



Australian Government

**Department of Regional Australia,
Regional Development and
Local Government**

PROPOSED CONSTRUCTION
OF
PROJECTS TWO AND THREE OF
THE CHRISTMAS ISLAND NEW HOUSING PROGRAM

STATEMENT OF EVIDENCE

TO THE
PARLIAMENTARY STANDING COMMITTEE
ON PUBLIC WORKS

NOVEMBER 2011

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Summary

1. This submission by the Department of Regional Australia, Regional Development and Local Government (the Department) provides evidence to the Parliamentary Standing Committee on Public Works (PWC) on Projects Two and Project Three of the Christmas Island (CI) New Housing Program. The proposed site for Project Two is Drumsite and the preferred sites for Project Three are located in Guano Court.

Identification of the Need

Project Objectives

2. This submission by the Department provides evidence to the Parliamentary Standing Committee on Public Works (PWC) on Project Two and Project Three of the CI New Housing Program. The proposed site for Project Two is Drumsite Village adjoining the notified Project One site while Guano Court is the preferred site for Project Three. A map of CI appears at Attachment 2.
3. Project One of the CI New Housing Program has previously been notified as a medium work by the Public Works Committee and the construction of 16 dwellings and associated infrastructure commenced in September 2011. The contract value is \$11.4 million.
4. CI is facing a critical housing shortage which impacts on the provision of public services. The CI New Housing Program aims to reduce pressure on the rental market by constructing 14 dwellings in Project Two to accommodate the increase in personnel required for policing, health, administration and education services. The increase in the number of dwellings is commensurate with a growth in the island's population, due to an escalation in immigration activity on CI.
5. Construction of Project Three will depend on the balance of the funds remaining after the actual cost of Project Two has been determined.

Historical Background

6. The project is part of the CI New Housing Program, for which Cabinet approved funding in May 2010 of \$26.6 million over three years, to ease the current housing shortfall and reduce rental costs in the private rental market.
7. The preferred sites for Projects Two and Three are located within existing residential areas, known as 'Drumsite Village' and Guano Court respectively. The Drumsite location was previously used to provide short term accommodation for construction workers. The site has been cleared and construction of Project One has commenced there.
8. A map of the proposed Drumsite Village development site and location of adjacent community facilities appears at Attachment 2.

The Need

9. Currently, the Commonwealth leases 33 dwellings on the CI private rental market. The Department currently manages another 158 dwellings for purposes of employee and public housing.

10. Table 1 below summarises the housing market on CI and the island's population.

Table 1. Summary of CI Housing and Population

Housing Market CI November 2010	
Commonwealth Owned Employee Housing	40
Commonwealth Employee Housing Private Market	33
Commonwealth Owned Public Housing (estimated)	118
Private Dwellings (estimated)	596
CI Population	1300 - 1800
Fly In Fly Out Numbers Estimated Additional Population Provision of Government Services (estimated)	400 - 500

11. The CI New Housing Program aims to reduce the number of houses leased on the private rental market to accommodate Commonwealth employees. The impact on the private rental market is expected to be a reduction in housing demand and rental costs, making accommodation more affordable to the local community.

Options Considered for Meeting the Need

Description of the Proposal

12. The Drumsite Village site is located on Lot 645 on Deposited Plan 40603. The site is 8,532m², however the proposed overall site plan extends beyond the boundaries into crown land on the south and eastern sides of the lot and will be required to be adjusted for future titling of the lots, creating a total area of 9,271m². The proposed Lot 645 configuration is shown in Figure 2, Attachment 3. The site is zoned 'Residential Development' under the provisions of the Shire of CI (SOCl) Town Planning Scheme. The site will allow for the construction of medium density housing.
13. Project One is currently being constructed and will build 16 dwellings on approximately half of the site. Project Two proposes 14 dwellings on the remaining portion of Lot 645.
14. Project Three would construct two larger houses on Lots 348 and 352, (718m² and 708m² respectively), in Guano Court, Silver City.
15. The general dwelling design philosophy for Projects Two and Three will be in accordance with the Principal's Project Requirements (PPR) which has been developed for Project One following thorough consultation with key stakeholders. The PPR is largely a performance based specification, while particularly addressing the local conditions and the architectural style of the island, and in accordance with relevant Australian Standards and the Building Code of Australia,

2011 Edition (BCA, 2011). As both sites are within 1km of the ocean, BCA marine requirements may apply, while the remote, harsh tropical environment will also necessitate careful consideration of materials and finishes.

Other Options Considered

16. The construction of housing and unit accommodation on CI has largely been undertaken by the Commonwealth. With no established housing industry on the island, alternate options are limited.
Six site options for Projects Two and Three have been identified: Drumsite Village, Guano Court, Silver City, Arenga Close, Seaview Drive and Plant Hill Road. A site location map is attached at Figure 3, Attachment 4.
17. The direct purchase of existing dwellings will not reduce the pressure on the private rental market, a main objective of this program. Nonetheless, the Department has purchased 3 existing dwellings as an interim measure, to ensure accommodation for staff providing essential services. These houses have been purchased for less than their replacement cost.

Reasons for Selecting the Preferred Option

18. Land suitable for residential construction is in short supply on CI. A Site Selection Assessment has been conducted on the six options, taking into account (with weightings): cost; environmental and planning approvals; site risks addressing community, existing infrastructure, community safety and constructability; and contribution to the program, such as functionality, required dwellings mix, and time to market.
19. The estimated build cost (per bedroom) for each site option was assessed. The estimated build cost for the Drumsite option is less than other locations, except for the least cost at Guano Court. With other factors included, Drumsite Village and Guano Court are the preferred sites. Layout options for Drumsite Village are shown in Figure 4 (Option 2A, 16 dwellings) and Figure 5 (Option 2B, 14 dwellings) in Attachment 4.
Option 2B is the preferred option.
20. The preferred sites for Projects Two and Three are immediately available. These project sites are in well-established residential areas and have access to existing residential facilities and services.

Heritage Considerations

21. CI has a vast and diverse cultural heritage, with many sites and pieces of infrastructure of significant heritage value to the community. A number of these places are registered on the Commonwealth Heritage List (CHL), which comprises natural, indigenous and historic places on Commonwealth land. Entries on the CHL are protected under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC)*.
22. There are no known heritage considerations applying to the sites for Projects Two and Three, noting that heritage consideration forms part of the *Environment Protection and Biodiversity Conservation Act 1999* referral.

Environmental Considerations

23. The impact on the natural environment will be minimal, given the chosen sites have already been developed. However, a Referral under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) covering the proposed residential development of Lot 645 is required. A Referral Decision of 22 September 2011 advised that the proposed works are not a controlled action, if undertaken in particular manner. Refer to Attachment 9 for the EPBC Referral Details. The Decision covers the enlarged Lot 645, and required measures are included below in paragraph 26 Environment Management Plan (EMP) Key Points.
24. CI has a distinctive yet fragile ecological setting, requiring significantly greater environmental safeguards and controls than many Australian mainland developments. The successful contractor will be required to take appropriate precautions in consultation with Parks Australia North at various stages of the project to ensure compliance with the project's Environmental Management Plan.
25. Key points from the EMP are:
- Flora and Vegetation. As the remnant rainforest area is upslope of the project site, on rocky ground, the risks of direct and indirect impact from clearing and run off is low. Weed clearing, tree preservation, and temporary fencing will be included. Earthmoving activities within or near vegetation will require close liaison with Parks Australia North, including any necessary works approvals. Vegetation clearing and tree felling will be restricted, and not outside the new boundary area of Lot 645.
 - Fauna. Due to previous native fauna habitat clearing, new effects on native species are limited. Small numbers of Red Crabs are recorded in the area, therefore steps including migration training lanes/ temporary barrier fencing to adjacent bushland, earthworks and clearing limitations during migration periods, and monitoring will be undertaken. Red Crabs shall be physically removed from site where necessary. Additionally prompt reporting of fauna injuries (except crabs) shall be made to Parks Australia North.
 - Surface and Ground Water. The local soils are porous and offer no protection to the ground water supply from contaminants. The contractor will not store bulk fuel or chemicals nor refuel heavy equipment onsite and will provide spill containment/clean-up equipment and procedures. Site run-off and erosion will be contained with temporary drainage structures.
 - Air Quality, Noise and Waste. Special protection measures and monitoring will be implemented to manage any potential damage to the environment and adjacent residences, such as noise, vibration, waste disposal and litter, and dust control.

Key Legislation

26. The following key legislation is relevant to the CI New Housing Program:
- *Environmental Protection and Biodiversity Conservation Act 1999*;
 - *Building and Construction Industry Improvement Act 2005*;

- *Building and Construction Industry Improvement (Accreditation Scheme) Regulations 2005;*
- *Federal Disability Discrimination Act 1992;*
- *Financial Management and Accountability Act 1997.*

Relevant Australian Standards and the BCA are applicable to all design and fabrication and installation works.

Stakeholder Consultation

27. Stakeholders have been engaged from the outset of Project One, with continuation to Projects Two and Three. A Project Communications Plan has been developed which identifies key stakeholders and how they will be kept informed and engaged.

Authority Approvals

28. The proposed development will be subject to the normal development application process, including consultation with the Shire of Christmas Island (SOCl). Consultation will be undertaken throughout the design and delivery stages.
29. Approval of a Development Application and a Building License will be required from SOCl before construction can commence. These will be well informed by the experience of the Project One approvals process. The Contractor may be required to assist in obtaining these approvals.
30. As noted above, a Referral Decision under the EBPC Act determined the proposed works are not a controlled action.

Government Departments

31. A continuous dialogue is maintained between the Department and client departments including Department of Immigration and Citizenship.

Revenue

32. The CI New Housing Program will not be revenue-producing, except to the extent that Commonwealth staff on CI make a rental contribution. Currently, 33 properties are leased by the Commonwealth on the private rental market. Project completion will reduce Departmental outlays for rental accommodation.
33. Details of the financial aspects of the project are included by the Department in a separate commercial-in-confidence briefing to the PWC (Submission 1.1).

Purpose of Works

Project Location

34. The Drumsite Village site is surrounded by existing residential development and forms part of the existing Drumsite residential area. Project Two is an extension of Project One works. Project Three proposes to build on two vacant lots in Guano Court, an established part of the Silver City residential area.

Project Scope

35. The Project Two scope is to design and construct 14 dwellings. Work upgrading the existing service connections to the site and internal road works form part of the scope for Project One. The proposed construction of a further two dwellings at Guano Court for Project Three is dependent on balance of the available funds following the completion of Projects One and Two.

Site Selection

36. A site selection assessment has been conducted and is at Attachment 5. The Drumsite Village site is a vacant site held by the Commonwealth and is located within the Drumsite residential area. The total area of the site is to be in excess of 9,200m². The Guano Court sites are also Commonwealth land located in the Silver City sub-division.

Site Description

37. The Project Two Drumsite Village site is a serviced block with potential for flexible housing options. It has previously been developed and it is cleared and relatively flat. The site is suitable for higher density development including 2 bedroom units or 3-4 bedroom town houses. Project One has 16 dwellings under construction on approximately half of this site.

38. Project Three comprises two lots in Guano Court; both are within an existing residential areas, accessible to existing services and infrastructure. The lots are extremely steep, with a gradient of up to 18% on one of the lots. The lots are surrounded by existing one and two storey residential dwellings.

Zoning, Land Approvals and Land Acquisition

39. The Drumsite Village site and the two blocks at Guano Court are held by the Commonwealth. No land acquisition is needed, including the new boundary extension into crown land.

40. The sites are zoned for 'residential development'. The process for planning and environmental approval will be relatively straight forward and low risk. The Guano Court lots only require compliance with CI Residential Design Codes for the existing sub-division.

Codes and Practices

41. All design and construction works carried out as part of this project will comply with or exceed local, state and federal controls and requirements; all housing work will meet the relevant Australian Standards and BCA 2011.

42. It will be the responsibility of the Design and Construct (D&C) contractor to provide for engineering consultation concerning civil works and all construction will be certified by qualified and approved private certifiers.
43. The successful Design and Construct contractor must be accredited by the Office of Federal Safety Commissioner under the Australian Government Building and Construction OHS Accreditation Scheme, and comply with the National Code of Practice for the Construction Industry.

Planning and Design Concepts

Design Philosophy

44. The general dwelling design philosophy for Projects Two and Three will be in accordance with the Principal's Project Requirements (PPR), developed for Project One. The PPR has been developed following thorough consultation with key stakeholders and has been approved by the Department. Refer to Attachment 6 for the PPR.
45. The housing is intended for long term residents and must encourage a sense of place and community. A number of the homes constructed shall be 'adaptable' with a view to meeting future housing needs of the Christmas Island community that may arise because of age, disability or changing circumstances.
46. The proposed housing designs need to demonstrate good principles of tropical design with an emphasis on a tropical aesthetic which is a response to the climatic and physical needs of the sites. The designs need to be sympathetic to the local vernacular architecture and utilise a complimentary limited palette of materials which enhance the contemporary tropical aesthetic of the dwellings and are resilient to the harsh maritime tropical climate.
47. Dwelling unit design and orientation is to take account of breezes, sun and storm control and maintain principles of good design to suit the island's climate.
48. The dwelling unit design shall consider factors that improve overall building performance under cyclonic conditions. However, the design shall be in accordance with AS 1170 Part 2.
49. Well designed covered alfresco areas are essential to enjoying island life, and need to accommodate the provision for wet weather screening to allow the areas to be used throughout the wet season.
50. The design will provide a tropical aesthetic with a practical 'fit for purpose solution', taking into account the physical and environmental conditions. The design of the housing will be informed by the following elements:
 - existing built environment;
 - climate;
 - durability;
 - transport to remote location;

- site conditions, and
- suitability of materials and components.

51. Further details on design intent based on Project One is provided at Attachment 1 for the CI New Housing Program – Project One Drumsite Village – Vision Document.

Construction

52. Dwellings will be designed and built by a contractor engaged by the Department under a two stage process comprising a Request for Expression of Interest and a Request for Tender, in accordance with the Commonwealth Procurement Guidelines.

53. The Principal's Project Requirement encourages the Design and Construct (D&C) Contractor to employ a modular or pre-fabricated approach to dwelling construction. The dwellings will be constructed using materials suitable for use in a harsh tropical, maritime environment and requiring minimal maintenance.

Subsurface Conditions

54. CI sites generally comprise poor, highly reactive soils with the top soil being thin and sporadic. The soil is categorised as clay between rock which is very susceptible to differential movement. The Project Two site (as stated in paragraph 8 'Historical Background') has previously been developed. The Project Three lots are within a developed residential area.

55. A geotechnical assessment has been carried out on the Drumsite to determine the soil conditions for preparation of civil and structural works and a site classification has been prepared. Testing of the soil has been undertaken to manage the risk of encountering latent conditions related to the site's previous uses. Refer to Attachment 7 for the Preliminary Site Investigation and Asbestos Assessment and Attachment 8 for the Report on Geotechnical Investigation.

56. A geotechnical assessment of the Guano Court lots will be undertaken.

Terrain Conditions

57. A preliminary rock fall assessment of the Drumsite Village location has been conducted and a risk assessment prepared by GHD. The initial rock fall assessment report prepared by GHD identified a cliff face rock fall hazard to the south of the site. The inaccessibility of the cliff-face precluded a full assessment; further investigation and modelling is needed to determine whether designed solutions are required to mitigate any risk of the rock fall hazard to the residential development. Refer to Attachment 8 for the Report on Geotechnical Investigation.

Erosion and Sediment Control

58. Significant earthworks will not be necessary for the previously levelled site at Drumsite. In accordance with the EMP, an erosion, dust mitigation and sediment control plan will be implemented for the project site by the D&C contractor.

59. The steep slopes at Guano Court will require management in accordance with the EMP for run-off from the site, which has the potential to create erosion in top soil, sedimentation and loss of

vegetation downslope of the site and eventual impacts such as sediment plumes to nearby marine areas.

Waste Disposal

60. Existing rubbish found on site will be removed; soil, building and general waste will be removed from site to the Shire landfill. Waste management shall provide protection of neighbouring properties and discouragement of feral and native animal species foraging on the construction site.
61. The D&C Contractor will be required to implement an Asbestos Management Plan, in accordance with SOCI requirements, to deal with any residual asbestos waste discovered on-site. A provisional rate for asbestos removal shall be included in the Contract.

Water Supply

62. The proposed project sites have existing town water supply. The volume adequacy of the existing water supply has been assessed as sufficient by the project's engineers GHD.
63. However, it is understood that the current available mains pressure at Drumsite may be inadequate to cover both potable water and fire services. However, the Project One D&C contractor shall determine pressure requirements and allow for additional infrastructure where required.

Drainage

64. The project sites have existing stormwater connections. The adequacy of the existing stormwater connections has been assessed as sufficient by the project's engineers GHD. The sites will be prepared to ensure that sufficient drainage is maintained from the developed sites. Approval of the final design shall be obtained from SOCI. Guano Court lots are expected to connect to the existing drainage system.

Sewage

65. The project sites have existing sewage connections. The adequacy of the existing sewer infrastructure servicing the surrounding area has been assessed by the project's engineers GHD as sufficient. Additionally, Project One will install new sewer lines at Drumsite to service the new development and this would be extended for Project Two. Guano Court lots are expected to be serviced by existing services.

Electrical Services

66. The project sites have existing electrical connections. A detailed design undertaken to support Project One will ensure that the existing electrical infrastructure has sufficient capacity under design load conditions. The determination of load capacity will include the additional requirements of Project Two, which is to cater for the total capacity of 30 dwellings at Drumsite Village.

Broadband/Telecommunications

67. CI has an existing copper network, with spare capacity. This network will be extended to cover telephone connection to the new lots.
RF video services shall be provided via TV antenna installation to each dwelling for analogue and digital TV transmissions.

Mechanical Services

68. Similar mechanical services incorporated into Project One will be designed into the subsequent dwellings. Energy saving design features will be incorporated, making use of natural and mechanical ventilation. Air conditioning will be provided as specified.

Acoustics

69. There are no known acoustic considerations.
70. Noise produced during the construction phase will be addressed in the EMP. The plan will cover working hours and notification of adjacent residents. Special consideration to minimise noise shall be made in respect to the Baha'i temple on the adjoining lot.

Water and Energy Conservation Measures

Water

71. The demand on the potable water supply will be reduced by adopting minimum Water Efficiency Labelling and Standards (WELS), with minimum ratings of 4.5 star for tap ware, 3.5 star for showers and 4 star WC suites (6/3L dual flush).

Energy Consumption

72. Dwelling unit design and orientation shall demonstrate good principles of tropical design, accommodating climatic and physical needs of the sites, taking account of breezes, sun and storm control. Designs will make intelligent use of the prevailing breeze, and deep shading of the exterior windows, to minimise the need for air conditioner use.
73. Energy efficient hot water generation and air conditioning will be installed.

Energy Rating

74. Low thermal capacity (lightweight) construction is to be encouraged. The dwellings will achieve a minimum 6 star Nationwide Housing Energy Rating System (NatHERS) or equivalent, according to the environmental ratings in the 2011 Building Code of Australia.

Site Planning Considerations

Lot Pattern

75. The dwelling sizes and shapes will reflect the existing character of development on the Island. The existing character is indicated in the Vision document at Attachment 1.

Density and Lot Sizes

76. The density and dwelling sizes will be determined by balancing economic use of the site, and the provision of 'fit for purpose' housing.

Roads

77. The Drumsite Village location has existing road access from two sides; Tong Yan Loh runs east to west and Sung Miaw Loh north to south. From these, a new 5 metre wide one way road, with parallel car bays on one side and a pedestrian footpath on the other, is to be constructed as part of the Project One works and will serve the needs of Project Two. The majority of the services are to be housed within the 9 metre road reserve.

78. The Guano Court lots have well-established road infrastructure in place.

Public Access

79. An opportunity exists to provide a pedestrian linkage within Drumsite Village.

Open Space

80. The site has a portion of vacant Crown Land and is relatively close to a variety of other open space. Project Two will feature a park with a BBQ servicing the whole development.

Provision for People with Disabilities

81. The Principal's Project Requirement contains accessibility provisions which will ensure a number of dwellings constructed shall be 'adaptable' with a view to meeting future housing needs of the CI community that may arise because of age, disability or changing circumstances. Where this is not achievable, families with special needs will be accommodated by modifying a suitable dwelling in accordance with appropriate standards.

Heritage Considerations

82. As noted in paragraph 22, there are no registered or recorded heritage sites within the project area.

83. Drumsite has been cleared of former buildings and only remnant infrastructure (carparks and laneways) is evident. The site is partially covered with secondary regrowth, with a mature rainforest adjoining the south-east area. The Guano Court lots are among developed lots with vegetation regularly cleared.

Community Facilities

Shops and Services

84. The Drumsite Village residential area has an adjacent local shop and a tavern/restaurant within approximately 200 metres.

Education

85. The CI District High School (which includes primary and pre-primary) is within Drumsite, within one kilometre from Drumsite Village. The CI Kindergarten is located several kilometres away in Settlement, at the foot of the island.

Public Transport

86. There is a twice daily bus service linking Drumsite to the other settled areas of CI. A free school bus service runs adjacent to Drumsite Village; a designated bus stop can be incorporated into the proposed development if school children numbers require.

A kindergarten bus service operates from Drumsite on the same route as the CI High School bus, on each day that the kindergarten is operational.

Fire Protection

87. Dwelling construction will conform to Australian Standards and BCA 2011. As noted in paragraph 56, a pressure pump may be required at the Drumsite to increase the water pressure to meet BCA fire requirements. The Guano Court site is within an existing residential subdivision and a requirement for additional hydrants or a higher water pressure is not envisaged.

Occupational Health and Safety

88. The D&C contractors tendering for the contract must hold current accreditation with the Office of the Federal Safety Commissioner at the date of contract award.

Landscaping

89. A well considered landscape design is vital to the overall aesthetic of the new built form at the site. A landscape plan will be developed for the site by the D&C contractor, using predominately local materials and native species suitable for CI. Quality soft and hard landscaping should enhance the contemporary tropical aesthetic of the new dwellings.

Consultation with Authorities

90. Consultation with the following bodies is planned:

- Department of Sustainability, Environment, Water, Population and Communities
- Shire of Christmas Island
- Western Australian Planning Commission
- Department of Immigration and Citizenship
- Other Commonwealth agencies with staff on CI,
- Parks Australia North; and the
- Indian Ocean Territories Administrator.

Impact on Local Community

General

91. The addition of 14 dwellings in Project Two at the Drumsite Village, and two dwellings in Project Three at Guano Court, will have a positive impact on the local community providing much needed relief to the private rental market and assist with the provision of state type services to the community.
92. A construction camp has been developed at part of Project One to mitigate construction worker accommodation risks. This camp will be available for Projects Two and Three to further mitigate this risk.

Traffic

93. The predicted increase in traffic volumes is low and the small increase in traffic will have a negligible impact on other road users. Nonetheless, the D&C Contractor will be required to prepare a Traffic Management Plan.

Economic

94. The CI New Housing Program will have a positive economic effect during the development and construction period. The D&C contractor will be encouraged to, wherever possible, create employment opportunities for local residents.
95. The lack of staff accommodation and public housing is also constraining attempts by businesses to expand as they have difficulty securing medium to long term accommodation on the island.

Cost Effectiveness and Public Value

Project Costs

96. The budget of the CI New Housing Program is \$26.6 million.
97. Feedback has been received from Departmental maintenance staff to ensure the design and specifications inform the Principals Project Requirements to reduce future maintenance requirements and life cycle cost of the dwellings. The PPR has specifically addressed the local conditions and the architectural style of the island to reduce the Life Cycle Cost of the program.

Project Delivery System

98. The preferred delivery option is 'Design and Construct'. Delivery options will be assessed in the project business case currently being prepared by the Project Manager. A two stage open tender process has been conducted with four companies shortlisted for Project One. This open tender process allowed for Projects Two and Three. For Projects Two and Three, the Department has the option of either negotiating directly with the company awarded the contract for Project One or alternatively approaching one or all of the shortlisted companies with a request for tender. A decision regarding the preferred procurement method will be informed by an evaluation of value for money, performance and current capacity. The tender process undertaken is compliant with the Commonwealth Procurement Guidelines issued by the Minister for Finance and Deregulation (Finance Minister) under the *Financial Management and Accountability Regulations 1997* (FMA Regulations).

Project Schedule

99. Indicative Project Schedule for Project Two and Project Three are outlined below. Refer to Attachment 10 for the detailed program.

Activity	Completion
Project One Practical Completion	June 2012
Project Two Practical Completion	April 2013
Project Three Practical Completion	June 2013

Public Value

100. This project adds to the Public Value by increasing the supply of housing on Christmas Island. The need for the program arises from an increase in population on CI which has increased demand for rental accommodation and the rental costs resulting in some local residents paying highly inflated rentals or being pressured out of the market altogether. The construction of additional housing will help to increase the supply of rental accommodation by enabling houses currently leased by the Commonwealth to be returned to the market.
101. Limited availability of housing has resulted in an inability to house additional Commonwealth employees, therefore the additional dwellings when constructed will enable additional Commonwealth staff (current and future) to be housed in quality accommodation.

VISION DOCUMENT – PROJECT 1 DRUMSITE VILLAGE



Vision Document APRIL 2011

Project 1 - Drumsite Village, Vision Document

Existing Vernacular Architecture

The local vernacular housing types are varied, but exhibit many desirable similar characteristics.

These aspects are to be incorporated into the Master planning & dwelling design of the Drumsite Project 1:

Relationship to the natural ground

- Majority of the dwellings are raised off the ground to provide ventilated sub-floors, as an economic response to the steep terrain and assist the migration of the iconic red crabs.
- The underside of sub-floors are to be screened, with a access for maintenance inspections. Screening should be raised 150mm above natural ground level to assist crab migration in the area.
- Where a small percentage of the less steep terrain is terraced to create flat sites, low retaining walls are to preferably be constructed from local random stone

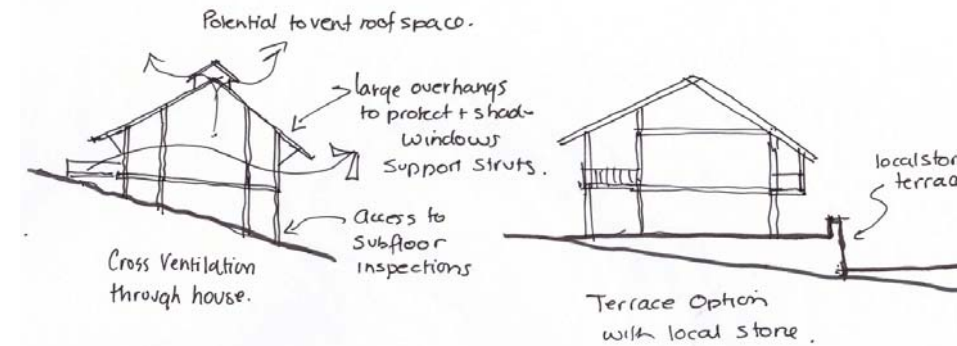
Relationship to the street

- The single lot housing on the island is traditionally setback from the road, surrounded by large grassed lawns and verges.
- The terrace housing & higher density housing on the island is traditionally parallel to the street, and dual faced to present balcony's to the ocean side.
- The older style lower density walk up apartments are on their own lot, with green space around them, and not necessarily orientated parallel to the street.
- Similar principles have been used in the indicative master plan on the Drum site.
- The only form of street fencing, is the construction of low natural local stone walls, which assist in defining the street boundary and transitions the levels from road to house. This is the only permitted form of front fencing.
- There are a number of 'compound' or 'U' shaped buildings on the island, where a number of dwellings/ buildings are located around an open courtyard. This structure has been used in the walk-ups at the north east of the site.
- Covered carports are to be provided, but should not dominate the streetscape

Roof Form

- Simple pitched roof forms, are used across the island.
- Gable & pavilion, simple pitched roofs - min 27-30° pitch,
- Skillion roofs (Tropical style), refer elevation example, - min 15° pitch
- Large roof overhangs (1200mm - min), are prevalent and provide for sun protection and rain protection and enhance the tropical aesthetic of the island
- Variations to roof pitch/overhang may be permitted where it can be illustrated that design intent or function is not compromised. Requires Approval.
- Box Gutters are not permitted, and valley gutters should be minimal as they are prone to leaking. Gutters are to be used only above access/pathway areas.
- Lined eaves are prone to mould and water damage. Eaves to be open, but ensure that rafter ends are covered by roof sheeting, and that roofs are well sealed at wall joint.
- The incorporation of ceilings lined on the rake in living/dining areas is strongly encouraged. It enhances the spatial feel of the unit, and increases the potential for venting of roof spaces.

Examples & Characteristics



Project 1 - Drumsite Village, Vision Document

Existing Vernacular Architecture

Characteristics

Alfresco Areas

- Covered alfresco decks on the ocean side of the dwelling, are raised above the street, to provide a sense of privacy to the resident and capture the breezes & views. Alfresco areas overlooking streets promote neighbourhood interaction and assist in creating a sense of community and a sense of place.
- Alfresco roofs may be on a lesser pitch, provided they are separated in plane from the main roof, to avoid leaking at change of pitch location. (Min pitch of alfresco roof areas 15°). They should contribute to the overall dwelling design.
- Where possible alfresco areas should be hardwood decking, in keeping with the traditional architecture of the island.
- Alfresco areas are to be located adjacent to dining/living areas and be easily accessible.
- Alfresco areas are to be of practical and useable size - Refer unit type requirements.



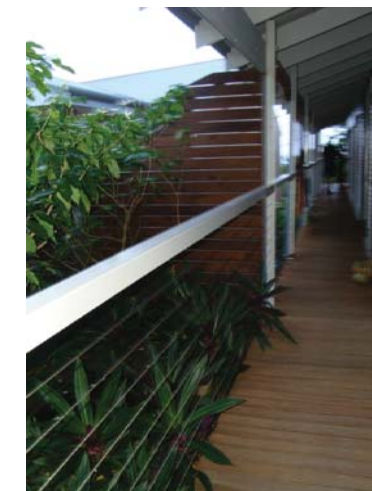
Openings

- The more desirable dwellings on the island have a high percentage of window to wall ratio, which provides a sense of light and space, high level of cross ventilation, and encourages the indoor/outdoor relationship to the alfresco areas.
- External Door/window height should be a minimum of 2.4m or a combination of standard head height with fixed light to 2.65m. The use of high level louvres is encouraged, to promote cross ventilation through living areas.
- Utilise operable glass & solid/cedar louvres to maximise cross ventilation, and assist in controlling airflow through the dwellings to encourage passive cooling.
- Fenestration proportions and break-ups should complement the dwelling design, and enhance the spatial feel of the internal rooms.
- Where possible master bedrooms should have glazed sliding doors onto balcony's to allow for greater ventilation and improve the window/wall ratio of the dwellings.



Limited palette of Materials & Colour

- A limited palette of Materials and Colour assist in providing the Drumsite with a sense of identity.
- Local stone, lightweight cladding, natural anodized windows frames, glass and cedar louvres, natural hardwood decking, natural galvanized steel and aluminium roof sheeting all contribute to a tropical aesthetic which respects the harsh coastal tropical environment which makes it unique to Christmas Island.
- The colour palette is earthy and light, with the additional of coastal colours which are found in the earlier settlement housing.
- All materials and finishes are to be suitable to the harsh tropical environment of Christmas Island and be highly resistant to rotting, rusting, mould and termites.
- Materials are to be low maintenance.





Houses too close together, reduces ventilation, low ceiling height, No sense of entry, inappropriate building type to the island



Relatively low window to wall ratio, means that dwelling does not interact with street, and exposed under floor unattractive



Nice aesthetic, however separated living and bedroom wings by breezeway is unpopular with residents.



Dated architecture, roof pitch unattractive, very limited alfresco area. House has low aesthetic value.



Unattractive roof form, lack of detail and no sense of entry or tropical aesthetic which represents Christmas Island



Low window to wall ratio, presents a building which is more institutional than residential. min overhang - screens filthy



Unscreened sub-floor unattractive and area dangerous for children as it is accessible. Needs to be screened, with lockable access door



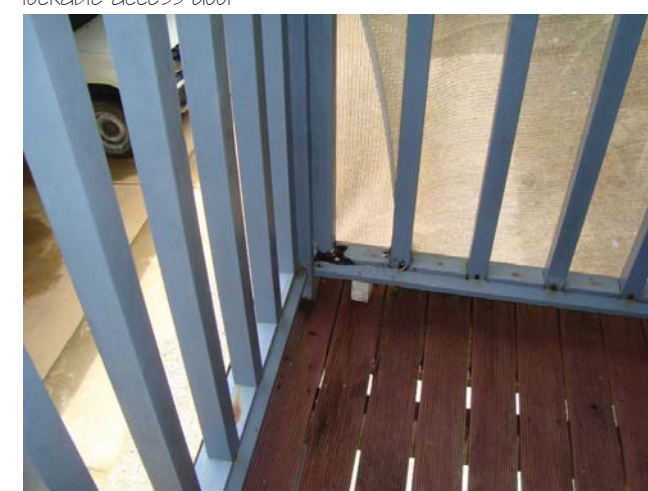
Inappropriate roof form to tropical climate. Sloped grass area unpopular with residents as dangerous for kids to play.



Stained pine decking, rotting where exposed to elements on upper floor. Main flooring rotting, inappropriate material.



Where roof pitch changes at valley, roof leaking and damaging floor below. Leaking exacerbated by low pitch to verandah



Where water leaks are dripping on floor & balustrade, timber is rotting. All timber to be fully covered by roof overhangs



Screws not appropriate to marine environment - rusting. Where water drips on timber, timber is rotting.

Project 1 - Drumsite Village, Vision Document

IMAGE BOARD & PALETTE OF MATERIALS

Wall Colour Palette

Wall Colours are to be earth tones, as represented by the colour palette indicated below. The colours below are not a complete range, but an example of a colour palette for the built form.



Note:

Contractor to provide proposed palette of materials and colour board for approval, prior to ordering.

Wall Material Palette

It is strongly recommended that retaining walls be natural local random stonework where practical.
 Ground floor walls may be masonry or lightweight construction.
 Upper floors to be lightweight construction/ cladding.
 Dwellings to use a mix of materials to provide interest, articulation, light and shade and be used to enhance the tropical aesthetic of the development
 Walls to have a 1/3, 2/3 split of materials. Any change in material should be expressed.



Well articulated streetscape with natural finishes, Troppo Architects | Boarding, large overhangs and screening to windows. | Example of palette of natural finishes | Local stone retaining walls & landscape | Landscape with colour | Colorbond wall cladding with natural timber



Example of light and airy interiors & alfresco area, with a natural finishes palette. home by architect Duncan Utz-Sanby | Contemporary Kitchen | Modern Bathrooms w/ mirror cabinet | Troppo Architects - Medium density project, illustrates Large overhangs, natural palette of materials



Articulated mix of materials on facade, with simple roof form | Tropical medium density housing with supported overhangs, pitched roofs and tropical landscape | Tropical feel to dwelling, with natural palette of materials, Large overhangs, pitched gabled roofs. Dwellings raised off the ground -Troppo Architects | Example of attention to detail with cladding and Natural palette of materials.

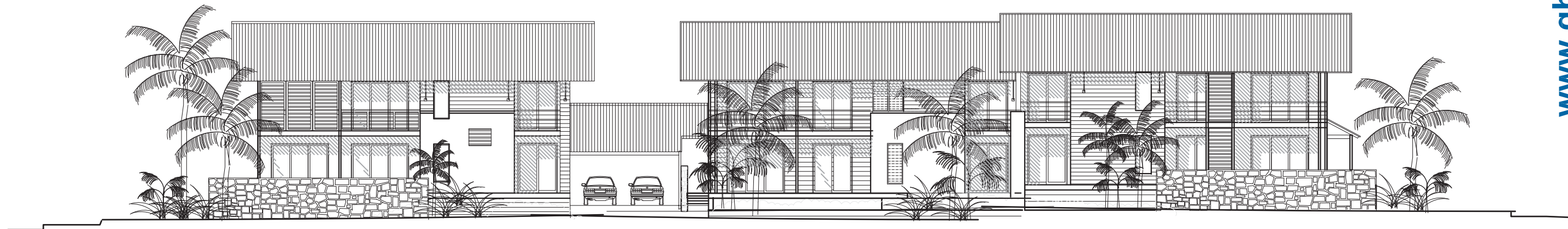
Roof Colour Palette

Aluminium roof sheet



Window Frames & Ancillary Items

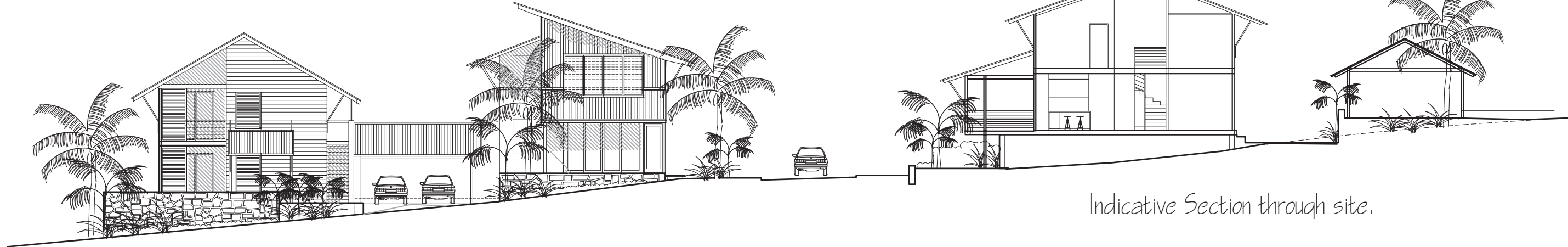
All window & door frames to be anodised aluminium or powder coated a light colour. Posts & steel work to be fully galvanised.



Indicative Street Elevation

Indicative Elevations of Preliminary Concept Master plan. Elevations demonstrate, scale, varied streetscape and articulation to facades.

Note: Roof form could be varied to provide further articulation to main streetscape. The inclusion of 1 x (2- Type D Walk-up units) into Project 1 is acceptable, provided it can be demonstrated it sits well in the site plan and contributes to the overall streetscape.



Indicative Section through site.

Unit Types, can be elevated with varying roof form, mix of materials, and minor detail changes to present an articulated streetscape, which contributes to an overall tropical aesthetic.

Note: Concept Unit types and street elevations are indicative only to provide tenderer with a suggestion of the type of form, size of dwellings and type of aesthetic desired for the site.



Drumsite - photos of adjoining buildings and site

DEPARTMENT OF REGIONAL AUSTRALIA, REGIONAL DEVELOPMENT AND LOCAL GOVERNMENT

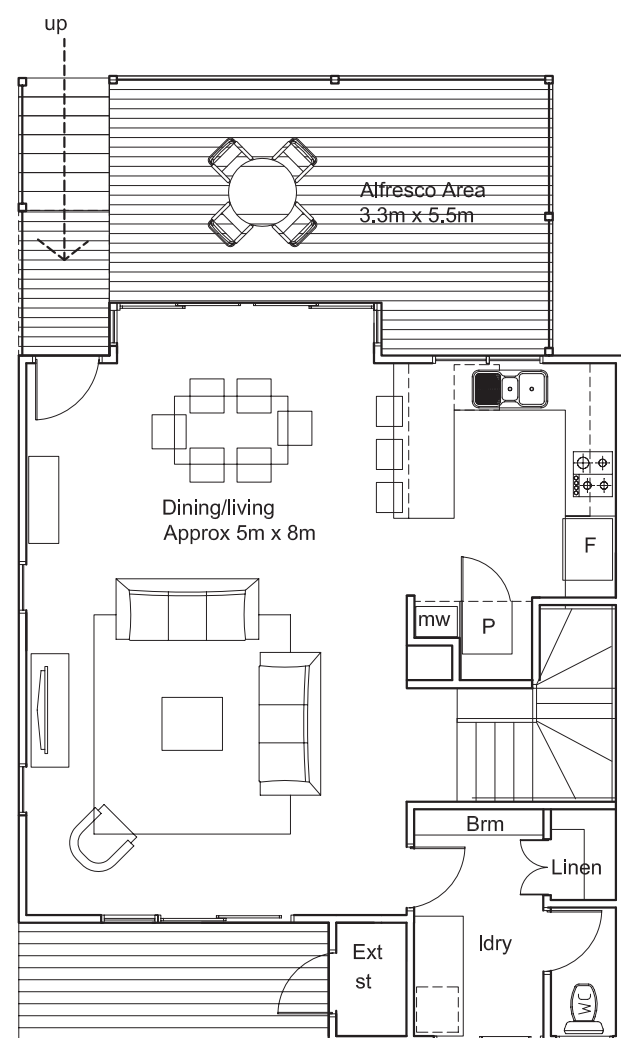
NEW HOUSING PROGRAM ON CHRISTMAS ISLAND - PROJECT 1 DRUMSITE VILLAGE

date: MARCH 2011

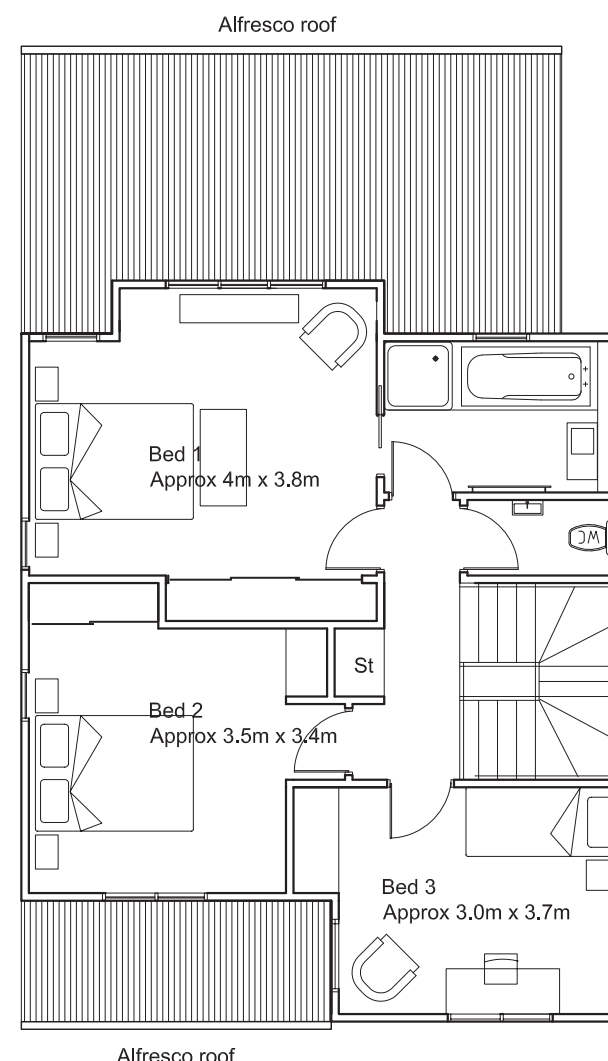
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drawing: Sk 301

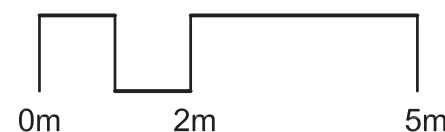




Ground Floor Plan



Upper Floor Plan



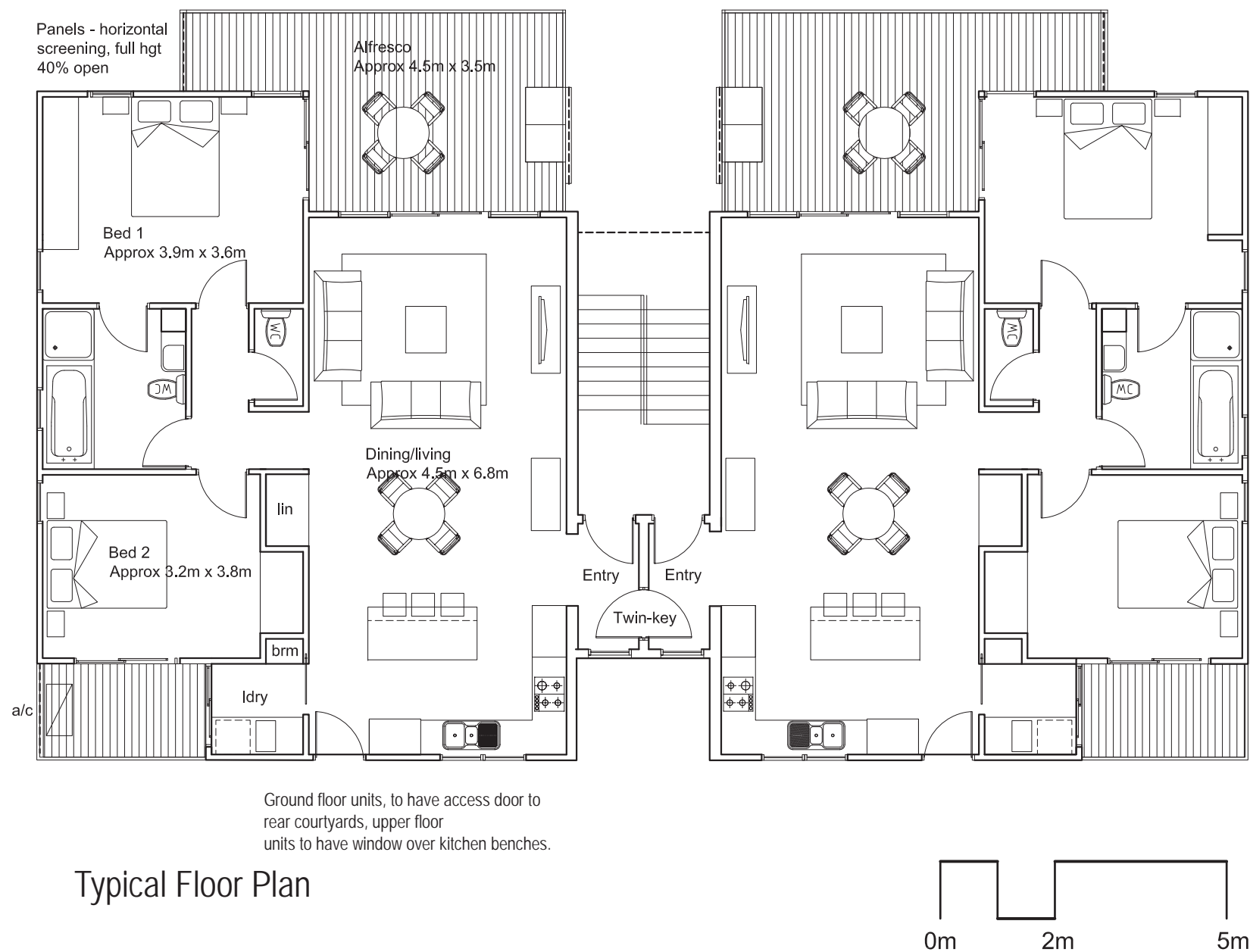
Indicative Floor Plans - Drumsite

3 Bed Townhouse Type C

Gross Floor Area Min - 138m²

Criteria specific to Type C

- Minimum of one covered carbay per townhouse. Carports to be located either adjacent, or to the rear of the townhouses.
- Minimum 50% of Type C's to have a second covered carbay. Overall car parking numbers as per the R-Codes
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m.
- Alfresco Area - Majority of alfresco areas in Type C's, are to be raised above the ground and face the street/ocean side. Where the townhouse is located at similar ground level to street level, alfresco area to be re-located to rear of dwelling for privacy reasons. However a front porch must still be provided, minimum 2.4m deep.
- Alfresco area to functionally allow for table for 6, and freestanding BBQ.
- Dining/Living area to connect alfresco area and courtyard.
- Kitchen to have breakfast bar which can accommodate 2-3 stools. Kitchen to be contemporary and light.
- Min courtyard depth 4.2m. Rear courtyards to be fenced to 1600mm above ground level. Ensure fencing does not inhibit crab migration.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Separate laundry to be provided with separate WC located on ground level.
- Semi-ensuite to be located upstairs. Separate WC to be provided, ensure located outside main bathroom.
- Landscaping to front and rear courtyards.
- Minimum paved area in courtyard of 20m²
- Ensure that air-conditioning unit placements are considered, and are centrally placed on walls.



Typical Floor Plan

Indicative Floor Plans - Drumsite 2 Bedroom Walk-up Type D

Gross Floor Area 95m² - Ground Floor Units

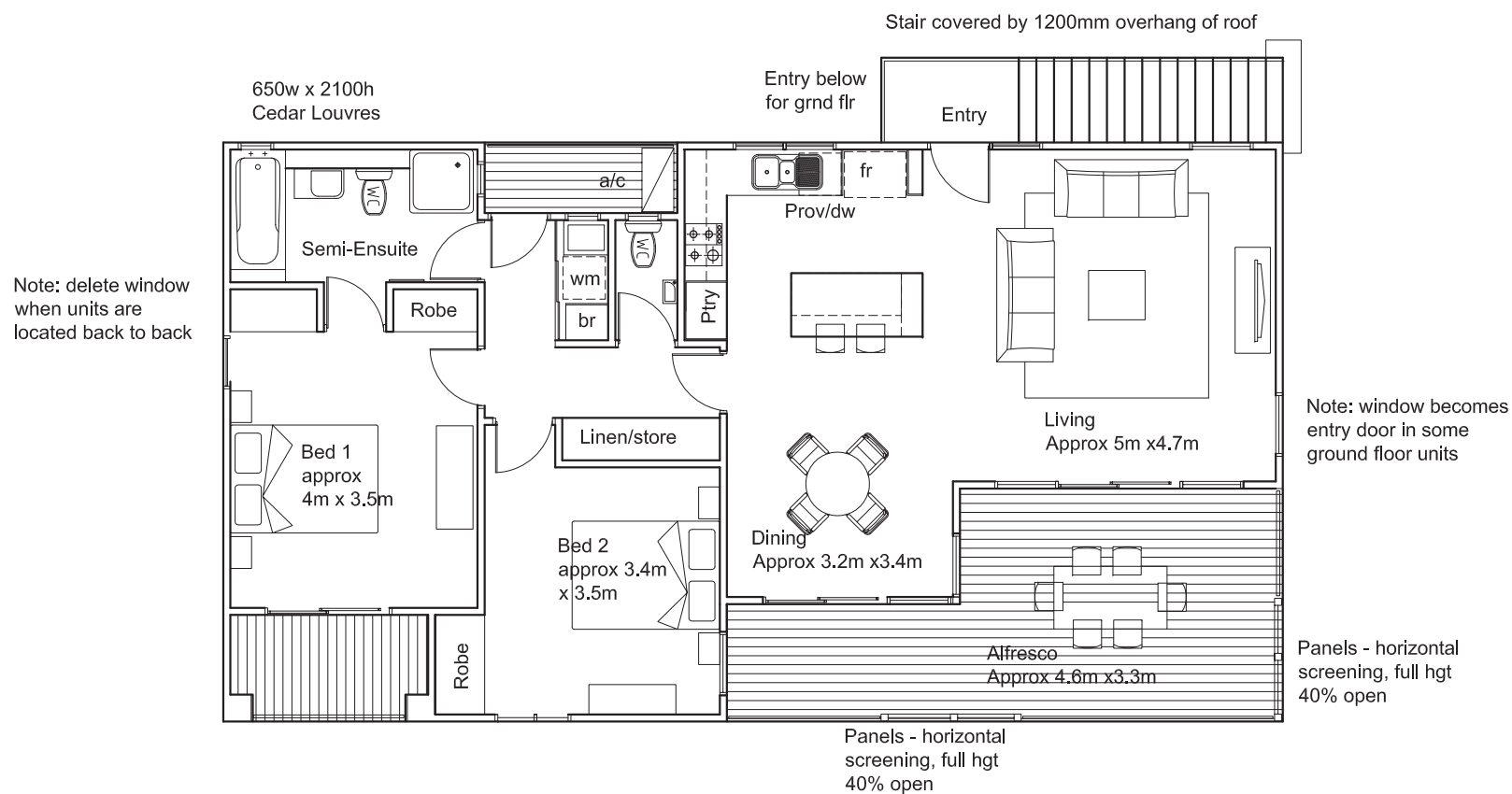
Gross Floor Area 97m² - Upper Floor (Inc sep entry)

Criteria specific to Type D

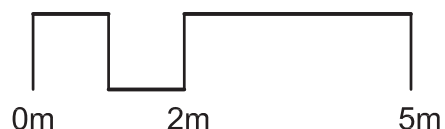
- Minimum of one covered carbay per walk-up unit. Carports to be located either adjacent, or to the rear of units with easy access to either front or rear door of unit.
- Remainder of carbays as per the R-Codes
- Type D units to have legible front door.
- Twin key units as indicated are for future stages, and are not applicable to Project 1.
- Access stair to upper floor units to be covered and legible from street.
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m. However ceiling height to bathroom and kitchen areas on lower floor may be reduced to 2400mm to accommodate plumbing and drainage.
- Alfresco Area - Locate alfresco areas to address main street corners, and take advantage of ocean vistas and breezes. Provide provision for future zip down blinds, or operable louvres to exposed corners of balcony's.
- Alfresco area to functionally allow for table for 6, and free standing BBQ
- Dining/Living area to connect alfresco area.
- Kitchen to have island bench which can accommodate 2-3 stools. Kitchen to be contemporary and light. Kitchen to relate to dining/living areas.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Laundry to be provided as separate room adjacent to kitchens.
- Landscaping to front and rear courtyards.
- Min paved area in rear courtyard of 12m²
- Ensure that aircon unit placements are considered, and are centrally placed on walls.
- Door in kitchen only applicable to ground floor units, it is to be a window over kitchen benches in upper floor units.

Note:

- For Project 1, Type D unit to be a one set of walk-up units with private stair to upper floor unit.
- For Project 1, the pair of Unit Type D's are to have a internal entry area, similar to that shown on the upper floor plan adjacent.
- Minor amendments have been made to the extent of balcony, and master bedroom layout for the Type D unit shown in Project 1.



Typical Floor Plan



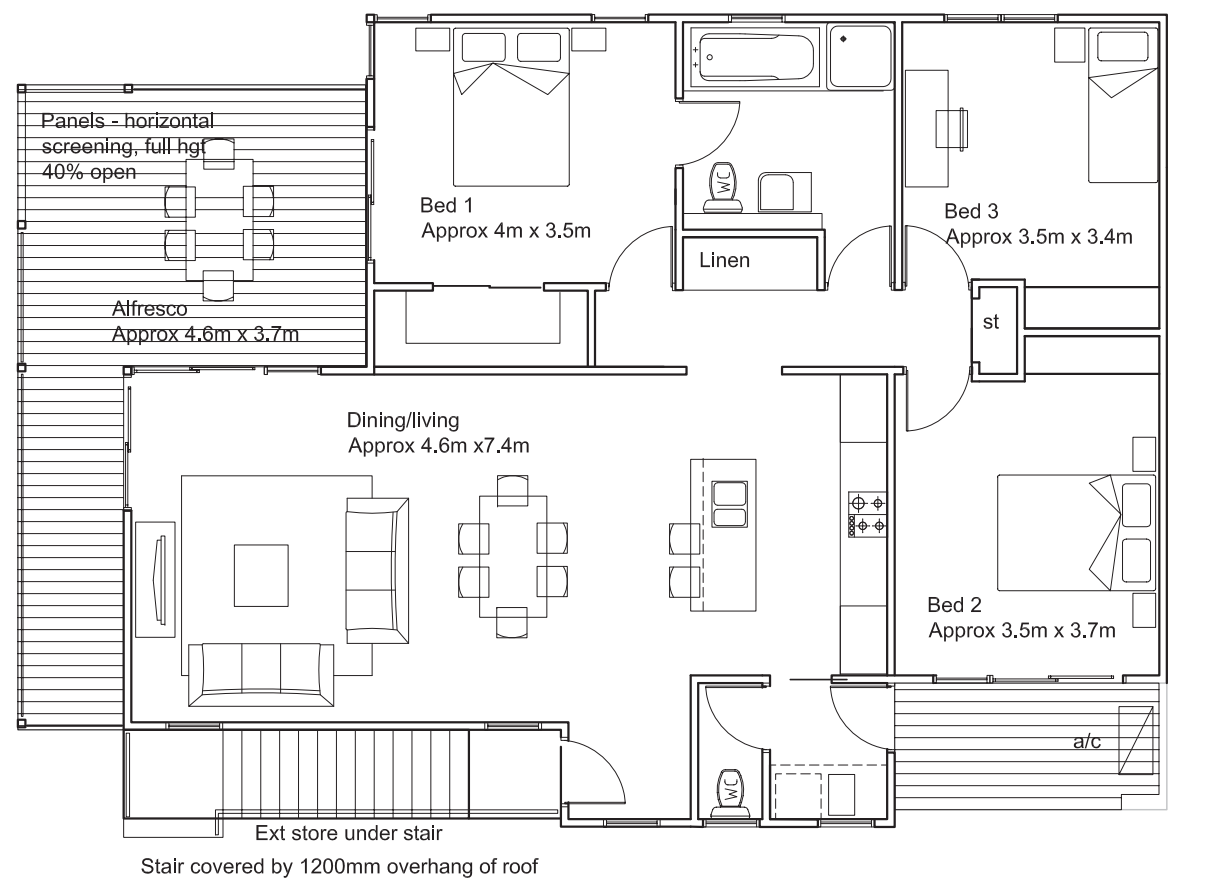
Indicative Floor Plans - Drumsite

2 Bedroom Walk-up Type F

Gross Floor Area Min 95m²

Criteria specific to Type F

- Minimum of one covered carbay per walk-up unit. Carports to be located either adjacent, or to the rear of units with easy access to either front or rear door of unit.
- Remainder of carbays as per the R-Codes
- Type F units to have legible front door.
- Access stair to upper floor units to be covered and legible from street.
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m.
- Alfresco Area - Locate alfresco areas to address main street corners, and take advantage of ocean vistas and breezes. Provide provision for future zip down blinds, or operable louvres to exposed corners of balcony's.
- Alfresco area to functionally allow for table for 6, and free standing BBQ
- Dining/Living area to connect alfresco area.
- Kitchen to have island bench which can accommodate 2-3 stools. Kitchen to be contemporary and light. Kitchen to relate to dining/living areas.
- Minimum courtyard depth 3.2m. Rear courtyards to be fenced to 1600mm above ground level. Ensure fencing does not inhibit crab migration.
- Ground floor units to have direct access to rear courtyards from unit, and visual connection from a habitable rooms such as /kitchen or living area.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Laundry may be in a cupboard behind louvered doors, or provided as a separate room with openable window. Both options must be adjacent to a covered balcony suitable for drying clothes. Provide pull out line on balcony's. Where pull out line on upper floor balcony's could be visible from street, provide a communal drying area at ground level for each pair of units.
- Landscaping to front and rear courtyards.
- Min paved area in rear courtyard of 12m²
- Ensure that aircon unit placements are considered, and are centrally placed on walls.



Typical Floor Plan

Indicative Floor Plans - Drumsite
3 Bedroom Walk-up Type G
Gross Floor Area 120m² -

Drumsite Project 1 - Vision Document

Unit Type Requirements -



Note :
Unit type G will be part of future stages.
Unit Type A,B,& E are not applicable to Project 1 Drumsite Village.

Type	Type C- Project 1	Type D- Project 1	Type F- Project 1	Type G- Future Stages
No Bedrooms	3 Bedrooms	2 Bedrooms	2 Bedrooms	3 Bedrooms
No Bathrooms	1 x Semi-ensuite with a shower, separate bath, & basin with storage. 1x separate WC with small hand basin upstairs & 1x separate WC in laundry	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC with small handbasin	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC with small handbasin
No Covered Car bays	Min 1 Covered Car bay. 50% of Townhouses to have two covered car bays.	Min one covered carbay to each unit Remainder as per the R-codes	Min one covered carbay to each unit Remainder as per the R-codes	Min one covered carbay to each unit Remainder as per the R-codes
Size of Alfresco Area - Minimum	3.2m x 5m Note: min depth of courtyard 4.2m	3.6m x 4.5m	3.3m x 4.6m	3.6m x 4m
Separate Laundry	Yes, must have direct access to external undercover balcony	Yes, must have direct access to external undercover balcony	May be separate laundry or behind louvered doors, with adjoining sliding door to undercover balcony	Yes, must have direct access to external undercover balcony
Minimum Gross Floor Area	138m ²	95m ² (no sep entry) 97m ² (if separate entry)	95m ²	120m ²
Min Size of Bedrooms	Bed 1 - 4.2m x3.8m Min Dim 3.6m Bed 2, - 3.2m x 3.5m Min Dim 3.2m Bed 3 - 3m x 3.7m Min Dim 3m	Bed 1 - 4m x3.5m Bed 2, - 3.8m x 3.2m	Bed 1 - 4m x3.5m Bed 2, - 3.2m x 3.7m	Bed 1 - 4m x3.5m Bed 2, - 3.2m x 3.7m Bed 3 - 3m x 3.5m
Min Size of Dining/Living	7.8m x4.8m	6.8m x4.5m	Living min 5m x4.6m Dining min 3.2 x 3.6m	7.5m x4.5m
Linen & General Storage	Linen - min 1.5m x .6m Gen Store - min 1mx .6m Brm - Min .5m x .5m Ext Store - as per r-codes	Linen - min .7m x .6m Gen Store - min .6mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes	Linen - min 1m x .6m Gen Store - min 1mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes	Linen - min 1.5m x .6m Gen Store - min 1mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes
Indicative Project 1 mix	6 Townhouses	2 Walk-ups	8 Walk-ups	
Indicative future mix	N/A	11 x 2 Bed Walk-ups	N/A	5 x 3 Bed Walk-ups

Note: Room Sizes all units
Min internal dimensions are:
Bed 1 - 3.5m
Bed 2 - 3.2m
Bed 3 - 3.0m

Note: Room sizes can vary provided that the total clear area of the room and min size dimension are equivalent to example sizes.

ie Bed 1 Could be 4mx3.5 or 3.8x 3.7m

Wardrobe Sizes all units
Min Dimensions are:
Bed 1 - 2.4m
Bed 2 - 1.4m
Bed 3 - 1.2m

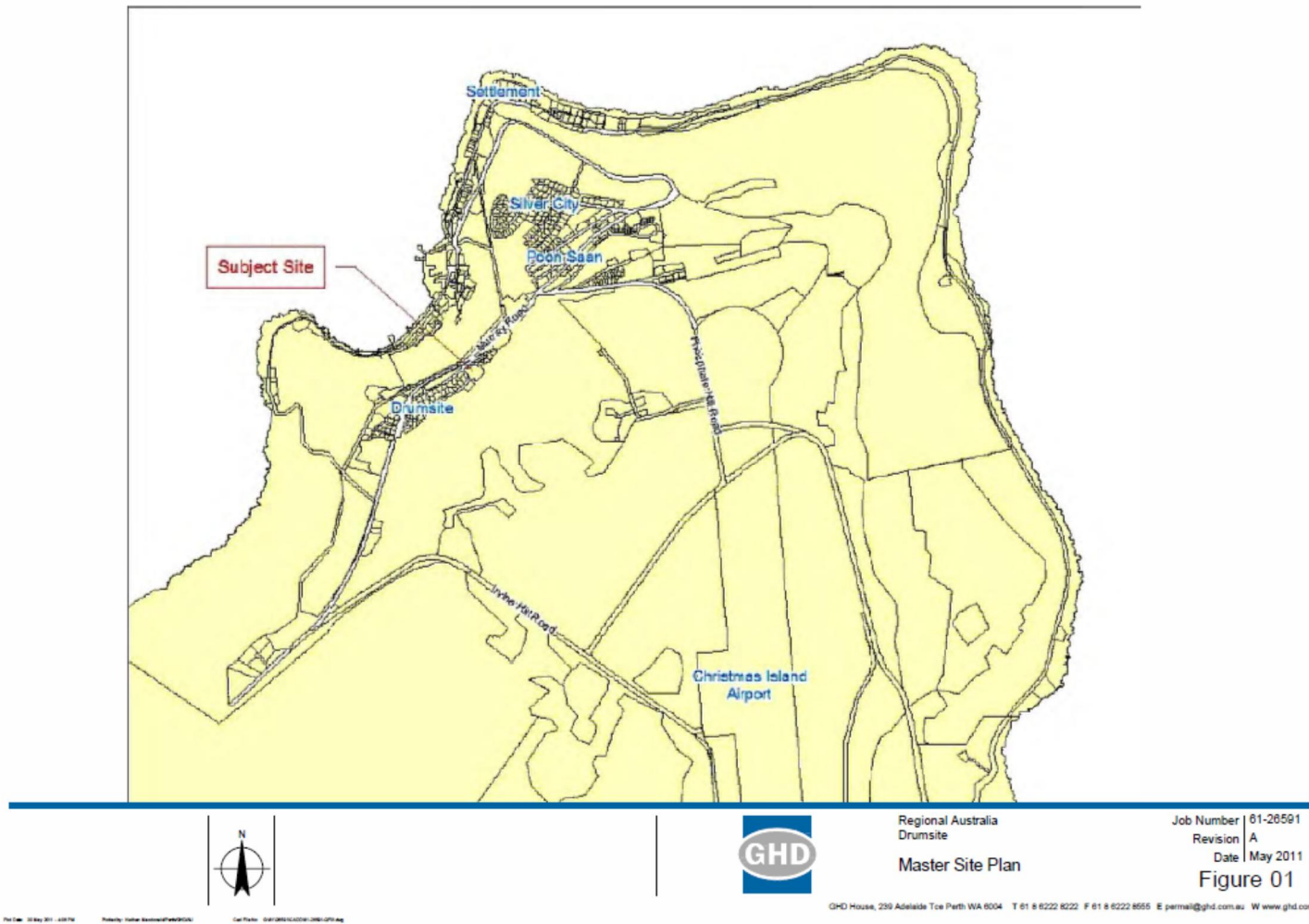
Kitchens to include for:

- Fridge Recess
- Microwave Recess
- 600mm electric hotplate
- 600mm underbench oven
- Rangehood ducted to external
- 1 1/2 bowl sink
- Pantry
- Prov for dishwasher

Note - All areas are gross floor area.

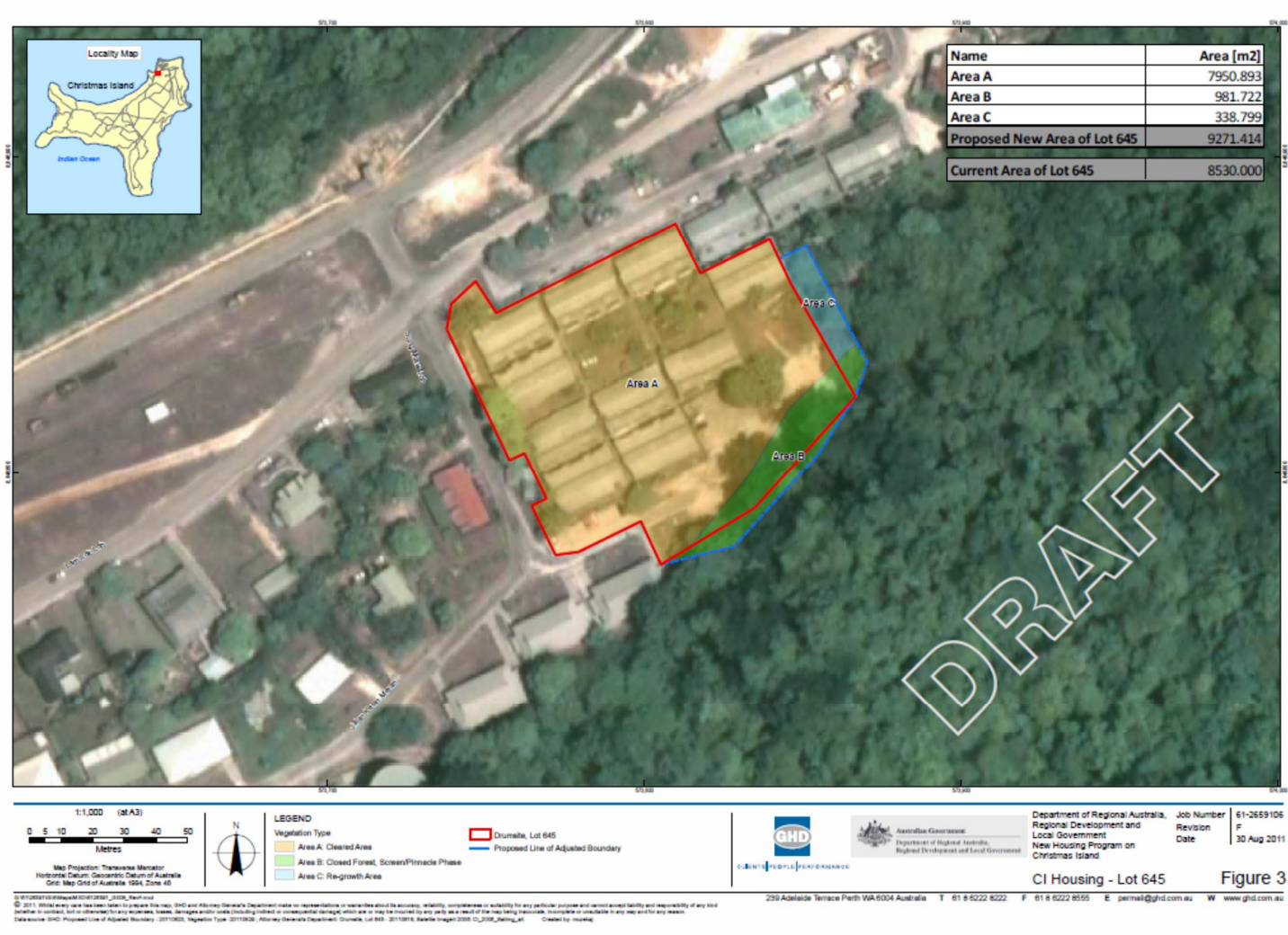
MAP OF CI SETTLED AREAS

Figure 1. Master Site Plan (Drumsite)



MAP OF DRUMSITE VILLAGE DEVELOPMENT SITE (LOT 645)

Figure 2 Drumsite Lot 645



SITE OPTIONS FOR PROJECT TWO AND PROJECT THREE

Figure 3. Six Site Options Identified for Projects Two (Area 1) and Three (Area 6)

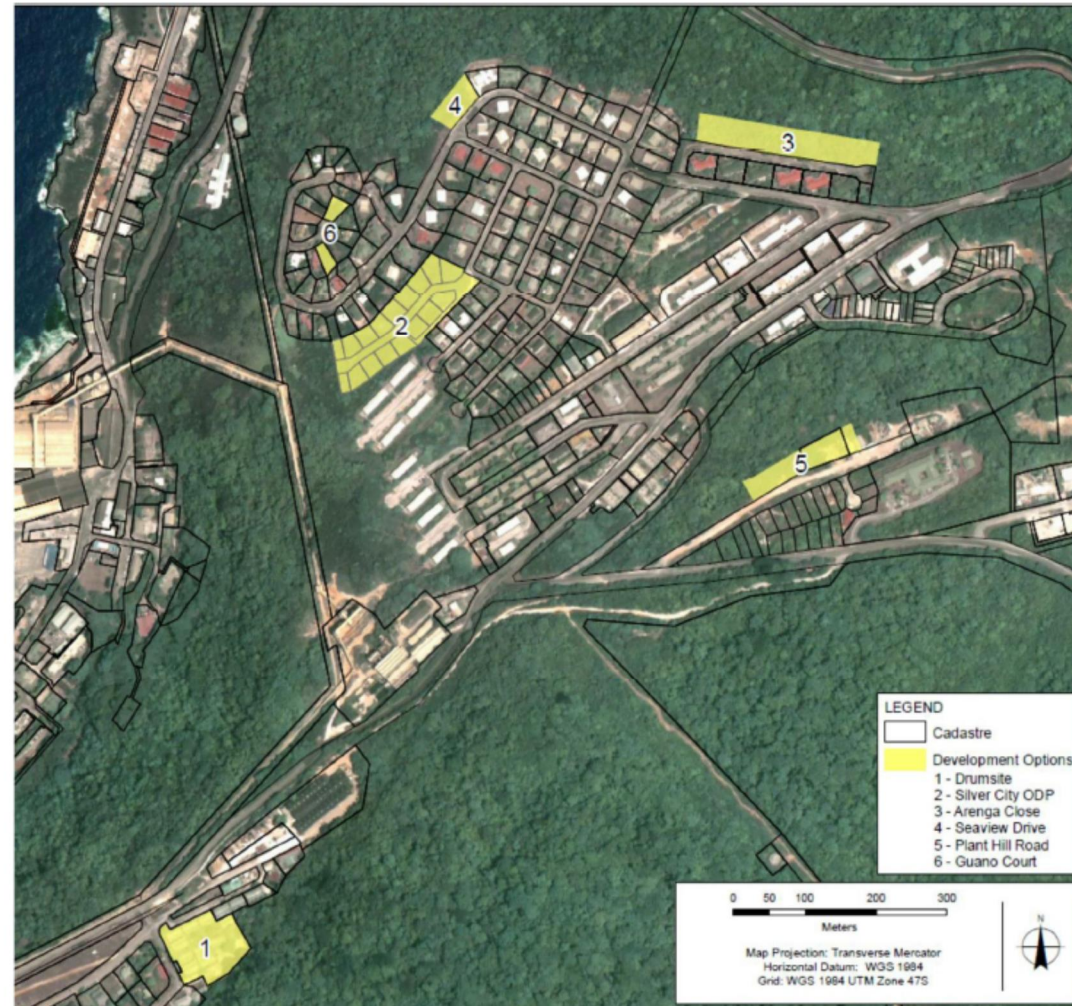


Figure 4. Option 2A (16 Dwellings)



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Figure 5. Option 2B (14 Dwellings)



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PROJECT TWO AND THREE SITE SELECTION ASSESSMENT



CLIENTS | PEOPLE | PERFORMANCE

**Department of Regional Australia,
Regional Development and Local
Government**

Report for New Housing Program
on Christmas Island

Project Two and Three Site
Selection Assessment

September 2011



This Project 2 & 3 Site Selection Assessment ("Report"):

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The services undertaken by GHD in connection with preparing this Report:

- were limited to those specifically detailed in section 1, 2,3 and 4 of this Report;*

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report ("Assumptions"), including (but not limited to):

- nil*

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

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Appendices

- A Drumsite Options
- B Cost Estimates
- C Option Assessment Table



1. Introduction

This report summarises the Options assessment workshop held on the 27th of July 2011. The aim of the workshop was to agree on the development sites that gives an outcome which best meets the project objectives in terms of housing needs within the available budget.

The workshop considered key project constraints, risks and opportunities in order to determine the most feasible development site. Some of the issues considered include:

- ▶ Cost;
- ▶ Planning;
- ▶ Design;
- ▶ Capacity and availability of infrastructure;
- ▶ Environment;
- ▶ Dwelling mix;
- ▶ Budget; and
- ▶ Project One.

At the end of the workshop the project stakeholders have agreed to develop a business case to progress Drumsite as the preferred option and to meet with the project control group to further discuss this.

1.1 Attendees

The workshop was attended by the stakeholders outlined in Table 1 below:

Table 1 Attendees

Name	Organisation	Role
Liviu Mihov-Nicotodis	DRA	Director of Procurement Policy – Territories West
David Nutt	DRA	Project Director
Karen Singer	DRA	Policy
Stephen Elliot	DRA	Land Manager
Kevin Walton	DRA	Maintenance
Peter Seman	GHD	Project Director
Cameron Owen	GHD	Project Manager
Pav Pillai	GHD	Assistant Project Manager
Anna Napier (part)	GHD	Environmental Scientist



Name	Organisation	Role
Kym Muir	Muir Architects	Architect
Jonathan Brown	Aquenta	Quantity Surveyor

DRA – Department of Regional Australia, Regional Development and Local Government



2. Project Background

2.1 Project Need

The objective of the project is to deliver approximately 40 new Commonwealth Government dwellings on Christmas Island (CI), delivered using a staged approach.

The housing is to be delivered in three projects to address the following requirements:

- ▶ Urgent Staff Dwellings; and
- ▶ Additional Departmental Housing Requirements.

The construction of the new housing at CI is required to achieve the following:

- ▶ Increase the supply of housing on CI;
- ▶ Improve and increase business opportunities;
- ▶ Increase availability of private rental housing to local residents;
- ▶ Increase staff dwelling to house essential staff members; and
- ▶ Reduce dependency on private rental housing.

2.2 Project One

Project 1 has progressed at the Drumsite Village and it includes a mix of 16 two and three bedroom apartments and townhouses. Contract negotiations are progressing and it is anticipated that the contractor will be engaged in August 2011.

The current master plan for the Drumsite includes the requirements for Project 1. Approximately one third of lot will remain undeveloped with the potential to be completed as part of Project 2 or 3.

2.3 Project Two and Three

The approximately 24 remaining dwellings to complete the New Housing Program on Christmas Island are to be progressed in Project 2 and 3. The mix of dwellings and land development options is yet to be determined and following this workshop it is anticipated that preferred options will be agreed and progressed accordingly.

2.4 Dwelling Design Philosophy

The general dwelling design philosophy for Project 2 and 3 will be in accordance with the Principal's Project Requirements (PPR) which has been developed for Project 1. The PPR has been developed following thorough consultation with key stakeholders and has been approved by Department of Regional Australia (DRA).

2.5 Housing Mix

Feedback from stakeholders has been used to determine the current demand for accommodation and the mix is detailed in Table 2 below. This represents the



accommodation needs of employees that have recently been recruited. The number of bedrooms is based on one bedroom per child. Stakeholder consultation indicated that a spare bedroom is desirable, but not a necessity. It was also noted that one bedroom dwellings do not meet the long term requirements of the employees and therefore have not been included in the final dwelling mix. Table 2 Current Housing Demand

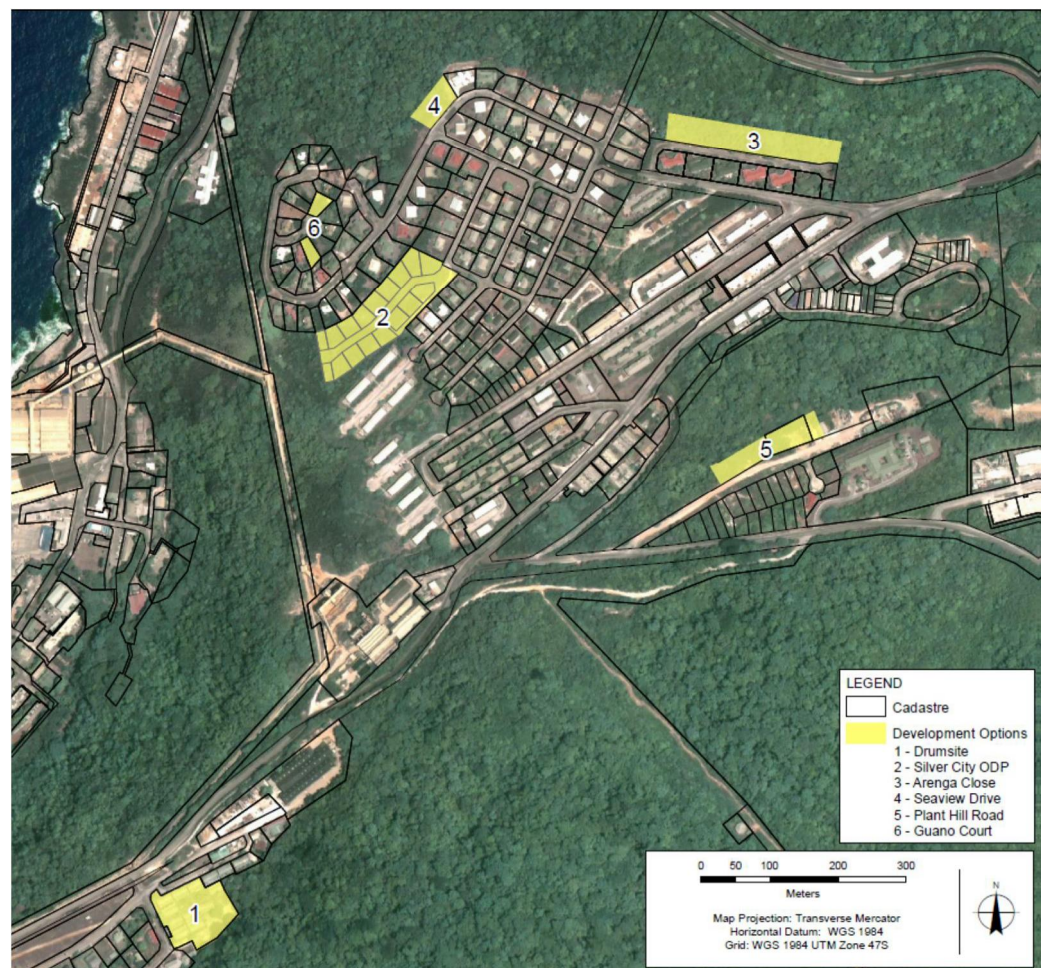
Houses required	No of Bedrooms needed
1	5
1	4
3	3
5	2

The significant demand for 2 and 3 bedroom dwellings is clear and will be particularly met by Project 1 which will provides 10 two bedroom units and 6 three bedroom townhouses. The provision of additional 2 or 3 bedroom units should still be considered as part of Project 2 and 3 to allow existing tenants, who have been allocated larger houses than they require, to be relocated to more appropriate dwellings. However, the demand for larger 4 bedroom dwellings is recognised and needs to be addressed in project's 2 & 3.

3. Development Options

The housing program is to be delivered over 3 years with the first dwellings scheduled for completion June 2012. Six site options for Project's 2 and 3 have been identified. Each option offers its own potential benefits and risks and must be considered in its own right. The Drumsite was selected for Project 1 as it offered the earliest completion date for Project 1. The six options to be considered for Project's 2 and 3 are summarised as follows:

Figure 1 – Site Location Map



Drumsite Village

The Drumsite Village is a serviced block with potential for flexible housing options. It has previously been developed and it is cleared and relatively flat. The site is suitable for higher density development including 2 bedroom units or 3-4 bedroom town houses.

Silver City ODP



A large distinct land parcel, held by the Commonwealth as a portion of Unallocated Crown Land is available for subdivision of 15 individual residential lots. The lot sizes ranged from 700m² to 884m².

Located to the west of Silver City and east of the CI Phosphate conveyor belt, the site is currently zoned "Residential Development" under the provisions of the Shire of CI Town Planning Scheme No.1 District Zoning Scheme. Each of the 15 lots within the site may potentially be Green Titled. The proposed single residential lots are expected to house up to 30 people.

Arenga Close

Located off Silver City Road the lots on the south side are currently developed. These dwellings are public housing. The proposed area for development is currently natural rainforest and is unallocated crown land. The land is gently sloping to the North. This land is suitable for larger 3 – 4 bedroom dwellings.

Seaview Drive

There is an opportunity to develop 3 lots on Seaview Drive. The area is near the intersection with Pai Chin Loh. The land is currently unallocated crown land. The land is suitable for up to 3 larger 4 bedroom dwellings.

Plant Hill Road

Plant Hill Road currently provides access to the bus depot and a private residential development on the south side. There is an opportunity to develop a number of large residential dwellings to the north side. The land is currently unallocated crown land.

Guano Court

The Commonwealth owns two vacant blocks of land on Guano Court. The blocks would be suited to the development of one 3-4 bedroom dwelling per block.

3.1 Drumsite Village

Project 1 is currently underway and development at the Drumsite will commence in Late 2011. This project uses approximately two thirds of the available land, with the remaining third included in the master plan for a future project, which maybe project 2 or 3.

The Drumsite Village site is on the land contained in Lot 645 on Deposited Plan 40603, being 2-2A Tong Yan Loh in Drumsite. The site currently has a small temple block inset on the western boundary (Lot 449 on Deposited Plan contained within Crown Land Title LR3106 Folio 112) along Sung Miaw Long. Directly opposite that on the other side of the road is the Baha'i Centre. On the northern side of the Site there is also an inset residential block (Christmas Location 310 on Deposited Plan 190992 contained within Certificate of Title Volume 2014 Folio 705) along Tong Yan Loh.

The majority of this Site is cleared and all buildings associated with previous developments have been demolished. However, there is remnant infrastructure from this development such as hard stand car parking areas, access roads and services. There is a risk that asbestos from the previous development is still present.



The site has already been cleared in the past and has also been severely impacted by introduced vegetation species. As the remnant rainforest area is upslope of the project site, on rocky ground, the risks of direct and indirect impact from clearing and runoff is low. The vegetation re-growth across the Site is minimal and consists of grass and small shrubs. There are mature mango trees along the western boundary of the Site.

The Site is 8,530m² and is mostly zoned residential (R40), which is suited to medium to higher density development. The Shire of Christmas Island is currently reviewing the Town Planning Scheme and it has been indicated that the zoning may be revised to R80. Town town planning approval for project 1 has been obtained; however further approvals will be required for project 2 or 3 and , it is considered that these are low risk and unlikely to impact the development process.

The geotechnical investigations that have been completed confirm that the geotechnical conditions are typical of Christmas Island. The site has been previously developed and is relatively level. There is angular limestone bedrock surface occurring at shallow depth, with poorly developed pinnacles. The soil cover varies from non-existent in areas of outcrop to about deeper than the limit of the excavator used to undertake the investigation.

The site is relatively level, cleared and has existing services available it is considered that this site conditions are favourable and there are no significant buildability issues associated with it.

It is considered that the Drumsite is likely to suit a fast tracked development due to minimal land development and low risks associated with approvals.

The anticipated cost for completing the development at the Drumsite is approximately \$ 11m.

3.1.1 Drumsite Options

The current masterplan for the Drumsite includes an allowance for an additional 11 two bedroom units and five 3 bedroom units to be developed as a future project. To address the demand for 4 bedroom housing the current master plan for the Drumsite can be revised to include the allowance for two 4 bedroom townhouses, along with three 3 bedroom units and nine 2 bedroom units. This revision reduces the overall dwellings at the Drumsite by 2 to 30.

It was agreed that the addition of 4 bedroom townhouses to the Drumsite masterplan would have a positive impact by assisting to develop a more diverse community. The townhouse layout with limited yard space was consistent with the CI lifestyle reducing the need for garden maintenance.

To progress the option analysis further two options for the Drumsite shall be further considered as follows:

- ▶ Option 2A – Current Masterplan; and
- ▶ Option 2B – Revised Masterplan.

Layout plans for each option and the proposed 4 bedroom townhouse are attached at **Appendix A**.



3.1.2 Strengths and Weaknesses

Table 3 – Drumsite Village Strengths and Weaknesses Summary

Strengths	Weaknesses
Previously developed, cleared and Homogeneous	Potential for existing asbestos contamination.
Existing services available.	Not suitable for large family homes.
Limited environmental impact and/or management requirements.	Existing temple may constrain development.
Higher density options feasible.	Possible to require a rock fall barrier to the north of the site.
Suits 2-3 bedroom developments, with limited 4 bed townhouses	
Opportunity to yield higher number of dwelling numbers for capital outlay.	
Shorter works period required than housing development in greenfield site.	
Higher density development is positive for the island as it has land availability constraints.	
Infrastructure already partially installed as part of Project 1.	
Design Developed and Master Plan agreed.	
Planning approval for Project 1 has been obtained	
Close to amenities and walking distance to school.	
Completes an already partially developed lot.	
Limited yard space suits the CI lifestyle.	



3.2 Silver City Outline Development Plan (ODP) Site

This site is the subject of the Report for Silver City Residential Expansion: Outline Development Plan (ODP) dated May 2010. It is an area to the west of Silver City and east of the Christmas Island Phosphate conveyor belt and forms the area shown in Figure 2. The site is Unallocated Crown Land with no active land use within the site. It is surrounded to the north, east and south by development, with only the western boundary of the ODP site abutting Unallocated Crown Land, which serves as a buffer to the conveyor belt.

The ODP site is not included in the National Park and has coverage of shrub and secondary growth forest over phosphate deposits and rock outcrops. The Town Planning Scheme designates the site suited for development.

Residential land uses predominate on the eastern, northern and southern boundaries of the ODP, with an R17.5 density associated with single dwellings on Pak Kam Loh, Jalan Perak and Seaview Drive. The site is currently zoned Residential (R17.5) and provides the opportunity to create 15 green title lots averaging 738m² as shown in Figure 3.

A terrace formation of development will be required together with retaining walls, reflective of site constraints and Island-wide practice. This is likely to require significant land development works prior to housing construction commencing. This will impact on the time line and costs for development at this location.

Impact on the natural environment will be minimal compared with a site with significant primary growth, and environmental approvals are considered low risk.

The site is affected by significant stormwater discharge from surrounding areas, particularly from the south and from the east at Pak Kam Loh where a drainage channel traverses the site. This channel from Pak Kam Loh, provides drainage for major storms for the existing developed area east and south of the site. The safe collection and conveyance of these overland stormwater flows presents a unique constraint to development of the site.

The ODP site is serviced by a network of existing roads with direct access to Pak Kam Loh. The relative location of the ODP site provides opportunities for integrating with the existing transport network in the area. Access between Pak Kam Loh and the ODP site is from an elbow junction which may pose some traffic management and safety issues without an adequate solution.

It is understood from previous geotechnical investigations that have been completed in the vicinity of this site that the geotechnical conditions are typical of Christmas Island. The site has an irregular and angular limestone bedrock surface occurring at shallow depth, with poorly developed pinnacles. The soil cover varies from non-existent in areas of outcrop to about 1.5m deep. The very high strength limestone bedrock below the soil will require blasting or heavy rock breaking equipment and therefore presents potential difficult and costly excavation.

A dedicated road through the site will provide linkage from Pak Kam Loh and will provide a reserve for utilities. A cul-de-sac at the end of this road would be positioned to allow for the future connection of the road south to Seaview Drive if required.

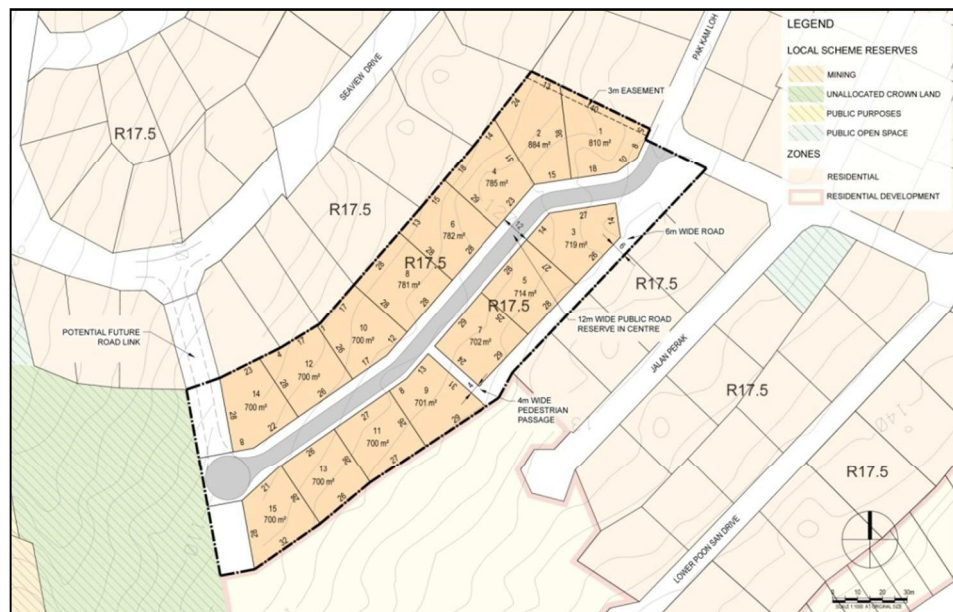
All services are available to the site including water, sewer and power.

The anticipated cost for completing the development at the Silver City ODP is approximately \$ 23.5m. The contribution to the overall program would be 15 houses in a mix of 3 – 4 bedrooms.

Figure 2 – Silver City ODP area



Figure 3 – Proposed development





3.2.1 Strengths and Weaknesses

Table 4– Silver City ODP Strengths and Weaknesses

Strengths	Weaknesses
Opportunity to extend the residential land uses within the local Silver City area.	Full servicing infrastructure required within the development.
Suitable for larger family homes.	The land development required will result in a long development time.
Currently zoned residential development under the Shire of Christmas Island Town Planning Scheme.	Anticipated high development costs due to topography and stormwater management.
Low-moderate environmental impact and/or management requirements anticipated.	

3.3 Arenga Close

The proposed site is currently undeveloped side of Arenga Close within the Silver City locality as shown in Figure 4. It is part of a larger area of unallocated crown land bounded by Murray Road.

The area is does not currently fall within a residential development zone under the Shire of Christmas Island Town Planning Scheme. However, the scheme is currently under revision and it is understood that this area is likely be zoned urban development under the new scheme. The site could yield up to 15 green titled lots depending on lot size; however, based on the fall of the land and future town planning considerations 11 lots are considered achievable. An important consideration in any development in this location is to ensure that it does not sterilise further development in the vicinity.

This area has been identified as part of the Local Planning Strategy review process as a future urban development area for residential land uses. If this site is chosen, then the final configuration of lots on the northern side of Arenga Close should be designed in such a way as to not preclude further urban development in this area.

The area is not within the national park and the road verge and adjacent areas are currently used by local residents for storage of miscellaneous items. The environmental assessment undertaken by GHD in January 2011 indicates that the site is currently covered with rain forest. Anecdotal evidence from local residents suggests that there may be some threatened or vulnerable species in the area and it may present a higher risk of obtaining environmental approvals compared to other options. This site will require referral under the EPBC act.

Further to the anecdotal evidence in relation to environmental matters, it is also understood that there is likely to be a higher level community interest in this development and a more detailed community consultation process would be required.

The site slopes away from the existing road at a reasonable continuous grade and there are no obvious gullies or water courses. This should provide for a reasonable minimum of retaining and stormwater management in relation to other site considered. There would be no requirement to upgrade the existing road.

The anticipated cost for completing the development at the Arenga Close is approximately \$ 13.7m. The contribution to the overall program would be 11 houses in a mix of 3 – 4 bedrooms.

Figure 4 – Arenga Close development option area



3.3.1 Strengths and Weaknesses

Table 5– Arenga Close Strengths and Weaknesses

Strengths	Weaknesses
Existing road access reduces land development cost.	Not currently zoned for residential development (review pending).
The area has a lower requirement for	An Outline Development Plan will be



Strengths	Weaknesses
retaining and drainage works than other options.	required for the area, which will require additional time.
Will complement existing residential development on the opposite side of the road.	Higher Risk environmental and planning approvals.
Suitable to a mix of 3-4 bedroom properties.	Potential community concerns.
	Relatively high development costs.

3.4 Seaview Drive (Silver City)

The area being considered on Seaview Drive, in Silver City, is on the western side of the road between the intersection with Pai Chin Lu and existing houses to the north. The site is within an established single house residential area. There is a narrow strip of land adjacent to the road in this area that is relatively level with minimal vegetation coverage. Further west, away from the road the terrain drops off and becomes very steep, with dense vegetation.

The site under consideration is part of a larger parcel of Unallocated Crown Land (UCL) that is over 29 ha in size. The maximum depth of any residential lots in this area would be 40m before the land becomes too steep for development.

This site consists of two terraces. The upper terrace is at road height and the lower terrace is down a step of approximately 3 m below the road height. There is currently no geotechnical information available for this site; however, irregular and angular limestone pinnacles are present. These observations indicate that a rock breaking and retaining structures will be required. No upgrade to the existing road network is required.

This area has been identified as part of the Local Planning Strategy review process as a future urban development area for residential/tourism land uses. If this site is chosen, then the final configuration of lots on the western side of Seaview Drive should be designed in such a way as to not preclude further urban development in this area.

The area is not within the national park. The environmental assessment undertaken by GHD in January 2011 indicates that the site is dominated by Coffee Bush; however, the potential for endangered species is noted and the site will require referral under the EPBC act.

There number of lots available at this location is limited to approximately 3, more likely 2, and it would be most suited to larger 3-4 bedroom family homes.



The anticipated cost for completing the development at the Seaview Drive is approximately \$ 4.3m. The contribution to the overall program would be 2 houses with 4 bedrooms.

3.4.1 Strengths and Weaknesses

Table 6– Seaview Drive Strengths and Weaknesses

Strengths	Weaknesses
Opportunity to extend the residential land uses within the local Silver City area.	Referral under the EPBC act required.
Suitable for larger family homes.	Anticipated higher land development costs due to topography and stormwater management.
Low-moderate environmental impact and/or management requirements anticipated.	
No additional road infrastructure is required.	
Low Risk Planning approvals required	

3.5 Plant Hill Road

The site being considered on Plant Hill Road is on the northern side of the road, adjacent to an existing residential subdivision and near the hospital. The adjacent subdivision has been vacant for some time and only now are residential dwellings starting to be constructed. The site would enjoy views to the north overlooking the Indian Ocean.

The site under consideration is part of a larger parcel which is predominantly Unallocated Crown Land (UCL) that is almost 8 ha in size. The portion of the land in question is zoned Residential. There is an existing lot, lot No 226 that is 2297 square meters.

The site consists of a relatively level clearing made of uncontrolled fill. The site is relatively level with Plant Hill Road and behind the clearing it drops away very steeply (almost a vertical drop) approximately 10 m. The site is at the same height (and marginally below) the tree canopy of the rainforest growing at the base of the drop.

There is very little information on the quality of the fill. It does appear from aerial photography that it was deposited over 30 years ago. There is no further geotechnical information available. Prior to construction at this site a detailed geotechnical investigation would be required to determine the quality of the fill. If the fill is



determined to be of reasonable quality then development at this site would be feasible. There would be no requirement to upgrade the road networks and there is access to services.

The site would be suited to 3-4 bedroom properties and it is considered that 8 – 10 lots could be developed at this location.

There is no vegetation of significance on the site.

The anticipated cost for completing the development at the Plant Hill Road is approximately \$ 13.5m. The contribution to the overall program would be 10 houses with 4 bedrooms.

3.5.1 Strengths and Weaknesses

Table 7– Plant Hill Road Strengths and Weaknesses

Strengths	Weaknesses
Large area of land available for development	Uncontrolled fill may be costly to remediate
Suitable for larger family homes	Planning approvals required.
Low environmental impact and/or management requirements anticipated	
No additional road infrastructure is required.	
Access to exiting services	
Limited land development required	

3.6 Guano Court

The Commonwealth owns two vacant lots on Gauno Crt. These lots are vacant lots within the Silver City area, which is characterised by single residential dwellings. The lots are extremely steep, with a gradient of up to 18% on one of the lots. The area is heavily developed with one and two storey residential dwellings.

The lots in question are vacant and covered in vegetation. The areas of the lots are:

- ▶ Lot 348 – 718m²
- ▶ Lot 352 – 708m²

The lots cannot be subdivided and are suitable for large family homes. However, ancillary accommodation, in the form of studio apartments (or ‘granny flats’), is permitted on these lots subject to the SOCI conditions.



As the lots are located within a developed area, there will be no requirement to upgrade the existing roads and services are reticulated through the area.

The process for Planning and environmental approval will be relatively straight forward and low risk.

The anticipated cost for completing the development at the Guano Court is approximately \$ 2.6m. The contribution to the overall program would be 2 houses with 4 bedrooms.

3.6.1 Strengths and Weaknesses

Table 8– Guano Court Strengths and Weaknesses

Strengths	Weaknesses
Suitable for larger family homes	Only two houses possible
Low environmental impact and/or management requirements anticipated	
No additional road infrastructure is required.	
Access to exiting services	
Limited land development required	
Shorter works period required	
Granny flat maybe considered as an additional dwelling	



4. Cost Estimates

4.1 Program Budget

The approved Budget for the Christmas Island Housing Program is broken down as detailed in **Error! Reference source not found.**Table 9. This budget is for the construction of approximately 40 dwellings. The anticipated costs for Project 1 are \$12m for 16 dwellings. Based on this estimate there is approximately \$11.6m remaining for the completion of Project 2 and 3 which aims to construct approximately 24 dwellings. Refer to Table 9 and Table 10 for a breakdown of the costs and budget figures.

Table 9– Project Budget Table

Project	Budget Amount
Project 1	\$7.7m
Project 2	\$8.4m
Project 3	\$10.5m
Total (A)	\$26.6m

Table 10– Cost Summary Table

Project	Forecast Amount
Project 1* (16 Dwellings)	\$12m
GHD Consultancy Costs	\$1.5m
Dwellings purchase by DRA	\$1.5m
Total (B)*	\$15m
Remaining Budget for Project 2&3 (Total A - Total B*)	\$11.6m

*Subject to negotiation

4.2 Project 2 & 3 Cost Estimates

GHD's sub consultant Aquenta has prepared preliminary cost estimates based on the indicative sketches for each option and information prepared by in the initial stages of the options assessment. These cost estimates are outline in Table 11. For more detailed breakdown of the cost estimates refer to **Appendix B.**



Table 11– Cost Estimate Summary Table

Option	No.	Total	Total Cost per Dwelling	Total Cost per bedroom	Ranking
Drumsite 2A	16				1
Drumsite 2B	14				2
Silver City ODP	12				7
Arenga Close	11				3
Seaview Drive	3				6
Guano Crt	2				4
Plant Hill Rd	10				5
Project 1 – Drumsite	16				

4.3 Budget Considerations

It is apparent that from the remaining budget of \$ 11.6m there is insufficient budget to progress the Silver City ODP, Plant Hill Road or the Arenga Close options. It is also unlikely that 40 dwellings can be provided under the Housing program without additional funding being made available.



5. Option Assessment

The Option assessment was undertaken considering the information provided in Section 3, input from attendees and the criteria outlined in **Error! Reference source not found.** The relative ranking agreed for each option will assist in providing direction to progress Projects 2 & 3. The Options assessment was conducted in two parts.

The first element included an assessment of the merit of each option, in this instance all aspects excluding the cost assessment were undertaken resulting in a preliminary ranking.

On completion of the cost assessment a final ranking was agreed and a level of risk allocated to each option.

5.1 Options Assessment Criteria

In order to rank the various options they were assessed against the key criteria. Each criteria was assigned a weighting that was agreed with workshop participants at the commencement of the ranking. The details are as follows:

Table 12 Option Assessment Criteria

No	Criteria	Description	Weighting
1	Cost	Based on cost per dwelling	30
2	Approvals - Environmental	Addresses the risk associated with obtaining environmental approvals	10
3	Approvals - Planning	Addresses the risks associated with planning and master planning	5
4	Site Issues	Addresses the risks associated with existing infrastructure, community, safety and constructability	15
5	Contribution to program	Addresses key project requirements such as functionality, No of dwellings and time to market	40

5.2 Option Assessment Summary

A summary of the outcome of the option assessment is detailed in Table 13. For detailed rankings refer to **Appendix C**.



Table 13 Option Assessment Summary

Option	Score	Final Ranking	Risk*	Comment
Drumsite 2A	84.5	2	L	<ul style="list-style-type: none"> On all criteria Drumsite was rated high, it represented the lowest risk in relation to delivery and contribution to the overall program objectives. The only negative consideration in relation to Option 2A is the failure to deliver any larger 4 bedroom dwellings.
Drumsite 2B	87	1	L	<ul style="list-style-type: none"> On all criteria Drumsite was rated high, it represented the Lowest risk in relation to delivery and contribution to the overall program objectives. Option 2B included 2 larger 4 bedroom dwellings and accordingly was ranked slightly higher than Option 2A. However, this is at the expense of overall dwelling numbers.
Guano Crt	69.25	3	L	<ul style="list-style-type: none"> Guano Crt was rated high to medium in relation to most criteria; however it was considered slightly weaker in the contribution to the overall program as it only delivered two dwellings (potentially 3 taking into consideration the granny flat), Approvals were considered Low risk and development could proceed relatively quickly.
Arenga Close	52	6	M/H	<ul style="list-style-type: none"> Arenga Close was considered to pose significantly higher risk in relation to approvals and community impact. The ranking for contribution to the overall program was reduced due to potential delays, requirement to clear rainforest when other options were available and potential community dissatisfaction. The relative estimated cost to develop this option also reduced the overall ranking.
Seaview Drive	49.5	7	M/H	<ul style="list-style-type: none"> In relation to Guano Court , Seaview Drive was considered to pose slightly higher risk in relation to approvals, as there is a requirement to clear more bush.



Option	Score	Final Ranking	Risk*	Comment
				<ul style="list-style-type: none"> • The difficulties associated with clearing and levelling the block reduced its criteria four ranking. • Contribution to the overall program was slightly lower than Guano Crt as only two dwellings could be delivered and there is limited opportunity for a Granny Flat. • The relative estimated cost to develop this option also reduced the overall ranking.
Silver City ODP	53.5	5	M	<ul style="list-style-type: none"> • Silver City ODP was considered low risk in relation to Approvals. • Silver City was considered to provide a strong contribution to the overall program objectives as it has the potential to deliver 15 dwellings in an area designated and approved for development. • The extent of land development required increased the relative cost of this option and thus reduced the overall ranking.
Plant Hill Rd	58	4	H	<ul style="list-style-type: none"> • Plant Hill road was considered high risk in relation to the uncontrolled fill and how this could be managed in progressing design. • Approvals were considered low risk. • An allowance within the cost estimate to treat the uncertain geotechnical conditions increased the relative costs of this option and thus reduced its ranking. • The contribution to the program for this option was ranked slightly higher than some other candidates as if the geotechnical conditions were favourable development could progress relative quickly and provide large family dwellings,

*L – Low, M – Medium, H – High.



6. Summary

There is approximately \$11.6m remaining in the budget for the Program to progress Project 2 & 3. This takes into account the estimated cost of Project 1 of \$12m, DRA purchase of 3 existing dwellings for \$1.5m and GHD's fees of approximately \$1.5m.

Project 1 will provide 16 dwellings consisting of a mix of 2 – 3 bedroom units and town houses. Project 2 & 3 should maximise the number of dwellings constructed while meeting the required dwelling mix, augmenting the existing housing stock including the requirement for 4 bedroom dwellings.

It is apparent from the Options Assessment that developing the remaining area of the Drumsite is the most viable option, with Option 2B being ranked slightly higher than Option 2A as it is able to assist in meeting the demand for 4 bedroom dwellings. Either of the Drumsite options can be progressed with-in the forecast available budget based on the preliminary cost estimates. Progressing Option 2B would result in a total of 30 dwellings built at the Drumsite.

The options that allow infill development of larger residential dwellings could be progressed within the program budget constraints; however, the number of dwellings delivered will be limited to a maximum of 5 at Guano Court and Seaview Drive.

Silver City ODP, Arenga Close and Plant Hill Road although clearly contributing to the dwelling numbers required by the program are not able to be completed based on estimated construction costs with-in the current budget.

The Housing Program aims to deliver approximately 40 dwellings. It is unlikely based on the cost estimates prepared that 40 dwellings can be constructed with-in the available budget. The most likely outcome at this stage is the completion of development at the Drumsite delivering 30 dwellings, in addition to the three purchased by DRA, totalling 33 dwellings.



7. Recommendation

In order to achieve the best outcome for the housing program, it is recommended that development of the remaining portion of the Drumsite be progressed in line with Option 2B as Project 2. It is anticipated that this could be completed within the available budget. This would result in a total of 30 new dwellings constructed by the Program. Subject to the tender pricing for Stage 2 being consistent with Stage 1 tender pricing, Guano Court should be progressed as Project 3 and considered in conjunction with the dwelling mix of project 2 on the Drumsite. (For example the Project Steering Committee may elect to complete the Drumsite with two bedroom townhouses to enable the dwellings at Guano Court to be completed.)

If the Drumsite option 2B is progressed the Program will deliver 33 (including houses purchased by DRA) of the approximately 40 dwellings outlined in the Project brief, with the potential to increase this to 34 or 35 depending on actual costs for Project 2.



Appendix A
Drumsite Options



PROJECT ONE

OPTION 2A

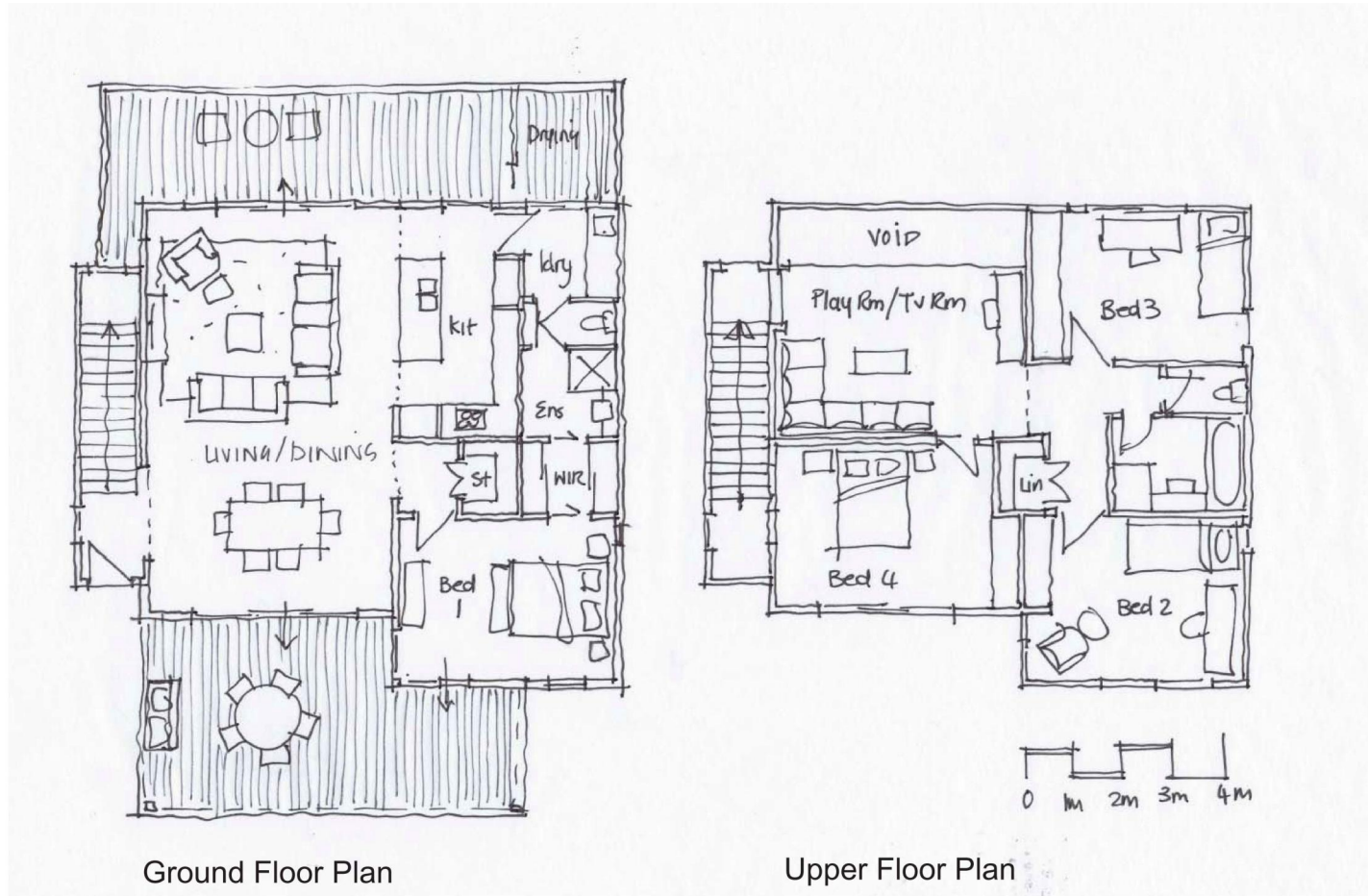
Project One - (16 Dwellings)
 10 x 2 Bed Walk-up Units
 6 x 3 Bed Townhouses

Option 2A - (16 Dwellings)
 11 x 2 Bed Walk-up Units
 5 x 3 Bed Walk-up Units

Total - 32 Dwellings, 46 Carbays

NOTE: Levels shown are indicative only





Ground Floor Plan

Upper Floor Plan

Indicative 4 bed Townhouse Plan
Approx 185m²




Appendix B
Not Used



Appendix C
Option Assessment Table

Project: New Housing Project On Christmas Island
 Client: Department of Regional Australia, Regional Development and Local Government

Ref #	Option 	Score	Final Ranking	Risk	Ranking before cost assessment	Criteria 1: Cost (lower the relative cost, the higher the ranking)	Criteria 2: Approvals- Environmental,	Criteria 3: Approvals- Planning, Master Planning	Criteria 4: Issues: Services, Community, Safety, Constructibility	Criteria 5: Contribution to the overall program objectives.	Consider Option Further? Yes / No	Comment	Capital Cost	Average cost per Dwelling
	Weighting					30	10	5	15	40				
1	Drumsite Option 2A (16 Dwellings) Lot 645 Tong Yan Loh 8580 m ² , R40 zoning Multi or Group dwellings	84.5	2	Low	2	10	9	9	9	8				
2	Drumsite Option 2B (2 x4 bed townhouses 14 dwellings) Lot 645 Tong Yan Loh 8580 m ² , R40 zoning Multi or Group dwellings	87	1	Low	1	9	9	9	10	9				
3	Guano Court R17.5 zoning Site is very steep	69.25	3	Low	5	7	9	10	7.5	7				
4	Arenga Close (11 lots 3.4 or 5 b/m) Reserved under the TPS as Unallocated Crown Land Site is heavily vegetated and relatively steep	52	6	Medium/High	7	5	4	4	6	6				
5	Seaview Drive in Silver City 29ha in size, part of Unallocated Crown Land R17.5 zoning narrow strip of land adjacent to road	49.5	7	Medium/High	6	3	6	8	7	6				
6	Silver City Outline Development Plan (ODP) Zoned Residential Development Site affected by significant stormwater discharge	53.5	5	Medium	3	1	7	10	5	9				
7	Plant Hill Road R40 zoning Site under consideration is part of a larger parcel which is predominantly Unallocated Crown Land, almost 8ha in size Site is extremely steep and covered in dense vegetation	58	4	High	4	4	9	9	6	7				



GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permal@ghd.com.au

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PROJECT 1 - PRINCIPAL'S PROJECT REQUIREMENTS



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GHD

Report for New Housing
Program on Christmas Island

Principal's Project
Requirements - Project 1
Drumsite Village

May 2011

This Principal's Project Requirements ("Report"):

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Appendices

- A Vision Document –Project 1 Drumsite Village
- B Indicative Drawings
- C Information Drawings – Survey and GIS Details
- D Christmas Island – Seismic Hazard Assessment
- E Draft Environmental Management Plan

1. Project One – Overview

Proposal

To provide the Department with 16 fit for purpose residential townhouses and associated infrastructure works on the Drumsite Village site.

The Christmas Island Housing Project one is for the Design and Construction of 16 dwellings at the Drumsite Village (Site). The mix of dwellings is to be 6 x 3 bedroom townhouse type dwellings and the remaining dwellings as 2 Bedroom walkups. The works include the associated site works, services, parking and landscape at Site.

The site is located on Lot 645 on the corner of Tong Yan Loh and Sung Miaw Loh, Christmas Island. The site is approx 8532m², however the proposed overall site plan extends the boundaries into crown land on the southern side of the lot and will be required to be adjusted for future titling of the lots. There is an approximate 8m fall across the Site.

The dwellings are intended to be managed by the Christmas Island Administration and Strata Titled at a later date. All design and construction shall allow for relevant Shire of Christmas Island (SOCl) requirements.

This Principal's Project Requirements document sets out the functional requirements for the design and captures the feedback from key project stakeholders.

1.1 The works

The Works which will be carried out as project one of the program will include:

- Preparation of Project Management Plans in accordance with the Contract Requirements.
- Design and construction of 16 residential dwellings.
- Provision of associated civil works such as minor earthworks, services relocation, construction of road access and connection and upgrade of services (if required) such as power, water and sewerage.
- Obtaining all necessary approvals apart from Development Approval and approvals required under the Environment Protection and Biodiversity Conservation Act 1999.
- Supply, delivery and installation of all fixtures and fittings as well as necessary plant, equipment and material to the Site to enable construction of the dwellings.

1.2 Site

The location of the Works will be at the site known as Drumsite Village, Christmas Island.

The proposed Site is on the land contained in Lot 645 on Deposited Plan 40603, being 2-2A Tong Yan Loh in Drumsite. The Site currently has a small temple block inset on

the western boundary (Lot 449 on Deposited Plan contained within Crown Land Title LR3106 Folio 112) along Sung Miaw Long. Directly opposite that on the other side of the road is the Baha'i Centre. On the northern side of the Site there is also an inset residential block (Christmas Location 310 on Deposited Plan 190992 contained within Certificate of Title Volume 2014 Folio 705) along Tong Yan Loh. Design and construction should take these factors into consideration.

The majority of this Site is cleared and all buildings associated with previous developments have been demolished. There is remnant infrastructure from this development such as hard stand car parking areas, access roads and services. The vegetation re-growth across the Site is minimal and consists of grass and small shrubs. There are mature mango trees along the western boundary of the Site.

The Site is 8,530m² and is mostly zoned residential (R40).

Details of the Site are found Deposited Plan 40603 contained within Crown Land Title LR3134 Folio 201.

1.3 Approvals

Refer to the contract terms and conditions

Development Application approval and approval under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) will be required before building can commence. The Contractor may be required to assist in obtaining these approvals.

2. Design Requirements

The following Principal's Project Requirements set out the design intent, aesthetic and functional design requirements, and construction standards which are a general guide for the development of the design.

2.1 Design intent

This is a performance based Principal's design requirements.

The design objective of Project 1 at the Site is to provide quality permanent fit for purpose housing for Commonwealth Government employees and families, which recognises the physical, cultural, heritage and environmental conditions of Christmas Island.

The design and construction of the proposed works must conform to the relevant sections the Australian Standards and Codes, including the Building Code of Australia 2011, as well as Commonwealth and state legislation.

Design and construct all roads earthworks and traffic control devices in accordance with the relevant standards and authority requirements. The contractor shall develop the design and apply construction methods, materials to optimise the life cycle costs for the Commonwealth for the life of the assets.

The design and construction of the proposed works will be carried out in accordance in accordance with the legislative requirements, and the national code of Practice for the Construction Industry.

The housing is to be designed to achieve value for money, be fit-for-purpose and have low ongoing maintenance costs.

Give consideration when evaluating and electing materials to minimise waste during manufacture, construction and use. Old growth and rainforest timbers will not be used. Consider using plantation timbers from an area under a Regional Forest Agreement.

The housing is intended for long term residents and must encourage a sense of place and community. A number of the homes constructed shall be 'adaptable' with a view to meeting future housing needs of the Christmas Island community that may arise because of age, disability or changing circumstances.

The proposed housing designs need to demonstrate good principles of tropical design with an emphasis on a tropical aesthetic which is a response to the climatic and physical needs of the sites. The designs need to be sympathetic to the local vernacular architecture and utilise a complimentary limited palette of materials which enhance the contemporary tropical aesthetic of the dwellings and are resilient to the harsh maritime tropical climate.

Dwelling unit design and orientation is to take account of breezes, sun and storm control and maintain principles of good design to suit the island's climate.

The dwelling unit design shall consider factors that improve overall building performance under cyclonic conditions. However, the design shall be in accordance with AS 1170 Part 2.

Well designed covered alfresco areas are essential to enjoying island life, and need to accommodate the provision for wet weather screening to allow the areas to be used throughout the wet season.

The respondent is encouraged to explore innovative use of building materials and construction techniques suitable for remote locality projects. This could include the use of prefabrication, precast and tilt up concrete construction and fast track delivery methods. Selection of construction materials must recognize the severe corrosive marine environment.

Large supported overhangs, deep covered balconies and high pitched simple roof forms are vital to the design of the dwellings.

Use of the local stone for retaining walls and feature stone walls is encouraged throughout the development to enhance the aesthetic of the Site.

A well considered landscape design is vital to the overall aesthetic of the new built form at the Site. Quality soft and hard landscaping should enhance the contemporary tropical aesthetic of the new dwellings. If the Contractor intends to bring plant material on to the island then AQIS approval will be required. Consultation with Parks Australia may be required regarding plant selections.

The overall aesthetic is to be a contemporary interpretation of tropical architecture unique to Christmas Island. The project should not appear as institutional or temporary accommodation.

The interior fixtures, fittings and finishes are to be light, and from a natural palette of materials and colours. The design of the kitchens and bathrooms are to be functional, contemporary and light.

For further details on design intent refer to **Appendix A** for the New Housing Program on Christmas Island – Project One Drumsite Village – Vision Document.

2.2 Site planning

The site is currently zoned R40, but is likely to be amended to a higher density of R80. The Contractor is to liaise with Shire of Christmas Island with regard to changes in density and planning & building requirements. Concept schemes attached reflect R50 minimum expected development standard.

2.2.1 Proposed Setbacks

Setbacks	Multiple Dwellings	Grouped Dwellings
Primary Street	3m min – 4m max (to deck/bldg line)	4m (to deck/building line)
Secondary Street	3m min – 4m max (to deck/bldg line)	3.6m (to deck/bldg line)

Internal Street	3m min to bldg/2m min to deck area	3m min to bldg area, / 2m to deck
Rear	3m min	3m min

Note setback minimums may vary under R80 zoning.

2.3 Functional requirements for site wide development

2.3.1 Relationship to the street

Provide legible entrances to the site, through placement of dwellings, landscape and road/verge materials.

Provide legible entrances to dwellings. Ensure that entrances to ground floor units have a minimum roof cover of 1.5m. Ensure that access to upper floor units is covered.

Use a mix of unit types to achieve a varied and well articulated streetscape reflective of the tropical location.

The site planning should encourage open elongated unit plan types which facilitate the cross ventilation of breezes and limit solar penetration and heat gain. A variation to this is allowed where unit types are required for streetscape consistency to directly address main external to street boundary as per adjoining properties on Tong Yan Loh. All development however is required to meet the new 6 Star environmental ratings in the 2011 BCA.

The temple which is on the western edge of the site is independent of the site. All works on the Site should respect the temple and provide appropriate planting/screening for privacy and noise reduction.

2.3.2 Street relationship to lighting

Provide a lighting plan for the development, which enhances the overall aesthetic of the Drumsite. Lighting should ensure safe ease of access to, from and through the site at night for pedestrians and vehicles, and provide lit routes from car parking into residences and around pathways. External lighting to be provided to courtyards and all alfresco areas.

Refer to section 4.15 for detailed electrical and lighting requirements.

Contractor to liaise with Shire of Christmas Island and any other relevant authorities with regards to lighting and external works requirements.

2.3.3 Street relationship to landscaping

Provide a landscaping plan for the site which incorporates the soft and hard landscaping for the project, including dwellings courtyards, verges, internal road, driveways, visitor's carbays, footpaths and laneways. Design and materials selection for both soft and hard landscaping is to enhance the tropical aesthetic of the Drumsite and be appropriate to the harsh climatic conditions of the site. Choice of soft

landscaping should be suitable to the varied monthly rainfall on the island. Soft landscaping is to be a mix of size of plants, colour and species, suitable to the climate.

All landscaping designs are to be low maintenance.

It is not necessary to retain the large Fig & Mango trees on the site.

2.3.4 Relationship to the natural ground

Dwellings should be elevated above natural ground level where possible to minimise ground disturbance, allow for water run off, and facilitate crab migration in the area. Underside of dwellings should be screened as per section 4.4.2. In some areas, it will be more appropriate to terrace the site levels, and provide low local stone retaining walls. Design is to ensure that an alternative crab migration path is available. Ensure that FFL of dwellings is not below adjacent finished street levels.

Where a retaining wall is required between units, ensure that the retaining wall does not directly abut a habitable room, but is separated by a pathway, min. 1000mm wide. To allow for water run off, retaining walls may abut open carports.

Where dwellings are raised above ground level, secure access is required to the sub-floor for maintenance inspections.

Front fencing is not required, however where change of levels occur use of low local stone retaining walls is strongly encouraged.

General Low level retaining walls required across the site are envisaged to be from local stone as identified in the Vision Document included at **Appendix A**. All retaining walls and earth works form part of the contractors work. Retaining walls require structural engineer certification and to have safety barriers as per relevant building codes, and Australian standards. In design of retaining walls the Contractor should address the recommendations of the Christmas Island Seismic Hazard Assessment the relevant extract is attached at **Appendix D**. Due to the high rainfall in the area, all retaining walls to have suitable drainage.

2.3.5 Services and access in relation to site-planning.

Note: Refer to Detailed Site Development Requirements in section 3.

It is envisaged that a one way road will be required. The Indicative Site Master Plan included at **Appendix B** includes a 9m road reserve which has been allotted within the lot boundary. The 9m is made up of a 5m one way road, with parallel car bays on one side and a pedestrian footpath on the other. The majority of the services to be housed within the 9m road reserve.

Provide a 6m laneway at the southern end of the site which maintains access to the carports of the Department of Immigration and Citizenship (DIAC) house immediately adjacent to the southern corner of the site.

Maintain sewer connections to DIAC houses which currently run through the Site.

Provide a vehicle link to a future 6m laneway, which is to run along the back of the asbestos flats located on Tong Yam Loh to the future commercial precinct it will serve.

The internal road is to accommodate vehicle access for rubbish trucks and FESA appliances. Contractor to ensure turning circles of relevant vehicles can be accommodated.

Bin services and any other ancillary services (Transformers, pumps and tanks etc) are to be provided in an area which does not diminish the overall aesthetic of the streetscapes, ideally located adjacent to laneways etc for minimal impact on residences. Bin areas shall be screened and fully roofed. Provide appropriate concrete floor and screen finish suitable for wash down, Provide hose cock to allow wash down and drainage of floor of the bin stores.

Contractor is to liaise with local council for waste management requirements.

The sewer connection currently runs through the site to service the DIAC houses on the southern boundary. This service is to be maintained, however the current sewers can be re-located onsite to better suit the new development, and ensure the standard of the sewer and other services are suitable the quality of residential development being provided. An easement will need to be created from road, to the DIAC houses. Sewer services to the DIAC houses are required to be continuous throughout the development of the project.

2.3.6 Directional signage

Provide appropriate directional signage and unit plan numbers to all buildings at the Project 1 Site.

Ensure signage materials are able to withstand the corrosive environment.

2.3.7 Relevant Standards and Codes

All work is to comply with the latest versions of:

- Relevant WA and Commonwealth legislation
- Building Code of Australia 2011
- Relevant Australian Standards, including AS 1428 Part 1 (Design for access and mobility);
- Operational and Legislative requirements of the Shire of Christmas Island.
- A statement of compliance is required to be provided at the Detailed Design Report design review.

2.3.8 Access to premises.

Access to dwellings to meet minimum access requirements of revised BCA 2011-03-28

In addition to the BCA requirements '1' multiple dwelling in Project 1 (2 bed walk-up unit) is to be fully accessible and meet Australian Standard 1428. Future stages will require '1 x' 2 & 3 bedroom unit types to be fully accessible. This should be kept in

mind when setting levels for across the site. Any changes to the siting and master plan should not compromise the ability of future Drumsite stages to meet this requirement.

2.3.9 Functional car parking and stores requirement

Carports are not to dominate streetscapes, and should be set back further than dwellings. Refer to Table 1 set out below for requirements.

Internal road is to provide a limited number of visitor's car bays as per the R-codes. The southern laneway is to provide additional overflow parking and boat storage where practicable.

Carports should be located adjacent to dwellings where possible in some areas grouped areas of car parking are provided, ensure that clear, well lit access pathways are provided to dwellings.

Carports should have pitched roofs, steel frames and be in keeping with the general aesthetic of the adjoining dwellings.

Gradient of driveways as per the current relevant codes and Australian Standards.

External Stores are to be located adjacent to carports. Stores should be weatherproof and have a lockable access door and lighting. Area as per R-codes.

Table 1 – Car parking requirements

	Covered Car bays	Non-covered Car bays
Three bed dwellings	Min 1 Covered Car bay Min 60 % of 3 beds to have 1 additional covered car bay	As per R-codes
Two Bed dwellings	Min 1 Covered Car bay	As per R-codes
Visitors Car bays	As per R-codes, to be provided off internal street, laneways and integrated into primary and secondary street verges. Car bays are not to interfere with turning circle of rubbish trucks or FESA appliances' on bends. Min Height of carports for clearance 2.3m	
Size	Carports – double	5.5m wide by 5.5m depth (+eaves)
	Single	3.2m x 5.5m depth
	Visitors and Street bays	As per R-codes and relevant BCA and Aust Standards.
	Accessible Unit	As per 1428 & BCA

2.4 Dwelling design considerations

2.4.1 Roof form

Simple pitched roof forms are to be used. Min pitch of Gable and Pavilion Roofs – 27° to 30°.

Tropical style skillion roofs may be used, where two different sized skillions are abutted to provide high level openings, and articulated building form Min Pitch – 15°.

Box gutters are not permitted, and valley gutters are discouraged.

Gutters are to be provided only above access ways & entrances, such as entrance doors, stairwells to shield pedestrians from shedding water etc. Gutters to be a ½ round profile. Where valley gutters are used, gutters should be custom made with edges folded up to prevent any water migration into roof cavity.

Large roof overhangs are required, to provide rain and sun protection and enhance the tropical aesthetic of the dwellings. (Min 1200mm).

Note: Minor variations to roof overhang may be approved, provided contractor can demonstrate that the changes do not detract from the overall aesthetic and functionality of the roof design.

The incorporation of ceilings lined on the rake in living/dining's areas is strongly encouraged for upper floor units.

Lined eaves are not permitted, as they are prone to mould and water damage. Ensure that rafter ends are well covered by roof sheeting and that the wall/rafter connection is well sealed by suitable bird boards.

Ensure all external doors are protected by appropriate roof overhang or separate awning. Minimum roof coverage to main entrance doors to be 1500mm, minimum roof coverage to all other external doors 1200mm (i.e. sliding laundry doors).

2.4.2 Openings & fenestration

External door/window height shall be standard head height with the incorporation of fixed and operable highlight windows to the main living/dining room fenestration as a minimum. The use of operable awning or louvre highlight windows to assist cross ventilation is strongly encouraged.

The selection of a 2.4m high external doors/window system is also acceptable, provided a consistent window/door head height is achieved.

The selected window/door system design should have a consistent head height/highlight level, ie the mix of 2400mm high sliding doors, with 2100mm high windows is not permitted on the same elevation as they present an inconsistent façade.

The placement of a key feature window at a different head height level however is permitted.(eg low horizontal kitchen window, or picture window from a

stair)Door/window systems should be a commercial grade and suitable to the corrosive and climatic environment of Christmas Island.

Size and number of glazed doors and windows should be appropriate to contemporary living, and enhance the spatial characteristics of the dwelling design.

Openings should be located to enhance the indoor/outdoor feel between living rooms and alfresco areas.

All windows will require protection by means of eaves overhangs or awnings where not under terraces and balconies.

The use of solid louvres' is encouraged on east and west walls, to promote cross ventilation and minimise solar penetration and heat gain. Louvres are to be storm proof and meet the appropriate Australian Standard wind/storm ratings for the island.

The use of sliding glazed doors from master bedrooms on to balconies is encouraged, as it increased the airflow and feeling of light and space.

All operable doors and windows are to have flyscreens.

All habitable rooms should have a minimum of two operable windows placed in adjacent or opposite walls. Alternatively cross ventilation can be achieved when an adjoining linked room has ventilation opposite to habitable room windows–i.e. refer Type F plan, with semi-ensuite adjacent to bed 1.

Ensure that wall and ceiling framing to openings have adequate fixings and strength to accommodate the future installation of blinds/curtains or shutters to all openings.

2.4.3 Functional criteria – internal planning

Provide functional designs that promote good flow and use of external/internal living spaces.

Provide a front door to each dwelling.

Access doors of bedrooms shall not open directly into living areas.

Bathroom and WC should be accessible to the bedrooms without the need to pass through the living areas.

Direct vision from living areas into laundries, bathrooms and toilets is not acceptable.

Kitchen/Living/Dining to be open plan, and allow for practical placement of furniture, without people having to walk between couches and TV to access bedroom areas and front doors.

Wall framing to allow for the ability to install picture hooks at 1700mm AFFL for paintings and photographs in living/dining and bedrooms.

Master bedrooms to be able to accommodate a king size bed and side tables.

Second & third bedrooms should facilitate functional layouts for either a queen size bed and side tables; or a single bed, side table and 1500mm long study desk.

Living areas are to relate directly to external areas.

Where possible bed 1 & bed 2 are to have full length sliding/doors windows to balcony to enhance spatial feel of bedroom.

Upper floor living areas are encouraged to have raked ceilings. Minimum ceiling height - 2700mm.

Alfresco areas to have the provision for future installation of drop down blinds or operable louvres, to allow areas to be used throughout the wet season.

Minimum width of corridors 1000mm.

Refer to Section 5 Facilities and Room Sizes for minimum room sizes.

Storerooms and carports can be incorporated under upper floor level where terrain and conditions permit.

2.4.4 Air-conditioning locations

Split system air-conditioning (cooling only) to all habitable rooms (bedrooms, living areas, kitchens).

All air conditioner condensers to be screened from view, and not to be placed on street frontage.

Location of air conditioners in habitable rooms to be considered, and centred visually on walls. Units located in the corner of rooms are not permitted.

Ceiling fans are to be centred in rooms.

2.4.5 Bathrooms

All bathrooms to be located on external wall and to have permanent natural ventilation.

Bathrooms to be light and contemporary and provide bathroom storage and mirror, in addition to fixtures. White tiles are not permitted as floor tiles. Floor tiles should be slip resistant and easy to clean. Grout to be mould resistant and colour should be darker than tile colour to hide the presence of mould and dirt.

3 bedroom townhouses to have a separate WC downstairs in laundry area.

3 Bed Dwellings and 2 Bed Units to have separate roomed toilets not located in the bathroom and shall include floor wastes.

2.4.6 Laundry/clothesline

Clothesline to be provided for every dwelling. Location under eaves area preferred. Laundry to be provided with an external window and direct access to a balcony or undercover clothesline externally located.

Laundry may be located behind doors, provided area has openable window and venting to doors. Floor waste is required.

Laundry to have cabinet with inset flush line trough, broom closet component, location for washing machine and wall mounted dryer, overhead cupboard with min 2 shelves for storage.

Internal storage cupboards to have screened vents to assist air movement and discourage mould growth.

All Internal storage areas and wardrobes to have 'black heaters & power point, refer Section 4.15.

2.4.7 Kitchens

Kitchens to be light, contemporary and functional and have feature island benches or breakfast bars, with seating for 2-3 stools.

All kitchens to have built in pantry and fridge recess.

3 bed townhouse fridge recess 900mm x 1800mm height.

2 bed unit fridge recess 900mm x 1750mm height.

Min pantry width for 2 bed unit - 700mm, 3 bed unit – 900mm.

All kitchens to have 600 mm under bench oven flush electric hotplate, externally ducted range hood, and provision for dishwasher and microwave.

Overhead cupboards should be provided to provide additional storage in kitchens and house built in fixed externally ducted range hood.

Kitchen materials, finishes and appliances should be easy to clean.

2.4.8 Alfresco areas

Refer to Section 5 Facilities and Room Sizes for areas and minimum dimensions of alfresco areas.

Ideally alfresco areas should be raised above street level, to assist in privacy and relates to the street, promoting community interaction and activity.

Locate alfresco areas to take advantage of vistas and breezes.

Alfresco areas are to be of a practicable configuration, capable of seating a table for 6 and a freestanding BBQ.

Where possible alfresco areas should be decked to be in keeping with the traditional architecture of the island.

Alfresco areas to relate directly to living or dining areas.

Alfresco areas to allow for the future provision of zip down blinds or manually operable shutters.

2.4.9 Underside screening.

Any visible underside of dwellings is to be screened in a material that compliments the overall aesthetic design of the dwelling.

2.4.10 Rear fencing

Rear courtyards of townhouses to be fenced, with lockable access gate. The minimum courtyard depth for townhouses is 4.2m.

2.4.11 Limited Palette of materials and colour

A limited palette of materials and colour is to be proposed by the Contractor. The limited palette of materials and colour assist in providing the Site with a sense of identity and character. The colour palette is to be earthy and light, with the addition of coastal colours which are found in the settlement housing.

The use of local stone, lightweight horizontal or vertical cladding, natural finished window systems, glass and cedar louvres, natural hardwood decking, natural galvanised steel all contribute to a local tropical aesthetic which respects the harsh coastal environment which makes it unique to Christmas island.

Materials are to be low maintenance.

In order to achieve articulated streetscapes, the dwelling facades are to have minimum of two wall materials. An approx mix of 1/3 - 2/3rd is suggested to enhance the overall aesthetic of the street design. Where an alternative mix can be demonstrated to achieve a good aesthetic outcome, this % can be varied. Contractor to supply marked up elevations for approval. Design quality and aesthetic response will be assessed as a weighted criteria.

2.4.12 Thermal control

Designs shall incorporate large eaves overhangs, a minimum of 1200mm wide to assist in the control of solar penetration into windows and heat load onto walls. Alfresco areas to have permanent roof cover.

Designs shall demonstrate good thermal control by appropriate use of shading, materials and insulation to walls and roofing. A low thermal capacity i.e. lightweight construction is encouraged.

External surfaces to have good reflective qualities. The use of light colours externally is encouraged.

Insulation and vapour barriers are required. Refer to Construction and Materials Requirements Section 4.

Designs are required to comply with the new 6 star DTS requirements of the BCA which come into affect on the 1st of May 2011. Contractor is to supply accurate confirmation of 6 star rating for each dwelling.

2.4.13 Design for durability

Designs shall incorporate materials suitable to a tropical marine environment.

Particular attention needs to be paid to the selection of materials for the following:

Foundation posts and beams.

Floor framing - Concealed steel framing is to be galvanised. Exposed steel framing is to be hot dip galvanised.

Floor sheeting - **Particle board is not permitted**, even where water proof treated.

Wall framing – Concealed framing shall not be steel framed unless galvanised. Any timber framing to be H3 level treated.

Roof framing – Exposed framing shall not be steel framed unless hot dip galvanised. Any timber framing to be H3 level treated.

Aluminium window and louver frames are preferred. Louver infill may be glazed, powder coated aluminium All timber, joinery and cupboard materials. Use substrate that is highly moisture resistant. External timber shall be fit for purpose.,. Particle board is not permitted.

Wall and roof cladding materials – Roofing and wall cladding shall be BlueScope PVF2 coated marine grade aluminium (not steel) standard as a minimum with fixings as per manufacturers requirements. The fixings colour should match the roof / cladding colour finish . Alternative roof and wall cladding material will be considered, however, their use must be approved by the Superintendent.

Adhesives – moisture resistant.

Fixings fixing used will be selected for durability.

2.4.14 Paints

The Contractor shall detail material selections including adopting a manufacturers paint system or systems.

2.4.15 Design for transportation and ease of construction

Designs shall recognise the remoteness of the island.

The use of materials and easily transportable prefabricated systems that facilitates ease and speed of construction on site are encouraged, provided that environmental and maintenance considerations are satisfied.

2.4.16 Suitability of materials

Foundation posts and beams - If steel is selected for the primary structural member it shall be all hot dipped galvanised post fabrication. Where members enter ground footings they are to be fully coated in bituminous coating. Where galvanised steel is to be painted a high performance architectural paint system is to be applied. Other systems of equal durability will also be considered e.g. concrete columns and 2 pack epoxy paint coatings systems to cold rolled steel floor joints.

The use of unpainted hot dip galvanised components as architectural features is acceptable.

Wall framing (where applicable) concealed framing is to be suitable for the harsh marine tropical environment. H3 level treated plantation softwood or galvanised steel is preferred. All exposed steel framing is to be hot dip galvanised.

Roof framing - Roof framing is to be suitable for the harsh marine tropical environment, and **not** steel framed unless hot dip galvanised. Any timber is to be H3 level treated.

Floor framing - Floor framing is to be suitable for the harsh marine tropical environment. Galvanised steel framing with epoxy paint top coats is considered suitable. Any timber shall be H3 level treated.

2.4.17 Flooring material

Flooring materials to be suitable for the harsh marine tropical environment. Compressed fibre cement sheeting, H3 level treated and moisture/termite resistant Plyfloor are considered suitable.

Other floor systems such as insitu concrete or lightweight precast concrete panels may be considered. Timber systems are to be H3 level treated and termite attack resistant. External timber shall be fit for purpose.

2.4.18 Wall cladding and roof cladding material

Wall and roofing cladding to be suitable for the harsh marine tropical environment.

Materials such as waveline (custom orb) profile marine grade aluminium, PVF2 finish, is considered suitable and preferred for roofing with class 4 stainless steel fixings.

Metal cladding in commercial/industrial profiles is not considered appropriate for use.

The use of profiled fibre cement sheeting such as Hardies primeline series or approved equivalent is encouraged for wall facings.

Sandwich panel construction with fibre cement skins and lightweight concrete fill is also considered appropriate.

Other products such as fibre cement (boarding profile and sheeting) may be considered suitable.

2.4.19 Internal wall and ceiling linings

Wall and ceiling linings are to be suitable for the humid tropical environment.

Water-resistant plasterboard is considered suitable for internal linings. Standard plasterboard is not acceptable.

Wet areas to use flush villa board or approved equivalent.

Manholes are required into roof spaces. Locate manholes in areas such as laundries, where they will not detract from overall design and are easily accessible. Manholes to be durable and fully trimmed in roof section. Size 600mm x 600mm.

2.4.20 Unsuitable materials

The following materials have not performed well on Christmas Island and should not be used unless the contractor can adequately address the performance and life cycle considerations:

- Particle board.
- Non water resistant plasterboard.
- Untreated soft wood.
- Ferrous metals in appliances fitments eg. Fan blades, light casings, Air-conditioning screens etc.

3. Site Development Requirements

3.1 Development and servicing of lots

3.1.1 Selection of lots for servicing

The selected lots are to be developed to fully comply with all statutory requirements. The following services will be required as part of the land development and servicing of the lots. Allow for all headwork's charges and necessary fees required by the relevant authorities. Design and connection of all site works, earthworks, roadworks and servicing shall allow for Project 1 and future site development as broadly outlined in the Indicative Master Plan at **Appendix B**.

3.1.2 Potable water supply

The existing Drumsite tank has a capacity of 4500 kL, and has sufficient capacity for the proposed development. The minimum operating water level is 222.6m RL, leaving insufficient pressure for potable water and fire services. Pressure for these services will have to be boosted, and is addressed in further detail in section 4.10 Hydraulics under Construction and Material Requirements.

It is understood that site connection can be provided off the water main located in the Sung Miaw Loh road reserve and it is the responsibility of the Contractor to obtain approval for the connection and the final position thereof.

Reticulate potable water to lots from the nearest suitable existing water main in full accordance with Water Corporation and SOCI (Shire of Christmas Island) requirements and regulations. Liaise with Water Corporation for water meter types to be used. It is the responsibility of the Contractor to supply and install water meters to each dwelling unit and pay associated costs. All installations are to provide for both future green titling of attached groups and individual dwellings and future strata titling of individual units.

Ensure a minimum pressure of 350 kpa is available at each dwelling. It is understood that current available mains pressure will not achieve this. The Contractor is to determine the requirements and allow for additional infrastructure where required.

3.1.3 Sewer

The site was previously serviced by an outfall sewer line originating within the road reserve between Lam Lok Loh and Tong Yan Loh. It is indicated that two separate outfall lines on the site drains toward the main outfall, but the western line was not detected on the site survey and may have been removed. The eastern line appears to be live and is currently servicing neighbouring lots on the south-western corner of the site. The Contractor will install new sewer lines to lots from existing suitable sewer line service in full accordance with Water Corporation and SOCI requirements and regulations. Re-route existing sewer line within sites as required, and ensure that level of service is maintained for neighbouring lots dependent on that sewer line.

Sewer connections and sewer line is to be designed to provide for future strata titling of individual units. Maintain connection to adjoining DIAC housing.

3.1.4 Drainage

Prepare the sites to ensure that adequate drainage is maintained from the dwelling sites. Where necessary, re-route the drainage lines away from the developed sites. All drainage and discharge to be in accordance with SOCI and the requirements of the Environmental Officer. All existing drainage lines are to be re-routed as required to suit the proposed development. Drainage lines will not be permitted under proposed dwellings. Outfall drainage pipes are to connect to the existing drainage pipe infrastructure on Tong Yan Loh and Sung Main Loh. Approval is to be obtained from SOCI based on final design solution.

3.1.5 Electrical

Reticulate electrical services to lots from existing Substation SUB102 consisting of 315 kVA transformer and a RMU. All electrical works to be in accordance with Western Power and IOTPA (Indian Ocean Territory Power Authority) requirements and regulations. All electrical services are to be underground to IOTPA requirements.

IOTPA to be consulted with respect to all electrical works. In the event of no spare capacity available on the existing electrical infrastructure, the Contractor is to meet all costs associated with the upgrade of the power supply.

Liaise with IOTPA for energy meter installation and requirements. Allow for the supply and installation of all energy meters. Liaise with IOTPA and pay all costs associated with provision of power and street lighting to the new lots. Also refer to Section 4.15 – Construction and Material Requirements - Electrical Services. Electrical reticulation and design is to provide for future strata titling of individual units.

3.1.6 Telephone

Engage with Telstra to discuss the provision of as a minimum standard telephony services to individual lots under Telstra's obligation to comply with the universal Services Obligation (USO). Liaise with Telstra to confirm spare capacity at local RIM (Remote Integrated Multiplexer) exchange and organise to have copper telephone lines reticulated to dwelling lots from the RIM via existing infrastructure where possible. Provide all required services in full accordance with Telstra requirements and regulations. Contractor is to pay all associated costs.

Provide telephone lines and points to each of the residential dwelling/unit as per telephony installation schedule in section 4.15.15.

Telephony reticulation and design is to provide future strata titling of individual units.

3.1.7 IOTPA requirements

IOTPA is the local power authority and have full jurisdiction over the works.

IOTPA advise the following additional information for electrical services:

- Cable specification
 - Street mains - 240mm Alm Waveconn c/w nylon jacket.
 - LV Tee off to Pillars - 25mm XLPE Cu c/w nylon jacket
 - Street Lighting - 16mm Cu Single core neutral screen c/w nylon jacket.
Options other than 16sp mm neutral screen c/w nylon jacket may be considered provided full IOTPA approval is obtained by the contractor.
- Cable Installation
 - Cables are to be installed Category B system in screened bedding sand approved by IOTPA.
- Street Lighting
 - 7.5m columns with 2m outreach arm - direct buried (Riverton Engineering) and fitted with an approved luminaire to match existing.
Example: Phillips Metro 70w HPS luminaire c/v daylight control.
- Service Pillars
 - Two types of service pillars are utilised - universal and mini. Pillars approved by IOTPA are available from RIMCO in WA.

3.1.8 Road works and car parking construction

Generally all roads and drainage within road reserves shall be to the requirements of the local authority.

The provisions of AS2890.1 for off road car parking shall generally apply to this scope of work where specific requirements are not provided. (Refer also to 2.3.9).

It is envisaged that a 5m one way road system, with parallel car bay provision is to be provided as per the indicative concept plan at **Appendix B** and section 2.3.9 Functional Carparking Requirement and Stores. The road is to have street parking on one side and a pedestrian footpath on the other. Internal streets are to have street trees and to be landscaped.

All road pavements within private lots shall be a minimum thickness of 100mm chalk sub base and 100mm crushed rock base course. Pavements shall otherwise be designed to accommodate the loading from the largest foreseeable vehicle and shall be finished with hot bitumen two coat seal. Pavement design, specification and material details shall be forwarded for approval with other design submissions, alternative pavement designs may be adopted subject to Superintendent's approval. The site through-road is to accommodate refuse removal and fire vehicles. Where applicable, turning radii shall accommodate the movement of these vehicles with suitable pavement design.

All road pavements and parking bays within private lots shall have a minimum fall in any direction of 1:60, a maximum cross fall of 1:20 for significant access routes and a maximum fall in any other direction of 1:6 for roads and 1:20 for parking bays. All road pavements within private lots shall be kerbed with extruded concrete barrier kerb. All kerbs shall be backfilled with a minimum verge width of 1m.

All parking bays within private lots shall be marked with line marking paint. Colour to be confirmed with SOCI. Carbays shall be 5.5m long and 2.6 wide and shall be orientated and designed to ensure sufficient manoeuvrability for the intended vehicles. Disabled parking bays, where required for accessible units, shall comply with BCA 2011.

All road pavements within private lots shall be drained via drainage pits to local authority standards and flows shall discharge, via attenuation facilities if required, to the external road system at the location nominated by the local authority.

All road pavements shall be designed to ensure that flood routing does not impact upon existing or proposed private buildings.

3.1.9 Car parking requirements

Refer Access to Premises 2.3.8

Upgrade of Road Works and Stormwater (where necessary)

Allow for all necessary remedial works necessary to adjoining roadways and stormwater to lots selected for development. The extent of work is to include all repairs to kerbing (if applicable) and any required repairs to road surface.

3.1.10 Stabilisation of soil

The Contractor is fully responsible for stabilising all earthworks, ensuring that sites are not subject to erosion from water action during and after completion of construction. Appropriate means of stabilisation needs to be carried out where necessary to the full satisfaction of the Principal and SOCI. Planting to developed lots to be included as a counter-erosion measure to all built lots.

Retaining walls and/or stone pitched embankments may be required.

3.1.11 Existing services

The Contractor is to allow for connections to existing services as required to ensure the developments are fully operational on completion of the works.

The Contractor is to ensure that all services downstream of connection points are fully operational and that upstream services are accommodated where applicable. Modify and construct all existing services as required to ensure the completed developments are fully operational.

3.1.12 Coordination of services to lots

The Contractor is to liaise with the relevant authorities to ensure required trenching can be co-located where appropriate and permissible.

3.1.13 Minimum disturbance construction of lots

Wherever possible land is to be developed using minimum disturbance techniques by which clearing and earthworks are restricted to that necessary to provide services and on ground facilities only. Where considered appropriate slab on ground construction

will be allowed and the potentially live sewer line under the slab will need to be protected until it can be re-routed. Where applicable, the level of service for the existing sewer line must be maintained throughout the construction period where neighbouring dwellings are dependent on that pipeline. Measures of protection and relocation must be arranged with and approved by Water Corporation and SOCI.

3.1.14 Survey and titling

The lots offered by the Commonwealth have not been pegged by the Principal. The Contractor is to peg all sites. The Contractor is to allow for all other survey work necessary to carry out the development of the selected lots. The contours presented on the concept layout plans are based on photogrammetric work and may not be accurate. The Contractor is responsible to provide for all necessary survey works required.

The Contractor is to survey the adjoining DIAC houses to the immediate south/east corner of the Site development, and ensure that driveway access is maintained from the amended road location and amended road level.

Access to the carport of the DIAC houses is to be to the relevant Australian Standards.

3.1.15 Design and documentation requirements

The Contractor is to produce full design and documentation for the lots to be developed as part of the contract. The engineering drawings are to include all servicing required and extent of site works required.

3.1.16 Landscape plans

The Contractor is to liaise with SOCI, Parks Australia (PA) to ascertain minimum landscape requirements, and produce schematic Landscape Plans for submission to SOCI, and the Superintendent for approval.

Include in the landscape plans provision for car parking, Public Open Space and access to Public Open Space.

The Landscape Plans should ensure that street verge, common area and dwelling landscape design work together to:

- Enhance the tropical feel of the location and development.
- Be sympathetic to the location and dwelling/development design.
- Ensure vegetation elements comprise suitable grass cover and low maintenance garden beds.
- Ensure breezeways incorporated in the dwelling design are not inhibited.

Townhouses are to have a minimum paved area of 3x6 metres in rear yards with vegetation to borders.

Ground floor units are to have a defined rear garden/living area that comprises suitable decking/paved area with vegetation to borders where appropriate.

Provide reticulation to common areas, with controller.

Landscaping to be low maintenance.

3.1.17 Access to site

The development needs to allow for the access of SOCI rubbish and refuse collection vehicles and the access of school buses for the safe boarding and alighting of school children. Access is to be provided for FESA. Ensure FESA vehicle has/ have appropriate turning circle in internal roads. Design for FESA access should be guided by the principles in FESA guideline GL-11. However, it should be noted that the dimensions specified are not consistent with appliances used on Christmas Island. The Contractor is to obtain all required design data from FESA. As a guide it is understood that a new appliance based on an Iveco Acco 2350G will soon be on the island which would have the following properties:

- 8.0 metre length.
- 14.69 metre turning circle.

These details must be confirmed by the Contractor.

3.1.18 Provision of access to public open space

The Contractor is to allow for pedestrian access from the housing developments to the areas required for Public Open Space. This access is to be shown on the schematic proposal drawings and Landscape Plans.

4. Construction and Material Requirements – Minimum Standards

4.1 Demolition

4.1.1 Demolition and removal of structures from sites

All structures, debris and non essential items are to be removed from site in order to prepare site for development. Remove all redundant services to a depth of 800mm. Services not completely removed are to be capped. The Contractor is deemed to have visited the site and assessed such requirements or to have satisfied themselves as to the requirements.

Carry out all demolition and removal works in full accordance with the relevant authorities, obtain approvals and pay all fees levied by the relevant authorities.

4.2 Earthworks

4.2.1 Rock excavation

The Contractor shall meet the cost of all rock excavation for the project.

Site clean and trees

Remove all vegetation, foreign bodies, refuse and trees from the site area to be occupied by the dwellings, driveways, paths, other associated drying and entertainment areas plus 1500mm all round perimeter of dwelling. Remove all loose/unstable rocks from site.

Compaction

Compact soil to footings, and paved areas to local authority requirements, and provide an Engineers Certificate of compaction to both the Superintendent and local authority.

Anti termite treatment

Termite treatment shall be in full accordance with PA, SOCI requirements and Australian Standards. Liaise with PA to ensure their requirements are complied with. Submit to the Superintendent and Shire of Christmas Island at practical completion a certificate stating that all works were carried out in accordance with the above.

All floor stumps are to have ant caps in accordance SOCI requirements.

A BCA approved physical termite barrier system should be adopted.

4.3 Site works

4.3.1 Stormwater drainage

Provide stormwater drainage to the approval of the Local Authority.

Refer to section 3.1- Development and Servicing of Lots.

4.4 External items

4.4.1 Verandah flooring

Shall be reeded 80mm nominal x 19mm dry dressed plantation sourced hardwood timber decking (select) or equivalent approved by the Superintendent.

Fixings may be class 4 galvanised or equivalent.

4.4.2 Screening and fencing

All screening and fencing is to be raised 150mm above natural ground level, with the exception of posts or pillars, to facilitate crab migration. Screening and fencing is to be made from a material which is low maintenance and termite, rot and corrosion resistant.

Screening is to be 40% open to allow for ventilation.

Fencing minimum height is to be 1.6m above finished ground level.

4.4.3 Dwelling unit numbers

- Shall be powder coated aluminium, 100mm high.
- Supply and fix to house wall facing street frontage.
- Liaise with Christmas Island administration that will provide appropriate house or unit numbering.

4.5 Concrete

Concrete to any pad footings to conform to the requirements of local authority and to Australian Standards. All concrete in contact with ground to have a water proof membrane including footings.

4.6 Metal work

Shall be in accordance with Australian Standards.

Door frames can be either timber refer to section 4.17.5 or aluminium frame.

Aluminium Windows and Doors and louvre galleries.

To be supplied by an approved manufacturer and include all flyscreens.

Windows to be designed to relevant wind codes for Region B in accordance with AS1170 Part 2.

4.7 Windows and sliding doors

4.7.1 Type

Powder coated aluminium quality sliding doors at minimum height of 2400mm or standard with highlights over.

Windows may be casement or louvres with as much free open area as is achievable for ventilation.

Use of prefinished cedar or powder coated aluminium inserts is encouraged as feature windows on east/west facades.

4.7.2 Colour

To be selected or powder coat preferred.

Glass

Clear, to SAA Standards - Cintilla Satinlite obscure safety glass or similar to bathrooms and WC. Laminated safety glass clear or toughened generally.

4.7.3 Flyscreens

Throughout (black fibreglass mesh) to all windows or equivalent.

4.7.4 Flyscreen barrier doors

All front and rear doors are to include flyscreen barrier doors.

4.7.5 Locks

Include manufacturer's patent locking to all sliding windows and doors.

4.8 Doors

To all external doors hang on 4 No. 100mm S.S. butt hinges, fixed pin.

Door closers to all external doors.

Raven RP4 Weather seal to bottom of external doors.

Locksets: Entrance set at 1000mm above FFL. (Lockwood 530 series – 529 Entrance set with escape function or equivalent approved by the Superintendent).

4.8.1 Crab Barriers

Provide a removable crab barrier to all ground level external doors to be 150mm high by width of door.

4.8.2 Store door

Hang on 3 No. 100mm S.S. butt hinges.

Lockset: Key in knob lockset. (Lockwood 530 series – 529 Entrance set with escape function or equivalent approved by the Superintendent).

4.8.3 Internal doors

(Except WC) - Hang on 1 pair 85mm S/S loose pin hinges and fitted with a tubular passage set at 1000mm above FFL. (Lockwood 530 series – 532 Privacy Set or equivalent approved by the Superintendent).

4.8.4 WC doors

Hang on approved fixed pin lift off hinges to be fitted with a privacy latch set at 1000mm above FFL.(Lockwood 530 series – 532 Privacy Set or equivalent approved by the Superintendent).

4.8.5 Bathroom door

Hung as per internal door and fitted with a privacy latch set at 1000mm above FFL. (Lockwood 530 series – 532 Privacy Set or equivalent approved by the Superintendent).

4.8.6 Keying

External door locks to each dwelling unit to be keyed alike and master keyed.

Barrier screen door locks to each dwelling/unit to be keyed alike and master keyed.

Window/sliding door locks to each dwelling/unit to be keyed alike.

Keys to dwellings/units shall differ from each other.

Supply the Superintendent with 4 (four) keys of each dwelling unit lock type. Label keys to identify unit number, lot number, street name and locality.

4.8.7 Door buffers to all doors/cabin hooks & eyes

Install rubber buffers at skirting or floor location to prevent door furniture striking walls. Provide cabin hooks and eyes to all external hinged doors.

4.9 Bathroom

- Towel Rail to Bathrooms.
- Toilet Paper Holder to WCs.

Refer schedule Facilities and room sizes in section 5.

4.10 Materials

Second-hand materials are not to be used.

Samples of all materials selection and colours nominated shall be presented to the Superintendent for approval at commencement of contract prior to ordering. The samples shall be presented on appropriately designed colour boards.

4.11 Structural

Structural elements shall be durable, serviceable and have adequate strength for the functional requirements. Structures should satisfy other relevant requirements such as robustness, ease of construction and economy. A structure is durable if it withstands expected wear and deformation throughout its intended life without the need for undue maintenance.

The design of a structure and its component members should take into account but not be limited to:

- Stability
- Strength
- Serviceability
- Durability appropriate to Marine/Tropical Environments
- Fire resistance
- Design life 25 years minimum

4.11.1 Structural certification

The Contractor will be required to have the certification of a practising structural engineer for the design of the dwellings and all associated foundation i.e. post and beam support structure and for the house structure as constructed. Such elements include but are not restricted to the certification of design and construction of wall frames, roof frames, connections, roof sheeting fixing and windows.

The Contractor shall present the engineer's calculations with the construction drawings.

The Contractor will be required to produce certification by a practising structural engineer for the structural adequacy of design for each house's location based on a subsoil investigation.

Calculations shall be submitted with the drawings and both shall be signed by the design engineer and checking engineer.

The calculations shall establish the adequacy of all structural elements and of the structure as a whole including all necessary components together with bracing, connections and foundations.

Calculations shall clearly indicate the sources of formulae and assumptions used and shall demonstrate sufficient proof to the satisfaction of the Superintendent that each part of the structure, members and connections will satisfy the limit stated requirements on the applicable codes. Deflections from serviceability loads, temperature and other causes shall not cause any damage to the individual members, components, fittings, connections and finishes to the structure.

The Contractor shall note that review of structural calculations and drawings by the Superintendent will not absolve the Contractor from accepting full responsibility for complete and satisfactory design and documentation.

The Contractor's engineer shall certify that all reasonable care has been taken to ensure that the completed documents fulfil all requirements of the law, this specification and all regulations of the Statutory Authorities.

4.11.2 Design codes

Design and construction shall comply with the relevant Australian Codes and Standards and their latest amendments.

4.11.3 Basis of design

The structures and attachments shall be designed to resist the dead, live and wind loads as required by AS 1170.

Wind forces calculations are to be based on Region B in accordance with AS 1170 Part 2, for Structure Importance Level 2, Terrain Category 2.

Topographic Multiplier to be calculated based on an analysis of contour plans.

Seismic forces to be calculated as in accordance with AS 1170.4 and incorporating recommendation made in the Christmas Island Seismic Hazard Assessment the relevant extract is included at **Appendix D**.

Any other actions which may significantly affect strength, stability and serviceability of the structure must be taken into account.

4.11.4 Statement of design constraints

For design constraint requirements refer to section 2 Design Intent and Requirements.

4.11.5 Structural drawings

In accordance with the requirements of the Contract the Contractor shall show full details of all structural members and connections, duly signed by the engineer and certify the adequacy of the design as a whole.

The type of protective coatings and surface preparation are to be specified where required to satisfy the design life, after proper account has been taken of extremely harsh marine climatic conditions, maintenance provisions, and of the fabrication processes.

No structural work shall commence until permission to use has been given in writing by the Superintendent.

4.12 Stone work

To conform with the requirements of local authority and to Australian Standards and utilize local stone.

4.13 Roofing

4.13.1 Roofer

Roofing is to be proposed by the Contractor. Refer to Section 2.4.16 Suitability of Materials.

Special attention is to be paid to the manufacturer's recommendations for fixings. Fixings should be stainless steel.

Colours: To be selected. Light reflective colours are preferred.

Fixings: Manufacturer's recommended for harsh tropical/marine environments (class 4 coloured to match roof sheeting).

Dissimilar materials to have protective treatment between metals to prevent bi-metallic corrosion occurring in accordance with the manufacturers requirements.

Contractor to provide harness safety points on roofs where required under the BCA or relevant Australian Standards.

4.13.2 Exhaust Vents

To be flumed to external air in accordance with Public Health requirements. Where possible penetrations should be through walls, if penetrating the roofing material, a gas cowl is required.

Colour and material to match roofing material.

4.13.3 Flashings

To be provided to pipes and vents passing through roof and made water tight with compatible materials.

Colour and material to match roofing material.

All roof and wall flashings are to comply with the manufacturer's recommendation to ensure the building remains water tight.

4.13.4 Gutters

Employ gutters over entries, stairways, and walkways and as required avoiding shedding water over building users. Where gutters are required they are to be aluminium unless approved otherwise.

Colour and material to match roofing material.

Valley gutters if required to be custom made with folded edges to minimise water migration into roof cavity.

Where gutters required, use ½ round or approved similar.

Down pipes are to be extruded aluminium or equivalent.

4.13.5 Roof and wall framing

Roof or wall framing shall comply with the Building Code of Australia and Australian Standards AS. 1720 (1997) and be completed in accordance with good building practice. Timber to be treated if applicable (i.e. pine), refer to Section 2.4.16 Suitability of Materials.

Minimum treatment grade for pine to be H3 with additional anti-mould treatment suitable for use in humid tropical environment.

4.13.6 Fascias, barges and external timberwork

Use approved fit for purpose timbers with appropriate finish. Concealed surfaces to be sealed and primed prior to fixing in location.

4.13.7 Lined eaves, verandahs, terraces and balconies

Eaves not to be lined, ensure bird boards.

4.13.8 Gable ends and feature panels

To be framed out and trimmed to standard building detail. Note that all external timber shall be protected from weather.

4.14 Hydraulics

4.14.1 Sanitary plumbing

The whole of the sanitary plumbing, water supply and drainage work shall be carried out by or under the direct supervisions of a fully licensed sanitary plumber in strict accordance with the by-laws of the Water Authority, BCA 2011 Plumbing code of Australia and the requirements of the SOCI.

4.14.2 Application & fees

The Contractor is to make applications and pay all fees for installation of sanitary plumbing work and domestic water services, including testing and extra drawings or details that may be required by the Shire of Christmas Island.

The Contractor shall arrange for the Council to provide water connection point(s) and meter(s) to each lot. Contractor to allow for all costs associated with this work.

Refer also Section 3.1.14. 'Development and Servicing of Lots' with respect to green titling and strata titling requirements.

4.14.3 Sanitary fixtures

All fixtures to be first quality Australian made. Fixtures should be tested and stamped by the WA Water Corporation and be complete with CP waste outlet where required. Provide units complete with brackets, fixing bolts, screws, waste outlets, plugs and grates.

Isolation valves should be fitted to all basin, bath, laundry and kitchen mixers. Where possible isolation valves should be located in cabinets below fixtures. All exposed isolation valves are to be stainless steel or approved alternative.

All Fixtures are to be white and be Water Efficiency Labelling and Standards (WELS) rated with a minimum rating of:

WC Suites 4 star.

Basins Taps minimum 5 star.

Sink Taps minimum 4.5 star.

Shower Taps minimum 3.5 star.

Hot water unit

Refer to section 4.15.13 Electrical.

4.14.4 Materials

All materials to be installed in compliance with the manufacturer's instructions and recommendations

Sanitary Drainage: Pipes and fittings PVC Class SH to AS 1260.

Soil, Waste & Vents: Pipes and fittings PVC Class SWV to AS 1415.

Water Pipe: Copper Tube Type B to AS 1432 or PPR to AS4020.

4.14.5 Waste, vent pipes and floor wastes

All waste and vent pipes shall be of UPVC pipes of sizes set out by the AS3500 & the Water Authority and fully concealed. Provide and fix waste pipes to all sanitary fixtures complete with all necessary cleaning and inspection openings and complete with bends, junctions etc.

Wet areas are to be provided with a suitably sized trapped floor waste gully connected to the main sanitary system.

Note: All external exposed PVC to be 'UV' resistant and painted to match background.

4.14.6 Water meters

Provide a water meter concrete box with galvanised lid to each water meter to Homeswest standard.

Install a 20mm size copper water service from the boundary service. Provide a "Turbo flow" calcium inhibitor on reticulated hot and cold water to taps as required.

No more than two outlets shall be taken off 15mm size pipe. 15mm size pipe shall not exceed 6m length.

Hot water feed pipe size shall be 20mm size.

Provide two external hose cocks with backflow prevention devices (1 front and 1 rear) per dwelling and ground floor units, positioned against building to best suit landscape areas.

All internal taps to be identified with Hot and Cold buttons.

Sink and basins to be provided with 1 hole flick type mixers.

Install washing machine taps on wall adjacent to trough 1200mm above floor.

4.14.7 Hot water units

Refer to section 4.15.13 Electrical.

Provide stop cock, all necessary safety valves and safe tray to each water heater.

The temperature of hot water is to be controlled by a tempering valve located on the outlet of the hot water unit as required by the standards.

4.15 Electrical

4.15.1 Electrical work

Tradesmen: All electrical work shall be carried out by competent electrical tradesman, licensed in Western Australia to install electrical wiring in accordance with SAA Wiring Rules and to the requirements of the Supply Authority. Submission for commencement of work and completion certificate is to be sent to IOTPA. PO Box 126 Christmas Island 6798).

Cross reference: The electrical contractor shall cross reference the mechanical and hydraulic installations to ensure correct circuit wiring and equipment connections. No variations shall be accepted for obvious and/or necessary work.

4.15.2 Australian Standards

Conformity: All equipment, materials, workmanship, methods of installation and, if called for, testing procedures shall conform to the relevant standards and with any special requirements of the appropriate authority, i.e. Supply Authority.

4.15.3 Materials

All materials proposed for use shall be new and designed for operation on the supply potential in common use in the area in which the works apply. All external materials shall be designed for operation in an extremely corrosive and salt laden atmosphere.

Special attention shall be given to any external fittings, fixtures and/or fixings in component and the component parts to resist corrosion. Normally only stainless steel 316, marine aluminium and/or heavy duty galvanising are acceptable. Items shall be rejected by the Superintendent unless they met and/or exceed these requirements.

4.15.4 Building wiring

Unless otherwise specified, all wiring will consist of multicore, stranded copper cabling with earth, T.P.S. cable, without further enclosure except where required by regulation.

4.15.5 Power supply

Provide a site main switchboard (SMSB) adjacent to the kiosk substation and provide suitably sized consumers mains cable from the substation to the SMSB. The SMSB shall be located within 30m of the lot boundary and shall be positioned to suit the authority requirements. The SMSB shall contain authority owned kWhr meters for all of the dwellings, site services and other related loads on the site. The SMSB shall be of Form 1 construction and shall have a fault rating to suit the connection arrangement to the substation.

Provide a main switch for each house and for the site services. Provide an internal sub-circuit chassis for the site services. Provide 30 spare spaces in the SMSB in terms of spare pole spaces and switchboard capacity.

Arrangement: Provide an underground 240-V, single-phase, 50-Hz power supply to each residence in accordance with the IOTPA specified requirements. Each power supply shall originate from the SMSB. Contractor to allow for all costs associated with this work and pay all fees associated.

Refer to Section 3.1 Development and Servicing of Lots with respect to strata titling requirements.

4.15.6 Main switch & meter board

Requirement: The electrical installation, including meter panels, main switchboards and consumer mains shall comply with the WA Electrical Requirements and those of IOTPA. Provide and install main switch / meter boards complete with all neutral and earth links, circuit control & protection devices, and energy meters (Kilowatt hour meters for common services (house services) shall be Smart meters where the connected load is greater than 200 watts), suitable to allow future strata titling. Allow for at least 6 spare pole spaces on each house distribution board.

Location: Located externally on house wall accessible easily from street. Do not position in carport.

Circuit Protection: To be miniature circuit breakers and complete with covers if necessary. Provide MACB's with combined RCD's for all sub-circuits except for sub-circuits for hot water units and air conditioners.

Meter Panel: Provide a fixed panel to IOTPA requirements for use by the Supply authority to install their energy meters. Energy meter shall be provided by IOTPA.

Cabinet: To be fabricated from marine grade aluminium sheet metal or equivalent and finished to match the surrounding areas. All fillings, hinges, hasp and staple to be stainless steel grade 316.

4.15.7 Lighting installation

Requirement: Provide and install all outlets and associated luminaires together with all switches as required by this specification. All luminaires shall be fluorescent.

Circuit Breakers: Are to be 16A rating, single-pole and complete with cover as necessary.

Circuit Wiring: Unless otherwise specified cable shall consist of 1.5 mm² (7/0.50) twin & earth TPS cable allowing no more than twenty five (25) outlets per circuit. Provide a minimum of two lighting circuits per residence.

Switch Design: Unless otherwise specified all light switches shall be white in colour, manufactured from unbreakable plastic, all to a matching design.

Switch Mounting: Generally be mounted 1200 mm above finished floor.

Luminaires: Lighting to be provided to at least minimum wattage noted in Luminaire Schedule. Selection of diffusers / luminaires to be by Contractor, with Superintendent's approval required at 95% design approval stage. External fittings to be non ferrous, water proof polycarbonate glazed.

The selection of light fittings should be performance based on the likely activities undertaken in each room. For example the light fitting for bedrooms should produce enough light to allow for reading etc.

Suggested Luminaire Schedule (this is not an exhaustive list) Number and the performance needs to be determined by the contractor.

LOCATION	DESCRIPTION
Living room/ Dining	2 x 20W
Passage	1 x 18W
Bathroom	1 x 20W
Toilet	1 x 18W
Bedrooms	1 x 20W Each
Laundry	1 x 20W
Store	1 x 18W
Verandah	2 x 20W
External stairs	1 x 20W
Wardrobes, Linen cupboards	Provide black heater unit to each. Units not to exceed black heat or have thermostat control. Power point required.
Carports	1 x 20W
Balcony/Terraces/ Alfresco	2 x 20W
All fittings to have suitable diffuser/shadings fitted.	

4.15.8 Ceiling fan installation

Provide and install all outlets and associated ceiling-fans together with all controllers as required by this specification and as shown on the drawings.

Circuit Breakers: Are to be 16A rating, single-pole and complete with cover as necessary.

Circuit Wiring: Unless otherwise specified cable shall consist of 1.5 mm² (7/0.50) twin & earth TPS cable allowing no more than twenty five (25) outlets per circuit.

Ceiling Fan Schedule

Provide the following types of aluminium blade ceiling fans on this project:

Living Room/Dining:	2 x 1400 mm dia sweep 5-speed ceiling fan.
Bedrooms:	1400 mm dia sweep 5-speed ceiling fan.
Kitchen	900 mm dia sweep 5-speed ceiling fan.
Alfresco	1400mm dia sweep 5 speed marine grade stainless steel fan suitable for external use.

4.15.9 Exhaust fan installation

Provide and install exhaust fans to bathrooms & toilets together with ducted Range Hoods to kitchens.

Circuits: Connected to the ceiling fans circuit.

Mounting: Exhaust fans to be mounted to suit the installation. Exhaust fans can be ceiling or wall mounted depending on the situation. Range hoods to be wall mounted and fully ducted to exterior.

Ducting: All to be ducted to the building exterior. Fit automatic weatherproof covers to ducts.

Switching: Range hoods to be fitted with internal switches to control fan. Exhaust fans to be controlled by switches located at the door, adjacent to the light switch, unless required by the BCA.

Exhaust Fan Schedule

Provide the following types of exhaust fans on this project:

Kitchen:	Range hood - 600mm built into cupboards (exhaust to the outside).
Bathrooms	Exhaust fan - 250-mm dia, single speed, one-way, white.
Toilets:	Exhaust fan - 250-mm dia, single speed, one-way, white (exhaust to the outside).

4.15.10 Socket outlet installation

Provide and install all required socket outlets

Standards: To AS 3112

Rating: Minimum rating to be 240V, 10A.

Mechanism: On faceplates secure the mechanism with retaining screws, or construct the faceplate and mechanism so that the mechanism cannot be displaced during normal operation.

Indicator: Unless otherwise specified, provide a red indicator above the switch toggle, to be visible when the switch is "ON".

Pin Arrangement: Mount the outlet with the earth pin at the 6 o'clock position.

Construction: Faceplate to be of impact resistant plastic. Surface mounting types shall be complete with impact resistant plastic housing or mounting block.

Mounting: Wherever possible all socket outlets shall be flush mounted. For surface mounted outlets provide the correct type of mounting box, plate, and/or block to suit the type and location of the mounting method.

Circuit Wiring: Cabling shall consist of minimum 2.5 mm², (7/0.67), twin & earth, TPS cable size shall comply with the requirements of AS3000 with due allowance for any applicable de rating of circuits. Cabling shall allow a maximum of ten (10) outlets per

circuit, running from the board to the location of each outlet. Circuits to be controlled and protected by circuit breakers complete with residual current devices.

Circuits: Provide minimum circuits as follows

Kitchen	two circuits minimum
Living areas	one circuit minimum
Sleeping areas	one circuit minimum
Ground floor	one circuit minimum

Provide two way switches where appropriate and at ground floor and first floor of staircase in townhouses.

Provide sensor lights to external entries and staircases.

Indicative Socket Outlet Schedule:

This is not a complete list and the contractor should consider the complete design requirement for power outlets.

Provide the following types of power outlets on this project:

Kitchen	Dual 10A SO's complete with to those outlets mounted over the bench + 10A SO for fridge + 10A SO for range hood.
Living areas	Dual 10A SO's mounted at 200-mm above floor.
Sleeping areas	Dual 10A SO's mounted at 200-mm above floor. (Refer Section 5 Facilities and Room sizes)
Bathroom	Dual 10A SO mounted 1000mm above floor adjacent vanity unit.
Laundry & Store	Dual 10A SO's mounted at 1,350-mm above floor.
Alfresco	Dual 10 and 50 ISO rated at 1350 over deck level.

4.15.11 Air conditioning connections

Provide the following air conditioning power connections for split system refrigerated (cooling only) air-conditioning:

Kitchen/Living areas	Two direct wired connections. Provide an isolator adjacent to each unit fixed to the external wall and not the condenser unit.
All Bedrooms	Direct wired connection. Provide an isolator adjacent the unit fixed to the external wall and not the condenser unit.

4.15.12 Cooking installation

Provide and install cooking equipment to the kitchen bench.

Circuit Wiring: Cabling size shall be designated by the contractor to suit the electric stove installed.

Provide and install electric under bench oven, electronic ceramic cook top and under cupboard fixed range hood, externally vented.

4.15.13 Hot water system installation

Hot Water Units

The contractor is to provide an energy efficient hot water generation unit based on an electric heat pump system.

Hot water systems installed internally will be fitted on a drained tray.

4.15.14 Heat pump

The water heater shall be a heat pump of 315 litre capacity. The water heater shall conform to Australian Standard AS2712 and installed per manufacturers recommendations. The water heater shall be factory assembled and tested. Models shall be manufactured with an immersion electric heating unit fitted with a surface mounted thermostat incorporating a safety over temperature energy cut out. The water heater shall be insulated using CFC free material. The refrigeration circuit shall utilise R134a gas. The condenser coil shall be of the double wall plate type.

The system is to have the following warranties:

- 5 year cylinder warranty
- 3 year labour warranty on cylinder
- 2 year warranty on sealed system
- 1 year warranty on all parts

4.15.15 Telephony installation

Entire installation shall be in accordance with AS3080. Provide and install all equipment and cabling to allow for the installation of a hardwired telephone installation. Minimum 4 core cable.

Wire each of the telephone outlets back to a site main distribution frame (MDF) located at the entry of the site. Liaise directly with the nominated carrier for exact requirements. All site cabling between the MDF and the outlets in each of the houses shall be run in underground conduits.

Cabling Standard: Refer to Australian Standards above.

External Cabling: All external cabling not supplied by Telstra and the responsibility of the Contractor shall be buried underground, contained within white communications

conduit with a min diameter of 50mm, pits are to be used were the changes of direction of greater than 60° and shall be not further than 50m apart.

Internal Cabling: All internal cabling shall be installed to AS/ACIF S009:2001 standards.

Telephony installation schedule:

Living Room	One RJ11 phone outlet, to be nominated in Contractor's documentation.
2nd or 3rd Bedroom	One parallel RJ11 phone outlet, to be nominated in Contractor's documentation.

4.15.16 RF video services via TV antenna installation

Antennas shall suit all local analogue and digital TV transmissions. It is the Contractors responsibility to assess the current types of transmission (vertical and /or horizontal polarization) and install the appropriate antennas. Supply and install all the components, equipment and the like to give an effective and operating television antenna system. The Contractor shall ensure that antennas are able to receive horizontal polarised transmission.

Free to Air TV: The system shall be capable of receiving all locally transmitted television broadcast signals both analogue and digital.

Picture Quality: At each outlet, the picture received on a domestic TV receiver shall be free from discernible cross modulation, intermodulation, ring, noise, or other distortion.

Cabling Standard: Refer to Australian Standards above.

Internal Cabling: All internal cabling shall be installed to AS/ACIF S009:2001 standards.

Type: Single core coaxial cable with nominal impedance of 75-ohms,

Outlets: Coaxial cable sockets flush mounted on high impact plastic plate. Fix components on a printed board assembly fitted with a clamp and screw for cable termination.

RF Video Services Schedule:

Living Room	One outlet, to be nominated in Contractor's documentation.
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4.15.17 External security lighting

External lighting to covered areas and carports shall be provided.

Provide common area security lighting necessary to sufficiently illuminate grouped car parking bays, shared paths, and steps to standard.

Security lighting to be controlled by photoelectric switching supplied from common services electricity meter. Connect external site lighting circuits to the site main switchboard.

4.15.18 Smoke detection system

Smoke detection system shall comply with Homeswest requirements and AS1670. Install smoke detectors to each house or unit in full accordance with BCA, the Fire and Rescue Service of WA and the relevant Australian Standards.

4.16 Air conditioning

4.16.1 General

Air-conditioning load calculations

General: Calculate the cooling and heating loads using one of the following:

Manual methods: AIRAH DA09, ASHRAE or Carrier.

Electronic methods: ACADS-BSG Camel, Carrier E20 or Trane Trace.

Design

General: Provide systems designed in conformance with the following.

Outside design conditions: 30.3°C dry bulb, 26.6°C wet bulb

Indoor design conditions: 24.0°C dry bulb, 50%RH

Standards

Comply as minimum with the following standards

- Building Code of Australia.
- Electrical services: To Part 2 of AS/NZS 3000 unless otherwise documented.
- Electrical systems: To AS/NZS 3008.1.1 and SAA HB 301.
- Degrees of protection (IP code): To AS/NZS 60529.
- EMC: To AS/NZS 61000.
- Internal noise levels: To AS 2107.
- Mechanical ventilation and air conditioning: To AS/NZS 1668.1 and AS 1668.2, as required by the Building Code of Australia.
- SAA HB 40.2.
- Minimum energy performance standard (MEPS): To AS 3823.2
- Microbial control: To AS/NZS 3666.1, AS/NZS 3666.2 and the recommendations of SAA/SNZ HB 32.

- Refrigeration systems: To AS/NZS 1677.2 and the recommendations of SAA HB 40.1 and Rotating and reciprocating machinery noise and vibration: Vibration severity in Zone A to AS 2625.1 and AS 2625.4.
- Others: Other codes/standards as applicable
- In addition the design and installation of the air conditioning and ventilation systems shall comply with these requirements and follow best industry practice and the applicable references of organisations such as:
 - NAT SPEC specifications for general reference
 - The Australian Institute of Refrigeration, Air-conditioning, and Heating (AIRAH)
 - American Society of Heating, Refrigerating and Air-conditioning Engineers Inc (ASHRAE)
 - Chartered Institute of Building Services Engineers (CIBSE).

4.16.2 Air-conditioning equipment

General

Provide cooling only inverter split type air conditioning system as documented. Provide air conditioning to living/dining room and all bedrooms.

Standards

Non-ducted air conditioners: To AS/NZS 3823.1.1.

Equipment

Performance: Provide equipment in conformance with the following:

- Made by a manufacturer with a demonstrated ability to provide spare parts and service promptly to the site.
- Approved manufacturers include –Dakin, Panasonic and Fitjitsu alternative manufacturers may be considered provided specification and build quality is similar. Operational within the documented range of outdoor design conditions under the calculated loads without excessive head pressure or icing.
- Labelled to AS/NZS 3823.2.

Head pressure control: Provide manufacturer's standard head pressure control kit on units that operate in cooling mode at low ambient temperatures.

Cabinet: Aluminium, powder coated steel or moulded ABS plastic with metallic-coated steel or stainless steel fasteners. Insulate and vapour seal cabinet and drain trays to prevent external condensation under all operating conditions.

Drain trays: Aluminium, stainless steel or plastic to collect all moisture inside indoor and outdoor units.

Filters: Washable panel type. Performance when tested to AS 1324.2:

- Test Dust No. 1: $\geq 20\%$ efficiency.

- Test Dust No. 4: $\geq 85\%$ arrestance.
- Dust holding capacity: ≥ 130 g at 125 Pa against Test Dust No 4 for a nominal 600 mm x 600 mm cell.

Coils: Copper tube with aluminium plate fins.

Additional coil treatment

Provide additional anti-corrosion treatment to the coil of the outdoor units of the air-conditioning units so that the units could withstand the weather of the tropical marine environment.

Controller

General: Each air conditioning unit shall have a remote controller by which the control of the air conditioning unit is achieved. Mount the remote controller on wall with a mounting bracket located at the proximity of the air conditioning unit. The location of the remote controller shall allow the operation of the air conditioning using the remote controller without having to remove the remote controller from its mounting bracket.

Controls

The control shall provide, but not limited to, the following functions:

- Fan speed selection for multi and variable speed fans.
- Time switch for each system with ≥ 6 temperature programs per day, separate programs for each day of the week, manual set point override and Vacation temperature set back.

4.16.3 Installation of air conditioning equipment

The air conditioning unit shall be installed in accordance with the equipment manufacture's recommendations.

Each indoor fan coil unit shall be of white colour, and shall be located centrally on the internal walls in the respective area served.

Condensate drain pipe shall be oversized, and shall be insulated as per the equipment manufacturer's recommendations for insulating the refrigerant pipes.

Provide power supply to each condensing unit with IP56 rate power isolator. Isolator must not be mounted on the condenser unit.

All electrical wiring shall run in conduits.

Make good all building penetrations. Seal all building penetrations to ensure not water leakage.

Coordinate the final location of the drain point for the air conditioning unit condensate.

Concealment of Pipes and Conduits: As far as practical refrigerant and condensate piping and electrical conduits shall be covered. Piping shall not be run inside inaccessible wall cavities. Where piping and conduits must be run surface mounted it

shall be covered by Colorbond top hat sections of colours to match the surface on which they are installed, or indoor neat UV resistant plastic ductwork

No AC units with drainage pumps are to be installed.

No drainage, piping, wiring or ducting is to be visible on any interior wall.

Vibration isolation: Provide anti-vibration pads between the condensing unit's mounting feet and the mounting structure to which the condensing unit is mounted.

4.16.4 Metals

Aluminium and Aluminium Alloys

Drawn pipe: To AS/NZS 1867.

Drawn rod, bar and strip: To AS/NZS 1865.

Extrusions: To AS/NZS 1866.

Plate and sheets: To AS/NZS 1734.

Coated Steel

Electro galvanizing ferrous hollow and open sections: To AS 4750.

Hot-dip galvanizing (zinc):

- Ferrous open sections by an in-line process: To AS/NZS 4791.
- Ferrous hollow sections by a continuous or specialised process: To AS/NZS 4792.
- Metallic-coated sheet: To AS 1397.
- Thickness: Metal thicknesses specified are base metal thicknesses.
- Steel wire: To AS/NZS 4534.

Dissimilar metal

Provide durable dielectric spacer between the dissimilar metal to prevent galvanic corrosion.

4.16.5 Concrete plinths

Provide 100mm thick concrete plinths under condensing units and other equipment installed on slabs or ground. The plinth shall cause water to drain away from the equipment.

Dimensions: To suit equipment.

Concrete: Grade N25.

Finish: Steel float flush with the surround.

Reinforcement: Single layer of F62 fabric.

Forming: Form plinths to the required sizes.

Fixing to slab: Provide rag bolts or appropriate mechanical anchors to tie plinths to the slab and to prevent them from lifting. Do not rely on the concrete bond.

4.17 Carpentry and joinery

4.17.1 Materials

Generally carry out all work as specified in accordance with good trade practice. Sizes of material and grading of timber all as required by the Building Code of Australia and Australian Standards.

Second hand materials are not to be used.

Samples of all materials selection and colours nominated shall be presented to the Superintendent for approval at commencement of contract prior to ordering. The samples shall be presented on appropriately designed colour boards.

4.17.2 Kitchens

Cabinet work in general to be completed in accordance with good standard of workmanship.

All materials to be selected for durability, ease of cleaning and be highly moisture resistant.

Bench tops to be 0.8mm thick LP laminate on highly water resistant substrate. Edges of shelving and doors 2mm ABS matching. All front leading edges to bench tops to have bull nosing edge using post-forming grade laminate. Doors and drawer fronts, carcass and shelving to be pre-finished in a laminated surface on a highly water resistant substrate. All cabinetry to have balance veneer to tops and concealed faces not pre-finished. Composite materials can also be used for benchtops.

All hardware to be non ferrous and resistant to rust

Face of cabinet below cantilevered countertop/breakfast bar to be feature laminate finish or similar.

All carcasses to be raised 100mm above the FFL on feet with removable fitted solid timber kickboard with HP laminate facing to match cabinets.

Provide 128mm stainless steel handles to doors and drawers.

Provide a cutlery insert tray to the top drawer in kitchen.

Provide slide out 30lt waste bin with sealed lid, and 1 x tea towel hanging rail.

Hinges to be self closing where required (Blum or equal approved by the Superintendent). Kick boards to be constructed from solid timber.

Inset cook top, sink and fixed concealed range hood.

Under bench oven to be provided.

Microwave recess to be provided.

Provide overhead cupboards with built in fixed range hood (allow for 2 rows of adjustable shelves. to cupboards adjacent to range hood)

Dishwasher to be provided.

1 bank of crockery drawers min. 600 wide (allow 3 drawers)

1 bank of cutlery drawers min. 450 wide (allow 5 drawers)

Pantry – Min width 3 Bed 900mm, Min width 2 bed 700mm Provide 6 shelves to pantry

Provide fridge recess 3 bed 900mm width x 1800mm height, 2 bed 900mm x 1800mm. Fridge cabinet is to be designed to provide ventilation.

Note: Contractor to provide shop drawings of all cabinet work for approval prior to ordering. Shop drawings to be accompanied by sample boards showing colours and finishes. (2 alternative colour schemes to be provided – 50% to each dwelling type) 2 copies of each sample board are required to be provided to the Superintendent.

4.17.3 Laundry

- High pressure post formed laminate finish to top on highly moisture resistant substrate.
- Inset 45lt stainless steel trough.
- 800mm high overhead cabinets with 2 adjustable shelves.
- Provide broom closet – minimum 500mm wide.

4.17.4 Bathroom

- Vanity top to be high pressure laminate finish with matching down stand 240mm high or equivalent vanity unit with integrated basin may be acceptable. All materials to be highly moisture resistant substrate
- 2 banks of drawers (allow 2 drawers per bank).
- Cupboards to central part of vanity unit to conceal waste.
- Min 900mm x 1100mm high mirror.

4.17.5 Timber door frames for external and internal doors

Only use dry dressed hardwood for timber door frames.

External timber frames to front and rear doors to be double rebated for barrier screen doors and adequately flashed and finished.

4.17.6 Doors external

External doors are to be 920mm minimum width. Front door to be profiled Solid Core with solid block wood construction or similar fit for purpose external door water resistant paint grade ply faced two way edged stripped. Style to be approved by Superintendent. Rear doors to be flush panel solid core water resistant paint grade WP ply faced, two way edged strip.

4.17.7 Doors internal

- To be premium grade flush panel door sheeted with paint grade water resistant ply or equivalent approved by the Superintendent. (note Tasmanian Oak or Mountain Ash veneers are not recommended for tropical conditions).
- 820mm minimum width to all internal doors generally.
- 920mm minimum width to all internal doors for accessible units.

4.17.8 Skirtings

To be ex 60mm x 19mm Bull nosed dry dressed solid hardwood to all areas except bathroom, toilet and laundry. Hardwood to be light timber, Tasmanian Oak or Mountain Ash, clear finished.

4.17.9 Shelving

To be 18mm Melamine finished ply highly moisture resistant up to 900mm max spacing.

1 No. shelf to Wardrobes with 19mm stainless steel or approved equivalent hanging rails.

4 No. shelves to pantries and all other cupboards.

All external edges to have 2mm matching ABS edging.

Reverse faces, if not prefinished, to have balance melamine finish.

4.17.10 Timber cappings

Where required - dry dressed solid hardwood.

4.17.11 Sill nosings

Suitable timbers include solid hardwood or equivalent painted or clear finished except bathroom, toilet and laundry.

4.17.12 Balustrades/handrails

The following construction materials are deemed suitable for balustrades and handrails:

All dry dressed hardwood timber, paint finished.

aluminium with polyester powder coat finish.

stainless steel.

Hot dipped galvanised steel.

Provide balustrades and handrails to all external porches, landings, ramps in full accordance with the Building Code of Australia 2011.

Provide details and samples to Superintendent prior to ordering.

4.17.13 Appliance schedule

Contractor to provide a schedule of appliances suitable for 2 & 3 bedroom dwellings on Christmas Island.

Manufacturer to be a known quality brand, with back up service and easily available spare parts.

Approved Manufacturers include – Blanco, Bosch, Fisher & Paykel, and Electrolux. Alternative manufacturers may be proposed provided quality standards are met and is subject to Superintendent approval.

Manufacturers should have a proven track record of reliability in Australia.

ITEM Performance Criteria

Cook top 60cm ceramic cook top, Colour Black with Stainless steel controls

Oven 60cm multifunction below bench oven with fan forced and easy to use grill. Catalytic liners to the sides are a minimal requirement. Colour – Stainless Steel
Oven should be easy to use and have a timer and clock.

Range hood 60cm externally ducted 3 speed range hood with light built into overhead cupboards. Range hood should have filters which are easily removable and can be put in the dishwasher for cleaning.

Dishwasher Stainless Steel

Note: All appliances should be easy to clean and maintain.

4.18 Plastering and linings

4.18.1 Internal linings

All internal walls shall be lined with an approved paper reinforced water resistant plasterboard (minimum thickness of 13mm) fixed all in accordance with the manufacturer's instructions, free from fractures and cracks.

13mm Plasterboard or similar is appropriate.

Also refer to Section 2.4.13 Design for Durability.

All ceilings shall be lined with an approved paper reinforced water resistant plasterboard, all fixed in accordance with the manufacturer's instructions, free from fractures and cracks. Provide a cornice mould to junctions of walls and ceiling and flush fitting ceiling vents to all flumes. Install access to the roof space, fit tee bar mouldings around opening and provide a panel to match ceiling finish.

Also refer to Section 2.4.13 Design for Durability.

Vapour Barriers and Insulation

Roofing and gable ends - Provide 50mm anti-glare anticon - laid foil side up. Allow fully sealed and taped sisalation to underside. Use only hot melt fire retardant type sisalation foil suitable for tropical environment.

Allow for necessary brackets to avoid insulation crushing.

- Other types of sisalation will require approval for use by the Superintendent.
- Safety – adequately support anticon.
- Silicon seal and tape all laps to anticon sheeting to the satisfaction of the Superintendent's Representative.

Walls

- Sisalation to exterior and interior of wall frame. Use only hot melt fire retardant type sisalation foil suitable for tropical environment.
- Other types of sisalation will require approval to use by the Superintendent.
- Seal and tape all laps to sisalation.
- All partitions and external walls to have a min of R2.5 fibreglass rigid wall batts to wall framing, pinned and fixed into position.

Note:

- All sisalation and anticon foils to be not less than medium duty quality and approved by the Superintendent.

4.18.2 Party walls

Party and load bearing walls will need to be built in accordance with acoustic, fire and BCA requirements.

4.19 Tiling

Selected manufacturers are to be able to guarantee ongoing supply of wall and floor tiles. The tiles need to be available for the remaining works in New Housing Program on Christmas Island and for maintenance works.

4.19.1 Wall tiling

Prime cost (retail cost, Perth) – Floor tiling \$50/m².

Wall tiles - \$40/m² (note this cost is purchase only and does not allow for freight etc).

Wall tiles to be glazed ceramic generally 150mm x 150mm or 300mm x 100mm. Tiles are to be fixed with an approved adhesive, suitable for tropical climate. Joints are to be fully grouted all in accordance with good trade practice with mould resistant grout.

Floor and wall finishes in bathrooms should continue behind and under vanity units

All colours to be selected by the Contractor and approved by the Superintendent prior to ordering.

Tiled splashback to kitchen 300mm.

Bathrooms tiled to 1200mm AFFL except for shower recess where tiling should be 2100mm high. Fully tile any bathroom riser.

WC and laundry areas to have skirting tile and 300mm splashback to laundry bench and 200mm splashback to hand basin in separate WC's.

Include glazed ceramic soap holder to shower recesses and over bath tubs.

4.19.2 Floor tiling – wet areas only

A full wet seal is to be installed prior to tiling.

All floor tiles shall be fully vitrified ceramic to approval of the Superintendent. Lay floor tiles on a 3:1 cement sand mortar bed (depth of mortar bed to be in accordance with Australian Standards) graded to falls, fully grout joints with matching coloured grout. All colours are to be selected by the Contractor and approved by the Superintendent prior to ordering. Slip resistant R10.

(Falls to shower at 1:60 and 1:80 to other areas).

Allow to Bathrooms, Laundries and WCs.

The finished level of the wet area floor tiles shall be similar to the finished level of the adjacent floor covering.

Shower Recess and Bathtub

Modular plastic base is required to all shower recesses.

Bath and shower base to be fully bedded with mortar mix.

4.20 Resilient finishes

4.20.1 Sheet vinyl

Armstrong Nylex Corlon 'Impressions' (or equivalent similar), 1.5 mm thick set out to give a minimum number of joints. Seam seal and secure vinyl to floor all in accordance with manufacturer's instructions. (Alternative vinyls can be submitted for approval by the Superintendent). All joints to be hot welded. Vinyl to be laid on a suitable underlay.

All colours to be selected by the Contractor and approved by the Superintendent prior to ordering.

Location: All living areas, dining areas, kitchens, bedrooms and passages (include inside all cupboards and robes).

4.20.2 Junction between finishes

At junction of sheet vinyl with ceramic tiles finish with inset aluminium angle strip.

4.20.3 Glazing

All glazing shall be in accordance with Australian Standard 1288.

Glass shall be clear float glass free from defects and to a thickness suited to its area and its wind loading.

4.20.4 Obscure glass

Bathroom and WC windows are to be glazed in an approved obscure glass.
(Viridian décor satin or similar approved by the Superintendent.)

4.20.5 Mirrors

Mirrors shall be 6mm thick quality float glass with rounded edges.

Provide and install a dressing mirror - wall mounted 2000 height x 600 width to master bedrooms.

4.20.6 Shower screen, and door

Provide and fix a safety glass screen and hinged door secured in an approved polyester powder coated aluminium channel extrusions to all shower units or pivot.

4.20.7 Painter

All paint colours are to be selected by the Contractor, and illustrated on colour boards, for approval by the Superintendent.

Note: Paint dwellings throughout internally and externally. All non prefinished materials are required to be painted with the exception of approve natural galvanized components.

Paints shall be ready mixed paint obtained from a GPC approved manufacturer. Primers, sealers and undercoats shall be compatible with each other and the finished coats. All surfaces to be prepared to paint manufacture's recommendations. Use all mould resisting paints internally and externally, provide details of the paint systems to the Superintendent for approval.

All areas to be prepared in accordance with the best trade practice. Only skilled tradesmen are to be employed in this work, under the (supervision and control) of a registered painter. If paint is applied by spray then all coats must be rolled.

All hardware to be removed prior to painting and reinstalled on completion.

4.20.8 External work

Colours to be selected by the Contractor and approved by the Superintendent prior to ordering.

- Woodwork
- After preparation, apply 1 coat oil based primer, 1 coat oil based undercoat and 2 coats of oil based gloss enamel coats.
- Note: All doors to be primed on site prior to top coats being applied.

- Metal Work
- Apply suitable metal primer, 1 undercoat and 2 gloss enamel coats.
- Timber Door Frames
- Two coats primer to concealed faces before installation.
- Concrete (if applicable)
- Provide a suitable high built acrylic paint system to suit concrete precast/tilt up system. Supply all relevant data to the Superintendent's Representative for approval prior to ordering.
- Fibre Cement Sheeting
- Apply 1 sealer coat.
- Apply 2 coats of low sheen exterior 100% acrylic.

4.20.9 Internal work

- Colours to be selected by Contractor and approved by the Superintendent.
- After preparation, apply 1 oil based coat primer, 1 coat oil based undercoat and 2 coats oil based semi-gloss enamel.

4.20.10 Clear finishes (where applicable)

1 coat sanding sealer and 2 coats polyurethane finish appropriate for exposure conditions with light sanding between coats.

Ceilings

- Apply 1 coat of white sealer, appropriate to type of ceiling lining, prior to top coats specified below.
- Bathroom (Top Coats)
- Shower, ensuite, laundry and WC ceilings - apply 2 coats of low sheen 100% acrylic.
- All Other Ceilings (Top Coats)
- Apply 2 coats of flat 100% acrylic.

Walls

- Apply 1 sealer coat.
- Apply 2 coats of low sheen scrubbable 100% acrylic.

Protective Paint Systems

- Exposed Steel Floor Joists - Epoxy paint coatings over galvanised steel unless otherwise approved.
- Steel Posts & Stumps - Decorative painting as specified over hot dipped galvanised steel unless otherwise approved.

Identification

- On the inside of the meter box door neatly paint the brand of paint used and the date the painting was completed.

Completion

- Touch up and remove any paint splashes from all surfaces, secure any fittings and remove all containers.

5. Facilities and Room Sizes Summary Requirements

5.1 General

5.1.1 Main ceiling height

Minimum 2700mm floor to ceiling.

Kitchens located under bathroom areas may have a dropped ceiling. The minimum ceiling height is 2400mm.

5.1.2 Driveway (including crossover), and paving

Material	Bitumen sealed base to new roads. (Refer to Section 3.1.8) or approved equivalent material
	Concrete to crossovers car parking and carports
	Complete with drainage sumps with grates to collect stormwater. Fall paving as required to minimise size of drainage sump
Thickness	In accordance with the approved certified civil engineering design.
Minimum widths (driveway)	To Shire of Christmas Island requirements but 2.7m minimum
Bin Stores	Screened bin stores are to be provided in accordance with SOCI requirements.

5.1.3 Stairs – External

Stairs/verandahs to be 1000mm minimum clear width with slip resistant nosings.

Balustrading to be provided to all external stairs and internal returns.

5.1.4 Paved areas

- Paths to be 1000 mm wide concrete or similar and include:
 - Staircase to carport.
 - Laundry to drying area and carport.
- Drying area -generally 12m² per dwelling.
- Private outdoor living area - min. area 20m² to include privacy and sun screen area for dwellings.
- Paths to multi dwellings 1200mm wide to street front/car parking in common areas. Keep 3000mm away from walls from major openings in common areas.
- Provide paving to external doors for full width of door opening

5.1.5 Clothes hoist

1 paralline clothesline per dwelling/unit with 21 lineal metres of line, located under roof overhang where possible.

5.1.6 Corridor

Minimum width 1000mm internally.

Single GPO point for vacuum cleaner.

Note the Contractor is to provide electrical plans for each unit type for approval.

Electrical plan is to reflect furniture layouts.

5.2 Room sizes and facilities - 3 bedroom dwellings Type C

5.2.1 Living area/dining room

min. width:	4.8m
min. area:	38m ²
GPO's:	3 doubles
TV outlet and cable	1
RJ11 Phone Outlet	1
Ceiling fan:	1400mm dia blade
Lighting fittings:	as required also refer Electrical Section 4.15.7
Split system air-conditioner (cooling only)	Refer to section 4.16

5.2.2 Kitchen

min. width:	2.4m, 1.2m min access
min. area:	8.4m ²
GPO's:	2 doubles +1 single range hood + 1 single for dishwasher recess + 1 double for fridge + 1 for microwave recess
bench cupboard top (min clear area):	3m ² clear area Provide kitchen cupboards to 2400mm height. Provide water resistant plasterboard bulkheads between top of overhead cupboards and ceiling or similar
overhead cupboard (min. length)	1500mm
exhaust range hood over stove	1
dishwasher	1
1/1/2 bowl inset stainless steel sink:	1100mm long minimum
fridge and freezer space (min. width):	900mm (3 bed) 900mm (2 bed)
ceiling fan:	900mm dia blade
light fittings:	as required, refer Electrical Section 4.15.7

set of drawers in cupboards	1 x cutlery draws 450 wide (5 no. off) 1 x crockery draws 600mm wide (3 no. off)
pantry unit to incorporate door	800mm wide, 600mm deep
dishwasher recess	600mm wide in bench cupboard with cold water supply and waste connection Dishwasher recess to have removable under bench unit with door, toe recess and shelf. Floor covering to continue under recess
microwave recess	600 wide x 450mm deep GPO behind

5.2.3 Laundry

min. width:	1.6m
min. area:	4.3m ²
single stainless steel wash trough with laminated timber cabinet under	45 litre inset trough 1
broom closet	500mm wide
GPO's:	2 double Provide a SGPO for vacuuming hallways etc/ and living areas
light fittings:	as required

5.2.4 Bathroom

min. width:	1.6m
min. area:	7.0m ²
GPO's:	1 double
shower recess with preformed shower base:	Provide ceramic soap holder in tiling Provide shower screen and door
vanity cupboard with semi-recessed basin and, mirror over:	1 (minimum 900mm long x 360 deep)
exhaust fan:	250mm dia
bath tub:	1675 nom long acrylic
light fitting:	1
lockset to door:	privacy set

towel rail: 2

5.2.5 WC

min. width: 900mm
min. length: 1.7m
WC with dual flush cistern and pan: 3/6 litre
Hand basin (compact) 1
exhaust fan where required: 250mm dia
light fitting: 1
lockset to door privacy set
Toilet paper holder 1

5.2.6 Main bedroom

min. width: 3.8m
min. area: 16m² (exclusive of robes)
GPO's: 2 doubles
wardrobes, built in (min length): 2.7m (minimum 600mm in depth free hanging space) hgt 2.4m recess top shelf to allow access to high storage.
mirror: fixed to back of robe door or on wall
ceiling fan: 1400mm dia. blade
light fittings: as required refer Electrical Section 4.15.7
black heaters: to each wardrobe unit + SGPO
lockset to door: privacy set
Split system air-conditioner (cooling only) Refer to section 4.16

5.2.7 Other bedrooms

min. width: Bed 2 – 3.2m Bed 3 - 3.0m
min. area: Bed 2 – 12m² Bed 3 – 11m² (all exclusive of robes).
GPO's: 2 double to each room

RJ11 Phone Outlet	1 only to nominated room.
wardrobes, built in (min length):	1.4m (minimum 600mm in depth free hanging space)
ceiling fan:	1400mm dia blade
light fitting:	1
black heaters	to each wardrobe unit
lockset to door	privacy set
Split system air-conditioner (cooling only)	Refer to section 4.16

5.2.8 Linen cupboard

min. width:	0.5m ² linen storage upstairs, use minimum 820mm wide door 1 m ² linen storage ground floor, use 820mm minimum wide door. 450 minimum depth shelving.
black heater	1

5.2.9 Storeroom

min. width:	1.5m
min. area:	0.6m ²
light fitting:	1
GPO'S:	1 single

5.2.10 External living (terrace/balcony)

min. area:	14m ²
min. depth:	3.2m
light fitting:	1

5.2.11 Carports

Size:	Refer - Site Development Requirements Section 3.1.9.
GPO's:	1 external waterproof GPO

light fitting:

1, Refer Electrical Section 4.15.7

5.3 Room sizes and facilities - 2 bed units

5.3.1 Living area/dining room

min. width:	4.5 m minimum width living area. 3.2 m minimum width dining area. If separated see Type F.
min. area:	33m ²
GPO's:	3 doubles
TV outlet and cable	1
RJ11 Phone Outlet	1
Ceiling fan:	1400mm dia blade
Lighting fittings:	as required also refer Electrical Section 4.15.7
Split system air-conditioner (cooling only)	Refer to section 4.16

5.3.2 Kitchen

min. width:	2.4m, 1.2m min access
min. area:	8.4m ²
GPO's:	2 doubles +1 single range hood + 1 single for dishwasher recess + 1 double for fridge & microwave
bench cupboard top (min clear area):	3m ²
overhead cupboard (min. length)	1500mm
exhaust range hood over stove	1
Dishwasher	1
1 ½ bowl inset stainless steel sink:	1050mm long minimum
fridge and freezer space (min. width):	900mm
ceiling fan:	900mm dia blade
light fittings:	as required, refer Electrical Section 4.15.7
set of drawers in cupboards	1 x cutlery draws 450mm wide (5 no. off) 1 x crockery draws 600mm wide (3 no. off)

pantry unit to incorporate door	800mm wide, 600mm deep
dishwasher recess	600mm wide in bench cupboard with cold water supply and waste connection under sink . Dishwasher recess to have removable under bench unit with door, recess and shelf. Floor covering continue under dishwasher
microwave shelf	600 wide x 450mm deep

5.3.3 Laundry

min. width:	1.6m
min. area:	2m ²
single stainless steel wash trough with laminated timber cabinet under	45 litre inset trough 1
broom closet	500mm
GPO's:	1 double
light fittings:	as required

5.3.4 Bathroom

min. width:	1.6m
min. area:	4.3m ²
GPO's:	1 double
shower recess with preformed shower base	Provide ceramic soap holder in tiling Provide shower screen and door
vanity cupboard with inset basin or synthetic marble top, mirror over:	1 (minimum 900mm long x 500 deep)
exhaust fan:	250mm dia
bath tub:	1500 nom long acrylic
light fitting:	1
lockset to door:	privacy set
towel rail:	2

5.3.5 WC

min. width:	900mm
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min. length:	1.6m
WC with dual flush cistern and pan:	3/6 litre
exhaust fan where required:	250mm dia
light fitting:	1
lockset to door:	privacy set
Toilet paper holder:	1

5.3.6 Main bedroom

min. width:	3.5m
min. area:	14m ² (exclusive of robes)
GPO's:	2 doubles
wardrobes, built in (min length):	2.4m (minimum 600mm in depth) 2.4m high, sliding doors
mirror:	fixed to back of robe door or on wall
ceiling fan:	1400mm dia. blade
light fittings:	as required refer electrical section 4.15.7
black heaters:	to each wardrobe unit
lockset to door:	privacy set
Split system air-conditioner (cooling only)	Refer to section 4.16

5.3.7 Other bedroom

min. width:	3.2m
min. area:	11.5m ² (all exclusive of robes).
GPO's:	2 double to each room
RJ11 Phone Outlet	1
wardrobes, built in (min length):	1.4m (minimum 600mm in depth)
ceiling fan:	1400mm dia blade
light fitting:	1
black heaters:	to each wardrobe unit
lockset to door:	privacy set
Split system air-conditioner (cooling	Refer to section 4.16

only)

5.3.8 Linen / storage cupboard

min. width: 1500mm wide with double doors
450mm minimum depth shelving

black heater: 1

5.3.9 General storage cupboard

min. width: 0.6m

min. area: 0.4m²

light fitting: 1

GPO'S: 1 single

5.3.10 External living (terrace/balcony)

min. area: 15m²

min. depth: 3.5m type D, 3.3m Type F

light fitting 1

5.3.11 Carports

Size: Refer - Site Development Requirements 2.3.9

GPO: 1 external waterproof GPO

light fitting: 1, Refer Electrical Section 4.15.7

Appendix A
Vision Document –Project 1
Drumsite Village



Vision Document APRIL 2011

DEPARTMENT OF REGIONAL AUSTRALIA, REGIONAL DEVELOPMENT AND LOCAL GOVERNMENT

NEW HOUSING PROGRAM ON CHRISTMAS ISLAND - PROJECT 1 DRUMSITE VILLAGE



Project 1 - Drumsite Village, Vision Document

Existing Vernacular Architecture

The local vernacular housing types are varied, but exhibit many desirable similar characteristics.

These aspects are to be incorporated into the Master planning & dwelling design of the Drumsite Project 1:

Relationship to the natural ground

- Majority of the dwellings are raised off the ground to provide ventilated sub-floors, as an economic response to the steep terrain and assist the migration of the iconic red crabs.
- The underside of sub-floors are to be screened, with a access for maintenance inspections. Screening should be raised 150mm above natural ground level to assist crab migration in the area.
- Where a small percentage of the less steep terrain is terraced to create flat sites, low retaining walls are to preferably be constructed from local random stone

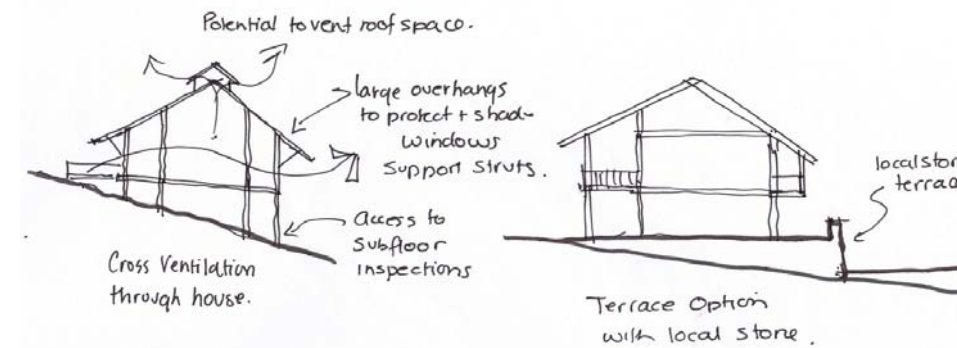
Relationship to the street

- The single lot housing on the island is traditionally setback from the road, surrounded by large grassed lawns and verges.
- The terrace housing & higher density housing on the island is traditionally parallel to the street, and dual faced to present balcony's to the ocean side.
- The older style lower density walk up apartments are on their own lot, with green space around them, and not necessarily orientated parallel to the street.
- Similar principles have been used in the indicative master plan on the Drum site.
- The only form of street fencing, is the construction of low natural local stone walls, which assist in defining the street boundary and transitions the levels from road to house. This is the only permitted form of front fencing.
- There are a number of 'compound' or 'U' shaped buildings on the island, where a number of dwellings/ buildings are located around an open courtyard. This structure has been used in the walk-ups at the north east of the site.
- Covered carports are to be provided, but should not dominate the streetscape

Roof Form

- Simple pitched roof forms, are used across the island.
- Gable & pavilion, simple pitched roofs - min 27-30° pitch,
- Skillion roofs (Tropical style), refer elevation example, - min 15° pitch
- Large roof overhangs (1200mm - min), are prevalent and provide for sun protection and rain protection and enhance the tropical aesthetic of the island
- Variations to roof pitch/overhang may be permitted where it can be illustrated that design intent or function is not compromised. Requires Approval.
- Box Gutters are not permitted, and valley gutters should be minimal as they are prone to leaking. Gutters are to be used only above access/pathway areas.
- Lined eaves are prone to mould and water damage. Eaves to be open, but ensure that rafter ends are covered by roof sheeting, and that roofs are well sealed at wall joint.
- The incorporation of ceilings lined on the rake in living/dining areas is strongly encouraged. It enhances the spatial feel of the unit, and increases the potential for venting of roof spaces.

Examples & Characteristics



Project 1 - Drumsite Village, Vision Document

Existing Vernacular Architecture

Characteristics

Alfresco Areas

- Covered alfresco decks on the ocean side of the dwelling, are raised above the street, to provide a sense of privacy to the resident and capture the breezes & views. Alfresco areas overlooking streets promote neighbourhood interaction and assist in creating a sense of community and a sense of place.
- Alfresco roofs may be on a lesser pitch, provided they are separated in plane from the main roof, to avoid leaking at change of pitch location. (Min pitch of alfresco roof areas 15°). They should contribute to the overall dwelling design.
- Where possible alfresco areas should be hardwood decking, in keeping with the traditional architecture of the island.
- Alfresco areas are to be located adjacent to dining/living areas and be easily accessible.
- Alfresco areas are to be of practical and useable size - Refer unit type requirements.



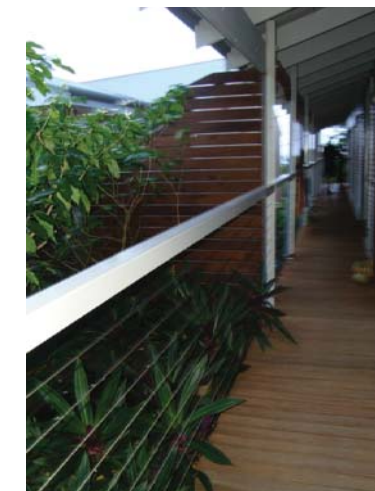
Openings

- The more desirable dwellings on the island have a high percentage of window to wall ratio, which provides a sense of light and space, high level of cross ventilation, and encourages the indoor/outdoor relationship to the alfresco areas.
- External Door/window height should be a minimum of 2.4m or a combination of standard head height with fixed light to 2.65m. The use of high level louvres is encouraged, to promote cross ventilation through living areas.
- Utilise operable glass & solid/cedar louvres to maximise cross ventilation, and assist in controlling airflow through the dwellings to encourage passive cooling.
- Fenestration proportions and break-ups should complement the dwelling design, and enhance the spatial feel of the internal rooms.
- Where possible master bedrooms should have glazed sliding doors onto balcony's to allow for greater ventilation and improve the window/wall ratio of the dwellings.



Limited palette of Materials & Colour

- A limited palette of Materials and Colour assist in providing the Drumsite with a sense of identity.
- Local stone, lightweight cladding, natural anodized windows frames, glass and cedar louvres, natural hardwood decking, natural galvanized steel and aluminium roof sheeting all contribute to a tropical aesthetic which respects the harsh coastal tropical environment which makes it unique to Christmas Island.
- The colour palette is earthy and light, with the additional of coastal colours which are found in the earlier settlement housing.
- All materials and finishes are to be suitable to the harsh tropical environment of Christmas Island and be highly resistant to rotting, rusting, mould and termites.
- Materials are to be low maintenance.





Houses too close together, reduces ventilation, low ceiling height,
No sense of entry, inappropriate building type to the island



Relatively low window to wall ratio, means that dwelling does not interact with street, and exposed under floor unattractive



Nice aesthetic, however separated living and bedroom wings by breezeway is unpopular with residents.



Dated architecture, roof pitch unattractive, very limited alfresco area. House has low aesthetic value.



Unattractive roof form, lack of detail and no sense of entry or tropical aesthetic which represents Christmas Island



Low window to wall ratio, presents a building which is more institutional than residential. min overhang - screens filthy



Unscreened sub-floor unattractive and area dangerous for children as it is accessible. Needs to be screened, with lockable access door



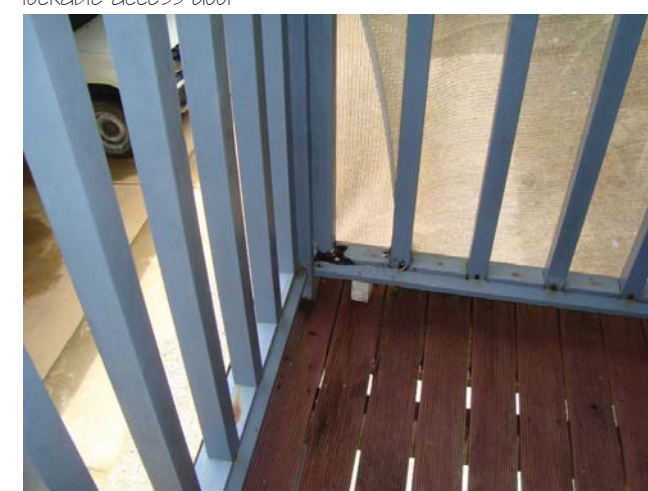
Inappropriate roof form to tropical climate. Sloped grass area unpopular with residents as dangerous for kids to play.



Stained pine decking, rotting where exposed to elements on upper floor.
Main flooring rotting, inappropriate material.



Where roof pitch changes at valley, roof leaking and damaging floor below. Leaking exacerbated by low pitch to verandah



Where water leaks are dripping on floor & balustrade, timber is rotting. All timber to be fully covered by roof overhangs



Screws not appropriate to marine environment - rusting. Where water drips on timber, timber is rotting.

Project 1 - Drumsite Village, Vision Document

IMAGE BOARD & PALETTE OF MATERIALS

Wall Colour Palette

Wall Colours are to be earth tones, as represented by the colour palette indicated below. The colours below are not a complete range, but an example of a colour palette for the built form.



Note:

Contractor to provide proposed palette of materials and colour board for approval, prior to ordering.

Wall Material Palette

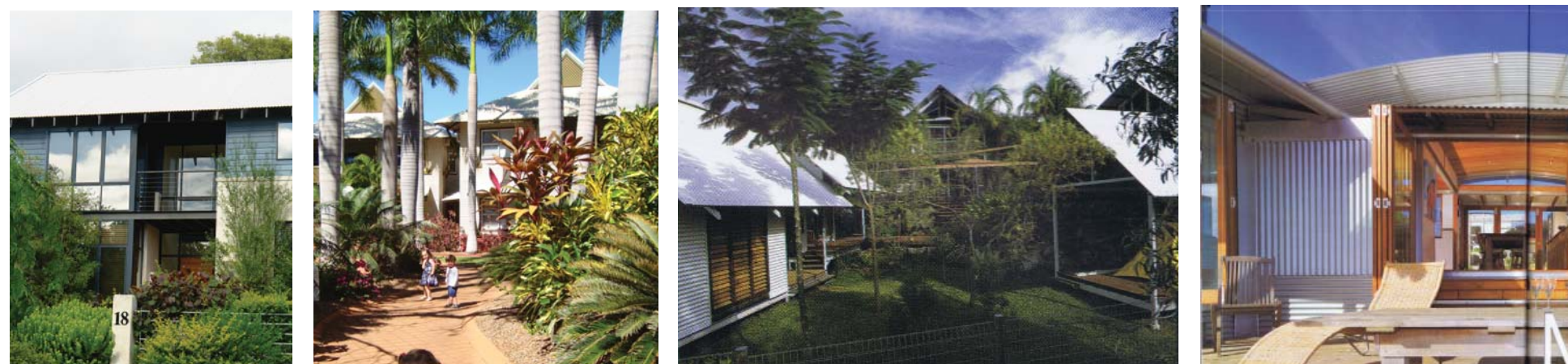
It is strongly recommended that retaining walls be natural local random stonework where practical.
 Ground floor walls may be masonry or lightweight construction.
 Upper floors to be lightweight construction/ cladding.
 Dwellings to use a mix of materials to provide interest, articulation, light and shade and be used to enhance the tropical aesthetic of the development
 Walls to have a 1/3, 2/3 split of materials. Any change in material should be expressed.



Well articulated streetscape with natural finishes, Troppo Architects | Boarding, large overhangs and screening to windows. | Example of palette of natural finishes | Local stone retaining walls & landscape | Landscape with colour | Colorbond wall cladding with natural timber



Example of light and airy interiors & alfresco area, with a natural finishes palette. home by architect Duncan Utz-Sanby | Contemporary Kitchen | Modern Bathrooms w/ mirror cabinet | Troppo Architects - Medium density project, illustrates Large overhangs, natural palette of materials



Articulated mix of materials on facade, with simple roof form | Tropical medium density housing with supported overhangs, pitched roofs and tropical landscape | Tropical feel to dwelling, with natural palette of materials, Large overhangs, pitched gabled roofs. Dwellings raised off the ground -Troppo Architects | Example of attention to detail with cladding and Natural palette of materials.

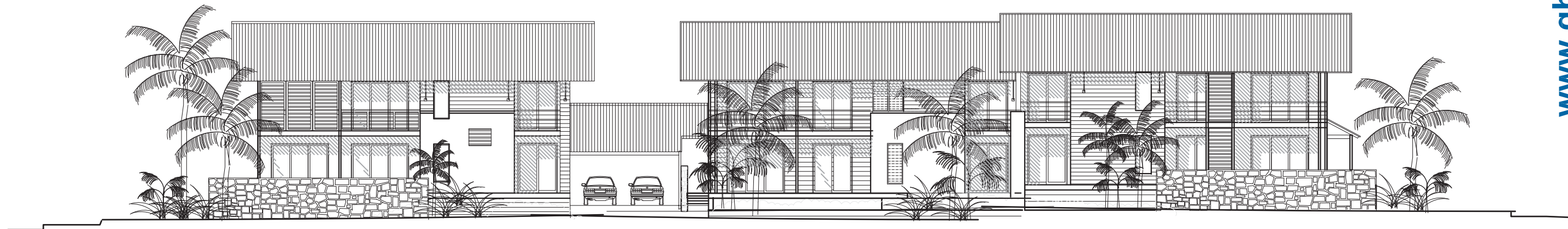
Roof Colour Palette

Aluminium roof sheet



Window Frames & Ancillary Items

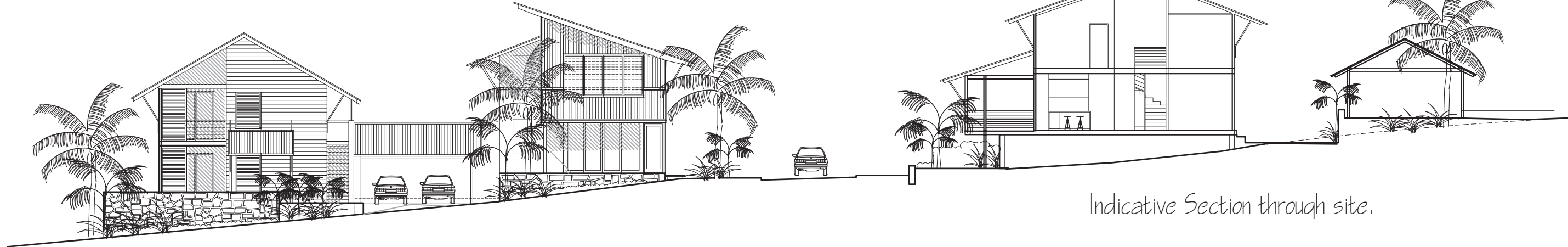
All window & door frames to be anodised aluminium or powder coated a light colour. Posts & steel work to be fully galvanised.



Indicative Street Elevation

Indicative Elevations of Preliminary Concept Master plan.
Elevations demonstrate, scale, varied streetscape and articulation to facades.

Note: Roof form could be varied to provide further articulation to main streetscape.
The inclusion of 1 x (2- Type D Walk-up units) into Project 1 is acceptable, provided it can be demonstrated it sits well in the site plan and contributes to the overall streetscape.



Indicative Section through site.

Unit Types, can be elevated with varying roof form, mix of materials, and minor detail changes to present an articulated streetscape, which contributes to an overall tropical aesthetic.

Note: Concept Unit types and street elevations are indicative only to provide tenderer with a suggestion of the type of form, size of dwellings and type of aesthetic desired for the site.



Drumsite - photos of adjoining buildings and site

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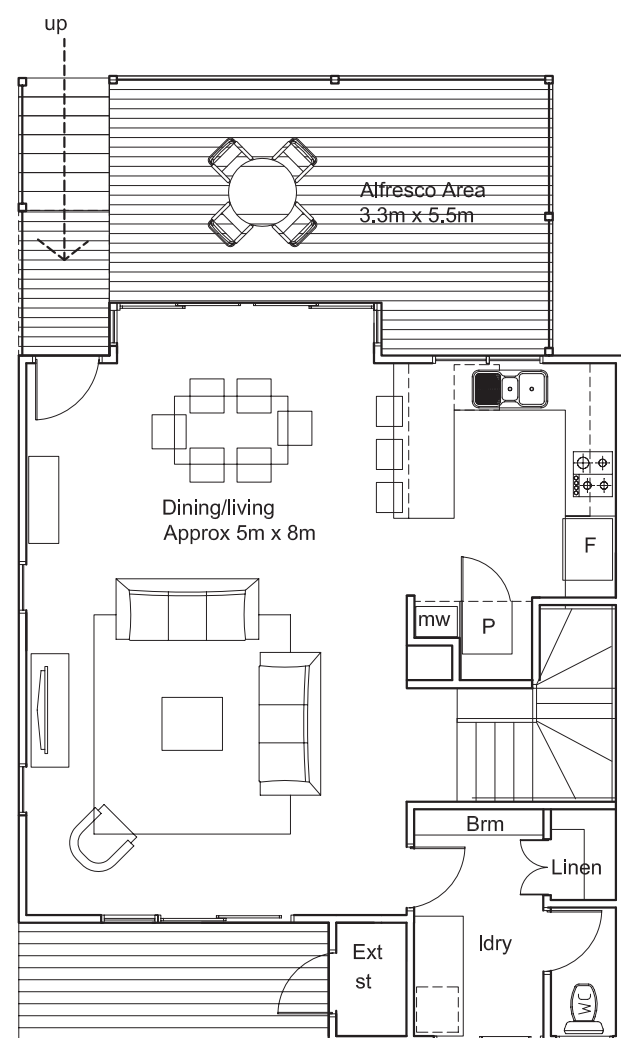
NEW HOUSING PROGRAM ON CHRISTMAS ISLAND - PROJECT 1 DRUMSITE VILLAGE

date: **MARCH 2011**

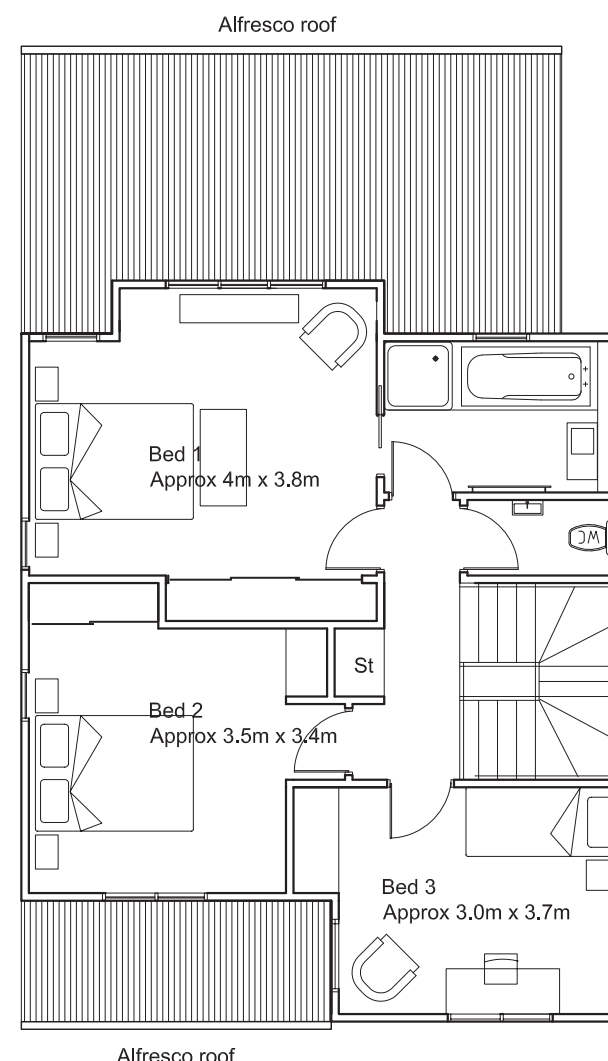
job no: **61-26591**

drawing: **Sk 301**

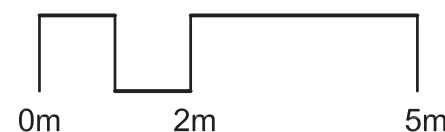




Ground Floor Plan



Upper Floor Plan



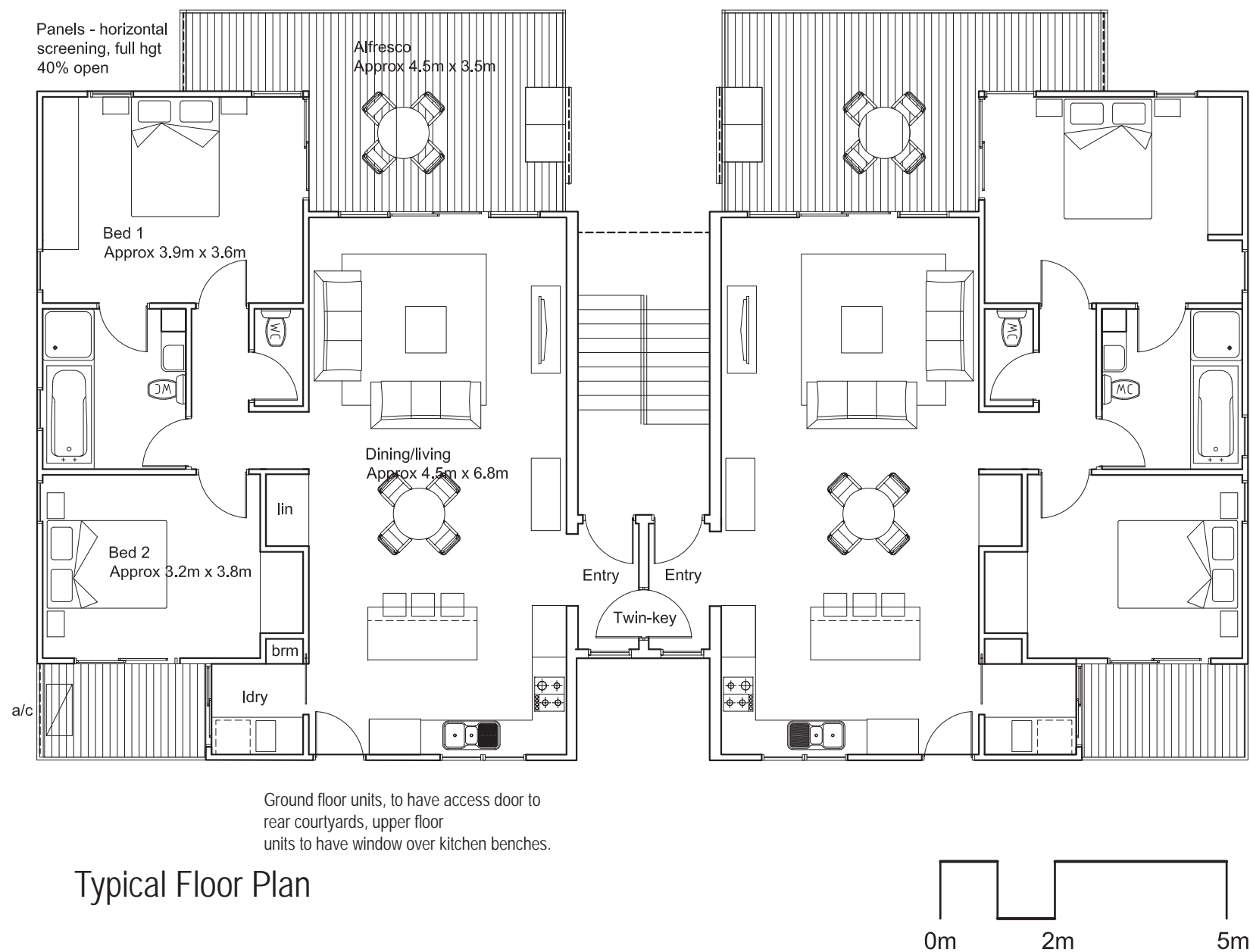
Indicative Floor Plans - Drumsite

3 Bed Townhouse Type C

Gross Floor Area Min - 138m²

Criteria specific to Type C

- Minimum of one covered carbay per townhouse. Carports to be located either adjacent, or to the rear of the townhouses.
- Minimum 50% of Type C's to have a second covered carbay. Overall car parking numbers as per the R-Codes
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m.
- Alfresco Area - Majority of alfresco areas in Type C's, are to be raised above the ground and face the street/ocean side. Where the townhouse is located at similar ground level to street level, alfresco area to be re-located to rear of dwelling for privacy reasons. However a front porch must still be provided, minimum 2.4m deep.
- Alfresco area to functionally allow for table for 6, and freestanding BBQ.
- Dining/Living area to connect alfresco area and courtyard.
- Kitchen to have breakfast bar which can accommodate 2-3 stools. Kitchen to be contemporary and light.
- Min courtyard depth 4.2m. Rear courtyards to be fenced to 1600mm above ground level. Ensure fencing does not inhibit crab migration.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Separate laundry to be provided with separate WC located on ground level.
- Semi-ensuite to be located upstairs. Separate WC to be provided, ensure located outside main bathroom.
- Landscaping to front and rear courtyards.
- Minimum paved area in courtyard of 20m²
- Ensure that air-conditioning unit placements are considered, and are centrally placed on walls.



Typical Floor Plan

Indicative Floor Plans - Drumsite 2 Bedroom Walk-up Type D

Gross Floor Area 95m² - Ground Floor Units

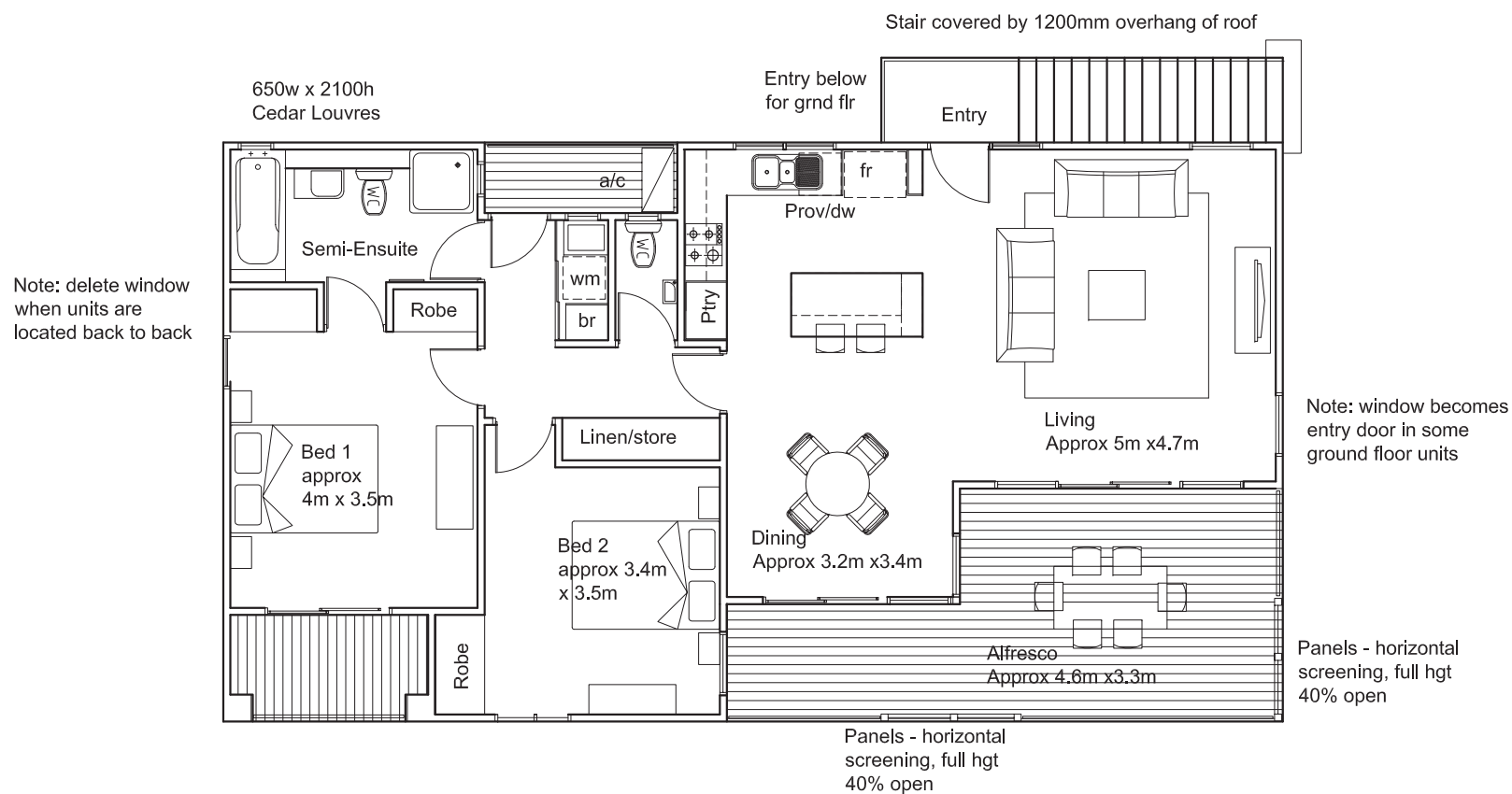
Gross Floor Area 97m² - Upper Floor (Inc sep entry)

Criteria specific to Type D

- Minimum of one covered carbay per walk-up unit. Carports to be located either adjacent, or to the rear of units with easy access to either front or rear door of unit.
- Remainder of carbays as per the R-Codes
- Type D units to have legible front door.
- Twin key units as indicated are for future stages, and are not applicable to Project 1.
- Access stair to upper floor units to be covered and legible from street.
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m. However ceiling height to bathroom and kitchen areas on lower floor may be reduced to 2400mm to accommodate plumbing and drainage.
- Alfresco Area - Locate alfresco areas to address main street corners, and take advantage of ocean vistas and breezes. Provide provision for future zip down blinds, or operable louvres to exposed corners of balcony's.
- Alfresco area to functionally allow for table for 6, and free standing BBQ
- Dining/Living area to connect alfresco area.
- Kitchen to have island bench which can accommodate 2-3 stools. Kitchen to be contemporary and light. Kitchen to relate to dining/living areas.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Laundry to be provided as separate room adjacent to kitchens.
- Landscaping to front and rear courtyards.
- Min paved area in rear courtyard of 12m²
- Ensure that aircon unit placements are considered, and are centrally placed on walls.
- Door in kitchen only applicable to ground floor units, it is to be a window over kitchen benches in upper floor units.

Note:

- For Project 1, Type D unit to be a one set of walk-up units with private stair to upper floor unit.
- For Project 1, the pair of Unit Type D's are to have a internal entry area, similar to that shown on the upper floor plan adjacent.
- Minor amendments have been made to the extent of balcony, and master bedroom layout for the Type D unit shown in Project 1.



Typical Floor Plan

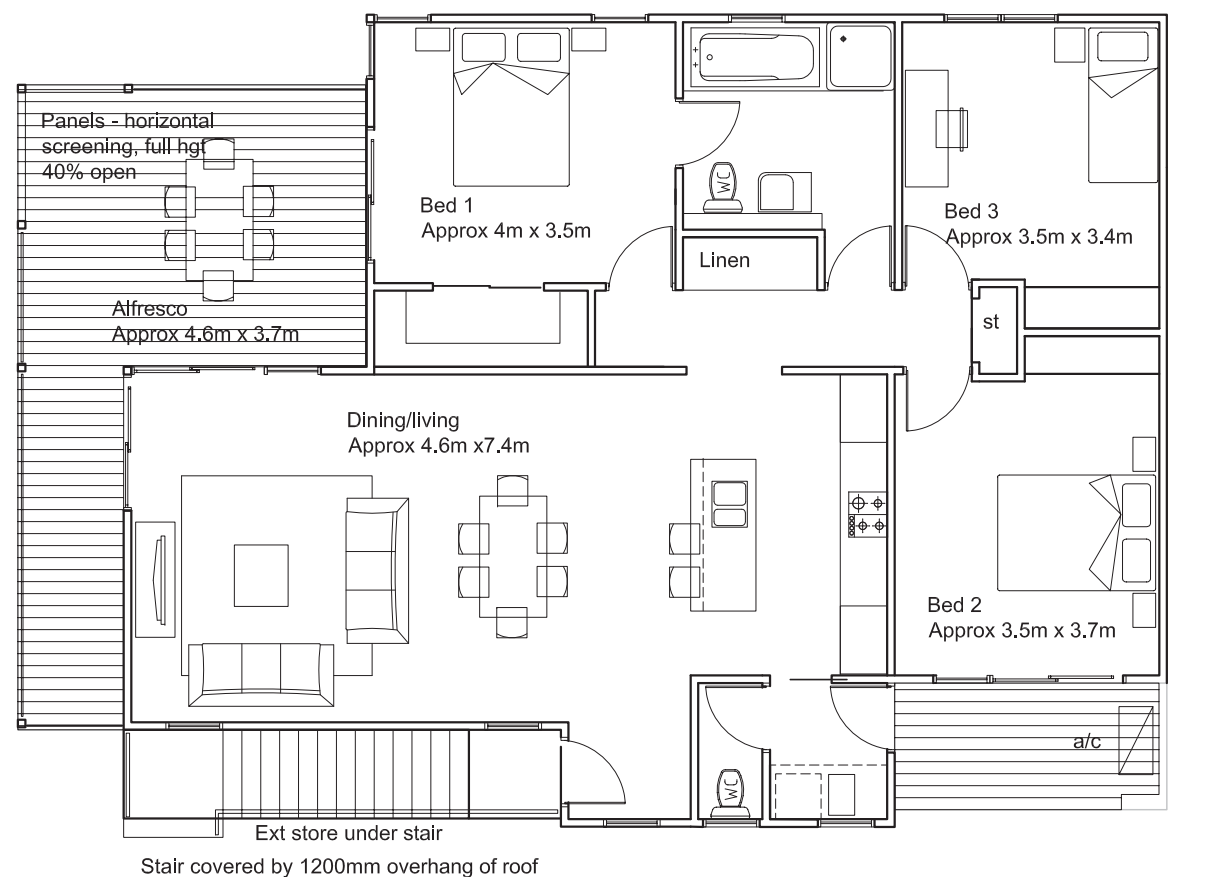
Indicative Floor Plans - Drumsite

2 Bedroom Walk-up Type F

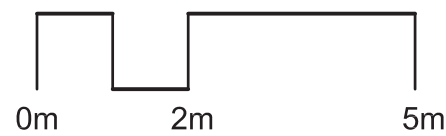
Gross Floor Area Min 95m²

Criteria specific to Type F

- Minimum of one covered carbay per walk-up unit. Carports to be located either adjacent, or to the rear of units with easy access to either front or rear door of unit.
- Remainder of carbays as per the R-Codes
- Type F units to have legible front door.
- Access stair to upper floor units to be covered and legible from street.
- Ensure that siting and placement of windows discourage overlooking between dwellings.
- Minimum Ceiling height in all rooms 2.7m.
- Alfresco Area - Locate alfresco areas to address main street corners, and take advantage of ocean vistas and breezes. Provide provision for future zip down blinds, or operable louvres to exposed corners of balcony's.
- Alfresco area to functionally allow for table for 6, and free standing BBQ
- Dining/Living area to connect alfresco area.
- Kitchen to have island bench which can accommodate 2-3 stools. Kitchen to be contemporary and light. Kitchen to relate to dining/living areas.
- Minimum courtyard depth 3.2m. Rear courtyards to be fenced to 1600mm above ground level. Ensure fencing does not inhibit crab migration.
- Ground floor units to have direct access to rear courtyards from unit, and visual connection from a habitable rooms such as /kitchen or living area.
- All bathroom and laundry areas to be located on external walls, with natural and mechanical ventilation.
- External stores as per the R-codes and be accessible from rear courtyards or carports.
- Cross Ventilation to be provided to every habitable room.
- Laundry may be in a cupboard behind louvered doors, or provided as a separate room with openable window. Both options must be adjacent to a covered balcony suitable for drying clothes. Provide pull out line on balcony's. Where pull out line on upper floor balcony's could be visible from street, provide a communal drying area at ground level for each pair of units.
- Landscaping to front and rear courtyards.
- Min paved area in rear courtyard of 12m²
- Ensure that aircon unit placements are considered, and are centrally placed on walls.



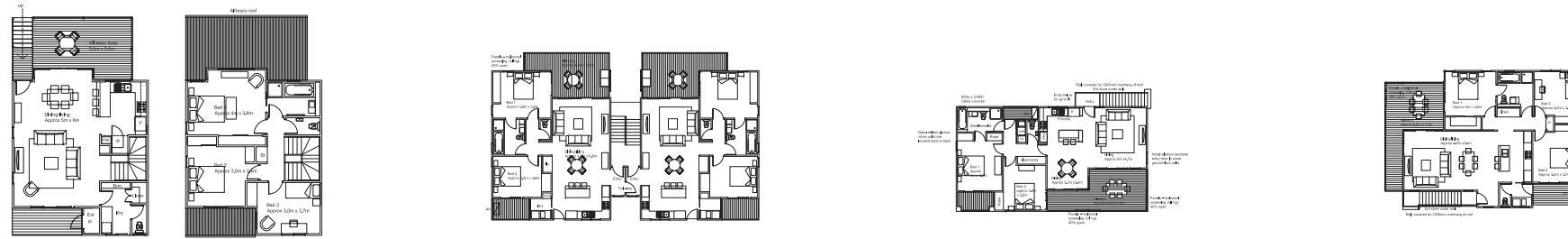
Typical Floor Plan



Indicative Floor Plans - Drumsite
3 Bedroom Walk-up Type G
Gross Floor Area 120m² -

Drumsite Project 1 - Vision Document

Unit Type Requirements -



Note :
Unit type G will be part of future stages.
Unit Type A,B,& E are not applicable to Project 1 Drumsite Village.

Type	Type C- Project 1	Type D- Project 1	Type F- Project 1	Type G- Future Stages
No Bedrooms	3 Bedrooms	2 Bedrooms	2 Bedrooms	3 Bedrooms
No Bathrooms	1 x Semi-ensuite with a shower, separate bath, & basin with storage. 1x separate WC with small hand basin upstairs & 1x separate WC in laundry	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC with small handbasin	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC	1 x Semi-ensuite with a shower, separate bath, wc & basin with storage. 1x separate WC with small handbasin
No Covered Car bays	Min 1 Covered Car bay. 50% of Townhouses to have two covered car bays.	Min one covered carbay to each unit Remainder as per the R-codes	Min one covered carbay to each unit Remainder as per the R-codes	Min one covered carbay to each unit Remainder as per the R-codes
Size of Alfresco Area - Minimum	3.2m x 5m Note: min depth of courtyard 4.2m	3.6m x 4.5m	3.3m x 4.6m	3.6m x 4m
Separate Laundry	Yes, must have direct access to external undercover balcony	Yes, must have direct access to external undercover balcony	May be separate laundry or behind louvered doors, with adjoining sliding door to undercover balcony	Yes, must have direct access to external undercover balcony
Minimum Gross Floor Area	138m ²	95m ² (no sep entry) 97m ² (if separate entry)	95m ²	120m ²
Min Size of Bedrooms	Bed 1 - 4.2m x3.8m Min Dim 3.6m Bed 2, - 3.2m x 3.5m Min Dim 3.2m Bed 3 - 3m x 3.7m Min Dim 3m	Bed 1 - 4m x3.5m Bed 2, - 3.8m x 3.2m	Bed 1 - 4m x3.5m Bed 2, - 3.2m x 3.7m	Bed 1 - 4m x3.5m Bed 2, - 3.2m x 3.7m Bed 3 - 3m x 3.5m
Min Size of Dining/Living	7.8m x4.8m	6.8m x4.5m	Living min 5m x4.6m Dining min 3.2 x 3.6m	7.5m x4.5m
Linen & General Storage	Linen - min 1.5m x .6m Gen Store - min 1mx .6m Brm - Min .5m x .5m Ext Store - as per r-codes	Linen - min .7m x .6m Gen Store - min .6mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes	Linen - min 1m x .6m Gen Store - min 1mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes	Linen - min 1.5m x .6m Gen Store - min 1mx .6m Brm - Min .4m x .5m Ext Store - as per r-codes
Indicative Project 1 mix	6 Townhouses	2 Walk-ups	8 Walk-ups	
Indicative future mix	N/A	11 x 2 Bed Walk-ups	N/A	5 x 3 Bed Walk-ups

Note: Room Sizes all units
Min internal dimensions are:
Bed 1 - 3.5m
Bed 2 - 3.2m
Bed 3 - 3.0m

Note: Room sizes can vary provided that the total clear area of the room and min size dimension are equivalent to example sizes.

ie Bed 1 Could be 4mx3.5 or 3.8x 3.7m

Wardrobe Sizes all units
Min Dimensions are:
Bed 1 - 2.4m
Bed 2 - 1.4m
Bed 3 - 1.2m

Kitchens to include for:

- Fridge Recess
- Microwave Recess
- 600mm electric hotplate
- 600mm underbench oven
- Rangehood ducted to external
- 1 1/2 bowl sink
- Pantry
- Prov for dishwasher

Note - All areas are gross floor area.

Appendix B
Indicative Drawings



PROJECT ONE

FUTURE

Project One - (16 Dwellings)
 10 x 2 Bed Walk-up Units
 6 x 3 Bed Townhouses

Future - (16 Dwellings)
 11 x 2 Bed Walk-up Units
 5 x 3 Bed Walk-up Units

Total - 32 Dwellings, 46 Carbays

NOTE: Levels shown are indicative only

0 5000 10000 15000 20000 25000mm

SCALE 1:500 AT ORIGINAL SIZE

REGIONAL AUSTRALIA
CHRISTMAS ISLAND HOUSING

Appendix C

Information Drawings – Survey and GIS Details



THE INFORMATION SHOWN ON THIS DRAWING IS BASED ON THE LATEST GIS DATA AVAILABLE. GHD CANNOT CONFIRM THE ACCURACY OF THIS INFORMATION.

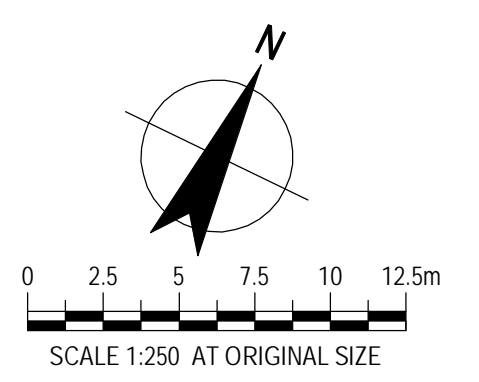




- NOTES:**
1. CONTOUR INTERVAL = 0.25m
 2. CADASTRAL EXTRACTED FROM LANDGATE. ACCURACIES VARY FROM 0.002m to 1.000m OVER LOT
 3. SEWER DATA PROVIDED BY WATER CORPORATION AND IS INDICATIVE ONLY.
 4. ONLY VISIBLE SERVICES AND MANHOLES LOCATED AT TIME OF SURVEY.
 5. BOUNDARIES OF SITE HAVE NOT BEEN REPEGGED. FURTHER SURVEY REQUIRED TO VERIFY BOUNDARIES.

LEGEND OF FEATURES

○	SIGN	—	CADASTRAL BOUNDARY
⬮	EARTH PIT	▭	BUILDING
⬮	CABLE DIRECTION MARKER	—	KERB
⬮	DISTRIBUTION BOARD	—	WALL
⬮	ELECTRIC CABLE DOME	—	TOP OF BANK
⬮	POWER METER BOX	—	BOTTOM OF BANK
⬮	LIGHT POLE (ONLY)	—	CHANGE OF GRADE
⬮	COMM PIT	—	EDGE OF CONCRETE
⬮	SEWER IO	—	EDGE OF BITUMEN
⬮	STOP VALVE	—	FENCE LOW
⬮	WATER METER	—	DRIVEWAY
⬮	BOLLARD	—	DRAIN PIPE
⬮	OBVERT	—	SEWER PIPE
⬮	INVERT	—	EDGE OF DRAIN
⬮	NATURAL SURFACE	—	ROAD - BROKEN LINE
⬮	ON ROAD	—	BUSHLINE
⬮	SEWER MANHOLE	—	ROCK OUTCROP
⬮	DRAINAGE MANHOLE		
⬮	DRAINAGE GULLY		
⬮	DRAINAGE SIDE ENTRY PIT		



No	Revision	Note	Drawn	Checked	Approved	Date
3		TOP OF WALL LEVELS ANNOTATED	KSJ*	CM*	CM*	03.03.11
2		WATER CORP SEWER ADDED	KSJ*	CM*	CM*	21.02.11
1		CADASTRAL BOUNDARY ADDED	CM*	CM*	CM*	18.02.11
0		ISSUED FOR INFORMATION	KSJ*	CM*	CM*	18.02.11

GHD CLIENTS | PEOPLE | PERFORMANCE

GHD House, 239 Adelaide Tce Perth WA 6004
 PO Box Y3106 Perth WA 6832 Australia
 T 61 8 6222 8222 F 61 8 6222 8555
 E permail@ghd.com.au W www.ghd.com

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Drawn	KSJ 18.02.11	Scale	1 : 250m
Drafting Check	CM	Surveyor	DS
Datum	CIHD	Field Book	3592
Grid	MGA 94 Zone 48	Level Book	*
Approved Date			

Client **REGIONAL AUSTRALIA**
 Project **DRUM SITE**
 Title **FEATURE AND LEVEL SURVEY**

Original Size **A1** Drawing No: **61-2659109-V01** Rev: **3**

This Drawing must not be used for Construction unless signed as Approved

Appendix D

Christmas Island – Seismic Hazard Assessment

6.2 Earthquake Design

6.2.1 Design of Structures to AS1170.4-2007

Based on the comparison of the results of this study to AS1170-2.2007, we recommend that earthquake design actions should be calculated in accordance with AS1170.4-2007, but the design response spectra for the appropriate return period should be used from the results of this study. Table 9 provides the spectral shape factors for three return periods.

Exceptions and clarifications as noted below:

- Single-story, importance level 2 structures less than 6m high may be designed to AS1170.4-2007 with no modifications.
- Importance level 2 structures greater than 6m high may be designed using an equivalent static method in accordance with AS1170.4-2007 taking Hazard Factor, $Z=0.19$.
- Dynamic analysis in accordance with AS1170.4-2007 Section 7 using either the design response spectra specified in Table 9 modified for site soil conditions or ground motion time histories developed in accordance with Section 7 of this report.

The 6m height limit represents the greatest structural period for a building of any material not affected by the increased response spectra at a 475-year return period from this study when compared to AS1170.4-2007. Following the results of this study, buildings greater than 6m would be subject to larger earthquake loads than expressed in AS1170.4-2007.

Design of Domestic Housing

Domestic housing is a single dwelling or one or more attached dwellings complying with Class 1a or 1b as defined in the Building Code of Australia.

Design of domestic housing of height less than 8.5m high is required to be designed and detailed in accordance with the simplified design rules in AS1170.4-2007 Appendix A - Paragraph A2 taking the appropriate Hazard Factor, ($Z=0.19$ from this study) or to AS1170.4-2007 as an importance level 2 structure (refer to Section 6.2.1). Design of domestic housing of height greater than 8.5m high is required to follow AS1170.4-2007 as an importance level 2 structure (refer to Section 6.2).

Based on the results of this study we recommend that earthquake design actions for domestic housing less than 6m high follow AS1170.4-2007 for importance level 2 structures and be designed to AS1170.4-2007 with no modifications.

Design of domestic housing of height greater than 6m high should follow AS1170.4-2007 as an importance level 2 structure and may be designed using an equivalent static method taking a Hazard Factor, $Z=0.19$.

Table 9 Design Response Spectra for 475, 1475 and 2475-year Return Periods

Spectral Acceleration (g)			
Period (s)	475-year (1/500 years)	1475-year (1/1500 year)	2475-year (1/2500 years)
0	0.18	0.29	0.35
0.1	0.41	0.67	0.82
0.2	0.44	0.71	0.87
0.3	0.37	0.60	0.73
0.4	0.30	0.48	0.60
0.5	0.27	0.44	0.54
0.6	0.24	0.40	0.49
0.7	0.21	0.36	0.44
0.8	0.18	0.31	0.39
0.9	0.16	0.27	0.34
1	0.13	0.23	0.29
1.2	0.11	0.20	0.26
1.5	0.09	0.17	0.22
1.7	0.76	1.44	1.90
2	0.55	1.10	1.48
2.5	0.44	0.89	1.20
3	0.33	0.68	0.93

6.2.2 Design of Bridge Structures to AS5100.2-2004

For bridge structures earthquake design actions should be calculated in accordance with AS5100.2-2004, but the design response spectra for the appropriate return period should be used from the results of this study. Table 9 provides the spectral shape factors for three return periods.

- Dynamic analysis in accordance with AS5100.2 Clause 14.6 may be carried out using either the design response spectra specified in Table 9 modified for site soil conditions or ground motion time histories developed in accordance with Section 7 of this report.

6.2.3 Design of Earth Retaining Structures to AS4678-2004

Earthquake design actions should be calculated in accordance with AS4678-2004. Following Appendix I – Earthquake Design the acceleration coefficient (a) should

be taken as 0.19 from the results of this study. The acceleration coefficient is the equivalent to the Hazard Factor in AS1170.4-2007.

AS4678-2004 uses a site factor with the acceleration coefficient to determine static or dynamic analyses. If dynamic analyses are required these should be undertaken using the design response spectra for the appropriate return period from the results of this study. Table 9 provides the spectral shape factors for three return periods.

6.2.4 Design of Other Structures

Following AS1170.4-2007 the following structures are outside the scope of the standards discussed above:

- a) High-risk structures.
- b) Tanks containing liquids.
- c) Civil structures including dams and bunds.
- d) Offshore structures that are partly or fully immersed.
- e) Structures with first mode periods greater than 5 s.

6.3 Topographic Effects

Topography influences ground motion and, will in general, increase the amplitude of shaking at mountain tops and ridges. In practice slopes greater than 15 degrees are susceptible to topographic effects.

Structures located on or proximal to the top of the steep slopes on Christmas Island (i.e above Flying Fish Cove) would be subject to this topographic effect. Following methodology to address topographic effect in Eurocode 8 we recommend scaling the design response spectra (Table 9) by a factor of 1.2 for these structures.

Appendix E
Draft Environmental Management
Plan

DRAFT ONLY*

**Department of Regional
Australia, Regional
Development and Local
Government**

**Report for Christmas Island-
New Housing Program
Environmental Management
Plan**

April 2011

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1. Background

1.1 Introduction

In January 2011, the Department of Regional Australia, Regional Development and Local Government engaged GHD to provide Project Management and Design Consultancy Services for the New Housing Program on Christmas Island (CI). Part of the development involves the construction of new residential dwellings at Drumsite. This Environmental Management Plan deals with the impacts associated with the Drumsite location, and outlines the expected impacts of the construction of the housing development, as well as associated management strategies to reduce impacts.

1.2 Existing Flora and Fauna

The majority of this site is cleared and has previously had buildings on it. There is remnant infrastructure from this development such as hard stand car parking areas and laneways.

The vegetation dominating the cleared area is the introduced herb *Asystasia cf. chelonoides* with occasional Coffee Bush (*Leucaena leucocephala*) shrubs and subshrubs of Sensitive Plant (*Mimosa pudica*). All three species are introduced. There are mature Mango Trees (*Mangifera indica*) along the western boundary of the site.

The southeast corner of the site consists of relatively mature rainforest with a canopy height of approximately 20m. The dominant tree species is the Strangler Fig (*Ficus microcarpa* var. *microcarpa*). The canopy is mature with the epiphytic ferns *Pyrrosia lanceolata* and *Asplenium nidus* (Bird's Nest Fern) abundant. In the understorey are the large palms *Pandanus elatus* and *Arenga listeri* (Christmas Island Palm).

Although the previously cleared area of the site has only a minor northward fall in topography, the south eastern corner (that which is covered by rainforest) rises significantly to the south west with limestone outcropping and boulders present. The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses.

The south eastern corner of the site (within the rainforest) contains Red Crabs (*Gecarcoidea natalis*). Individuals were observed foraging in the site and sheltering in burrows.

The forest of the south east corner of the Drumsite Village could potentially provide some nesting habitat for the Great Frigatebird (*Fregata minor listeri*) which is protected under the EPBC Act as a migratory marine species. However, this area is outside the proposed boundary of the Drumsite development and no current nesting sites have been recorded in or adjacent to this area.

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2. Environmental Management

2.1 General

This Environmental Management Plan has been prepared by GHD to outline the environmental requirements that are most likely needed to be addressed during construction at the Drumsite. It should be confirmed by the Contractor and form the basis of the Contractors Environmental Management Plan. The Contractor shall ensure that all construction staff have been provided with an induction covering the aspects and actions of their Environmental Management Plan, prior to them commencing work on site.

A register of inductions shall be kept.

2.2 Flora and Vegetation

2.2.1 Potential Impacts

The site has already been cleared in the past, and has also been severely impacted by introduced vegetation species. As the remnant rainforest area is upslope of the project site, on rocky ground, the risks of direct and indirect impact from clearing and runoff is low. Potential impacts to flora and vegetation on and adjacent to the project site from the proposed housing development include:

- ▶ Vegetation clearing;
- ▶ Soil degradation and erosion;
- ▶ Weed introduction and invasion;
- ▶ Ground disturbance from construction of houses;
- ▶ Changes in surface water flow and quality, and runoff impacting vegetation;
- ▶ Risks of pollution from hazardous materials during construction activities; and
- ▶ Dust generation during construction.

2.2.2 Management

Proposed management actions are outlined below:

- ▶ Existing weedy vegetation shall be cleared and removed to an area where weed material will not become a risk to native vegetation, as approved by Parks Australia or the Shire;
- ▶ Weed control shall be undertaken within a 10m strip adjacent to the remaining rainforest;
- ▶ Vegetation clearing shall be limited to approved areas and should not impact upon the adjacent rainforest;
- ▶ Any trees that can be retained shall not be damaged; and
- ▶ Temporary fencing shall be placed to delineate the areas which are not to be cleared or otherwise impacted.

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2.3 Fauna

2.3.1 Potential Impacts

No significant fauna species were observed, or are likely to depend on the project area. Small numbers of Red Crabs were recorded in the area. The habitat of the site is severely degraded, with limited native vegetation available for use by birds or other native fauna. The south-east rainforest corner will not be directly impacted by the housing development, as it rises relatively steeply up from the flatter, previously developed area. There is potential for minor loss of Red Crabs due to land clearing.

Potential impacts to fauna as a result of the housing development include:

- ▶ Loss of habitat;
- ▶ Direct mortality to individual fauna;
- ▶ Changes to predator-prey interactions; and
- ▶ Impacts from noise, vibration and dust during construction.

2.3.2 Management

The following management measures will be instigated:

- ▶ Minimise clearing to those areas specifically required for the project;
- ▶ Earthworks should not be undertaken during the red crab migration season if at all possible subject to program constraints;
- ▶ If Red Crabs are found to migrate across the construction area, temporary training walls shall be established to guide them away from risk zones and into adjacent bushland areas; and
- ▶ Any native fauna deaths or injury (except for crabs) shall be reported to Parks Australia within 4 hours of occurrence.

2.4 Surface and Ground Water

2.4.1 Impacts

The project site is relatively flat, due to previous site works for buildings. The site slopes upwards in the south-western corner. Groundwater levels are unknown.

Potential impacts to surface and groundwater include:

- ▶ Runoff from the site, which has the potential to create erosion in top soil, sedimentation and loss of vegetation downslope of the site and eventual impacts such as sediment plumes to nearby marine areas;
- ▶ Impacts on groundwater as a result of chemical or hydrocarbon spills; and
- ▶ Changes to natural/existing flow regimes resulting in downstream impacts or localised flooding.

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2.4.2 Management

Management measures which can reduce the impacts of erosion and groundwater impacts are outlined below:

- ▶ The development of temporary drainage structures across the construction site, to prevent scour and erosion. This will require a suitable downstream outlet into existing drainage systems or rock armouring to prevent erosion.
- ▶ Adequate planning of drainage from the housing development, particularly during construction, in order to prevent impacts such as plumes and turbidity on the marine environment or downstream erosion. This is likely to require silt traps during the construction and early post construction phases.
- ▶ No bulk fuels and chemicals shall be stored on site.
- ▶ Chemicals or fuels for daily use shall be stored and handled as per Materials Safety Data Sheet (MSDS) requirements to minimise the risk of spillage to the environment.
- ▶ Copies of relevant MSDSs shall be kept on site at all times.
- ▶ The Contractor shall provide spill containment and clean-up equipment on site at all times.

2.5 Air Quality

2.5.1 Impacts

Impacts to air quality likely from the construction of the housing development are limited predominantly to dust. Dust impacts include:

- ▶ Death of plant species due to thick dust cover;
- ▶ Impacts on ground fauna in adjacent bushland; and
- ▶ Nuisance impacts on adjacent residents and the Bahai Temple.

2.5.2 Management

- ▶ All cleared areas and roads shall be sprayed regularly with water during construction to minimise dust lift;
- ▶ Stockpiles of spoil or construction materials shall be covered or sprayed with water as required to minimise dust lift;
- ▶ A register of complaints regarding dust shall be kept and complaints investigated within 24 hours; and
- ▶ Mitigation measures to address nuisance dust shall be provided within 48 hours.

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2.6 Noise

2.6.1 Impacts

Noise impacts are managed through the *Environmental Protection (Noise) Regulations 1997* which specifies the maximum allowable external noise levels at various sensitive noise receptors. The Regulations also state requirements for construction sites.

For noise sensitive residences, the time of day also affects the assigned levels. The Regulations define three types of assigned noise level:

- ▶ $L_{A_{10}}$ assigned noise level which is not to be exceeded for more than 10% of the time;
- ▶ L_{A_1} assigned noise level which is not to be exceeded for more than 1% of the time; and
- ▶ $L_{A_{Max}}$ assigned noise level means a noise level which is not to be exceeded at any time.

The assigned noise levels are outlined below and the construction noise generation will need to be within these limits.

Table 1 Assigned noise levels, dB(A) (source: Western Australian Consolidated Regulations)

Type of premise receiving noise	Time of day	Assigned level		
		$L_{A_{10}}$	L_{A_1}	$L_{A_{Max}}$
Noise sensitive	07:00 to 19:00 Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	09:00 to 19:00 Sunday and public holidays (Sunday)	40 + IF	50 + IF	65 + IF
	19:00 to 22:00 all days (Evenings)	40 + IF	50 + IF	55 + IF
	22:00 on any day to 07:00 Monday to Saturday and 09:00 Sunday and public holidays (Night)	35 + IF	45 + IF	55 + IF
Noise sensitive	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial and utility	All hours	65	80	90

2.6.2 Management

Noise impacts shall be managed as follows:

- ▶ Noise shall be kept within the regulated levels so as to minimise disturbance to residents and sensitive fauna species;

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- ▶ Construction hours shall be restricted to Monday to Friday 7 am to 5 pm, unless otherwise approved by the Shire of Christmas Island and the Superintendent;
- ▶ Construction equipment shall be fitted with engine mufflers and well maintained exhaust systems at all times;
- ▶ A complaints register shall be kept with complaints investigated within 4 hours and mitigation implemented as soon as possible after investigations; and
- ▶ Special consideration to minimise noise shall be made with regards to the adjacent Bahai temple with regards to any fixed times of worship or other requirements.

2.7 Waste Disposal

2.7.1 Impacts

Potential impacts to the environment due to poor waste disposal include:

- ▶ Foraging of feral and native animal species on the construction site;
- ▶ Littering of adjacent housing areas and bushland; and
- ▶ Impacts on water quality due to solubility and run off of pollutants.

2.7.2 Management

The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses. Management measures for waste disposal include:

- ▶ Removal of existing wastes and appropriate disposal;
- ▶ Soil wastes during construction will be removed from site and disposed of at a suitable landfill site;
- ▶ General construction wastes will be disposed of at the Shire landfill;
- ▶ Sewage wastes from construction toilet facilities will either be pumped out and taken to the waste water treatment plant for processing, or portable toilets will be used;
- ▶ No bulldozers or other equipment will be permitted to refuel on site;
- ▶ No fuel or other dangerous goods will be stored on site; and
- ▶ General wastes produced during construction will be contained within lidded bins and regularly disposed of at the Shire landfill.

REFERENCES

Western Australian Consolidated Regulations Website, Environmental Protection (Noise) Regulations 1997- Reg 8, accessed 15 Feb 2011
http://www.austlii.edu.au/au/legis/wa/consol_reg/epr1997461/s8.html

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DRAFT ONLY*

GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

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Rev No.	Author	Reviewer		Approved for Issue		
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GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permal@ghd.com.au

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0	K Muir / I Hooke	R Kipperman		P Seman		
1	K Muir	C Owen		P Seman		
2	C Owen	P Seman	<i>P.A. Sem</i>	P Seman	<i>P.A. Sem</i>	<i>6/5/11</i>

PRELIMINARY SITE INVESTIGATION AND ASBESTOS ASSESSMENT



CLIENTS | PEOPLE | PERFORMANCE

**Department of Regional Australia, Regional
Development and Local Government**

Report for Christmas Island New
Housing Project - Project 1
Preliminary Site Investigation and Asbestos
Assessment

October 2011



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Executive Summary

Department of Regional Australia, Regional Development and Local Government commissioned GHD Pty Ltd (GHD) to undertake a Preliminary Site Investigation (PSI) with an asbestos assessment at Drumsite, 2A Tong Yan Loh, Christmas Island (hereafter referred to as 'the Site'). It is understood that the Site previously contained residential housing known to contain asbestos, and that the site has been previously associated with the presence of asbestos cement fragments in soil. Part of this investigation is to determine the presence, and if possible the likely extent, of asbestos impact to site soil and fill.

The objective of this PSI was to investigate the land use history of the Site in order to identify known or existing current and past practices that could have led to contamination, and to undertake a limited soil assessment for asbestos. This PSI has been undertaken with reference to the Department of Environment and Conservation (DEC) Contaminated Sites Management Series Guidelines.

Based upon the preliminary site investigation, the following conclusions are presented:

Desktop Study

- ▶ The sites topography slopes from the southern boundary down to the northern boundary. The site ranges from +194 m Christmas Island Height Datum (CIHD) to +203m CIHD (GHD, 2011).
- ▶ Previous investigations (GHD, 2011) reveal that the general geology of the site consisted of the following:
 - Fill consisting of sandy silt clay with brick and limestone gravel varying from depths of 0.1 - 0.75 m.
 - Orange brown silty clayey and/or clayey silt containing limestone gravel, cobbles and boulders from 0.4 m – 2.2 m below ground level.
 - Limestone rock forming pinnacles extending from surface to beyond the depths of excavation.
- ▶ The exact extent of the underground aquifer that sits on top of the basalt layer is currently unknown. Higher permeability of the limestone on the margin of the island results in the water table being just above sea level.
- ▶ No published ASS risk mapping was available from the DEC at the time of this study for use with respect to assessment of the Site. However due to the predicted depth to water and geology encountering ASS is predicted to be unlikely during redevelopment.
- ▶ The information contained within the DEC contaminated sites database does not extend to the Christmas Island area and therefore information was unobtainable. Up gradient land uses have the potential for affecting the condition of the groundwater beneath the site. However due to the site being elevated to a minimum of 194 m CHID and groundwater is likely to exist close to sea level, it is considered unlikely that any impacted groundwater is impacting the Site.
- ▶ From the information contained within the title deeds it would appear that the Site was historically and currently reserved as Crown Land and has not had any historical changes to land owner.
- ▶ A search of the DMP records produced no record of any dangerous goods licences or licence applications being made for the Site. However, this does not preclude the undocumented historical storage of dangerous goods on the Site.



- ▶ Discussions with Kevin Walton, Buildings and Works Supervisor reveal that the top 10 cm of soil had previously been removed from the unsealed area of the site on the completion of the demolition of the previously existing buildings. This was reportedly undertaken to remediate the site of asbestos contamination, however, no further details of the works or confirmatory validation works was made available.
- ▶ Review of the historical aerial photographs reveals that the Site has been used for residential housing since 1987 until recent demolition activities in 2008/09

Site Walkover

- ▶ During the Site walkover asbestos containing fragments were observed on the surface of the area that previously contained housing.
- ▶ No other areas of environmental concern were noted during the site walkover, however fill was recorded to approximately 0.75 m BGL during the soil sampling.

Asbestos Soil Sampling

An asbestos soil sampling exercise was undertaken to obtain more information on the nature and extent of the asbestos hazard at the site. This included a total of sixteen test pits excavated at the site to a maximum depth of 2 m BGL. Selected soil samples were field sieved in accordance with DoH Guidelines.

Based upon the assessment findings the asbestos hazard is in the form of ACM fragments present at the soil surface and identified to a maximum depth of 0.5 m BGL. A summary of the asbestos hazards with respect to the DoH 0.01% w/w guideline for residential usage is as follows:

- ▶ 6 locations (5 at surface; 1 at 0.5 m, BGL) reported concentrations of asbestos exceeding criteria. The asbestos recorded at depth (TP09_0.5) is an isolated occurrence and likely to be from fall back of surface material.
- ▶ 2 locations (at surface) reported concentrations below asbestos criteria
- ▶ 8 locations recorded no asbestos detected.

Based upon the preliminary site investigation, the following recommendations are presented;

Prior to site redevelopment the remediation of asbestos exceeding DoH criteria should be undertaken. Remediation may be in the form of:

- ▶ Treatment of the ACM on-site via a detailed rake of the top 10 cm of site soils (or as required) per the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, May 2009 and the collection and off-site disposal of collected ACM; or
- ▶ Bulk removal of the top 10 cm of soil (or as required) and disposal off-site as asbestos contaminated waste.

Where the detailed rake option is selected, care must be taken to first remove all surface obstructions as it is noted significant vegetation is present that may limit soil access. Conduct of the raking needs to be performed strictly in accordance with the guidance with the top 10 cm of soil made completely free of visible asbestos, otherwise there is potential for ACM to re-appear at the surface over time, or be intercepted during intrusive works such as construction or maintenance activities.



Irrespective of the selected remediation option, the works are to be undertaken in accordance with legislative requirements, the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, DoH, May 2009, and the *Asbestos Code of Practice 2005*, NHMRC. Validation of the completed remediation works must be undertaken by a competent person.

Management measures are required to address potential health risks associated with the presence of localised occurrences of asbestos fragments at surface soils of the Site. It is considered that potential health risks associated with ACM can be managed by:

- ▶ Development and implementation of a Site Management Plan to address potential occurrences of ACM, including;
 - Immediate response actions and contingency plans should asbestos be encountered during redevelopment works
 - Removal of surface ACM during excavation activity (remediation).
 - Adoption of relevant protection and monitoring measures for excavation activities

Whilst information to date suggests ASS is not likely to exist at the site we cannot rule this out due in part to the potential for the proposed development to require significant excavations. Due to the broad potential for ASS, and lack of information available regarding the presence of specific ASS at the site further investigations should be undertaken if any of the following are proposed:

- ▶ Excavation at or below the natural water table; or
- ▶ Lowering of the water table, whether temporary or permanent (e.g. for groundwater abstraction, dewatering, installation of new drainage, modification to existing drainage).



1. Introduction

Department of Regional Australia, Regional Development and Local Government commissioned GHD Pty Ltd (GHD) to undertake a Preliminary Site Investigation (PSI) with an asbestos assessment at Drumsite, 2A Tong Yan Loh, Christmas Island (hereafter referred to as 'the Site'). The Site location is shown in Figure 1. It is understood that the Site previously contained residential housing known to contain asbestos, and that the site has been previously associated with the presence of asbestos cement fragments in soil. Part of this investigation is to determine the presence, and if possible the likely extent, of asbestos impact to site soil and fill.

1.1 Objectives

The objective of this PSI was to investigate the land use history of the Site in order to identify known or existing current and past practices that could have led to contamination, and to undertake a limited soil assessment for asbestos.

This PSI has been undertaken with reference to the Department of Environment and Conservation (DEC) Contaminated Sites Management Series Guidelines.



2. Scope of Work

2.1 Desktop Study

- ▶ Review of any existing investigation reports and any other data made available;
- ▶ Review historical title deeds to determine past owners of the Site and the likely associated Site uses;
- ▶ Review historic aerials photographs, on a ten-year basis, showing the Site and its development over time;
- ▶ Review the results of a Dangerous Goods Licence search under the Freedom of Information (FOI) act to ascertain whether dangerous goods were likely to have been used or stored onsite;
- ▶ Review local and regional geology and hydrology, to determine the likely soil type and groundwater regime at the Site;
- ▶ Review a Department of Water bore search information to ascertain the use and available quality information of groundwater in the vicinity of the Site;
- ▶ Review local topography and surface waters to identify potential contaminant receptors; and
- ▶ Review the DEC *Contaminated Sites Database* to ascertain whether the Site or any surrounding properties have been identified as potentially contaminated sites.

2.2 Site Inspection

A GHD Environmental Scientist visited the Site on 5th and 6th of April 2011. Photographs of the Site were taken and are documented in this report (Appendix D).

GHD undertook discussions with employees to record their knowledge of the Site and historical operations and the potential for contamination to have occurred.

2.3 Asbestos Soil Sampling Programme

During the site visit, soil sampling was conducted for asbestos only in accordance with the DoH *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. Soil sampling was undertaken using a mini excavator with samples collected at sixteen test pits with depths varying from 0.5 metres to 2.0 metres to assess the soils for any potential asbestos contamination.

Soil samples were submitted to laboratories accredited by the National Association of Testing Authorities (NATA) for the required analysis.

2.4 Reporting

This Preliminary Site and Soil Investigation Report has been prepared with reference to the DEC guidelines and indicates areas, that may be contaminated, requiring further investigation or remediation under the current *Contaminated Sites Act 2003* and DEC guidelines.

Where other parties have supplied information or data, the data is included and used in the form provided by the parties. The responsibility for the accuracy of such data remains with the issuing authority not with GHD.



3. Site Characterisation

3.1 Legal Identification

The legal description of the Site is reported in Table 1. Copies of the Certificates of Title are presented in Appendix A.

Table 1 Legal Identification

Street Address:	2-2A Tong Yan Loh, Christmas Island
Legal Description:	Lot 645 on deposited plan 40603
Certificates of Title:	Volume: LR3134 Folio: 201
Local Government Authority:	Shire of Christmas Island
Ownership:	Commonwealth of Australia
Current Land Use:	Vacant

3.2 Site Description

The site comprises a total of 8,530 m² situated to the south east of the junction of Lam Lok Loh and Sung Miaw Loh, Drumsite. There is a small temple and shed adjacent to Sung Miaw Loh in the south west corner of the site, the remainder of the site is currently vacant but has had residential dwellings on it previously with the presence of two concrete walkways running through the centre of the site. The site is tiered sloping largely to the north west and has been cleared of most vegetation however recent growth of vines and scrubs form a dense cover, with a small number of mature trees remaining on the site. To the south of the site is a retaining wall above which cyclone fencing is present, beyond this a sealed car park area is present to the southern border.

3.3 Surrounding Land Use

The surrounding land uses are summarised below:

- North:** Along the north boundary is a sealed road, which services the mine, a small convenience store and the pub. Also situated along the service road are three single storey houses which appear to be made of asbestos containing material. Beyond the service road is a grassed area which is bordered by Lam Lok Loh.
- South:** To the south of the site is a small number of houses adjacent and beyond a cliff face is present covered by dense vegetation.
- East:** Situated on the eastern border is steep cliff face which is covered by dense vegetation largely inaccessible by foot.
- West:** The sealed Sung Miaw Loh road borders the site to the west, across which is a community centre and residential housing which are serviced by sealed roads are present. Situated approximately 800 metres west is the Christmas Island District High School.



3.4 Climate

The area has a Tropical climate with wet summers and dry humid winters. The closest meteorological monitoring station is Christmas Island Aero. The recorded climate data from this source is summarised in Table 2.

Table 2 Climate information from Christmas Island Aero

Station	Mean Annual Minimum Temperature Range	Mean Annual Maximum Temperature Range	Mean Annual Rainfall	Mean Annual Rain Days
Christmas Island Aero	22.2°C (August) to 23.8°C (May)	26°C (August) to 28.2°C (March)	2122.4 mm	129.4

(Source: Bureau of Meteorology Climatic Averages of Australian Sites, 2011)

3.5 Topography

The Island is the summit of a submarine mountain. It rises steeply to a central plateau which reaches heights of up to 361 metres and consists mainly of limestone with layers of volcanic rock. The Island's 80 kilometre coastline is an almost continuous sea cliff, ranging in height to 20 metres. In a few places (about 13) breaks in the cliff give way to shallow bays and small sand and coral beaches. There is virtually no coastal shelf and the sea plummets to a depth of about 5000 metres within 200 metres of the shore (Porritt & Bryan, 2003).

The sites topography slopes from the southern boundary down to the northern boundary. The site ranges from +194 m Christmas Island Height Datum (CIHD) to +203m CIHD (GHD, 2011).

3.6 Geology

Christmas Island forms the exposed summit of an isolated volcanic seamount that rises some 4.5 km from the seafloor near the edge of the Java Trench, which marks the margin of the Australian Continental Plate. The core of the island consists mainly of basaltic volcanic of Late Cretaceous age overlain by a sequence of limestone's, interbedded volcanic and phosphate rich deposits, that range from Eocene to Recent in age. The coastline is mostly comprised of steep cliffs and rises to a central plateau via a series of gently to steeply sloping escarpments with intervening flat areas commonly referred to as the "terraces" (Barrie, 1967).

The carbonate rock types comprise Eocene to recent limestone's ranging in thickness from tens of metres above the central plateau to in excess of 250 m along the edge of the island. The limestone ranges in composition from massive skeletal fossil coral to shallow marine calcarenites and calcirudites. The limestone has been variably affected by post-depositional processes, including the formation of solution features and recrystallization.

Limestone outcrops in the area around the caves on the Shore Terrace consist typically of a dark grey rock with rough weathered surfaces ("karren") and the formation of steep pinnacles with numerous open fissures and channels in the rock surface. The high to very high strength limestone pinnacles, with clayey phosphatic soils and limestone fragments in the area between pinnacles, are typical of Christmas Island. The limestone's are variable but can consist of cemented fragments of corals, shells, sands, gravel and



other coastal detritus. Recrystallisation has taken place in zones within the limestone, to form a variable, very high strength rock in places.

A residual soil cover, derived from weathering of limestone, occurs in places particularly in depressions or low-lying areas. The soil is generally a dark red to brown, sandy or clayey phosphatic material.

Previous investigations (GHD, 2011) reveal that the general geology of the site consisted of the following:

- ▶ Fill consisting of sandy silt clay with brick and limestone gravel varying from depths of 0.1 - 0.75 m.
- ▶ Orange brown silty clayey and/or clayey silt containing limestone gravel, cobbles and boulders from 0.4 m – 2.2 m below ground level.
- ▶ Limestone rock forming pinnacles extending from surface to beyond the depths of excavation.

3.7 Hydrology and Hydrogeology

3.7.1 Groundwater

The exact locations the water flows to the ocean, or pools on the basalt layer are currently unknown as there is no exact knowledge of the profile of the basalt layer. The exact extent of the underground aquifer that sits on top of the basalt layer is also currently unknown. Higher permeability of the limestone on the margin of the island results in the water table being just above sea level (Butcher, 2010).

Currently the WA Department of Water (DoW) is not regulating the installation of bores or the abstraction of groundwater on Christmas Island (GHD, 2009) and therefore no knowledge of bores existing in the vicinity of the site are known.

3.7.2 Surface Water

Most rain falling on the island percolates through the porous soil and limestone, and surface runoff only occurs after heavy rain. Groundwater tends to accumulate at the base of the interface of limestone and underlying volcanic rock, and then flows along the interface or down fractures in the volcanic rock. The flows along the interface emerge in some places as springs and streams or swampy areas. At the edges of the island the water table drops to just above sea level due to the presence of highly permeable limestone.

Situated to the western area of the island is The Dales a system of wetlands which contains most of the surface water present on Christmas Island. The Dales include perennial streams and a significant proportion of permanent springs found on the Island. Springs occur at points on three of the Dales, resulting in perennial streams. The other Dales only flow during periods of heavy rain or shortly after a downpour, so are more likely to be present during the wet season (December to April). These streams remain at the surface where they flow over the less porous basalt and generally go underground where limestone is present.

3.8 Acid Sulfate Soils

The DEC (2006) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominately pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign and not acidic.



However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid. The resulting sulphuric acid can also break heavy metal bonds, releasing metals such as aluminium, iron, and arsenic into the groundwater. Flushing of acidic leachate to groundwater and surface waters can cause offsite impacts including:

- ▶ Ecological damage to aquatic and riparian ecosystems;
- ▶ Effects on estuarine fisheries and aquaculture projects;
- ▶ Reduction in agricultural productivity through:
 - Contamination of groundwater with arsenic, aluminium and heavy metals;
 - Metal contamination of soils; and
 - Damage to infrastructure through the corrosion of concrete and steel pipes, bridges and other sub-surface assets.

No published ASS risk mapping was available from the DEC at the time of this study for use with respect to assessment of the Site. However, due to the water table likely to be situated just above sea level and the geology consisting of limestone at depth the risk of encountering acid sulphate soils are predicted to be unlikely.

3.9 DEC Contaminated Sites Database

The DEC Contaminated Sites Database presents information on known or suspected contaminated sites that have been classified by the DEC as one of the following categories:

- ▶ Contaminated - remediation required;
- ▶ Contaminated – restricted use; or
- ▶ Remediated for restricted use.

The information contained within the DEC contaminated sites database does not extend to the Christmas Island area and therefore information was unobtainable.

Up gradient land uses have the potential for affecting the condition of the groundwater beneath the site. However due to the site being elevated to a minimum of 194 m CHID and groundwater is likely to exist close to sea level, it is considered unlikely that any impacted groundwater is impacting groundwater beneath the Site.

3.10 Sensitive Receptors

Potential sensitive receptor of any contamination impacting the Site is groundwater beneath the site which can migrate and be intercepted by local bores.

Potentially contaminated soil or groundwater (if present) can pose human health risks through inhalation, ingestion and/or dermal contact. The nearest human receptors to any potential contamination on the Site currently comprise the general public accessing the Site and surrounding residents (bore users). Future receptors (industrial development) would comprise site residents, surrounding residents (bore users), visitors and workers (construction/maintenance). Potential risks to sensitive receptors (if any) are considered further in the Conceptual Site Model.



4. Site History

4.1 Certificates of Title

GHD has reviewed Certificate of Title deeds supplied by the Department of Land Information that document changes in land ownership. Details of the Site ownership history are summarised in Table 3 below and the title deeds are presented in Appendix A.

Table 3 Summary of Lot Ownership

Volume-Folio	Year of Transfer	Registered Proprietor	Responsible Authority
LR3105-346	22/09/2004	Commonwealth of Australia	Commonwealth of Australia
LR3134-201	Current	Commonwealth of Australia	Department of Regional Australia, Regional Development and Local Government

From the information contained within the title deeds it would appear that the Site was historically and currently reserved as Crown Land and has not had any historical changes to the land owner.

4.2 Aerial Photography

A review of historical aerial photographs was undertaken to assist in determining patterns in Site development over time. A summary description of aerial photography is provided below. Aerial photographs are presented in Appendix B. Landgate were unable to provide any aerial photography over the site. The only historical aerial photography that was available to review was obtained through the Australian Government Geoscience Australia Website.

4.2.1 August 1987

The majority of the site is covered by what appears to be residential houses, which are serviced by sealed roads directly to the north and west of the site boundary. Situated in the centre, south and south east corner of the site are cleared areas with several trees present. Beyond the site boundaries to the south dense vegetation is present.

Housing extends to the east of the site beyond which several large industrial buildings and associated infrastructure are present. North of the site across the sealed road system dense vegetation is present beyond which what appears to be residential housing present along the foreshore.

Residential housing extends to the west of the site with tree lined sealed and unsealed roads servicing the area. Situated to the south west of the site is a water tank.

4.3 Dangerous Goods

A request search was lodged with the DMP under the *Freedom of Information Act* (1992) on 05 May 2011, to determine whether any potentially hazardous materials have been licensed for use at or storage at the Site.



A search of the DMP records produced no record of any dangerous goods licences or licence applications being made for the Site. However, this does not preclude the historical storage of dangerous goods on the Site.

A copy of the correspondence received to date from the DMP is presented in Appendix C.

4.4 Other Information

Discussions with Kevin Walton, Buildings and Works Supervisor reveal that the top 10 cm of soil had previously been removed from the unsealed area of the site on the completion of the demolition of the previously existing buildings in approximately 2008/09. This was reportedly undertaken to remediate the site of asbestos contamination, however, no further details of the works or confirmatory validation works was made available

4.5 Summary of Site History

- ▶ From the information contained within the title deeds it would appear that the Site was historically and currently reserved as Crown Land and has not had any historical changes to the land use.
- ▶ Review of the historical aerial photographs reveals that the Site has been used for residential housing since 1987.
- ▶ A search of the DMP records produced no record of any dangerous goods licences or licence applications being made for the Site. However, this does not preclude the undocumented historical storage of dangerous goods on the Site.
- ▶ Anecdotal information revealed soil had previously been removed from site after demolition of buildings in approximately 2008/09, however no confirmatory validation works was made available.



5. Site Inspection

On the 6th of April 2011, a site inspection was undertaken by a GHD Occupational Hygienist and Environmental Scientist to observe current operations and understand historical operations at the Site that may have resulted in potential contamination of soil and groundwater at the Site. Photographs of the Site are presented in Appendix D.

The site is largely vacant with the exception of a small temple building situated on the south-western boundary of the site which is comprised of brick walls, fibre cement (non-asbestos) and tin roof. The site appears to be sloping toward the northern boundary and tiered with the southern portion elevated (Plate A); tiered concrete footpaths are present along the boundary of the previously existing residential buildings (Plate B). The site is largely covered by dense overgrowth with a small amount of mature trees present across the site (Plate C).

Along the southern boundary of the site a large retaining wall is present with cyclone fencing (Plate D), above which a sealed parking area was noted (Plate E). There was an elevated area along the eastern boundary of the site which was largely overgrown and inaccessible (Plate F).

Asbestos Debris

Asbestos fragments were observed across the majority of the site (Plate G), some areas where accessible due to the dense overgrowth and no ACM was recorded in the sealed car park area to the south and east borders of the site.

No other areas of environmental concern were noted during the site walkover, however fill was noted during the soil sampling to a depth of 0.75 m BGL.



6. Site Summary

- ▶ The sites topography slopes from the southern boundary down to the northern boundary. The site ranges from +194 m Christmas Island Height Datum (CIHD) to +203m CIHD (GHD, 2011).
- ▶ Previous investigations (GHD, 2011) reveal that the general geology of the site consisted of the following:
 - Fill consisting of sandy silt clay with brick and limestone gravel varying from depths of 0.1 - 0.75 m.
 - Orange brown silty clayey and/or clayey silt containing limestone gravel, cobbles and boulders from 0.4 m – 2.2 m below ground level.
 - Limestone rock forming pinnacles extending from surface to beyond the depths of excavation.
- ▶ The exact extent of the underground aquifer that sits on top of the basalt layer is currently unknown. Higher permeability of the limestone on the margin of the island results in the water table being just above sea level.
- ▶ No published ASS risk mapping was available from the DEC at the time of this study for use with respect to assessment of the Site. However due to depth to water and geology encountering ASS is predicted to be unlikely during redevelopment of the site.
- ▶ The information contained within the DEC contaminated sites database does not extend to the Christmas Island area and therefore information was unobtainable. Up gradient land uses have the potential for affecting the condition of the groundwater beneath the site. However due to the site being elevated to a minimum of 194 m CIHD and groundwater is likely to exist close to sea level, it is considered unlikely that any impacted groundwater is impacting groundwater beneath the Site,
- ▶ Potential sensitive receptor of any contamination impacting the Site is groundwater beneath the site. Groundwater beneath the site can migrate and be intercepted by local bores.
- ▶ From the information contained within the title deeds it would appear that the Site was historically and currently reserved as Crown Land and has not had any historical changes to the land owner.
- ▶ Review of the historical aerial photographs reveals that the Site has been used for residential housing since 1987.
- ▶ A search of the DMP records produced no record of any dangerous goods licences or licence applications being made for the Site. However, this does not preclude the undocumented historical storage of dangerous goods on the Site.
- ▶ Anecdotal information revealed soil had previously been removed from site after demolition of buildings in approximately 2008/09, however no confirmatory validation works was made available.
- ▶ During the Site walkover asbestos containing fragments were recorded on the surface of the areas that previously contained housing.



7. Conceptual Site Model

A Summary of the historical issues and current operations that may cause contaminants of concern and contaminant pathways based on the current status of the Site is provided in Table 4.

Item	Contamination Issue	Chemicals of Concern	Pathway	Likelihood
1	Observed suspected asbestos containing materials on surface	Asbestos	Several isolated areas of suspected asbestos fragments	Potential relocation if used as fill during construction. Some asbestos fragments present possible localised contamination issues. Inhalation of liberated fibres may be harmful.
2	Potential imported fill material	Asbestos, Metals, Organochlorine Pesticide (OCP), Organophosphate pesticides, Carbamates, Total petroleum hydrocarbons (TPH), Monocyclic aromatic hydrocarbons	Potential for historical filling of the Site as tiering of ground was present.	Potential impact to move horizontally through preferential pathways (e.g. stormwater runoff). Potential impacts in soils can migrate vertically to groundwater



8. Asbestos Soil Sampling

8.1 Service Location

GHD representatives met with personnel from the Water Corporation and Christmas Island Power Authorisation to locate services present at the site prior to the commencement of test pit excavations.

Services identified included the main sewer and the electrical service line. Sampling test pits were marked out for excavation avoiding these areas. A small portion of the north-east area was inaccessible due to underlying stone foundations and dense undergrowth.

8.2 Methodology

During the PSI sixteen test pits were excavated to depths varying from 0.5 metres to 2.0 metres depending on backhoe refusal (e.g. rock too hard to penetrate) or the lack of asbestos fragments in the sieved samples. Samples were collected and sieved in accordance with *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, May 2009, DoH.

A 10L soil sample was collected at each test pit location from the surface, and then the various excavation depths up to 2 m or refusal. Each 10L soil sample was screened manually on-site through a 6.25 x 6.25 mm sieve. Materials greater than 6.25 mm were inspected and any suspect material was collected, individually labelled and weighed. Additional soil samples were collected for selected locations where suspect asbestos containing material was collected and also laboratory tested for asbestos fibres.

A total of 33 primary soil samples, 2 ACM (bulk) fragments, 3 QA samples and 1 field blank were collected for the presence of asbestos fragments or asbestos fibres in soil. Soil logs are presented in Appendix E and laboratory reports are presented in Appendix F.

8.3 Asbestos Guidelines

The Department of Health (DoH) guidelines state the following with respect to Contamination Criteria:

The DoH takes a risk-based and where necessary, conservative approach to the uncertainties associated with protecting the public from asbestos-contaminated sites. As a result, the Guidelines employ the following four general contamination criteria:

- ▶ The investigation criterion or clean-up goal used by DoH is 0.001% asbestos in soil on a weight for weight basis (w/w) for free fibre-related materials including fibrous asbestos and free fibre itself;
- ▶ For remediation purposes, the top 10 cm of soil should also be made free of visible asbestos or ACM;
- ▶ Based on the above, soil asbestos investigation criteria presented in the DoH are as follows:
 - ▶ 0.001 % w/w asbestos for Fibrous Asbestos and AF – All site uses
 - ▶ 0.01 % w/w asbestos for ACM – Residential use, day care centres, preschools etc.,
 - ▶ 0.04% w/w asbestos for ACM – Residential, minimal soil access
 - ▶ 0.02% w/w asbestos for ACM – Parks, public open spaces, playing fields, etc.
 - ▶ 0.05% w/w asbestos for ACM – Commercial/Industrial



The FIBROUS ASBESTOS and ASBESTOS FINE criteria of 0.001% w/w remain fixed for all site uses because the means to determine concentration differences at this level of detection is difficult.



9. Asbestos in Soil Results

9.1 Determination of Asbestos in Soil Concentration Attributable to ACM

Asbestos concentrations in the soil were determined using the calculation outlined in the Department of Health (DoH) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, whereby:

$$\% \text{ Soil Asbestos} = \frac{\% \text{ Asbestos Content} \times \text{ACM (kg)}}{\text{Soil Volume (L)} \times \text{Soil Density (kg/L)}}$$

Where it is assumed that % asbestos content equals 15% and soil density is 1.65 kg/L based on Perth sandy soils

9.1.1 Results – Test pit sieving program

Twenty eight (28) 10 L soil samples were sieved for the presence of asbestos material, a soil sample from the surface of each sampling location was analysed for the presence of asbestos the remaining samples were put on hold at the laboratory for further analysis if required. Six visually identified ACM fragments from the sieving exercise were detected with weighed and labelled. All fragments were in the form of bonded non friable pieces and were present at the surface or near surface. Results from the investigation are summarised in the table below with laboratory reports provided in Appendix F.

Table 4 Asbestos Results

Location_Depth	Laboratory Result	Field Weight / w/w%
TP01_0.0	Asbestos not detected	Asbestos not detected
TP02_0.0	Asbestos not detected	17 g / 0.01545
TP03_0.0	Asbestos not detected	Asbestos not detected
TP04_0.0	w/w % = 0.004%	Asbestos not detected
TP05_0.0	Asbestos not detected	Asbestos not detected
TP06_0.0	Asbestos not detected	Asbestos not detected
TP07_0.0	Asbestos not detected	10 g / 0.00909
TP08_0.0	Asbestos not detected	Asbestos not detected
TP09_0.0	Asbestos not detected	17 g / 0.01545
TP09_0.5	Asbestos not detected	12 g / 0.01091
TP10_0.0	Asbestos not detected	Asbestos not detected
TP11_0.0	Asbestos not detected	Asbestos not detected
TP12_0.0	Asbestos not detected	57 g / 0.05182
TP13_0.0	w/w % = 0.005%	15 g / 0.01364



Location_Depth	Laboratory Result	Field Weight / w/w%
TP14_0.0	w/w % = 0.013%	Asbestos not detected
TP15_0.0	Asbestos not detected	Asbestos not detected
TP16_0.0	Asbestos not detected	Asbestos not detected

For the detections in soil ("Laboratory Result") these were in the form of small fragments less than 6.25 mm x 6.25 mm or fibres.

9.2 Summary

Eight surface and near surface locations recorded the presence of ACM either detected in the field or through laboratory analysis, six of these locations exceeded the most sensitive DOH guidance levels for residential use, day care centres, preschools etc. (0.01% w/w) and one location exceeded the guideline for commercial/industrial (TP12_0.0). The asbestos recorded at depth (TP09_0.5) is an isolated occurrence and likely to be from fall back of surface material. No fibrous asbestos or asbestos fines were recorded.



10. Conclusions

Based upon the preliminary site investigation, the following conclusions are presented:

Desktop Study

- ▶ The sites topography slopes from the southern boundary down to the northern boundary. The site ranges from +194 m Christmas Island Height Datum (CIHD) to +203m CIHD (GHD, 2011).
- ▶ Previous investigations (GHD, 2011) reveal that the general geology of the site consisted of the following:
 - Fill consisting of sandy silt clay with brick and limestone gravel varying from depths of 0.1 - 0.75 m.
 - Orange brown silty clayey and/or clayey silt containing limestone gravel, cobbles and boulders from 0.4 m – 2.2 m below ground level.
 - Limestone rock forming pinnacles extending from surface to beyond the depths of excavation.
- ▶ The exact extent of the underground aquifer that sits on top of the basalt layer is currently unknown. Higher permeability of the limestone on the margin of the island results in the water table being just above sea level.
- ▶ No published ASS risk mapping was available from the DEC at the time of this study for use with respect to assessment of the Site. However due to the depth to water and geology encountering ASS is predicted to be unlikely during redevelopment.
- ▶ The information contained within the DEC contaminated sites database does not extend to the Christmas Island area and therefore information was unobtainable. Up gradient land uses have the potential for affecting the condition of the groundwater beneath the site. However due to the site being elevated to a minimum of 194 m CHID and groundwater is likely to exist close to sea level, it is considered unlikely that any impacted groundwater is impacting the Site.
- ▶ From the information contained within the title deeds it would appear that the Site was historically and currently reserved as Crown Land and has not had any historical changes to land owner.
- ▶ A search of the DMP records produced no record of any dangerous goods licences or licence applications being made for the Site. However, this does not preclude the undocumented historical storage of dangerous goods on the Site.
- ▶ Discussions with Kevin Walton, Buildings and Works Supervisor reveal that the top 10 cm of soil had previously been removed from the unsealed area of the site on the completion of the demolition of the previously existing buildings. This was reportedly undertaken to remediate the site of asbestos contamination, however, no further details of the works or confirmatory validation works was made available.
- ▶ Review of the historical aerial photographs reveals that the Site has been used for residential housing since 1987 until recent demolition activities in 2008/09

Site Walkover

- ▶ During the Site walkover asbestos containing fragments were observed on the surface of the area that previously contained housing.



- ▶ No other areas of environmental concern were noted during the site walkover, however fill was recorded to approximately 0.75 m BGL during the soil sampling.

Asbestos Soil Sampling

An asbestos soil sampling exercise was undertaken to obtain more information on the nature and extent of the asbestos hazard at the site. This included a total of sixteen test pits excavated at the site to a maximum depth of 2 m BGL. Selected soil samples were field sieved in accordance with DoH Guidelines.

Based upon the assessment findings the asbestos hazard is in the form of ACM fragments present at the soil surface and identified to a maximum depth of 0.5 m BGL. A summary of the asbestos hazards with respect to the DoH 0.01% w/w guideline for residential usage is as follows:

- ▶ 6 locations (5 at surface; 1 at 0.5 m, BGL) reported concentrations of asbestos exceeding criteria. The asbestos recorded at depth (TP09_0.5) is an isolated occurrence and likely to be from fall back of surface material.
- ▶ 2 locations (at surface) reported concentrations below asbestos criteria
- ▶ 8 locations recorded no asbestos detected.



11. Recommendations

Prior to site redevelopment the remediation of asbestos exceeding DoH criteria should be undertaken. Remediation may be in the form of:

- ▶ Treatment of the ACM on-site via a detailed rake of the top 10 cm of site soils (or as required) per the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, May 2009 and the collection and off-site disposal of collected ACM; or
- ▶ Bulk removal of the top 10 cm of soil (or as required) and disposal off-site as asbestos contaminated waste.

Where the detailed rake option is selected, care must be taken to first remove all surface obstructions as it is noted significant vegetation is present that may limit soil access. Conduct of the raking needs to be performed strictly in accordance with the guidance with the top 10 cm of soil made completely free of visible asbestos, otherwise there is potential for ACM to re-appear at the surface over time, or be intercepted during intrusive works such as construction or maintenance activities.

Irrespective of the selected remediation option, the works are to be undertaken in accordance with legislative requirements, the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, DoH, May 2009, and the *Asbestos Code of Practice 2005*, NHMRC. Validation of the completed remediation works must be undertaken by a competent person.

Management measures are required to address potential health risks associated with the presence of localised occurrences of asbestos fragments at surface soils of the Site. It is considered that potential health risks associated with ACM can be managed by:

- ▶ Development and implementation of a Site Management Plan to address potential occurrences of ACM, including;
 - Immediate response actions and contingency plans should asbestos be encountered during redevelopment works
 - Removal of surface ACM during excavation activity (remediation).
 - Adoption of relevant protection and monitoring measures for excavation activities

Whilst information to date suggests ASS is not likely to exist at the site we cannot rule this out due in part to the potential for the proposed development to require significant excavations. Due to the broad potential for ASS, and lack of information available regarding the presence of specific ASS at the site further investigations should be undertaken if any of the following are proposed:

- ▶ Excavation at or below the natural water table; or
- ▶ Lowering of the water table, whether temporary or permanent (e.g. for groundwater abstraction, dewatering, installation of new drainage, modification to existing drainage).



12. References

Barrie J (1967). The Geology of Christmas Island. Bureau of Mineral Resources Geology and Geophysics, Record 1967/37.

GHD (2011) Christmas Island New Housing Project – Project 1, Preliminary Report on Geotechnical Investigation. GHD.

GHD (2010) Report for Christmas Island Light Industrial Area. GHD

GHD (2009) Report for Crown Land Management Plan Approvals Process – Case Study. GHD

Porritt K & Bryan J (2003) Christmas Island Geographic Information System, System Documentation. Department of Transport and Regional Services.

Butcher R (2010) Information Sheet on Ramsar Wetlands (RIS) – 2009-2012. Australian Government Department of Sustainability, Environment, Water, Population and Communities



13. Limitations

This Preliminary Site Investigation ("Report") of the land outlined in Figure 1 (the "Site"):

1. has been prepared by GHD Pty Ltd ("GHD") for the Department of Regional Australia, Regional Development and Local Government (DRA);
2. may only be used and relied on by the DRA;
3. must not be copied to, used by, or relied on by any person other than the DRA without the prior written consent of GHD and subject always to the next paragraph;
4. may only be used for the purpose of this commission (and must not be used for any other purpose).

If the DRA wishes to provide this Report to a third party recipient to use and rely upon, then GHD's prior written consent will be required. Before this Report is released to the third party recipient, the third party recipient will be required to execute a GHD prepared deed poll under which the recipient agrees:

- to acknowledge that the basis on which this Report may be relied upon is consistent with the principles in this section of the Report; and
- to the maximum extent permitted by law, GHD shall not have, and the recipient forever releases GHD from, any liability to the recipient for loss or damage howsoever in connection with, arising from or in respect of this Report whether such liability arises in contract, tort (including negligence).

The services undertaken by GHD in connection with preparing this Report:

- were limited to those specifically detailed in Section 2 of this Report;

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report ("Assumptions"), including (but not limited to):

- source-pathway-receptor linkages are as per conceptual site model in Section 7 of this Report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 12 months following issue of this Report, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations."

GHD has prepared this Report in part on the basis of information provided by the DRA which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. The site conditions at other parts of the Site may be different from the site conditions found at the specific sample points.



Investigations undertaken in respect of this Report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant the Site features and conditions may have been identified in this Report.

The site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD expressly disclaims responsibility:

- arising from, or in connection with, any change to the site conditions; and
- to update this Report if the site conditions change.

Figure 1 Study Area and Test pit Locations





Appendix A
Certificates of Title



REGISTER NUMBER 436/DP192388	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE
OF
CROWN LAND TITLE

VOLUME **LR3105** FOLIO **346**

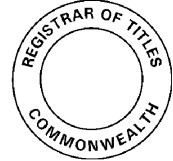
UNDER THE TRANSFER OF LAND ACT 1893 (WA) (CI) AS AMENDED
AND THE LAND ADMINISTRATION ACT 1997 (WA) (CI)

NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the COMMONWEALTH, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

B. Roberts

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 436 ON DEPOSITED PLAN 192388

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: COMMONWEALTH OF AUSTRALIA

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. J029935 FOLIO CANCELLED. NEW FOLIOS HAVE BEEN CREATED FOR LOT(S) ON DP40603 TO VOL 3134 FOL 201. REGISTERED 22.9.2004.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP192388 [SHEET 1].
PREVIOUS TITLE: This Title.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: NO LOCAL GOVERNMENT AUTHORITY INFORMATION AVAILABLE.
RESPONSIBLE AGENCY: COMMONWEALTH OF AUSTRALIA.

NOTE 1: A000001A CORRESPONDENCE FILE 50096-2004-01RO.

Cancelled



REGISTER NUMBER 645/DP40603	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

**RECORD OF QUALIFIED CERTIFICATE
OF
CROWN LAND TITLE**
UNDER THE TRANSFER OF LAND ACT 1893 (WA) (CI) AS AMENDED
AND THE LAND ADMINISTRATION ACT 1997 (WA) (CI)

VOLUME **LR3134** FOLIO **201**

NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the COMMONWEALTH, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

B. Roberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 645 ON DEPOSITED PLAN 40603

**STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)**

STATUS ORDER/INTEREST: RESERVE WITHOUT MANAGEMENT ORDER

PRIMARY INTEREST HOLDER: COMMONWEALTH OF AUSTRALIA

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. J029936 RESERVE 47930 FOR THE PURPOSE OF GOVERNMENT REQUIREMENTS REGISTERED 22.9.2004.

- Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.
(2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown hereon may have a different priority than shown.

-----END OF CERTIFICATE OF CROWN LAND TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.



SKETCH OF LAND: DP40603 [SHEET 1].
PREVIOUS TITLE: LR3105-346.
PROPERTY STREET ADDRESS: 2-2A TONG YAN LOH, CHRISTMAS ISLAND.
LOCAL GOVERNMENT AREA: SHIRE OF CHRISTMAS ISLAND.
RESPONSIBLE AGENCY: DEPARTMENT OF REGIONAL DEVELOPMENT AND LANDS (SLSD).

NOTE 1: J029935 CORRESPONDENCE FILE 51556-2003-01RO



Appendix B
Historical Aerial Photographs



<p>Legend</p>  Approximate Site Boundary	Created By MT	Checked MT	Approved AW	Preliminary Site Investigation Aerial Photograph 12/08/1987
	Date 15/06/2011	File location 61/26591/12/External Data		
	Revision 0	Source Commonwealth of Australia		1987 



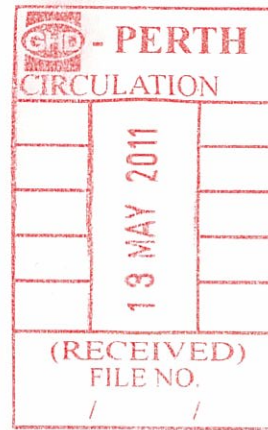


Appendix C
Dangerous Goods Search



Your Ref: 612659112
 Our Ref: **10/11:451** A0798/201101
 Enquiries: Doris Marenko
 Email: dmarenko@dmp.wa.gov.au
 Facsimile: 9358 8000

Ms M Thompson
 Environmental Scientist
 GHD Pty Ltd
 239 Adelaide Terrace
 EAST PERTH WA 6004




Dear Ms Thompson

NOTICE OF DECISION UNDER S30 FREEDOM OF INFORMATION ACT 1992 (the Act)	
Application Request:	Your application under the Act sought access to Dangerous Goods Storage (DGS) licence documents for the site at 2A Tong Yan Loh, Christmas Island..
Scope of documents requested:	<p>Copies of the following documents:</p> <ul style="list-style-type: none"> • current and historical copies of licences; • applications for licence to store flammable liquids/dangerous goods; • inspections reports with orders relating to underground tanks/fuel pumps; • site plans; and • any records of spills or accidents occurring at the site. <p>Personal information is not required.</p>
Decision:	For the reasons set out below, it was decided on 11 May 2011 by Liz Haddon-Cave, A/FOI Co-ordinator, Business Development, (delegated decision maker by a general directive provided under s.100 (1) (b) of the Act), to deny access to the documents under s.26 of the Act.
The Facts	<ol style="list-style-type: none"> 1. On the information you provided, a search of our records has failed to locate any documentation containing the information you seek. Under s26 of the Act, the failure of the Department to locate any documents after a diligent search is deemed as a refusal to grant access. 2. Location descriptors provided by applicants may not always match site location details in our database and we ask if possible applicants provide the DGS Licence number of the site of interest to them. We recognise this is not always possible and do all we reasonably can to search for the site from the information provided.

2/...

The Facts (cont'd)	3. The lack of information held by the Department in relation to this property does not necessarily mean the property is not or has ever been a dangerous goods storage site. Accordingly, if you have any reason to suspect the property is or may have been the subject of a DGS licence or dangerous goods may have been stored there, you may need to consider carrying out additional site inspection investigations.
Review Process	If you wish to contest the decision to refuse access, you have a right to have the decision reviewed. Details of the review process are set out in the attached notes.

Yours sincerely



Liz Haddon-Cave
A/FOI CO-ORDINATOR
RESOURCES SAFETY

11 May 2011

Enc. Notes

REVIEW AND APPEAL PROCESS (UNDER THE FREEDOM OF INFORMATION ACT 1992)

Internal Review (S.39-40 and 54)

If you are dissatisfied or aggrieved by certain decisions of an agency regarding access to documents or amendment of personal information, you can apply to the agency concerned for an internal review of its decision.

To apply for an internal review, you must lodge your request for review in writing with the agency which made the decision within 30 days after being given notice of the decision.

The application must give details of the decision you wish to have reviewed and give an address in Australia to which notices can be sent.

There is no right to an internal review of a decision made by a Minister or the principal officer of an agency.

There is no charge for an internal review of a decision.

External Review by the Information Commissioner (S. 65-66)

If, after an internal review has been completed, you are still dissatisfied with the agency's decision, you can make a complaint to the Information Commissioner. The Information Commissioner may allow a complaint to be made even though an internal review has not been sought or has not been completed if you can show that there are good reasons why you should not apply for an internal review or why an internal review should not be completed.

A complaint must be made in writing to the Information Commissioner. The address of the Information Commissioner is:

Office of the Information Commissioner
PO Box Z5386
St Georges Tce
PERTH WA 6000.

The complaint must include a copy of this decision and give an address in Australia to which notices can be sent.

If you are seeking access to documents or amendment of personal information, your complaint must be lodged within 60 days after being given written notice of the decision.

If you are a third party to an application for access to personal or commercial or business information concerning yourself, your complaint must be lodged within 30 days after being given written notice of the decision.

There is no charge for lodging a complaint with the Information Commissioner's Office, however each party is generally responsible for any costs they incur whilst pursuing the complaint.

Appeals to the Supreme Court (S.85)

The Commissioner may refer to the Supreme Court any question of law that arises in the course of dealing with a complaint. This may be done on the Commissioner's initiative or at the request of a party to the complaint. Parties to a complaint are generally responsible for their own costs.





Appendix D
Site Photographs



Photo Reference: Plate A



Photo Reference: Plate B



Photo Reference: Plate C



Photo Reference: Plate D



Photo Reference: Plate E



Photo Reference: Plate F



Photo Reference: Plate G



Appendix E
Test Pit Logs

SOIL TEST PIT LOG

TEST PIT No.: TP03

Page: 1 of 1

CLIENT: Department of Regional Australia PROJECT: Drumsite Test Pits LOCATION: Drumsite Christmas Island JOB No.: 61/26591/12 LOGGED BY: CC & MT CHECKED BY:	COMMENCED: 6/4/2011 COMPLETED: LENGTH (m): HORIZONTAL DATUM: VERTICAL DATUM:	CONTRACTOR: Acker Pty Ltd EQUIPMENT: HEADING (deg): MN <input type="checkbox"/> GN <input type="checkbox"/> X-COORDINATE: Y-COORDINATE: R.L. SURFACE (m): TOTAL DEPTH (m):
--	--	--

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP03-0.0	0.00	Ground Surface					0.0
0.0			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					0.0
0.2			-0.20	Brown/red fine medium grain silty clay medium sorted.					0.2
0.5			0.20	Natural brown fine medium grain silty clay. Well sorted. Limestone refusal at 1.5m.					0.5
1.0		TP03-1.0							1.0
1.5									1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP04

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/Relative Density	Graphic Log	Depth (m)
0.0		TP04-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					
			-0.20	Brown/red fine medium grain silty clay medium sorted.					
0.5			0.20	Natural brown fine medium grain silty clay. Well sorted. Limestone refusal at 1.0m.					0.5
1.0		TP04-1.0							1.0
1.5									1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP05

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 X-COORDINATE:
 Y-COORDINATE:
 TOTAL DEPTH (m):

LENGTH (m):
 HORIZONTAL DATUM:
 VERTICAL DATUM:
 WIDTH (m):
 R.L. SURFACE (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP05-0.0 Bulk TP05	0.00	Ground Surface	Fragments of ACM on topsoil				0.0
0.0			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					0.0
0.5			-0.20 0.20	Brown/red fine medium grain silty clay medium sorted. Natural brown fine medium grain silty clay. Well sorted. Limestone refusal at 1.5m.					0.5
1.0		TP05-0.5	-1.50	Limestone on one wall refusal, continues beneath the hole next to it. Limestone refusal at 1.8m.				1.5	
1.5					1.80				1.5
2.0								2.0	
2.5								2.5	
3.0								3.0	
3.5								3.5	
4.0								4.0	
4.5								4.5	
5.0								5.0	

SOIL TEST PIT LOG

TEST PIT No.: TP08

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 X-COORDINATE:
 Y-COORDINATE:
 TOTAL DEPTH (m):

LENGTH (m):
 HORIZONTAL DATUM:
 VERTICAL DATUM:

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/Relative Density	Graphic Log	Depth (m)
0.0		TP08-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					
		QA02	-0.30	Concrete slab at 0.2m					
			0.30	Brown/red fine medium grain silty clay medium sorted.					
0.5				Natural brown fine medium grain silty clay. Well sorted.					0.5
1.0									1.0
1.5									1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP09

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP09-0.0	0.00 0.00	Ground Surface	Asbestos fragments on surface close to hole	M			0.0
			-0.30 0.30	Overgrowth on top with fill a mixture of concrete debris and organic matter. Concrete slab at 0.2m-0.3m. Brown/red fine medium grain silty clay medium sorted.					0.5
0.5		TP09-0.5		Natural brown fine medium grain silty clay. Well sorted.					1.0
1.0		TP09-1.26	-0.90 0.90	Orange/brown sandy clay. Fine to medium grain. Moderately sorted.				1.5	
2.0				Bottom of hole at 2m				2.0	
2.5								2.5	
3.0								3.0	
3.5								3.5	
4.0								4.0	
4.5								4.5	
5.0								5.0	

SOIL TEST PIT LOG

TEST PIT No.: TP10

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP10-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					
		QA03	-0.20	Brown/red fine medium grain silty clay medium sorted.					
0.5			0.20	Natural brown fine medium grain silty clay. Well sorted. Large limestone cobbles & boulders.					0.5
1.0						M			1.0
1.5			-1.60						1.5
			1.60	Limestone refusal at 1.6m					2.0
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP11

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 LENGTH (m): WIDTH (m):
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP11-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					
			-0.20	Brown/red fine medium grain silty clay medium sorted.					
0.5			0.20	Natural brown fine medium grain silty clay. Well sorted. Large limestone cobbles & boulders.					0.5
1.0			-0.80	Bottom of hole at 0.8m		M			1.0
1.5			0.80						1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP12

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP12-0.0	0.00 0.00	Ground Surface					0.0
0.5		TP12-0.5		Overgrowth on top with fill a mixture of concrete debris and organic matter. Brown/red fine medium grain silty clay medium sorted. Concrete slab present at 0.1m					0.5
1.0				Natural brown fine medium grain silty clay. Well sorted.		M			1.0
2.0			-2.00 2.00	Large limestone cobbles & boulders. Bottom of hole at 2m					2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP14

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 LENGTH (m): WIDTH (m): R.L. SURFACE (m):
 VERTICAL DATUM: TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP14-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter. Brown/red fine medium grain silty clay medium sorted.					
0.5			-0.60	Natural brown fine medium grain silty clay. Well sorted.					0.5
			0.60	Limestone boulders at 0.6m		M			1.0
1.0									1.5
1.5									2.0
2.0									2.5
2.5									3.0
3.0									3.5
3.5									4.0
4.0									4.5
4.5									5.0
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP15

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP15-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter.					
0.5			-0.60	Brown/red fine medium grain silty clay medium sorted.					0.5
			0.60	Natural brown fine medium grain silty clay. Well sorted.			M		
				Limestone boulders at 0.6m					
1.0									1.0
1.5									1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0

SOIL TEST PIT LOG

TEST PIT No.: TP16

Page: 1 of 1

CLIENT: Department of Regional Australia
 PROJECT: Drumsite Test Pits
 LOCATION: Drumsite Christmas Island
 JOB No.: 61/26591/12
 LOGGED BY: CC & MT CHECKED BY:

COMMENCED: 6/4/2011
 COMPLETED:

CONTRACTOR: Acker Pty Ltd
 EQUIPMENT:
 HEADING (deg): MN GN
 HORIZONTAL DATUM: X-COORDINATE: Y-COORDINATE:
 VERTICAL DATUM: R.L. SURFACE (m): TOTAL DEPTH (m):

Depth (m)	Water	Sample Type/Number	Depth Elevation (m)	MATERIAL DESCRIPTION@#AS1726 Soil Group Symbol, colour, soil types, particle characteristics or fines plasticity, secondary and minor components.	CONTAMINANT INDICATORS@#Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Moisture Condition	Consistency/ Relative Density	Graphic Log	Depth (m)
0.0		TP16-0.0	0.00	Ground Surface					0.0
			0.00	Overgrowth on top with fill a mixture of concrete debris and organic matter. Brown/red fine medium grain silty clay medium sorted.					
0.5			-0.60	Natural brown fine medium grain silty clay. Well sorted.					0.5
			0.60	Limestone boulders at 0.6m			M		
1.0									1.0
1.5									1.5
2.0									2.0
2.5									2.5
3.0									3.0
3.5									3.5
4.0									4.0
4.5									4.5
5.0									5.0



Appendix F
Laboratory Certificates

**JO OF CUSTODY RECORD
AND ANALYSIS REQUEST**



CLIENTS|PEOPLE|PERFORMANCE

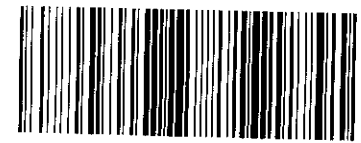
GHD House
239 Adelaide Terrace
Perth WA 6004

PO Box Y3106
Perth WA 6832

Telephone 08 6222 8222
Facsimile 08 6222 8555

Project CI Drumsite PSI				Laboratory: ALS				<p>Please Note: Please sign white copy on receipt and release of samples. Samples are delivered to Laboratory Address. On receipt of samples laboratory contact should sign white copy and fax to GHD contact at above address. On completion of analyses please return white copy with results. Yellow copy is retained by laboratory. Pink copy is retained by sampler.</p>							
Client		Job No. 612659112		Address: 10 HOD WAY MALDEN											
Laboratory Quote No.		Turnaround Time		Laboratory Contact:											
Job Manager (Invoice) Andrew Winters				Email Address (Results) Christine.Chilton@ghd.com											
GHD Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix	Container	No.	Total Volume (ml)	Analyses				Remarks			
								ASBESTOS	HOLD						
TP01_0.0	1	6.4.11		S BAG				✓	✓				<p>(*) Please contact Christine Chilton when samples are received.</p>		
TP01_0.3								✓	✓						
TP01_1.5								✓	✓						
TP02_0.0	2							✓	✓						
TP02_1.1								✓	✓						
TP03_0.0	3							✓	✓						
TP03_1.0								✓	✓						
TP04_0.0	4							✓	✓						
TP04_1.0								✓	✓						
TP05_0.0	5							✓	✓						
TP05_0.6								✓	✓						
TP06_0.0	6							✓	✓						
TP06_0.5								✓	✓						

Environmental Division
Perth
Work Order
EP1103146



Telephone : +61-8-9209 7655

Sampled by: C. CHILTON / M. THOMPSON	Date/Time: 6.4.11	Relinquished by:	Date/Time:
Received by: ROSS	Date/Time:	Relinquished by:	Date/Time:
Received by Lab: ALS	Date/Time: 19/5/11 15:30	Courier/Transport Company:	
Sample Conditions: OK	Remarks:		

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST



CLIENTS | PEOPLE | PERFORMANCE

GHD House
239 Adelaide Terrace
Perth WA 6004

PO Box Y3106
Perth WA 6832

Telephone 08 6222 8222
Facsimile 08 6222 8555

Project CI Drum site				Laboratory: ALS										<p>Please Note: Please sign white copy on receipt and release of samples. Samples are delivered to Laboratory Address. On receipt of samples laboratory contact should sign white copy and fax to GHD contact at above address. On completion of analyses please return white copy with results. Yellow copy is retained by laboratory. Pink copy is retained by sampler.</p>			
Client		Job No. 612659112		Address: 10 METHOD WAY, MALAGA													
Laboratory Quote No.		Turnaround Time		Laboratory Contact:													
Job Manager (Invoice) Andrew Winters		Email Address (Results) christine.chilton@ghd.com															
Sample ID	Quantity	Time	Container	No.	Analysis											Remarks	
TP07-0.0	7	6.4.11	5 BAG			ASBESTOS											
TP07-1.0																	
TP08-0.0	8																
TP09-0.0	9																
TP09-0.5																	
TP09-1.2																	
TP10-0.0	10																
TP11-0.0	11																
TP12-0.0	12																
TP13-0.0	13																
TP12-0.5																	
TP13-0.8																	
TP14-0.0	14																

Sampled by: C. CHILTON / M. THOMPSON	Date/Time: 6.4.11	Relinquished by:	Date/Time:
Received by: ROSS	Date/Time:	Relinquished by:	Date/Time:
Received by Lab: ALS	Date/Time: 19/5/11 1530	Courier/Transport Company:	
Sample Conditions: O/C	Remarks:		

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST



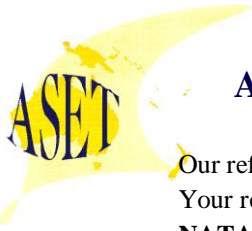
CLIENTS | PEOPLE | PERFORMANCE

GHD House
239 Adelaide Terrace
Perth WA 6004

PO Box Y3106
Perth WA 6832

Telephone 08 6222 8222
Facsimile 08 6222 8555

Project CI Drumsite				Laboratory: ALS				Please Note: Please sign white copy on receipt and release of samples. Samples are delivered to Laboratory Address. On receipt of samples laboratory contact should sign white copy and fax to GHD contact at above address. On completion of analyses please return white copy with results. Yellow copy is retained by laboratory. Pink copy is retained by sampler.														
Client		Job No. 612659112		Address: 10 Hod Way, MALAGA																		
Laboratory Quote No.		Turnaround Time		Laboratory Contact:																		
Job Manager (Invoice) Andrew Winters		Job Address (Results) Christine.Chilton@ghd																				
GHD Sample ID	Laboratory Sample ID	Date	Time	Container				Analyses												Remarks		
				Sample Matrix (Soil, Sludge, Water, Air)	Type (Bulk, Bag, Jar, etc)	Unpreserved (Yes/No)	No.	Total Volume (ml)														
TP15-0.0	15	6.4.11						ASBESTOS														
TP16-0.0	16	↓						✓														
QA1	17							✓														
QA02									✓													
QA03									✓													
TB01	18							✓														
TP12-0.0 TP12-0.0		6.4.11		ASBESTOS	BAG				✓													
BULK TP05	19	6.4.11							✓													
BULK TP01	20								✓													
TP02-0.0									✓													
TP07-0.0									✓													
TP09-0.0									✓													
TP09-0.5									✓													
TP13-0.0									✓													
Sampled by: C. CHILTON M. THOMPSON		Date/Time: 6.4.11		Relinquished by:				Date/Time:														
Received by: Ross		Date/Time:		Relinquished by:				Date/Time:														
Received by Lab: ALS		Date/Time: 19/5/11		Courier/Transport Company:																		
Sample Conditions: OK		Remarks: 15:30																				



Our ref: ASET26386/ 29566 / 1 - 20

Your ref: EP1103146

NATA Accreditation No: 14484

25 May 2011

Australian Laboratory Services Pty Ltd
10 Hod Way
Malaga WA 6090

Attn: Mr Luke Jones

Dear Luke,

Asbestos Identification

This report presents the results of twenty samples, forwarded by Australian Laboratory Services Pty Ltd on 23 May 2011, for analysis for asbestos.

1.Introduction: Twenty samples forwarded were examined and analysed for the presence of asbestos

2. Methods : The samples were examined under a Stereo Microscope and selected fibres were analysed by Polarized Light Microscopy in conjunction with Dispersion Staining Method (**Safer Environment Method 1 and Australian Standard AS 4964-2004.**)

3. Results : **Sample No. 1. ASET26386/ 29566 / 1. EP1103146 - 001 - TP01 - 0.0.**
Approx dimensions 7.6 cm x 7.2 cm x 4.3 cm
The sample consisted of a mixture of clayish soil, stones, plant matter, fragments of plaster, corroded metal and debris.
No asbestos detected.

Sample No. 2. ASET26386/ 29566 / 2. EP1103146 - 002 - TP02 - 0.0.
Approx dimensions 8.6 cm x 7.5 cm x 3.9 cm
The sample consisted of a mixture of clayish soil, stones, plant matter, synthetic mineral fibres, fragments of plaster and debris.
No asbestos detected.

Sample No. 3. ASET26386/ 29566 / 3. EP1103146 - 003 - TP03 - 0.0.
Approx dimensions 8.2 cm x 7.5 cm x 4.1 cm
The sample consisted of a mixture of clayish soil, stones, plant matter, fragments of plaster and debris.
No asbestos detected.



Sample No. 4. ASET26386 / 29566 / 4. EP1103146 - 004 - TP04 - 0.0.

Approx dimensions 6.8 cm x 6.5 cm x 3.8 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, fragments of fibre cement*, plaster and debris.

Chrysotile* (Estimated approximate weight = 0.003g) asbestos, Amosite* (Estimated approximate weight = 0.001g) asbestos and Crocidolite* (Estimated approximate weight = 0.0012g) asbestos detected.

Estimated approximate total weight of asbestos = 0.005g, Approximate total weight of fibre cement = 0.024g, Approximate total weight of soil = 116.0g.

w/w % = 0.004%

Sample No. 5. ASET 26386 / 29566 / 5. EP1103146 - 005 - TP05 - 0.0.

Approx dimensions 9.7 cm x 9.5 cm x 5.2 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, fragments of plaster and debris.

No asbestos detected.

Sample No. 6. ASET 26386 / 29566 / 6. EP1103146 - 006 - TP06 - 0.0.

Approx dimensions 8.6 cm x 8.4 cm x 4.9 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, synthetic mineral fibres, fragments of plaster and debris.

No asbestos detected.

Sample No. 7. ASET 26386 / 29566 / 7. EP1103146 - 007 - TP07 - 0.0.

Approx dimensions 8.2 cm x 7.3 cm x 3.4 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, fragments of plaster and debris.

No asbestos detected.

Sample No. 8. ASET 26386 / 29566 / 8. EP1103146 - 008 - TP08 - 0.0.

Approx dimensions 7.3 cm x 6.5 cm x 3.6 cm

The sample consisted of a mixture of clayish soil, stones, plant matter and fragments of plaster.

No asbestos detected.

Sample No. 9. ASET 26386 / 29566 / 9. EP1103146 - 009 - TP09 - 0.0.

Approx dimensions 7.6 cm x 6.4 cm x 4.2 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, synthetic mineral fibres, fragments of plaster and debris.

No asbestos detected.



Sample No. 10. ASET 26386 / 29566 / 10. EP1103146 - 010 - TP10 - 0.0.

Approx dimensions 7.6 cm x 7.5 cm x 4.4 cm

The sample consisted of a mixture of clayish soil, stones and plant matter.

No asbestos detected.

Sample No. 11. ASET 26386 / 29566 / 11. EP1103146 - 011 - TP11 - 0.0.

Approx dimensions 8.7 cm x 8.5 cm x 4.2 cm

The sample consisted of a mixture of clayish soil, stones and plant matter.

No asbestos detected.

Sample No. 12. ASET 26386 / 29566 / 12. EP1103146 - 012 - TP12 - 0.0.

Approx dimensions 8.2 cm x 7.6 cm x 3.9 cm

The sample consisted of a mixture of clayish soil, stones and fragments of plaster.

No asbestos detected.

Sample No. 13. ASET 26386 / 29566 / 13. EP1103146 - 013 - TP13 - 0.0.

Approx dimensions 7.4 cm x 6.5 cm x 3.7 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, synthetic mineral fibres, fragments of fibre cement*, plaster and debris.

Chrysotile* (Estimated approximate weight = 0.006g) asbestos detected.

Approximate total weight of fibre cement = 0.034g, Approximate total weight of soil = 116.0g

w/w % = 0.005%

Sample No. 14. ASET 26386 / 29566 / 14. EP1103146 - 014 - TP14 - 0.0.

Approx dimensions 7.4 cm x 7.2 cm x 4.6 cm

The sample consisted of a mixture of clayish soil, stones, plant matter, synthetic mineral fibres, fragments of fibre cement*, plaster and debris.

Chrysotile* (Estimated approximate weight = 0.038g) asbestos detected.

Approximate total weight of fibre cement = 0.213g, Approximate total weight of soil = 282.0g

w/w % = 0.013%

Sample No. 15. ASET 26386 / 29566 / 15. EP1103146 - 015 - TP15 - 0.0.

Approx dimensions 7.2 cm x 6.8 cm x 3.7 cm

The sample consisted of a mixture of clayish soil, stones and fragments of plaster.

No asbestos detected.

Sample No. 16. ASET 26386 / 29566 / 16. EP1103146 - 016 - TP16 - 0.0.

Approx dimensions 7.5 cm x 6.4 cm x 4.1 cm

The sample consisted of a mixture of clayish soil, stones, plant matter and debris.

No asbestos detected.



Sample No. 17. ASET 26386 / 29566 / 17. EP1103146 – 017 - QA01.

Approx dimensions 6.8 cm x 6.4 cm x 4.2 cm

The sample consisted of a mixture of clayish soil and stones.

No asbestos detected.

Sample No. 18. ASET 26386 / 29566 / 18. EP1103146 – 018 - TB01.

Approx dimensions 6.7 cm x 5.4 cm x 3.2 cm

The sample consisted of a mixture of sandy soil and stones.

No asbestos detected.

Sample No. 19. ASET 26386 / 29566 / 19. EP1103146 – 019 - BULK TP05.

Approx dimensions 8.2 cm x 4.3 cm x 0.6 cm

The sample consisted of a fragment of a fibre cement material.

Chrysotile (Estimated approximate weight= 4.7g) asbestos and Amosite (Estimated approximate weight= 1.02g) asbestos detected.

Estimated approximate total weight of asbestos = 5.72g, Approximate total weight of fibre cement = 34.0g

w/w % = 17%

Sample No. 20. ASET 26386 / 29566 / 20. EP1103146 – 020 - BULK TP01.

Approx dimensions 5.2 cm x 4.6 cm x 0.4 cm

The sample consisted of a fragment of a fibre cement material.

Chrysotile (Estimated approximate weight = 4.62g) asbestos and Amosite (Estimated approximate weight = 0.99g) asbestos detected.

Estimated approximate total weight of asbestos = 5.61g, Approximate total weight of fibre cement = 33.0g

w/w % = 17%

Analysed and reported by,

**Laxman Dias. BSc.
Approved Counter / Analyst
Approved Signatory**



This document is issued in accordance with NATA's Accreditation requirements. Accredited for compliance with ISO/IEC 17025.

The approx; weights given above can be used only as a guide. They do not represent absolute weights of each kind of asbestos as it is impossible to extract all loose fibres from soil and other asbestos containing building material samples using this method. However above figures may be used as closest approximations to the exact values in each case. Estimation of the asbestos fibre weights in fibre cement materials and soil is out of the Scope of the NATA Accreditation





GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permal@ghd.com.au

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		Name	Signature	Name	Signature	Date
0	C. Chilton M. Craig	A. Winters	On file	A. Winters	On file	220711
1	M. Craig	A. Winters		A. Winters P. Semar		220711 31/1/2011

REPORT ON GEOTECHNICAL INVESTIGATION



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**Department of Regional Australia,
Regional Development and
Local Government**

Christmas Island New Housing Project -
Project 1

Report on Geotechnical Investigation

July 2011



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1. Introduction

1.1 General

In January 2011, the Department of Regional Australia, Regional Development and Local Government engaged GHD to provide Project Management and Design Consultancy Services for the New Housing Program on Christmas Island (CI). Part of the program involves the construction of new residential dwellings at Lot 645 Tong Yan Loh in Drumsite, within the Shire of Christmas Island (refer Figures 1 and 2). It is intended to develop the site as two projects, each comprising the construction of 16 dwellings, with a total of 32 proposed.

A combined geotechnical and environmental investigation was undertaken at the site by undertaking test pitting. This report presents the results of the geotechnical investigation and appraisal of the site based on existing sources of data and data obtained from the site investigation.

1.2 Scope of Works

The scope of work for the geotechnical site investigation comprise of the following:

- ▶ Walkover inspection of the site;
- ▶ Rockfall assessment of a section of cliff face;
- ▶ Test pitting at fourteen (14) locations to provide information on subsurface ground and groundwater conditions for the site;
- ▶ Laboratory testing of selected samples; and
- ▶ Preparation of a geotechnical report presenting the results of the investigation and recommended Residential Site Classification in accordance with AS 2870-2011 "Residential slabs and footings".



2. Site Description

The site is located south east of the junction of Lam Lok Loh and Sung Miaw Loh, Drumsite. The site has approximate dimensions of 100m by 120m, an approximate area of 1.2ha (Figure 2 and 4).

The site is bounded to the northwest by Tong Yan Loh and to the south west by Sung Miaw Loh. There is an existing building that defines the north eastern corner of the site and the south eastern boundary of the existing car park area defines the south eastern boundary of the site.

There is a small temple and shed adjacent to Sung Miaw Loh in the south west corner of the site, the remainder of the site is currently vacant but has had residential dwellings on it previously. The site has been cleared of most vegetation although recent growth has restored some vegetation cover. There are a small number of mature trees remaining on the site.

There is some relic infrastructure on the site from the previous development, including footpaths, retaining walls, and an elevated parking area and associated access at the rear of the site. There are also several indicated underground utility services although these are reported to be disconnected. The site was the subject of a feature and level survey (ref: GHD drawing no. 61-2659109-V01) which shows the locations of these existing features.

The site is relatively flat in the north western part of the site with the ground level rising gently to the south west. From approximately midway along the north eastern boundary to the south western corner a series of retaining walls cross the site. The retaining walls are up to about 1.5m high but are generally less than 1 m in height. Behind the retaining walls the ground level is generally flat and level and forms a car park area with associated access road.

The ground level on the site ranges from +194 m Christmas Island Height Datum (CIHD) to +203mCIHD.

Outside of the site boundary to the south west, through dense jungle, the ground level can be seen to rise to the base of a limestone cliff of indeterminate height (Appendix B). The cliff base is estimated to be about 30m from the site boundary.

Surface exposures of pinnacles of slightly weathered to fresh limestone were identified in the north western corner of the site.



3. Proposed Development

Project One comprises the construction of 10 two bedroom units and six, three bedroom town houses for a total of 16 residential dwellings, together with an internal access road, associated car parking and communal open areas.

The proposed master site plan (ref: drawing SK205) is presented as Figure 2 in Appendix A.

A further 16 residences are proposed as part of a future development.



4. Fieldwork

4.1 General

The field investigation was carried out on 6th April 2011 by a Principal Engineering Geologist. The geotechnical scope of work comprised a walkover inspection, rockfall inspection and test pitting, which was undertaken in conjunction with an environmental investigation. The geotechnical fieldwork was generally conducted in accordance with the Standards Australia Site Investigation Code AS 1726 and standard GHD procedures.

4.2 Walkover Inspection

The walkover survey comprised a visual assessment of the site conditions and an assessment of geotechnical and geological risks to the site from local but external factors. Access to, and visibility of, areas adjacent to the site to the south east was restricted due to densely vegetated jungle a visual assessment was made of distances to features in these areas but these have not been verified. The walkover findings are presented on Figure 3. In summary the key findings were:

- ▶ There is a surface exposure of pinnacles of limestone in the northwest corner of the site (indicated on Figure 3);
- ▶ There was a slight seepage from the retaining wall located to the north of the site (indicated on Figure 3);
- ▶ The retaining walls showed signs of minor cracking; and
- ▶ There is evidence of rock falls from the cliffs to the southeast of the site with boulders of limestone seen adjacent to the site boundary in that vicinity. Boulders can be seen through the vegetation that are approximately 1 - 2m in size and blocky in nature (refer Plate 12, Appendix B).

The walkover inspection identified evidence of a rockfall hazard from the cliff to the south of the site. There are several boulders visible at the base of the slope below the cliff which indicates recent and potentially ongoing instability of the cliff. However, due to the inaccessibility of the cliff face no detailed assessment of the mechanisms of failure, the size of potentially unstable blocks and the general height and condition of the cliff face could be made.

4.3 Test Pitting

Test pitting was undertaken using a Yanmar Vi045 excavator supplied and operated by Acker Pty Ltd. The test pit investigation comprised:

- ▶ Nineteen test pits (TP19) were undertaken for the combined geotechnical and environmental investigation (TP01 to TP19);
- ▶ Fourteen test pits were used for the purposes of the geotechnical investigation (TP01 to TP03, TP05 to TP07, TP09, TP10, TP12, TP13 and TP16 to TP19); and
- ▶ Selected samples were taken from the test pits for subsequent laboratory testing.

The test pits were logged in general accordance of AS 1726. Preliminary engineering logs of the test pits and the geotechnical terms and symbols used in the preparation of the engineering logs are presented in Appendix C. Plates of photographs of select test pits are presented in Appendix D. The engineering logs



will be finalised once the results of the geotechnical laboratory are available and the logs included in this draft report are therefore preliminary and subject to change.

The test pits were backfilled upon completion. The excavator bucket and tracks used to compact the soil during backfilling.

The test pit locations are indicated in Figure 4, Test Pit Location Plan. The locations of the test pits were recorded using a handheld GPS. The recorded GPS coordinates were used in the preparation of the location plan. Due to the inherent inaccuracies of handheld GPS approximate ground levels at each test pit location were obtained using the feature survey. A summary of the test pit locations is presented in Table 1 below:

Table 1 Summary of test pit locations

Test Pit No.	Easting (m)	Northing (m)	Ground level (mCIHD)	Depth (m)	Reason for termination
TP01	573760	8846829	+196	1.9	Refusal
TP02	573783	8846853	+196	1.1	Target depth
TP03	573798	8846865	+197	1.5	Refusal
TP05	573824	8846851	+198	1.8	Refusal
TP06	573838	8846862	+198	2.2	Limit of reach
TP07	573822	8846830	+200	1.1	Refusal
TP09	573786	8846825	+199	1.7	Limit of reach
TP10	573820	8846807	+201	1.6	Refusal
TP12	573797	8846790	+200	2.0	Limit of reach
TP13	573779	8846789	+200	1.1	Refusal
TP16	573757	8846814	+199	1.7	Refusal
TP17	573817	8846788	+202	0.5	Refusal
TP18	573848	8846798	+201	0.9	Refusal
TP19	573857	8846829	+202	0.5	Refusal

Note: Grid is MGA 94 Zone 48.



5. Laboratory Testing

Geotechnical testing has been undertaken in accordance with the relevant Australian Standards by the NATA registered laboratory SGS Australia Pty Ltd.

The testing program comprises the following tests:

- ▶ 7 Moisture content ;
- ▶ 7 Particle size distribution with decant;
- ▶ 6 Atterberg limit;
- ▶ 1 Shrink/swell;
- ▶ 1 Modified compaction;
- ▶ 1 Soaked CBR; and
- ▶ 2 Point Load Index.



6. Geology

6.1 General Geology

Christmas Island forms the exposed summit of an isolated volcanic seamount that rises some 4.5 km from the seafloor near the edge of the Java Trench, which marks the margin of the Australian Continental Plate. The core of the island consists mainly of basaltic volcanics of Late Cretaceous age overlain by a sequence of limestone's, interbedded volcanics and phosphate rich deposits, that range from Eocene to Recent in age. The coastline is mostly comprised of steep cliffs and rises to a central plateau via a series of gently to steeply sloping escarpments with intervening flat areas commonly referred to as the "terraces" (Barrie, 1967).

The carbonate rock types comprise Eocene to Recent limestone's ranging in thickness from tens of metres above the central plateau to in excess of 250m along the edge of the island. The limestone's range in composition from massive skeletal fossil coral to shallow marine calcarenites and calcirudites. The limestone's have been variably affected by post-depositional processes, including the formation of solution features and recrystallization.

Limestone outcrops in the area around the caves on the Shore Terrace consist typically of a dark gray rock with rough weathered surfaces ("karren") and the formation of steep pinnacles with numerous open fissures and channels in the rock surface. The high to very high strength limestone pinnacles, with sandy phosphatic soils and limestone fragments in the area between pinnacles, are typical of Christmas Island. The limestone's are variable but can consist of cemented fragments of corals, shells, sands, gravel and other coastal detritus. Recrystallisation has taken place in zones within the limestone, to form a variable, very high strength rock in places.

A residual soil cover, derived from weathering of limestone, occurs in places particularly in depressions or low-lying areas. The soil is generally a dark red to brown, sandy or silty phosphatic material.

6.2 Site Geology

The investigation encountered the following strata:

Fill

Fill comprising stiff, silty sand of medium plasticity with gravel sized fragments of brick and limestone was encountered at all test locations. The encountered fill thickness varied from 0.1 m (TP17) to 0.75 m (TP1) and behind the retaining walls on the site the fill thickness may be thicker than this.

The silt and gravel content was variable across the site. The brick content within this stratum also varied and may be related to the demolition of the previous buildings on the site. Along the southwest corner away from the footprints of the previous buildings and close to the existing jungle the fill had a higher organic content and was described as fill/topsoil.

Colluvium

Possible colluvium was encountered at test pit TP18. This test pit is located in the south east corner of the site closest to the cliffs that form the hill behind the site. This material was described as dense, off white and light brown, sandy gravel with cobbles of limestone.



Residual Soil

Residual soils, derived from weathering of the limestone rock, were encountered in every test pit except for TP18 where possible colluvium was encountered instead. The residue soil occurs between pinnacles of limestone and was generally described as stiff, fine to coarse grained orange brown silty sand, containing scattered gravel, cobbles and boulders of limestone. The depth of the residual soil varied from 0.4m below existing ground level to beyond the depth of the investigation (2.2m).

Limestone

Limestone rock was encountered in several test pits (TP01, TP05, TP07, TP13, TP16, TP17, TP18 and TP19). The limestone was also identified as a surface exposure in the locality of TP01. The limestone formed characteristic pinnacles, which extended from ground surface to depths in excess of the limit of the excavator. The pinnacle surface of the limestone is irregular and several test pits encountered limestone that was possibly boulders and not intact bedrock.

The limestone encountered consisted of a light grey, low to high strength rock. The upper margin of the limestone was generally lower strength and some penetration was made by the excavator before refusal on the higher strength materials.



7. Geotechnical Evaluation and Recommendations

7.1 General

The investigation was to assess the subsurface conditions with respect to geotechnical design and construction aspects of relevance to the proposed residential development. It must be noted that the recommendations provided in this section are preliminary due to the pending geotechnical laboratory testing.

7.2 Residential Site Classification

Site classifications recommended in this report are based on the definitions provided in Australian Standard AS 2870-2011, "Residential slabs and footings". It should be noted, however, that the residential site classification standard is not appropriate to industrial or commercial construction.

Based on the preliminary results of the investigation, it is concluded that the site may generally be classified as "Class S" (Slightly Reactive Clay Site) according to Section 2 of AS 2870 - 2011.

AS 2870-2011 provided a system of site classification as shown in the following table.

Table 2 General Definition of AS 2870 Site Classes

Class	Foundation	Characteristic Surface Movement
A	Mostly sand and rock sites with little or no ground movement from moisture changes.	0 mm
S	Slightly reactive clay sites, with may experience only slight ground movement from moisture changes.	0 to 20 mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes.	20 to 40 mm
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes.	40 to 60 mm
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes.	60 to 75 mm
E	Extremely reactive sites which may experience extreme ground movement from moisture changes.	>75mm
P	Sites which include soft soils, such as soft clay or slit or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture condition or site which cannot be classified otherwise.	N/A



7.3 Shallow Foundations

Investigations show the soils at the site consist generally of stiff silty sand and sandy soils. Based on the results of this investigation a maximum allowable bearing capacity of 100 kPa is recommended for the class S (Section 7.2) strip and pad footings founded at depths of no less than 400mm to 500mm below the final finished earthworks level. Total settlement under the recommended maximum bearing pressure would generally be anticipated to be less than 25mm.

It should be noted that the recommended maximum bearing pressures presented make no allowance for any simultaneous horizontal load or vertical load eccentricity. The presence of either may have a reducing effect on the maximum bearing pressure recommendations. Ideally, it would be preferable for resultant eccentric design loads to be contained within the middle third of the footing (i.e. $e < B/6$; where e = load eccentricity, B = footing width). The designer may make allowance for the effect of load eccentricity by consideration of an "equivalent" footing size, where, for analytical purposes, the actual footing dimensions are reduced by 2 times the load eccentricity in each corresponding direction (i.e. $L' = L - 2e_1$, $B' = B - 2e_2$).

7.4 Earthworks

7.4.1 Site Preparation

Site construction works should be preceded by appropriate preparation of the ground surface in areas of proposed development. Preparation should include the following as applicable;

- ▶ Identification of and diversion/protection of any buried services within work areas;
- ▶ Grubbing of any tree roots;
- ▶ Removal of topsoil containing significant quantities of organic material to stockpile. A typical topsoil stripping depth of 50mm is envisaged;
- ▶ Excavation and removal of any refuse, and/or localised loosened or soft zones identified by visual examination of the stripped ground surface; and
- ▶ Contouring/shaping of the ground surface to ensure surface run off water is directed away from the site.

Following topsoil stripping, the exposed surface should be proof rolled.

7.4.2 Excavation

All excavations should be carried out in accordance with "Excavation" – Code of Practice (2005) published by the Commission for Occupational Safety and Health. In particular, excavations below a depth of 1.5m will require temporary shoring or be battered back to a maximum slope of 1V:2H. No significant loads (dead or live loads) should be placed within a distance of the slope crest, equivalent to the excavation depth. The earthworks Contractor should be required to verify the adequacy of each slope design on a case by case basis.

Excavations during rainfall periods should be avoided, and appropriate procedures implemented to prevent possible accumulation of rainfall runoff in the base of excavations. It is likely that the batters of any unretained excavations opened beneath the groundwater table or during rainfall periods will require flattening of the slopes to maintain stability of the excavation, unless otherwise demonstrated by the earthworks Contractor.



7.4.3 Foundation Preparation - Pinnacles

The majority of the foundations at this site will be founded in residual soil. Some sites may have areas of limestone or pinnacles of limestone at the surface. Where this occurs the limestone or pinnacles should be excavated to a depth of at least 0.7m below the final finished grade and the area filled with suitably compacted fill similar in composition to the soils below the remainder of the structure. This will minimise the potential for differential settlement occurring below the footings of the structures.

7.4.4 Fill Placement and Compaction

Following topsoil stripping, the exposed surface should be proof rolled and compacted to a minimum density ratio of 95% as determined by the standard compaction test (AS 1289.5.1.1) prior to being allowed to accept imported fill or pavement gravel. Where fill is required to achieve design levels, the material should comprise suitable on-site material or stable, imported select granular material having a maximum particle size of 37.5mm.

Fill material should be placed in loose layers not exceeding 300mm loose thickness, and each layer should be compacted with suitable equipment to achieve both a minimum density ratio of 95% as determined by the modified compaction test (AS 1289.5.2.1) and a minimum relative density of 70% as determined by the minimum/maximum density index test (AS 1289.5.5.1).

It is recommended that confirmation of compliance with compaction requirements be made by field density testing in accordance with AS 3798-2007, "Guidelines on earthworks for commercial and residential developments".

7.5 Retaining Wall Design

Backfill behind retaining structures should be free draining and low in fines content. Retaining structures should be designed in accordance with AS 4678-2002 "Earth Retaining Structures". For the design of retaining structures the following parameters are appropriate for materials compacted in accordance with Section 7.4.4.

Material	Free Draining Sand	Compacted Silty Sand
Angle of Friction (Φ)	32°	30°
Coefficient of Active Earth Pressure	0.31	0.3
Coefficient of Passive Earth Pressure	3.25	3
At Rest Coefficient of Earth Pressure	0.47	0.5

Compaction plant may increase the lateral earth pressures acting on retaining walls. It is recommended that hand held compaction equipment is used within 2m of any such retaining structures to minimise compaction pressures.



7.6 Pavement Design Parameters

California Bearing Ratio (CBR) values were estimated based on laboratory soaked CBR testing, presumptive values presented in Austroads Part 2 (2008) and on visual classification of the soils at the site a preliminary California Bearing Ratio (CBR) of 10% is deemed to be appropriate for the sand / silty sand soils found on the site.

7.7 Rock Fall Hazard Assessment

The walkover inspection identified evidence of a rockfall hazard from the cliff to the south of the site. There are several boulders visible at the base of the slope below the cliff which indicates recent and potentially ongoing instability of the cliff. However, due to the inaccessibility of the cliff face no detailed assessment of the mechanisms of failure, the size of potentially unstable blocks and the general height and condition of the cliff face could be made.

It is recommended that a further assessment of the cliff is made utilising rope access techniques to better assess the rock fall hazard. The assessment should be designed so that the cliff will be inspected to identify the nature of the potential hazards and that rockfall modelling be undertaken to assess the impact on the proposed development. Recommendations can then be made on appropriate solutions to mitigate the risk from rock falls on the residential development.

7.8 Earthquake Engineering Parameters

The site sub-soil class has been determined from the geological information collected from the test pit data.

Based on the conditions encountered during the fieldwork, a sub-soil class of Class Be – Rock Site, in accordance with Section 4.2.5 of AS 1170.4 – 2007, is considered appropriate for the site as the soil profile is generally less than 3m in thickness.

A Site Hazard Factor (Z) of 0.15, determined from Table 3.2 of AS 1170.4 – 2007, is considered suitable for the site.



8. References

Australian Standard, AS 1289. Testing Soils for Engineering Purposes. Standards Australia.

Australian Standard, AS 1726-1993. Geotechnical Site Investigations. Standards Australia.

Australian Standard, AS 2870-2011. Residential slabs and footings, Standards Australia.

Australian Standard AS 3798-1996. Guidelines On Earthworks For Commercial And Residential Developments. Standards Australia.

Barrie, J., 1967. The Geology of Christmas Island. Bureau of Mineral Resources Geology and Geophysics, Record 1967/37.

Austrroads Guide to Pavement Technology Part 2: Pavement Structural Design (2008)



9. Reliance

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Appendix A

Figures

Figure 1 Site Location Plan

Figure 2 Master Site Plan

Figure 3 Walkover Inspection Notes

Figure 4 Test Pit Location Plan



Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113

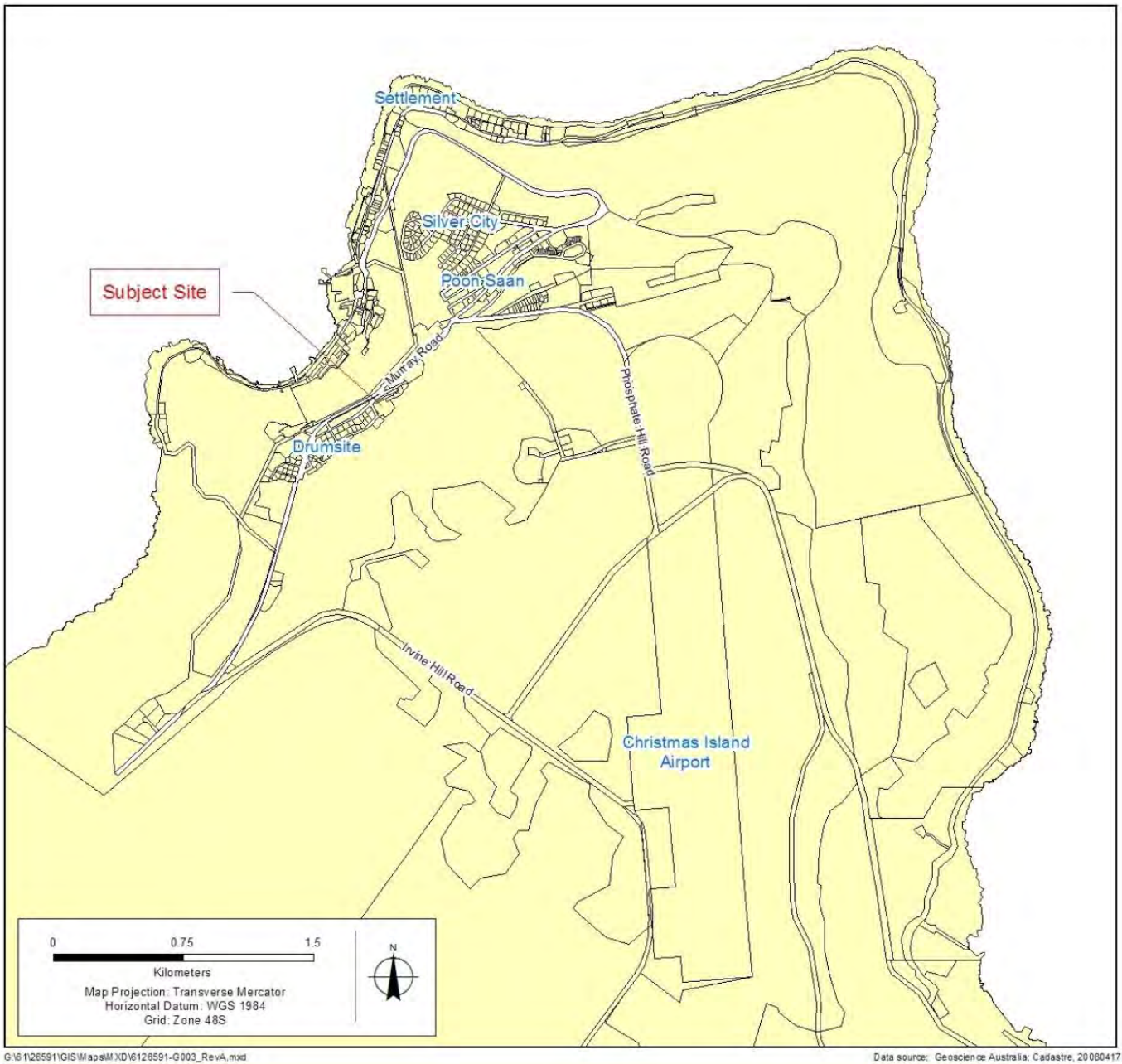
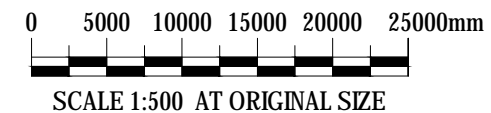


Figure 1: Site Location Plan



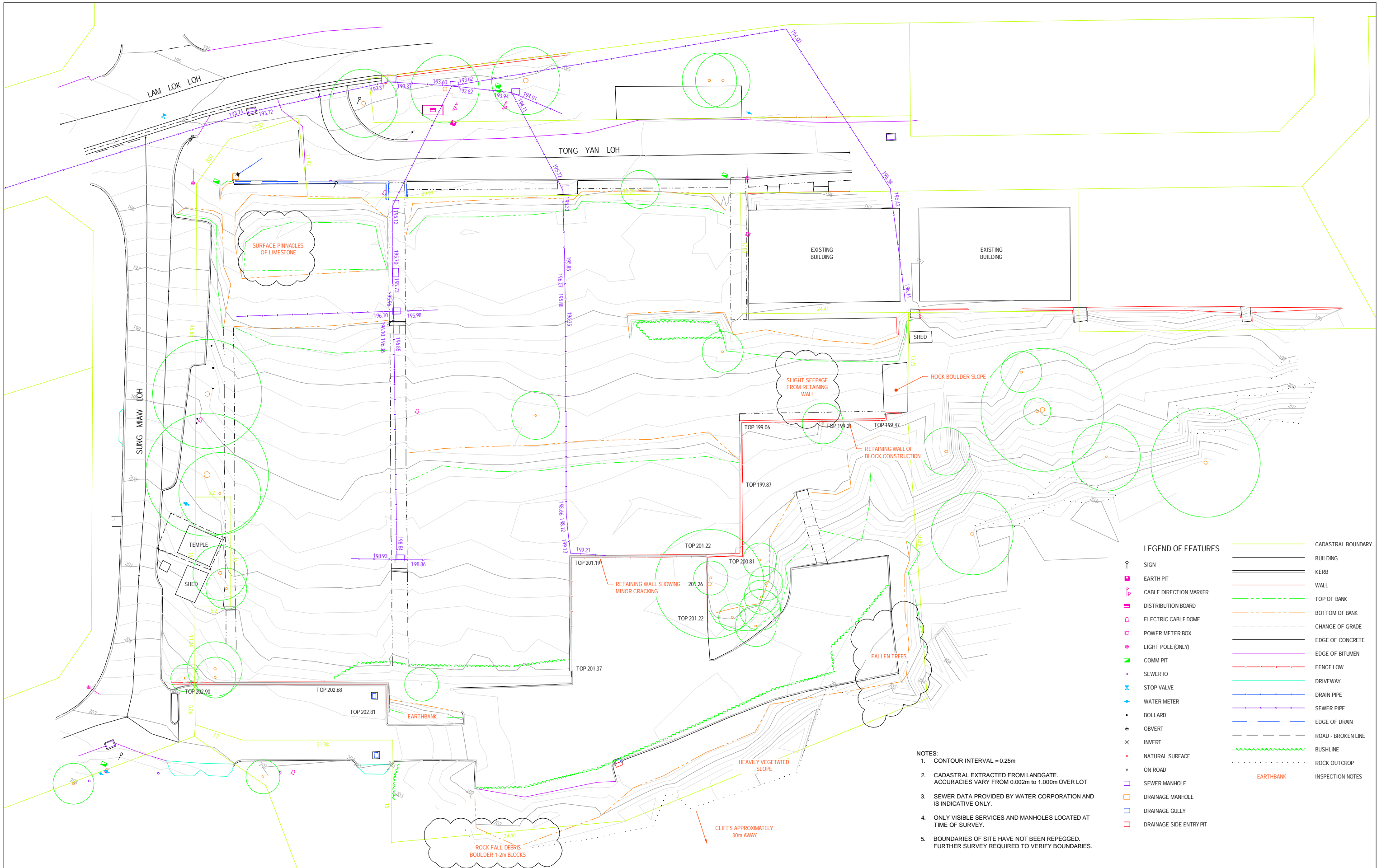
REGIONAL AUSTRALIA
CHRISTMAS ISLAND HOUSING



date: **MARCH 2011**
 job no: **61-26591**
 drawing: **SK205**



NOTE: Levels shown are indicative only



LEGEND OF FEATURES	
	SIGN
	EARTH PIT
	CABLE DIRECTION MARKER
	DISTRIBUTION BOARD
	ELECTRIC CABLE DOME
	POWER METER BOX
	LIGHT POLE (ONLY)
	COMM PIT
	SEWER ID
	STOP VALVE
	WATER METER
	BOLLARD
	OBVERT
	INVERT
	NATURAL SURFACE
	ON ROAD
	SEWER MANHOLE
	DRAINAGE MANHOLE
	DRAINAGE GULLY
	DRAINAGE SIDE ENTRY PIT
	CADASTRAL BOUNDARY
	BUILDING
	KERB
	WALL
	TOP OF BANK
	BOTTOM OF BANK
	CHANGE OF GRADE
	EDGE OF CONCRETE
	EDGE OF BITUMEN
	FENCE LOW
	DRIVEWAY
	DRAIN PIPE
	SEWER PIPE
	EDGE OF DRAIN
	ROAD - BROKEN LINE
	BUSHLINE
	ROCK OUTCROP
	EARTH BANK
	INSPECTION NOTES

- NOTES:
- CONTOUR INTERVAL = 0.25m
 - CADASTRAL EXTRACTED FROM LANDGATE. ACCURACIES VARY FROM 0.002m to 1.000m OVER LOT
 - SEWER DATA PROVIDED BY WATER CORPORATION AND IS INDICATIVE ONLY.
 - ONLY VISIBLE SERVICES AND MANHOLES LOCATED AT TIME OF SURVEY.
 - BOUNDARIES OF SITE HAVE NOT BEEN REPEGGED. FURTHER SURVEY REQUIRED TO VERIFY BOUNDARIES.

No	Revision	Note	Drawn	Checked	Approved	Date



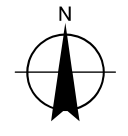
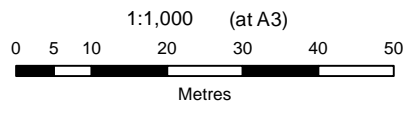
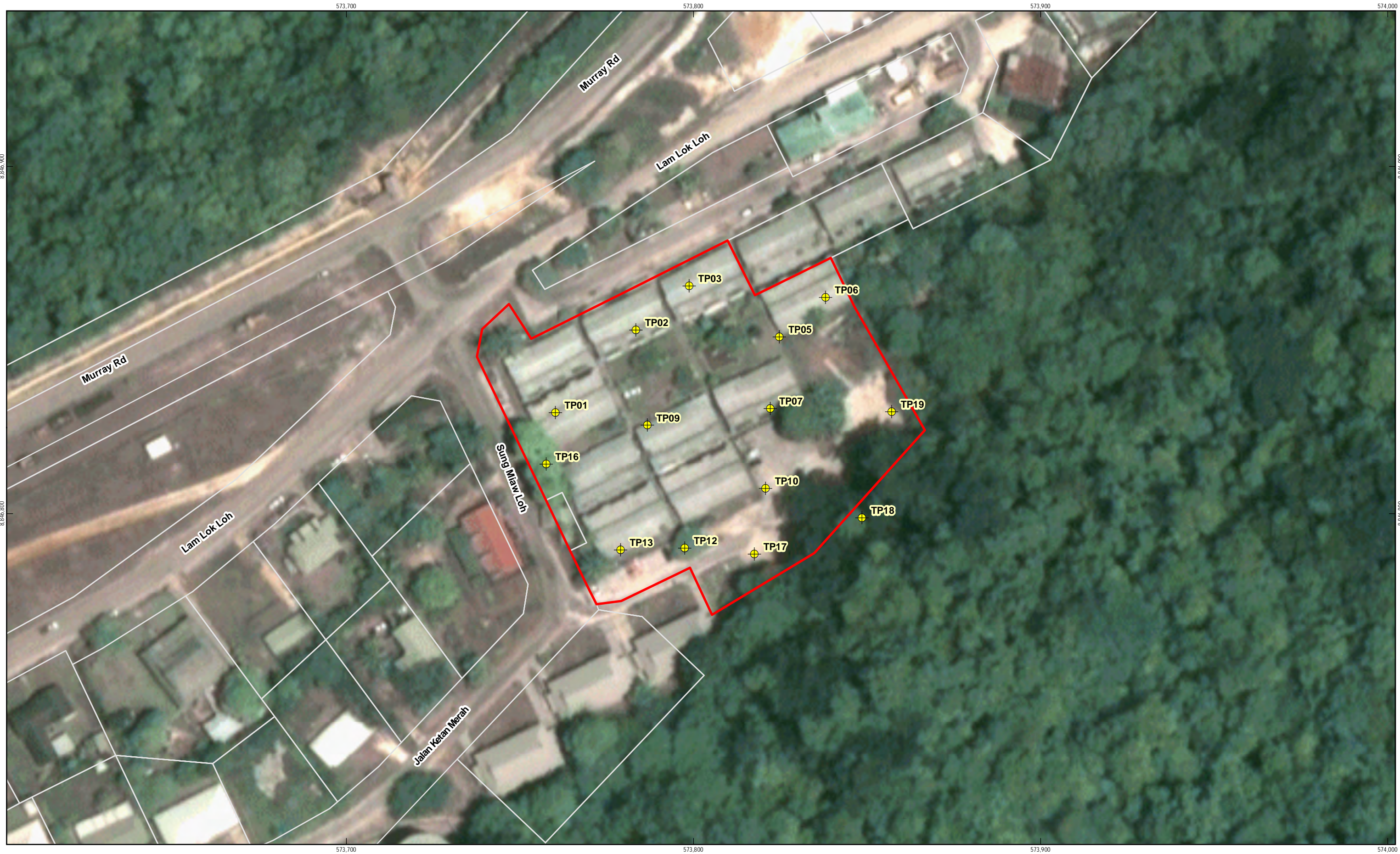
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GHD House, 239 Adelaide Tce Perth WA 6004
 PO Box Y3106 Perth WA 6832 Australia
 T 61 8 6222 8222 F 61 8 6222 8555
 E pemail@ghd.com.au W www.ghd.com

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Approved Date	This Drawing must not be used for Construction unless signed as Approved	

Client **REGIONAL AUSTRALIA**
 Project **DRUM SITE**
 Title **WALK OVER INSPECTION NOTES**

Original Size **A1** Drawing No: **61-2659113-Figure 3** Rev: **A**



- LEGEND**
-  Test Pit
 -  Study Area
 -  Cadastre

Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia
 Grid: Map Grid of Australia 1994, Zone 48



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Department of Regional Australia
 Regional Development and Local Government
 New Housing Program on Christmas Island

Study Area and Geotechnical Investigation Test Locations

Job Number	61-26591-13
Revision	0
Date	20 May 2011

Figure 4



Appendix B
Rock Fall Photograph



ROCK FALL PHOTOGRAPH

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113
Date: 6 April 2011



Plate 12: Photograph of boulders at southern boundary of site



Appendix C
Test Pit Engineering Logs



TEST EXCAVATION LOG

Test Pit
No.:

TP01

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 760, N 8846 829
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +196.0m CIHD **Total Depth:** 1.9m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NW/SE	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	Groundwater was not encountered	0.75 +195.3			SP	GRAVELLY SAND with SILT Brown, fine to coarse grained, subangular. gravel of brick and limestone fragments. FILL At 0.4m boulder of limestone	D	MD	0.00 0.25	D		
1		1.9 +194.1			SP	GRAVELLY SAND with SILT Yellow brown, spotted white, fine to medium grained. Gravel is fine to medium grained subangular of limestone. Below 1.6m becoming light yellow brown, increasing content of limestone gravel with trace of boulders of limestone up to 400mm diameter. LIMESTONE Light grey, slightly weathered to fresh, high strength. Irregular surface extends from 1.2m to base of pit.		MD	1.30 1.50	D		1
2						Termination Depth = 1.90m (Refusal)						2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP02

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 783, N 8846 853
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +196.0m CIHD **Total Depth:** 1.1m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NW/SE	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.3 +195.7			SMG	SILTY SAND with GRAVEL Friable, brown, fine to medium grained. Silt is high plasticity. Gravel is fine to medium grained, of brick and limestone fragments.	D	MD				1
		1.1 +194.9			SM	FILL Concrete block from old foundation at end of pit. SILTY SAND with GRAVEL Orange brown, fine to medium grained. silt is high plasticity. Gravel is fine to coarse grained subangular of limestone. With boulders of limestone			0.80 1.00	D		1
2						Termination Depth = 1.10m (Target Depth)						2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP03

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 799, N 8846 866
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +197.0m CIHD **Total Depth:** 1.5m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045 **Excavation Width (m):** Not Recorded **Logged:** GW 06-Apr-11
Bucket Size (m): 0.4 **Excavation Length (m):** Not Recorded **Processed:** GW 29-Jul-11
Orientation/ Bearing: NE/SW **Checked:** 29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.25	Groundwater was not encountered	+196.8			SM	SILTY SAND Friable, brown, fine to medium grained. Silt is high plasticity. Trace Gravel of fine to medium grained brick and limestone fragments.	D	MD				0.25
1.5		+195.5			SM	FILL SILTY SAND Orange brown, fine to medium grained. Silt is high plasticity. Trace of fine grained subangular gravel of limestone. At 0.6m boulder of slightly weathered to fresh, high strength limestone.						1.5
1.5						Termination Depth = 1.50m (Refusal)						1.5



TEST EXCAVATION LOG

Test Pit
No.:

TP05

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 825, N 8846 851
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +198.0m CIHD **Total Depth:** 1.8m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NE/SW	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.15 +197.9			SM	SILTY SAND Brown, fine to medium grained. Silt is high plasticity. Trace of fine grained gravel of limestone. FILL	D	MD				1
2		1.8 +196.2			SM	SILTY SAND with GRAVEL Orange brown, fine to coarse grained. Silt is high plasticity, gravel is fine grained limestone. LIMESTONE Light grey, distinctly weathered, low strength. Irregular surface, crosses pit between 0.4m depth and base of pit.			0.60	B		2
3						Termination Depth = 1.80m (Refusal)						3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP06

Sheet 1 of 1

Client:	Department of Regional Australia	Coordinates:	E 573 838, N 8846 862
Project:	Christmas Island New Housing Project - Project 1 Drumsite	Ground Surface Elevation:	+198.0m CIHD Total Depth: 2.2m
Job No.:	61/26591/13	Commenced:	06-Apr-11 Completed: 06-Apr-11
		Contractor:	Acker Pty Ltd

Equipment:	YANMAR V1045	Excavation Width (m):	Not Recorded	Logged:	GW	06-Apr-11
Bucket Size (m):	0.4	Excavation Length (m):	Not Recorded	Processed:	GW	29-Jul-11
		Orientation/ Bearing:	NE/SW	Checked:		29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
		0.25 +197.8			SM	SILTY SAND Dark brown, fine to medium grained. Silt is high plasticity. Trace of fine to medium grained subangular gravel of limestone and brick fragments. With roots.	D	MD				
		0.9 +197.1			SM	FILL SILTY SAND Orange brown, fine to coarse grained with trace of fine grained gravel of limestone. Silt is medium plasticity.						
1	Groundwater was not encountered				SP	SAND with SILT and GRAVEL Orange brown, fine to coarse grained. Silt is high plasticity, gravel is fine to coarse grained of limestone.			1.00	D		
						At 1.5m cobble of light grey limestone. At 1.6m becomes light yellow brown.					Below 1.5m becoming harder to excavate	
2												
		2.2 +195.8				Termination Depth = 2.20m (End of Reach)			2.10	D		
3												
4												
5												



TEST EXCAVATION LOG

Test Pit
No.:

TP07

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 822, N 8846 830
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +200.0m CIHD **Total Depth:** 1.1m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NW/SE	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.25 +199.8			SMG	SILTY SAND with GRAVEL Light yellow brown, fine to medium grained. Silt is high plasticity. Gravel is Fine to medium grained, subangular, of limestone and roots.	D	MD				1
		0.8 +199.2			SM	At 0.5m a concrete block at end of pit. FILL SILTY SAND with GRAVEL Friable, orange brown, fine to medium grained. Silt is high plasticity. Gravel is fine to medium grained, subangular, of limestone and trace of subangular blocky cobbles of limestone.		HS				
		1.1 +198.9				LIMESTONE Light grey, slightly decomposed to fresh, high strength. Irregular surface, possibly a boulder.			1.00	R		
						Termination Depth = 1.10m (Refusal)						
2												2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP09

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 787, N 8846 826
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +199.0m CIHD **Total Depth:** 1.7m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045 **Excavation Width (m):** Not Recorded **Logged:** GW 06-Apr-11
Bucket Size (m): 0.4 **Excavation Length (m):** Not Recorded **Processed:** GW 29-Jul-11
Orientation/ Bearing: NW/SE **Checked:** 29-Jul-11

Depth Scale (m)	Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.3	Groundwater was not encountered	+198.7			SMG	SILTY SAND with GRAVEL Light brown, fine to medium grained. Silt is high plasticity. Gravel is fine to medium grained, subangular, of limestone and brick fragments. With roots.	D	MD				0.3
1.7		+197.3			SM	FILL SILTY SAND Brown, fine to medium grained. Silt is high plasticity. Trace of limestone gravel. At 0.4m boulder of limestone below 0.8m becomes orange brown			0.90	D		1.7
1.7						Below 1.6m gravel content increases. Termination Depth = 1.70m (End of Reach)						1.7



TEST EXCAVATION LOG

Test Pit
No.:

TP10

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 821, N 8846 807
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +201.0m CIHD **Total Depth:** 1.6m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045 **Excavation Width (m):** Not Recorded **Logged:** GW 06-Apr-11
Bucket Size (m): 0.4 **Excavation Length (m):** Not Recorded **Processed:** GW 29-Jul-11
Orientation/ Bearing: NW/SE **Checked:** 29-Jul-11

Depth Scale (m)	Water	Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.3	Groundwater was not encountered	+200.7			SMG	GRAVELLY SILTY SAND Friable, light brown, fine to medium grained. Silt is high plasticity. Gravel is fine to coarse grained of limestone.	D	MD				0.3
1.6		+199.4			SM	FILL GRAVELLY SILTY SAND Brown, fine to medium grained. Silt is high plasticity. Gravel is coarse grained of limestone. with cobbles and trace boulders of limestone. Below 1.6m becoming orange brown and limestone cobble and boulder content increasing.						1.6
1.6						Termination Depth = 1.60m (Refusal)						1.6



TEST EXCAVATION LOG

Test Pit
No.:

TP12

Sheet 1 of 1

Client:	Department of Regional Australia	Coordinates:	E 573 797, N 8846 790
Project:	Christmas Island New Housing Project - Project 1	Ground Surface Elevation:	+200.0m CIHD Total Depth: 2.0m
	Drumsite	Commenced:	06-Apr-11 Completed: 06-Apr-11
Job No.:	61/26591/13	Contractor:	Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
Bucket Size (m): 0.4	Orientation/ Bearing: NW/SE	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m)/ [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
		0.15 +199.9			SMG	SILTY SAND with GRAVEL Friable, fine to medium grained. Silt is high plasticity. gravel is fine grained, subangular, of limestone.	D	MD				
					SP	FILL Concrete block from old foundation at end of pit. GRAVELLY SAND with SILT Friable, orange brown, fine to coarse grained. Gravel is fine to coarse grained of limestone. Silt is high plasticity. At 1.1m boulder of limestone. Becoming lighter and gravel content increasing with depth.						
1	Groundwater was not encountered											1
2		2 +198.0				Termination Depth = 2.00m (End of Reach)				1.90 B		2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP13

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 779, N 8846 790
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +200.0m CIHD **Total Depth:** 1.1m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NE/SW	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.2 +199.8			SM	SILTY SAND Dark brown, fine to medium grained. Silt is high plasticity. trace of gravel, fine grained, subangular of limestone. With roots.	D	MD				1
		1			SM	FILL SILTY SAND with GRAVEL Friable, orange brown, fine to medium grained. Silt is high plasticity. Gravel is fine to coarse grained, subangular, of limestone			0.90	R		
		+198.9				LIMESTONE Light grey, slightly weathered limestone, high strength. Irregular pinnacled surface. Weaker strength and excavatable initially. Termination Depth = 1.10m (Refusal)		HS				
2											2	
3											3	
4											4	
5											5	



TEST EXCAVATION LOG

Test Pit
No.:

TP16

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 758, N 8846 814
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +199.0m CIHD **Total Depth:** 1.7m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045 **Excavation Width (m):** Not Recorded **Logged:** GW 06-Apr-11
Bucket Size (m): 0.4 **Excavation Length (m):** Not Recorded **Processed:** GW 29-Jul-11
Orientation/ Bearing: NE/SW **Checked:** 29-Jul-11

Depth Scale (m)	Water	Depth (m) [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
0.15	Groundwater was not encountered	+198.9			SM	SILTY SAND Friable, dark brown, fine to medium grained. Silt is high plasticity. Trace of gravel, fine grained, of limestone.	MD					0.15
1.0					SM	GRAVELLY SILTY SAND Friable, orange brown, fine to coarse grained. Silt is high plasticity. Gravel is fine to coarse grained subangular limestone. Below 1.2m becoming lighter. At 0.4m a root. LIMESTONE Light grey, high strength, irregular surface from 0.4m to base of pit, possibly an irregular boulder.						0.80
1.7		+187.3				Termination Depth = 1.70m (Near Refusal)						1.7
2.0												2.0
3.0												3.0
4.0												4.0
5.0												5.0



TEST EXCAVATION LOG

Test Pit
No.:

TP17

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 818, N 8846 788
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +202.0m CIHD **Total Depth:** 0.5m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: N/S	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	+201.9 0.45 +201.5			SM SM	<p>SILTY SAND Dark brown, fine to medium grained. Silt is high plasticity. with general refuse and roots. FILL</p> <p>SILTY SAND with GRAVEL Orange brown, fine to medium grained. Silt is high plasticity. Gravel is fine to coarse grained subangular gravel of limestone. Trace of roots.</p> <p>LIMESTONE High strength, light grey, slightly weathered to fresh limestone. Weak, excavatable upper margin. Termination Depth = 0.50m (Refusal)</p>	D	MD HS				1
2												2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP18

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 848, N 8846 799
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +201.0m CIHD **Total Depth:** 0.9m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NW/SE	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.3 +200.7			SM	SILTY SAND Dark brown, fine to medium grained. Silt is high plasticity. trace of roots. FILL / TOPSOIL	D	MD				1
		0.9 +200.1			GP	SANDY GRAVEL with COBBLES Off white and light brown. Gravel is medium to coarse grained subangular of limestone. Cobbles are subrounded of limestone. FILL / COLLUVIUM? LIMESTONE Light grey, slightly weathered to fresh, high strength. Irregular surface from 0.6m to base of pit. Termination Depth = 0.90m (Refusal)		D				
2												2
3												3
4												4
5												5



TEST EXCAVATION LOG

Test Pit
No.:

TP19

Sheet 1 of 1

Client: Department of Regional Australia **Coordinates:** E 573 857, N 8846 829
Project: Christmas Island New Housing Project - Project 1 **Ground Surface Elevation:** +202.0m CIHD **Total Depth:** 1.5m
 Drumsite **Commenced:** 06-Apr-11 **Completed:** 06-Apr-11
Job No.: 61/26591/13 **Contractor:** Acker Pty Ltd

Equipment: YANMAR V1045	Excavation Width (m): Not Recorded	Logged: GW	06-Apr-11
Bucket Size (m): 0.4	Excavation Length (m): Not Recorded	Processed: GW	29-Jul-11
	Orientation/ Bearing: NE/SW	Checked:	29-Jul-11

Depth Scale (m)	Water	Depth (m) / [Elev.]	Geological Unit	Graphic Log	Classification	Strata Description <small>(type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)</small>	Moisture Condition	Consistency/Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater was not encountered	0.15 +201.9			SM	SILTY SAND Dark brown, fine to medium grained. Silt is high plasticity. trace of roots.	D	MD				
		0.4 +201.6			GP	FILL / TOPSOIL		D				
		1.5 +206.5			SM	SANDY GRAVEL Off white. Gravel is fine to coarse grained subrounded to rounded of limestone, Trace Silt SILTY SAND with GRAVEL Orange brown, fine to coarse grained, Silt is high plasticity, Gravel is fine to medium grained, subrounded, of limestone LIMESTONE Light grey, highly weathered, low strength. irregular surface from 0.9m to base of pit. Possible boulder.		MD	0.60	B		
2					Termination Depth = 1.50m (Refusal)						2	
3												3
4												4
5												5



Appendix D
Test Pit Photographs



TEST PIT PHOTOGRAPHS

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113
Date: 6 April 2011



Plate 01: TP01



Plate 02: TP03



TEST PIT PHOTOGRAPHS

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113

Date: 6 April 2011



Plate 03: TP05



Plate 04: TP09



TEST PIT PHOTOGRAPHS

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113

Date: 6 April 2011



Plate 05: TP10



Plate 06: TP12



TEST PIT PHOTOGRAPHS

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113

Date: 6 April 2011



Plate 07: TP13



Plate 08: TP16



TEST PIT PHOTOGRAPHS

Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113

Date: 6 April 2011



Plate 09: TP17



Plate 10: TP18



Project: Christmas Island New Housing Project – Project 1
Drumsite

Job No: 61/2659113
Date: 6 April 2011



Plate 11: TP19



Appendix E
Laboratory Test Records



TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5289
Lab:	Welshpool	Sample ID:	TP01 (0.0m - 0.25m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 21.9

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



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Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5289-S200
Page: 1

ABN: 44 000 964 278
 ph: 1300 781 744
 fx: (08) 9458 3700

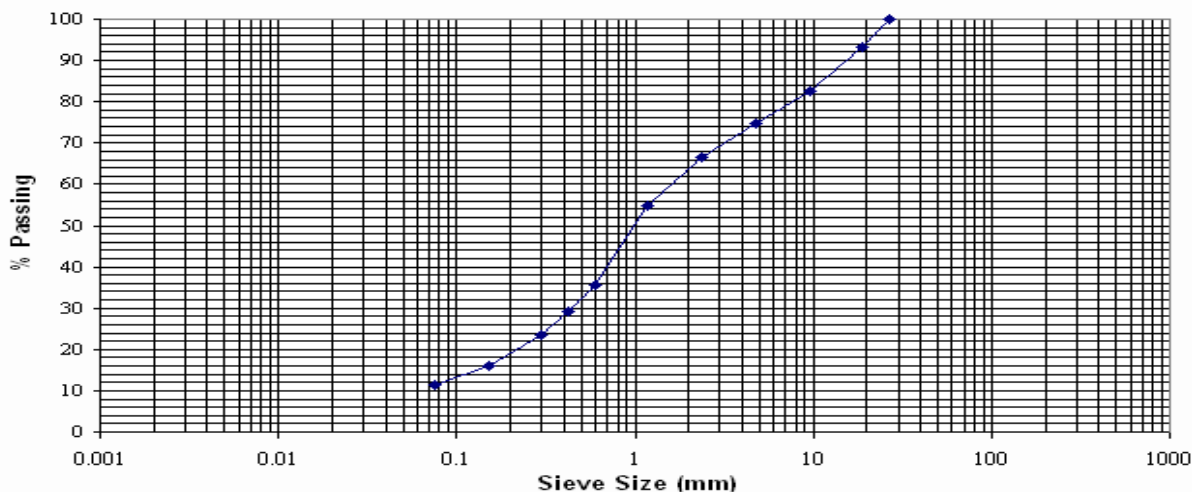
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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5289
Lab:	Welshpool	Sample ID:	TP01 (0.0m - 0.25m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	67
		1.18	55
		0.600	36
26.5	100	0.425	29
19.0	93	0.300	23
9.5	83	0.150	16
4.75	75	0.075	12

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S301.LCER/A/01.01.2009

Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
 Cert No.: 11-MT-5289-S301
 Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	30/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5289
Lab:	Welshpool	Sample ID:	TP01 (0.0m - 0.25m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 49

AS 1289.3.2.1

Plastic Limit (%): 30

AS1289.3.3.1

Plastic Index (%): 19

AS 1289.3.4.1

Linear Shrinkage (%): 6.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Oven Dried <50°C

Method of Preparation Dry Sieved

Note: Sample supplied by client.

Approved Signatory:



(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements



TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5290
Lab:	Welshpool	Sample ID:	TP01 (1.3m - 1.5m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 24.9

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5290-S200
Page: 1

ABN: 44 000 964 278
 ph: 1300 781 744
 fx: (08) 9458 3700

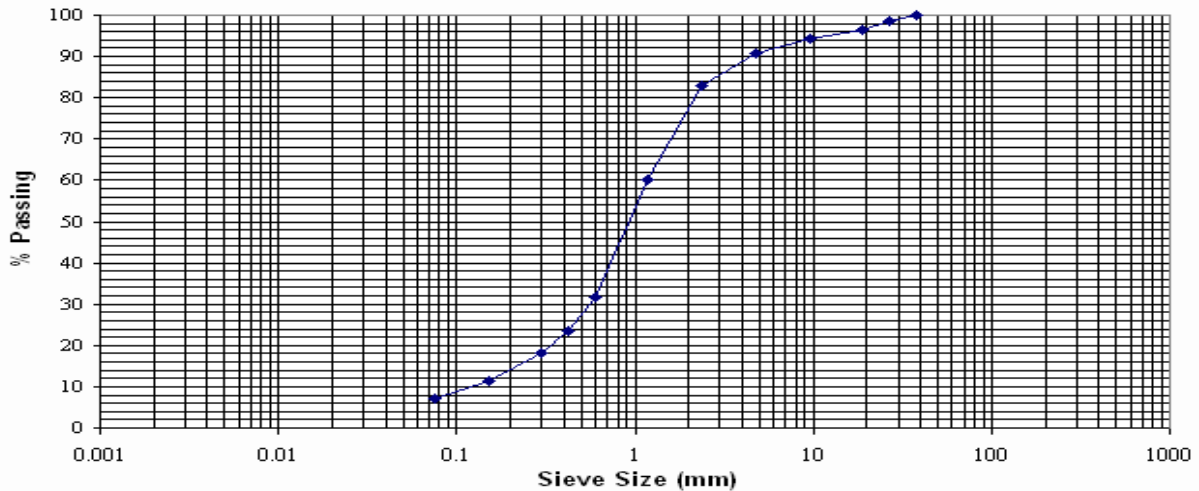
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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5290
Lab:	Welshpool	Sample ID:	TP01 (1.3m - 1.5m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	83
		1.18	60
37.5	100	0.600	32
26.5	99	0.425	23
19.0	96	0.300	18
9.5	94	0.150	11
4.75	91	0.075	7

Note: Sample supplied by client.

Approved Signatory: (Anthony.Harrap)

Date: 13/07/2011



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PO Box 219 Bentley WA 6982
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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 32.6

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

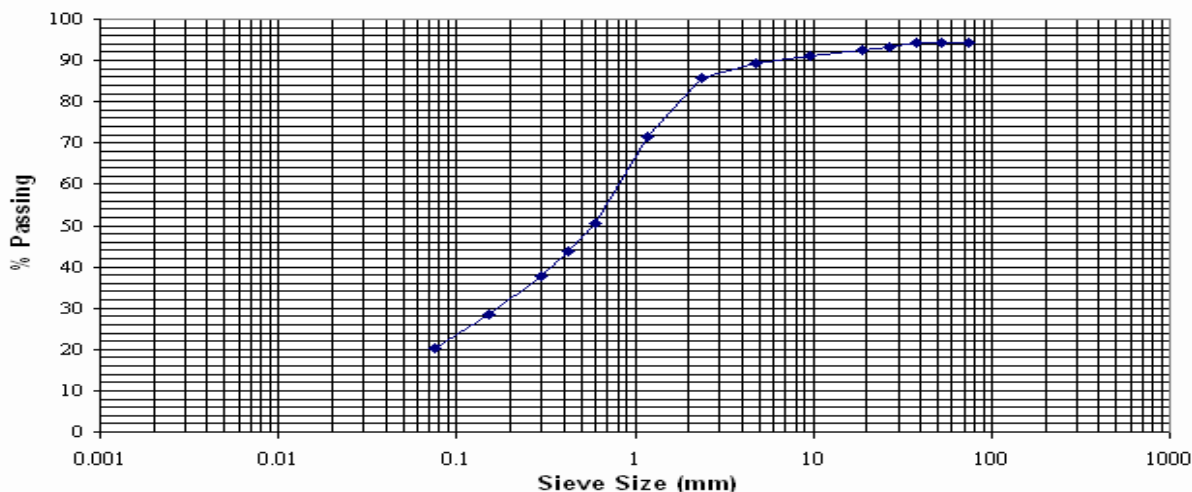
Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5292-S200
Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
0.0	100	2.36	86
75.0	94	1.18	72
53.0	94	0.600	51
37.5	94	0.425	44
26.5	93	0.300	38
19.0	92	0.150	29
9.5	91	0.075	20
4.75	89		

Note: Sample supplied by client.

Approved Signatory: (Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements



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SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	29/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 58

AS 1289.3.2.1

Plastic Limit (%): 33

AS1289.3.3.1

Plastic Index (%): 25

AS 1289.3.4.1

Linear Shrinkage (%): 11.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Oven Dried <50°C

Method of Preparation Dry Sieved

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S311.LCER/B/27.05.09

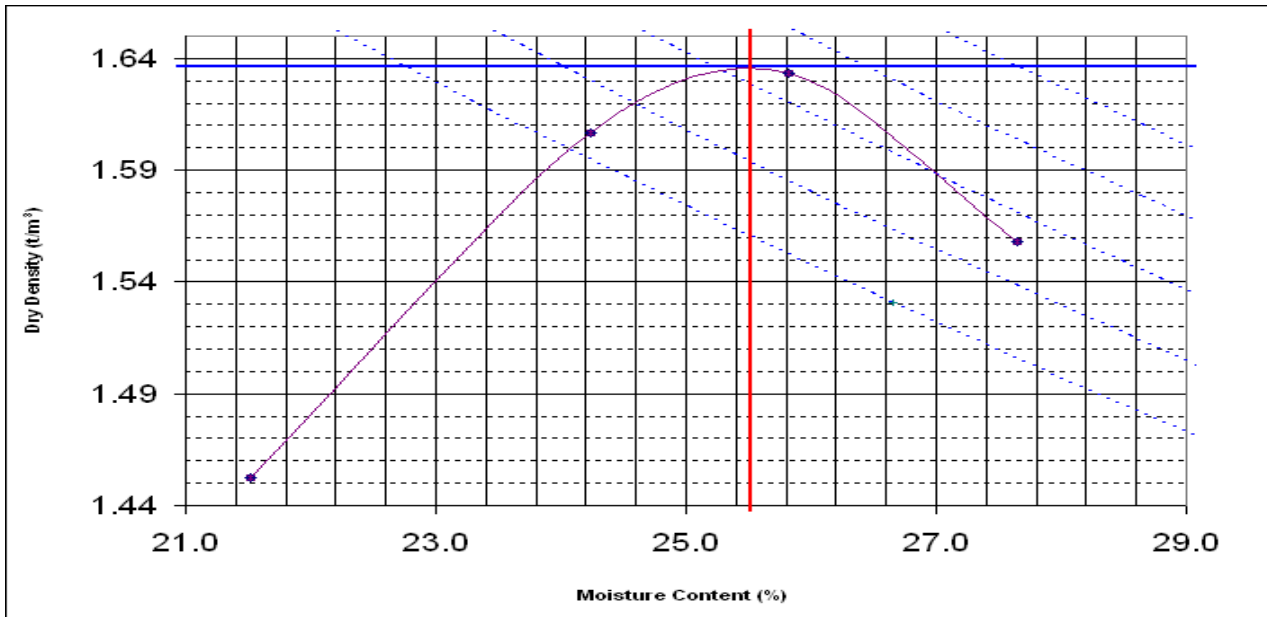
Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5292-S311
Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	30/12/1899	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

DRY DENSITY/MOISTURE CONTENT RELATIONSHIP OF A SOIL

AS 1289.5.2.1 (Modified Compactive Effort)



Modified Effort	
Maximum Dry Density (t/m³)	1.64
Optimum Moisture Content (%)	25.5
% Retained 19.0mm	6
% Retained 37.5mm	5
Air Voids Curves:	Voids %: 0 - 2 - 4 - 6 - 8 at SPD: 2.99

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	30/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

METHOD FOR DETERMINATION OF CALIFORNIA BEARING RATIO

AS1289.6.1.1 (Soaked)

SOAKED

MODIFIED

COMPACTIVE EFFORT USED:

Rammer Mass (kg):	4.9
Drop Height (mm):	450
No. of Layers	5
No. Blows/Layer	10

MOISTURE CONTENTS:

At Compaction:	24.7 % - 97 % OMC
After Soaking:	26.5 % - 104 % OMC

AFTER PENETRATION

Top 30mm:	27.2
Remaining Depth (mm):	27.1

DRY DENSITY

At Compaction:	1.62 t/m ³ - 99 %MDD
After Soaking:	1.62 t/m ³ - 99 %MDD

SOAKING DETAILS

Swell (%) - Soaking Period	0 % - 4 Days
Surcharge (kg):	4.5

MAXIMUM DRY DENSITY

1.64 t/m³ @ OMC:25.5%

Acc. To: AS1289.5.2.1

Referenced from: MT-5292

CALIFORNIA

BEARING RATIO: 25 % At 5.0mm Penetration

% Retained 19.0mm: 8 (Not Replaced)

Note: Sample supplied by client.

Approved Signatory:

Paul Murray

(Paul .Murray)

Date: 15/07/2011



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TEST CERTIFICATE

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	14/07/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5292
Lab:	Welshpool	Sample ID:	TP05 (0.6m - 0.7m)

DETERMINATION OF THE SHRINKAGE INDEX OF A SOIL - SHRINK-SWELL INDEX

AS 1289.7.1.1

SWELL TEST

Initial Moisture Content: 32.1 %

Final Moisture Content: 32.3 %

SHRINKAGE TEST

Moisture Content: 32.0 %

Estimated Percent

Significant Inert Inclusions: 0

Extent of Crumbling: non

Extent of Cracking: diametrial

SHRINK - SWELL

INDEX (Iss): 2.7

Sample Description: dark reddish brown silty
CLAY

Note: Sample supplied by client.

Approved Signatory:  (Qader.Yazdari)

Date: 21/07/2011

Form No.PF-(AU)-[IND(MTE)]-TE-Z300.LCER/A/23.02.2011

Site No.: 2411
Cert No.: 11-MT-5292-Z300
Page: 1

Client Address: PO Box Y3106 Perth WA 6832



TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

ABN: 44 000 964 278
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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5293
Lab:	Welshpool	Sample ID:	TP06 (1.0m - 1.1m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 28.0

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5293-S200
Page: 1

ABN: 44 000 964 278
 ph: 1300 781 744
 fx: (08) 9458 3700

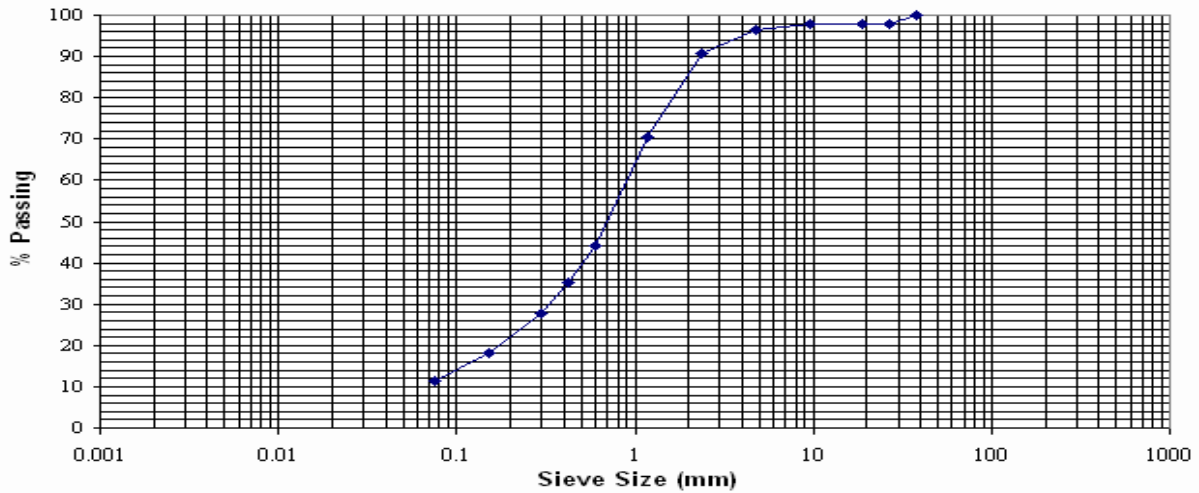
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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5293
Lab:	Welshpool	Sample ID:	TP06 (1.0m - 1.1m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	91
		1.18	70
37.5	100	0.600	44
26.5	98	0.425	35
19.0	98	0.300	28
9.5	98	0.150	18
4.75	96	0.075	12

Note: Sample supplied by client.

Approved Signatory: (Anthony.Harrap)

Date: 13/07/2011



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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	29/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5293
Lab:	Welshpool	Sample ID:	TP06 (1.0m - 1.1m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 56

AS 1289.3.2.1

Plastic Limit (%): 30

AS1289.3.3.1

Plastic Index (%): 26

AS 1289.3.4.1

Linear Shrinkage (%): 9.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Oven Dried <50°C

Method of Preparation Dry Sieved

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S311.LCER/B/27.05.09

Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5293-S311
Page: 1



TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5294
Lab:	Welshpool	Sample ID:	TP06 (2.1m - 2.2m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 27.6

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

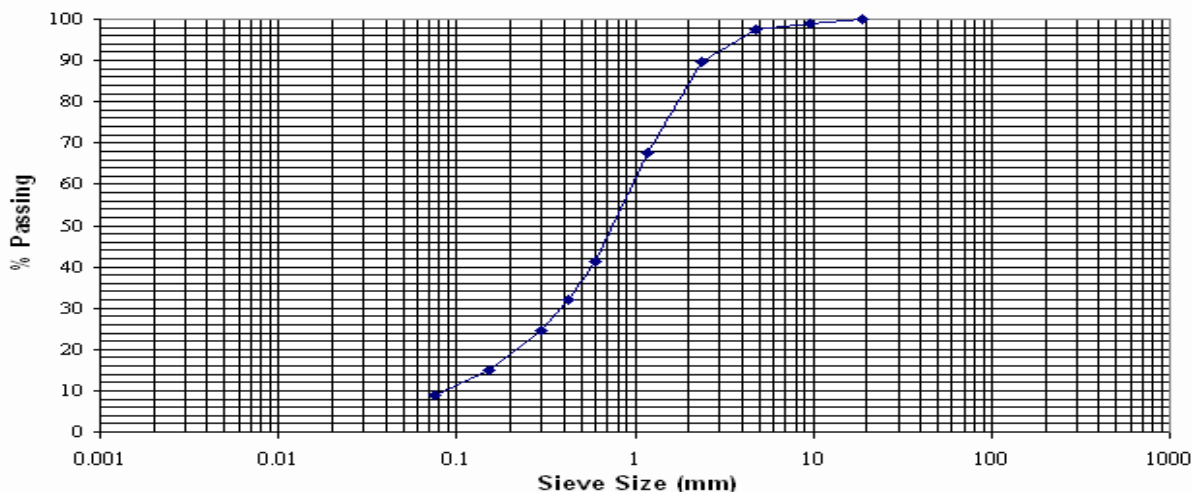
Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5294-S200
Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5294
Lab:	Welshpool	Sample ID:	TP06 (2.1m - 2.2m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
		2.36	90
		1.18	68
		0.600	41
		0.425	32
19.0	100	0.300	24
9.5	99	0.150	15
4.75	97	0.075	9

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	29/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5294
Lab:	Welshpool	Sample ID:	TP06 (2.1m - 2.2m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 56

AS 1289.3.2.1

Plastic Limit (%): 29

AS1289.3.3.1

Plastic Index (%): 27

AS 1289.3.4.1

Linear Shrinkage (%): 9.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Oven Dried <50°C

Method of Preparation Dry Sieved

Note: Sample supplied by client.

Approved Signatory:



(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements



TEST CERTIFICATE

SGS Australia Pty Ltd
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

ABN: 44 000 964 278
ph: 1300 781 744
fx: (08) 9458 3700

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	8/07/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5295
Lab:	Welshpool	Sample ID:	TP07 1.0m

POINT LOAD INDEX

AS4133.4.1

Test No.: 1

Test Type: I

Platen Separation

D: 60

Specimen Width

W: 81

Load at Failure

P: 6.7

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 1.2

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa) : 1.4

Load (kN): 6.7

Note: Sample supplied by client.

1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory:

(Zahir.Bouali)

Date: 8/07/2011



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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5297
Lab:	Welshpool	Sample ID:	TP12 (1.9m - 2.0m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 35.4

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



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Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

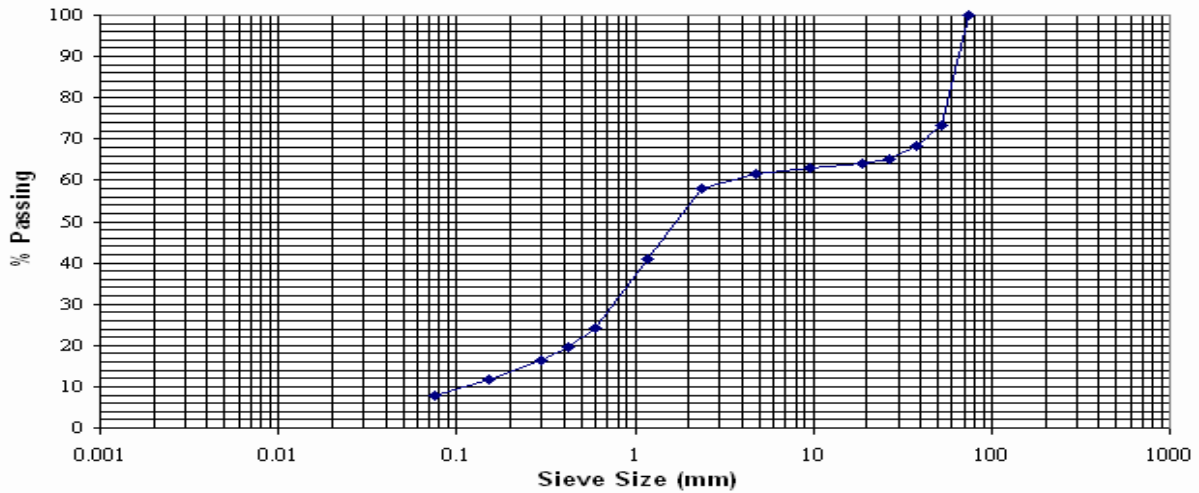
Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5297-S200
Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5297
Lab:	Welshpool	Sample ID:	TP12 (1.9m - 2.0m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
75.0	100	2.36	58
53.0	73	1.18	41
37.5	68	0.600	24
26.5	65	0.425	20
19.0	64	0.300	16
9.5	63	0.150	12
4.75	62	0.075	8

Note: Sample supplied by client.

Approved Signatory: (Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	29/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5297
Lab:	Welshpool	Sample ID:	TP12 (1.9m - 2.0m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 64

AS 1289.3.2.1

Plastic Limit (%): 34

AS1289.3.3.1

Plastic Index (%): 30

AS 1289.3.4.1

Linear Shrinkage (%): 10.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Natural State

Method of Preparation Natural State

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	8/07/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5298
Lab:	Welshpool	Sample ID:	TP13 0.9m

POINT LOAD INDEX

AS4133.4.1

Test No.:	1
Test Type:	I
Platen Separation	
D:	43
Specimen Width	
W:	52
Load at Failure	
P:	8.4
UNCORRECTED POINT LOAD	
STRENGTH Is (MPa):	3.2
CORRECTED POINT LOAD	
STRENGTH Is (50) (MPa) :	3.3
Load (kN):	8.4

Note: Sample supplied by client.

1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory:

(Zahir.Bouali)

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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	22/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5299
Lab:	Welshpool	Sample ID:	TP16 (0.8m - 0.9m)

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 31.9

Note: Sample supplied by client.

Approved Signatory:

(Anthony.Harrap)

Date: 13/07/2011



This document is issued in accordance with NATA's accreditation requirements

Accreditation No.: 2418

Form No. PF-(AU)-[IND(MTE)]-TE-S200.LCER/A/01.01.2009

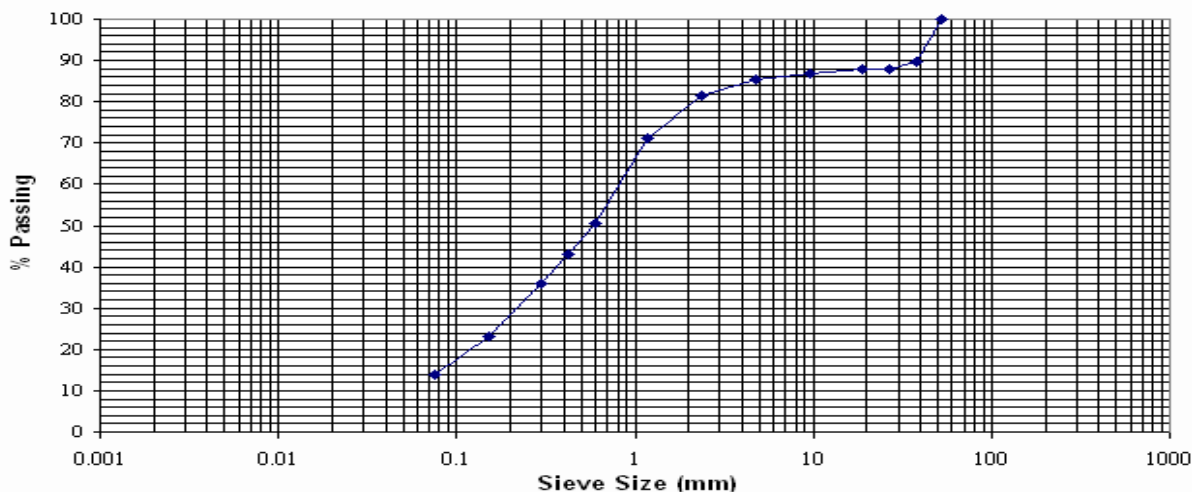
Client Address: PO Box Y3106 Perth WA 6832

Site No.: 2411
Cert No.: 11-MT-5299-S200
Page: 1

Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	23/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5299
Lab:	Welshpool	Sample ID:	TP16 (0.8m - 0.9m)

PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1



Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
53.0	100	2.36	81
37.5	90	1.18	71
26.5	88	0.600	50
19.0	88	0.425	43
9.5	87	0.300	36
4.75	85	0.150	23
		0.075	14

Note: Sample supplied by client.

Approved Signatory: (Anthony.Harrap)

Date: 13/07/2011



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Client:	GHD Services Pty Ltd	Client Job No:	61/2659113
Order No:	53858	Project:	Christmas Island New Housing Project Project 1 Drumsite
Tested Date:	29/06/2011	Location:	
SGS Job Number:	11-01-804	Sample No:	11-MT-5299
Lab:	Welshpool	Sample ID:	TP16 (0.8m - 0.9m)

ATTERBERG LIMITS (PLASTICITY INDEX)

AS1289.3.1.1(Liquid Limit), 3.2.1(Plastic Limit), 3.3.1(Plasticity Index), 3.4.1(Linear Shrinkage)

AS 1289.3.1.1

Liquid Limit (%): 64

AS 1289.3.2.1

Plastic Limit (%): 35

AS1289.3.3.1

Plastic Index (%): 29

AS 1289.3.4.1

Linear Shrinkage (%): 10.0

Nature of Shrinkage Flat

Length of Mould (mm) 125

History of the Sample Oven Dried <50°C

Method of Preparation Dry Sieved

Note: Sample supplied by client.

Approved Signatory:



(Anthony.Harrap)

Date: 13/07/2011



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GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	G. Whatmore	A. Jennings		A. Jennings		
1	T. Mardesic	G. Whatmore		G. Whatmore		29/7/11

EPBC REFERRAL DETAILS



**Notification of
REFERRAL DECISION – not controlled action if undertaken in a particular
manner**

Christmas Island New Housing Program – EPBC 2011/6056

This decision is made under sections 75 and 77A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person named in the referral Department of Regional Australia, Regional Development and Local Government
ABN: 37 862 725 624

proposed action To construct new residential dwellings on Lot 645 Tong Yan Loh, Drumsite, Christmas Island. (See EPBC Referral 2011/6056).

Referral decision: **Not a controlled action if undertaken in a particular manner**

status of proposed action The proposed action is not a controlled action provided it is undertaken in the manner set out in this decision.

Person authorised to make decision

Name and position Richard McAllister
Assistant Secretary
Environment Assessment Branch

signature

date of decision

22 September 2011

manner in which proposed action must be taken

The following measures must be taken to avoid significant impacts on

- The environment from a Commonwealth action (sections 28)

The following mitigation measures must be implemented to minimise impacts on Red Crabs (*Gecarcoidea natalis*):

- 1) Should construction works fall during crab migration then:
 - a) works involving movement or operation of vehicles and machinery on the site must not occur during peak activity time for crabs, that is usually between 6 - 9 am and 3 - 6 pm. (Note: During 2011 crab migration is likely to occur between early November and late December).
 - b) Temporary barrier fencing must be erected to prevent

red crabs from entering the construction area and to guide crabs around the risk zones . Placement of fencing must be done in consultation with Parks Australia staff.

- 2) Red crabs must be physically removed from the worksite if they are at risk of being injured and killed.
 - 3) Vegetation must not be cleared or damaged outside the proposed new boundary area of Lot 645 Tong Yan Loh, Drumsite, (outlined as Area A, B & C in Figure at Attachment 1).
 - 4) Trees to be removed must be felled in a manner ensuring trees fall within the approved clearing area or onto already cleared land.
-
-



Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Referral of proposed action

What is a referral?

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of NES without approval from the Australian Government Environment Minister or the Minister's delegate. (Further references to 'the Minister' in this form include references to the Minister's delegate.) To obtain approval from the Environment Minister, a proposed action should be referred. The purpose of a referral is to obtain a decision on whether your proposed action will need formal assessment and approval under the EPBC Act.

Your referral will be the principal basis for the Minister's decision as to whether approval is necessary and, if so, the type of assessment that will be undertaken. These decisions are made within 20 business days, provided that sufficient information is provided in the referral.

Who can make a referral?

Referrals may be made by or on behalf of a person proposing to take an action, the Commonwealth or a Commonwealth agency, a state or territory government, or agency, provided that the relevant government or agency has administrative responsibilities relating to the action.

When do I need to make a referral?

A referral must be made for actions that are likely to have a significant impact on the following matters protected by Part 3 of the EPBC Act:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Wetlands of international importance (sections 16 and 17B)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Protection of the environment from nuclear actions (sections 21 and 22A)
- Commonwealth marine environment (sections 23 and 24A)
- Great Barrier Reef Marine Park (sections 24B and 24C)
- The environment, if the action involves Commonwealth land (sections 26 and 27A), including:
 - actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land);
 - actions taken on Commonwealth land that may have a significant impact on the environment generally;
- The environment, if the action is taken by the Commonwealth (section 28)
- Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C)

You may still make a referral if you believe your action is not going to have a significant impact, or if you are unsure. This will provide a greater level of certainty that Commonwealth assessment requirements have been met.

To help you decide whether or not your proposed action requires approval (and therefore, if you should make a referral), the following guidance is available from:

- the Policy Statement titled Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Additional sectoral guidelines are also available.
- the Policy Statement titled Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies.

- the interactive map tool (enter a location to obtain a report on what matters of NES may occur in that location).

Can I refer part of a larger action?

In certain circumstances, the Minister may not accept a referral for an action that is a component of a larger action and may request the person proposing to take the action to refer the larger action for consideration under the EPBC Act (Section 74A, EPBC Act). If you wish to make a referral for a staged or component referral, read 'Fact Sheet 6 Staged Developments/Split Referrals' and contact the Referral Business Entry Point (1800 803 772).

Do I need a permit?

Some activities may also require a permit under other sections of the EPBC Act or another law of the Commonwealth. Information is available on the Department's web site.

Is your action in the Great Barrier Reef Marine Park?

If your action is in the Great Barrier Reef Marine Park it may require permission under the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act). If a permission is required, referral of the action under the EPBC Act is deemed to be an application under the GBRMP Act (see section 37AB, GBRMP Act). This referral will be forwarded to the Great Barrier Reef Marine Park Authority (the Authority) for the Authority to commence its permit processes as required under the Great Barrier Reef Marine Park Regulations 1983. If a permission is not required under the GBRMP Act, no approval under the EPBC Act is required (see section 43, EPBC Act). The Authority can provide advice on relevant permission requirements applying to activities in the Marine Park.

The Authority is responsible for assessing applications for permissions under the GBRMP Act, GBRMP Regulations and Zoning Plan. Where assessment and approval is also required under the EPBC Act, a single integrated assessment for the purposes of both Acts will apply in most cases. Further information on environmental approval requirements applying to actions in the Great Barrier Reef Marine Park is available from <http://www.gbrmpa.gov.au/> or by contacting GBRMPA's Environmental Assessment and Management Section on (07) 4750 0700.

The Authority may require a permit application assessment fee to be paid in relation to the assessment of applications for permissions required under the GBRMP Act, even if the permission is made as a referral under the EPBC Act. Further information on this is available from the Authority:

Great Barrier Reef Marine Park Authority

2-68 Flinders Street PO Box 1379

Townsville QLD 4810

AUSTRALIA

Phone: + 61 7 4750 0700

Fax: + 61 7 4772 6093

www.gbrmpa.gov.au

What information do I need to provide?

Completing all parts of this form will ensure that you submit the required information and will also assist the Department to process your referral efficiently.

You can complete your referral by entering your information into this Word file.

Instructions

Instructions are provided in green text throughout the form.

Attachments/supporting information

The referral form should contain sufficient information to provide an adequate basis for a decision on the likely impacts of the proposed action. You should also provide supporting documentation, such as environmental reports or surveys, as attachments.

Coloured maps, figures or photographs to help explain the project and its location should also be submitted with your referral. Aerial photographs, in particular, can provide a useful perspective and context. Figures should be good quality as they may be scanned and viewed electronically as black and white documents. Maps should be of a scale that clearly shows the location of the proposed action and any environmental aspects of interest.

Please ensure any attachments are below two megabytes (2mb) as they will be published on the Department's website for public comment. To minimise file size, enclose maps and figures as separate files if necessary. If unsure, contact the Referral Business Entry Point for advice. Attachments larger than two megabytes (2mb) may delay processing of your referral.

Note: the Minister may decide not to publish information that the Minister is satisfied is commercial-in-confidence.

How do I submit a referral?

Referrals may be submitted by mail, fax or email.

Mail to:

Referral Business Entry Point
Environment Assessment Branch
Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
CANBERRA ACT 2601

- If submitting via mail, electronic copies of documentation (on CD/DVD or by email) are appreciated.

Fax to: 02 6274 1789

- Faxed documents must be of sufficiently clear quality to be scanned into electronic format.
- Address the fax to the mailing address, and clearly mark it as a 'Referral under the EPBC Act'.
- Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

Email to: epbc.referrals@environment.gov.au

- Clearly mark the email as a 'Referral under the EPBC Act'.
- Attach the referral as a Microsoft Word file and, if possible, a PDF file.
- Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

What happens next?

Following receipt of a valid referral (containing all required information) you will be advised of the next steps in the process, and the referral and attachments will be published on the Department's web site for public comment.

The Department will write to you within 20 business days to advise you of the outcome of your referral and whether or not formal assessment and approval under the EPBC Act is required. There are a number of possible decisions regarding your referral:

The proposed action is NOT LIKELY to have a significant impact and does NOT NEED approval. No further consideration is required under the environmental assessment provisions of the EPBC Act and the action can proceed (subject to any other Commonwealth, state or local government requirements).

The proposed action is NOT LIKELY to have a significant impact IF undertaken in a particular manner.

The action can proceed if undertaken in a particular manner (subject to any other Commonwealth, state or local government requirements). The particular manner in which you must carry out the action will be identified as part of the final decision. You must report your compliance with the particular manner to the Department.

The proposed action is LIKELY to have a significant impact and does NEED approval.

If the action is likely to have a significant impact a decision will be made that it is a *controlled action*. The particular matters upon which the action may have a significant impact (such as World Heritage values or threatened species) are known as the *controlling provisions*.

The controlled action is subject to a public assessment process before a final decision can be made about whether to approve it. The assessment approach will usually be decided at the same time as the controlled action decision. (Further information about the levels of assessment and basis for deciding the approach are available on the Department's web site.)

The proposed action would have UNACCEPTABLE impacts and CANNOT proceed

The Minister may decide, on the basis of the information in the referral, that a referred action would have clearly unacceptable impacts on a protected matter and cannot proceed.

Compliance audits

If a decision is made to approve a project, the Department may audit it at any time to ensure that it is completed in accordance with the approval decision or the information provided in the referral. If the project changes, such that the likelihood of significant impacts could vary, you should write to the Department to advise of the changes. If your project is in the Great Barrier Reef Marine Park and a decision is made to approve it, the Authority may also audit it. (See "*Is your action in the Great Barrier Reef Marine Park,*" p.2, for more details).

For more information

- call the Department of Sustainability, Environment, Water, Populations and Communities Community Information Unit on 1800 803 772 or
- visit the web site www.environment.gov.au/epbc

All the information you need to make a referral, including documents referenced in this form, can be accessed from the above web site.

Referral of proposed action

Project title: Christmas Island – New Housing Program

1 Summary of proposed action

1.1 Short description
 The Department of Regional Australia, Regional Development and Local Government is proposing to develop a New Housing Program on Christmas Island (CI). Part of the development involves the construction of new residential dwellings at Drumsite.

1.2 Latitude and longitude – The project has an area of less than 1 ha		Latitude			Longitude		
	location point	degrees	minutes	seconds	degrees	minutes	seconds
	.	10	25	22	105	40	25

1.3 Locality and property description
 The project will occur at Drumsite on Christmas Island. Christmas Island is approximately 2600 km northwest of Perth.

1.4 Size of the development footprint or work area (hectares) The project has a footprint of approximately 1 ha.

1.5 Street address of the site Lot 645 Tong Yan Loh, Drumsite

1.6 Lot description
 Lot 645

1.7 Local Government Area and Council contact (if known)
 Mr Colin Wheadon
 Manager Planning, Building and Health
 Shire of Christmas Island
 PO Box 863
 Christmas Island Indian Ocean 6798.
 Ph: 9164 8300 ext 238, mobile - 0439 215 307

1.8 Time frame													
	<table border="1"> <thead> <tr> <th>Item</th> <th>Date</th> </tr> </thead> <tbody> <tr> <td>Advertise tenders for construction</td> <td>April 2011</td> </tr> <tr> <td>Tenders close (6 week tender period)</td> <td>June 2011</td> </tr> <tr> <td>Award contract</td> <td>July 2011</td> </tr> <tr> <td>Commence construction</td> <td>October 2011</td> </tr> <tr> <td>Practical completion,</td> <td>February 2012</td> </tr> </tbody> </table>	Item	Date	Advertise tenders for construction	April 2011	Tenders close (6 week tender period)	June 2011	Award contract	July 2011	Commence construction	October 2011	Practical completion,	February 2012
Item	Date												
Advertise tenders for construction	April 2011												
Tenders close (6 week tender period)	June 2011												
Award contract	July 2011												
Commence construction	October 2011												
Practical completion,	February 2012												

1.9	Alternatives to proposed action Were any feasible alternatives to taking the proposed action (including not taking the action) considered but are not proposed?	√	No
			Yes, you must also complete section 2.2
1.10	Alternative time frames etc Does the proposed action include alternative time frames, locations or activities?	√	No
			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	State assessment Is the action subject to a state or territory environmental impact assessment?	√	No
			Yes, you must also complete Section 2.5
1.12	Component of larger action Is the proposed action a component of a larger action?	√	No
			Yes, you must also complete Section 2.7
1.13	Related actions/proposals Is the proposed action related to other actions or proposals in the region (if known)?	√	No
			Yes, provide details:
1.14	Australian Government funding Has the person proposing to take the action received any Australian Government grant funding to undertake this project?		No
		√	Yes, provide details: The project will be funded by the Department of Regional Australia, Regional Development and Local Government
1.15	Great Barrier Reef Marine Park Is the proposed action inside the Great Barrier Reef Marine Park?	√	No
			Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

NOTE: It is important that the description is complete and includes all components and activities associated with the action. If certain related components are not intended to be included within the scope of the referral, this should be clearly explained in section 2.7.

2.1 Description of proposed action

This should be a detailed description outlining all activities and aspects of the proposed action and should reference figures and/or attachments, as appropriate.

Construction of 16 two and three bedroom dwellings and associated site works at Drumsite Village.

The location of Drumsite (centre of the island) is shown in Attachment 1 and a layout is provided in Attachment 2.

2.2 Alternatives to taking the proposed action

This should be a detailed description outlining any feasible alternatives to taking the proposed action (including not taking the action) that were considered but are not proposed (note, this is distinct from any *proposed* alternatives relating to location, time frames, or activities – see section 2.3).

Not applicable. The site has been previously cleared levelled and serviced.

2.3 Alternative locations, time frames or activities that form part of the referred action

If you have identified that the proposed action includes alternative time frames, locations or activities (in section 1.10) you must complete this section. Describe any alternatives related to the physical location of the action, time frames within which the action is to be taken and alternative methods or activities for undertaking the action. For each alternative location, time frame or activity identified, you must also complete (where relevant) the details in sections 1.2-1.9, 2.4-2.7, 3.3 and 4. Please note, if the action that you propose to take is determined to be a controlled action, any alternative locations, time frames or activities that are identified here may be subject to environmental assessment and a decision on whether to approve the alternative.

Not applicable.

2.4 Context, planning framework and state/local government requirements

Explain the context in which the action is proposed, including any relevant planning framework at the state and/or local government level (e.g. within scope of a management plan, planning initiative or policy framework). Describe any Commonwealth or state legislation or policies under which approvals are required or will be considered against.

The following policy and legislation has been considered during preparation of this referral:

- The provisions of the Environment Protection and Biodiversity Conservation Act 1999
- Planning and Development Act (2005) (WA) (CI)
- Christmas Island Town Planning Scheme No 1.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

If you have identified that the proposed action will be or has been subject to a state or territory environmental impact statement (in section 1.11) you must complete this section. Describe any environmental assessment of the relevant impacts of the project that has been, is being, or will be carried out under state or territory legislation. Specify the type and nature of the assessment, the relevant legislation and the current status of any assessments or approvals. Where possible, provide contact details for the state/territory assessment contact officer.

Describe or summarise any public consultation undertaken, or to be undertaken, during the assessment. Attach copies of relevant assessment documentation and outcomes of public consultations (if available).

The majority of this site is cleared and has previously had buildings on it. There is remnant infrastructure from this development such as hard stand car parking areas and laneways.

The vegetation dominating the cleared area is the introduced herb *Asystasia cf. chelonoides* with occasional Coffee Bush (*Leucaena leucocephala*) shrubs and subshrubs of Sensitive Plant (*Mimosa pudica*). All three species are introduced. There are mature Mango Trees (*Mangifera indica*) along the western boundary of the site.

The southeast corner of the site consists of relatively mature rainforest with a canopy height of approximately 20m. The dominant tree species is the Strangler Fig (*Ficus microcarpa var.*

microcarpa). The canopy is mature with the epiphytic ferns *Pyrrosia lanceolata* and *Asplenium nidus* (Bird's Nest Fern) abundant. In the understorey are the large palms *Pandanus elatus* and *Arenga listeri* (Christmas Island Palm).

Although the previously cleared area of the site has only a minor northward fall in topography, the south eastern corner (that which is covered by rainforest) rises significantly to the south west with limestone outcropping and boulders present. The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses.

The south eastern corner of the site (within the rainforest) contains Red Crabs (*Gecarcoidea natalis*). Individuals were observed foraging in the site and sheltering in burrows.

The forest of the south east corner of the Drumsite Village could potentially provide some nesting habitat for the Great Frigatebird (*Fregata minor listeri*) which is protected under the EPBC Act as a migratory marine species. However, this area is outside the proposed boundary of the Drumsite development and no current nesting sites have been recorded in or adjacent to this area.

The Department of Sustainability, Environment, Water, Population and Communities provided the locations of Christmas Island Frigatebird colonies in 2003. Attachment 3 indicates colonies within the national park, Flying Fish Cove and Dryers (western side of the island). These areas are more than 2 km from the project area at Drumsite, therefore impacts are not considered likely.

Attachment 4 shows that potentially two trees may be impacted by the project, therefore clearing is minimal.

2.6 Public consultation (including with Indigenous stakeholders)

Your referral must include a description of any public consultation that has been, or is being, undertaken. Where Indigenous stakeholders are likely to be affected by your proposed action, your referral should describe any consultations undertaken with Indigenous stakeholders. Identify the relevant stakeholders and the status of consultations at the time of the referral. Where appropriate include copies of documents recording the outcomes of any consultations.

Public consultation occurred through the Development Application process

2.7 A staged development or component of a larger project

If you have identified that the proposed action is a component of a larger action (in section 1.12) you must complete this section. Provide information about the larger action and details of any interdependency between the stages/components and the larger action. You may also provide justification as to why you believe it is reasonable for the referred action to be considered separately from the larger proposal (e.g. the referred action is 'stand-alone' and viable in its own right, there are separate responsibilities for component actions or approvals have been split in a similar way at the state or local government levels).

Stage 1 of the project will develop approximately 1/2 of the site. Stages 2 and 3 will construct an additional 24 dwellings. These stages will occur on previously disturbed land on Lot 645.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

Describe the affected area and the likely impacts of the proposal, emphasising the relevant matters protected by the EPBC Act. Refer to relevant maps as appropriate. The interactive map tool can help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in your area of interest.

Your assessment of likely impacts should refer to the following resources (available from the Department's web site):

- specific values of individual World Heritage properties and National Heritage places and the ecological character of Ramsar wetlands;
- profiles of relevant species/communities (where available), that will assist in the identification of whether there is likely to be a significant impact on them if the proposal proceeds;
- *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*; and
- associated sectoral and species policy statements available on the web site, as relevant.

Note that even if your proposal will not be taken in a World Heritage area, Ramsar wetland, Commonwealth marine area, the Great Barrier Reef Marine Park or on Commonwealth land, it could still impact upon these areas (for example, through downstream impacts). Consideration of likely impacts should include both direct and indirect impacts.

3.1 (a) World Heritage Properties

Description

There are no World Heritage Properties within the Project area boundary.

Nature and extent of likely impact

Not applicable

3.1 (b) National Heritage Places

Description

The Protected Matters Search Tool indicates that the Project Site is within the "Christmas Island Natural Areas". The status is that of "Ministerial Request for Assessment".

Nature and extent of likely impact

The total area of the housing program is less than 1 ha on predominantly cleared land. The likely impacts is considered minimal based on the previous land disturbance.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

The Protected Matters Search Tool indicates that the Project Area is within 10 km of Hosnies Springs and "the dales". Both are RAMSAR sites.

Nature and extent of likely impact

No impacts are expected based on the Hosnie's Springs is approximately 4 km to the southeast of the Project Area and The Dales are located towards the western side of the island.

3.1 (d) Listed threatened species and ecological communities

Description

There are no listed threatened ecological communities within the Project area boundary.

Nineteen threatened species are listed from the EPBC Act Protected Matters Search.

Nature and extent of likely impact

A risk based assessment of the seven listed threatened species is provided in Attachment 5.

In, summary, the likelihood of these listed threatened species being impacted by the proposed Project is considered negligible.

3.1 (e) Listed migratory species

Description

Nineteen migratory species are listed from the EPBC Act Protected Matters Search.

Nature and extent of likely impact

A risk based assessment of the sixteen listed threatened species is provided in Attachment 5.

In summary, the likelihood of these listed migratory species being impacted by the proposed Project is considered negligible.

3.1 (f) Commonwealth marine area

(If the action is in the Commonwealth marine area, complete 3.2(c) instead. This section is for actions taken outside the Commonwealth marine area that may have impacts on that area.)

Not applicable.

3.1 (g) Commonwealth land

(If the action is on Commonwealth land, complete 3.2(d) instead. This section is for actions taken outside Commonwealth land that may have impacts on that land.)

The project is occurring on Commonwealth Land. Refer to 3.2(d).

Preliminary discussions with the Department of Sustainability, Environment, Water, Population and Communities raised a query in regard to heritage impacts at of the site.

Attachment 6 provided by the Department of Regional Australia shows that the project area (Drumsite Village) is not within the historical Drumsite Historical Area.

Description

If the action will affect Commonwealth land also describe the more general environment. The Policy Statement titled *Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* provides further details on the type of information needed. If applicable, identify any potential impacts from actions taken outside the Australian jurisdiction on the environment in a Commonwealth Heritage Place overseas.

Nature and extent of likely impact

Address any impacts on any part of the environment in the Commonwealth land. Your assessment of impacts should refer to the *Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* and specifically address impacts on:

- ecosystems and their constituent parts, including people and communities;
 - natural and physical resources;
 - the qualities and characteristics of locations, places and areas;
 - the heritage values of places; and
 - the social, economic and cultural aspects of the above things.
-

3.1 (h) The Great Barrier Reef Marine Park

Description
Not applicable

Nature and extent of likely impact
Not applicable

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

You must describe the nature and extent of likely impacts (both direct & indirect) on the whole environment if your project:

- is a nuclear action;
- will be taken by the Commonwealth or a Commonwealth agency;
- will be taken in a Commonwealth marine area;
- will be taken on Commonwealth land; or
- will be taken in the Great Barrier Reef marine Park.

Your assessment of impacts should refer to the *Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* and specifically address impacts on:

- ecosystems and their constituent parts, including people and communities;
- natural and physical resources;
- the qualities and characteristics of locations, places and areas;
- the heritage values of places; and
- the social, economic and cultural aspects of the above things.

3.2 (a)	Is the proposed action a nuclear action?	√	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment

3.2 (b)	Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?		No
		√	Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment
The Department of Regional Australia, Regional Development and Local Government
Refer to Attachment 2 in relation to risk assessment

3.2 (c)	Is the proposed action to be taken in a Commonwealth marine area?	√	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))
Not applicable

3.2 (d)	Is the proposed action to be taken on Commonwealth land?		No
		√	Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))

Refer to Attachment 5 in relation to risk assessment

Preliminary discussions with the Department of Sustainability, Environment, Water, Population and Communities raised a query in regard to heritage impacts at of the site.

Attachment 6 provided by the Department of Regional Australia shows that the project area (Drumsite Village) is not within the historical Drumsite Historical Area.

3.2 (e)	Is the proposed action to be taken in the Great Barrier Reef Marine Park?	√	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))

3.3 Other important features of the environment

Provide a description of the project area and the affected area, including information about the following features (where relevant to the project area and/or affected area, and to the extent not otherwise addressed above). If at Section 2.3 you identified any alternative locations, time frames or activities for your proposed action, you must complete each of the details below (where relevant) for each alternative identified.

3.3 (a) Flora and fauna

The majority of this site is cleared and has previously had buildings on it. There is remnant infrastructure from this development such as hard stand car parking areas and laneways.

The vegetation dominating the cleared area is the introduced herb *Asystasia cf. chelonoides* with occasional Coffee Bush (*Leucaena leucocephala*) shrubs and subshrubs of Sensitive Plant (*Mimosa pudica*). All three species are introduced. There are mature Mango Trees (*Mangifera indica*) along the western boundary of the site.

The southeast corner of the site consists of relatively mature rainforest with a canopy height of approximately 20m. The dominant tree species is the Strangler Fig (*Ficus microcarpa* var. *microcarpa*). The canopy is mature with the epiphytic ferns *Pyrrosia lanceolata* and *Asplenium nidus* (Bird's Nest Fern) abundant. In the understorey are the large palms *Pandanus elatus* and *Arenga listeri* (Christmas Island Palm).

Although the previously cleared area of the site has only a minor northward fall in topography, the south eastern corner (that which is covered by rainforest) rises significantly to the south west with limestone outcropping and boulders present. The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses.

The south eastern corner of the site (within the rainforest) contains Red Crabs (*Gecarcoidea natalis*). Individuals were observed foraging in the site and sheltering in burrows.

The forest of the south east corner of the Drumsite Village could potentially provide some nesting habitat for the Great Frigatebird (*Fregata minor listeri*) which is protected under the EPBC Act as a migratory marine species. However, this area is outside the proposed boundary of the Drumsite development and no current nesting sites have been recorded in or adjacent to this area.

Two trees may be impacted as part of the project (Attachment 4).

3.3 (b) Hydrology, including water flows

The site is predominantly flat and no impacts on hydrology or surface water flows are expected.

3.3 (c) Soil and Vegetation characteristics

Refer to Section 3.3(a) in regard to vegetation characteristics.

The soil has been disturbed and compacted due to previous development.

3.3 (d) Outstanding natural features

Not applicable.

3.3 (e) Remnant native vegetation

Refer to Section 3.3(a)

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

Not applicable

3.3 (g) Current state of the environment

Include information about the extent of erosion, whether the area is infested with weeds or feral animals and whether the area is covered by native vegetation or crops.

The majority of this site is cleared and has previously had buildings on it.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

Preliminary discussions with the Department of Sustainability, Environment, Water, Population and Communities raised a query in regard to heritage impacts at of the site.

Attachment 6 provided by the Department of Regional Australia shows that the project area (Drumsite Village) is not within the historical Drumsite Historical Area.

3.3 (i) Indigenous heritage values

Not applicable

3.3 (j) Other important or unique values of the environment

Describe any other key features of the environment affected by, or in proximity to the proposed action (for example, any national parks, conservation reserves, wetlands of national significance etc).

Not applicable.

3.3 (k) Tenure of the action area (e.g. freehold, leasehold)

The project area is freehold.

3.3 (l) Existing land/marine uses of area

The majority of this site is cleared and has previously had buildings on it.

3.3 (m) Any proposed land/marine uses of area

It is proposed that the land will be used for housing.

4 Measures to avoid or reduce impacts

No significant impacts as a result of the proposed Project are expected.

The Department of Regional Australia, Regional Development and Local Government makes the following management commitments to minimise potential impacts of the Project:

- A construction Environmental Management Plan will be developed for pre-construction, construction and post construction activities associated with the Project. Refer to Attachment 7

5 Conclusion on the likelihood of significant impacts

Identify whether or not you believe the action is a controlled action (ie. whether you think that significant impacts on the matters protected under Part 3 of the EPBC Act are likely) and the reasons why.

5.1 Do you THINK your proposed action is a controlled action?

- No, complete section 5.2
 Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

As detailed in Section 3.1, the action will not impact on any World Heritage properties, National Heritage places, wetlands of international significance or threatened ecological communities.

Due to the nature of the existing land-use and environment, threatened and migratory species identified from the *EPBC Act 1999* Protected Matters Search Tool are considered unlikely to be significantly impacted by the proposed action

5.3 Proposed action IS a controlled action

Type 'x' in the box for the matter(s) protected under the EPBC Act that you think are likely to be significantly impacted. (The 'sections' identified below are the relevant sections of the EPBC Act.)

Matters likely to be impacted

- | | |
|--------------------------|--|
| <input type="checkbox"/> | World Heritage values (sections 12 and 15A) |
| <input type="checkbox"/> | National Heritage places (sections 15B and 15C) |
| <input type="checkbox"/> | Wetlands of international importance (sections 16 and 17B) |
| <input type="checkbox"/> | Listed threatened species and communities (sections 18 and 18A) |
| <input type="checkbox"/> | Listed migratory species (sections 20 and 20A) |
| <input type="checkbox"/> | Protection of the environment from nuclear actions (sections 21 and 22A) |
| <input type="checkbox"/> | Commonwealth marine environment (sections 23 and 24A) |
| <input type="checkbox"/> | Great Barrier Reef Marine Park (sections 24B and 24C) |
| <input type="checkbox"/> | Protection of the environment from actions involving Commonwealth land (sections 26 and 27A) |
| <input type="checkbox"/> | Protection of the environment from Commonwealth actions (section 28) |
| <input type="checkbox"/> | Commonwealth Heritage places overseas (sections 27B and 27C) |

Specify the key reasons why you think the proposed action is likely to have a significant adverse impact on the matters identified above.

6 Environmental record of the responsible party

NOTE: If a decision is made that a proposal needs approval under the EPBC Act, the Environment Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach.

	Yes	No
<p>6.1 Does the party taking the action have a satisfactory record of responsible environmental management?</p> <p>The Department of Regional Australia, Regional Development and Local Government is a responsible land manager with significant land assets in the Indian Ocean Territories. Land is managed in accordance with all applicable Commonwealth environmental legislation.</p>	√	
<p>6.2 Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?</p> <p>If yes, provide details</p>		√
<p>6.3 If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?</p> <p>If yes, provide details of environmental policy and planning framework</p>		√
<p>6.4 Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?</p> <p>Provide name of proposal and EPBC reference number (if known)</p> <ul style="list-style-type: none"> • Community Centre on Cocos (Keeling) Islands, EPBC 2010/5306 • Asbestos Removal on Cocos (Keeling) Islands, EPBC 2009/4887 • Asbestos Removal on Christmas Island, EPBC 2009/4873 • Cocos (Keeling) Islands – Home Island Slipway and Access Channel from Home Island Port Facility to Direction Island EPBC 	√	

7 Information sources and attachments

(For the information provided above)

7.1 References

Department of the Sustainability, Water, Populations and Communities (2011) *Environment Protection and Biodiversity Act 1999* Protected Matters Search Tool. Accessed (14/6/11) online at: http://www.environment.gov.au/cgi-bin/erin/ert/epbc/epbc_report.pl#land for search coordinates: -10.43108, 105.6736, - (1 km buffer area).

7.2 Reliability and date of information

- Department of the Sustainability, Water, Populations and Communities (2011) Environment Protection and Biodiversity Act 1999 Protected Matters Search Tool. Accessed (14/6/11) online at: http://www.environment.gov.au/cgi-bin/erin/ert/epbc/epbc_report.pl#land for search coordinates: -10.43108, 105.6736, - (1 km buffer area).
- Dated: 14 June 2011
- The information is considered a reliable source from a Commonwealth government agency

7.3 Attachments

Indicate the documents you have attached. All attachments must be less than two megabytes (2mb) so they can be published on the Department's website. Attachments larger than two megabytes (2mb) may delay the processing of your referral.

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Attachments 1 and 2
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Attachments 1 and 2
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)		
	copies of any flora and fauna investigations and surveys (section 3)		Attachment 3 – Christmas Island Frigatebird Locations (Source: DSEWPC)
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	Attachment 5 – Risk Assessment Attachment 6 – Heritage information.
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		

8 Contacts, signatures and declarations

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action (which can include a person acting on their behalf); or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action¹.

Project title: Christmas Island – New Housing Program

8.1 Person proposing to take action

This is the individual, government agency or company that will be principally responsible for, or who will carry out, the proposed action.

If the proposed action will be taken under a contract or other arrangement, this is:

- the person for whose benefit the action will be taken; or
- the person who procured the contract or other arrangement and who will have principal control and responsibility for the taking of the proposed action.

If the proposed action requires a permit under the Great Barrier Reef Marine Park Act², this is the person requiring the grant of a GBRMP permission.

The Minister may also request relevant additional information from this person.

If further assessment and approval for the action is required, any approval which may be granted will be issued to the person proposing to take the action. This person will be responsible for complying with any conditions attached to the approval.

If the Minister decides that further assessment and approval is required, the Minister must designate a person as a proponent of the action. The proponent is responsible for meeting the requirements of the EPBC Act during the assessment process. The proponent will generally be the person proposing to take the action³.

Name	Liviu Mihov-Nicotodis Director Capital and Procurement Policy.
Title	Director Capital and Procurement Policy.
Organisation	The Department of Regional Australia, Regional Development and Local Government
ACN / ABN (if applicable)	37 862 725 624
Postal address	PO box 803 Canberra ACT 2601
Telephone	02 6274 7924
Email	Liviu.Mihov-Nicotodis@regional.gov.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be the proponent for this action.
Signature	Date

¹ If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.

² If your referred action, or a component of it, is to be taken in the Great Barrier Reef Marine Park the Minister is required to provide a copy of your referral to the Great Barrier Reef Marine Park Authority (GBRMPA) (see section 73A, EPBC Act). For information about how the GBRMPA may use your information, see http://www.gbrmpa.gov.au/privacy/privacy_notice_for_permits.

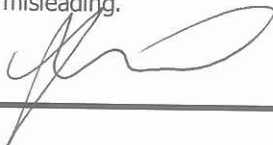
³ If a person other than the person proposing to take action is to be nominated as the proponent, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.

8.2 Person preparing the referral information (if different from 8.1)

Individual or organisation who has prepared the information contained in this referral form.

Name Andrew Nagle
Title Principal Environmental Scientist
Organisation GHD Pty Ltd
ACN / ABN (if applicable) 39 008 488 373
Postal address PO Box 164, Geraldton, WA, 6531
Telephone 08 9920 9401
Email anagle@ghd.com
Declaration I declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature



Date 25 July 2011

REFERRAL CHECKLIST

NOTE: This checklist is to help ensure that all the relevant referral information has been provided. It is not a part of the referral form and does not need to be sent to the Department.

HAVE YOU:

- Completed all required sections of the referral form?
- Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- Provided a map showing the location and approximate boundaries of the project area?
- Provided a map/plan showing the location of the action in relation to any matters of NES?
- Provided complete contact details and signed the form?
- Provided copies of any documents referenced in the referral form?
- Ensured that all attachments are less than two megabytes (2mb)?
- Sent the referral to the Department (electronic and hard copy preferred)?



Attachment 1 – Location Map



House Purchased

AFP Existing HQ

Fuel Storage Settlement

Arenga Close

House Purchased

Chinese Literary Association

Silver City vacant blocks

Service Stn

Tourism Office

Silver City Development Site

New AFP HQ (proposed)

PRL Wharf Infrastructure

Plant Hill Rd

Hospital

Smith Point

Flying Fish Cove Wharf Extension

Waste Water Treatment Plant

Drumsite Village

DIAC Family Camp

DIAC Phosphate Hill Camp

PRL Main Office

Power Station

400 0 400 800 Meters





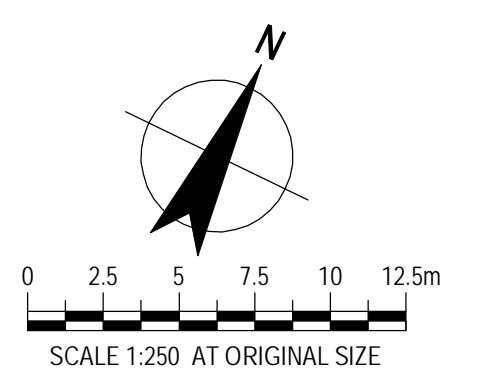
Attachment 2 – Site Layout



- NOTES:**
1. CONTOUR INTERVAL = 0.25m
 2. CADASTRAL EXTRACTED FROM LANDGATE. ACCURACIES VARY FROM 0.002m to 1.000m OVER LOT
 3. SEWER DATA PROVIDED BY WATER CORPORATION AND IS INDICATIVE ONLY.
 4. ONLY VISIBLE SERVICES AND MANHOLES LOCATED AT TIME OF SURVEY.
 5. BOUNDARIES OF SITE HAVE NOT BEEN REPEGGED. FURTHER SURVEY REQUIRED TO VERIFY BOUNDARIES.

LEGEND OF FEATURES

○	SIGN	—	CADASTRAL BOUNDARY
⬮	EARTH PIT	▭	BUILDING
⬮	CABLE DIRECTION MARKER	—	KERB
⬮	DISTRIBUTION BOARD	—	WALL
⬮	ELECTRIC CABLE DOME	—	TOP OF BANK
⬮	POWER METER BOX	—	BOTTOM OF BANK
⬮	LIGHT POLE (ONLY)	—	CHANGE OF GRADE
⬮	COMM PIT	—	EDGE OF CONCRETE
⬮	SEWER IO	—	EDGE OF BITUMEN
⬮	STOP VALVE	—	FENCE LOW
⬮	WATER METER	—	DRIVEWAY
⬮	BOLLARD	—	DRAIN PIPE
⬮	OBVERT	—	SEWER PIPE
⬮	INVERT	—	EDGE OF DRAIN
⬮	NATURAL SURFACE	—	ROAD - BROKEN LINE
⬮	ON ROAD	—	BUSHLINE
⬮	SEWER MANHOLE	—	ROCK OUTCROP
⬮	DRAINAGE MANHOLE		
⬮	DRAINAGE GULLY		
⬮	DRAINAGE SIDE ENTRY PIT		



No	Revision	Note	Drawn	Checked	Approved	Date
3		TOP OF WALL LEVELS ANNOTATED	KSJ*	CM*	CM*	03.03.11
2		WATER CORP SEWER ADDED	KSJ*	CM*	CM*	21.02.11
1		CADASTRAL BOUNDARY ADDED	CM*	CM*	CM*	18.02.11
0		ISSUED FOR INFORMATION	KSJ*	CM*	CM*	18.02.11

GHD CLIENTS | PEOPLE | PERFORMANCE

GHD House, 239 Adelaide Tce Perth WA 6004
 PO Box Y3106 Perth WA 6832 Australia
 T 61 8 6222 8222 F 61 8 6222 8555
 E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

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Drawn	KSJ 18.02.11	Scale	1 : 250m
Drafting Check	CM	Surveyor	DS
Datum	CIHD	Field Book	3592
Grid	MGA 94 Zone 48	Level Book	*
Approved Date			

Client **REGIONAL AUSTRALIA**
 Project **DRUM SITE**
 Title **FEATURE AND LEVEL SURVEY**

Original Size **A1** Drawing No: **61-2659109-V01** Rev: **3**

This Drawing must not be used for Construction unless signed as Approved



Attachment 3 – Christmas Island Frigatebird Locations

Location of CI Frigatebird Colonies on Christmas Island in 2003

Legend

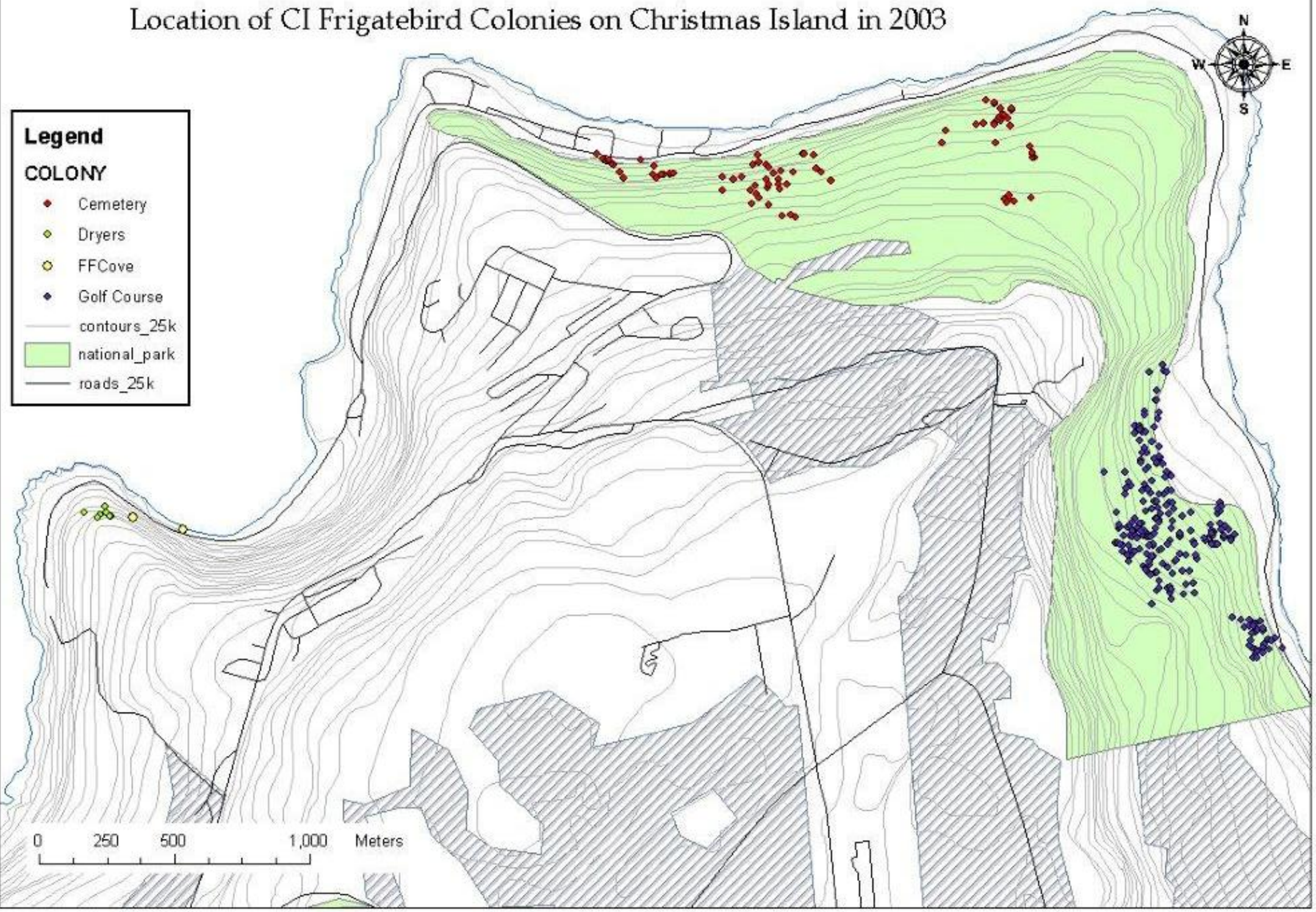
COLONY

- Cemetery
- Dryers
- FFCove
- Golf Course

— contours_25k

■ national_park

— roads_25k





Attachment 4 – Clearing Area



[Territories Office Home](#) [Online Map](#) [Help](#) [Metadata](#) [Documents](#) [Acknowledgements](#) [Disclaimer](#) [Copyright](#)



Imagery ©2011 GeoEye



Attachment 5 – Risk Based Assessment



CLIENTS | PEOPLE | PERFORMANCE

**Department of Regional
Australia, Regional
Development and Local
Government**

Report for Christmas Island -
New Housing Program

*Environment Protection
(Biodiversity Conservation) Act
1999 - Risk Assessment*

June 2011



This Christmas Island - New Housing Program Environment Protection (Biodiversity Conservation) Act 1999 - Risk Assessment ("Report"):

- 1. has been prepared by GHD Pty Ltd or GHD Australia Pty Ltd] ("GHD") for Department of Regional Australia, Regional Development and Local Government.*
- 2. may only be used and relied on by the Department of Regional Australia, Regional Development and Local Government.*
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The services undertaken by GHD in connection with preparing this Report:

- were limited to those specifically detailed in section 1.2 of this Report;*

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report ("Assumptions"), including (but not limited to):

- Commonwealth database accuracy*

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Appendices

- A EPBC Act Protected Matter Report



1. Introduction

1.1 Background

The Department of Regional Australia, Regional Development and Local Government are proposing to construct approximately 32, two and three bedroom dwellings at Drumsite on Christmas Island. Christmas Island is approximately 2600 km north of Perth.

1.2 Scope

A search of the Department of the Sustainability, Environment, Water, Populations and Communities (DSEWPC), *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)* Protected Matters Search Tool was undertaken for the Project area (including a 1 km buffer) was undertaken in June 2011. A copy of the report is contained within Appendix A.

This report provides a risk assessment for those threatened species identified as potentially present in the Project area.

Please note that the site is predominantly cleared of vegetation and this is illustrated in Figure 1.



Figure 1 Project Area – indicating little vegetation (facing north)



2. Risk Analysis

2.1 Risk Assessment Method

A standard risk assessment approach has been used to examine the potential impact to each threatened species identified as potentially occurring within the Project area.

The likelihood (Table 1) and consequence (Table 2) of each action was estimated and the risk matrix (Table 3) used to generate a risk category for each threatened species.

Table 1 Definitions of likelihood used in risk assessment

Likelihood	
Expected	Expected to occur during the life cycle of the species
Probable	Will probably occur at normal circumstances during the life cycle of the species
Moderate	Likely to occur during the life cycle of the species
Unlikely	Unlikely, but possible to occur during the life cycle of the species
Rare	May occur under exceptional circumstances.

Table 2 Definitions of consequence used in risk assessment

Consequence	
Serious	Large scale, adverse effect on ecosystem (e.g. abundance, fecundity, age, structure). Decades to recover.
Significant	Adverse effect on significant local ecosystem factors. Years to decades to recover.
Moderate	Impact causing detectable change in ecosystem factors. Months to years to recover.
Minor	Incidental changes in biota of affected area. Insignificant impact on ecosystem function. Month to recover.
Negligible	Short-term, localised and insignificant impacts. Recover in days to months.



Table 3 Risk assessment matrix

Risk Assessment Matrix		Consequence				
		Serious	Significant	Moderate	Minor	Negligible
Likelihood	Expected	U	U	U	L	N
	Probable	U	U	H	L	N
	Moderate	U	H	L	L	N
	Unlikely	H	H	L	N	N
	Rare	H	L	N	N	N

Where:

Unacceptable (U) = Immediate changes to design or procedures required.

High (H) = Risk reduction measures and monitoring required.

Low (L) = Acceptable risk, monitoring activity and manage as required.

Negligible (N) = Risks are acceptable, no further management.

2.2 Risk Assessment Results

The Department of the Sustainability, Environment, Water, Populations and Communities Protected Matters Search Tool identified a number of threatened fauna species potentially occurring within the Project area. The likelihood of these species occurring in the project area and relevant management actions are provided in Table 4.



Table 4 EPBC Act 1999 listed species potentially found within 5 km of the Project area and their likelihood of presence.

Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
Birds							
<i>Accipiter hiogaster natalis</i> Christmas Island Goshawk	Endangered	Species or species habitat likely to occur within area	The Christmas Island Goshawk is confined to Christmas Island and described as ‘widespread but uncommon’. (DSEWPC, 2011a). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	Christmas Island Goshawks are described on the island. However, as the project site is disturbed and provide little habitat, impacts are highly unlikely and no management actions are necessary.
<i>Chalcophaps indica natalis</i> Emerald Dove (Christmas Island)	Endangered	Species or species habitat may occur within area	The Emerald Dove (Christmas Island) is confined to Christmas Island where it is widespread and common in areas of rainforest (DSEWPC, 2011b). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat.



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Fregata andrewsi</i> Christmas Island Frigatebird	Vulnerable	Breeding known to occur within area	<p>Little is known of the specific habitat requirements of the Christmas Island Frigatebird for breeding. It nests in species of trees that occur throughout Christmas Island, yet it nests in only a small area of the island. It prefers to nest in Indian Almond trees <i>Terminalia catappa</i> (DSEWPC, 2011c).</p> <p>Potential impact could be via habitat disturbance.</p>	Unlikely	Minor	Negligible	<p>No management action is required.</p> <p>The project area is predominantly cleared of vegetation.</p> <p>The vegetation dominating the cleared area is the introduced herb <i>Asystasia cf. chelonoides</i> with occasional Coffee Bush (<i>Leucaena leucocephala</i>) shrubs and subshrubs of Sensitive Plant (<i>Mimosa pudica</i>). There are mature Mango Trees (<i>Mangifera indica</i>) along the western boundary of the site. All four species are introduced.</p> <p>The southeast corner of the site consists of mature rainforest with a canopy height of approximately 20 m. The dominant tree species is the Strangler Fig (<i>Ficus microcarpa var. microcarpa</i>). The canopy is mature with the epiphytic ferns <i>Pyrrhosia lanceolata</i> and <i>Asplenium nidus</i> (Bird's Nest Fern) abundant. In the understorey are the large palms <i>Pandanus elatus</i> and <i>Arenga listeri</i> (Christmas Island Palm).</p>



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Ninox natalis</i> Christmas Island Hawk Owl	Vulnerable	Species or species habitat may occur within area	This species is confined to Christmas Island in the Indian Ocean. This species occupies permanent territories in all forest types on the island, with highest densities in primary forest and lowest in post-mining regrowth (DSEWPC, 2011d). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat
<i>Papasula abbotti</i> Abbott's Booby	Endangered	Breeding known to occur within area	Abbott's Booby is a marine species. It spends much of its time at sea, but needs to come ashore to breed. It nests in tall rainforest trees in the western, central and northern portions of Christmas Island (DSEWPC, 2011e). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	The project is located on the eastern end of the island. No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat.



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Turdus poliocephalus erythropleurus</i> Island Thrush (Christmas Island)	Endangered	Species or species habitat may occur within area	<p>The Island Thrush (Christmas Island) is confined to Christmas Island where it is considered to be widespread. It is common in most habitats, including tall closed evergreen rainforest, open semi-deciduous rainforest, secondary regrowth, thickets of weeds and semi-deciduous vines, settled areas (where it forages on lawns and nests on buildings), and on the Christmas Island golf course (DSEWPC, 2011f).</p> <p>Potential impact could be via habitat disturbance.</p>	Unlikely	Minor	Negligible	<p>No management action is required.</p> <p>The project area is predominantly cleared of vegetation and lacks suitable habitat</p>
Mammals							
<i>Balaenoptera borealis</i> Sei Whale	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based.	Unlikely	Minor	Negligible	Not applicable.



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Balaenoptera musculus</i> Blue Whale	Endangered	Species or species habitat may occur within area	Not applicable as the project is terrestrial based.	Unlikely	Minor	Negligible	Not applicable.
<i>Megaptera novaeangliae</i> Humpback Whale	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based.	Unlikely	Minor	Negligible	Not applicable.
<i>Crocidura attenuata trichura</i> Christmas Island Shrew	Endangered	Species or species habitat may occur within area	The preferred habitat of the Christmas Island Shrew is unknown. However, it is considered widespread and abundant on Christmas Island (DSEWPC, 2011g). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat.



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Pipistrellus murrayi</i> Christmas Island Pipistrelle	Critically Endangered	Species or species habitat may occur within area	The former and current distribution of this species is limited to Christmas Island, in the Indian Ocean. Prior to the 1990s, the species was widespread across the whole island. Since then its distribution has contracted dramatically westwards and it is now only found in the western section of the island (DSEWPC, 2011h). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and the project site is located on the eastern side of the island.
Flora							
<i>Tectaria devexa</i>	Endangered	Species or species habitat likely to occur within area	The DSEWPC, website indicates this species is located in Queensland.	Not applicable	Not applicable	Not applicable	Not applicable. A flora assessment in the project area also did not identify this species.
Reptiles							



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Caretta caretta</i> Loggerhead Turtle	Endangered	Species or species habitat may occur within area	Not applicable as the project is terrestrial based.	Unlikely	Minor	Negligible	Not applicable
<i>Chelonia mydas</i> Green Turtle	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based	Unlikely	Minor	Negligible	Not applicable
<i>Dermochelys coriacea</i> Leatherback Turtle	Endangered	Species or species habitat may occur within area	Not applicable as the project is terrestrial based	Unlikely	Minor	Negligible	Not applicable



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Eretmochelys imbricata</i> Hawksbill Turtle	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based	Unlikely	Minor	Negligible	Not applicable
<i>Natador depressus</i> Flatback turtle	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based	Unlikely	Minor	Negligible	Not applicable
<i>Lepidodactylus listeri</i> Christmas Island Gecko	Vulnerable	Species or species habitat may occur within area	Most abundant in primary rainforest on the plateau, but also occurs in disturbed plateau habitat including secondary forest growth. Least abundant on terraces and absent from mined areas. Does not utilise areas revegetated after mining activities (DSEWPC, 2011i). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat.



Species	Status	Type of Presence	Mechanisms for Contact and Potential Impact	Likelihood	Consequence	Risk	Potential Consequences and Management Actions
<i>Typhlops exocoeti</i> Christmas Island Blind Snake	Vulnerable	Species or species habitat may occur within area	One specimen was collected in 1975 in primary rainforest on the plateau. The site is now cleared land (DSEWPC, 2011j). Potential impact could be via habitat disturbance.	Unlikely	Minor	Negligible	No management action is required. The project area is predominantly cleared of vegetation and lacks suitable habitat.
Sharks							
<i>Rhincodon typus</i> Whale Shark	Vulnerable	Species or species habitat may occur within area	Not applicable as the project is terrestrial based	Unlikely	Minor	Negligible	Not applicable

2.3 Listed migratory species

Nineteen listed migratory species have been recorded within a 1 km radius of the proposed Project area. These species are presented in Table 5. The likelihood of these species being impacted by the Project is considered negligible. This is based on the following factors:

- ▶ The site is predominantly cleared of native vegetation
- ▶ Lack of habitat within the proposed Project area

Table 5 Migratory species potentially found within 1 km of the proposed Project and the likelihood of impact

Scientific Name	Common Name	Type of Presence	Risk of Impact
Migratory Marine Birds			
<i>Fregata andrewsi</i>	Christmas Island Frigatebird, Andrew's Frigatebird	Breeding known to occur within area	Negligible (refer to Table 4)
<i>Fregata minor</i>	Great Frigatebird, Greater Frigatebird	Breeding known to occur within area	Negligible
<i>Papasula abbotti</i>	Abbott's Booby	Breeding known to occur within area	Negligible (refer to Table 4)
<i>Phaethon lepturus</i>	White-tailed Tropicbird	Breeding known to occur within area	Negligible
<i>Sula leucogaster</i>	Brown Booby	Breeding known to occur within area	Negligible
<i>Sula sula</i>	Red-footed Booby	Breeding known to occur within area	Negligible
Migratory Marine Mammals			
<i>Balaenoptera bonaerensis</i>	Antarctic Minke Whale, Dark-shoulder Minke Whale	Species or species habitat may occur within area	Not applicable
<i>Balaenoptera borealis</i>	Sei Whale	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Balaenoptera edeni</i>	Bryde's Whale	Species or species habitat may occur within area	Not applicable
<i>Balaenoptera musculus</i>	Blue Whale	Species or species habitat may occur within area	Not applicable (refer to Table 4)



Scientific Name	Common Name	Type of Presence	Risk of Impact
<i>Megaptera novaeangliae</i>	Humpback Whale	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Orcinus orca</i>	Killer Whale, Orca	Species or species habitat may occur within area	Not applicable
<i>Physeter macrocephalus</i>	Sperm Whale	Species or species habitat may occur within area	Not applicable
Migratory Marine Reptiles			
<i>Chelonia mydas</i>	Green Turtle	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Caretta caretta</i>	Loggerhead Turtle	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Dermochelys coriacea</i>	Leatherback Turtle	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Natador depressus</i>	Flatback Turtle	Species or species habitat may occur within area	Not applicable (refer to Table 4)
<i>Rhincodon typus</i>	Whale Shark	Species or species habitat may occur within area	Not applicable (refer to Table 4)



3. Conclusion

The Department of Regional Australia, Regional Development and Local Government are proposing to construct 16, two and three bedroom dwellings at Drumsite on Christmas Island.

An *Environmental Protection (Biodiversity Conservation) Act 1999* Protected Matters Report was accessed from the Department of the Sustainability, Environment, Water, Populations and Communities.

A risk assessment for potential impacts was completed against the species identified in the Protection Matters Report.

The risk assessment indicates that negligible impacts would be expected due to the construction of the new dwellings. The project is predominantly cleared of vegetation and suitable habitat for flora and fauna is minimal.



4. References

Department of the Environment, Water, Heritage and the Arts (2011a) *Species Profile and Threats Database - Accipiter hiogaster natalis* - Christmas Island Goshawk Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82408

Department of the Environment, Water, Heritage and the Arts (2011b) *Species Profile and Threats Database - Chalcophaps indica natalis*- Christmas Island Goshawk Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67030

Department of the Environment, Water, Heritage and the Arts (2011c) *Species Profile and Threats Database – Fregata andrewsi* - Christmas Island Frigatebird Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1011

Department of the Environment, Water, Heritage and the Arts (2011d) *Species Profile and Threats Database – Ninox natalis* - Christmas Island Hawk – Owl Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66671

Department of the Environment, Water, Heritage and the Arts (2011d) *Species Profile and Threats Database – Papasula abbotti* – Abbott’s Booby, Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59297

Department of the Environment, Water, Heritage and the Arts (2011f) *Species Profile and Threats Database – Turdus poliocephalus erythropleurus* Island Thrush (Christmas Island) Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67122

Department of the Environment, Water, Heritage and the Arts (2011g) *Species Profile and Threats Database – Crocidura attenuata trichura* Christmas Island Shrew Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66638

Department of the Environment, Water, Heritage and the Arts (2011h) *Species Profile and Threats Database – Pipistrellus murrayi* Christmas Island Pipistrelle Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64383

Department of the Environment, Water, Heritage and the Arts (2011h) *Species Profile and Threats Database – Lepidodactylus listeri* Christmas Island Gecko, Lister's Gecko Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1711

Department of the Environment, Water, Heritage and the Arts (2011h) *Species Profile and Threats Database – Typhlops exocoeti* — Christmas Island Blind Snake Accessed online (14/6/11)

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=79036



Appendix A
EPBC Act Protected Matters Report



Australian Government

Department of Sustainability, Environment,
Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 14/06/11 14:08:06



[Summary](#)

[Details](#)

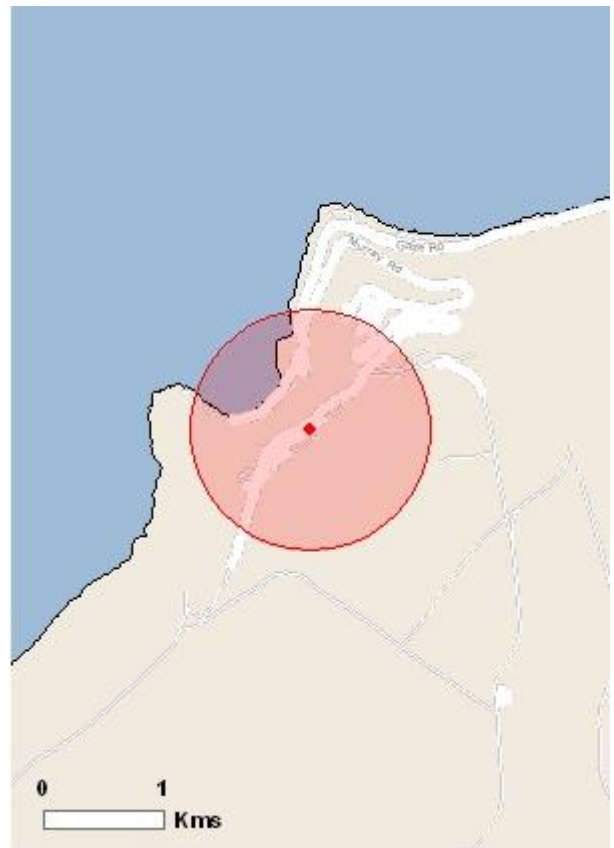
[Matters of NES](#)

[Other matters protected by
the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 1.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Significance (Ramsar Wetlands):	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	Relevant
Threatened Ecological Communities:	None
Threatened Species:	20
Migratory Species:	19

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	1
Commonwealth Heritage Places:	9
Listed Marine Species:	46
Whales and Other Cetaceans:	25

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	9
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

National Heritage Places [\[Resource Information \]](#)

Name	Status
------	--------

Natural

[Christmas Island Natural Areas](#) Ministerial request for assessment
[EXT](#)

Wetlands of International Significance (RAMSAR Sites) [\[Resource Information \]](#)

Name	Proximity
------	-----------

[Hosnies springs](#) Within 10km of Ramsar site
["the dales", christmas island](#) Upstream from Ramsar site

Commonwealth Marine Areas [\[Resource Information \]](#)

Approval may be required for a proposed activity that is likely to have a significant impact on the environment in a Commonwealth Marine Area, when the action is outside the Commonwealth Marine Area, or the environment anywhere when the action is taken within the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

EEZ and Territorial Sea

Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
------	--------	------------------

BIRDS

[Accipiter hiogaster natalis](#)
Christmas Island Goshawk [82408] Endangered Species or species habitat likely to occur within area

[Chalcophaps indica natalis](#)
Emerald Dove (Christmas Island) [67030] Endangered Species or species habitat likely to occur within area

[Fregata andrewsi](#)
Christmas Island Frigatebird, Andrew's Frigatebird [1011] Vulnerable Breeding known to occur within area

[Ninox natalis](#)

Christmas Island Hawk-Owl [66671]	Vulnerable	Species or species habitat known to occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Breeding likely to occur within area
Turdus poliocephalus erythropleurus		
Island Thrush (Christmas Island) [67122]	Endangered	Species or species habitat likely to occur within area

MAMMALS

Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Crocidura attenuata trichura		
Christmas Island Shrew [66638]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Pipistrellus murrayi		
Christmas Island Pipistrelle [64383]	Critically Endangered	Species or species habitat may occur within area

PLANTS

Tectaria devexa [14767]	Endangered	Species or species habitat likely to occur within area
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REPTILES

Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat may occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat may occur within area
Lepidodactylus listeri		
Christmas Island Gecko, Lister's Gecko [1711]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Typhlops exocoeti		
Christmas Island Blind Snake [79036]	Vulnerable	Species or species habitat likely to occur within area

SHARKS

Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
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Migratory Marine Birds

[Fregata andrewsi](#)

Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Vulnerable	Breeding known to occur within area
--	------------	-------------------------------------

[Fregata minor](#)

Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
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[Papasula abbotti](#)

Abbott's Booby [59297]	Endangered	Breeding likely to occur within area
------------------------	------------	--------------------------------------

[Phaethon lepturus](#)

White-tailed Tropicbird [1014]		Breeding known to occur within area
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[Sula leucogaster](#)

Brown Booby [1022]		Breeding known to occur within area
--------------------	--	-------------------------------------

[Sula sula](#)

Red-footed Booby [1023]		Breeding known to occur within area
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Migratory Marine Species[Balaenoptera bonaerensis](#)

Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat may occur within area
---	--	--

[Balaenoptera borealis](#)

Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
----------------	------------	--

[Balaenoptera edeni](#)

Bryde's Whale [35]		Species or species habitat may occur within area
--------------------	--	--

[Balaenoptera musculus](#)

Blue Whale [36]	Endangered	Species or species habitat may occur within area
-----------------	------------	--

[Caretta caretta](#)

Loggerhead Turtle [1763]	Endangered	Species or species habitat may occur within area
--------------------------	------------	--

[Chelonia mydas](#)

Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
---------------------	------------	--

[Dermochelys coriacea](#)

Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
--	------------	--

[Eretmochelys imbricata](#)

Hawksbill Turtle [1766]	Vulnerable	Species or species habitat may occur within area
-------------------------	------------	--

[Megaptera novaeangliae](#)

Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
---------------------	------------	--

[Natator depressus](#)

Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
-------------------------	------------	--

[Orcinus orca](#)

Killer Whale, Orca [46]		Species or species habitat may occur within area
-------------------------	--	--

[Physeter macrocephalus](#)

Sperm Whale [59]		Species or species habitat may occur within area
------------------	--	--

[Rhincodon typus](#)

Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
---------------------	------------	--

Other Matters Protected by the EPBC Act**Commonwealth Lands****[Resource Information]**

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Heritage Places**[Resource Information]**

Name	Status
Natural	
Christmas Island Natural Areas EXT	Listed place

Historic

Administrators House Precinct EXT	Listed place
Bungalow 702 EXT	Listed place
Drumsite Industrial Area EXT	Listed place
Industrial and Administrative Group EXT	Listed place
Malay Kampong Group EXT	Listed place
Malay Kampong Precinct EXT	Listed place
Poon Saan Group EXT	Listed place
Settlement Christmas Island EXT	Listed place

Listed Marine Species**[Resource Information]**

Name	Status	Type of Presence
Birds		
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Vulnerable	Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Breeding likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus White-tailed Tropicbird (Christmas Island), Golden Bosunbird [26021]		Breeding likely to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Fish		
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys sculptus Sculptured Pipefish [66197]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish,		Species or species habitat may occur within area

Yellow-banded Pipefish, Network Pipefish [66200] Corythoichthys haematopterus	Species or species habitat may occur within area
Reef-top Pipefish [66201] Corythoichthys intestinalis	Species or species habitat may occur within area
Australian Messmate Pipefish, Banded Pipefish [66202] Corythoichthys schultzi	Species or species habitat may occur within area
Schultz's Pipefish [66205] Cosmocampus banneri	Species or species habitat may occur within area
Roughridge Pipefish [66206] Cosmocampus maxweberi	Species or species habitat may occur within area
Maxweber's Pipefish [66209] Doryrhamphus baldwini	Species or species habitat may occur within area
Redstripe Pipefish [66718] Doryrhamphus dactyliophorus	Species or species habitat may occur within area
Banded Pipefish, Ringed Pipefish [66210] Doryrhamphus excisus	Species or species habitat may occur within area
Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211] Doryrhamphus janssi	Species or species habitat may occur within area
Cleaner Pipefish, Janss' Pipefish [66212] Doryrhamphus negrosensis	Species or species habitat may occur within area
Flagtail Pipefish, Masthead Island Pipefish [66213] Halicampus brocki	Species or species habitat may occur within area
Brock's Pipefish [66219] Halicampus dunckeri	Species or species habitat may occur within area
Red-hair Pipefish, Duncker's Pipefish [66220] Halicampus macrorhynchus	Species or species habitat may occur within area
Whiskered Pipefish, Ornate Pipefish [66222] Halicampus mataafae	Species or species habitat may occur within area
Samoan Pipefish [66223] Halicampus nitidus	Species or species habitat may occur within area
Glittering Pipefish [66224] Halicampus spinirostris	Species or species habitat may occur within area
Spiny-snout Pipefish [66225] Hippichthys cyanospilos	Species or species habitat may occur within area
Blue-speckled Pipefish, Blue-spotted Pipefish [66228] Hippichthys heptagonus	Species or species habitat may occur within area
Madura Pipefish, Reticulated Freshwater Pipefish [66229] Hippichthys penicillus	Species or species habitat may occur within area
Beady Pipefish, Steep-nosed Pipefish [66231] Hippichthys spicifer	Species or species habitat may occur within area
Belly-barred Pipefish, Banded	Species or species habitat may occur within area

Freshwater Pipefish [66232] Hippocampus histrix			
Spiny Seahorse, Thorny Seahorse [66236] Hippocampus kuda			Species or species habitat may occur within area
Spotted Seahorse, Yellow Seahorse [66237] Hippocampus spinosissimus			Species or species habitat may occur within area
Hedgehog Seahorse [66239] Micrognathus brevisrostris			Species or species habitat may occur within area
thorntail Pipefish, Thorn-tailed Pipefish [66254] Micrognathus micronotopterus			Species or species habitat may occur within area
Tidepool Pipefish [66255] Solegnathus lettiensis			Species or species habitat may occur within area
Gunther's Pipehorse, Indonesian Pipefish [66273] Syngnathoides biaculeatus			Species or species habitat may occur within area
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] Trachyrhamphus bicoarctatus			Species or species habitat may occur within area
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280] Trachyrhamphus longirostris			Species or species habitat may occur within area
Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281] Trachyrhamphus longirostris			Species or species habitat may occur within area

Reptiles

Caretta caretta			
Loggerhead Turtle [1763]	Endangered		Species or species habitat may occur within area
Chelonia mydas			
Green Turtle [1765]	Vulnerable		Species or species habitat may occur within area
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered		Species or species habitat may occur within area
Eretmochelys imbricata			
Hawksbill Turtle [1766]	Vulnerable		Species or species habitat may occur within area
Natator depressus			
Flatback Turtle [59257]	Vulnerable		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Name	Status	Type of Presence
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Mammals

Balaenoptera bonaerensis			
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812] Balaenoptera borealis			Species or species habitat may occur within area
Sei Whale [34] Balaenoptera edeni	Vulnerable		Species or species habitat may occur within area
Bryde's Whale [35] Balaenoptera musculus			Species or species habitat may occur within area

Blue Whale [36] Delphinus delphis	Endangered	Species or species habitat may occur within area
Common Dophin, Short-beaked Common Dolphin [60] Feresa attenuata		Species or species habitat may occur within area
Pygmy Killer Whale [61] Globicephala macrorhynchus		Species or species habitat may occur within area
Short-finned Pilot Whale [62] Grampus griseus		Species or species habitat may occur within area
Risso's Dolphin, Grampus [64] Indopacetus pacificus		Species or species habitat may occur within area
Longman's Beaked Whale [72] Kogia breviceps		Species or species habitat may occur within area
Pygmy Sperm Whale [57] Kogia simus		Species or species habitat may occur within area
Dwarf Sperm Whale [58] Lagenodelphis hosei		Species or species habitat may occur within area
Fraser's Dolphin, Sarawak Dolphin [41] Megaptera novaeangliae		Species or species habitat may occur within area
Humpback Whale [38] Mesoplodon densirostris	Vulnerable	Species or species habitat may occur within area
Blainville's Beaked Whale, Dense-beaked Whale [74] Mesoplodon ginkgodens		Species or species habitat may occur within area
Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564] Orcinus orca		Species or species habitat may occur within area
Killer Whale, Orca [46] Peponocephala electra		Species or species habitat may occur within area
Melon-headed Whale [47] Physeter macrocephalus		Species or species habitat may occur within area
Sperm Whale [59] Pseudorca crassidens		Species or species habitat may occur within area
False Killer Whale [48] Stenella attenuata		Species or species habitat may occur within area
Spotted Dolphin, Pantropical Spotted Dolphin [51] Stenella coeruleoalba		Species or species habitat may occur within area
Striped Dolphin, Euphrosyne Dolphin [52] Stenella longirostris		Species or species habitat may occur within area
Long-snouted Spinner Dolphin [29] Steno bredanensis		Species or species habitat may occur within area
Rough-toothed Dolphin [30] Tursiops truncatus s. str.		Species or species habitat may occur within area
Bottlenose Dolphin [68417] Ziphius cavirostris		Species or species habitat may occur within area
Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Christmas Island Natural Areas EXT	Registered
Historic	
Administrators House Precinct EXT	Registered
Bungalow 702 EXT	Registered
Drumsite Industrial Area EXT	Registered
Industrial and Administrative Group EXT	Registered
Malay Kampong Group EXT	Registered
Malay Kampong Precinct EXT	Registered
Poon Saan Group EXT	Registered
Settlement Christmas Island EXT	Registered

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-10.43111 105.67364

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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[Department of Sustainability, Environment, Water, Population and Communities](#)

GPO Box 787

Canberra ACT 2601 Australia

+61 2 6274 1111 [ABN](#)

| [Australian Government](#) |



GHD

76 Forrest Street Geraldton WA 6530

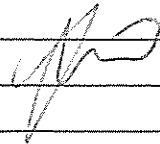

PO BOX 164 Geraldton WA 6531

T: (08) 9920 9400 F: (08) 9921 7997 E: getmail@ghd.com.au

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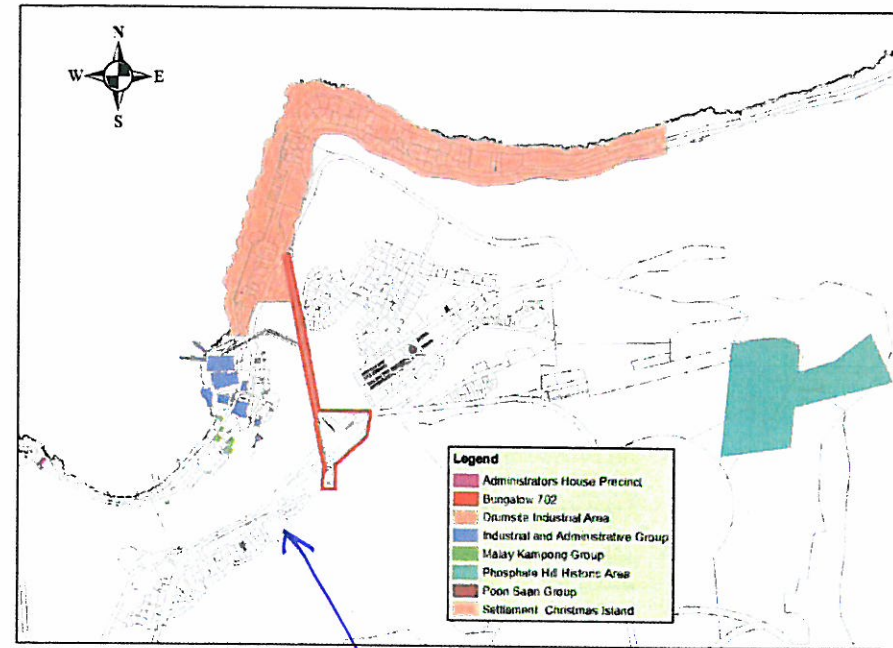
Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A						16/6/11
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Attachment 6 – Heritage



Name of Place—Drumsite Historic Industrial Area



Proposed boundary of Drumsite Historic Industrial Area (outlined in red). (Source: GML, 2008)

DRUMSITE VILLAGE



Name of Place—Drumsite Historic Industrial Area

Historical Context

The Drumsite Historic Industrial Area includes modern industrial site and the historic 'old dryers area', and continues to play an important role in the history of phosphate mining on Christmas Island. Modern dryers, haulage area, elevated conveyors and other infrastructure are located adjacent to the old dryers area. The main office of Christmas Islands Phosphates, a purpose-built office (c1958) is also located nearby in the residential area of Drumsite.

The Drumsite Historic Industrial Area includes remnants of the incline railway, constructed in 1914. The railway was the main means of transport between settlement and the upper terrace of Christmas Island until construction of the modern road (Murray Road) to Poon Saan from 1958. The average gradient of the line was 1 in 6.5. The permanent way comprises two standard gauge tracks, with a concrete strip between. One track was for rail traffic going up, the other for rail cars going down. Motor vehicles could use the strip in between.

At Drumsite, loaded rail wagons were attached to a cable, while empty wagons at the bottom of the incline were similarly attached. The empty wagons provided some counterbalance to the full wagons, but the essential power and control was supplied by winding gear which wound the cables over drums at Drumsite. Goods and people were also raised and lowered on the incline. The incline railway system was fundamental to the success and expansion of the mining operation, permitting large volumes of ore to be moved from the mining site to the lower terrace for export. It was also a considerable technical achievement.



Drumsite Historic Industrial Area—(left-right) remnants of the historic incline railway, contemporary incline conveyor, historic sample shed, contemporary dryer sheds. (Source: GML 2008)



Drumsite Historic Industrial Area—(left-right) 1950s laboratory, contemporary phosphate dryer and dust silos, and former railway workshops (the historic railway used to go through this building) adjacent to the sample shed and the spray paint shop. (Source: GML 2008)

Revised Assessment Against the Commonwealth Heritage Criteria

<p>A—Historic</p>	<p>The incline railway, 1930s chute and winding gear sheds are historically significant as evidence of previous phases of the mining industry on Christmas Island. The incline railway is of particular significance as it was fundamental to the success and expansion of the phosphate mining operation on Christmas Island and, therefore, the development of the island community.</p> <p>Attributes All of the fabric and engineering associated with the historic railway and old dryer area, including the laboratory, old dryer sheds and concrete railway piers.</p>
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Attachment 7 – Environmental Management Plan

DRAFT ONLY*

**Department of Regional
Australia, Regional
Development and Local
Government**

**Report for Christmas Island-
New Housing Program
Environmental Management
Plan**

April 2011

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1. Background

1.1 Introduction

In January 2011, the Department of Regional Australia, Regional Development and Local Government engaged GHD to provide Project Management and Design Consultancy Services for the New Housing Program on Christmas Island (CI). Part of the development involves the construction of new residential dwellings at Drumsite. This Environmental Management Plan deals with the impacts associated with the Drumsite location, and outlines the expected impacts of the construction of the housing development, as well as associated management strategies to reduce impacts.

1.2 Existing Flora and Fauna

The majority of this site is cleared and has previously had buildings on it. There is remnant infrastructure from this development such as hard stand car parking areas and laneways.

The vegetation dominating the cleared area is the introduced herb *Asystasia cf. chelonoides* with occasional Coffee Bush (*Leucaena leucocephala*) shrubs and subshrubs of Sensitive Plant (*Mimosa pudica*). All three species are introduced. There are mature Mango Trees (*Mangifera indica*) along the western boundary of the site.

The southeast corner of the site consists of relatively mature rainforest with a canopy height of approximately 20m. The dominant tree species is the Strangler Fig (*Ficus microcarpa* var. *microcarpa*). The canopy is mature with the epiphytic ferns *Pyrrosia lanceolata* and *Asplenium nidus* (Bird's Nest Fern) abundant. In the understorey are the large palms *Pandanus elatus* and *Arenga listeri* (Christmas Island Palm).

Although the previously cleared area of the site has only a minor northward fall in topography, the south eastern corner (that which is covered by rainforest) rises significantly to the south west with limestone outcropping and boulders present. The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses.

The south eastern corner of the site (within the rainforest) contains Red Crabs (*Gecarcoidea natalis*). Individuals were observed foraging in the site and sheltering in burrows.

The forest of the south east corner of the Drumsite Village could potentially provide some nesting habitat for the Great Frigatebird (*Fregata minor listeri*) which is protected under the EPBC Act as a migratory marine species. However, this area is outside the proposed boundary of the Drumsite development and no current nesting sites have been recorded in or adjacent to this area.

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2. Environmental Management

2.1 General

This Environmental Management Plan has been prepared by GHD to outline the environmental requirements that are most likely needed to be addressed during construction at the Drumsite. It should be confirmed by the Contractor and form the basis of the Contractors Environmental Management Plan. The Contractor shall ensure that all construction staff have been provided with an induction covering the aspects and actions of their Environmental Management Plan, prior to them commencing work on site.

A register of inductions shall be kept.

2.2 Flora and Vegetation

2.2.1 Potential Impacts

The site has already been cleared in the past, and has also been severely impacted by introduced vegetation species. As the remnant rainforest area is upslope of the project site, on rocky ground, the risks of direct and indirect impact from clearing and runoff is low. Potential impacts to flora and vegetation on and adjacent to the project site from the proposed housing development include:

- ▶ Vegetation clearing;
- ▶ Soil degradation and erosion;
- ▶ Weed introduction and invasion;
- ▶ Ground disturbance from construction of houses;
- ▶ Changes in surface water flow and quality, and runoff impacting vegetation;
- ▶ Risks of pollution from hazardous materials during construction activities; and
- ▶ Dust generation during construction.

2.2.2 Management

Proposed management actions are outlined below:

- ▶ Existing weedy vegetation shall be cleared and removed to an area where weed material will not become a risk to native vegetation, as approved by Parks Australia or the Shire;
- ▶ Weed control shall be undertaken within a 10m strip adjacent to the remaining rainforest;
- ▶ Vegetation clearing shall be limited to approved areas and should not impact upon the adjacent rainforest;
- ▶ Any trees that can be retained shall not be damaged; and
- ▶ Temporary fencing shall be placed to delineate the areas which are not to be cleared or otherwise impacted.

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2.3 Fauna

2.3.1 Potential Impacts

No significant fauna species were observed, or are likely to depend on the project area. Small numbers of Red Crabs were recorded in the area. The habitat of the site is severely degraded, with limited native vegetation available for use by birds or other native fauna. The south-east rainforest corner will not be directly impacted by the housing development, as it rises relatively steeply up from the flatter, previously developed area. There is potential for minor loss of Red Crabs due to land clearing.

Potential impacts to fauna as a result of the housing development include:

- ▶ Loss of habitat;
- ▶ Direct mortality to individual fauna;
- ▶ Changes to predator-prey interactions; and
- ▶ Impacts from noise, vibration and dust during construction.

2.3.2 Management

The following management measures will be instigated:

- ▶ Minimise clearing to those areas specifically required for the project;
- ▶ Earthworks should not be undertaken during the red crab migration season if at all possible subject to program constraints;
- ▶ If Red Crabs are found to migrate across the construction area, temporary training walls shall be established to guide them away from risk zones and into adjacent bushland areas; and
- ▶ Any native fauna deaths or injury (except for crabs) shall be reported to Parks Australia within 4 hours of occurrence.

2.4 Surface and Ground Water

2.4.1 Impacts

The project site is relatively flat, due to previous site works for buildings. The site slopes upwards in the south-western corner. Groundwater levels are unknown.

Potential impacts to surface and groundwater include:

- ▶ Runoff from the site, which has the potential to create erosion in top soil, sedimentation and loss of vegetation downslope of the site and eventual impacts such as sediment plumes to nearby marine areas;
- ▶ Impacts on groundwater as a result of chemical or hydrocarbon spills; and
- ▶ Changes to natural/existing flow regimes resulting in downstream impacts or localised flooding.

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2.4.2 Management

Management measures which can reduce the impacts of erosion and groundwater impacts are outlined below:

- ▶ The development of temporary drainage structures across the construction site, to prevent scour and erosion. This will require a suitable downstream outlet into existing drainage systems or rock armouring to prevent erosion.
- ▶ Adequate planning of drainage from the housing development, particularly during construction, in order to prevent impacts such as plumes and turbidity on the marine environment or downstream erosion. This is likely to require silt traps during the construction and early post construction phases.
- ▶ No bulk fuels and chemicals shall be stored on site.
- ▶ Chemicals or fuels for daily use shall be stored and handled as per Materials Safety Data Sheet (MSDS) requirements to minimise the risk of spillage to the environment.
- ▶ Copies of relevant MSDSs shall be kept on site at all times.
- ▶ The Contractor shall provide spill containment and clean-up equipment on site at all times.

2.5 Air Quality

2.5.1 Impacts

Impacts to air quality likely from the construction of the housing development are limited predominantly to dust. Dust impacts include:

- ▶ Death of plant species due to thick dust cover;
- ▶ Impacts on ground fauna in adjacent bushland; and
- ▶ Nuisance impacts on adjacent residents and the Bahai Temple.

2.5.2 Management

- ▶ All cleared areas and roads shall be sprayed regularly with water during construction to minimise dust lift;
- ▶ Stockpiles of spoil or construction materials shall be covered or sprayed with water as required to minimise dust lift;
- ▶ A register of complaints regarding dust shall be kept and complaints investigated within 24 hours; and
- ▶ Mitigation measures to address nuisance dust shall be provided within 48 hours.

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2.6 Noise

2.6.1 Impacts

Noise impacts are managed through the *Environmental Protection (Noise) Regulations 1997* which specifies the maximum allowable external noise levels at various sensitive noise receptors. The Regulations also state requirements for construction sites.

For noise sensitive residences, the time of day also affects the assigned levels. The Regulations define three types of assigned noise level:

- ▶ $L_{A_{10}}$ assigned noise level which is not to be exceeded for more than 10% of the time;
- ▶ L_{A_1} assigned noise level which is not to be exceeded for more than 1% of the time; and
- ▶ $L_{A_{Max}}$ assigned noise level means a noise level which is not to be exceeded at any time.

The assigned noise levels are outlined below and the construction noise generation will need to be within these limits.

Table 1 Assigned noise levels, dB(A) (source: Western Australian Consolidated Regulations)

Type of premise receiving noise	Time of day	Assigned level		
		$L_{A_{10}}$	L_{A_1}	$L_{A_{Max}}$
Noise sensitive	07:00 to 19:00 Monday to Saturday (Day)	45 + IF	55 + IF	65 + IF
	09:00 to 19:00 Sunday and public holidays (Sunday)	40 + IF	50 + IF	65 + IF
	19:00 to 22:00 all days (Evenings)	40 + IF	50 + IF	55 + IF
	22:00 on any day to 07:00 Monday to Saturday and 09:00 Sunday and public holidays (Night)	35 + IF	45 + IF	55 + IF
Noise sensitive	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial and utility	All hours	65	80	90

2.6.2 Management

Noise impacts shall be managed as follows:

- ▶ Noise shall be kept within the regulated levels so as to minimise disturbance to residents and sensitive fauna species;

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- ▶ Construction hours shall be restricted to Monday to Friday 7 am to 5 pm, unless otherwise approved by the Shire of Christmas Island and the Superintendent;
- ▶ Construction equipment shall be fitted with engine mufflers and well maintained exhaust systems at all times;
- ▶ A complaints register shall be kept with complaints investigated within 4 hours and mitigation implemented as soon as possible after investigations; and
- ▶ Special consideration to minimise noise shall be made with regards to the adjacent Bahai temple with regards to any fixed times of worship or other requirements.

2.7 Waste Disposal

2.7.1 Impacts

Potential impacts to the environment due to poor waste disposal include:

- ▶ Foraging of feral and native animal species on the construction site;
- ▶ Littering of adjacent housing areas and bushland; and
- ▶ Impacts on water quality due to solubility and run off of pollutants.

2.7.2 Management

The understorey in this area of rainforest is disturbed with old piping, corrugated metal sheeting, nets and other rubbish in the forest behind the neighbouring houses. Management measures for waste disposal include:

- ▶ Removal of existing wastes and appropriate disposal;
- ▶ Soil wastes during construction will be removed from site and disposed of at a suitable landfill site;
- ▶ General construction wastes will be disposed of at the Shire landfill;
- ▶ Sewage wastes from construction toilet facilities will either be pumped out and taken to the waste water treatment plant for processing, or portable toilets will be used;
- ▶ No bulldozers or other equipment will be permitted to refuel on site;
- ▶ No fuel or other dangerous goods will be stored on site; and
- ▶ General wastes produced during construction will be contained within lidded bins and regularly disposed of at the Shire landfill.

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3. References

Western Australian Consolidated Regulations Website, Environmental Protection (Noise) Regulations 1997- Reg 8, accessed 15 Feb 2011
http://www.austlii.edu.au/au/legis/wa/consol_reg/epr1997461/s8.html

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GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004
P.O. Box 3106, Perth WA 6832
T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com.au

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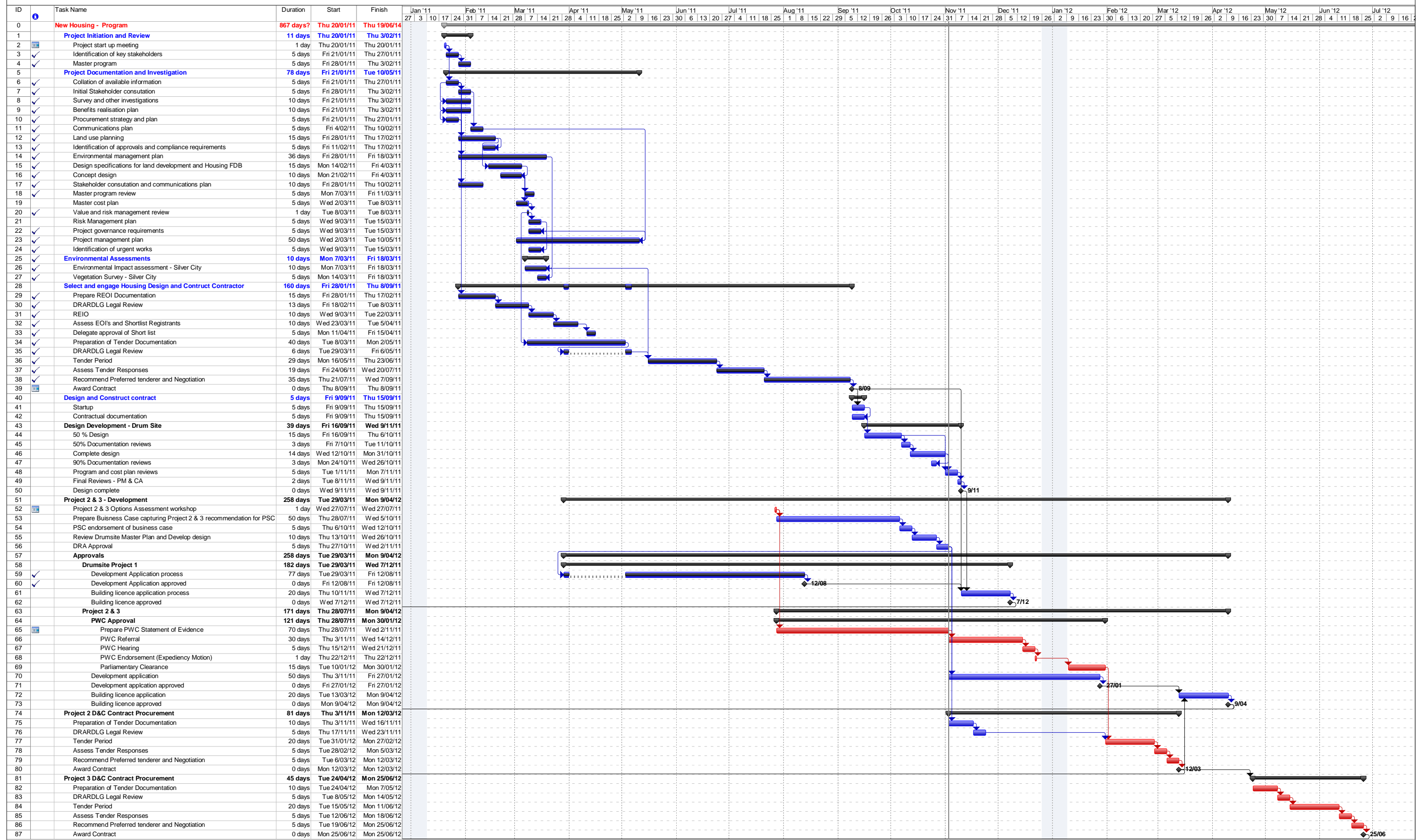
Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0						16/6/11

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DETAILED PROGRAM

NEW HOUSING PROGRAM ON CHRISTMAS ISLAND PROGRAM



Project: New Housing - Program
Date: Thu 3/11/11
Revision 8

Task	Summary	Rolled Up Milestone	External Tasks	Inactive Task	Manual Task	Manual Summary	Progress
Critical Task	Rolled Up Task	Rolled Up Progress	Project Summary	Inactive Milestone	Duration-only	Start-only	Deadline
Milestone	Rolled Up Critical Task	Split	Group by Summary	Inactive Summary	Manual Summary Rollup	Finish-only	

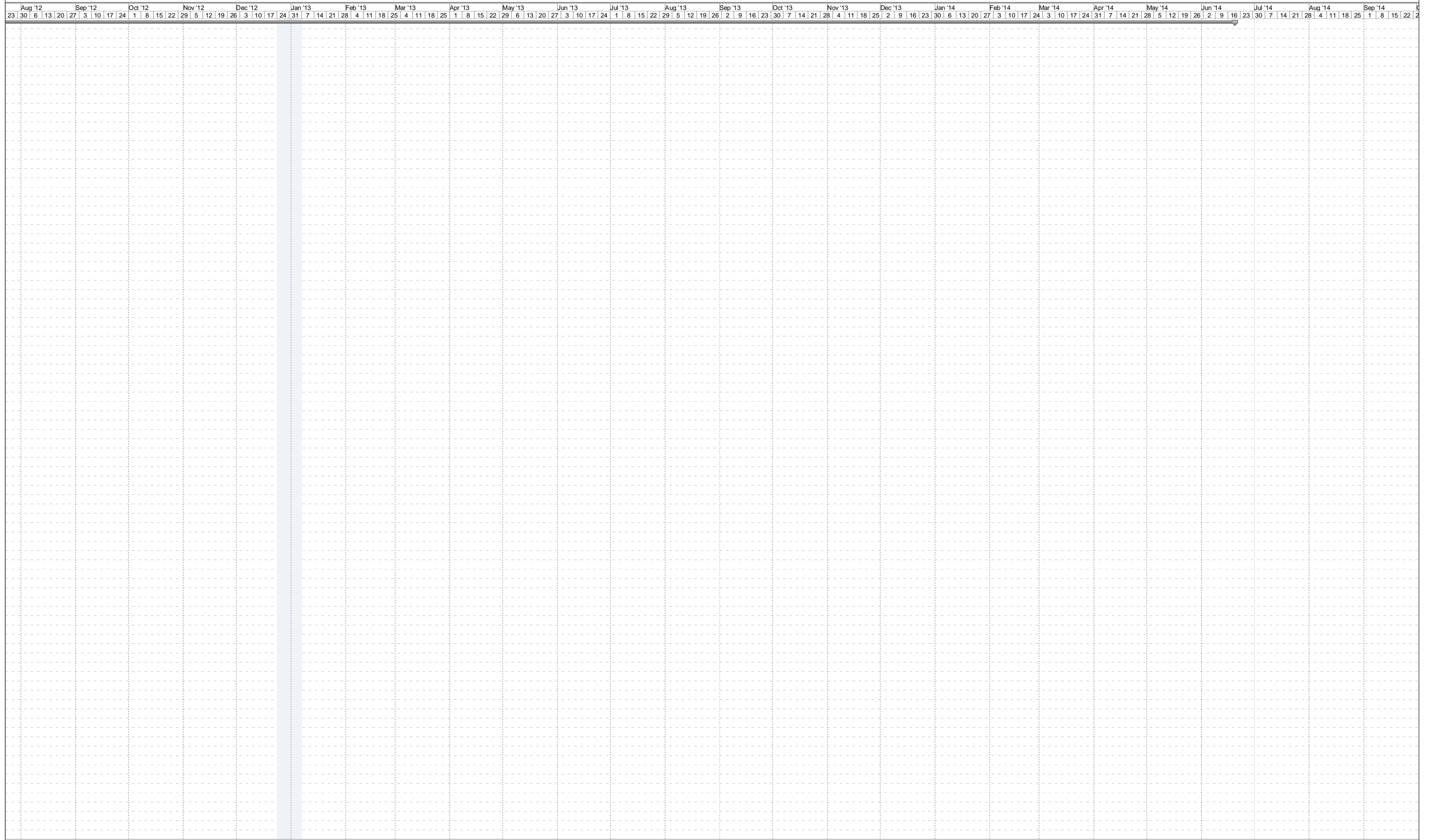
Page 1

NEW HOUSING PROGRAM ON CHRISTMAS ISLAND PROGRAM

ID	Task Name	Duration	Start	Finish	Jan '11	Feb '11	Mar '11	Apr '11	May '11	Jun '11	Jul '11	Aug '11	Sep '11	Oct '11	Nov '11	Dec '11	Jan '12	Feb '12	Mar '12	Apr '12	May '12	Jun '12	Jul '12
88	Buidling - Phase 1	408 days	Thu 3/11/11	Sun 30/06/13																			
89	Offsite fabrication	12 wks	Thu 3/11/11	Fri 10/02/12																			
90	Shipping	70 days	Thu 17/11/11	Fri 9/03/12																			
91	Construction	25 wks	Thu 15/12/11	Fri 22/06/12																			
92	Commissioning	5 days	Mon 25/06/12	Fri 29/06/12																			
93	Handover	0 days	Fri 29/06/12	Fri 29/06/12																			
94	Defects liability and post occupancy evaluation	12.2 emons	Fri 29/06/12	Sun 30/06/13																			
95	Buidling - Project 2	527 days	Tue 13/03/12	Sat 5/04/14																			
96	Design and Building Licence	10 wks	Tue 13/03/12	Mon 21/05/12																			
97	Offsite fabrication	15 wks	Tue 13/03/12	Mon 23/07/12																			
98	Shipping	60 days	Tue 24/07/12	Mon 15/10/12																			
99	Construction	22 wks	Tue 16/10/12	Wed 3/04/13																			
100	Commissioning	5 days	Thu 4/04/13	Wed 10/04/13																			
101	Handover	0 days	Wed 10/04/13	Wed 10/04/13																			
102	Defects liability and post occupancy evaluation	12 emons	Wed 10/04/13	Sat 5/04/14																			
103	Buidling - Project 3	506 days?	Tue 26/06/12	Thu 19/06/14																			
104	Design and Building Licence	10 wks?	Tue 26/06/12	Mon 3/09/12																			
105	Offsite fabrication	12 wks	Tue 24/07/12	Mon 15/10/12																			
106	Shipping	60 days	Tue 16/10/12	Wed 23/01/13																			
107	Construction	20 wks	Thu 24/01/13	Wed 12/06/13																			
108	Commissioning	5 days	Thu 13/06/13	Wed 19/06/13																			
109	Handover	0 days	Wed 19/06/13	Wed 19/06/13																			
110	Defects liability and post occupancy evaluation	13.05 mons	Thu 20/06/13	Thu 19/06/14																			

Project: New Housing - Program Date: Thu 3/11/11 Revision 8	Task		Summary		Rolled Up Milestone		External Tasks		Inactive Task		Manual Task		Manual Summary		Progress
	Critical Task		Rolled Up Task		Rolled Up Progress		Project Summary		Inactive Milestone		Duration-only		Start-only		Deadline
	Milestone		Rolled Up Critical Task		Split		Group By Summary		Inactive Summary		Manual Summary Rollup		Finish-only		

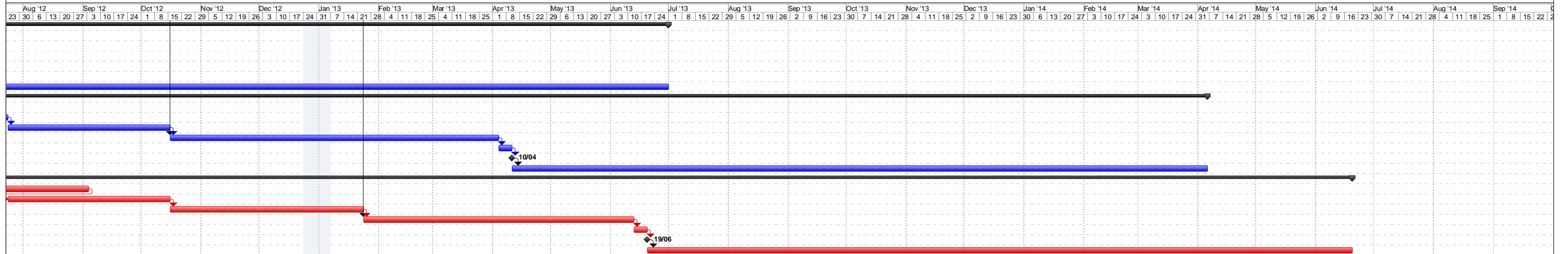
NEW HOUSING PROGRAM ON CHRISTMAS ISLAND PROGRAM



Project: New Housing - Program
 Date: Thu 3/11/11
 Revision: 8

Task	Summary	Rolled Up Milestone	External Tasks	Inactive Task	Manual Task	Manual Summary	Progress
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NEW HOUSING PROGRAM ON CHRISTMAS ISLAND PROGRAM



Project: New Housing - Program
Date: Thu 3/11/11
Revision 8

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