CORANGAMITE CMA SOIL HEALTH STRATEGY

Identification and management of acid sulfate soils

Australian Government

Victoria
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CORANGAMITE CMA
HEALTHY CATCHMENTS - HEALTHY WATERWAYS

Produced for the Corangamite Catchment Management Authority by the Victorian Department of Primary Industries

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Cover Photos:
Potential acid sulfate soils showing dark sulfidic material. Photo by Richard Merry.

Concrete pipe has eroded due to the action of sulfuric acid released from ASS. Photo by Richard Merry.

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Introduction – Acid sulfate soils

- **These soils, when disturbed are potentially very dangerous and destructive to the environment and property.**
- The existing maps of known locations of acid sulfate soils are still in development and should be considered as indicative, not absolute.
- A key point is that whatever our individual role in excavation or construction work, job planning, site supervisor or plant operator, we all share the responsibility for being aware of and taking account of the potential for acid sulfate soils in the environment.
- 'Acid sulfate soils' is the common name given to soils containing iron sulfides. These are found in many parts of the world.
- In Australia, the acid sulfate soils of most concern are those which formed within the past 10,000 years, after the last major sea level rise.
- When exposed to air, iron sulfides in the soil become oxidized, producing sulfuric acid - hence the name 'acid sulfate soils.'
- Iron sulfides are generally found within in a layer of waterlogged soil. This layer can be clay, loam or sand, and is usually dark grey and soft.
- In their natural, (unexcavated) state, these soils present no hazard since waterlogging prevents oxygen in the air from reaching the iron sulfides – hence the name 'potential acid sulfate soil' (PASS).

Fig. 1: Once disturbed and exposed to oxygen in the air, acid sulfate soils go on producing high concentration sulfuric acid.

Known and possible locations of acid sulfate soils (ASS)

- Iron sulfide layers in the soil were formed thousands of years ago under tidal conditions, so they are found today in low-lying areas, usually but not always:
  - near the coast, especially in estuaries and other tidal areas
  - in inland areas that were once tidal – such as around lakes and swamps

  where the surface elevation is less than five metres above mean sea level.
- Iron sulfide layers are still being formed today in mangrove forests and salt marshes, estuaries and tidal lakes.
- Possible coastal locations of ASS in the CCMA region include:
  - Point Henry and Moolap
  - Bellarine Peninsula, including Lake Connewarre
  - Breamlea
  - Anglesea
  - Apollo Bay
  - Aire River
  - Princetown and the Gellibrand River.
- Remember, ASS can also occur in inland areas but little is known about their distribution.

Key points to remember

- If you are going to work at a coastal or low-lying area, has your supervisor advised you that ASS may be present at this work site? If yes:

  - BE OBSERVANT

  - USE ACTION FLOW CHART.

- If no, and you know that the work site is low-lying, please remind the supervisor about the risk of acid sulfate soils.
- Remember to keep a sharp eye out for the signs of ASS - maps that identify the presence of acid sulfate soils are indicative and not absolute – so you may still dig into trouble!
- Once excavation starts, do the exposed soil types look like they may contain iron sulfide (pyrite)? If yes:

  - CONSULT HAZARD IDENTIFICATION

  - USE THE ACTION FLOW CHART

  If no, and you know you are in a low-lying area, please stay vigilant and look out for the indicators of their presence in a soil layer or changing soil type.

- Are there signs in the nearby areas of the impacts of ASS such as severely scalded ground, fish kills in water, iron staining in water or severe degradation of concrete structures in contact with the soil? If yes:

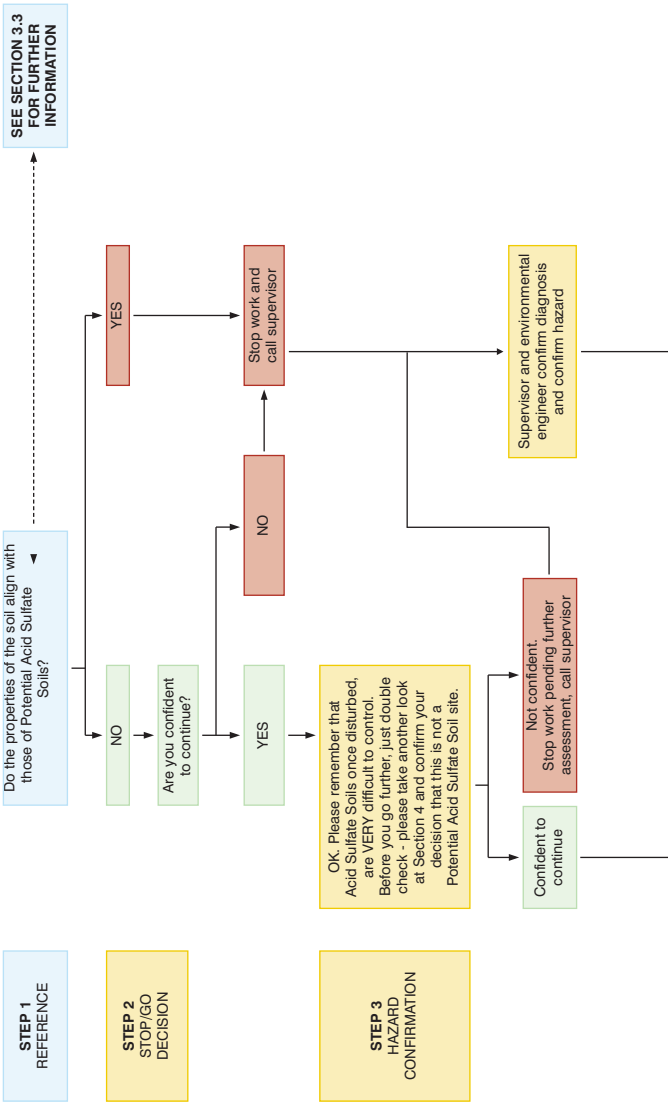
  - CONTACT YOUR SUPERVISOR IMMEDIATELY

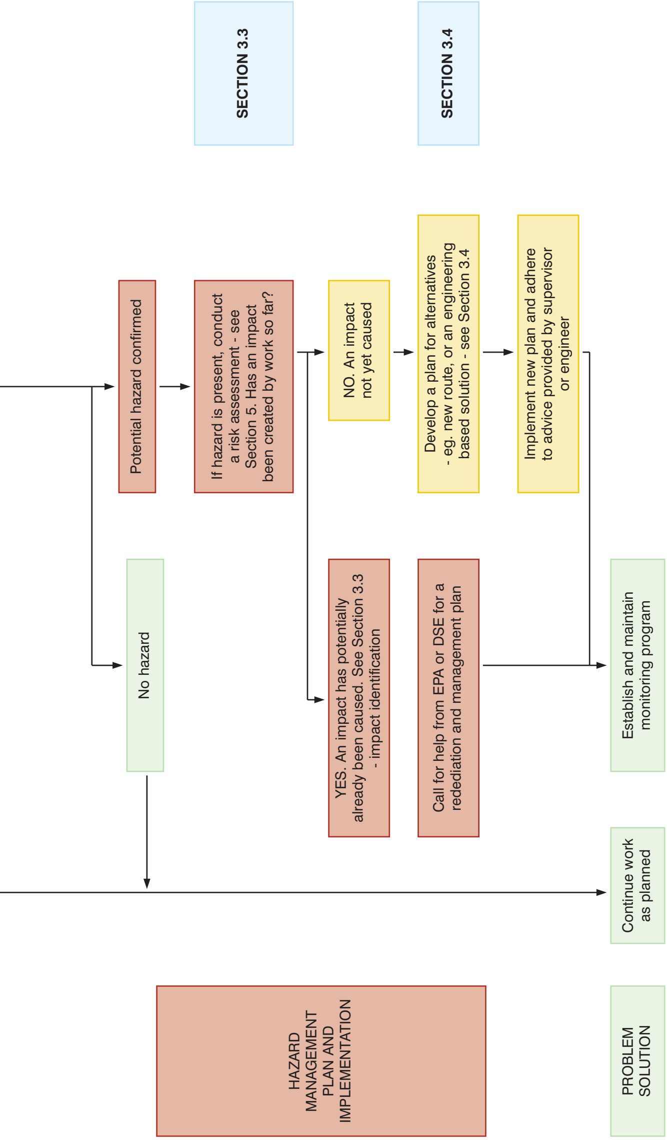
  - USE THE ACTION FLOW CHART.

If you are in doubt about whether ASS may exist or there has been an impact from ASS, **STOP** and contact your supervisor.

Fig. 2: Acid water derived from acid sulfate soils.

Action flow chart for acid sulfate soils





HAZARD MANAGEMENT PLAN AND IMPLEMENTATION
PROBLEM SOLUTION
Potential hazard confirmed
No hazard
If hazard is present, conduct a risk assessment - see Section 5. Has an impact been created by work so far?
SECTION 3.3
NO. An impact not yet caused
YES. An impact has potentially already been caused. See Section 3.3 - impact identification
Develop a plan for alternatives - eg. new route, or an engineering based solution - see Section 3.4
SECTION 3.4
Call for help from EPA or DSE for a rediation and management plan
Implement new plan and adhere to advice provided by supervisor or engineer
Establish and maintain monitoring program
Continue work as planned

Hazard identification

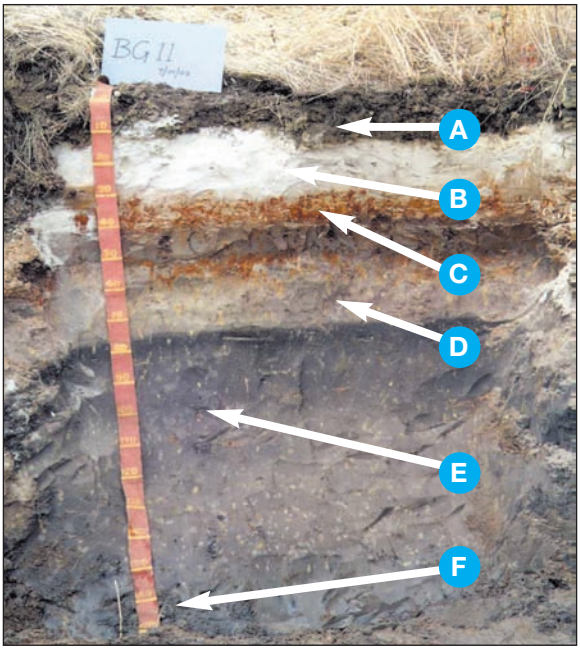


Fig. 3: Actual acid sulfate soils showing yellow streaks and mottling patterns containing jarosite (pH<4) in the grey subsoil.

Iron Sulfides appear as yellow streaks in dark grey soils. Other layers may show bleaching.

A - Clayey saline sediments at surface pH 7
B - Leached Sand
C - Iron oxides and gypsum deposited above a less permeable clay layer
D - Leached Sand
E - Sulfuric horizon with yellow jarosite mottles pH<3.5
F - Sulfidic material with pyrite framboides pH >5

ON SITE ACTION:

- Stop excavation
- Fill in excavation if in contact with water
- Contact Supervisor

Fig. 4: Potential acid sulfate soils showing dark sulfidic material (pH 7).

Sulfidic materials may appear as dark grey soils, typical of PASS.

ON SITE ACTION:

- Stop excavation
- Fill in excavation, especially if in contact with water
- Contact Supervisor

Iron Sulfides appear as yellow streaks in dark grey soils.

ON SITE ACTION:

- Stop excavation
- Fill in excavation if in contact with water
- Contact Supervisor

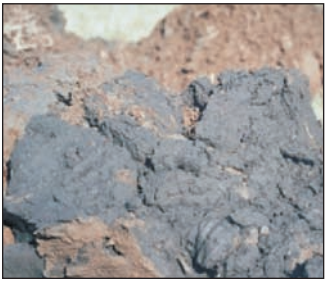


Fig. 5: Black stickey soil is often an indication of potential acid sulfate soils.

Impact of acid sulfate soils

Fig. 6: Iron precipitation in water can occur after ASS has been exposed.

Fig. 7: Fish kills can occur due to the release of sulfuric acid after ASS has been exposed.

Fig. 8: Concrete pipe has eroded due to the action of sulfuric acid released from ASS.

Further information

Contact your Supervisor who will have access to more detailed information on acid sulfate soils from the Corangamite Catchment Management Authority. Additional information also available on the CCMA Soil Health Web site at **www.ccma.vic.gov.au/soilhealth**

Acknowledgement: Much of this information has been sourced from other documents and full reference is given in the accompanying training manual.

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For further information on Soil Health in the Corangamite region:
www.ccma.vic.gov.au/soilhealth

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