Fit for purpose coastal erosion mapping

- a look at the States declared erosion prone areas.

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Purpose of the presentation

- Provide a brief overview of the history of coastal erosion hazard mapping in Queenslansand
- Perspective on the quality of the erosion assessment and mapping product and how it can be viewed in terms of ‘fit for purpose’
- Where to from here?

Some attributes of the Qld coast

- 5000km of coastline
- landforms are dominantly dune systems , beach ridge plains and river delta coasts - sedimentary coasts
- erodible and often low lying
- exposed to cyclones, open ocean swell waves, water level changes and tidal flows

Everybody wants to be there

- coasts are a highly desirable lifestyle choice hence driver for near coast new urban development
- extensive urbanisation on the coastal plains

But there's a problem!

Exposure to coastal hazards

- Coastal erosion
- Storm tide inundation
- Climate change sea level rise and cyclone intensification are the key threats

State Planning Policy - requirements for coastal hazards

- Identify erosion hazard areas
- Undertake a fit for purpose risk assessment to identify and achieve to tolerable level or acceptable levels of risk for the community
- AS/NZS ISO31000 risk assessment and management framework identified as a guiding document

Similar approach for Qcoast2100 coastal hazard adaptation strategies.

Head of power for erosion hazard determination

- Section 70 of the *Coastal Protection and Management Act 1995* may declare an area to be an erosion prone area.
- May be amended from time to time by EHP
- Continues original provisions in the *Beach protection Act 1968*.

History

- State focus on coastal erosion driven by massive erosion events in 1960 – 70s especially Gold Coast
- Erosion prone area declared for all open coasts in 1984 and
- Extended to all land abutting tidal water in 1995

EPA erosion assessment methodology

- Science based assessment:
  - o Short term (storm cut) erosion, 100 year ARI, plus
  - o Long term (sediment supply deficit, channel migration) erosion for 50-100yr planning period, plus
  - o Impact of sea level rise to 2100 (permanent inundation and morphological response of 0.8m sea level rise), plus
  - o Scarp collapse component, plus
  - o Safety factor of 140%

$$E = [(N \times R) + C + S] \times (1 + F) + D$$

Methodology published in EHPs Coastal Hazard Technical Guide

Methodology continued

- Subdivision of coast into some 2300 compartments with uniform characteristics (landform, sediment type, exposure)
- Erosion extents derived by several approaches:
  - regional coastal process investigations
  - site specific assessments
  - regional erosion values applied to geomorphic/exposure based beach types
  - default values
- Supported by recent work of NCCARF (Approaches to risk assessment on Australian coasts, 2012, Woodroffe el al)
- Components can also be integrated through shoreface evolution models – capacity to simulate short to geological time scale.

Studies

Regional studies

- Mulgrave Shire Northern Beaches
- Capricorn Coast Beaches
- Hervey Bay Beaches
- Mackay Coast Study

Local studies

- Gold coast beaches
- Shoreline erosion management plans
- Local coastal process studies
- Lot specific EPA reassessmants
- Coastal conditions data collection and analysis

Regional erosion values applied to geomorphic/exposure based beach types

Typical Values for Buffer Zone Widths

A. For the case where no boulder wall exists

(a) Pocket beach, extensive intertidal flats 65m

(b) Pocket beach, no intertidal flats 95m

(c) Long straight beach, extensive intertidal flats 80m

(d) Long straight beach, no intertidal flats 110m

B. For the case where a boulder wall exists

(a) Beach with extensive intertidal flats 55m

(b) Beach with no intertidal flats 80m

C. Where rock outcrops in calculated buffer zone, width is determined by location of rock.

D. Where rock strata are known to underly beach sand at shallow depth - Short term component + 40% Factor of Safety + Dune Scarp Component

E. Beaches influenced by river and creek mouths. 400m

The above values are for low dune beaches. For beaches with dunes higher than 5m above MHWS the zone widths should be adjusted making allowance for the presence of the high dunes.

Erosion Prone Area
Fraser Coast Region Local Government Area

Erosion Prone Area Definition

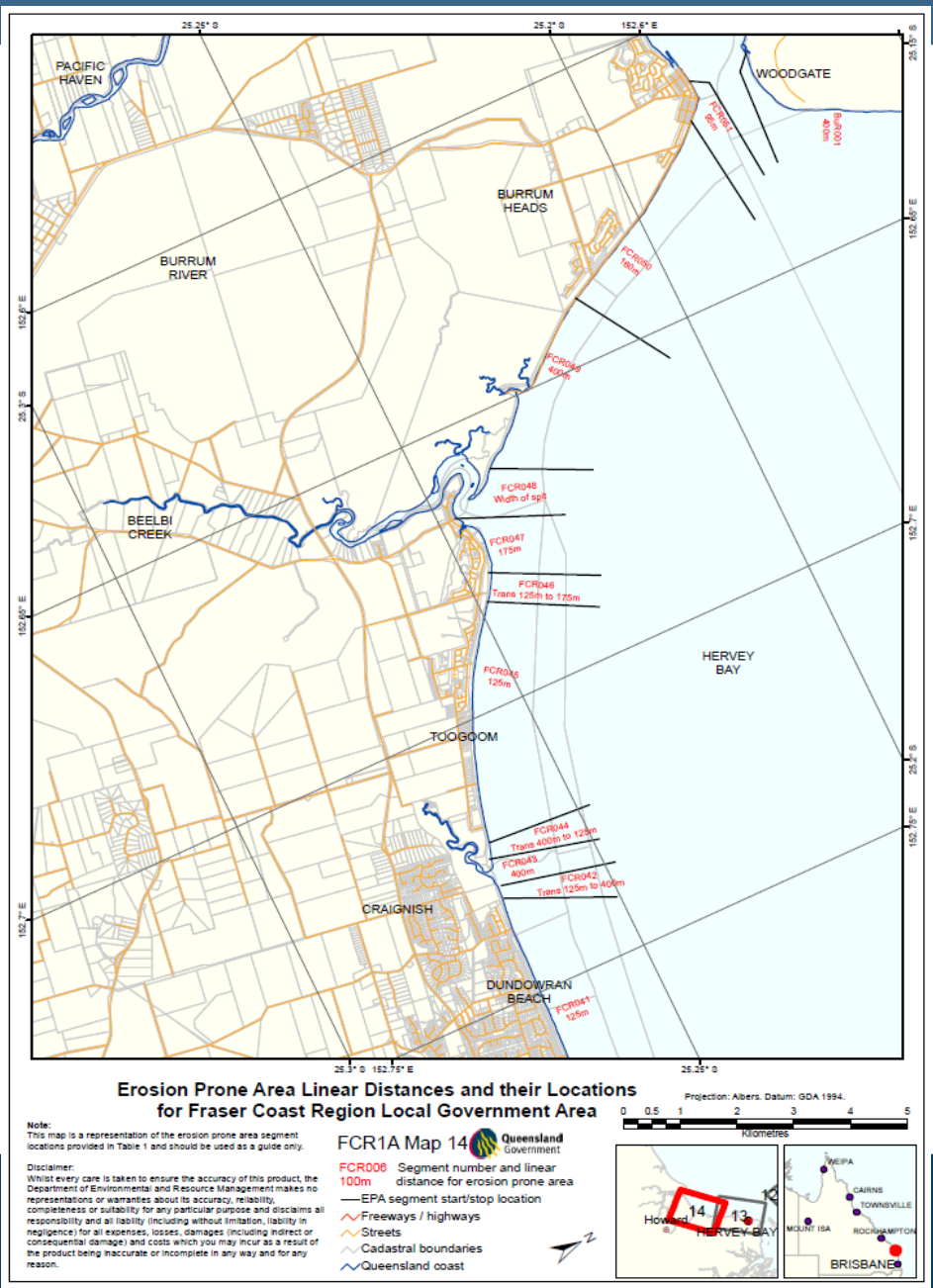
1. Erosion prone areas are deemed to exist over all tidal water to the extent of Queensland Coastal Waters and on all land adjacent to tidal water.
2. Erosion prone areas include areas subject to inundation by the highest astronomical tides (HAT) by the year 2100 or at risk from sea erosion.
3. On land adjacent to tidal water the landward boundary of the erosion prone area shall be defined by whichever of the following methods gives the greater erosion prone area width:
   a. a line measured 40 metres landward of the plan position of the present day HAT level except where approved revetments exist in which case the line is measured 10 metres landward of the upper seaward edge of the revetment, irrespective of the presence of outcropping bedrock;
   b. a line located by the linear distance shown on Table 1 and measured, unless specified otherwise, inland from:
      i. the seaward toe of the frontal dune (the seaward toe of the frontal dune is normally approximated by the seaward limit of terrestrial vegetation or, where this cannot be determined, the level of present day HAT); or
      ii. a straight line drawn across the mouth of a waterway between the alignment of the seaward toe of the frontal dune on either side of the mouth
   c. the plan position of the level of HAT plus 0.8 m vertical elevation.

   Except:
   i. where the linear distance specified in 3b is less than 40 metres, in which case section 3a. does not apply and the erosion prone area width will be the greater of 3b and 3c; or
   ii. where outcropping bedrock is present and no approved revetments exist, in which case the line is defined as being coincident with the most seaward bedrock outcrop at the plan position of present day HAT plus 0.8m; or
   iii. in approved canals in which case the line of present day HAT applies, irrespective of the presence of approved revetments or outcropping bedrock.

4. Erosion prone areas defined in accordance with the above are deemed to exist throughout all the local government areas, irrespective of whether the entire local government area is depicted on erosion prone area plans for the area.

Notes to clarify the definition

1. The specific location along the coast to which each erosion prone area linear distance applies (a segment) is shown in Table 1.
2. A map indicating the approximate location along the coast of each linear distance segment is attached.
3. Each erosion prone area segment is located on the coastline between 2 points defined by latitude and longitude. A projection of each point to the nearest actual coastline and continuing inland perpendicular to the coast defines the erosion prone area segment.
4. "Present day HAT" in the definition is always taken to be the present day level of HAT for the coastline as defined in the Queensland Tide Tables for that year or as defined by empirical methodology at the site.
5. The extent of the erosion prone area where it is defined by "HAT plus 0.8m" is the HAT coastline at the year 2100 and includes sea level rise to that time. It is determined by the area of land inundated to the level HAT of the nearest adjacent open coast or river tide gauge plus 0.8m vertical elevation. Site based HAT is not to be used as present day attenuation of inland HAT level due to flow constraints may not persist to 2100 with coastline response to sea level rise. For further explanation see the Coastal Hazard Technical Guide.
6. Where noted on Table 1 (and the map) the specified linear distance applies except where a revetment has been constructed and maintained to the approved design in which case the landward boundary of the erosion prone area is at the upper seaward edge of the revetment (A-line).
7. The approximate erosion prone area footprint is shown on Coastal Hazard Area Maps available on the Department of Environment and Heritage Protection website at www.ehp.qld.gov.au. These footprints are indicative only and the definition in this plan prevails for any inconsistency between the two.
8. This erosion prone area plan may be updated from time to time and a new revision created. Please check with the Department of Environment and Heritage Protection or the local government that this copy is the current version prior to using the contained information in any way.



Erosion Prone Area Linear Distances and their Locations for Fraser Coast Region Local Government Area

Projection: Albers. Datum: GDA 1994.

0 0.5 1 2 3 4 5 Kilometres

FCR1A Map 14

Queensland Government

FCR006 100m — Segment number and linear distance for erosion prone area

EPA segment start/stop location

Freeways / highways

Streets

Cadastral boundaries

Queensland coast

Note:
This map is a representation of the erosion prone area segment locations provided in Table 1 and should be used as a guide only.

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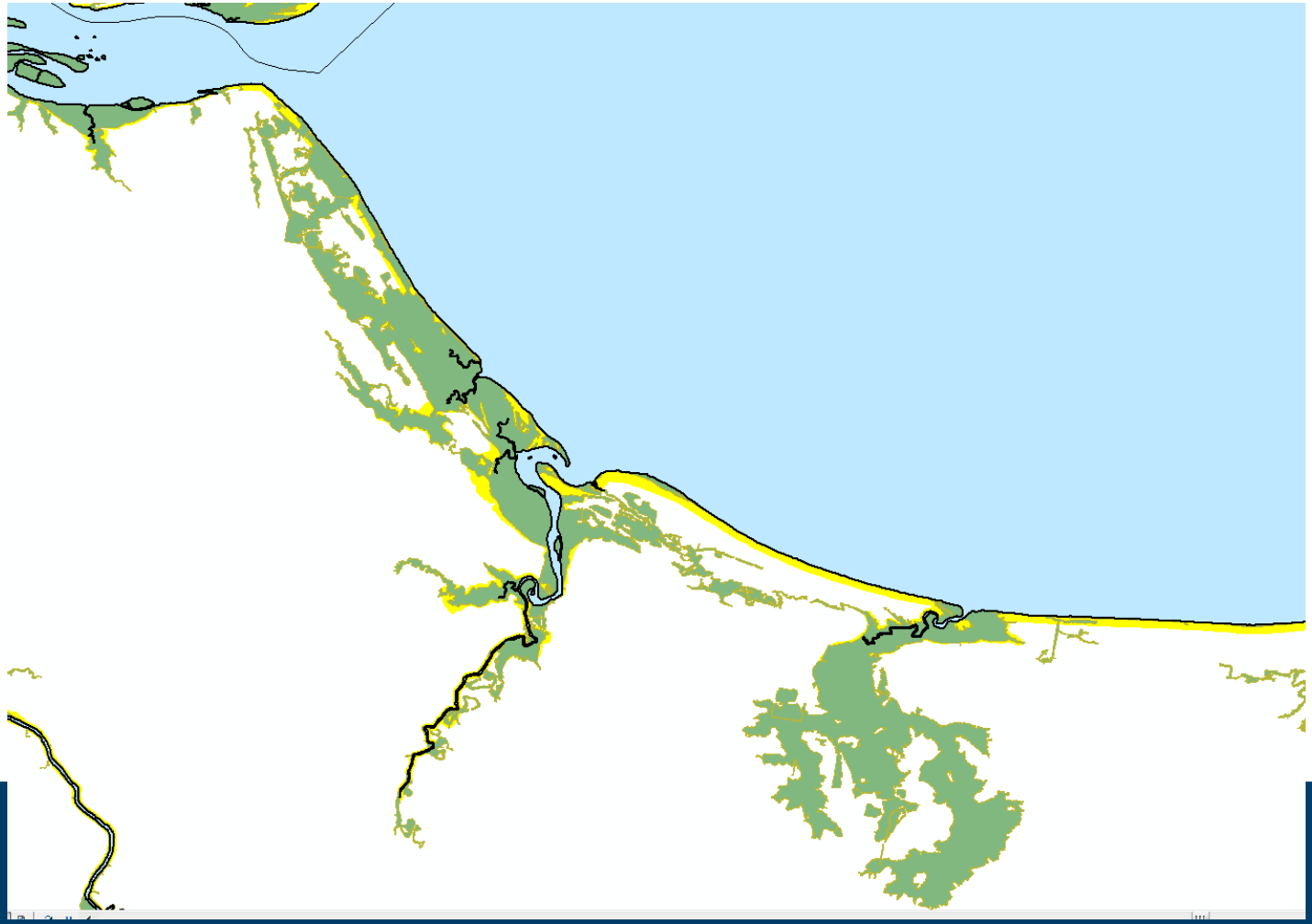
The State govt provides indicative footprint mapping of the EPA for the entire coastline



Use of EPA and mapping for CHAP and planning schemes

Test 1: Is the EPA 'Fit for purpose'?

(Fit for purpose – tailored to meet the local needs, circumstances and resources of a community)

- EPA perceived as a basic (first pass) assessment and therefore not good enough
- EPA 'quality' varies from location to location - usually based on method of assessment
- Older EPAs tend to be very conservative or 'safe'. Overestimate hazard therefore low risk, but at a cost of additional land capture.
- Irrespective of method can have age related issues if work was done 10 or 20 years ago – may need to consider recent changes and newer data sources.
- Default value (40m) based on a 'reasonable' buffer concept, not processes, in complex estuarine /riverine environments

Test 2: how good is the footprint mapping?

- Based on ‘time of mapping coastline which is around 2011-2014 coastline (toe of dune) – but erosion extent is measured from a moveable tidal boundary
- Statewide mapping approach cannot interpret revetment quality or rock clauses in the definition
- Ground truthing not possible
- Sea level rise inundation area based on coastal LIDAR circa 2011, error up to +-15cm vertical elevation

Decision to reassess EPA or repeat mapping?

- value and use of the land
- whether it is in or out of the urban footprint – future development potential
- timeframe of future decisions regarding rezoning or development

- cost of the work

- technical difficulty especially with large geographical extent
- data availability to support new mapping

Erosion Prone Areas – development free buffer zones

Erosion Prone Area

Development free buffer zone