefacts. Twenty three of the 44 pits yielded artefacts, of which 13 contained one artefact, five contained two artefacts, three contained three artefacts, and two contained four artefacts. This represents an average of 0.45 artefacts for every square metre excavated, ranging from 0.57 artefacts per square metre on the spur crest, to 0.33 artefacts per square metre on its upper slopes.

Subsurface artefacts were intercepted with highest frequency adjacent to Upper Orara Road, between the existing house and shed, and east of the house (Figure 5). These locations appear to have largely escaped the land levelling, cultivation, services installation and/or driveway/track construction modifications apparent elsewhere, but will have been similarly subject to the topsoil churning effects of tree root removal, cattle trampling and invertebrate bio-turbation. Although a loose level of horizontal spatial integrity has probably been maintained, there is little doubt that the artefact distribution has been substantially disturbed.

All 40 of the recovered artefacts lay within the topsoil. Due to the overall homogeneity of raw material and artefact types, and the perceived high level of topsoil disturbance, these artefacts are not considered to have been chronologically stratified. The reasonably similar dimensions of artefacts recovered in immediate subsurface (grass roots), mid-topsoil and topsoil/basal clay interface contexts (mean maximums of 31.75 [range 13-50], 34.8 [range 27-38] and 32.63 [range 17-62] millimetres), points to a vertical artefact distribution primarily disturbed by processes other than ploughing, which generally results in a consistent artefact size reduction with depth (cf Boismier 1991:18; Schofield 1991). Although the vertical artefact distribution is concentrated at the topsoil/clay interface and thus exhibits characteristics associated with natural bio-turbation (cf Mitchell 1988), the presence of artefacts throughout the topsoil profile is probably more attributable to cattle trampling than to any other sole disturbance source.

On the basis of the character, density and distribution of the recovered sample, in tandem with a consideration of disturbance factors, it is concluded that the study area's artefact assemblage was most likely discarded as a result of repeated itinerant use of the entire spur crest, and that this use extended to a lesser degree to the upper spur slopes.



Figure 5. Number of stone artefacts recovered from test excavation pits

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Test pit with artefacts
(as numbered)



Sterile test pit

147
148



Plate 1. View north along spur crest to the existing house



Plate 2. View south across spur east of the existing house



Plate 3. View west across spur north of the existing house



Plate 4. Typical excavation procedure (TP A2)



Plate 5. Excavated spoil placed directly on sieve (TP A3)



Plate 6. Typical sieving procedure. Sediment sieved and residue inspected by entire field team (TP A3)



Plate 7. Typical view of excavation proceedings (TP A12)



Plate 8. Typical test pit showing the basal clay unit (TP A2)

6.4 Charcoal

Charcoal, mostly occurring as large nodules, was recovered in nine test pits (Appendix A). Due to its consistent association with introduced materials such as glass, china, metal, brick fragments and/or imported gravel, it is concluded that this charcoal is the product of recent European rather than Aboriginal activities.

7 CONCLUSIONS

The archaeological test excavations revealed a sparse distribution of Aboriginal stone artefacts across the study area spur crest and its upper slopes, ranging in density from less than 0.5 artefacts per square metre up to a maximum of two artefacts per square metre. All of the recovered artefacts occurred within the topsoil, which has been subject to disturbance stemming from natural bio-turbation and cattle trampling, through to cultivation and land leveling. In light of the systematic subsurface sampling strategy used, the recovered artefact assemblage is considered reliably representative of the site as a whole.

All 40 of the recovered artefacts represent waste material- no modified artefacts or 'tools' were found. The absence of small flakes and paucity of flaked pieces suggest that cores and other artefacts were not habitually reduced in the study area, but that they were usually brought in in an already reduced state, and then subject to either limited further reduction or discarded in their original form.

Due to the apparent restricted range of activities that have taken place, coupled with the low artefact density and its widespread, unfocussed distribution (even allowing for disturbance factors), the site detected during the subsurface investigation is considered to constitute a 'background' scatter of artefacts that has accumulated as a result of repeated low-level use of the spur crest and its upper slopes, rather than a campsite proper. The unspecialised nature of the artefact assemblage places it within the 'core and flake tool industry' as defined by Witter (1992:28), the chief function of which was to provide edged tools for a variety of cutting and chopping tasks. It is envisaged that small family groups or individuals ranging from seasonal base camps elsewhere in the Orara Valley visited both the study spur and other similar spurs fringing Mount Browne to exploit their rainforest resources. These spurs were probably also used as access routes to the drier forests on Mount Browne itself, which on the basis of past survey results, appear to have experienced a higher level of traditional use.

Although raw stone materials differ, the investigation results are consistent with the results of Kelton's 2005 investigation on the shoulder/upper slopes of the adjacent easterly spur, where a similar unspecialised assemblage of unmodified flakes/flake fragments and a single core was recovered at an average density of 0.41 artefacts per square metre. As outlined in Section 6.3, artefacts were recovered in the present study area at an average density of 0.33 per square metre on the upper slopes, and 0.57 per square metre on the spur crest itself. Kelton concluded that the low density of artefacts in his investigation area was probably reflective of an 'edge effect' associated with Aboriginal occupation of the adjoining spur crest. However, the present results suggest that this may not be the case. Rather, Kelton's result reinforces the contention that the series of once-rainforested spurs extending towards the Orara River along the northern foot of Mount Browne were not targeted for traditional occupation, but contain background artefact distributions associated with off-site resource gathering and probably transit activities.

8 SIGNIFICANCE ASSESSMENT

8.1 Background

Unlike aspects of the natural environment, cultural heritage sites and places are social constructs that have no intrinsic significance- "cultural heritage places are not alive in themselves, people give them 'life' and meaning by the way they treat them and by the way they think and feel about them. ... their value lies entirely within human culture" (Byrne *et al* 2001:22-23). The degree and type of value of a place will be different for various groups and individuals. All places are not equally significant or important, and consequently are not equally worthy of conservation and management (Pearson and Sullivan 1999:17). Assessments of significance thus form the basis for management decisions and guide the development of impact mitigation strategies where these are warranted.

Aboriginal sites and places may have educational, tourism and other public values, but their primary values are generally those relating to their cultural/social significance to Aboriginal people, and scientific significance from an archaeological perspective (NPWS 1997:25). While sites considered to be scientifically significant are usually also significant to the Aboriginal community, others may be of outstanding Aboriginal cultural/social significance but have little or no scientific value.

Aboriginal cultural/social significance

Aboriginal cultural heritage is by no means confined to physical (archaeological) evidence. The cultural environment contains an invisible overlay of attachments and meanings, and Aboriginal

people can and do hold equally strong and equally legitimate attachments to natural, unmodified, features of the landscape, and to entire landscapes themselves. The preservation of sites and places of cultural/social significance can be fundamental to maintaining an Aboriginal community's integrity, sense of place and unique cultural identity.

The level of significance that an individual site or place may hold for the present-day Aboriginal community is often dependent upon a variety of factors, including the nature, type and integrity of the site/place, the spiritual, emotional, historical and/or contemporary attachments attributed to it, its setting and importance within the traditional and/or contemporary cultural landscape, and the perceived value of the site/place in connecting past, present and future generations.

Scientific/archaeological significance

This type of significance is essentially an assessment of a site's potential to add to our understanding of past human behaviour. Such assessment is made not only with regard to currently available knowledge, theories and data retrieval methods, but with consideration of likely future scientific developments. Sites have particular potential, and thus greater scientific significance, if there are few other sites that can contribute similar types of information, if they are in a good state of preservation, if they can provide a chronology extending back into the past, and/or if they form part of a larger site complex (NPWS 1997:26-28).

From a management and research perspective it is desirable that a representative sample of Aboriginal sites be maintained for the future. This means that not only are rare and unusual site types scientifically significant, but that a well-preserved site that provides a characteristic example of other sites common to its specific type, content and location may also be of scientific significance. Any determination of representativeness must, by necessity, be based on the known sites in a region. Clearly, this will depend on the extent to which a region has been surveyed and as more work is completed and additional sites recorded, site representation (and significance) can change.

8.2 Significance of the study area

Aboriginal cultural/social significance

The Aboriginal consultation undertaken in conjunction with this assessment revealed that the proposed Water Treatment Plant development would have no adverse impact on any known sites of mythological, ceremonial or otherwise spiritual significance, nor would it affect any resources or unmodified sites/places of historical or contemporary attachment.

Because all Aboriginal archaeological sites contain evidence of prior occupation and/or use of the landscape, the CHLALC and Gumbula Julipi Elders consider all sites within their territory to have at least some cultural value. However, following a consideration of the test pit results and the extent of existing disturbance, Aboriginal Stakeholders have assessed the investigation site to have a low level of cultural/social significance.

Scientific/archaeological significance

The test pit results indicate that the investigation site is highly disturbed, and that its contents are restricted to a low density of stone flaking debitage mixed within the topsoil. This site is not culturally stratified and has no potential for dating. Due to its lack of integrity and structure, and low diversity of cultural material, the site has very little further research potential. While it is reasonable to assume that the site was used by at least some of the people who occupied other nearby sites, including those on Mount Browne, there is no conclusive evidence for its 'connectedness' with any other sites. Although the investigation site currently represents one of the few known examples of an artefact scatter on a once-rainforested hinterland spur, there is little doubt that further subsurface work would reveal the presence of many similar 'background' scatters along the margins of the Orara River valley alone, and that some of these will occur in less disturbed forested environments.

Considering all of these factors, the investigation site is assessed to have a low level of scientific/archaeological significance.

9 IMPACT ASSESSMENT AND MITIGATION OPTIONS

Information revealed by Aboriginal informants in tandem with the archaeological data reviewed and recorded during the subsurface investigation provides an overview of an Aboriginal cultural landscape that extends from traditional, through the early European contact period to recent times. This landscape includes mythological sites, traditional walking trails, campsites and burials, historic campsites and places of work, and more recent places of work and domestic activity.

It also includes 'background' scatters of artefacts discarded during the course of traditional resource exploitation and transit. Development of the Water Treatment Plant would involve the construction of facilities across the entire study area spur (Figure 3), and result in the destruction of one of these 'background' artefact scatters. This scatter has already been substantially impacted by past dairy farming practices, and a systematic sample of 88 square metres has been recovered and analysed as a result of the present test pit investigation.

Given that all of the Water Treatment Plant facilities shown on Figure 3 are necessary, there is little scope for re-designing the development to allow conservation of any part of the study area likely to contain further artefacts. Impacts could be avoided by moving the development to an alternative low-gradient location within suitable proximity of Karangi Dam, but this option is not desirable owing to the high likelihood of a similar artefact scatter occurring on any alternative site.

Although the study area will undoubtedly contain many more artefacts, the sample recovered during the investigation is considered to be reliably representative of the site as a whole. Due to the low artefact density and its lack of integrity, structure and contents diversity, information of further cultural and/or scientific value is unlikely to be gained as a result of a more comprehensive investigation and salvage program.

In view of the site's assessed low cultural/social and scientific/archaeological significance, and the negligible likelihood of *in situ* cultural materials occurring, CHLALC and Gumbula Julipi Elders Stakeholders have advised that the test pit investigation described in this report has satisfactorily addressed their cultural concerns, and that the results have provided information of community educational value sufficient to off-set the loss of the artefact scatter during the course of Water Treatment Plant development.

10 MANAGEMENT RECOMMENDATIONS

With the support of the registered Aboriginal Stakeholders, it is recommended that:

- The proposed Coffs Harbour Water Treatment Plant development proceed as planned.
- The Coffs Harbour and District Local Aboriginal Land Council and Gumbula Julipi Elders be given the opportunity to re-deposit artefacts recovered during the test pit investigation in a location as close as possible to their origin, preferably on the 140 Upper Orara Road spur crest. The re-deposition location should be agreed with Coffs Harbour City Council, and the re-deposition take place once all development-related disturbance works have been completed.

To obtain formal permission from the Department of Environment and Climate Change (DECC) to allow re-deposition of the artefacts, an 'Application for a Care Agreement for Aboriginal Objects' has been completed by the Coffs Harbour and District Local Aboriginal Land Council. Once formal permission has been granted, details of the re-deposition location should be supplied to the DECC for its records.

- In the unlikely event that any material evidence of potentially high cultural significance, especially any evidence of Aboriginal burial/s, is uncovered during any stage of the Water Treatment Plant development, all disturbance works must cease in the vicinity of the find. The DECC (Northern Aboriginal Heritage Unit, Coffs Harbour), Coffs Harbour and District Local Aboriginal Land Council and the Gumbula Julipi Elders should be immediately contacted for management advice.
- To maintain a positive relationship between parties, Council should continue to liaise closely with the Coffs Harbour and District Local Aboriginal Land Council and the Gumbula Julipi Elders in relation to cultural matters. To this end, these groups should be kept informed of the timetable for works associated with planning and construction of the Coffs Harbour Water Treatment Plant.

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GLOSSARY

ARCHAEOLOGICAL SITE

A place containing cultural materials of sufficient quality and quantity to allow inferences about human behaviour at that location (Plog *et al* 1978:383).

ARGILLITE

A rock derived from mudstone or shale that has been altered and indurated by pressure and cementation. Argillites are mid-way in metamorphism between shale and slate (Lapidus 1987:36).

ARTEFACT

Any object having attributes as a consequence of human activity (Dunnell 1971).

ASSEMBLAGE

A set of artefacts found in association with each other and therefore assumed to belong to the one phase or one group of people (Champion 1980:11).

BIPOLAR CORE

An artefact with either negative flake scars present on opposite ends, or with negative flake scars and crushing (point initiations) present on opposite ends (McCarthy 1976:102).

BLADE

An elongated flake with lateral edges parallel or sub-parallel to each other. Specialised blades are produced by a systematic knapping technique (Crabtree 1972:42; McCarthy 1976:101).

BROAD PLATFORM

A platform which, when viewed from above, obscures the body of the flake. Usually produced by detaching the flake by striking well behind the platform margin (Witter 1992:110).

CARBONIFEROUS

The time interval between 360 and 290 million years ago (Lapidus 1987:90).

CHERT

A dense, extremely hard, microcrystalline or cryptocrystalline siliceous sedimentary rock, consisting mainly of inter-locking quartz crystals, sub-microscopic and sometimes containing opal (amorphous silica). Chert occurs mainly as nodular or concretionary aggregations in limestone and dolomite, and less frequently as layered deposits (banded chert). It may be an organic deposit (radiolarian chert), an inorganic precipitate (the primary deposit of colloidal silica), or as a siliceous replacement of pre-existing rocks. Flint is a variety of chert occurring as nodules in chalk and having a conchoidal fracture (Lapidus 1987:102).

CORE

A piece of stone which has been used as a source for flake production. Cores are thus generally characterised by negative flake scars (Morwood and L'Oste-Brown 1995:162).

CORTEX

The natural weathered surface of rock, not the result of human activity (McCarthy 1976:101).

CREST

Landform element standing above all or most points in the adjacent terrain. Usually smoothly convex (Speight 1990:13).

DISTAL

The opposite end of an artefact to the platform end. The blade of an edge-ground axe or the working edge of other implements form the distal end (McCarthy 1976:101).

DORSAL

The face of a flake that was exposed on the core before removal of the flake (Phagan 1976:39).

FEATHER TERMINATION

Is identified on the distal end of a flake which terminates in a sharp edge with a minimal margin. Feather terminations are an indicator of good knapping control (Crabtree 1972:64).

FLAKE

A piece of stone detached from a larger mass by the application of force and having a feather, hinge or step termination and a bulb of percussion. A platform may be present if the proximal end is unbroken (Crabtree 1972:64).

FLAKED PIECE

Chipped artefacts with negative flake scars which cannot be classified as a flake, core or retouched flake (Hiscock 1988:64).

FOCAL PLATFORM

A platform having a small area such that when viewed from above, most of the remaining body of the flake can be seen. Focalised platforms are produced by striking close to the platform edge (Witter 1992:110).

GREYWACKE

Sedimentary rock. A very hard, dark grey or greenish-grey, coarse-grained sandstone characterised by angular particles and rock fragments embedded in a clayey matrix (Lapidus 1987:265).

HINGE TERMINATION

Is identified on the distal end of a flake which terminates in a blunted or rounded right-angled break. Hinge terminations occur when inadequate percussive force is applied and are thus an indicator of poor knapping control (Hiscock 1986b:49).

JASPER

A compact, microcrystalline variety of quartz. Its colours are variable, including white, grey, red, brown and black (Lapidus 1987:308).

LATERAL MARGINS

The sides of an artefact- between the proximal and distal ends (McCarthy 1976:101).

LENGTH

Maximum dimension of a core or flaked piece in any direction; maximum distance along the percussion axis of a flake from the platform to the distal margin (Witter 1986:2).

METASEDIMENT

A metamorphosed sedimentary rock in which the original texture is still recognisable (Lapidus 1987:345).

MUDSTONE

A commonly-used synonym for Mudrock. A fine-grained sedimentary rock composed chiefly of particles in the silt-clay size range. Mudrock/mudstone is a general term used to distinguish the finer-grained sedimentary rocks from sandstones or limestones (Lapidus 1987:362).

MULTI-PLATFORM CORE

A core with at least one negative scar running in a different direction to the remainder. Multi-directional scars indicate that the core has been rotated to get the most economical use of the raw material (Hiscock 1986:49).

NATURAL MYTHOLOGICAL SITE

Unlike archaeological sites, these sites are unmodified natural features of the landscape that derive their cultural importance from myths and ceremonies associated with them. They are sacred areas and most would have been restricted to certain members of the society (for instance, restrictions on age, gender or degrees of initiation). Usually, these sites are of enduring spiritual significance and remain an integral part of contemporary Aboriginal culture.

NEGATIVE FLAKE SCAR

Concave surface resulting from the removal of a flake (Phagan 1976:39).

OVERPASS TERMINATION

Is identified on the distal end of a flake whose fracture plane (ventral surface) curves markedly away from the core face (dorsal surface) and continues directly into the core, removing the base of the core and giving the flake a J shape in longitudinal cross section (Hiscock 1988:86).

PEBBLE

Stone worn and rounded by water and other natural forces (McCarthy 1976:101).

PLATFORM

The plane or surface against which force is applied in order to detach a flake from a core. The platform may be the natural surface of the stone, or cortex, it may be a surface produced by the prior removal of one or more flakes, or a surface produced by grinding or abrading (Phagan 1976:11).

PLATFORM PREPARATION

Accomplished when the knapper strikes or brushes the edge of the core platform and removes small flakes from the edge. This prevents the platform from shattering (Hiscock 1988:86).

PLUNGE TERMINATION

Occurs when a flake passes right through a mass of stone. This is indicated by the presence of cortex on the distal surface of the flake (L'Oste-Brown 1992).

PODZOLIC SOIL

Soils with a strongly bleached eluvial horizon (Charman 1978:108).

PROXIMAL

The butt or platform end of an artefact (McCarthy 1976:102).

QUARTZ

Crystalline silica having no cleavage but a conchoidal fracture (Lapidus 1987:429).

RETOUCH

The alteration to the primary termination of a flake caused by deliberate secondary flaking in order to resharpen or modify the edge (Crabtree 1972:89).

RIDGE

A compound landform element comprising a narrow spine crest and its immediately adjoining slope with the spine length being greater than the width (Packard 1992:100).

SADDLE

Landform element comprising a lower, relatively level point along the spine of a ridge or spur (Packard 1992:100).

SCARRED TREE

These are trees that bear scars caused through the removal of bark or wood for making material items such as canoes, shields and containers, or which have been marked for other reasons.

Because scarred trees are usually associated with domestic activities, their distribution often correlates with the distribution of artefact scatters and other types of campsites (Long 1998:28).

SILCRETE

A siliceous duricrust composed of sand and gravel cemented by opal, chert and quartz, formed by chemical weathering and water evaporation (Lapidus 1987:472).

SILTSTONE

A fine-grained sedimentary rock principally composed of silt-grade material. Intermediate between sandstone and shale, siltstone contains less clay than shale and lacks its fissility and fine laminations (Lapidus 1987:474).

SINGLE PLATFORM CORE

A single platform is indicated when all scars on a core or the dorsal surface of a flake run in the same direction. A single platform on a core signifies less efficient use of the raw material than a rotated core with multiple platforms (Hiscock 1986b:49).

SPUR

Landform element comprising a lower, subsidiary ridge leading down from a locally dominant ridge or crest (Packard 1992:100).

STONE ARTEFACT

Fragment of stone which generally possesses one or more of the following characteristics:

- Positive or negative ring crack
- Distinct positive or negative bulb of force
- Definite erailure scar in position beneath a platform
- Definite remnants of flake scars (ie dorsal scars and ridges)

These traits indicate the application of an external force to a core, and are characteristic of the spalls removed by humans using direct percussion. Stone artefacts which have none of the above may be identified as such if they possess ground facet/s characteristic of human industry (Hiscock 1984:128).

STONE QUARRY (ABORIGINAL)

As the locations of stone sources exploited by Aborigines, quarry sites usually show evidence of procurement and preliminary processing activities, and may be found where outcrops of suitable siliceous or igneous rocks occur. While quarry sites may be represented by as little as one or two flaked boulders or a single extraction pit, most contain a cluster of quarry pits and/or flaking floors where the stones have been trimmed to sizes suitable for transport (NPWS 1988:18-19).

THICKNESS

The greatest dimension perpendicular to both the length and width of an artefact (Witter 1986:2).

TUFF

A pyroclastic rock composed mainly of volcanic ash. Tuffs may be crystal (composed mostly of crystal fragments), vitric (composed mostly of glass and pumice fragments) or lithic (composed mostly of rock fragments) (Lapidus 1987:519-520).

UPPER SLOPE

A slope landform element adjacent below a crest or flat but not adjacent above a flat or depression (Speight 1990:11-34).

VALLEY FLAT

A small, gently inclined to level flat, aggraded or sometimes eroded by channelled or over-bank stream flow, typically enclosed by hillslopes (Speight 1990:34).

VOLCANIC ROCK

Very fine-grained or glassy igneous rock produced by volcanic action at or near the earth's surface, either extruded as lava or expelled explosively (Lapidus 1987:535).

WIDTH

The maximum distance between the lateral margins of an artefact, measured at right angles to the length (Witter 1986:2).

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APPENDIX A

Content of excavation test pits

Test pit	Depth (cm)	Landform element	Sediment description	Disturbance indicators	# stone artefacts
A1	0-10	Crest	Very dark brown loam		0
	10-20		Very dark brown loam		1
	20-30		Dark yellowish brown clay		0
A2	0-10	Crest	Very dark brown loam	Brick fragments	0
	10-20		Very dark brown loam	Brick fragments	0
	20-30		Very dark brown loam		3
	30-40		Dark yellowish brown clay		0
A3	0-10	Crest	Very dark brown loam		1
	10-20		Very dark brown loam		1
	20-30		Very dark brown loam		1
	30-40		Dark yellowish brown clay		0
A4	0-10	Crest	Very dark brown loam	Brick, glass, plastic	0
	10-15		Very dark brown loam	Brick, glass, plastic	0
	15-25		Dark yellowish brown clay		0
A6	0-10	Crest	Very dark brown loam	Gravel, glass, metal	0
	10-20		Very dark brown loam	Gravel, glass, metal	1
	20-30		Dark yellowish brown clay		0
A7	0-10	Crest	Very dark brown loam	Gravel, glass	2
	10-20		Very dark brown loam	Gravel, glass	2
	20-30		Dark yellowish brown clay		0
A8	0-10	Crest	Brown loam/clay mixed	China, glass, metal	0
	10-20		Brown loam/clay mixed	Gravel, glass, metal	0
	20-30		Brown loam/clay mixed	Gravel, glass, metal	1
	30-40		Brown loam/clay mixed	Gravel, glass, metal	0
A9	0-10	Crest	Brown loam/clay mixed	China, metal, gravel, glass, charcoal	0
	10-20		Brown loam/clay mixed		1
	20-30		Dark yellowish brown clay		0
A10	0-10	Crest	Brown loam/clay mixed	China, metal, gravel, glass, charcoal	0
	10-15		Brown loam/clay mixed		0
	15-25		Dark yellowish brown clay		0
A11	0-10	Crest	Brown loam/clay mixed	Plough marks to 25 cm depth	0
	10-20		Brown loam/clay mixed		0
	20-25		Brown loam/clay mixed		0
	25-35		Dark yellowish brown clay		0
A12	0-10	Crest	Very dark brown loam		1
	10-20		Very dark brown loam		0
	20-30		Dark yellowish brown clay		0

Test pit	Depth (cm)	Landform element	Sediment description	Disturbance indicators	# stone artefacts
B1	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		1
	20-30		Dark yellowish brown clay		0
B2	0-10	Upper slope	Very dark brown loam	Brick, glass, plastic, charcoal	0
	10-20		Very dark brown loam		0
	20-30		Dark yellowish brown clay		0
B3	0-10	Upper slope	Very dark brown loam	Brick, glass, plastic, charcoal	0
	10-20		Very dark brown loam		0
	20-30		Very dark brown loam		1
	30-40		Dark yellowish brown clay		0
B4	0-10	Upper slope	Very dark brown loam		0
	10-15		Very dark brown loam		0
	15-25		Dark brown clay		0
B5	0-10	Upper slope	Very dark brown loam	Gravel, glass, concrete	0
	10-15		Very dark brown loam	Gravel, glass, concrete	0
	15-25		Dark brown clay		0
B6	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-30		Very dark brown loam	Brick	1
	30-40		Dark brown clay		0
B7	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		1
	20-30		Very dark brown loam		1
	30-40		Dark brown clay		0
B8	0-10	Crest	Very dark brown loam	Glass, china	0
	10-20		Very dark brown loam	Glass, china	2
	20-30		Dark yellowish brown clay		0
B9	0-10	Crest	Brown loam/clay mixed	China, metal, gravel, glass, charcoal	0
	10-20		Brown loam/clay mixed		0
	20-30		Dark yellowish brown clay		0
B10	0-10	Crest	Brown loam/clay mixed	Plough marks to 25 cm depth	1
	10-20		Brown loam/clay mixed		0
	20-25		Brown loam/clay mixed		0
	25-30		Dark yellowish brown clay		0
B11	0-10	Crest	Brown loam/clay mixed	Plough marks to 25 cm depth	0
	10-20		Brown loam/clay mixed		0
	20-25		Brown loam/clay mixed		1

Test pit	Depth (cm)	Landform element	Sediment description	Disturbance indicators	# stone artefacts
B12	0-10	Crest	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-30		Dark yellowish brown clay		0
C1	0-10	Upper slope	Very dark brown loam	Surface erosion, gravel	0
	10-20		Very dark brown loam	Gravel	2
	20-30		Dark yellowish brown clay		0
C5	0-10	Crest	Very dark brown loam	Gravel	0
	10-20		Very dark brown loam	Gravel	0
	20-30		Dark yellowish brown clay		0
C7	0-10	Crest	Very dark brown loam	Tree roots, gravel	1
	10-20		Dark yellowish brown clay	Tree roots	0
C8	0-10	Crest	Very dark brown loam		1
	10-15		Very dark brown loam		0
	15-25		Dark yellowish brown clay		0
C9	0-10	Upper slope	Very dark brown loam	China, metal, gravel,	0
	10-20		Very dark brown loam	glass, charcoal	3
	20-25		Very dark brown loam		1
	25-35		Dark yellowish brown clay		0
C10	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-30		Dark brown clay		0
C11	0-10	Upper slope	Very dark brown loam		0
	10-20		Dark brown clay		0
C12	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-25		Very dark brown loam		0
	25-35		Dark brown clay		0
D12	0-10	Upper slope	Very dark brown loam	Brick, charcoal	0
	10-15		Very dark brown loam		0
	15-25		Dark brown clay		0
E8	0-10	Upper slope	Brown loam/clay mixed	Metal, glass, china,	0
	10-20		Brown loam/clay mixed	charcoal, gravel	0
	20-30		Brown loam/clay mixed	throughout	0
E9	0-10	Crest	Brown loam/clay mixed	Metal, glass, china,	0
	10-20		Brown loam/clay mixed	charcoal, gravel	0
	20-30		Brown loam/clay mixed	throughout	0

Test pit	Depth (cm)	Landform element	Sediment description	Disturbance indicators	# stone artefacts
E12	0-10	Upper slope	Very dark brown loam	Surface hollow- previous excavation	0
	10-20		Dark yellowish brown clay		0
F8	0-10	Upper slope	Very dark brown loam	Gravel	0
	10-20		Very dark brown loam	Gravel	0
	20-30		Dark brown clay		0
F9	0-10	Crest	Very dark brown loam		1
	10-20		Very dark brown loam		1
	20-30		Dark brown clay		0
F10	0-10	Crest	Very dark brown loam	Gravel	0
	10-20		Very dark brown loam	Gravel	2
	20-30		Dark yellowish brown clay		0
F11	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-30		Dark brown clay		0
F12	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		0
	20-30		Very dark brown loam		0
	30-40		Dark brown clay		0
G9	0-10	Upper slope	Very dark brown loam		0
	10-20		Very dark brown loam		3
	20-30		Dark brown clay		0
G10	0-10	Crest	Very dark brown loam	Gravel	0
	10-20		Very dark brown loam	Gravel	1
	20-30		Dark brown clay		0
G11	0-10	Upper slope	Very dark brown loam	Gravel	0
	10-15		Very dark brown loam	Gravel	0
	15-25		Dark brown clay		0
H10	0-10	Upper slope	Very dark brown loam	Gravel	0
	10-15		Very dark brown loam	Gravel	0
	15-25		Dark brown clay		0

APPENDIX B

Stone artefact catalogue

Test pit	Depth (cm)	Artefact type	Raw material	Length (mm)	Width (mm)	Thickness (mm)	Platform type	Termination type	Cortex (%)	Platform prep.	Comment
A1	10-20	Flake	Chert	18	27	6	Focal	Plunge	0	0	6 dorsal -ve scars
A2	20-30	Flake	Siltstone	21	29	5	Broad	Feather	0	0	7 dorsal -ve scars
		Flake fragment	Greywacke	20	34	6	Absent		0	0	Proximal fragment
		Flake	Siltstone	24	38	7	Broad	Hinge	90	1	Terrestrial cortex
A3	0-10	Bipolar core	Volcanic	50	37	21			40	0	10 -ve scars
A5	10-20	Flake	Volcanic	35	34	9	Broad	Feather	0	0	Terrestrial cortex
		Flake	Greywacke	20	15	2	Absent	Feather	0	0	5 dorsal -ve scars
											3 dorsal -ve scars
A6	10-20	Flake	Quartz	12	19	5	Broad	Feather	0	0	3 dorsal -ve scars
A7	0-10	Flake	Volcanic	46	30	12	Focal	Plunge	0	1	2 dorsal -ve scars
		Flaked piece	Volcanic	22	11	6			0	0	
	10-20	Flake	Volcanic	34	40	15	Cortical	Plunge	0	0	Pebble cortex
		Flake fragment	Volcanic	23	12	6	Focal	Feather	0	0	Lateral fragment
A8	20-30	Flake fragment	Volcanic	22	16	5	Broad		0	1	Proximal fragment
A9	10-20	Flake	Volcanic	25	13	3	Focal	Feather	0	0	6 dorsal -ve scars
A12	0-10	Flake fragment	Quartz	10	13	2	Absent		0	0	1 dorsal -ve scar
B1	10-20	Flake	Siltstone	29	19	11	Absent	Feather	0	0	5 dorsal -ve scars
B3	20-30	Flake	Metasediment	41	34	11	Absent	Feather	40	0	Terrestrial cortex
B6	20-30	Multi-platform core	Volcanic	43	25	15			Indet.	0	6 -ve scars
B7	10-20	Flake fragment	Greywacke	20	27	9		Feather	0	0	Distal fragment
	20-30	Flake fragment	Greywacke	11	31	8	Broad		0	0	Proximal fragment

Test pit	Depth (cm)	Artefact type	Raw material	Length (mm)	Width (mm)	Thickness (mm)	Platform type	Termination type	Cortex (%)	Platform prep.	Comment
B8	10-20	Flake	Volcanic	40	62	12	Broad	Feather	50	0	Terrestrial cortex
		Flake	Volcanic	40	57	16	Focal	Feather	50	1	3 dorsal -ve scars
B10	0-10	Flake	Greywacke	39	32	10	Broad	Overpass	50	0	Pebble cortex
B11	20-30	Flake fragment	Metasediment	18	26	10	Broad		0	0	Proximal fragment
C1	10-20	Flake	Metasediment	25	35	7	Broad	Overpass	30	0	Terrestrial cortex
		Flake	Quartz	17	10	3	Absent	Feather	0	0	4 dorsal -ve scars
C7	0-10	Bipolar core	Volcanic	25	14	14			0	0	7 -ve scars
C8	0-10	Single platform core	Metasediment	30	20	8			50	0	6 -ve scars
C9	10-20	Flake	Metasediment	27	37	7	Focal	Feather	100	0	Terrestrial cortex
		Flake	Metasediment	37	33	13	Absent	Plunge	0	0	6 dorsal -ve scars
		Flaked piece	Metasediment	38	17	13			10	0	Pebble cortex
	20-30	Bipolar core	Metasediment	38	25	10			0	0	6 -ve scars
F9	0-10	Flake	Metasediment	16	29	11	Broad	Feather	0	0	2 dorsal -ve scars
	10-20	Flake	Volcanic	22	28	8	Broad	Feather	0	1	1 dorsal -ve scar
F10	10-20	Flake	Quartz	20	9	5	Absent	Feather	0	0	2 dorsal -ve scars
		Flake	Metasediment	24	36	10	Broad	Feather	100	0	Pebble cortex
G9	10-20	Bipolar core	Quartz	33	25	16			0	0	6 -ve scars
		Flake	Metasediment	25	25	8	Absent	Feather	0	0	3 dorsal -ve scars
		Bipolar core	Metasediment	39	35	18			0	0	15 -ve scars
G10	10-20	Flake fragment	Volcanic	26	19	13	Broad	Feather	0	0	Lateral fragment

APPENDIX C

Aboriginal Stakeholder correspondence



Coffs Harbour & District Local Aboriginal Land Council

Cnr Pacific Highway & Arthur Street, Coffs Harbour 2450

PO Box 6150, Coffs Harbour Plaza NSW 2450

Phone: (02) 6652 8740

Fax: (02) 6652 5923

26th June 2007

Attention: Jackie Collins

Adise Archaeological Services Pty Ltd
11 Camden Head Road
Dunbogan NSW 2443

**Re: Cultural Heritage Subsurface Investigation
Water Treatment Plant, Karangi**

Dear Jackie,

The Coffs Harbour and District Local Aboriginal Land Council and the Gumbula Julipi Elders Group thank you for your assistance with the sub surface investigation of the proposed Water Treatment Plant at Karangi.

After having received and reviewed your report on the results and Cultural significance of the sub surface investigations it has been concluded that the information contained in the report accurately reflects the recommendations of the Coffs Harbour and District Local Aboriginal Land Council and the Gumbula Julipi Elders Group.

The Coffs Harbour and District Local Aboriginal Land Council and the Gumbula Julipi Elders Group will need to further discuss with Coffs Harbour City Council on an agreed area for redepositing of Cultural items that have been located. A Care and Control agreement will be forwarded to DECC for Cultural items until the completion of the project.

If you have any questions in relation to this matter please do not hesitate to contact me on (02) 6652 8740.

Yours truly,

Chris Spencer
Coordinator

APPENDIX 2

RESPONSE TO QUERIES ON PHA



5 July 2007

To	Sohan Fernando - NSW Dept. of Planning		
Copy to	Andrew Sutherland		
From	Carlo Modulon	Tel	(03) 8687 8197
Subject	Coffs Harbour WTP - Responses to Queries on PHA	Job no.	31/18991

Sohan,

Please find below a consolidated response to the queries raised in your emails dated 8 & 14 June 2007 on the PHA that was included with the EA for the proposed Coffs Harbour WTP.

A. Responses to queries received on 8 June 2007

1. A yet to be issued draft of the revised P&ID for the proposed chlorination plant is attached to this memo. It now clarifies many of the queries raised in both of your emails.

The connection and mounting of the 'Chlorguard' unit and vacuum regulator to the drum will be as per the attached photo of the existing chlorination plant in Coffs Harbour at the Red Hill tank site.

Any piping connections under pressure (i.e. up to including the inlet of the vacuum regulator) will be steel. All vacuum piping after the regulator will be uPVC.

Drum changeover will occur when the duty drum is exhausted. The vacuum level in the draw off line from this drum will rise causing the vacuum regulator to shut off and almost simultaneously cause the standby vacuum regulator on the standby drum to switch from standby mode to operating mode (i.e. permit gas to be withdrawn from the drum). The weigh scales are not proposed to be used for drum changeover, but are provided for inventory control and monitoring.

2. It was assumed that 4 full drums were present on site, of which 2 were connected to the manifold. There was no distinction drawn between 'connected' and 'on-line'. In the QRA it was assumed that the drums would be connected via pigtails to a carbon steel manifold all of which would be under pressure. GHD has since been informed by Coffs Harbour City Council (CHCC) operations staff that the drum gas valve will be connected directly to vacuum regulators therefore no pipework downstream of this point will be under pressure. The QRA that has been produced is therefore considered to be conservative.

3. SAFETI limits releases to 60 minutes. Although small (e.g. 3 mm) leaks could continue for longer than 60 mins any sustained leak is assumed to have reached steady state within 60 minutes. Once at steady state, the consequence footprint of a leak will not increase.

In the event of a chlorine leak being detected, the plant SCADA system will generate an alarm on site and also via CHCC's emergency response service (which is manned 24/7). CHCC has formal emergency procedures in place to deal with a chlorine leak. All site personnel are trained and equipped with the appropriate PPE to deal with a chlorine leak. If there are no personnel present on site at the time of the alarm the emergency response service personnel will contact the duty operator who is normally able to be onsite within 30 minutes. If for whatever reason the duty



operator is unavailable, the contact details of the other plant operators is kept on hand to ensure that a relevant person is alerted to take action.

4. Release cases are grouped by leak size and release inventory. Pigtails and changeover valve release scenarios are included in release cases 4-6 as they are considered part of the manifold system. This has been shown to be conservative as the manifold system will not be under pressure due to the presence of vacuum regulators attached to the drum gas valve. The drum system boundary is the 'Chlorguard' auto shut-off valve, as the auto shutoff valve will limit the release inventory of any leak downstream of this valve, whereas upstream of this valve the entire contents of a drum will be released.
5. Based on published data (Lees) the reliability of detectors is considered high relative to the other elements of both the extraction system and the emergency isolation system. There will be two chlorine detectors each with a sensor in the drum room, which are assumed to be 'smart' detectors (self check every hour). Additionally, CHCC personnel will conduct weekly gas detector tests to confirm operation. Although the failure of the detectors was considered when developing the extraction system failure rate the actual probability was not included in the calculation as it was two orders of magnitude lower than the failure probability of the other components of the extraction system.
6. Both full and empty drums are double handled. Although there are only 20 deliveries / removals of drums each year the transfer failure frequency of drums is calculated based on 40 movements so as to incorporate the 2 handling operations during each delivery / removal.

$$20 \text{ movements} \times 2 \text{ transfers per movement} \times 1\text{e-}^6 = 4\text{e-}^5$$

B. Responses to comments received 14/6/07

1. The 'Chlorguard' system was inadvertently not indicated on the preliminary P&ID, but will be included in the scope of the project. The complete system (incl. drum valve closure mechanism and dedicated gas leak detector) will be leased from Orica, and will include a servicing agreement.

The chlorination system is totally vacuum operated and does not use pigtails.
2. Valves 289-V-09 & 12 are vacuum regulating valves, which are mounted on the drum (immediately downstream of the Chlorguard units) to immediately reduce the pressurized gas to vacuum. These also serve as automatic switchover valves for drum changeover.
3. The drum isolating valves 289-V-08 & 11 are closed via the Chlorguard system if a chlorine leak is detected.
4. The vacuum regulator is mounted directly on the chlorine drum – immediately downstream of the aforementioned Chlorguard units.
5. Typo: The text should read 'air' not oxygen
6. Typo: One drum, limited by a 6 mm release rate for 60 minutes = 224 kg (not 187 kg) – 224 kg chlorine release was modelled.



If you have any further queries, please don't hesitate to contact myself on the details as per below.

Regards,

Carlo Modulon

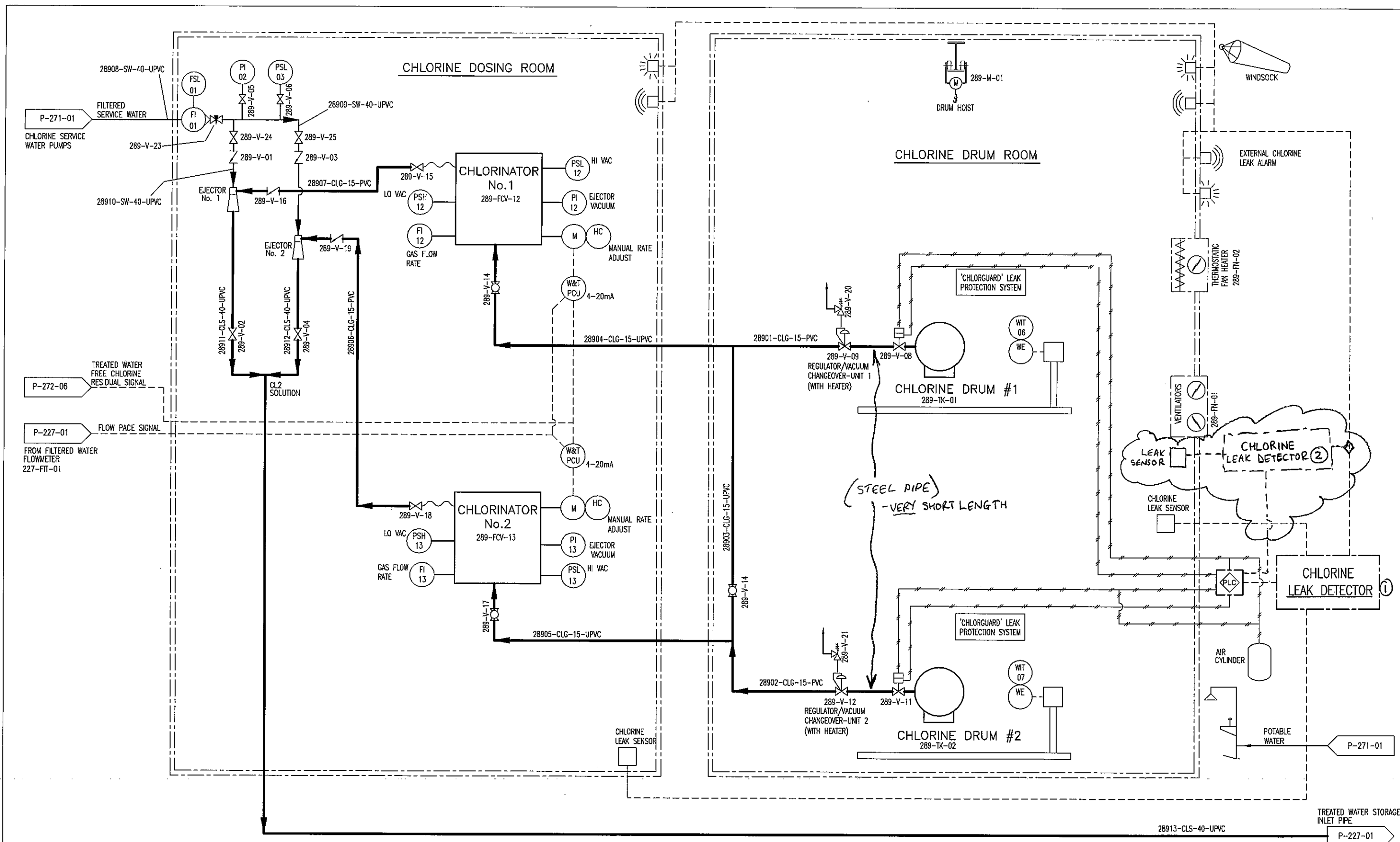
Senior Engineer

(03) 8687 8197

carlo.modulon@ghd.com.au



Chlorine drum connection detail showing Chlorguard unit and vacuum regulator.
(Photo taken from Coffs Harbour City Council's Red Hill tank site chlorination plant)



FOR APPROVAL

MECHANICAL DRAWING NUMBER :

8282A -008

B	SOUND CHECK & SYMBOL REVISION TO D&P FOR INFO.				5/7/07
	A	FOR APPROVAL	27-04-07	27-04-07	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing			
		Drawn	Checked	Approved	Date

Plot Date: 29 June, 2007 - 2:43 PM

Cad File No: G:\411553\WTP\8282A-008.dwg



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Drafting	DA	15.6.07	Design	Check
Approved				
Date				
Scale	AS SHOWN			

Client	COFFS HARBOUR CITY COUNCIL			
Project	WATER TREATMENT PLANT			
Title	P & ID CHLORINE DOSING SYSTEM			
Original Size	A1	Drawing No:	WTP-P-289-01-B (DRAFT)	

ISSUED TO NSW D&P FOR INFO. 5/7/07

APPENDIX 3

GOVERNMENT AGENCY SUBMISSIONS

Our reference : FIL08/1508
Contact : Ian Greenbank, 02 6640 2510

Ms Rebecca Newman
Major Infrastructure Assessments
Department of Planning
GPO Box 39
SYDNEY NSW 2001

23 JUL 2007

Dear Mr Osborne,

COFFS HARBOUR WATER TREATMENT PLANT (MP06 0285) – DRAFT ENVIRONMENTAL ASSESSMENT

Thank you for your letter of 18 June 2007 concerning the Coffs Harbour City Councils Water Treatment Plant Draft Environmental Assessment (EA). In this regard we refer to our letter of 18 April 2007.

We have considered the details of the draft assessment and offer the following comments:-

Pipeline Construction

We are pleased to see that the finalised EA includes details about construction site and pipeline erosion and sediment controls. We note that the controls will be based on the "Managing Urban Stormwater Sedimentation Control Plan" (NSW Department of Housing 2004).

Noise Pollution Control

In our letter mentioned above we asked that consideration be given to the Construction Noise levels. We note that the finalised Environmental Assessment examines the levels of noise and makes recommendations for its attenuation. These recommendations seem to be reasonable based on the information provided. However, we would suggest that if noise complaints are received during the construction phase that all efforts are taken to ameliorate the offending circumstance and do any additional works required to resolve the issue.

Wastewater Management

One of our main concerns with this development is the potential for the discharge of polluted waters from the site. It is pleasing to note that backwash material will be settled and the supernatant sent back to the Karangi Dam or plant head works. In addition the inclusion of an emergency storage lagoon on the site will help avoid any discharge.

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NSW Government Offices,
49 Victoria Street, Grafton NSW
Tel: (02) 6640 2500 Fax: (02) 6642 7743
ABN 30 841 387 271
www.environment.nsw.gov.au

Department of Environment and Conservation NSW

Flora and Fauna

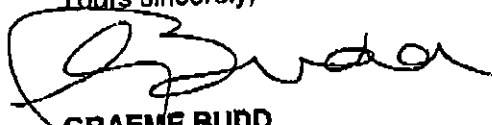
We note that an Ecological Assessment has been undertaken in August 2006. Based on the information provided it appears this has been adequately dealt with.

Aboriginal Heritage

This matter will be reviewed separately and a response will be forwarded to you in the near future, if required.

We hope the above information has been helpful. If you have any further inquiries please contact Ian Greenbank in the Grafton office on 66402510.

Yours sincerely,



GRAEME BUDD
Head Waters and Catchment Unit
North Coast Region
Environment Protection and Regulation Division.

26 July 2007

Rebecca Newman
Major Infrastructure Assessments
Department of Planning
GPO Box 39
SYDNEY NSW 2001
c/- rebecca_newman@planning.nsw.gov.au

Dear Rebecca

Coffs Harbour Water Treatment Plant, 8511WTP, Environmental Assessment

Thank you for the opportunity to provide comment on the final Environmental Assessment for the above project. The majority of my concerns relating to the early draft of the EA have been addressed; however there are a couple of items in this document for which I provide the following comments and recommendations for your consideration.

- 1.3 – Powdered Activated Carbon can have toxin removal qualities as well as its ability to remove taste & odour components. This does not appear to be reflected within the EA. The selection of the type of PAC to be used at the plant should reflect the nature of the pollutants it is most likely to be required to remove. If possible, the design of the PAC storage and dosing plant should be flexible enough to enable a variety of PACs to be able to be used, dependant on need.
- 5.2 & 5.3 – Algal toxins are not described here as a water quality risk. If algal presence is likely, particularly blue-green algae, then algal toxins, taste and odour must all be considered risks to water quality. Toxins are listed in table 5.3, so should also be mentioned in these earlier sections for continuity.
- 5.3 – the 3rd last paragraph describes a year long pesticide study completed in conjunction with the NSW Department of Health, but does not provide any reference for the study, its timing, nor the body of water involved in the study. The EA should reference any material relied upon in decision making, to enable readers to investigate further. I am not aware of the study as it is described in the EA.
- Table 5.3 - the performance target for chlorine should be more clearly stated; I could find no other reference in the document to describe what the "set point" would be
- 5.6 – Chlorination should be listed here as a critical control point, as it is listed in Appendix 15 as a CCP on two occasions.
As the remainder of the Control Plan is not available in Appendix 15, the method for determination of CCPs cannot be reviewed, however, it seems unusual to me that fluoridation would be a critical control point, and that repairs of burst mains is a critical control point rather than a corrective action.
- 7.11 – mosquitoes can breed in very small puddles, so if possible the emergency storage lagoon should be designed in such a way as to minimise the potential for any water at all to be stored in it, either from pumping or following rainfall, to ensure it does not become a mosquito breeding site.

7.12 – the selection of a pump out system for on-site sewage treatment is probably the most appropriate option, however it would be good for the EA to describe the decision making process that discounted other types of systems with less on going costs.

8.4.2 – the EA should describe the period of time the plant would be operated during validation and verification, and where the water will be directed to during this time (assuming that it is not being passed onto consumers through the supply system).

8.4.2 – this section should describe the parameters to be tested, the frequency of testing and the laboratories to be used during verification and validation monitoring of the treatment process. The statement under the subheading of *Operation* is a start, but does not contain sufficient detail.

Fluoridation - Early consultations should occur with NSW Health regarding the design and nature of the fluoridation of the water supply. The nature of the fluoridating agent to be used may determine the design features of the fluoride storage area (dust extraction, smooth surfaces, etc.) and dosing system.

It is pleasing to see the ongoing commitment of the Coffs Infrastructure Alliance to addressing water management for the benefit of the community and the environment, and that public health is seen as a key aspect of these considerations. Officers from the Public Health Unit are keen to be involved in any HACCP teams established for similar projects in the future.

Thank you for the opportunity to make the above comments. Should you have any queries, please contact me at the Port Macquarie office of the Public Health Unit on 0265 882750 or PO Box 126, Port Macquarie, NSW 2444.

Yours faithfully

KERRYNN ALLEN
Senior Environmental Health Officer

Your reference : S06/000885
Our reference : DOC07/23680.emb.
Contact : Estelle Blair, 6659 8256
Date : 30 July 2007

Ms R Newman
Senior Environmental Planning Officer
Major Infrastructure Assessments
Department of Planning
GPO Box 39
SYDNET NSW 2001

Dear Ms Newman

Re: Proposed Coffs Harbour Water Treatment Plant – Coffs Harbour Local Government Area (Major Project No. 06_02285)

I refer to your letter dated 20 June 2007 advising the Department of Environment and Climate Change (DECC) of the above major project and requesting comment on the Environmental Assessment report. Further to the DECC's response dated 23 July 2007, additional comments on Aboriginal cultural heritage considerations are provided below.

The *Coffs Harbour City Council Water Treatment Plant Environmental Assessment Appendix 4 – Aboriginal Cultural Heritage Assessment* has been reviewed. It was noted that further investigation was considered essential by the consultant and the local Aboriginal community, to adequately assess the potential impacts of the proposed Major Project. Accordingly, the DECC could not ascertain whether impacts would be significant or not without this additional information.

A supplementary report, *Proposed Coffs Harbour Water Treatment Plant Supplementary Aboriginal cultural heritage assessment* dated June 2007 (the supplementary report) was received by the DECC on 26 July 2007 and has been reviewed. This report reveals that both the archaeological and cultural heritage values of the subject site are considered to be of low significance, such that there is no impediment to the proposed development proceeding.

The management recommendations provided in the supplementary report are supported and should be incorporated into any conditions of consent provided to the applicant.

Thank you for the opportunity to provide additional comment on the Major Project. Should you wish to discuss these matters further please contact Estelle Blair, Conservation Planning Officer on 6659 8256.

Yours sincerely

DIANE CROSDALE
Acting Manager Planning and Aboriginal Heritage - North East
Climate Change and Environment Protection



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating NSW Fisheries
ABN 51 734 124 190-002

Our Ref: S06-00885

Ms Rebecca Newman
Senior Environmental Planning Officer
Major Infrastructure Assessment
GPO Box 39
SYDNEY NSW 2001

26 July 2007

Dear Ms Newman

**Re: Proposed Coffs Harbour Water Treatment Plant – Coffs Harbour LGA
Major Project No. 06_0285**

Thank you for your letter of dated 18 June 2007 requesting the Department of Primary Industries (DPI) provide comment on the above mentioned development application.

The NSW Department of Primary Industries (NSW DPI) has been formed by the merger of NSW Fisheries, Department of Mineral Resources, State Forests and NSW Agriculture.

There are no agricultural, mining or forestry issues. Removal from the proposal of the route and installation of the proposed Coramba supply line avoids fisheries issues from the proposal at this stage. It should be noted that the pipeline route and watercourse crossings will require appropriate assessment by the Aquatic Habitat Protection Unit within DPI when that proposal is finalised.

If you have any further enquiries please contact me on (02) 6626 1397.

Yours sincerely

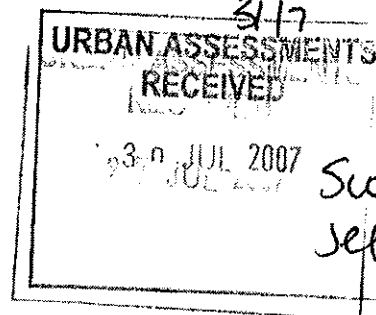

Patrick Dwyer
Fisheries Conservation Manager (North)

FISHERIES MANAGEMENT DIVISION
AQUATIC HABITAT PROTECTION BRANCH

1243 Bruxner Highway
WOLLONGBAR NSW 2477

ABN 51 734 124 190
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Fax: 02 6626 1377

The original copy of this letter has been printed on both sides of the page to reduce waste of valuable natural resources



Reviewed to
KATIE LINDON

Re m
31/7

ML
31/7
↓ to

MIA

↓
Scott
Jeffrey

APPENDIX 4

STATEMENT OF COMMITMENTS

Environmental Issue	Commitment		Timing
	Outcome	Measures	
1. Flora & Fauna	1.1 Protection of flora.	Proposed amelioration and safeguard measures include: 1.1.1 The large, hollow-bearing Sydney Blue Gum on the site would be retained and appropriately protected pending an arborist's advice on safety concerns; <i>1.1.2 The Gadagi Trees on the apex of the corner on the southern side of Upper Orara Road would be retained.</i>	Construction and operation
	1.2 Amelioration for the removal of a flooded gum (recognised koala food tree).	1.2.1 Planting along the south-western boundary of the site would be conducted with local Koala food tree species (including Tallowwood, Flooded Gum and/or Sydney Blue Gum). Seed would be sourced from appropriate local trees and planting would be undertaken according to advice from appropriate personnel with specific knowledge of local Koala populations and relevant ecological requirements, for example from Council's Koala Management Advisory Committee;	Construction
	1.3 Protection of native fauna.	1.3.1 An observer with appropriate local ecological experience would be present on-site during any required tree removal or other significant disturbances to extant vegetation; and 1.3.2 During the construction period, construction personnel and all other on-site staff and visitors would be appropriately made aware of the possible presence of wildlife on the site and would be advised to exercise caution when departing or traversing the site. 1.3.3 Inclusion of flora and fauna amelioration and safeguard measures within the environmental management plans for construction and operation.	Construction and operation

Environmental Issue	Commitment		Timing
	Outcome	Measures	
2. Noise impacts	2.1 Minimising Construction Noise Impacts	2.1.1 During construction activities, residential receivers located within close proximity to the site would be advised of the anticipated construction program and residences kept informed throughout the construction period; 2.1.2 All site workers would be made aware of the potential noise impacts for local residents and encouraged to minimise noise during the course of their activities; 2.1.3 Construction activities that cause excessive noise would be limited to normal business days between 7 am and 6 pm and Saturdays between 8 am and 1 pm; 2.1.4 All construction equipment would be maintained in good condition and all machines found to produce excessive noise would be removed from the site or stood down until repairs can be made; 2.1.5 All combustion engine plant are to be fitted with residential grade exhaust silencers; 2.1.6 Noise management strategy to be included within the environmental management plan.	Construction
	2.2 Avoiding Operational Noise Impacts	2.2.1 All noise sources are to be located within buildings and acoustically treated rooms to provide the noise attenuation modelled as part of the noise impact assessment.	
3. Air Quality	3.1 Avoiding off site odour impacts.	3.1.1 Sludge dewatering facilities to be located within an enclosed building. 3.1.2 Dewatered sludge is to be placed into a storage bin for off site disposal at Councils resource recovery centre and would not be stored onsite for significant time periods. 3.1.3 Maintain buffer distances required to minimise off-site odour impacts from the proposed sludge dewatering activities. These distances are currently readily achievable within the currently proposed site layout and design.	Operation

Environmental Issue	Commitment		Timing
	Outcome	Measures	
	3.2 Minimise dust emissions	3.2.1 Activities undertaken in a manner that minimises dust emissions such as wind blown and traffic generated dust. 3.2.2 Measures to minimise dust to be specified in the environmental management plan	Construction
4. Indigenous Heritage	4.1 Avoid indigenous heritage impacts.	4.1.1 The LALC and Gumbula Julipi Elders are to be given the opportunity to re-deposit any of the recovered artefacts following the completion of all development related disturbance works. 4.1.2 In the unlikely event that any material of potentially high cultural significance is uncovered during any stage of the development all disturbance works must cease in the vicinity of the find. The DECC, LALC and Gumbula Julipi Elders would then be required to be immediately contacted for management advice. 4.1.3 Council would continue to closely liaise with the LALC and Gumbula Julipi Elders in relation to cultural matters and be kept informed of the timetable for works associated with the planning and construction of the WTP.	Prior to the commencement of construction
5. European Heritage	5.1 Retain dairy bail	5.1.1 Conserve galvanised roof sheets and timber vertical wall cladding 5.1.2 Maintain grass and ground line around the 'clean-up' area to prevent moisture further deteriorating timber frame and cladding. 5.1.3 Replace roof with second hand sheets as required to keep roof waterproof. 5.1.4 Implement a maintenance strategy. 5.1.5 Internal 'non original' additions should be removed, whilst maintaining the	Construction and operation

Environmental Issue	Commitment		Timing
	Outcome	Measures	
		existing dairy era fabric. 5.1.6 Significance of dairy bails and conservation requirements to be included within environmental management plan.	
6. Hazardous Materials	6.1 Reduce the risk to safety, environment and property	6.1.1 All relevant Australian Standards would be followed for the construction of storage vessels and barriers thereby reducing potential for unplanned releases; 6.1.2 Implementation of the Barriers outlined in the PHA (Table A3 - Hazard Identification); 6.1.3 Implementation of the design initiatives and adherence to Australian Standards; and 6.1.4 Implement safety conscious operating procedures for the storage of dangerous goods.	Construction and operation
7. Traffic & Transport	7.1 Minimise traffic hazards.	7.1.1 The front entrance gate to the WTP would be re-located from its current position, further uphill and 20 metres inside the site's front property boundary; 7.1.2 Improve visibility for traffic approaching the site access by reshaping the embankment on the southern side of Upper Orara Road adjacent to the site access point. 7.1.3 Advance advisory signs would be installed on the approaches to the site's access point; 7.1.4 During the construction period, traffic using Upper Orara Road in the vicinity of the WTP would be under "Traffic Control" conditions that includes: • Appropriate signage being provided; • Qualified Traffic Controllers being allocated, wherever necessary; and	Construction

Environmental Issue	Commitment		Timing
	Outcome	Measures	
		Reduced speed limits being applied adjacent to the work site when necessary.	
8. Soils	8.1 Minimise environmental and OH&S risks associated with potentially contaminated material.	8.1.1 Appropriate removal and disposal of any excavated material that potentially contain asbestos would be carried out, in accordance with the relevant requirements of the <i>Occupational Health and Safety Regulations 2001</i> and the <i>Code of Practice for the Safe Removal of Asbestos</i>. 8.1.2 Surface soil samples should be collected from around the location of the former sheds and houses for further asbestos analysis and for additional hydrocarbon and pesticide analysis as appropriate.	Construction
9. Water	9.1 Management of storm water runoff.	9.1.1 All activities (including pipelines) to be undertaken in a manner that minimises erosion and sedimentation. 9.1.2 Environmental management plan to include erosion and sedimentation control plan prepared in accordance with the NSW Department of Housing's '<i>Managing Urban Stormwater</i>' 2004. 9.1.3 Velocity reduction techniques applied to final operational stormwater outlets to prevent scouring and maximise infiltration.	Construction Incorporated into design and implemented and prior to operation

Environmental Issue	Commitment		Timing
	Outcome	Measures	
	9.2 Management of operational waste water and surface water run off	9.2.1 Zero discharge of operational wastewater. 9.2.2 All chemical storage to be stored as required for hazardous materials (i.e. bunded areas). 9.2.3 Capacity of emergency storage lagoon to be maintained. 9.2.4 Storm water to be directed around emergency storage lagoon and towards natural drainage paths. 9.2.5 Laboratory, toilet, shower and basin waste water to be directed to an underground wastewater collection tank for pump out and appropriate disposal. 9.2.6 Requirements to be included within operational environmental management plan.	Operation
10. Visual Amenity	10.1 Minimise the visual impact of the proposal on the surrounding landscape.	10.1.1 Install screen planting immediately on the southern and western boundaries of the proposed WTP site, consistent with the buffer planting recommendations made in Section 8 of the Visual Impact Assessment report; 10.1.2 Screen plantings would be located between the southern and western boundaries and the proposed control building, DAFF building and the Chemical Plant; 10.1.3 Screen plantings would be established along the entire length of the southern and western boundaries (but not including at the site entrance, along the southern boundary); 10.1.4 Screen planting would include trees, shrubs and ground cover to create a dense visual barrier and foliage should be kept compact and dense;	Construction

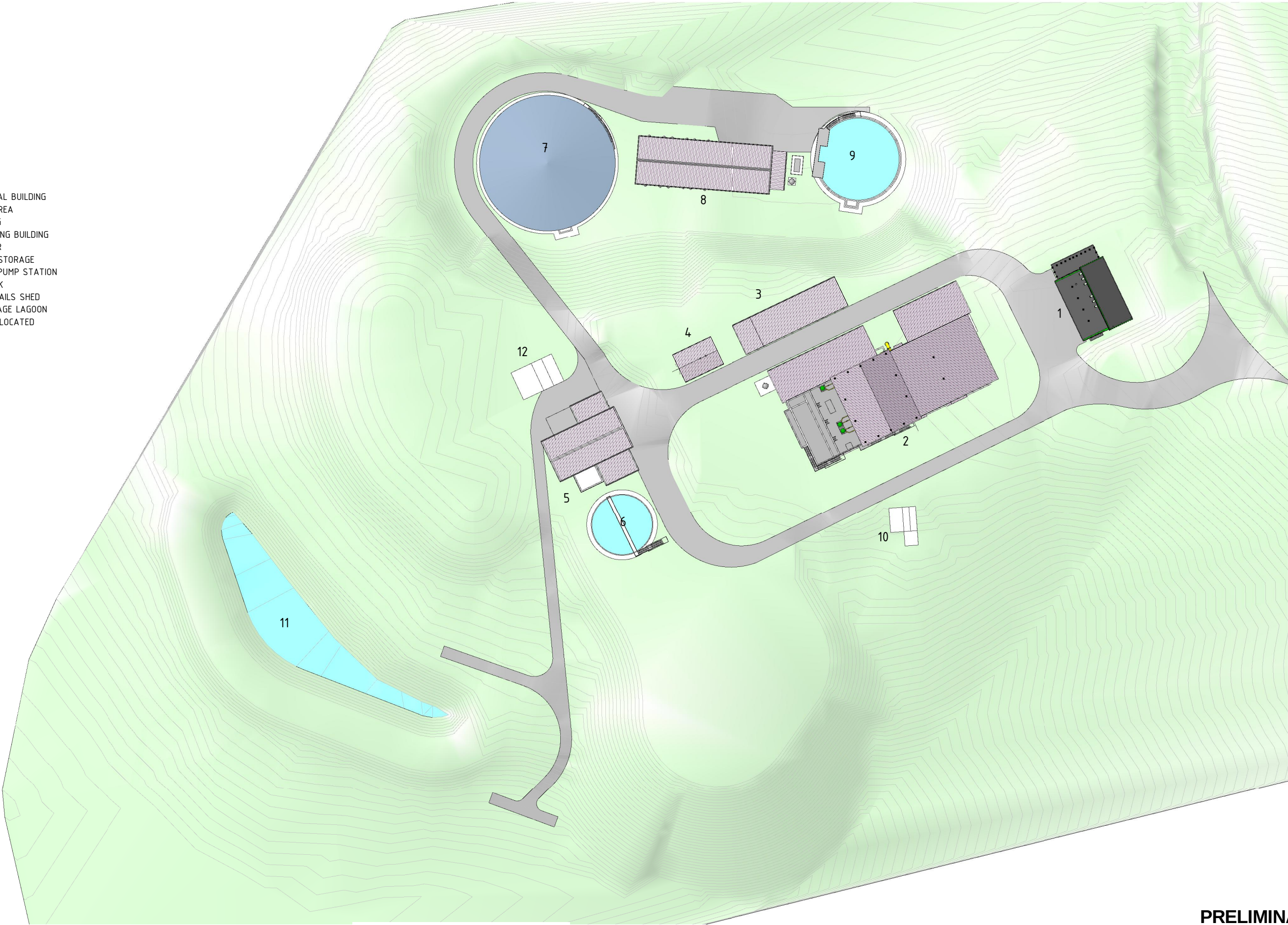
Environmental Issue	Commitment		Timing
	Outcome	Measures	
		10.1.5 A muted colour would be selected for the southern WTP buildings; 10.1.6 All existing vegetation would be maintained (on the boundaries) between affected properties and the proposed WTP site; 10.1.7 Internal WTP spaces would be kept “simple” and uncluttered; 10.1.8 Council would liaise with the property owners at 186 Upper Orara Road, Karangi, with a view to installing a planted buffer at the top of the ridge between this property and its views towards the proposed WTP site; and 10.1.9 Native vegetation would be installed between properties at 121 and 147 Upper Orara Road, Karangi and the proposed WTP site to provide ongoing visual screen of the WTP from these properties <i>10.1.10 The security fence along the western side of the site would be offset three metres from the boundary fence to allow room for screen plantings between the boundary and security fence.</i> <i>10.1.11 Camphor laurel trees that are currently providing a visual screen of the Transgrid substation and associated infrastructure are to be maintained on site until such time as native tree plantings are established.</i>	
11. Construction Waste	11.1 Minimise the volume of material sent to landfill	11.1.1 Uncontaminated fill is to be reused onsite 11.1.2 Reuse and recycling principals to be adopted for construction materials 11.1.3 Waste management strategy to be incorporated into the environmental management plan.	Construction

APPENDIX 5

REVISED ARCHITECTURAL DRAWINGS

LEGEND

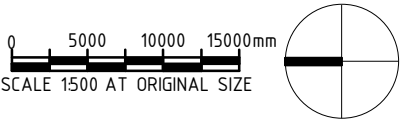
- 1. CONTROL BUILDING
- 2. DAFF AND CHEMICAL BUILDING
- 3. CHEMICAL BUND AREA
- 4. CHLORIDE BUILDING
- 5. SLUDGE DEWATERING BUILDING
- 6. SLUDGE THICKENER
- 7. TREATED WATER STORAGE
- 8. TREATED WATER PUMP STATION
- 9. WASHWATER TANK
- 10. EXISTING DAIRY BAILS SHED
- 11. EMERGENCY STORAGE LAGOON
- 12. EXISTING SHED RELOCATED



SITE PLAN
SCALE 1 : 1000

PRELIMINARY

D	ISSUE FOR EA	RC			24.07.07	
C	SLUDGE THICKENER ADDED	JT	KH	KH	23.05.07	
B	REVISED	BL	KH	KH	18.05.07	
A	ISSUE FOR EIS INCLUSION	BL	KH	KH	17.05.07	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date



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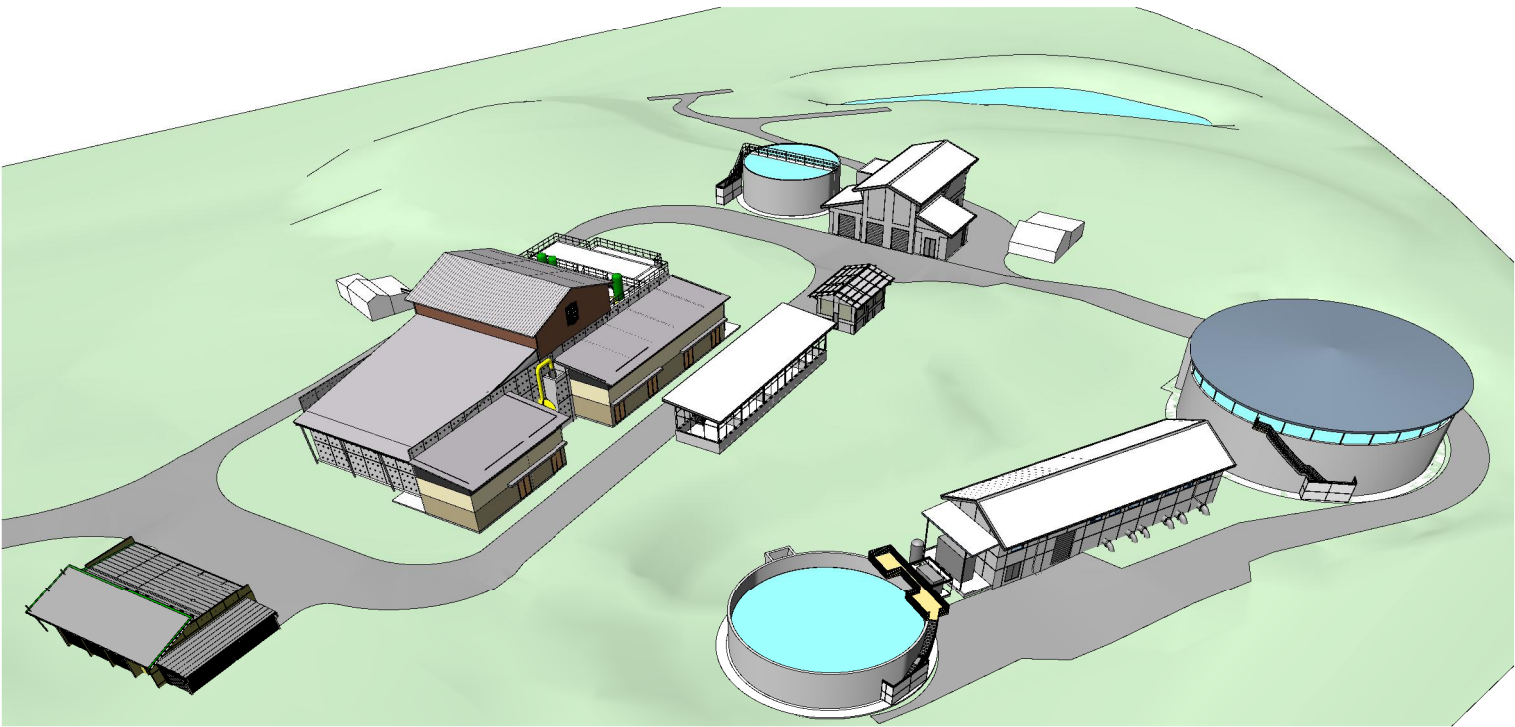
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Date			
Scale	1 : 1000		

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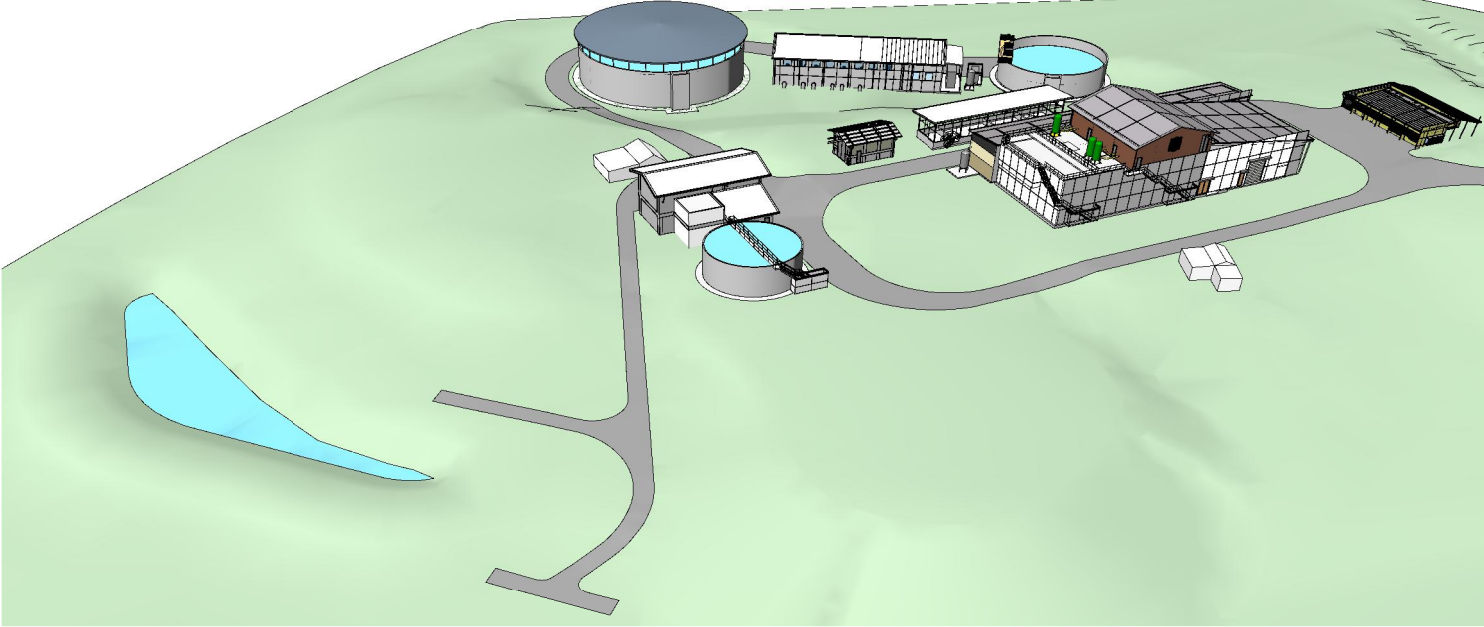
Client	COFFS HARBOUR CITY COUNCIL
Project	COFFS HARBOUR WTP
Title	SITE PLAN
Original Size	A3
Drawing No:	31-18991- SK001
Rev:	D



AERIAL VIEW 1
SCALE



AERIAL VIEW 2
SCALE



AERIAL VIEW 3
SCALE

PRELIMINARY

D	ISSUE FOR EA	RC			24.07.07	
C	SLUDGE THICKENER ADDED	JT	KH	KH	23.05.07	
B	REVISED	BL	KH	KH	18.05.07	
A	ISSUE FOR EIS INCLUSION	BL	KH	KH	17.05.07	
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Drafting Check		Design Check	
Approved			
Date			
Scale			

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Client COFFS HARBOUR CITY COUNCIL
Project COFFS HARBOUR WTP

Title SITE AERIAL VIEWS

Original Size A3 Drawing No: 31-18991- SK002

Rev: D