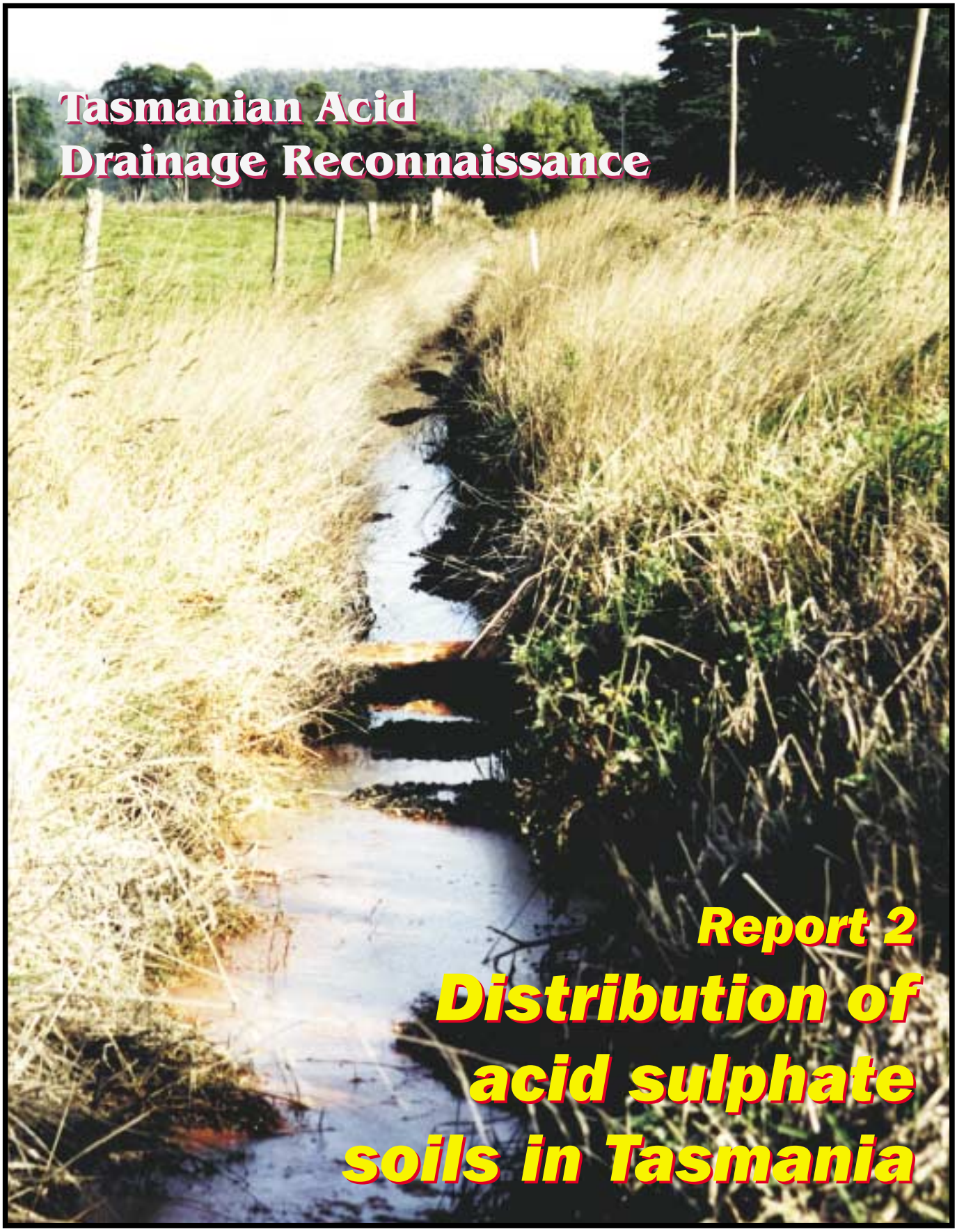

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Tasmanian Acid Drainage Reconnaissance

2. Distribution of acid sulphate soils in Tasmania

Dr Shivaraj Gurung

FOREWORD

Acid sulphate soils are pyritic sediments that can produce acid when exposed to oxidising conditions. These sediments typically occur in low-lying coastal areas, backswamps and in estuarine environments. The acid drainage resulting from the disturbance of acid sulphate soils can dissolve and mobilise toxic metals which can enter the receiving environment, causing serious damage to the aquatic ecosystem. Acid water and heavy metal pollution from the disturbance of acid sulphate soils is a major strategic environmental issue for management of coastal regions around Australia.

Section 36.1 of the Tasmanian *State Policy on Water Quality Management* (1997) requires that "a survey is carried out to identify Tasmanian soils and surface geology with the potential to give rise to highly acidic drainage if disturbed or developed". This reconnaissance investigation provides a basis for this objective. The program is a component of the proposed State *Water Quality and Quantity* programs and was largely funded by the National Heritage Trust. Water analyses were carried out by the Department of Primary Industries, Water and Environment at the Analytical Services Tasmania laboratory. Geochemical analyses, map production and project management were carried out by Mineral Resources Tasmania.

This report presents the results of a reconnaissance survey of acid sulphate soils in Tasmania. A new set of data on acid sulphate has been compiled which can serve as a preliminary baseline for future investigations. This report accompanies a map showing the distribution of actual and potential acid sulphate soil occurrences in Tasmania.

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EXECUTIVE SUMMARY

Desktop evaluation of background information has indicated that about 200 km of the Tasmanian coastline contains sediments with the potential to host acid sulphate soils. The potential sites typically occur along the northern Tasmanian coastline and on King Island and Flinders Island. Coastal, estuarine and backswamp sediments deposited since the Holocene period (about 6500 years ago) were found to be potential hosts for the development of acid sulphate soils in Tasmania.

Results from this survey indicate that acid sulphate soils occur in Holocene sediments, especially in areas where backswamps and remnant saltwater lagoons are common. Field evidence of the occurrence of potential acid sulphate soils was found at a number of locations in northern coastal Tasmania. Disturbance of these sediments is likely to expose pyritic layers that can readily oxidise to produce metal-rich acid drainage. With increasing demand for land development and intensive agricultural practices in coastal areas, the likelihood of greater exposure of acid sulphate soils poses a serious pollution problem in receiving waters adjoining heavily drained areas.

The investigation also indicated that the occurrence of acid sulphate soils in Tasmania is not confined to low-lying coastal sediments but that the soils may be extensively developed in inland bogs, lagoons and backswamps at elevations exceeding 20 m above sea level. These areas are commonly fertile land under intensive use and agricultural drainage, and the risk of disturbance of acid sulphate soils is therefore high. Field identification of actual acid sulphate soils occurrence at a number of locations in the northwest coastal regions and on King Island suggest that there is a need for further investigation to identify impacted areas in Tasmania which require further action.

This report presents the results of a reconnaissance survey of acid sulphate soils in Tasmania. A map indicating acid sulphate soil occurrence sites and the overall distribution of Holocene-age sediments as potential hosts has been produced as part of this study. The indicator map and field data from this survey are intended to serve as baseline information for carrying out systematic surveys to identify areas with the potential to give rise to acid drainage if disturbed by land-use practices.

ACRONYMS

AD	Acid drainage
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment Consultative Committee
AASS	Actual acid sulphate soil
ASS	Acid sulphate soil
NASS	Non-acid sulphate soil
NSMCASS	National Strategy for the Management of Coastal Acid Sulphate Soils
NWPASS	National Working Party on Acid Sulphate Soils
pHF	Field pH of soil in water
pHFOX	Field pH of soil in 30% hydrogen peroxide solution
PASS	Potential acid sulphate soil
QUASSIT	Queensland Acid Sulphate Soils Investigation Team
QUASSMAC	Queensland Acid Sulphate Soils Management Advisory Committee
TOS	Total oxidisable sulphur

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INTRODUCTION

Acid sulphate soils (ASS) are sediments that contain iron sulphide minerals (dominantly pyrite) which can result in net acid generation when exposed to oxidising conditions. These sediments formed in environments where key ingredients; sulphate, organic matter and iron oxides; were present under anaerobic conditions. Estuarine and coastal sediments, and remnant saltwater lagoons and backswamps formed during the Holocene period (6500 years ago), are considered ideal environments for the development of acid sulphate soils under anaerobic conditions. Low pH soils and acidic drainage waters are commonly associated with the disturbance of acid sulphate soils.

Disturbance and exposure of acid sulphate soils by earth moving practices and fluctuations in groundwater levels can facilitate the oxidation of pyrite, resulting in the generation of sulphuric acid. The acid can destroy soil structure and mobilise toxic metals liberated from acid-decomposition of clay minerals. Elevated levels of mobilised trace heavy metals in soil and water can be toxic to aquatic life if released into the drainage system during high flow events or a rise in the groundwater table. Several massive fish kills in coastal rivers have been caused by acid flush during major flood events. Land areas impacted by exposed acid sulphate soils have poor fertility, high vegetation dieback and are prone to surface scalding and erosion.

Potential acid sulphate soils (PASS) occur throughout Australia's coastal regions, with an estimated 40 000 km^2 of Australian coastal zones being affected by PASS (Sammut and Lines-Kelly, 2000). Inland areas containing peat bogs, swamp environments and lowland soils developed from dominantly pyritic parent materials are also potential hosts for the formation of acid sulphate soils. The formation of inland acid sulphate soils from mobilisation and accumulation of sulphur and iron in salt-scalded discharge areas has been reported by Fitzpatrick and Self (1997). Such areas are common in northern and central Tasmania where groundwater usage is high. Extensive drainage excavations in intensive agricultural and dairying lands in northern and central Tasmania are therefore likely to expose acid sulphate soils which can release acid generated from the oxidation of pyrite. The acid drainage can itself be highly corrosive to metal and concrete infrastructure.

In the past decade there have been spirited efforts to highlight the impacts of acid drainage developed from acid sulphate soils on the aquatic environment. Agencies such as the Queensland Acid Sulphate Soils Management Advisory Committee (QUASSMAC), the NSW Acid Sulphate Soils Management Advisory Committee (ASSMAC) and the National Working Party on Acid Sulphate Soils (NWPASS) continue to streamline guidelines for the management of coastal acid sulphate soils and have been developing strategies for the rehabilitation of severely impacted areas. The *National Strategy for the Management of Coastal Acid Sulphate Soils* has been prepared for the identification and management of coastal environments impacted by acid sulphate soils. Several priority management areas have already been mapped and identified in coastal areas of New South Wales (Tulau, 1999*a–f*, Tulau and Naylor, 1999).

There is currently no national standard method for mapping acid sulphate soils. The Queensland Acid Sulfate Soils Investigation Team (QASSIT) guidelines (Ahern *et al*., 1998*a*) and the field methods outlined in Woodhead *et al*. (2000) are specific to Queensland and New South Wales lowland acid sulphate soils respectively. The screening criteria and methods reported so far have been developed in northern NSW and Queensland, where lowland acid sulphate soils have been extensively studied in the last decade or so. In Tasmania, the coastal geomorphology and geological distribution of Holocene sediments with potential to host acid sulphate soils are entirely different to the lowland mangrove swamps and tidal flats of NSW and Queensland.

Although there have been occurrences where acid drainage discharging from suspected acid sulphate soils disturbance has caused environmental impact on water quality, the recent dry period in Tasmania has accentuated the problem in historic agricultural and drainage pastures. Lack of information on acid sulphate soils distribution in Tasmania warrants an urgent need to carry out systematic mapping to identify priority management areas and develop remediation strategies for achieving Tasmania's water quality objectives under the *State Policy on Water Quality Management* (1997).

OBJECTIVES

The general objective of this reconnaissance study was to implement section 36.1 of the Tasmanian *State Policy on Water Quality Management* (1997): ". . . . a survey is carried out to identify Tasmanian soils and surface geology with the potential to give rise to highly acidic drainage if disturbed or developed".

The specific project objectives were:

- to define areas and geological units where there is the potential for acid drainage to occur as a result of development or disturbance of acid sulphate soils;
- to generate a reconnaissance map of the distribution of acid sulphate soils in Tasmania; and
- to provide baseline information on acid sulphate soils priority risk areas so that an appropriate remediation strategy may be developed to achieve the water quality objectives.

METHODS

The project primarily involved desktop assessment of the distribution of potential host sediments for acid sulphate soils followed by selective field investigation of the sites. The survey involved field indicator mapping, surface water sampling and soil core sampling of selected suspect sites. Depth profile sampling was carried out in localities where actual acid sulphate was encountered.

Desktop evaluation

Desktop evaluations of geology, geomorphology, soil type, soil chemical data and surface water chemistry were carried out to build baseline information for targeting field investigation and reconnaissance mapping of acid sulphate soils. Holocene sediments, low-lying river flats, remnant saltwater lagoons/lakes and backswamps were specifically targeted for field investigation. Holocene coastal sediments located below 20 m AHD, and which were likely to be disturbed by land-use practices, were selected for confirmatory investigation and sampling. Background information and relevant data explored for desktop evaluation are listed in Table 1.

Field assessments

An acid sulphate soil field testing kit obtained from NSW Agriculture was used for quick pH testing of the soil core samples. Where possible, the assessment and interpretation methods outlined in Woodhead *et al*. (2000) were followed. Field measurement of pH and electrical conductivity (EC) of surface waters in drains, creeks and seepages were carried out at 83 sites and fifty sites were sampled for laboratory analysis. Field measurement and sampling were also carried out for selected groundwater bores on King Island, Flinders Island and at Mella.

Soil core samples were taken from selected sites which showed field indications of potential acid sulphate soil presence. Only one depth (maximum 1.5 m) sample of PASS was collected from each site for geochemical analysis. Depth-wise core sampling was carried out for sites that had strong field evidence of actual acid sulphate soil. A total of 137 sites were investigated and 115 core samples collected. Sampling and analysis guidelines for acid sulphate soil in Ahern *et al*. (1998*a*) were followed wherever possible.

Analytical methods

Laboratory measurements of pH, EC, sulphate, acidity, alkalinity and metals (Al, As, Cd, Cu, Fe, Mn, Pb, Zn) in surface and ground waters were carried out

Table 1

Description of desktop data sources

Data source	*Description*	*Reference #*
HYDROL	Chemical and biological analysis of mainly surface waters	Hydrol database, DPIWE
BORIS	Groundwater chemistry, bore logs	Boris database, MRT
TASGEOL	Quaternary geology	Tasgeol database, MRT
MAJOR	Soil chemistry data	Major database, DPIWE
Relevant literature	Relevant literature reviewed	Sammut and Lines-Kelly, 2000; Woodhead *et al*.,2000; Ahern and Hey, 1999; Ahern *et al*., 1999; Anorov and Hey, 1999; Hey, 1999; Hey and Ahern, 1999; McElnea and Ahern, 1999; Powell and Ahern, 1999; Tipman, 1999; Ahern *et al*., 1998*a*; Ahern *et al*., 1998*b*; Stone *et al*., 1998; Ahern *et al*., 1997; Dent and Bowman, 1996; White *et al*., 1996; White *et al*., 1995; Melville *et al*., 1993.

Full listing of relevant literature is given in the Reference section of this report

Table 2

Acid sulphate soil screening criteria

TOS (%)	#*Drain Water pH*	*Field Soil pH* $pH_{(F)}$	*Field Peroxide pH* $pH_{(FOX)}$	*ASS types*
>0.10	<5.0	<4.0	<4.0	AASS
>0.10	>5.0	>4.0	<4.0	PASS
>0.10	>5.0	>4.0	>4.0	NASS

If drainage water is present

by Analytical Services Tasmania using the standard methods outlined in Rayment and Higginson (1992).

The pyrite content in the soil samples was determined by total oxidisable sulphur (Method 20 in Ahern *et al*., 1998*b*). Total sulphur, S(T), and trace element concentration in soil samples were measured by X-ray fluorescence (XRF) in pressed powder pellets. Hydrochloric acid extractable sulphur, S(HCl), was determined in 4 M HCl extracts. Total oxidisable sulphur (TOS) was calculated as S(T) - S(HCl). The acid-producing potential (APP) of the sample was calculated as TOS (%) × 30.6, based on the stoichiometry of the pyrite oxidation reaction.

The QUASSIT uses TOS >0.03% as a screening action criteria based on the clay content of the soils and extent of exposure. For disturbance ≥1000 tonnes of ASS with ≥0.03% oxidisable sulphur or equivalent APP, a detailed management plan and development consent is recommended (Ahern *et al*., 1998*a*). The minimum XRF detection limit concentration of total sulphur (0.1% S) was found to be a more appropriate sulphur trail for the dominantly sandy loam soils hosting potential acid sulphate soils in Tasmanian coastal areas. Combined field and laboratory measurement screening criteria used to confirm potential acid sulphate soil (PASS), actual acid sulphate soils (AASS), and non-acid sulphate soils (NASS) are given in Table 2.

Presentation of survey results

- This report.
- A map indicating the distribution of acid sulphate soils in Tasmania.
- Soil chemical data.
- Water chemistry data.

RESULTS AND DISCUSSION

Distribution of Holocene sediments in coastal Tasmania

Tasmanian coastal areas generally consist of undulating lowlands, coastal plains and extensive sand barriers, with isolated granite peaks and dolerite plateaux separated by areas of moderate relief. Deposition of marine sediments during the Holocene period (6500 years ago) resulted in major changes to the Tasmanian shoreline and coastal landscape. Large tidal flats and inland areas of saltwater lagoons and backswamps developed with emerging sand barriers. As sea level stabilised, the gradual sedimentation of the sulphate-rich tidal flats, saltwater lagoons and backswamps with marine sediments may have created an ideal environment for the formation of pyrite, and hence development of acid sulphate soils.

In Tasmania, Holocene sediments with the potential to host acid sulphate soils mostly occur along the northern coastline and on King Island and Flinders Island. Unlike Queensland and New South Wales, where extensive mangrove swamps and estuarine sediments occur below 5 m AHD, coastal sediments in Tasmania may occur at AHD of up to 30 metres.

A map showing the distribution of Holocene-age coastal sediments and the possible potential acid sulphate sites investigated in this survey has been produced (Map 4). This map is part of the series of four maps created for the Tasmanian acid drainage reconnaissance project. The following sections briefly describe possible indications of acid sulphate soil occurrences in Tasmania.

Distribution of acid sulphate soils in Tasmania

Northwest Tasmania

Desktop and field evidence of acid sulphate soil occurrence in northwest Tasmania indicated that isolated pockets of pyritic sediments, which are potential acid sulphate soils, may occur buried under the coastal sediments. Holocene sediments with the potential to host acid sulphate soils (PASS) occur mostly in the Smithton and Woolnorth areas. These areas also contain a number of backswamps such as the Mowbray (Mella), Montagu and Brittons swamps which have been extensively drained for dairying. Field and laboratory results indicate that these swamps contain pockets of acid sulphate soils that are exposed at a number of localities and are currently discharging acid drainage into the receiving waters.

Acid drainage from the disturbance of acid sulphate soils was evident at a number of localities in northwest Tasmania. Large areas of heavily drained swamp at Mella and coastal sand flats in the Harcus River area showed field evidence of acid sulphate soils in excavated drains. The drains affected by acid sulphate soils generally had very low pH (<3.5) waters containing very high levels of sulphate and dissolved metals. Field pH tests of the soil samples showed strong oxidation reaction with hydrogen peroxide solution (Plate 1). Reported incidences of fish kills at lower Scopus Creek in 2000 (David Krushka, pers. comm.) suggest that periodic flushing of the stored acid into the drainage system during peak flow events may seriously impact aquatic life downstream.

Land-use practices, local hydrology and climatic conditions in the northwest coastal areas have had a direct affect on acid drainage generation from disturbance of acid sulphate soils. The magnitude of the impact on the receiving environment may be dependent on the fluctuations in groundwater surface in response to water usage and the frequency of rainfall events. This may be the case at Mella, where lowering of the water table during high groundwater usage facilitates a buildup of acid generated from the oxidation of the acid sulphate soil. The stored acid is periodically flushed into the drainage system during rises in the groundwater table from precipitation recharge or during periods of low usage (Plates 2 and 3). Deep drainage in the Mella area commonly exposes acid sulphate soils that contain significant amounts of stored acid which periodically gets flushed during rainfall events or when groundwater levels rise (Plate 4). A conservative estimate shows that at Mella, about 1000 ha of acid sulphate soils may be contributing acid drainage to Scopus Creek during periods of peak drainage flow. Swamp environments similar to Mella also occur at Togari, Montagu and Brittons. Drainage water quality in these areas is generally poor, with high salinity and sulphate levels. A typical acid sulphate soil profile at Mella and in the Harcus River area is given in Table 3.

Drainage waters affected by acid drainage seepage in the Mella area generally had a pH <4.0 and EC ranging from 1.0 to 25.0 dS/m (at the Malugas Road drain), indicating that salinity may be a major problem resulting from current land-use practice. Acidity in the drain water is commonly in the range 1000–4000 mg $CaCO_3$/L, with sulphate as high as 12 000 mg/L. Dissolved Al (5–90 mg/L), Fe (5–1500 mg/L) and Mn (0.5–2.0 mg/L) are the main metal contaminants in the surface drain waters. Groundwater in the Mella area is acidic (pH <5.0) and contains high dissolved Fe and total dissolved solids.

A depth profile at Mella (Table 3) showed that acid sulphate soils in the area occur at depths of 0.0–2.0 m, although more detailed sampling is required to assess the actual thickness distribution in the area. The low-lying coastal sediments north of Montagu and at Woolnorth are likely to host potential acid sulphate soil at near-surface depths. Drains in the area generally contain iron-oxyhydroxide flocs and occasional jarosite coatings on drain banks.

Plate 1. *Field testing of acid sulphate soil at Mella, northwest Tasmania*

Plate 2. *Acid drainage discharge from disturbance of acid sulphate soil at Mella, northwest Tasmania*

Low-lying coastal sand dunes and swamp sediments in the area may be potential hosts for buried PASS, as occurs at a channel excavation site in the Harcus River area (Plate 5). Large bands of heavily mottled iron-rich sediments are exposed at a depth of about 10 m at this site (Plate 6). When exposed these PASS sediments rapidly oxidise to generate acid, resulting in metal-rich acid drainage during surface runoff. The Harcus and Welcome river catchments drain large areas of low-lying coastal and swamp sediments. The area is currently under pasture but a change in land use involving deep channel cuts and large-scale disturbance may lead to the exposure of buried PASS. The resulting large quantity of acid flush into the Harcus and Welcome rivers may pose a potential threat to the aquatic environment and coastal fauna.

Figure 1 shows a general indication of the distribution of Holocene-age sediments likely to host acid sulphate soils at various depths. Potential indicator sites investigated in this survey showed that PASS may be well developed in the northwest coastal area of Tasmania. Field identification of acid drainage from the disturbance of acid sulphate soils at some sites in northwest Tasmania suggests that more detailed mapping in the area is required to delineate priority management areas.

Table 3

Acid sulphate soil profiles chemistry at selected sites in northwest Tasmania

Location	*Field No.*	*Depth (m)*	*pH_F*	*pH_{FOX}*	*TOS (%)*	*APP (kg H_2SO_4/t)*	*Approx. area affected (ha)*
Mella,	E201297	0.50	3.6	3.3	2.7	83	1000
Smithton:	E201298	1.00	3.6	2.5	18.4	563	
336 178 mE,	E201299	1.50	3.5	3.4	16.5	505	
5 475 478 mN	E201300	2.50	6.7	5.7	0.5	15.3	
Harcus River, Woolnorth: 316 525 mE, 5 480 295 mN	E201210	7.00	3.10	2.5	7.3	223	1500

Note: Harcus River site is a channel cut of approximately 10 m depth and one kilometre long.

Plate 3. *Typical acid drainage in drains excavated in acid sulphate soils at Mella, northwest Tasmania*

Plate 4. *Acid flush during peak flow in drain containing acid sulphate soil exposures*

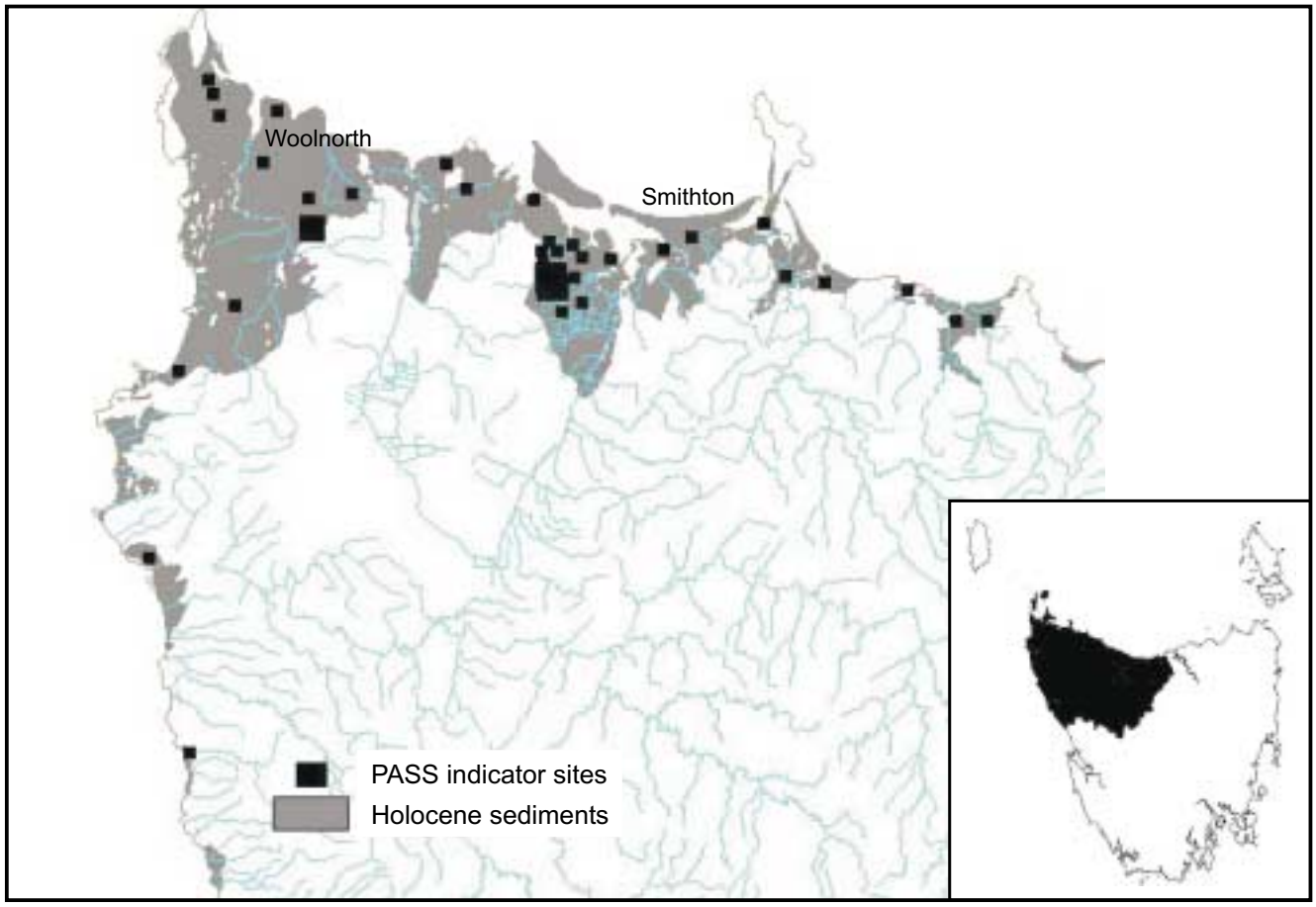

Figure 1. *Distribution of potential acid sulphate soils (PASS) in northwest Tasmania*

Plate 5. *Potential acid sulphate soil disturbance from a channel excavation, northwest Tasmania*

Plate 6. *Potential acid sulphate soil layers in the channel excavation shown in Plate 5, northwest Tasmania*

Northeast Tasmania

Extensive coastal sand dunes and barriers, as well as saltwater lagoons, occur along the Bass Strait coastline east of George Town (fig. 2). Core sampling with a hand auger was not suitable in most of the low-lying flats. Where sampling was carried out, the top 1.5 m of the sandy clay loam sediments contained TOS <0.10%. At George Town, a soil sample taken from an excavated pit showed TOS of 1.6% (APP = 48 kg H_2SO_4/t). It is possible that some areas may contain potential acid sulphate soils buried at depth, especially in the Bridport–Tomahawk areas. Drilling to a depth of more than ten metres may be necessary to confirm the presence of potential acid sulphate soils in these areas. Clayey marine sediments also occur in patches along the coastal areas from St Helens to Falmouth. A soil sample taken at St Helens (E201371) showed a TOS of 3.2% (APP = 98 kg H_2SO_4/t) at AHD 52 m and it is possible that several of the low-lying flats may contain potential acid sulphate soils.

Drainage water in the area shows generally neutral pH and elevated levels of EC and dissolved metals. Land development in the area is minimal and therefore the impact from potential acid sulphate soils on water quality cannot be assessed.

King Island

Most of the northern part of King Island is blanketed with thick coastal sediments ranging from lacustrine deposits to recent aeolian sands. Soils developed in the coastal areas are predominantly calcareous sandy loam with significant organic topsoil depth. Soil types on King Island have been described by Stephens and Hosking (1932). Low pH soils are common, especially in the Reekara and Egg Lagoon areas.

The occurrence of iron hardpan and coffee rock in the central parts of King Island indicates that iron-rich sediments in the underlying coastal marine sediments may have provided an ideal environment for bacteria to activate the pyrite-forming process in the presence of seawater sulphate and organic matter. Alternatively the dominantly pyritic metasedimentary rocks of the Rocky Cape Group in the southern part of King Island

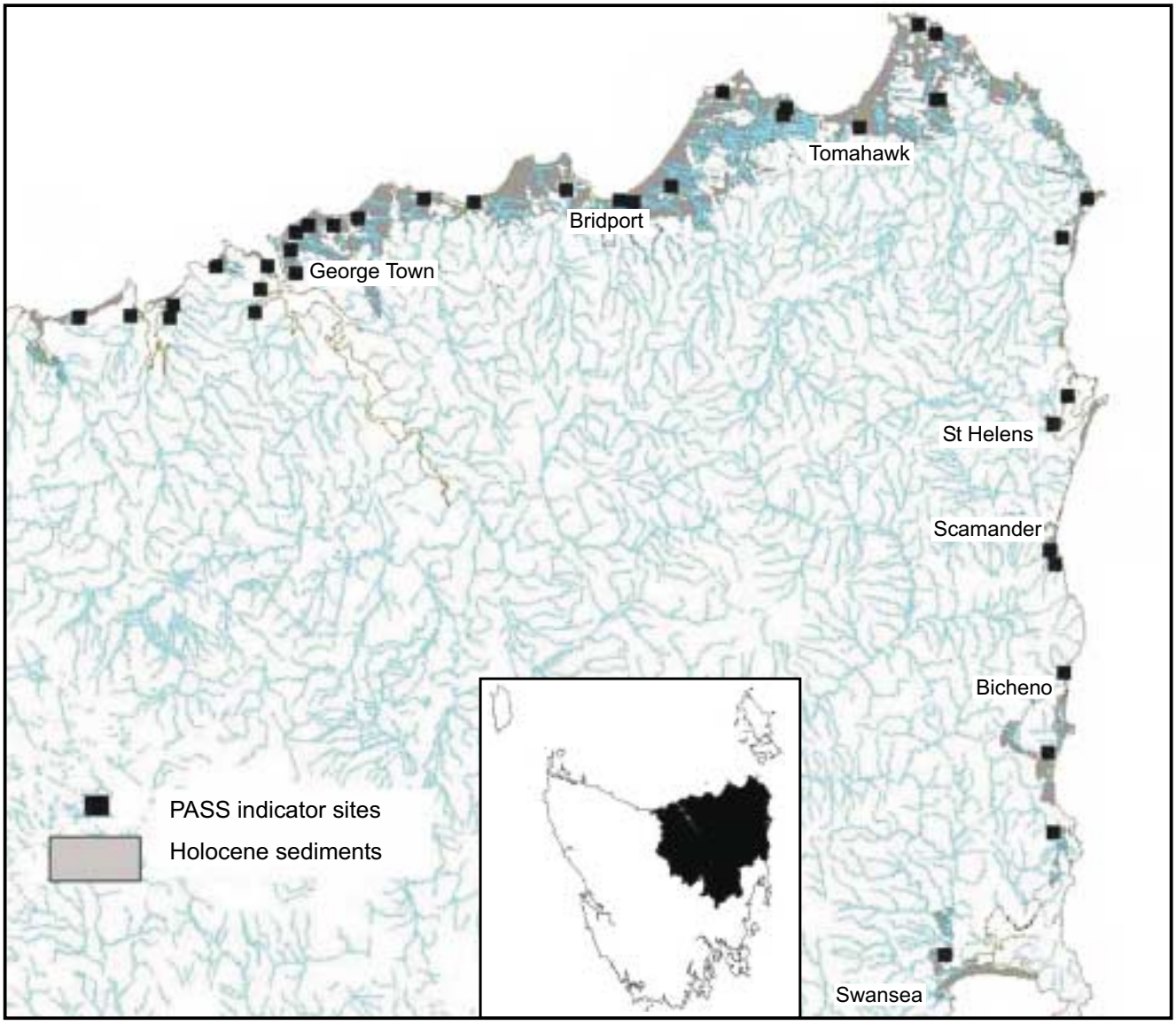

Figure 2
Distribution of potential acid sulphate soils (PASS) in northeast Tasmania

may have provided suitable parent material for the development of pyritic soil.

Pyritic soils in the Bungaree Creek area are dominantly black loamy sands with very little topsoil cover. Soil cores taken to depth of about 1.5 m contained total oxidisable sulphur (TOS) >2% and a field pH <4.0. Site profile chemistry indicates increasing TOS with depth, suggesting that the area may contain a significant amount of acid sulphate soil at depths of more than 1.5 metres (Table 4).

Large-scale channel excavation along Bungaree Creek has exposed a large section of the creek containing significant amounts of acid sulphate soil exposures. This is shown by the extremely low pH (<3.5) water in the creek and copious amounts of jarosite coatings on creek banks. Significant amounts of Fe-hydroxide

Table 4
Acid sulphate soil profile chemistry in the Bungaree area, King Island

Location	*Field No.*	*Depth (m)*	*pH_F*	*pH_{FOX}*	*TOS (%)*	*APP (kg H_2SO_4/t)*	*Approx. area affected (ha)*
Bungaree,	E201200	0.10	3.7	3.6	2.5	77	600
King Island:	E201201	0.20	4.0	3.6	5.4	165	
232 000 mE,	E201102	0.50	3.0	2.6	5.6	171	
5 593 599 mN	E201203	1.00	3.8	3.1	8.3	254	
	E201204	1.50	4.1	3.7	9.7	298	

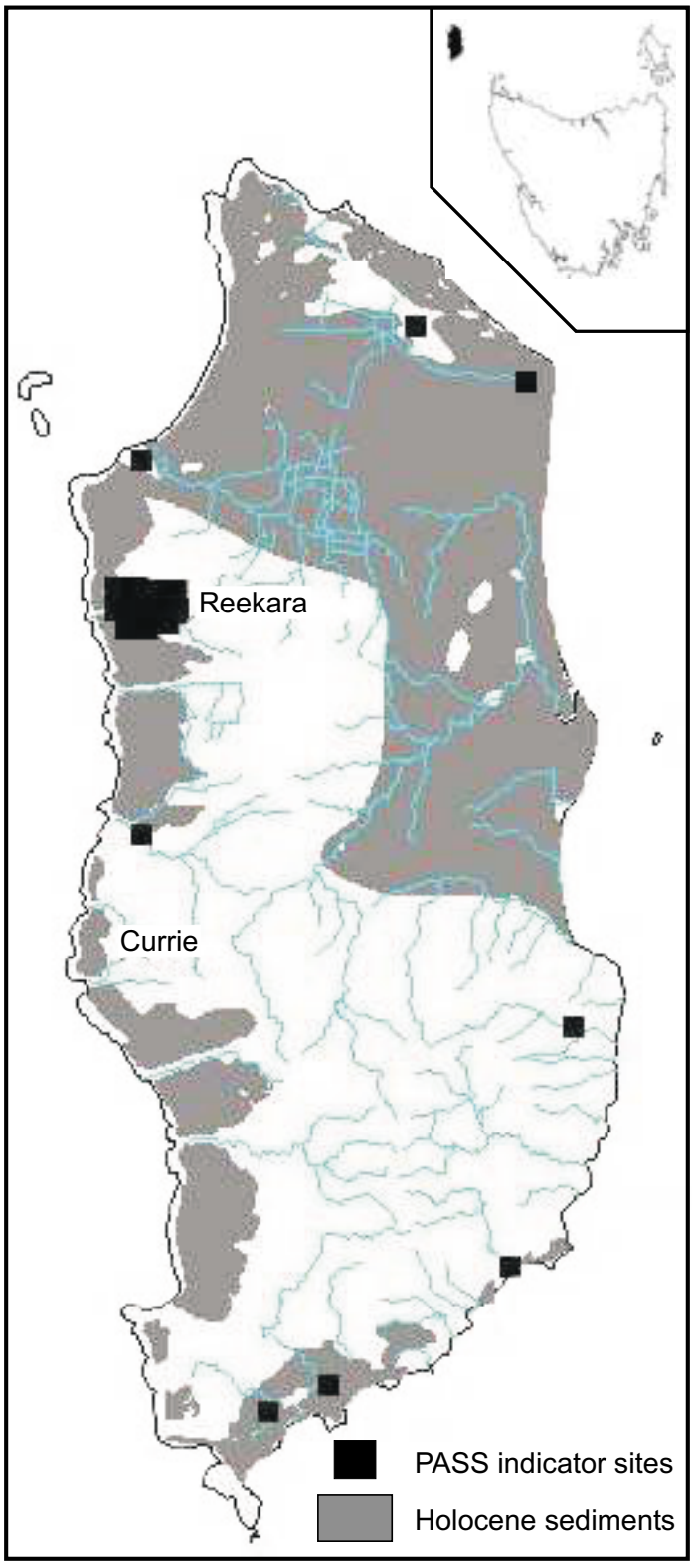

Figure 3
Distribution of potential acid sulphate soils (PASS) on King Island

coatings on the downstream creek bed, and on the root mesh of ti trees, suggest that acid flush from oxidised acid sulphate soil is occurring during high flow events. The base flow waters of Bungaree Creek contain high sulphate, Al, Fe and Mn. The EC is in the range 2–8 dS/m and is generally higher at the excavated site. Although the creek water has high acidity, it also has high alkalinity (liming effect), and the effect of neutralisation is evident in a higher pH downstream (Appendix 2).

Flinders Island

The eastern half of Flinders Island consists of mostly low-lying coastal plains underlain by mostly Quaternary to Holocene-age sediments, with several inland lagoons and swamp lands. The soils developed in the area are dominantly sandy to peaty clay loam derived from granitic parent materials and belonging to the Nala association of Dimmock (1957). Mottling and hardpan formation at depth are common. Topsoil pH is generally less than 5.5 in the area.

Because of limited time, only seventeen sites around the island were investigated and sampled. Except for a site in the Wingaroo area, the TOS content of the top 1.5 m of soil cores was generally less that 0.1%. A core sample of peaty clay loam at Wingaroo had a TOS of about 1.1% (APP = 33 kg H_2SO_4/t) but field pH >5.0. Other sites in the Memana, Palama and Nala areas had field test pH of less than 4.0.

Although this survey did not locate significant areas of potential acid sulphate soil on Flinders Island, evidence of hardpan formation at depth and common mottling in the soils indicates that oxidation of iron-rich sediment at depth is taking place. Iron and sulphate-rich groundwater in the Memana and Lady Barron areas indicate possible sulphide-rich sediments at depth in Holocene sediments.

Drainage water in the area generally had near neutral pH but very high EC and sulphate concentration (Appendix 2). Arsenic and aluminium in the water were the dominant species of concern.

Southeast Tasmania

Most of the raised coastal areas in southeast Tasmania comprise mainly dolerite and basaltic cliffs, and the likelihood of potential acid sulphate soils occurring is therefore minimal. The distribution of Holocene sediments along coastal areas in southeast Tasmania is limited to small patches in low-lying flats in the Scamander, Bicheno, Swansea and Dodges Ferry areas. A few samples taken from these localities had TOS <0.1%.

Southwest Tasmania

Except for a large stretch of sand dunes (Henty dunes) in the Strahan area, very few deposits of Holocene sediments occur along the southwest coast because of the geomorphology of the area. The raised coasts are generally at AHD >50 m and the coastal rocks exposed in these areas are dominantly volcanic metasedimentary rocks. Although not strictly acid sulphate soil, recent pyritic tailings sediments deposited in the King River delta area are commonly of acid producing types, with TOS values of 4.0% and field pH <4.0.

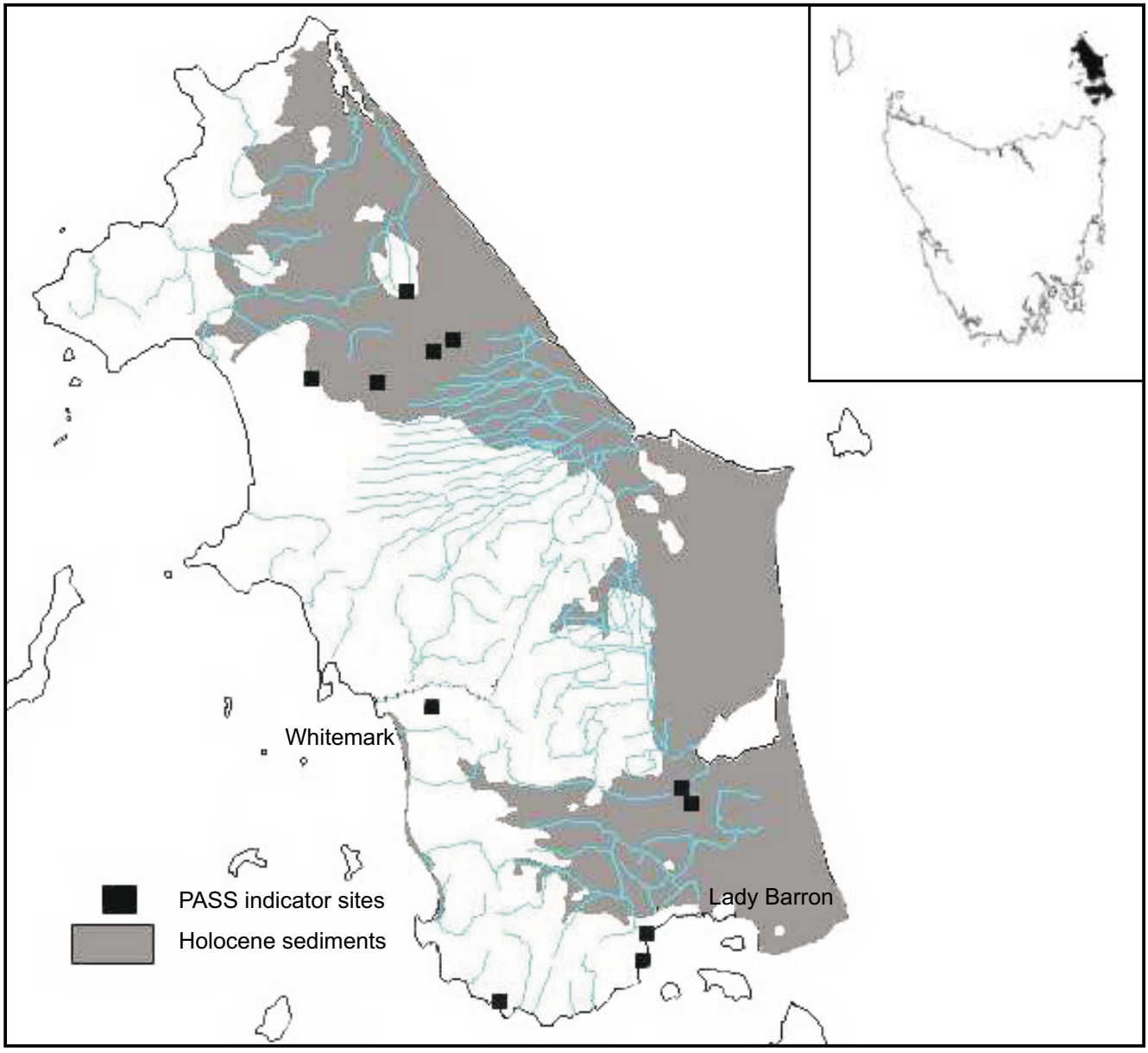

Figure 4

Distribution of potential acid sulphate soils (PASS) on Flinders Island

CONCLUSIONS

Potential acid sulphate soils occur along the northern coastal regions of Tasmania and on King Island and Flinders Island, where Holocene sediments are most extensive. The southern coastal regions of Tasmania are mostly rugged and hold little prospect for the development of acid sulphate soils.

The distribution of potential acid sulphate soils in Tasmania is not confined to coastal Holocene sediments. Several backswamps and remnant saltwater lagoons are ideal environments for the formation of potential acid sulphate soils and these areas are likely to contain host sediments in isolated pockets.

Increasing land and water development pressure and the current land-use practices in the northern Tasmanian coastal areas are likely to increase the likelihood of exposing potential acid sulphate soils.

This reconnaissance survey has indicated the presence of acid sulphate soils in coastal areas of Tasmania. There is a potential risk of pollution of coastal waterways from acid drainage resulting from the disturbance of acid sulphate soils in some areas northern Tasmania.

RECOMMENDATIONS

This report highlights the presence of acid sulphate soils in Tasmania but the information gathered so far is limited. The systematic mapping of acid sulphate soils to identify areas with the potential to give rise to acid drainage from disturbance or land development activity is warranted.

Detailed follow-up investigations should be carried out in the priority risk areas and appropriate draft development controls should be developed to minimise risks.

Once priority risk areas are identified, management awareness programs should be developed for land users.

In areas where acid drainage from actual acid sulphate soils has impacted on the water quality, site-specific remediation methods should be developed to meet the water quality objectives.

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[30 April 2002]

APPENDIX 1

Soil chemistry data

Explanations

FIELD_NO	Field number of sample
LOCATION	Location of sample site
AHD	Australian height datum in metres
LITHOLOGY	Lithological description
RCODE	Rock code of geological units
SOIL_CODE	Soil code for Tasmanian soil map
$pH_{(F)}$	Field paste pH of the soil sample
$pH_{(FOX)}$	Field paste pH in 30% hydrogen peroxide
$pH_{(L)}$	Soil paste pH in laboratory
Lab_EC	Electrical conductivity of the paste sample in laboratory
$S_{(T)}$	Total sulphur (%)
$S_{(HCl)}$	Sulphate sulphur in 4M HCl extract
TOS	Total oxidisable sulphur (S(T) – S(HCl)
APP	Acid producing potential
ANC	Acid neutralising capacity
TYPE	Acid sulphate soil classification
	NASS = Non-acid sulphate
	AASS = Actual acid sulphate soils
	PASS = Potential acid sulphate soils
REG_NO	Registration number at laboratory
GEOLOGY	Geology rock types
DATE	Date of sampling

Trace elements: arsenic (As), cobalt (Co), copper (Cu), nickel (Ni), lead (Pb), tin (Sn), tungsten (W) and zinc (Zn) in mg/kg

Major elements: silica (Si), iron (Fe), titanium (Ti), aluminium (Al), manganese (Mn), magnesium (Mg), calcium (Ca), sodium (Na), potassium (K) and phosphorous (P) in %.

All data by S. Gurung, 2001

FIELD No	LOCATION	AMG East	AMG North	R CODE	SOIL CODE	AHD (m)	CATCHMENT	REG No	GEOLOGY	GEOL_DESCRIPTION	SOIL_DESCRIPTION	DATE
E201147	Smithton	338473	5477954	7527	558	8.0	Duck River	20000088	Qps	Coastal sand and gravel	Clay loam with mottles	08/04/2001
E201148	Smithton	340678	5477855	7527	558	3.0	Duck River	20000089	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201149	Smithton	334502	5482592	7527	1434	2.0	Duck River	20000090	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201150	Smithton	337850	5476348	7527	1434	8.0	Duck River	20000091	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201151	Smithton	338362	5474256	7527	3040	18.0	Duck River	20000092	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201152	Smithton	336757	5473555	7527	3040	19.0	Duck River	20000093	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201153	Smithton	345016	5478637	7527	558	16.0	Duck River	20000094	Qps	Coastal sand and gravel	Clay loam with mottles	14/01/2000
E201154	Montagu	329112	5483506	7527	558	7.0	Montagu River	20000095	Qps	Coastal sand and gravel	Clay loam with mottles	13/04/2001
E201155	Montagu	327463	5485590	7527	558	7.0	Montagu River	20000096	Qps	Coastal sand and gravel	Clay loam with mottles	13/04/2001
E201156	Woolnorth	319802	5483190	7527	558	13.0	Welcome River	20000097	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201157	Woolnorth	316300	5482746	7527	558	10.0	Welcome River	20000098	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201158	Woolnorth	312653	5485718	7527	558	10.0	Welcome River	20000099	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201159	Woolnorth	309065	5489502	7527	558	9.0	Welcome River	20000100	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201182	Corinna	327760	5384183	57	996	17.0	Pieman	20000318	Lrc	Pyritic, siltstone and mudstone	Pyritic sandy loam	05/04/2001
E201183	Strahan	355501	5345569	7527	558	10.0	King–Henty River	20000319	Qps	Coastal sand and gravel	Sandy loam	05/04/2001
E201184	Kelso Road	481253	5446205	6505	560	21.0	Tamar River	20000320	Ts	Gravel, sand, silt, clay and regolith	Sandy loam	16/03/2001
E201185	Waterhouse Road	545374	5462238	7527	563	25.0	Great Forester	20000321	Qps	Coastal sand and gravel	Sandy loam	12/02/2001
E201186	Bonney Banks	480442	5442609	6505	560	10.0	Tamar River	20000322	Ts_Pl	Gravel, sand, silt, clay and regolith	Sandy loam	16/03/2001
E201187	George Town	486831	5455071	7527	563	27.0	Tamar River	20000323	Qps	Coastal sand and gravel	Sandy loam	16/03/2001
E201188	Reekara	234444	5593273	7527	20	30.0	King Island	20000324	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	06/04/2000
E201189	Bungaree	233808	5593539	7527	20	30.0	King Island	20000325	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	05/04/2000
E201190	Bungaree	233434	5593025	7527	20	30.0	King Island	20000326	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	05/04/2000
E201191	Bungaree	232822	5593517	7527	20	30.0	King Island	20000327	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	05/04/2000
E201193	Yellow Rock	232748	5600153	2	20	9.0	King Island	20000329	Lg	Granite	Residual soil	05/04/2000
E201194	George Town	485917	5452330	7527	563	5.0	Tamar River	20000330	Qps	Coastal sand and gravel	Clay loam with mottles	16/03/2001
E201195	Porky Creek	232755	5582627	7527	20	18.0	King Island	20000331	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	06/04/2000
E201196	Port Sorell	460958	5442208	6505	559	8.0	Rubicon River	20000332	Ts	Gravel, sand, silt, clay and regolith	Clay loam	06/04/2001
E201197	Colliery Lagoon	241529	5556837	7527	562	10.0	King Island	20000333	Qps_Qh	Coastal sand and gravel	Clayey loam with peaty TS	09/04/2000
E201198	Big Lake	238660	5555530	7527	562	5.0	King Island	20000334	Qps_Qh	Coastal sand and gravel	Clayey loam with peaty TS	09/04/2000
E201199	Port Sorell	466989	5441900	6505	559	19.0	Rubicon River	20000335	Ts_Cw	Gravel, sand, silt, clay and regolith	Clayey-sandy loam	06/04/2001
E201200	Bungaree	232000	5593599	7527	20	30.0	King Island	20000336	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	05/04/2000
E201202	Bungaree	232000	5593599	7527	20	30.0	King Island	20000338	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	07/04/2000
E201205	Bungaree	232509	5592800	7527	20	30.0	King Island	20000341	Qps_Lg	Coastal sand and gravel/granite	Sandy loam with organic-rich TS	07/04/2000
E201207	Woolnorth	316511	5480301	7527	558	10.0	Welcome River	20000343	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201210	Woolnorth	316525	5480295	7527	558	9.0	Welcome River	20000346	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201211	Marrawah	310319	5473978	7527	558	16.0	Welcome River	20000347	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001

FIELD No	LOCATION	AMG East	AMG North	R CODE	SOIL CODE	AHD (m)	CATCHMENT	REG No	GEOLOGY	GEOL_DESCRIPTION	SOIL_DESCRIPTION	DATE
E201212	Marrawah	305774	5468709	7527	558	15.0	Welcome River	20000348	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001
E201213	Arthur River	303366	5453526	7527	558	16.0	Arthur River	20000349	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001
E201214	Rebecca Lagoon	306596	5437693	7527	558	8.0	Nelson Bay	20000350	Qps_Lrc	Coastal sand and gravel	Sandy loam with mottles	06/04/2001
E201215	Crayfish Creek	364790	5475349	7527	1434	8.0	Black–Detention River	20000351	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001
E201216	Pebbly Bay	371179	5472744	7527	1434	10.0	Black–Detention River	20000352	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001
E201217	Wynyard	393703	5459786	7527	1455	13.0	Inglis River	20000353	Qps	Coastal sand and gravel	Clay loam with mottles	06/04/2001
E201218	Turners Beach	436043	5441055	7501	1455	4.0	Forth–Wilmot River	20000354	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	26/03/2001
E201219	Devonport Airport	452904	5441747	7501	1455	10.0	Rubicon River	20000355	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	26/03/2001
E201220	Long Flat	488676	5456301	7527	563	22.0	Tamar River	20000356	Qps	Coastal sand and gravel	Sandy loam with hardpan	16/03/2001
E201221	Beechford	496483	5457506	7527	563	21.0	Pipers River	20000357	Qps	Coastal sand and gravel	Sandy loam with hardpan	28/03/2001
E201222	Lulworth	506929	5460384	7527	2540	14.0	Pipers River	20000358	Qps	Coastal sand and gravel	Sandy loam with hardpan	12/02/2001
E201223	Eddystone	610452	5460512	7527	2540	20.0	Musselroe–Ansons Bay	20000359	Qps_Dgaas	Coastal sand and gravel/granite	Residual soil	07/02/2001
E201224	St Helens	605197	5425245	7501	559	5.0	George River	20000360	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	04/02/2001
E201225	Asbestos Range Park	474369	5449742	7527	974	10.0	Tamar River	20000361	Qps_Ts	Coastal sand and gravel	Sandy loam with some mottles	16/03/2001
E201226	Scamander	604165	5373697	7501	2371	10.0	Scamander–Douglas River	20000362	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	31/01/2001
E201227	Lilla Villa	605130	5361158	7501	2561	18.0	Swan–Apsley River	20000363	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	30/01/2001
E201228	Belmont	588090	5342110	7501	2561	5.0	Swan–Apsley River	20000364	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	30/01/2001
E201229	Egg Lagoon	245600	5606470	2	562	40.0	King Island	20000365	Lg	Granites	Residual soil	10/04/2000
E201230	Barrier Creek	252926	5573644	28	2410	70.0	King Island	20000366	Lr	Sedimentary rock	Ferruginous sandy loam	13/04/2000
E201231	Nook Swamp	250787	5603851	7501	562	10.0	King Island	20000367	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	13/04/2000
E201232	Grassy coast	250070	5562333	7501	562	3.0	King Island	20000368	Qh	Sand gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	13/04/2000
E201244	Smithton	335129	5478442	1579	3040	10.0	Duck River	20000557	Cm	Marine conglomerate	Clay loam with mottles	08/04/2001
E201245	Smithton	335284	5477480	7527	3040	13.0	Duck River	20000558	Qps	Coastal sand and gravel	Clayey loam with dense mottling	08/04/2001
E201246	Smithton	335809	5479261	7527	1434	7.0	Duck River	20000559	Qps	Coastal sand and gravel	Clayey loam with dense mottling	08/04/2001
E201247	Deep Creek	347331	5479611	7527	558	3.0	Black–Detention River	20000560	Qps	Coastal sand and gravel	Clayey loam with dense mottling	07/04/2001
E201248	Curries Rivulet	492571	5456301	7527	2540	20.0	Pipers River	20000561	Qps	Coastal sand and gravel	Clayey loam with dense mottling	16/03/2001
E201249	Smithton	354820	5476490	7527	1434	18.0	Black–Detention River	20000562	Qps	Coastal sand and gravel	Sandy clayey loam with mottling	07/04/2001
E201250	Smithton	335366	5476438	7527	3040	14.0	Duck River	20000563	Qps	Coastal sand and gravel	Sandy clayey loam with mottling	08/04/2001
E201251	Smithton	335416	5475855	7527	3040	15.0	Duck River	20000564	Qps	Coastal sand and gravel	Sandy clayey loam with mottling	08/04/2001
E201252	Smithton	336432	5478428	7527	1434	7.0	Duck River	20000565	Qps	Coastal sand and gravel	Sandy clayey loam with mottling	08/04/2001
E201253	Wiltshire	353131	5480747	7527	558	2.0	Black–Detention River	20000566	Qps	Coastal sand and gravel	Clayey loam with dense mottling	06/04/2001
E201254	Montagu	337662	5478945	7527	558	4.0	Duck River	20000567	Qps	Coastal sand and gravel	Clayey loam with dense mottling	13/04/2001
E201255	Smithton	335915	5476775	7527	3040	14.0	Duck River	20000568	Qps	Coastal sand and gravel	Sandy clayey loam with mottling	08/04/2001
E201294	Mella	336259	5475467	7527	3040	16.0	Duck River	20000680	Qps	Coastal sand and gravel	Clayey loam with dense mottling	29/08/2000
E201297	Mella	336178	5475478	7527	3040	16.0	Duck River	20000683	Qps	Coastal sand and gravel	Clayey loam with dense mottling	29/08/2000
E201301	Mella	335886	5475430	7527	3040	16.0	Duck River	20000687	Qps	Coastal sand and gravel	Clayey loam with dense mottling	29/08/2000

FIELD No	LOCATION	AMG East	AMG North	R CODE	SOIL CODE	AHD (m)	CATCHMENT	REG No	GEOLOGY	GEOL_DESCRIPTION	SOIL_DESCRIPTION	DATE
E201305	Woolnorth	313678	5489852	7527	558	5.0	Welcome River	20000691	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201306	Woolnorth	308114	5492354	7527	558	6.0	Welcome River	20000692	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201307	Woolnorth	308587	5491245	7527	558	6.0	Welcome River	20000693	Qps	Coastal sand and gravel	Clay loam with mottles	05/04/2001
E201356	Cannes Hill	588095	5560691	7530	674	94.0	Flinders Island	20010033	Q/Dgaas	Undifferentiated Quaternary sediments	Residual soil	05/12/2000
E201357	Markarna Park	584758	5580335	7527	2974	25.0	Flinders Island	20010034	Qps	Coastal sand and gravel	Peaty loam	05/12/2000
E201358	Markarna Park	588188	5582227	7527	2974	12.0	Flinders Island	20010035	Qps	Coastal sand and gravel	Peaty loam	05/12/2000
E201359	Big River	592264	5542665	4095	985	35.0	Flinders Island	20010036	Dgas	Granites	Residual soil	06/12/2000
E201360	Reedy Lagoon Road	603329	5555701	7530	564	5.0	Flinders Island	20010037	Q	Undifferentiated Quaternary sediments	Sand with mottles	08/12/2000
E201361	Lady Barron	601006	5545159	3004	2951	5.0	Flinders Island	20010038	OD	Turbidites	Clay loam with mottles	08/12/2000
E201362	Lady Barron	601222	5546786	3004	2951	5.0	Flinders Island	20010039	OD	Turbidites	Clay loam with mottles	08/12/2000
E201363	Shag Lagoon area	603871	5554793	7530	564	5.0	Flinders Island	20010040	Q	Undifferentiated Quaternary sediments	Sand with mottles	08/12/2000
E201364	Port Sorell	467561	5443703	6505	559	11.0	Rubicon River	20010041	Ts_Qh	Gravel, sand, silt, clay and regolith	Loamy sand with mottles	06/04/2001
E201365	Markarna Park	580821	5580574	7527	674	30.0	Flinders Island	20010042	Qps_Qpl	Coastal sand and gravel/limestone	Clay loam with shell fragments.	05/12/2000
E201366	Wingaroo	586533	5585990	6503	2974	9.0	Flinders Island	20010043	Tm_Qps	Marine limestone	Clayey sand with mottles	10/12/2000
E201367	Wingaroo	589422	5583000	7530	2974	8.0	Flinders Island	20010044	Q	Undifferentiated Quaternary sediments	Sand with mottles	10/12/2000
E201368	Falmouth	605347	5403292	7527	559	6.0	Scamander–Douglas River	20010083	Qps	Coastal sand and gravel	Clay loam	01/02/2001
E201369	Falmouth	604475	5405571	7501	559	10.0	Scamander–Douglas River	20010084	Qh_Tq	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	01/02/2001
E201370	Policemans Point	606398	5454364	3005	2540	20.0	Musselroe–Ansons Bay	20010085	ODq	Quartzwacke turbidite sequence	Clay loam with mottles	06/02/2001
E201371	St Helens	607215	5429532	7501	1481	4.0	George River	20010086	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	04/02/2001
E201372	Great Musselroe Bay	553540	5477074	7527	563	52.0	Boobyalla–Tomahawk	20010087	Qps	Coastal sand and gravel	Clay loam	06/02/2001
E201373	Little Musselroe Bay	586819	5486179	7527	563	10.0	Musselroe–Ansons Bay	20010088	Qps	Coastal sand and gravel	Sandy-clayey loam with some mottles	06/02/2001
E201374	Little Musselroe Bay	583918	5487738	7501	563	10.0	Musselroe–Ansons Bay	20010089	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	06/02/2001
E201375	Rushy Lagoon	587250	5475960	7501	563	40.0	Musselroe–Ansons Bay	20010090	Qh_Qps	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	07/02/2001
E201376	Rushy Lagoon	586876	5475930	7527	563	40.0	Musselroe–Ansons Bay	20010091	Qps_Qh	Coastal sand and gravel	Clayey loam with peaty TS	07/02/2001
E201377	Boobyalla	574841	5471425	7527	563	17.0	Boobyalla–Tomahawk	20010092	Qps	Coastal sand and gravel	Sandy-clayey loam with some mottles	08/02/2001
E201378	Tomahawk	563487	5474515	7527	563	10.0	Boobyalla–Tomahawk	20010093	Qps_Dgaa	Coastal sand and gravel/granite	Sandy loam, some hardpan and mottles	08/02/2001
E201379	Tomahawk	562892	5473537	7527	563	10.0	Boobyalla–Tomahawk	20010094	Qps_Dgaa	Coastal sand and gravel/granite	Residual soil	08/02/2001
E201380	Bridport	529106	5461940	7527	2540	10.0	Little Forester	20010095	Qps	Coastal sand and gravel	Sand clay loam	09/02/2001
E201381	Bridport	539583	5459998	7501	563	4.0	Great Forester	20010096	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	10/02/2001
E201382	Bridport	537356	5460057	7501	21	12.0	Great Forester	20010097	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	12/02/2001
E201383	Bellingham	514699	5459835	7501	2540	12.0	Pipers River	20010098	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	12/02/2001
E201386	George Town	486741	5448827	6505	563	20.0	Tamar River	20010100	Ts_Qps	Gravel, sand, silt, clay and regolith	Clay loam with mottles	16/03/2001
E201387	Beauty Point	482452	5449755	6505	560	2.0	Tamar River	20010101	Ts	Gravel, sand, silt, clay and regolith	Clay loam	16/03/2001
E201388	Scamander	606693	5386372	7527	1481	10.0	Scamander–Douglas River	20010103	Qps_Dgaa	Coastal sand and gravel	Sandy loam with organic clay lenses	31/01/2001
E201389	Pebbly Bay	368719	5472727	7527	1434	12.0	Black–Detention River	20010104	Qps	Coastal sand and gravel	Sandy loam	06/04/2001
E201390	Mella	335825	5475438	7527	3040	16.0	Duck River	20010105	Qps	Coastal sand and gravel	Peaty loam	11/04/2001

FIELD No	LOCATION	AMG East	AMG North	R CODE	SOIL CODE	AHD (m)	CATCHMENT	REG No	GEOLOGY	GEOL_DESCRIPTION	SOIL_DESCRIPTION	DATE
E201391	Smithton	335680	5475347	7527	3040	16.0	Duck River	20010106	Qps	Coastal sand and gravel	Sandy loam with mottles	11/04/2001
E201392	Black River	358102	5475938	7527	1434	8.0	Black–Detention River	20010107	Qps	Coastal sand and gravel	Sandy loam with mottles	06/04/2001
E201393	Mella	335952	5476155	7527	3040	14.0	Duck River	20010108	Qps	Coastal sand and gravel	Sandy loam	11/04/2001
E201394	Strahan	360100	5329883	7527	996	10.0	King–Henty River	20010109	Qps_Ts	Coastal sand and gravel/Tertiary sediment	Sandy loam with some mottles	27/04/2001
E201395	Strahan	356490	5332491	7527	558	6.0	King–Henty River	20010110	Qps	Coastal sand and gravel	Sandy loam	01/05/2001
E201396	Strahan	363642	5329834	7527	996	3.0	King–Henty River	20010111	Qps_Cdsv	Coastal sand and gravel	Clay loam with dense mottles	01/05/2001
E201397	Strahan	364570	5327510	7501	996	2.0	King–Henty River	20010112	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Pyritic sand cf. King River	01/05/2001
FT1	Beaconsfield	477838	5449938	7530	560	20	Tamar River	NA	Q	Undifferentiated Quaternary sediments	Sand with mottles	14/03/2001
FT2	Bluff Point	305373	5440109	57	558	15	Nelson Bay	NA	Lrc	Pyritic siltstone and mudstone	Pyritic sandy loam	06/04/2001
FT3	Cooma	599275	5547523	3004	2951	35	Flinders Island	NA	OD	Turbidites	Clay loam with mottles	09/12/2000
FT4	Marrawah	303612	5464932	7527	558	40	Welcome River	NA	Qps	Coastal sand and gravel	Sandy loam	06/04/2001
FT5	Mella	334850	5475450	7527	3040	15	Duck River	NA	Qps	Coastal sand and gravel	Sandy loam	10/04/2001
FT6	Mella	335500	5476100	7527	3040	15	Duck River	NA	Qps	Coastal sand and gravel	Sandy loam	10/04/2001
FT7	Memana	592584	5580912	7530	2974	65	Flinders Island	NA	Q	Undifferentiated Quaternary sediments	Sand with mottles	09/12/2000
FT8	Memana	597688	5578979	7530	564	5	Flinders Island	NA	Q	Undifferentiated Quaternary sediments	Sand with mottles	09/12/2000
FT9	Nala	603097	5558546	7530	564	4	Flinders Island	NA	Q	Undifferentiated Quaternary sediments	Sand with mottles	09/12/2000
FT10	Naracoopa	252700	5576150	28	2410	5	King Island	NA	Lr	Sedimentary rock	Ferruginous sandy loam	08/04/2000
FT11	Palama	575619	5594052	7528	2949	7	Flinders Island	NA	Qpl	Limestone	Calcarenites	09/12/2000
FT12	Petibela	600984	5569703	7530	2951	8	Flinders Island	NA	Q	Undifferentiated Quaternary sediments	Sand with mottles	09/12/2000
FT13	Reekara	233500	5592500	2	20	8	King Island	NA	Lg	Granite	Residual soil	08/04/2000
FT14	Spreyton	444900	5437700	7501	2674	7	Mersey River	NA	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	07/04/2001
FT15	Spreyton	445200	5436200	7501	2674	15	Mersey River	NA	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	07/04/2001
FT16	Turners Beach	436100	5441800	7501	559	3	Forth–Wilmot River	NA	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	07/04/2001
FT17	Wellington	391716	5460968	7527	1434	20	Inglis River	NA	Qps	Coastal sand and gravel	Sandy loam	06/04/2001
FT18	Wellington	392950	5459300	7527	1434	30	Inglis River	NA	Qps	Coastal sand and gravel	Sandy loam	06/04/2001
FT19	Wellington	388050	5463609	7501	559	20	Inglis River	NA	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	06/04/2001
FT20	Wesley Vale	454625	5441625	6505	1455	50	Rubicon River	NA	Ts	Gravel, sand, silt, clay and regolith	Clay loam	07/04/2001
FT21	Wesley Vale	455650	5442675	7501	559	4	Rubicon River	NA	Qh	Sand, gravel and mud of alluvial, lacustrine and littoral origin	Sandy clay with mottles	07/04/2001
FT22	Woolnorth	308546	5490204	7527	558	5	Welcome River	NA	Qps	Coastal sand and gravel	Sandy loam	05/04/2001

FIELD No.	DEPTH (m)	$pH_{(F)}$	$pH_{(FOX)}$	Lab pH (L)	Lab EC	S(T)	S(HCl)	TOS	APP	TYPE	Co	As (ppm)	Bi (ppm)	Ga (ppm)	Zn (ppm)	W (ppm)	Cu (ppm)	Ni (ppm)	Sn (ppm)	Pb (ppm)	Si (ppm)	Fe (%)	Ti (%)	Al (%)	Mn (%)	Mg (%)	Ca (%)	Na (%)	K (%)	P (%)	Total (%)
E201147	1.00	6.70	6.50	6.80	0.34	0.10	0.01	0.09	2.88	NASS	9.00	20.00	5.00	13.00	42.00	10.00	5.00	36.00	9.00	13.00	80.70	1.80	1.60	8.00	0.00	0.40	0.20	0.00	0.90	0.10	93.70
E201148	1.50	6.30	5.40	6.30	0.17	0.10	0.00	0.10	2.93	NASS	10.00	20.00	5.00	13.00	39.00	10.00	5.00	34.00	9.00	12.00	85.60	1.70	1.70	8.70	0.00	0.30	0.10	0.00	0.80	0.10	99.00
E201149	1.50	5.50	5.30	5.40	0.10	0.10	0.00	0.10	2.94	NASS	10.00	20.00	5.00	13.00	38.00	10.00	5.00	34.00	9.00	11.00	85.00	1.80	1.70	9.10	0.00	0.30	0.10	0.00	0.90	0.00	98.90
E201150	1.50	5.70	4.50	5.00	0.08	0.10	0.00	0.10	2.94	NASS	8.00	20.00	5.00	13.00	40.00	10.00	5.00	35.00	9.00	12.00	83.40	2.00	1.70	9.50	0.00	0.40	0.10	0.00	0.90	0.00	98.00
E201151	1.50	5.40	4.80	5.10	0.08	0.10	0.00	0.10	2.95	NASS	9.00	20.00	5.00	14.00	41.00	10.00	5.00	36.00	9.00	12.00	82.90	2.30	1.70	9.70	0.00	0.40	0.10	0.00	0.90	0.00	98.00
E201152	1.50	5.20	4.60	5.10	0.07	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	14.00	42.00	10.00	5.00	37.00	9.00	14.00	84.10	2.60	1.70	10.10	0.00	0.40	0.10	0.00	0.90	0.00	99.90
E201153	1.50	5.00	4.80	5.00	0.07	0.10	0.00	0.10	2.95	NASS	9.00	20.00	5.00	14.00	41.00	10.00	5.00	37.00	9.00	13.00	82.80	2.30	1.70	9.90	0.00	0.40	0.10	0.00	0.90	0.00	98.10
E201154	1.00	5.20	4.50	5.00	0.08	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	15.00	49.00	10.00	5.00	41.00	9.00	14.00	80.90	3.90	1.80	11.10	0.00	0.60	0.10	0.00	1.00	0.00	99.40
E201155	1.00	5.00	4.30	5.00	0.08	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	15.00	51.00	10.00	5.00	40.00	9.00	13.00	80.70	4.20	1.80	11.40	0.00	0.50	0.10	0.00	1.00	0.00	99.70
E201156	1.00	5.20	4.40	5.10	0.07	0.10	0.00	0.10	2.97	NASS	10.00	20.00	5.00	14.00	43.00	10.00	5.00	36.00	9.00	12.00	83.60	2.10	1.80	9.80	0.00	0.40	0.10	0.00	0.90	0.00	98.70
E201157	1.10	5.10	4.60	5.10	0.07	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	14.00	51.00	10.00	5.00	40.00	9.00	13.00	82.20	3.10	1.80	10.90	0.00	0.50	0.10	0.00	1.00	0.00	99.60
E201158	1.20	5.10	4.70	5.00	0.08	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	16.00	52.00	10.00	5.00	43.00	9.00	15.00	78.90	4.80	1.80	11.50	0.00	0.60	0.10	0.00	1.00	0.00	98.70
E201159	1.30	5.00	4.50	5.00	0.08	0.10	0.00	0.10	2.96	NASS	8.00	20.00	5.00	15.00	49.00	10.00	5.00	41.00	9.00	14.00	78.80	3.90	1.80	11.30	0.00	0.50	0.10	0.00	1.00	0.00	97.40
E201182	1.50	5.50	3.30	5.70	1.20	0.60	0.03	0.57	17.46	PASS	23.00	20.00	5.00	22.00	84.00	10.00	29.00	41.00	9.00	31.00	70.40	6.30	0.70	19.80	0.10	1.40	0.30	1.60	3.80	0.10	104.50
E201183	1.50	6.60	5.50	6.20	0.76	0.10	0.01	0.09	2.82	NASS	8.00	20.00	5.00	17.00	46.00	10.00	5.00	12.00	9.00	30.00	66.90	3.90	0.20	14.30	0.00	0.50	0.10	1.30	4.80	0.10	92.10
E201184	1.00	6.50	5.50	6.20	0.99	0.10	0.01	0.09	2.74	NASS	8.00	20.00	5.00	19.00	45.00	10.00	5.00	11.00	9.00	37.00	72.00	1.60	0.30	16.60	0.00	0.50	0.10	1.70	4.60	0.00	97.40
E201185	1.00	6.70	5.30	6.60	1.16	0.10	0.01	0.09	2.67	NASS	8.00	20.00	5.00	19.00	58.00	10.00	5.00	10.00	9.00	32.00	71.70	2.20	0.30	17.00	0.00	0.60	0.10	1.80	4.80	0.00	98.50
E201186	1.00	7.40	6.50	7.00	0.50	0.10	0.01	0.10	2.91	NASS	8.00	20.00	5.00	18.00	53.00	10.00	5.00	13.00	9.00	35.00	75.20	2.10	0.20	15.20	0.00	0.60	0.10	1.30	5.90	0.00	100.60
E201187	1.00	5.70	5.50	6.50	1.07	0.10	0.01	0.09	2.64	NASS	9.00	20.00	5.00	16.00	40.00	10.00	5.00	16.00	9.00	35.00	77.00	2.10	0.40	15.30	0.00	0.50	0.10	1.00	5.00	0.00	101.40
E201188	0.10	3.70	3.30	4.00	1.38	3.10	0.28	2.82	86.19	AASS	8.00	20.00	17.00	11.00	48.00	10.00	5.00	24.00	9.00	36.00	14.50	15.50	0.20	5.70	0.00	0.40	0.50	2.30	0.30	0.40	39.80
E201189	1.50	3.60	3.30	3.50	2.38	5.50	0.22	5.28	161.56	AASS	11.00	20.00	18.00	9.00	41.00	10.00	5.00	25.00	9.00	25.00	8.20	6.00	0.10	3.00	0.00	0.10	0.90	0.50	0.10	0.30	19.20
E201190	1.50	3.20	2.50	3.00	3.37	7.00	0.31	6.69	204.82	AASS	11.00	20.00	21.00	9.00	70.00	10.00	5.00	26.00	9.00	29.00	7.30	8.00	0.10	3.40	0.00	0.20	0.90	0.80	0.20	0.30	21.20
E201191	1.25	3.10	2.40	3.05	5.74	10.55	0.89	9.66	295.50	AASS	33.00	20.00	20.00	8.00	77.00	10.00	5.00	39.50	9.00	29.50	5.15	7.00	0.10	3.00	0.00	0.30	1.65	0.65	0.20	0.20	18.25
E201193	1.50	5.50	4.30	5.40	0.37	2.50	0.05	2.45	74.97	NASS	8.00	20.00	14.00	12.00	46.00	10.00	5.00	29.00	9.00	31.00	18.60	9.10	0.20	8.10	0.00	0.10	1.60	0.60	0.30	0.40	39.00
E201194	1.50	4.50	4.00	4.30	0.84	1.60	0.05	1.55	47.48	PASS	9.00	20.00	5.00	9.00	25.00	10.00	5.00	23.00	9.00	16.00	48.40	2.40	0.20	5.10	0.00	0.00	0.50	0.10	2.20	0.10	59.00
E201195	1.50	4.50	3.90	4.50	0.33	0.30	0.02	0.28	8.62	PASS	8.00	20.00	5.00	9.00	22.00	10.00	5.00	11.00	9.00	13.00	68.40	1.10	0.20	4.50	0.00	0.00	0.20	0.00	2.50	0.00	76.90
E201196	1.50	5.40	4.70	5.00	0.22	0.10	0.03	0.07	2.26	NASS	8.00	20.00	5.00	8.00	22.00	10.00	5.00	8.00	9.00	11.00	78.80	0.90	0.20	4.50	0.00	0.00	0.10	0.00	2.50	0.00	87.00
E201197	1.50	5.00	4.90	5.00	0.22	0.20	0.02	0.18	5.57	NASS	8.00	20.00	5.00	8.00	21.00	10.00	5.00	9.00	9.00	12.00	78.60	1.00	0.20	4.30	0.00	0.00	0.10	0.00	2.40	0.00	86.60
E201198	1.50	5.30	5.00	5.50	0.22	0.10	0.02	0.09	2.59	NASS	8.00	20.00	5.00	8.00	21.00	10.00	5.00	10.00	9.00	11.00	81.20	0.90	0.20	4.10	0.00	0.00	0.10	0.00	2.40	0.00	88.90
E201199	1.50	5.60	5.20	5.50	0.17	0.10	0.01	0.09	2.75	NASS	8.00	20.00	5.00	8.00	21.00	10.00	5.00	12.00	9.00	12.00	83.60	1.00	0.10	4.00	0.00	0.00	0.10	0.00	2.30	0.00	91.10
E201200	1.25	3.70	3.60	4.05	2.50	4.20	0.26	3.94	120.47	AASS	11.00	20.00	17.50	9.00	46.00	10.00	5.00	23.00	9.00	24.00	11.00	9.95	0.15	4.50	0.00	0.25	1.65	0.80	0.20	0.25	28.75
E201202	1.00	3.00	2.60	3.10	6.88	9.00	1.11	7.89	241.51	AASS	21.33	20.00	15.00	8.00	82.00	10.00	5.00	29.33	9.00	17.67	11.97	13.07	0.10	4.37	0.03	0.53	1.47	1.23	0.10	0.20	33.07
E201205	1.00	3.50	3.10	3.35	4.02	6.55	0.63	5.92	181.12	AASS	19.50	20.00	19.75	8.50	55.75	10.00	5.75	27.25	9.00	22.75	7.05	12.15	0.13	2.98	0.00	0.30	0.98	1.10	0.18	0.25	25.10
E201207	1.00	3.30	3.20	3.80	2.92	4.60	0.30	4.30	131.55	AASS	8.00	20.00	20.00	8.00	46.00	10.00	5.00	21.00	9.00	26.00	6.10	9.90	0.10	2.40	0.00	0.20	0.80	0.80	0.20	0.30	20.80
E201210	7.00	3.10	2.50	3.00	4.72	8.60	1.33	7.27	222.45	AASS	12.00	20.00	12.00	10.00	50.00	10.00	5.00	30.00	9.00	24.00	17.30	9.50	0.20	5.30	0.00	0.40	2.40	0.70	0.50	0.10	36.40
E201211	1.00	7.00	6.50	7.00	0.25	0.10	0.00	0.10	2.98	NASS	8.00	20.00	5.00	23.00	82.00	10.00	15.00	17.00	9.00	24.00	72.00	3.60	0.80	20.20	0.00	1.50	0.20	0.10	5.90	0.00	104.30
E201212	1.50	7.89	6.90	7.80	0.26	0.10	0.00	0.10	3.00	NASS	10.00	20.00	5.00	21.00	76.00	10.00	12.00	19.00	9.00	20.00	72.20	4.20	0.70	18.00	0.00	1.70	0.60	0.50	4.80	0.00	102.70

FIELD No.	DEPTH (m)	$pH_{(F)}$	$pH_{(FOX)}$	Lab pH (L)	Lab EC	S(T)	S(HCl)	TOS	APP	TYPE	Co	As (ppm)	Bi (ppm)	Ga (ppm)	Zn (ppm)	W (ppm)	Cu (ppm)	Ni (ppm)	Sn (ppm)	Pb (ppm)	Si (ppm)	Fe (%)	Ti (%)	Al (%)	Mn (%)	Mg (%)	Ca (%)	Na (%)	K (%)	P (%)	Total (%)
E201213	1.50	8.00	7.50	7.90	0.25	0.10	0.00	0.10	3.01	NASS	10.00	20.00	5.00	19.00	75.00	10.00	13.00	19.00	9.00	21.00	72.50	4.10	0.60	17.30	0.00	1.80	0.50	1.00	4.40	0.00	102.20
E201214	1.00	8.00	6.90	7.80	0.22	0.10	0.01	0.09	2.87	NASS	8.00	20.00	5.00	15.00	52.00	10.00	5.00	11.00	9.00	25.00	74.60	2.90	0.40	14.10	0.00	1.30	0.30	1.60	3.00	0.00	98.20
E201215	1.00	7.60	6.50	7.60	0.28	0.10	0.01	0.09	2.76	NASS	12.00	21.00	5.00	26.00	98.00	10.00	22.00	24.00	9.00	20.00	74.90	5.90	0.80	21.40	0.10	2.50	0.20	1.20	5.50	0.10	112.60
E201216	1.00	7.90	6.50	7.80	0.22	0.10	0.01	0.09	2.87	NASS	8.00	20.00	5.00	21.00	95.00	10.00	13.00	20.00	9.00	26.00	74.60	4.70	0.60	18.10	0.10	2.10	0.30	1.60	4.70	0.10	106.90
E201217	1.50	7.80	5.70	7.50	0.29	0.10	0.01	0.09	2.71	NASS	14.00	20.00	5.00	24.00	92.00	10.00	19.00	24.00	9.00	22.00	74.00	5.50	0.70	19.60	0.10	2.20	0.30	1.10	5.20	0.10	108.80
E201218	1.00	8.00	7.50	8.00	0.23	0.10	0.00	0.10	2.97	NASS	8.00	20.00	5.00	16.00	61.00	10.00	5.00	11.00	9.00	26.00	73.20	4.60	0.50	14.60	0.10	1.50	0.50	3.10	2.60	0.10	100.80
E201219	1.00	8.00	7.10	8.00	0.26	0.10	0.01	0.10	2.90	NASS	8.00	20.00	5.00	19.00	69.00	10.00	5.00	17.00	9.00	18.00	73.30	4.90	0.50	16.30	0.10	1.60	0.60	2.00	3.40	0.20	102.90
E201220	1.00	7.50	7.40	7.80	0.43	0.10	0.00	0.10	3.04	NASS	8.00	22.00	5.00	14.00	35.00	10.00	5.00	12.00	9.00	19.00	68.30	7.30	0.40	13.70	0.00	0.50	0.90	0.60	2.20	0.20	94.10
E201221	1.00	7.60	7.40	7.60	0.43	0.10	0.00	0.10	3.02	NASS	8.00	20.00	5.00	8.00	26.00	10.00	6.00	15.00	9.00	12.00	83.90	0.70	0.20	5.20	0.00	0.00	0.30	0.20	2.60	0.00	93.10
E201222	1.00	7.60	7.00	7.50	0.32	0.10	0.00	0.10	3.04	NASS	8.00	20.00	5.00	12.00	25.00	10.00	5.00	11.00	9.00	14.00	79.70	1.80	0.30	10.60	0.00	0.10	0.40	0.30	2.40	0.00	95.60
E201223	1.00	7.50	6.60	7.60	0.33	0.10	0.00	0.10	2.99	NASS	8.00	20.00	5.00	14.00	33.00	10.00	5.00	17.00	9.00	19.00	73.30	3.90	0.30	15.60	0.00	0.50	0.40	0.20	2.30	0.00	96.50
E201224	1.00	7.50	6.80	7.60	0.31	0.10	0.00	0.10	3.01	NASS	8.00	20.00	5.00	15.00	34.00	10.00	5.00	15.00	9.00	22.00	70.90	5.20	0.30	15.30	0.00	0.60	0.40	0.50	2.40	0.00	95.60
E201225	1.50	7.50	6.50	7.70	0.29	0.10	0.00	0.10	2.98	NASS	8.00	20.00	5.00	14.00	33.00	10.00	5.00	13.00	9.00	20.00	73.50	5.30	0.30	14.50	0.00	0.50	0.40	0.70	2.40	0.00	97.60
E201226	1.00	5.40	5.20	5.70	1.28	0.10	0.01	0.09	2.68	NASS	8.00	20.00	7.00	28.00	88.00	10.00	9.00	25.00	9.00	34.00	42.80	24.70	3.80	20.10	0.10	3.80	0.20	2.50	3.20	0.10	101.30
E201227	1.00	6.00	5.20	6.00	0.87	0.10	0.01	0.09	2.63	NASS	8.00	20.00	5.00	25.00	43.00	10.00	5.00	15.00	9.00	25.00	58.90	6.10	1.50	23.10	0.00	1.50	0.30	0.50	2.90	0.00	94.80
E201228	1.00	6.40	5.40	6.30	0.67	0.10	0.01	0.09	2.73	NASS	8.00	20.00	5.00	19.00	30.00	10.00	5.00	15.00	9.00	26.00	70.30	5.20	0.40	15.20	0.00	0.60	0.30	1.90	4.20	0.00	98.10
E201229	1.50	6.10	5.40	6.10	0.23	0.10	0.01	0.09	2.86	NASS	8.00	20.00	5.00	23.00	29.00	10.00	5.00	11.00	9.00	20.00	71.90	4.20	1.50	16.70	0.00	0.30	0.20	0.20	1.40	0.00	96.40
E201230	1.50	5.60	5.10	5.50	0.75	0.20	0.10	0.10	3.18	NASS	8.00	28.00	5.00	8.00	26.00	11.00	5.00	9.00	9.00	10.00	72.70	4.00	0.30	3.90	0.00	0.00	0.20	0.00	0.10	0.00	81.20
E201231	1.50	8.80	7.00	8.40	0.60	0.20	0.01	0.19	5.69	NASS	13.00	46.00	5.00	22.00	165.00	3200.00	120.00	46.00	48.00	17.00	41.30	14.30	1.00	7.50	0.60	6.50	21.20	2.00	0.70	0.30	95.40
E201232	1.00	8.50	7.70	8.50	0.52	0.20	0.01	0.19	5.77	NASS	17.00	50.00	15.00	25.00	190.00	2800.00	115.00	64.00	44.00	23.00	46.10	16.50	1.10	8.90	0.70	8.60	18.90	2.30	0.90	0.60	104.60
E201244	1.00	5.50	4.70	5.00	0.08	0.10	0.00	0.10	2.94	NASS	8.00	20.00	5.00	22.00	47.00	10.00	12.00	44.00	9.00	18.00	69.10	3.20	1.50	17.10	0.00	0.90	0.10	0.00	1.80	0.10	93.80
E201245	1.00	4.90	4.30	5.20	0.08	0.10	0.00	0.10	2.97	NASS	9.00	20.00	5.00	24.00	51.00	10.00	16.00	50.00	9.00	18.00	69.30	2.80	1.50	19.60	0.00	0.90	0.10	0.00	2.00	0.00	96.20
E201246	1.50	5.70	5.30	5.80	0.19	0.10	0.01	0.09	2.80	NASS	11.00	20.00	5.00	13.00	41.00	10.00	5.00	51.00	9.00	11.00	78.10	2.80	2.20	9.00	0.00	0.50	0.10	0.00	0.90	0.00	93.60
E201247	1.00	6.70	5.20	6.60	0.17	0.10	0.01	0.09	2.85	NASS	13.00	20.00	5.00	15.00	43.00	10.00	5.00	60.00	9.00	14.00	77.90	3.10	2.20	11.30	0.00	0.60	0.10	0.00	1.00	0.00	96.20
E201248	1.00	6.00	5.40	6.10	0.08	0.10	0.00	0.10	2.96	NASS	8.00	20.00	5.00	16.00	49.00	10.00	5.00	49.00	9.00	14.00	74.10	2.70	1.60	11.60	0.00	0.50	0.10	0.00	1.10	0.10	91.80
E201249	1.00	6.00	5.40	5.90	0.10	0.10	0.00	0.10	3.00	NASS	12.00	20.00	5.00	20.00	66.00	10.00	7.00	94.00	9.00	18.00	75.00	3.30	1.90	16.60	0.00	0.80	0.10	0.00	1.30	0.10	99.10
E201250	1.00	6.10	5.40	6.00	0.09	0.10	0.01	0.10	2.92	NASS	33.00	21.00	5.00	25.00	92.00	10.00	10.00	155.00	9.00	22.00	64.00	7.50	1.90	19.30	0.10	1.00	0.40	0.40	1.20	0.10	95.90
E201251	1.00	6.40	5.70	6.00	0.13	0.10	0.01	0.09	2.89	NASS	34.00	23.00	5.00	26.00	96.00	10.00	17.00	170.00	9.00	23.00	60.90	10.60	1.90	20.30	0.10	1.10	0.40	0.50	1.20	0.20	97.20
E201252	1.50	6.50	5.30	6.40	0.14	0.10	0.00	0.10	2.93	NASS	13.00	20.00	5.00	15.00	48.00	10.00	6.00	65.00	9.00	11.00	78.60	3.00	0.70	12.20	0.00	0.40	0.20	0.00	0.60	0.00	95.70
E201253	1.00	6.50	5.60	6.40	0.12	0.10	0.00	0.10	2.93	NASS	11.00	20.00	5.00	15.00	45.00	10.00	8.00	68.00	9.00	11.00	64.70	4.60	0.70	12.10	0.00	0.40	0.30	0.00	0.70	0.00	83.50
E201254	1.50	7.90	5.10	7.90	0.65	0.50	0.02	0.48	14.64	NASS	9.00	50.00	5.00	11.00	37.00	10.00	5.00	30.00	9.00	13.00	42.70	5.70	0.60	6.20	0.00	0.40	6.00	0.20	0.60	0.20	62.60
E201255	1.00	7.75	5.90	7.70	0.33	0.10	0.01	0.09	2.82	NASS	8.00	20.00	5.00	9.00	23.00	10.00	5.00	13.00	9.00	10.00	80.80	1.20	0.40	4.00	0.00	0.00	0.70	0.00	0.30	0.00	87.40
E201294	1.50	3.50	3.00	3.30	2.62	7.00	0.38	6.62	202.47	AASS	8.00	20.00	8.33	9.00	58.33	10.00	10.67	14.67	9.00	16.00	34.27	14.23	0.43	4.47	0.00	0.90	2.00	0.93	0.57	0.40	73.80
E201297	1.50	3.60	3.30	4.33	2.31	9.93	0.42	9.50	290.83	AASS	8.00	287.50	8.75	7.00	36.75	10.00	10.00	10.00	9.00	12.25	34.40	13.48	0.30	2.68	0.00	0.78	2.48	0.88	0.35	0.23	67.58
E201301	2.00	4.00	2.80	5.10	2.44	12.60	0.41	12.19	372.94	AASS	8.00	228.75	7.50	6.50	39.50	10.00	14.00	10.50	9.00	12.50	32.38	14.40	0.23	2.13	0.00	0.95	3.53	0.95	0.35	0.28	67.40
E201305	1.00	4.00	2.70	4.10	1.79	1.90	0.15	1.75	53.47	AASS	8.00	37.00	10.00	12.00	62.00	10.00	21.00	17.00	9.00	16.00	29.20	18.60	0.60	6.10	0.00	1.00	2.20	1.30	0.70	0.60	75.70
E201306	1.00	4.00	3.10	4.10	1.20	1.80	0.13	1.67	51.22	AASS	8.00	20.00	5.00	5.00	5.00	10.00	8.00	8.00	9.00	10.00	65.60	2.80	0.10	1.20	0.00	0.10	0.10	0.20	0.20	0.00	80.30

FIELD No.	DEPTH (m)	$pH_{(F)}$	$pH_{(FOX)}$	Lab pH (L)	Lab EC	S(T)	S(HCl)	TOS	APP	TYPE	Co	As (ppm)	Bi (ppm)	Ga (ppm)	Zn (ppm)	W (ppm)	Cu (ppm)	Ni (ppm)	Sn (ppm)	Pb (ppm)	Si (ppm)	Fe (%)	Ti (%)	Al (%)	Mn (%)	Mg (%)	Ca (%)	Na (%)	K (%)	P (%)	Total (%)
E201307	2.00	4.50	3.00	4.60	0.92	0.70	0.09	0.61	18.70	PASS	8.00	20.00	5.00	5.00	5.00	10.00	6.00	5.00	9.00	10.00	67.80	1.10	0.10	0.60	0.00	0.00	0.00	0.10	0.10	0.00	79.80
E201356	1.50	5.00	4.50	4.80	0.08	0.10	0.00	0.10	2.95	NASS	8.00	20.00	5.00	24.00	17.00	10.00	6.00	7.00	9.00	26.00	53.10	4.40	0.40	19.00	0.00	0.50	0.10	0.60	3.10	0.10	81.30
E201357	1.50	6.80	5.00	6.80	0.38	1.10	0.01	1.09	33.33	NASS	8.00	20.00	21.00	6.00	5.00	10.00	540.00	6.00	9.00	17.00	80.90	0.80	0.00	10.80	0.00	0.10	0.50	0.20	0.20	0.00	93.50
E201358	1.50	7.10	6.70	7.40	0.36	0.10	0.00	0.10	2.99	NASS	8.00	20.00	5.00	5.00	5.00	10.00	7.00	7.00	9.00	10.00	76.60	1.20	0.10	3.30	0.00	0.10	0.20	0.30	0.90	0.00	82.70
E201359	1.00	5.40	5.10	5.20	0.20	0.10	0.01	0.09	2.79	NASS	8.00	20.00	5.00	25.00	14.00	10.00	5.00	5.00	13.00	15.00	57.70	1.50	0.20	18.30	0.00	0.40	0.00	0.40	2.70	0.00	81.20
E201360	1.00	5.20	5.00	5.20	0.23	0.10	0.01	0.09	2.78	NASS	8.00	20.00	5.00	15.00	13.00	10.00	7.00	12.00	9.00	17.00	56.10	6.10	0.70	10.90	0.00	0.70	0.00	0.60	1.90	0.00	77.00
E201361	1.50	5.30	5.00	5.10	0.43	0.10	0.01	0.09	2.71	NASS	8.00	20.00	5.00	17.00	20.00	10.00	10.00	15.00	9.00	17.00	60.20	4.90	0.70	13.90	0.00	1.00	0.10	0.60	1.70	0.50	83.60
E201362	1.50	5.50	5.10	5.30	0.55	0.10	0.01	0.10	2.89	NASS	21.00	20.00	5.00	24.00	41.00	10.00	24.00	110.00	9.00	14.00	52.60	13.00	2.40	20.10	0.00	2.10	0.40	1.20	1.00	0.10	92.90
E201363	1.50	6.30	6.00	6.30	0.08	0.10	0.00	0.10	3.05	NASS	8.00	20.00	5.00	9.00	5.00	10.00	7.00	11.00	9.00	10.00	69.70	2.90	0.20	9.30	0.00	0.40	0.20	0.40	1.10	0.00	84.20
E201364	1.00	7.60	7.10	7.80	0.35	0.10	0.00	0.10	3.05	NASS	24.00	42.00	5.00	24.00	47.00	10.00	12.00	43.00	9.00	30.00	50.50	9.20	1.00	19.00	0.00	1.20	0.90	0.50	2.00	0.10	84.40
E201365	2.00	6.50	6.50	6.80	0.32	0.10	0.00	0.10	3.01	NASS	8.00	20.00	5.00	12.00	31.00	10.00	8.00	17.00	9.00	15.00	62.40	3.20	0.40	12.50	0.00	0.60	0.40	0.50	2.40	0.00	82.40
E201366	1.00	7.20	6.70	7.00	0.39	0.10	0.01	0.09	2.76	NASS	8.00	20.00	5.00	13.00	19.00	10.00	7.00	16.00	9.00	13.00	54.70	8.00	0.60	14.30	0.00	1.30	1.20	0.60	2.30	0.10	83.10
E201367	1.50	7.60	6.10	7.50	0.80	0.10	0.01	0.09	2.71	NASS	8.00	20.00	5.00	8.00	5.00	10.00	8.00	12.00	9.00	10.00	70.50	1.80	0.20	7.80	0.00	0.60	0.50	0.40	0.90	0.00	82.70
E201368	1.00	6.30	5.50	6.30	0.84	0.10	0.01	0.09	2.66	NASS	17.00	20.00	5.00	19.00	38.00	10.00	11.00	14.00	9.00	18.00	52.00	4.40	0.70	14.30	0.00	1.00	0.80	0.80	1.80	0.10	75.90
E201369	1.50	5.00	4.30	5.20	2.48	0.30	0.03	0.27	8.33	NASS	8.00	20.00	5.00	8.00	5.00	10.00	7.00	13.00	9.00	10.00	69.80	1.00	0.20	5.40	0.00	0.50	0.10	0.90	0.30	0.00	78.20
E201370	1.50	6.50	5.40	6.80	5.57	0.30	0.06	0.24	7.26	NASS	9.00	20.00	5.00	14.00	25.00	10.00	10.00	24.00	9.00	11.00	60.40	2.60	0.90	11.80	0.00	1.40	0.30	1.60	1.50	0.10	80.60
E201371	1.50	5.50	2.90	5.80	55.60	3.80	0.61	3.19	97.69	PASS	8.00	20.00	5.00	9.00	15.00	10.00	5.00	10.00	9.00	10.00	21.30	2.70	0.10	6.90	0.00	3.50	1.10	9.70	0.90	0.40	46.60
E201372	1.50	6.40	4.90	6.30	0.52	1.60	0.03	1.58	48.18	NASS	9.00	20.00	5.00	7.00	5.00	10.00	12.00	11.00	9.00	10.00	64.80	1.00	0.30	4.80	0.00	0.80	1.80	0.60	1.00	0.00	75.10
E201373	1.50	7.60	6.30	7.50	0.62	0.10	0.01	0.09	2.77	NASS	16.00	20.00	5.00	8.00	6.00	10.00	9.00	17.00	10.00	10.00	73.60	3.10	0.20	8.00	0.20	0.60	0.10	0.70	1.10	0.00	87.60
E201374	1.50	6.90	4.00	6.80	4.20	1.30	0.53	0.77	23.47	PASS	23.00	20.00	5.00	10.00	17.00	10.00	20.00	41.00	9.00	10.00	63.40	3.70	0.50	8.80	0.10	1.00	1.90	0.80	1.40	0.10	81.70
E201375	1.50	6.80	5.90	6.70	0.23	0.10	0.01	0.10	2.91	NASS	8.00	20.00	5.00	6.00	5.00	10.00	11.00	10.00	9.00	10.00	81.80	1.00	0.10	2.90	0.00	0.10	0.00	0.30	0.90	0.00	87.10
E201376	1.50	6.20	5.50	6.00	0.13	0.10	0.01	0.09	2.86	NASS	9.00	20.00	5.00	10.00	12.00	10.00	29.00	28.00	9.00	10.00	78.30	1.70	0.30	10.90	0.00	0.60	0.30	0.80	1.30	0.00	94.20
E201377	1.50	6.20	5.40	5.70	0.17	0.10	0.01	0.09	2.81	NASS	8.00	20.00	5.00	9.00	5.00	10.00	9.00	13.00	9.00	10.00	60.00	2.60	0.10	11.10	0.00	0.10	0.00	0.40	1.80	0.00	76.10
E201378	1.50	5.90	5.10	5.70	0.06	0.10	0.00	0.10	2.94	NASS	8.00	20.00	5.00	7.00	5.00	10.00	10.00	7.00	9.00	10.00	74.50	1.10	0.10	4.70	0.00	0.10	0.00	0.40	1.00	0.00	81.90
E201379	1.50	6.40	6.00	6.20	0.16	0.10	0.00	0.10	3.02	NASS	8.00	20.00	5.00	6.00	5.00	10.00	15.00	6.00	9.00	10.00	85.40	0.90	0.10	3.10	0.00	0.10	0.00	0.50	1.00	0.00	91.10
E201380	1.50	6.00	5.50	5.90	0.14	0.10	0.00	0.10	2.93	NASS	8.00	20.00	5.00	16.00	27.00	10.00	11.00	12.00	9.00	15.00	63.10	3.20	0.60	17.70	0.00	0.70	0.00	0.70	3.00	0.00	89.00
E201381	1.50	5.50	4.00	5.00	3.70	0.20	0.04	0.16	5.03	PASS	12.00	20.00	5.00	27.00	46.00	10.00	16.00	27.00	9.00	27.00	51.80	3.30	1.00	17.90	0.00	0.60	0.20	0.70	1.20	0.20	76.90
E201382	1.50	5.60	4.80	5.70	0.38	0.10	0.02	0.08	2.36	NASS	8.00	20.00	5.00	11.00	20.00	10.00	11.00	21.00	9.00	13.00	66.90	3.20	0.50	10.30	0.00	0.50	0.50	0.60	1.20	0.20	83.90
E201383	1.50	5.90	5.50	5.90	0.28	0.10	0.01	0.10	2.89	NASS	8.00	20.00	5.00	7.00	5.00	10.00	9.00	9.00	9.00	17.00	78.70	1.10	0.40	5.30	0.00	0.20	0.10	0.60	1.10	0.00	87.50
E201386	1.50	5.60	5.40	5.60	0.26	0.10	0.01	0.09	2.75	NASS	11.00	20.00	5.00	15.00	13.00	10.00	13.00	25.00	9.00	10.00	64.60	3.10	1.30	12.60	0.00	0.50	0.00	0.40	0.10	0.00	82.60
E201387	1.00	7.50	4.60	7.70	5.40	2.40	0.11	2.29	70.09	NASS	26.00	20.00	5.00	26.00	89.00	10.00	39.00	130.00	9.00	10.00	39.40	13.30	2.10	16.20	0.10	1.80	1.10	2.00	0.90	0.10	77.00
E201388	1.00	5.00	3.90	4.70	0.09	0.10	0.01	0.10	2.91	PASS	8.00	20.00	5.00	5.00	5.00	10.00	10.00	7.00	9.00	10.00	86.10	0.70	0.10	0.90	0.00	0.10	0.00	0.30	0.10	0.00	88.30
E201389	1.00	5.10	4.70	5.20	0.07	0.10	0.00	0.10	2.98	NASS	8.00	20.00	5.00	5.00	5.00	10.00	13.00	9.00	9.00	10.00	84.80	0.70	0.20	0.90	0.00	0.10	0.00	0.20	0.00	0.00	86.90
E201390	1.00	3.00	2.10	2.60	3.50	7.50	0.62	6.88	210.58	AASS	8.00	250.00	20.00	8.00	35.00	10.00	12.00	8.00	12.00	10.00	8.00	38.20	0.40	1.80	0.00	1.20	0.40	2.40	0.60	0.30	53.30
E201391	1.00	6.50	5.50	6.00	0.13	0.10	0.00	0.10	2.96	NASS	8.00	20.00	5.00	7.00	14.00	10.00	5.00	11.00	9.00	10.00	57.10	12.40	0.30	4.20	0.00	0.60	0.30	1.20	0.30	0.40	76.80
E201392	1.00	4.00	3.60	4.10	0.54	0.40	0.14	0.26	7.93	PASS	8.00	20.00	5.00	5.00	5.00	10.00	8.00	6.00	9.00	10.00	81.90	1.50	0.10	0.60	0.00	0.00	0.00	0.40	0.20	0.00	84.70
E201393	3.00	3.40	2.10	2.60	18.20	25.00	2.64	22.36	684.21	AASS	8.00	105.00	16.00	5.00	22.00	10.00	5.00	6.00	9.00	10.00	4.50	22.90	0.20	1.00	0.00	1.20	6.00	2.20	0.30	0.10	38.40

FIELD No.	DEPTH (m)	$pH_{(F)}$	$pH_{(FOX)}$	Lab pH (L)	Lab EC	S(T)	S(HCl)	TOS	APP	TYPE	Co	As (ppm)	Bi (ppm)	Ga (ppm)	Zn (ppm)	W (ppm)	Cu (ppm)	Ni (ppm)	Sn (ppm)	Pb (ppm)	Si (ppm)	Fe (%)	Ti (%)	Al (%)	Mn (%)	Mg (%)	Ca (%)	Na (%)	K (%)	P (%)	Total (%)
E201394	1.50	5.60	5.00	5.50	0.09	0.10	0.00	0.10	3.04	NASS	8.00	42.00	5.00	8.00	5.00	10.00	7.00	5.00	9.00	10.00	68.90	5.30	0.30	6.40	0.00	0.40	0.00	0.40	1.00	0.00	82.70
E201395	1.50	3.50	2.83	3.50	4.00	1.40	0.10	1.30	39.74	AASS	8.00	20.00	5.00	5.00	14.00	10.00	13.00	14.00	9.00	10.00	61.70	3.60	0.60	1.10	0.00	0.70	0.20	1.50	0.20	0.10	69.70
E201396	1.00	4.00	3.50	4.30	0.59	0.60	0.06	0.54	16.56	PASS	23.00	20.00	5.00	10.00	65.00	10.00	115.00	15.00	9.00	19.00	70.90	2.70	0.40	7.30	0.00	0.80	0.10	0.60	1.50	0.10	84.40
E201397	1.00	3.80	2.20	4.10	0.49	3.80	0.09	3.71	113.47	AASS	65.00	33.00	5.00	12.00	68.00	32.00	280.00	16.00	9.00	62.00	71.30	8.20	0.40	9.60	0.00	1.10	0.00	0.80	2.10	0.20	93.70
FT1	0.50	5.00	3.50	4.80	2.02					PASS																					
FT2	0.50	4.50	3.80	4.30	0.16					PASS																					
FT3	0.50	4.70	3.30	4.50	2.29					PASS																					
FT4	0.50	4.60	3.50	4.50	3.02					PASS																					
FT5	0.50	5.40	4.40	5.30	0.19					NASS																					
FT6	0.50	5.10	4.50	5.00	1.25					NASS																					
FT7	0.50	5.00	3.70	4.90	1.08					PASS																					
FT8	0.50	5.10	3.80	4.80	1.11					PASS																					
FT9	0.50	4.50	4.00	4.50	2.05					PASS																					
FT10	0.50	4.10	3.80	4.11	2.32					PASS																					
FT11	0.50	4.50	3.70	4.40	2.27					PASS																					
FT12	0.50	4.50	4.00	4.30	2.25					PASS																					
FT13	0.50	5.50	4.20	5.27	1.55					NASS																					
FT14	0.50	5.00	4.00	4.60	1.17					PASS																					
FT15	0.50	5.20	5.00	5.00	1.04					NASS																					
FT16	0.50	4.50	2.90	4.50	1.80					PASS																					
FT17	0.50	4.50	3.90	4.40	1.15					PASS																					
FT18	0.50	4.80	3.60	4.70	1.03					PASS																					
FT19	0.50	4.30	3.70	4.30	1.21					PASS																					
FT20	0.50	5.00	4.00	4.70	1.02					PASS																					
FT21	0.50	5.30	4.70	5.30	0.76					NASS																					
FT22	0.50	5.50	4.70	5.50	0.17					NASS																					

APPENDIX 2

Water chemistry data

Explanations

Date	Date of sampling	Site	Location of sampling
Site_ID	Site No. or Sample No.	Field_pH	pH of the water at site
Field_EC	Electrical conductivity (dS/m) of water at site	Alk	Alkalinity (mg $CaCO_3$/L)
Acid	Acidity (mg $CaCO_3$/L)	SO_4^{2-}	Sulphate (mg/L)
Al_D	Dissolved aluminium (mg/L)	As_D	Dissolved arsenic (mg/L)
Cd_D	Dissolved cadmium (mg/L)	Cu_D	Dissolved copper (mg/L)
Fe_D	Dissolved iron (mg/L)	Mn_D	Dissolved manganese (mg/L)
Pb_D	Dissolved lead (mg/L)	Zn_D	Dissolved zinc (mg/L)
Al_T	Total aluminium (mg/L)	As_T	Total arsenic (mg/L)
Cd_T	Total cadmium (mg/L)	Cu_T	Total copper (mg/L)
Fe_T	Total iron (mg/L)	Mn_T	Total manganese (mg/L)
Pb_T	Total lead (mg/L)	Zn_T	Total zinc (mg/L)
Field_T	Field temperature of water (°C)	Lab_No.	Laboratory analysis number
Source	Source of analytical data		

DATE	SITE	AMG East	AMG North	SITE ID	FIELD pH	FIELD EC	ALK	ACID	SO_4^{2-}	Al_D	As_D	Cd_D	Cu_D	Fe_D	Mn_D	Pb_D	Zn_D	At_T	As_T	Cd_T	Cu_T	Fe_T	Mn_T	Pb_T	Zn_T	FIELD T	LAB No.	SOURCE
02.12.2000	King River @ Cryptic Falls	366354	5326934	KR11	5.57	0.06	3.00	6.00	11.00	0.10	0.01	0.00	0.06	0.09	0.13	0.01	0.02	0.39	0.01	0.00	0.08	1.18	0.13	0.01	0.03	15.4	1404	Gurung
02.12.2000	Fentons Creek @ Montagu Road	337942	5478701	UNCK1	4.74	0.05	1.00	7.00	2.20	0.03	0.01	0.00	0.00	0.07	0.01	0.01	0.00	0.04	0.01	0.00	0.00	0.10	0.01	0.01	0.01	17.4	1415	Krasnicki
05.12.2000	Markarna Park	588193	5582230	GWB-2	7.62	2.85	361.00	17.00	87.00	0.01	0.20	0.01	0.01	0.00	0.00	0.00	0.00	0.04	0.99	0.03	0.03	0.01	0.01	0.00	0.00	16.5	14618	Gurung
06.12.2000	Nalinga Creek	588032	5555937	Nalinga Ck-1	7.42	2.90	125.00	6.00	90.00	0.29	0.69	0.01	0.01	0.00	0.00	0.01	0.01	0.32	1.56	0.01	0.18	0.01	0.01	0.14	0.18	16.0	14619	Gurung
06.12.2000	Fatheringate Creek	588828	5547120	Fgate Ck	5.15	0.44	1.00	13.00	8.40	0.93	1.05	0.01	0.01	0.00	0.00	0.00	0.00	0.33	0.41	0.01	0.01	0.01	0.01	0.01	0.01	16.6	14623	Gurung
06.12.2000	Big River	593739	5543622	Big R	4.65	0.58	1.00	14.00	12.00	0.99	1.07	0.01	0.01	0.00	0.00	0.00	0.00	0.52	0.69	0.03	0.03	0.01	0.01	0.01	0.05	16.3	14626	Gurung
06.12.2000	Red Creek @ Coast Road	599695	5549651	Red Ck	6.31	2.65	189.00	9.00	22.00	0.08	0.45	0.01	0.01	0.00	0.00	0.00	0.00	0.08	0.65	0.01	0.27	0.01	0.01	0.01	0.01	19.3	14627	Gurung
06.12.2000	Sapphire River	601050	5547345	Sapphire R	6.32	7.90	15.00	9.00	330.00	0.93	1.60	0.01	0.01	0.00	0.00	0.00	0.00	0.64	1.45	0.05	0.05	0.01	0.01	0.01	0.01	19.5	14628	Gurung
07.12.2000	Ranga	593757	5553062	WM Ck	6.30	1.16	207.00	9.00	260.00	0.01	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.05	0.77	0.01	0.21	0.01	0.01	0.00	0.00	17.3	14629	Gurung
07.12.2000	Whitemark	587087	5559220	Pats R	7.52	8.10	171.00	12.00	250.00	1.10	1.48	0.01	0.01	0.00	0.00	0.00	0.00	4.44	6.82	0.56	0.79	0.01	0.01	0.01	0.01	15.6	14629	Gurung
07.12.2000	Pats River @ airport	585766	5561328	Pats-U5	7.41	5.55	14.00	26.00	36.00	0.41	1.06	0.01	0.01	0.00	0.00	0.00	0.00	0.76	1.33	0.03	0.19	0.01	0.01	0.01	0.01	17.1	14630	Gurung
09.12.2000	Mines Creek @ West End Road	574449	5584111	Mines Ck	5.35	0.61	1.00	24.00	11.00	1.90	2.38	0.01	0.01	0.00	0.00	0.00	0.00	1.52	3.49	0.01	0.01	0.01	0.01	0.01	0.01	18.8	14766	Gurung
09.12.2000	Creek @ West End Road	570586	5582412	Tanbay Ck	4.75	0.99	1.00	34.00	9.40	2.83	2.85	0.01	0.01	0.00	0.00	0.00	0.00	1.42	1.54	0.01	0.01	0.01	0.01	0.01	0.01	15.8	14767	Gurung
09.12.2000	Edens Creek @ Edens Road	576304	5597784	Edens Ck	8.10	3.28	404.00	7.00	180.00	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.07	0.07	0.01	0.01	0.01	0.01	0.00	0.00	17.2	14770	Gurung
10.12.2000	Patriarch River	600126	5576440	Patriarch R	7.72	20.60	215.00	15.00	900.00	0.02	0.15	0.01	0.01	0.00	0.00	0.00	0.00	0.04	0.34	0.01	0.05	0.01	0.01	0.00	0.01	20.0	14773	Gurung
11.12.2000	Killiecrankie Creek	572663	5588523	KC Creek	4.53	0.87	1.00	41.00	14.00	2.38	0.01	0.00	0.00	3.21	0.01	0.01	0.00	2.59	0.01	0.00	0.00	3.38	0.01	0.01	0.00	17.7	14788	Gurung
12.04.2001	Malugas Road drain	336486	5475474	Malugas-1	2.50	2.41	1.00	1060.00	2900.00	21.60	0.11	0.00	0.00	455.00	0.30	0.03	0.14	20.30	0.11	0.00	0.00	406.00	0.29	0.03	0.14	14.2	19956	Gurung
12.04.2001	Mella Rd drain > Malugas Road	336494	5475459	Mella-1	2.80	2.93	1.00	512.00	3100.00	24.50	0.01	0.00	0.00	63.70	0.71	0.01	0.03	25.20	0.01	0.00	0.01	158.00	0.73	0.01	0.06	11.8	19957	Gurung
12.04.2001	Drain off Hawthorns @ Malugas Road	336330	5475491	Malugas-2	7.30	0.70	398.00	11.00	3.00	0.02	0.01	0.00	0.00	0.02	0.04	0.01	0.00	0.02	0.01	0.00	0.00	0.33	0.09	0.01	0.00	12.2	19958	Gurung
12.04.2001	Malugas Road drain	336365	5475461	Malugas-3	2.70	5.27	1.00	4830.00	12000.00	90.80	0.01	0.00	0.00	1730.00	0.82	0.09	0.20	90.00	0.01	0.00	0.01	6.11	0.86	0.10	0.23	12.8	19959	Gurung
12.04.2001	Malugas Road drain	336022	5475519	Malugas-4	2.80	2.90	1.00	543.00	4600.00	10.70	0.01	0.00	0.00	128.00	0.66	0.01	0.02	10.60	0.01	0.00	0.00	141.00	0.67	0.01	0.03	13.4	19960	Gurung
12.04.2001	Malugas Road drain	335826	5475439	Malugas-5	2.80	1.96	1.00	383.00	2500.00	5.87	0.01	0.00	0.00	63.30	0.28	0.01	0.00	6.17	0.01	0.00	0.00	70.90	0.29	0.01	0.02	14.2	19961	Gurung
12.04.2001	Scopus Creek @ Malugas Road	335686	5475396	Scopus-1	3.20	1.29	1.00	132.00	760.00	11.10	0.01	0.00	0.00	31.30	0.24	0.01	0.01	11.10	0.01	0.00	0.00	32.80	0.24	0.01	0.02	14.0	19962	Gurung
11.04.2001	Excavated drain @ Harcus River Road	316428	5480393	HREXCA-1	3.10	1.28	1.00	236.00	680.00	31.80	0.01	0.00	0.00	8.63	1.68	0.01	0.02	32.60	0.01	0.00	0.00	5.58	1.70	0.01	0.03	11.0	19963	Gurung
11.04.2001	Harcus River @ Harcus Road	315004	5478775	Harcus-1	8.00	1.44	287.00	2.00	67.00	0.02	0.01	0.00	0.00	0.04	0.01	0.01	0.00	0.04	0.01	0.00	0.00	0.22	0.01	0.01	0.00	12.8	19964	Gurung
05.04.2000	Bungaree Creek (Lower)	230992	5593074	Bung-1	7.00	1.94	150.00	303.00	11.00	0.01	0.01	0.00	0.00	0.07	0.01	0.01	0.00	0.04	0.01	0.00	0.00	3.05	0.14	0.01	0.01	12.2	4977	Gurung
05.04.2000	Bungaree Creek (Middle)	231839	5593202	Bung-2	5.20	1.94	1100.00	426.00	27.00	0.11	0.01	0.00	0.01	0.08	0.01	0.03	0.01	2.05	0.01	0.00	0.01	4.71	0.28	0.03	0.00	12.4	4978	Gurung
05.04.2000	Bungaree Creek (Middle)	232434	5593367	Bung-3	4.04	12.34	1300.00	84.00	25.00	0.16	0.01	0.00	0.01	1.72	1.13	0.02	0.02	0.46	0.01	0.00	0.01	11.80	1.18	0.02	0.01	12.0	4979	Gurung
05.04.2000	Bungaree Creek (Upper)	233057	5593282	Bung-4	3.84	8.11	1500.00	1.00	83.00	8.61	0.06	0.00	0.00	0.58	2.89	0.02	0.03	9.87	0.01	0.00	0.00	13.00	3.08	0.02	0.03	13.7	4980	Gurung
06.04.2000	Pearshape Quarry	238543	5560412	Pear-2	2.38	8.03	4500.00	1.00	1280.00	99.90	0.15	0.00	1.02	120.00	4.96	0.01	6.87	105.00	0.16	0.01	1.04	121.00	5.02	0.01	6.98	12.1	4983	Gurung
06.04.2000	Egg Lagoon Creek	240263	5606350	EggCk-1	6.95	1.93	240.00	664.00	46.00	0.15	0.01	0.00	0.00	0.26	0.02	0.02	0.01	0.62	0.01	0.00	0.00	1.05	0.35	0.02	0.01	13.2	4987	Gurung
10.04.2000	Porky Creek	232297	5582951	PorkyCk	6.65	1.79	46.00	350.00	17.00	0.23	0.01	0.00	0.00	0.10	0.01	0.01	0.01	0.16	0.01	0.00	0.01	0.20	0.22	0.01	0.02	12.6	4990	Gurung
12.04.2000	Sea Elephant River	248208	5588379	Sea Elephant-1	6.31	0.37	13.00	14.00	9.00	0.01	0.01	0.00	0.00	0.33	0.01	0.01	0.00	0.08	0.01	0.00	0.00	2.73	0.12	0.01	0.01	14.8	5219	Gurung
12.04.2000	Robin Hamilton's farm	247116	5595459	GWB-13	5.42	1.03	130.00	29.00	27.00	0.01	0.01	0.00	0.00	0.32	0.11	0.01	0.00	0.03	0.01	0.00	0.00	2.79	0.12	0.01	0.01	11.9	5220	Gurung
12.04.2000	Yellow Rock River	234593	5599140	Yellow Rock	6.73	1.85	2.40	140.00	12.00	0.01	0.01	0.00	0.00	0.82	0.01	0.01	0.00	0.05	0.01	0.00	0.00	2.96	0.22	0.01	0.00	14.3	5222	Gurung
12.04.2000	Yellow Rock River (Lower)	233028	5600135	Yellow Rock-1	7.82	1.70	71.00	300.00	9.00	0.14	0.01	0.00	0.00	0.09	0.10	0.01	0.01	0.24	0.01	0.00	0.00	0.49	1.18	0.01	0.01	14.5	5223	Gurung
13.04.2000	Grassy upper dam	249525	5562868	Grassy Dam-1	6.62	0.46	15.00	60.00	6.00	0.01	0.01	0.00	0.00	1.61	0.01	0.01	0.00	0.05	0.01	0.00	0.00	2.06	0.15	0.01	0.00	12.6	5226	Gurung
10.05.2000	Montagu River @ Bass Highway	321735	5463385	Montagu-1	7.24	0.23	30.00	3.00	24.00	0.05	0.01	0.00	0.06	0.12	0.01	0.01	0.01	0.09	0.01	0.00	0.00	0.29	0.01	0.01	0.00	13.5	6194	Gurung
10.05.2000	Montagu River @ Renison Road	321074	5468232	Montagu-2	7.05	0.61	217.00	12.00	7.40	0.01	0.01	0.00	0.00	0.22	0.01	0.01	0.00	0.03	0.01	0.00	0.00	1.20	0.03	0.01	0.00	14.1	6195	Gurung

DATE	SITE	AMG East	AMG North	SITE ID	FIELD pH	FIELD EC	ALK	ACID	SO_4^{2-}	Al_D	As_D	Cd_D	Cu_D	Fe_D	Mn_D	Pb_D	Zn_D	At_T	As_T	Cd_T	Cu_T	Fe_T	Mn_T	Pb_T	Zn_T	FIELD T	LAB No.	SOURCE
10.05.2000	Welcome River @ Harcus River Road	313707	5477629	Welcome	7.74	1.17	280.00	4.00	27.00	0.01	0.01	0.00	0.01	0.10	0.01	0.01	0.01	0.07	0.01	0.00	0.00	1.11	0.06	0.01	0.00	13.8	6196	Gurung
10.05.2000	Harcus River @ Harcus River Road	315020	5478772	Harcus R	7.84	1.50	290.00	4.00	37.00	0.03	0.01	0.00	0.00	0.10	0.01	0.01	0.01	0.08	0.01	0.00	0.00	0.53	0.14	0.01	0.00	14.2	6197	Gurung
10.05.2000	Montagu River @ Montagu Road bridge	325872	5483562	Montagu-3	7.89	0.76	275.00	4.00	13.00	0.02	0.01	0.00	0.00	0.10	0.01	0.01	0.00	0.05	0.01	0.00	0.00	0.74	0.04	0.01	0.00	13.7	6198	Gurung
10.05.2000	Scopus Creek @ Hardmans Road	335563	5477614	Scopus-1	6.65	1.39	11.00	12.00	680.00	0.01	0.01	0.00	0.00	0.07	0.54	0.01	0.01	0.35	0.01	0.00	0.00	20.50	0.55	0.01	0.02	14.1	6199	Gurung
10.05.2000	Scopus Creek @ Montagu Road	336248	5479240	Scopus-2	6.85	1.28	62.00	7.00	540.00	0.01	0.01	0.00	0.00	0.23	0.66	0.01	0.00	0.05	0.01	0.00	0.00	1.65	0.76	0.01	0.00	14.5	6200	Gurung
11.05.2000	Mowbray	335684	5477672	GWBH-22	8.20	1.20	456.00	1.00	7.60	0.01	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.12	0.02	0.01	0.00	13.9	6201	Gurung
11.05.2000	Scopus Creek < Lacrum dairy	335470	5477023	Scopus-3	6.82	1.25	39.00	23.00	520.00	0.01	0.01	0.00	0.00	0.07	0.42	0.01	0.01	1.42	0.01	0.00	0.00	19.10	0.43	0.01	0.02	14.7	6202	Gurung
11.05.2000	Lacrum dairy	335581	5476932	GWBH-23	7.15	0.95	431.00	17.00	14.00	0.01	0.01	0.00	0.00	0.07	0.06	0.01	0.00	0.01	0.01	0.00	0.00	2.03	0.06	0.01	0.00	13.2	6203	Gurung
11.05.2000	Tiddly Creek	337032	5477645	Tiddly Ck	7.65	0.98	384.00	8.00	92.00	0.01	0.01	0.00	0.00	0.06	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.12	0.01	0.01	0.00	13.5	6205	Gurung
24.06.2000	Nike Creek @ Zeehan Highway	361412	5361570	Nike Ck	5.54	0.20	5.00	4.00	12.00	0.07	0.01	0.01	0.00	0.31	0.88	0.18	1.55	0.22	0.01	0.01	0.01	0.76	0.95	0.33	1.70	11.3	8057	Gurung
25.06.2000	Silver Lead Creek d/s Heemskirk Road	361051	5362131	Slead25	2.88	0.38	1.00	49.00	73.00	1.59	0.01	0.01	0.06	1.53	2.28	0.27	2.96	1.69	0.03	0.01	0.07	11.50	2.41	0.29	3.13	11.4	8059	Gurung
12.04.2001	Malugas Road drain	336194	5475512	FM	2.53	5.60																				13.1		Gurung
06.06.2000	Scopus Creek @ Malugas Road	335365	5474543	Mella_S3	2.57	2.62																				9.6		Hydrol
05.70.1993 1993	Quarry drain > Seal River	238347	5559713	SIN2	2.75	2.95		419.13	1756.00				0.71	5.80	9.40	0.02	9.10									9.6		Innes,
12.04.2001	Mella Road drain	336896	5476945	FM	2.86	2.61																				17.1		Gurung
12.04.2001	Malugas Road drain	335688	5475397	FM	2.86	2.59																				14.1		Gurung
12.04.2001	Mella Road drain	336589	5475579	FM	3.03	2.89																				16.1		Gurung
12.04.2001	Scopus Creek	335647	5475837	FM	3.26	1.72																				11.8		Gurung
12.04.2001	Scopus Creek	335670	5475548	FM	3.43	1.58																				12.8		Gurung
12.04.2001	Mella Road drain	336288	5475218	FM	3.48	3.11																				15.1		Gurung
12.04.2001	Scopus Creek	335637	5476068	FM	3.59	1.50																				11.2		Gurung
12.04.2001	Malugas Road drain	336412	5475486	FM	3.60	23.57																				17.0		Gurung
19.04.2001	Silver Lead Creek @ Zeehan	361535	5362233	FM	3.63	0.00								5.57	2.97											11.5		Parr, 1997
12.04.2001	Scopus Creek @ Malugas Road	335683	5475341	FM	3.90	1.37																				13.5		Gurung
06.06.2000	Scopus Creek @ Montagu Road	336248	5479240	Mella_S1	4.95	0.66																				7.5		Hydrol
15.04.2000	Barrier Creek	252784	5573645	FM	5.11	0.78																				12.3		Gurung
10.04.1995	Little Henty @ Zeehan Highway	364876	5362559	A16	5.30	0.10			7.00			0.00	0.01			0.00	0.03									9.0		Krasnicki
12.04.2001	Mella Road drain	337185	5476289	FM	5.35	1.52																				17.0		Gurung
11.04.2000	Granite Lagoon	247035	5608316	FM	5.46	0.88																				12.5		Gurung
12.04.2001	Malugas Road drain	336376	5475490	FM	5.55	1.84																				15.2		Gurung
13.03.1997	Nike Creek	361424	5361576	ZWSS6	5.73	0.42	66.20		1.80	0.06	0.01	0.01	0.00	1.56	1.49	0.17	1.53									11.4		Parr
14.04.2000	Seal River	241073	5557012	FM	5.89	0.65																				13.7		Gurung
21.01.1998	Tuckers Creek > Great Forester	539388	5460014	3464	5.91	0.21			3.10	0.29		0.00	0.00	1.20	0.06	0.00	0.00									16.2		Hydrol
19.04.2001	Zeehan Rivulet	362437	5361530	FM	5.95	0.00						0.00		0.74	0.16	0.00	0.02									15.1		Parr
08.04.2000	Little Porky Creek	234201	5584725	FM	5.99	1.41																				12.4		Gurung
09.03.1995	Tully @ Rayner Road	359000	5342300	A10	6.00	0.10			16.00			0.00	0.00			0.00	0.01									15.0		Krasnicki
19.06.1997	Keel Ridge Creek	361094	5360588	recon17	6.00	0.00						0.04		0.61	0.28	0.18	0.05									12.7		Parr
08.04.2000	Badger Box Creek	235710	5572313	FM	6.05	0.81																				12.2		Gurung

DATE	SITE	AMG East	AMG North	SITE ID	FIELD pH	FIELD EC	ALK	ACID	SO_4^{2-}	Al_D	As_D	Cd_D	Cu_D	Fe_D	Mn_D	Pb_D	Zn_D	At_T	As_T	Cd_T	Cu_T	Fe_T	Mn_T	Pb_T	Zn_T	FIELD T	LAB No.	SOURCE
14.04.2000	Macks Creek @ South Road	237439	5556417	FM	6.05	0.96																				12.2		Gurung
20.07.1999	Yellow Rock River	240350	5599500	3638	6.10	2.28																				10.8		Hydrol
12.04.2001	Scopus Creek	335858	5476159	FM	6.15	0.79																				12.3		Gurung
12.12.2000	Chew Tobacco Creek @ Thule Road	593978	5555906	FM	6.17	0.54																				17.2		Gurung
09.03.1995	Lost Creek @ Zeplin Road	362000	5342600	A13	6.20	0.09			34.00			0.00	0.00			0.00	0.01									14.5		Krasnicki
30.01.2001	Avenue River @ Knob Road	596991	5410501	FM	6.45	0.21																				21.0		Gurung
12.04.2001	Reemans Road drain > Duck River	337800	5476124	FM	6.79	0.98																				18.0		Gurung
23.07.1999	Fraser River	251800	5578600	3616	6.83	0.43			14.00					2.90	0.05											10.2		Hydrol
09.02.2001	Little Forester River	529523	5461313	FM	6.97	14.52																				20.0		Gurung
12.02.2001	Drain @ Great Forester	536761	5459526	FM	6.98	0.22																				19.2		Gurung
03.02.2001	Scamander River	599615	5411200	FM	6.99	0.11																				24.0		Gurung
14.04.2000	Shearing Shed Lagoon	236680	5554389	FM	7.01	0.92																				10.3		Gurung
03.02.2001	Binns Creek @ Upper Scamander Road	601483	5410220	FM	7.10	21.30																				24.0		Gurung
15.04.2000	Blowhole Creek	251289	5585566	FM	7.11	1.47																				13.1		Gurung
14.04.2000	Ettrick River	234752	5568200	FM	7.15	4.56																				12.8		Gurung
20.07.1999	Pass River	234200	5589600	3621	7.30	2.08																				10.2		Hydrol
08.02.2001	Tomahawk Creek @ Waterhouse Road	562969	5473725	FM	7.34	0.29																				23.0		Gurung
30.03.1995	Cullenswood	594500	5395300	730	7.35	0.14					0.01	0.00	0.00			0.00	0.01									9.9		Hydrol
08.02.2001	Boobyalla River	573861	5472470	FM	7.45	40.10																				16.2		Gurung
03.20.2000	Wakefield Creek @ Trial Harbour	348635	5356153	FM	7.60	0.28																				17.8		Gurung
08.02.2001	Tomahawk Creek	562928	5473513	FM	7.68	50.30																				23.0		Gurung
21.06.2000	Egg Lagoon Creek @ Mansons Road Bridge	245900	5604745	DK7	8.00	6.12																				14.4		Krushka
19.08.2000	Ettrick River @ old station	234776	5568215	DK1	8.10	0.69																				12.1		Krushka