Title: Coastal Acid Sulphate Soils of Australia

Custodian: CSIRO Land & Water

Jurisdiction: Australia

Search Words: HAZARDS Mapping, SOIL Chemistry Indicators, SOIL Chemistry Mapping

Abstract:

This dataset depicts a national map of available ASS mapping with common legend that includes risk assessment criteria and correlations between Australian and International Soil Classification Systems.

Existing digital datasets of ASS mapping has been sourced from each coastal state and territory and combined into a single national dataset. Original state classifications have been translated to a common national classification system by the respective creators of the original data and other experts.

The mapping scale of source data ranges from 1:10K aerial photography in SA to 1:250K vegetation mapping in WA and NT, with most East coast mapping being at the 1:100K scale.

Lineage:

Existing state CASS mapping was received and processed to varying degrees to conform to the NatCASS national ASS classification system. Spatially, all datasets were reprojected from their original projections to geographic GDA94. Classification of state mapping polygons to the NatCASS classification system was as follows. In the case of SA, NSW, Qld and WA it was a matter of directly translating the original state ASS classifications to the NatCASS classifications. These translations were undertaken by the creators of the state data and other experts within the respective states.

Due to the more broad classifications of the original Vic and NT ASS mapping, polygons for these two states were initially translated to a NatCASS classification group (eg Tidal, Non-Tidal) by the data custodians then subsequently differentiated further through intersecting with other layers. These included the 3 second SRTM DEM and North Coast Mangrove mapping GIS datasets. The former being used to differentiate within the Non-Tidal zones (ie classes 1e-j and 2e-j) and the latter used to differentiate the Tidal zones (ie 1b-d, 2b-d).

Mapping of the Tidal-Zone classes was augmented for all states except SA and NSW with 1:100K Coastal Waterways Geomorphic Habitat Mapping (Geoscience Australia). This dataset was used to infer additional areas of bottom sediments (class 1a & 2a) and Intertidal Flats (class 2a & 2b),

The lineage of the individual original state maps, taken from their respective metadata records or associated reports are reproduced below. Notes on state specific modifications/augmentations undertaken as part of the National Mapping process are appended to each section.

SA

State Mapping:
Landform and Lifeform boundaries for individual salt marsh complexes are interpreted form Predominantly 1:10,000 or 1:15,000 colour aerial photography (sometimes 1:40,000 aerial photography is used where the more detailed aerial photography is not available) and drafted onto a stable film base. Environmental boundaries are digitised in Map Grid of Australia (MGA) coordinates and coded with a specific landform / lifeform code. Individual salt marsh complex data sets are then re-projected into a Lambert Conformal Conic coordinate system and appended into a state-wide data set. Acid Sulfate Soil codes were determined by CSIRO Land and Water based on field soil sampling.

Modifications for National Mapping:
State ASS codes for polygons were translated to the National codes by Rob Fitzpatrick CSIRO Land & Water. Polygons dissolved on new National codes.

NSW

State Mapping:
The maps predict the distribution of Acid Sulfate Soils (ASS) based on an assessment of the geomorphic environment. This assessment has involved mapping of the environments in which they are likely to be found, being the coastal lowlands up to approximately 10m AHD and carrying out fieldwork to establish field relationships between landform, elevation and occurrence of ASS. Landform elements were used as the basic mapping unit. These provide a basis for land use planning and allow the application of elevation classes so that the depth of occurrence of ASS within a landform element can be estimated. It allows the prediction of soil management problems in other areas with similar landform and soil characteristics. ASS

maps are not intended to provide site specific ASS information. The information derived from the maps cannot be used in the assessment of the potential to effectively manage ASS in a particular development. When using ASS maps, it must always be remembered that that there can be expected to be extreme variations in the nature and distribution of of ASS and that the depth to the ASS layer can be highly variable. The depths given in the map key should be used as a guide only and not used for a specific assessment of development potential. It is recommended that all land use activities likely to disturb ASS require appropriate soil investigations and a management plan to avoid environmental degradation.

Modifications for National Mapping:
State ASS codes for polygons were translated to the National codes by experts in NSW DIPNR (see acknowledgements), Polygons were then dissolved on new National (NatCASS) codes.

Qld

State Mapping:
ASS for Southeast Qld was interpreted from 1:100K topographic maps with ground truthing

Ground truthing has been carried out at an intensity of one site per square kilometre. Potential acidity has been assessed by laboratory testing and actual acidity is indicated when field pH is < 4.0. Potential acidity from soil sulfides has been assessed principally by the Total Oxidisable Sulfur (TOS) method (Method 20). A selection of samples has been tested using the POCAS method (Method 21 - Ahern et al 1998).
Limited or no field checking has been carried out on disturbed lands. The outer boundary of estuarine ASS is established using limited field checking together with use of contour lines and geological map boundaries. The NS2 unit is not ground truthed at 1:100 000 scale and it should be noted that certain lithologies within it may contain sulfidic material of non estuarine/holocene origin.
Base Map: Infrastructure, hydrographic and relief data supplied courtesy of AUSLIG.

ASS classes for the remainder of the Qld coast were interpreted from 1:100K mangrove mapping. Landsat TM imagery was digitally classified and interpreted with colour 1:50 000 aerial photography and ground truthing.

Modifications for National Mapping:
State ASS codes from the SE QLD ASS mapping dataset and Mangrove polygons were translated to the National codes by experts in QNRM (see acknowledgements). Coverage was augmented with the Coastal Waterways Geomorphic Habitat Mapping for Qld dataset that had also been translated to National codes (see end of section). Polygons were then dissolved on new National codes.

Vic

State Mapping:
Assessment of geological records, analysis of digital elevation models, aerial photo interpretation, extensive field work and laboratory analyses of soil samples were used to produce acid sulfate soil risk maps. A set of 1:100 000 scale maps of coastal acid sulfate soils is presented for the purposes of land management and environmental planning in landscapes in coastal Victoria.

Modifications for National Mapping:
Polygons in the Vic ASS mapping were assigned a NatCASS code by expertis in Vic DPI on a 1:100K mapsheet basis. The SRTM DEM was used to further differentiate the Vic ASS polygons coded to the height dependent NatCASS codes in Non-tidal zones (e-j). THe DEM was also used to differentiate Tidal zone classes (b & c) in the cases where the Vic translations have not been specific (ie Geelong, Western Port & Warragul mapsheets). t). Coverage was augmented with the Coastal Waterways Geomorphic Habitat Mapping for Vic dataset that had also been translated o National codes (see end of section). Polygons then dissolved on new National codes.

NT
State Mapping:
NT info. Is derived from land systems data, rather than soil units. I do not see this as a
problem due to the scale adopted for the National coverage.
Operationally, we generally use higher resolution data for assessment of development proposals - around Darwin Harbour 1:25k and 1:10k has proved to be useful.
Detailed mangrove mapping, led by Peter Brocklehurst, now extends from the Adelaide R estuary westward to the Finniss R. The current program will take in the Daly R (any volunteers for the fieldwork?).

WA

State Mapping:
Swan Coastal Plain

Classification of map units in 1:50 000 Urban Geology (UG) and Environmental Geology (EG) map series (Department of Mineral and Petroleum Resources) conducted by Department for Planning and Infrastructure (2003) under advice from Department of Environment. Classification of existing environmental and urban geology map units updated with information from on-ground mapping program. Mapping of ASS risk around Peel-Harvey Inlet was conducted using a combination geology, soil land-scape mapping and surface contour information guided by on-ground soil survey information and aerial photography. Soil-landscape mapping used for this process consisted of Department of Agriculture 1:50 000 soil-landscape map sheets Peel Harvey north, Mandurah-Murray, Peel-Harvey South and Harvey-Capel.

NorthWest WA

Classification of 1:100 000 NW coastal wetland map units (obtained from the WA EPA from work undertaken for the NorthWest Shelf Coastal Wetland Mapping, 1999-2000) was undertaken by Brad Degens. 1:100 000 geology mapping was sourced from the Department of Industry and Resources, WA Pre-European Vegeation mapping data was sourced from the WA Department of Conservation and Land Management (2002).

Modifications for National Mapping:
State ASS codes from the SE QLD ASS mapping dataset and Mangrove polygons were translated to the National codes by experts in QNRM (see acknowledgements). Coverage was augmented with the Coastal Waterways Geomorphic Habitat Mapping for WA dataset that had also been translated to National codes (see end of section). This augmentation was applied only to areas outside the original NorthWest mapping extent. Polygons were then dissolved on new National codes.

Tas

State Mapping:
ASS polygons delineated based on desktop evaluations of geology, geomorphology, soil type, soil chemical data and surface water chemistry. This baseline information was used for targeting field investigation laboratory analysis and reconnaissance mapping of acid sulphate soils. A total of 137 sites were investigated and 115 core samples collected. (Ref Gurung, S2001. Tasmanian Acid Drainage Reconnaissance. Map 4. Distribution of Acid Sulphate Soils in Tasmania. Mineral Resources Tasmania)

Modifications for National Mapping:
The SRTM DEM was used to differentiate Tasmanian ASS extent polygons into the three height bands of the Non-Tidal Sandplains and Dunes classes, i.e. < 2m, 2-10m and > 10m for NatCASS classes 1h, 1i and 1j respectively Coverage was augmented with the Coastal Waterways Geomorphic Habitat Mapping for Tas dataset that had also been translated to National codes (see below). Polygons were then dissolved on new National codes.

Coastal Waters Geomorphic Habitat Mapping:

This layer was used to augment the coverage of coastal ASS risk for those states indicated. Coastal Habitat Classes were translated to the NatCASS codes as follows.

Coastal Habitat Class	Inferred NatCASS code	Notes
Central Basin	1a (bottom sediments)	All
Fluvial Delta	1a (bottom sediments)	All
Flood & Ebb-tide Delta	Applied to states	All
Channel	1a (bottom sediments)	All
Mangrove	1b (intertidal flats)	All
Intertidal Flats	1b (intertidal flats)	WA only
Intertidal Flats	2b (intertidal flats)	All except WA
Saltmarsh/Saltflat	1d (extratidal flat)	WA only

All Subscripts = p, Confidence = 3 for Qld and NT. Confidence = 4 for Vic, Tas and WA. Does not apply to SA and NSW.

Positional accuracy

Data has been captured at varying scales depending on location. Data collection scale for the respective areas are as follows.

SA: 1:10K, 1:15K and 1:40K aerial photography
Qld: 1:100K vegetation and topographic mapping, 1:100K Estuaries mapping
Vic: 1:63K and 1:250K geology mapping, 1:100K soil-landform mapping and DEM derived from 1:25K topographic mapping, :100K Estuaries mapping.
NSW: 1:25K maps.
WA: 1:50K soil-landscape and geological mapping (Swan Coastal Plain) 1:100K geology and wetland mapping, 1:250K vegetation mapping (Northern WA) and 1:100K Estuaries mapping.
NT: 1:250K and 1:100K Estuaries mapping
Tas: 1:100K Estuaries mapping and unspecified Geological/geomorphology/Soil base maps, presumably 1:250K

Attribute Accuracy

Attribute accuracy is as per the source data. Notes on the attribute accuracy of the respective areas taken from original metadata and associated documents are as follows. These state specific notes pertain to the original state ASS mapping layer received. For SA and NSW the polygon coverage is unaltered save for the dissolving of neighbouring polygons having the same NatCASS classification. For the rest, original state coverage has been modified or augmented with other layers. Attribute accuracy notes on those follow.

SA

Classification based on aerial photo interpretation, survey data, ground truthing and expert knowledge.

NSW

Mapped codes were checked as part of the GIS capture quality assurance procedures, including a visual check of polygon tags against field sheets following digital capture. Soil samples were taken in the field and analysed in the laboratory. During the field work phase, field meetings were held with ASS surveyors to ensure consistency in site selection strategies, soil profile description methods and soil sampling techniques. Quality control and consistency in the mapping and coding of landform elements were also maintained by field checking by other ASS surveyors in the team and regular meetings to discuss and review the process

Qld

SE Qld: Occasionally, land has been mapped where there is actual acidity, but the oxidisable sulfur percentage may not exceed the `action level`. The reliability of elevation data is variable across the study area.

Mangroves: approximately 80%

Vic

The mapped extent of probable ASS is based on a combination of knowledge and data, including formation processes, height above current sea level, geological mapping, soil mapping and site assessment. Due to the state of flux of the environment in which ASS form, and due to the processes that have occurred since their formation, the actual distribution of ASS is difficult to accurately predict. What is mapped is the most likely occurrence of the formation of ASS.

WA

Good - all populated content for physical and environmental categories are known and verified by custodian.

NT

unknown

Tas

Verified by lab analyses.

Logical Consistency

Additional Metadata

LEGEND for National Coastal ASS Map

Code and Map Unit	Distinguishing soil/sediment properties, vegetation, landforms, or other characteristics
1. High Probability of Occurrence of Acid Sulfate Soils[1]	
TIDAL ZONES	
1a Bottom sediments	PASS[2] material and/or MBO[3]. Often seagrasses.
1b Intertidal[4] flats	PASS[2] within upper 1 m. Often with mangroves.
1c Supratidal[5] flats	ASS[6] within upper 1 m. Halophytes (mainly samphire), salt marsh, salt pans.
1d Extratidal[7] flats	ASS[6] within upper 1 m.
NON-TIDAL ZONES **Floodplains**	
1e Floodplains < 2 m AHD[8]	ASS[6], generally within upper 1 m. Grasslands, reedlands and wetland forests (e.g. *Melaleuca, Casuarina*). Includes backplains, backswamps and interbarrier swamps.
1f Floodplains 2 - 4 m AHD[8]	ASS[6], generally below 1 m from the surface. Generally wetland forests (e.g. *Melaleuca*, *Casuarina*). Includes plains and levees.
1g Floodplains > 4 m AHD[8]	ASS[6], generally below 3 m from the surface. Generally forests. Includes plains and levees.
NON-TIDAL ZONES **Sandplains and dunes**	
1h Sandplains and dunes, 0 - 2 m AHD[8]	ASS[6], within 1 m of the surface. Often wet heath. Holocene or Pleistocene.
1i Sandplains and dunes, 2 - 10 m AHD[8]	ASS[6], below 1 m from the surface. Heath, forests. Holocene or Pleistocene.
1j Sandplains and dunes, > 10 m AHD[8]	ASS[6], generally below 1 m from the surface. Heath, forests. Mainly Pleistocene.

Profoundly disturbed	
1x Disturbed ASS[6] terrain	AASS[11] material present in former tidal zones inside bund walls and/or anthropic[9] ASS material > 0.3 m thick, e.g. dredge spoil, fill, ponds, excavations, urban development.

2. Low Probability of Occurrence of Acid Sulfate Soils[10]	
TIDAL ZONES	
2a Bottom sediments	PASS[2] material and/or MBO[3]. Often seagrasses.
2b Intertidal[4] flats	PASS[2] within upper 1 m. Often with mangroves.
2c Supratidal[5] flats	ASS[6] within upper 1 m. Halophytes (mainly samphire), salt marsh, salt pans.
2d Extratidal[7] flats	ASS[6] within upper 1 m.
NON-TIDAL ZONES **Floodplains**	
2e Floodplains < 2 m AHD[8]	ASS[6], generally within upper 1 m. Grasslands, reedlands and wetland forests (e.g. *Melaleuca, Casuarina*). Includes backplains, backswamps and interbarrier swamps.
2f Floodplains 2 - 4 m AHD[8]	ASS[6], generally below 1 m from the surface. Generally wetland forests (e.g. *Melaleuca*, *Casuarina*). Includes plains and levees.
2g Floodplains > 4 m AHD[8]	ASS[6], generally below 3 m from the surface. Generally forests. Includes plains and levees.
NON-TIDAL ZONES **Sandplains and dunes**	
2h Sandplains and dunes, 0 - 2 m AHD[8]	ASS[6], within 1 m of the surface. Often wet heath. Holocene or Pleistocene.
2i Sandplains and dunes, 2 - 10 m AHD[8]	ASS[6], below 1 m from the surface. Heath, forests. Holocene or Pleistocene.
2j Sandplains and dunes, > 10 m AHD[8]	ASS[6], generally below 1 m from the surface. Heath, forests. Mainly Pleistocene.

Profoundly disturbed	
2x Disturbed ASS[6] terrain	AASS[11] material present in former tidal zones inside bund walls and/or anthropic[9] ASS material > 0.3 m thick, e.g. dredge spoil, fill, ponds, excavations, urban development.

3. No Known Occurrence of ASS

4. Not Assessed

Subscripts to codes:
(a) = Actual ASS (AASS[11]) confirmed by sampling or field observation.
(p) = Potential ASS (PASS[2]) confirmed by sampling or field observation.
(h) = Hypersaline[12] or gypseous[13] horizons generally within 10 cm of the surface.
(o) = Organic[14] surface horizons.
(P)= Pleistocene (all other units are Holocene).
Confidence levels (after Isbell 1996)
Map polygon contains ASS, and
1 = all necessary analytical and morphological data are available;
2 = analytical data are incomplete but are sufficient to classify the soil with a reasonable degree of confidence;

3 = no necessary analytical; data are available but confidence is fair, based on a knowledge of similar soils in similar environments;
4 = no necessary analytical data are available and the classifier has little knowledge or experience with this kind of soil, hence the classification is provisional.

Example: 1e (a1) – polygon is a floodplain < 2 m AHD, with actual ASS confirmed by analytical and morphological data.

Footnotes:

1. High probability is > 70% of mapping unit.
2. Potential acid sulfate soil (PASS) = sulfidic material (see Isbell 1996, pp. 121-122).
3. Monosulfidic Black Ooze (MBO) is organic ooze enriched by iron monosulfides. See Bush *et al*. (2004).
4. The intertidal zone is that between mean lower low water (MLLW) and mean higher high water (MHHW) (see MHL).
5. The supratidal zone is that above mean higher high water (MHHW), but below the extratidal zone. Spring tides will reach the lower part of the supratidal zone, the average spring tidal level being that known as mean high water springs (MHWS). See Isbell (1996, p 47) and MHL
6. Acid sulfate soil (ASS) may include PASS or AASS + PASS.
7. The boundary between the extratidal zone and the supratidal zone (see below) is defined by vegetation community, i.e. grassland v saltmarsh (see Isbell 1996, p 47).
8. Australian Height Datum (AHD) approximates mean sea level. AHD is a surface based on mean sea level adopted in 1971, and described in Special Publication 10 -Australian Geodetic Datum Technical Manual, Division of National Mapping, for the National Mapping Council.
9. Anthropic material is profoundly modified soil material, the term being derived from the soil order Anthroposol as defined by Isbell (1996, p 18).
10. Low probability is < 70% of mapping unit.
11. Actual acid sulfate soil (AASS) = sulfuric material (see Isbell 1996, p.122.)
12. Hypersaline is equivalent to hypersalic as defined by Isbell (1996, p 47). Saltpans are common, rainfall is generally < 400 mm, and the vegetation is dominated by halophytes (samphire, salt bush, blue bush).
13. Gypseous is equivalent to gypsic as defined by Isbell (1996, p 114).
14. Organic, as for organic materials defined by Isbell (1996, p 116). Rainfall is generally > 400 mm, and the vegetation is mainly grassland (e.g. saltwater couch, *Phragmites*)

References:

Isbell, R.F. (1996). The Australian Soil Classification. CSIRO Australia.
Manly Hydraulics Laboratory (MHL): http://www.mhl.nsw.gov.au/www/tide_glossary.htmlx#IZ
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Acknowledgements:

National Co-ordination:
Rob Fitzpatrick (CSIRO) with assistance from Bernie Powell (QNRM), GIS by Steve Marvanek (CSIRO)

State ASS mapping contributors:

NSW (DIPNR)
- Mitch Tulau
- Greg Chapman
- Glenn Atkinson

NT (Land & Vegetation)
- Dave Howe

WA (Environment)
- Brad Degens

SA (DEH)
- Doug Fotheringham
- Tim Noyce (GIS)

Vic (DPI)
- Austin Brown
- Nathan Robinson

Qld (QNRM)
- Bernie Powell
- Don Malcolm

Tasmania
- Chris Grose with Wojciech Grun (original mapping) and Ken Bird (GIS)