Tables Outlining How to Use Remote Sensing for Coastal Applications

The logic and structure of this section guide you through a standard set of questions that would be used to determine the environmental variable to be mapped, and a suitable remotely –senses data set and mapping procedure(s). The information you have filled out in Table 2 will be used to drive this process. A graphic interface is used to link the variable to be mapped and type of environment to suitable data sets and processing techniques. The logic employed is to provide a guide on what is required, not exact details on how to do it, but to give an idea of scope and costs for implementing such a project. The detailed information specified for each application will include:

- Required image data
- Hardware and software requirements
- Level of Personnel
- Processing approach(es)
- Output product(s)
- Cost and Time for mapping
- Who to contact for expertise?

Table 1 The remotely sensed variable BENTHIC COVER TYPE
(applies to coastal indicators: Benthic Cover Type - Estuary, Coral Reefs, and Rock platforms) and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Airborne hyperspectral**
Spatial Dimensions		
Area to cover	185km x 185km per scene	Up to 1000km^2
Mapping unit	15m panchromatic 30m multi-spectral	0.5m – 5m
Positional accuracy	Dependent on georeferencing process	Dependent on Georeferencing process
Temporal Dimensions		
When	Approx 9.45am	User defined
How often	every 16 days	User defined (can be < 1 day)
Variable to map	Substrate-cover type	Substrate-cover type
Environmental Restrictions	For sub-tidal vegetation to < 5m	For sub-tidal vegetation to < 5m Strong winds, breaking waves
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to be mapped	Trained in hyperspectral data processing. Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image classification to Benthic	Image pre-processing (1 day)

	Types (15 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	Image mapping to Benthic Types (10 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 17 days per site
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire from Dept. of Natural Resources Ancillary data (topo sheets)= $200 Processing = 28 days of technical officer @ $875/day = $24500 Total = $26450 Note: This assumes software have been purchased	Data acquisition: Image data = $20000 Processing = 17 days of technical officer @ $875/day = $14875 Total = $34875 Note: This assumes software have been purchased

Table 2 The remotely sensed variable BENTHIC (SPECIES, DENSITY, BIOMASS) and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Quickbird	**DATA OPTION 2: Airborne hyperspectral data**
Spatial Dimensions		
Area to cover	12km x 12km per scene	Up to 1000km^2
Mapping unit	068m panchromatic 4.0m multi-spectral	0.5m – 5m
Positional accuracy	Dependent on georef-erencing process	Dependent on Georeferencing process
Temporal Dimensions		
When	Approx 10.45am	User defined
How often	Minimum every 4 days	User defined (can be < 1 day)
Variable to map	Benthic (species, density, biomass)	Benthic (species, density, biomass)
Environmental Restrictions	For sub-tidal vegetation to < 5m, inter-tidal and supra tidal vegetation Not possible for coral species	For sub-tidal vegetation to < 5m Strong winds, breaking waves
Processing technique **(Output)**	Image classification or feature detection using segmentation and classification (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in image classification Experience with high	Trained in hyperspectral data processing. Knowledge of area to be

	spatial resolution data Knowledge of area to be mapped	mapped
Estimated task and times	Image pre-processing (1 day) Image classification to cover types (8 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 19 days per scene	Image pre-processing (1 day) Image mapping to Benthic Types (10 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 17 days per site
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $4500 Ancillary data (topo sheets)= $200 Processing = 19 days of technical officer at $875/day= $16625 Total = $21325 Note: This assumes software have been purchased	Data acquisition: Image data = $20000 Processing = 17 days of technical officer @ $875/day= $14875 Total = $34875 Note: This assumes software have been purchased

Table 3 The remotely sensed variable Mangrove COVER TYPE
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Radarsat**
Spatial Dimensions		
Area to cover	185km x 185km per scene	Up to 3600km^2
Mapping unit	15m panchromatic 30m multi-spectral	5m -60mm
Positional accuracy	Depends on level of georeferencing	Dependent on Georeferencing process
Temporal Dimensions		
When	Approx 9.45am	User defined
How often	every 16 days	User defined (can be < 1 day)
Variable to map	Mangrove cover.	Mangrove cover
Environmental Restrictions	For mangrove vegetation which covers several areas. Cloud cover Mangrove fringe can be narrow, smaller then pixel size	For mangrove vegetation which covers several areas. Strong winds Mangrove fringe can be narrow, smaller then pixel size
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software with radar image analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in image classification Experience with Landsat data	Trained in radardata processing. Knowledge of area to be mapped

	Knowledge of area to be mapped	
Estimated task and times	Image pre-processing (1 day) Image classification to Mangrove cover (15 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	Image pre-processing (2 day) Image classification mapping to Mangrove Types (10 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 18days per site (several 100 sites make up landsat scene)
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire from Dept. of Natural Resources Ancillary data (topo sheets)= $200 Processing = 28 days of technical officer @ $875/day= $24500 Total = $26650 Note: This assumes software have been purchased	Data acquisition: Image data = $8000 Processing = 18 days of technical officer @ $875/day= $?? Total = $15750 Note: This assumes software have been purchased

Table 4 The remotely sensed variable Mangrove (SPECIES, DENSITY, BIOMASS) and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Airborne hyperspectral data**
Spatial Dimensions		
Area to cover	185km x 185km per scene	Up to 1000km^2
Mapping unit	15m panchromatic 30m multi-spectral	0.5m – 5m
Positional accuracy	Depends on level of georeferencing	Dependent on Georeferencing process
Temporal Dimensions		
When	Approx 9.45am	User defined
How often	every 16 days	User defined (can be < 1 day)
Variable to map	Mangrove (species, density, biomass)	Mangrove (species, density, biomass)
Environmental Restrictions	For mangrove vegetation which covers several areas. Cloud cover Mangrove fringe can be narrow, smaller then pixel size	For mangrove vegetation which covers several areas. Strong winds, Cloud cover
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in image classification	Trained in hyperspectral data processing.

	Experience with Landsat data Knowledge of area to be mapped	Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image classification to Mangrove cover (15 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	Image pre-processing (1 day) Image classification mapping to Mangrove Types (10 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 17 days per site (several 100 sites make up landsat scene)
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire from Dept. of Natural Resources Ancillary data (topo sheets)= $200 Processing = 28 days of technical officer @ $875/day= $24500 Total = $26650 Note: This assumes software have been purchased	Data acquisition: Image data = $20000 Processing = 17 days of technical officer @ $875/day= $14875 Total = $34875 Note: This assumes software have been purchased

Table 5 The remotely sensed variable WATER QUALITY: Chlorophyll (CHL) CONTENT and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: MERIS	**DATA OPTION 2: Airborne hyperspectral**
Spatial Dimensions		
Area to cover	Swath width 572km	Up to 1000km^2
Mapping unit	300m	0.5m – 5m
Positional accuracy	Dependent on Georeferencing process	Dependent on Georeferencing process
Temporal Dimensions		
When	1030 hrs	User defined
How often	3 days	User defined (can be < 1 day)
Variable to map	Chlorophyll A concentrations	Chlorophyll A concentrations
Environmental Restrictions	Optically shallow areas Strong winds, breaking waves	For sub-tidal vegetation to < 5m Strong winds, breaking waves
Processing technique **(Output)**	Image based deterministic (inversion of radiative transfer model). (Map showing Chl a concentration in mg/m^3 in each pixel)	Image based deterministic (inversion of radiative transfer model) or empirical approach using field data (Map showing Chl a concentration in mg/m^3 in each pixel)
Resources – Hardware and Software	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in hyperspectral data processing. Knowledge of area to be mapped	Trained in hyperspectral data processing. Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day)	Image pre-processing (1 day)

	Image modeling (4 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 11 days per site	Image modeling (6 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 13 days per site
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = no cost Processing = 11 days of technical officer @ $875/day= $9625 Total = $9625 Note: This assumes software have been purchased	Data acquisition: Image data = $20000 Processing = 13 days of technical officer @ $875/day= $11375 Total = $31375 Note: This assumes software have been purchased

Table 6 The remotely sensed variable WATER QUALITY: ALGALBLOOM
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

ALGAL BLOOMS	**DATA OPTION 1: Landsat ETM**	**DATA OPTION 2: Airborne Hyperspectral**
Spatial Dimensions		
Area to cover	185km x 185km per scene	Up to 1000km^2
Mapping unit	15m panchromatic 30m multi-spectral	0.5m – 5m
Positional accuracy	Dependent on georeferencing process	Dependent on georeferencing process
Temporal Dimensions		
When	Approx 9.45am	User defined
How often	every 16 days	User defined (can be < 1 day)
Variable to map	Algal boom presence and thickness.	Algal boom presence and thickness.
Environmental Restrictions	Strong winds, breaking waves	Strong winds, breaking waves
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to be mapped	Trained in hyperspectral data processing. Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image classification to Benthic Types (15 days per scene) Field/Photo verification for a	Image pre-processing (1 day) Image mapping to Benthic Types (10 days per site)

	select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 17 days per site
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire from Dept. of Natural Resources Processing = 28 days of technical officer @ $875/day= $24500 Total = $26450 Note: This assumes software have been purchased	Data acquisition: Image data = $20000 Processing = 17 days of technical officer @ $875/day= $14875 Total = $34875 Note: This assumes software have been purchased

Table 7 The remotely sensed variable WATER QUALITY: SUSPENDED MATTER and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: MERIS	**DATA OPTION 2: Lansat ETM**
Spatial Dimensions		
Area to cover	Swath width 572km	185km x 185km per scene
Mapping unit	300m	15m panchromatic 30m multi-spectral
Positinal accuracy	Dependent on Georeferencing process	Depends on level of georeferencing
Temporal Dimensions		
When	1030 hrs	Approx 0945hrs
How often	Every 3 days	every 16 days
Variable to map	Chlorophyll A concentrations	Concentration of suspended organic and inorganic materials
Environmental Restrictions	Optically shallow areas Strong winds, breaking waves	Optically shallow water bodies
Processing technique **(Output)**	Image based deterministic (inversion of radiative transfer model). (Map showing suspended sediment concentration in mg/m^3 in each pixel)	Image modeling using empirical or process radiative transfer models.
Resources – Hardware and Software	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)
Resource – Personnel	Trained in hyperspectral data processing. Knowledge of area to be mapped	Trained in image modellling Experience with Landsat data Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image modeling (4 days per site)	Image pre-processing (1 day) Image classification or model required. Types (15 days per scene)

	Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 11 days per site	Map output production: (2 days) Total = 18 days per scene
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = no cost Processing = 11 days of technical officer @ $875/day= $9625 Total = $9625 Note: This assumes software have been purchased	Data acquisition: Image data = $1950 Processing = 18 days of technical officer @ $875/day= $15750 Total = $17700 Note: This assumes software have been purchased

Table 8 The remotely sensed variable WATER QUALITY: CDOM
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: MERIS	**DATA OPTION 2: Lansat ETM**
Spatial Dimensions		
Area to cover	Swath width 572km	185km x 185km per scene
Mapping unit	300m	15m panchromatic 30m multi-spectral
Positional accuracy	Dependent on Georeferencing process	Depends on level of georeferencing
Temporal Dimensions		
When	1030 hrs	Approx 0945hrs
How often	Every 3 days	Avery 16 days
Variable to map	Coloured Dissolved Organic Matter concentrations	Coloured Dissolved Organic Matter concentrations
Environmental Restrictions	Optically shallow areas Strong winds, breaking waves	Optically shallow water bodies
Processing technique **(Output)**	Image based deterministic (inversion of radiative transfer model). (Map showing CDOM concentration in each pixel)	Image modeling using empirical or process radiative transfer models.
Resources – Hardware and Software	PC Image processing software with Hyperspectral analysis capabilities, including sub-pixel mapping techniques.	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)
Resource – Personnel	Trained in hyperspectral data processing. Knowledge of area to be mapped	Trained in image modellling Experience with Landsat data Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day)	Image pre-processing (1 day)

	Image modeling (4 days per site) Field/Photo verification for a select number of sample sites: (4 days) Map output production: (2 days) Total = 11 days per site	Image classification or model required. Types (15 days per scene) Map output production: (2 days) Total = 18 days per scene
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = no cost Processing = 11 days of technical officer @ $875/day= $9625 Total = $9625 Note: This assumes software have been purchased	Data acquisition: Image data = $1950 Processing = 18 days of technical officer @ $875/day= $17700 Total = $17700 Note: This assumes software have been purchased

Table 9 The remotely sensed variable SEA SURFACE TEMPERATURE
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

SEA SURFACE TEMPERATURE	**Data type #1 Landsat ETM**	**Data type #2 MODIS SST**
Spatial Dimensions		
Area to cover	185km x 185km per scene	2000km wide segments
Mapping unit	60m thermal	1km for level 2 daily product
Positional accuracy	Depends on level of georeferencing	Depends on level of georeferencing
Temporal Dimensions		
When	Approx 0945hrs	Approx. 1030hrs and 2230hrs
How often	every 16 days	Twice daily
Variable to map	Sea surface temperature	Sea surface temperature
Environmental Restrictions	N/A	N/A
Processing technique **(Output)**	Image density slicing and colour coding Map of SST variation	Image density slicing and colour coding Map of SST variation
Resources – Hardware and Software	PC Image processing software	PC Image processing software
Resource – Personnel	Trained in image analysis and experience with Landsat thermal data Knowledge of area to be mapped	Trained in image analysis and experience with MODIS thermal data Knowledge of area to be mapped
Estimated task and times	Image pre-processing and analysis (1 day) Map output production: (1 days) Total = 2 days per scene	Image pre-processing and analysis (< 1 day) Map output production: (< 1 days) Total = 1 day per scene

Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Processing = 2 days of technical officer @ $875/day= $1750 Total = $3700 Note: This assumes software have been purchased	Processing = 1 days of technical officer @ $875/day= $875 Total = $875 Note: This assumes software have been purchased

Table 10 The remotely sensed variable BATHYMETRY
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Airborne Laser Scanning	**DATA OPTION 2: Landsat ETM (or other satellite multi-spectral)**
Spatial Dimensions		
Area to cover	Can be up to 1000km^2	185km x 185km per scene
Mapping unit	0.5m to 10m – depends on sample intensity	15m panchromatic 30m multi-spectral
Positional accuracy	????	Dependent on georef-erencing process
Temporal Dimensions		
When	User controlled	Approx 9.45am
How often	User controlled	every 16 days
Variable to map	Sea surface and seafloor height	Seafloor elevation
Environmental Restrictions	Clarity of the water column – does not work in turbid areas.	Clarity of the water column – does not work in turbid areas. In clear areas only down to 15-20m.
Processing technique **(Output)**	Ocean surface and seafloor return extraction, interpolation and ground and canopy mapping. Raster or image surface with each pixel containing an absolute elevation.	Inversion of radiative transfer model to estimate depth.
Resources – Hardware and Software	PC Image processing software GIS with image analysis capabilities.	PC Image processing software with capability to develop mathematical models and implement in image processing.
Resource – Personnel	Trained and with experience in ALS mapping. Knowledge of area to be mapped	Trained in biophysical image processing, including inversion techniques. Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day)	Image pre-processing (1 day)

	Image analysis and DEM generation (4 days) Map output production: (2 days) Total = 10 days per scene	Image modeling and depth extraction (8 days) Map output production: (2 days) Total = 11 days per scene
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data quotes can be obtained from ALS data providers, e.g. AAM Hatch or Royal Australian Navy. Processing = 10 days of technical officer @ $875/day= 8750 Total = dependent on survey extent Note: This assumes software have been purchased	Data acquisition: Image data = $1950 Processing = 11 days of technical officer @ $875/day= $9625 Total = $11575 Note: This assumes software have been purchased

Table 11 The remotely sensed variable LAND-COVER
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Quickbird**
Spatial Dimensions		
Area to cover	185km x 185km per scene	12km x 12km per scene
Mapping unit	15m panchromatic 30m multi-spectral	068m panchromatic 4.0m multi-spectral
Positional accuracy	Dependent on georef-erencing process	Dependent on georef-erencing process
Temporal Dimensions		
When	Approx 9.45am	Approx 10.45am
How often	every 16 days	Minimum every 4 days
Variable to map	Land-cover or vegetation-cover type	Land-cover or vegetation-cover type
Environmental Restrictions	For sub-tidal vegetation to < 5m, inter-tidal and supra tidal vegetation	For sub-tidal vegetation to < 5m, inter-tidal and supra tidal vegetation
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection using segmentation and classification (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to be mapped	Trained in image classification Experience with high spatial resolution data Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image classification to	Image pre-processing (1 day) Image classification to cover

	cover types (15 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	types (8 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 19 days per scene
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire Ancillary data (topo sheets)= $200 Processing = 28 days of technical officer @ $875/day= $24500 Total = $26650 Note: This assumes software have been purchased	Data acquisition: Image data = $4500 Ancillary data (topo sheets)= $200 Processing = 19 days of technical officer at $875/day= $16625 Total = $21325 Note: This assumes software have been purchased

Table 12 The remotely sensed variable VEGETATION
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Landsat ETM	**DATA OPTION 2: Quickbird**
Spatial Dimensions		
Area to cover	185km x 185km per scene	12km x 12km per scene
Mapping unit	15m panchromatic 30m multi-spectral	068m panchromatic 4.0m multi-spectral
Positional accuracy	Dependent on georef-erencing process	Dependent on georef-erencing process
Temporal Dimensions		
When	Approx 9.45am	Approx 10.45am
How often	every 16 days	Minimum every 4 days
Variable to map	Vegetation-cover type to genus or species level	Land-cover or vegetation-cover type
Environmental Restrictions	For sub-tidal vegetation to < 5m, inter-tidal and supra tidal vegetation	For sub-tidal vegetation to < 5m, inter-tidal and supra tidal vegetation
Processing technique **(Output)**	Image classification or feature detection (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.	Image classification or feature detection using segmentation and classification (Vegetation type map and target features) Note: The ability to map specific targets will depend on their growth form and extent.
Resources – Hardware and Software	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)	PC Image processing software GIS with image classification module (e.g. Arc-View Image Analyst)
Resource – Personnel	Trained in image classification Experience with Landsat data Knowledge of area to be mapped	Trained in image classification Experience with high spatial resolution data Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day)	Image pre-processing (1 day)

	Image classification to vegetation types (15 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 26 days per scene	Image classification to cover types (8 days per scene) Field/Photo verification for a select number of sample sites: (8 days) Map output production: (2 days) Total = 19 days per scene
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data = $1950 Aerial Photos (10) = $90/frame to acquire or less to hire Ancillary data (topo sheets)= $200 Processing = 28 days of technical officer @ $875/day= $24500 Total = $26650 Note: This assumes software have been purchased	Data acquisition: Image data = $4500 Ancillary data (topo sheets)= $200 Processing = 19 days of technical officer at $875/day= $16625 Total = $21325 Note: This assumes software have been purchased

Table 13 The remotely sensed variable TOPOGRAPHY
and the listing of data types, processing requirements and costs for mapping and monitoring this variable using several suitable types of remotely sensed data. MMU: Minimum mapping unit; GRE: Ground resolution element

	DATA OPTION 1: Airborne Laser Scanning	**DATA OPTION 2: Stereo-photography**
Spatial Dimensions		
Area to cover	Can be up to 1000km^2 or more	Can be up to 1000km^2 or more
Mapping unit	0.5m to 10m	0.1m to 5m
Positional accuracy	Within 5m or less dependent on GPS base station used	Within 1m
Temporal Dimensions		
When	User controlled	User controlled
How often	User controlled	User controlled
Variable to map	Land surface height	Land surface height
Environmental Restrictions	Density of vegetation height.	Density of vegetation height.
Processing technique	Ground and canopy return extraction, interpolation and ground and canopy mapping.	Softcopy Photogrammetry
(Output)	Raster or image surface with each pixel containing an absolute elevation.	Raster or image surface with each pixel containing an absolute elevation and an orthophotograph free of radial distortions.
Resources – Hardware and Software	PC Image processing software GIS with image analysis capabilities.	PC Softcopy photogrammetry software with DEM and orthophoto production capacity.
Resource – Personnel	Trained and with experience in ALS mapping. Knowledge of area to be mapped	Trained and with experience in softcopy photogrammetry. Knowledge of area to be mapped
Estimated task and times	Image pre-processing (1 day) Image analysis and DEM generation (4 days)	Photo pre-processing and control (1 day) Photo analysis and DEM generation (5 days)

	Map output production: (2 days) Total = 10 days per scene	Map output production: (2 days) Total = 8 days per area covered
Estimated Cost Note that these are estimates are flexible	Data acquisition: Image data quotes can be obtained from ALS data providers, e.g. AAM Hatch. Processing = 10 days of technical officer @ $875/day= 8750 Total = dependent on survey extent Note: This assumes software have been purchased	Data acquisition: Data can be obtained . from aerial survey companies, largest in Australia is Fugro. Processing = 8 days of technical officer @ $875/day= 7000 Total = dependent on survey extent Note: This assumes software have been purchased