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Lower Lakes & Coorong Recovery

Acid Sulfate Soils Research Program

Spatial Variability of Subaqueous and Terrestrial Acid Sulfate Soils and Their Properties, for the Lower Lakes

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Government of South Australia

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Cover image

Lower Lakes, May 2009 (DENR 2009)

Spatial Variability of Subaqueous and Terrestrial Acid Sulfate Soils and Their Properties, for the Lower Lakes South Australia

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Executive Summary

Background and Aim

This study was commissioned by the Murray Futures Lower Lakes & Coorong Recovery Acid Sulfate Soils Research Program [Department of Environment and Natural Resources (previously Department for Environment and Heritage, South Australia] to conduct a field survey and laboratory analyses in the Lower Lakes of South Australia, (Figure 1-1), to provide the following:

1. A spatially valid data set of acid sulfate soil properties that are required to support on-going modelling work.
2. Maps showing the spatial heterogeneity of the soil morphological and acid base accounting properties of subaqueous soils, submerged soils and exposed soils at time of sampling properties that determine net acidity.
3. To map the wide distribution of acid sulfate soil materials by classification of soil types and subtypes.

The study area includes Lake Albert, Lake Alexandrina and the tributaries of Finniss River and Currency Creek. These areas, in the lower reaches of the River Murray in South Australia, have recently experienced falling and historically low water levels due to extreme drought conditions. The exposure and drying of hypersulfidic materials can potentially have serious environmental consequences relating to soil and water acidification, metal mobilisation, de-oxygenation of water and formation of malodours (H_2S, organo-S compounds). Left untreated, these soils can cause acidification of water bodies and toxic impacts on aquatic biota and human health.

To provide information to address the three requirements listed above, the survey design focused on providing a spatially distributed site data set to collect samples for analysis of surface soil layers from sites distributed across the study area. The sites were located using a stratified random approach that provided coverage throughout the study area but focused on areas near the shoreline where there was expected to be greatest variability in acid sulfate soil change and processes occurring. In addition to surface soil samples, CSIRO also collected subsoil samples at some sites that were later included as part of the study to provide additional information on subsoil properties. The field survey conducted in August 2009 described and sampled 330 sites from which 706 samples were analysed for pH and acid base accounting parameters.

Key Findings

A spatially reliable database of acid sulfate soil property data was produced and compiled for use with sets of maps showing distribution of acid sulfate soil parameters.

Acid sulfate soil material comprising both potential (hypersulfidic and hyposulfidic materials) and actual (sulfuric materials) acidity are widespread throughout the Lower Lakes study area. In summary, the information shows:

- 10% of the samples collected contained sulfuric material (pH < 4.0) and
- 39% of sites have considerable potential for further developing sulfuric materials from hypersulfidic materials if the water levels continue to drop exposing these soil materials allowing them to oxidise.

The acid sulfate soil map identifies the following areas classified as:

- Hypersulfidic subaqueous soils with associated hyposulfidic subaqueous soils and hypersulfidic hydrosols comprise 70,829 ha (i.e. are significant covering about 80% of the 89,219 ha.)
- Sulfuric unsaturated soils and sulfuric hydrosols comprise 18,226 ha (i.e. accounting for about 20% of the 89,219 ha).
- Sulfuric subaqueous soils comprise 165 ha (i.e. accounting for about 0.2% of the 89,219 ha).

Soil properties of electrical conductivity, $pH_{soil:water}$, $pH_{soil:peroxide}$, soil texture and net acidity showed good spatial dependence, allowing geostatistical maps to be generated for the surface layer. Acid neutralising capacity, acid generating potential (chromium reducible sulfur) and titratable actual acidity did not show good spatial dependence, and therefore would require further detailed geostatistical investigations to develop an improved map.

The maps identified areas of concern where low $pH_{soil:water}$ (sulfuric material) and / or high net acidity, and medium to high electrical conductivity occurred at Loveday Bay, near the barrages to the south of Alexandrina, near Clayton, Finniss River and Currency Creek, in the north of Lake Alexandrina (Boggy Lake and Dog Lake), and numerous isolated areas around the margins of Lake Albert.

Other areas were identified with low $pH_{soil:peroxide}$, net acidity and $pH_{incubation}$ that would indicate potential areas of concern (sulfidic material) if water levels continue to lower and the acid sulfate soils are oxidised. These areas include isolated locations throughout Lake Alexandrina and all of Lake Albert.

The soil map, in combination with the conceptual toposequence models, presents an understanding of acid sulfate soil distribution in three dimensions. Conceptualised temporal soil-regolith models have been included to describe the current understanding of acid sulfate soil distribution and to demonstrate predictive scenarios for changes occurring over time (e.g. progression from pre-drought to drought or current conditions and future possible conditions such as reflooding or continuation of drought conditions). This was demonstrated with an example from Loveday Bay to explain the occurrence of more than 100 ha of acidic water and subaqueous sulfuric soils.

Finally, this work provided the opportunity to exploit data from several previous CSIRO studies from the study area, which was integrated with the new data of the current project. This new consolidated data set remains an asset for exploitation in future projects and research in the study area.

Recommendations

Monitoring

Monitoring is considered an essential component of acid sulfate soil assessments because of the temporal nature of the acid sulfate soil processes. Monitoring should continue to be conducted during the current drought, and also during the re-wetting phases when acidity and metal mobilisation are likely to occur.

It is recommended that a follow-up survey is conducted within 1 to 2 years to characterise and identify acid sulfate soil changes. The intention would be to revisit selected sites sampled as part of the present project, which provides a baseline of acid sulfate conditions.

Data Interrogation

The geostatistically rigorous sample collection method used in the project has created a well distributed data set that has substantial potential for further acid sulfate soil-type analyses including:

- Understanding of soil process and variation by studying the data collected for targeted, localised areas rather than the broader study area.
- Revisiting the geostatistical analysis approach and to conduct a number additional work flow analyses, a number of such recommendations are outlined at the end of the Geostatistical Analysis Section.
- Include multitemporal survey data to establish acid sulfate mechanisms and processes of integration in predictive modelling.
- The site distribution and maps produced provide the opportunity to conduct monitoring on a spatial basis rather than a site (small location) basis.

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1 Introduction

This report provides data and assessment of the properties, presence (or absence) and spatial extent of various types of acid sulfate soils in the Lower Lakes of South Australia, namely Lake Albert, Lake Alexandrina and the tributaries of Finniss River and Currency Creek. These areas (Figure 1-1), in the lower reaches of the River Murray, have recently experienced falling and historically low water levels due to extreme drought conditions in the river catchment. The exposure and drying of hypersulfidic materials can potentially have serious environmental consequences relating to soil and water acidification, metal mobilisation, de-oxygenation of water, or formation of malodours (H_2S, organo-S compounds). Left untreated, these soils can cause acidification of water bodies and toxic impacts on aquatic biota and human health.

Acid sulfate soil characterisation work has been undertaken by CSIRO at several locations in the Lower Lakes (Fitzpatrick *et al.* 2008b, e). This work was conducted to identify the occurrence of acid sulfate soils and provides an understanding of the distribution pattern. Based on the data, expert knowledge, and using conceptual soil-regolith models the information was then extrapolated to generate a map of the likely spatial distribution. This map output has proved to be robust and well used to provide guidance for several management decisions and generally the guidance it has provided has received widespread positive feedback from users. However, limitations were recognised in the initial map production methodology, particularly with respect to the number of characterised sites used. Furthermore, there is concern about the distribution of the characterised sites used, and whether these were representative of overall lakes' conditions. These factors combined has therefore prompted this, a more comprehensive study, with a focus on better accounting for soil spatial variability using a geostatistically robust sampling design to support more reliable acid sulfate soil mapping.

An independent review of the CSIRO study commissioned by the Murray-Darling Basin Authority and conducted by Aquaterra Consulting (unpublished 2008) considered that the studies undertaken and the methods and tools employed are adequate, given the limited time frame and scope of the projects completed and unequivocally identified the presence of acid sulfate soils occurring in the lake environment. The reconnaissance scale nature of the previous baseline studies by Fitzpatrick *et al.* (2008a,b, e) with a low sample density means that the precise nature and extent of these soils could not be determined with confidence those studies.

Aquaterra Consulting identified the following limitations:

- The acid sulfate soil mapping conducted to date is at a reconnaissance level and insufficiently reliable to predict acid sulfate soil subtype distribution in the Lower Lakes; subsequently the earlier findings can only be used to assess relative risk, and caution should be exercised when integrating this work into biogeochemical models due to the low spatial detail and reliability. The level of detail of the earlier study is also insufficient to help determine precise management options based on acid sulfate soils thresholds. The continuation of additional site description, soil sampling and laboratory analysis was strongly supported in the review report by Aquaterra Consulting (unpublished 2008).
- Whilst the conclusions in the report by Aquaterra Consulting (unpublished 2008) are non-contentious, the report does not venture what an appropriate mapping scale would be to support site-specific ("hot-spot") management.

Based on the conclusions of Aquaterra Consulting (unpublished 2008), a need for further investigations was identified and outlined in the Request for Tender for this study, namely:

> "More detailed sampling of soils around Lake Alexandrina and Lake Albert and determination of their acid sulfate soils characteristics is urgently required to inform geochemical modelling being undertaken by the University of Western Australia as part of the seawater inundation Environmental Impact Statement (EIS) that is being prepared. The true spatial extent of potential and available acidity is a key knowledge gap that must be filled to provide more confidence in the model outputs.
>
> Knowledge of the spatial heterogeneity of potential and available acidity is also required for preparation of alternative management options. For example, it may be possible to treat acid "hotspots" separately if they are identified, potentially saving resources.

Based on this urgent need, and in the context of the above independent review, there is a clear need to improve our understanding of the spatial heterogeneity of acid sulfate soils around the Lower Lakes."

The project work described in this report was commissioned and largely funded by the Department of Environment and Natural Resources (DENR), South Australia (previously Department for Environment and Heritage, South Australia), Murray Futures Lower Lakes & Coorong Recovery Acid Sulfate Soils Research Program to improve on the existing acid sulfate soil information. CSIRO also contributed a significant amount of time 'in-kind' to support this work, for example: (i) in acquiring and making available unpublished data from several ongoing acid sulfate soil projects in the Lower Lakes, and (ii) extending the depth at selected sites for soil sample collection.

The Request for Tender summarised the project as follows:

> "The work will involve field sampling and laboratory analyses to develop further understanding of the spatial distribution and characteristics (potential and available acidity) of acid sulfate soils.
>
> The outcomes will be used to inform geochemical modelling being undertaken as part of the seawater inundation Environmental Impact Statement (EIS) that is being prepared. The outcomes will also provide information to enable scoping of alternative management options (e.g. liming)."

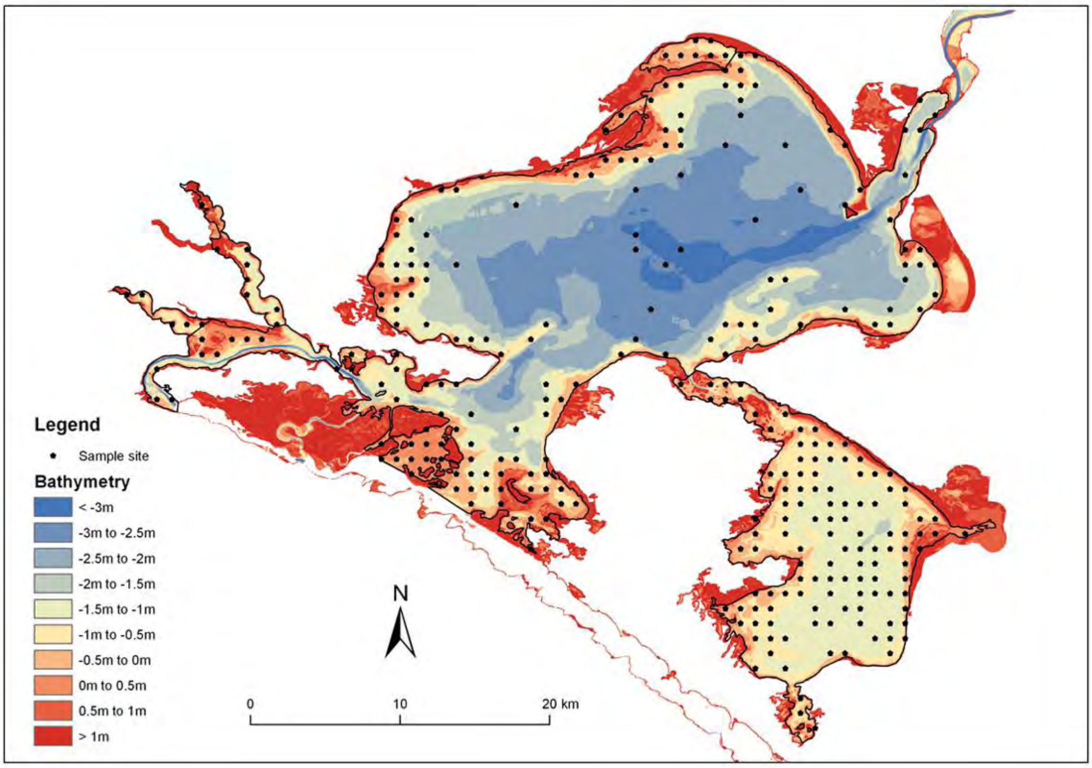


Figure 1-1: Map showing survey area and location of the 330 survey sample sites and bathymetry depth intervals relative to Australian Height Datum (AHD).

1.1 Objectives

The objectives of this project are to:

- Provide detailed information on the spatial extent and heterogeneity of potential and available acidity in sediments around the Lower Lakes.
- Provide results in a suitable form for geochemical modelling of the Lower lakes.

To achieve these objectives project tasks included to undertake the study design, implementation and interpretation of results to the satisfaction of DENR SA (previously DEH SA) and the project stakeholders. Specifically, the tasks included:

- Brief review of currently available data and relevant maps.
- Design of an appropriate sampling strategy (statistically robust and utilising random sampling techniques) to provide information suitable for geochemical modelling and preparation of alternative management options. The design must provide as much spatial sampling density as possible with the given time and resources and take into account the geochemical modelling needs and Aquaterra Consulting (unpublished 2008) review comments.
- Sampling of currently exposed sediments (0 to -1m AHD) around Lakes Alexandrina and Albert at an appropriate spatial density assisted by a quad bike, boat, or hovercraft.
- Sampling of sub-aqueous sediments in the range of minus 1-1.5 m AHD at an appropriate spatial density (this encompasses most of Lake Albert, parts of tributaries such as the Finniss River, Currency Creek and fringes of Lake Alexandrina).
- Basic description of samples (e.g. GPS location, photograph, soil classification, depth of oxidised layer).
- Subsample(s) of sediment profiles.
- pH and pH peroxide in field and full acid base accounting analyses in laboratory.
- Interpolation of data onto ASCII grids for geochemical modelling purposes.
- Creation of maps in geographic information system (GIS).
- Preliminary interpretation of data and production of brief summary report.

2 Review of Currently Available Data and Maps

2.1 Background

Acid sulfate soils are those soils containing iron sulfide minerals (e.g. Pons 1973; Fanning 2002). These soils may either contain sulfuric acid (sulfuric material), or have the potential to form sulfuric acid (sulfidic material), or cause de-oxygenation (monosulfidic material often know as monosulfidic black ooze), or release contaminants. Acid sulfate soils form naturally when sulfate in the water is converted to sulfide by bacteria. These sulfides react with metals, especially iron (Fe), to form sulfidic materials (typically pyrite: FeS_2) in subaqueous acid sulfate soil or sediments in rivers and wetlands.

Changes to the hydrology in regulated sections of the Murray-Darling Basin (MDB) system, and the chemistry of rivers and wetlands have caused significant accumulation of sulfidic material in sub-aqueous and margin soils. If left undisturbed and covered with water, sulfidic material poses little or no threat to human health or the environment. However, when sulfidic material is exposed to the air, the sulfides react with air (oxygen) to form sulfuric materials with pH < 4. When these sulfuric materials subsequently come into contact with water, significant amounts of sulfuric acid can be released into the water.

Other risks associated with acid sulfate soils include: (i) mobilisation of metals, metalloids and non-metals, (ii) decrease in oxygen in the water column when monosulfidic materials are mobilised into the water column, and (iii) production of noxious gases. In severe cases, these risks can potentially lead to damage to the environment, and have impacts on water supplies, and human and livestock health (e.g. Stauber *et al.* 2008; Simpson *et al.* 2008).

As water levels decline in Lake Albert and Lake Alexandrina (the Lower Lakes) and the River Murray system below Blanchetown (Lock 1) due to the current, unprecedented drought conditions, the anaerobic sulfidic materials that were once covered by water are now exposed to oxygen at the river and lake margins, and in adjacent wetlands. With continued lowering of water levels, the hypersulfidic material can become progressively oxidised to greater depths within the soil profile, generating sulfuric material (pH < 4).

Despite decades of scientific investigation of the ecological (e.g. Living Murray Icon Site Environmental Management Plan: MDBC, 2006a,b,c), hydrological (salinity), water quality and geological features of wetlands in the MDB, we have only recently begun to appreciate the wide spectrum of acid sulfate soil subtypes and processes that are operating in these contemporary environmental settings - especially from continued lowering of water levels (e.g. Fitzpatrick *et al.* 2008a,b,d,e; 2009a; Fitzpatrick and Shand 2008; Lamontagne *et al.* 2004; Shand *et al.* 2008; Simpson *et al.* 2008).

2.2 Definitions of Acid Sulfate Soil Material

Recently, the Acid Sulfate Soils Working Group of the International Union of Soil Sciences agreed to adopt in principle the following five descriptive terminology and classification definitions of acid sulfate soil materials proposed by Sullivan *et al.* (2010) at the 6th International Acid Sulfate Soil and Acid Rock Drainage Conference in September 2008 in Guangzhou, China. This new classification system for acid sulfate soil materials has also been recently (October 2008) adopted by the Scientific Reference Panel of the MDB Acid Sulfate Soil Risk Assessment Group for use in the detailed assessment of acid sulfate soils in the MDB (Murray–Darling Basin Authority, 2010).

The criteria to define the soil materials are as follows:

Acid Sulfate Soil Materials

1. **Sulfuric materials** – soil materials currently defined as sulfuric by the Australian Soil Classification (Isbell 1996). Essentially, these are soil materials with a pH_w < 4 as a result of sulfide oxidation.

2. **Sulfidic materials*** – soil materials containing detectable sulfide minerals (defined as containing greater than or equal to 0.01% sulfidic S). The intent is for this term is to be used in a descriptive context (e.g. sulfidic soil material or sulfidic sediment) and to align with general definitions applied by other scientific disciplines such as geology and ecology (e.g. sulfidic sediment). The method with the lowest detection limit is the Cr-reducible sulfide method, which currently has a detection limit of 0.01%; other methods (e.g. X-ray diffraction, visual

identification, Raman spectroscopy or infra red spectroscopy) can also be used to identify sulfidic materials.

**This term differs from previously published definitions in various soil classifications (e.g. Isbell, 1996).*

3. **Hypersulfidic material** – (adapted from Isbell (1996) with modifications to inter alia account for recent improvements to the incubation method (Sullivan et al., 2010)):

   Hypersulfidic material is a sulfidic material that has a field pH of 4 or more and is identified by experiencing a substantial* drop in pH to 4 or less (1:1 by weight in water, or in a minimum of water to permit measurement) when a 2 - 10 mm thick layer is incubated aerobically at field capacity. The duration of the incubation is either: a) until the soil pH changes by at least 0.5 pH unit to below 4, or b) until a stable** pH is reached after at least 8 weeks of incubation.

   *A substantial drop in pH arising from incubation is regarded as an overall decrease of at least 0.5 pH unit.

   **A stable pH is assumed to have been reached after at least 8 weeks of incubation when either the decrease in pH is < 0.1 pH unit over at least a 14 day period, or the pH begins to increase.

4. **Hyposulfidic material** – [adapted from Isbell (1996) with modifications to inter alia account for recent improvements to the incubation method (Sullivan *et al*., 2010)]:

   Hyposulfidic material is a sulfidic material that (i) has a field pH of 4 or more and (ii) does not experience a substantial* drop in pH to 4 or less (1:1 by weight in water, or in a minimum of water to permit measurement) when a 2 - 10 mm thick layer is incubated aerobically at field capacity. The duration of the incubation is until a stable** pH is reached after at least 8 weeks of incubation.

   *A substantial drop in pH arising from incubation is regarded as an overall decrease of at least 0.5 pH unit.

   **A stable pH is assumed to have been reached after at least 8 weeks of incubation when either the decrease in pH is < 0.1 pH unit over at least a 14 day period, or the pH begins to increase.

5. **Monosulfidic materials** - soil materials with an acid volatile sulfur content of 0.01%S or more. Monosulfidic materials are subaqueous or waterlogged organic rich materials that contain appreciable concentrations of monosulfides (Sullivan *et al*., 2010). Monosulfidic black oozes are specific materials characterised by their gel-like consistence (Sullivan *et al*., 2009).

Non-Acid Sulfate Soil materials

In addition, the Scientific Reference Panel of the MDB Acid Sulfate Soil Risk Assessment Project agreed to identify the other acidic soil materials arising from the detailed assessment of wetland soils in the MDB even though these materials may not be the result of acid sulfate soil processes (e.g. the acidity developed during ageing may be the result of Fe^{2+} hydrolysis, which may or may not be associated with acid sulfate soil processes). Also the acidity present in field soils may be due to the accumulation of acidic organic matter and/or the leaching of bases. Of course, these acidic soil materials may also pose a risk to the environment and would be identified during the present course of the Phase 1 detailed assessment (Murray–Darling Basin Authority 2010). The definition of these *other acidic soil materials* for the detailed assessment of acid sulfate soils in the MDB is as follows:

1. **Other acidic soil materials** – Either:

   a. non-sulfidic soil materials that acidify by at least a 0.5 pH_w unit to a pH_w of < 5.5 during moist aerobic incubation, or

   b. soil materials with a $pH_w \geq 4$ but < 5.5 in the field.

2. **Other soil materials** – soils that do not have acid sulfate soil characteristics.

2.3 Soil Identification Key Classification

Special-purpose, technical classification system keys are needed because general-purpose classification systems such as the Australian Soil Classification (Isbell 1996) and other internationally recognised classification systems (e.g. Soil Taxonomy; Soil Survey Staff 2003) often do not yet incorporate new acid sulfate soil terminologies, including: (i) monosulfidic, hypersulfidic and hyposulfidic materials (Sullivan *et al.* 2010) and (ii) subaqueous soils, which are used in the nationally consistent legend of "The Atlas of Australian Acid Sulfate Soils" (Fitzpatrick *et al*. 2008a; available on the Australian Soil Resource Information System: www.asris.gov.au).

To assist users to discriminate the range of acid sulfate soils, a special-purpose, technical classification system in the form of a user-friendly Soil Identification Key (See Appendix A1.1) was developed to more readily define and identify the various types, subtypes and related non-acid sulfate soil. The key is designed for people who are not experts in soil classification systems such as the Australian Soil Classification (Isbell 1996). Hence it has been used to deliver soil-specific land development and soil management packages to advisors, planners and engineers working in the MDB (e.g. Murray-Darling Basin Authority 2010).

2.4 Summary of Previous Work

Previous acid sulfate soil work conducted and reported for the Lower Lakes areas relevant to this project are listed below, and which are reviewed in Appendix A1.2:

- **Acid sulfate soils in subaqueous, waterlogged and drained soil environments in Lake Albert, Lake Alexandrina and River Murray below Blanchetown (Lock 1): properties, distribution, genesis, risks and management.** Fitzpatrick R.W., Shand P., Marvanek S., Merry R.H., Thomas M., Simpson S.L., Raven M.D., McClure S., 2008. Prepared for Department for Environment and Heritage, SA. CSIRO Land and Water Science Report 46/08. CSIRO, Adelaide, 167. pp.

  http://www.clw.csiro.au/publications/science/2008/sr46-08.pdf

- **Acid sulfate soils in the Coorong, Lake Alexandrina and Lake Albert: properties, distribution, genesis, risks and management of subaqueous, waterlogged and drained soil environments.** Fitzpatrick R.W., Shand P., Thomas B., Marvanek S., Merry R.H., Creeper N., Thomas M., Raven M.D., Simpson S.L., McClure S., Jayalath N., 2008. Prepared for Department for Water, Environment, Heritage and Arts. CSIRO Land and Water Science Report 52/08. CSIRO, Adelaide, 167. pp.

  http://www.clw.csiro.au/publications/science/2008/sr52-08.pdf

- **Acid sulfate soil assessment in Finniss River, Currency Creek, Black Swamp and Goolwa Channel, South Australia.** Fitzpatrick R.W., Grealish G., Shand P., Simpson S.L., Merry R.H., and Raven M.D., June 2009. Prepared for the Murray Darling Basin Authority. CSIRO Land and Water Science Report 26/09. CSIRO, Adelaide, 213 pp.

  http://www.clw.csiro.au/publications/science/2009/sr26-09.pdf

- **Acid, Metal and Nutrient Mobilisation Following Rewetting of Acid Sulfate soils in the Lower Murray.** Simpson S., Angel B., Spadara D., Fitzpatrick R.W., Shand P., Merry R.H., and Thomas M. 2008. Prepared for the South Australian Environmental Protection Agency. CSIRO Land and Water Science Report 27/08. CSIRO, Adelaide, 150pp.

  http://www.clw.csiro.au/publications/science/2008/sr27-08.pdf

- **Atlas of Australian Acid Sulfate Soils – ASRIS database.** Fitzpatrick RW, Powell B, Marvanek S 2008c. Atlas of Australian Acid Sulfate Soils. In Inland Acid Sulfate Soil Systems Across Australia (Eds Rob Fitzpatrick and Paul Shand). pp 63-77. CRC LEME Open File Report No. 249. (Thematic Volume) CRC LEME, Perth, Australia

- **Community Group Assessment.** Thomas, M and Fitzpatrick, R.W. 2010. Community monitoring of Acid Sulfate Soils in the Lower Lakes, South Australia: Four surveys between August 2009 and June 2010. Prepared for Department of Environment and Natural

Resources, South Australia (DENR SA). Client Report: CSIRO Sustainable Agriculture National Research Flagship 157 pp. http://www.clw.csiro.au/publications/science/2010.pdf

3 Field and Laboratory Methods

3.1 Site Selection for Sampling

The review by Aquaterra Consulting (unpublished 2008) suggests a minimum map scale of 1:50,000, with a minimum matching average density of sites of 1 every 100 ha. Aquaterra Consulting has indicated that they prefer the sites to be distributed according to a grid strategy rather than conduct site selection according to transects based on landscape and hydrology. The study area (Figure 1-1) includes Lake Albert, Lake Alexandrina, and the tributaries of Finniss River and Currency Creek covering about 90,000 ha. At the suggested sampling intensity, this equates to 920 survey sites needed.

Time available and budget meant that it was not possible to sample this number of sites, and hence it was pragmatic to reduce the sampling density. Applying scientifically-based protocols, we determined that a reduction in sampling intensity could be achieved without significant cost to mapping reliability by applying relationships between acid sulfate soil subtypes and patterns of bathymetry/elevation, vegetation and remote sensing.

The review of previous work in Section 2 establishes relationships between acid sulfate soil materials and subtypes with elevation (bathymetry) and soil texture (Fitzpatrick *et al.* 2008a,b,e). Conceptual models of toposequences and hydrosequences demonstrate that there is a pattern of acid sulfate soil occurrence and position in the landscape, with the maximum variability in acid sulfate soil status occurring near the shoreline where drying (oxidising) and waterlogging (reducing) conditions are juxtaposed and dynamic.

3.1.1 Process to select sites

The following steps were taken to ensure random site selection for sampling:

- The study area boundary was defined by a +0.8m AHD elevation as the maximum extent and that the study area was below this elevation and identified Lake Albert, Lake Alexandrina, tributaries of Finniss River, Currency Creek and Goolwa Channel Lower Murray.
- A 1 km by 1 km grid was placed over the study area, corresponding to the national easting and northing grid, with each square covering 100 ha. The grid line intersections represent potential sites for sampling.
- The study area was stratified by geographic regions and bathymetry depths. Geographic regions of Lake Albert, Lake Alexandrina, and the Goolwa Channel were created. Bathymetry depths were separated into 0.5 m increments below and above zero Australian Height Datum (ADH).
- Each grid line intersection was identified with a unique number that consists of the last 3 digits from the easting coordinate and the last 4 digits from the northing coordinate, down to the kilometre number.
- A count of sites from the grid intersections by geographic region and bathymetry depth was conducted on the map dataset to provide an initial indication of site distribution. A break down of the site count is shown in Table 3-1.
- A list of the potential sites was generated and then assigned a random number and then the sites were ordered from lowest to highest.
- The total potential number of sites was reduced by random selection and stratification of the study area. The stratification placed more sites in areas where knowledge indicates greater variation is likely to occur, that is where dry (oxidised) soils occur and that is close to the current shoreline where the soils are under wetting and drying conditions. Those soils under deep water will be expected to have less variability.
- The proportion of the potential site total shown in the table below, shows that the depths of major concern have less of a reduction (0 to -0.5m at 75% of total) compared with those sites that occur in deeper waters (-1.5 to -4m at 5% of total) as shown in Table 3-1.

- The sites selected for sampling were determined from the subset of potential site locations that occurred for each stratification using the random number ordering of the sites from lowest to highest until the required number of sites was obtained, and ensuring that the relative distribution between sites in localities of Lake Albert, Lake Alexandrina, and the Goolwa Channel and tributaries area was maintained.
- The selection of these sites from the total potential population was done randomly. This reduces the number of sites to be sampled to 332.
- The coordinate locations of these sites were used to guide the surveyor to the sample site location.
- Distributing sites in this way provided complete spatial coverage, a random distribution for statistical analysis, and quantitative data.
- A map showing the selected site distribution is presented in Figure 1-1.

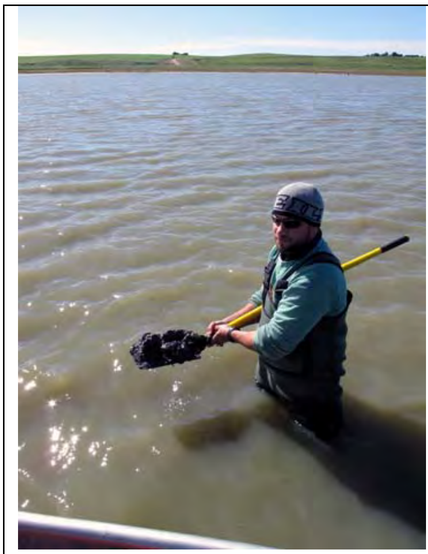
Table 3-1. Potential site numbers by geographic region and bathymetry depth and proposed reduction and distribution by bathymetry depth.

Locations	Total	Bathymetry Depth (metres)			
		1 to -0.5	-0.5 to -1	-1 to -1.5	-1.5 to -4
Total Potential Sites	**977**	**298**	**94**	**164**	**421**
Proposed proportion as a % of total		75	50	25	5
Number of Sites recommended to be sampled	**332**	**223**	**47**	**41**	**21**

3.1.2 Rules for field operations to select sites

Rules were developed to assist with conducting the field work efficiently and practically, and guidelines for operation included:

- Generate maps of survey area that show all potential field sites and their identification number, highlight sites that have been selected based on the stratified randomisation described above. Pre-load selected sites into global positioning system (GPS) units for navigation to sites.
- The field surveyor will systematically go to each selected site.
- The field surveyor will aim to navigate as close as possible to the selected site coordinates.
- If for safety or severe access problems the site cannot be reached it will be marked as 'abandoned' and move on to the next site.
- Each site will be identified by the surface sample identification number.
- Coordinates for the actual sample site will be obtained and used for subsequent analysis, the predetermined grid point coordinates are not used.
- Approximately 10% of the sites were not included in this process but retained to be used for ad-hoc selection of sample sites determined by the surveyor. These ad-hoc sites were: (i) placed in sample areas of interest missed by the random selection, (ii) or placed as part of a transect to assist with describing a topo-sequence, (iii) or placed at closer spacing's to obtain short range variability information.
- Sites were accessed where possible by boat (Figure 3-2), and for shallow and dry land areas by hovercraft (Figure 3-3).



Surface sampling using shovel in shallow waters

Soils being described, placed in chip-tray and mixed prior to placing in sample jars.

Sampling tube and suction used to obtain core samples in deeper water.

Disturbance of black Monosulfidic material by agitation from outboard motor propulsion.

Extracted sample core, measured and sample layers placed in chip-tray with site number and depth recorded.

Figure 3-2: Collecting samples using a boat.

On a sand bar out from Point Sturt, site dug with shovel to obtain samples.

Black monosulfidic material stirred up in the shallow waters

Collecting of samples into jars and chip-trays

South side of Loveday Bay

Hovercraft provided an excellent platform for shallow water sampling of soils

Hovercraft provided rapid access to shallow water sampling sites and dry terrestrial locations

Figure 3-3: Collecting samples using a hovercraft.

3.2 Field Sampling of Soil

Field survey work was conducted between 4th and 13th August 2008. During this time 330 sites were visited and 706 soil layers described, of which 698 underwent laboratory analysis. The distribution of these site locations is shown in Figure 1-1.

Sample site location coordinates were obtained using a GPS, using the WGS 84 Datum: Zone 54 South.

The project was tasked with collecting the surface soil sample and this was generally defined as the 0 to 10 cm depth interval. The sample was obtained by digging with a shovel. Where there was water and a shovel did not work, a core retrieval was used. In deep water areas and where there was a layer of gel, it was difficult to determine the exact sample depth because of sample compression. Therefore these samples represented a thicker sample range of 0 to 20 cm.

The brief of the client was to collect the surface soil sample for acid sulfate soil assessment. In addition, CSIRO took the opportunity to also collect subsoil samples from the 10 to 30 cm and 30 to 50 cm depth intervals at many of the sites visited. The collection of these subsoil samples was not rigorously done at every site because at the time of the field survey it was not a requirement of the project. Sampling of the lower depths was conducted less frequently therefore there were less than the surface sample numbers. Subsequent to completion of the field survey, it was decided that the subsoil samples should be analysed and the data included as part of the study. As the subsoil samples were not collected according to the rigorous survey design used for the surface samples, geostatistical analysis with mapping of the subsoil layers was not carried out.

At each survey site, a number of soil samples were taken for each layer, including:

- Two 70 ml screw-top plastic jars, with care taken to exclude air by filling the jars to the maximum level to limit sulfur oxidation during transit and storage. One jar was for chromium reducible sulfur (S_{Cr}) analyses for acid base accounting. The other used for pH_{water}, $pH_{peroxide}$ and Electrical Conductivity analysis with the remaining placed in long term storage should further analyses be required.

- Two sub-samples from the layers were placed in different chip-trays, one used to display morphologically representative aggregates for each of the sampled layers for later visual reference (e.g. during report writing and placed in the CSIRO Land and Water soil archive), and the second chip-tray was used for acid sulfate soil incubation (pH ageing) in the laboratory.

3.3 Data Collected and Laboratory Analyses

Data collected and a list of field and laboratory tests conducted on the samples are listed in Table 3-2.

3.3.1 Laboratory analyses

Three sets of laboratory analyses are usually conducted on soil samples collected for acid sulfate soil laboratory testing. The analyses and objectives include:

- Soil pH_w, $pH_{incubation}$, and $pH_{peroxide}$ analysis. These analyses are used to determine the current status of the soil acidity (pH_w), the type of acid sulfate soil material present that are based on the soil pH_w value (to identify sulfuric materials) or change in pH on ageing ($pH_{incubation}$ to identify hypersulfidic or hyposulfidic materials). $pH_{peroxide}$ identifies a potential end pH after oxidisation and if it declines to 2.5 or less then it can be assumed that acidification will take place on drying.
- Chromium reducible sulfur, titratable actual acidity, retained acidity, pH_{KCl} and acid neutralising capacity analyses are used in acid base accounting. These measures are used to assess both the potential of a soil material to produce acidity from sulfide oxidation and also its ability to neutralise acid formed.
- Water extractable sulfate analysis is used to identify surface soil samples that may potentially form monosulfidic soil materials when inundated (Murray-Darling Basin Authority2010).

Soil pH_w, $pH_{incubation}$ and $pH_{peroxide}$

Measuring soil pH_w and $pH_{incubation}$ standard acid sulfate tests used in the Australian Soil Classification (Isbell 1996). The method has been described in more detail by Sullivan *et al*. (2009) and Fitzpatrick *et al*. (2010).

Measuring $pH_{peroxide}$ is a standard test (Ahern *et al.* 2004).

The standard acid base accounting applicable to acid sulfate soils is described in Ahern *et al.* (2004) and summarised here. The equation below shows the calculation of Net Acidity (NA).

Net Acidity (NA) = Potential Sulfidic Acidity (PSA) + Titratable Actual Acidity (TAA) + Retained Acidity (RA) – Acid Neutralising Capacity (ANC)/Fineness Factor (FF)

Where:

- Potential Sulfidic Acidity (PSA) also known as the 'acid generation potential' (AGP) is most easily and accurately determined by assessing the chromium reducible sulfur (S_{CR} or CRS) and then converting this to PSA (AGP) as described in Ahern *et al*. (2004).
- Titratable Actual Acidity (TAA) is a measure of the actual acidity in acid sulfate soil materials that have already oxidised. It measures the sum of both soluble and exchangeable acidity.
- Retained Acidity (RA) is the acidity 'stored' in minerals such as jarosite, schwertmannite and other hydroxy sulfate minerals. Although these minerals may be stable under acidic conditions, they can release acidity to the environment when these conditions change.
- Acid Neutralising Capacity (ANC) is measured in soils with pH_{KCl} values > 6.5. These soils may potentially have ANC in the form of (usually) carbonate minerals, principally of calcium, magnesium and sodium. The carbonate minerals present are estimated by titration and alkalinity present expressed in $CaCO_3$ equivalents. By accepted definition (Ahern et al. 2004), any acid sulfate soil material with a pH_{KCl} < 6.5 has a zero ANC.
- Fineness Factor (FF) is defined by Ahern *et al*. (2004) as 'A factor applied to the acid neutralising capacity result in the acid base account to allow for the poor reactivity of coarser carbonate or other acid neutralising material. The minimum factor is 1.5 for finely divided pure agricultural lime, but may be as high as 3.0 for coarser shell material'. Fine grinding of soil materials may lead to an over-estimate of ANC when carbonates are present in the form of hard nodules or shells. In the soil environment, they may provide little effective ANC as exposure to acid may result in the formation of surface crusts (iron oxides or gypsum), preventing or slowing further neutralisation reactions. For reasons including those above, the use of the Fineness Factor also applies to those naturally occurring alkalinity sources in soil materials as measured by the ANC methods.

Table 3-2. List and method for field data collection and laboratory analysis conducted.

Data and Analysis	Objective	Method
Field Data		
Site number	uniquely identifies the site	Unique alpha numeric code (e.g. LL1045) LL – project name XXXX – 4 digit number
Site location (Zone, easting, northing coordinates)	accurately places the sample site within the study area	Global positioning system (GPS) + or – 1 meters, locate to the WGS 84 Z 54S Grid.
Depth of water or depth to water table below soil surface	Current status of water level relative to the soil surface	Tape measure (National Committee on Soil and Terrain 2009)
Site description	Places the sample site within the landscape and surrounding environment, to enable extrapolation of the profile information and to estimate the proportion that it represents in the study area	Refer for guidance to National Committee on Soil and Terrain (2009).

Data and Analysis	Objective	Method
Sample depth (upper and lower)	Estimating the layer thickness and position in the profile of the soil sample	Tape measure (National Committee on Soil and Terrain 2009)
Soil Morphology Description [colour – not recorded in Appendix 2, field texture, consistence, structure, moisture status, and other diagnostic features if present, such as mottling (redoximorphic features), odour, organic material, shell fragments, minerals such as jarosite, crystals, coarse fragments)	For characterisation and classification of the soil. To facilitate understanding of soil variability and transfer of quantitative data between profiles and layers that appear similar through this qualitative description	National Committee on Soil and Terrain (2009); Schoeneberger *et al.* (2002) – for redoximorphic features
Laboratory Analysis		
pH_{water}	Measures the current sampled status of the soil acidity or alkalinity	pH meter; 1:1 soil:water (Rayment and Higginson 1992)
$pH_{peroxide}$	Measures the potential end oxidized status of the soil pH	pH meter; Method 4E1 (Rayment and Higginson 1992)
$pH_{incubation}$	Represents a scenario for soil sample on exposure to air (oxygen) for a specified period of time	Fitzpatrick *et al*. 2008
Electrical conductivity	Measure of the soil salt content	(Rayment and Higginson 1992)
Soil texture	Assessment of texture to assist with interpretation of acid base accounting results	Hand texture determination placed into 3 classes – coarse, medium, fine
pH_{KCl}	pH value. Provides trigger value (pHKCL >6.5) for deciding to test for acid neutralising capacity.	pH meter. Method 23A (Ahern *et al*. 2004)
Chromium reducible sulfur (S_{CR})	Identifies presence of sulfides. For acid base accounting	Method 23B (Ahern *et al.* 2004)
Titratable actual acidity (TAA)	Identifies soil acidity. For acid base accounting.	Method 23F (Ahern *et al.* 2004)
Acid neutralising capacity (ANC) (where pH_{KCl} >6.5)	Identifies neutralising capacity of soil. For acid base accounting.	Method 19A2 (Ahern *et al.* 2004)
Retained acidity (RA)	Identifies stored soil acidity. For acid base accounting.	Method 20J (Ahern *et al*. 2004)
Net acidity (NA)	Identifies the soil acidity (or alkalinity)	Calculated (Ahern *et al.* 2004)

For coastal and inland acid sulfate soils in Australia, the action criteria or trigger values for the preparation of an acid sulfate soil management plan are shown in Table 1 (Dear *et al*. 2002). Based on Table 3-3, the trigger values for sands to loamy sands is 0.03 % S, which equates to 18.7 mole H+/tonne (i.e. approximately 19 mole H+/tonne). This method enables the range of acid sulfate soil materials to be ranked according to treatment categories. Texture-based action criteria for acid sulfate soil management planning has been developed by Ahern *et al.* (1998) and requires that if a development project is to disturb < 1000 t of acid sulfate soil material with a net acidity of 18.7 mol H+/t for coarse texture soil (sand to loamy sand), 37.4 mol H+/t for medium texture soil (sandy loam to light clay and 64.8 mol H+/t for fine textured soils (medium heavy clay to silty clay). For disturbances > 1000 t the action criteria is set at 18.7 mol H+/t for all texture classes. For disturbances, greater than

1000 m^3, the highest net acidity detected at the site should be used to calculate the amount of neutralising material required. When the volume of soil to be disturbed is less than 1000m^3, the mean net acidity plus the standard deviation may be used to calculate the amount of neutralising material required, provided a sufficient number of laboratory analyses have been performed to satisfactorily characterise the soil profile and acid sulfate soil materials at the site (Ahern et al. 1998). Net acidity provides a measure of the degree of the acidification hazard. To better understand the hazards posed by acidification, the components of net acidity (existing acidity, potential sulfidic acidity and ANC) should be considered in order to provide a temporal element to the acidification hazard. Consequently, the following ‘net acidity thresholds’ are currently being applied for reporting purposes by the MDB Authority:

- low net acidity (<19 mole H+/tonne)
- moderate net acidity (19 - 100 mole H+/tonne)
- high net acidity (> 100 mole H+/tonne)

Table 3-3. Criteria indicating the need for an acid sulfate soil management plan based on texture range and chromium reducible sulfur concentration and amount of soil material disturbed (Dear *et al*. 2002).

Texture range	**Existing + Potential Acidity** **TAA + S_{CR} Equivalent sulfur (%S) (dry weight basis)**	
	<1000 t disturbed soil	**>1000 t disturbed soil**
Coarse: Sands to loamy sands	0.03	0.03
Medium: Sandy loams to light clays	0.06	0.03
Fine: Medium to heavy clays	0.10	0.03

4 Summary of Data

This section identifies the general features of the soil morphology and laboratory data for the study area. The following sections will then provide the information in a spatial context.

As discussed above, the field survey work was conducted between 4th and 13th August 2009, and in this time 330 sites were visited and 707 soil layers described and sampled. Laboratory analyses for acid base accounting parameters, pH testing and electrical conductivity were completed by the end of September and for $pH_{incubation}$ by mid October 2009.

A listing of the site location and laboratory data results is provided in Appendix 2. A comprehensive database in Excel format also accompanies this report.

4.1 Soil Morphology Data

Soil morphology data for the samples describing the sample depth, field texture and soil consistence is tabled in Appendix 2 and in a more comprehensive database in Excel format, accompanies this report.

Soil colour for samples was dominantly dark grey as most samples were collected below water in saturated conditions. In some areas the colour was black were either the sample contained organic material or was at the surface where monosulfidic material occurred. On the sandy fringing areas above the water level the soil colour was typically a brownish grey.

Field soil texture identified more than half (60%) of samples as sands and over a third (38%) as clays, with the remaining 2% of soils being loams The distribution of these materials is discussed in later sections.

Field soil consistence identified that nearly all samples were characterised as soft or very soft (87%), some samples at the surface were characterised as gels (5%), with the remaining samples being firm consistence.

4.2 Soil Laboratory Data

A summary of the results of the soil laboratory data for pH testing and acid base accounting chemistry is presented in Table 4-1. Cumulative distribution of the data is shown in Figure 4-1.

The data presented includes all results and does not discriminate those samples collected at different depths, which will have more of an influence on the behaviour or hazard caused by the sampled layer. However, considering the population of samples as a whole, the figures identify the following exceeding threshold or trigger values.

Electrical conductivity (SEC) Figure 4-1a – approximately 25% of samples were above 4 mS cm^{-1} that identifies soils reaching a level of concern for salt content.

pH_w Figure 4-1b – approximately 10% of samples were below a pH_w of 4, which identifies a strongly acidic soil, and would be considered in these conditions to be sulfuric and of concern.

$pH_{peroxide}$ Figure 4-1b – approximately 55% of samples were below a $pH_{peroxide}$ of 2.5 that identifies soils that could oxidise and form sulfuric soils, and are of potential concern.

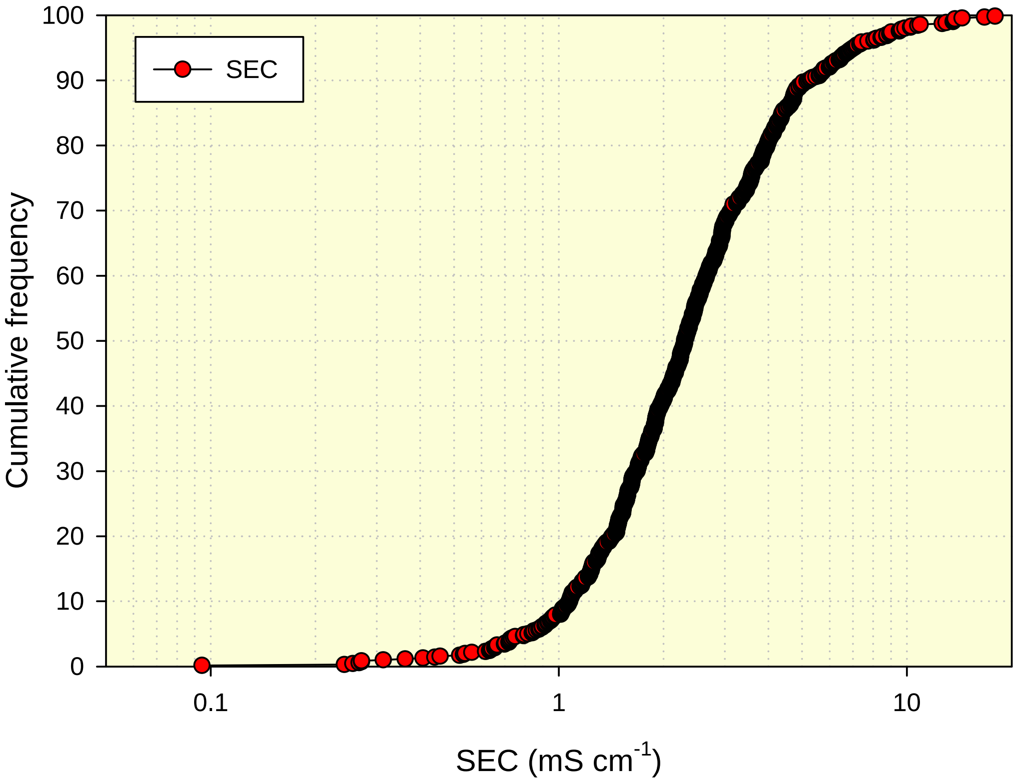
Chromium reducible sulfur (S_{CR}) Figure 4-1c – approximately 40% of samples were above a S_{CR} of 0.3 identify soils that are above trigger levels for treatment if exposed and oxidised (Dear *et al.* 2002) and would be of concern.

Acid neutralising capacity Figure 4-1d – approximately 65% of samples were above 0 wt. % identifying acid neutralising capacity in the soils.

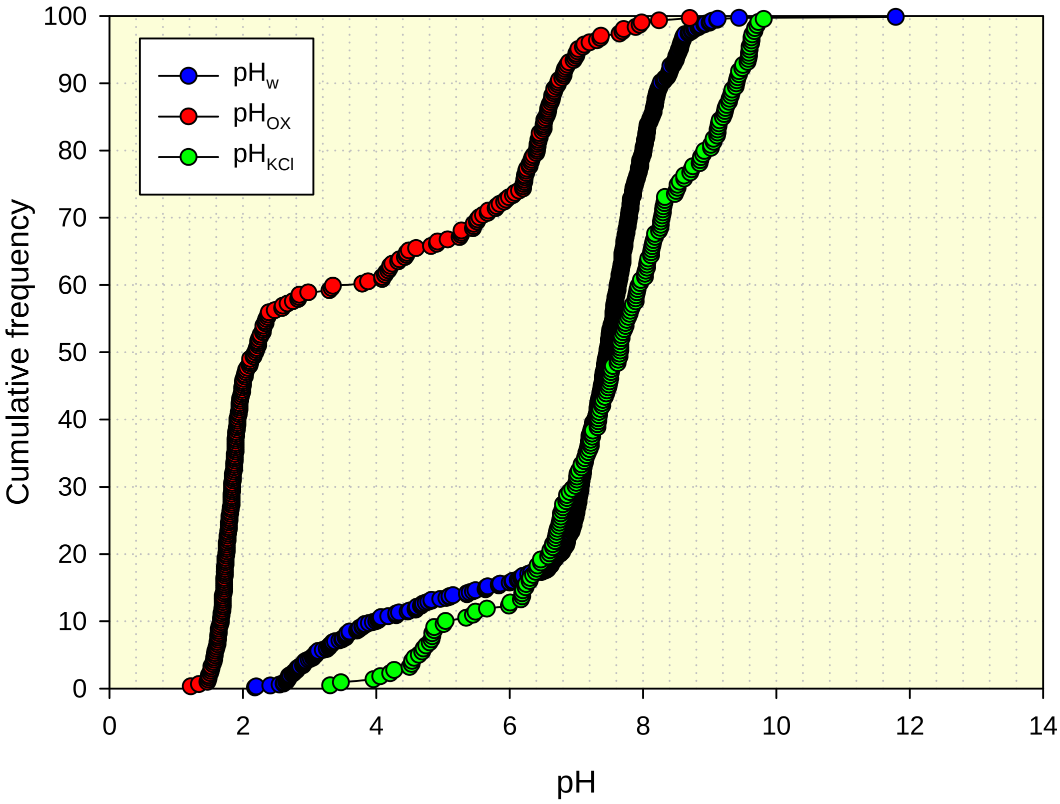
Net acidity Figure 4-1e – approximately 60% of samples were above 0 mole H^+ $Tonne^{-1}$ identifying acidic soils of concern.

Table 4-1. Laboratory data summary of pH testing and sulfate chemistry, for all samples.

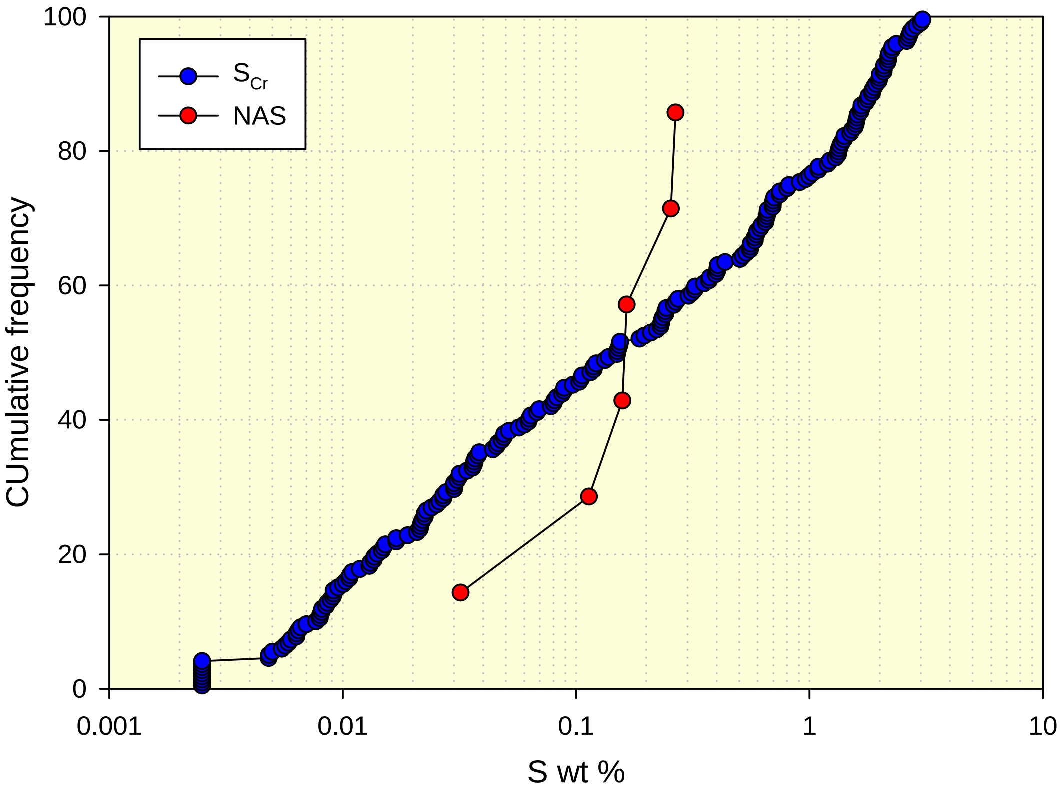
Parameter	Description	Units	Minimum	Median	Mean	Maximum	Count
SEC	Electrical conductivity	mS/cm	0.09	2.3	2.90	17.92	707
pH_w	pH in water	pH unit	2.18	7.47	7.01	11.79	707
pH_{FOX}	pH after peroxide treatment	pH unit	1.22	2.66	3.68	8.70	707
$pH_{incubation}$	pH after ageing 8 weeks	pH unit	1.6	4.21	4.74	8.28	707
pH_{KCl}	pH in KCl	pH unit	3.15	7.34	7.42	9.81	707
S_{CR}	Cr-reducible sulfur	%SCr	0	0.06	0.43	3.05	707
TAA	Titratable actual acidity	mole H^+/ tonne	0	0	4.47	270.45	707
RA	Retained acidity	mole H^+/ tonne	0	0	1.33	124.62	707
ANC	Acid neutralising capacity as $\%CaCO_3$	$\%CaCO_3$	0	0.41	1.36	45.07	707
NA	Net acidity	mole H^+/ tonne	-5859.72	10.34	123.79	1772.41	707



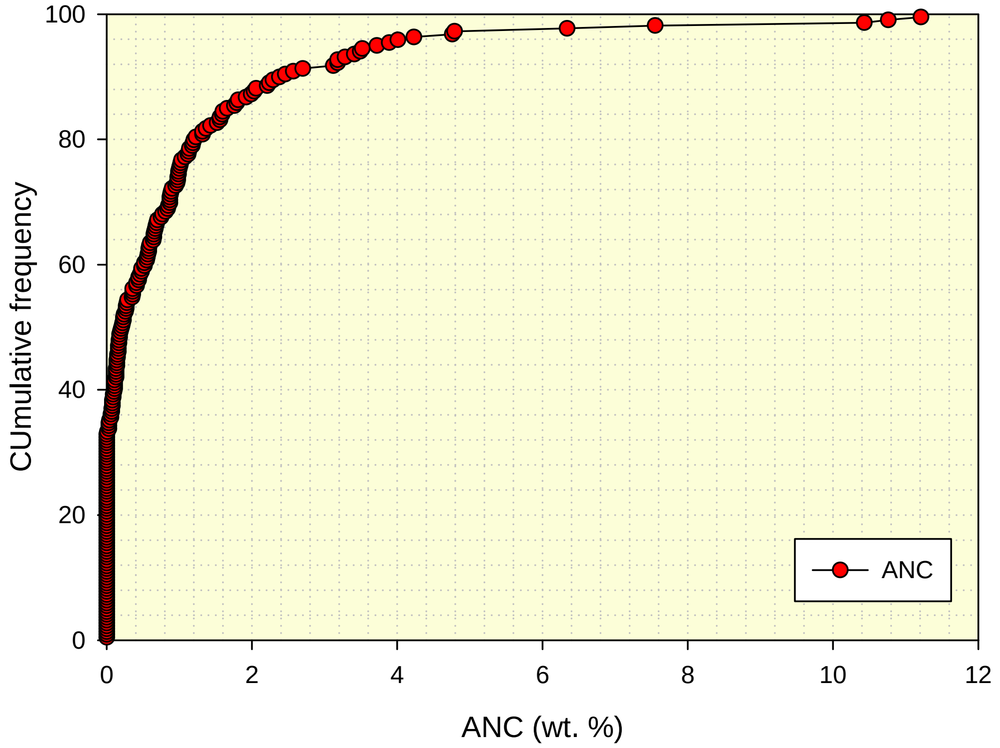
a) Electrical conductivity



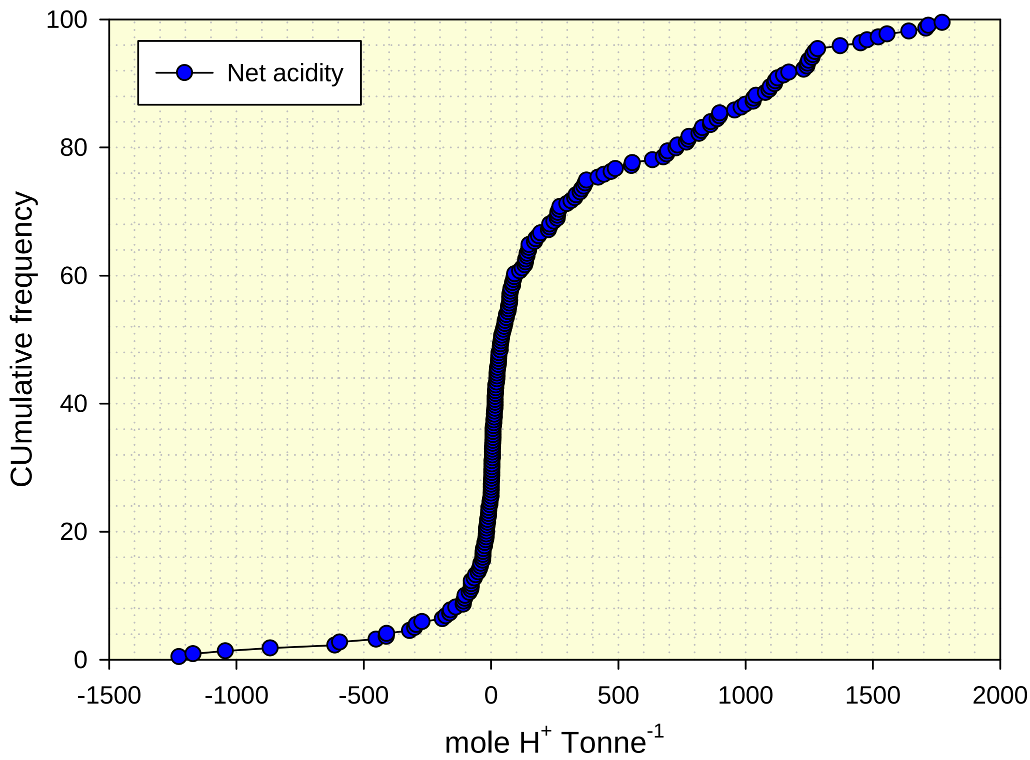
b) pH tests



c) Chromium reducible sulfur



d) Acid neutralising capacity



e) Net acidity

Figure 4-1. Cumulative frequency distribution for the laboratory parameters shown in graphs a to e.

4.3 *Acid Sulfate Soil Material and Site Classification*

4.3.1 Acid sulfate soil material

Based on the definitions of acid sulfate soil material types (Section 2.2) all of the samples were classified. A list of the samples is presented in Appendix 3 and a summary of the number of samples that occurred in each of the acid sulfate soil material classes is provide in Table 4-2.

The information shows that 10% of the samples collected contained sulfuric material (pH < 4.0) and 39% of sites had considerable potential for further developing sulfuric materials from hypersulfidic materials if the water levels continue to drop exposing these soil materials allowing them to oxidise.

Only 12% of samples did not trigger as an acid sulfate soil material. Given the random method of site selection for sample collection the data set indicates that acid sulfate soil material both potential and actual is widespread throughout the Lower Lakes study area. Further analysis and discussion of the spatial distribution is presented in later sections of this report.

Table 4-2. Acid sulfate soil material type and number of samples.

Acid Sulfate Soil Material Type	Count of Samples	Proportion of Total (%)
sulfuric	69	10
hypersulfidic	271	39
hyposulfidic (S_{CR}≥0.10%)	182	26
hyposulfidic (S_{CR}<0.10%)	94	13
other	82	12
Total	698	100

4.3.2 Soil classification

For each soil profile, information on the acid sulfate soil material and soil texture throughout the profile (often 3 layers to at least 50 cm depth) was considered and the soil profile allocated to a soil class based on the Acid Sulfate Soil Identification Key (Appendix 1). A summary of sites that occurs for each soil type is shown in Table 4-3.

The information shows that 13% of sites are considered to be sulfuric soils (pH < 4.0) with coarse texture being more dominant. Hypersulfidic soils account for 41% of sites with a reasonably even distribution of sites being coarse or fine textured. Hyposulfidic soils account for 21% of sites and are dominated by coarse textures. Only 14% of sites did not classify as an acid sulfate soil.

A visual distribution of the soil types is graphically presented in Figure 4-2. Where symbols are used to identify the soil texture (star – sands, square – loams, triangle – clays, circle – rock or no texture) and colour fill of the symbol identifies the acid sulfate soil class (red – sulfuric, orange – hypersulfidic, yellow – hyposulfidic, green – other). The bathymetry depths are shown as coloured areas.

Visual inspection of the sites on the map identified sulfuric soil areas at Loveday Bay, Finniss River, Currency Creek, in the north of Lake Alexandrina (Boggy Lake and Dog Lake), and numerous isolated areas on the margins of Lake Albert. Hypersulfidic soil areas occur throughout the lakes with fine texture being more dominant in the centre of lakes and sands on the margins.

This information was used to construct a soil classification map presented in Section 7, and to support the development of conceptual toposequence models presented in Section 5.

Visually it can be seen that there are patterns to the soil distributions, and that further detailed investigation of the data may provide an improved understanding of the trends and processes of acid sulfate soils in the Lower Lakes. The focus of this study was to generate maps of soil property distribution but there is certainly more information that could be extracted from the data sets in the future.

Table 4-3. Summary of site classification.

Dominant acid sulfate soil material at site	Soil texture	Site tag	Count of sites	Proportion of total sites
sulfuric	sand	sc	24	7
sulfuric	loam	sm	15	5
sulfuric	clay	sf	3	1
hypersulfidic	sand	hc	64	19
hypersulfidic	loam	hm	24	7
hypersulfidic	clay	hf	82	25
hyposulfidic	sand	oc	50	15
hyposulfidic	loam	om	11	3
hyposulfidic	clay	of	11	3
other		ac, na, ot	46	14
		Grand Total	330	100

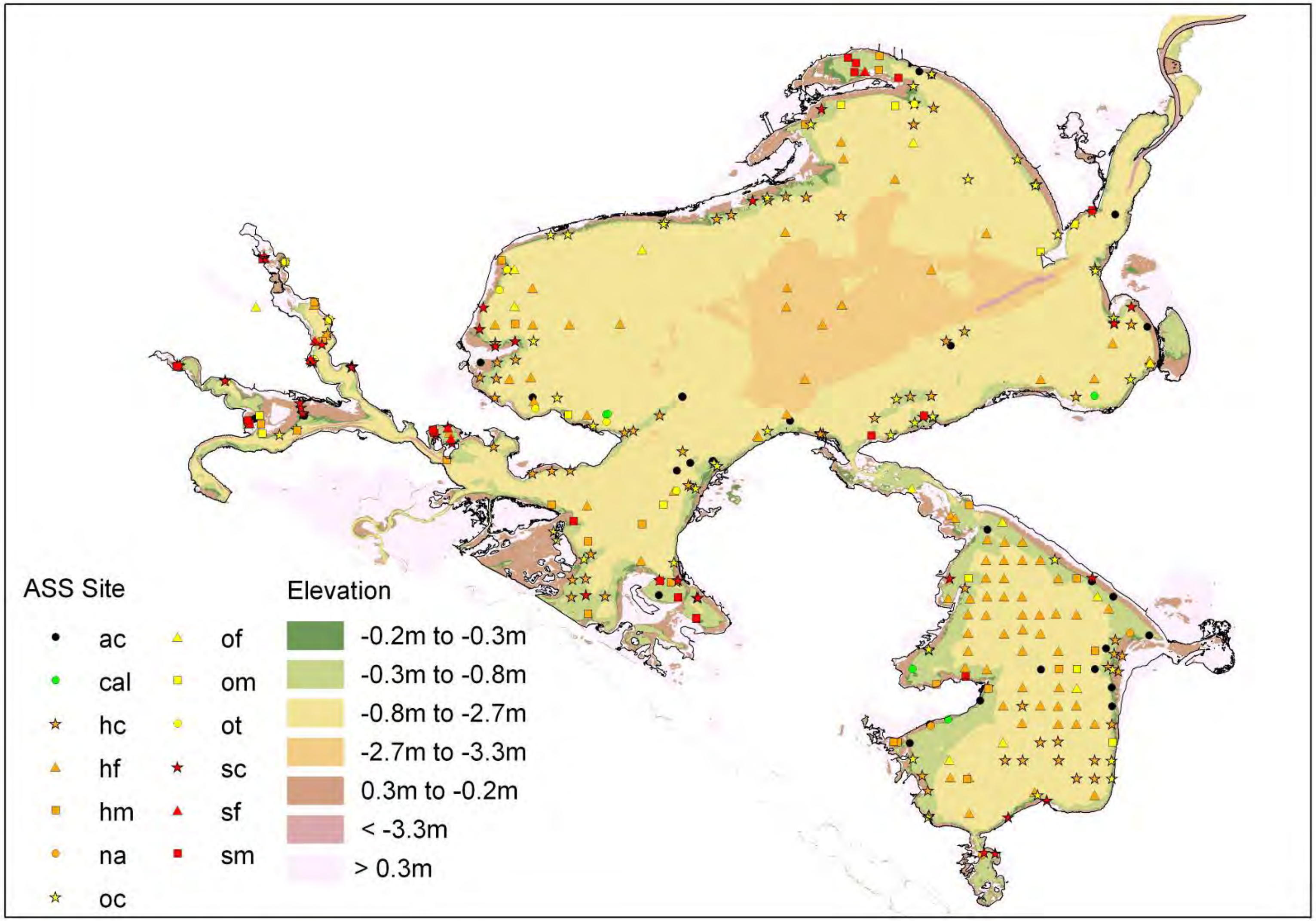


Figure 4-2. Map showing site location, bathymetry depths and acid sulfate soil material classification (symbols described in Table 4-3).

5 Spatial and Temporal Variability of Acid Sulfate Soils

An understanding of the detailed behaviour of various Acid Sulfate Soil materials (e.g. hypersulfidic or sulfuric) and features (e.g. cracks or salt efflorescences) in layers, horizons and deep regolith is fundamental to successful characterisation and mapping of inland acid sulfate soils in the Lower Lakes region. This section provides a summary of how conceptual soil-regolith models are used to describe and explain the spatial heterogeneity of acid sulfate soil properties. For example, these models help to describe and predict soil-regolith processes that occur as a consequence of fundamental shifts in the "environmental equilibrium" brought about by the impact of current management practices, such as the recent pumping of water from Lake Alexandrina to Lake Albert. Acid sulfate soils in a fluctuating water environment are not stable and therefore may undergo rapid change depending on whether water levels are dropping or rising. Acid sulfate soil materials change depending on the water status of the soil (saturated or unsaturated), which controls whether chemical processes are oxidising or reducing, and the acid status.

The type of acid sulfate soil materials that occur on the shoreline around the Lower Lakes area have been changing because they are being exposed to fluctuating water levels. Therefore the ability to determine what acid sulfate soil material occurs for an area - and the impact on management - is dependent on the water level status. This means that the map of soil distribution is only indicative of the conditions at time of sampling and corresponding analyses.

The acid sulfate soil map of the kind generated in this project only represents a "snap shot" of conditions at the time of survey, and should only be interpreted within the context of the broader environmental conditions, i.e. are the lake levels rising or lowering, where are the hot-spots and what is the nature of assets to be protected? Given the complex nature of acid sulfate soils, their classification and their response to environmental conditions, interpretation by lay-persons should be done with assistance of expert knowledge to achieve best management outcomes (e.g. different water levels in parts of the lakes will likely alter or reverse the occurrences of certain soil Subtypes due for example to water being pumped from one lake to another).

5.1 Conceptual Soil-regolith Models

To aid in understanding the spatial heterogeneity of acid sulfate soil properties, soil landscape cross-sections in the form of conceptual soil-regolith toposequence models are constructed from field and laboratory data, and surveyor knowledge. Conceptual soil-regolith process models enable workers to develop and present a mechanistic understanding of complex spatial and temporal soil-regolith environments (Fritsch and Fitzpatrick 1994). These models are cross-sectional representations of soil-regolith-bedrock profiles that illustrate vertical and lateral changes that occur across wetland or lake hydro-toposequences. They also tell a story explaining the complex soil, hydrological and biogeochemical interactions that have led to the development of an acid sulfate soil problem (e.g. Fitzpatrick and Merry 2002).

To support management of acid sulfate soils in the Lower Lakes area an understanding of the variation both spatially and with time is required. The understanding is presented here as descriptive and predictive conceptual models that could be modified for future scenario.

5.2 Descriptive Soil-regolith Models

Descriptive soil-regolith models are presented for areas in Lake Albert (Figure 5-1 and Figure 5-2) and in Lake Alexandrina (Figure 5-4). These models characterise the lateral and vertical spatial variability of current soil-regolith layers, horizons, materials (e.g. transition of hypersulfidic and sulfuric) and features (salt efflorescences) occurring in the unsaturated sands on the water margins, and subaqueous hypersulfidic material occurring below water. An important finding of this study was the occurrence of sulfuric subaqueous soils with overlying acidic water (pH < 3) and that they occur over significant areas. Near Campbell Park in Lake Albert these soils occurred where there were isolated pools of acidic water that formed in surface depressions (Figure 5-1 and Figure 5-2). In Loveday Bay within Lake Alexandrina these soils occurred over more than 100 ha where there was shallow surface water that formed a lake at the base of a large catchment that was separated by a sand bar from Lake Alexandrina (Figure 5-4).

5.3 Predictive Soil-regolith Models

Predictive soil-regolith models (4D) are constructed to illustrate specific wetland transects and scenarios using a time-sequence of figures (e.g. collage of cartoons), which illustrate several stages of soil-regolith condition in response to natural or human induced (e.g. management) changes over time. These conceptual models can be used to illustrate predictions using expert knowledge processes and potential consequences, but not the timing of events, which will depend on weather, changes in water level and land management.

Construction of predictive soil-regolith models are based on detailed knowledge from repeat site visits over time to areas, such as in Lake Albert (Figure 5-1 and Figure 5-2) and in Lake Alexandrina (Figure 5-4). The final predictive soil-regolith models shown for Lake Albert (Figure 5-3) and Lake Alexandrina (Figure 5-5) illustrates the complex and varied distribution of acid sulfate soil subtypes in these lakes due to the temporal variation caused by fluctuating water levels.

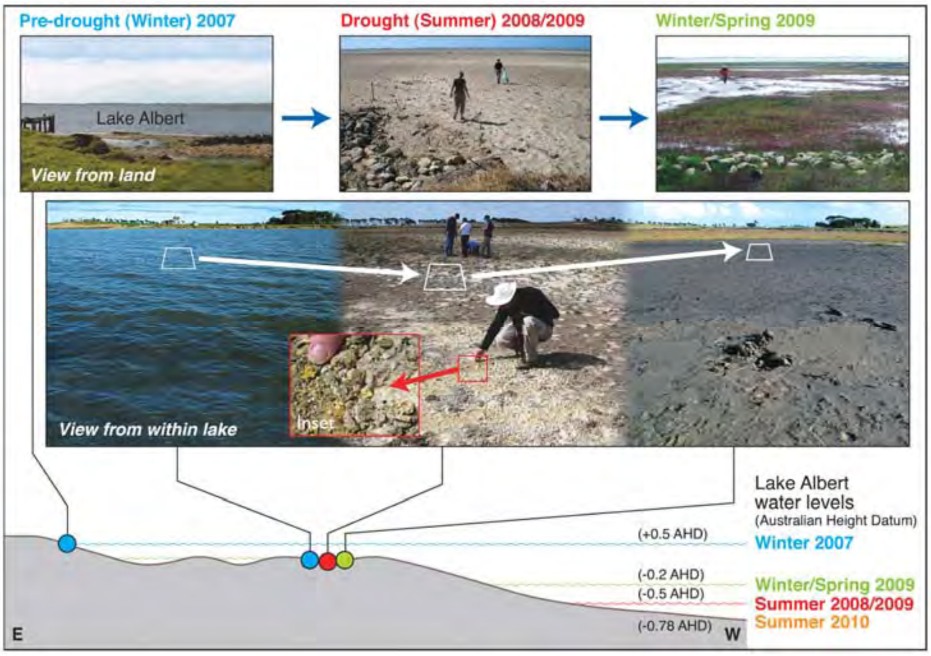


Figure 5-1. Descriptive soil-regolith toposequence model for an area near Campbell Park in Lake Albert showing pictorial variation of acid sulfate soil features in Pre-drought (winter) 2007, Drought (Summer) 2008 and Winter-Spring 2009).

The predictive soil-regolith models show that pre-drought (Figure 5-3–a, and Figure 5-5-a) water levels were higher and connected to the main Lake water body; the soils were covered with water and were considered as subaqueous hypersulfidic soils.

Due to lowering water levels, areas became disconnected from the main lake water body, surface water evaporated and the saturated hypersulfidic soils became unsaturated and oxidised to form sulfuric soils (Figure 5-3–b and Figure 5-5-b).

Water levels remained low enough to keep the areas disconnected from the main lake water bodies, and with winter rains, water flowed over and through the sulfuric soils and collected in depression areas. The following consequences of these soil-water interaction processes were observed during the August 2009 mapping survey and described in Figure 5-2 and Figure 5-4:

1. A series of very small shallow depressions up to 30 cm deep with acidic water near Campbell Park in Lake Albert (Figure 5-2). Also, note the location of the hypersulfidic soils that are adjacent to the main lake water bodies and how their position shifts with time due to the fluctuating water conditions due to the pumping of water from Lake Alexandrina to Lake Albert [see panels (b) to (d) in Figure 5-3].

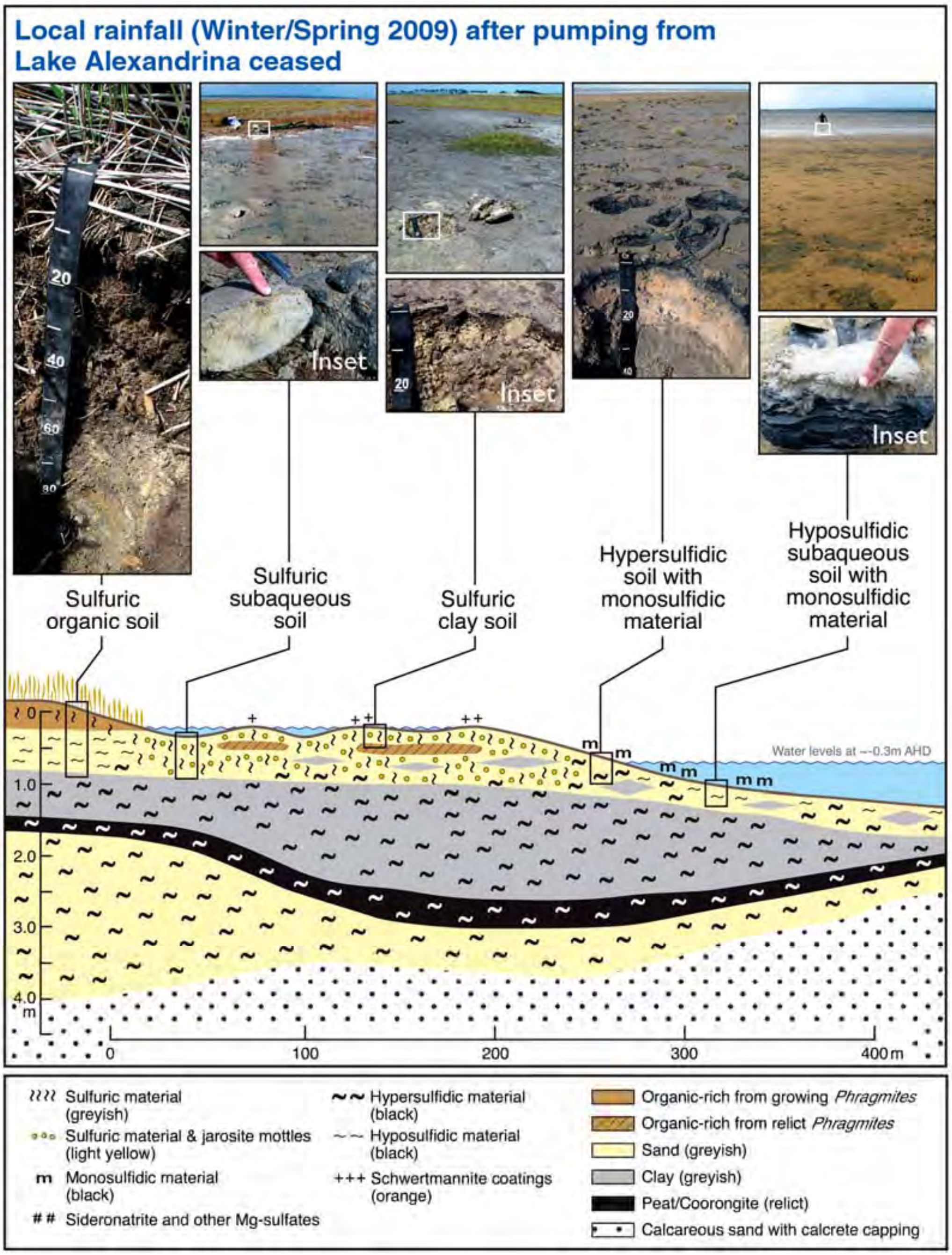


Figure 5-2. Descriptive soil-regolith toposequence model for an area near Campbell Park in Lake Albert showing spatial variation of acid sulfate soil materials (winter / spring 2009).

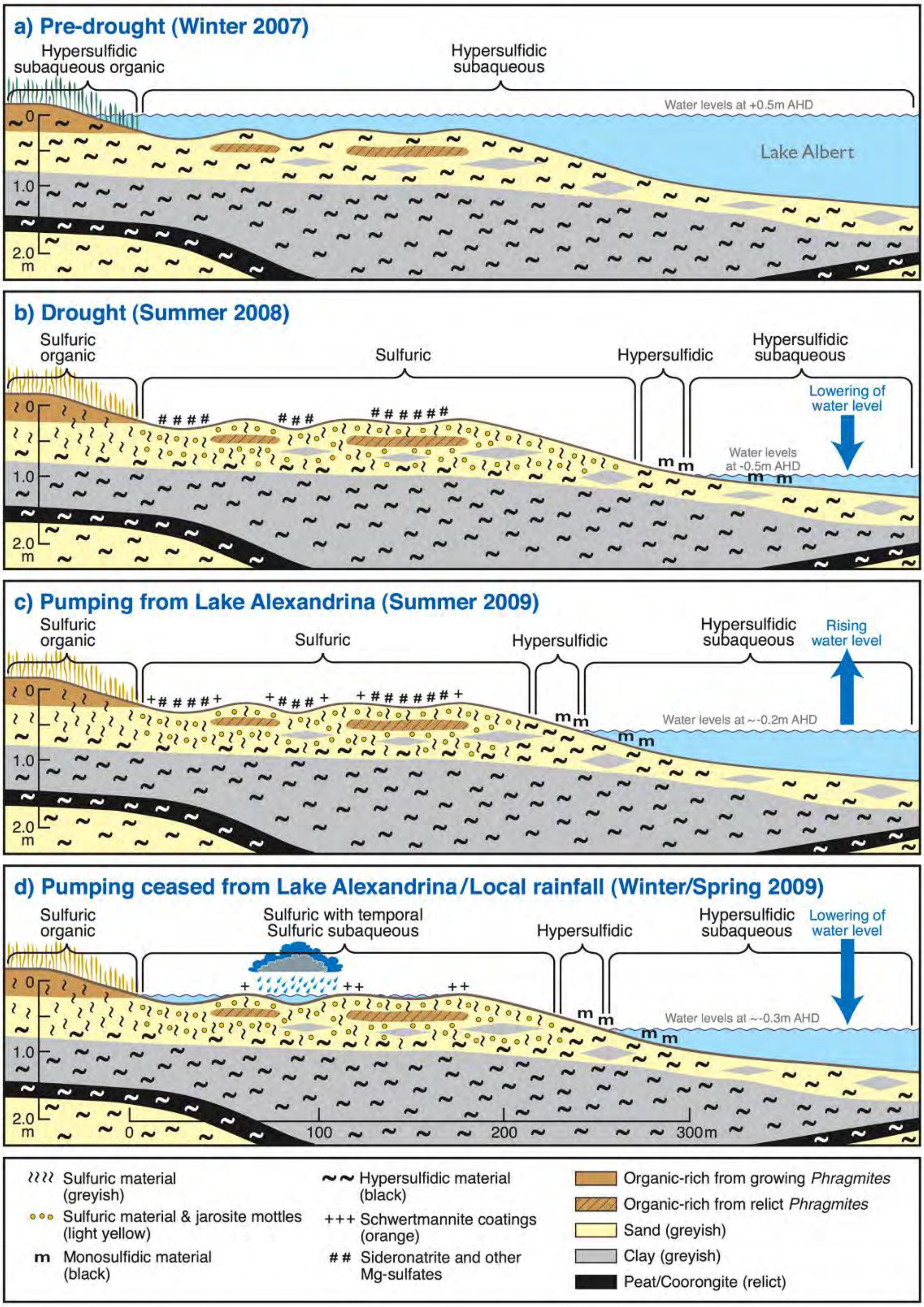


Figure 5-3. Predictive soil-regolith model for an area near Campbell Park in Lake Albert that shows the changes of acid sulfate soil material with time due to fluctuating water conditions.

2. A very large (more than 200ha) depression is filled with acidic water (pH 2.5 to 2.8), which in places is up to 80 cm deep in Loveday Bay adjacent to Lake Alexandrina (see left hand side photographs in Figure 5-4). The acid sulfate soil material below the very acidic water has remained acidic (i.e. < pH 4.0) and consequently comprises sulfuric material (i.e. Sulfuric subaqueous soil subtype). In contrast, the saturated acid sulfate soil subtype on the edge of the acidic water has a high amount of monosulfidic material (i.e. Hypersulfidic soil with monosulfidic material; centre photographs in Figure 5-4). Most of the adjacent exposed sandy beach areas comprised Sulfuric soil with abundant highly acidic salt efflorescences (comprising mostly sideronatrite with pH 1.2 to 2.5) (right hand side photographs in Figure 5-4).

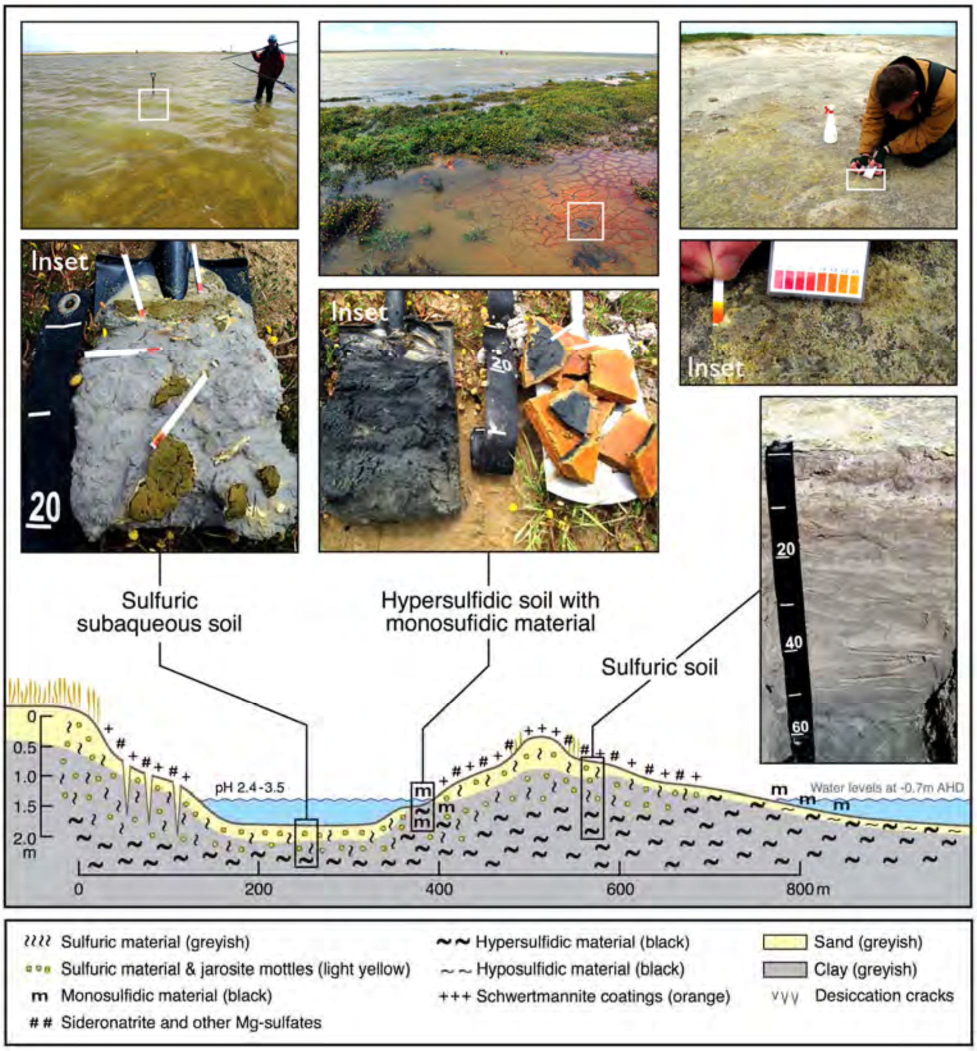


Figure 5-4. Descriptive soil-regolith model for Loveday Bay in Lake Alexandrina showing spatial variation of acid sulfate soil materials (winter / spring 2009).

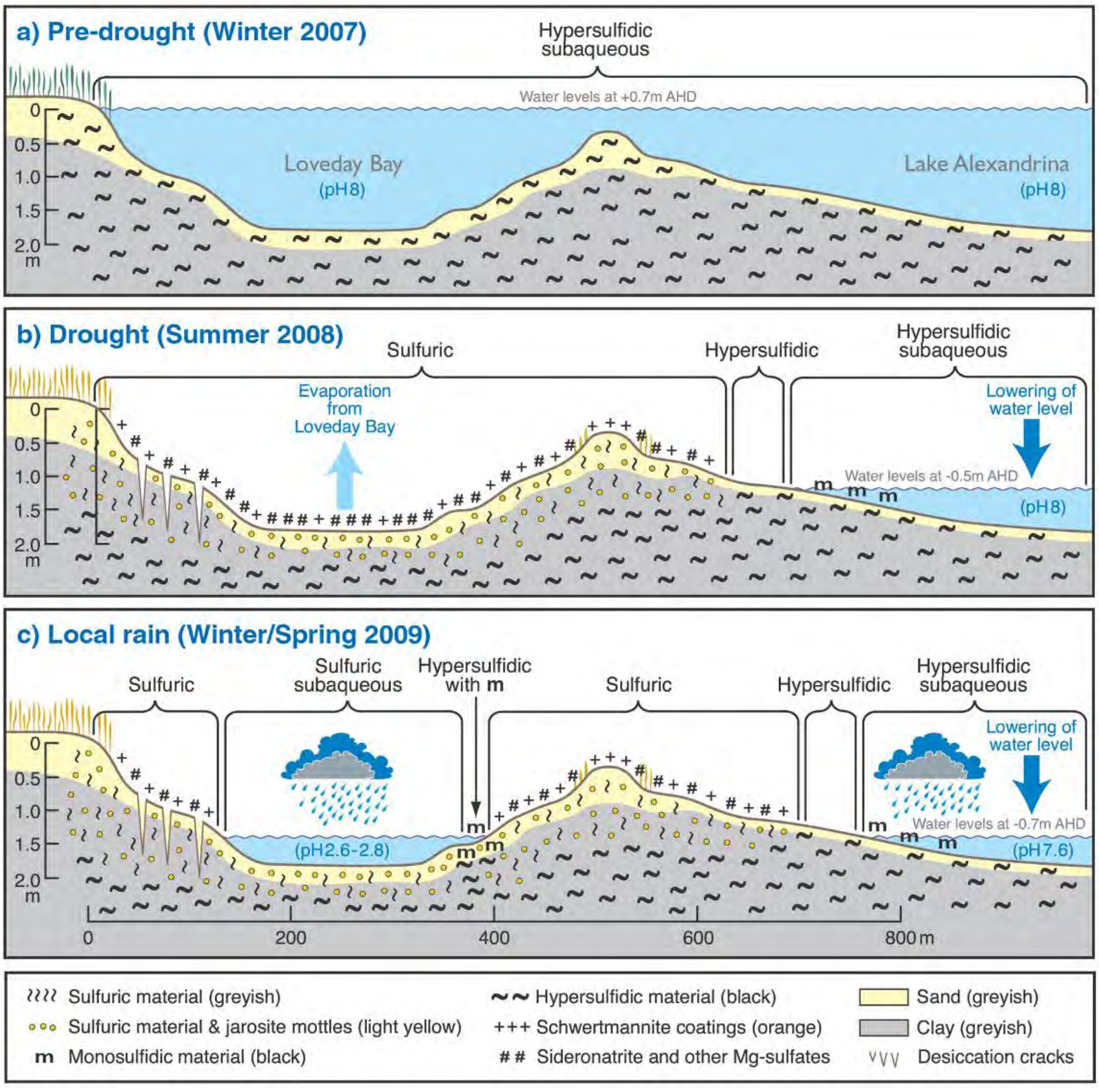


Figure 5-5. Predictive soil-regolith model for Loveday Bay in Lake Alexandrina, which shows changes of acid sulfate soil material with time due to fluctuating water conditions.

These soil-regolith models confirm that mapping these soil subtypes at these soil locations changes and is highly dependent on the water level at the time of field survey. This clearly demonstrates that acid sulfate soil materials and subtypes vary both spatial and temporally. As our knowledge and understanding improves, predictive soil-regolith models can be prepared to illustrate potential changes in the future.

In summary, the acid sulfate soil maps together with the conceptual soil-regolith toposequence models can be used to show predictions of acid sulfate soil changes and generate “interpretive maps” and data sets to support management planning.

While the maps and data produced from this study are static for the time when the field work was conducted, there is a very good opportunity to extract and provide information from acid sulfate soil maps, which can be extrapolated to support decision making.

6 Geostatistical Analysis

6.1 Requirement

Maps are required for each of several key properties that are diagnostic of the soil status in the Lower Lakes. These properties are Electrical Conductivity (EC), pH in water (pH_w), pH in peroxide (pH_{fox}), sediment texture (Fine, Medium, Coarse), Titratable Actual Acidity (TAA), Acid Neutralising Capacity (ANC), Net Acidity (NA) and Acid Generating Potential as chromium reducible sulfur (AGP). The maps of these properties are required to cover the area corresponding to - 0.8 m AHD. This area coincides largely with the wetted area of the Lower Lakes and is estimated to be 886 km^2. The maps are required to represent a single soil surface layer (in the range 0 - 10 cm) with estimates of the key properties made at points spaced every 100 m across the grid domain. The grid domain is shown below (Figure 6-6), defined using an origin and locations are expressed according to the WGS 84 geoid.

The specification of the grid is below and grid points within the grid domain but which are outside the study area are given an arbitrary value of -9999 to indicate that no estimate was made.

Number of columns:	594
Number of rows:	485
Minimum Eastings:	296700
Minimum Northings:	6043500
Cellsize:	100
No estimate:	-9999

In addition to this fundamental requirement it is useful and sometimes essential to know the uncertainty associated with the map and / or each pixel within the map. This uncertainty is valuable when compounding the sources of uncertainty through a model to understand how much confidence can be placed in the final model outcome. A by-product of the mapping approach used here provides spatial uncertainty and these maps are provided. Also related to the mapping approach used here is the ability to consider the probability of for example, exceeding a critical threshold.

Geostatistical analysis of the data set is focused on the upper soil layer (in the range 0 – 10 cm) data because this is the layer with the most data points and is the layer of concern where there is likely to be a soil water interface. We recognise data are available for the lower sampled layers (i.e. 10 – 30 cm) and a map could be generated, however because of the lower sample density to work with there would be low confidence in an initial generated map. It is possible to generate a geostatistical map of the lower layer soil properties but this will require significant research to determine an appropriate approach and investigate co-varying factors that could be used to improve the confidence – this is a project in itself.

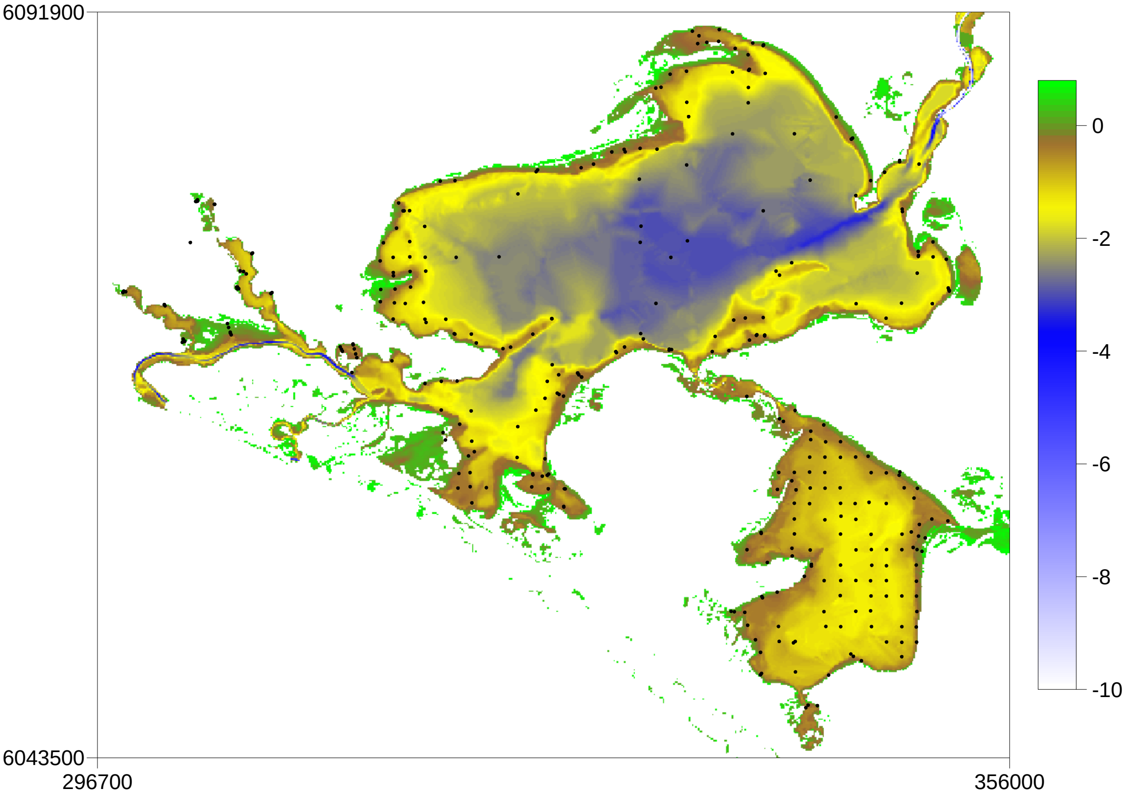


Figure 6-6. Grid domain with the scale showing the elevations according to the Australian Height Datum (AHD), including the study area (<0.8 m AHD) within the Lower Lakes. The locations of samples used in the analysis are shown as black dots (total 346).

6.2 Prediction Methods and Data

Maps of sampled data can be made using a number of methods. One of quickest and consequently perhaps the most common method is to use an arbitrary mathematical interpolator (e.g., inverse distance-squared). Often this approach produces artifacts such as the well-known bulls-eye effect and a map produced in this way has no measure of confidence or uncertainty, for these reasons this approach is not used. Geostatistics is used in this analysis as the primary tool for providing estimates at unsampled locations and for estimating the uncertainty in making the estimates. The semi-variogram (commonly variogram) is the central tool in geostatistics and it is used to estimate the expected squared difference between two sample values and their respective separation distance. The semi-variance is commonly computed as:

$$\hat{\gamma}(h) = \frac{1}{2m(h)} \sum_{i=1}^{m(\mathrm{h})} \{z(x_i) - z(x_i + h)\}^2 \qquad \text{(Eq. 1)}$$

where the z(**x**) and z(**x**+**h**) represent actual values of a property Z at places separated by the lag vector **h** for a set of data z($\mathbf{x}_i$), *i*=1, 2, ...*m*(**h**), where m(**h**) is the number of pairs of data points. The variogram summarises the spatial variation in a property and describes how that variation changes with increasing separation distance between samples. Once the variogram has been calculated it is fitted with a model selected from several families of models which have been previously checked to satisfy certain conditions when making estimates at unsampled locations. Figure 6-7 shows a schematic representation of a bounded function fitted to the experimental variogram. The steepness of the initial slope of the variogram indicates the intensity of change with distance in a property and the rate of decrease in spatial dependence. Where the extent and intensity of sampling enables the scale of spatial dependence to be determined, the variogram will reach a maximum, called the **sill** variance, where it flattens (Figure 6-7). The lag separation distance at which the sill is reached is the **range**, or limit of spatial dependence (Figure 6-7). This bounded form of the variogram is generally interpreted as representing variation that consists of transition features such as different types of soil. When sampling has not captured all of the variation that occurs at smaller scales the experimental data typically intercepts the y-axis. The distance along that axis from the origin is called the **nugget** variance. It reduces the sill variance and the ratio of the nugget: sill variance is an expression of the amount of spatial dependence captured by the sampling strategy.

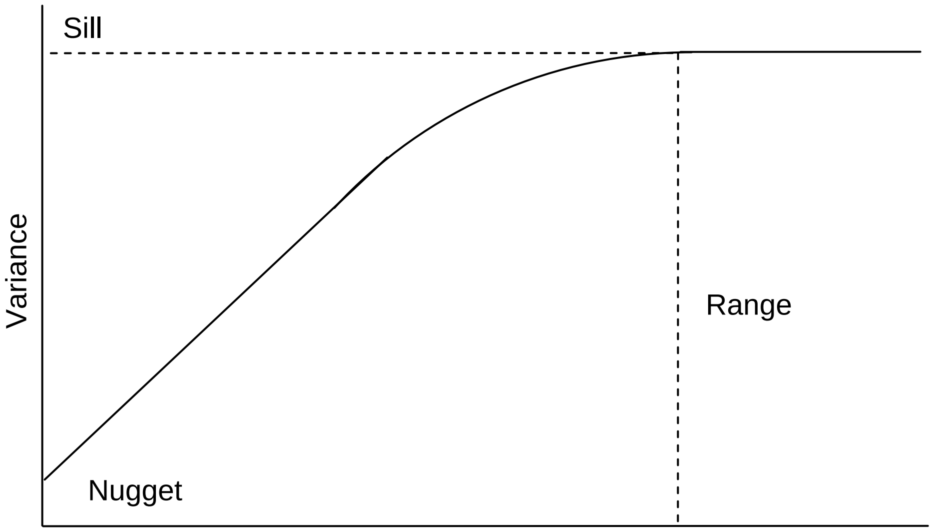


Figure 6-7. Theoretical function for spatial correlation showing bounded variogram with sill, range and nugget.

Kriging is the method of geostatistical estimation at unsampled locations. It is similar to methods of interpolation in its use of a weighted average of nearby samples. However, the main difference is that the weights used are derived from the variogram model rather than using an arbitrary mathematical function. Since the variogram model is fitted to the experimental variogram, which itself was derived from the existing samples as described above, the variogram provides an appropriate relationship between distance and the variation of the property in space. Kriging can be used to make estimates at points and over blocks of any reasonable size. Ancillary data can be used to improve the estimates of the property of interest at unsampled locations using co-kriging. The benefits of this approach are greatest when the secondary ancillary variable, for example, elevation is related to the primary variable of interest. Furthermore, indicator kriging may be used to capture the spatial structure at different thresholds and better represent the extreme variation than ordinary kriging.

Indicator kriging requires the estimation and modelling of *K* indicator variograms and solving *K* kriging systems at each location **u**. The modelling and computational processing can be substantially alleviated if the following two conditions are jointly met:

1. The *K* indicator RFs $I(\mathbf{u}; z_k)$ are intrinsically correlated, the variogram models are proportional (φ) to a common variogram model $\gamma_{mI}(\mathbf{h})$ [*Journel*, 1984] for separation distances (**h**) where:

   $\gamma_I(\mathbf{h}; z_k) = \varphi_k \cdot \gamma_{mI}(\mathbf{h}) \quad \forall\ k$ (Eq. 2)

2. All vectors of indicator data are complete (equally sampled case); there are no missing indicator values such as implied by constraint intervals.

The common model $\gamma mI(h)$ is usually inferred from the indicator variogram at the median threshold. Median indicator data are evenly distributed as 0 and 1 values which usually renders the sample indicator variogram $\hat{\gamma}_I(h; z_M)$ better defined than at other threshold values. The estimator is called median indicator kriging (mIK):

$$\left[F(u;z_k|(n))\right]^*_{mIK} = \sum_{\alpha=1}^{n(u)} \lambda_\alpha^{OK}(u) I(u_\alpha; z_k)$$

$$= \left[F(u;z_k|(n))\right]^*_{oIK} \quad k = 1,\ldots, K \qquad \text{(Eq. 3)}$$

Since the indicator data configuration is the same for all threshold values, the kriging weights do not depend on the threshold being considered; therefore only one IK system needs to be solved at each location **u** decreasing calculations and processing time.

Kriging is one of the most reliable two-dimensional spatial estimators and produces more reliable estimates than methods of interpolation. However, the map of local estimates is often not best as a whole. Estimation algorithms tend to smooth out local details of the spatial variation of the property of interest. Such conditional bias is a serious shortcoming when trying to detect patterns of extremes. The smoothing tends not to be uniform as it depends on the local data configuration. Thus, maps produced using kriging may display artifact structures. Stochastic simulation for uncertainty modelling generates an ensemble of equally probable realisations of the property spatial distribution and enables differences amongst the realisations to be used as a measure of uncertainty. There are many simulation techniques to choose from and no one technique is best for all cases. Instead of a single map of local best estimates, stochastic simulation generates multiple maps or realizations of *z* values $\{z^{(l)}(\mathbf{u}), \mathbf{u} \in \boldsymbol{A}\}$ where *l* denotes the l^{th} realization which reproduces statistics pertinent to the problem e.g., data values are honoured at their locations $z^{(l)}(\mathbf{u}) = z(\mathbf{u}_\alpha)$ $\forall$ $\mathbf{u}=\mathbf{u}_\alpha, \alpha=1, \ldots, n$ when the realization is said to be conditional, the histogram of simulated values may reproduce the sample histogram and the set of indicator variograms may be reproduced by variograms of the simulated values. The stochastic simulation approach can be extended to use secondary data (such as bathymetry) to improve the simulations.

The sequential indicator simulation (SIS) approach is not dependent on an underlying distribution and allows one to account for class-specific patterns of spatial continuity using different indicator variograms (Goovaerts, 1997). The SIS approach of a single continuous attribute *z* at *N* grid nodes $\mathbf{u}'_j$ conditional on the *z*-data, proceeds by discretising the range of variation of *z* into (*K*+1) classes. A random path is defined that visits each node of the grid only once. At each node (Goovaerts, 1997):

1. Determine the **u***'* of *K* conditional cumulative distribution function [ccdf] values $[F(\mathbf{u'}; z_k | (n))]^*$ using median indicator kriging. The conditioning information consists of indicator transforms of neighbouring original *z*-data and previously simulated *z*-values;
2. Correct for any order relation deviations and build a complete ccdf model $F(\mathbf{u'}; z_k | (n)))$, $\forall$ *z,* using the median approximation indicator kriging estimation algorithm;
3. Draw a simulated value $z^{(l)}(\mathbf{u'})$ from the ccdf;
4. Add the simulated value to the conditioning data set;
5. Proceed to the next node along the random path and repeat steps 1 to 4.

This process is repeated with different random paths for each realisation $\{z^{(l')}(\mathbf{u'}_j), j=1, \ldots, N)\}, l' \neq l$.

A database of collected samples was supplied and 346 locations were extracted and included three phases of data collection (November, 2008; May 2009 and August 2009). The majority (89%) of the samples were from the most recent phase of sampling conducted as part of this study in August 2009. The database of collected samples and the values of the key diagnostic properties show that many samples were obtained from a range of depths between 0 - 0.2 m with 8 locations using sample data down to 0.3 m. Approximately 250 locations that were collected on dry land had a sample depth range of 0 - 0.1 m with the remainder collected under water had a sample depth range of 0 - 0.2 m. For simplicity, the samples obtained within the 0 - 0.2 m layer were used in this analysis regardless of whether the sample captured the entire depth of soil. This mismatch between the requirement and the sampling may cause some additional uncertainty in the estimates. A suggestion for further work and repeated mapping is described below. The supplied database was screened for errors and spurious data using summary statistics. In addition, several quantiles (5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} and 95^{th}) were also calculated for use in the subsequent geostatistical analysis and provide a comparison between the properties.

The intention was to use the original bathymetry data to produce a map over appropriate, for example, 100 m blocks using a similar geostatistical approach to that described above. Unfortunately, the original (raw) data was not supplied. Instead, a previously interpolated bathymetry surface was supplied which has variable spacing grid point. This data was resampled to provide a regular 100 m grid across the Lower Lakes area as defined above. This bathymetry data was used to improve the spatial analysis because it provided a full coverage data set across the entire study area and there was a reasonable spatial relationship between bathymetry depth and the soil properties to be mapped. The bathymetry data was used to improve the spatial analysis using sequential indicator co-simulation and to make estimates of the key diagnostic properties on a regular 100 m grid. The time for analysis was limited and several days were consumed in the preparation of the ancillary data and in developing a suitable workflow. Since time was limited, only 50 realisations for each of the key diagnostic properties were produced and post-processed to calculate the pixel-based average and conditional variance at each pixel to summarise the uncertainty in mapping each property. Furthermore, maps of the probability of exceeding a threshold are provided. In the absence of any other information this threshold was made equivalent to the 90^{th} and 10^{th} percentiles of the sample data. A suggestion for further work and repeated mapping is described below.

6.3 Results

Summary statistics for the data used in the analysis are displayed in Table 6-1. Three key diagnostic properties (EC, pH_w and pH_{fox}) had four fewer sample locations than the other properties. Differences in the mean and the median statistics and the skewness values showed that only the pH_{fox} and fine and coarse sediment texture were approximately normally distributed. The remaining properties were positively and negatively skewed. Extreme cases of skewness included EC and TAA. The properties EC, TAA and ANC had large values of coefficient of variation indicating considerable variability in the distribution. The TAA, ANC and to a lesser extent AGP, data are highly skewed because they are formed from truncated distributions. With the time available they could not be treated separately in the workflow to the other properties and were therefore treated as continuous variables. Further work is required to treat these data more appropriately and provide more accurate estimates (see further work section below).

Table 6-2 presents the results of fitting variogram models to the experimental median indicator variograms of the key diagnostic properties. The directional variograms for all properties were more erratic than those of the omni-directional variograms. None of the directional variograms for any of the properties showed any evidence of strong anisotropy. Figure 6-8 shows the variograms for pH_{FOX} as a typical example of the variograms for all properties.

There were two properties (medium texture and TAA) that showed no evidence of spatial dependence and consequently variograms could not be computed for them. Since all properties were measured at the same locations the absence of spatial dependence is due to one or more of the following conditions:

1. The spatial scale of variation is considerably shorter than 3000 m (the shortest range captured by the sampling strategy) and consequently more samples at smaller separation distances are required
2. A larger proportion of the ‘signal’ has been lost in these properties due to noise from many potential sources of variation but most likely the sample depth issue (see section on further work below).
3. The treatment of truncated properties (TAA, ANC and AGP) as continuous data may cause a loss of spatially dependent information.

The variograms of the other properties showed that the sampling design had captured the spatial scale of variation. The ratio of the nugget variance to the sill variance indicated that the sampling design has successfully captured between 32 – 60 % of the spatial variation in properties across the study area using only 346 samples. Using consistent density with 346 samples across the study area 2881 km^2 would require a regular grid of approximately 8 km spacing. In this case, there is only the possibility of capturing the spatial dependence of EC and Net Acidity and this may not have been possible using a regular grid. Consequently, without the property variograms there would have been no choice but to make the maps using an arbitrary mathematical interpolator. Using the variograms as a summary of that spatial variation it is possible to design an optimal sampling strategy for future sampling or monitoring (see section on further work below).

Table 6-1. Summary statistics for the data used in the geospatial analysis.

Statistics	Elevation (m AHD)	Electrical conductivity (mS/cm)	pH soil in water (pH_W)	pH after peroxide treatment (pH_{FOX})	Sediment texture			TAA (mol H^+ t^{-1})	ANC (mol H^+ t^{-1})	Net acidity (NA mol t)	AGP (as CRS) (mol H^+ t^{-1})
					Fine	Medium	Coarse				
Number	88590	342	342	342	346	346	346	346	346	346	346
Minimum	-16.6	0.09	2.15	1.28	0	0	0	0	0	-2077	0
Maximum	0.8	223.95	9.44	8.7	1	1	1	353	3563	1718	1869
Mean	-1.4	4.59	6.85	4.09	0.31	0.14	0.54	8.15	148.3	135.6	224.4
5th	-2.9	0.78	2.96	1.63	NA	NA	NA	0.00	0.00	-304.1	0.00
10th	-2.7	1.09	3.6	1.74	NA	NA	NA	0.00	0.00	-84.8	0.00
25th	-2.3	1.63	6.9	1.96	NA	NA	NA	0.00	0.00	-31.0	3.96
Median	-1.4	2.32	7.41	3.83	NA	NA	NA	0.00	54.5	6.5	20.6
75th	-0.6	3.56	7.8	6.30	NA	NA	NA	0.00	133.9	168.3	251.4
90th	0.05	5.74	8.13	6.71	NA	NA	NA	9.11	350.8	726.1	844.8
95th	0.46	7.43	8.35	9.97	NA	NA	NA	33.90	708.1	1100.5	1192.2
Standard deviation	1.1	16.56	1.61	2.12	0.46	0.35	0.50	37.16	322.5	420	392.6
Coefficient variation	0.7	13.52	5.86	4.11	2.16	2.84	2.00	9.50	11.1	4.1	4.8
Skewness	-0.6	10.73	-1.53	0.17	0.82	2.02	-0.15	6.67	5.6	0.99	2.15

Shaded cells are used in maps showing the probability of exceeding a specified threshold
NA indicates that this statistic cannot be calculated for the variable.

The nugget: sill ratio also indicates that the properties may be separated in two: those properties including pHw, fine texture, ANC, AGP and net acidity with small nugget variance and the remainder with considerably larger nugget variance. Notwithstanding difference in the strength of spatial dependence was also considerable variation in the spatial scale of variation. The largest range of spatial dependence was evident for EC and Net Acidity, whilst the smallest was associated with coarse texture. Properties pH_w and fine texture had a similar range only slightly larger than that of coarse texture. Properties AGP, ANC and pH_{fox} had similar ranges of between 4000 and 5000 m. Considerably different spatial scales indicate the likelihood of separate processes responsible for the spatial variation in values.

Table 6-2. Parameters fitted to the experimental variograms of the median indicator data for each of the key diagnostic properties.

Property	**Model type**	**Range (metres)**	**Sill variance (*c*)**	**Nugget (c_0)**	**Ratio c_0 / c*100 (%)**
EC	Spherical	10000	0.27	0.16	60
pH_W	Exponential	3700	0.27	0.12	44
pH_{FOX}	Spherical	5000	0.25	0.17	68
Fine	Spherical	4000	0.21	0.08	38
Medium	No spatial dependence				
Coarse	Exponential	3000	0.25	0.15	60
TAA	No spatial dependence				
ANC	Spherical	5000	0.25	0.10	40
Net acidity	Exponential	10000	0.25	0.11	44
AGP	Exponential	4000	0.26	0.11	42

The parameters of the models fitted to experimental median indicator variograms were used in the sequential indicator co-simulation with the bathymetry data to provide the per pixel average and variance maps of the properties and the probability of exceeding or falling below thresholds defined using the 10^{th} and 90^{th} percentiles, respectively. The exceptions to this approach included maps of fine and coarse texture which could not be combined with bathymetry data and it was decided to use ordinary indicator kriging to produce a map for each property. A map is also provided that shows the sample locations and their values using an interval. Provided below is a brief description of the maps and any associated observations. Note that the locations and values of the samples are incorporated in the maps.

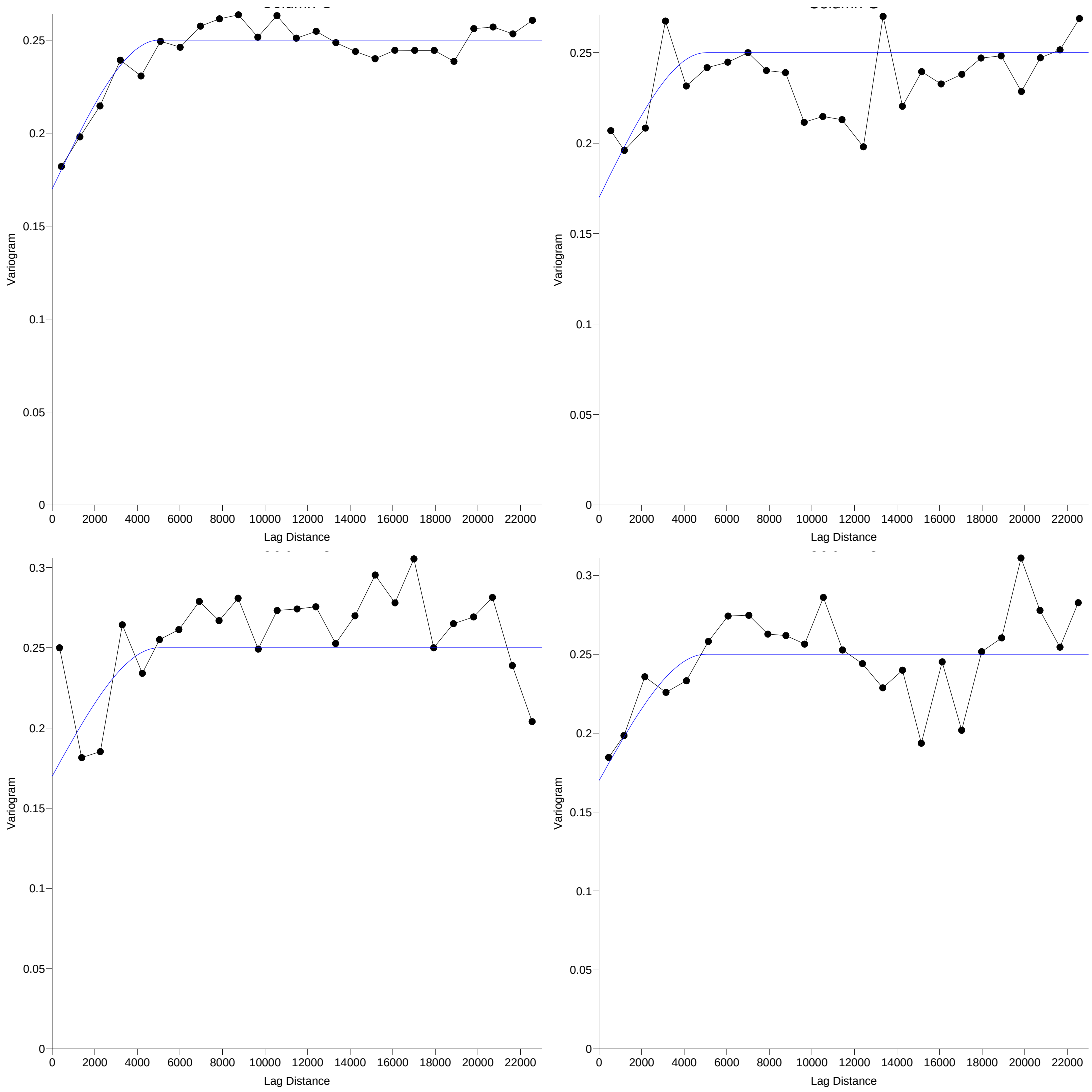


Figure 6-8. Median indicator variograms for pH_{fox} for (a) omni-directional, (b) N-S direction, (c) NE-SW direction and (d) E-W direction. The model fitted to the omni-directional variogram is shown in the other figures.

6.3.1 Electrical conductivity (EC)

Figure 6-9 shows the maps for electrical conductivity (EC) using the sample values (a). Evidently, large values of EC are found predominantly around the edge of the Lower Lakes study area (b). The largest concentration of points with large values of EC is found in the Goolwa Channel and to the southern extremities of lakes Alexandrina and Albert. Much smaller values of EC are found towards the centres of the lakes. The per pixel map of conditional variance (c) provides an assessment of uncertainty in making the estimates. The variance is small overall but there is less confidence in those high valued areas of EC. The map (d) of exceeding the 90th percentile (5.7 mS) shows that in the high-valued areas we can be more than 75% confident. Similarly, the majority of the remaining area of the Lower Lakes is 25% or less in the probability of exceeding that threshold. At the other extreme the map (e) of not exceeding 1.1 mS shows a strong relationship with bathymetry and the deep water channels in the Goolwa Channel and coming in to Lake Alexandrina.

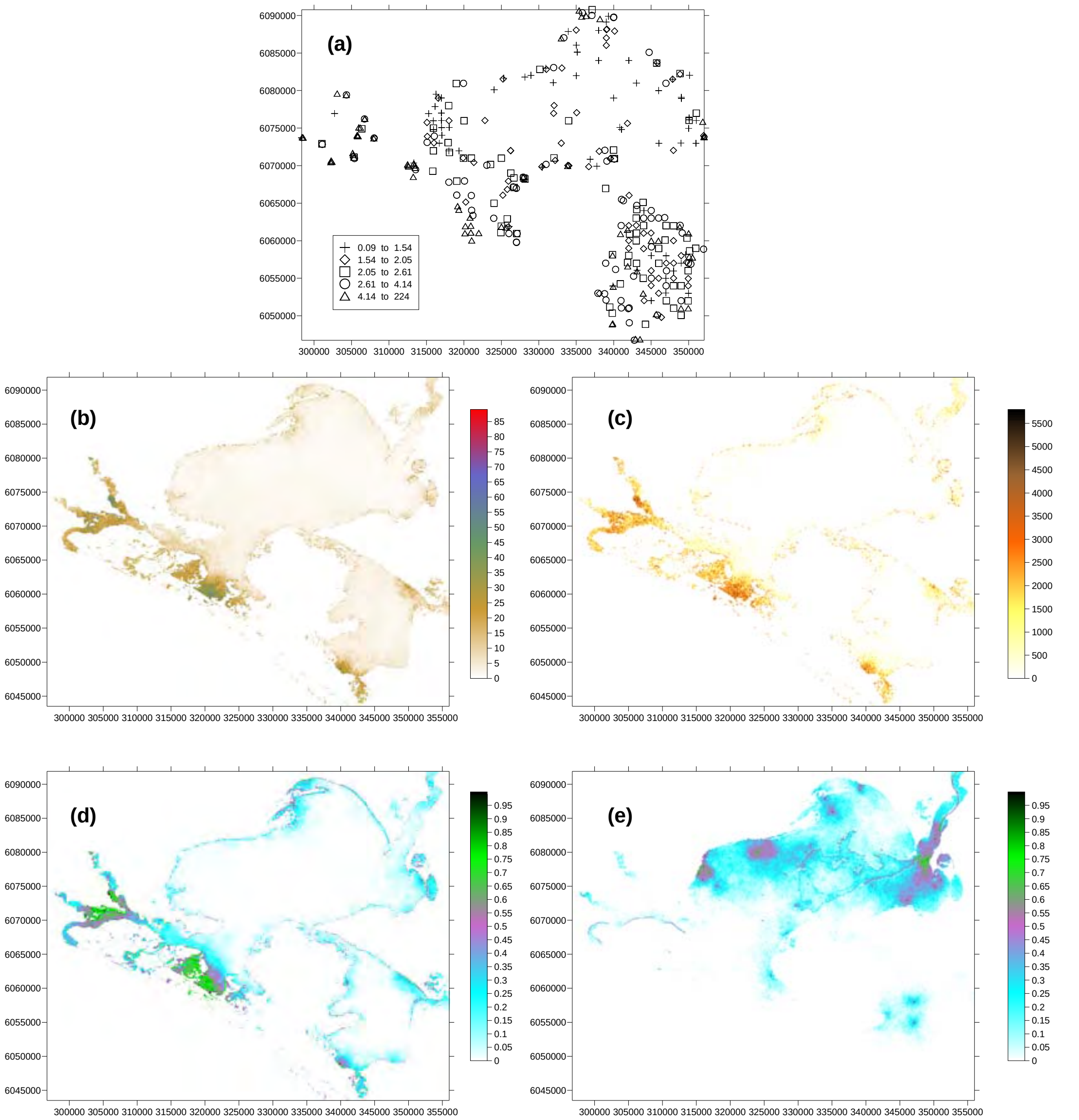


Figure 6-9. Electrical conductivity sample values and location (legend units are mS/cm) (a) and the sequential median indicator simulation showing the per pixel average (legend units are mS; b) and conditional variance (legend units mS; c) and the probability of exceeding the threshold of 5.7 mS (% d) and not exceeding the threshold of 1.1 mS (% e).

6.3.2 pH soil in water (pH$_w$)

Figure 6-10 shows the results of mapping pH in water (pH$_w$) using the sample values (a). It is evident by comparing the pattern of bathymetry (Figure 6-6) with that of pH$_w$, the latter is very strongly associated with bathymetry. The per pixel average (b) shows that a vast majority of both lakes have large pH 6 - 8 values and the highest concentration is located in Alexandrina. Small values of pH are found in some of those areas associated with large EC values that is, Goolwa Channel southern lake areas. However, small pH values are also found where EC is also small. The per pixel variance map (c) is considerably smaller in magnitude than that of EC suggesting considerably greater consistency in the estimates of pH$_w$. As before areas of larger variation in pH$_w$ are found in the large valued areas. The map of the probability of exceeding the 90th percentile (d) shows that there are four main areas in Lake Alexandrina where the probability of exceeding 8.1 units is much greater than 50%. The map of the probability of not exceeding the 10th percentile (e) shows that areas with a considerable probability are largely in the extremes of Lake Alexandrina.

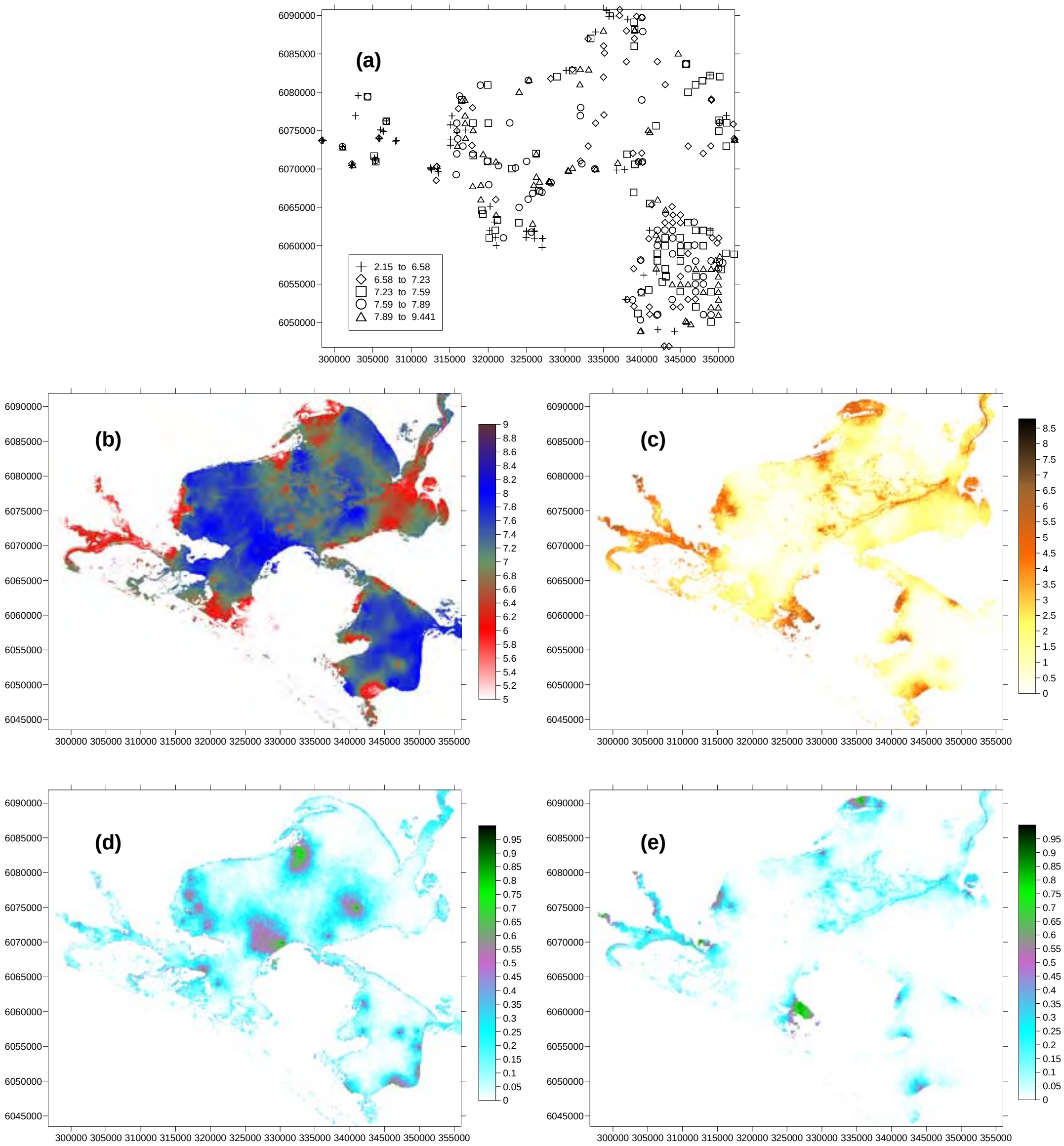


Figure 6-10. pH in water sample values and location (a) and the sequential median indicator simulation showing the per pixel average (b; scale pH unit) and conditional variance (c) and the probability of exceeding the threshold of 8.1 units (d) and not exceeding the threshold of 2.6 units (e).

6.3.3 pH peroxide treatment (pH_{fox})

Figure 6-11 shows the results of mapping pH after peroxide treatment (pH_{fox}) using the sample values (a). The pattern of bathymetry is very clear in some of the maps indicating that pH_{fox} is strongly associated with bathymetry. The per pixel average (b) shows that a vast majority of both lakes have small pH_{fox} values but pockets of large pH_{fox} values occur along the northern edges of Lake Alexandrina and eastern end of lake Albert. The per pixel variance map (c) has a similar magnitude to that of pH_w. The map is slightly different to that of pH_w in that large variance is not associated with large values of pH_{fox}. Instead, intermediate variance is found distributed across the majority of the Lower Lakes area and small variance is found elsewhere. The map of the probability of exceeding the 90th percentile (d) shows one main area in the northeast of Lake Alexandrina. The map of the probability of not exceeding the 10th percentile (e) shows three areas: north of Alexandrina, the connection between the lakes and the northern part of the Goolwa Channel.

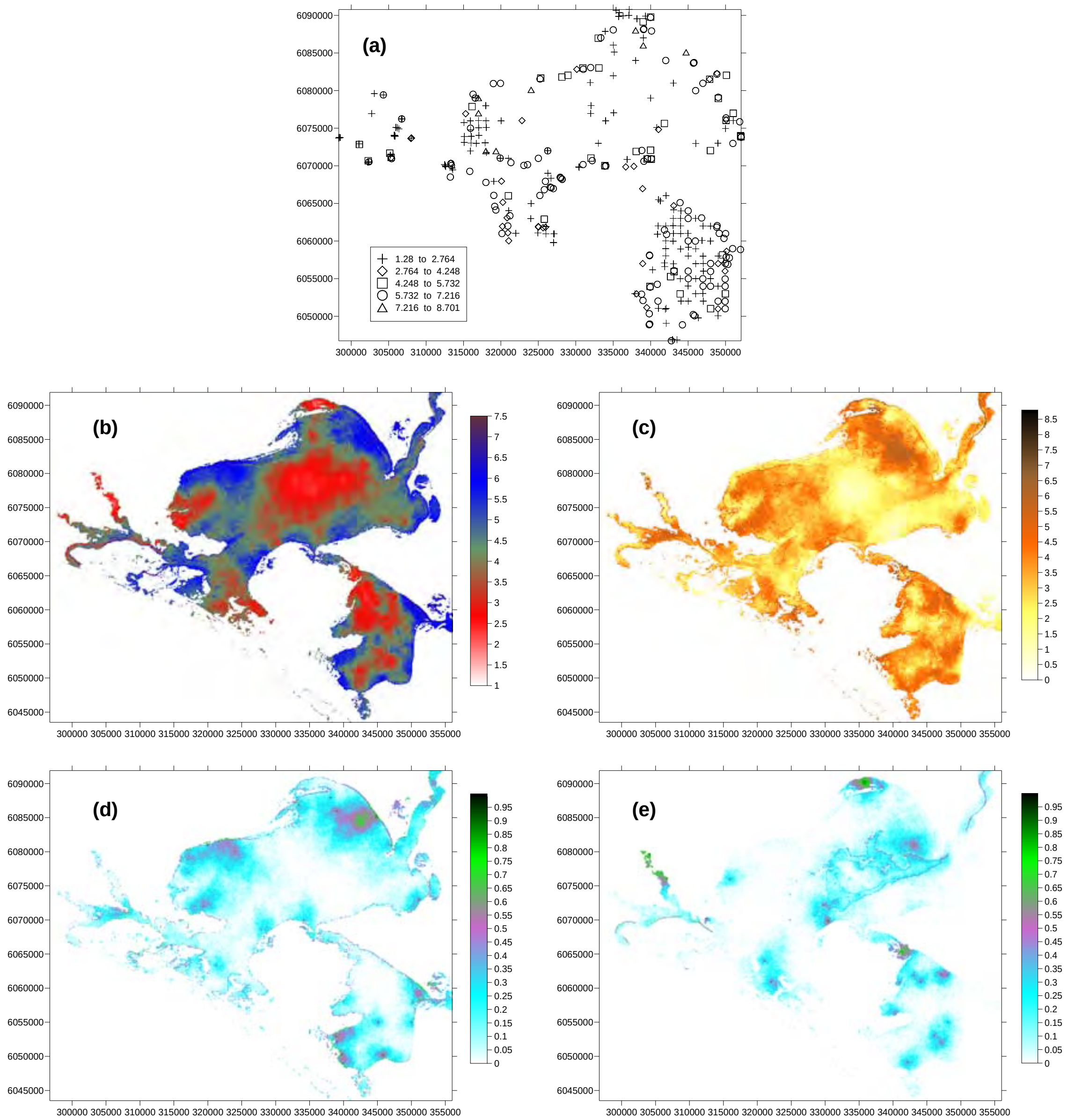


Figure 6-11. pH in peroxide treated sample values and location (a) and the sequential median indicator simulation showing the per pixel average (b; scale is pH unit) and conditional variance (c) and the probability of exceeding the threshold of 6.7 units (d) and not exceeding the threshold of 1.7 units (e).

6.3.4 Fine and coarse texture

Joint probability of occurrence of fine and coarse material is mapped using sequential indicator simulation and provides a probability of occurrence. A value near ‘0’ indicates the soil texture is likely to be fine and a value near ‘1’ indicates coarse.

The map of sample values shows that the central portions of the lakes are associated with fine texture and that generally the edges of the lakes are associated with a coarse texture (Figure 6-12). Medium texture is not mapped because there was no spatial dependence (Table 6-2).

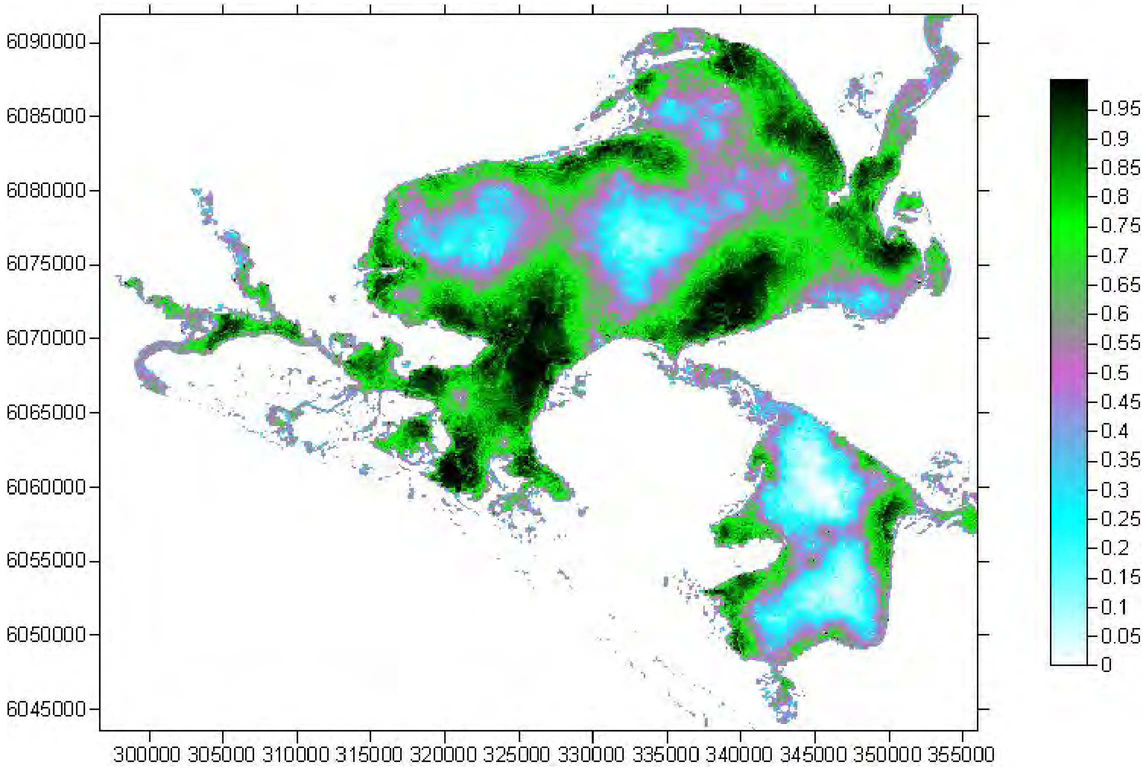


Figure 6-12. Soil texture presented from a joint probability of fine and coarse texture sample values.

6.3.5 Acid neutralising capacity (ANC)

Figure 6-13 shows the results of mapping acid neutralising capacity (ANC) using the sample values (a). The per pixel average (b) shows that Lake Albert has a slightly larger level of ANC than Lake Alexandrina. Both lakes show distinct 'hotspots' in addition to the elevated levels along the lakes boundary. The per pixel variance map (c) has the largest magnitude of all of the properties indicating that there is considerable inconsistency in the estimates particularly in those hotspot areas. This is created by, amongst other things, the extremely skewed distribution with very long tails in which a small difference in amount makes a considerable difference to the probability. As mentioned above this should be the focus of further work to treat ANC differently and considerably reduce the spatial uncertainty. The map of the probability of exceeding the 90th percentile (d) emphasises the main hotspot areas indicated in the per pixel average map. The map of the probability of not exceeding the 50th percentile (e) shows a very strong association with bathymetry and there is more than 75% probability that the majority of the lake fringe will not exceed that median value.

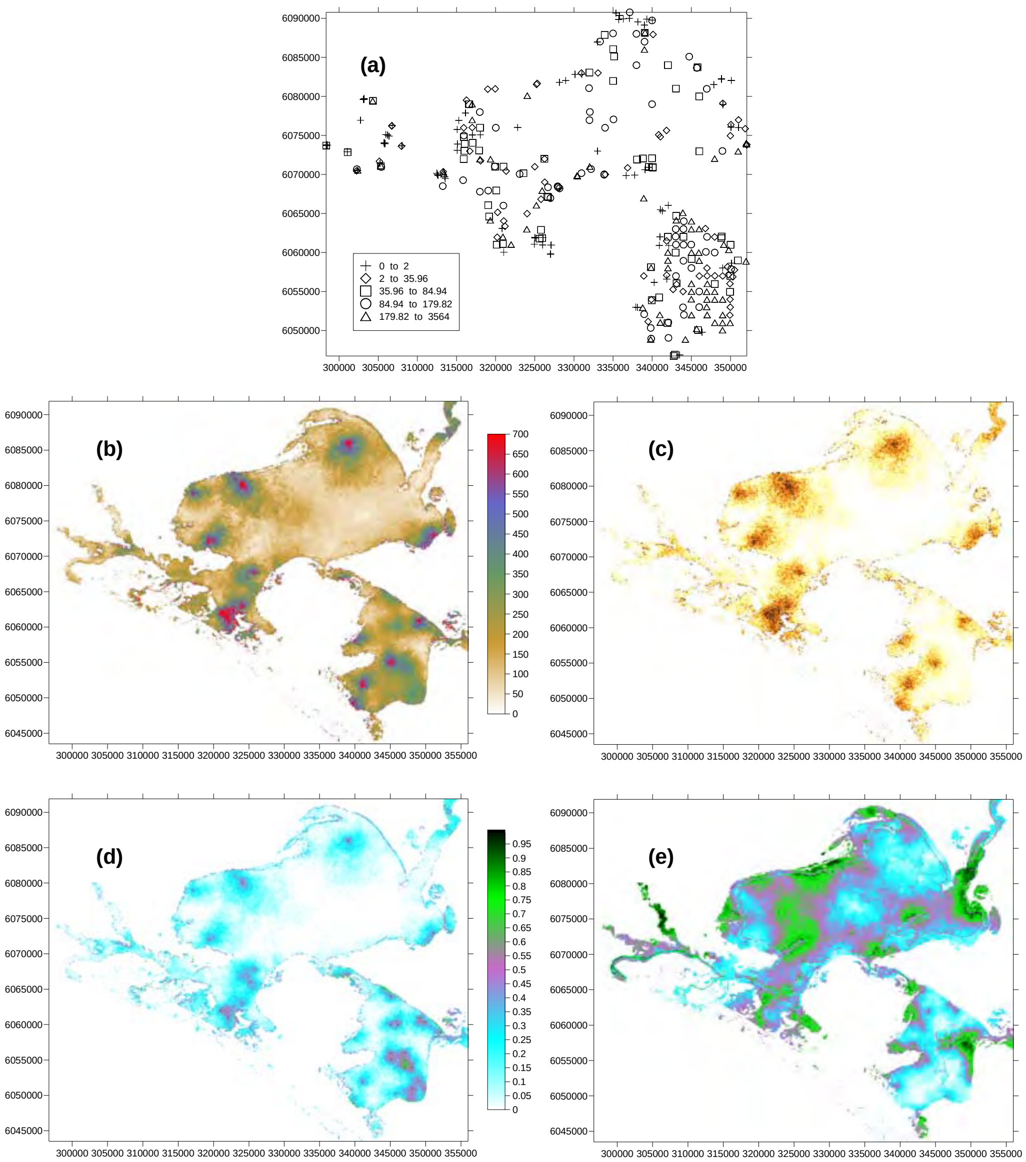


Figure 6-13. ANC sample values and location (a) and the sequential median indicator simulation showing the per pixel average (b; scale in mol H+ t-1) and conditional variance (c) and the probability of exceeding the threshold of 351 (d; mol H+ t-1) and not exceeding the threshold of 55 (e; mol H^+ t^{-1}).

6.3.6 Acid generating potential (AGP)

Figure 6-14 shows the results of mapping AGP measured from chromium reducible sulfur using the sample values (a). The per pixel average map (b) shows that Lake Albert has a larger level of AGP than Lake Alexandrina. Some of the deeper water in both lakes is where the largest values of AGP are evident. The smallest values of AGP are evident along the northern and south-eastern shores of Lake Alexandrina and in the east of Lake Albert. These patterns are consistent with those of Net Acidity. The per pixel variance map (c) indicates that there is considerable inconsistency in the estimates (by comparison with e.g., pH). The greatest variance appears to be in relatively few patches many of which occur in Lake Albert but the deep water of Lake Alexandrina and upper reaches of the lake have similarly large variance. The map of the probability of exceeding the 90th percentile (d) shows that the northern portion of Lake Albert is most likely to exceed that threshold. The map of the probability of not exceeding the 10th percentile (e) shows a strong association with bathymetry and there is more than 75% probability that much of the shoreline and the upper reaches of Lake Alexandrina will not exceed the 10th percentile.

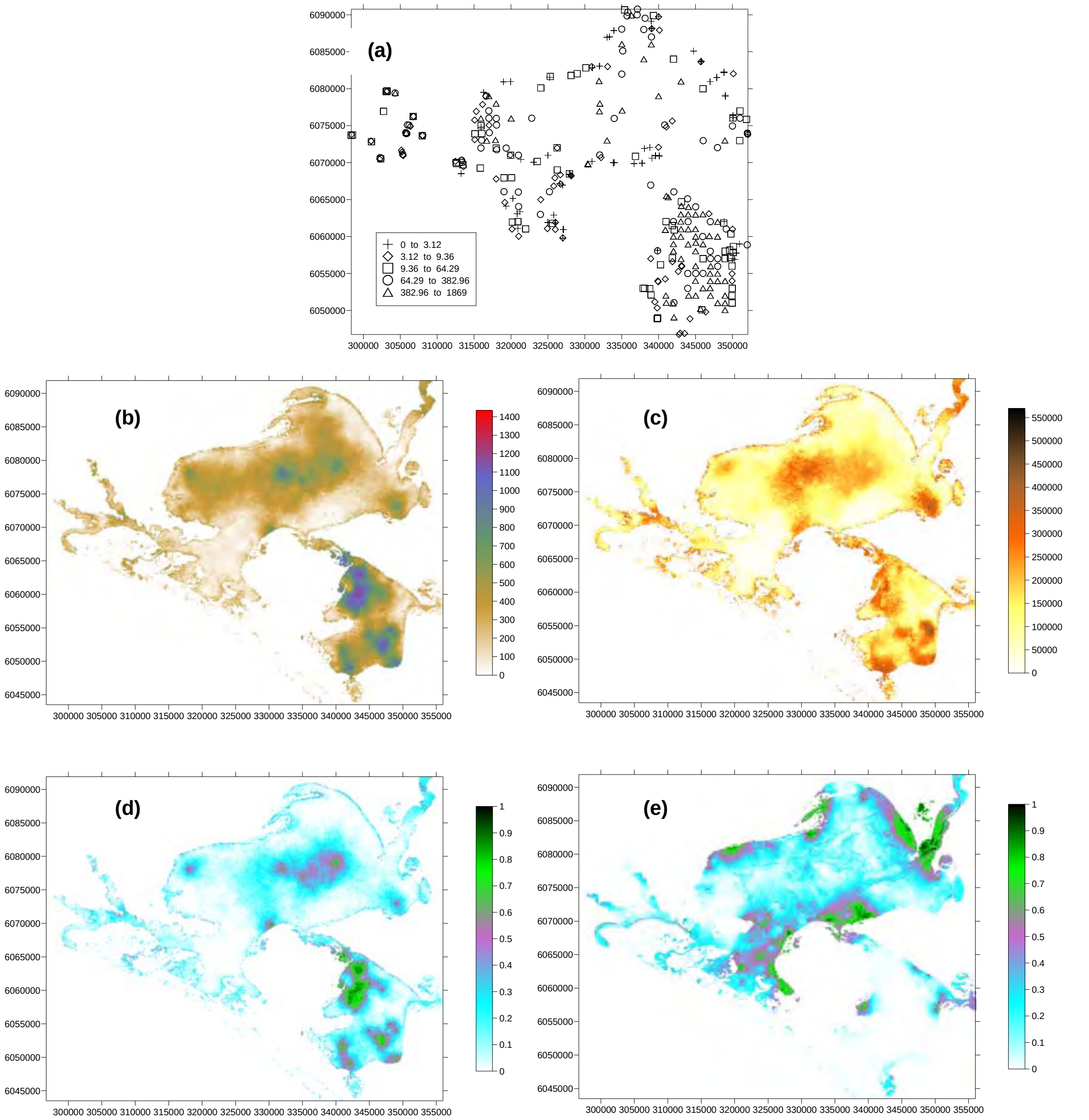


Figure 6-14. Acid generating potential sample values and location (a) and the sequential median indicator simulation showing the per pixel average (b; mol H+ t-1) and conditional variance (c) and the probability of exceeding the threshold of 845 (d; mol H+ t-1) and not exceeding the threshold of 4 (e; mol H^+ t^{-1}).

6.3.7 Net Acidity (NA)

Figure 6-15 shows the results of mapping Net Acidity using the sample values (a). The per pixel average map (b) shows that Lake Albert has a larger level of Net Acidity than lake Alexandrina. Some of the deeper water in both lakes is where the largest values of Net Acidity are evident. The smallest (negative) values of Net Acidity are evident along the northern and southeastern shores of Lake Alexandrina and in the east of Lake Albert. The per pixel variance map (c) indicates that there is considerable inconsistency in the estimates. The greatest variance appears to be in relatively few locations many in Lake Albert since the majority of the map has similarly small variance. The map of the probability of exceeding the 90th percentile (d) shows that the northern portion of Lake Albert is most likely to exceed that threshold. The map of the probability of not exceeding the 10th percentile (e) shows a strong association with bathymetry and there is more than 75% probability that the Goolwa Channel will not exceed that median value.

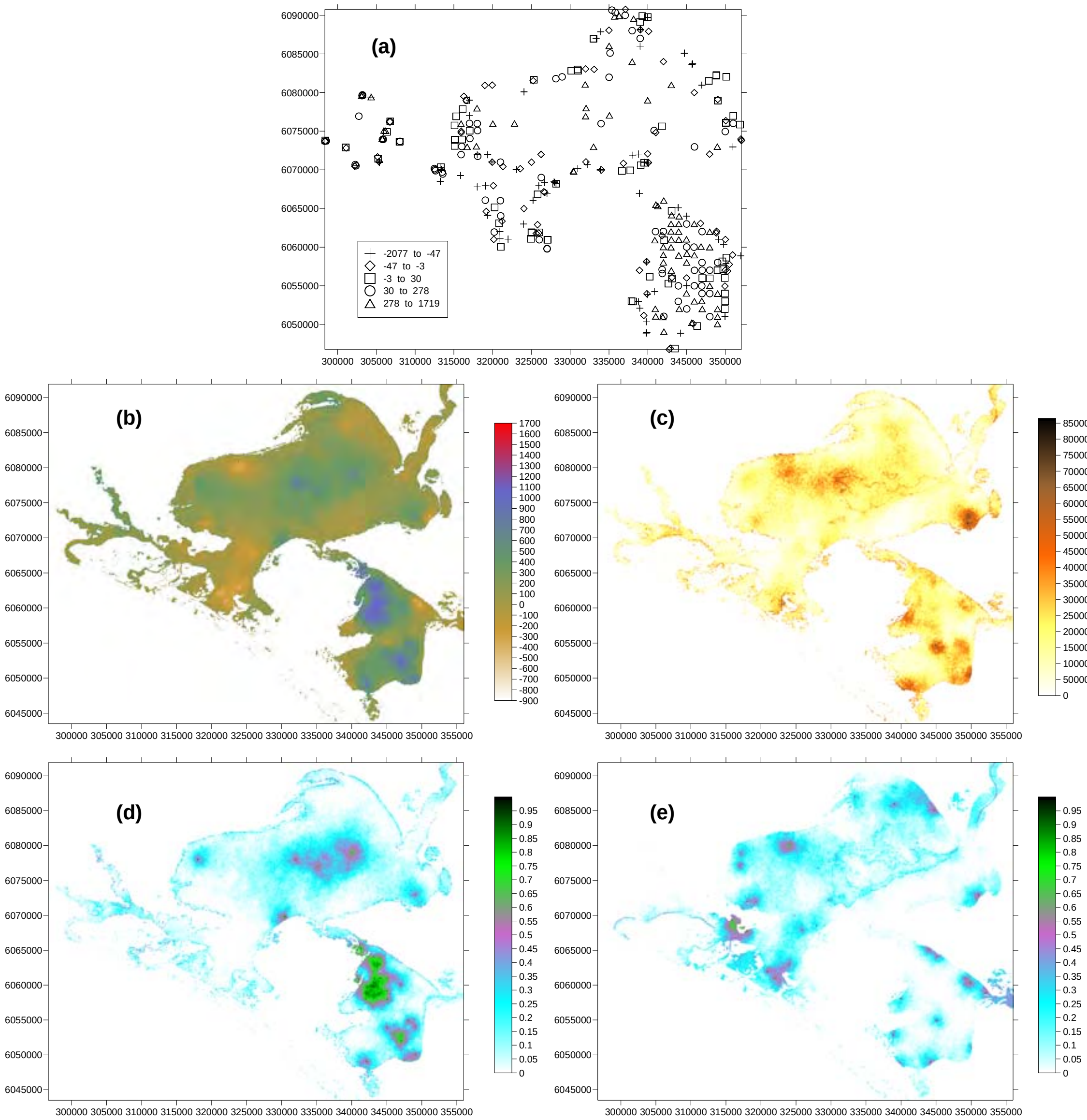


Figure 6-15. Net acidity sample values and location (a) and the sequential median indicator simulation showing the per pixel average (b; NA mol H+ t-1) and conditional variance (c) and the probability of exceeding the threshold of 725 (d; NA mol H+ t-1) and not exceeding the threshold of -85 (e; NA mol H^+ t^{-1}).

6.3.8 Output data quality assurance

There was no requirement to assess the map data quality and ensure that the results are valid and fit for purpose. Although an assessment of uncertainty is provided as a by-product of the mapping process it is not clear to what extent the maps and their statistics represent the original data. Theoretically, as explained above, the distributions of the maps should match approximately those of the original sample data and there should be little statistical bias in the distributions. These types of assessment can be performed relatively quickly using straightforward statistics e.g., q-q plots. A recommendation for this type of work is included below and would complement the uncertainty maps.

A request has recently been received for an assessment of the proportion of the Lower Lakes area that a particular variable is below or above a given value. This type of data analysis is consistent with the quality assurance. These types of data can be represented rapidly using a cumulative distribution function (CDF) of the per-pixel mean map (b in figures 6 - 4, 5, 6, 8, 9,10). The texture maps are not included in this assessment. Figure 6-16 shows the CDFs. The x-axis represents the value of the variable described and the y-axis is the number of pixels (relative to the total number of pixels = 88590) that are below a given value. The curves of the CDFs describe the change in the relative proportion of the Lower Lakes for each variable.

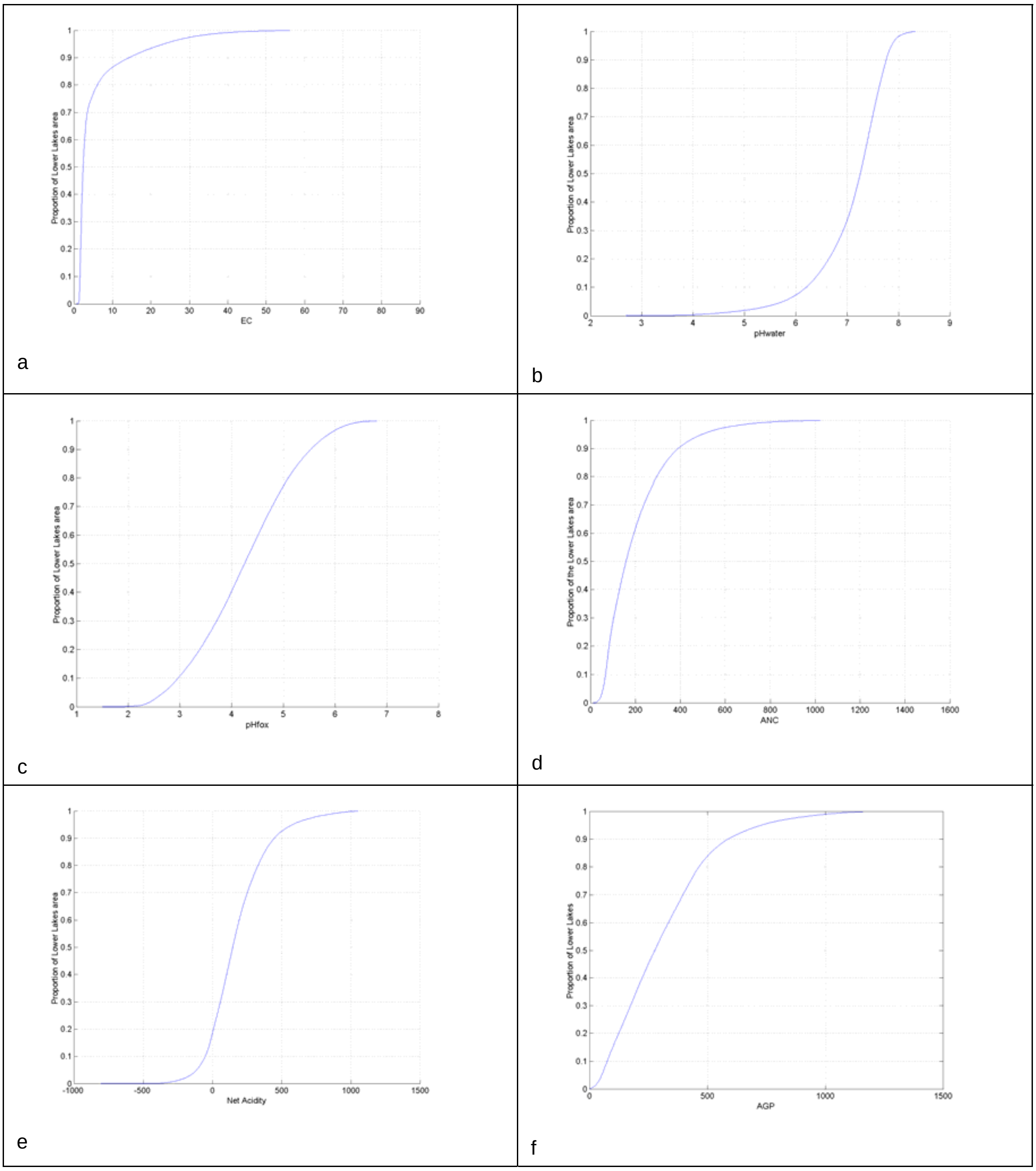


Figure 6-16. Cumulative distribution functions of the proportion of 100 m x 100 m pixels relative to the total number of pixels (88590) in the Lower Lakes for electrical conductivity (a), pHw (b), pHfox (c), Acid Neutralising Capacity (d), Net Acidity (e), and Acid Generating Potential (f).

6.4 Scope for further work

Sample depth and map estimate inconsistency

In the requirements section above was raised of the inconsistency between the requirement of maps for the depth layer 0 - 0.2 m and the sampling, which was conducted for: (i) 0 - 0.1 m, (ii) 0 - 0.2 m and (iii) 8 sites taken at a depth of 0 - 0.3 m. Consequently, there are values that have come from different sample depths that are assumed to represent the value for the depth 0 - 0.2 m. In the case that a steep (perhaps exponential) gradient exists over depth for a particular variate, the value included in the analysis may not adequately represent the value for 0 - 0.2 m. The effect will be to increase the apparent small scale spatial variability. This induced ‘noise’ may be largely responsible for the high variance ratio (Table 6-2), the absence of spatial dependence in the coarse texture and TAA and the inability to map these properties. In those properties that have been mapped the same source of 'noise' may also have contributed to the very large per pixel variance in some properties.

Recommendation: Conduct a 3D geostatistical analysis of the properties. This will require additional variogram modelling over depth. However, the additional analysis will best account for differences in depth measurements across space. In the same way as estimates are made across space they would also be made for separate increments in depth (0 - 0.2 m) and variation in the volume can be investigated. This approach will best represent the difference in the properties near the water and soil interface and show the change in gradient with depth across the lakes.

Mapping other sample layer depths

As discussed in the introduction to this geostatistical section, while it is possible to construct maps of the soil properties for the deeper surface layers, confidence in the initial outputs would be low. A significant research effort is required to understand and then determine appropriate work-flows and approaches. This would require an iterative testing to identify the best method.

Recommendation: Conduct research, identify and test methods to generate soil property maps for the subsoil layers.

Mapping realisations

Typically, more than 100 realisations would be produced for each property of interest. Given the limited time available to conduct the analysis, the number of realisations for each of the key diagnostic properties was reduced to 50. Since the data are now in place and the work flow has been refined it is a relatively straight forward and efficient operation to repeat the analyses using many more realisations and perhaps with different and more appropriate thresholds than those chosen here.

Recommendation: Repeat the geostatistical analyses using twice as many realisations and with thresholds appropriate for perhaps treatment / monitoring purposes.

Exploratory multivariate data analysis

There is considerable scope for exploratory data analysis of this multivariate dataset including principal components analysis and non-hierarchical multivariate classification to summarise the pattern of variation. It would provide the basis for the use of ancillary data to improve variate estimates across the study area and may reveal that whilst bathymetry is evidently very useful for improving estimates of pH some combination of texture and bathymetry may be more useful for the map estimates of other variates. Furthermore, a multivariate analysis could identify regions (with greater similarity within and between areas) within the study area and to answer questions such as should / could lake Albert be treated as a separate region? Are there similar sized areas within Lake Alexandrina that could / should be treated separately from other areas?

Recommendation: Fundamental and rapid multivariate analysis to understand the correlation between intrinsic and extrinsic variates and to identify regions within the study area for treatment and / or monitoring purposes.

Mapping texture using joint probability

The maps of fine and coarse texture are crude because they do not account for the presence and absence of other textures (joint probability). Additional work would be required to produce the joint probability of occurrence between fine and coarse texture to improve these maps. This would also be worthwhile if the texture maps could be used to supplement or replace the use of bathymetry as an ancillary variable where there appears to be little relationship between the variate of interest and bathymetry. Although not provided for this analysis, there are additional data on soil / sediment type which could be used in addition to or to replace the basic texture assessment.

Recommendation: Conduct categorical analysis of texture information particularly if this were to coincide with the improved specification of the depth analysis so that the medium texture could be included.

Grid or point estimates?

The analysis conducted assumed a requirement of maps produced using points with a resolution of 100 m. As a consequence of the decision to make estimates for points rather than blocks the resulting maps show small scale variation (speckled appearance). There are situations when maps based on points are useful. However, estimates made over blocks are often more suitable than estimates made on points. For example, maps made for 100 m contiguous blocks would be smoother than those made using points because the variation of points within a block would be removed. All other aspects of the maps would be identical and assessments using e.g., probability of exceeding a threshold can still be made. Notably, block estimates are used in contamination studies where remediation costs can be made on the basis of treating a given volume of sediment.

Recommendation: If a repeat geostatistical analysis is required it should be performed on a block of a size appropriate to the nature of the investigation.

Ancillary data

The bathymetry data was central to providing fine resolution maps, particularly those maps with such small variance, using only a small number of samples across a very large area (e.g., pH). However, the bathymetry data used in this study was resampled to 100 m points from a previous assimilation of LiDAR and SONAR data. Since this ancillary data is so important for the mapping procedure it is suggested that the original raw point data is provided so that the data can be estimated to points or blocks of a size suitable for the mapping procedure.

Recommendation: Provide original point SONAR data for the Lower Lakes study area and produce a regular grid at a resolution suitable for use as the ancillary data in a repeated geostatistical analysis.

Optimised sampling

The variograms of the key diagnostic properties provide a summary of the spatial variation. The variograms show that the amount of variation in a particular property increases with increasing lag separation distance until reaching the range which is where the sill reaches its plateau and variation remains consistent over space. This means that if a standard error for the estimates can be set the optimal number of samples (on a regular grid) can be designed. Furthermore, additional locations where there is particular interest for example hotspots, can be included. The maps of spatial uncertainty can also be used to identify those areas were there was greater than acceptable uncertainty.

Recommendation: Either use the existing variograms or preferably refine the existing variograms with repeated geostatistical analysis so that an optimised sampling design can be provided based on a prescribed level.

Truncated data distributions

The analysis of ANC, TAA and AGP data was based on the same workflow as the other properties and assumed continuous data. However, it appears that these variables are truncated (the lower portion of the distributions below a threshold have been set to zero). In these cases the data should be treated as categorical across the threshold and as continuous data above the threshold and the two resulting maps merged to form a final map.

Recommendation: Repeat the analysis of ANC, TAA and AGP treating the data as truncated-continuous distributions.

Quality assessment of maps and their statistics

As mentioned above there is a need assess the quality of the stochastic simulation process and the resulting maps and arising statistics to ensure that the maps represent adequately the original sample distribution and provide an unbiased estimate of the distributions.

Recommendation: Conduct straightforward statistics of the resulting map data and present the results using histograms and q-q plots.

7 Soil Classification Map

A soil classification map was constructed that identifies areas defined by "polygon boundaries" where a soil class is likely to occur. The soil classification map differs from the geostatistical maps in that it classifies a number of soil properties throughout the depth of the soil profile and allocates it to a soil class, whereas each of the geostatistical maps presented in the previous section are for one soil property that occurs for a layer.

To construct the soil classification map the following input steps were used:

1. Each site was classified (e.g. sulfuric sand or sulfuric clay as shown in Figure 4-2; Table 4-3) according to dominant acid sulfate soil material (i.e. Soil Type in accordance to the soil identification key in Table A1.1.1 outlined in Appendix A1) and texture (i.e. Soil Subtype in accordance to the soil identification key in Table A1.1.2 outlined in Appendix A1).
2. Bathymetry data contoured to identify surface water level, 2.5m below the surface water level (i.e. to estimate areas with subaqueous soils) and 0.50 cm above the surface water level.
3. Spatial data sets were combined to produce overlays for visual inspection.
4. Map of soil texture grouped as clay and sand based on information from the geostatistical soil texture map (Figure 6-12).
5. Allocate Acid Sulfate Soil Type (e.g. Subaqueous soil) and Subtype (e.g. Hypersulfidic subaqueous clayey soil) to map polygons based on Information from steps 1 to 4 together with soil surveyor and local knowledge.
6. Identify list of potential or preliminary soil map units as shown in the map legend in Table 7-1 based on steps 1 to 5.
7. Allocate final Soil Map Unit Names to polygons after creating combined map overlays for visual inspection. A back check was then conducted to identify how well the map units 'honoured' the sites that occurred in each map unit and agreed with the map unit description, and a further iteration of the map was conducted to update and refine. The Soil Classification Map is presented in Figure 7-1.

A summary of area measurements for each of the soil classes as mapped in Figure 7-1 is presented in Table 7-2. The data shows the study area is dominated by soils classified as subaqueous (~ 80% of area). These are mainly hypersulfidic soils with associated hyposulfidic soils occurring in some areas. Large areas of Sulfuric soil subtypes also occur throughout the study area (~ 20% of area).

The map presented in Figure 7-1 and area data in Table 7-2 shows that at the time of field survey the following sulfuric soil subtypes were identified along the margins of Lake Albert and Lake Alexandrina: (i) sulfuric soils (hydrosols) occurring in Currency Creek and Finniss River, adjacent to the barrages and near Loveday Bay, and along the north eastern shores of both lakes, and (ii) sulfuric (unsaturated) soils predominantly occurring in Currency Creek and Finniss River, near the barrages and along the north western and north eastern shores of Lake Alexandrina and North eastern shores of Lake Albert. The following new soil subtype was identified in Loveday Bay, namely a sulfuric subaqueous soil.

Acid sulfate soils with hypersulfidic and hyposulfidic material dominate most of the project area. Hypersulfidic and hyposulfidic subaqueous soil subtypes (overlying water 0 to 2.5 m) are the most dominant soil subtypes in the area. In contrast, "hypersulfidic (~ 90%) and hyposulfidic (~ 10%) deep water soils" were localised and only occurred where deep channels were identified by bathymetry such as in the Goolwa channel near the River Murray mouth (Figure 7-1). Hypersulfidic and hyposulfidic hydrosols (sandy) (i.e. saturated within 50 cm below soil surface), occurred along the exposed margins of Lake Alexandrina and were associated with sand bars that were at the water level.

Table 7-1. Map Legend showing potential soil map units ordered by landscape (bathymetry level) and then acid sulfate soil class and texture.

Landscape	Acid Sulfate Soil Class	Soil Texture Class	Soil Map Unit Name
Deep Water (Below >2.5m water depth)			
	Hypersulfidic	Fine	Hypersulfidic deep water clays
	Hyposulfidic	Fine	Hyposulfidic deep water clays
	Non-acid	Fine, Medium or Coarse	Non-acid deep water soils
Subaqueous (0 to 2.5m water depth)			
	Sulfuric	Fine	Sulfuric subaqueous clays
	Sulfuric	Coarse	Sulfuric subaqueous sands
	Hypersulfidic	Organic	Hypersulfidic subaqueous organics
	Hypersulfidic	Fine	Hypersulfidic subaqueous clays
	Hypersulfidic	Medium	Hypersulfidic subaqueous loams
	Hypersulfidic	Coarse	Hypersulfidic subaqueous sands
	Hyposulfidic	Organic	Hyposulfidic subaqueous organics
	Hyposulfidic	Fine	Hyposulfidic subaqueous clays
	Hyposulfidic	Medium	Hyposulfidic subaqueous loams
	Hyposulfidic	Coarse	Hyposulfidic subaqueous sands
	Monosulfidic	Ooze	Monosulfidic subaqueous ooze
	Non-acid	Fine, Medium or Coarse	Non-acid subaqueous soils
Hydrosols (saturated within 50cm below soil surface)			
	Sulfuric	Fine	Sulfuric hydrosols clays
	Sulfuric	Coarse	Sulfuric hydrosols sands
	Hypersulfidic	Fine	Hypersulfidic hydrosols clays
	Hypersulfidic	Medium	Hypersulfidic hydrosols loams
	Hypersulfidic	Coarse	Hypersulfidic hydrosols sands
	Hyposulfidic	Fine	Hyposulfidic hydrosols clays
	Hyposulfidic	Medium	Hyposulfidic hydrosols loams
	Hyposulfidic	Coarse	Hyposulfidic hydrosols sands
	Monosulfidic	Ooze	Monosulfidic hydrosols ooze
	Non-acid	Fine, Medium or Coarse	Non-acid hydrosols soils
Unsaturated (unsaturated within 50cm below soil surface)			
	Sulfuric	Fine	Sulfuric clays
	Sulfuric	Coarse	Sulfuric sands
	Hypersulfidic	Fine	Hypersulfidic clays
	Hypersulfidic	Medium	Hypersulfidic loams
	Hypersulfidic	Coarse	Hypersulfidic sands
	Hyposulfidic	Fine	Hyposulfidic clays

Landscape	Acid Sulfate Soil Class	Soil Texture Class	Soil Map Unit Name
	Hyposulfidic	Medium	Hyposulfidic loams
	Hyposulfidic	Coarse	Hyposulfidic sands
	Monosulfidic	Ooze	Monosulfidic ooze
	Non-acid	Fine, Medium or Coarse	Non-acid
Calcrete outcrop			
Granite outcrop			

Table 7-2. Area measurements for the soil map units.

Map Unit Name	Area (ha)	Map unit groups	Area (ha)
Hypersulfidic (~90%) & hyposulfidic (~10%) deep water clays	166	Hypersulfidic (~90%) & hyposulfidic (~10%) deep water clays and sands	439
Hypersulfidic (~90%) & hyposulfidic (~10%) deep water sands	272		
Hypersulfidic (~80%) & hyposulfidic (~20%) hydrosol sands	3,304	Hypersulfidic (~80%) & hyposulfidic (~20%) hydrosol sands	3,304
Hypersulfidic (~90%) & hyposulfidic (~10%) subaqueous clays	23,717	Hypersulfidic (~90%) & hyposulfidic (~10%) subaqueous clays and sands	66,714
Hypersulfidic (~90%) & hyposulfidic (~10%) subaqueous sands	42,997		
Hypersulfidic (~60%) & hyposulfidic (~40%) subaqueous clays with MBO	44	Hypersulfidic (~60%) & hyposulfidic (~40%) subaqueous clays and sands with MBO	372
Hypersulfidic (~60%) & hyposulfidic (~40%) subaqueous sands with MBO	328		
Sulfuric (~90%) & hypersulfidic (~10%) hydrosol clays	898	Sulfuric (~90%) & hypersulfidic (~10%) hydrosol clays and sands	4,514
Sulfuric (~90%) & hypersulfidic (~10%) hydrosol sands	3,615		
Sulfuric (~90%) & hypersulfidic (~10%) subaqueous sands	165	Sulfuric (~90%) & hypersulfidic (~10%) subaqueous sands	165
Sulfuric (~90%) & hypersulfidic (~10%) unsaturated clays	1,579	Sulfuric (~90%) & hypersulfidic (~10%) unsaturated clays and sands	13,712
Sulfuric (~90%) & hypersulfidic (~10%) unsaturated sands	12,133		
Grand Total	89,219	Grand Total	89,219

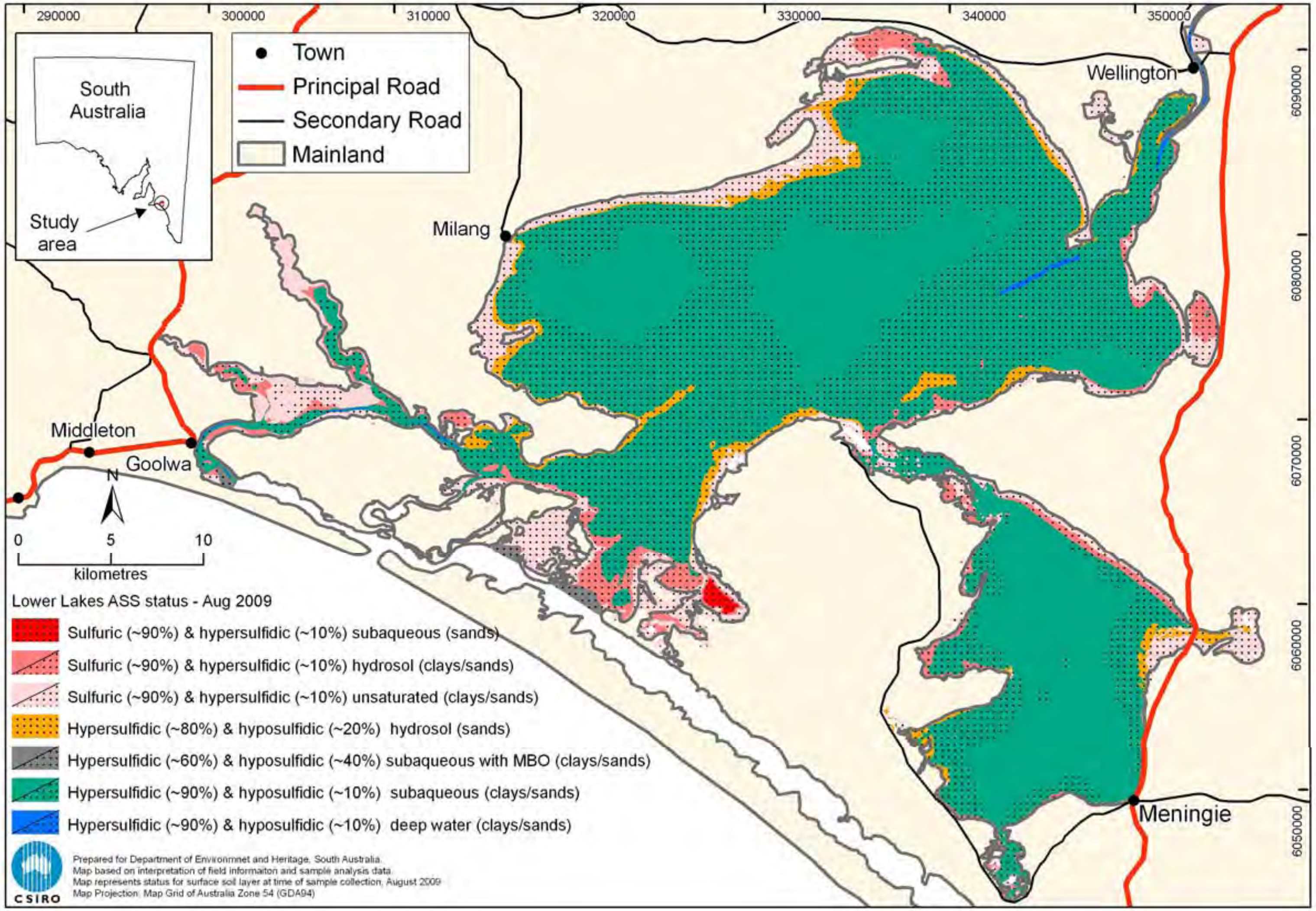


Figure 7-1. Soil classification map of the distribution of the wide range of acid sulfate soil subtypes. Map legend showing: i) acid sulfate soil materials with sulfuric (pH <4), hypersulfidic (pH <4 after incubation), hyposulfidic (pH >4 after incubation) and monosulfidic (MBO) materials; ii) depth of water with deep water (overlying water >2.5 m), subaqueous (overlying water 0 to 2.5 m), hydrosols (saturated to a depth of 50 cm below the mineral soil surface), and unsaturated (unsaturated to a depth of 50 cm below the mineral soil surface); iii) soil texture with sands, loams, and clays.

7.1 *Acidification, metal mobilisation, and de-oxygenation hazards determined by soil material categorisation*

Several investigations of inland acid sulfate soils have used the robust and tested coastal acid sulfate soil assessment methodologies (e.g. peroxide testing, acid-base accounting, water soluble sulfate, soil incubation/ageing, and surface and ground water quality measurements) to characterise various types of acid sulfate soil materials identified in the wide range of acid sulfate soils in Lake Alexandrina and Lake Albert, SA and adjacent wetlands (e.g. Finniss River, Currency Creek, Goolwa Channel and Black Swamp areas; see Fitzpatrick *et al.* 2009a; Simpson *et al.* 2008). With this approach, each acid sulfate soil material type identified is assessed for existing hazards or its potential to present a number of environmental hazards, specifically:

- acidification (of soil, groundwater and surface waters),
- metal mobilisation (from acid sulfate soil material to groundwater and surface water), and
- deoxygenation of surface waters.

The hydrogeochemical processes that are responsible for these hazards are inherently linked, in that both acidification and oxidation are likely to cause the mobilisation of metals. Acid sulfate soil materials may present a 'current' hazard to an environment where the hazard has been measured or observed, or present a 'potential' hazard to a particular environment where laboratory analyses of soil properties indicates that a hazard is likely to eventuate if environmental conditions are changed. The general relationship between the acid sulfate soil material types and the hazard condition is presented in Table 7-3.

Table 7-3. General relationships between acid sulfate soil materials/other acidic materials and hazard condition (from Fitzpatrick *et al.*2009a).

	Hazard Type and Condition		
Type of Acid Sulfate Soil Material	**Acidification**	**Metal Mobilisation**	**Deoxygenation**
Sulfuric	current	current	none
Hypersulfidic	potential	potential	none
Hyposulfidic (S_{CR} ≥ 0.10%)	potential	potential	none
Monosulfidic (observed)	potential	current	current
Monosulfidic (potential)	potential	potential	potential
Hyposulfidic (S_{CR} < 0.10%)	potential	potential	none
Other acidic soil materials (pH_w &/or $pH_{incubation}$) 4 - 5.5	current or potential	current or potential	none
Other soil materials	none	none	none

When using the soil map (Figure 7-1) the following notes should be taken into consideration.

Note 1:

The map legend presented in Figure 7-1 shows that 7 map units occur. The remaining potential map units as identified in Table 7-1 are not shown primarily because they did not occur for a large enough extent to be shown at the scale of mapping or there was insufficient information to identify their occurrence.

Note 2:

The lines on the soil map are the boundaries of soil map units, or soil polygons, where soils in each are uniform in soil profile (or vertical section) soil texture distribution. The polygons are parts of a distinctive set of "Soil Map Units" (see map legend description in Table 7-1). Each map unit or polygon bears a colour and stippling pattern chosen to show its map unit that relate to the Atlas of Australian Acid Sulfate Soils (AAASS; Fitzpatrick *et al.* 2008a). The user should start using the soil map by reading its soil code, then refer to the map legend giving full soil classification descriptions of the soil that is most likely to occur within it.

Note 3:

Soil maps (Acid Sulfate Soils and Other Soils) provide a statement of the natural environment as it is expressed through the soil at the time it was investigated (i.e. August, 2009). This “static map” is an “almost permanent statement’, of the soil materials, soil profiles, soil Types and soil Subtypes surveyed during August 2009. Acid sulfate soils and their classification is strongly dependant on water conditions and therefore a change in water level will influence soil redox conditions and its acid status.

Hence, it should be noted that the acid sulfate soil map is not an end in itself and to be a useful aid to any form of land management, it has to be interpreted, often with supplementary information for the user. Such a person or group may find it difficult to even read a soil map, despite the kind of guidance given in reports, and may not realise the potential value of soil maps to their kind of land management interest. It may be necessary for a professional expert to produce “interpretative maps”, based on soil maps, but adding other information relevant to the specific application of the map (e.g. different water levels in parts of the lakes will likely alter or reverse the occurrences of certain soil Subtypes due for example to water being pumped from one lake to another).

Note 4:

Water levels between the lakes in August 2009 were at different elevations. For Lake Alexandrina surface water was at -0.8 m AHD, therefore deep water is considered below -3.3 m AHD, subaqueous -3.3 to -0.8 m, hydrosols -0.8 to -0.3 m, and unsaturated above -0.3 m. For Lake Albert surface -0.2 m AHD, therefore deep water is considered below -2.7 m AHD, subaqueous -2.7 to -0.2 m, hydrosols -0.2 to 0.3 m, and unsaturated above 0.3 m.

8 Derived Soil Maps

Derived soil maps show spatial patterns and trends of "critical soil property changes" such as soil Electrical Conductivity (EC in dS/m), soil pH in water ($pH_{soil:water}$), soil pH after oxidation with hydrogen peroxide ($pH_{soil:peroxide}$), Titratable Actual Acidity (TAA), Net Acidity (NA), Acid Neutralising Capacity (ANC) and Soil Texture (sands and clays) to identify where they are occurring in the landscape.

The following is a set of maps that are based on the geostatistical average maps where the values have been grouped so that classes for the soil properties are shown rather than a continuous range. The class ranges selected for the soil properties are based on appropriate separations for the data set that allow general trends and patterns to be shown for the study area. Alternative versions of the same maps could be produced by selecting different class range boundaries. Each of the 100 by100 m pixels has an average value and this pixel is allocated to the appropriate soil property class that it occurs in. Each soil class is allocated a colour that is applied to the pixels and the coloured map produced with the accompanying map legend that describes the classified soil property groupings.

It should be noted that preparation of these maps have gone through a number of process to extrapolate the measured data sets across the study area and then aggregate the information to a few groups. The maps are primarily constructed for the most needed set of information to describe the surface soil layer (approximately 0 to 20 cm depth) which is where the immediate interaction of soil with water and acid sulfate soil processes occurs.

The maps do show a very good representation of the soil property heterogeneity and what is likely to be found for an area. However the maps, because of their printed size and scale and inherent soil variability cannot be expected to accurately predict the value of a property for a given site, this can only be determined by site inspection.

8.1 Electrical Conductivity Classified Map

Electrical conductivity map data was grouped into four classes as shown in Figure 8-1. The map shows that higher soil salinity is found in:

(i) areas closely associated with acid sulfate soils containing high amounts of "sulfuric materials" (e.g. Finniss River, Currency Creek and Goolwa Channel and isolated areas on the margins to the north of the lakes; see also areas with "sulfuric soils" shown in the soil map Figure 4-2 Figure 7-1) and

(ii) areas near the seaward side of the lakes adjacent to the barrages due to seawater leakage and occurrence of acid sulfate soils with Monosulfidic materials.

The electrical conductivity changes to low values for the main lake areas, which is what would be expected where it is associated with the main lake waters.

8.2 $pH_{soil:water}$ Classificatied Map

The $pH_{soil:water}$ map data was grouped into four classes as shown in Figure 8-2. The map shows areas with low pH, identifying acid sulfate soils with sulfuric soils, which occur in areas of Loveday Bay, Finniss River, near Clayton and other isolated areas on the margins of the lake.

As expected the pH values are near neutral where the main lake water occurs.

8.3 $pH_{soil:peroxide}$ Classificatied Map

The $pH_{soil:peroxide}$ map data was grouped into four classes as shown in Figure 8-3. The map shows that low pH occurs in the same areas as identified in the $pH_{soil:water}$ map that would be acid sulfate soils with sulfuric materials (see Figure 7-1) and then extends into most of the remaining lake areas identifying that hypersulfidic materials occur almost through the entire study area. Near neutral pH values occur along the lake margins in a few isolated areas.

8.4 Titratable Actual Acidity Classified Map

Analysis of titratable actual acidity (TAA) identified that the data set for all layers was highly skewed. The data is highly skewed because it is formed from truncated distributions. By definition when pH_{KCl} is greater than 6.5, then titratable actual acidity is zero. As discussed in the geostatistical section for the surface layer data set, titratable actual acidity data showed no evidence of spatial dependence and consequently variograms could not be computed and therefore a geostatistical map was not constructed. The absence of spatial dependence is due to one or more reasons including spatial scale, data noise or treatment of truncated data, all of which would require detailed further exploratory analysis to determine if the property could be mapped using a geostatistical approach.

To generate a map of titratable actual acidity (TAA) the polygon soil classification map (see Figure 7-1) was used. It was found that there was a strong relationship between the acid sulfate soils with sulfuric materials (i.e. classes with sulfuric clays and sands; sulfuric hydrosol clays and sands – shown in Figure 6-1) and titratable actual acidity (Figure 8-4). The map unit data was analysed with the sample data and each of the eight map units allocated to either no, high or very high classes.

The three classes mapped are shown in Figure 8-4. The map shows that titratable actual acidity is high or very high on the margins of both lakes and the Finniss River and Currency Creek areas. As expected, where the main body of water is occurring there was no titratable actual acidity identified.

8.5 Acid Neutralising Capacity Classified Map

The acid neutralising capacity map data was grouped into five classes as shown in Figure 8-5. This map should be used with extreme care, because of the skewed nature of the data and the low spatial dependence when constructing the geostatistical map. The main issue is that we know there are areas where acid neutralising capacity is zero, however the extent of these low values we believe is not very well portrayed in the current map. To improve the map alternative methods of analysis would be required, including detailed analysis of the dataset to understand the distribution and probably establishing correlations with other variables to assist with mapping.

The map as presented shows that high acid neutralising capacity locations occur throughout parts of the lakes and the majority these areas appear to be somewhat associated with where calcrete rock is located nearby. Further investigation is required to confirm this relationship.

8.6 Acid Generating Potential Classified Map

The acid generating potential map data (based on the chromium reducible sulfur data) was grouped into five classes as shown in Figure 8-6. This map should be used with extreme care, because of the skewed nature of the data and the low spatial dependence when constructing the geostatistical map. The main issue is that we know there are areas where acid generating potential is zero, however the extent of these low values we believe is not very well portrayed in the current map. To improve the map alternative methods of analysis would be required, including detailed analysis of the dataset to understand the distribution and probably establishing correlations with other variables to assist with mapping.

The map shows that high acid generating potential occurs in central parts of Lake Albert with some very high ‘hotspots’ occurring, high values are also found in the central parts of Lake Albert.

8.7 Net Acidity Classification Map

The net acidity map data was grouped into five classes as shown in Figure 8-7. This is based on Table 3-3 where the trigger values for sands to loamy sands is 0.03 % S, which equates to approximately 19 mole H+/tonne enables the following range of acid sulfate soil materials to be ranked according to treatment categories:

- low net acidity (<19 mole H+/tonne)
- moderate net acidity (19 - 100 mole H+/tonne)
- high net acidity (>100 mole H+/tonne)

The map clearly shows that high net acidity occurs throughout a large area of Lake Albert and in the centre of Lake Alexandrina (although this should be read with caution because there was limited sample data for this area and therefore the confidence would be low for this predication).

The net acidy map also shows that low pH occurs in the same areas as identified in the:

(i) $pH_{soil:water}$ map (Figure 8-2),

(ii) $pH_{soil:peroxide}$ map (Figure 8-3),

(iii) TAA map (Figure 8-4) and

(iv) soil map (Figure 7-1), which shows “sulfuric soils” (i.e. acid sulfate soils with sulfuric materials).

Negative net acidity occurs in isolated areas throughout both lakes and is somewhat associated with either calcrete outcrops or sandy textures.

8.8 Soil Texture Classified Map

The soil texture map data was grouped into two classes as shown in Figure 8-8. The geostatistical data ranges as a joint probability from 0 (as fine) to 1 (as coarse). To generate this soil texture map we have used an arbitrary break of 0 to 0.5 to represent clays and 0.5 to 1 to represent sands.

The map shows for the surface soil layer that clay occurs throughout a large central area of the Lake Albert and Lake Alexandrina, with sands more commonly fringing around the margins.

8.9 Subsoil Net Acidity Maps

The maps generated and described above are focussed on the project objectives to provide a spatial data set of the surface acid sulfate soil properties. The project collected subsoil samples, but not rigorously according to the survey project design because at the time of the field survey they were not requested to be part of the project and where collected because of the opportunity to acquire more data. The data was primarily used to classify the soil layers to assist with the construction of the acid sulfate soil map described in Section 8 and the conceptual soil landscape models described in Section 5. A spatial representation of the subsoil data sets for the net acidity property using simple interpolation was requested, this is presented for the upper subsoil 10 to 30 cm in Figure 8-9, and for the lower subsoil 30 to 50 cm in Figure 8-10. CSIRO does not necessarily agree that this is an appropriate use of the data but have produced the maps as requested.

The maps were created in the geographic information system (GIS) by an interpolation model using default settings for Universal Kriging as this appeared to best fit the data set by visual observation. It should be noted that the maps have not been produced by a geostatistical approach where data trends have been investigated. The site locations used for the interpolation are included on the map so that judgements can be made as to the confidence in the interpolation. The maps are presented to show general trends for net acidity and should not be used to provide an absolute value. Should an absolute value be required then the measured site data should be used.

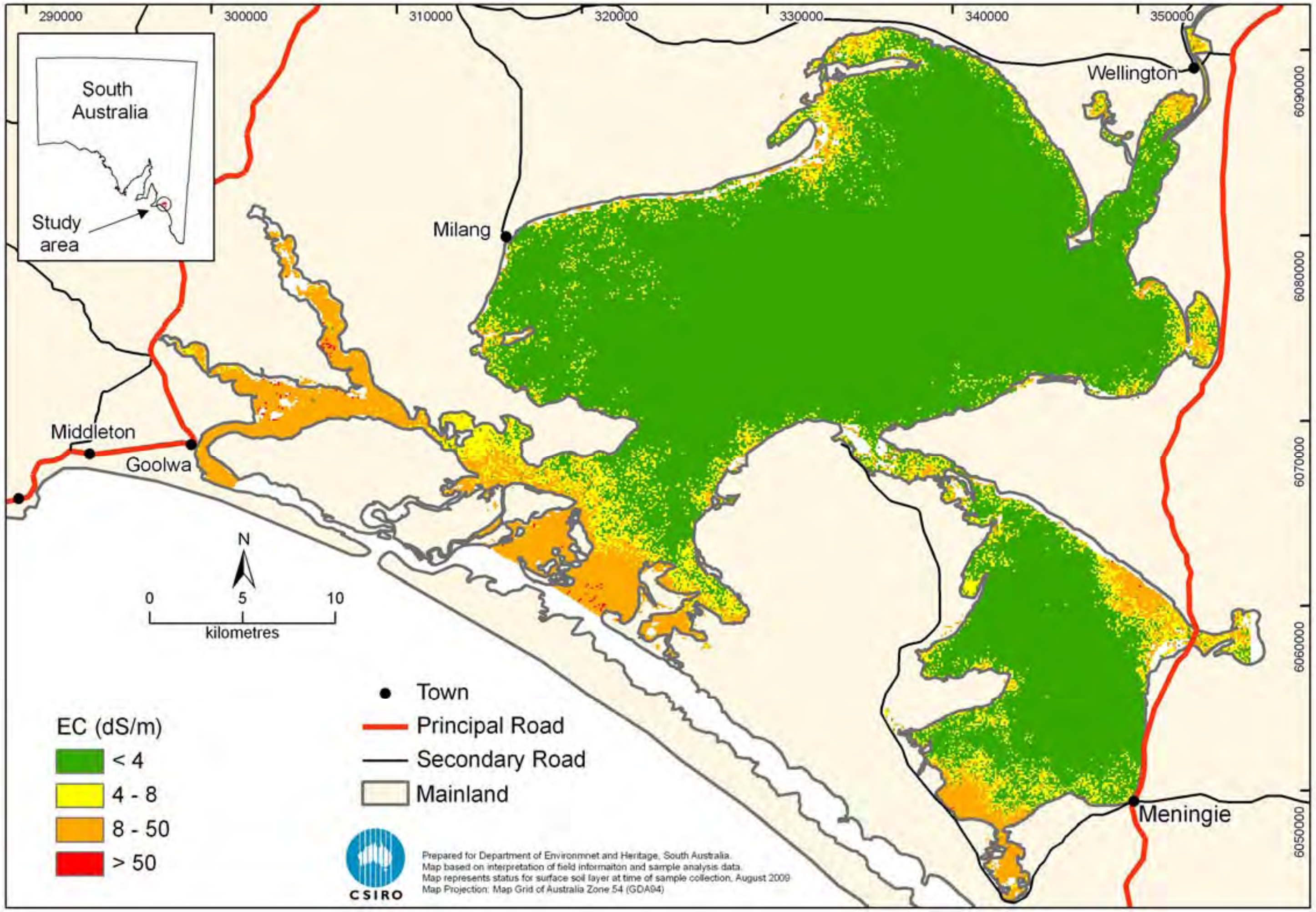


Figure 8-1. Electrical conductivity map data grouped into four classes for upper soil layer.

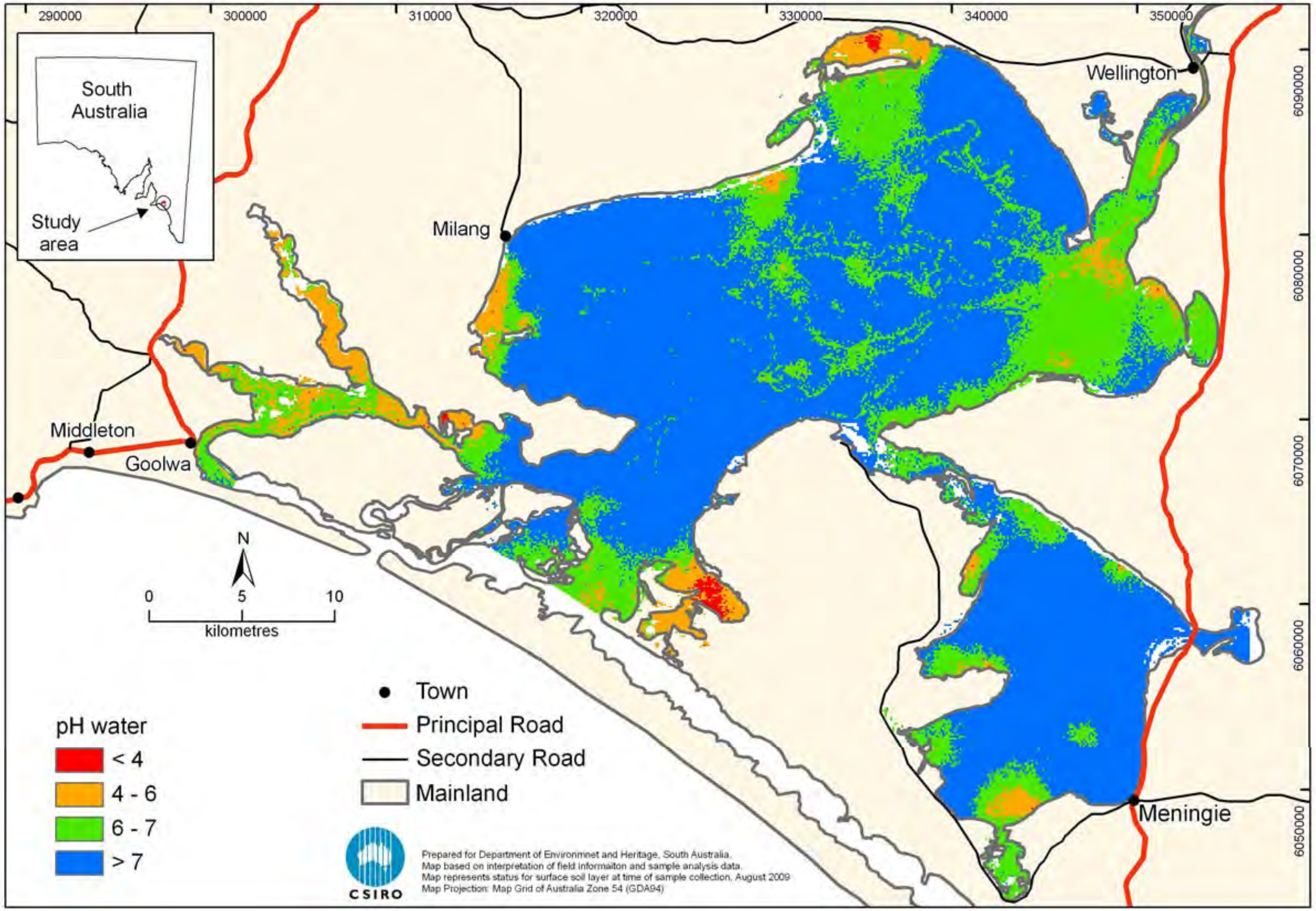


Figure 8-2. pHw map data grouped into four classes for upper soil layer.

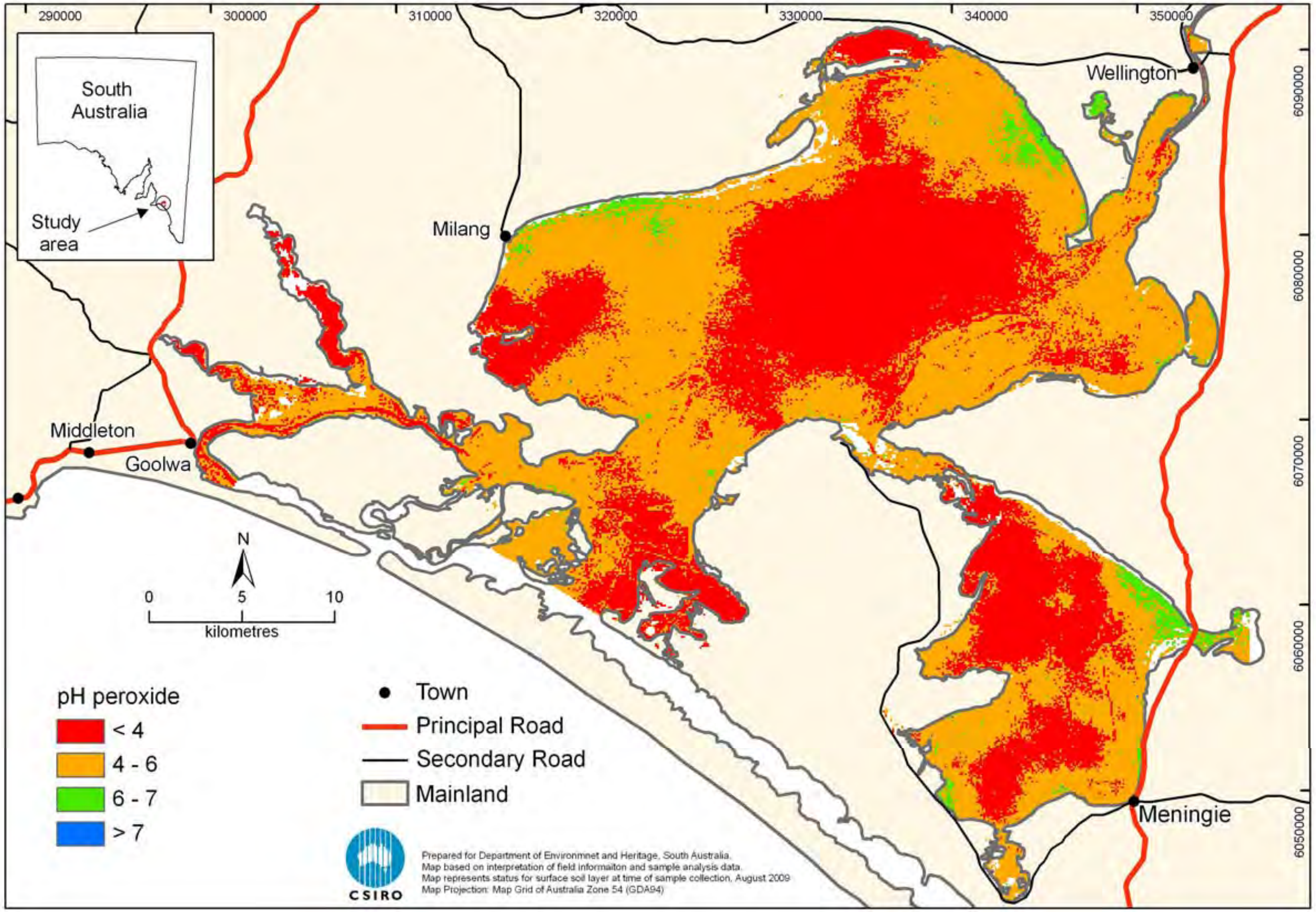


Figure 8-3. $pH_{soil:peroxide}$ map data grouped into 4 classes for upper soil layer.

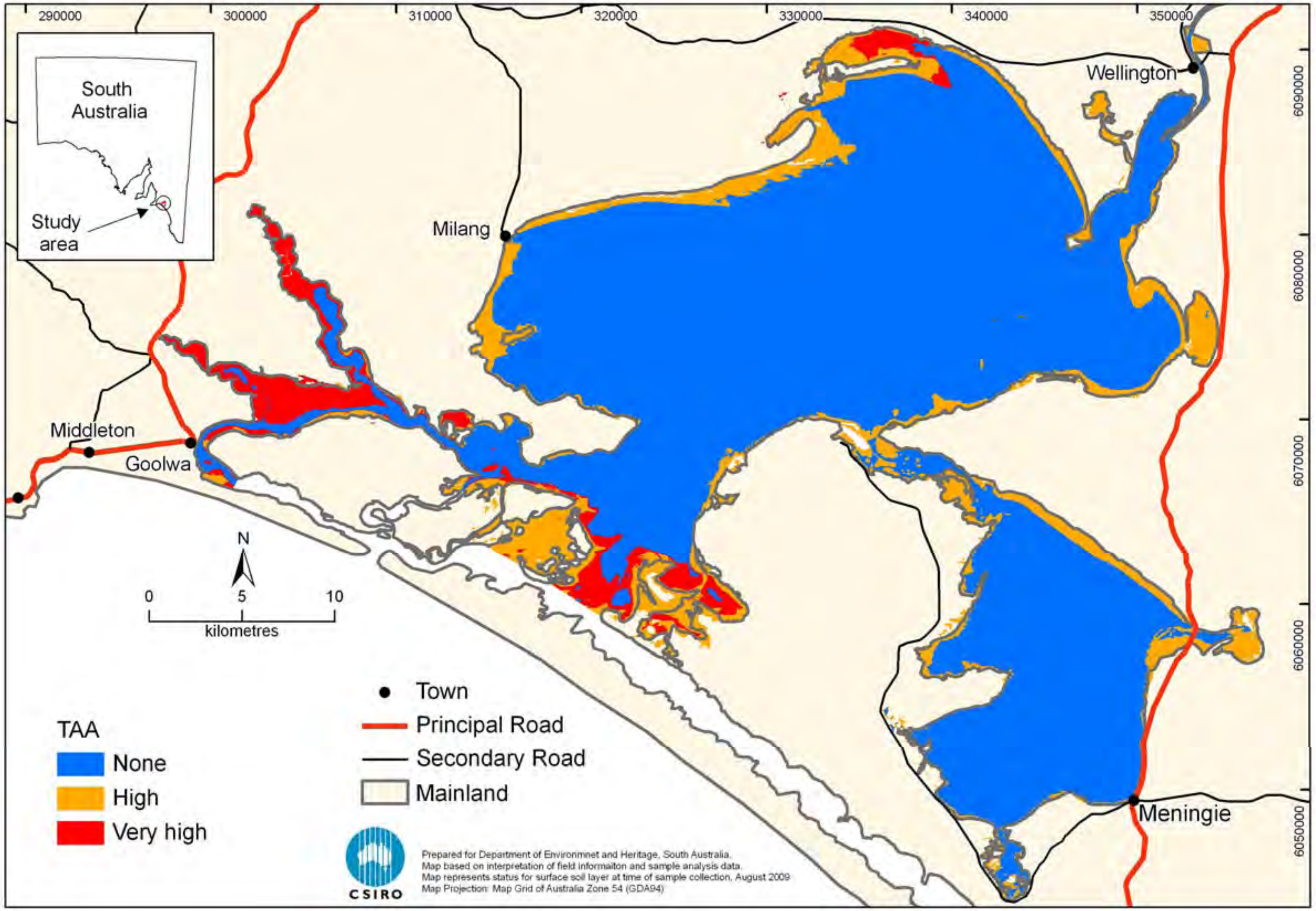


Figure 8-4. Titratable actual acidity map data grouped into three classes for upper soil layer.

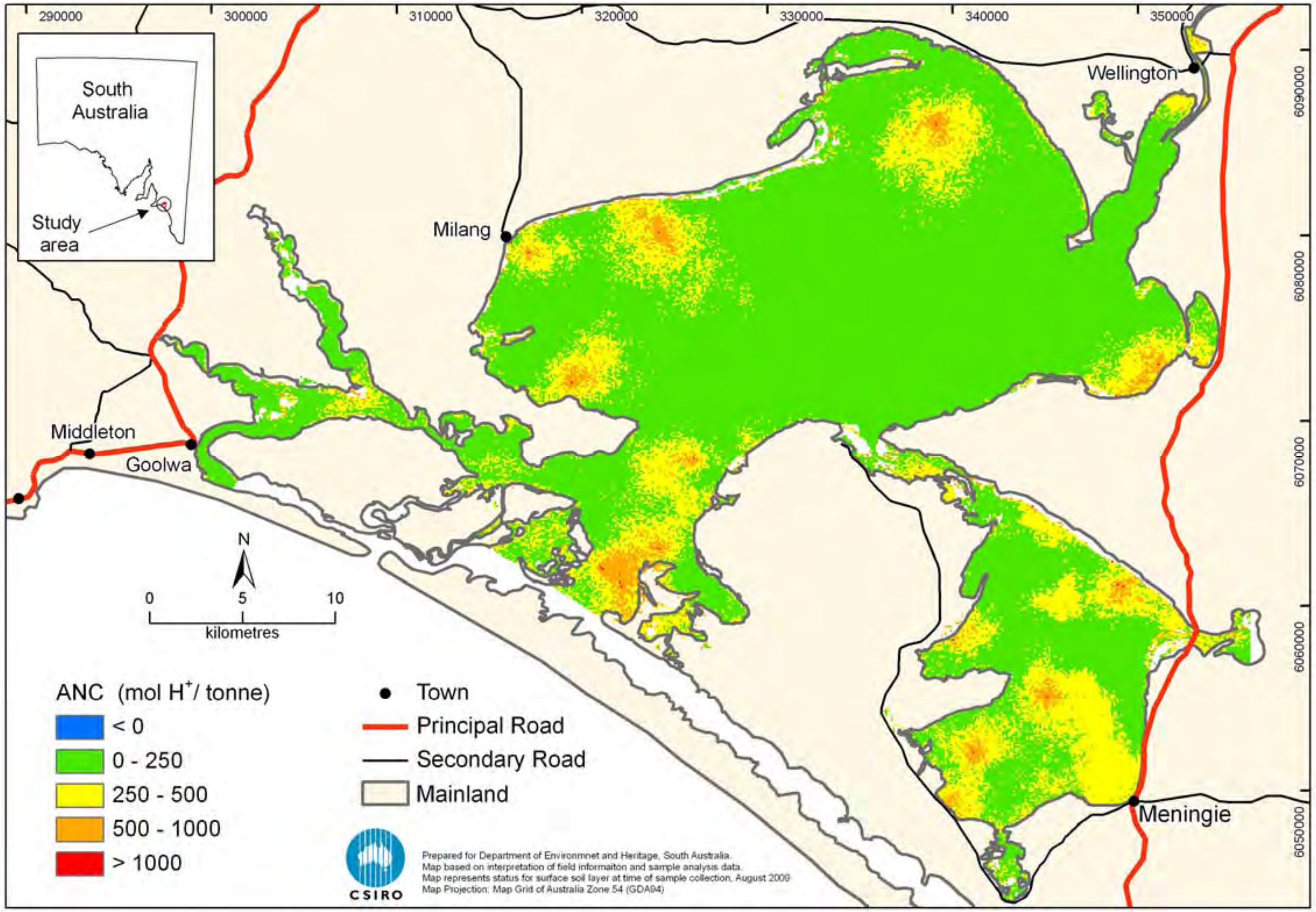


Figure 8-5. Acid neutralising capacity map data grouped into five classes for upper soil layer. (Note: this map should be used with extreme care, see related text).

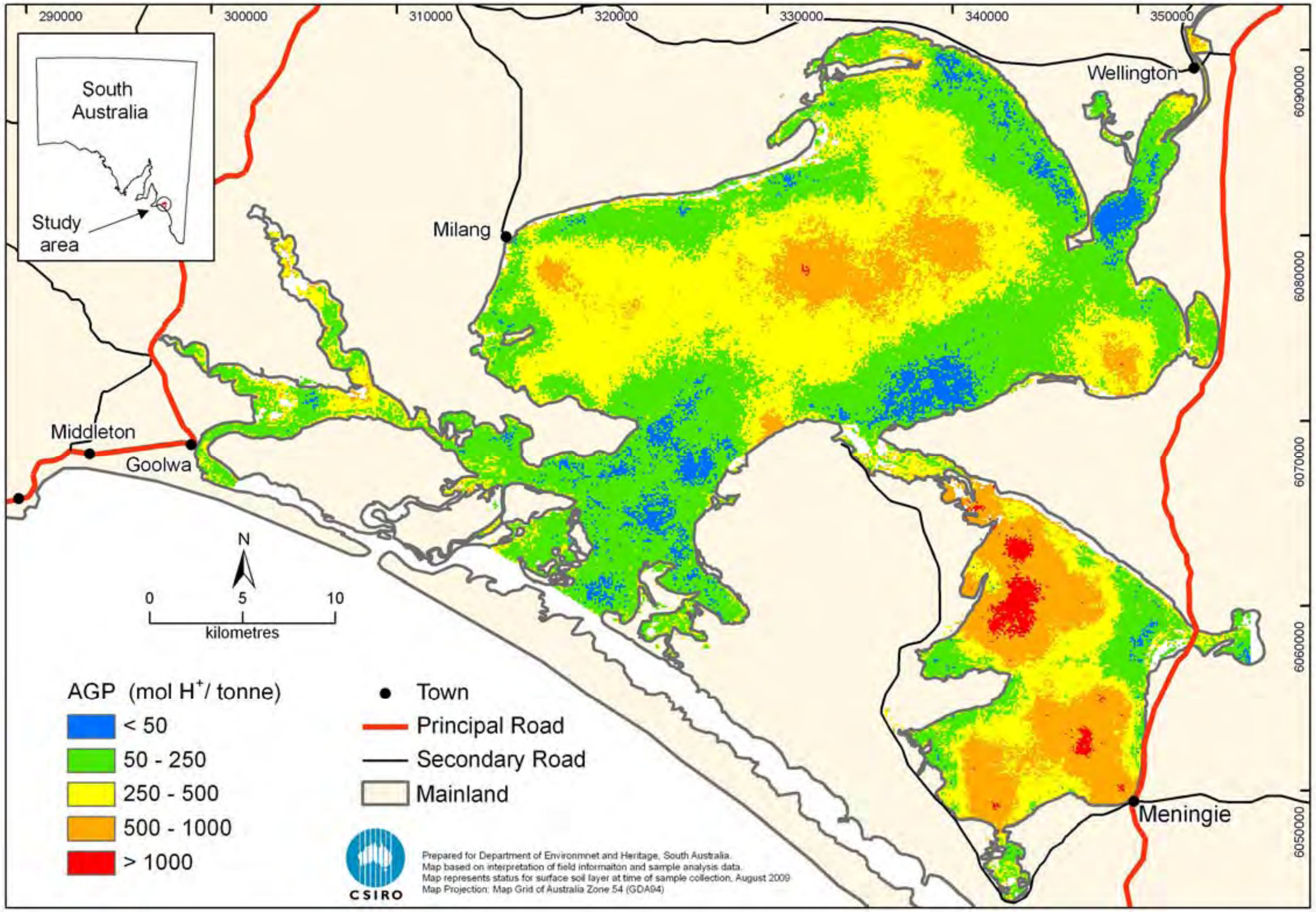


Figure 8-6. Acid generating potential map data grouped into five classes for upper soil layer. (Note: this map should be used with extreme care, see related text)

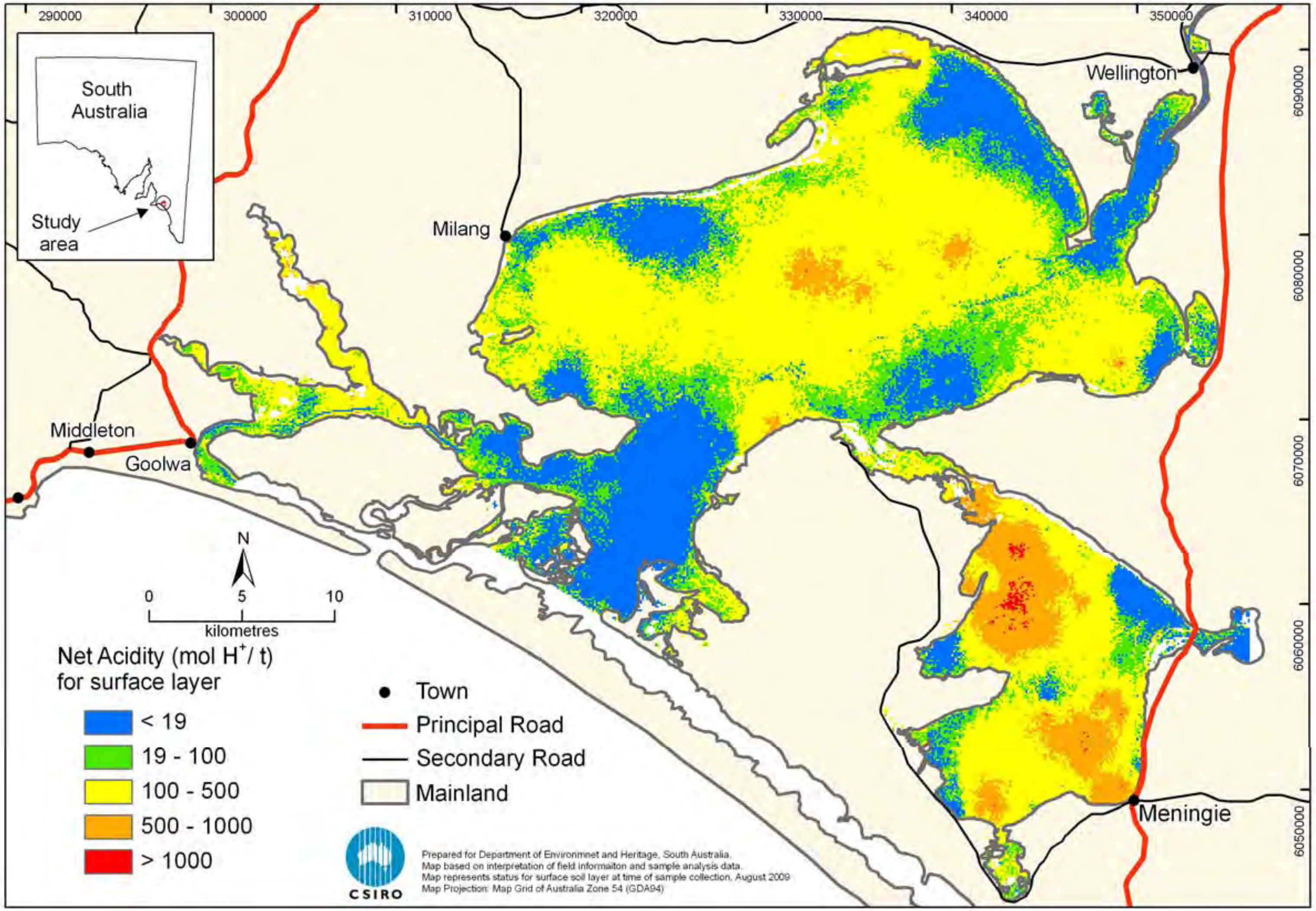


Figure 8-7. Net acidity map showing data grouped into five classes for the upper soil layer (0 to 10cm)

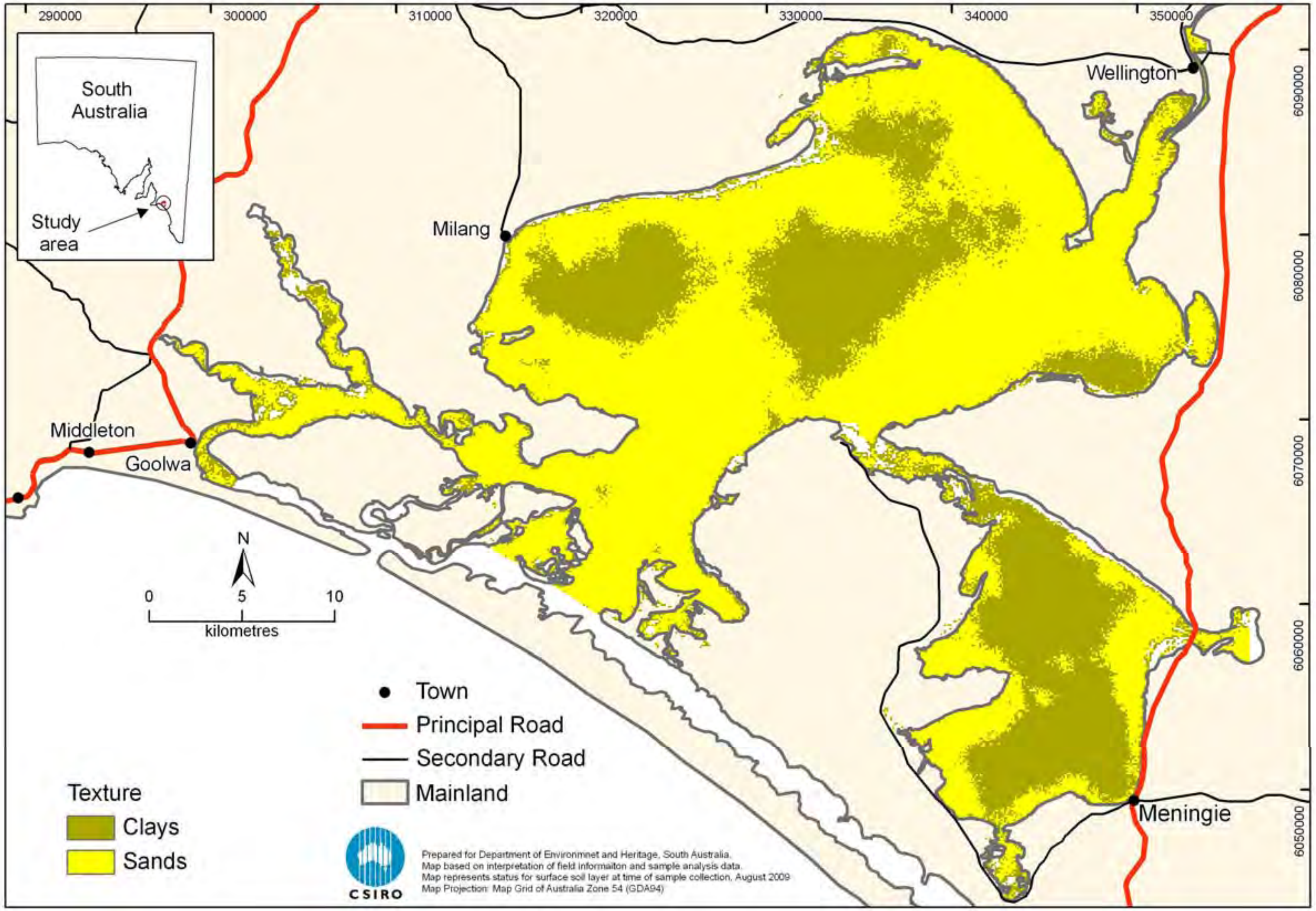


Figure 8-8. Soil texture map data grouped into two classes to show distribution of clay and sand for upper soil layer.

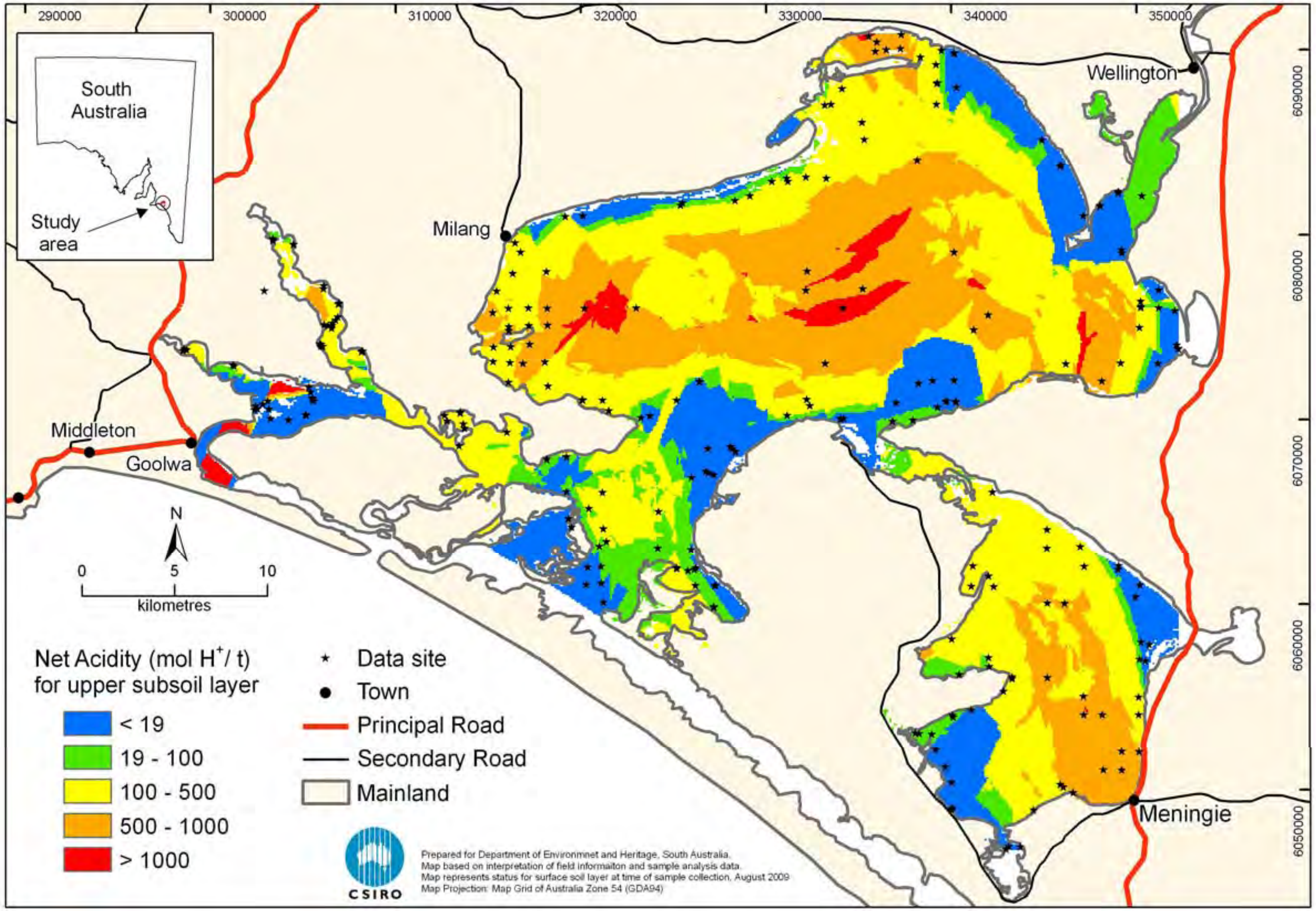


Figure 8-9. Upper subsoil layer (10 to 30 cm) map showing net acidity.

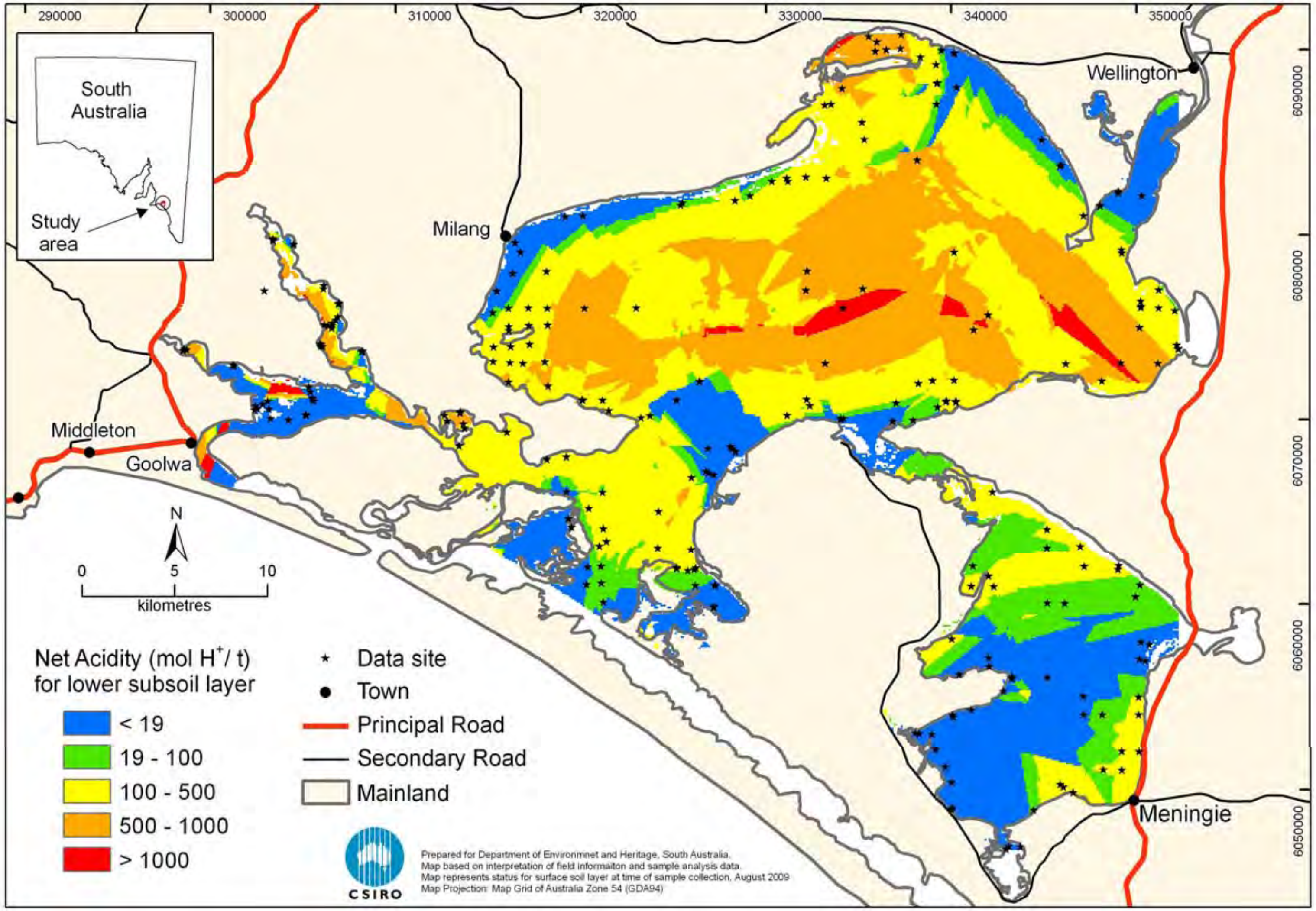


Figure 8-10. Lower subsoil layer (30 to 50 cm) map showing net acidity.

9 Conclusions

9.1 Key Findings

The study provides a spatially valid site and sample dataset for the soil conditions at the time of sampling (winter August 2009) from which maps were generated to show the spatial heterogeneity of acid sulfate soil properties throughout Lake Alexandrina, Lake Albert and the tributaries of Finniss River and Currency Creek.

This work provided the opportunity to capture data from previous CSIRO studies in the study area and integrate new data collected as part of the current project, thereby generating a new consolidated database, which can be updated in the future as further data becomes available.

The field survey described and sampled 330 sites from which 706 samples were analysed for pH and acid base accounting parameters. The sites were located using a stratified random approach to enable distribution throughout the study area, but with a focus on the areas near the shoreline where there was expected to be greatest variability in acid sulfate soil conditions. Combined with recent survey information from the Finniss River and Currency Creek area (39 sites and 129 samples) this provided a well distributed site and sample data set. The number of sites is a third less than the optimum recommended by reviewers of previous work but using prior information, a pragmatic sampling design that included a stratified sampling approach, geostatistical analysis and co-kriging allowed a variety of maps to be generated with known confidence levels.

The information shows that 10% of the samples collected contained sulfuric material (pH < 4.0) and 39% of sites have considerable potential for further developing sulfuric materials from hypersulfidic materials if the water levels continue to drop, exposing these soil materials allowing them to oxidise. This study shows that acid sulfate soil material both potential and actual acidity are widespread throughout the Lower Lakes study area.

Soil properties of electrical conductivity, $pH_{soil:water}$, $pH_{soil:peroxide}$, soil texture and net acidity showed good spatial dependence allowing geostatistical maps to be generated for the surface layer. Acid neutralising capacity, acid generating potential and titratable actual acidity did not and would require further investigation to determine if an improved map could be developed.

The geostatistical map data was simplified by classifying the outputs into categories, or classes, that allowed general patterns and trends to be observed. The maps clearly identified areas of concern where low $pH_{soil:water}$ (sulfuric material) and / or high net acidity occur. Medium to high electrical conductivity occurred at Loveday Bay, near the barrages to the south of Alexandrina, near Clayton, Finniss River and Currency Creek, in the north of Lake Alexandrina (Boggy Lake and Dog Lake), and numerous isolated areas around the margins of Lake Albert. Other areas were identified with $pH_{soil:peroxide}$, net acidity and $pH_{incubation}$ that would be areas of potential risk (sulfidic material) if water levels continue to lower, and the acid sulfate soils are oxidised. These areas include isolated locations throughout Lake Alexandrina and all of Lake Albert.

A soil map showing acid sulfate soil classes was also produced that allowed integration of additional information to be incorporated such as soil characteristics with soil depth, water depth or water saturation of the soil through the use of bathymetry, identification of monosulfidic material and knowledge about the location of calcrete and granite rock outcrops. This map provides a generalised overview of acid sulfate soil variation that occurred when the survey was conducted in August 2009.

The soil map in combination with the conceptual toposequence models presents an understanding of acid sulfate soil distribution in three dimensions. Temporal models have been included showing change over time and using the models predictions could be made by considering different scenarios. This was demonstrated with an example from Loveday Bay to explain more than 100 ha of acidic water and subaqueous sulfuric soils.

9.2 Recommendations

Monitoring

Monitoring is considered an essential component of acid sulfate soil assessments because of the temporal nature of the processes. Monitoring should be conducted during the current drought, but also during the re-wetting phases when acidity and metal mobilisation are likely to occur.

It is recommended that a follow-up survey is conducted within 1 to 2 years to characterise and identify the changes that are occurring. The intention would be to go back to sites sampled as part of this project. However the field and sampling component could be reduced as we now have this prior dataset (baseline) and knowledge base to target only those areas of interest rather than placing sites randomly throughout the entire study area again. This would significantly reduce cost by reducing field and analysis efforts, hence would provide a robust result. The intention of a monitoring program would be to characterise the spatial component to analyse area changes with time. The design for selecting field sites for spatial analysis is different to longer term site and transects monitoring efforts, although there would be overlap of data and uses.

Data Interrogation

The data gathered has been analysed for the requirements that the project was commissioned, which was to primarily provide a reliable spatial data set of acid sulfate soil properties to support modelling of chemical processes, and to provide maps of acid sulfate soil property variation.

The comprehensive data set generated has considerable potential for further analysis including:

- Understanding of soil process and variation by studying the data collected for localised areas rather than the study area as a whole.
- Revisiting the geostatistical analysis approach and to conduct improved work flows, a number of recommendations are outlined at the end of Section 6.
- Integrating the current project data set as a baseline with future data sets to identify acid sulfate soil changes, explain the processes at play, and then develop predictions based on environmental scenarios.
- The site distribution and maps produced allow the potential to conduct monitoring on a spatial basis rather than a site, or localised basis. To do this would first require further study to develop an appropriate work approach.

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APPENDIX 1: Detailed Summary of Available Data and Maps

A1.1 Soil Identification Key

Australia's current national soil classification (Isbell 1996) and other internationally recognised classification systems such as Soil Taxonomy (Soil Survey Staff 2003) require considerable expertise and experience to be used effectively. More importantly, these classification systems do not yet incorporate new acid sulfate soil terminologies such as: (i) monosulfidic, hypersulfidic and hyposulfidic material (Sullivan *et al*. 2010) and (ii) subaqueous soils, which is used in the nationally consistent legend of "The Atlas of Australian Acid Sulfate Soils" (Fitzpatrick *et al*. 2008c; available on the Australian Soil Resource Information System: www.asris.gov.au). To assist users to identify types and subtypes of soils a user-friendly Soil Identification Key was developed to more readily define and identify the various types and subtypes of acid sulfate soil and non-acid sulfate soil (see Fitzpatrick *et al*. 2008a,b,d,e; 2009a,b). The key is designed for people who are not experts in soil classification systems such as the Australian Soil Classification (Isbell 1996). Hence it has been used to deliver soil-specific land development and soil management packages to advisors, planners and engineers working in the Murray-Darling Basin.

The soil identification key uses non-technical terms to categorise acid sulfate soils and other soils in terms of attributes that can be assessed in the field by people with limited soil classification experience. Attributes include water inundation (subaqueous soils), soil cracks, structure, texture, colour, features indicating water logging and 'acid' status – already acidified, i.e. sulfuric material, or with the potential to acidify, i.e. sulfidic material – and the depths at which they occur or change in the soil profile.

The key consists of a systematic arrangement of soils into 5 broad acid sulfate soil types, each of which can be divided into up to 6 soil subtypes. The key layout is bifurcating, being based on the presence or absence of particular soil profile features (i.e. using a series of questions set out in a key). A soil is allocated to the first type whose diagnostic features it matches, even though it may also match diagnostic features further down the key. The key uses a collection of plain language names for types and subtypes of acid sulfate soil in accordance with the legend for the Atlas of Australian Acid Sulfate Soils (Fitzpatrick *et al*. 2008c). It recognises the following five acid sulfate soil types: (i) Subaqueous Soils, (ii) Organic Soils, (iii) Cracking Clay Soils, (iv) Sulfuric Soils and (v) Hypersulfidic Soils. These are further sub-divided into 18 soil subtypes based on occurrence of sulfuric material, hypersulfidic material, hyporsulfidic material, clayey or sandy layers; monosulfidic material and firmness.

Table A1.1.1 Summary soil identification key for Acid Sulfate Soil Types in the Murray-Darling basin and Lower Lakes. After finding the soil type use Table A1.1.2 to find the soil Subtype.

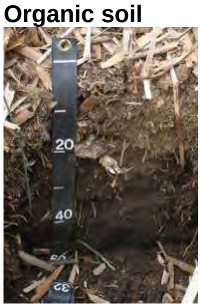
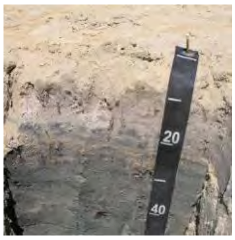
Diagnostic features for Soil Type	Soil Type	
Does the soil occur in shallow permanent flooded environments (typically not greater then 2.5 m)? No ↓ Yes →	**Subaqueous soil** 	**1**
Does the upper 80cm of soil consist of more than 40 cm of organic material (peat)? No ↓ Yes →	**Organic soil** 	**2**
Does the soil develop cracks at the surface OR in a clay layer within 100 cm of the soil surface OR have slickensides (polished and grooved surfaces between soil aggregates), **AND** is the subsoil uniformly grey coloured (poorly drained or very poorly drained)? No ↓ Yes →	**Cracking clay soil** 	**3**
Does a sulfuric layer (pH<4) occur within 150 cm of the soil surface, **AND** is the subsoil uniformly grey coloured (poorly drained)? No ↓ Yes →	**Sulfuric soil** 	**4**
Does sulfidic material (pH>4 which changes on ageing to pH<4) occur within 100 cm of the soil surface, **AND** is the subsoil uniformly grey coloured (poorly drained)? No ↓ Yes →	**Hypersulfidic soil or Hyposulfidic soil** 	**5**
Other soils	**Other soils**	**6**

Table A1.1.2 Soil identification key for Acid Sulfate Soil Subtypes.

Soil Type	*Diagnostic features for Soil Subtype		*Soil Subtype	
Subaqueous soil No ↓ Yes →	Does **hypersulfidic** material (pH>4 which changes on ageing to pH<4) occur within 100 cm of the soil surface? **AND** Does a clayey layer with slickensides occur within 100 cm of the soil surface? No ↓ Yes →	Does a **monosulfidic black ooze (MBO)** material layer >10 cm thick occur within 50 cm of the soil surface? No ↓ Yes →	***Hypersulfidic subaqueous clayey soil with MBO**	**1.1**
	↓	→	**Hypersulfidic subaqueous clayey soil**	**1.2**
	↓	Does a **sandy or loamy** layer occur within 100 cm of the soil surface? No ↓ Yes →	**Sulfidic subaqueous soil**	**1.3**
	Does **sulfuric** material occur within 100 cm of the soil surface? No ↓ Yes →	→	**Sulfuric subaqueous soil**	**1.4**
	→	→	**Subaqueous soil**	**1.5**
Organic soil No ↓ Yes →	Does **hypersulfidic** material (pH>4 which changes on ageing to pH<4) occur within 100 cm of the soil surface? **AND** Does a clayey layer with slickensides occur within 100 cm of the soil surface? No ↓ Yes →	Does a monosulfidic black ooze (MBO) material layer >10 cm thick occur within 50 cm of the soil surface? No ↓ Yes →	**Hypersulfidic organic clayey soil with MBO**	**2.1**
	→	→	**Hypersulfidic organic clayey soil**	**2.2**
	→	Does a **sandy or loamy** layer occur within 100 cm of the soil surface? No ↓ Yes →	**Hypersulfidic organic soil**	**2.3**
	Does **sulfuric** material occur within 100 cm of the soil surface? **AND** Does a clayey layer with slickensides occur within 100 cm of the soil surface? No ↓ Yes →	→	**Sulfuric organic clayey soil**	**2.4**
	→	Does a **sandy or loamy** layer occur within 100 cm of the soil surface? No ↓ Yes →	**Sulfuric organic soil**	**2.5**

Soil Type	*Diagnostic features for Soil Subtype		*Soil Subtype	
[1]**Cracking clay soil** No ↓ Yes →	Does **hypersulfidic** material occur within 100 cm of the soil surface? **AND** Does a clayey layer with slickensides occur within 100 cm of the soil surface? No ↓ Yes →	Does a monosulfidic black ooze (**MBO**) material layer >10 cm thick occur within 50 cm of the soil surface? No ↓ Yes →	**Hypersulfidic cracking clay soil with MBO**	**3.1**
		→	**Hypersulfidic cracking clay soil**	**3.2**
	Does **sulfuric** material occur within 100 cm of the soil surface? **AND** Does a clayey layer with slickensides occur within 100 cm of the soil surface? No ↓ Yes →	→	**Sulfuric cracking clay soil**	**3.3**
	→	→	**Cracking clay soils**	**3.4**
Sulfuric soil No ↓ Yes →	Does **sulfuric** material occur within 100 cm of the soil surface? No ↓ Yes →	→	**Sulfuric soil**	**4.1**
Hypersulfidic soil No ↓ Yes →	Does **hypersulfidic** material **and** a sandy to loamy layer occur within 100 cm of the soil surface?	Does a monosulfidic black ooze (MBO) material layer >10 cm thick occur within 50 cm of the soil surface? No ↓ Yes →	**Hypersulfidic soil with MBO**	**5.1**
		No ↓ Yes →	**Hypersulfidic soil**	**5.2**
Other soils	→	→	**Hydrosol - sandy or loamy**	**6.1**

***Hypersulfidic or Hyposulfidic**

1"Cracking clay soil" is equivalent to "Vertosol" (Isbell 1996) e.g. Sulfuric cracking clay soil is similar to: "Sulfuric Vertosol. The latter terminology is used in the Legend of the "Atlas for Australian Acid Sulfate Soils" by Fitzpatrick, Powell and Marvanek (2006) and in the acid sulfate soil maps of the Lower Lakes and River Murray below Lock 1 because it of necessity saves space on Legends displayed on acid sulfate soil maps (Fitzpatrick et al. 2008a).

A1.2 Brief Review of Previous Work

Acid sulfate soils in subaqueous, waterlogged and drained soil environments in Lake Albert, Lake Alexandrina and River Murray below Blanchetown (Lock 1): properties, distribution, genesis, risks and management (Fitzpatrick *et al*. 2008b).

The objective of this report was to:

i. Verify the presence (or absence) of acid sulfate soils in the study area at selected sites in the River Murray channel below Lock1 near Blanchetown and the Lower Lakes, to assess the risk that exposed anaerobic soil materials might pose to infrastructure and environmental assets, due to acid sulfate soil and salt efflorescence's caused by lowering water levels.

ii. Identify the various subtypes of acid sulfate soil and non-acid sulfate soil material present.

iii. Provide predictive capability of current and potential acid sulfate soil hazard as water bodies and wetlands drain further and then re-flood.

Key findings identified that of the 103 profiles (that included assessment of 458 soil layers) investigated greater than 70% exceeded a moderate risk of acidification, concluding that significant acidification is present and also likely to increase to become a significant management burden. These profiles were spread throughout the lakes and river area. For sites in Lake Alexandrina 46 out of 53 sites (87%) were classified as moderate or higher risk, with 17 of those sites (32%) being very high or extremely high risk. For Lake Albert all 25 sites were classified as a moderate or higher risk of acidification with 16 of those sites (64%) being very high or extremely high risk.

The field survey provided a baseline assessment for soil condition of subaqueous, waterlogged and now-dry soils in the study area and obtained samples that were analysed. Field and laboratory tests concluded that significant acidification is present and also likely to increase. A user-friendly "soil identification key" was used to identify and classify the various acid sulfate soil subtypes and non-acid subtypes, this enabled communication of the soil properties and distribution and interrelationships of the subtypes. It was vital for effective evaluation of the environmental risk.

Mineralogy and identification of salt efflorescence's by X-Ray Diffraction documented the occurrences of a number of oxyhydroxysulfate and iron oxyhydroxide minerals that are indicators of very acidic soil conditions and as such are important environmental indicators of acid sulfate soil conditions. These minerals may become a problem when dissolved on reflooding or rewetting with rain resulting in mobilisation of acid, iron, sulfate and sodium ions, or have the potential for aerial transport when dry.

A conceptual model was used to explain and predict the sequential formation and transformation of various subtypes of acid sulfate soils due to lowering of water levels Figure A1.2.1. The generalised predictive soil-regolith model (Figure A1.2.2) illustrates the Lower Lakes and River Murray region that experienced drought lowering of water levels followed by winter rainfall rewetting. It outlines sequential transformation progressively through **five** sediment/soil types due to lowering of water levels and rewetting from:

1. Alkaline deep water sediments →
2. Alkaline subaqueous soils →
3. Neutral waterlogged soils containing "benign" hypersulfidic material →
4. Acidic drained soils containing "nasty" sulfuric material (pH<4) →
5. Rewetted acidic subaqueous soils and water.

Using this model and integrating it with bathymetric, vegetation and soil map data for the lakes area, a prediction of the transition of acid sulfate soil subtypes as water levels drop from pre-drought (+0.50m AHD), current (-0.5m AHD) to further 1m drop in lake water (-1.50m AHD) was made. The results are shown for Lake Albert in Figure A1.2.3 and for Lake Alexandrina Figure A1.2.4. The maps indicate that the transfer in spatial extent of sulfidic to sulfuric materials will be significant in the shallow Lower Lakes areas. The information that underpins these predictions is at a coarse level and therefore the results show a trend and possible areas of change and of concern where acidity issues may occur. It is not intended to be a true reflection of the on-site conditions, as this would require a detailed mapping assessment study. The investigation shows a strong relationship between bathymetry depth and the type of acid sulfate soil presence.

Eight conceptual model soil-landscape cross-section were constructed for a line through Lake Albert to illustrate how acid sulfate soil materials have sequentially changed with time and management in the lake and predict future scenarios. The series of cross-section conceptual models are used to explain and predict the widespread occurrences of sulfide minerals in sulfidic materials and sulfate-containing minerals in acidic salt efflorescence's and predict impacts of further drought on acid sulfate soil formation and decline in water quality. The final two models show predictions scenarios for Lake Albert a) if water is not pumped in therefore water levels decline, sulfuric materials occur, deep desiccation cracks form, sulfate rich salt efflorescences cover the surface and localised areas with fine textured dried monosulfidic black ooze material occurs, b) if water is pumped in therefore water levels are maintained to minimise the risk of soil and water acidification.

Recommendations from the study identified that careful monitoring of soils and water is required as water levels rise and on re-wetting by rainfall at selected sites, and to set trigger values

A summary of the data sets collected in this study are presented in Table A1.2.1

Table A1.2.1: Summary of measurements made and result data relevant to this mapping study.

Measurement	Number of data results	Comment on Relevance for this study
Field descriptions of landscape, layer depths, colour, texture, mottles and other features	78 sites That included more than 200 layers	Not directly relevant but does provide the base information to correlate linkage with like soil profiles and layers within and between studies.
Acid base accounting parameters (pH_{KCL}, S_{CR} %, $CaCO_3$ %) $pH_{soil:water}$, $pH_{soil:peroxide}$, $pH_{incubation}$	Lake Albert 22 sites including 83 layers Lake Alexandrina 36 sites including 137 layers	Very relevant and with coordinates this quantitative data may be used. Some sites have surface layer data, while others have multiple layers down to about 60cm and for some drill core sites over 4m depth
Minor and major elements	Lake Albert 14 sites including 37 layers Lake Alexandrina 23 sites including 106 layers	Not directly relevant. But does indicate that concentrations are mostly thought to be typical for these soils and none of the minor and trace elements would normally be considered to be of concern, although some arsenic concentrations are higher than normal. Cobalt and aluminium represent a potential risk when mobilised.
Mineralogy	5 sites including 11 samples	Not directly relevant. But does confirm presence of acid sulfate soil minerals

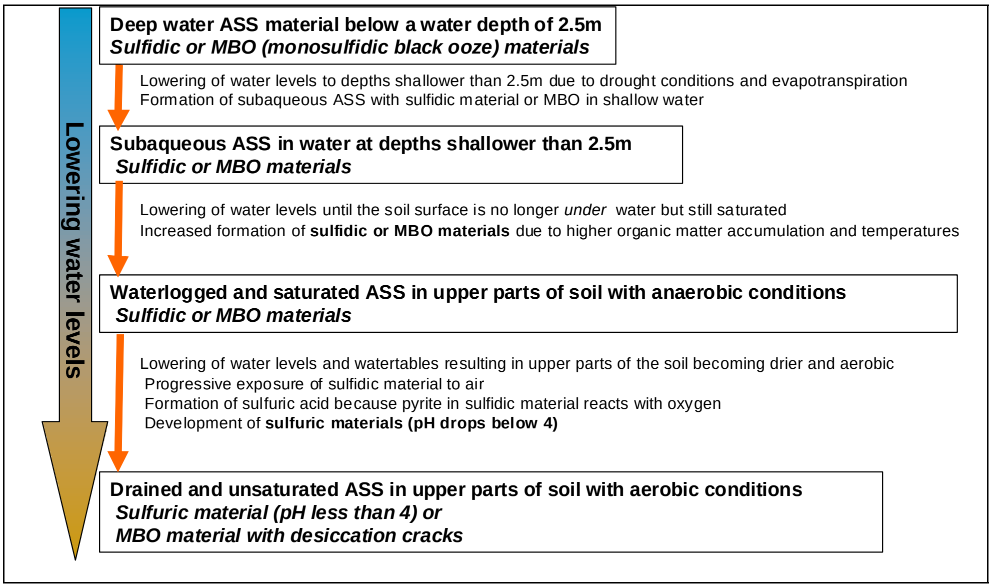


Figure A1.2.1: Generalised conceptual model showing the sequential transformation of four Classes of acid sulfate soil due to lowering of water levels (from Fitzpatrick *et al*. 2008b).

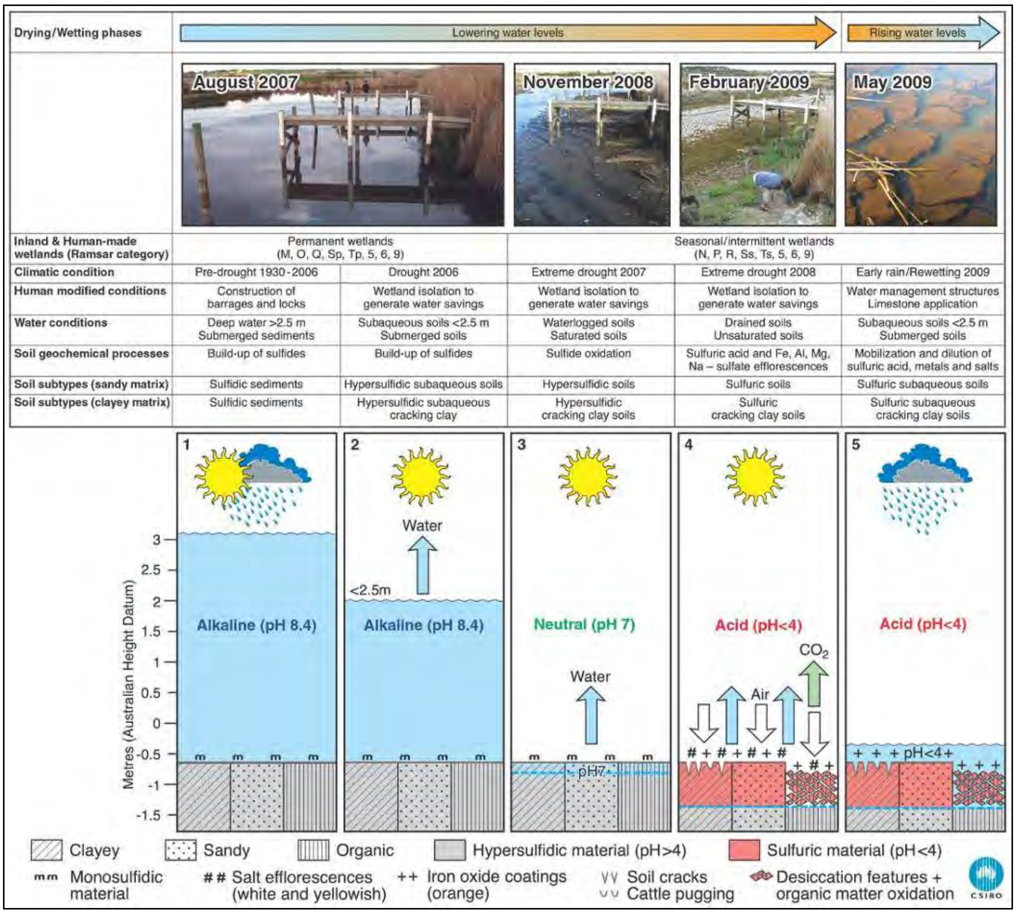


Figure A1.2.2: Generalised predictive model illustrating the role of climate variation (drought triggered and early winter rains), environmental conditions imposed by humans (e.g. modifications from barrages, isolating wetlands and weirs) and water conditions (subaqueous, waterlogged, dried and rewetted) play a vital role in the alteration of soil geochemical processes and sequential transformation of acid sulfate soils (from Fitzpatrick *et al*. 2009b).

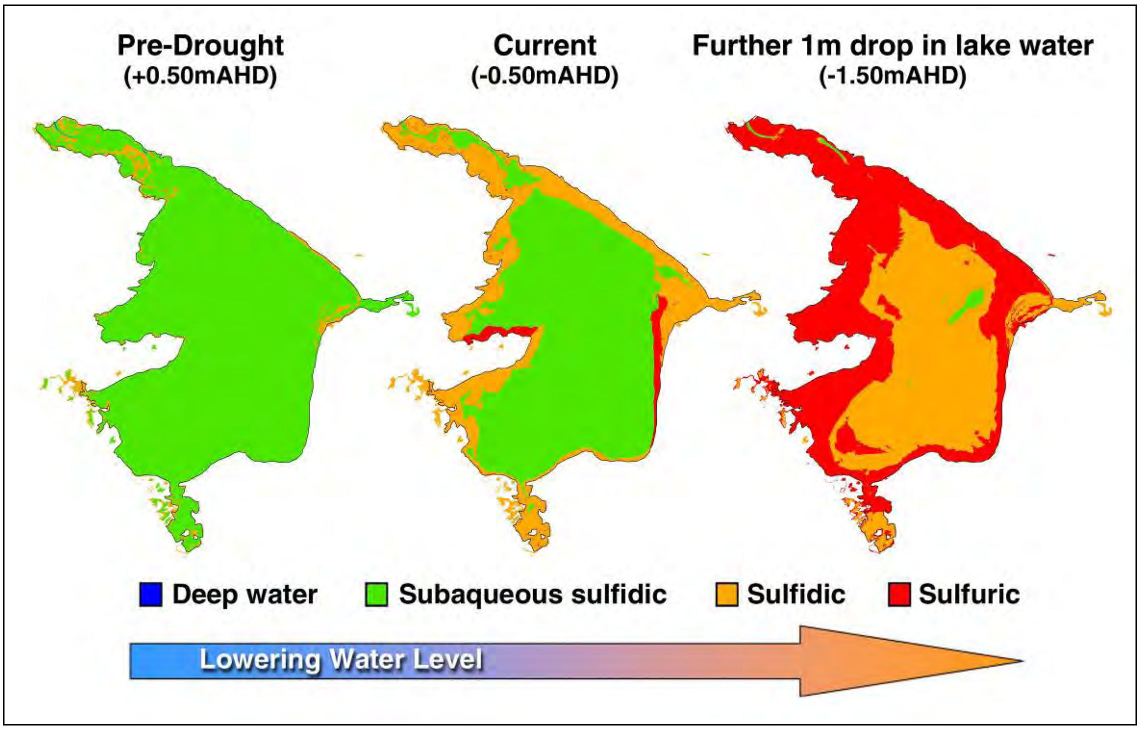


Figure A1.2.3: Lake Albert predictive scenario maps depicting changes in acid sulfate soil materials at different water levels (+0.5 m AHD, –0.5 m AHD and –1.5 m AHD) from Fitzpatrick *et al*. 2008b.

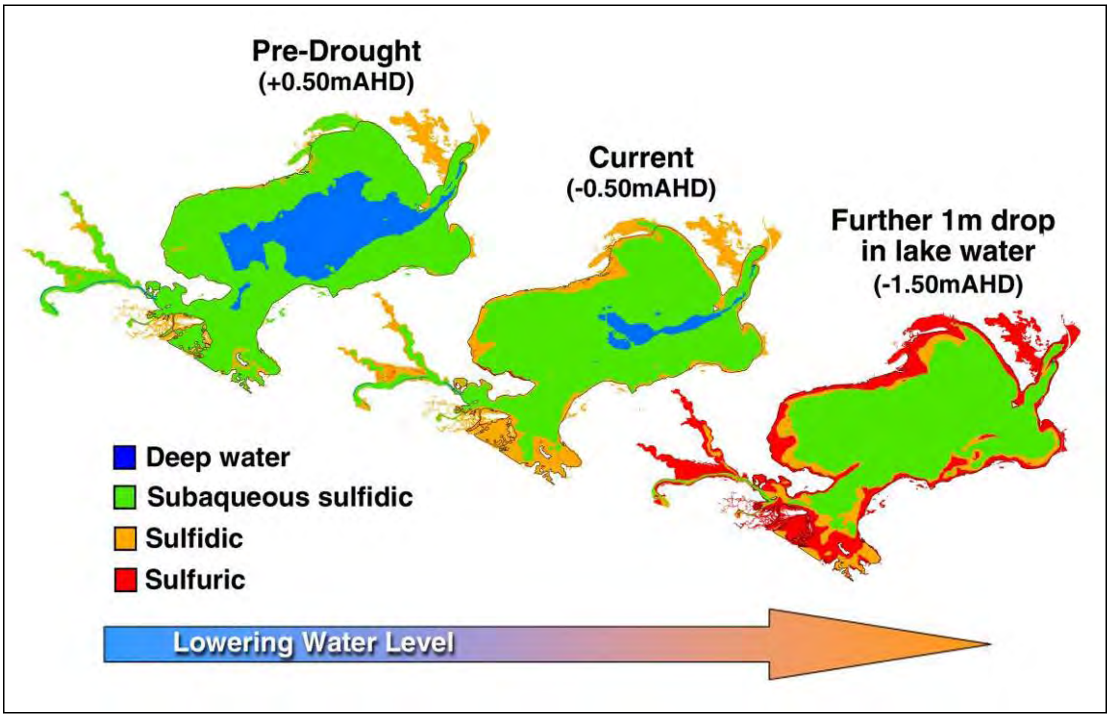


Figure A1.2.4: Lake Alexandrina predictive scenario maps depicting changes in acid sulfate soil materials at different water levels (+0.5 m AHD, –0.5 m AHD and –1.5 m AHD) from Fitzpatrick *et al*. 2008b.

Acid sulfate soils in subaqueous, waterlogged and drained soil environments in the Coorong, Lake Alexandrina and Lake Albert: properties, distribution, genesis, risks and management (Fitzpatrick *et al.* 2008e).

The Coorong, Lower Lakes and Murray Mouth (1,400 km^2) are a RAMSAR site and protecting their long term environmental health is a priority. The overall objective of this project was to:

i. implement an effective and integrated process of field and laboratory investigations to acquire knowledge of acid sulfate soils at these sites;

ii. stakeholder engagement and;

iii. communication to utilise local knowledge and to inform environmental managers and community members of findings to assist acid sulfate soil management.

To achieve this overall objective, the aims of this investigation were to verify the presence (or absence) of the types of acid sulfate soil materials in the Coorong and Lower Lakes and, assess the risk potential that dried soil materials might pose to infrastructure and environmental assets due to possible presence of acid sulfate soils with sulfuric material caused by the lowering the water levels.

This study investigated 30 sites and analysed 130 sample layers, the distribution of sites and layers is presented in Table A1.2.2.

This project used a growing body of recent acid sulfate soil research conducted in the Lower Lakes work and this increased the available information to 90 profiles that included 386 soil samples to support the assessment of the Lakes.

Table A1.2.2: Site and sample distribution for study area Lakes Alexandrina and Albert and Coorong project.

Survey locality	Survey site name (and ID)	Number of profiles sampled	Number of layers analysed
Coorong	Coorong (COO)	10	31
Lake Alexandrina	Lake Alexandrina (AA)	7	38
	Poltalloch Station (PO)	4	17
	Wellington Weir - proposed (WWBH)	2	11
Lake Albert	Lake Albert (AT)	7	33
Total		**30**	**130**

Key findings identified as shown in Table A1.2.3, that of the 90 profiles (that included assessment of 386 soil layers) investigated greater than 86% exceeded a moderate risk of acidification, concluding that significant acidification is present and also likely to increase to become a significant management burden. These profiles were spread throughout the lakes and Coorong area. For sites in Lake Alexandrina 48 out of 55 sites (87%) were classified as moderate or higher risk, with 19 of those sites (35%) being very high or extremely high risk. For Lake Albert all 25 sites were classified as a moderate or higher risk of acidification with 16 of those sites (64%) being very high or extremely high risk. The Coorong results indicated lower overall acid sulfate soil risk compared to those of the Lower Lakes.

Widespread occurrences of salt efflorescences of were identified and characterised. Oxyhydroxysulfate and iron oxyhydroxide minerals are indicators of very acidic soil conditions (i.e. the presence or former presence of oxidised pyrite), and as such their presence provides important environmental indicators of acid sulfate soils. These minerals not only form seasonally during summer heat and high evaporative conditions in soils exposed by drought, but also during: (i) the winter rainfall cyclic wetting and drying events and (ii) the cyclic rewetting of the sulfidic materials due to lake level changes associated with seiching, which is likely to be an important acidity transfer mechanism from acid sulfate soils to lake water. For example, the rewetting of sideronatrite by rainwater and seiching causes mineral dissolution and the resultant mobilisation of acid, iron, sulfate and sodium ions to immediately adjacent, temporary ponded areas, where orange coloured schwertmannite rapidly crystallises.

Table A1.2.3: Number of sites by risk class.

Locality	Number of sites by risk class (risk class according to Dear el at. 2002)					
	Low or No	Moderate	High	Very High	Extremely High	Total
Lake Alexandrina	7	14	15	5	14	55
Lake Albert		4	5	11	5	25
Coorong	6	3	1	0	0	10

The maps in the previous report (shown for Lake Albert in Figure A1.2.3 and for Lake Alexandrina Figure A1.2.4) were presented and calculations of the acid sulfate soil transitions from the wetter to drier subtypes made. A summary of predicted aerial extents is shown in Table A1.2.4. The data identifies that with the lowering of the water level there is predicted to be a major shift from Subaqueous Sulfidic at +0.5m AHD to Sulfidic at -0.5m AHD and then a massive shift to Sulfuric at -1.5m AHD. Highlighting that significant acidification is present and also likely to increase to become a significant management burden.

Table A1.2.4: Summary of predicted aerial extents (ha) of acid sulfate soil types coverages for Lake Alexandrina and Lake Albert under water levels of +0.5, -0.5 and -1.5m AHD.

	Predicted aerial extent, ha (% value)		
Acid Sulfate Soiltypes	**+0.5 m AHD (previous, pre-drought)**	**–0.5 m AHD (current, drought)**	**–1.5 m AHD (future, persistent drought)**
Sulfidic, deeper than 2 m	16,912 (18%)	3,061 (3%)	32 (0%)
subaqueous sulfidic	67,584 (72%)	64,790 (69%)	42,492 (45%)
sulfidic	8,970 (10%)	24,575 (26%)	18,253 (20%)
sulfuric	0 (0%)	1,039 (1%)	32,699 (35%)

Based on current investigations and historical/palaeopedological knowledge of the Murray-Darling Basin, a series of 8 soil regolith conceptual models were constructed that illustrate how various acid sulfate soil materials in subaqueous, waterlogged (saturated) and dried conditions have sequentially changed – and will change over time in the Coorong and Lower Lakes. To illustrate these sequential changes, the following series of representative conceptual cross-sections across Lake Alexandrina were developed covering the periods (the cross-sectional diagrams and descriptive information for each are provided in the report):

i. before the 1880s (approximately 5,500 BC to 1880s period), Lake Alexandrina cycled between natural wetting and flushing, and partial drying conditions,

ii. during the 1880s to 1930s when the river and lake systems were modified for irrigation purposes,

iii. during the 1930s to 2006, when Lake Alexandrina was first managed using locks and barrages.

iv. during 2006 to 2007 when partial drying of wetlands and beaches surrounding Lake Alexandrina took place,

v. during 2007 to 2008 when complete (unprecedented since installation of the barrages) drying of beaches surrounding Lake Alexandrina and adjacent whole wetlands took place,

vi. during 2008 to 2009 if no pumping from Lake Alexandrina occurs and extreme drought conditions continue, and

vii. during the 2008, when pumping water from Lake Alexandrina to Lake Albert took place to maintain water levels, and for bioremediation.

This report added to a growing body of acid sulfate soil research conducted by CSIRO Land and Water that is informing the decisions of senior environmental managers, such as pumping water from

Alexandrina into Lake Albert to maintain water levels to arrest the formation of acid sulfate soils on Lake Albert shores and guiding bioremediation research on the shores of Lake Albert.

Recommendations from the work identified the need for the initiation of careful monitoring of soils and water in the Lower Lakes, and establishment of soil and water trigger values for management decisions or interventions. Monitoring should be based on the approach and indicators identified in this study and should use selected representative sites featured in this study.

A summary of the data sets collected in this study are summarised in Table A1.2.5.

Table A1.2.5: Summary of measurements made and result data relevant to this mapping study.

Measurement	Number of data results	Comment on Relevance for this study
Field descriptions of landscape, layer depths, colour, texture, mottles and other features	30 sites That included 130 layers	Not directly relevant but does provide the base information to correlate linkage with like soil profiles and layers within and between studies.
Acid base accounting parameters (pH_{KCL}, S_{CR} %, $CaCO_3$ %) pH_{water}, $pH_{peroxide}$, $pH_{incubation}$	Lake Albert 7 sites including 33 layers Lake Alexandrina 13 sites including 66 layers	Very relevant and with coordinates this quantitative data may be used. Some sites have surface layer data, while others have multiple layers down to about 60cm and for some drill core sites over 4m depth
Mineralogy	1 sites including 3 samples	Not directly relevant. But does confirm presence of acid sulfate soil minerals

Acid sulfate soil assessment in Finniss River, Currency Creek, Black Swamp and Goolwa Channel, South Australia (Fitzpatrick *et al*. 2009a).

This study conducted acid sulfate soil assessment in the Finniss River, Currency Creek, Goolwa Channel and Black Swamp/Tookayerta Creek areas that are adjacent to Lake Alexandrina. The study aimed to:

i. verify the presence (or absence) of acid sulfate soils,

ii. assess the hazards of any acid sulfate soil material found, and

iii. determine the surface water quality of waters present in the area.

Key findings identified that more than half of the sites investigated contained sulfuric material (pH < 4.0). The remainder of sites had considerable potential for further developing sulfuric materials from hypersulfidic materials if the water levels continue to drop, although the risk of this occurring is low to moderate provided the materials are kept under anaerobic conditions.

Hazard assessment was based on a framework used for coastal acid sulfate soil assessment, as discussed in the report, and provides a means to compare soils relatively and identify those of concern. Based on this assessment framework 37 of the 39 sites (94%) have sufficient net acidity that, if disturbed, would be of concern. More than 91% of the sites assessed have a high, very high, or extra high hazard classification indicating a considerable potential acid hazard.

In this study, 12 transects that included 39 geographically well-distributed and locally representative soil profiles were investigated. A total of 143 layers were described, that included 119 soil samples and 17 water samples for laboratory analysis, and 9 layers of surface salt efflorescences.

Areas were characterised by placing sites along toposequence-based transects from dry inland areas down to water level. This allowed the layer distribution of materials to be better understood and very detailed conceptual toposequence models were constructed to provide an improved understanding of the temporal and spatial extent of the acid sulfate soil materials (these can be viewed in the report). These figures show that sulfuric material occurs not only on the dry soil surfaces but also down to 30 cm depth in both dry and rewetted soils, and that the strongly acidic layers are common in both sandy and clayey soils that have cracked to form columns. Hypersulfidic material occurs either below the sulfuric layer or below surface water bodies (subaqueous) or the water table in the soil. The hypersulfidic layer ranges in thickness up to, and in some areas more, than one metre and is often formed in black, soft clay.

The conceptual toposequence models provide an understanding of the soil distribution that then allowed the earlier predictive maps to be tested and updated with more confidence. Large areas of extremely acidic soils (sulfuric materials: pH < 4.0) were present and confirmed previous predictions (Fitzpatrick et al. 2008b) that these areas have a high potential of developing sulfuric materials (i.e. soil pH < 4). There is also a high potential of developing more sulfuric materials from existing hypersulfidic materials, which have not yet oxidised.

A predictive acid sulfate soil chronosequence model illustrating the formation and transformation of sulfidic materials has been constructed for the Finniss River using Wally's Landing and adjacent wetlands as a case study. This provides an understanding of how these soil materials change with time and the events involved to make this happen.

Based on field investigations and historical/palaeo-pedological knowledge of the Finniss River, a series of nine conceptual models have been constructed that illustrate how various acid sulfate soil materials have sequentially changed under subaqueous, waterlogged (saturated) and dried conditions, and have further changed, because of recent re-wetting by winter rainfall events.

Recommendations stated that monitoring is considered an essential component of acid sulfate soil assessments, not only during the current drought, but also during the re-wetting phases when acidity and metal mobilisation are likely to occur.

Acid, metal and nutrient mobilisation following rewetting of acid sulfate soils in the Lower Murray (Simpson et al. 2008).

This study assessed the potential for the mobilisation of acid and metals following the rewetting of a wide range of dried acid sulfate soil subtypes from Lakes Albert and Alexandrina. Large amounts of aluminium, iron and some trace metals were released in the metal mobilisation studies conducted, which may potentially cause direct acute toxicity from aluminium and some trace metals or indirect effects from precipitation and particulate iron and aluminium. Trace metal-enriched precipitates may form and may cause chronic toxicity to a variety of filter feeding or benthic organisms.

The study found that upon wetting of the soils with River Murray water using a rapid laboratory testing method, the water was effectively buffered to the pH of the soil. For soils that resulted in water pH <6.2 (28 of 85), the concentrations of dissolved metals released to the waters were quantified. The metal release from the soils was rapid and varied over several orders of magnitude for different soil types. There were exceedances of the water quality guidelines (WQGs) for all metals for which WQGs exist. The metals that most often exceeded the WQGs were Cu (57% of 28 samples), Zn (54%), Ni (46%), Co (39%), Cd (36%), Mn (36%) and Al (>25%). For Co, Cu, and Zn the concentrations were often greater than 10 times greater than WQGs. For aluminium, some results exceeded the WQGs by more than 100 times.

The release of Al, Fe, Cr Cu, V and Zn increased as pH decreased and was adequately modelled using power functions. The mixing of acidic metal-rich waters (mobilised from soils) with River Murray water (pH 7, 40 mgL–1 CaCO3 alkalinity) was demonstrated to result in the co-precipitation and adsorption of trace metals forming Al, Fe and Mn oxyhydroxide phases. The soil re-wetting experiments and relationships between pH and metal release indicated that exceedances of WQGs in the River Murray system are likely if the mixed waters have pH 5, but possible at pH 6 if attenuation processes are inadequate.

Atlas of Australian Acid Sulfate Soils

The Atlas of Australian Acid Sulfate Soils (AAASS) (Fitzpatrick et al. 2008a) is a Web-based hazard assessment tool with a nationally consistent legend, which provides information about the distribution and properties of both coastal and inland acid sulfate soils across Australia. This tool is available on ASRIS (Australian Soil Resource Information System: www.asris.gov.au) and every polygon or mapping unit is attributed with information pertaining to: (i) classes of "probability of occurrence", (ii) levels of confidence relating to the quality of data source, and (iii) additional descriptors such as desiccation cracks. The Atlas is a constantly evolving national map of available acid sulfate soil information, which also includes priority case studies at a range of localities across Australia. (e.g. http://www.clw.csiro.au/acidsulfatesoils/index.html).

Community group assessment.

Community volunteers are providing on-going data that is used to assess acid sulfate soil conditions. The community volunteers have been trained at workshops and providing with field sampling and operating guidelines.

During the first 2 weeks of August 2009, at least 30 volunteers conducted surveys at 38 well-distributed sites around the Lower Lakes. Immediately after sampling was complete, chip-trays, soil and water 70 ml jars were frozen and transferred to the CSIRO laboratory, which provided pH data for 111 profiles that included 333 samples. Four consecutive community surveys have been completed between August 2009 and June 2010 and all the acid sulfate soil data has been uploaded to the ASRIS website and also interpreted in a recently published report by Thomas and Fitzpatrick (2010).

Appendix 2: Sample Location, Depth, Morphology and Laboratory Results

A complete set of all data accompanies this report and is provided in an Excel database – presented in this Appendix is listed the main data parameters and results.

The methods are described in the methods section for additional details of approach.

All analysis is based on dry weight. Results at or below detection limits are replaced with '0' for calculation purposes.

The table columns present the data in the following order:

1. Site ID Number – unique alphanumeric site identification.
2. Layer Number – 1 is surface layer 0-10cm, 2 is subsurface layer 10-30cm, 3 is upper subsoil layer 30-50cm.
3. Sample ID Number – unique alphanumeric number for the sample
4. Easting (Zone 54H) – Co-ordinates in metres
5. Northing (Zone 54H) – Co-ordinates in metres
6. EC (mS/cm) – electrical conductivity
7. pH (soil:water) – pH unit of the soil
8. pH(soil:peroxide) – pH unit of the soil after peroxide treatment
9. pH(ageing) – pH unit of the soil after incubation for 8 weeks
10. Lab texture – texture of the soil as characterised by the laboratory prior to analysis, there are 3 categories coarse, medium and fine
11. pH(KCl) – pH unit of the soil after KCl treatment
12. S_{CR} (%) – reduced inorganic sulfur measured as % chromium reducible sulfur
13. TAA (mol H t^{-1}) – titratable actual acidity.
14. RA (mol H t^{-1}) – retained acidity
15. ANC (%$CaCO_3$) - acid neutralising capacity expressed as equivalent % $CaCO_3$.
16. Net Acidity (mol H t^{-1}) – Potential Sulfidic Acidity (ie. S_{CR}) + Titratable Actual Acidity + Retained Acidity - measured ANC/FF. Note FF (fineness factor) set at 1.5
17. Field texture – soil texture as measured in the field (C – clay, SC – sandy clay, CL – clay loam, L – loam, SCL – sandy clay loam, SL – sandy loam, LS – loamy sand, CS – clayey sand, S- sand, PEAT - peat)
18. Field consistence – soil consistence as measured in the field (GEL – gel, VS – very soft, S – soft, FI – firm, EFI – extremely firm, VF – very firm, EH – extremely hard, FR – friable, L - loose)

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol $H^+ t^{-1}$)	RA (mol $H^+ t^{-1}$)	ANC (%$CaCO_3$)	NA (mol $H^+ t^{-1}$)	Field texture	Field consistence
LL1001	1	LL.1001	345680	6050233	0-10	5.22	7.94	6.72	7.14	Fine	7.24	1.093	0.00	0.00	1.79	443.29	C	GEL
LL1001	2	LL.1002	345680	6050233	10-30	2.74	7.69	1.90	2.23	Fine	6.76	2.355	0.00	0.00	1.66	1247.73	C	VS
LL1003	1	LL.1003	342080	6049071	0-20	2.83	6.55	1.73	2.29	Fine	6.90	2.880	0.00	0.00	0.66	1708.38	C	GEL
LL1004	1	LL.1004	341951	6050962	0-10	3.89	7.62	1.83	3.24	Medium	7.01	0.648	0.00	0.00	0.36	356.21	SC	VS
LL1005	1	LL.1005	344057	6052021	0-20	1.85	7.08	2.30	2.82	Fine	6.75	0.745	0.00	0.00	0.67	375.42	C	VS
LL1006	1	LL.1006	345022	6052011	0-20	1.13	7.09	2.39	3.30	Fine	6.86	0.614	0.00	0.00	0.90	263.08	C	VS
LL1007	1	LL.1007	347024	6052014	0-20	2.20	7.56	1.68	2.43	Fine	7.22	2.710	0.00	0.00	1.60	1477.14	C	VS
LL1008	1	LL.1008	348003	6051013	0-10	2.54	7.76	5.60	7.37	Fine	7.85	0.908	0.00	0.00	2.29	261.30	C	GEL
LL1008	2	LL.1009	348003	6051013	10-30	2.82	7.50	1.63	2.17	Fine	7.43	3.051	0.00	0.00	0.98	1772.41	C	VS
LL1010	1	LL.1010	348994	6050994	0-20	4.58	7.66	4.21	3.98	Fine	7.80	0.802	0.00	0.00	1.52	297.75	C	GEL
LL1010	2	LL.1011	348994	6050994	20-30	1.62	8.40	1.70	2.28	Fine	7.33	2.650	0.00	0.00	0.99	1520.97	C	VS
LL1012	1	LL.1012	348998	6052008	0-10	2.63	8.00	6.56	7.53	Fine	8.06	1.029	0.00	0.00	2.46	314.13	C	GEL

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1012	2	LL.1013	348998	6052008	10-30	2.10	7.51	1.82	2.17	Fine	7.33	1.653	0.00	0.00	1.00	897.80	C	VS
LL1014	1	LL.1014	346965	6053040	0-30	1.50	6.82	1.76	2.22	Fine	7.12	2.260	0.00	0.00	0.95	1283.05	C	VS
LL1015	1	LL.1015	346004	6053006	0-30	1.54	6.90	1.61	2.39	Fine	7.53	1.893	0.00	0.00	0.77	1078.13	C	VS
LL1016	1	LL.1016	343935	6052983	0-30	4.25	7.82	4.43	7.10	Fine	8.27	0.402	0.00	0.00	0.56	176.14	C	S
LL1017	1	LL.1017	344992	6054028	0-30	1.75	7.23	1.85	2.21	Fine	7.65	2.610	0.00	0.00	1.32	1452.07	C	VS
LL1018	1	LL.1018	346994	6054000	0-10	3.29	7.79	6.52	7.43	Fine	8.07	0.746	0.00	0.00	1.76	230.86	C	VS
LL1018	2	LL.1019	346994	6054000	10-30	1.48	7.38	1.94	2.71	Fine	7.39	1.293	0.00	0.00	0.55	733.20	C	VS
LL1020	1	LL.1020	347992	6053993	0-10	2.35	7.91	6.30	7.36	Fine	8.08	0.695	0.00	0.00	2.57	91.16	C	GEL
LL1020	2	LL.1021	347992	6053993	10-30	2.29	7.49	1.92	2.96	Fine	7.40	2.178	0.00	0.00	0.98	1227.91	C	S
LL1022	1	LL.1022	348999	6054000	0-20	2.55	7.40	1.79	2.91	Fine	7.76	2.996	0.00	0.00	1.13	1718.13	C	S
LL1023	1	LL.1023	343946	6054998	0-30	2.58	7.94	1.92	7.30	Fine	7.66	0.133	0.00	0.00	0.11	68.30	C	S
LL1024	1	LL.1024	345021	6055001	0-10	3.56	7.99	6.73	2.12	Coarse	8.29	0.504	0.00	0.00	4.76	-319.68	SC	GEL
LL1025	1	LL.1025	346007	6055007	10-30	1.89	7.98	2.16	4.17	Fine	7.34	0.374	0.00	0.00	0.69	141.36	C	S
LL1026	1	LL.1026	346964	6054990	0-20	1.08	7.80	6.14	7.46	Fine	8.03	0.657	0.00	0.00	2.38	92.76	C	GEL
LL1026	2	LL.1027	346964	6054990	10-30	1.40	7.25	1.92	2.34	Fine	7.48	1.932	0.00	0.00	0.85	1091.79	C	VS
LL1028	1	LL.1028	347993	6055001	0-20	1.98	7.65	1.73	2.66	Fine	7.74	2.081	0.00	0.00	1.12	1148.76	C	VS
LL1029	1	LL.1029	349945	6054961	0-5	1.80	8.23	7.20	7.67	Coarse	9.06	0.011	0.00	0.00	0.21	-21.11	S	F
LL1029	2	LL.1030	349945	6054961	5-20	1.32	8.16	7.00	7.16	Medium	9.12	0.064	0.00	0.00	0.88	-77.30	S	F
LL1031	1	LL.1031	349935	6056008	0-20	2.49	7.96	3.30	5.26	Medium	8.12	0.049	0.00	0.00	0.11	15.91	S	F
LL1032	1	LL.1032	347997	6055965	0-20	1.11	7.78	6.23	6.63	Fine	9.02	0.122	0.00	0.00	0.41	21.48	S	F
LL1033	1	LL.1033	347041	6055995	0-20	2.85	7.48	2.07	5.52	Fine	8.33	0.697	0.00	0.00	3.18	11.15	SC	VS
LL1034	1	LL.1034	345011	6056007	0-10	1.69	7.22	6.67	6.94	Fine	8.28	0.662	0.00	0.00	3.41	-41.31	C	GEL
LL1034	2	LL.1035	345011	6056007	10-30	1.85	7.47	1.84	2.87	Fine	6.99	1.669	0.00	0.00	0.44	982.37	C	VS
LL1036	1	LL.1036	346018	6056995	0-30	2.54	7.81	2.24	7.48	Coarse	9.26	0.083	0.00	0.00	0.09	39.78	S	GEL
LL1037	1	LL.1037	347017	6057014	0-20	1.92	8.18	1.84	3.28	Medium	8.03	0.241	0.00	0.00	0.01	148.98	SC	GEL
LL1038	1	LL.1038	348001	6057015	0-20	1.57	8.07	6.58	7.07	Medium	9.32	0.115	0.00	0.00	0.08	61.07	S	S
LL1039	1	LL.1039	348998	6057006	0-20	1.51	8.06	3.35	4.12	Medium	8.62	0.037	0.00	0.00	0.13	5.76	S	S
LL1040	1	LL.1040	349733	6057152	0-20	1.99	8.18	2.26	3.37	Coarse	8.27	0.030	0.00	0.00	0.09	6.72	S	S
LL1041	1	LL.1041	349613	6058158	0-20	1.53	8.06	5.67	7.14	Coarse	8.71	0.031	0.00	0.00	0.03	15.34	S	S
LL1042	1	LL.1042	349008	6058015	0-20	1.71	7.80	2.35	2.39	Medium	8.18	0.089	0.00	0.00	0.00	55.51	S	S
LL1043	1	LL.1043	346996	6058004	0-20	1.09	7.75	1.83	2.25	Fine	7.32	0.403	0.00	0.00	0.03	247.36	C	GEL
LL1044	1	LL.1044	345010	6058019	0-20	1.23	7.24	1.98	2.64	Fine	7.32	1.341	0.00	0.00	0.46	775.13	C	GEL
LL1045	1	LL.1045	343994	6058944	0-20	1.85	7.85	1.90	1.87	Fine	7.18	2.777	0.00	0.00	0.68	1641.48	C	GEL
LL1046	1	LL.1046	349950	6053995	0-10	1.55	7.92	6.60	7.62	Coarse	9.20	0.010	0.00	0.00	0.04	0.91	S	S
LL1046	2	LL.1047	349950	6053995	10-20	1.84	8.01	4.35	3.56	Coarse	7.52	0.013	0.00	0.00	0.00	8.11	S	S
LL1048	1	LL.1048	349974	6052992	0-20	1.36	7.93	5.51	7.37	Medium	9.44	0.030	0.00	0.00	0.13	1.40	S	S
LL1049	1	LL.1049	349934	6051986	0-10	2.23	8.21	6.43	7.85	Coarse	9.57	0.017	0.00	0.00	0.06	2.61	S	S
LL1049	2	LL.1050	349934	6051986	10-20	2.47	8.32	2.60	7.40	Coarse	9.63	0.044	0.00	0.00	0.18	3.47	S	S
LL1051	1	LL.1051	349956	6051007	0-20	4.76	8.16	6.36	7.14	Coarse	9.81	0.022	0.00	0.00	3.18	-409.85	S	S
LL1052	1	LL.1052	350136	6058644	0-20	2.27	7.94	2.98	3.09	Coarse	8.12	0.030	0.00	0.00	0.00	18.71	S	S
LL1053	1	LL.1053	346008	6058974	0-20	2.55	7.11	2.30	2.40	Fine	7.62	0.998	0.00	0.00	1.01	487.93	C	VS
LL1054	1	LL.1054	345040	6059178	0-20	2.82	7.25	1.94	2.02	Fine	7.22	1.324	0.00	0.00	0.36	777.84	C	VS
LL1055	1	LL.1055	345012	6060015	0-10	4.78	7.60	6.51	7.34	Fine	7.01	0.964	0.00	0.00	3.52	132.40	C	VS
LL1055	2	LL.1056	345012	6060015	10-30	1.62	7.44	1.91	2.09	Fine	8.52	1.774	0.00	0.00	0.58	1029.21	C	VS
LL1057	1	LL.1057	345961	6060000	0-10	4.73	7.36	6.42	7.57	Fine	8.26	0.559	0.00	0.00	2.21	54.28	C	GEL
LL1057	2	LL.1058	345961	6060000	10-30	1.69	7.23	2.19	2.34	Fine	7.39	1.599	0.00	0.00	0.75	897.42	C	VS

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1}	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1059	1	LL.1059	346862	6060082	0-20	2.05	7.88	1.79	2.20	Fine	7.51	1.610	0.00	0.00	0.87	888.29	C	GEL
LL1060	1	LL.1060	347984	6060002	0-20	1.84	7.42	1.89	2.60	Fine	7.46	1.196	0.00	0.00	0.84	634.07	C	GEL
LL1061	1	LL.1061	349789	6060354	0-10	2.38	7.01	6.43	7.27	Fine	8.14	0.022	0.00	0.00	3.49	-451.33	C	GEL
LL1061	2	LL.1062	349789	6060354	10-30	1.02	7.20	1.68	7.09	Medium	9.22	0.651	0.00	0.00	1.59	194.25	SC	S
LL1063	1	LL.1063	349149	6061024	0-20	3.62	7.10	6.45	7.34	Fine	8.15	0.244	0.00	0.00	4.23	-411.25	C	S
LL1064	1	LL.1064	347989	6061992	0-20	2.32	7.47	1.57	2.63	Medium	7.45	0.706	0.00	0.00	0.15	420.36	SC	S
LL1065	1	LL.1065	347000	6062008	0-10	2.45	7.51	1.59	7.32	Fine	7.97	0.353	0.00	0.00	0.59	141.58	SC	GEL
LL1065	2	LL.1066	347000	6062008	10-30	1.68	7.96	5.99	7.66	Medium	8.62	0.596	0.00	0.00	4.01	-162.40	PEAT	S
LL1067	1	LL.1067	346804	6063071	0-10	3.27	7.85	6.52	7.78	Coarse	9.41	0.006	0.00	0.00	0.17	-18.90	S	S
LL1067	2	LL.1068	346804	6063071	10-30	1.97	7.60	5.27	7.38	Coarse	8.06	<0.005	0.00	0.00	0.00	0.00	S	S
LL1069	1	LL.1069	345994	6063021	0-20	2.74	7.58	2.27	7.49	Fine	8.55	1.223	0.00	0.00	1.56	555.01	C	VS
LL1070	1	LL.1070	345006	6063000	0-10	4.02	6.98	6.54	7.37	Fine	7.20	0.699	0.00	0.00	1.32	260.15	C	GEL
LL1070	2	LL.1071	345006	6063000	10-30	1.25	7.46	1.96	2.31	Fine	6.72	2.178	0.00	0.00	0.65	1271.87	C	VS
LL1072	1	LL.1072	345010	6064016	0-10	2.97	6.85	6.30	7.27	Fine	7.55	0.322	0.00	0.00	2.70	-158.80	C	GEL
LL1072	2	LL.1073	345010	6064016	10-30	2.82	7.19	1.99	2.34	Fine	7.78	0.536	0.00	0.00	1.99	69.24	C	VS
LL1074	1	LL.1074	343998	6063015	0-20	2.73	7.13	1.87	2.25	Fine	7.22	1.997	0.00	0.00	0.57	1169.63	C	VS
LL1075	1	LL.1075	344042	6064007	0-20	1.50	7.17	1.76	3.75	Fine	7.13	1.404	0.00	0.00	0.81	767.80	C	VS
LL1076	1	LL.1076	343919	6065104	0-20	2.13	6.89	6.22	7.06	Fine	7.72	0.303	0.00	0.00	2.24	-109.38	C	VS
LL1077	1	LL.1077	343075	6064699	0-20	2.66	7.96	4.24	7.12	Coarse	7.91	0.087	0.00	0.00	0.22	24.96	S	S
LL1078	1	LL.1078	343073	6064149	0-20	2.25	7.19	1.90	2.57	Fine	7.83	1.376	0.00	0.00	0.99	726.36	C	S
LL1079	1	LL.1079	343009	6063010	0-20	2.49	7.05	1.85	2.96	Fine	7.08	2.158	0.00	0.00	0.64	1260.73	C	S
LL1080	1	LL.1080	342010	6062022	0-20	1.81	7.77	2.34	6.95	Medium	7.16	0.405	0.00	0.00	0.20	225.96	SC	S
LL1081	1	LL.1081	342998	6062042	0-20	1.62	7.86	1.72	1.96	Fine	7.04	1.521	0.00	0.00	0.65	862.09	C	VS
LL1082	1	LL.1082	343988	6062016	0-20	2.24	7.79	1.95	3.05	Fine	7.08	0.583	0.00	0.00	0.26	328.99	C	VS
LL1083	1	LL.1083	344985	6061021	0-20	1.90	7.55	1.89	2.14	Fine	6.77	1.495	0.00	0.00	0.52	863.19	C	VS
LL1084	1	LL.1084	344003	6060996	0-20	1.79	7.71	1.72	1.90	Fine	6.69	2.680	0.00	0.00	0.87	1555.67	C	VS
LL1085	1	LL.1085	343039	6061011	0-20	2.08	7.55	1.74	2.05	Fine	6.94	1.981	0.00	0.00	0.89	1117.03	C	VS
LL1086	1	LL.1086	342116	6060890	0-10	2.14	8.41	6.51	6.67	Coarse	8.73	0.026	0.00	0.00	0.00	16.22	S	S
LL1086	2	LL.1087	342116	6060890	10-30	2.02	8.68	1.87	2.19	Coarse	7.66	0.048	0.00	0.00	0.14	11.29	S	S
LL1088	1	LL.1088	342006	6060021	0-20	1.97	7.74	2.03	6.69	Fine	7.74	1.861	0.00	0.00	0.97	1031.53	C	S
LL1089	1	LL.1089	342007	6058997	0-20	1.93	7.57	1.85	2.25	Fine	6.80	2.252	0.00	0.00	1.23	1240.77	C	GEL
LL1090	1	LL.1090	342997	6059992	0-20	2.06	7.32	1.88	2.36	Fine	6.74	2.078	0.00	0.00	0.24	1264.11	C	VS
LL1091	1	LL.1091	342012	6058032	0-20	2.19	7.55	1.96	2.85	Fine	7.50	1.789	0.00	0.00	1.19	957.32	C	VS
LL1092	1	LL.1092	341853	6057095	0-10	2.25	8.49	2.00	7.08	Coarse	7.34	0.103	0.00	0.00	0.14	45.59	S	S
LL1092	2	LL.1093	341853	6057095	10-30	2.38	7.79	1.89	2.23	Coarse	6.35	0.105	1.00	0.00	0.00	66.49	S	S
LL1094	1	LL.1094	343040	6056986	0-20	2.30	7.41	1.79	4.32	Fine	6.79	1.412	0.00	0.00	0.48	816.75	C	VS
LL1095	1	LL.1095	340975	6052022	0-20	3.37	7.20	6.08	7.35	Fine	7.81	1.587	0.00	0.00	3.89	471.69	C	VS
LL1096	1	LL.1096	341025	6051052	0-20	2.95	7.15	2.05	5.70	Fine	7.65	1.356	0.00	0.00	1.14	693.91	C	GEL
LL1097	1	LL.1097	342065	6051048	0-20	2.96	7.59	2.03	7.38	Fine	7.66	0.557	0.00	0.00	0.60	267.49	C	VS
LL1098	1	LL.1098	345847	6050083	0-10	3.99	8.54	7.03	7.59	Coarse	9.24	0.027	0.00	0.00	0.35	-29.78	S	S
LL1098	2	LL.1099	345847	6050083	10-30	4.24	8.41	6.87	7.82	Coarse	9.29	0.024	0.00	0.00	0.41	-39.64	S	S
LL1100	1	LL.1100	348991	6050061	0-20	2.23	7.44	1.80	2.32	Fine	7.70	2.091	0.00	0.00	1.43	1113.71	C	VS
LL1101	1	LL.1101	341043	6065503	0-20	3.54	7.37	1.47	2.67	Fine	6.47	1.667	0.98	0.00	0.00	1040.69	C	VS
LL1102	1	LL.1102	342056	6066044	0-10	1.55	7.89	1.67	2.44	Medium	6.42	0.592	0.98	0.00	0.00	370.02	SC	VS
LL1102	2	LL.1103	342056	6066044	10-30	1.47	7.62	1.63	1.83	Medium	6.47	0.583	0.98	0.00	0.00	364.76	SC	VS
LL1102	3	LL.1104	342056	6066044	30-50	2.46	7.73	1.60	2.23	Medium	6.61	0.187	0.00	0.00	1.37	-65.98	SC	VS

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1105	1	LL.1105	340996	6062016	0-10	3.10	2.86	1.74	3.40	Coarse	4.64	0.015	27.44	0.00	0.00	36.95	CS	S
LL1105	2	LL.1106	340996	6062016	10-30	3.48	2.55	1.62	2.20	Medium	5.01	0.011	29.89	0.00	0.00	36.58	C	S
LL1105	3	LL.1107	340996	6062016	30-50	3.41	3.75	1.66	2.04	Medium	4.69	0.241	36.26	0.00	0.00	186.72	C	S
LL1108	1	LL.1108	340909	6060914	0-10	6.07	6.69	1.67	2.39	Fine	6.19	1.741	11.27	0.00	0.00	1097.20	C	S
LL1108	2	LL.1109	340909	6060914	10-30	3.57	7.47	1.64	1.75	Fine	6.39	1.993	0.98	0.00	0.00	1243.79	C	S
LL1108	3	LL.1110	340909	6060914	30-50	3.16	7.85	1.87	2.19	Fine	6.77	1.853	0.00	0.00	0.23	1125.29	C	S
LL1111	1	LL.1111	341845	6061476	0-10	4.77	8.19	6.22	6.02	Coarse	8.75	0.021	0.00	0.00	0.17	-9.24	S	S
LL1111	2	LL.1112	341845	6061476	10-30	2.72	8.21	1.89	3.02	Coarse	7.68	0.232	0.00	0.00	0.12	129.02	CS	S
LL1111	3	LL.1113	341845	6061476	30-50	2.08	7.98	1.83	3.26	Medium	7.24	0.153	0.00	0.00	0.16	74.35	SC	S
LL1114	1	LL.1114	339855	6058064	0-10	4.90	7.06	6.81	6.90	Fine	8.13	0.222	0.00	0.00	7.99	-926.07	C	GEL
LL1114	2	LL.1115	339855	6058064	10-30	2.83	7.46	5.46	5.04	Coarse	8.04	0.008	0.00	0.00	0.08	-5.60	S	S
LL1116	1	LL.1116	339843	6058134	0-20	2.23	7.75	5.85	8.01	Coarse	9.11	<0.005	0.00	0.00	0.28	-37.30	S	S
LL1117	1	LL.1117	338931	6057006	0-20	2.90	7.15	4.13	7.54	Coarse	7.93	0.005	0.00	0.00	0.08	-7.24	S	S
LL1118	1	LL.1118	340253	6056176	0-10	3.30	4.07	1.70	2.14	Coarse	6.20	0.032	3.92	0.00	0.00	23.62	S	S
LL1118	2	LL.1119	340253	6056176	10-30	2.01	7.14	1.53	3.38	Medium	6.80	0.274	0.00	0.00	0.20	144.13	S	S
LL1120	1	LL.1120	341870	6056597	0-10	4.74	2.91	2.17	3.46	Medium	4.80	0.008	25.48	0.00	0.00	30.28	S	S
LL1120	2	LL.1121	341870	6056597	10-30	5.31	2.74	1.52	2.72	Medium	5.49	0.038	24.50	0.00	0.00	48.51	SCL	S
LL1120	3	LL.1122	341870	6056597	30-50	6.26	6.66	7.00	7.22	Coarse	8.24	0.624	0.00	0.00	11.20	-1102.64	CS	S
LL1123	1	LL.1123	343116	6055941	0-10	4.51	7.41	5.68	7.39	Coarse	7.89	0.015	0.00	0.00	0.01	8.00	S	S
LL1123	2	LL.1124	343116	6055941	10-30	5.36	7.83	1.70	2.13	Medium	8.87	0.150	0.00	0.00	0.50	26.98	S	S
LL1125	1	LL.1125	343115	6056062	0-10	0.98	7.38	6.62	7.67	Medium	9.02	0.007	0.00	0.00	0.32	-38.50	S	S
LL1125	2	LL.1126	343115	6056062	10-30	3.02	7.06	5.52	1.88	Coarse	7.63	0.037	0.00	0.00	0.42	-33.13	SL	S
LL1125	3	LL.1127	343115	6056062	30-50	2.95	6.64	1.88	3.70	Coarse	6.24	0.138	2.45	0.00	0.00	88.40	SL	S
LL1128	1	LL.1128	341296	6065332	0-20	2.89	7.07	1.67	2.38	Fine	6.30	2.193	3.92	0.00	0.00	1371.79	C	VS
LL1129	1	LL.1129	338921	6066958	0-20	2.46	7.36	4.18	7.32	Fine	8.16	0.397	0.00	0.00	2.36	-66.95	C	GEL
LL1130	1	LL.1130	348820	6061838	0-10	5.85	7.52	6.67	8.12	Coarse	9.42	0.021	0.00	0.00	0.33	-30.96	S	S
LL1130	2	LL.1131	348820	6061838	10-30	3.46	7.10	4.20	6.44	Coarse	7.89	0.021	0.00	0.00	0.12	-2.63	S	S
LL1130	3	LL.1132	348820	6061838	30-50	3.37	7.64	6.32	4.97	Coarse	8.18	0.025	0.00	0.00	0.13	-1.54	S	S
LL1133	1	LL.1133	342659	6055280	0-10	2.78	7.58	5.07	7.57	Coarse	7.51	0.006	0.00	0.00	0.02	1.29	S	S
LL1133	2	LL.1134	342659	6055280	10-30	3.98	5.86	1.72	7.44	Coarse	6.19	0.063	1.96	0.00	0.00	41.32	S	S
LL1135	1	LL.1135	340890	6054250	0-10	2.59	7.49	6.96	7.86	Coarse	9.71	0.009	0.00	0.00	0.41	-49.24	S	S
LL1135	2	LL.1136	340890	6054250	10-30	2.28	8.03	6.25	7.67	Coarse	9.64	0.014	0.00	0.00	0.36	-39.42	S	S
LL1135	3	LL.1137	340890	6054250	30-50	2.68	8.19	6.41	7.47	Coarse	9.06	0.028	0.00	0.00	0.20	-9.34	S	S
LL1138	1	LL.1138	339939	6053884	0-10	4.29	7.40	7.02	7.53	Coarse	9.60	0.008	0.00	0.00	0.41	-49.53	S	S
LL1138	2	LL.1139	339939	6053884	10-30	4.25	7.33	4.49	7.44	Coarse	8.52	0.006	0.00	0.00	0.04	-1.38	S	S
LL1138	3	LL.1140	339939	6053884	30-50	4.41	6.83	4.60	7.29	Coarse	9.50	0.068	0.00	0.00	0.41	-12.17	S	S
LL1141	1	LL.1141	339893	6053973	0-10	1.48	7.77	5.46	6.50	Coarse	9.14	0.008	0.00	0.00	0.07	-4.03	S	S
LL1141	2	LL.1142	339893	6053973	10-30	0.90	7.50	1.64	7.05	Coarse	9.13	0.022	0.00	0.00	0.16	-7.31	S	S
LL1143	1	LL.1143	338785	6052939	0-10	2.93	7.64	7.12	8.02	Coarse	9.62	0.046	0.00	0.00	1.42	-160.68	S	S
LL1143	2	LL.1144	338785	6052939	10-30	3.05	7.81	2.84	4.81	Coarse	8.86	0.046	0.00	0.00	0.19	3.55	S	S
LL1143	3	LL.1145	338785	6052939	30-50	2.85	8.20	6.33	4.78	Coarse	9.39	0.231	0.00	0.00	3.12	-271.21	S	S
LL1146	1	LL.1146	338104	6052977	0-10	1.79	6.93	2.85	7.16	Coarse	6.85	0.038	0.00	0.00	0.00	23.65	S	S
LL1146	2	LL.1147	338104	6052977	10-30	1.61	7.33	1.65	2.00	Medium	6.70	0.196	0.00	0.00	0.00	122.40	S	S
LL1148	1	LL.1148	337894	6053008	0-10	2.92	5.65	1.91	3.49	Coarse	5.99	0.017	8.33	0.00	0.00	18.90	S	S
LL1148	2	LL.1149	337894	6053008	10-30	2.61	4.74	1.83	3.18	Medium	4.54	0.036	29.40	0.00	0.00	52.13	LS	S
LL1148	3	LL.1150	337894	6053008	30-50	2.30	4.50	1.49	2.04	Medium	5.04	0.089	18.13	0.00	0.00	73.43	SL	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1151	1	LL.1151	338973	6052102	0-10	2.79	6.87	6.81	7.37	Coarse	9.33	0.023	0.00	0.00	0.70	-78.98	S	S
LL1151	2	LL.1152	338973	6052102	10-30	3.90	7.31	6.45	7.40	Coarse	9.30	0.080	0.00	0.00	1.81	-191.18	S	S
LL1151	3	LL.1154	338973	6052102	30-50	4.35	7.67	6.70	7.57	Coarse	9.60	0.262	0.00	0.00	10.43	-1225.80	S	S
LL1155	1	LL.1155	339481	6051162	0-10	2.17	7.35	3.79	5.36	Coarse	8.31	0.011	0.00	0.00	0.08	-4.00	S	S
LL1155	2	LL.1156	339481	6051162	10-30	1.72	5.45	1.86	2.19	Coarse	4.87	0.106	18.62	0.00	0.00	84.81	S	S
LL1155	3	LL.1157	339481	6051162	30-50	2.17	6.97	2.23	5.60	Coarse	9.23	0.371	0.00	0.00	6.34	-613.12	S	S
LL1158	1	LL.1158	339810	6050343	0-10	2.37	7.59	6.89	7.54	Coarse	9.59	0.015	0.00	0.00	0.52	-60.09	S	S
LL1158	2	LL.1159	339810	6050343	10-30	3.93	7.62	6.74	7.73	Coarse	8.92	0.010	0.00	0.00	0.16	-15.35	CS	S
LL1158	3	LL.1160	339810	6050343	30-50	2.65	7.09	1.75	2.91	Coarse	7.90	0.052	0.00	0.00	0.11	17.50	S	S
LL1161	1	LL.1161	339871	6048974	0-10	8.18	8.02	6.82	7.63	Medium	9.63	0.063	0.00	0.00	0.87	-76.90	LS	S
LL1161	2	LL.1162	339871	6048974	10-30	10.91	7.72	1.75	2.88	Coarse	9.34	0.119	0.00	0.00	0.44	15.82	LS	S
LL1161	3	LL.1163	339871	6048974	30-50	10.74	11.79	1.95	7.95	Coarse	9.15	0.313	0.00	0.00	3.72	-300.04	SL	S
LL1164	1	LL.1164	339799	6048879	0-10	10.31	8.57	6.49	7.51	Coarse	9.12	0.069	0.00	0.00	4.79	-594.73	LS	S
LL1164	2	LL.1165	339799	6048879	10-30	10.25	7.38	4.82	7.55	Fine	8.30	0.119	0.00	0.00	1.20	-85.60	SC	S
LL1164	3	LL.1166	339799	6048879	30-50	17.92	7.04	6.66	7.26	Medium	8.90	0.518	0.00	0.00	11.21	-1170.12	SCL	S
LL1167	1	LL.1167	342905	6046919	0-10	14.40	7.06	2.59	5.75	Coarse	7.92	0.012	0.00	0.00	0.19	-17.92	S	S
LL1167	2	LL.1168	342905	6046919	10-30	3.27	8.94	7.31	6.59	Coarse	5.35	0.014	20.58	0.00	0.00	29.36	SL	S
LL1167	3	LL.1169	342905	6046919	30-50	4.06	3.95	1.73	2.19	Medium	4.83	0.324	27.93	0.00	0.00	229.85	C	S
LL1170	1	LL.1170	342758	6046753	0-10	3.46	5.64	6.45	7.35	Medium	8.33	0.009	0.00	0.00	0.23	-24.94	LS	S
LL1170	2	LL.1171	342758	6046753	10-30	4.72	7.50	6.21	7.52	Coarse	8.85	0.009	0.00	0.00	0.14	-12.99	SL	S
LL1170	3	LL.1172	342758	6046753	30-50	3.17	6.87	6.41	7.65	Coarse	9.44	0.008	0.00	0.00	0.27	-30.98	SL	S
LL1173	1	LL.1173	343509	6046886	0-10	4.34	7.19	2.38	3.04	Coarse	7.02	0.006	0.00	0.00	0.00	3.54	S	S
LL1173	2	LL.1174	343509	6046886	10-30	2.42	3.54	2.00	2.45	Coarse	6.17	0.006	3.43	0.00	0.00	7.47	LS	S
LL1173	3	LL.1175	343509	6046886	30-50	3.02	3.07	1.51	2.02	Coarse	5.45	0.034	4.90	0.00	0.00	26.17	S	S
LL1176	1	LL.1176	344238	6048868	0-10	2.22	3.31	6.57	7.84	Coarse	9.73	0.009	0.00	0.00	1.08	-138.32	S	S
LL1176	2	LL.1177	344238	6048868	10-30	1.82	6.83	6.40	7.49	Coarse	9.68	0.057	0.00	0.00	1.03	-101.85	S	S
LL1176	3	LL.1178	344238	6048868	30-50	2.94	9.12	6.23	7.54	Coarse	9.49	0.154	0.00	0.00	2.06	-178.15	SL	S
LL1179	1	LL.1179	346369	6049797	0-10	1.93	8.77	2.34	3.96	Coarse	4.84	0.013	0.00	0.00	0.00	8.18	S	S
LL1179	2	LL.1180	346369	6049797	10-30	3.89	3.80	1.76	2.76	Coarse	4.87	0.014	0.00	0.00	0.00	8.46	S	S
LL1179	3	LL.1181	346369	6049797	30-50	4.38	3.20	1.70	2.22	Coarse	4.71	0.049	0.00	0.00	0.00	30.66	LS	S
LL1182	1	LL.1182	348871	6062047	0-10	4.06	2.81	6.63	7.65	Coarse	9.58	0.005	0.00	0.00	0.36	-44.94	S	S
LL1182	2	LL.1183	348871	6062047	10-30	13.62	6.85	1.77	2.24	Coarse	8.30	0.150	0.00	0.00	0.15	73.43	S	S
LL1182	3	LL.1184	348871	6062047	30-50	13.57	7.01	1.22	1.73	Coarse	7.49	0.434	0.00	0.00	0.00	270.81	S	S
LL1185	1	LL.1185	350010	6060990	0-10	13.74	7.00	6.85	7.01	Coarse	9.40	0.009	0.00	0.00	0.28	-31.59	S	S
LL1185	2	LL.1186	350010	6060990	10-30	3.37	7.61	6.58	7.74	Coarse	8.32	<0.005	0.00	0.00	0.07	-9.32	CS	S
LL1185	3	LL.1187	350010	6060990	30-50	4.13	7.47	6.20	7.50	Coarse	7.96	0.006	0.00	0.00	0.06	-4.34	S	S
LL1188	1	LL.1188	351992	6058875	0-20	3.81	7.43	6.64	7.37	Fine	8.50	0.268	0.00	0.00	2.03	-103.50	C	VS
LL1189	1	LL.1189	350947	6058993	0-20	2.55	7.56	6.98	7.79	Coarse	9.59	0.005	0.00	0.00	0.27	-32.95	S	S
LL1190	1	LL.1190	350084	6057886	0-20	4.29	7.82	6.79	7.98	Coarse	9.67	0.022	0.00	0.00	0.48	-49.94	S	S
LL1190	2	LL.1191	350084	6057886	10-30	3.04	7.78	6.20	7.70	Coarse	7.25	<0.005	0.00	0.00	0.10	-13.32	S	S
LL1190	3	LL.1192	350084	6057886	30-50	3.71	7.62	1.84	2.37	Coarse	6.86	0.032	0.00	0.00	0.16	-1.55	S	S
LL1193	1	LL.1193	350517	6057771	0-20	4.82	7.65	6.26	7.27	Coarse	6.71	<0.005	0.00	0.00	0.13	-17.32	S	S
LL1193	2	LL.1194	350517	6057771	10-30	9.65	4.67	3.33	3.74	Coarse	6.31	<0.005	1.47	0.00	0.00	1.47	S	S
LL1193	3	LL.1195	350517	6057771	30-50	3.10	3.83	1.48	1.74	Coarse	6.68	0.097	0.00	0.00	0.00	60.36	S	S
LL1201	1	LL.1201	312626	6069882	0-10	6.39	2.95	1.63	2.40	Coarse	4.21	0.019	48.00	53.14	0.00	112.99	CS	S
LL1201	2	LL.1202	312626	6069882	10-30	8.93	2.71	1.72	2.01	Fine	3.31	0.555	206.00	124.62	0.00	676.78	C	VS

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1201	3	LL.1203	312626	6069882	30-50	4.80	6.12	1.58	2.06	Fine	6.01	1.091	10.00	0.00	0.00	690.47	C	VS
LL1204	1	LL.1204	312557	6070019	0-20	5.03	3.10	1.85	2.72	Medium	4.06	0.036	40.00	73.91	0.00	136.36	C	VS
LL1205	1	LL.1205	312481	6070172	0-10	5.16	2.61	1.53	2.48	Medium	4.84	0.005	34.00	0.00	0.00	37.12	SC	VS
LL1205	2	LL.1206	312481	6070172	10-30	6.91	4.18	1.58	2.26	Fine	3.47	0.152	136.00	119.19	0.00	349.99	C	VS
LL1205	3	LL.1207	312481	6070172	30-50	3.16	5.84	1.74	2.37	Fine	5.66	1.563	24.00	0.00	0.00	998.86	C	VS
LL1208	1	LL.1208	313561	6069469	0-10	3.59	3.26	2.11		Coarse	4.57	0.007	27.00	0.00	0.00	31.37	CS	VS
LL1208	2	LL.1209	313561	6069469	10-30	7.41	2.66	1.55	2.84	Medium	3.96	0.027	53.00	14.97	0.00	84.81	C	VS
LL1208	3	LL.1210	313561	6069469	30-50	2.94	7.88	1.72	2.07	Fine	6.65	0.660	0.00	0.00	0.58	334.39	C	VS
LL1211	1	LL.1211	313489	6069710	0-10	4.65	3.30	1.83	2.70	Fine	4.27	0.060	33.00	77.09	0.00	147.51	C	VS
LL1211	2	LL.1212	313489	6069710	10-30	6.16	4.59	1.62	2.70	Fine	4.50	0.817	42.00	0.00	0.00	551.57	C	VS
LL1211	3	LL.1213	313489	6069710	30-50	3.81	7.02	1.70	2.02	Fine	6.65	1.577	0.00	0.00	1.18	826.42	C	VS
LL1214	1	LL.1214	313400	6070038	0-20	7.19	6.32	6.34	1.95	Fine	7.36	0.209	0.00	0.00	1.56	-77.44	C	VS
LL1215	1	LL.1215	313323	6070304	0-10	5.02	7.18	5.92	7.32	Medium	7.68	0.230	0.00	0.00	3.28	-293.44	SC	S
LL1215	2	LL.1216	313323	6070304	10-30	5.27	3.09	1.57	2.09	Fine	4.75	0.081	26.00	0.00	0.00	76.52	C	VS
LL1215	3	LL.1217	313323	6070304	30-50	6.08	6.14	1.77	1.89	Fine	6.41	1.330	1.00	0.00	0.00	830.54	C	VS
LL1218	1	LL.1218	313314	6070361	0-10	0.24	6.77	4.15	6.71	Coarse	6.58	0.008	0.00	0.00	0.03	0.99	S	S
LL1218	2	LL.1219	313314	6070361	10-30	1.80	3.05	1.34	2.22	Medium	4.53	0.078	24.00	0.00	0.00	72.65	S	S
LL1218	3	LL.1220	313314	6070361	30-50	7.72	4.47	1.49	2.39	Coarse	6.25	0.235	3.00	0.00	0.00	149.57	S	S
LL1224	1	LL.1224	349984	6057014	0-10	3.96	7.62	6.59	7.51	Coarse	8.48	<0.005	0.00	0.00	0.18	-23.98	S	S
LL1224	2	LL.1225	349984	6057014	10-30	4.82	7.43	5.79	7.01	Coarse	7.00	<0.005	0.00	0.00	0.13	-17.32	S	S
LL1226	1	LL.1226	350305	6056899	0-10	2.70	7.56	6.42	7.57	Coarse	7.66	<0.005	0.00	0.00	0.08	-10.66	S	S
LL1226	2	LL.1227	350305	6056899	10-30	3.51	7.28	4.91		Coarse	6.60	0.010	0.00	0.00	0.29	-32.18	S	S
LL1228	1	LL.1228	324039	6080099	0-20	0.86	7.89	7.95	8.17	Fine	7.80	0.089	0.00	0.00	5.49	-676.39	C	VS
LL1229	1	LL.1229	331931	6081055	0-20	0.84	8.24	1.83	3.15	Fine	7.30	1.203	0.00	0.00	0.53	679.75	C	S
LL1230	1	LL.1230	333082	6083000	0-10	1.70	8.14	5.28	5.74	Coarse	7.80	0.008	0.00	0.00	0.17	-17.93	S	S
LL1230	2	LL.1231	333082	6083000	10-30	1.28	8.20	3.88	3.38	Coarse	7.30	0.014	0.00	0.00	0.15	-11.55	S	S
LL1232	1	LL.1232	335007	6081979	0-20	1.36	7.07	1.80	2.27	Coarse	6.86	0.186	0.00	0.00	0.19	91.13	LS	S
LL1233	1	LL.1233	335136	6085115	0-10	1.12	6.85	2.20	3.31	Fine	6.98	0.193	0.00	0.00	0.28	83.20	SC	S
LL1233	2	LL.1234	335136	6085115	10-30	0.64	7.61	1.70	2.14	Fine	6.63	1.056	0.00	0.00	0.41	603.75	C	S
LL1235	1	LL.1235	335016	6086044	0-10	1.04	6.90	1.93	3.42	Fine	6.50	0.874	0.00	0.00	0.26	510.46	SC	S
LL1235	2	LL.1236	335016	6086044	10-30	0.62	7.72	1.72	2.28	Medium	6.52	0.479	0.00	0.00	0.31	257.47	SC	S
LL1235	3	LL.1237	335016	6086044	30-50	0.84	8.06	2.31	2.54	Fine	6.73	0.693	0.00	0.00	1.10	285.78	PEAT	S
LL1238	1	LL.1238	337991	6083995	0-10	1.22	7.13	2.00	7.09	Fine	7.23	1.333	0.00	0.00	0.81	723.81	C	GEL
LL1238	2	LL.1239	337991	6083995	10-30	0.85	7.87	1.76	2.44	Fine	6.99	1.397	0.00	0.00	0.74	773.11	C	S
LL1238	3	LL.1240	337991	6083995	30-50	0.56	8.54	1.81	2.40	Fine	7.04	1.093	0.00	0.00	0.78	577.92	C	S
LL1241	1	LL.1241	339008	6086012	0-20	1.67	7.32	7.36	7.34	Fine	8.34	1.086	0.00	0.00	11.71	-882.91	C	S
LL1242	1	LL.1242	339022	6087007	0-10	1.63	7.14	2.37	6.55	Fine	7.89	0.266	0.00	0.00	0.55	93.30	C	GEL
LL1242	2	LL.1243	339022	6087007	10-30	0.66	7.42	1.78	1.83	Coarse	7.49	0.455	0.00	0.00	0.19	258.23	CS	S
LL1244	1	LL.1244	337986	6088009	0-20	1.47	7.22	7.37	7.06	Medium	9.06	0.446	0.00	0.00	0.83	168.28	SC	S
LL1245	1	LL.1245	339044	6088128	0-10	2.01	7.50	6.51	7.72	Coarse	9.30	<0.005	0.00	0.00	0.28	-37.32	S	S
LL1245	2	LL.1246	339044	6088128	10-30	2.16	7.56	5.45	3.91	Coarse	9.18	0.008	0.00	0.00	0.17	-17.93	S	S
LL1245	3	LL.1247	339044	6088128	30-50	1.57	7.51	4.92	6.15	Coarse	9.06	0.005	0.00	0.00	0.18	-20.86	S	S
LL1248	1	LL.1248	340115	6087921	0-10	1.57	7.74	6.25	5.68	Coarse	8.58	0.007	0.00	0.00	0.15	-15.61	S	S
LL1248	2	LL.1249	340115	6087921	10-30	1.25	7.71	4.33	3.64	Coarse	8.30	0.013	0.00	0.00	0.11	-6.54	S	S
LL1250	1	LL.1250	342012	6083999	0-20	1.40	7.19	6.83	7.21	Coarse	9.14	0.024	0.00	0.00	0.32	-27.65	S	S
LL1251	1	LL.1251	343034	6080992	0-20	1.35	7.10	1.73	3.28	Fine	7.53	1.184	0.00	0.00	0.29	699.85	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1252	1	LL.1252	346002	6079994	0-20	1.22	7.38	5.95	6.70	Medium	8.77	0.045	0.00	0.00	0.35	-18.55	SC	S
LL1253	1	LL.1253	350115	6082035	0-10	0.63	7.39	5.28	6.50	Coarse	7.40	0.006	0.00	0.00	0.00	3.74	S	S
LL1253	2	LL.1254	350115	6082035	10-30	0.67	6.86	2.48	4.78	Medium	7.58	0.059	0.00	0.00	0.06	28.81	SC	S
LL1253	3	LL.1255	350115	6082035	30-50	1.02	6.86	2.67	5.38	Medium	7.32	0.080	0.00	0.00	0.32	7.27	SC	S
LL1256	1	LL.1256	349020	6079111	0-10	0.74	7.04	6.05	6.52	Coarse	7.50	<0.005	0.00	0.00	0.06	-7.99	S	S
LL1256	2	LL.1257	349020	6079111	10-30	0.73	7.08	5.81	7.20	Coarse	7.10	<0.005	0.00	0.00	0.00	0.00	S	S
LL1256	3	LL.1258	349020	6079111	30-50	1.08	7.17	4.45	6.23	Coarse	7.34	0.006	0.00	0.00	0.00	3.45	S	S
LL1259	1	LL.1259	349995	6074955	0-10	1.09	7.34	1.97	2.54	Medium	6.59	0.421	0.00	0.00	0.08	251.83	SC	VS
LL1259	2	LL.1260	349995	6074955	10-30	0.72	7.75	1.72	2.39	Fine	6.88	2.410	0.00	0.00	0.72	1407.36	C	S
LL1259	3	LL.1261	349995	6074955	30-50	0.54	7.37	1.84	2.42	Fine	6.54	2.147	0.00	0.00	0.83	1228.36	C	S
LL1262	1	LL.1262	351026	6076011	0-10	0.72	7.49	2.11	2.43	Coarse	6.95	0.168	0.00	0.00	0.00	104.81	CS	VS
LL1262	2	LL.1263	351026	6076011	10-30	0.44	8.07	1.95	2.46	Coarse	6.73	0.074	0.00	0.00	0.00	45.98	CS	VS
LL1264	1	LL.1264	352012	6073993	0-10	2.03	6.79	5.25	7.45	Fine	7.63	0.229	0.00	0.00	1.34	-35.61	C	GEL
LL1264	2	LL.1265	352012	6073993	10-30	1.25	7.19	4.09	4.85	Fine	6.85	0.122	0.00	0.00	0.45	15.89	C	VS
LL1264	3	LL.1266	352012	6073993	30-50	0.36	7.20	2.75	3.87	Fine	7.17	1.609	0.00	0.00	0.43	946.09	C	S
LL1267	1	LL.1267	350980	6072974	0-10	1.12	7.58	7.10	7.24	Medium	8.78	0.080	0.00	0.00	4.70	-576.03	CS	VS
LL1267	2	LL.1268	350980	6072974	10-30	0.70	7.81	7.89	7.58	Coarse	9.38	0.261	0.00	0.00	13.87	-1685.35	S	S
LL1269	1	LL.1269	348975	6073006	0-10	1.23	7.02	1.82	2.22	Fine	7.50	2.340	0.00	0.00	0.80	1353.10	SC	VS
LL1269	2	LL.1270	348975	6073006	10-30	1.09	7.47	1.88	2.79	Fine	7.32	2.604	0.00	0.00	0.68	1532.66	C	S
LL1269	3	LL.1271	348975	6073006	30-50	1.58	7.84	1.81	2.42	Fine	7.51	1.946	0.00	0.00	0.90	1093.96	C	S
LL1272	1	LL.1272	348969	6072061	no sample-												ROCK	
LL1273	1	LL.1273	347971	6072029	0-10	1.73	7.11	5.55	7.41	Fine	8.18	0.181	0.00	0.00	1.06	-29.00	C	GEL
LL1273	2	LL.1274	347971	6072029	10-30	0.79	7.41	1.89	1.60	Coarse	7.24	0.193	0.00	0.00	0.03	116.27	CS	S
LL1281	1	LL.1281	332039	6078005	0-10	1.83	7.73	1.79	2.08	Fine	7.29	2.203	0.00	0.00	0.52	1304.46	C	S
LL1281	2	LL.1282	332039	6078005	10-30	1.48	8.70	1.76	2.46	Fine	7.34	2.434	0.00	0.00	1.17	1362.14	C	S
LL1283	1	LL.1283	331987	6076956	0-10	1.88	7.71	2.15	3.74	Fine	7.16	1.323	0.00	0.00	0.83	714.32	C	VS
LL1283	2	LL.1284	331987	6076956	10-30	1.51	8.23	1.88	2.86	Fine	7.10	2.449	0.00	0.00	0.96	1399.50	C	S
LL1283	3	LL.1285	331987	6076956	30-50	1.22	8.56	1.91	2.13	Fine	7.40	2.466	0.00	0.00	1.44	1345.52	C	S
LL1286	1	LL.1286	339985	6079002	0-10	1.49	7.65	1.91	3.23	Fine	6.99	1.443	0.00	0.00	0.50	833.79	C	S
LL1286	2	LL.1287	339985	6079002	10-30	1.26	8.16	1.95	2.68	Fine	7.14	2.479	0.00	0.00	1.09	1401.12	C	S
LL1286	3	LL.1288	339985	6079002	30-50	1.30	8.50	2.16	2.96	Fine	6.99	2.125	0.00	0.00	1.19	1166.20	C	S
LL1289	1	LL.1289	346025	6072972	0-10	0.92	6.86	2.12	3.58	Fine	6.74	0.240	0.00	0.00	0.29	111.62	SC	GEL
LL1289	2	LL.1290	346025	6072972	10-30	0.97	7.27	1.79	2.57	Fine	6.45	2.122	2.00	0.00	0.00	1325.32	C	S
LL1289	3	LL.1291	346025	6072972	30-50	1.06	7.82	1.81	2.45	Fine	6.64	2.449	0.00	0.00	1.11	1379.17	C	S
LL1292	1	LL.1292	341835	6075631	0-10	1.62	7.57	4.29	4.97	Coarse	7.14	0.010	0.00	0.00	0.05	-0.01	S	VS
LL1292	2	LL.1293	341835	6075631	10-30	1.16	7.72	2.88	3.74	Coarse	6.96	0.020	0.00	0.00	0.14	-6.01	S	S
LL1294	1	LL.1294	340818	6075090	0-10	1.09	8.45	2.02	3.38	Coarse	6.90	0.118	0.00	0.00	0.17	50.85	S	VS
LL1295	1	LL.1295	341044	6074825	0-10	1.17	8.33	3.92	6.40	Coarse	7.10	0.008	0.00	0.00	0.10	-8.90	S	S
LL1295	2	LL.1296	341044	6074825	10-30	1.07	8.19	2.41	5.21	Coarse	7.53	0.034	0.00	0.00	0.14	3.08	S	S
LL1301	1	LL.1301	335056	6077052	0-10	1.72	7.07	1.75	2.76	Fine	6.53	1.413	0.00	0.00	0.55	808.23	C	VS
LL1301	2	LL.1302	335056	6077052	10-30	1.24	8.25	1.76	2.50	Fine	6.89	2.492	0.00	0.00	1.09	1408.58	C	VS
LL1301		LL.1303	335056	6077052	no sample-													
LL1301	3	LL.1304	335056	6077052	30-50	1.23	8.50	1.77	2.48	Fine	6.91	2.130	0.00	0.00	1.49	1129.96	C	S
LL1305	1	LL.1305	333981	6075981	0-10	2.13	7.07	2.57	2.92	Fine	6.72	0.319	0.00	0.00	0.58	121.32	C	VS
LL1305	2	LL.1306	333981	6075981	10-30	1.44	8.04	1.65	2.34	Fine	6.89	2.315	0.00	0.00	1.23	1280.51	C	S
LL1305	3	LL.1307	333981	6075981	30-50	1.53	8.60	1.67	2.54	Fine	7.04	2.454	0.00	0.00	1.57	1321.56	C	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol $H^+ t^{-1}$)	RA (mol $H^+ t^{-1}$)	ANC (%$CaCO_3$)	NA (mol $H^+ t^{-1}$)	Field texture	Field consistence
LL1308	1	LL.1308	333011	6072993	0-10	1.90	7.10	2.02	3.58	Fine	6.43	0.661	1.91	0.00	0.00	414.23	C	S
LL1308	2	LL.1309	333011	6072993	10-30	1.47	8.58	1.73	3.01	Fine	6.94	2.255	0.00	0.00	1.60	1193.65	C	S
LL1308	3	LL.1310	333011	6072993	30-50	1.47	8.73	1.75	3.14	Fine	6.88	2.135	0.00	0.00	1.58	1121.52	C	S
LL1311	1	LL.1311	336860	6070848	0-10	1.37	8.26	2.62	3.04	Coarse	7.39	0.019	0.00	0.00	0.12	-3.53	S	S
LL1311	2	LL.1312	336860	6070848	10-30	1.81	8.41	2.97	4.99	Coarse	8.71	0.035	0.00	0.00	0.27	-13.76	LS	S
LL1311	3	LL.1313	336860	6070848	30-50	1.03	9.11	2.99	6.27	Coarse	8.70	0.230	0.00	0.00	0.74	44.41	LS	S
LL1314	1	LL.1314	334025	6069996	0-10	2.00	8.00	6.75	7.68	Coarse	8.82	0.001	0.00	0.00	0.03	-3.63	S	VS
LL1314	2	LL.1315	334025	6069996	10-30	1.40	7.68	6.13	6.74	Coarse	9.39	0.004	0.00	0.00	0.26	-32.16	CS	S
LL1314	3	LL.1316	334025	6069996	30-50	1.53	7.30	2.09	2.98	Coarse	9.08	0.033	0.00	0.00	0.15	1.26	S	S
LL1317	1	LL.1317	332019	6071033	0-10	2.24	6.93	4.52	5.67	Fine	7.60	0.220	0.00	0.00	1.22	-25.56	C	GEL
LL1317	2	LL.1318	332019	6071033	10-30	1.55	7.00	2.39	3.54	Fine	6.86	0.685	0.00	0.00	0.55	354.40	C	S
LL1317	3	LL.1319	332019	6071033	30-50	1.49	7.46	2.21	2.51	Medium	7.22	0.849	0.00	0.00	0.20	502.85	SC	S
LL1320	1	LL.1320	330395	6069865	0-20	1.63	8.39	1.60	3.55	Fine	7.04	1.628	0.00	0.00	1.50	815.89	PEAT	VS
LL1321	1	LL.1321	330445	6069793	0-20	1.33	8.48	1.48	3.32	Fine	7.34	1.894	0.00	0.00	1.72	952.33	PEAT	VS
LL1322	1	LL.1322	326266	6069010	0-20	2.14	8.56	2.06	2.55	Coarse	7.08	0.068	0.00	0.00	0.05	35.15	S	S
LL1323	1	LL.1323	325945	6067933	0-20	1.92	7.91	6.61	7.83	Coarse	9.54	0.013	0.00	0.00	4.83	-634.65	CS	S
LL1324	1	LL.1324	325916	6066825	no sample-													
LL1325	1	LL.1325	325798	6066831	0-10	1.88	7.67	6.48	7.53	Coarse	9.09	0.006	0.00	0.00	0.05	-3.34	S	S
LL1325	2	LL.1326	325798	6066831	10-30	1.57	8.92	2.81	7.40	Coarse	9.12	0.209	0.00	0.00	0.36	81.97	CS	S
LL1325	3	LL.1327	325798	6066831	30-50	2.37	8.60	1.66	3.15	Fine	7.86	1.152	0.00	0.00	1.19	560.60	C	S
LL1328	1	LL.1328	325204	6066062	0-20	1.88	7.69	6.26	7.45	Medium	9.16	0.349	0.00	0.00	2.19	-73.57	SC	VS
LL1329	1	LL.1329	324026	6064991	0-10	2.42	7.75	2.10	2.48	Coarse	7.67	0.006	0.00	0.00	0.09	-8.69	S	VS
LL1329	2	LL.1330	324026	6064991	10-30	2.17	8.49	1.82	3.22	Medium	7.81	0.280	0.00	0.00	0.20	148.15	SC	VS
LL1331	1	LL.1331	323983	6062991	0-10	3.54	7.29	2.02	3.82	Fine	8.70	0.399	0.00	0.00	5.06	-424.87	C	GEL
LL1331	2	LL.1332	323983	6062991	10-30	3.48	7.86	1.82	3.11	Fine	7.91	0.453	0.00	0.00	0.45	222.91	C	VS
LL1331	3	LL.1333	323983	6062991	30-50	5.77	8.18	2.02	3.17	Fine	8.09	1.489	0.00	0.00	1.42	739.22	C	S
LL1334	1	LL.1334	321034	6064048	0-10	2.94	8.27	1.72	5.53	Medium	7.45	0.281	0.00	0.00	0.17	152.17	C	GEL
LL1334	2	LL.1335	321034	6064048	10-30	4.37	8.41	1.69	5.76	Medium	7.48	0.391	0.00	0.00	0.28	205.86	SC	S
LL1336	1	LL.1336	320995	6066015	0-10	3.03	6.94	4.46	4.01	Fine	7.12	0.304	0.00	0.00	0.83	79.69	C	VS
LL1336	2	LL.1337	320995	6066015	10-30	2.45	7.30	2.23	2.95	Fine	7.11	1.235	0.00	0.00	0.99	638.51	C	S
LL1336	3	LL.1338	320995	6066015	30-50	2.89	8.03	2.21	4.82	Fine	8.16	0.858	0.00	0.00	0.86	420.55	C	S
LL1339	1	LL.1339	316992	6079012	0-20	1.31	8.61	8.24	7.98	Fine	8.84	0.663	0.00	0.00	5.36	-300.23	C	VS
LL1340	1	LL.1340	317977	6077989	0-10	2.24	7.20	2.23	3.16	Fine	7.37	1.460	0.00	0.00	0.60	830.59	C	S
LL1340	2	LL.1341	317977	6077989	10-30	1.10	8.54	7.71	6.79	Fine	8.38	1.848	0.00	0.00	2.10	872.71	C	F
LL1342	1	LL.1342	316640	6078998	0-20	1.07	8.59	1.99	6.40	Coarse	8.26	0.173	0.00	0.00	0.29	69.31	S	VS
LL1343	1	LL.1343	320023	6075982	0-10	2.11	7.25	1.77	3.49	Fine	6.59	0.842	0.00	0.00	0.61	443.70	C	S
LL1343	2	LL.1344	320023	6075982	10-30	1.68	7.48	1.69	2.72	Fine	6.51	2.601	0.00	0.00	1.02	1486.73	C	S
LL1343	3	LL.1345	320023	6075982	30-50	1.53	8.26	1.56	2.87	Fine	7.28	2.134	0.00	0.00	1.62	1115.07	C	F
LL1346	1	LL.1346	317001	6077003	0-20	0.95	9.44	8.70	8.27	Fine	9.00	0.184	0.00	0.00	1.66	-106.21	C	S
LL1347	1	LL.1347	317009	6076011	0-10	1.18	8.40	1.74	3.43	Medium	8.36	0.272	0.00	0.00	0.08	158.73	CS	VS
LL1347	2	LL.1348	317009	6076011	10-30	1.02	8.52	2.83	7.92	Medium	8.88	0.633	0.00	0.00	2.78	24.08	C	F
LL1349	1	LL.1349	315921	6075980	0-10	0.95	7.59	1.64	2.84	Medium	7.33	0.707	0.00	0.00	0.14	422.93	SC	VS
LL1349	2	LL.1350	315921	6075980	10-30	0.93	8.11	1.78	2.60	Fine	7.57	1.834	0.00	0.00	0.87	1027.99	C	S
LL1349	3	LL.1351	315921	6075980	30-50	1.11	8.05	1.89	2.70	Fine	7.12	1.376	0.00	0.00	0.59	780.30	C	S
LL1352	1	LL.1352	318009	6075988	0-10	1.90	7.34	2.11	4.83	Fine	7.39	0.488	0.00	0.00	0.32	261.81	C	GEL
LL1352	2	LL.1353	318009	6075988	10-30	1.17	8.32	1.89	3.30	Fine	7.24	0.725	0.00	0.00	0.44	393.21	C	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1354	1	LL.1354	318043	6075088	0-10	0.93	8.50	2.04	6.46	Coarse	7.16	0.127	0.00	0.00	0.00	79.21	S	VS
LL1354	2	LL.1355	318043	6075088	10-30	1.08	8.79	7.98	7.84	Medium	8.96	0.625	0.00	0.00	2.30	83.53	LS	S
LL1356	1	LL.1356	317897	6073061	0-10	2.35	7.11	2.01	2.97	Fine	6.76	0.784	0.00	0.00	0.36	441.39	C	S
LL1356	2	LL.1357	317897	6073061	10-30	1.30	8.20	1.87	2.61	Fine	7.23	2.443	0.00	0.00	0.88	1406.54	C	F
LL1356	3	LL.1358	317897	6073061	30-50	1.50	7.94	1.92	3.08	Fine	7.17	2.033	0.00	0.00	1.27	1099.50	C	F
LL1359	1	LL.1359	316712	6072985	0-10	1.42	7.61	1.95	1.90	Fine	7.04	0.621	0.00	0.00	0.14	368.59	C	VS
LL1359	2	LL.1360	316712	6072985	10-30	1.30	8.41	1.88	2.85	Fine	6.99	1.936	0.00	0.00	0.94	1082.15	C	F
LL1359	3	LL.1361	316712	6072985	30-50	1.47	8.12	1.84	3.22	Fine	7.11	1.757	0.00	0.00	0.99	963.65	C	F
LL1362	1	LL.1362	317993	6071964	0-10	1.30	7.86	7.65	7.50	Coarse	9.37	0.060	0.00	0.00	1.18	-119.27	S	VS
LL1363	1	LL.1363	318065	6071757	0-10	2.30	7.25	2.10	3.79	Fine	7.87	0.168	0.00	0.00	0.15	84.71	S	VS
LL1363	2	LL.1364	318065	6071757	10-30	1.62	7.98	1.76	2.30	Fine	7.51	1.725	0.00	0.00	0.80	969.18	C	S
LL1363	3	LL.1365	318065	6071757	30-50	1.08	8.05	1.71	2.47	Fine	7.31	1.046	0.00	0.00	0.74	553.79	C	S
LL1366		LL.1366	318138	6071359	no sample-				7.25						0.00	0.00		
LL1368	1	LL.1368	319349	6071964	0-10	1.48	8.85	7.69	7.37	Coarse	9.21	0.172	0.00	0.00	4.40	-478.35	S	VS
LL1369	1	LL.1369	321007	6071000	0-10	2.47	8.00	1.99	3.12	Medium	7.41	0.495	0.00	0.00	0.30	269.24	S	VS
LL1369	2	LL.1370	321007	6071000	10-30	3.99	7.63	1.73	2.23	Fine	7.54	2.463	0.00	0.00	1.08	1392.61	C	F
LL1369	3	LL.1371	321007	6071000	30-50	4.67	7.78	1.79	2.66	Fine	7.24	1.999	0.00	0.00	0.56	1171.77	C	F
LL1369		LL.1372	321007	6071000	no sample-												S	
LL1373		LL.1373	322033	6071012	no sample-												ROCK	
LL1374		LL.1374	322125	6071068	no sample-												ROCK	
LL1375		LL.1375	322066	6070613	no sample-												ROCK	
LL1376	1	LL.1376	326231	6072005	0-10	1.61	7.56	1.80	7.02	Coarse	9.39	0.028	0.00	0.00	0.27	-17.94	S	S
LL1376	2	LL.1377	326231	6072005	10-30	2.34	7.12	2.31	5.89	Coarse	6.97	0.014	0.00	0.00	0.10	-4.18	S	S
LL1378	1	LL.1378	322811	6076014	0-10	1.70	7.81	4.09	3.34	Fine	6.39	0.497	1.92	0.00	0.00	311.91	C	GEL
LL1378	2	LL.1379	322811	6076014	10-30	1.65	8.46	6.64	2.48	Fine	6.36	2.201	3.36	0.00	0.00	1376.15	C	S
LL1378	3	LL.1380	322811	6076014	30-50	5.48	7.59	1.86	2.92	Fine	7.07	2.217	0.00	0.00	1.41	1194.82	C	S
LL1501	1	LL.1501	331981	6083057	0-10	3.74	8.17	6.23	8.28	Coarse	9.17	<0.005	0.00	0.00	0.19	-25.28	S	VS
LL1501	2	LL.1502	331981	6083057	10-30	3.08	8.08	1.77	2.38	Coarse	7.26	0.043	0.00	0.00	0.01	25.49	S	S
LL1501	3	LL.1503	331981	6083057	30-50	0.27	6.93	1.79	2.29	Coarse	6.89	0.054	0.00	0.00	0.00	33.68	S	S
LL1504	1	LL.1504	330942	6082988	0-10	1.24	6.58	4.82	5.24	Coarse	6.53	0.006	0.00	0.00	0.05	-2.92	S	VS
LL1504	2	LL.1505	330942	6082988	10-30	1.46	7.23	4.77	5.98	Coarse	6.53	<0.005	0.00	0.00	0.00	0.00	S	S
LL1504	3	LL.1506	330942	6082988	30-50	1.98	7.45	4.96	7.22	Coarse	7.05	<0.005	0.00	0.00	0.11	-14.65	S	S
LL1507	1	LL.1507	331007	6082829	0-10	1.60	7.39	6.21	7.27	Coarse	7.09	<0.005	0.00	0.00	0.00	0.00	S	VS
LL1507	2	LL.1508	331007	6082829	10-30	2.24	7.77	3.62	7.33	Coarse	6.96	<0.005	0.00	0.00	0.04	-5.33	S	S
LL1507	3	LL.1509	331007	6082829	30-50	6.00	4.34	5.22		Coarse	6.80	<0.005	0.00	0.00	0.13	-17.32	S	S
LL1510	1	LL.1510	330141	6082823	0-10	2.52	2.90	3.63	4.20	Coarse	5.76	0.020	3.84	0.00	0.00	16.54	S	S
LL1510	2	LL.1511	330141	6082823	10-30	1.87	3.49	2.08	2.58	Coarse	4.76	<0.005	18.23	0.00	0.00	18.23	S	S
LL1510	3	LL.1512	330141	6082823	30-50	1.59	5.36	1.67	2.08	Coarse	5.81	<0.005	6.72	0.00	0.00	6.72	S	S
LL1513	1	LL.1513	328952	6082032	0-10	1.24	7.33	4.58	4.55	Coarse	6.25	0.074	1.44	0.00	0.00	47.29	S	S
LL1513	2	LL.1514	328952	6082032	10-30	1.26	8.61	2.01	2.32	Coarse	6.45	<0.005	1.44	0.00	0.00	1.44	S	S
LL1513	3	LL.1515	328952	6082032	30-50	1.08	4.83	1.90	2.38	Coarse	6.76	0.035	0.00	0.00	0.03	18.13	S	S
LL1516	1	LL.1516	328145	6081796	0-10	1.23	7.13	4.72	3.94	Coarse	6.18	0.048	1.92	0.00	0.00	32.02	S	S
LL1516	2	LL.1517	328145	6081796	10-30	1.30	7.14	1.89	2.28	Coarse	7.32	<0.005	0.00	0.00	0.09	-11.90	S	S
LL1516	3	LL.1518	328145	6081796	30-50	0.41	7.56	2.06	2.83	Coarse	6.33	0.033	0.96	0.00	0.00	21.55	S	S
LL1519	1	LL.1519	325315	6081657	0-10	1.05	8.01	5.68	6.67	Coarse	6.53	0.020	0.00	0.00	0.02	9.59	S	S
LL1519	2	LL.1520	325315	6081657	10-30	1.65	7.89	5.70	7.92	Coarse	7.96	<0.005	0.00	0.00	0.08	-10.04	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1}	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1521	1	LL.1521	325222	6081539	0-10	1.90	7.82	6.48	7.87	Coarse	8.15	<0.005	0.00	0.00	0.04	-5.63	S	S
LL1521	2	LL.1522	325222	6081539	10-30	1.90	7.56	5.64	6.62	Coarse	7.24	<0.005	0.00	0.00	0.08	-11.28	S	S
LL1521	3	LL.1523	325222	6081539	30-50	2.70	7.43	5.64	5.72	Coarse	7.07	<0.005	0.00	0.00	0.04	-5.00	S	S
LL1524	1	LL.1524	319946	6080960	0-10	2.61	7.46	7.06	7.53	Coarse	8.79	<0.005	0.00	0.00	0.04	-5.01	S	S
LL1524	2	LL.1525	319946	6080960	10-30	2.26	7.45	5.01	7.14	Coarse	7.43	<0.005	0.00	0.00	0.04	-5.63	S	S
LL1524	3	LL.1526	319946	6080960	30-50	2.15	7.53	4.62	6.90	Coarse	9.51	0.006	0.00	0.00	0.31	-37.92	S	S
LL1527	1	LL.1527	318988	6080930	0-10	2.59	7.72	6.18	7.54	Coarse	8.56	<0.005	0.00	0.00	0.14	-18.09	LS	S
LL1527	2	LL.1528	318988	6080930	10-30	2.42	5.36	2.68	4.41	Coarse	5.85	<0.005	2.48	0.00	0.00	2.48	LS	S
LL1527	3	LL.1529	318988	6080930	30-50	1.79	6.86	2.91	5.83	Fine	6.42	0.130	2.98	0.00	0.00	84.07	C	F
LL1530	1	LL.1530	316280	6079511	0-10	0.27	7.70	5.93	5.88	Medium	8.21	<0.005	0.00	0.00	0.10	-13.79	S	S
LL1530	2	LL.1531	316280	6079511	10-30	0.31	5.40	3.61	4.96	Medium	6.38	<0.005	0.99	0.00	0.00	0.99	S	S
LL1530	3	LL.1532	316280	6079511	30-50	0.88	5.10	3.56	4.86	Medium	5.92	<0.005	3.47	0.00	0.00	3.47	SL	F
LL1533	1	LL.1533	323065	6070053	0-10	4.00	7.56	6.62	7.56	Coarse	9.54	<0.005	0.00	0.00	0.47	-61.95	S	S
LL1533	2	LL.1534	323065	6070053	10-30	1.63	8.37	2.05	2.13	Coarse	7.53	0.137	0.00	0.00	0.53	14.54	S	S
LL1533	3	LL.1535	323065	6070053	30-50	1.19	8.56	2.10	2.01	Coarse	6.76	0.094	0.00	0.00	0.07	49.15	S	S
LL1536	1	LL.1536	325004	6070994	0-10	2.35	7.74	6.16	6.05	Coarse	9.51	<0.005	0.00	0.00	0.13	-16.95	S	S
LL1536	2	LL.1537	325004	6070994	10-30	1.24	8.83	1.81	2.92	Coarse	7.42	0.077	0.00	0.00	0.15	27.84	S	S
LL1536	3	LL.1538	325004	6070994	30-50	1.16	9.04	1.85	2.57	Coarse	6.72	0.068	0.00	0.00	0.21	14.26	S	S
LL1539	1	LL.1539	326253	6071993	0-10	1.81	8.16	5.92	7.48	Coarse	8.94	0.007	0.00	0.00	0.17	-18.50	S	S
LL1539	2	LL.1540	326253	6071993	10-30	1.47	9.00	3.73	6.36	Coarse	9.20	0.026	0.00	0.00	0.27	-19.88	S	S
LL1541	1	LL.1541	323558	6070152	0-10	2.29	7.72	6.51	8.00	Coarse	9.29	0.040	0.00	0.00	0.27	-11.19	S	S
LL1541	2	LL.1542	323558	6070152	10-30	0.96	8.57	2.19	2.34	Coarse	7.02	0.112	0.00	0.00	0.23	39.42	S	S
LL1541	3	LL.1543	323558	6070152	30-50	0.95	9.01	2.14	2.38	Coarse	6.68	0.111	0.00	0.00	0.14	50.28	S	S
LL1544	1	LL.1544	321334	6070428	0-10	1.78	7.74	6.18	7.82	Coarse	6.55	<0.005	0.00	0.00	0.12	-15.98	S	S
LL1544	2	LL.1545	321334	6070428	10-30	1.53	7.57	6.44	7.74	Coarse	8.98	<0.005	0.00	0.00	0.02	-2.66	S	S
LL1546	1	LL.1546	319939	6070993	0-10	2.37	7.40	2.07	4.25	Medium	7.08	0.053	0.00	0.00	0.31	-8.30	SC	S
LL1546	2	LL.1547	319939	6070993	10-30	3.11	7.48	8.43	7.64	Medium	8.63	0.452	0.00	0.00	10.75	-1150.15	SC	F
LL1548	1	LL.1548	319897	6071025	0-10	1.78	7.65	6.54	7.78	Coarse	9.59	0.008	0.00	0.00	0.43	-51.57	S	S
LL1548	2	LL.1549	319897	6071025	10-30	2.28	7.70	6.51	7.56	Coarse	9.58	0.020	0.00	0.00	0.51	-56.10	S	S
LL1548	3	LL.1550	319897	6071025	30-50	1.90	7.75	6.34	7.55	Coarse	9.48	0.015	0.00	0.00	0.51	-58.51	S	S
LL1551	1	LL.1551	315926	6071973	0-10	2.52	7.69	1.77	2.38	Coarse	7.48	0.163	0.00	0.00	0.28	64.97	S	S
LL1551	2	LL.1552	315926	6071973	10-30	2.28	8.14	2.03	2.91	Coarse	6.91	0.088	0.00	0.00	0.25	21.94	S	S
LL1551	3	LL.1553	315926	6071973	30-50	2.12	8.22	2.62	3.08	Medium	8.15	1.100	0.00	0.00	0.85	572.09	SC	S
LL1554	1	LL.1554	316010	6073030	0-10	2.01	8.16	1.78	2.35	Coarse	7.09	0.162	0.00	0.00	0.29	62.58	S	S
LL1554	2	LL.1555	316010	6073030	10-30	2.53	8.07	1.67	1.96	Coarse	6.62	0.220	0.00	0.00	0.38	86.45	S	S
LL1556	1	LL.1556	316051	6073920	0-10	3.02	7.68	2.67	2.93	Coarse	8.33	0.077	0.00	0.00	0.37	-0.91	S	S
LL1556	2	LL.1557	316051	6073920	10-30	2.46	7.49	2.18	2.82	Medium	6.71	1.329	0.00	0.00	0.34	783.80	C	F
LL1558	1	LL.1558	315117	6073897	0-10	1.68	4.30	2.50	3.92	Medium	5.22	0.021	8.80	0.00	0.00	21.72	S	S
LL1558	2	LL.1559	315117	6073897	10-30	2.17	6.05	4.65	5.83	Medium	5.58	0.009	13.21	0.00	0.00	18.98	C	F
LL1560	1	LL.1560	315092	6073100	0-10	3.15	6.48	1.94	3.56	Coarse	6.16	0.013	2.45	0.00	0.00	10.83	S	S
LL1560	2	LL.1561	315092	6073100	10-30	3.35	7.34	2.56	3.94	Medium	8.56	0.834	0.00	0.00	2.29	214.97	C	F
LL1562	1	LL.1562	317058	6074052	0-10	1.48	8.56	1.98	7.22	Coarse	8.16	0.131	0.00	0.00	0.33	37.25	S	S
LL1562	2	LL.1563	317058	6074052	10-30	1.19	8.60	6.57	4.37	Fine	8.50	1.001	0.00	0.00	1.28	454.07	C	F
LL1564	1	LL.1564	317025	6075068	0-10	1.15	3.33	2.42	3.15	Coarse	5.67	0.007	4.89	0.00	0.00	9.42	S	S
LL1564	2	LL.1565	317025	6075068	10-30	2.46	2.92	2.16	2.60	Coarse	5.01	0.008	6.36	0.00	0.00	11.41	S	S
LL1566	1	LL.1566	315937	6074993	0-10	2.32	7.00	6.07	6.84	Coarse	9.40	0.033	0.00	0.00	0.47	-42.04	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1566	2	LL.1567	315937	6074993	10-30	2.33	7.25	1.85	7.30	Coarse	9.35	0.100	0.00	0.00	1.26	-105.35	S	S
LL1566	3	LL.1568	315937	6074993	30-50	1.41	8.58	6.67	8.11	Medium	9.10	0.336	0.00	0.00	12.37	-1437.89	C	F
LL1569	1	LL.1569	315944	6074789	0-10	1.33	3.60	2.67	4.57	Coarse	6.60	0.005	0.00	0.00	0.22	-26.23	S	S
LL1569	2	LL.1570	315944	6074789	10-30	2.95	6.96	2.05	1.94	Medium	5.15	1.931	17.61	0.00	0.00	1221.69	C	F
LL1571	1	LL.1571	315079	6075751	0-10	1.72	3.12	2.22	2.86	Coarse	5.03	0.008	7.34	0.00	0.00	12.63	S	S
LL1571	2	LL.1572	315079	6075751	10-30	2.81	4.61	1.87	2.25	Medium	3.80	1.881	99.78	12.64	0.00	1285.70	C	F
LL1573	1	LL.1573	315292	6076925	0-10	0.27	3.54	3.24	3.02	Coarse	5.54	0.012	5.38	0.00	0.00	13.02	S	S
LL1573	2	LL.1574	315292	6076925	10-30	1.01	3.56	2.74	3.30	Coarse	5.24	0.007	4.89	0.00	0.00	9.01	S	S
LL1573	3	LL.1575	315292	6076925	30-50	1.85	5.15	3.35	3.57	Coarse	6.04	0.008	2.45	0.00	0.00	7.45	S	S
LL1576	1	LL.1576	316146	6077874	0-10	0.09	6.79	4.69	6.11	Coarse	6.29	0.005	1.47	0.00	0.00	4.73	S	S
LL1576	2	LL.1577	316146	6077874	10-30	0.26	4.83	3.63	4.51	Coarse	5.74	0.006	3.91	0.00	0.00	7.89	S	S
LL1576	3	LL.1578	316146	6077874	30-50	1.56	7.44	3.78	6.95	Coarse	6.50	0.008	0.00	0.00	0.33	-38.88	S	S
LL1579	1	LL.1579	316567	6079001	0-10	1.96	7.58	6.47	3.13	Coarse	9.43	0.009	0.00	0.00	0.37	-43.92	S	S
LL1579	2	LL.1580	316567	6079001	10-30	2.65	6.99	3.89	3.06	Coarse	6.88	0.009	0.00	0.00	0.29	-33.00	S	S
LL1581	1	LL.1581	306378	6074908	0-10	2.34	3.73	2.35	3.14	Coarse	5.22	0.011	8.19	0.00	0.00	15.06	S	S
LL1581	2	LL.1582	306378	6074908	10-30	3.82	7.05	1.35	2.13	Coarse	6.56	0.155	0.00	0.00	0.36	48.67	LS	S
LL1581	3	LL.1583	306378	6074908	30-50	2.71	7.56	1.27	2.38	Medium	6.45	0.559	0.96	0.00	0.00	349.81	SCL	F
LL1584	1	LL.1584	306390	6075059	0-10	2.62	7.00	1.68	2.25	Medium	5.82	0.648	17.35	0.00	0.00	421.78	SCL	F
LL1584	2	LL.1585	306390	6075059	10-30	5.03	6.60	1.35	1.93	Medium	6.15	1.195	10.12	0.00	0.00	755.76	C	F
LL1584	3	LL.1586	306390	6075059	30-50	3.95	7.82	1.58	2.11	Fine	6.81	1.756	0.00	0.00	1.65	875.71	C	F
LL1587	1	LL.1587	306414	6075179	0-10	4.16	7.32	1.60	2.41	Fine	6.79	0.965	0.00	0.00	1.03	465.00	C	F
LL1587	2	LL.1588	306414	6075179	10-30	5.61	7.37	1.27	2.04	Fine	6.51	1.228	0.00	0.00	0.96	637.83	C	F
LL1587	3	LL.1589	306414	6075179	30-50	4.03	7.72	1.50	2.49	Fine	6.92	1.763	0.00	0.00	1.39	914.71	C	F
LL1590	1	LL.1590	306589	6075360	0-10	8.04	7.20	1.40	1.95	Fine	6.55	1.324	0.00	0.00	0.88	708.41	C	VS
LL1590	2	LL.1591	306589	6075360	10-30	6.58	7.60	1.49	2.27	Fine	6.78	1.516	0.00	0.00	1.33	768.31	C	VS
LL1592	1	LL.1592	306706	6075522	0-10	3.83	6.98	4.66	7.06	Coarse	7.35	0.008	0.00	0.00	0.38	-45.49	S	VS
LL1592	2	LL.1593	306706	6075522	10-30	3.87	7.09	2.78	3.21	Coarse	7.01	0.020	0.00	0.00	0.27	-23.74	S	S
LL1592	3	LL.1594	306706	6075522	30-50	4.41	7.10	2.87	3.46	Coarse	6.95	0.015	0.00	0.00	0.33	-34.29	S	S
LL1595	1	LL.1595	305939	6077049	0-10	5.69	7.36	1.47	2.31	Fine	6.65	0.791	0.00	0.00	0.76	392.67	SC	VS
LL1595	2	LL.1596	305939	6077049	10-30	5.99	7.79	1.41	1.86	Fine	6.58	1.291	0.00	0.00	0.89	686.49	SC	S
LL1595	3	LL.1601	305939	6077049	30-50	3.67	8.31	1.56	2.37	Fine	6.75	1.680	0.00	0.00	1.68	823.95	C	S
LL1602	1	LL.1602	305956	6077214	0-10	12.63	7.06	1.56	3.38	Medium	7.47	0.466	0.00	0.00	1.08	146.71	C	VS
LL1602	2	LL.1603	305956	6077214	10-30	8.75	7.52	2.46	3.93	Medium	8.37	0.584	0.00	0.00	1.44	172.82	SCL	VS
LL1602	3	LL.1604	305956	6077214	30-50	3.82	8.05	6.37	7.66	Medium	8.91	0.632	0.00	0.00	4.62	-221.01	SCL	S
LL1605	1	LL.1605	304044	6069915	0-10	0.72	8.13	6.32	8.09	Coarse	9.07	0.017	0.00	0.00	1.02	-125.17	S	S
LL1605	2	LL.1606	304044	6069915	10-30	6.69	7.00	6.84	7.83	Coarse	8.95	0.100	0.00	0.00	23.47	-3063.73	CS	S
LL1605	3	LL.1607	304044	6069915	30-50	5.70	7.34	6.68	7.59	Coarse	9.45	0.195	0.00	0.00	37.79	-4912.47	CS	S
LL1608	1	LL.1608	303065	6069994	0-10	2.16	7.88	6.51	7.89	Medium	9.62	0.036	0.00	0.00	10.20	-1335.61	S	VS
LL1608	2	LL.1609	303065	6069994	10-30	7.10	7.40	6.68	7.48	Medium	8.06	0.589	0.00	0.00	26.60	-3175.43	SC	S
LL1608	3	LL.1610	303065	6069994	30-50	6.75	7.57	6.59	7.47	Medium	9.02	0.232	0.00	0.00	13.77	-1689.06	C	S
LL1611	1	LL.1611	303000	6070500	0-10	12.95	7.10	2.06	3.21	Medium	8.95	0.075	0.00	0.00	0.66	-40.42	SL	S
LL1611	2	LL.1612	303000	6070500	10-30	4.72	7.53	6.19	6.81	Medium	8.76	0.270	0.00	0.00	0.93	44.92	SCL	S
LL1611	3	LL.1613	303000	6070500	30-50	3.60	8.21	6.43	7.42	Medium	9.11	0.243	0.00	0.00	7.17	-803.43	SC	S
LL1614	1	LL.1614	302927	6070962	0-10	5.60	8.03	7.02	7.44	Medium	9.31	0.052	0.00	0.00	1.25	-133.63	S	VS
LL1614	2	LL.1615	302927	6070962	10-30	8.98	8.09	5.86	7.35	Medium	9.08	0.193	0.00	0.00	1.63	-96.35	SC	S
LL1614	3	LL.1616	302927	6070962	30-50	7.32	8.36	6.14	7.28	Medium	9.20	0.194	0.00	0.00	6.99	-809.79	SC	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1617	1	LL.1617	302646	6070789	0-10	4.49	7.17	4.14	4.67	Medium	8.64	0.001	0.00	0.00	0.71	-94.38	S	VS
LL1617	2	LL.1618	302646	6070789	10-30	4.97	6.76	4.69	7.55	Medium	9.21	0.026	0.00	0.00	5.59	-727.88	SCL	S
LL1617	3	LL.1619	302646	6070789	30-50	6.20	7.03	6.98	7.65	Coarse	9.32	0.082	0.00	0.00	36.14	-4762.60	SCL	S
LL1620	1	LL.1620	304972	6070211	0-10	7.15	7.32	6.41	7.73	Coarse	9.69	0.018	0.00	0.00	3.12	-404.25	S	S
LL1620	2	LL.1621	304972	6070211	10-30	9.58	7.33	6.79	7.53	Coarse	9.27	0.320	0.00	0.00	36.65	-4681.92	CS	S
LL1620	3	LL.1622	304972	6070211	30-50	6.96	7.73	6.75	7.69	Coarse	9.58	0.197	0.00	0.00	39.39	-5124.18	SL	S
LL1623	1	LL.1623	304997	6070162	0-10	8.77	7.38	6.80	7.54	Medium	9.46	0.171	0.00	0.00	17.25	-2190.98	CS	S
LL1623	2	LL.1624	304997	6070162	10-30	2.65	7.78	6.65	7.79	Medium	9.44	0.230	0.00	0.00	45.07	-5859.72	CS	S
LL1625	1	LL.1625	313246	6068509	0-10	4.63	7.15	5.84	7.47	Coarse	9.36	<0.005	0.00	0.00	0.54	-72.07	CS	S
LL1625	2	LL.1626	313246	6068509	10-30	1.79	7.04	1.95	2.36	Medium	7.66	0.280	0.00	0.00	0.54	102.47	CS	S
LL1625	3	LL.1627	313246	6068509	30-50	1.30	8.22	1.77	3.13	Medium	8.06	0.239	0.00	0.00	1.07	7.00	CS	S
LL1628	1	LL.1628	315844	6069265	0-10	2.59	7.77	6.60	7.16	Coarse	9.53	0.033	0.00	0.00	0.82	-88.34	CS	S
LL1628	2	LL.1629	315844	6069265	10-30	2.94	8.52	1.77	5.94	Coarse	8.39	0.111	0.00	0.00	0.46	8.37	CS	S
LL1630	1	LL.1630	317994	6067793	0-10	3.60	7.96	6.63	7.70	Coarse	9.67	0.007	0.00	0.00	0.85	-108.11	S	S
LL1630	2	LL.1631	317994	6067793	10-30	3.97	7.40	3.97	3.86	Coarse	8.46	0.017	0.00	0.00	0.62	-72.22	S	S
LL1630	3	LL.1632	317994	6067793	30-50	1.53	8.47	1.90	2.02	Coarse	7.84	0.145	0.00	0.00	0.47	27.71	CS	S
LL1633	1	LL.1633	319053	6067933	0-10	2.24	8.07	1.96	6.88	Coarse	8.80	0.018	0.00	0.00	0.53	-59.24	S	S
LL1633	2	LL.1634	319053	6067933	10-30	2.12	8.53	2.16	3.32	Coarse	8.31	0.051	0.00	0.00	0.05	25.35	S	S
LL1635	1	LL.1635	320079	6067955	0-10	3.96	7.63	2.94	2.59	Coarse	9.30	0.033	0.00	0.00	0.28	-16.90	S	S
LL1636	1	LL.1636	319049	6066070	0-10	2.70	8.25	6.45	5.92	Medium	8.03	0.131	0.00	0.00	0.20	55.34	SL	S
LL1636	2	LL.1637	319049	6066070	10-30	2.93	7.85	1.69	2.81	Medium	7.63	0.191	0.00	0.00	0.15	99.15	SL	S
LL1636	3	LL.1638	319049	6066070	30-50	2.99	8.11	1.79	2.10	Medium	7.57	0.173	0.00	0.00	0.28	70.64	SCL	S
LL1639	1	LL.1639	320250	6065151	0-10	1.80	3.79	3.16	3.83	Medium	7.01	<0.005	0.00	0.00	0.01	-1.33	S	S
LL1639	2	LL.1640	320250	6065151	10-30	2.80	3.35	2.55	3.23	Medium	5.97	<0.005	3.85	0.00	0.00	3.85	S	S
LL1639	3	LL.1641	320250	6065151	30-50	4.14	7.03	6.07	7.34	Medium	9.22	0.046	0.00	0.00	1.52	-173.77	S	S
LL1642	1	LL.1642	319170	6064610	0-10	9.87	7.57	6.34	7.63	Coarse	9.44	0.007	0.00	0.00	0.35	-42.25	S	S
LL1642	2	LL.1643	319170	6064610	10-30	7.03	7.62	6.39	7.85	Coarse	9.50	0.010	0.00	0.00	0.36	-41.71	S	S
LL1642	3	LL.1644	319170	6064610	30-50	6.05	8.06	6.69	7.94	Coarse	8.90	0.543	0.00	0.00	2.91	-48.94	SCL	S
LL1645	1	LL.1645	319324	6064128	0-10	6.51	7.55	6.69	7.88	Coarse	9.37	<0.005	0.00	0.00	1.70	-226.44	S	S
LL1645	2	LL.1646	319324	6064128	10-30	6.85	7.44	6.69	7.80	Coarse	9.54	0.017	0.00	0.00	1.71	-217.17	S	S
LL1645	3	LL.1647	319324	6064128	30-50	8.06	8.01	6.65	7.62	Medium	9.56	0.036	0.00	0.00	0.95	-104.09	S	S
LL1648	1	LL.1648	320822	6063092	0-10	6.49	5.49	3.82	7.36	Coarse	7.32	<0.005	0.00	0.00	0.00	0.00	S	S
LL1648	2	LL.1649	320822	6063092	10-30	3.00	6.28	4.15	3.94	Coarse	6.90	0.008	0.00	0.00	0.00	4.99	S	S
LL1648	3	LL.1650	320822	6063092	30-50	4.25	7.81	2.37	2.74	Coarse	8.12	0.023	0.00	0.00	0.03	10.35	S	S
LL1651	1	LL.1651	321203	6063364	0-10	3.08	7.44	6.90	7.43	Coarse	8.27	<0.005	0.00	0.00	0.03	-4.00	S	S
LL1651	2	LL.1652	321203	6063364	10-30	2.23	8.03	1.84	3.28	Coarse	7.05	0.076	0.00	0.00	0.08	36.75	S	S
LL1653	1	LL.1653	320923	6062009	0-10	5.62	7.35	6.40	7.44	Coarse	9.47	0.072	0.00	0.00	3.64	-439.94	SL	S
LL1653	2	LL.1654	320923	6062009	10-30	3.40	8.74	6.40	7.47	Coarse	9.17	0.159	0.00	0.00	1.40	-87.31	SL	S
LL1653	3	LL.1655	320923	6062009	30-50	2.62	8.87	2.16	3.26	Coarse	8.58	0.178	0.00	0.00	0.33	67.07	CS	S
LL1656	1	LL.1656	320200	6061950	0-10	6.61	5.05	3.76	4.19	Coarse	7.22	0.088	0.00	0.00	0.05	48.23	S	S
LL1656	2	LL.1657	320200	6061950	10-30	3.54	7.50	4.54	6.87	Coarse	9.24	0.008	0.00	0.00	0.29	-33.64	S	S
LL1656	3	LL.1658	320200	6061950	30-50	1.91	8.63	3.10	6.50	Coarse	8.79	0.174	0.00	0.00	0.35	61.91	CS	S
LL1659	1	LL.1659	320141	6061005	0-10	16.72	7.40	6.28	7.27	Coarse	9.54	0.008	0.00	0.00	0.24	-26.98	S	S
LL1659	2	LL.1660	320141	6061005	10-30	8.50	8.27	2.07	7.00	Coarse	9.31	0.130	0.00	0.00	1.07	-61.44	S	S
LL1659	3	LL.1661	320141	6061005	30-50	3.62	8.63	1.78	3.76	Medium	8.08	0.156	0.00	0.00	0.54	25.37	SCL	S
LL1662	1	LL.1662	320932	6061096	0-10	13.75	4.60	3.60	3.98	Coarse	8.39	<0.005	0.00	0.00	0.41	-54.61	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1662	2	LL.1663	320932	6061096	10-30	7.40	3.45	2.91	2.59	Coarse	5.49	0.015	4.80	0.00	0.00	14.16	S	S
LL1662	3	LL.1664	320932	6061096	30-50	4.42	7.69	1.72	2.41	Medium	6.63	0.147	0.00	0.00	0.45	31.75	SL	S
LL1665	1	LL.1665	321044	6060043	0-10	9.01	6.00	3.70	5.97	Coarse	6.20	0.014	1.90	0.00	0.00	10.63	S	S
LL1665	2	LL.1666	321044	6060043	10-30	4.90	4.96	1.64	1.95	Medium	4.69	0.168	21.13	0.00	0.00	125.91	SCL	S
LL1665	3	LL.1667	321044	6060043	30-50	2.44	7.69	1.75	2.40	Medium	7.84	0.315	0.00	0.00	0.66	108.56	SC	S
LL1668	1	LL.1668	321985	6061033	0-10	4.24	7.69	1.57	7.74	Coarse	9.71	0.015	0.00	0.00	3.94	-515.45	S	S
LL1669	1	LL.1669	335723	6089854	0-10	4.90	2.62	1.35	2.29	Medium	4.03	0.362	110.44	102.07	0.00	438.29	SC	S
LL1669	2	LL.1670	335723	6089854	10-30	3.86	5.65	6.72	1.87	Fine	3.84	1.814	106.37	21.61	0.00	1259.40	C	F
LL1669	3	LL.1671	335723	6089854	30-50	1.82	7.64	1.67	1.86	Fine	5.78	1.885	9.06	0.00	0.00	1184.76	C	F
LL1672	1	LL.1672	335377	6090661	0-10	6.80	2.41	1.57	2.22	Medium	3.86	0.026	58.19	28.91	0.00	103.32	SL	F
LL1672	2	LL.1673	335377	6090661	10-30	8.43	2.18	1.30	2.32	Medium	3.15	0.437	270.45	23.48	0.00	566.50	SC	F
LL1672	3	LL.1674	335377	6090661	30-50	6.44	2.20	1.46	1.71	Medium	3.19	0.305	242.31	56.23	0.00	488.77	C	F
LL1675	1	LL.1675	335809	6090361	0-10	2.90	2.91	1.38	2.50	Medium	3.88	0.139	61.53	38.08	0.00	186.30	SC	F
LL1675	2	LL.1676	335809	6090361	10-30	3.58	3.71	1.62	1.75	Fine	3.69	1.229	151.68	9.45	0.00	927.67	C	F
LL1675	3	LL.1677	335809	6090361	30-50	1.92	6.87	1.70	1.92	Fine	6.29	1.348	3.34	0.00	0.00	844.10	C	F
LL1678	1	LL.1678	336317	6089935	0-10	4.67	3.83	1.64	2.58	Fine	4.35	0.924	33.87	33.77	0.00	643.95	C	S
LL1678	2	LL.1679	336317	6089935	10-30	3.70	6.04	1.55	1.80	Fine	5.62	1.852	26.23	0.00	0.00	1181.35	C	F
LL1678	3	LL.1680	336317	6089935	30-50	2.37	7.02	1.74	1.74	Fine	6.25	2.073	8.11	0.00	0.00	1300.89	C	F
LL1681	1	LL.1681	337087	6090000	0-10	3.16	6.58	1.87	2.60	Medium	6.34	0.355	9.54	0.00	0.00	231.06	C	F
LL1681	2	LL.1682	337087	6090000	10-30	1.62	8.03	1.74	1.75	Medium	5.78	1.253	15.74	0.00	0.00	797.12	C	F
LL1681	3	LL.1683	337087	6090000	30-50	2.94	6.57	1.72	1.93	Fine	6.64	1.461	0.00	0.00	0.93	787.21	C	F
LL1686	1	LL.1686	337126	6090767	0-10	2.30	7.08	1.84	6.73	Medium	7.54	0.144	0.00	0.00	0.84	-22.37	C	F
LL1686	2	LL.1687	337126	6090767	10-30	1.58	7.18	1.61	1.99	Medium	6.34	0.957	9.06	0.00	0.00	605.89	C	F
LL1686	3	LL.1688	337126	6090767	30-50	1.33	7.80	1.76	2.45	Fine	6.31	0.815	4.77	0.00	0.00	513.10	C	F
LL1689	1	LL.1689	338162	6089539	0-10	4.19	3.38	1.64	2.07	Medium	3.67	0.418	127.83	29.10	0.00	417.92	C	F
LL1689	2	LL.1690	338162	6089539	10-30	2.20	7.22	1.73	2.12	Medium	4.65	0.821	39.59	0.00	0.00	551.85	C	F
LL1689	3	LL.1691	338162	6089539	30-50	1.47	7.15	1.86	2.66	Medium	6.38	0.802	5.72	0.00	0.00	506.10	C	F
LL1692	1	LL.1692	339002	6089132	0-10	0.52	7.53	5.03	6.80	Coarse	6.37	<0.005	1.43	0.00	0.00	1.43	S	S
LL1692	2	LL.1693	339002	6089132	10-30	1.17	4.68	4.17	4.48	Coarse	6.15	<0.005	2.86	0.00	0.00	2.86	S	S
LL1692	3	LL.1694	339002	6089132	30-50	1.70	6.18	3.33	3.42	Coarse	6.25	0.007	1.43	0.00	0.00	5.84	S	S
LL1695	1	LL.1695	334997	6088062	0-10	1.58	7.93	6.29	6.56	Medium	7.85	0.103	0.00	0.00	0.64	-20.96	SC	S
LL1696	1	LL.1696	333933	6087868	0-10	0.66	3.60	2.65	3.89	Coarse	6.51	<0.005	0.00	0.00	0.40	-53.28	S	S
LL1696	2	LL.1701	333933	6087868	10-30	2.31	3.02	2.29	3.06	Coarse	4.90	<0.005	7.15	0.00	0.00	7.15	S	S
LL1696	3	LL.1702	333933	6087868	30-50	4.13	2.68	1.64	2.74	Coarse	4.54	0.028	20.03	0.00	0.00	37.27	S	S
LL1703	1	LL.1703	333000	6086965	0-10	5.76	6.96	4.28	7.03	Coarse	6.46	<0.005	1.43	0.00	0.00	1.43	S	S
LL1703	2	LL.1704	333000	6086965	10-30	4.08	7.07	7.49	2.12	Medium	7.88	0.100	0.00	0.00	1.38	-121.37	SC	F
LL1705	1	LL.1705	333342	6087023	0-10	2.86	7.41	6.83	6.40	Coarse	9.11	<0.005	0.00	0.00	0.64	-85.25	S	S
LL1705	2	LL.1706	333342	6087023	10-30	4.17	8.01	5.64	4.21	Medium	8.41	0.432	0.00	0.00	0.86	154.85	SC	S
LL1707	1	LL.1707	339050	6088117	0-20	1.88	8.10	6.21	6.77	Coarse	8.42	0.009	0.00	0.00	0.47	-57.04	S	S
LL1708	1	LL.1708	339087	6088186	0-10	1.58	7.96	6.07	7.13	Coarse	7.26	<0.005	0.00	0.00	1.14	-151.85	S	S
LL1708	2	LL.1709	339087	6088186	10-30	1.89	7.63	1.87	3.25	Coarse	8.89	0.050	0.00	0.00	0.62	-51.53	S	S
LL1710	1	LL.1710	339981	6089724	0-10	3.84	7.65	6.58	7.86	Coarse	9.15	0.009	0.00	0.00	0.65	-80.73	S	S
LL1710	2	LL.1711	339981	6089724	10-30	4.72	7.03	3.58	5.57	Medium	7.38	0.016	0.00	0.00	0.52	-59.53	S	S
LL1710	3	LL.1712	339981	6089724	30-50	3.16	6.62	3.50	5.12	Medium	6.59	0.009	0.00	0.00	0.54	-66.19	SC	S
LL1713	1	LL.1713	340008	6089774	0-10	3.47	7.03	4.35	5.40	Coarse	6.38	<0.005	1.43	0.00	0.00	1.43	S	S
LL1713	2	LL.1714	340008	6089774	10-30	1.05	7.06	4.24	6.69	Coarse	6.86	0.006	0.00	0.00	0.56	-71.14	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1713	3	LL.1715	340008	6089774	30-50	0.91	6.65	4.14	5.14	Coarse	7.38	0.006	0.00	0.00	0.55	-69.43	S	S
LL1716	1	LL.1716	344728	6085091	0-10	3.57	8.13	7.45	7.70	Coarse	9.28	<0.005	0.00	0.00	0.68	-90.58	S	S
LL1716	2	LL.1717	344728	6085091	10-30	1.58	7.33	5.29	6.47	Coarse	8.98	<0.005	0.00	0.00	0.53	-70.60	S	S
LL1716	3	LL.1718	344728	6085091	30-50	1.73	6.90	4.69	5.91	Coarse	7.58	0.007	0.00	0.00	0.50	-62.23	S	S
LL1719	1	LL.1719	345792	6083722	0-10	1.57	7.43	5.76	7.10	Coarse	7.82	<0.005	0.00	0.00	0.42	-55.94	S	S
LL1719	2	LL.1720	345792	6083722	10-30	0.75	7.66	5.96	7.92	Coarse	6.24	<0.005	1.44	0.00	0.00	1.44	S	S
LL1721	1	LL.1721	345727	6083665	0-10	2.42	7.82	6.66	7.82	Coarse	8.29	<0.005	0.00	0.00	0.48	-63.94	S	S
LL1721	2	LL.1722	345727	6083665	10-30	1.53	7.90	7.11	7.79	Coarse	8.06	<0.005	0.00	0.00	0.47	-62.60	S	S
LL1721	3	LL.1723	345727	6083665	30-50	0.96	7.50	4.09	5.38	Medium	6.79	0.005	0.00	0.00	0.50	-63.53	LS	S
LL1724	1	LL.1724	345708	6083649	0-10	1.25	7.51	6.43	5.29	Medium	6.79	0.006	0.00	0.00	0.58	-73.81	LS	S
LL1724	2	LL.1725	345708	6083649	10-30	0.82	6.71	3.49	5.12	Medium	6.28	0.011	0.00	0.00	0.00	7.03	LS	S
LL1726	1	LL.1726	346972	6080964	0-10	2.87	7.57	6.94	7.84	Coarse	8.38	<0.005	0.00	0.00	0.52	-69.26	S	S
LL1726	2	LL.1727	346972	6080964	10-30	2.76	7.49	6.17	7.64	Coarse	7.23	<0.005	0.00	0.00	0.53	-70.60	S	S
LL1726	3	LL.1728	346972	6080964	30-50	3.27	7.49	3.08	4.05	Medium	8.63	0.029	0.00	0.00	0.05	11.69	SC	S
LL1729	1	LL.1729	347867	6081511	0-10	1.73	7.40	4.21	7.55	Coarse	7.45	<0.005	0.00	0.00	0.00	0.00	S	S
LL1729	2	LL.1730	347867	6081511	10-30	1.49	7.30	2.63	4.21	Coarse	6.55	0.008	0.00	0.00	0.00	4.70	S	S
LL1729	3	LL.1731	347867	6081511	30-50	1.29	6.99	3.29	4.44	Medium	6.58	0.010	0.00	0.00	0.00	6.50	SL	S
LL1732	1	LL.1732	347876	6081501	0-10	1.07	7.31	4.52	5.17	Medium	5.90	<0.005	1.92	0.00	0.00	1.92	S	S
LL1732	2	LL.1733	347876	6081501	10-30	0.70	7.04	3.52	4.87	Medium	6.48	0.005	0.96	0.00	0.00	4.37	S	S
LL1734	1	LL.1734	348850	6082182	0-10	1.58	7.36	6.84	7.38	Coarse	6.51	<0.005	0.00	0.00	0.00	0.00	S	S
LL1734	2	LL.1735	348850	6082182	10-30	0.90	7.40	2.37	5.61	Coarse	6.27	0.011	1.92	0.00	0.00	8.70	S	S
LL1734	3	LL.1736	348850	6082182	30-50	0.88	8.05	1.67	2.75	Coarse	6.65	0.058	0.00	0.00	0.00	36.35	S	S
LL1737	1	LL.1737	348855	6082269	0-10	2.06	3.89	3.08	3.67	Medium	6.05	<0.005	4.80	0.00	0.00	4.80	S	S
LL1737	2	LL.1738	348855	6082269	10-30	3.58	3.05	2.19	2.61	Medium	4.61	0.005	7.20	0.00	0.00	10.33	S	S
LL1739	1	LL.1739	349036	6078954	0-10	0.79	6.79	5.00	6.82	Coarse	6.35	<0.005	1.92	0.00	0.00	1.92	S	S
LL1739	2	LL.1740	349036	6078954	10-30	0.66	7.32	4.27	5.40	Coarse	6.63	0.006	0.00	0.00	0.00	3.59	S	S
LL1741	1	LL.1741	350077	6076105	0-10	1.34	6.20	3.84	4.66	Coarse	6.53	<0.005	0.00	0.00	0.00	0.00	S	S
LL1741	2	LL.1742	350077	6076105	10-30	2.30	6.96	3.60	4.69	Coarse	6.07	0.005	2.88	0.00	0.00	5.96	S	S
LL1741	3	LL.1743	350077	6076105	30-50	1.52	7.10	2.78	3.10	Coarse	9.34	0.016	0.00	0.00	0.09	-1.70	S	S
LL1744	1	LL.1744	350058	6076367	0-10	0.53	7.32	6.42	4.70	Coarse	8.16	<0.005	0.00	0.00	0.03	-4.00	S	S
LL1744	2	LL.1745	350058	6076367	10-30	1.35	4.70	1.76	2.00	Coarse	5.84	0.006	2.88	0.00	0.00	6.78	S	S
LL1744	3	LL.1746	350058	6076367	30-50	1.75	6.17	1.70	2.03	Coarse	5.40	0.058	5.76	0.00	0.00	41.94	S	S
LL1748	1	LL.1747	350068	6076039	10-30	2.10	7.70	4.47		Coarse	6.51	0.017	0.00	0.00	0.00	10.60	S	S
LL1748	2	LL.1748	350068	6076039	0-10	0.64	3.56	4.08	4.73	Coarse	6.89	0.034	0.00	0.00	0.00	21.21	S	S
LL1749	1	LL.1749	351022	6076982	0-10	2.45	2.99	5.48	6.73	Coarse	9.51	0.023	0.00	0.00	0.11	-0.31	S	S
LL1749	2	LL.1750	351022	6076982	10-30	4.07	2.69	1.61	2.74	Coarse	6.42	0.054	5.28	0.00	0.00	38.96	S	S
LL1751	1	LL.1751	351889	6075854	0-10	5.75	6.79	6.45	7.78	Coarse	9.42	0.019	0.00	0.00	0.03	7.85	S	S
LL1751	2	LL.1752	351889	6075854	10-30	4.63	7.08	6.42	4.47	Coarse	8.87	0.031	0.00	0.00	0.12	3.35	S	S
LL1751	3	LL.1753	351889	6075854	30-50	2.96	7.43	3.69	5.92	Coarse	7.45	0.006	0.00	0.00	0.06	-4.25	S	S
LL1754	1	LL.1754	352051	6073873	0-20	4.52	8.01	4.41	5.62	Fine	7.01	0.180	0.00	0.00	1.26	-55.56	C	F
LL1755	1	LL.1755	352086	6073824	0-10	1.90	8.06	6.71	7.94	Coarse	9.01	0.005	0.00	0.00	0.13	-14.20	S	F
LL1755	2	LL.1756	352086	6073824	10-30	1.77	7.96	6.68	7.84	Coarse	9.42	0.009	0.00	0.00	0.13	-11.70	S	S
LL1755	3	LL.1757	352086	6073824	30-50	3.66	7.67	6.79	7.82	Coarse	9.07	0.008	0.00	0.00	0.03	0.99	S	S
LL1758	1	LL.1758	352080	6073792	0-10	4.74	7.13	6.50	7.79	Coarse	9.51	<0.005	0.00	0.00	0.05	-6.66	S	S
LL1758	2	LL.1759	352080	6073792	10-30	4.58	6.69	4.28	4.74	Coarse	7.04	<0.005	0.00	0.00	0.00	0.00	S	S
LL1758	3	LL.1760	352080	6073792	30-50	3.58	7.02	3.36	4.30	Coarse	7.65	0.009	0.00	0.00	0.00	5.61	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1}	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1761	1	LL.1761	339304	6089898	0-10	1.02	7.05	2.52	6.20	Medium	6.84	0.025	0.00	0.00	0.00	15.59	SC	VS
LL1761	2	LL.1762	339304	6089898	10-30	3.44	7.92	2.32	4.29	Medium	6.43	0.042	1.44	0.00	0.00	27.64	SC	S
LL1761	3	LL.1763	339304	6089898	30-50	1.53	7.43	2.65	5.06	Medium	6.38	0.028	2.88	0.00	0.00	20.34	SCL	S
LL1765	1	LL.1765	333876	6070022	0-10	1.62	7.69	5.11	4.82	Coarse	9.71	<0.005	0.00	0.00	0.70	-93.24	S	S
LL1765	2	LL.1766	333876	6070022	10-30	1.92	7.68	4.75	6.38	Coarse	7.22	0.008	0.00	0.00	0.35	-41.63	S	S
LL1767	1	LL.1767	333865	6069961	0-10	4.14	6.94	5.86	7.17	Coarse	9.03	<0.005	0.00	0.00	0.56	-74.59	S	S
LL1767	2	LL.1768	333865	6069961	10-30	3.51	7.91	5.64	7.43	Coarse	8.22	<0.005	0.00	0.00	0.37	-49.28	S	S
LL1767	3	LL.1769	333865	6069961	30-50	2.64	7.66	2.05	5.00	Coarse	9.62	0.037	0.00	0.00	0.69	-68.83	S	S
LL1770	1	LL.1770	332190	6070688	0-10	1.84	7.85	6.33	7.07	Coarse	8.55	0.006	0.00	0.00	0.53	-66.85	S	S
LL1770	2	LL.1771	332190	6070688	10-30	2.99	7.69	6.57	7.32	Medium	9.30	0.068	0.00	0.00	1.52	-159.83	S	S
LL1772	1	LL.1772	330967	6070164	0-10	2.96	7.97	6.62	7.74	Coarse	8.91	<0.005	0.00	0.00	0.45	-59.94	S	S
LL1772	2	LL.1773	330967	6070164	10-30	3.24	7.18	4.45	7.41	Coarse	8.75	<0.005	0.00	0.00	0.41	-54.61	S	S
LL1772	3	LL.1774	330967	6070164	30-50	2.26	6.99	4.18	6.78	Coarse	7.25	<0.005	0.00	0.00	0.39	-51.95	S	S
LL1775	1	LL.1775	327996	6068355	0-10	2.35	8.02	6.26	7.47	Coarse	8.77	<0.005	0.00	0.00	0.43	-57.28	S	S
LL1775	2	LL.1776	327996	6068355	10-30	1.70	5.84	4.09	5.33	Coarse	6.32	0.005	1.92	0.00	0.00	4.85	S	S
LL1775	3	LL.1777	327996	6068355	30-50	2.71	7.06	4.49	6.26	Coarse	7.15	0.005	0.00	0.00	0.39	-49.10	S	S
LL1778	1	LL.1778	328181	6068201	0-10	0.46	7.69	5.79	7.28	Coarse	6.39	<0.005	1.44	0.00	0.00	1.44	S	S
LL1778	2	LL.1779	328181	6068201	10-30	1.02	7.72	6.24	7.25	Coarse	8.99	<0.005	0.00	0.00	0.54	-71.93	S	S
LL1778	3	LL.1780	328181	6068201	30-50	1.91	7.79	6.13	7.45	Coarse	9.39	0.005	0.00	0.00	0.38	-47.57	S	S
LL1781	1	LL.1781	328165	6068220	0-10	2.40	7.86	6.27	7.71	Coarse	9.41	0.006	0.00	0.00	0.63	-80.41	S	S
LL1781	2	LL.1782	328165	6068220	10-30	1.95	7.69	6.26	7.62	Coarse	9.56	0.233	0.00	0.00	11.69	-1411.58	S	S
LL1781	3	LL.1783	328165	6068220	30-50	2.39	8.18	6.30	8.05	Coarse	9.71	0.262	0.00	0.00	18.25	-2267.30	S	S
LL1784	1	LL.1784	327926	6068459	0-10	3.17	8.46	6.80	8.24	Coarse	9.72	0.005	0.00	0.00	0.77	-99.61	S	S
LL1784	2	LL.1785	327926	6068459	10-30	4.36	8.10	6.54	6.92	Coarse	7.79	0.026	0.00	0.00	0.32	-26.67	S	S
LL1784	3	LL.1786	327926	6068459	30-50	4.37	8.17	6.60	6.52	Coarse	8.30	0.036	0.00	0.00	0.42	-33.54	S	S
LL1787	1	LL.1787	327919	6068475	0-10	6.44	8.19	7.04	7.62	Coarse	9.17	0.028	0.00	0.00	0.78	-86.68	S	S
LL1787	2	LL.1788	327919	6068475	10-30	9.51	8.05	6.97	7.58	Coarse	9.26	0.036	0.00	0.00	0.84	-89.17	S	S
LL1789	1	LL.1789	326686	6068360	0-10	2.42	7.96	2.76	7.81	Coarse	9.09	0.014	0.00	0.00	0.48	-55.51	S	S
LL1789	2	LL.1790	326686	6068360	10-30	2.68	8.39	1.85	5.28	Coarse	8.00	0.046	0.00	0.00	0.45	-31.27	S	S
LL1791	1	LL.1791	327001	6066971	0-10	3.46	7.85	6.36	6.37	Coarse	9.19	0.005	0.00	0.00	0.52	-66.33	S	S
LL1791	2	LL.1792	327001	6066971	10-30	2.87	6.97	3.56	6.10	Coarse	7.49	<0.005	0.00	0.00	0.34	-45.29	S	S
LL1791	3	LL.1793	327001	6066971	30-50	2.94	8.05	1.60	2.17	Fine	7.05	1.701	0.00	0.00	1.47	865.03	C	S
LL1794	1	LL.1794	326713	6067088	0-10	2.58	7.76	6.19	5.23	Coarse	7.16	0.008	0.00	0.00	0.27	-30.91	S	S
LL1794	2	LL.1795	326713	6067088	10-30	2.21	6.73	4.26	3.77	Coarse	7.03	<0.005	0.00	0.00	0.32	-42.62	S	S
LL1794	3	LL.1796	326713	6067088	30-50	1.69	7.81	1.74	2.28	Coarse	7.10	0.079	0.00	0.00	0.44	-9.33	S	S
LL1801	1	LL.1801	326593	6067164	0-10	3.28	7.57	6.42	7.42	Coarse	7.10	<0.005	0.00	0.00	0.28	-37.30	S	S
LL1801	2	LL.1802	326593	6067164	10-30	4.35	7.94	1.76	2.49	Coarse	7.09	0.049	0.00	0.00	1.72	-198.54	CS	S
LL1801	3	LL.1803	326593	6067164	30-50	2.00	8.38	1.77	2.38	Medium	6.99	0.337	0.00	0.00	0.55	136.93	SC	S
LL1804	1	LL.1804	325793	6062905	0-10	2.44	8.00	5.63	6.77	Coarse	7.76	<0.005	0.00	0.00	0.32	-42.62	S	S
LL1804	2	LL.1805	325793	6062905	10-30	2.50	7.17	3.73	4.24	Coarse	6.98	0.007	0.00	0.00	0.32	-38.26	S	S
LL1804	3	LL.1806	325793	6062905	30-50	2.06	8.37	2.12	3.53	Coarse	8.76	0.079	0.00	0.00	0.28	11.98	S	S
LL1807	1	LL.1807	326031	6061914	0-10	0.72	3.34	2.12	3.08	Coarse	5.67	0.006	11.51	0.00	0.00	15.37	S	S
LL1807	2	LL.1808	326031	6061914	10-30	0.92	3.29	2.15	2.76	Coarse	4.92	<0.005	12.47	0.00	0.00	12.47	S	S
LL1807	3	LL.1809	326031	6061914	30-50	1.95	3.10	2.45	2.81	Coarse	5.02	<0.005	11.03	0.00	0.00	11.03	S	S
LL1810	1	LL.1810	325945	6061835	0-10	2.04	5.10	3.85	4.91	Coarse	6.55	<0.005	0.00	0.00	0.30	-39.96	S	S
LL1810	2	LL.1811	325945	6061835	10-30	1.82	6.67	2.16	2.61	Coarse	6.46	0.023	0.96	0.00	0.00	15.05	S	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1810	3	LL.1812	325945	6061835	30-50	1.88	8.51	1.72	2.92	Coarse	6.68	0.098	0.00	0.00	0.00	61.41	SL	S
LL1813	1	LL.1813	325621	6061776	0-10	4.33	7.69	3.68	6.97	Coarse	7.09	0.039	0.00	0.00	0.41	-29.98	LS	S
LL1813	2	LL.1814	325621	6061776	10-30	2.51	7.96	1.66	2.84	Medium	6.83	0.203	0.00	0.00	0.42	70.40	SCL	S
LL1813	3	LL.1815	325621	6061776	30-50	2.21	8.15	1.66	2.56	Medium	6.63	0.265	0.00	0.00	1.88	-85.02	SCL	F
LL1816	1	LL.1816	325017	6061866	0-10	4.17	4.03	3.49	3.42	Coarse	6.39	<0.005	1.44	0.00	0.00	1.44	S	S
LL1816	2	LL.1817	325017	6061866	10-30	3.73	3.55	1.66	2.21	Medium	4.62	0.109	19.18	0.00	0.00	87.37	LS	S
LL1816	3	LL.1818	325017	6061866	30-50	2.40	6.28	1.81	2.75	Medium	6.39	0.222	4.32	0.00	0.00	142.69	SCL	S
LL1819	1	LL.1819	324995	6061932	0-10	2.33	3.75	3.36	3.71	Coarse	5.95	<0.005	3.84	0.00	0.00	3.84	S	S
LL1819	2	LL.1820	324995	6061932	10-30	1.28	4.78	1.68	2.27	Medium	5.04	0.080	11.03	0.00	0.00	60.69	SCL	S
LL1819	3	LL.1821	324995	6061932	30-50	1.07	7.55	1.73	2.15	Medium	6.53	0.167	0.00	0.00	0.59	25.65	SCL	S
LL1822	1	LL.1822	324936	6061080	0-20	2.08	4.30	2.66	5.77	Coarse	6.37	0.007	2.88	0.00	0.00	7.07	S	S
LL1823	1	LL.1823	326009	6060962	0-10	3.67	2.76	1.82	2.68	Medium	4.44	0.014	26.38	17.96	0.00	52.80	LS	VS
LL1823	2	LL.1824	326009	6060962	10-30	2.57	4.00	1.63	2.02	Medium	4.22	0.165	33.09	3.37	0.00	139.36	SCL	S
LL1823	3	LL.1825	326009	6060962	30-50	1.96	6.99	1.62	2.24	Medium	6.50	0.236	0.00	0.00	0.54	75.49	SCL	S
LL1826	1	LL.1826	327059	6060959	0-10	2.16	2.93	2.16	3.19	Coarse	4.70	<0.005	9.11	0.00	0.00	9.11	S	S
LL1826	2	LL.1827	327059	6060959	10-30	3.13	2.79	1.92	2.51	Coarse	4.50	<0.005	14.87	4.58	0.00	19.45	CS	S
LL1828	1	LL.1828	327110	6060953	0-10	3.82	2.82	1.87	2.90	Coarse	4.92	<0.005	9.11	0.00	0.00	9.11	S	S
LL1828	2	LL.1829	327110	6060953	10-30	3.78	2.65	1.79	2.41	Coarse	4.57	<0.005	13.43	0.00	0.00	13.43	SL	S
LL1828	3	LL.1830	327110	6060953	30-50	1.33	2.81	2.04	2.30	Coarse	5.18	<0.005	5.76	0.00	0.00	5.76	S	S
LL1831	1	LL.1831	327021	6059776	0-10	2.98	2.67	1.92	2.51	Medium	4.43	<0.005	25.42	19.93	0.00	45.35	LS	S
LL1831	2	LL.1832	327021	6059776	10-30	2.90	2.68	1.78	2.36	Medium	4.26	0.008	38.85	25.82	0.00	69.84	SCL	S
LL1831	3	LL.1833	327021	6059776	30-50	2.79	3.13	1.65	2.18	Medium	4.25	0.076	43.17	1.96	0.00	92.80	SL	S
LL1834	1	LL.1834	327015	6059816	0-10	2.67	2.84	2.07	2.78	Medium	4.43	0.007	27.34	11.13	0.00	42.61	SCL	S
LL1834	2	LL.1835	327015	6059816	10-30	3.86	2.69	1.69	2.51	Medium	4.32	0.006	35.49	26.01	0.00	65.38	SCL	S
LL1836	1	LL.1836	336671	6069862	0-10	2.01	4.06	3.41	4.55	Coarse	6.22	<0.005	1.92	0.00	0.00	1.92	S	S
LL1836	2	LL.1837	336671	6069862	10-30	2.12	3.26	1.67	1.90	Medium	4.71	0.092	12.95	0.00	0.00	70.33	SCL	S
LL1836	3	LL.1838	336671	6069862	30-50	1.42	4.59	1.70	2.02	Coarse	6.36	0.049	1.92	0.00	0.00	32.48	S	S
LL1839	1	LL.1839	337752	6069926	0-10	1.53	5.67	4.06	4.14	Coarse	6.41	<0.005	1.44	0.00	0.00	1.44	S	S
LL1839	2	LL.1840	337752	6069926	10-30	1.44	6.70	6.25	6.12	Coarse	6.47	<0.005	0.96	0.00	0.00	0.96	S	S
LL1839	3	LL.1841	337752	6069926	30-50	1.19	7.20	4.67	6.71	Coarse	8.62	<0.005	0.00	0.00	0.73	-97.24	S	S
LL1842	1	LL.1842	339092	6070607	0-10	2.90	7.27	6.60	7.53	Coarse	8.85	<0.005	0.00	0.00	0.00	0.00	S	S
LL1842	2	LL.1843	339092	6070607	10-30	3.87	7.31	2.88	5.00	Medium	8.68	0.211	0.00	0.00	0.00	131.60	SL	S
LL1844	1	LL.1844	339539	6070916	0-10	1.65	7.79	5.73	7.68	Coarse	8.10	<0.005	0.00	0.00	0.00	0.00	S	S
LL1844	2	LL.1845	339539	6070916	10-30	1.43	3.50	2.81	3.45	Coarse	6.68	0.005	0.00	0.00	0.00	3.12	S	S
LL1846	1	LL.1846	339575	6070958	0-10	1.80	6.95	6.23	7.43	Coarse	7.62	<0.005	0.00	0.00	0.41	-54.61	S	S
LL1846	2	LL.1847	339575	6070958	10-30	4.71	2.77	1.54	2.16	Medium	4.52	0.130	45.56	0.00	0.00	126.65	SCL	S
LL1846	3	LL.1848	339575	6070958	30-50	4.01	4.04	1.65	2.13	Medium	6.02	0.209	8.63	0.00	0.00	138.99	SCL	S
LL1849	1	LL.1849	340076	6070883	0-10	2.66	6.62	5.17	6.49	coarse	6.58	<0.005	0.00	0.00	0.40	-53.28	S	S
LL1849	2	LL.1850	340076	6070883	10-30	2.12	6.62	4.42	4.62	coarse	8.34	<0.005	0.00	0.00	0.47	-62.60	S	S
LL1849	3	LL.1851	340076	6070883	30-50	2.41	6.51	1.79	2.37	coarse	7.87	0.025	0.00	0.00	0.37	-33.69	S	S
LL1852	1	LL.1852	340083	6070939	0-10	2.52	7.66	6.88	7.74	coarse	8.68	<0.005	0.00	0.00	0.32	-42.62	S	S
LL1852	2	LL.1853	340083	6070939	10-30	2.80	7.77	6.49	7.68	Coarse	8.79	0.005	0.00	0.00	0.44	-55.49	S	S
LL1854	1	LL.1854	339983	6072076	0-10	2.32	6.96	4.25	2.85	coarse	7.69	0.011	0.00	0.00	0.38	-43.76	S	S
LL1854	2	LL.1855	339983	6072076	10-30	2.55	4.30	1.79	2.11	coarse	6.99	0.042	0.00	0.00	0.37	-23.09	LS	S
LL1856	1	LL.1856	338819	6072045	0-10	3.56	6.95	6.25	5.86	coarse	7.34	<0.005	0.00	0.00	0.42	-55.94	S	S
LL1856	2	LL.1857	338819	6072045	10-30	2.47	7.67	6.25	7.47	Medium	9.19	0.007	0.00	0.00	0.66	-83.55	SL	S

Site ID Number	Layer Number	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl)	S_{CR} (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1}	ANC (%$CaCO_3$)	NA (mol H^+ t^{-1})	Field texture	Field consistence
LL1856	3	LL.1858	338819	6072045	30-50	2.09	7.22	1.56	1.62	Coarse	8.03	0.113	0.00	0.00	0.41	15.87	S	S
LL1859	1	LL.1859	338067	6071909	0-10	1.66	7.49	5.63	5.61	Coarse	7.38	<0.005	0.00	0.00	0.37	-49.28	S	S
LL1859	2	LL.1860	338067	6071909	10-30	1.61	7.12	4.65	5.01	Coarse	6.19	<0.005	1.44	0.00	0.00	1.44	S	S
LL1859	3	LL.1861	338067	6071909	30-50	2.90	7.03	2.42	8.22	Coarse	8.23	0.019	0.00	0.00	0.00	11.85	S	S

The following data set was not collected as part of this field survey; it was collected as part of the project for assessment of Finniss River and Currency Creek. This dataset was incorporated and used to assist with mapping.

Site ID Number	Layer No.	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl	SCr (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$	NA (mol H^+ t^{-1})	Field texture	Field consistence
CUR11	1	CUR 11.1	302384	6070538	0 - 3	7.24	7.91	6.34	7.00	Fine	8.65	0.472	0.00	0.00	8.48	-835.35	C	FR
CUR11	2	CUR 11.2	302384	6070538	3 - 10	6.87	8.03	5.54	7.00	Fine	8.31	0.552	0.00	0.00	2.90	-42.80	C	VS
CUR11	3	CUR 11.3	302384	6070538	10 - 50	6.17	8.02	1.96	3.30	Fine	7.58	1.272	0.00	0.00	1.37	610.53	C	VS
CUR11	4	CUR 11.4	302384	6070538	50 - 100	5.48	8.25	6.62	7.00	Medium	9.10	0.203	0.00	0.00	8.68	-1029.39	SC	VS
CUR12	1	CUR 12.1	302365	6070521	0 - 5	11.32	3.85	1.97	7.00	Medium	6.15	0.057	7.47	0.00	0.00	42.98	SCL	FR
CUR12	2	CUR 12.2	302365	6070521	5 - 25	4.64	2.95	1.75	3.60	Medium	4.02	<0.01	39.34	--	0.00	42.45	SL	FI
CUR12	3	CUR 12.3	302365	6070521	25 - 40	4.49	7.39	6.59	7.00	Coarse	8.78	0.142	0.00	0.00	3.12	-326.39	S	S
CUR12	4	CUR 12.4	302365	6070521	40 - 110	5.12	7.95	6.40	3.90	Coarse	9.22	0.209	0.00	0.00	10.07	-1210.77	LS	VS
CUR13	0	CUR 13.1	302272	6070678	0 - 1	22.40	6.92	3.06	7.00	Medium	8.04	0.291	0.00	0.00	8.50	-950.91	CL	FI
CUR13	1	CUR 13.2	302272	6070678	1 - 10	10.15	7.06	4.48	3.00	Fine	6.51	0.266	0.00	0.00	0.61	85.37	C	FI
CUR13	2	CUR 13.3	302272	6070678	10 - 18	6.47	3.10	1.67	2.50	Medium	4.22	0.069	27.51	--	0.00	70.26	SC	S
CUR13	0	CUR 13.4	302272	6070678	18 - 30	5.08	4.15	1.70	2.50	Medium	5.13	0.250	11.26	0.00	0.00	167.00	SL	S
CUR13	3	CUR 13.5	302272	6070678	30 - 100	2.50	8.10	6.70	7.00	Medium	9.17	0.191	0.00	0.00	15.50	-1945.54	SL	VS
CUR14	0	CUR 14.1	302218	6070463	0 - 0.5												S	FI
CUR14	1	CUR 14.2	302218	6070463	0.5 - 15	4.44	4.24	2.32	7.00	Coarse	6.56	0.010	0.00	0.00	0.10	-7.57	S	L
CUR14	2	CUR 14.3	302218	6070463	15 - 40	4.50	7.67	7.21	7.00	Coarse	9.23	0.012	0.00	0.00	8.70	-1151.77	S	FI
CUR14	3	CUR 14.4	302218	6070463	40 - 60	4.24	8.38	6.75	7.00	Medium	9.48	<0.01	0.00	0.00	17.12	-2277.00	SL	FR
CUR14	4	CUR 14.5	302218	6070463	60 - 80												SC	FR
CUR15	1	CUR 15.1	305343	6071064	0 - 5	8.42	4.75	3.18	5.00	Medium	9.14	0.010	0.00	0.00	0.40	-46.92	SL	FI
CUR15	2	CUR 15.2	305343	6071064	5 - 15	9.27	3.75	2.40	2.50	Coarse	5.14	<0.01	5.95	0.00	0.00	9.07	LS	S
CUR15	3	CUR 15.3	305343	6071064	15 - 40	3.04	7.70	3.20	1.90	Medium	4.73	1.606	20.28	0.00	0.00	1022.13	SC	S
CUR15	4	CUR 15.4	305343	6071064	40 - 60	0.61	8.60	7.59	7.00	Medium	8.40	0.065	0.00	0.00	1.12	-108.72	SC	EF
CUR16	0	CUR 16.0	305395	6070954	-10 - 0												WATER	
CUR16	1	CUR 16.1	305395	6070954	0 - 5	3.03	7.54	7.10	7.00	Coarse	9.42	0.010	0.00	0.00	0.62	-76.30	S	VS
CUR16	2	CUR 16.2	305395	6070954	5 - 30	2.76	7.68	2.10	4.50	Coarse	8.68	0.030	0.00	0.00	0.10	5.45	S	FI
CUR16	3	CUR 16.3	305395	6070954	30 - 40												CS	FI
CUR17	1	CUR 17.1	305334	6071123	0 - 12	2.19	7.72	5.67	7.00	Coarse	8.23	0.143	0.00	0.00	5.43	-634.98	PEAT	S
CUR17	2	CUR 17.2	305334	6071123	12 - 18	1.59	6.34	2.95	7.00	Coarse	6.19	0.007	2.57	0.00	0.00	6.66	S	FI
CUR17	0	CUR 17.3	305334	6071123	18 - 27	2.06	3.64	2.81	3.90	coarse	5.76	0.010	2.28	0.00	0.00	8.51	S	FI
CUR17	3	CUR 17.4	305334	6071123	27 - 40	6.45	3.00	1.53	2.50	Medium	4.79	0.053	11.41	0.00	0.00	44.72	SL	S
CUR17	5	CUR 17.5	305334	6071123	40 - 48	5.89	4.08	1.83	1.90	Medium	4.35	0.938	31.78	--	0.00	616.76	SC	FI
CUR17	6	CUR 17.6	305334	6071123	48 - 55	3.69	5.70	1.83	1.90	Medium	4.84	0.883	11.66	0.00	0.00	562.24	SC	FI
CUR17	7	CUR 17.7	305334	6071123	55 - 65	2.91	6.29	2.76	5.80	Fine	6.63	0.017	0.00	0.00	0.28	-27.40	C	VFI
CUR18	1	CUR 18.1	305224	6071431	0 - 20	6.56	3.03	1.87	2.50	Coarse	5.14	0.010	5.96	0.00	0.00	12.19	S	L
CUR18	2	CUR 18.2	305224	6071431	20 - 50	5.84	2.55	1.59	2.20	coarse	4.34	0.010	28.38	--	0.00	34.62	S	FR
CUR18	3	CUR 18.3	305224	6071431	50 - 75	2.75	7.70	2.00	1.90	coarse	8.23	4.323	0.00	0.00	0.91	2575.48	LS	FI
CUR18	4	CUR 18.4	305224	6071431	75 - 90	0.93	8.60	7.38	7.00	Fine	8.83	0.168	0.00	0.00	1.48	-93.13	C	EFI
CUR19	1	CUR 19.1	305152	6071684	0 - 3	7.10	7.45	4.78	7.00	coarse	7.77	0.010	0.00	0.00	0.10	-7.70	S	L
CUR19	2	CUR 19.2	305152	6071684	3 - 25	4.29	2.61	1.85	2.20	coarse	4.27	0.043	27.50	--	0.00	54.12	LS	FI
CUR19	3	CUR 19.3	305152	6071684	25 - 55	2.86	7.42	1.75	2.20	coarse	5.39	3.119	9.04	0.00	0.00	1954.16	CS	FI
CUR19	4	CUR 19.4	305152	6071684	55 - 65												C	EFI
CUR20	0	CUR 20.0	298356	6073698	-40 - 0												WATER	
CUR20	1	CUR 20.1	298356	6073698	0 - 5	1.08	7.04	2.25	4.50	coarse	6.63	0.040	0.00	0.00	0.31	-16.84	LS	S
CUR20	2	CUR 20.2	298356	6073698	5 - 10	4.94	5.80	1.58	4.50	Fine	4.96	0.218	11.01	0.00	0.00	147.28	C	VS

Site ID Number	Layer No.	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl	SCr (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$	NA (mol H^+ t^{-1})	Field texture	Field consistence
CUR20	3	CUR 20.3	298356	6073698	10 - 25	1.60	6.69	1.59	2.50	Fine	5.39	0.565	8.93	0.00	0.00	361.12	C	FI
CUR21	0	CUR 21.1	298352	6073708	0 - 0.5	178.72	5.07	2.20	4.20	Coarse	4.70	0.019	31.53	0.00	0.00	43.51	CRYSTALS	FR
CUR21	1	CUR 21.2	298352	6073708	0.5 - 10	1.39	4.87	2.01	4.50	Coarse	4.99	0.036	9.68	0.00	0.00	31.91	PEAT	FI
CUR21	2	CUR 21.3	298352	6073708	10 - 20	1.44	3.98	1.85	3.90	Medium	4.55	0.006	13.88	0.00	0.00	17.53	SL	FR
CUR21	0	CUR 21.4	298352	6073708	20 - 35	63.40	3.52	1.70	3.90	Medium	4.23	0.021	77.42	--	0.00	90.46	SCL	FR
CUR21	3	CUR 21.5	298352	6073708	35 - 70	7.72	6.97	1.63	1.90	Fine	4.35	1.486	48.93	--	0.00	975.95	C	S
CUR22	0	CUR 22.1	298350	6073695	0 - 0.5												CRYSTALS	FR
CUR22	1	CUR 22.2	298350	6073695	0.5 - 2												S	FR
CUR23	0	CUR 23.1	298538	6073748	0 - 0.5	17.18	6.53	2.84	5.00	Medium	5.91	0.028	3.12	0.00	0.00	20.72	CL	FR
CUR23	1	CUR 23.2	298538	6073748	0.5 - 5	6.52	3.48	1.95	3.60	Coarse	4.49	0.048	16.53	--	0.00	46.29	LS	FI
CUR23	2	CUR 23.3	298538	6073748	5 - 15	7.00	3.58	1.70	1.90	Fine	3.81	1.087	115.12	--	0.00	792.91	C	FR
CUR23	3	CUR 23.4	298538	6073748	15 - 35	6.34	6.58	1.76	2.50	Fine	5.23	1.416	15.40	0.00	0.00	898.42	C	VS
CUR24	0	CUR 24.0	298557	6073753	-30 - 0												WATER	
CUR25	0	CUR 25.1A	298414	6073793	0 - 0.05												CRYSTALS	L
CUR25	0	CUR 25.1B	298414	6073793	0.05 - 0.5	19.58	3.43	2.35	2.50	Coarse	4.55	<0.01	29.02	0.00	0.00	32.13	CRYSTALS	L
CUR25	1	CUR 25.2	298414	6073793	0.5 - 10	5.30	2.99	1.80	2.50	Coarse	4.76	<0.01	10.08	0.00	0.00	13.20	S	L
CUR25	2	CUR 25.3	298414	6073793	10 - 25	3.10	2.95	1.38	2.50	Medium	4.02	0.048	41.47	--	0.00	71.68	SC	FI
CUR25	0	CUR 25.4	298414	6073793	25 - 35	5.96	3.36	1.38	1.90	Fine	3.78	0.688	138.11	--	0.00	566.92	C	S
CUR25	3	CUR 25.5	298414	6073793	35 - 70												C	VS
CUR26	0	CUR 26.0	301098	6072836	-20 - 0												WATER	
CUR26	1	CUR 26.1	301098	6072836	0 - 5	3.70	8.33	4.95	> 7	Coarse	9.21	0.042	0.00	0.00	0.37	-22.68	LS	S
CUR26	2	CUR 26.2	301098	6072836	5 - 25	2.36	8.26	1.59	> 7	Coarse	6.53	0.106	0.00	0.00	0.11	51.41	LS	VS
CUR27	0	CUR 27.1	301049	6072909	0 - 0.5	5.00	7.30	5.28	4.50	Coarse	7.75	0.008	0.00	0.00	0.34	-39.97	S	FR
CUR27	1	CUR 27.2	301049	6072909	0.5 - 10	2.47	2.94	2.44	4.50	Coarse	5.47	<0.01	3.35	0.00	0.00	6.47	LS	L
CUR27	2	CUR 27.3	301049	6072909	10 - 25	3.68	6.53	1.58	1.90	Coarse	4.69	0.041	12.78	0.00	0.00	38.38	LS	L
CUR27	0	CUR 27.4	301049	6072909	25 - 35	119.76	3.43	1.70	1.90	Coarse	4.57	0.076	15.37	0.00	0.00	62.69	LS	S
CUR27	3	CUR 27.5	301049	6072909	35 - 60	2.10	7.14	1.70	1.90	Coarse	5.35	0.125	4.86	0.00	0.00	82.59	LS	S
CUR28	1	CUR 28.1	301047	6072912	0 - 0.5	2.14	7.85	2.30	2.50	Coarse	5.45	<0.01	6.45	0.00	0.00	9.57	S	L
FIN20	0	FIN 20.0	305780	6073935	0 - 0												WATER	
FIN20	1	FIN 20.1	305780	6073935	0 - 10	48.63	3.79	1.28	3.30	Coarse	3.94	0.201	143.62	--	0.00	269.22	CRYSTALS	L
FIN20	0	FIN 20.2	305780	6073935	0 - 10	71.58	3.85	1.62	5.00	Coarse	4.31	0.212	69.63	--	0.00	202.07	C	HA
FIN20	2	FIN 20.3	305780	6073935	10 - 18	18.39	2.99	1.00	2.50	Coarse	3.28	0.150	400.15	--	0.00	493.74	CRYSTALS	L
FIN20	0	FIN 20.4	305780	6073935	10 - 18	4.62	3.05	1.36	5.00	Coarse	3.30	0.118	400.57	--	0.00	473.87	PEAT	EH
FIN20	3	FIN 20.5	305780	6073935	18 - 45	20.89	3.41	1.59	3.00	Fine	3.47	0.098	152.55	--	0.00	213.61	CRYSTALS	L
FIN20	0	FIN 20.6	305780	6073935	18 - 45	10.00	2.83	1.57	2.50	Fine	3.49	0.291	114.86	--	0.00	296.32	C	FI
FIN20	7	FIN 20.7	305780	6073935	45 - 150	7.68	7.43	1.80	2.50	Fine	6.83	1.339	0.00	0.00	1.33	658.33	C	VS
FIN21	1	FIN 21.1	305888	6073941	0 - 5	164.64	4.25	1.80	4.70	Fine	4.31	0.254	78.32	--	0.00	236.75	C	L
FIN21	2	FIN 21.2	305888	6073941	5 - 35	735.60	3.91	1.24	4.00	Coarse	4.36	0.132	101.42	--	0.00	183.59	CRYSTALS	L
FIN21	0	FIN 21.3	305888	6073941	5 - 35	8.55	5.76	2.57	4.50	Coarse	5.62	0.191	32.57	0.00	0.00	151.85	PEAT	FI
FIN21	3	FIN 21.4	305888	6073941	35 - 55	7.48	4.02	1.20	2.50	Fine	4.24	0.991	83.90	--	0.00	702.28	C	FI
FIN21	5	FIN 21.5	305888	6073941	55 - 70												C	VS
FIN22	0	FIN 22.0	305945	6074053	-10 - 0												WATER	
FIN23	0	FIN 23.1	305748	6074053	0 - 0.5	183.09	3.37	1.96	4.20	Fine	3.60	0.365	205.47	--	0.00	433.44	CRUST	FR
FIN23	1	FIN 23.2	305748	6074053	0 - 10	127.35	2.97	2.60	4.20	Fine	3.33	0.528	295.41	--	0.00	624.50	CRUST	FR
FIN23	0	FIN 23.3	305748	6074053	0 - 10	4.46	4.16	1.55	3.60	Fine	4.20	0.239	96.18	--	0.00	245.42	C	VR

Site ID Number	Layer No.	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl	SCr (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$	NA (mol H^+ t^{-1})	Field texture	Field consistence
FIN23	2	FIN 23.4	305748	6074053	10 - 18	6.08	3.51	1.44	2.50	coarse	3.60	0.197	157.59	--	0.00	280.62	PEAT	FI
FIN23	0	FIN 23.5	305748	6074053	18 - 30	6.04	3.50	1.58	2.50	Fine	3.55	0.080	139.22	--	0.00	189.03	C	FR
FIN23	3	FIN 23.6	305748	6074053	30 - 70	3.76	7.52	1.80	2.50	Fine	6.88	1.416	0.00	0.00	1.33	705.85	C	VS
FIN24	1	FIN 24.1	305756	6074049	0 - 0.05	223.95	2.91	2.38	3.30	coarse	3.44	0.135	294.67	--	0.00	378.84	CRUST	FR
FIN25	1	FIN 25.1	305810	6074047	0 - 5	5.24	6.62	1.62	4.20	Coarse	5.85	1.113	15.82	0.00	0.00	710.29	PEAT	FR
FIN25	2	FIN 25.2	305810	6074047	5 - 15	4.21	5.86	1.55	4.20	Fine	5.42	0.419	18.61	0.00	0.00	279.78	C	S
FIN25	3	FIN 25.3	305810	6074047	15 - 70	3.40	8.29	1.80	2.50	Fine	6.17	1.490	4.06	0.00	0.00	933.67	C	VS
FIN26	0	FIN 26.1	303084	6079608	0 - 0.05	756.00	2.70	1.97	2.50	Medium	2.89	0.008	2420.21	--	0.00	2425.00	CRYSTALS	FR
FIN26	0	FIN 26.2	303084	6079608	0 - 0.05												CRYSTALS	FR
FIN26	1	FIN 26.3	303084	6079608	0 - 5	10.62	2.15	1.45	1.90	Medium	3.21	0.035	256.26	--	0.00	278.12	SC	FR
FIN26	0	FIN 26.4	303084	6079608	0 - 0.5												CRYSTALS	FR
FIN27	1	FIN 27.1	306196	6075060	0 - 5	4.62	4.95	1.33	4.50	Fine	4.55	0.356	68.96	0.00	0.00	291.25	C	FR
FIN27	2	FIN 27.2	306196	6075060	5 - 25	6.32	6.08	1.30	2.50	Fine	5.48	1.263	24.94	0.00	0.00	812.65	C	FR
FIN27	3	FIN 27.3	306196	6075060	25 - 70	0.00	8.00	1.70	2.50	Fine	6.60	1.713	0.00	0.00	1.49	869.82	C	VS
FIN28	0	FIN 28.1	305974	6075099	0 - 0.5	17.03	3.47	2.32	3.60	Fine	3.09	0.099	361.47	--	0.00	422.93	CRYSTALS	FR
FIN28	1	FIN 28.2	305974	6075099	0.5 - 10	17.57	3.40	1.78	3.90	Fine	3.97	0.422	105.81	--	0.00	369.13	C	H
FIN28	2	FIN 28.3	305974	6075099	10 - 35	7.59	3.13	1.76	2.50	Fine	3.59	0.507	127.83	--	0.00	444.34	C	FR
FIN28	3	FIN 28.4	305974	6075099	35 - 75	6.22	6.58	1.94	2.50	Fine	4.77	1.692	32.75	0.00	0.00	1087.77	C	VS
FIN29	0	FIN 29.1	302739	6076943	-20 - 0												WATER	
FIN29	1	FIN 29.2	302739	6076943	0 - 15	0.36	5.56	1.66	4.00	Fine	4.36	0.033	201.37	--	0.00	222.06	PEAT	FI
FIN29	2	FIN 29.3	302739	6076943	15 - 80	0.82	4.83	1.90	4.20	Fine	3.95	0.071	265.47	--	0.00	309.91	PEAT	FR
FIN29	4	FIN 29.4	302739	6076943	80 - 100	0.85	4.81	1.34	2.50	Fine	4.09	0.964	203.81	--	0.00	805.23	C	S
FIN30	0	FIN 30.0	307978	6073636	-30 - 0												WATER	
FIN30	0	FIN 30.1	307978	6073636	0 - 1	3.00	8.14	4.63	5.00	Coarse	6.87	0.010	0.00	0.00	0.07	-3.26	S	S
FIN30	1	FIN 30.2	307978	6073636	1 - 20	6.65	5.26	4.18	2.50	Coarse	7.60	0.017	0.00	0.00	0.10	-2.53	S	S
FIN30	2	FIN 30.3	307978	6073636	20 - 150	1.51	3.87	1.80	2.50	Fine	6.74	1.296	0.00	0.00	1.22	645.52	C	VS
FIN31	0	FIN 31.1	308016	6073669	0 - 0.5	2.52	7.28	3.19	5.00	Coarse	5.84	<0.01	0.00	0.00	0.00	3.12	S	FI
FIN31	1	FIN 31.2	308016	6073669	0.5 - 15	2.63	3.03	2.44	3.60	Coarse	4.89	<0.01	3.07	0.00	0.00	6.18	S	FR
FIN31	2	FIN 31.3	308016	6073669	15 - 30	20.35	3.33	1.87	2.50	Coarse	5.11	0.179	5.62	0.00	0.00	117.41	S	FI
FIN31	3	FIN 31.4	308016	6073669	30 - 90	108.00	2.00	1.77	2.50	Coarse	5.20	0.043	3.39	0.00	0.00	29.95	LS	FI
FIN32	1	FIN 32.1	308051	6073691	0 - 15	1.89	4.76	3.39	4.70	Coarse	5.59	0.147	2.88	0.00	0.00	94.64	S	L
FIN32	2	FIN 32.2	308051	6073691	15 - 32	4.45	5.66	2.80	4.40	Coarse	5.97	0.014	3.07	0.00	0.00	11.91	S	FR
FIN32	3	FIN 32.3	308051	6073691	32 - 60	2.42	6.30	1.64	2.50	Coarse	5.09	0.147	2.53	0.00	0.00	93.94	S	FR
FIN32	4	FIN 32.4	308051	6073691	60 - 90	1.36	8.13	1.99	2.50	Coarse	5.98	0.098	5.29	0.00	0.00	66.47	LS	FI
FIN33	1	FIN 33.1	306784	6076264	0 - 15	4.65	4.55	1.69	3.00	Coarse	5.63	0.006	2.81	0.00	0.00	6.54	S	L
FIN33	2	FIN 33.2	306784	6076264	15 - 40	6.50	7.00	1.40	2.50	Coarse	8.33	1.164	2.33	0.00	1.01	593.62	S	S
FIN33	3	FIN 33.3	306784	6076264	40 - 70	4.23	8.05	6.77	6.50	Medium	9.11	0.121	0.00	0.00	3.07	-334.12	SCL	FI
FIN34	0	FIN 34.1	306777	6076255	0 - 0.5												S	FR
FIN35	0	FIN 35.1	306748	6076232	0 - 1	6.14	7.64	3.17	7.00	Coarse	8.47	0.276	0.00	0.00	3.75	-327.38	PEAT	S
FIN35	1	FIN 35.2	306748	6076232	1 - 8	6.77	7.28	5.89	6.50	Coarse	9.28	0.025	0.00	0.00	0.18	-8.08	S	S
FIN35	2	FIN 35.3	306748	6076232	8 - 30	5.07	7.66	1.38	2.50	Coarse	7.20	0.142	0.00	0.00	0.07	78.77	S	FR
FIN35	3	FIN 35.4	306748	6076232	30 - 60	3.67	7.69	1.81	3.00	Coarse	6.64	0.072	0.00	0.00	0.00	44.79	S	FI
FIN36	0	FIN 36.0	306736	6076216	-20 - 0												WATER	
FIN36	1	FIN 36.1	306736	6076216	0 - 15	3.54	7.73	1.44	2.50	Medium	6.77	0.200	0.00	0.00	0.08	114.66	SCL	S
FIN36	2	FIN 36.2	306736	6076216	15 - 150	6.43	7.72	1.72	2.50	Fine	7.35	0.753	0.00	0.00	0.74	371.25	C	VS
FIN37	1	FIN 37.1	304329	6079422	0 - 5													

Site ID Number	Layer No.	Sample ID Number	Easting (Zone 54H)	Northing (Zone 54H)	Depth range (cm)	EC (mS/cm)	pH (soil: water)	pH (soil: peroxide)	pH (ageing)	Lab texture	pH (KCl	SCr (%)	TAA (mol H^+ t^{-1})	RA (mol H^+ t^{-1})	ANC (%$CaCO_3$	NA (mol H^+ t^{-1})	Field texture	Field consistence
FIN38	0	FIN 38.1	304329	6079422	0 - 1	8.02	7.86	6.76	7.00	coarse	9.44	0.082	0.00	0.00	3.60	-428.29	S	FR
FIN38	1	FIN 38.2	304329	6079422	1 - 20	3.44	7.82	1.39	2.50	Medium	6.90	0.822	0.00	0.00	0.25	480.02	SCL	FI
FIN38	2	FIN 38.3	304329	6079422	20 - 50	2.93	7.73	1.45	2.50	coarse	6.14	0.509	3.27	0.00	0.00	320.74	LS	S
FIN39	0	FIN 39.0	304300	6079424	-3 - 0												WATER	
FIN39	1	FIN 39.1	304300	6079424	0 - 15	6.83	7.37	6.24	7.00	coarse	8.79	0.479	0.00	0.00	17.84	-2077.05	S	VS
FIN39	2	FIN 39.2	304300	6079424	15 - 25	3.14	7.76	3.09	7.00	Fine	8.75	0.291	0.00	0.00	2.77	-188.04	C	VS
FIN39	3	FIN 39.3	304300	6079424	25 - 100	4.11	7.50	2.31	2.50	Fine	8.35	0.431	0.00	0.00	2.53	-68.37	C	VS

Appendix 3: Acid Sulfate Soil Material Class and Site Soil Type

The following table lists all samples and their allocation to an acid sulfate soil material class as defined in Section 2.2. All of the site information was assessed and allocated to an acid sulfate soil type based on the classification in Appendix 1, the final part of the site classification has not been included and this would identify in the classification the water condition of the site at the time of sampling by determining if the site is deep water, subaqueous, hydrosol or unsaturated.

≥

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1001	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1001	hypersulfidic clay
LL.1002	10-30	hypersulfidic	LL1001	
LL.1003	0-20	hypersulfidic	LL1003	hypersulfidic clay
LL.1004	0-10	hypersulfidic	LL1004	hypersulfidic loam
LL.1005	0-20	hypersulfidic	LL1005	hypersulfidic sand
LL.1006	0-20	hypersulfidic	LL1006	hypersulfidic sand
LL.1007	0-20	hypersulfidic	LL1007	hypersulfidic sand
LL.1008	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1008	hypersulfidic sand
LL.1009	10-30	hypersulfidic	LL1008	
LL.1010	0-20	hypersulfidic	LL1010	hypersulfidic sand
LL.1011	20-30	hypersulfidic	LL1010	
LL.1012	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1012	hypersulfidic sand
LL.1013	10-30	hypersulfidic	LL1012	
LL.1014	0-30	hypersulfidic	LL1014	hypersulfidic sand
LL.1015	0-30	hypersulfidic	LL1015	hypersulfidic sand
LL.1016	0-30	hyposulfidic (S_{CR}≥0.10%)	LL1016	hyposulfidic clay
LL.1017	0-30	hypersulfidic	LL1017	hypersulfidic clay
LL.1018	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1018	hypersulfidic clay
LL.1019	10-30	hypersulfidic	LL1018	
LL.1020	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1020	hypersulfidic clay
LL.1021	10-30	hypersulfidic	LL1020	
LL.1022	0-20	hypersulfidic	LL1022	hypersulfidic clay
LL.1023	0-30	hyposulfidic (S_{CR}≥0.10%)	LL1023	hypersulfidic clay
LL.1024	0-10	hypersulfidic	LL1024	hypersulfidic sand
LL.1025	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1025	hypersulfidic clay
LL.1026	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1026	hypersulfidic clay
LL.1027	10-30	hypersulfidic	LL1026	
LL.1028	0-20	hypersulfidic	LL1028	hypersulfidic clay
LL.1029	0-5	hyposulfidic (S_{CR}<0.10%)	LL1029	acidic sand
LL.1030	5-20	hyposulfidic (S_{CR}<0.10%)	LL1029	
LL.1031	0-20	hyposulfidic (S_{CR}<0.10%)	LL1031	acidic sand
LL.1032	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1032	hyposulfidic clay
LL.1033	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1033	hypersulfidic clay
LL.1034	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1034	hypersulfidic clay
LL.1035	10-30	hypersulfidic	LL1034	
LL.1036	0-30	hyposulfidic (S_{CR}<0.10%)	LL1036	acidic sand
LL.1037	0-20	hypersulfidic	LL1037	hypersulfidic loam
LL.1038	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1038	hyposulfidic loam
LL.1039	0-20	hyposulfidic (S_{CR}<0.10%)	LL1039	acidic sand
LL.1040	0-20	hypersulfidic	LL1040	hypersulfidic sand
LL.1041	0-20	hyposulfidic (S_{CR}<0.10%)	LL1041	acidic sand
LL.1042	0-20	hypersulfidic	LL1042	hypersulfidic loam
LL.1043	0-20	hypersulfidic	LL1043	hypersulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1044	0-20	hypersulfidic	LL1044	hypersulfidic clay
LL.1045	0-20	hypersulfidic	LL1045	hypersulfidic clay
LL.1046	0-10	hyposulfidic (S_{CR}<0.10%)	LL1046	hypersulfidic sand
LL.1047	10-20	hypersulfidic	LL1046	
LL.1048	0-20	hyposulfidic (S_{CR}<0.10%)	LL1048	hyposulfidic loam
LL.1049	0-10	hyposulfidic (S_{CR}<0.10%)	LL1049	hyposulfidic sand
LL.1050	10-20	hyposulfidic (S_{CR}<0.10%)	LL1049	
LL.1051	0-20	hyposulfidic (S_{CR}<0.10%)	LL1051	hyposulfidic sand
LL.1052	0-20	hypersulfidic	LL1052	hypersulfidic sand
LL.1053	0-20	hypersulfidic	LL1053	hypersulfidic clay
LL.1054	0-20	hypersulfidic	LL1054	hypersulfidic clay
LL.1055	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1055	hypersulfidic clay
LL.1056	10-30	hypersulfidic	LL1055	
LL.1057	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1057	hypersulfidic clay
LL.1058	10-30	hypersulfidic	LL1057	
LL.1059	0-20	hypersulfidic	LL1059	hypersulfidic clay
LL.1060	0-20	hypersulfidic	LL1060	hypersulfidic clay
LL.1061	0-10	hyposulfidic (S_{CR}<0.10%)	LL1061	hypersulfidic clay
LL.1062	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1061	
LL.1063	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1063	hyposulfidic clay
LL.1064	0-20	hypersulfidic	LL1064	hypersulfidic loam
LL.1065	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1065	hypersulfidic clay
LL.1066	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1065	
LL.1067	0-10	other	LL1067	hyposulfidic sand
LL.1068	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1067	
LL.1069	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1069	hypersulfidic clay
LL.1070	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1070	hypersulfidic clay
LL.1071	10-30	hypersulfidic	LL1070	
LL.1072	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1072	hypersulfidic clay
LL.1073	10-30	hypersulfidic	LL1072	
LL.1074	0-20	hypersulfidic	LL1074	hypersulfidic clay
LL.1075	0-20	hypersulfidic	LL1075	hypersulfidic clay
LL.1076	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1076	hyposulfidic clay
LL.1077	0-20	hyposulfidic (S_{CR}<0.10%)	LL1077	acidic sand
LL.1078	0-20	hypersulfidic	LL1078	hypersulfidic clay
LL.1079	0-20	hypersulfidic	LL1079	hypersulfidic clay
LL.1080	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1080	hyposulfidic loam
LL.1081	0-20	hypersulfidic	LL1081	hypersulfidic clay
LL.1082	0-20	hypersulfidic	LL1082	hypersulfidic clay
LL.1083	0-20	hypersulfidic	LL1083	hypersulfidic clay
LL.1084	0-20	hypersulfidic	LL1084	hypersulfidic clay
LL.1085	0-20	hypersulfidic	LL1085	hypersulfidic clay
LL.1086	0-10	hyposulfidic (S_{CR}<0.10%)	LL1086	hypersulfidic clay
LL.1087	10-30	hypersulfidic	LL1086	
LL.1088	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1088	hypersulfidic clay
LL.1089	0-20	hypersulfidic	LL1089	hypersulfidic clay
LL.1090	0-20	hypersulfidic	LL1090	hypersulfidic clay
LL.1091	0-20	hypersulfidic	LL1091	hypersulfidic clay
LL.1092	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1092	hypersulfidic clay
LL.1093	10-30	hypersulfidic	LL1092	
LL.1094	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1094	hypersulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1095	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1095	hyposulfidic clay
LL.1096	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1096	hypersulfidic clay
LL.1097	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1097	hypersulfidic clay
LL.1098	0-10	hyposulfidic (S_{CR}<0.10%)	LL1098	hyposulfidic sand
LL.1099	10-30	hyposulfidic (S_{CR}<0.10%)	LL1098	
LL.1100	0-20	hypersulfidic	LL1100	hypersulfidic clay
LL.1101	0-20	hypersulfidic	LL1101	hypersulfidic clay
LL.1102	0-10	hypersulfidic	LL1102	hypersulfidic loam
LL.1103	10-30	hypersulfidic	LL1102	
LL.1104	30-50	hypersulfidic	LL1102	
LL.1105	0-10	sulfuric	LL1105	sulfuric sand
LL.1106	10-30	sulfuric	LL1105	
LL.1107	30-50	sulfuric	LL1105	
LL.1108	0-10	hypersulfidic	LL1108	hypersulfidic clay
LL.1109	10-30	hypersulfidic	LL1108	
LL.1110	30-50	hypersulfidic	LL1108	
LL.1111	0-10	hyposulfidic (S_{CR}<0.10%)	LL1111	hypersulfidic sand
LL.1112	10-30	hypersulfidic	LL1111	
LL.1113	30-50	hypersulfidic	LL1111	
LL.1114	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1114	hyposulfidic sand
LL.1115	10-30	other	LL1114	
LL.1116	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1116	hyposulfidic sand
LL.1117	0-20	other	LL1117	na
LL.1118	0-10	hypersulfidic	LL1118	hypersulfidic loam
LL.1119	10-30	hypersulfidic	LL1118	
LL.1120	0-10	sulfuric	LL1120	sulfuric loam
LL.1121	10-30	sulfuric	LL1120	
LL.1122	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1120	
LL.1123	0-10	hyposulfidic (S_{CR}<0.10%)	LL1123	hypersulfidic loam
LL.1124	10-30	hypersulfidic	LL1123	
LL.1125	0-10	other	LL1125	hypersulfidic sand
LL.1126	10-30	hypersulfidic	LL1125	
LL.1127	30-50	hypersulfidic	LL1125	
LL.1128	0-20	hypersulfidic	LL1128	hypersulfidic clay
LL.1129	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1129	hyposulfidic clay
LL.1130	0-10	hyposulfidic (S_{CR}<0.10%)	LL1130	acidic sand
LL.1131	10-30	hyposulfidic (S_{CR}<0.10%)	LL1130	
LL.1132	30-50	hyposulfidic (S_{CR}<0.10%)	LL1130	
LL.1133	0-10	other	LL1133	acidic sand
LL.1134	10-30	hyposulfidic (S_{CR}<0.10%)	LL1133	
LL.1135	0-10	other	LL1135	acidic sand
LL.1136	10-30	hyposulfidic (S_{CR}<0.10%)	LL1135	
LL.1137	30-50	hyposulfidic (S_{CR}<0.10%)	LL1135	
LL.1138	0-10	other	LL1138	na
LL.1139	10-30	other	LL1138	
LL.1140	30-50	hyposulfidic (S_{CR}<0.10%)	LL1138	
LL.1141	0-10	other	LL1141	acidic sand
LL.1142	10-30	hyposulfidic (S_{CR}<0.10%)	LL1141	
LL.1143	0-10	hyposulfidic (S_{CR}<0.10%)	LL1143	acidic sand
LL.1144	10-30	hyposulfidic (S_{CR}<0.10%)	LL1143	
LL.1145	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1143	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1146	0-10	hyposulfidic (S_{CR}<0.10%)	LL1146	hypersulfidic loam
LL.1147	10-30	hypersulfidic	LL1146	
LL.1148	0-10	hypersulfidic	LL1148	hypersulfidic loam
LL.1149	10-30	hypersulfidic	LL1148	
LL.1150	30-50	hypersulfidic	LL1148	
LL.1151	0-10	hyposulfidic (S_{CR}<0.10%)	LL1151	hyposulfidic sand
LL.1152	10-30	hyposulfidic (S_{CR}<0.10%)	LL1151	
LL.1154	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1151	
LL.1155	0-10	hyposulfidic (S_{CR}<0.10%)	LL1155	hypersulfidic sand
LL.1156	10-30	hypersulfidic	LL1155	
LL.1157	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1155	
LL.1158	0-10	hyposulfidic (S_{CR}<0.10%)	LL1158	hypersulfidic sand
LL.1159	10-30	other	LL1158	
LL.1160	30-50	hypersulfidic	LL1158	
LL.1161	0-10	hyposulfidic (S_{CR}<0.10%)	LL1161	hypersulfidic sand
LL.1162	10-30	hypersulfidic	LL1161	
LL.1163	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1161	
LL.1164	0-10	hyposulfidic (S_{CR}<0.10%)	LL1164	hyposulfidic sand
LL.1165	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1164	
LL.1166	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1164	
LL.1167	0-10	hyposulfidic (S_{CR}<0.10%)	LL1167	sulfuric sand
LL.1168	10-30	hyposulfidic (S_{CR}<0.10%)	LL1167	
LL.1169	30-50	sulfuric	LL1167	
LL.1170	0-10	other	LL1170	na
LL.1171	10-30	other	LL1170	
LL.1172	30-50	other	LL1170	
LL.1173	0-10	other	LL1173	sulfuric sand
LL.1174	10-30	sulfuric	LL1173	
LL.1175	30-50	sulfuric	LL1173	
LL.1176	0-10	sulfuric	LL1176	sulfuric sand
LL.1177	10-30	hyposulfidic (S_{CR}<0.10%)	LL1176	
LL.1178	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1176	
LL.1179	0-10	hypersulfidic	LL1179	sulfuric sand
LL.1180	10-30	sulfuric	LL1179	
LL.1181	30-50	sulfuric	LL1179	
LL.1182	0-10	sulfuric	LL1182	sulfuric sand
LL.1183	10-30	hypersulfidic	LL1182	
LL.1184	30-50	hypersulfidic	LL1182	
LL.1185	0-10	other	LL1185	acidic sand
LL.1186	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1185	
LL.1187	30-50	other	LL1185	
LL.1188	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1188	acidic sand
LL.1189	0-20	other	LL1189	na
LL.1190	0-20	hyposulfidic (S_{CR}<0.10%)	LL1190	hypersulfidic sand
LL.1191	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1190	
LL.1192	30-50	hypersulfidic	LL1190	
LL.1193	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1193	hypersulfidic sand
LL.1194	10-30	hypersulfidic	LL1193	
LL.1195	30-50	sulfuric	LL1193	
LL.1201	0-10	sulfuric	LL1201	sulfuric sand
LL.1202	10-30	sulfuric	LL1201	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1203	30-50	hypersulfidic	LL1201	
LL.1204	0-20	sulfuric	LL1204	sulfuric loam
LL.1205	0-10	sulfuric	LL1205	sulfuric loam
LL.1206	10-30	hypersulfidic	LL1205	
LL.1207	30-50	hypersulfidic	LL1205	
LL.1208	0-10	sulfuric	LL1208	sulfuric sand
LL.1209	10-30	sulfuric	LL1208	
LL.1210	30-50	hypersulfidic	LL1208	
LL.1211	0-10	sulfuric	LL1211	sulfuric lclay
LL.1212	10-30	hypersulfidic	LL1211	
LL.1213	30-50	hypersulfidic	LL1211	
LL.1214	0-20	hypersulfidic	LL1214	hypersulfidic clay
LL.1215	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1215	sulfuric lclay
LL.1216	10-30	sulfuric	LL1215	
LL.1217	30-50	hypersulfidic	LL1215	
LL.1218	0-10	other	LL1218	sulfuric sand
LL.1219	10-30	sulfuric	LL1218	
LL.1220	30-50	hypersulfidic	LL1218	
LL.1224	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1224	hyposulfidic sand
LL.1225	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1224	
LL.1226	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1226	hypersulfidic sand
LL.1227	10-30	hypersulfidic	LL1226	
LL.1228	0-20	hyposulfidic (S_{CR}<0.10%)	LL1228	hyposulfidic clay
LL.1229	0-20	hypersulfidic	LL1229	hypersulfidic clay
LL.1230	0-10	other	LL1230	hypersulfidic sand
LL.1231	10-30	hypersulfidic	LL1230	
LL.1232	0-20	hypersulfidic	LL1232	hypersulfidic sand
LL.1233	0-10	hypersulfidic	LL1233	hypersulfidic clay
LL.1234	10-30	hypersulfidic	LL1233	
LL.1235	0-10	hypersulfidic	LL1235	hypersulfidic clay
LL.1236	10-30	hypersulfidic	LL1235	
LL.1237	30-50	hypersulfidic	LL1235	
LL.1238	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1238	hypersulfidic clay
LL.1239	10-30	hypersulfidic	LL1238	
LL.1240	30-50	hypersulfidic	LL1238	
LL.1241	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1241	hyposulfidic clay
LL.1242	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1242	hypersulfidic sand
LL.1243	10-30	hypersulfidic	LL1242	
LL.1244	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1244	hyposulfidic loam
LL.1245	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1245	hyposulfidic sand
LL.1246	10-30	other	LL1245	
LL.1247	30-50	other	LL1245	
LL.1248	0-10	other	LL1248	hypersulfidic sand
LL.1249	10-30	hypersulfidic	LL1248	
LL.1250	0-20	hyposulfidic (S_{CR}<0.10%)	LL1250	hyposulfidic sand
LL.1251	0-20	hypersulfidic	LL1251	hypersulfidic clay
LL.1252	0-20	hyposulfidic (S_{CR}<0.10%)	LL1252	hyposulfidic loam
LL.1253	0-10	other	LL1253	acidic sand
LL.1254	10-30	hyposulfidic (S_{CR}<0.10%)	LL1253	
LL.1255	30-50	hyposulfidic (S_{CR}<0.10%)	LL1253	
LL.1256	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1256	hypersulfidic sand

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1257	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1256	
LL.1258	30-50	other	LL1256	
LL.1259	0-10	hypersulfidic	LL1259	hypersulfidic clay
LL.1260	10-30	hypersulfidic	LL1259	
LL.1261	30-50	hypersulfidic	LL1259	
LL.1262	0-10	hypersulfidic	LL1262	hypersulfidic sand
LL.1263	10-30	hypersulfidic	LL1262	
LL.1264	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1264	hypersulfidic clay
LL.1265	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1264	
LL.1266	30-50	hypersulfidic	LL1264	
LL.1267	0-10	hyposulfidic (S_{CR}<0.10%)	LL1267	hyposulfidic sand
LL.1268	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1267	
LL.1269	0-10	hypersulfidic	LL1269	hypersulfidic clay
LL.1270	10-30	hypersulfidic	LL1269	
LL.1271	30-50	hypersulfidic	LL1269	
LL.1272	no sample-	other	LL1272	other soil
LL.1273	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1273	hypersulfidic sand
LL.1274	10-30	hypersulfidic	LL1273	
LL.1281	0-10	hypersulfidic	LL1281	hypersulfidic clay
LL.1282	10-30	hypersulfidic	LL1281	
LL.1283	0-10	hypersulfidic	LL1283	hypersulfidic clay
LL.1284	10-30	hypersulfidic	LL1283	
LL.1285	30-50	hypersulfidic	LL1283	
LL.1286	0-10	hypersulfidic	LL1286	hypersulfidic clay
LL.1287	10-30	hypersulfidic	LL1286	
LL.1288	30-50	hypersulfidic	LL1286	
LL.1289	0-10	hypersulfidic	LL1289	hypersulfidic clay
LL.1290	10-30	hypersulfidic	LL1289	
LL.1291	30-50	hypersulfidic	LL1289	
LL.1292	0-10	other	LL1292	hypersulfidic sand
LL.1293	10-30	hypersulfidic	LL1292	
LL.1294	0-10	hypersulfidic	LL1294	hypersulfidic sand
LL.1295	0-10	other	LL1295	acidic sand
LL.1296	10-30	hyposulfidic (S_{CR}<0.10%)	LL1295	
LL.1301	0-10	hypersulfidic	LL1301	hypersulfidic clay
LL.1302	10-30	hypersulfidic	LL1301	
LL.1303	no sample-		LL1301	
LL.1304	30-50	hypersulfidic	LL1301	
LL.1305	0-10	hypersulfidic	LL1305	hypersulfidic clay
LL.1306	10-30	hypersulfidic	LL1305	
LL.1307	30-50	hypersulfidic	LL1305	
LL.1308	0-10	hypersulfidic	LL1308	hypersulfidic clay
LL.1309	10-30	hypersulfidic	LL1308	
LL.1310	30-50	hypersulfidic	LL1308	
LL.1311	0-10	hypersulfidic	LL1311	hypersulfidic sand
LL.1312	10-30	hyposulfidic (S_{CR}<0.10%)	LL1311	
LL.1313	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1311	
LL.1314	0-10	other	LL1314	hypersulfidic sand
LL.1315	10-30	other	LL1314	
LL.1316	30-50	hypersulfidic	LL1314	
LL.1317	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1317	hypersulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1318	10-30	hypersulfidic	LL1317	
LL.1319	30-50	hypersulfidic	LL1317	
LL.1320	0-20	hypersulfidic	LL1320	hypersulfidic clay
LL.1321	0-20	hypersulfidic	LL1321	hypersulfidic clay
LL.1322	0-20	hypersulfidic	LL1322	hypersulfidic sand
LL.1323	0-20	hyposulfidic (S_{CR}<0.10%)	LL1323	acidic sand
LL.1324	no sample-		LL1324	other soil
LL.1325	0-10	other	LL1325	hypersulfidic clay
LL.1326	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1325	
LL.1327	30-50	hypersulfidic	LL1325	
LL.1328	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1328	hyposulfidic loam
LL.1329	0-10	other	LL1329	hypersulfidic loam
LL.1330	10-30	hypersulfidic	LL1329	
LL.1331	0-10	hypersulfidic	LL1331	hypersulfidic clay
LL.1332	10-30	hypersulfidic	LL1331	
LL.1333	30-50	hypersulfidic	LL1331	
LL.1334	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1334	hypersulfidic loam
LL.1335	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1334	
LL.1336	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1336	hypersulfidic clay
LL.1337	10-30	hypersulfidic	LL1336	
LL.1338	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1336	
LL.1339	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1339	hyposulfidic clay
LL.1340	0-10	hypersulfidic	LL1340	hypersulfidic clay
LL.1341	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1340	
LL.1342	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1342	hyposulfidic sand
LL.1343	0-10	hypersulfidic	LL1343	hypersulfidic clay
LL.1344	10-30	hypersulfidic	LL1343	
LL.1345	30-50	hypersulfidic	LL1343	
LL.1346	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1346	hyposulfidic clay
LL.1347	0-10	hypersulfidic	LL1347	hypersulfidic loam
LL.1348	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1347	
LL.1349	0-10	hypersulfidic	LL1349	hypersulfidic clay
LL.1350	10-30	hypersulfidic	LL1349	
LL.1351	30-50	hypersulfidic	LL1349	
LL.1352	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1352	hypersulfidic clay
LL.1353	10-30	hypersulfidic	LL1352	
LL.1354	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1354	hyposulfidic sand
LL.1355	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1354	
LL.1356	0-10	hypersulfidic	LL1356	hypersulfidic clay
LL.1357	10-30	hypersulfidic	LL1356	
LL.1358	30-50	hypersulfidic	LL1356	
LL.1359	0-10	hypersulfidic	LL1359	hypersulfidic clay
LL.1360	10-30	hypersulfidic	LL1359	
LL.1361	30-50	hypersulfidic	LL1359	
LL.1362	0-10	hyposulfidic (S_{CR}<0.10%)	LL1362	acidic sand
LL.1363	0-10	hypersulfidic	LL1363	hypersulfidic clay
LL.1364	10-30	hypersulfidic	LL1363	
LL.1365	30-50	hypersulfidic	LL1363	
LL.1366	no sample-		LL1366	other soil
LL.1368	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1368	hyposulfidic sand
LL.1369	0-10	hypersulfidic	LL1369	hypersulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1370	10-30	hypersulfidic	LL1369	
LL.1371	30-50	hypersulfidic	LL1369	
LL.1372	no sample-		LL1369	
LL.1373	no sample-		LL1373	other soil
LL.1374	no sample-		LL1374	other soil
LL.1375	no sample-		LL1375	other soil
LL.1376	0-10	hyposulfidic (S_{CR}<0.10%)	LL1376	acidic sand
LL.1377	10-30	hyposulfidic (S_{CR}<0.10%)	LL1376	
LL.1378	0-10	hypersulfidic	LL1378	hypersulfidic clay
LL.1379	10-30	hypersulfidic	LL1378	
LL.1380	30-50	hypersulfidic	LL1378	
LL.1501	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1501	hypersulfidic sand
LL.1502	10-30	hypersulfidic	LL1501	
LL.1503	30-50	hypersulfidic	LL1501	
LL.1504	0-10	other	LL1504	hyposulfidic sand
LL.1505	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1504	
LL.1506	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1504	
LL.1507	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1507	hypersulfidic sand
LL.1508	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1507	
LL.1509	30-50	hypersulfidic	LL1507	
LL.1510	0-10	sulfuric	LL1510	sulfuric sand
LL.1511	10-30	sulfuric	LL1510	
LL.1512	30-50	hypersulfidic	LL1510	
LL.1513	0-10	hyposulfidic (S_{CR}<0.10%)	LL1513	hypersulfidic sand
LL.1514	10-30	hypersulfidic	LL1513	
LL.1515	30-50	hypersulfidic	LL1513	
LL.1516	0-10	hypersulfidic	LL1516	hypersulfidic sand
LL.1517	10-30	hypersulfidic	LL1516	
LL.1518	30-50	hypersulfidic	LL1516	
LL.1519	0-10	hyposulfidic (S_{CR}<0.10%)	LL1519	hyposulfidic sand
LL.1520	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1519	
LL.1521	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1521	hyposulfidic sand
LL.1522	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1521	
LL.1523	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1521	
LL.1524	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1524	hyposulfidic sand
LL.1525	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1524	
LL.1526	30-50	other	LL1524	
LL.1527	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1527	hyposulfidic sand
LL.1528	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1527	
LL.1529	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1527	
LL.1530	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1530	hypersulfidic loam
LL.1531	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1530	
LL.1532	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1530	
LL.1533	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1533	hypersulfidic sand
LL.1534	10-30	hypersulfidic	LL1533	
LL.1535	30-50	hypersulfidic	LL1533	
LL.1536	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1536	hypersulfidic sand
LL.1537	10-30	hypersulfidic	LL1536	
LL.1538	30-50	hypersulfidic	LL1536	
LL.1539	0-10	other	LL1539	acidic sand
LL.1540	10-30	hyposulfidic (S_{CR}<0.10%)	LL1539	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1541	0-10	hyposulfidic (S_{CR}<0.10%)	LL1541	hypersulfidic sand
LL.1542	10-30	hypersulfidic	LL1541	
LL.1543	30-50	hypersulfidic	LL1541	
LL.1544	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1544	hyposulfidic sand
LL.1545	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1544	
LL.1546	0-10	hyposulfidic (S_{CR}<0.10%)	LL1546	hyposulfidic loam
LL.1547	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1546	
LL.1548	0-10	other	LL1548	acidic sand
LL.1549	10-30	hyposulfidic (S_{CR}<0.10%)	LL1548	
LL.1550	30-50	hyposulfidic (S_{CR}<0.10%)	LL1548	
LL.1551	0-10	hypersulfidic	LL1551	hypersulfidic sand
LL.1552	10-30	hypersulfidic	LL1551	
LL.1553	30-50	hypersulfidic	LL1551	
LL.1554	0-10	hypersulfidic	LL1554	hypersulfidic sand
LL.1555	10-30	hypersulfidic	LL1554	
LL.1556	0-10	hypersulfidic	LL1556	hypersulfidic sand
LL.1557	10-30	hypersulfidic	LL1556	
LL.1558	0-10	hyposulfidic (S_{CR}<0.10%)	LL1558	acidic sand
LL.1559	10-30	other	LL1558	
LL.1560	0-10	hypersulfidic	LL1560	hypersulfidic sand
LL.1561	10-30	hypersulfidic	LL1560	
LL.1562	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1562	hypersulfidic sand
LL.1563	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1562	
LL.1564	0-10	sulfuric	LL1564	sulfuric sand
LL.1565	10-30	sulfuric	LL1564	
LL.1566	0-10	hyposulfidic (S_{CR}<0.10%)	LL1566	hypersulfidic sand
LL.1567	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1566	
LL.1568	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1566	
LL.1569	0-10	sulfuric	LL1569	sulfuric sand
LL.1570	10-30	hypersulfidic	LL1569	
LL.1571	0-10	sulfuric	LL1571	sulfuric sand
LL.1572	10-30	hypersulfidic	LL1571	
LL.1573	0-10	sulfuric	LL1573	sulfuric sand
LL.1574	10-30	sulfuric	LL1573	
LL.1575	30-50	other acidic sandidic	LL1573	
LL.1576	0-10	other	LL1576	other soil
LL.1577	10-30	other acidic sandidic	LL1576	
LL.1578	30-50	other	LL1576	
LL.1579	0-10	other	LL1579	other soil
LL.1580	10-30	other	LL1579	
LL.1581	0-10	sulfuric	LL1581	sulfuric sand
LL.1582	10-30	hypersulfidic	LL1581	
LL.1583	30-50	hypersulfidic	LL1581	
LL.1584	0-10	hypersulfidic	LL1584	hypersulfidic loam
LL.1585	10-30	hypersulfidic	LL1584	
LL.1586	30-50	hypersulfidic	LL1584	
LL.1587	0-10	hypersulfidic	LL1587	hypersulfidic clay
LL.1588	10-30	hypersulfidic	LL1587	
LL.1589	30-50	hypersulfidic	LL1587	
LL.1590	0-10	hypersulfidic	LL1590	hypersulfidic clay
LL.1591	10-30	hypersulfidic	LL1590	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1592	0-10	other	LL1592	hypersulfidic sand
LL.1593	10-30	hypersulfidic	LL1592	
LL.1594	30-50	hypersulfidic	LL1592	
LL.1595	0-10	hypersulfidic	LL1595	hypersulfidic clay
LL.1596	10-30	hypersulfidic	LL1595	
LL.1601	30-50	hypersulfidic	LL1595	
LL.1602	0-10	hypersulfidic	LL1602	hypersulfidic loam
LL.1603	10-30	hypersulfidic	LL1602	
LL.1604	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1602	
LL.1605	0-10	hyposulfidic (S_{CR}<0.10%)	LL1605	hyposulfidic sand
LL.1606	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1605	
LL.1607	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1605	
LL.1608	0-10	hyposulfidic (S_{CR}<0.10%)	LL1608	hyposulfidic loam
LL.1609	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1608	
LL.1610	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1608	
LL.1611	0-10	hypersulfidic	LL1611	hypersulfidic loam
LL.1612	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1611	
LL.1613	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1611	
LL.1614	0-10	hyposulfidic (S_{CR}<0.10%)	LL1614	hyposulfidic loam
LL.1615	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1614	
LL.1616	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1614	
LL.1617	0-10	other	LL1617	acidic sand
LL.1618	10-30	hyposulfidic (S_{CR}<0.10%)	LL1617	
LL.1619	30-50	hyposulfidic (S_{CR}<0.10%)	LL1617	
LL.1620	0-10	hyposulfidic (S_{CR}<0.10%)	LL1620	hypersulfidic sand
LL.1621	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1620	
LL.1622	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1620	
LL.1623	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1623	hypersulfidic loam
LL.1624	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1623	
LL.1625	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1625	hypersulfidic loam
LL.1626	10-30	hypersulfidic	LL1625	
LL.1627	30-50	hypersulfidic	LL1625	
LL.1628	0-10	hyposulfidic (S_{CR}<0.10%)	LL1628	hypersulfidic sand
LL.1629	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1628	
LL.1630	0-10	other	LL1630	hypersulfidic sand
LL.1631	10-30	hypersulfidic	LL1630	
LL.1632	30-50	hypersulfidic	LL1630	
LL.1633	0-10	hyposulfidic (S_{CR}<0.10%)	LL1633	hypersulfidic sand
LL.1634	10-30	hypersulfidic	LL1633	
LL.1635	0-10	hypersulfidic	LL1635	hypersulfidic sand
LL.1636	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1636	hypersulfidic loam
LL.1637	10-30	hypersulfidic	LL1636	
LL.1638	30-50	hypersulfidic	LL1636	
LL.1639	0-10	sulfuric	LL1639	sulfuric loam
LL.1640	10-30	sulfuric	LL1639	
LL.1641	30-50	hyposulfidic (S_{CR}<0.10%)	LL1639	
LL.1642	0-10	other	LL1642	hyposulfidic sand
LL.1643	10-30	hyposulfidic (S_{CR}<0.10%)	LL1642	
LL.1644	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1642	
LL.1645	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1645	hyposulfidic sand
LL.1646	10-30	hyposulfidic (S_{CR}<0.10%)	LL1645	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1647	30-50	hyposulfidic (S_{CR}<0.10%)	LL1645	
LL.1648	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1648	hyposulfidic sand
LL.1649	10-30	other	LL1648	
LL.1650	30-50	hypersulfidic	LL1648	
LL.1651	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1651	hypersulfidic sand
LL.1652	10-30	hypersulfidic	LL1651	
LL.1653	0-10	hyposulfidic (S_{CR}<0.10%)	LL1653	hypersulfidic sand
LL.1654	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1653	
LL.1655	30-50	hypersulfidic	LL1653	
LL.1656	0-10	hyposulfidic (S_{CR}<0.10%)	LL1656	hypersulfidic sand
LL.1657	10-30	other	LL1656	
LL.1658	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1656	
LL.1659	0-10	other	LL1659	hypersulfidic sand
LL.1660	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1659	
LL.1661	30-50	hypersulfidic	LL1659	
LL.1662	0-10	hypersulfidic	LL1662	sulfuric sand
LL.1663	10-30	sulfuric	LL1662	
LL.1664	30-50	hypersulfidic	LL1662	
LL.1665	0-10	hyposulfidic (S_{CR}<0.10%)	LL1665	hypersulfidic loam
LL.1666	10-30	hypersulfidic	LL1665	
LL.1667	30-50	hypersulfidic	LL1665	
LL.1668	0-10	hyposulfidic (S_{CR}<0.10%)	LL1668	hypersulfidic sand
LL.1669	0-10	sulfuric	LL1669	sulfuric loam
LL.1670	10-30	hypersulfidic	LL1669	
LL.1671	30-50	hypersulfidic	LL1669	
LL.1672	0-10	sulfuric	LL1672	sulfuric loam
LL.1673	10-30	sulfuric	LL1672	
LL.1674	30-50	sulfuric	LL1672	
LL.1675	0-10	sulfuric	LL1675	sulfuric loam
LL.1676	10-30	sulfuric	LL1675	
LL.1677	30-50	hypersulfidic	LL1675	
LL.1678	0-10	sulfuric	LL1678	sulfuric lclay
LL.1679	10-30	hypersulfidic	LL1678	
LL.1680	30-50	hypersulfidic	LL1678	
LL.1681	0-10	hypersulfidic	LL1681	hypersulfidic loam
LL.1682	10-30	hypersulfidic	LL1681	
LL.1683	30-50	hypersulfidic	LL1681	
LL.1686	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1686	hypersulfidic loam
LL.1687	10-30	hypersulfidic	LL1686	
LL.1688	30-50	hypersulfidic	LL1686	
LL.1689	0-10	sulfuric	LL1689	sulfuric loam
LL.1690	10-30	hypersulfidic	LL1689	
LL.1691	30-50	hypersulfidic	LL1689	
LL.1692	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1692	hyposulfidic sand
LL.1693	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1692	
LL.1694	30-50	other	LL1692	
LL.1695	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1695	hyposulfidic loam
LL.1696	0-10	sulfuric	LL1696	sulfuric sand
LL.1701	10-30	sulfuric	LL1696	
LL.1702	30-50	sulfuric	LL1696	
LL.1703	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1703	hypersulfidic loam

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1704	10-30	hypersulfidic	LL1703	
LL.1705	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1705	hyposulfidic sand
LL.1706	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1705	
LL.1707	0-20	other	LL1707	other soil
LL.1708	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1708	hypersulfidic sand
LL.1709	10-30	hypersulfidic	LL1708	
LL.1710	0-10	other	LL1710	acidic sand
LL.1711	10-30	hyposulfidic (S_{CR}<0.10%)	LL1710	
LL.1712	30-50	other	LL1710	
LL.1713	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1713	hyposulfidic sand
LL.1714	10-30	other	LL1713	
LL.1715	30-50	other	LL1713	
LL.1716	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1716	hyposulfidic sand
LL.1717	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1716	
LL.1718	30-50	other	LL1716	
LL.1719	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1719	hyposulfidic sand
LL.1720	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1719	
LL.1721	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1721	hyposulfidic sand
LL.1722	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1721	
LL.1723	30-50	other	LL1721	
LL.1724	0-10	other	LL1724	acidic sand
LL.1725	10-30	hyposulfidic (S_{CR}<0.10%)	LL1724	
LL.1726	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1726	hyposulfidic sand
LL.1727	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1726	
LL.1728	30-50	hyposulfidic (S_{CR}<0.10%)	LL1726	
LL.1729	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1729	hyposulfidic sand
LL.1730	10-30	other	LL1729	
LL.1731	30-50	hyposulfidic (S_{CR}<0.10%)	LL1729	
LL.1732	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1732	hyposulfidic loam
LL.1733	10-30	other	LL1732	
LL.1734	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1734	hyposulfidic sand
LL.1735	10-30	hyposulfidic (S_{CR}<0.10%)	LL1734	
LL.1736	30-50	hypersulfidic	LL1734	
LL.1737	0-10	sulfuric	LL1737	sulfuric loam
LL.1738	10-30	sulfuric	LL1737	
LL.1739	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1739	hyposulfidic sand
LL.1740	10-30	other	LL1739	
LL.1741	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1741	hyposulfidic sand
LL.1742	10-30	other	LL1741	
LL.1743	30-50	hypersulfidic	LL1741	
LL.1744	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1744	hyposulfidic sand
LL.1745	10-30	other acidic sandidic	LL1744	
LL.1746	30-50	hypersulfidic	LL1744	
LL.1747	10-30	hypersulfidic	LL1748	sulfuric sand
LL.1748	0-10	sulfuric	LL1748	
LL.1749	0-10	sulfuric	LL1749	sulfuric sand
LL.1750	10-30	sulfuric	LL1749	
LL.1751	0-10	hyposulfidic (S_{CR}<0.10%)	LL1751	acidic sand
LL.1752	10-30	hyposulfidic (S_{CR}<0.10%)	LL1751	
LL.1753	30-50	other	LL1751	
LL.1754	0-20	hyposulfidic (S_{CR}≥0.10%)	LL1754	hyposulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1755	0-10	other	LL1755	na
LL.1756	10-30	other	LL1755	
LL.1757	30-50	other	LL1755	
LL.1758	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1758	hyposulfidic sand
LL.1759	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1758	
LL.1760	30-50	other	LL1758	
LL.1761	0-10	hyposulfidic (S_{CR}<0.10%)	LL1761	acidic sand
LL.1762	10-30	hyposulfidic (S_{CR}<0.10%)	LL1761	
LL.1763	30-50	hyposulfidic (S_{CR}<0.10%)	LL1761	
LL.1765	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1765	hypersulfidic sand
LL.1766	10-30	other	LL1765	
LL.1767	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1767	hypersulfidic sand
LL.1768	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1767	
LL.1769	30-50	hyposulfidic (S_{CR}<0.10%)	LL1767	
LL.1770	0-10	other	LL1770	acidic sand
LL.1771	10-30	hyposulfidic (S_{CR}<0.10%)	LL1770	
LL.1772	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1772	hyposulfidic sand
LL.1773	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1772	
LL.1774	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1772	
LL.1775	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1775	hyposulfidic sand
LL.1776	10-30	other	LL1775	
LL.1777	30-50	other	LL1775	
LL.1778	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1778	hyposulfidic sand
LL.1779	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1778	
LL.1780	30-50	other	LL1778	
LL.1781	0-10	other	LL1781	hyposulfidic sand
LL.1782	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1781	
LL.1783	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1781	
LL.1784	0-10	other	LL1784	acidic sand
LL.1785	10-30	hyposulfidic (S_{CR}<0.10%)	LL1784	
LL.1786	30-50	hyposulfidic (S_{CR}<0.10%)	LL1784	
LL.1787	0-10	hyposulfidic (S_{CR}<0.10%)	LL1787	acidic sand
LL.1788	10-30	hyposulfidic (S_{CR}<0.10%)	LL1787	
LL.1789	0-10	hyposulfidic (S_{CR}<0.10%)	LL1789	acidic sand
LL.1790	10-30	hyposulfidic (S_{CR}<0.10%)	LL1789	
LL.1791	0-10	other	LL1791	hyposulfidic sand
LL.1792	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1791	
LL.1793	30-50	hypersulfidic	LL1791	
LL.1794	0-10	other	LL1794	hypersulfidic sand
LL.1795	10-30	hypersulfidic	LL1794	
LL.1796	30-50	hypersulfidic	LL1794	
LL.1801	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1801	hypersulfidic sand
LL.1802	10-30	hypersulfidic	LL1801	
LL.1803	30-50	hypersulfidic	LL1801	
LL.1804	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1804	hyposulfidic sand
LL.1805	10-30	other	LL1804	
LL.1806	30-50	hypersulfidic	LL1804	
LL.1807	0-10	sulfuric	LL1807	sulfuric sand
LL.1808	10-30	sulfuric	LL1807	
LL.1809	30-50	sulfuric	LL1807	
LL.1810	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1810	hypersulfidic sand

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
LL.1811	10-30	hypersulfidic	LL1810	
LL.1812	30-50	hypersulfidic	LL1810	
LL.1813	0-10	hyposulfidic (S_{CR}<0.10%)	LL1813	hypersulfidic loam
LL.1814	10-30	hypersulfidic	LL1813	
LL.1815	30-50	hypersulfidic	LL1813	
LL.1816	0-10	hypersulfidic	LL1816	sulfuric loam
LL.1817	10-30	sulfuric	LL1816	
LL.1818	30-50	hypersulfidic	LL1816	
LL.1819	0-10	sulfuric	LL1819	sulfuric sand
LL.1820	10-30	hypersulfidic	LL1819	
LL.1821	30-50	hypersulfidic	LL1819	
LL.1822	0-20	other acidic sandidic	LL1822	acidic sand
LL.1823	0-10	sulfuric	LL1823	sulfuric loam
LL.1824	10-30	hypersulfidic	LL1823	
LL.1825	30-50	hypersulfidic	LL1823	
LL.1826	0-10	sulfuric	LL1826	sulfuric sand
LL.1827	10-30	sulfuric	LL1826	
LL.1828	0-10	sulfuric	LL1828	sulfuric sand
LL.1829	10-30	sulfuric	LL1828	
LL.1830	30-50	sulfuric	LL1828	
LL.1831	0-10	sulfuric	LL1831	sulfuric loam
LL.1832	10-30	sulfuric	LL1831	
LL.1833	30-50	sulfuric	LL1831	
LL.1834	0-10	sulfuric	LL1834	sulfuric loam
LL.1835	10-30	sulfuric	LL1834	
LL.1836	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1836	sulfuric loam
LL.1837	10-30	sulfuric	LL1836	
LL.1838	30-50	hypersulfidic	LL1836	
LL.1839	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1839	hyposulfidic sand
LL.1840	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1839	
LL.1841	30-50	hyposulfidic (S_{CR}≥0.10%)	LL1839	
LL.1842	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1842	hyposulfidic sand
LL.1843	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1842	
LL.1844	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1844	hyposulfidic sand
LL.1845	10-30	sulfuric	LL1844	sulfuric sand
LL.1846	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1846	sulfuric loam
LL.1847	10-30	sulfuric	LL1846	
LL.1848	30-50	hypersulfidic	LL1846	
LL.1849	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1849	hyposulfidic sand
LL.1850	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1849	
LL.1851	30-50	hypersulfidic	LL1849	
LL.1852	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1852	hyposulfidic sand
LL.1853	10-30	other	LL1852	
LL.1854	0-10	hypersulfidic	LL1854	hypersulfidic sand
LL.1855	10-30	hypersulfidic	LL1854	
LL.1856	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1856	hypersulfidic sand
LL.1857	10-30	other	LL1856	
LL.1858	30-50	hypersulfidic	LL1856	
LL.1859	0-10	hyposulfidic (S_{CR}≥0.10%)	LL1859	hyposulfidic sand
LL.1860	10-30	hyposulfidic (S_{CR}≥0.10%)	LL1859	
LL.1861	30-50	hyposulfidic (S_{CR}<0.10%)	LL1859	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
CUR 11.0	-10 - 0	water	CUR11	
CUR 11.1	0 - 3	hyposulfidic (S_{CR}≥0.10%)	CUR11	hypersulfidic clay
CUR 11.2	3 - 10	hyposulfidic (S_{CR}≥0.10%)	CUR11	
CUR 11.3	10 - 50	hypersulfidic	CUR11	
CUR 11.4	50 - 100	hyposulfidic (S_{CR}≥0.10%)	CUR11	
CUR 12.1	0 - 5	sulfuric	CUR12	sulfuric loam
CUR 12.2	5 - 25	sulfuric	CUR12	
CUR 12.3	25 - 40	hyposulfidic (S_{CR}≥0.10%)	CUR12	
CUR 12.4	40 - 110	hypersulfidic	CUR12	
CUR 13.1	0 - 1	hyposulfidic (S_{CR}≥0.10%)	CUR13	sulfuric loam
CUR 13.2	1 - 10	hypersulfidic	CUR13	
CUR 13.3	10 - 18	sulfuric	CUR13	
CUR 13.4	18 - 30	hypersulfidic	CUR13	
CUR 13.5	30 - 100	hyposulfidic (S_{CR}≥0.10%)	CUR13	
CUR 14.1	0 - 0.5	salt	CUR14	
CUR 14.2	0.5 - 15	other acidic sandidic	CUR14	hyposulfidic loam
CUR 14.3	15 - 40	hyposulfidic (S_{CR}<0.10%)	CUR14	
CUR 14.4	40 - 60	hyposulfidic (S_{CR}≥0.10%)	CUR14	
CUR 14.5	60 - 80		CUR14	
CUR 15.1	0 - 5	hyposulfidic (S_{CR}<0.10%)	CUR15	sulfuric sand
CUR 15.2	5 - 15	sulfuric	CUR15	
CUR 15.3	15 - 40	hypersulfidic	CUR15	
CUR 15.4	40 - 60	hyposulfidic (S_{CR}<0.10%)	CUR15	
CUR 16.0	-10 - 0	water	CUR16	
CUR 16.1	0 - 5	other	CUR16	acidic sand
CUR 16.2	5 - 30	hyposulfidic (S_{CR}<0.10%)	CUR16	
CUR 16.3	30 - 40	#VALUE!	CUR16	
CUR 17.1	0 - 12	hyposulfidic (S_{CR}≥0.10%)	CUR17	sulfuric sand
CUR 17.2	12 - 18	other	CUR17	
CUR 17.3	18 - 27	sulfuric	CUR17	
CUR 17.4	27 - 40	sulfuric	CUR17	
CUR 17.5	40 - 48	hypersulfidic	CUR17	
CUR 17.6	48 - 55	hypersulfidic	CUR17	
CUR 17.7	55 - 65	hyposulfidic (S_{CR}<0.10%)	CUR17	
CUR 18.1	0 - 20	sulfuric	CUR18	sulfuric sand
CUR 18.2	20 - 50	sulfuric	CUR18	
CUR 18.3	50 - 75	hypersulfidic	CUR18	
CUR 18.4	75 - 90	hyposulfidic (S_{CR}≥0.10%)	CUR18	
CUR 19.1	0 - 3	other	CUR19	sulfuric sand
CUR 19.2	3 - 25	sulfuric	CUR19	
CUR 19.3	25 - 55	hypersulfidic	CUR19	
CUR 19.4	55 - 65		CUR19	
CUR 20.0	-40 - 0		CUR20	
CUR 20.1	0 - 5	hyposulfidic (S_{CR}<0.10%)	CUR20	hypersulfidic clay
CUR 20.2	5 - 10	hyposulfidic (S_{CR}≥0.10%)	CUR20	
CUR 20.3	10 - 25	hypersulfidic	CUR20	
CUR 21.1	0 - 0.5	hyposulfidic (S_{CR}<0.10%)	CUR21	sulfuric loam
CUR 21.2	0.5 - 10	hyposulfidic (S_{CR}<0.10%)	CUR21	
CUR 21.3	10 - 20	sulfuric	CUR21	
CUR 21.4	20 - 35	sulfuric	CUR21	
CUR 21.5	35 - 70	hypersulfidic	CUR21	

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
CUR 22.1	0 - 0.5	Salt	CUR22	other soil
CUR 22.2	0.5 - 2	salt	CUR22	
CUR 23.1	0 - 0.5	hyposulfidic (S_{CR}<0.10%)	CUR23	sulfuric sand
CUR 23.2	0.5 - 5	sulfuric	CUR23	
CUR 23.3	5 - 15	sulfuric	CUR23	
CUR 23.4	15 - 35	hypersulfidic	CUR23	
CUR 24.0	-30 - 0	water	CUR24	other soil
CUR 25.1A	0 - 0.05	salt	CUR25	
CUR 25.1B	0.05 - 0.5	sulfuric	CUR25	sulfuric sand
CUR 25.2	0.5 - 10	sulfuric	CUR25	
CUR 25.3	10 - 25	sulfuric	CUR25	
CUR 25.4	25 - 35	sulfuric	CUR25	
CUR 25.5	35 - 70		CUR25	
CUR 26.0	-20 - 0	water	CUR26	other soil
CUR 26.1	0 - 5		CUR26	
CUR 26.2	5 - 25		CUR26	
CUR 27.1	0 - 0.5	other	CUR27	sulfuric sand
CUR 27.2	0.5 - 10	sulfuric	CUR27	
CUR 27.3	10 - 25	hypersulfidic	CUR27	
CUR 27.4	25 - 35	sulfuric	CUR27	
CUR 27.5	35 - 60	hypersulfidic	CUR27	
CUR 28.1	0 - 0.5	hypersulfidic	CUR28	hypersulfidic sand
FIN 20.0	0 - 0	salt	FIN20	
FIN 20.1	0 - 10	sulfuric	FIN20	sulfuric sand
FIN 20.2	0 - 10	sulfuric	FIN20	
FIN 20.3	10 - 18	sulfuric	FIN20	
FIN 20.4	10 - 18	sulfuric	FIN20	
FIN 20.5	18 - 45	sulfuric	FIN20	
FIN 20.6	18 - 45	sulfuric	FIN20	
FIN 20.7	45 - 150	hypersulfidic	FIN20	
FIN 21.1	0 - 5	hyposulfidic (S_{CR}≥0.10%)	FIN21	sulfuric sand
FIN 21.2	5 - 35	sulfuric	FIN21	
FIN 21.3	5 - 35	hyposulfidic (S_{CR}≥0.10%)	FIN21	
FIN 21.4	35 - 55	hypersulfidic	FIN21	
FIN 21.5	55 - 70		FIN21	
FIN 22.0	-10 - 0	water	FIN22	other soil
FIN 23.1	0 - 0.5	sulfuric	FIN23	sulfuric lclay
FIN 23.2	0 - 10	sulfuric	FIN23	
FIN 23.3	0 - 10	hypersulfidic	FIN23	
FIN 23.4	10 - 18	sulfuric	FIN23	
FIN 23.5	18 - 30	sulfuric	FIN23	
FIN 23.6	30 - 70	hypersulfidic	FIN23	
FIN 24.1	0 - 0.05	sulfuric	FIN24	sulfuric sand
FIN 25.1	0 - 5	hyposulfidic (S_{CR}≥0.10%)	FIN25	hypersulfidic clay
FIN 25.2	5 - 15	hyposulfidic (S_{CR}≥0.10%)	FIN25	
FIN 25.3	15 - 70	hypersulfidic	FIN25	
FIN 26.1	0 - 0.05	sulfuric	FIN26	sulfuric loam
FIN 26.2	0 - 0.05	Salt	FIN26	
FIN 26.3	0 - 5	sulfuric	FIN26	
FIN 26.4	0 - 0.5	salt	FIN26	
FIN 27.1	0 - 5	hyposulfidic (S_{CR}≥0.10%)	FIN27	hypersulfidic clay

Sample Layer ID	Depth range	Type of ASS material	Site No.	ASS Soil type
FIN 27.2	5 - 25	hypersulfidic	FIN27	
FIN 27.3	25 - 70	hypersulfidic	FIN27	
FIN 28.1	0 - 0.5	sulfuric	FIN28	sulfuric lclay
FIN 28.2	0.5 - 10	sulfuric	FIN28	
FIN 28.3	10 - 35	sulfuric	FIN28	
FIN 28.4	35 - 75	hypersulfidic	FIN28	
FIN 29.1	-20 - 0	Water	FIN29	
FIN 29.2	0 - 15	hyposulfidic (S_{CR}<0.10%)	FIN29	hyposulfidic clay
FIN 29.3	15 - 80	hyposulfidic (S_{CR}<0.10%)	FIN29	
FIN 29.4	80 - 100	hypersulfidic	FIN29	
FIN 30.0	-30 - 0	water	FIN30	
FIN 30.1	0 - 1	other	FIN30	sulfuric sand
FIN 30.2	1 - 20	hypersulfidic	FIN30	
FIN 30.3	20 - 150	sulfuric	FIN30	
FIN 31.1	0 - 0.5	hyposulfidic (S_{CR}≥0.10%)	FIN31	sulfuric sand
FIN 31.2	0.5 - 15	sulfuric	FIN31	
FIN 31.3	15 - 30	sulfuric	FIN31	
FIN 31.4	30 - 90	sulfuric	FIN31	
FIN 32.1	0 - 15	hyposulfidic (S_{CR}≥0.10%)	FIN32	hypersulfidic sand
FIN 32.2	15 - 32	hyposulfidic (S_{CR}<0.10%)	FIN32	
FIN 32.3	32 - 60	hypersulfidic	FIN32	
FIN 32.4	60 - 90	hypersulfidic	FIN32	
FIN 33.1	0 - 15	other acidic sandidic	FIN33	hypersulfidic sand
FIN 33.2	15 - 40	hypersulfidic	FIN33	
FIN 33.3	40 - 70	hyposulfidic (S_{CR}≥0.10%)	FIN33	
FIN 34.1	0 - 0.5	Salt	FIN34	other soil
FIN 35.1	0 - 1	hyposulfidic (S_{CR}≥0.10%)	FIN35	
FIN 35.2	1 - 8	hyposulfidic (S_{CR}<0.10%)	FIN35	hypersulfidic sand
FIN 35.3	8 - 30	hypersulfidic	FIN35	
FIN 35.4	30 - 60	hypersulfidic	FIN35	
FIN 36.0	-20 - 0	water	FIN36	
FIN 36.1	0 - 15	hypersulfidic	FIN36	hypersulfidic loam
FIN 36.2	15 - 150	hypersulfidic	FIN36	
FIN 37.1	0 - 5		FIN37	other soil
FIN 38.1	0 - 1	hyposulfidic (S_{CR}<0.10%)	FIN38	
FIN 38.2	1 - 20	hypersulfidic	FIN38	hypersulfidic loam
FIN 38.3	20 - 50	hypersulfidic	FIN38	
FIN 39.0	-3 - 0	water	FIN39	
FIN 39.1	0 - 15	hyposulfidic (S_{CR}≥0.10%)	FIN39	hyposulfidic sand
FIN 39.2	15 - 25	hyposulfidic (S_{CR}≥0.10%)	FIN39	
FIN 39.3	25 - 100	hypersulfidic	FIN39	