




STRATFORDCOAL
Part of the Yancoal Australia Group

Stratford Extension Project
Environmental Impact Statement

APPENDIX L

GEOCHEMISTRY ASSESSMENT

On Thursday 28 June 2012, Yancoal Australia Limited was listed on the Australian Stock Exchange and merged with Gloucester Coal Ltd (GCL) under a scheme of agreement on the same date. Stratford Coal Pty Ltd is now a wholly owned subsidiary of Yancoal Australia Limited. Any reference to GCL in this Appendix should be read as Yancoal Australia Limited.

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Geochemical Assessment of the Stratford Extension Project

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1.0 Introduction

Environmental Geochemistry International Pty Ltd (EGi) were commissioned by Stratford Coal Pty Ltd (SCPL) (a wholly owned subsidiary of Gloucester Coal Ltd [GCL]) to conduct geochemical assessment of the Stratford Extension Project (the Project). The Stratford Mining Complex is located approximately 10 kilometres (km) south of the town of Gloucester in the Gloucester Valley in New South Wales (Figure 1). The nearby Duralie Coal Mine (DCM) is owned by GCL and is located approximately 20 km south of the Stratford Mining Complex (Figure 1).

The objectives of the work were to: assess the acid rock drainage (ARD) potential of waste rock (including overburden, interburden and pit floor materials) and Coal Handling and Preparation Plant (CHPP) wastes; identify the main ARD issues; and provide recommendations for materials management and any follow up test work.

2.0 Project Background and Geology

2.1 Project Background

The Project coal deposits are within the middle to lower parts of the Gloucester Basin and are of late Permian age. Figure 2 shows the stratigraphic units for the Project area and Figure 3 shows the typical stratigraphic columns for the individual Project open cuts. The Project would include open cut mining of three additional areas (Figure 4):

- Roseville West Pit Extension - an extension to the current Roseville West Pit workings in the western and southern directions. The pit stratigraphic extent includes the top of Marker Seam 7 to the base of Marker Seam 1 (Figure 3), with focus on continued mining of the Cloverdale and Roseville Seams. Seams dip approximately 35° to 55° to the west. Development would mainly produce coking coal with a thermal coal component. As the Roseville West Pit Extension mining operation progresses to the south, the previously mined and backfilled Roseville Pit would be excavated/cut-back to allow mining through to the stratigraphically deeper Roseville Seam. The backfill includes waste rock and previously deposited co-disposed coarse and fine rejects.
- Stratford East Open Cut - an additional open cut located on the south-eastern margin of the site to mine from the Cheer-up Seams to the base of the Clareval Seams (Figure 3), but is unlikely to include mining of the Weismantel Seam. Seams are steeply dipping at approximately 55° to 65° to the west. Development would mainly produce thermal coal and a slightly lower proportion of coking coal.

- Avon North Open Cut - an additional open cut located to the north-east of the Stratford Main Pit. Mining would cover from the top of the Marker 2 Seam to the base of the Triple Seams, with the Avon Seam the main target, and the possibility of mining (or at least exposing) part of the Glenview Seam (Figure 3) in late stages of mining in the north part of the open cut. Seams are relatively steeply dipping at approximately 40° to 50° to the west, with north-south trending steeply west dipping thrust faulting resulting in significant displacement. Development would mainly produce coking coal and a slightly lower proportion of thermal coal.

Development of the Project would include the completion of mining of the currently approved Bowens Road North Open Cut in Year 1 of the Project. During this time, operations at the Bowens Road North Open Cut would remain within the currently approved development extent. As mining in the Bowens Road North Open Cut would not go beyond currently approved development extent, the ARD potential of overburden, interburden, pit floor materials and CHPP wastes has not been considered in detail in this assessment.

Development of the Project would also include the rehandling and reprocessing of CHPP rejects from a previous co-disposal emplacement area (the Western Co-disposal Area) on the southern edge of the Roseville West Pit Extension (Figure 4).

Conventional open cut mining using drill and blast, and truck and shovel extraction methods would be used at the Project as per current operations.

2.2 Waste Rock Management

Waste rock disposal would involve a combination of out-of-pit dumping and in-pit backfill. Waste rock would be placed in all open cuts and in the Northern Waste Emplacement and the Stratford Waste Emplacement (Figure 4). Where potentially acid forming (PAF) waste rock are identified, they would be:

- placed in-pit and below the final water table for ultimate inundation and long term control of oxidation at closure; or
- encapsulated within constructed containment cells and capped with a low permeability layer when placed in out-of-pit waste rock emplacements.

In addition, interim PAF waste rock dump lifts/faces and PAF pit floors would be treated with crushed limestone as required for operational control of ARD before inundation or encapsulation is carried out.

It is currently planned that the co-disposed coarse and fine rejects previously backfilled in the Roseville Pit would be mined as waste rock during development of the Roseville West Pit Extension, rather than undergoing re-processing at the CHPP. There is only limited information on the geochemical characteristics of these rejects from testing of 9 deposited Stratford Mining Complex CHPP rejects samples carried out in 1997 and 1998[1, 2] (prior to processing of DCM coal), and they would be treated as PAF waste rock unless follow up geochemical investigations show that they are non acid forming (NAF). Note that this preliminary work indicated that most rejects represented by the 9 samples tested were likely to be NAF.

2.3 CHPP Reject Management

Run of mine (ROM) coal would be blended as required (together with ROM coal from DCM) and washed at the existing CHPP. CHPP rejects (i.e. co-disposed fine and coarse rejects) would continue to be placed into the Stratford Main Pit and in the Avon North Open Cut later in the Project life. As noted in Section 2.1, the Project would include re-processing of previously deposited CHPP rejects from the Western Co-disposal Area, and the resulting rejects would be treated the same way as the other CHPP rejects.

The CHPP rejects would be disposed in accordance with current practice described in the *Life of Mine Reject Disposal Plan*[3] to control short and long term generation of ARD. CHPP rejects are currently placed into the Stratford Main Pit where they are progressively inundated with water to prevent significant pyrite oxidation and acid generation in the long term, with monitoring of water quality undertaken during operations and provision for lime (calcium hydroxide - $Ca[OH]_2$) dosing and limestone (calcium carbonate - $CaCO_3$) treatment as required. CHPP rejects disposal into the Stratford Main Pit has been carried out since May 2003. Stratford Main Pit water quality during this period shows elevated sulphate (SO_4) of generally greater than 1000 milligrams per litre (mg/L) (Figure 5), which may be due to some oxidation of pyrite during CHPP rejects disposal, but pH trends (Figure 6) show that current management has successfully maintained a circum-neutral pH in the Stratford Main Pit. The elevated SO_4 concentrations may be also be due to the introduction of mine water with elevated SO_4 concentrations from the Bowens Road North Open Cut.

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[1] EGi Document No 6903/332, "Stratford Coal Mine, Geochemical Assessment of Coal Reject Disposal Options, Stage 1: Geochemical Characterisation of Coal Reject and Spoil", November 1997.

[2] EGi Document No 6903/362, "Stratford Coal Mine, Geochemical Assessment of Coal Reject Disposal Options, Stage 2: Leaching Behaviour of Coal Reject", July 1998.

[3] Stratford Coal Pty Ltd, "Life of Mine Reject Disposal Plan", 2010.

2.4 Examination of Drill Core

Selected core from across the Project area (NS192C, NS147AC, NS175C, NS174C, NS146C, NS142C and NS173C) was examined during a site visit in September 2010 to check for evidence of pyrite and neutralising carbonate occurrence, and obtain a better understanding of the continuity and variation of the major rock types through the planned mine stratigraphic sequence. Apart from the coal, the stratigraphic sequence in the Project area appears to be dominated by sandstones and siltstones, with lesser conglomerates, claystones and carbonaceous claystones/siltstones.

Overall, pyrite appeared to be mainly scattered and in low abundance in Roseville West Pit Extension and Avon North Open Cut, usually occurring as thin veneers on bedding surfaces associated with carbonaceous partings and particularly with leaf fossils (Plates 1 and 2), and on fracture/joint surfaces. Occasional, thin zones of higher pyrite concentrations were observed (highlighted by the presence of jarosite and sulphate salts due to partial oxidation of the pyrite), generally associated with coaly or carbonaceous units (Plates 3 and 4). It was reported by SCPL site personnel that previous development of the Stratford Main Pit exposed a pyritic section of the Glenview Seam, which resulted in spontaneous combustion. The Glenview Seam may also be exposed in the proposed Avon North Open Cut, and the ARD potential of this unit would need to be considered during mining.

Plate 1: Pyrite coatings associated with leaf fossils. Hole NS147AC at 48.5 m.

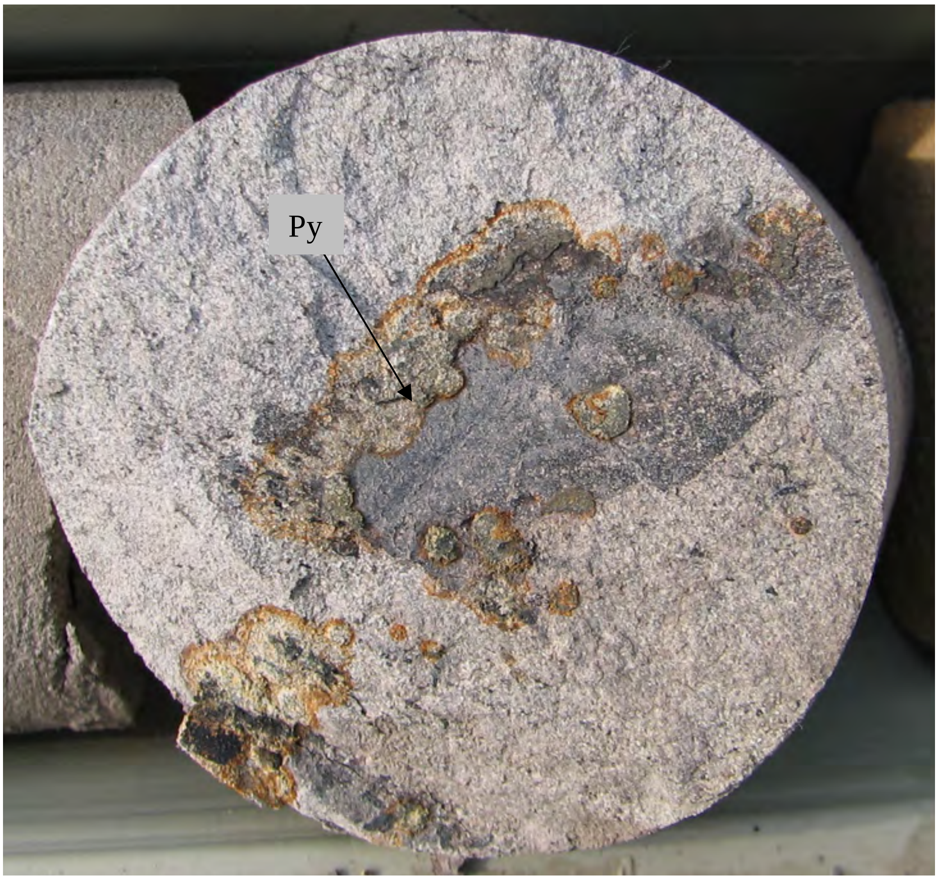

Plate 2: Pyrite coatings associated with leaf fossils. Hole NS175C at 45.0 m.

Plate 3: Pyritic zone (approx. 0.5 m thick) in carbonaceous claystone and coal (Triple Seam) with jarosite and sulphate salts due to partial oxidation of pyrite. Hole SC48 at 73.9 m.

Plate 4: Pyritic zone (approx. 0.2 m thick) in carbonaceous siltstone just below Bindaboo Seam 6 Upper with jarosite and sulphate salts due to partial oxidation of pyrite. Hole NS175C at 89.6 m.

Based on the available core for the Stratford East Open Cut, pyrite occurrence appeared to be more widespread and often associated with carbonaceous layers and partings in sandstones, but difficult to quantify, consistent with observations for the Duralie Extension Project[4].

During inspection of the core, 10% hydrochloric acid (HCl) was applied to the core intermittently to provide an indication of the presence of reactive carbonate such as calcite and dolomite. Generally only slight fizzing was observed in the core examined, indicating low to moderate contents of neutralising carbonate. Occasional zones of strong fizzing indicative of calcite were observed in sandstones and sideritic zones where there was obvious carbonate veining, with fizzing apparent both from the veins and in the matrix (Plate 5 and 6).

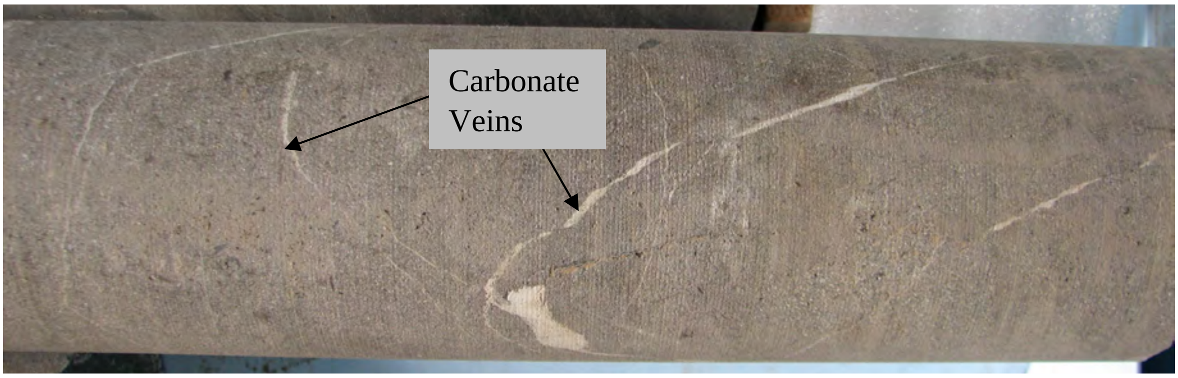

Plate 5: Sandstone with reactive carbonate in matrix and veins. Hole NS193C at 112.4 m.

[4] EGi Document No 6902/869, "Duralie Extension Project Geochemical Assessment of Overburden and Floor Rock", November 2009.

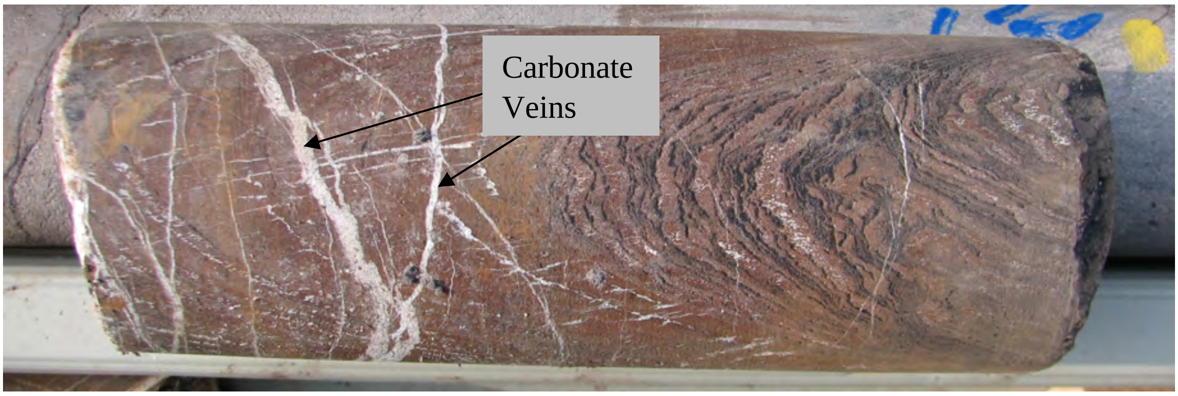

Plate 6: Carbonate veining in sideritic zone. Hole NS175C at 124.3 m.

In summary, examination of the core indicates that pyrite abundance is likely to be minor overall, but occasional pyritic zones occur close to coal seams, and higher pyrite contents are indicated for the Stratford East Open Cut. Acid neutralising carbonates appear to occur in low abundances, with occasional calcitic carbonate zones.

3.0 Previous Geochemical Assessment

3.1 Stratford Coal Project Environmental Impact Statement

A geochemical assessment was prepared by Dames and Moore[5] for the existing Stratford Coal Mine operations for inclusion in the *Stratford Coal Project Environmental Impact Statement*[6].

A total of 41 waste rock (including overburden/interburden) and 23 laboratory generated wash trial rejects samples were geochemically tested, with focus on water extract testing. The waste rock samples comprised intermittent discs of core approximately 2 centimetres thick collected each metre from drillholes SDH4, SDH5 and SDH6 and composited into lithological units. The laboratory generated rejects samples comprised fine (<0.5 millimetres [mm]) and coarse (>0.5 mm) rejects from washability testing of coal from Avon 1, Avon 2 and Triple Seams intercepted in hole SC12. Testing included pH, electrical conductivity (EC), anions/cations and multi-elements on saturated water extracts, multi-elements of sample solids, total sulphur (S) and acid neutralising capacity (ANC).

Most total S values for waste rock were relatively low at less than 0.2%S, except for sample 4 from the Avon 1 Seam roof in hole SDH4 (equivalent to Avon A [AVA] Seam roof in current nomenclature) with a total S of 2.6%S. ANC values ranged from 1 to 51 kilograms of sulphuric acid per tonne (kg H_2SO_4/t) (converted from % $CaCO_3$), with most samples having relative low ANC of less than 20 kg H_2SO_4/t. The Avon Seam roof sample was the only waste rock sample with significant net acid producing potential (NAPP) at 75 kg H_2SO_4/t.

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[5] Dames and Moore, “Gloucester Coal Project – Overburden Study”, 1984.

[6] Stratford Coal Pty Ltd, “Stratford Coal Project Environmental Impact Statement”, 1994.

The total S of laboratory-generated washery rejects samples varied from 0.16 to 2.77%S and ANC was insignificant at 1 kg H_2SO_4/t or less. The Avon 1 Seam laboratory-generated rejects samples had high total S and, as with waste rock, was the only material with significant NAPP in both fine and coarse rejects at 71 and 84 kg H_2SO_4/t, respectively.

Sampling was not sufficient to represent the full mine stratigraphy but did indicate that the Avon Seam roof and some CHPP rejects may be PAF.

3.2 HLA Envirosciences Assessment of Stratford Soil and Mine Waste

Physical and geochemical characterisation of soil and waste rock materials from the Stratford Coal Mine was carried out by HLA Envirosciences Pty Limited in 1996[7]. Geochemical testing comprised pH and EC of 1:5 (solid to liquor) deionised water extracts, total S and S forms, and ANC. Samples were collected from overburden dumps, topsoil stockpiles and co-disposed CHPP rejects as follows:

- 4 composite shale and mudstone waste rock samples;
- 4 composite carbonaceous waste rock samples;
- 4 clay overburden samples;
- 4 surface samples of graded waste rock;
- 4 topsoil samples; and
- 4 CHPP rejects samples.

Results indicated that materials represented by the carbonaceous overburden and CHPP rejects samples were PAF, but that other materials were unlikely to produce acid.

The overburden sampling was limited and the samples were not matched to particular units or rock types from the Stratford Coal Mine, and hence the findings cannot be directly applied to the Project. However, the results confirm that some waste rock materials from the Project may be PAF. Results for the CHPP rejects are consistent with testing of deposited CHPP rejects carried out in 2010 (see Section 3.5).

3.3 Bowens Road North Project Environmental Impact Statement

The *Bowens Road North Project Environmental Impact Statement*[8] included a geochemical assessment[9] of waste rock from the Bowens Road North Open Cut.

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[7] HLA Envirosciences Project No. F1325, “Stratford Coal Mine Soil and Mine Waste Characterisation Report”, February 1996.

[8] Stratford Coal Pty Ltd, “Bowens Road North Project Environmental Impact Statement”, 2001.

[9] Resource Strategies, “Bowens Road North Project Environmental Geochemical Assessment of Waste Rock”, January 2001.

A total of six samples from three drillholes covering various depth intervals and various rock types within the waste rock were geochemically tested. Testing included pH, EC, total S, ANC, net acid generation (NAG), multi element scans of sample solids and shake solubility tests.

The testing was limited, but results indicated that the samples were NAF and unlikely to generate environmentally harmful leachate when exposed to surface oxidation processes.

3.4 Duralie Extension Project Environmental Assessment

EGi[10] carried out a geochemical assessment of the Duralie Extension Project in 2009, which was incorporated into Appendix I of the *Duralie Extension Project Environmental Assessment*[11]. Part of the work included assessment of Clareval Seam waste rock (including overburden/interburden and floor). The proposed Stratford East Open Cut represents the northern extension of the Clareval Seam stratigraphic package, and hence the findings for the Duralie Extension Project have relevance to the Project.

A total of 168 samples from 8 drillholes covering Clareval Seam waste rock (including overburden/interburden and floor) materials were geochemically tested. Testing included Leco total S (or equivalent) and single addition NAG testing on all samples, and pH and EC on water extracts and ANC on a smaller sub set. Selected samples were also subjected to specialised testing to help resolve uncertainties in classification, identify any potential elemental concerns and provide initial elemental solubility data. Specialised tests included sequential NAG, kinetic NAG, acid buffering characteristic curves (ABCC), and multi-element testing of solids and water extracts. A general description of ARD tests and their use is included in Attachment A.

Results of ARD investigations indicated that the mine stratigraphic sequence for the Clareval Seam includes NAF, PAF and lower capacity PAF (PAF-LC) materials. The approximate breakdown of geochemical rock types based on sample intervals tested (not taking spatial distribution or mining blocks into account) were as follows:

Material Type	PAF	PAF-LC	NAF
Clareval Seam Overburden	28%	19%	53%
Clareval Seam Floor	0%	20%	80%

[10] EGi Document No 6902/869, "Duralie Extension Project Geochemical Assessment of Overburden and Floor Rock", November 2009.

[11] Duralie Coal Pty Ltd, "Duralie Extension Project Environmental Assessment", 2010.

Figure 7 is a plot of NAGpH profiles for the Clareval Seam drill holes. PAF and PAF-LC samples are shown as red symbols, and approximate zones of NAF and PAF are shown with blue and pink shading, respectively. The drill holes are aligned according to seam and are ordered approximately north to south from left to right. Holes DU109R, DU126R and DU165R overlap to represent most of the waste rock stratigraphy likely to be mined above the Clareval Seam. Results indicated the following in regards to the distribution of ARD rock types:

- strongly weathered waste rock is likely to be laterally continuous, have low pyrite content and be NAF;
- all waste rock below the depth of strong weathering is likely to be pyritic, and about half is expected to be NAF and half PAF/PAF-LC, occurring in multiple horizons;
- the occurrence of NAF is generally due to the presence of moderate to high ANC rather than low pyritic S;
- the immediate roof within a few metres of the Clareval Seam is likely to be PAF and strongly pyritic and reactive;
- PAF and PAF-LC materials are likely to show a short lag before onset of acid generation after exposure to atmospheric oxidation conditions; and
- Clareval Seam floor appears to be mainly NAF.

Multi-element analysis suggested that materials represented by the samples tested would have no significant elemental enrichment (except for S), but would mobilise significant concentrations of metals and other constituents at low pH. Pyrite oxidation and acid release is likely to be accompanied by release of elevated concentrations of SO_4, aluminium (Al), cobalt (Co), iron (Fe), manganese (Mn), nickel (Ni) and zinc (Zn).

The results discussed in this section are used in conjunction with current testing to assist geochemical assessment of the Stratford East Open Cut.

3.5 Geochemical Assessment of Stratford Mining Complex and DCM CHPP Rejects

EGi[12] carried out a previous geochemical assessment of Stratford Mining Complex CHPP rejects (including DCM rejects) in 2010. The assessment included reviews of laboratory-generated wash trial and CHPP rejects testing carried out between 1995 and 1998, and co-disposed CHPP rejects testing in the Stratford Main Pit conducted in 2008.

[12] EGi Document No 6902/905, "Geochemical Assessment of Co-Disposed Rejects and Tailings from the Duralie Extension Project and the Stratford Coal Mine", March 2010.

Results showed that most co-disposed CHPP rejects represented by the samples tested from the Stratford Main Pit deposition area were PAF or PAF-LC, with low ANC and fast rates of reaction. Multi-element analysis suggested that materials represented by the samples tested would have no significant elemental enrichment (except for S), but would mobilise metals at low pH. Pyrite oxidation and acid release would be associated with elevated metal concentrations, including Al, Fe, Mn, Ni and Zn. These results indicated that implementation of appropriate management measures would be required to manage potential ARD impacts associated with the existing and proposed co-disposed CHPP rejects. Note that Stratford Main Pit water quality monitoring discussed in Section 2.3 confirms that current management measures have successfully controlled pH from deposited CHPP rejects and maintained a circum neutral pH in the Stratford Main Pit (Figure 6).

The CHPP reject samples tested had lower acid forming potential than the laboratory generated DCM rejects samples, and indicated that the overall PAF/PAF-LC nature of the combined CHPP rejects deposited at the Stratford Main Pit was due mainly to the DCM ROM coal feed.

Based on the above, it will be assumed that all CHPP rejects produced at the Project are PAF for this assessment.

4.0 Sample Selection and Preparation

A sampling programme was undertaken to capture a complete stratigraphic section through the proposed mine stratigraphy at Roseville West Pit Extension, Stratford East Open Cut and Avon North Open Cut. This was achieved by using existing cored holes where possible and drilling infill open holes to cover gaps in the stratigraphic coverage. The cored holes and open holes selected for sampling were as follows:

Roseville West Pit Extension	
Cored holes	NS232C, NS170C, NS235C, NS193C, NS142C, NS173C and NS185C
Open holes	NS595R, NS591R and NS594R
Stratford East Open Cut	
Cored holes	NS273AC, NS274C, SS194C and SS221C
Open holes	NS576R, NS577R and NS587R
Avon North Open Cut	
Cored holes	SC48C
Open holes	NS602R, NS603R and NS604R

Locations of the above holes are shown in Figure 4.

All holes were sampled continuously except where there were missing intervals. Sample intervals were selected by SCPL geologists in conjunction with EGi to match geological boundaries, with intervals ranging from less than 0.5 metres (m) to over 5 m. A total of 998 samples were tested.

Open hole samples were collected by SCPL personnel at metre intervals from the end of a T-Piece connected to the hole collar. The full metre was represented in each sample, and the hole was cleared between each sample to reduce cross contamination. Around 5 kilograms (kg) of sample was collected for each metre, and these were sub-sampled by spearing a PVC pipe from the top to the bottom of the sample (to ensure the entire metre was represented). Sub samples were combined in the field on an equal volume basis to make up composites according to geological boundaries.

Sample preparation was arranged by SCPL geologists with advice from EGi, and was carried out by Coal and Seam Gas (CSG) Services in Queensland, which involved drying (as required), crushing to a nominal <4 mm (core samples only), splitting, pulverising a 300 gram (g) to 500 g split to <212 microns (µm), and dispatch of 300 g to 500 g of <212 µm pulverised samples and <4 mm crushed samples to EGi.

5.0 Test Methodology

Leco or Leco equivalent total S was carried out on all 998 samples. A smaller sub set of 435 samples was subjected to standard geochemical characterisation as follows:

- pH and EC of deionised water extracts at a ratio of 1 part solid to 2 parts water ($pH_{1:2}$ and $EC_{1:2}$);
- ANC;
- NAPP, calculated from total S and ANC; and
- standard single addition NAG test.

Further testing was carried out on selected samples to help resolve uncertainties in the above test results, as follows:

- extended boil and calculated NAG testing to account for high organic carbon contents (7 samples);
- sequential NAG (3 samples);
- kinetic NAG test (7 samples); and
- ABCC test (18 samples).

A general description of ARD test methods and calculations used is provided in Attachment A.

In addition, 23 selected samples were assayed for the following to identify any potential elemental concerns and to provide initial elemental solubility data:

- multi-element scans of solids; and
- multi-element scans of deionised water extracts (ratio of 1 part solid to 2 parts water).

Note that testing of Stratford East Open Cut infill holes NS576R, NS577R and NS587R and Roseville West Pit Extension infill holes NS595R, NS591R and NS594R was limited to total S only. Additional testing of these holes is planned as part of a follow up programme.

Water extractions for $pH_{1:2}$ and $EC_{1:2}$ and multi-element testing were carried out on <4 mm crushed samples. Pulverised samples were used for all other tests.

Total S assays were carried out by CSG Services. Multi-element analyses of solids were carried out by ALS Laboratory Group (Brisbane). Multi-element analyses of water extracts were carried out by ALS Laboratory Group (Sydney). Analyses of NAG solutions were carried out by Levay & Co. Environmental Services (Adelaide). All other analyses were carried out by EGi.

6.0 Standard Geochemical Characterisation Results

Table 1 presents standard geochemical characterisation results for all cored holes (hole names suffixed with C or AC) from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes (suffixed with R) from Avon North Open Cut. Table 2 shows results for the infill open holes from Roseville West Pit Extension and Stratford East Open Cut, which were tested for total S only to assist correlation of geochemical rock types.

6.1 pH and EC

The $pH_{1:2}$ and $EC_{1:2}$ results were determined by equilibrating the sample in deionised water for approximately 16 hours at a solid to water ratio of 1:2 (by weight). This gives an indication of the inherent acidity and salinity of the waste rock material when initially exposed in a waste rock emplacement area.

The $pH_{1:2}$ values ranged from 2.6 to 9.2, with most samples (approximately 85%) showing no inherent acidity having a pH greater than 6. Less than 5% of the samples tested had an acidic pH of less than 4.0. Figure 8 is a box plot showing the distribution of $pH_{1:2}$ values split by open cut, showing that Roseville West Pit Extension and Stratford East Open Cut samples include more slightly acidic $pH_{1:2}$ values (pH <5) than Avon North Open Cut samples. Note that the acidic Roseville West Pit Extension samples are mainly associated with small (<0.5 m) coal intervals where as the acidic Stratford East Open Cut samples are mainly associated with thicker (>1 m) intervals of sandstone and siltstone (Table 1).

$EC_{1:2}$ values ranged from 0.07 to 5.98 deci-siemens per metre (dS/m) with most samples (approximately 85%) falling within the non-saline to slightly saline range having an EC of less than 0.8 dS/m[13]. Less than 5% of the samples were saline (>1.6 dS/m). Figure 9 is a box plot showing the distribution of $EC_{1:2}$ values split by project area, which shows the Stratford East Open Cut samples are generally slightly more saline than samples from the other open cuts.

Figure 10 is a plot of $pH_{1:2}$ and $EC_{1:2}$ versus total S, which shows that the lower $pH_{1:2}$ values and higher $EC_{1:2}$ values are generally associated with higher S samples. This indicates that lower $pH_{1:2}$ and higher $EC_{1:2}$ values are the result of partial pyrite oxidation occurring between sample collection and sample testing.

Results indicate a general lack of immediately available acidity and salinity in the samples except where due to partial oxidation of pyrite. Pyrite oxidation would therefore be the main source of salinity in overburden and interburden materials. The greater proportion of lower $pH_{1:2}$ and higher $EC_{1:2}$ samples from the Stratford East Open Cut is due to the greater proportion of pyritic materials.

6.2 Acid Base (NAPP) Results

Total S ranges from below detection to 8.38%S, with most (approximately 75%) samples having low total S of less than 0.2%S. Figure 11 is a box plot of the distribution of total S split by open cut, showing the Stratford East Open Cut samples have distinctly higher total S than the other open cuts, having a median of approximately 0.3%S compared to medians of 0.05%S and less for the other two open cuts. A total of 40% of Stratford East Open Cut samples have total S values greater than 0.5%S.

[13] Salinity criteria adapted from Richards, LA., (ed) (1954), Diagnosis and Improvement of Saline and Alkaline Soils, USDA Handbook No. 60, Washington DC.

Figure 12 is a box plot of the distribution of ANC split by Project open cut. The range in ANC values is similar in all three open cuts, but the Stratford East Open Cut samples have a slightly lower median ANC of 8 kg H_2SO_4/t, compared to 12 kg H_2SO_4/t and 16 kg H_2SO_4/t for Avon North Open Cut and Roseville West Pit Extension samples, respectively. The median ANC values for all three open cuts are relatively low at less than 20 kg H_2SO_4/t, but 25% of samples have moderate to high ANC values of greater than 20 kg H_2SO_4/t, with a maximum value of 315 kg H_2SO_4/t.

The NAPP value is an acid-base account calculation using measured total S and ANC values. It represents the balance between the maximum potential acidity (MPA) and ANC. A negative NAPP value indicates that the sample may have sufficient ANC to prevent acid generation. Conversely, a positive NAPP value indicates that the material may be acid generating.

Figure 13 is an acid-base account plot of ANC verses total S, split by open cut. Figure 14 is the same acid-base account plot as Figure 13, but re-scaled to better represent total S below 3%S and ANC below 100kg H_2SO_4/t. The NAPP zero line is shown which defines the NAPP positive and NAPP negative domains, and the line representing an ANC/MPA ratio value of 2 is also plotted. Note that the NAPP = 0 line is equivalent to an ANC/MPA ratio of l. The ANC/MPA ratio is used as an indication of the relative factor of safety within the NAPP negative domain. Usually a ratio of 2 or more signifies a high probability that the material will remain circum-neutral in pH and thereby should not be problematic with respect to ARD.

The plots show that most Avon North Open Cut and Roseville West Pit Extension samples plot in the NAPP negative domain but that the Stratford East Open Cut samples show a broad scatter of total S and ANC values. Approximately 90% of Avon North Open Cut samples plotted in the NAPP negative domain, with 80% also having an ANC/MPA ratio of 2 or more, indicating a high factor of safety. Roseville West Pit Extension samples were 75% NAPP negative and with 65% also having an ANC/MPA ratio of 2 or more. Stratford East Open Cut samples had a much lower proportion of NAPP negative samples, with 50% NAPP negative and 30% also having an ANC/MPA ratio of 2 or more.

6.3 Single Addition NAG Results

NAG test results are used in conjunction with NAPP values to classify samples according to acid forming potential. Figure 15 is an ARD classification plot showing NAGpH versus NAPP value, with results split according to open cut. Figure 16 is the same ARD classification plot rescaled to better represent the NAPP range from -40 to 60 kg H_2SO_4/t. PAF, NAF and uncertain (UC) classification domains are indicated. A sample is classified PAF when it has a positive NAPP and NAGpH < 4.5, and NAF when it has a negative NAPP and NAGpH greater than or equal to 4.5. Samples are classified uncertain when there is an apparent conflict between the NAPP and NAG results, i.e. when the NAPP is positive and NAGpH greater than or equal to 4.5, or when the NAPP is negative and NAGpH < 4.5. Note that most of the samples with low total S of 0.05%S or less were not NAG tested and are not represented on the Figures 15 and 16, but have a negligible risk of acid formation are expected to be NAF.

The plots show that most samples have consistent NAPP and NAGpH results, plotting in either the PAF or NAF domain, but some samples plot in the upper right and lower left uncertain domains.

A total of 277 samples plot in the NAF domain, accounting for most of the Avon North Open Cut and Roseville West Extension Pit samples and just under half of Stratford East Open Cut samples.

A total of 12 samples plot in the upper right uncertain domain. Nine of these samples have total S values of around 1%S or less and low ANC of less than 20 kg H_2SO_4/t, and in these cases the NAG test would normally account for all pyritic S in the sample and are expected to be NAF in accordance with the NAG results. The three remaining samples have moderate to high ANC and total S greater than 1%S, and pyrite oxidation may not be complete in the single addition NAG test. Specialised testing was carried out to help resolve the uncertainty in these samples.

Thirty one samples plot in the bottom left hand uncertain domain, with acidic NAGpH values of 2.6 to 4.4 and NAPP values of 0 and -34 kg H_2SO_4/t. Most of the samples show evidence of organic acid effects, indicated by a large difference between the $NAG_{(pH4.5)}$ and $NAG_{(pH7.0)}$ values, and $NAG_{(pH4.5)}$ values that exceed the MPA. In these samples the NAG results overestimate the acid potential. Standard NAG test results affected by organic acids are highlighted in yellow in Table 1. Specialised testing was carried out to help resolve uncertainties in classification of these samples. Five of the samples did not appear to be influenced by organic acids, but only had marginally acidic NAGpH values of 4.1 to 4.4, which are most likely due to a lack of buffering and the effects of residual hydrogen peroxide in the sample. These materials are likely to be non-reactive, i.e. no significant acid generation or buffering potential, and are expected to be NAF consistent with NAPP results.

There are 115 samples that plot in the PAF domain. Thirty two of these have low NAG values to pH 4.5 of 5 kg H_2SO_4/t or less and are expected to be PAF but with a lower capacity to generate acid (i.e. PAF-LC). A number of PAF domain samples also show evidence of organic acid effects, and again the NAG results may overestimate the acid potential with some samples potentially being NAF.

7.0 Specialised Geochemical Characterisation Results

7.1 Extended Boil and Calculated NAG Results

Extended boil and calculated NAG testing was carried out on 7 selected samples to help resolve the uncertainty in ARD classification based on standard NAG test results, as discussed in Section 6.3. Results are shown in Table 3.

Results show that the NAGpH value increases by around 3 pH units or more after the extended boiling step on all samples except sample 45153. The increase in NAGpH confirms the effects of organic acids. The extended boil NAGpH of sample 45153 remained less than 4.5, indicating this sample is likely to be PAF.

Note that the extended boil NAGpH value can be used to confirm samples are PAF, but an extended boil NAGpH value greater than 4.5 does not necessarily mean that samples are NAF, due to some loss of free acid during the extended boiling procedure. To address this issue, a calculated NAG value is determined from assays of anions and cations released to the NAG solution. A calculated NAG value of less than or equal to 0 kg H_2SO_4/t indicates the sample is likely to be NAF, and a value of more than 0 kg H_2SO_4/t indicates the sample may be PAF. Samples plotting in the lower left uncertain domain and affected by organic acids are therefore expected to be NAF in accordance with NAPP results.

The calculated NAG value for sample 45153 was positive, confirming that this samples is PAF. The calculated NAG values for the remaining 6 samples were negative, indicating that all acid generated in the standard NAG test for these samples is organic, and that materials represented by these samples are likely to be NAF under field conditions.

Table 3 indicates that, in carbonaceous materials, the NAPP values and the standard NAG values may overestimate the true acid potential. This is due to the presence of non acid generating S forms and the generation of organic acids in the standard NAG test. Therefore some of the samples plotting in the PAF domain shown on Figure 15, may be less acid generating than indicated by the NAPP value or even not acid generating. Extensive additional testing would be required to resolve this issue on individual samples and hence in this report, it is conservatively assumed that all samples not subjected to calculated NAG that plot in the PAF domain are classified PAF.

7.2 Sequential NAG Testing

When testing samples with high sulphide contents it is common for oxidation to be incomplete in the single addition NAG test. Sequential NAG testing overcomes this limitation to an extent through successive additions of peroxide to the same sample. Sequential NAG testing of up to 4 stages was carried out on 3 selected samples with total S greater than 1%S and moderate ANC values of 34 to 85 kg H_2SO_4/t to help resolve uncertainties in ARD classification. Results are presented in Table 4.

Samples 1260 and 1269 were NAPP negative with high ANC and single addition NAGpH values of greater than 7. Sequential NAG testing was carried out to confirm that the rates of acid buffering matched the rates of acid generation in these samples. The NAGpH values of all 4 sequential NAG stages were above 4.5, confirming these samples are NAF.

Sample 1264 had a positive NAPP of 4 kg H_2SO_4/t but a single addition NAGpH of 7.3, and sequential NAG testing was carried out to check whether additional stages of NAG testing would result in acid production. All 4 stages had a NAGpH value greater than 4.5, confirming this sample is likely to be NAF, consistent with single addition NAG test results.

Results confirm that single addition NAG testing is a reliable indication of acid forming potential in non-carbonaceous material, consistent with results of testing similar materials for the Duralie Extension Project in 2009[14]. Hence samples in Table 1 with a positive NAPP and a single addition NAGpH of 4.5 or greater are expected to be NAF.

7.3 Kinetic NAG Testing

Kinetic NAG tests provide an indication of the kinetics of sulphide oxidation and acid generation for a sample. Figures 17 to 23 present kinetic NAG test results for 7 selected Stratford East Open Cut samples plotting in the PAF domain and with total S values greater than 0.7%S.

Samples 1142, 1256, 1276, 1315 have low ANC (0 to 1 kg H_2SO_4/t) and the kinetic NAG profiles (Figures 17, 18, 21 and 23) show a rapid pH decrease with time, starting below pH 4 or reaching pH 4 in 5 minutes or less, indicating short lag times of a month or less before materials represented by these samples would generate low pH under atmospheric oxidation conditions.

Samples 1263, 1268 and 1280 have a moderate ANC of 19 to 55 kg H_2SO_4/t, and all three show significant lag times of over 100 minutes (Figures 19, 20 and 22), indicating longer lags of at least 12 months.

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[14] EGi Document No 6902/869, “Duralie Extension Project Geochemical Assessment of Overburden and Floor Rock”, November 2009.

Results indicate that low ANC PAF waste rock represented by these samples are likely to produce acid in a short time frame (within 1 month) after exposure to atmospheric oxidation, but that materials with moderate ANC may show a lag of 1 year of more before onset of acid conditions.

7.4 Acid Buffering Characteristic Curve (ABCC) Testing

An ABCC profile is produced by slow titration of a sample with acid, and provides an indication of the relative reactivity of the ANC measured. The acid buffering of a sample to pH 4 can be used as an estimate of the proportion of readily available ANC. ABCC tests were carried out on 18 selected samples to evaluate the availability of the ANC measured. Results are presented in Figures 24 to 34, with calcite, dolomite, ferroan dolomite and siderite standard curves as reference. Calcite and dolomite readily dissolve in acid and exhibit strongly buffered pH curves in the ABCC test, rapidly dropping once the ANC value is reached. The siderite standard provides very poor acid buffering, exhibiting a very steep pH curve in the ABCC test. Ferroan dolomite is between siderite and dolomite in acid buffering availability.

Eleven of the 18 samples have ABCC curves that plot close to dolomite and calcite standard trends, indicating reactive ANC with generally 70% or more of the total ANC measured readily available (Figures 24 to 34).

Samples 864 (Figure 25) and 1027 (Figure 24) have ABCC curves that plot between the dolomite and ferroan dolomite standard trends, indicating that the ANC is less reactive than dolomite with approximately 80% of the total ANC measured readily available.

The curves for samples 45178 (Figure 25), 997 (Figure 27) and 1042 (Figures 29) plot close to the ferroan dolomite standard trends, indicating neutralising carbonates are slowly reactive, and that 50% to 80% of the total ANC measured is readily available.

Samples 45028 (Figure 26) and 865 (Figure 27) have profiles that plot between the ferroan dolomite and siderite standard curves, indicating that the ANC is poorly reactive, with around 40% likely to be effective.

Overall, ABCC results suggest that the acid buffering minerals within the samples tested are generally reactive, and that the ANC would be mainly effective.

7.5 Multi-Elements of Solids and Water Extracts

A total of 23 waste rock sample solids were analysed for multi-elements. Results were compared to the median soil abundance (from Bowen, 1979[15]) to highlight enriched elements. The extent of enrichment is reported as the Geochemical Abundance Index (GAI), which relates the actual concentration with an average abundance on a log 2 scale. The GAI is expressed in integer increments where a GAI of 0 indicates the element is present at a concentration similar to, or less than, average abundance; and a GAI of 6 indicates approximately a 100-fold enrichment above average abundance. As a general rule, a GAI of 3 or greater signifies enrichment that warrants further examination.

Results of multi-element analysis are presented in Table 5 and the corresponding GAI values are presented in Table 6. Results show enrichment in S for a number of samples and particularly from Stratford East Open Cut (which is already discussed above in the context of acid forming potential), slight enrichment in beryllium (Be), enrichment in silver (Ag) and arsenic (As) for sample 45119 and enrichment in selenium (Se) for sample 1290. Although Be is slightly enriched, it is within normal ranges for sedimentary rocks. The elevated Ag value for sample 45119 is also within normal ranges for carbonaceous materials. The As enrichment is associated with elevated S of 0.71%S, and it is likely to be due to small amounts arsenopyrite associated with the pyrite in this sample.

The same 23 samples were subjected to deionised water extraction at a solids:liquor ratio of 1:2, and the resulting liquors were analysed for multi-elements. Results are given in Table 7.

All of the Stratford East Open Cut samples with the exception of sample 1320 had elevated total S of 0.7%S or greater, and some partial pyrite oxidation was expected due to extended sample storage prior to analysis. Water extracts for samples 1256 and 1290 had acidic pH values of 4.5 and 3.7 and moderately saline (1.34 dS/m) and saline (1.98 dS/m) EC values, respectively, mainly due to elevated Ca and SO_4, confirming the effects of partial pyrite oxidation. The chemistry of the water extracts for these lower pH samples show that pyrite oxidation and acid release is likely to be accompanied by release of elevated concentrations of Al, Co, copper (Cu), Fe, Mn, Ni and Zn. The solubility of these elements is largely determined by pH and therefore control of acid generation would effectively control metal leaching. The remaining higher total S Stratford East Open Cut samples produced circum-neutral pH extracts, but also had elevated SO_4 concentrations of greater than 600 mg/L, reflecting pyrite oxidation and neutralisation reactions occurring in the sample prior to testing.

The Roseville West Pit Extension water extracts were generally circum-neutral and did not show any significant mobilisation of metals/metalloids, apart from some slight As mobility indicated in sample 45178 and elevated Fe in sample 863. Fe concentrations are generally highly insoluble at these pH values, and the cause of the elevated Fe is most likely due to the presence of fine or colloidal particulates in the solution after filtering.

[15] Bowen, H.J.M. (1979) Environmental Chemistry of the Elements. Academic Press, New York, p 36-37.

Results suggest that materials represented by these samples have no significant elemental enrichment in solids apart from S, but would mobilise elevated concentrations of some metals/metalloids at low pH. Significant salinity was only released from higher S samples, suggesting that salinity release would be primarily controlled by pyrite oxidation and sulphate generation. Water extracts from NAF materials indicated that neutral mine drainage was unlikely to contain significant metal/metalloid concentrations, but elevated SO_4 may occur where there is significant pyritic present.

8.0 Sample Classification and Distribution of ARD Waste Rock Types

Results and discussions above were used to classify samples as NAF, PAF, PAF-LC or UC in Table 1. PAF-LC samples are defined as having an acid capacity of 5 kg H_2SO_4/t or less. All samples with total S values of less than or equal to 0.05%S were classified NAF due to the negligible risk of acid formation.

The following shows the approximate breakdown of geochemical rock types based on sample intervals tested to date (not taking spatial distribution or mining blocks into account) for each of the open cuts:

Open Cut	NAF inc. UC(NAF)	PAF-LC	PAF
Roseville West Pit Extension	98%	1%	1%
Avon North Open Cut	96%	3%	1%
Stratford East Open Cut	64%	10%	26%

The estimated proportion of geochemical waste rock types indicates a very low occurrence of PAF and PAF-LC materials for Roseville West Pit Extension and Avon North Open Cut, most of which are associated with coal intervals and would mainly report to the CHPP rather than waste rock emplacements. Given the limited proportion of PAF and PAF-LC materials and the excess acid buffering in much of the waste rock, it is expected that dilution and mixing during mining would be sufficient to negate any significant ARD risk from the Roseville West Pit Extension and Avon North Open Cut.

Note that during previous mining, a pyritic unit was observed at the base of the Stratford Main Pit (just south of the proposed Avon North Open Cut) associated with the Glenview Seam (see Section 2.4). This part of the stratigraphy was not intersected in the holes tested, and more evaluation is required to assess the distribution and continuity of this unit in the proposed Avon North Open Cut. Note also that in previous work a single sample indicated that the AVA Seam roof may be PAF (see Section 3.1), but results of current testing suggest the AVA Seam roof is likely to be less of an issue with a PAF-LC classification. Additional evaluation of the variability of acid potential in the AVA Seam roof should be carried out as part of operational monitoring during Project mining operations (Section 10.1).

The co-disposed coarse and fine rejects backfilled in the Roseville Pit are assumed to be PAF unless more comprehensive test work shows otherwise. Note that preliminary work carried out in 1997 and 1998 (see Section 2.2) indicated that most Stratford Mining Complex CHPP rejects represented by the 9 samples tested were likely to be NAF, and there may be an opportunity to significantly reduce the volume of materials being handled as PAF with follow up testing on backfilled co-disposed coarse and fine rejects.

Stratford East Open Cut samples show a higher proportion of PAF compared to the other two open cuts, in keeping with expectations from previous testing of this stratigraphic sequence for the Duralie Extension Project (see Section 3.4).

Figure 35 is a plot showing the distribution of total S by ARD classification type, with NAF and UC(NAF) combined and PAF and PAF-LC combined. The plot shows that a conservative cut off of 0.2%S could be used alone as a screening criteria to distinguish NAF and PAF/PAF-LC waste rock types. A cut off of 0.2% includes 85% of NAF samples and less than 10% of PAF/PAF-LC samples (all of which are low capacity). These criteria were applied to the infill holes from Stratford East Open Cut (NS576R, NS577R and NS587R) and Roseville West Pit Extension (NS595R, NS591R and NS594R) as a first pass ARD classification, with samples classified as NAF (0.2%S) or UC(PAF/PAF-LC) (Table 2). Note that the PAF/PAF-LC classification based on total S alone is uncertain and conservative since the acid buffering potential is not fully taken into account, and a portion of these samples are likely to have sufficient ANC to be classified NAF.

Table 2 shows that Roseville West Pit Extension samples are mainly NAF with scattered UC(PAF/PAF-LC) samples generally associated with coal seams. NAF samples account for 92% of the intervals tested from the overburden/interburden in these open holes (i.e. excluding coal seam intervals), with the 8% of UC(PAF/PAF-LC) overburden/interburden sample intervals having relatively low S of 0.62% and less. Overall results suggest a low ARD potential in the Roseville West Pit Extension infill open holes, consistent with results for cored holes. Further testing of the open hole samples should be carried out to resolve uncertainties in PAF/PAF-LC classification.

The Stratford East Open Cut infill open holes comprise NS587R and NS577R drilled to sample the overburden in the western part of the open cut, and NS576R drilled to sample materials potentially excavated below the CLL6L Seam in the eastern part of the open cut. The two western holes include a high proportion of samples classified UC(PAF/PAF-LC), accounting for 78% of the total interval tested. Note again that the total S only criteria overestimates the amount of PAF/PAF-LC, and the proportion is likely to decrease with more complete testing. By contrast, samples from hole NS576R located in the eastern part of the Stratford East Open Cut show only a few minor UC(PAF/PAF-LC) samples associated with coal seams.

Figure 36 is a plot of total S profiles for the Stratford East Open Cut diamond drillholes and three infill open holes. In addition to total S, the hole profiles also show coal seams and sample ARD classification, with NAF and UC(NAF) samples represented as blue symbols, PAF-LC samples as orange symbols, PAF samples and UC(PAF/PAF-LC) samples as red symbols. The holes are approximately aligned according to coal seam stratigraphy. These initial results suggest that there are multiple PAF units associated with waste rock from most of the western extent of the Stratford East Open Cut through to the Cheer Up Seam (CH1), and down to the top of Clermont Lower 3 Upper Seam (CLL3U). Below the CLL3U Seam interburden is mainly NAF, down through what is expected to cover the eastern extent of the Stratford East Open Cut in hole NS576R. Testing of additional drill holes would be required to confirm trends and continuity of PAF and NAF units.

9.0 CHPP Rejects ARD Potential

CHPP rejects samples for the Project were not available for testing, but the rejects to be produced are not expected to have a greater acid potential than CHPP rejects currently produced by washing coal from the current DCM and Stratford Mining Complex operations.

Figure 37 shows the total S distribution in raw coal samples from the DCM current and future pits mining Weismantel and Clareval Seams, compared to raw coal total S for Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut. Results show that the total S of coal for all three of the proposed open cuts is significantly less than total S for the DCM raw coal, with DCM median raw total S above 1%S and median raw total S for the Project below 0.8%S. Results suggest that the CHPP rejects produced from the Project are likely to have a lower pyrite content than those produced through current washing of DCM coal, and hence are likely to have a lower acid potential.

Note that the raw coal total S data used for the Project was limited and the full variation may not be captured. However, the current management of CHPP rejects is designed to account for materials with a high acid potential (see Section 2.3), and results are sufficient to indicate that the CHPP rejects produced by development of the Project would not require modification of these strategies. Ongoing monitoring should be carried out during operations to confirm this.

10.0 Conclusions and Recommendations

10.1 Waste Rock

Results of ARD investigations to date indicate that the vast majority of waste rock (including overburden/interburden and floor materials) for the Roseville West Pit Extension and Avon North Open Cut are likely to be NAF. However, there may be some PAF materials be associated with the Glenview Seam and Avon Seam roof, which may occur in the Avon North Open Cut.

Waste rock (including overburden/interburden and floor materials) from the Stratford East Open Cut would include NAF, PAF and PAF-LC materials, consistent with previous investigations of the same stratigraphy at DCM. A guide to the relative proportion of NAF and PAF/PAF-LC was calculated based on sample interval weightings, and NAF materials were estimated to make up approximately 65% of waste rock. Initial results suggest there are multiple PAF units associated with overburden and interburden from the western extent of the Stratford East Open Cut down to the top of Clermont Lower 3 Upper Seam (CLL3U), but that below the CLL3U Seam interburden is expected to be mainly NAF. Kinetic NAG testing indicates that low ANC PAF waste rock is likely to produce acid in a short time frame (1 month or less) after exposure to atmospheric oxidation, but that materials with moderate ANC may show a lag of 1 or more years before onset of acid conditions.

Multi-element analysis suggests that waste rock represented by the samples tested would have no significant elemental enrichment apart from S (mainly for Stratford East Open Cut). Under neutral pH conditions (neutral mine drainage) there would be negligible mobilisation of metals/metalloids, but elevated SO_4 salinity may occur where there are pyritic materials present. Pyrite oxidation and acid release is likely to be accompanied by release of elevated concentrations of metals/metalloids, particularly Al, Co, Cu, Fe, Mn, Ni and Zn. Significant salinity was only released from higher S samples, suggesting that salinity release would be primarily controlled by pyrite oxidation and sulphate generation.

Most of the waste rock from Roseville West Pit Extension and Avon North Open Cut are expected to be NAF and would not require special handling. Limited previous testing[16] and operational experience indicates that most waste rock from the Bowens Road North Open Cut would also be NAF.

Stratford East Open Cut is expected to include a significant portion of PAF materials that would require materials segregation and management to prevent ARD. Management may also be required for the Glenview Seam and Avon Seam roof in the Avon North Open Cut, depending on the outcomes of follow up investigations. In addition, previously backfilled co-disposed coarse and fine rejects in the Roseville Pit that would be mined as part of the Roseville West Pit Extension would be treated as PAF waste rock unless follow up geochemical investigations show that they are NAF.

[16] Resource Strategies, “Bowens Road North Project Environmental Geochemical Assessment of Waste Rock”, January 2001.

The following management strategies are recommended for control of ARD from PAF materials:

- PAF waste rock should be placed in-pit and below the level of the final water table for ultimate inundation and long term control of oxidation at closure. This management measure is currently successfully implemented at DCM.
- If the amount of PAF overburden exceeds the level of the final water table, or placement of PAF in out-of-pit dumps is required, long term control for the excess material would need to rely on control of infiltration and oxygen diffusion through placement of PAF materials below a designed cover system. The details of the design would require assessment of the hydraulic and physical properties of the various mine materials in conjunction with local climate controls to determine the type of cover system that is appropriate.
- Interim PAF waste rock dump lifts/faces and PAF pit floors should be treated with crushed limestone for operational control of ARD before inundation or cover placement can take place. Initial limestone application rates should be at least 20 tonnes $CaCO_3$/ha, but these rates may need to be modified based on performance monitoring of effectiveness.
- Reliable segregation of PAF and NAF overburden/interburden from Stratford East Open Cut would be key to operational and long term ARD control. Initial results suggest the presence of multiple PAF horizons, and additional testing would be required to define the distribution and continuity of geochemical rock types. Segregation of waste rock should focus on extraction of well defined NAF horizons for placement above the final water table recovery level and for use in construction of surface structures. Mixed PAF and NAF that are not readily separated during mining would need to be managed as PAF.
- Paddock dumping and traffic compacting PAF materials in lifts of 5 m or less should be considered to minimise the risk of accelerated oxidation through convection.
- Infiltration into dumped PAF materials should be minimised by prompt removal of water from pit sumps, dump shaping to encourage runoff, and diversion of runoff from NAF materials and natural ground.
- Contingency should be made for water treatment (i.e. neutralisation with hydrated lime or limestone) of open pit water and CHPP rejects storage sites if acid generation occurs.

In addition to the above, routine monitoring across the site should be carried out to provide checks on materials management and effects of ARD as follows:

- A programme of routine sampling and geochemical testing of waste rock materials is recommended during operations to monitor variation in acid potential and to reconcile the predicted distribution of ARD rock types in overburden.
- Water quality monitoring of seepage and runoff from open cut surfaces and waste rock dumps should be carried out to check for ARD generation, assess the performance of management strategies, and determine and/or refine limestone treatment requirements.
- Routine site water quality monitoring programmes should include pH, EC, acidity/alkalinity, SO_4, Al, Co, Fe, Mn, Ni, Zn and storage volumes and flows to monitor the performance of the ARD control programme.

The sampling and testing programme conducted in this assessment together with operational experience at the existing Stratford Mining Complex and DCM was sufficient to provide an overall indication of the relative ARD potential of overburden/interburden and floor materials for the Project. However, the following work is recommended to better define the distribution of ARD rock types:

- Continue geochemical characterisation of infill open hole samples from Stratford East Open Cut (NS576R, NS577R and NS587R) and Roseville West Pit Extension (NS595R, NS591R and NS594R) to complete the current assessment programme.
- Carry out additional testing of drillholes for Stratford East Open Cut waste rock (including overburden/interburden and floor) to model the distribution of NAF and PAF materials. The samples tested should capture the full potential mine stratigraphy, and be collected from sufficient holes to adequately represent the expected variation in geology and geochemistry.
- Investigate the ARD risks for the Avon North Open Cut associated with the Glenview Seam and Avon Seam roof.
- Carry out geochemical assessment of the previously backfilled co-disposed rejects in the Roseville Pit that would be mined as part of the Roseville West Pit Extension to identify opportunities for reducing the volume of materials being handled as PAF.

10.2 CHPP Rejects

Raw coal total S distributions indicate that the CHPP rejects from the Project are likely to have a lower pyrite content and hence are likely to have a lower acid potential than CHPP rejects currently produced from the DCM operations.

ROM coal (including CHPP rejects from the Western Co-Disposal Area) would continue to be blended as required (together with ROM coal from DCM) and washed at the existing CHPP. The resulting CHPP rejects would be placed into the Stratford Main Pit and in the Avon North Open Cut later in the Project life and managed in accordance with the *Life of Mine Reject Disposal Plan*[17]. The rejects disposal plan involves progressive inundation of the placed rejects with water to prevent significant pyrite oxidation and acid generation in the long term, and includes monitoring of water quality during operations and provision for lime dosing and limestone treatment as required. These management strategies have successfully maintained a circum-neutral pH in the Stratford Main Pit, and available results are sufficient to indicate that the CHPP rejects produced by development of the Project would not require modification of these strategies.

Ongoing monitoring should be carried out during operations to confirm this.

[17] Stratford Coal Pty Ltd, "Life of Mine Reject Disposal Plan", 2010.

TABLES 1 to 7

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
NS232C	0.00	31.10	31.10			Roseville West	Open Hole													
NS232C	31.10	31.45	0.35	Coal	M7BU	Roseville West	Open Hole													
NS232C	31.45	31.60	0.15	No Sample		Roseville West														
NS232C	31.60	31.95	0.35	Siltstone/Carb Claystone		Roseville West		NS232C-1	1003	7.6	0.14	0.08	2	36	-34	14.71	8.3	0	0	NAF
NS232C	31.95	33.85	1.90	Sandstone/Siltstone		Roseville West		NS232C-2	1004	7.7	0.23	0.08	2	20	-18	8.17	8.2	0	0	NAF
NS232C	33.85	36.85	3.00	Sandstone		Roseville West		NS232C-3	1005			0.04	1							NAF
NS232C	36.85	39.10	2.25	Sandstone		Roseville West		NS232C-4	1006	7.8	0.32	0.06	2	23	-21	12.53	8.5	0	0	NAF
NS232C	39.10	39.45	0.35	Siltstone		Roseville West		NS232C-5	1007	7.9	0.29	0.33	10	9	1	0.89	4.8	0	5	UC(NAF)
NS232C	39.45	40.34	0.89	Coal	M7B	Roseville West														
NS232C	40.34	40.67	0.33	Siltstone		Roseville West		NS232C-6	1008	7.2	0.29	0.14	4	8	-4	1.87	4.3	1	11	UC(NAF)
NS232C	40.67	40.72	0.05	No Sample	M7BL1	Roseville West														
NS232C	40.72	40.89	0.17	Coal	M7BL1	Roseville West		NS232C-7	1009	3.4	2.36	0.88	27	1	26	0.04	2.9	20	29	PAF
NS232C	40.89	41.04	0.15	No Sample	M7BL1	Roseville West														
NS232C	41.04	41.84	0.80	Sandstone/Siltstone		Roseville West		NS232C-8	1010	6.7	0.53	0.12	4	9	-5	2.45	4.4	0.4	8	UC(NAF)
NS232C	41.84	42.23	0.39	Sandstone/Coal/Carb Claystone	BAND1	Roseville West	Band 1 at 41.84-41.97m	NS232C-9	1011	6.8	0.61	0.11	3	32	-29	9.51	7.9	0	0	NAF
NS232C	42.23	42.38	0.15	Coal	M7BL2	Roseville West														
NS232C	42.38	42.85	0.47	Sandstone		Roseville West		NS232C-10	1012	5.9	0.52	0.34	10	4	6	0.38	4.4	1	7	PAF-LC
NS232C	42.85	45.80	2.95	Sandstone		Roseville West		NS232C-11	1013	7.6	0.18	0.05	2	80	-78	52.29	8.2	0	0	NAF
NS232C	45.80	47.79	1.99	Sandstone/Siltstone		Roseville West		NS232C-12	1014			0.04	1							NAF
NS232C	47.79	50.67	2.88	Sandstone		Roseville West		NS232C-13	1015	7.7	0.19	0.20	6	31	-25	5.07	8.3	0	0	NAF
NS232C	50.67	51.01	0.34	Siltstone		Roseville West		NS232C-14	1016	7.5	0.14	0.14	4	7	-3	1.63	4.3	1	10	UC(NAF)
NS232C	51.01	51.15	0.14	Coal	M7AU2	Roseville West		NS232C-15	1017	4.8	1.76	0.98	30	22	8	0.73	3.5	13	20	PAF
NS232C	51.15	52.56	1.41	Sandstone/Siltstone		Roseville West		NS232C-16	1018	6.7	0.71	0.05	2	29	-27	18.95	7.5	0	0	NAF
NS232C	52.56	53.09	0.53	Siltstone/Carb Claystone/Coal	BAND2	Roseville West	Band 2 at 53.00-53.09m	NS232C-17	1019	5.2	0.92	0.69	21	10	11	0.47	3.6	3	10	PAF-LC
NS232C	53.09	54.35	1.26	Siltstone/Sandstone		Roseville West		NS232C-18	1020	6.5	0.32	0.08	2	20	-18	8.17	8.1	0	0	NAF
NS232C	54.35	54.40	0.05	Coal	BAND3	Roseville West		NS232C-19	1021	3.0	4.78	3.04	93	8	85	0.09	2.5	48	64	PAF
NS232C	54.40	55.65	1.25	Sandstone/Siltstone		Roseville West	ST at base	NS232C-20	1022	6.8	0.18	0.05	2	42	-40	27.45	7.6	0	0	NAF
NS232C	55.65	55.92	0.27	Coal	M7AU1	Roseville West														
NS232C	55.92	57.95	2.03	Sandstone		Roseville West		NS232C-21	1023	7.2	0.22	0.08	2	44	-42	17.97	8.2	0	0	NAF
NS232C	57.95	59.85	1.90	Sandstone		Roseville West		NS232C-22	1024	7.4	0.21	0.10	3	33	-30	10.78	8.3	0	0	NAF
NS232C	59.85	60.02	0.17	Claystone/Coal	BAND4	Roseville West	Band 4 at 59.85-59.90m	NS232C-23	1025	7.3	0.18	0.44	13	5	8	0.37	4.4	1	7	PAF-LC
NS232C	60.02	60.21	0.19	Coal	M7AU0	Roseville West														
NS232C	60.21	60.63	0.42	Sandstone		Roseville West		NS232C-24	1026	7.5	0.20	0.07	2	7	-5	3.27	5.1	0	5	NAF
NS232C	60.63	60.91	0.28	Coal	M7A	Roseville West														
NS232C	60.91	62.14	1.23	Sandstone/Carb Claystone		Roseville West	CS at base	NS232C-25	1027	7.6	0.17	0.06	2	11	-9	5.99	7.3	0	0	NAF
NS232C	62.14	62.33	0.19	Coal	M7AL0	Roseville West														
NS232C	62.33	63.15	0.82	Sandstone/Siltstone/Coal		Roseville West	Band 5 at 63.08-63.15m	NS232C-26	1028	7.3	0.52	0.15	5	40	-35	8.71	7.8	0	0	NAF
NS232C	63.15	66.30	3.15	Sandstone		Roseville West		NS232C-27	1029	7.5	0.42	0.05	2	40	-38	26.14	8.3	0	0	NAF
NS232C	66.30	66.63	0.33	Siltstone/Carb Claystone/Coal		Roseville West	Inc Band 6 at 66.55-66.63m	NS232C-28	1030	7.6	0.35	0.53	16	50	-34	3.08	8.1	0	0	NAF
NS232C	66.63	67.00	0.37	Sandstone		Roseville West		NS232C-29	1031	7.9	0.23	0.08	2	8	-6	3.27	4.9	0	5	NAF
NS232C	67.00	68.96	1.96	Sandstone		Roseville West		NS232C-30	1032	7.7	0.22	0.03	1	30	-29	32.68	8.3	0	0	NAF
NS232C	68.96	68.99	0.03	Carb Claystone		Roseville West		NS232C-31	1033	7.8	0.21	0.39	12	153	-141	12.82	8.2	0	0	NAF
NS232C	68.99	70.00	1.01	Sandstone		Roseville West		NS232C-32	1034	7.6	0.22	0.03	1	115	-114	125.27	8.6	0	0	NAF
NS232C	70.00	70.23	0.23	Sandstone		Roseville West		NS232C-33	1035			0.05	2							NAF
NS232C	70.23	71.29	1.06	Sandstone		Roseville West		NS232C-34	1036	7.5	0.21	0.08	2	9	-7	3.68	7.4	0	0	NAF
NS232C	71.29	71.78	0.49	Coal/Siltstone		Roseville West	Inc Band 7 & 8	NS232C-35	1037	7.4	0.19	0.32	10	11	-1	1.12	4.6	0	10	NAF
NS232C	71.78	71.96	0.18	Coal	M7AL1	Roseville West														
NS232C	71.96	72.02	0.06	Siltstone		Roseville West														
NS232C	72.02	72.11	0.09	Coal	BAND9	Roseville West														
NS232C	72.11	72.17	0.06	Claystone		Roseville West														
NS232C	72.17	72.85	0.68	Coal	M7AL2	Roseville West														
NS232C	72.85	73.82	0.97	Siltstone/Carb Claystone/Coal		Roseville West	Inc Band 10	NS232C-36	1038	7.5	0.19	0.10	3	17	-14	5.56	7.6	0	0	NAF
NS232C	73.82	73.96	0.14	Coal	M7AL3	Roseville West		NS232C-37	1039	7.4	0.82	0.75	23	42	-19	1.83	7.9	0	0	NAF
NS232C	73.96	75.03	1.07	Sandstone		Roseville West	Inc Band 11 at base	NS232C-38	1040	7.6	0.22	0.05	2	17	-15	11.11	7.6	0	0	NAF
NS232C	75.03	77.70	2.67	Sandstone		Roseville West		NS232C-39	1041			0.03	1							NAF
NS232C	77.70	78.43	0.73	Siltstone/Claystone/Coal		Roseville West	Inc Band 12	NS232C-40	1042	7.7	0.23	0.14	4	33	-29	7.70	8.2	0	0	NAF
NS232C	78.43	79.22	0.79	Coal	M7U3	Roseville West														
NS232C	79.22	80.07	0.85	Sandstone		Roseville West		NS232C-41	1043			0.03	1							NAF
NS232C	80.07	80.32	0.25	Coal	M7U1	Roseville West														
NS232C	80.32	81.16	0.84	Sandstone		Roseville West		NS232C-42	1044			0.04	1							NAF
NS232C	81.16	81.53	0.37	Coal	M7	Roseville West														
NS232C	81.53	84.39	2.86	Sandstone		Roseville West		NS232C-43	1045			0.04	1							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS232C	84.39	85.00	0.61	Siltstone/Tuff/Coal		Roseville West	Inc Band 13	NS232C-44	1046	7.8	0.26	0.11	3	22	-19	6.54	8.4	0	0	NAF
NS232C	85.00	87.15	2.15	Sandstone		Roseville West		NS232C-45	1047			0.04	1							NAF
NS232C	87.15	88.00	0.85	Sandstone/Coal	BAND14	Roseville West	Inc Band 14	NS232C-46	1048	7.9	0.27	0.10	3	11	-8	3.59	7.1	0	0	NAF
NS232C	88.00	88.54	0.54	Siltstone/Carb Claystone/Coal		Roseville West	Inc Band 15	NS232C-47	1049	8.0	0.24	0.15	5	7	-2	1.53	4.0	2	14	NAF
NS232C	88.54	89.15	0.61	Coal	M7L1	Roseville West														
NS232C	89.15	91.58	2.43	Sandstone		Roseville West		NS232C-48	1050	7.8	0.28	0.06	2	29	-27	15.80	8.4	0	0	NAF
NS232C	91.58	91.88	0.30	Coal	M7L3	Roseville West														
NS232C	91.88	92.24	0.36	Siltstone		Roseville West		NS232C-49	1051			0.05	2							NAF
NS232C	92.24	92.60	0.36	Coal	M7L3L	Roseville West														
NS232C	92.60	95.96	3.36	Sandstone		Roseville West		NS232C-50	1052	8.1	0.29	0.03	1	24	-23	26.14	8.5	0	0	NAF
NS232C	95.96	96.27	0.31	Siltstone/Coal	BAND16/M7L4	Roseville West	Inc Band 16 & M7L4	NS232C-51	1053	8.3	0.14	0.34	10	6	4	0.58	2.9	29	55	PAF-LC
NS232C	96.27	97.00	0.73	Sandstone		Roseville West		NS232C-52	1054			0.03	1							NAF
NS232C	97.00	100.00	3.00	Sandstone		Roseville West		NS232C-53	1055			0.03	1							NAF
NS232C	100.00	103.00	3.00	Sandstone		Roseville West		NS232C-54	1056			0.04	1							NAF
NS232C	103.00	105.40	2.40	Sandstone		Roseville West		NS232C-55	1057			0.05	2							NAF
NS232C	105.40	106.94	1.54	Sandstone		Roseville West	Minor Coal	NS232C-56	1058	8.4	0.12	0.04	1	58	-57	47.39	7.9	0	0	NAF
NS232C	106.94	107.23	0.29	Coal/Claystone		Roseville West		NS232C-57	1059	9.2	0.17	0.29	9	5	4	0.56	2.7	17	29	NAF
NS232C	107.23	109.00	1.77	Sandstone		Roseville West	Minor Coal	NS232C-58	1060			0.03	1							NAF
NS170C	0.00	17.94	17.94			Roseville West	Open Hole													
NS170C	17.94	21.37	3.43	Sandstone		Roseville West	Rare Calcite	NS170C-1	45051			0.05	2							NAF
NS170C	21.37	21.67	0.30	No Sample		Roseville West														
NS170C	21.67	24.09	2.42	Sandstone/Siltstone		Roseville West	Some Calcite	NS170C-2	45052			0.04	1							NAF
NS170C	24.09	24.67	0.58	Sandstone/Siltstone		Roseville West		NS170C-3	45053	5.7	0.92	0.03	1	21	-20	22.88	7.5	0	0	NAF
NS170C	24.67	25.29	0.62	Coal	BD2	Roseville West		NS170C-4	45054	6.4	0.82	0.16	5	5	0	1.02	4.6	0	6	NAF
NS170C	25.29	25.63	0.34	Coal		Roseville West														
NS170C	25.63	26.39	0.76	Sandstone		Roseville West	Common Calcite	NS170C-5	45055	5.5	0.72	0.02	1	57	-56	93.14	7.4	0	0	NAF
NS170C	26.39	27.21	0.82	Sandstone/Siltstone/Tuff		Roseville West		NS170C-6	45056			0.03	1							NAF
NS170C	27.21	28.00	0.79	Claystone/Sandstone		Roseville West		NS170C-7	45057	7.3	0.13	0.06	2	16	-14	8.71	7.5	0	0	NAF
NS170C	28.00	30.31	2.31	Sandstone/Siltstone		Roseville West		NS170C-8	45058			0.03	1							NAF
NS170C	30.31	32.47	2.16	Siltstone/Sandstone		Roseville West	Rare Calcite	NS170C-9	45059			0.09	3							UC(NAF)
NS170C	32.47	34.34	1.87	Sandstone/Siltstone		Roseville West	Rare Calcite	NS170C-10	45060			0.04	1							NAF
NS170C	34.34	36.52	2.18	Sandstone		Roseville West	Rare Calcite	NS170C-11	45061			0.03	1							NAF
NS170C	36.52	36.62	0.10	No Sample		Roseville West														
NS170C	36.62	36.98	0.36	Siltstone/Claystone		Roseville West	Rare Calcite	NS170C-12	45062	5.6	0.32	0.12	4	5	-1	1.36	5.2	0	2	NAF
NS170C	36.98	38.77	1.79	Sandstone		Roseville West		NS170C-13	45063	6.4	0.63	0.03	1	18	-17	19.61	7.2	0	0	NAF
NS170C	38.77	40.27	1.50	Coal	BD4	Roseville West														
NS170C	39.91	40.54	0.63	Claystone/Coal	BD4	Roseville West		NS170C-14	45064	5.5	0.72	0.22	7	5	2	0.74	4.6	0	6	UC(NAF)
NS170C	40.54	42.46	1.92	Sandstone		Roseville West		NS170C-15	45065			0.04	1							NAF
NS170C	42.46	42.54	0.08	No Sample		Roseville West														
NS170C	42.54	43.70	1.16	Sandstone		Roseville West		NS170C-16	45066			0.03	1							NAF
NS170C	43.70	43.85	0.15	No Sample		Roseville West														
NS170C	43.85	45.44	1.59	Sandstone/Siltstone		Roseville West		NS170C-17	45067			0.03	1							NAF
NS170C	45.44	46.71	1.27	Sandstone/Coal		Roseville West	Rare Pyrite	NS170C-18	45068			0.05	2							NAF
NS170C	46.71	46.89	0.18	No Sample	BD4U	Roseville West														
NS170C	46.89	46.99	0.10	No Sample		Roseville West														
NS170C	46.99	47.24	0.25	No Sample	BD4	Roseville West	Rare Calcite													
NS170C	47.24	47.57	0.33	Coal	BD4	Roseville West		NS170C-19	45069	4.3	1.14	0.53	16	3	13	0.18	2.5	30	50	PAF
NS170C	47.57	48.07	0.50	No Sample	BD4	Roseville West														
NS170C	48.07	48.44	0.37	Sandstone		Roseville West		NS170C-20	45070	6.7	0.81	0.12	4	3	1	0.82	4.1	0	5	PAF-LC
NS170C	48.44	51.09	2.65	Sandstone		Roseville West		NS170C-21	45071			0.02	1							NAF
NS170C	51.09	52.42	1.33	Siltstone/Sandstone/Carb Siltstone		Roseville West	Minor Coal	NS170C-22	45072	7.2	0.09	0.04	1	21	-20	17.16	7.6	0	0	NAF
NS170C	52.42	52.49	0.07	No Sample	BD5U	Roseville West														
NS170C	52.49	52.70	0.21	Claystone		Roseville West		NS170C-23	45073	6.7	0.22	0.26	8	12	-4	1.51	5.2	0	2	NAF
NS170C	52.70	52.98	0.28	Carb Siltstone		Roseville West		NS170C-24	45074	6.6	0.25	0.10	3	13	-10	4.25	6.9	0	0	NAF
NS170C	52.98	53.03	0.05	Carb Claystone		Roseville West		NS170C-25	45075	5.9	0.14	0.06	2	17	-15	9.26	7.2	0	0	NAF
NS170C	53.03	53.20	0.17	Carb Siltstone		Roseville West		NS170C-26	45076	4.5	0.12	0.78	24	14	10	0.59	3.3	6	12	PAF
NS170C	53.20	53.30	0.10	No Sample		Roseville West														
NS170C	53.30	53.75	0.45	No Sample	BD5	Roseville West														
NS170C	53.75	54.54	0.79	Sandstone		Roseville West		NS170C-27	45077	6.3	0.15	0.03	1	6	-5	6.54	6.9	0	0	NAF
NS170C	54.54	59.39	4.85	Sandstone		Roseville West		NS170C-28	45078			0.01	0							NAF
NS170C	59.39	64.41	5.02	Sandstone		Roseville West	Rare Calcite	NS170C-29	45079			0.02	1							NAF
NS170C	64.41	68.08	3.67	Sandstone		Roseville West		NS170C-30	45080			0.03	1							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS170C	68.08	68.60	0.52	Siltstone		Roseville West		NS170C-31	45081			0.02	1							NAF
NS170C	68.60	70.52	1.92	Sandstone		Roseville West		NS170C-32	45082			0.02	1							NAF
NS170C	70.52	71.06	0.54	Siltstone		Roseville West	Calcitic	NS170C-33	45083	6.6	0.16	0.06	2	27	-25	14.71	7.5	0	0	NAF
NS170C	71.06	71.52	0.46	No Sample	BD6	Roseville West														
NS170C	71.52	72.22	0.70	No Sample	BD6	Roseville West		NS170C-34	45084	4.3	1.46	0.31	9	11	-2	1.16	3.3	10	28	UC(NAF)
NS170C	72.22	72.44	0.22	No Sample	BD6	Roseville West														
NS170C	72.44	73.37	0.93	Sandstone		Roseville West		NS170C-35	45085	7.2	0.14	0.05	2	18	-16	11.76	7.9	0	0	NAF
NS170C	73.37	75.50	2.13	Sandstone		Roseville West		NS170C-36	45086			0.02	1							NAF
NS170C	75.50	78.71	3.21	Sandstone		Roseville West		NS170C-37	45087			0.02	1							NAF
NS170C	78.71	79.20	0.49	Sandstone		Roseville West		NS170C-38	45088	7.1	0.14	0.06	2	8	-6	4.36	7.1	0	0	NAF
NS170C	79.20	79.50	0.30	No Sample	DR0U	Roseville West														
NS170C	79.50	80.74	1.24	Sandstone		Roseville West		NS170C-39	45089			0.03	1							NAF
NS170C	80.74	81.04	0.30	Siltstone		Roseville West	Minor CS	NS170C-40	45090	7.5	0.12	0.17	5	11	-6	2.11	7.2	0	0	NAF
NS170C	81.04	81.14	0.10	Coal	DR0	Roseville West		NS170C-41	45091	4.6	1.76	0.78	24	1	23	0.04	2.8	7	9	PAF
NS170C	81.14	81.51	0.37	Coal	DR0	Roseville West														
NS170C	81.51	82.14	0.63	Coal	DR0	Roseville West		NS170C-42	45092	4.8	1.88	0.76	23	2	21	0.09	3.0	5	20	PAF-LC
NS170C	82.14	83.19	1.05	Sandstone		Roseville West		NS170C-43	45093	5.4	0.24	0.05	2	37	-35	24.18	7.7	0	0	NAF
NS170C	83.19	83.53	0.34	No Sample	BAND2	Roseville West														
NS170C	83.53	84.41	0.88	Sandstone		Roseville West		NS170C-44	45094			0.01	0							NAF
NS170C	84.41	87.31	2.90	Sandstone		Roseville West		NS170C-45	45095			0.02	1							NAF
NS170C	87.31	87.41	0.10	No Sample		Roseville West														
NS170C	87.41	88.42	1.01	Sandstone		Roseville West		NS170C-46	45096			0.05	2							NAF
NS170C	88.42	88.87	0.45	Carb Claystone		Roseville West		NS170C-47	45097	5.5	1.21	0.78	24	9	15	0.38	3.1	7	14	PAF
NS170C	88.87	89.27	0.40	Sandstone		Roseville West		NS170C-48	45098	6.7	0.14	0.06	2	77	-75	41.94	7.9	0	0	NAF
NS170C	89.27	89.61	0.34	No Sample		Roseville West														
NS170C	89.61	89.71	0.10	Coal	DRU	Roseville West		NS170C-49	45099	5.3	1.11	0.15	5	6	-1	1.31	3.3	7	21	UC(NAF)
NS170C	89.71	90.41	0.70	Coal	DRU	Roseville West	Some Pyrite	NS170C-50	45100	7.4	0.08	1.37	42	28	14	0.67	3.6	7	15	PAF
NS170C	90.41	91.31	0.90	Coal	DRU	Roseville West		NS170C-51	45101	7.2	0.08	0.42	13	13	0	1.01	5.6	0	1	NAF
NS170C	91.31	91.38	0.07	Coal	DRU	Roseville West		NS170C-52	45102	4.6	1.35	0.43	13	6	7	0.46	2.6	27	47	PAF
NS170C	91.38	92.52	1.14	Sandstone/Siltstone		Roseville West		NS170C-53	45103			0.04	1							NAF
NS170C	92.52	93.18	0.66	Coal	DR	Roseville West		NS170C-54	45104	7.4	0.11	0.18	6	17	-11	3.09	7.2	0	0	NAF
NS170C	93.18	93.28	0.10	No Sample	DR	Roseville West														
NS170C	93.28	93.38	0.10	Coal	DR	Roseville West		NS170C-55	45105	7.5	0.12	0.40	12	135	-123	11.03	7.8	0	0	NAF
NS170C	93.38	93.51	0.13	No Sample	DR	Roseville West														
NS170C	93.51	93.76	0.25	Carb Claystone/Siltstone		Roseville West		NS170C-56	45106	7.7	0.18	0.14	4	76	-72	17.74	7.6	0	0	NAF
NS170C	93.76	93.92	0.16	Coal	DRL	Roseville West		NS170C-57	45107	7.6	0.12	0.37	11	17	-6	1.50	7.1	0	0	NAF
NS170C	93.92	94.12	0.20	No Sample	DR	Roseville West														
NS170C	94.12	94.60	0.48	Coal	DRL	Roseville West		NS170C-58	45108	7.8	0.13	0.26	8	21	-13	2.64	7.6	0	0	NAF
NS170C	94.60	96.53	1.93	Sandstone		Roseville West		NS170C-59	45109			0.02	1							NAF
NS170C	96.53	96.87	0.34	Siltstone/Coal	BAND2	Roseville West	Common Calcite	NS170C-60	45110	7.6	0.12	0.24	7	6	1	0.82	3.8	2	12	PAF-LC
NS170C	96.87	97.96	1.09	Siltstone/Sandstone		Roseville West		NS170C-61	45111			0.04	1							NAF
NS170C	97.96	98.58	0.62	Sandstone/Carb Siltstone		Roseville West		NS170C-62	45112			0.03	1							NAF
NS170C	98.58	98.77	0.19	Coal	BAND4	Roseville West		NS170C-63	45113	4.5	1.52	0.72	22	3	19	0.14	2.7	20	37	PAF
NS170C	98.77	100.35	1.58	Sandstone		Roseville West	CZ top&base	NS170C-64	45114			0.03	1							NAF
NS170C	100.35	101.10	0.75	Sandstone/Carb Siltstone	BAND5	Roseville West	Includes Band 5 (0.04m)	NS170C-65	45115			0.05	2							NAF
NS170C	101.10	102.33	1.23	Carb Siltstone/Sandstone		Roseville West		NS170C-66	45116			0.04	1							NAF
NS170C	102.33	102.41	0.08	No Sample		Roseville West														
NS170C	102.41	105.39	2.98	Sandstone		Roseville West		NS170C-67	45117			0.02	1							NAF
NS170C	105.39	107.83	2.44	Sandstone		Roseville West		NS170C-68	45118			0.02	1							NAF
NS170C	107.83	108.27	0.44	Carb Siltstone		Roseville West		NS170C-69	45119	4.4	2.21	0.71	22	15	7	0.69	3.7	3	11	PAF-LC
NS170C	108.27	108.41	0.14	No Sample	DR1	Roseville West														
NS170C	108.41	109.67	1.26	Coal	DR1	Roseville West	Some Calcite, Minor Pyrite	NS170C-70	45120	6.8	0.32	0.41	13	15	-2	1.20	6.9	0	0	NAF
NS170C	109.67	109.77	0.10	No Sample	DR1	Roseville West														
NS170C	109.77	111.29	1.52	Sandstone		Roseville West		NS170C-71	45121			0.02	1							NAF
NS170C	111.29	111.41	0.12	No Sample		Roseville West														
NS170C	111.41	113.64	2.23	Sandstone		Roseville West		NS170C-72	45122			0.02	1							NAF
NS170C	113.64	114.54	0.90	Sandstone/Carb Siltstone		Roseville West		NS170C-73	45123			0.05	2							NAF
NS170C	114.54	115.18	0.64	Coal	BAND6	Roseville West		NS170C-74	45124	7.2	0.23	0.11	3	17	-14	5.05	7.2	0	0	NAF
NS170C	115.18	116.50	1.32	Sandstone/Siltstone/Carb Siltstone		Roseville West		NS170C-75	45125			0.04	1							NAF
NS170C	116.50	116.75	0.25	No Sample	DR2	Roseville West														
NS170C	116.75	116.91	0.16	Coal	DR2	Roseville West		NS170C-76	45126	4.3	1.14	0.31	9	9	0	1.00	3.3	10	24	UC(NAF)
NS170C	116.91	117.07	0.16	Carb Siltstone		Roseville West		NS170C-77	45127	6.5	0.22	0.07	2	9	-7	4.20	5.2	0	3	NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS170C	117.07	117.27	0.20	Coal	DR3	Roseville West		NS170C-78	45128			0.03	1							NAF
NS170C	117.27	117.41	0.14	No Sample	DR3	Roseville West														
NS170C	117.41	117.82	0.41	Sandstone	DR3	Roseville West		NS170C-79	45129			0.01	0							NAF
NS170C	117.82	118.37	0.55	Coal	DR3	Roseville West		NS170C-80	45130	6.8	0.22	0.36	11	15	-4	1.36	7.2	0	0	NAF
NS170C	118.37	118.52	0.15	No Sample	DR3	Roseville West														
NS170C	118.52	119.43	0.91	Sandstone		Roseville West	Minor CS	NS170C-81	45131	6.7	0.31	0.06	2	12	-10	6.54	7.4	0	0	NAF
NS170C	119.43	120.41	0.98	Sandstone		Roseville West		NS170C-82	45132			0.02	1							NAF
NS170C	120.41	123.34	2.93	Sandstone		Roseville West		NS170C-83	45133			0.03	1							NAF
NS170C	123.34	123.45	0.11	No Sample		Roseville West														
NS170C	123.45	124.47	1.02	Carb Siltstone		Roseville West	Rare Pyrite	NS170C-84	45134	6.9	0.28	0.17	5	10	-5	1.92	5.1	0	3	NAF
NS170C	124.47	125.39	0.92	Carb Siltstone/Sandstone/Siltstone		Roseville West	Calcite	NS170C-85	45135			0.05	2							NAF
NS170C	125.39	125.97	0.58	Carb Siltstone/Carb Claystone	BAND7	Roseville West	Includes Band 7 (0.06m)	NS170C-86	45136	7.2	0.12	0.29	9	7	2	0.79	4.5	0	8	UC(NAF)
NS170C	125.97	126.33	0.36	Sandstone		Roseville West		NS170C-87	45137			0.01	0							NAF
NS170C	126.33	126.41	0.08	No Sample		Roseville West														
NS170C	126.41	126.65	0.24	Carb Siltstone		Roseville West		NS170C-88	45138			<0.01	0							NAF
NS170C	126.65	128.80	2.15	Sandstone		Roseville West		NS170C-89	45139			0.02	1							NAF
NS170C	128.80	129.41	0.61	No Sample		Roseville West														
NS170C	129.41	130.13	0.72	Sandstone		Roseville West		NS170C-90	45140			0.02	1							NAF
NS170C	130.13	130.60	0.47	No Sample		Roseville West														
NS170C	130.60	131.47	0.87	Coal	DR4	Roseville West		NS170C-91	45141			0.05	2							NAF
NS170C	131.47	131.90	0.43	Coal	DR4	Roseville West														
NS170C	131.90	131.95	0.05	Coal	DR4	Roseville West		NS170C-92	45142	4.5	1.46	0.24	7	5	2	0.68	3.2	8	24	PAF-LC
NS170C	131.95	132.42	0.47	Coal	DR4	Roseville West														
NS170C	132.42	133.27	0.85	Coal	DR4	Roseville West		NS170C-93	45143	7.4	0.12	0.07	2	133	-131	62.09	7.8	0	0	NAF
NS170C	133.27	134.17	0.90	Sandstone		Roseville West		NS170C-94	45144			0.04	1							NAF
NS170C	134.17	134.92	0.75	Coal	BAND8	Roseville West		NS170C-95	45145	7.3	0.12	0.31	9	84	-75	8.86	7.7	0	0	NAF
NS170C	134.92	135.42	0.50	No Sample	BAND8	Roseville West														
NS170C	135.42	137.80	2.38	Sandstone		Roseville West		NS170C-96	45146			0.02	1							NAF
NS170C	137.80	138.06	0.26	No Sample		Roseville West														
NS170C	138.06	138.34	0.28	Sandstone		Roseville West		NS170C-97	45147			0.02	1							NAF
NS170C	138.34	138.42	0.08	No Sample		Roseville West														
NS170C	138.42	140.62	2.20	Sandstone		Roseville West		NS170C-98	45148			0.03	1							NAF
NS170C	140.62	141.42	0.80	No Sample		Roseville West														
NS235C	148.32	148.98	0.66	Coal	DR4	Roseville West														
NS235C	148.98	150.20	1.22	Sandstone/Siltstone		Roseville West		NS235C-1	1061			0.05	2							NAF
NS235C	150.20	154.11	3.91	Sandstone/Siltstone		Roseville West		NS235C-2	1062			0.02	1							NAF
NS235C	154.11	156.74	2.63	Sandstone		Roseville West		NS235C-3	1063			0.02	1							NAF
NS235C	156.74	161.74	5.00	Sandstone		Roseville West		NS235C-4	1064			0.02	1							NAF
NS235C	161.74	161.79	0.05	No Sample		Roseville West														
NS235C	161.79	165.49	3.70	Sandstone		Roseville West		NS235C-5	1065	7.2	0.23	0.04	1	143	-142	116.83	8.1	0	0	NAF
NS235C	165.49	165.96	0.47	Siltstone/Carb Siltstone		Roseville West		NS235C-6	1066	6.4	0.62	0.75	23	12	11	0.52	3.6	5	17	PAF-LC
NS235C	165.96	166.21	0.25	No Sample		Roseville West														
NS235C	166.21	167.25	1.04	Siltstone/Sandstone		Roseville West		NS235C-7	1067	7.4	0.32	0.05	2	13	-11	8.50	7.1	0	0	NAF
NS235C	167.25	169.36	2.11	Coal	CV1	Roseville West														
NS235C	169.36	169.73	0.37	Siltstone/Carb Siltstone		Roseville West		NS235C-8	1068	7.6	0.31	0.19	6	25	-19	4.30	7.2	0	0	NAF
NS235C	169.73	171.32	1.59	Coal	CV2	Roseville West														
NS235C	171.32	172.36	1.04	Siltstone/Sandstone		Roseville West		NS235C-9	1069			0.04	1							NAF
NS235C	172.36	172.51	0.15	No Sample		Roseville West														
NS235C	172.51	174.28	1.77	Sandstone/Siltstone		Roseville West		NS235C-10	1070			0.03	1							NAF
NS235C	174.28	176.45	2.17	Sandstone/Siltstone		Roseville West		NS235C-11	1071			0.03	1							NAF
NS235C	176.45	177.08	0.63	Claystone		Roseville West		NS235C-12	1072			0.05	2							NAF
NS235C	177.08	177.91	0.83	Coal	CV2L	Roseville West														
NS235C	177.91	178.89	0.98	Siltstone/Carb Siltstone		Roseville West		NS235C-13	1073	7.8	0.22	0.29	9	76	-67	8.56	8.0	0	0	NAF
NS235C	178.89	179.08	0.19	Coal	BAND8	Roseville West		NS235C-14	1074	7.7	0.24	0.59	18	28	-10	1.55	3.5	8	23	UC(NAF)
NS235C	179.08	180.60	1.52	Sandstone		Roseville West		NS235C-15	1075			0.02	1							NAF
NS235C	180.60	182.75	2.15	Sandstone		Roseville West		NS235C-16	1076	7.9	0.28	0.06	2	32	-30	17.43	7.5	0	0	NAF
NS235C	182.75	182.77	0.02	No Sample		Roseville West														
NS235C	182.77	182.97	0.20	Coal	CV3	Roseville West		NS235C-17	1077	5.4	0.65	0.82	25	5	20	0.20	2.7	17	29	PAF
NS235C	182.97	183.30	0.33	No Sample	CV3	Roseville West														
NS235C	183.30	183.62	0.32	Siltstone/Coal	CV3	Roseville West		NS235C-18	1078	8.2	0.31	0.09	3	10	-7	3.63	4.1	1	10	UC(NAF)
NS235C	183.62	184.24	0.62	Coal	CV3	Roseville West														
NS235C	184.24	186.18	1.94	Sandstone		Roseville West		NS235C-19	1079	8.3	3.55	0.02	1	81	-80	132.35	7.8	0	0	NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m) From	To	Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
NS235C	186.18	186.63	0.45	Sandstone/Siltstone		Roseville West		NS235C-20	1080			0.02	1							NAF
NS193C	90.55	91.37	0.82	Sandstone		Roseville West		NS193C-1	45149			0.03	1							NAF
NS193C	91.37	93.93	2.56	Siltstone/Sandstone		Roseville West		NS193C-2	45150			0.03	1							NAF
NS193C	93.93	94.71	0.78	Siltstone/Carb Siltstone		Roseville West		NS193C-3	45151	7.5	0.11	0.11	3	7	-4	2.08	4.7	0	15	NAF
NS193C	94.71	94.83	0.12	Coal	BAND	Roseville West		NS193C-4	45152	4.7	1.21	0.46	14	4	10	0.28	2.7	25	47	PAF
NS193C	94.83	95.04	0.21	Tuff/Carb Siltstone		Roseville West		NS193C-5	45153	4.8	1.35	0.72	22	2	20	0.09	3.4	7	18	PAF
NS193C	95.04	95.36	0.32	Coal	CV3U	Roseville West														
NS193C	95.36	95.66	0.30	Siltstone		Roseville West		NS193C-6	45154			0.04	1							NAF
NS193C	95.66	95.92	0.26	Coal	CV3	Roseville West														
NS193C	95.92	97.04	1.12	Siltstone/Carb Siltstone		Roseville West		NS193C-7	45155	7.3	0.09	0.07	2	13	-11	6.07	6.9	0	0	NAF
NS193C	97.04	99.91	2.87	Sandstone		Roseville West	minor CZ	NS193C-8	45156			0.04	1							NAF
NS193C	99.91	101.26	1.35	Sandstone/Carb Siltstone		Roseville West	Coal at base	NS193C-9	45157	7.5	0.09	0.11	3	81	-78	24.06	7.6	0	0	NAF
NS193C	101.26	102.02	0.76	Coal	CV4	Roseville West														
NS193C	102.02	103.84	1.82	Sandstone		Roseville West		NS193C-10	45158			0.02	1							NAF
NS193C	103.84	105.93	2.09	Siltstone		Roseville West		NS193C-11	45159			0.02	1							NAF
NS193C	105.93	108.91	2.98	Sandstone		Roseville West		NS193C-12	45160			0.02	1							NAF
NS193C	108.91	112.99	4.08	Sandstone		Roseville West		NS193C-13	45161			0.03	1							NAF
NS193C	112.99	117.91	4.92	Sandstone		Roseville West		NS193C-14	45162			0.04	1							NAF
NS193C	117.91	120.51	2.60	Sandstone		Roseville West		NS193C-15	45163			0.05	2							NAF
NS193C	120.51	123.80	3.29	Sandstone		Roseville West		NS193C-16	45164			0.05	2							NAF
NS193C	123.80	126.71	2.91	Sandstone/Conglomerate		Roseville West		NS193C-17	45165			0.04	1							NAF
NS193C	126.71	129.91	3.20	Sandstone		Roseville West		NS193C-18	45166	7.6	0.10	0.03	1	26	-25	28.32	7.9	0	0	NAF
NS193C	129.91	133.19	3.28	Sandstone		Roseville West		NS193C-19	45167			0.02	1							NAF
NS193C	133.19	136.35	3.16	Sandstone/Siltstone		Roseville West		NS193C-20	45168			0.02	1							NAF
NS193C	136.35	139.96	3.61	Sandstone		Roseville West		NS193C-21	45169			0.02	1							NAF
NS193C	139.96	140.27	0.31	Siltstone		Roseville West		NS193C-22	45170			0.03	1							NAF
NS193C	140.27	144.91	4.64	Sandstone		Roseville West		NS193C-23	45171			0.03	1							NAF
NS193C	144.91	146.12	1.21	Sandstone/Siltstone		Roseville West		NS193C-24	45172			0.03	1							NAF
NS193C	146.12	146.46	0.34	Carb Siltstone		Roseville West		NS193C-25	45173	7.7	0.09	0.04	1	11	-10	8.99	7.1	0	0	NAF
NS193C	146.46	146.53	0.07	No Sample		Roseville West														
NS193C	146.53	146.78	0.25	Carb Siltstone		Roseville West		NS193C-26	45174			0.03	1							NAF
NS193C	146.78	148.31	1.53	Siltstone/Coal		Roseville West		NS193C-27	45175	7.2	0.08	0.04	1	16	-15	13.07	7.2	0	0	NAF
NS193C	148.31	150.90	2.59	Siltstone		Roseville West	Minor Coal at base	NS193C-28	45176			0.02	1							NAF
NS193C	150.90	150.97	0.07	No Sample		Roseville West														
NS193C	150.97	152.43	1.46	Siltstone/Carb Siltstone		Roseville West		NS193C-29	45177			0.02	1							NAF
NS193C	152.43	153.97	1.54	Siltstone		Roseville West		NS193C-30	45178	7.1	0.07	0.03	1	15	-14	16.34	7.3	0	0	NAF
NS142C	26.48	28.47	1.99	Carb Claystone	CV3	Roseville West														
NS142C	28.47	29.95	1.48	Sandstone		Roseville West		NS142C-1	45024	7.4	0.12	0.07	2	5	-3	2.33	6.9	0	0	NAF
NS142C	29.95	30.15	0.20	No Sample		Roseville West														
NS142C	30.15	30.50	0.35	Coal		Roseville West		NS142C-2	45025	4.7	1.25	0.63	19	8	11	0.41	2.8	21	44	NAF
NS142C	30.50	31.55	1.05	Sandstone		Roseville West		NS142C-3	45026			0.04	1							NAF
NS142C	31.55	32.10	0.55	No Sample		Roseville West														
NS142C	32.10	32.97	0.87	Sandstone/Siltstone		Roseville West		NS142C-4	45027			0.05	2							NAF
NS142C	32.97	35.70	2.73	Coal	CV4U	Roseville West														
NS142C	35.70	36.20	0.50	No Sample		Roseville West														
NS142C	36.20	37.70	1.50	Siltstone		Roseville West		NS142C-5	45028	6.7	0.24	0.11	3	20	-17	5.94	7.6	0	0	NAF
NS142C	37.70	39.20	1.50	No Sample		Roseville West														
NS142C	39.20	39.29	0.09	Siltstone		Roseville West		NS142C-6	45029	7.2	0.15	0.13	4	7	-3	1.76	4.8	0	10	NAF
NS142C	39.29	40.07	0.78	Coal	CV4L	Roseville West														
NS142C	40.07	40.70	0.63	Sandstone		Roseville West		NS142C-7	45030			0.02	1							NAF
NS142C	40.70	41.00	0.30	No Sample		Roseville West														
NS142C	41.00	42.20	1.20	Sandstone		Roseville West		NS142C-8	45031			0.01	0							NAF
NS142C	42.20	42.90	0.70	Siltstone		Roseville West		NS142C-9	45032	7.3	0.12	0.04	1	15	-14	12.25	7.4	0	0	NAF
NS142C	42.90	43.00	0.10	No Sample		Roseville West														
NS142C	43.00	43.63	0.63	Siltstone/Sandstone		Roseville West		NS142C-10	45033	6.2	0.36	0.08	2	11	-9	4.49	6.9	0	0	NAF
NS142C	43.63	43.79	0.16	Coal	BAND2	Roseville West														
NS142C	43.79	44.99	1.20	Siltstone		Roseville West		NS142C-11	45034	7.2	0.14	0.11	3	16	-13	4.75	7.2	0	0	NAF
NS142C	44.99	46.25	1.26	Siltstone		Roseville West		NS142C-12	45035	6.5	0.36	0.11	3	22	-19	6.54	7.4	0	0	NAF
NS142C	46.25	48.50	2.25	No Sample	CV5	Roseville West														
NS142C	48.50	48.77	0.27	Sandstone		Roseville West		NS142C-13	45036			0.02	1							NAF
NS142C	48.77	48.90	0.13	No Sample		Roseville West														
NS142C	48.90	51.10	2.20	Sandstone		Roseville West		NS142C-14	45037			0.03	1							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS142C	51.10	51.14	0.04	No Sample		Roseville West														
NS142C	51.14	52.38	1.24	Sandstone		Roseville West		NS142C-15	45038			0.03	1							NAF
NS142C	52.38	53.53	1.15	Sandstone		Roseville West		NS142C-16	45039			0.05	2							NAF
NS142C	53.53	53.97	0.44	Coal	BAND3	Roseville West														
NS142C	53.97	54.86	0.89	Sandstone/Siltstone		Roseville West		NS142C-17	45040	7.3	0.18	0.04	1	9	-8	7.35	7.3	0	0	NAF
NS142C	54.86	57.82	2.96	Sandstone		Roseville West	calcite	NS142C-18	45041			0.01	0							NAF
NS142C	57.82	60.20	2.38	Sandstone		Roseville West		NS142C-19	45042			0.01	0							NAF
NS142C	60.20	65.25	5.05	Sandstone		Roseville West		NS142C-20	45043			0.02	1							NAF
NS142C	65.25	66.26	1.01	Siltstone		Roseville West		NS142C-21	45044	5.9	0.49	0.25	8	21	-13	2.75	7.2	0	0	NAF
NS142C	66.26	67.04	0.78	Coal/Siltstone		Roseville West		NS142C-22	45045	7.2	0.11	0.64	20	3	17	0.15	3.5	2	15	PAF-LC
NS142C	67.04	67.54	0.50	Coal	CV6U	Roseville West														
NS142C	67.54	68.60	1.06	Carb Claystone		Roseville West		NS142C-23	45046	6.6	0.24	0.37	11	5	6	0.44	3.5	5	19	NAF
NS142C	68.60	69.09	0.49	Siltstone		Roseville West		NS142C-24	45047	7.2	0.11	0.05	2	19	-17	12.42	7.2	0	0	NAF
NS142C	69.09	69.20	0.11	No Sample		Roseville West														
NS142C	69.20	69.74	0.54	Sandstone/Carb Claystone		Roseville West		NS142C-25	45048	7.4	0.12	0.08	2	11	-9	4.49	7.3	0	0	NAF
NS142C	69.74	70.12	0.38	Coal	CV6	Roseville West														
NS142C	70.12	70.87	0.75	Sandstone		Roseville West		NS142C-26	45049	6.3	0.62	0.02	1	11	-10	17.97	7.4	0	0	NAF
NS142C	70.87	71.94	1.07	Sandstone		Roseville West		NS142C-27	45050			0.02	1							NAF
NS173C	0.00	44.00	44.00			Roseville West	Open Hole													
NS173C	44.00	44.72	0.72	Carb Claystone/Claystone		Roseville West		NS173C-1	859	7.3	0.47	0.13	4	11	-7	2.77	7.1	0	0	NAF
NS173C	44.72	45.15	0.43	No Sample		Roseville West														
NS173C	45.15	46.89	1.74	Sandstone		Roseville West		NS173C-2	860			0.04	1							NAF
NS173C	46.89	47.28	0.39	Carb Claystone/Coal		Roseville West		NS173C-3	861	7.5	0.26	0.13	4	9	-5	2.26	5.6	0	5	NAF
NS173C	47.28	47.59	0.31	No Sample		Roseville West														
NS173C	47.59	48.15	0.56	Sandstone		Roseville West		NS173C-4	862	7.8	0.22	0.03	1	14	-13	15.25	7.9	0	0	NAF
NS173C	48.15	49.86	1.71	Claystone/Carb Claystone		Roseville West		NS173C-5	863	4.7	0.81	0.19	6	9	-3	1.55	6.9	0	0	NAF
NS173C	49.86	50.55	0.69	No Sample		Roseville West														
NS173C	50.55	51.36	0.81	Sandstone		Roseville West		NS173C-6	864	5.9	0.95	0.47	14	13	1	0.90	4.5	0	7	UC(NAF)
NS173C	51.36	53.05	1.69	Claystone		Roseville West		NS173C-7	865	7.2	0.42	0.12	4	24	-20	6.54	7.5	0	0	NAF
NS173C	53.05	53.25	0.20	No Sample	CV6L	Roseville West														
NS173C	53.25	53.55	0.30	Coal	CV6L	Roseville West		NS173C-8	866	4.2	0.83	0.59	18	8	10	0.44	5.2	0	10	UC(NAF)
NS173C	53.55	54.15	0.60	No Sample	CV6L	Roseville West														
NS173C	54.15	55.17	1.02	Sandstone		Roseville West		NS173C-9	867	8.8	0.31	0.02	1	53	-52	86.60	8.3	0	0	NAF
NS173C	55.17	56.88	1.71	Sandstone/Siltstone		Roseville West	Coal at base	NS173C-10	868			0.04	1							NAF
NS173C	56.88	57.15	0.27	No Sample		Roseville West														
NS173C	57.15	60.93	3.78	Sandstone		Roseville West		NS173C-11	869			0.02	1							NAF
NS173C	60.93	63.06	2.13	Sandstone		Roseville West		NS173C-12	870			0.03	1							NAF
NS173C	63.06	63.70	0.64	Claystone		Roseville West	Siderite	NS173C-13	871	7.1	0.58	0.13	4	16	-12	4.02	7.8	0	0	NAF
NS173C	63.70	63.81	0.11	Coal	BAND2	Roseville West		NS173C-14	872	3.9	1.24	1.06	32	14	18	0.43	4.6	0	18	UC(NAF)
NS173C	63.81	65.20	1.39	Sandstone		Roseville West		NS173C-15	873	8.8	0.19	0.02	1	20	-19	32.68	8.1			NAF
NS173C	65.20	67.27	2.07	Sandstone		Roseville West	Calcite	NS173C-16	874			0.03	1					0	0	NAF
NS173C	67.27	70.71	3.44	Sandstone		Roseville West		NS173C-17	875			0.04	1							NAF
NS173C	70.71	71.06	0.35	Claystone/Siderite		Roseville West	Siderite, calcite	NS173C-18	876	8.5	0.29	0.06	2	36	-34	19.61	8.2	0	0	NAF
NS173C	71.06	74.52	3.46	Claystone		Roseville West		NS173C-19	877	8.7	0.19	0.09	3	20	-17	7.26	8.0	0	0	NAF
NS173C	74.52	75.04	0.52	Siderite/Carb Claystone/Coal		Roseville West	Siderite	NS173C-20	878	8.6	0.13	0.09	3	62	-59	22.51	8.1	0	0	NAF
NS173C	75.04	77.27	2.23	Sandstone		Roseville West	Siderite	NS173C-21	879			0.03	1							NAF
NS173C	77.27	77.61	0.34	Carb Claystone		Roseville West	Siderite	NS173C-22	880	8.1	0.31	0.19	6	32	-26	5.50	6.3	0	1	NAF
NS173C	77.61	78.67	1.06	Coal	CV7	Roseville West														
NS173C	78.67	78.83	0.16	Coal	CV7	Roseville West		NS173C-22A	881	7.1	0.42	0.38	12	6	6	0.52	2.3	7	26	PAF
NS173C	78.83	79.14	0.31	Carb Claystone		Roseville West		NS173C-23	882	7.2	0.37	0.16	5	19	-14	3.88	5.1	0	6	NAF
NS173C	79.14	79.62	0.48	No Sample		Roseville West														
NS173C	79.62	80.30	0.68	No Sample	CV8U	Roseville West														
NS173C	80.30	80.45	0.15	No Sample		Roseville West														
NS173C	80.45	81.15	0.70	Carb Claystone/Coal		Roseville West		NS173C-24	883	7.5	0.15	0.23	7	8	-1	1.14	3.3	10	32	NAF
NS173C	81.15	81.40	0.25	No Sample		Roseville West														
NS173C	81.40	82.95	1.55	No Sample	CV8	Roseville West														
NS173C	82.95	83.45	0.50	Carb Claystone		Roseville West		NS173C-25	884	8.1	0.18	0.05	2	4	-2	2.61	3.4	6	21	NAF
NS173C	83.45	85.67	2.22	Sandstone		Roseville West	Mod Calcite	NS173C-26	885	8.6	0.17	0.02	1	23	-22	37.58	8.2	0	0	NAF
NS173C	85.67	87.15	1.48	Carb Claystone/Siderite/Claystone		Roseville West	Siderite	NS173C-27	886	8.2	0.30	0.08	2	26	-24	10.62	8.1	0	0	NAF
NS173C	87.15	87.30	0.15	No Sample		Roseville West														
NS173C	87.30	87.35	0.05	Coal	CV9	Roseville West														
NS173C	87.35	87.55	0.20	Coal	CV9	Roseville West		NS173C-27A	887	5.8	0.48	0.47	14	7	7	0.49	4.1	1	17	PAF-LC

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Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
NS173C	87.55	88.94	1.39	Coal	CV9	Roseville West														
NS173C	88.94	90.04	1.10	Siderite/Claystone/Carb Claystone		Roseville West	Siderite	NS173C-28	888	8.4	0.15	0.04	1	5	-4	4.08	7.1	0	0	NAF
NS173C	90.04	95.48	5.44	Sandstone		Roseville West		NS173C-29	889			0.04	1							NAF
NS173C	95.48	97.03	1.55	Claystone/Siderite		Roseville West	Siderite, Calcite	NS173C-30	890	7.6	0.32	0.15	5	21	-16	4.58	7.6	0	0	NAF
NS173C	97.03	98.28	1.25	Carb Claystone		Roseville West	Siderite	NS173C-31	891	7.5	0.25	0.10	3	8	-5	2.61	6.3	0	1	NAF
NS173C	98.28	98.48	0.20	No Sample		Roseville West														
NS173C	98.48	99.02	0.54	Coal	CV10U	Roseville West														
NS173C	99.02	100.69	1.67	Coal	CV10	Roseville West														
NS173C	100.69	101.91	1.22	Coal	CV10L	Roseville West														
NS173C	101.91	103.00	1.09	Sandstone		Roseville West		NS173C-32	892	8.9	0.11	0.02	1	10	-9	16.34	7.5	0	0	NAF
NS173C	103.00	105.00	2.00	Sandstone		Roseville West		NS173C-33	893			0.03	1							NAF
NS173C	105.00	108.15	3.15	Sandstone		Roseville West		NS173C-34	894			0.04	1							NAF
NS185C	0.00	48.60	48.60	Coal		Roseville West	Open Hole													
NS185C	48.60	50.78	2.18	Siltstone/Sandstone		Roseville West		NS185C-1	953			0.05	2							NAF
NS185C	50.78	50.85	0.07	No Sample		Roseville West														
NS185C	50.85	53.85	3.00	Siltstone/Sandstone		Roseville West		NS185C-2	954			0.04	1							NAF
NS185C	53.85	56.94	3.09	Sandstone/Siltstone		Roseville West		NS185C-3	955			0.03	1							NAF
NS185C	56.94	59.36	2.42	Sandstone/Siltstone		Roseville West		NS185C-4	956			0.04	1							NAF
NS185C	59.36	60.11	0.75	Siltstone/Coal		Roseville West	pyrite	NS185C-5	957	8.8	0.24	0.14	4	35	-31	8.17	8.5	0	0	NAF
NS185C	60.11	61.63	1.52	Siltstone		Roseville West		NS185C-6	958			0.04	1							NAF
NS185C	61.63	62.72	1.09	Siltstone/Sandstone		Roseville West	rare calcite	NS185C-7	959			0.03	1							NAF
NS185C	62.72	64.40	1.68	Sandstone		Roseville West	calcite	NS185C-8	960			0.03	1							NAF
NS185C	64.40	68.35	3.95	Sandstone/Siltstone		Roseville West		NS185C-9	961			0.04	1							NAF
NS185C	68.35	69.56	1.21	Sandstone/Siltstone		Roseville West		NS185C-10	962	8.3	0.22	0.15	5	19	-14	4.14	8.3	0	0	NAF
NS185C	69.56	71.37	1.81	Coal	RV0	Roseville West														
NS185C	71.37	71.41	0.04	Carb Claystone		Roseville West														
NS185C	71.41	73.60	2.19	Coal	RV0L	Roseville West														
NS185C	73.60	74.06	0.46	Carb Siltstone/Coal		Roseville West		NS185C-11	963	8.5	0.24	0.18	6	20	-14	3.63	7.1	0	0	NAF
NS185C	74.06	74.25	0.19	Coal	BAND3	Roseville West		NS185C-12	964	7.5	0.26	0.49	15	6	9	0.40	2.9	31	57	PAF
NS185C	74.25	75.05	0.80	Carb Siltstone/Coal		Roseville West		NS185C-13	965	7.8	0.18	0.27	8	26	-18	3.15	7.6	0	0	NAF
NS185C	75.05	75.26	0.21	Coal	BAND4	Roseville West		NS185C-14	966	7.2	0.23	0.49	15	9	6	0.60	2.8	25	48	PAF
NS185C	75.26	76.75	1.49	Carb Siltstone/Claystone		Roseville West		NS185C-15	967	7.6	0.31	0.12	4	26	-22	7.08	7.8	0	0	NAF
NS185C	76.75	76.90	0.15	Coal	BAND5	Roseville West		NS185C-16	968	7.7	0.31	0.22	7	7	0	1.04	2.9	21	41	UC(NAF)
NS185C	76.90	77.32	0.42	Carb Siltstone/Carb Claystone		Roseville West		NS185C-17	969	7.8	0.21	0.15	5	35	-30	7.63	7.7	0	0	NAF
NS185C	77.32	79.30	1.98	Coal	RV1	Roseville West														
NS185C	79.30	79.76	0.46	Siltstone		Roseville West		NS185C-18	970	7.9	0.21	0.07	2	17	-15	7.94	8.1	0	0	NAF
NS185C	79.76	80.72	0.96	Sandstone		Roseville West		NS185C-19	971			0.02	1							NAF
NS185C	80.72	80.95	0.23	Carb Siltstone/Coal		Roseville West		NS185C-20	972	8.1	0.26	0.13	4	6	-2	1.51	3.8	3	15	NAF
NS185C	80.95	84.55	3.60	Sandstone/Siltstone		Roseville West		NS185C-21	973			0.02	1							NAF
NS185C	84.55	86.06	1.51	Siltstone		Roseville West		NS185C-22	974			0.04	1							NAF
NS185C	86.06	87.68	1.62	Siltstone/Sandstone		Roseville West		NS185C-23	975			0.03	1							NAF
NS185C	87.68	89.12	1.44	Siltstone/Carb Siltstone		Roseville West		NS185C-24	976			0.03	1							NAF
NS185C	89.12	89.54	0.42	Sandstone/Siltstone/Carb Siltstone		Roseville West		NS185C-25	977			0.04	1							NAF
NS185C	89.54	89.61	0.07	No Sample		Roseville West														
NS185C	89.61	90.07	0.46	Coal	RV2	Roseville West		NS185C-26	978	6.8	0.56	0.34	10	13	-3	1.25	3.3	11	30	UC(NAF)
NS185C	90.07	90.51	0.44	Coal	RV2	Roseville West														
NS185C	90.51	91.05	0.54	Carb Claystone/Carb Siltstone/Coal		Roseville West		NS185C-27	979	7.5	0.22	0.14	4	39	-35	9.10	7.6	0	0	NAF
NS185C	91.05	93.10	2.05	Coal	RV3	Roseville West														
NS185C	93.10	94.28	1.18	Carb Siltstone/Coal		Roseville West		NS185C-28	980	7.6	0.22	0.15	5	28	-23	6.10	7.9	0	0	NAF
NS185C	94.28	94.69	0.41	Coal	RV4	Roseville West														
NS185C	94.69	95.16	0.47	Sandstone		Roseville West		NS185C-29	981			0.03	1							NAF
NS185C	95.16	95.31	0.15	Carb Siltstone/Coal		Roseville West		NS185C-30	982	7.8	0.25	0.07	2	5	-3	2.33	3.5	5	19	UC(NAF)
NS185C	95.31	96.90	1.59	Sandstone		Roseville West		NS185C-31	983			0.03	1							NAF
NS185C	96.90	97.29	0.39	Siltstone		Roseville West		NS185C-32	984	7.9	0.24	0.13	4	23	-19	5.78	7.5	0	0	NAF
NS185C	97.29	97.60	0.31	Coal	RV5	Roseville West														
NS185C	97.60	98.97	1.37	Sandstone		Roseville West		NS185C-33	985			0.02	1							NAF
NS185C	98.97	99.96	0.99	Sandstone/Siltstone		Roseville West		NS185C-34	986			0.04	1							NAF
NS185C	99.96	100.42	0.46	Claystone/Siltstone		Roseville West		NS185C-35	987	7.4	0.32	0.10	3	99	-96	32.35	8.1	0	0	NAF
NS185C	100.42	100.50	0.08	No Sample		Roseville West														
NS185C	100.50	102.50	2.00	No Sample	RV6	Roseville West														
NS185C	102.50	102.75	0.25	Sandstone/Coal		Roseville West		NS185C-36	988	7.3	0.41	0.24	7	17	-10	2.31	8.2	0	0	NAF
NS185C	102.75	104.56	1.81	Sandstone/Siltstone		Roseville West		NS185C-37	989			0.05	2							NAF

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NS185C	104.56	104.91	0.35	Coal	RV7	Roseville West														
NS185C	104.91	105.88	0.97	Sandstone/Siltstone		Roseville West	CS at base	NS185C-38	990			0.05	2							NAF
NS185C	105.88	109.99	4.11	Sandstone/Siltstone		Roseville West		NS185C-39	991			0.03	1							NAF
NS185C	109.99	113.94	3.95	Sandstone/Siltstone		Roseville West		NS185C-40	992			0.04	1							NAF
NS185C	113.94	116.94	3.00	Sandstone/Siltstone		Roseville West		NS185C-41	993			0.04	1							NAF
NS185C	116.94	117.95	1.01	Sandstone/Siltstone		Roseville West		NS185C-42	994	7.2	0.28	0.06	2	21	-19	11.44	8.1	0	0	NAF
NS185C	117.95	118.15	0.20	Coal	RV8	Roseville West		NS185C-43	995	6.7	0.72	0.54	17	5	12	0.30	2.8	36	63	PAF
NS185C	118.15	118.64	0.49	Sandstone		Roseville West		NS185C-44	996			0.05	2							NAF
NS185C	118.64	120.56	1.92	Sandstone/Siltstone		Roseville West		NS185C-45	997	7.4	0.15	0.09	3	23	-20	8.35	7.9	0	0	NAF
NS185C	120.56	120.67	0.11	Coal/Carb Claystone		Roseville West		NS185C-46	998	4.7	1.08	1.98	61	20	41	0.33	3.0	13	25	PAF
NS185C	120.67	121.71	1.04	Sandstone/Siltstone		Roseville West		NS185C-47	999	7.6	0.18	0.05	2	19	-17	12.42	7.6	0	0	NAF
NS185C	121.71	122.43	0.72	Siltstone/Coal	BAND9	Roseville West		NS185C-48	1000	7.5	0.18	0.19	6	21	-15	3.61	7.4	0	0	NAF
NS185C	122.43	122.54	0.11	Carb Siltstone		Roseville West		NS185C-49	1001	6.3	0.52	0.71	22	10	12	0.46	2.8	20	39	PAF
NS185C	122.54	123.00	0.46	Siltstone		Roseville West		NS185C-50	1002	7.4	0.20	0.07	2	33	-31	15.41	8.1	0	0	NAF
SC48C	60.22	62.90	2.68	Coal	AVC	Avon North		SC48C-1	1188	5.2	0.53	0.39	12	12	0	1.01	3.0	24	47	UC(NAF)
SC48C	62.90	64.13	1.23	Undifferentiated Sediment		Avon North		SC48C-2	1189	6.8	0.33	0.17	5	10	-5	1.92	4.3	1	17	UC(NAF)
SC48C	64.13	66.24	2.11	Coal	AVD	Avon North	0.90 Core Loss	SC48C-3	1190	6.6	0.28	0.39	12	17	-5	1.42	5.9	0	3	NAF
SC48C	66.24	66.77	0.53	Coal	AVE	Avon North	Includes AVD-AVE parting	SC48C-4	1191	7.2	0.09	0.31	9	29	-20	3.06	7.2	0	0	NAF
SC48C	66.77	66.96	0.19	Undifferentiated Sediment		Avon North		SC48C-5	1192	7.4	0.09	0.28	9	28	-19	3.27	6.1	0	2	NAF
SC48C	66.96	67.90	0.94	Coal	AVF	Avon North		SC48C-6	1193	7.3	0.08	0.40	12	27	-15	2.21	7.5	0	0	NAF
SC48C	67.90	69.07	1.17	Undifferentiated Sediment		Avon North		SC48C-7	1194	7.2	0.10	0.09	3	16	-13	5.81	7.6	0	0	NAF
SC48C	69.07	69.33	0.26	Coal Stony	AVG	Avon North		SC48C-8	1195	7.5	0.11	0.30	9	15	-6	1.63	6.9	0	0	NAF
SC48C	69.33	69.83	0.50	Undifferentiated Sediment		Avon North		SC48C-9	1196	7.7	0.11	0.16	5	22	-17	4.49	7.7	0	0	NAF
SC48C	69.83	70.11	0.28	Coal Stony	AVHU1	Avon North	Includes AVHU1-AVH parting	SC48C-10	1197	7.6	0.13	0.27	8	12	-4	1.45	4.9	0	13	NAF
SC48C	70.11	71.84	1.73	Coal	AVH	Avon North		SC48C-11	1198	4.8	0.92	0.53	16	10	6	0.62	2.8	30	57	PAF
SC48C	71.84	72.32	0.48	Undifferentiated Sediment		Avon North		SC48C-12	1199	6.7	0.25	0.41	13	24	-11	1.91	4.8	0	11	NAF
SC48C	72.32	73.28	0.96	Coal	AVHL1	Avon North		SC48C-13	1200	4.9	0.88	0.58	18	52	-34	2.93	2.6	38	62	UC(NAF)
SC48C	73.28	73.82	0.54	Undifferentiated Sediment		Avon North		SC48C-14	1201	6.8	0.14	0.10	3	23	-20	7.52	7.4	0	0	NAF
SC48C	73.82	74.09	0.27	Coal	TR	Avon North		SC48C-15	1202	4.1	1.46	0.70	21	0	21	0.00	2.6	34	56	PAF
SC48C	74.09	74.60	0.51	Undifferentiated Sediment		Avon North		SC48C-16	1203	7.2	0.15	0.03	1	11	-10	11.98	7.6	0	0	NAF
NS602R	51.00	59.00	8.00	Coal	AVD	Avon North		NS602R-1	1692	7.5	0.14	0.19	6	5	1	0.86	2.7	18	39	PAF-LC
NS602R	59.00	60.00	1.00	Siltstone		Avon North		NS602R-2	1693	7.8	0.15	0.02	1	7	-6	11.44	7.2	0	0	NAF
NS602R	60.00	61.00	1.00	Siltstone		Avon North		NS602R-3	1694			0.04	1							NAF
NS602R	61.00	63.00	2.00	Sandstone		Avon North		NS602R-4	1695			0.02	1							NAF
NS602R	63.00	65.00	2.00	Sandstone		Avon North		NS602R-5	1696			0.02	1							NAF
NS602R	65.00	66.00	1.00	Sandstone		Avon North		NS602R-6	1697	7.9	0.15	0.02	1	11	-10	17.97	7.5	0	0	NAF
NS602R	66.00	67.00	1.00	Coal/Sandstone	AVE	Avon North		NS602R-7	1698	6.6	0.32	0.26	8	5	3	0.63	4.4	0.4	9	PAF-LC
NS602R	67.00	68.00	1.00	Sandstone		Avon North		NS602R-8	1699	7.3	0.24	0.02	1	14	-13	22.88	7.2	0	0	NAF
NS602R	68.00	70.00	2.00	Sandstone		Avon North		NS602R-9	1700			0.02	1							NAF
NS602R	70.00	74.00	4.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-10	1701			0.01	0							NAF
NS602R	74.00	78.00	4.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-11	1702	8.2	0.14	0.02	1	8	-7	13.07	7.1	0	0	NAF
NS602R	78.00	83.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-12	1703			0.03	1							NAF
NS602R	83.00	88.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-13	1704			0.03	1							NAF
NS602R	88.00	93.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-14	1705			0.03	1							NAF
NS602R	93.00	98.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-15	1706			0.03	1							NAF
NS602R	98.00	103.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-16	1707			0.02	1							NAF
NS602R	103.00	108.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-17	1708	8.4	0.12	0.02	1	9	-8	14.71	7.4	0	0	NAF
NS602R	108.00	113.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-18	1709			0.03	1							NAF
NS602R	113.00	117.00	4.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-19	1710			0.04	1							NAF
NS602R	117.00	119.00	2.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-20	1711	7.8	0.12	0.04	1	22	-21	17.97	7.7	0	0	NAF
NS602R	119.00	120.00	1.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-21	1712			0.04	1							NAF
NS602R	120.00	121.00	1.00	Sandstone/Carb Siltstone	AVFU	Avon North		NS602R-22	1713			0.03	1							NAF
NS602R	121.00	122.00	1.00	Sandstone		Avon North		NS602R-23	1714	8.1	0.11	0.03	1	9	-8	9.80	7.6	0	0	NAF
NS602R	122.00	126.00	4.00	Carb Siltstone	AVF	Avon North		NS602R-24	1715	6.7	0.28	0.07	2	7	-5	3.27	4.2	2	14	UC(NAF)
NS602R	126.00	127.00	1.00	Siltstone		Avon North		NS602R-25	1716	7.5	0.21	0.02	1	17	-16	27.78	8.3	0	0	NAF
NS602R	127.00	129.00	2.00	Siltstone		Avon North		NS602R-26	1717			0.02	1							NAF
NS602R	129.00	130.00	1.00	Siltstone		Avon North		NS602R-27	1718			0.03	1							NAF
NS602R	130.00	131.00	1.00	Siltstone	AVGU	Avon North		NS602R-28	1719	7.6	0.33	0.03	1	9	-8	9.80	7.2	0	0	NAF
NS602R	131.00	135.00	4.00	Coal/Claystone	AVG	Avon North		NS602R-29	1720	7.8	0.25	0.50	15	16	-1	1.05	4.9	0	11	NAF
NS602R	135.00	136.00	1.00	Siltstone		Avon North	MN CO CONTAMINATION	NS602R-30	1721	6.6	0.33	0.06	2	8	-6	4.36	4.8	0	5	NAF
NS602R	136.00	137.00	1.00	Sandstone	AVHU	Avon North	MN CO CONTAMINATION	NS602R-31	1722	7.4	0.2	0.02	1	6	-5	9.80	7.1	0	0	NAF
NS602R	137.00	138.00	1.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-32	1723			0.02	1							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS602R	138.00	140.00	2.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-33	1724			0.02	1							NAF
NS602R	140.00	145.00	5.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-34	1725	8	0.09	0.03	1	17	-16	18.52	7.8	0	0	NAF
NS602R	145.00	147.00	2.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-35	1726			0.03	1							NAF
NS602R	147.00	148.00	1.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-36	1727			0.02	1							NAF
NS602R	148.00	149.00	1.00	Sandstone/Siltstone	AVH	Avon North	Coal	NS602R-37	1728	7.8	0.18	0.07	2	12	-10	5.60	7.6	0	0	NAF
NS602R	149.00	150.00	1.00	Sandstone		Avon North	MN CO CONTAMINATION	NS602R-38	1729			0.03	1							NAF
NS603R	0.00	1.00	1.00	Sandstone		Avon North		NS603R-1	1730	7.5	0.15	<0.01	0	0	0		4.5	0	16	NAF
NS603R	1.00	2.00	1.00	Clay		Avon North		NS603R-2	1731			<0.01	0							NAF
NS603R	2.00	4.00	2.00	Clay		Avon North		NS603R-3	1732	8.2	0.22	0.01	0	3	-3	9.80	5.9	0	5	NAF
NS603R	4.00	7.00	3.00	Clay		Avon North		NS603R-4	1733			0.01	0							NAF
NS603R	7.00	9.00	2.00	Sandstone		Avon North		NS603R-5	1734	7.6	0.31	0.02	1	3	-2	4.90	5.7	0	6	NAF
NS603R	9.00	10.00	1.00	Sandstone		Avon North	MN CW FA	NS603R-6	1735			0.02	1							NAF
NS603R	10.00	11.00	1.00	Siltstone		Avon North		NS603R-7	1736			0.01	0							NAF
NS603R	11.00	14.00	1.00	Sandstone		Avon North		NS603R-8	1737			0.01	0							NAF
NS603R	14.00	16.00	2.00	Sandstone		Avon North	M CO WI	NS603R-9	1738	7.7	0.23	0.01	0	6	-6	19.61	6.9	0	0	NAF
NS603R	16.00	17.00	1.00	Sandstone		Avon North		NS603R-10	1739			<0.01	0							NAF
NS603R	17.00	18.00	1.00	Sandstone		Avon North		NS603R-11	1740			0.02	1							NAF
NS603R	18.00	19.00	1.00	Sandstone/Coal	M2BU	Avon North	CO? CZ? ST?	NS603R-12	1741			0.02	1							NAF
NS603R	19.00	20.00	1.00	Sandstone		Avon North	CO? CZ? ST?	NS603R-13	1742			0.02	1							NAF
NS603R	20.00	23.00	3.00	Siltstone		Avon North		NS603R-14	1743			0.02	1							NAF
NS603R	23.00	25.00	2.00	Sandstone		Avon North	CO WI?	NS603R-15	1744	8.3	0.18	0.03	1	8	-7	8.71	7.6	0	0	NAF
NS603R	25.00	26.00	1.00	Sandstone		Avon North	CO WI?	NS603R-16	1745	6.9	0.19	0.02	1	9	-8	14.71	7.4	0	0	NAF
NS603R	26.00	27.00	1.00	Sandstone/Carb Siltstone	M2B	Avon North		NS603R-17	1746	6	0.38	1.19	36	24	12	0.66	3.1	6	11	PAF
NS603R	27.00	28.00	1.00	Sandstone		Avon North	CO WI?	NS603R-18	1747	7.5	0.14	0.25	8	63	-55	8.24	7.8	0	0	NAF
NS603R	28.00	30.00	2.00	Sandstone		Avon North		NS603R-19	1748	8.2	0.23	0.09	3	9	-6	3.27	7.5	0	0	NAF
NS603R	30.00	31.00	1.00	Siltstone		Avon North		NS603R-20	1749	7.8	0.12	0.40	12	8	4	0.65	4.0	1	7	PAF-LC
NS603R	31.00	32.00	1.00	Siltstone		Avon North		NS603R-21	1750	8.1	0.11	0.08	2	7	-5	2.86	5.7	0	1	NAF
NS603R	32.00	33.00	1.00	Coal/Siltstone	M2A	Avon North		NS603R-22	1751	7.4	0.11	0.18	6	21	-15	3.81	7.4	0	0	NAF
NS603R	33.00	34.00	1.00	Sandstone		Avon North		NS603R-23	1752	7.5	0.14	0.09	3	9	-6	3.27	7.1	0	0	NAF
NS603R	34.00	36.00	2.00	Sandstone		Avon North		NS603R-24	1753	8.3	0.1	0.03	1	11	-10	11.98	7.9	0	0	NAF
NS603R	36.00	37.00	1.00	Siltstone		Avon North	ST BA	NS603R-25	1754			0.04	1							NAF
NS603R	37.00	38.00	1.00	Carb Siltstone		Avon North		NS603R-26	1755			0.04	1							NAF
NS603R	38.00	41.00	3.00	Siltstone		Avon North		NS603R-27	1756	7.6	0.13	0.03	1	8	-7	8.71	7.3	0	0	NAF
NS603R	41.00	44.00	3.00	Sandstone		Avon North		NS603R-28	1757	7.7	0.15	0.06	2	15	-13	8.17	7.6	0	0	NAF
NS603R	44.00	49.00	5.00	Sandstone		Avon North		NS603R-29	1758	8	0.09	0.08	2	78	-76	31.86	8.1	0	0	NAF
NS603R	49.00	52.00	3.00	Sandstone		Avon North		NS603R-30	1759	7.4	0.15	0.04	1	18	-17	14.71	8.5	0	0	NAF
NS603R	52.00	55.00	3.00	Siltstone		Avon North		NS603R-31	1760			0.04	1							NAF
NS603R	55.00	59.00	4.00	Sandstone		Avon North		NS603R-32	1761			0.04	1							NAF
NS603R	59.00	62.00	3.00	Sandstone		Avon North		NS603R-33	1762	7.3	0.18	0.03	1	11	-10	11.98	7.9	0	0	NAF
NS603R	62.00	63.00	1.00	Siltstone		Avon North		NS603R-34	1763	8.1	0.19	0.06	2	10	-8	5.45	7.3	0	0	NAF
NS603R	63.00	64.00	1.00	Siltstone		Avon North	CO IP	NS603R-35	1764			0.04	1							NAF
NS603R	64.00	65.00	1.00	Carb Siltstone		Avon North		NS603R-36	1765	7.6	0.2	0.04	1	7	-6	5.72	6.6	0	1	NAF
NS603R	65.00	71.00	6.00	Coal	M2	Avon North		NS603R-37	1766	7.7	0.14	0.19	6	25	-19	4.30	7.6	0	0	NAF
NS603R	71.00	72.00	1.00	Carb Siltstone	M2L1/M2L2	Avon North	Coal	NS603R-38	1767	7.5	0.13	0.06	2	7	-5	3.81	3.7	5	18	UC(NAF)
NS603R	72.00	73.00	1.00	Sandstone		Avon North		NS603R-39	1768			0.04	1							NAF
NS603R	73.00	76.00	3.00	Sandstone		Avon North		NS603R-40	1769	8.2	0.09	0.03	1	15	-14	16.34	7.3	0	0	NAF
NS603R	76.00	77.00	1.00	Sandstone		Avon North		NS603R-41	1770			0.03	1							NAF
NS603R	77.00	78.00	1.00	Sandstone/Coal	BAND	Avon North		NS603R-42	1771	7.6	0.21	0.05	2	14	-12	9.15	5.5	0	2	NAF
NS603R	78.00	79.00	1.00	Sandstone		Avon North	CO WI	NS603R-43	1772	7.7	0.24	0.09	3	10	-7	3.63	7.4	0	0	NAF
NS603R	79.00	81.00	2.00	Sandstone		Avon North		NS603R-44	1773	7.5	0.22	0.03	1	29	-28	31.59	8.2	0	0	NAF
NS603R	81.00	85.00	4.00	Sandstone		Avon North		NS603R-45	1774			0.03	1							NAF
NS603R	85.00	86.00	1.00	Siltstone, No Sample		Avon North	No Sample	NS603R-46					0							NAF
NS603R	86.00	90.00	4.00	Sandstone		Avon North		NS603R-47	1775			0.02	1							NAF
NS603R	90.00	95.00	5.00	Sandstone		Avon North		NS603R-48	1776			0.02	1							NAF
NS603R	95.00	100.00	5.00	Sandstone		Avon North		NS603R-49	1777	7.5	0.23	0.02	1	43	-42	70.26	8.1	0	0	NAF
NS603R	100.00	105.00	5.00	Sandstone		Avon North	MN CO FA	NS603R-50	1778			0.03	1							NAF
NS603R	105.00	110.00	5.00	Sandstone		Avon North		NS603R-51	1779			0.03	1							NAF
NS603R	110.00	115.00	5.00	Sandstone		Avon North		NS603R-52	1780			0.02	1							NAF
NS603R	115.00	120.00	5.00	Sandstone		Avon North		NS603R-53	1781			0.03	1							NAF
NS603R	120.00	125.00	5.00	Sandstone		Avon North		NS603R-54	1782			0.01	0							NAF
NS603R	125.00	130.00	5.00	Sandstone		Avon North		NS603R-55	1783	8.2	0.31	0.02	1	21	-20	34.31	8.4	0	0	NAF
NS603R	130.00	135.00	5.00	Sandstone		Avon North		NS603R-56	1784			0.01	0							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
NS603R	135.00	140.00	5.00	Sandstone		Avon North		NS603R-57	1785			0.02	1							NAF
NS603R	140.00	142.00	2.00	Sandstone		Avon North		NS603R-58	1786	7.4	0.35	0.02	1	12	-11	19.61	8.0	0	0	NAF
NS603R	142.00	143.00	1.00	Sandstone		Avon North		NS603R-59	1787	6.1	0.68	0.19	6	3	3	0.52	2.7	18	35	PAF-LC
NS603R	143.00	146.00	3.00	Coal	AVA	Avon North		NS603R-60	1788	7.8	0.28	0.22	7	9	-2	1.34	4.3	1	15	UC(NAF)
NS603R	146.00	150.00	4.00	Coal	AVB	Avon North		NS603R-61	1789	8.4	0.1	0.15	5	8	-3	1.74	2.7	27	55	UC(NAF)
NS603R	150.00	151.00	1.00	Sandstone		Avon North		NS603R-62	1790	8.3	0.28	0.05	2	91	-89	59.48	7.6	0	0	NAF
NS603R	151.00	154.00	3.00	Coal	AVC	Avon North		NS603R-63	1791	6	0.52	0.13	4	7	-3	1.76	3.0	15	36	UC(NAF)
NS603R	154.00	159.00	5.00	Coal	AVD	Avon North		NS603R-64	1792	6.2	0.48	0.11	3	7	-4	2.08	3.3	6	23	UC(NAF)
NS603R	159.00	160.00	1.00	Coal	AVD/AVE	Avon North	COAL CONTAMINATION	NS603R-65	1793	7.4	0.26	0.05	2	8	-6	5.23	5.4	0	2	NAF
NS603R	160.00	161.00	1.00	Siltstone		Avon North		NS603R-66	1794	8.2	0.09	0.11	3	7	-4	2.08	5.5	0	1	NAF
NS603R	161.00	163.00	2.00	Sandstone		Avon North		NS603R-67	1795	7.6	0.26	0.04	1	8	-7	6.54	7.5	0	0	NAF
NS603R	163.00	166.00	3.00	Sandstone		Avon North		NS603R-68	1796	7.7	0.25	0.02	1	7	-6	11.44	7.4	0	0	NAF
NS603R	166.00	170.00	4.00	Sandstone		Avon North		NS603R-69	1797	7.9	0.25	0.04	1	11	-10	8.99	8.1	0	0	NAF
NS604R	58.00	59.00	1.00	Siltstone		Avon North		NS604R-1	1798			0.01	0							NAF
NS604R	59.00	63.00	4.00	Sandstone		Avon North		NS604R-2	1799	7.5	0.14	<0.01	0	42	-42	274.51	8.4	0	0	NAF
NS604R	63.00	67.00	4.00	Sandstone		Avon North		NS604R-3	1800			<0.01	0							NAF
NS604R	67.00	71.00	4.00	Sandstone		Avon North		NS604R-4	1801			<0.01	0							NAF
NS604R	71.00	73.00	2.00	Siltstone		Avon North		NS604R-5	1802	7.6	0.14	<0.01	0	18	-18	117.65	8.2	0	0	NAF
NS604R	73.00	74.00	1.00	Sandstone		Avon North		NS604R-6	1803			<0.01	0							NAF
NS604R	74.00	76.00	2.00	Siltstone		Avon North		NS604R-7	1804			<0.01	0							NAF
NS604R	76.00	77.00	1.00	Sandstone		Avon North		NS604R-8	1805			<0.01	0							NAF
NS604R	77.00	79.00	2.00	Siltstone		Avon North	CS	NS604R-9	1806	8.1	0.13	<0.01	0	34	-34	222.22	8.6	0	0	NAF
NS604R	79.00	80.00	1.00	Carb Siltstone		Avon North		NS604R-10	1807	6.6	0.42	0.40	12	7	5	0.57	4.2	1	11	PAF-LC
NS604R	80.00	82.00	2.00	Coal	AVA	Avon North		NS604R-11	1808	7.9	0.22	0.09	3	25	-22	9.08	7.6	0	0	NAF
NS604R	82.00	83.00	1.00	Sandstone		Avon North	CS WI	NS604R-12	1809	8.3	0.09	0.01	0	19	-19	62.09	8.2	0	0	NAF
NS604R	83.00	85.00	2.00	Carb Siltstone		Avon North		NS604R-13	1810			<0.01	0							NAF
NS604R	85.00	87.00	2.00	Siltstone		Avon North		NS604R-14	1811			<0.01	0							NAF
NS604R	87.00	90.00	3.00	Sandstone		Avon North		NS604R-15	1812	8.2	0.2	<0.01	0	19	-19	124.18	8.7	0	0	NAF
NS604R	90.00	92.00	2.00	Sandstone		Avon North	MN CO FA	NS604R-16	1813			<0.01	0							NAF
NS604R	92.00	93.00	1.00	Siltstone		Avon North		NS604R-17	1814	8	0.21	0.02	1	9	-8	14.71	7.5	0	0	NAF
NS604R	93.00	94.00	1.00	Carb Siltstone		Avon North		NS604R-18	1815	7.8	0.21	0.10	3	24	-21	7.84	8.0	0	0	NAF
NS604R	94.00	99.00	5.00	Carb Siltstone/Coal	AVA	Avon North		NS604R-19	1816	7.6	0.24	0.05	2	17	-15	11.11	7.6	0	0	NAF
NS604R	99.00	100.00	1.00	Sandstone		Avon North		NS604R-20	1817			0.01	0							NAF
NS604R	100.00	102.00	2.00	Sandstone		Avon North		NS604R-21	1818			<0.01	0							NAF
NS604R	102.00	104.00	2.00	Sandstone		Avon North		NS604R-22	1819	7.5	0.28	<0.01	0	23	-23	150.33	8.2	0	0	NAF
NS604R	104.00	106.00	2.00	Sandstone		Avon North	CY CONTAMINATION	NS604R-23	1820			<0.01	0							NAF
NS604R	106.00	107.00	1.00	Sandstone		Avon North		NS604R-24	1821			<0.01	0							NAF
NS604R	107.00	110.00	3.00	Carb Siltstone	AVA	Avon North		NS604R-25	1822			0.05	2							NAF
NS604R	110.00	111.00	1.00	Siltstone		Avon North	CO FA	NS604R-26	1823			0.02	1							NAF
NS604R	111.00	112.00	1.00	Siltstone		Avon North		NS604R-27	1824			<0.01	0							NAF
NS604R	112.00	113.00	1.00	Sandstone		Avon North		NS604R-28	1825			<0.01	0							NAF
NS604R	113.00	114.00	1.00	Sandstone		Avon North		NS604R-29	1826	7.9	0.25	<0.01	0	38	-38	248.37	8.3	0	0	NAF
NS604R	114.00	121.00	7.00	Coal	AVB	Avon North		NS604R-30	1827	7.8	0.22	0.08	2	19	-17	7.76	7.5	0	0	NAF
NS604R	121.00	122.00	1.00	Siltstone		Avon North		NS604R-31	1828	8	0.09	0.01	0	9	-9	29.41	7.2	0	0	NAF
NS604R	122.00	124.00	2.00	Siltstone		Avon North		NS604R-32	1829			0.02	1							NAF
NS604R	124.00	127.00	3.00	Siltstone		Avon North		NS604R-33	1830			0.02	1							NAF
NS604R	127.00	129.00	2.00	Sandstone		Avon North		NS604R-34	1831			<0.01	0							NAF
NS604R	129.00	131.00	2.00	Sandstone		Avon North		NS604R-35	1832	7.7	0.17	<0.01	0	59	-59	385.62	8.7	0	0	NAF
NS604R	131.00	132.00	1.00	Sandstone		Avon North	CS	NS604R-36	1833			<0.01	0							NAF
NS604R	132.00	140.00	8.00	Coal	AVB	Avon North		NS604R-37	1834			<0.01	0							NAF
NS604R	140.00	141.00	1.00	Siltstone		Avon North		NS604R-38	1835			0.05	2							NAF
NS604R	141.00	145.00	4.00	Coal/Siltstone	AVB	Avon North		NS604R-39	1836			<0.01	0							NAF
NS604R	145.00	146.00	1.00	Siltstone		Avon North		NS604R-40	1837			0.03	1							NAF
NS604R	146.00	147.00	1.00	Sandstone		Avon North		NS604R-41	1838			0.01	0							NAF
NS604R	147.00	148.00	1.00	Siltstone		Avon North		NS604R-42	1839	8.2	0.16	0.03	1	25	-24	27.23	8.9	0	0	NAF
NS604R	148.00	150.00	2.00	Sandstone		Avon North		NS604R-43	1840			<0.01	0							NAF
NS604R	150.00	151.00	1.00	Siltstone		Avon North		NS604R-44	1841			<0.01	0							NAF
NS604R	151.00	155.00	4.00	Sandstone		Avon North		NS604R-45	1842			<0.01	0							NAF
NS604R	155.00	158.00	3.00	Siltstone		Avon North		NS604R-46	1843	8.1	0.14	<0.01	0	49	-49	320.26	8.9	0	0	NAF
NS604R	158.00	159.00	1.00	Siltstone		Avon North	SS IP	NS604R-47	1844			<0.01	0							NAF
NS604R	159.00	164.00	5.00	Coal/Siltstone	AVC	Avon North		NS604R-48	1845	7.8	0.14	0.01	0	20	-20	65.36	7.5	0	0	NAF
NS604R	164.00	165.00	1.00	Siltstone		Avon North		NS604R-49	1846	7.9	0.23	0.10	3	10	-7	3.27	6.4	0	1	NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
NS604R	165.00	168.00	3.00	Carb Siltstone/Coal/Sandstone	AVD	Avon North	ST BA	NS604R-50	1847	7.6	0.15	0.04	1	14	-13	11.44	7.4	0	0	NAF
NS604R	168.00	169.00	1.00	Sandstone		Avon North		NS604R-51	1848	7.4	0.18	0.08	2	16	-14	6.54	7.6	0	0	NAF
NS604R	169.00	170.00	1.00	Sandstone		Avon North		NS604R-52	1849	7.5	0.22	0.02	1	12	-11	19.61	7.8	0	0	NAF
NS604R	170.00	171.00	1.00	Sandstone		Avon North		NS604R-53	1850			0.01	0							NAF
NS604R	171.00	172.00	1.00	Sandstone	AVE	Avon North	probably washed out	NS604R-54	1851			<0.01	0							NAF
NS604R	172.00	173.00	1.00	Sandstone		Avon North		NS604R-55	1852			<0.01	0							NAF
NS604R	173.00	175.00	2.00	Sandstone		Avon North		NS604R-56	1853	7.8	0.22	<0.01	0	18	-18	117.65	8.3	0	0	NAF
NS604R	175.00	180.00	5.00	Sandstone		Avon North		NS604R-57	1854			<0.01	0							NAF
NS604R	180.00	185.00	5.00	Sandstone		Avon North		NS604R-58	1855			<0.01	0							NAF
NS604R	185.00	190.00	5.00	Sandstone		Avon North		NS604R-59	1856			<0.01	0							NAF
NS604R	190.00	195.00	5.00	Sandstone		Avon North		NS604R-60	1857	7.6	0.14	<0.01	0	24	-24	156.86	8.8	0	0	NAF
NS604R	195.00	198.00	3.00	Sandstone		Avon North		NS604R-61	1858			<0.01	0							NAF
NS273AC	5.90	7.10	1.20	Sandstone		Stratford East	High Weathered	NS273AC-1	1081	6.3	0.12	0.03	1	2	-1	2.18	5.7	0	3	NAF
NS273AC	7.10	7.41	0.31	Conglomerate		Stratford East	Mod Weathered	NS273AC-2	1082	6.9	0.13	0.02	1	6	-5	9.80	5.7	0	6	NAF
NS273AC	8.09	8.95	0.86	Sandstone/Clay		Stratford East	Mod Weathered, BOW	NS273AC-3	1083	7.2	0.12	0.06	2	2	0	1.09	5.2	0	5	NAF
NS273AC	8.95	10.83	1.88	Carb Claystone		Stratford East		NS273AC-4	1084	4.6	1.14	2.29	70	0	70	0.00	2.3	41	53	PAF
NS273AC	10.83	12.43	1.60	Carb Claystone		Stratford East		NS273AC-5	1085	5.7	1.12	0.76	23	0	23	0.00	2.9	7	19	PAF
NS273AC	12.43	12.89	0.46	Carb Claystone		Stratford East		NS273AC-6	1086	3.5	1.71	1.73	53	0	53	0.00	2.5	22	33	PAF
NS273AC	12.89	13.06	0.17	Coal	CH1	Stratford East		NS273AC-6A	1087	4.7	0.98	2.20	67	0	67	0.00	2.3	32	47	PAF
NS273AC	14.06	14.18	0.12	Carb Claystone		Stratford East		NS273AC-7	1088	5.9	1.07	0.74	23	0	23	0.00	2.8	5	19	PAF-LC
NS273AC	14.18	15.50	1.32	Siltstone		Stratford East		NS273AC-8	1089	7.5	0.13	0.12	4	29	-25	7.90	4.6	0	3	NAF
NS273AC	15.50	17.42	1.92	Siltstone		Stratford East		NS273AC-9	1090	4.6	1.14	1.07	33	6	27	0.18	3.4	6	15	PAF
NS273AC	17.66	21.50	3.84	Siltstone		Stratford East		NS273AC-10	1091	6.0	0.82	0.98	30	5	25	0.17	3.0	10	19	PAF
NS273AC	21.50	24.43	2.93	Siltstone		Stratford East		NS273AC-11	1092	5.9	0.92	0.74	23	7	16	0.31	3.2	7	16	PAF
NS273AC	24.43	26.59	2.16	Siltstone		Stratford East		NS273AC-12	1093	4.1	1.22	1.50	46	4	42	0.09	2.7	17	28	PAF
NS273AC	28.37	28.47	0.10	Siltstone		Stratford East		NS273AC-13	1094	3.6	1.27	1.01	31	0	31	0.00	2.3	36	47	PAF
NS273AC	28.80	30.55	1.75	Siltstone		Stratford East		NS273AC-14	1095	7.4	0.82	0.20	6	37	-31	6.05	7.7	0	0	NAF
NS273AC	30.55	33.55	3.00	Siltstone		Stratford East		NS273AC-15	1096	7.3	0.72	1.06	32	17	15	0.52	3.5	4	12	PAF-LC
NS273AC	33.55	37.92	4.37	Siltstone		Stratford East		NS273AC-16	1097	7.2	0.51	1.18	36	44	-8	1.22	7.6	0	0	NAF
NS273AC	37.92	42.65	4.73	Siltstone		Stratford East		NS273AC-17	1098	7.6	0.62	1.06	32	23	9	0.71	3.8	2	9	PAF-LC
NS273AC	42.65	45.12	2.47	Siltstone		Stratford East		NS273AC-18	1099	7.7	0.43	1.88	58	53	5	0.92	7.6	0	0	UC(NAF)
NS273AC	45.12	47.88	2.76	Siltstone		Stratford East		NS273AC-19	1100	7.5	1.24	1.77	54	88	-34	1.62	7.4	0	0	NAF
NS273AC	47.88	48.63	0.75	Carb Claystone		Stratford East		NS273AC-20	1101	6.2	1.21	4.35	133	0	133	0.00	2.2	84	99	PAF
SS194C	29.32	29.70	0.38	Sandstone		Stratford East	Rare Calcite	SS194C-1	1102	7.6	0.22	0.73	22	148	-126	6.63	7.3	0	0	NAF
SS194C	29.70	30.04	0.34	Claystone		Stratford East		SS194C-2	1103	7.7	0.32	0.69	21	33	-12	1.56	7.4	0	0	NAF
SS194C	30.04	32.78	2.74	Siltstone		Stratford East	Rare Pyrite	SS194C-3	1104	5.9	0.83	2.08	64	17	47	0.27	3.0	10	22	PAF
SS194C	32.78	34.50	1.72	Sandstone		Stratford East	Rare Calcite	SS194C-4	1105	7.1	0.14	1.83	56	39	17	0.70	7.5	0	0	UC(NAF)
SS194C	34.50	35.43	0.93	Sandstone		Stratford East	Rare Calcite	SS194C-5	1106	5.4	0.91	1.82	56	19	37	0.34	3.1	6	15	PAF
SS194C	35.92	37.00	1.08	Sandstone No Sample		Stratford East	Rare Siderite & Calcite	SS194C-6												
SS194C	37.00	40.00	3.00	Sandstone		Stratford East	Rare Siderite & Calcite	SS194C-7	1107	6.2	1.48	1.15	35	10	25	0.28	3.0	10	19	PAF
SS194C	40.00	44.25	4.25	Sandstone		Stratford East	Rare Siderite & Calcite	SS194C-8	1108	7.4	0.28	1.24	38	97	-59	2.56	7.6	0	0	NAF
SS194C	44.25	44.47	0.22	Claystone		Stratford East		SS194C-9	1109	7.5	0.22	0.24	7	315	-308	42.89	7.7	0	0	NAF
SS194C	44.47	45.02	0.55	Sandstone		Stratford East	Pyrite	SS194C-10	1110	7.9	0.10	0.46	14	131	-117	9.31	7.8	0	0	NAF
SS194C	45.02	48.00	2.98	Siltstone/Sandstone		Stratford East	Rare Calcite	SS194C-11	1111	7.4	0.12	1.23	38	16	22	0.43	3.2	5	14	PAF-LC
SS194C	48.00	50.98	2.98	Sandstone		Stratford East	Rare Calcite	SS194C-12	1112	7.5	0.15	1.50	46	63	-17	1.37	7.6	0	0	NAF
SS194C	50.98	53.97	2.99	Siltstone		Stratford East	Rare Calcite	SS194C-13	1113	7.6	0.23	1.89	58	19	39	0.33	2.8	15	27	PAF
SS194C	53.97	56.00	2.03	Sandstone		Stratford East	Rare Calcite	SS194C-14	1114	7.5	0.30	1.83	56	36	20	0.64	3.4	4	11	PAF-LC
SS194C	56.00	57.19	1.19	Sandstone		Stratford East	Rare Calcite	SS194C-15	1115	3.5	1.85	2.82	86	0	86	0.00	2.3	49	62	PAF
SS194C	66.07	66.97	0.90	Sandstone/Carb Claystone		Stratford East		SS194C-16	1116	7.3	0.13	0.11	3	3	0	1.00	3.5	2	13	UC(NAF)
SS194C	66.97	68.83	1.86	Sandstone		Stratford East		SS194C-17	1117	6.9	0.17	0.07	2	12	-10	5.60	6.9	0	0	NAF
SS194C	68.83	69.29	0.46	Carb Claystone		Stratford East		SS194C-18	1118	7.1	0.15	0.16	5	6	-1	1.23	5.0	0	5	NAF
SS194C	69.29	69.64	0.35	Coal	CLML	Stratford East		SS194C-19	1119	7.2	0.21	0.82	25	1	24	0.04	2.3	33	51	PAF
SS194C	69.64	70.91	1.27	Sandstone/Carb Claystone		Stratford East		SS194C-20	1120	6.8	0.18	0.15	5	3	2	0.65	3.4	3	14	PAF-LC
SS194C	71.08	71.13	0.05	Coal	CLL1	Stratford East		SS194C-21	1121	6.7	0.20	0.75	23	2	21	0.09	2.4	28	49	PAF
SS194C	71.13	71.97	0.84	Sandstone		Stratford East		SS194C-22	1122	7.5	0.16	0.32	10	3	7	0.31	3.3	2	8	PAF-LC
SS194C	71.97	73.34	1.37	Sandstone		Stratford East		SS194C-23	1123	7.3	0.15	0.08	2	9	-7	3.68	7.5	0	0	NAF
SS194C	73.34	73.99	0.65	Carb Claystone		Stratford East		SS194C-24	1124	3.3	1.37	2.26	69	0	69	0.00	2.4	33	43	PAF
SS194C	73.99	75.40	1.41	Sandstone		Stratford East		SS194C-25	1125	7.4	0.13	0.07	2	10	-8	4.67	5.0	0	3	NAF
SS194C	75.40	75.98	0.58	Siltstone/Carb Claystone		Stratford East		SS194C-26	1126	7.5	0.12	0.19	6	7	-1	1.20	5.1	0	5	NAF
SS194C	75.98	77.81	1.83	Sandstone		Stratford East		SS194C-27	1127	7.6	0.28	0.06	2	5	-3	2.72	7.1	0	0	NAF
SS194C	77.81	78.03	0.22	Sandstone/Carb Claystone		Stratford East		SS194C-28	1128	7.4	0.32	0.07	2	5	-3	2.33	5.5	0	2	NAF
SS194C	78.27	78.51	0.24	Coal	CLL2U	Stratford East		SS194C-29	1129	7.8	0.18	0.27	8	6	2	0.73	4.5	0	8	UC(NAF)

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
SS194C	78.51	78.84	0.33	Sandstone/Carb Claystone		Stratford East		SS194C-30	1130	7.6	0.19	0.23	7	4	3	0.57	3.5	3	17	PAF-LC
SS194C	79.12	79.60	0.48	Coal	CLL2	Stratford East		SS194C-31	1131	7.9	0.08	0.61	19	3	16	0.16	2.3	39	62	PAF
SS194C	79.60	79.80	0.20	Carb Claystone		Stratford East		SS194C-32	1132	7.7	0.09	0.77	24	2	22	0.08	2.7	11	17	PAF
SS194C	79.80	82.91	3.11	Sandstone		Stratford East		SS194C-33	1133	7.3	0.14	1.10	34	38	-4	1.13	7.5	0	0	NAF
SS194C	82.91	83.56	0.65	Carb Claystone		Stratford East		SS194C-34	1134	6.8	0.35	0.76	23	0	23	0.00	2.7	8	19	PAF
SS194C	83.56	83.60	0.04	Coal	CLL2L	Stratford East		SS194C-35	1135	6.7	0.42	0.82	25	2	23	0.08	2.3	29	49	PAF
SS194C	83.60	83.80	0.20	Coal	CLL2L	Stratford East		SS194C-36	1136	2.6	5.98	6.00	184	0	184	0.00	2.0	110	122	PAF
SS194C	83.80	85.00	1.20	Sandstone		Stratford East		SS194C-37	1137	7.3	0.28	0.10	3	5	-2	1.63	4.6	0	4	NAF
SS194C	85.00	86.12	1.12	Conglomerate/Sandstone		Stratford East		SS194C-38	1138	7.7	0.34	0.04	1	9	-8	7.35	7.3	0	0	NAF
NS274C	38.92	40.43	1.51	Coal	CLL2	Stratford East														
NS274C	40.43	41.30	0.87	Sandstone		Stratford East	CS at top	NS274C-1	1139	4.2	1.24	0.73	22	3	19	0.13	3.2	6	15	PAF
NS274C	41.30	43.44	2.14	Sandstone		Stratford East	Minor Calcite	NS274C-2	1140	6.7	0.72	0.51	16	6	10	0.38	3.8	1	5	PAF-LC
NS274C	43.44	45.53	2.09	Sandstone		Stratford East	Minor Calcite	NS274C-3	1141	4.5	1.09	0.73	22	0	22	0.00	2.9	8	13	PAF
NS274C	45.53	46.71	1.18	Carb Siltstone/Sandstone		Stratford East		NS274C-4	1142	4.4	1.11	0.75	23	0	23	0.00	2.9	9	19	PAF
NS274C	46.71	46.76	0.05	No Sample		Stratford East														
NS274C	46.76	47.07	0.31	Claystone/Carb Claystone		Stratford East		NS274C-5	1143	6.7	0.33	0.11	3	2	1	0.59	4.2	1	9	PAF-LC
NS274C	47.07	48.54	1.47	Conglomerate		Stratford East		NS274C-6	1144	6.8	0.22	0.07	2	4	-2	1.87	6.9	0	0	NAF
NS274C	48.54	48.94	0.40	Claystone		Stratford East		NS274C-7	1145			0.03	1							NAF
NS274C	48.94	49.09	0.15	Coal	CLL3U	Stratford East														
NS274C	49.09	50.29	1.20	Siltstone		Stratford East		NS274C-8	1146	7.2	0.18	0.07	2	3	-1	1.40	4.9	0	5	NAF
NS274C	50.29	50.82	0.53	Coal	CLL3	Stratford East														
NS274C	50.82	52.34	1.52	Sandstone		Stratford East		NS274C-9	1147			0.04	1							NAF
NS274C	52.34	52.51	0.17	Coal	BAND1	Stratford East		NS274C-10	1148	7.5	0.16	0.11	3	2	1	0.59	4.1	1	10	PAF-LC
NS274C	52.51	52.99	0.48	Claystone		Stratford East		NS274C-11	1149	7.3	0.12	0.08	2	3	-1	1.23	5.1	0	3	NAF
NS274C	52.99	55.16	2.17	Sandstone/Conglomerate		Stratford East		NS274C-12	1150			0.03	1							NAF
NS274C	55.16	56.29	1.13	Conglomerate		Stratford East		NS274C-13	1151	6.8	0.35	0.06	2	21	-19	11.44	8.4	0	0	NAF
NS274C	56.29	56.58	0.29	No Sample		Stratford East														
NS274C	56.58	56.70	0.12	Sandstone		Stratford East		NS274C-14	1152	5.4	0.28	0.16	5	3	2	0.61	3.2	10	25	PAF-LC
NS274C	56.70	56.87	0.17	Coal	BAND2	Stratford East														
NS274C	56.87	57.96	1.09	Sandstone/Carb Claystone		Stratford East		NS274C-15	1153	6.7	0.30	0.12	4	3	1	0.82	4.7	0	7	UC(NAF)
NS274C	57.96	59.10	1.14	Conglomerate/Carb Claystone		Stratford East		NS274C-16	1154	6.6	0.31	0.08	2	7	-5	2.86	7.1	0	0	NAF
NS274C	59.10	59.91	0.81	Sandstone		Stratford East		NS274C-17	1155	7.2	0.14	0.06	2	3	-1	1.63	6.0	0	1	NAF
NS274C	59.91	60.09	0.18	Coal	CLL4U	Stratford East														
NS274C	60.09	62.48	2.39	Sandstone		Stratford East		NS274C-19	1156			0.05	2							NAF
NS274C	62.48	62.77	0.29	Sandstone		Stratford East		NS274C-20	1157	7.5	0.13	0.11	3	4	-1	1.19	5.1	0	6	NAF
NS274C	62.77	63.00	0.23	No Sample		Stratford East														
NS274C	63.00	63.84	0.84	Sandstone		Stratford East		NS274C-21	1158	7.1	0.15	0.10	3	3	0	1.00	4.1	2	12	UC(NAF)
NS274C	63.84	63.89	0.05	Coal	CLL4	Stratford East														
NS274C	63.89	65.56	1.67	Sandstone/Conglomerate		Stratford East		NS274C-22	1159			0.03	1							NAF
NS274C	65.56	66.99	1.43	Sandstone/Carb Siltstone		Stratford East		NS274C-23	1160	7.4	0.13	0.09	3	6	-3	2.18	6.3	0	1	NAF
NS274C	66.99	67.17	0.18	Coal	CLL4L	Stratford East														
NS274C	67.17	67.97	0.80	Siltstone/Carb Siltstone		Stratford East		NS274C-24	1161	7.6	0.13	0.10	3	15	-12	4.90	7.6	0	0	NAF
NS274C	67.97	69.32	1.35	Sandstone		Stratford East		NS274C-25	1162			0.03	1							NAF
NS274C	69.32	71.46	2.14	Conglomerate		Stratford East		NS274C-26	1163			0.03	1							NAF
NS274C	71.46	74.46	3.00	Conglomerate		Stratford East		NS274C-27	1164	7.5	0.11	0.04	1	22	-21	17.97	8.1	0	0	NAF
NS274C	74.46	78.03	3.57	Conglomerate/Sandstone		Stratford East	Rare Calcite	NS274C-28	1165			0.04	1							NAF
NS274C	78.03	82.37	4.34	Conglomerate		Stratford East	Rare Calcite	NS274C-29	1166			0.04	1							NAF
NS274C	82.37	83.46	1.09	Sandstone/Conglomerate		Stratford East		NS274C-30	1167	6.5	0.52	0.07	2	15	-13	7.00	8.0	0	0	NAF
NS274C	83.46	85.17	1.71	Conglomerate		Stratford East		NS274C-31	1168			0.05	2							NAF
NS274C	85.17	88.97	3.80	Conglomerate/Sandstone		Stratford East		NS274C-32	1169			0.04	1							NAF
NS274C	88.97	92.52	3.55	Conglomerate		Stratford East		NS274C-33	1170			0.04	1							NAF
NS274C	92.52	95.23	2.71	Conglomerate/Sandstone		Stratford East		NS274C-34	1171			0.03	1							NAF
NS274C	95.23	96.17	0.94	Sandstone		Stratford East		NS274C-35	1172			0.04	1							NAF
NS274C	96.17	97.05	0.88	Siltstone/Sandstone		Stratford East		NS274C-36	1173			0.04	1							NAF
NS274C	97.05	97.52	0.47	Coal/Siltstone	CLL5A/5U	Stratford East	Includes parting	NS274C-37	1174	4.8	1.42	0.12	4	3	1	0.82	4.0	3	16	PAF-LC
NS274C	97.52	98.89	1.37	Sandstone/Carb Claystone		Stratford East	Siderite	NS274C-38	1175	6.7	0.43	0.21	6	9	-3	1.40	5.6	0	2	NAF
NS274C	98.89	99.81	0.92	Siltstone/Sandstone/Carb Claystone		Stratford East		NS274C-39	1176			0.05	2							NAF
NS274C	99.81	100.42	0.61	Coal	CLL5	Stratford East														
NS274C	100.42	100.49	0.07	No Sample	CLL5L	Stratford East														
NS274C	100.49	100.93	0.44	Sandstone		Stratford East		NS274C-40	1177			0.04	1							NAF
NS274C	100.93	104.62	3.69	Conglomerate		Stratford East		NS274C-41	1178			0.04	1							NAF
NS274C	104.62	107.62	3.00	Conglomerate		Stratford East		NS274C-42	1179	6.3	0.61	0.10	3	18	-15	5.88	7.7	0	0	NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS Total %S	MPA	ANC	NAPP	ANC/MPA	SINGLE ADDITION NAG NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
NS274C	107.62	111.38	3.76	Conglomerate		Stratford East		NS274C-43	1180			0.04	1							NAF
NS274C	111.38	112.55	1.17	Sandstone/Siltstone		Stratford East		NS274C-44	1181	6.6	0.53	0.34	10	4	6	0.38	4.2	1	8	PAF-LC
NS274C	112.55	113.62	1.07	Sandstone		Stratford East		NS274C-45	1182	7.2	0.24	0.09	3	3	0	1.09	5.0	0	4	NAF
NS274C	113.62	114.04	0.42	Coal	CLL6	Stratford East														
NS274C	114.04	115.12	1.08	Sandstone/Carb Siltstone		Stratford East		NS274C-46	1183	7.4	0.18	0.19	6	2	4	0.34	4.2	1	6	PAF-LC
NS274C	115.12	115.24	0.12	Coal	CLL6L	Stratford East														
NS274C	115.24	116.01	0.77	Sandstone		Stratford East		NS274C-47	1184	7.2	0.13	0.14	4	4	0	1.00	4.4	0.4	7	UC(NAF)
NS274C	116.01	116.42	0.41	Conglomerate		Stratford East		NS274C-48	1185	7.4	0.13	0.09	3	8	-5	2.90	6.9	0	0	NAF
NS274C	116.42	117.34	0.92	Siltstone		Stratford East		NS274C-49	1186	7.3	0.14	0.06	2	8	-6	4.36	6.9	0	0	NAF
NS274C	117.34	118.64	1.30	Conglomerate		Stratford East		NS274C-50	1187	6.7	0.22	0.10	3	35	-32	11.44	8.2	0	0	NAF
SS221C	12.14	12.55	0.41	Sandstone		Stratford East	Rare Calcite	SS221C-1	1254	4.0	1.31	0.62	19	0	19	0.00	2.9	6	12	PAF
SS221C	12.55	12.87	0.32	Carb Siltstone		Stratford East	Common Calcite	SS221C-2	1255	6.1	0.82	0.98	30	0	30	0.00	2.6	13	22	PAF
SS221C	12.87	14.18	1.31	Sandstone		Stratford East	Rare Calcite	SS221C-3	1256	5.9	0.85	0.72	22	0	22	0.00	2.8	9	17	PAF
SS221C	14.18	17.18	3.00	Sandstone		Stratford East	Common Calcite	SS221C-4	1257	7.3	0.14	0.52	16	85	-69	5.34	8.1	0	0	NAF
SS221C	17.18	20.32	3.14	Sandstone		Stratford East	Rare Calcite	SS221C-5	1258	7.5	0.18	0.72	22	19	3	0.86	4.2	1	4	PAF-LC
SS221C	20.32	23.27	2.95	Sandstone		Stratford East		SS221C-6	1259	7.4	0.17	0.69	21	25	-4	1.18	7.6	0	0	NAF
SS221C	23.27	25.92	2.65	Sandstone		Stratford East	Rare Calcite	SS221C-7	1260	7.6	0.90	1.22	37	70	-33	1.88	7.9	0	0	NAF
SS221C	25.92	29.05	3.13	Sandstone		Stratford East	Rare Calcite	SS221C-8	1261	7.7	0.53	1.34	41	28	13	0.68	3.2	6	13	PAF
SS221C	29.05	32.15	3.10	Sandstone		Stratford East	Rare Calcite	SS221C-9	1262	7.8	0.41	1.16	35	140	-105	3.94	7.9	0	0	NAF
SS221C	32.15	35.27	3.12	Sandstone		Stratford East		SS221C-10	1263	7.6	0.91	1.40	43	20	23	0.47	2.8	14	26	PAF
SS221C	35.27	38.26	2.99	Sandstone		Stratford East		SS221C-11	1264	7.4	0.34	1.23	38	34	4	0.90	7.6	0	0	UC(NAF)
SS221C	38.26	41.26	3.00	Sandstone		Stratford East		SS221C-12	1265	7.3	0.42	1.45	44	38	6	0.86	3.8	2	9	PAF-LC
SS221C	41.26	44.31	3.05	Sandstone		Stratford East		SS221C-13	1266	7.4	0.52	1.87	57	36	21	0.63	3.1	8	18	PAF
SS221C	44.31	47.31	3.00	Sandstone		Stratford East		SS221C-14	1267	7.6	0.22	2.14	65	31	34	0.47	3.1	7	18	PAF
SS221C	47.31	48.42	1.11	Siltstone		Stratford East		SS221C-15	1268	7.5	1.69	2.49	76	55	21	0.72	2.6	23	38	PAF
SS221C	48.42	51.45	3.03	Sandstone/Siltstone		Stratford East	Rare Calcite	SS221C-16	1269	7.6	0.82	2.41	74	85	-11	1.15	7.8	0	0	NAF
SS221C	51.45	52.58	1.13	Sandstone		Stratford East	Rare Calcite	SS221C-17	1270	4.5	1.21	2.76	84	10	74	0.12	2.5	26	39	PAF
SS221C	52.58	53.25	0.67	Carb Claystone/Carb Siltstone		Stratford East	Common Calcite	SS221C-18	1271	4.3	1.15	4.22	129	38	91	0.29	2.7	15	37	PAF
SS221C	53.25	55.11	1.86	Sandstone/Siltstone		Stratford East	Rare Calcite, Pyrite	SS221C-19	1272	3.9	1.42	2.59	79	10	69	0.13	2.6	23	40	PAF
SS221C	55.11	56.09	0.98	Sandstone/Siltstone		Stratford East	Rare Calcite, Pyrite at base	SS221C-20	1273	3.8	2.39	3.66	112	0	112	0.00	2.2	42	57	PAF
SS221C	56.09	56.38	0.29	Coal	BAND1	Stratford East	Common Pyrite, Rare Calcite													
SS221C	56.38	57.53	1.15	Siltstone		Stratford East	Common Pyrite	SS221C-21	1274	4.8	1.32	2.20	67	1	66	0.01	2.2	36	52	PAF
SS221C	57.53	58.76	1.23	Siltstone/Sandstone/Carb Siltstone		Stratford East	Rare Calcite	SS221C-22	1275	4.6	1.55	2.57	79	0	79	0.00	2.4	25	39	PAF
SS221C	58.76	62.88	4.12	Siltstone		Stratford East	Rare Calcite, Rare Pyrite	SS221C-23	1276	4.7	1.67	1.85	57	1	56	0.02	2.7	15	29	PAF
SS221C	62.88	64.21	1.33	Siltstone/Sandstone		Stratford East	Rare Calcite	SS221C-24	1277	7.1	0.14	0.76	23	37	-14	1.59	7.8	0	0	NAF
SS221C	64.21	65.47	1.26	Siltstone/Carb Siltstone		Stratford East	Rare Calcite	SS221C-25	1278	6.9	1.82	1.64	50	12	38	0.24	2.6	18	30	PAF
SS221C	65.47	68.28	2.81	Siltstone		Stratford East		SS221C-26	1279	7.2	0.15	0.47	14	31	-17	2.16	7.9	0	0	NAF
SS221C	68.28	71.26	2.98	Siltstone/Carb Siltstone		Stratford East	Rare Calcite	SS221C-27	1280	6.8	0.32	1.66	51	19	32	0.37	2.9	15	27	PAF
SS221C	71.26	74.29	3.03	Siltstone		Stratford East		SS221C-28	1281	6.7	0.32	1.61	49	15	34	0.30	2.8	15	29	PAF
SS221C	74.29	77.28	2.99	Sandstone		Stratford East		SS221C-29	1282	7.5	0.11	0.63	19	43	-24	2.23	7.7	0	0	NAF
SS221C	77.28	80.35	3.07	Sandstone/Conglomerate		Stratford East		SS221C-30	1283	7.8	0.81	0.61	19	49	-30	2.63	7.8	0	0	NAF
SS221C	80.35	83.35	3.00	Sandstone		Stratford East		SS221C-31	1284	7.6	0.34	1.31	40	226	-186	5.64	7.9	0	0	NAF
SS221C	83.35	85.38	2.03	Siltstone		Stratford East	Siderite, Calcite	SS221C-32	1285	7.5	0.22	1.08	33	75	-42	2.27	8.3	0	0	NAF
SS221C	85.38	88.44	3.06	Igneous Rock/Siltstone		Stratford East	Pyrite	SS221C-33	1286	7.4	0.24	0.15	5	96	-91	20.92	8.2	0	0	NAF
SS221C	88.44	88.68	0.24	Siderite		Stratford East	Calcite	SS221C-34	1287	7.3	0.25	0.69	21	199	-178	9.43	8.3	0	0	NAF
SS221C	88.68	89.18	0.50	Carb Siltstone		Stratford East	Pyrite	SS221C-35	1288	3.9	1.85	1.07	33	0	33	0.00	3.1	8	20	PAF
SS221C	89.18	91.00	1.82	Sandstone		Stratford East		SS221C-36	1289	4.1	1.34	1.23	38	4	34	0.11	2.8	12	28	PAF
SS221C	91.00	92.08	1.08	Sandstone		Stratford East		SS221C-37	1290	4.3	1.21	2.33	71	0	71	0.00	2.3	53	68	PAF
SS221C	92.08	103.88	11.80	Coal	CLM	Stratford East														
SS221C	103.88	105.08	1.20	Sandstone/Claystone		Stratford East		SS221C-38	1291	7.5	0.24	0.06	2	3	-1	1.63	4.8	0	6	NAF
SS221C	105.08	105.26	0.18	Coal	CLML	Stratford East														
SS221C	105.26	106.21	0.95	Sandstone/Siltstone		Stratford East		SS221C-39	1292			0.04	1							NAF
SS221C	106.21	108.06	1.85	Sandstone/Conglomerate		Stratford East		SS221C-40	1293			0.04	1							NAF
SS221C	108.06	109.01	0.95	Carb Claystone		Stratford East		SS221C-41	1294	7.4	0.12	0.10	3	3	0	1.00	4.1	1	14	UC(NAF)
SS221C	109.01	109.19	0.18	No Sample		Stratford East														
SS221C	109.19	110.91	1.72	Sandstone		Stratford East		SS221C-42	1295			0.04	1							NAF
SS221C	110.91	111.03	0.12	Coal/Carb Claystone	CLML	Stratford East		SS221C-43	1296	7.6	0.09	0.14	4	3	1	0.70	3.4	6	22	PAF-LC
SS221C	111.03	112.22	1.19	Sandstone/Carb Claystone		Stratford East	Rare Calcite	SS221C-44	1297			0.05	2							NAF
SS221C	112.22	113.27	1.05	Sandstone		Stratford East		SS221C-45	1298			0.04	1							NAF
SS221C	113.27	113.64	0.37	Siltstone		Stratford East	Pyrite	SS221C-46	1299			0.04	1							NAF
SS221C	113.64	114.88	1.24	Sandstone		Stratford East		SS221C-47	1300			0.04	1							NAF
SS221C	114.88	115.52	0.64	Siltstone		Stratford East		SS221C-48	1301			0.04	1							NAF

Table 1: Acid forming characteristics of samples from cored holes from Roseville West Pit Extension, Avon North Open Cut and Stratford East Open Cut, and open holes from Avon North Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
	From	To	Interval									Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
SS221C	115.52	116.37	0.85	Coal	CLL1	Stratford East														
SS221C	116.37	117.43	1.06	Siltstone/Carb Claystone		Stratford East	Calcite	SS221C-49	1302	7.5	0.22	0.07	2	4	-2	1.87	5.1	0	4	NAF
SS221C	117.43	118.38	0.95	Siltstone/Sandstone		Stratford East		SS221C-50	1303	7.3	0.14	0.11	3	7	-4	2.08	7.2	0	0	NAF
SS221C	118.38	118.48	0.10	No Sample		Stratford East														
SS221C	118.48	121.44	2.96	Sandstone/Siltstone		Stratford East	Rare Calcite	SS221C-51	1304	7.2	0.19	0.07	2	14	-12	6.54	7.4	0	0	NAF
SS221C	121.44	121.59	0.15	No Sample		Stratford East														
SS221C	121.59	122.88	1.29	Sandstone/Siltstone		Stratford East		SS221C-52	1305	7.4	0.14	0.14	4	4	0	1.00	5.2	0	3	NAF
SS221C	122.88	123.00	0.12	No Sample		Stratford East														
SS221C	123.00	123.12	0.12	Coal		Stratford East		SS221C-53	1306	7.7	0.09	0.38	12	16	-4	1.38	2.9	17	36	UC(NAF)
SS221C	123.12	123.45	0.33	No Sample		Stratford East														
SS221C	123.45	123.87	0.42	Siltstone		Stratford East		SS221C-54	1307	7.6	0.11	0.07	2	4	-2	1.87	4.7	0	7	NAF
SS221C	123.87	126.34	2.47	No Sample	CLL2	Stratford East														
SS221C	126.34	126.70	0.36	Sandstone/Coal		Stratford East	Pyrite	SS221C-55	1308	7.8	0.11	0.63	19	12	7	0.62	4.0	1	6	PAF-LC
SS221C	126.70	128.65	1.95	Sandstone		Stratford East	Pyrite	SS221C-56	1309	7.6	0.18	0.27	8	165	-157	19.97	7.7	0	0	NAF
SS221C	128.65	131.61	2.96	Sandstone		Stratford East	Calcite	SS221C-57	1310	7.5	0.18	0.40	12	42	-30	3.43	8.3	0	0	NAF
SS221C	131.61	133.00	1.39	Sandstone		Stratford East		SS221C-58	1311	7.2	0.14	0.76	23	16	7	0.69	4.5	0	3	UC(NAF)
SS221C	133.00	134.23	1.23	Sandstone		Stratford East		SS221C-59	1312	6.8	1.61	1.62	50	0	50	0.00	2.5	25	34	PAF
SS221C	134.23	134.34	0.11	Coal	CLL2L	Stratford East	Pyrite	SS221C-59A	1313	7.7	0.91	8.38	256	15	241	0.06	2.0	109	131	PAF
SS221C	134.34	135.89	1.55	Sandstone/Carb Siltstone/Claystone		Stratford East		SS221C-60	1314	7.2	0.52	0.76	23	30	-7	1.29	4.9	0	1	NAF
SS221C	135.89	137.08	1.19	Siltstone		Stratford East		SS221C-61	1315	6.9	0.25	2.05	63	0	63	0.00	2.3	27	40	PAF
SS221C	137.08	139.75	2.67	Sandstone		Stratford East		SS221C-62	1316	7.8	0.62	0.61	19	34	-15	1.82	7.6	0	0	NAF
SS221C	139.75	140.56	0.81	Carb Claystone/Coal		Stratford East	Siderite, Calcite	SS221C-63	1317	7.5	0.33	0.43	13	17	-4	1.29	6.5	0	0	NAF
SS221C	140.56	141.49	0.93	Sandstone/Conglomerate		Stratford East		SS221C-64	1318	7.4	0.42	0.19	6	32	-26	5.50	7.9	0	0	NAF
SS221C	141.49	142.96	1.47	Carb Siltstone	CLL3U	Stratford East	CLL3U as core loss	SS221C-65	1319	5.9	0.51	0.79	24	3	21	0.12	2.6	14	26	PAF
SS221C	142.96	143.04	0.08	No Sample		Stratford East														
SS221C	143.04	144.23	1.19	Sandstone		Stratford East		SS221C-67	1320	6.4	0.28	0.04	1	15	-14	12.25	7.5	0	0	NAF
SS221C	144.23	145.09	0.86	Carb Siltstone		Stratford East		SS221C-68	1321	7.4	0.23	0.70	21	4	17	0.19	3.2	5	19	PAF-LC
SS221C	145.09	145.50	0.41	Coal	CLL3	Stratford East														
SS221C	145.50	145.86	0.36	Sandstone		Stratford East		SS221C-69	1322	7.3	0.23	0.03	1	12	-11	13.07	7.1	0	0	NAF
SS221C	145.86	146.11	0.25	No Sample		Stratford East														
SS221C	146.11	149.18	3.07	Sandstone		Stratford East		SS221C-70	1323	7.2	0.21	0.02	1	15	-14	24.51	7.8	0	0	NAF
SS221C	149.18	150.72	1.54	Sandstone/Conglomerate		Stratford East	Siderite, Common Calcite, Pyrite	SS221C-71	1324	6.9	0.22	0.15	5	58	-53	12.64	8.2	0	0	NAF
SS221C	150.72	151.94	1.22	Igneous Rock/Coal/Carb Claystone		Stratford East	Common Calcite	SS221C-72	1325	7.5	0.20	0.22	7	78	-71	11.59	8.1	0	0	NAF
SS221C	151.94	152.61	0.67	Coal	CLL4U	Stratford East	Calcite, Pyrite	SS221C-73	1326	7.8	0.48	2.34	72	30	42	0.42	2.4	35	50	PAF
SS221C	152.61	152.80	0.19	Coal/Carb Claystone	CLL4U	Stratford East	Includes CLL4U-CLL4 Interburden	SS221C-74	1327	7.6	0.32	0.19	6	42	-36	7.22	7.5	0	0	NAF
SS221C	152.80	153.61	0.81	Coal	CLL4	Stratford East														
SS221C	153.61	155.35	1.74	Sandstone/Siltstone		Stratford East	Rare Calcite	SS221C-75	1328			0.04	1							NAF
SS221C	155.35	156.96	1.61	Sandstone		Stratford East		SS221C-76	1329			0.05	2							NAF
SS221C	156.96	157.04	0.08	Carb Claystone/Coal	CLL4L	Stratford East	Rare Calcite	SS221C-77	1330	7.8	0.28	0.16	5	83	-78	16.95	7.6	0	0	NAF
SS221C	157.04	157.81	0.77	Sandstone/Carb Claystone		Stratford East		SS221C-78	1331			0.04	1							NAF
SS221C	157.81	159.49	1.68	Sandstone/Conglomerate		Stratford East	Calcite	SS221C-79	1332			0.04	1							NAF
SS221C	159.49	160.40	0.91	Siltstone/Carb Claystone		Stratford East	Calcite	SS221C-80	1333	7.7	0.21	0.15	5	5	0	1.09	3.2	9	24	UC(NAF)
SS221C	160.40	161.08	0.68	Sandstone		Stratford East	Abundant Pyrite	SS221C-81	1334	7.3	0.35	0.73	22	6	16	0.27	2.9	8	14	PAF
SS221C	161.08	162.17	1.09	Siltstone/Carb Claystone		Stratford East		SS221C-82	1335	7.2	0.37	0.06	2	9	-7	4.90	7.2	0	0	NAF
SS221C	162.17	162.25	0.08	Carb Siltstone/Coal	CLL5A	Stratford East		SS221C-83	1336	8.1	0.22	0.09	3	6	-3	2.18	3.7	3	13	UC(NAF)
SS221C	162.25	162.59	0.34	Siltstone		Stratford East		SS221C-84	1337			0.02	1							NAF
SS221C	162.59	164.62	2.03	Sandstone/Conglomerate		Stratford East	Rare Calcite	SS221C-85	1338			0.05	2							NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Electrical Conductivity of 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kgH_2SO_4/t)
ANC = Acid Neutralising Capacity (kgH_2SO_4/t)
NAPP = Net Acid Producing Potential (kgH_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)
$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF Low Capacity
UC = Uncertain Classification
(expected classification in brackets)

Coal seam interval
Missing interval or sample not available
Standard NAG results overestimate acid potential due to organic acid effects

Table 2: Total S results for open holes from Roseville West Pit Extension and Stratford East Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	Total %S	Preliminary ARD Classification
	From	To	Interval								
NS595R	84.00	85.00	1.00	Siltstone		Roseville West		NS595R-1		0.08	NAF
NS595R	85.00	86.00	1.00	Sandstone		Roseville West		NS595R-2		0.08	NAF
NS595R	86.00	91.00	5.00	Sandstone		Roseville West		NS595R-3		<0.01	NAF
NS595R	91.00	92.00	1.00	Sandstone		Roseville West		NS595R-4		0.21	UC(PAF/PAF-LC)
NS595R	92.00	93.00	1.00	Siltstone		Roseville West		NS595R-5		0.06	NAF
NS595R	93.00	94.00	1.00	Siltstone		Roseville West		NS595R-6		0.06	NAF
NS595R	94.00	96.00	2.00	Coal	CV10U	Roseville West		NS595R-7		0.38	UC(PAF/PAF-LC)
NS595R	96.00	98.00	2.00	Coal	CV10L	Roseville West		NS595R-8		0.20	NAF
NS595R	98.00	99.00	1.00	Siltstone		Roseville West		NS595R-9		0.03	NAF
NS595R	99.00	100.00	1.00	Sandstone		Roseville West		NS595R-10		0.03	NAF
NS595R	100.00	101.00	1.00	Sandstone		Roseville West	Minor Coaly Fragments	NS595R-11		0.03	NAF
NS595R	101.00	105.00	4.00	Sandstone		Roseville West		NS595R-12		<0.01	NAF
NS595R	105.00	106.00	1.00	Sandstone		Roseville West		NS595R-13		0.05	NAF
NS595R	106.00	108.00	2.00	Siltstone		Roseville West		NS595R-14		0.04	NAF
NS595R	108.00	111.00	3.00	Carb Siltstone		Roseville West		NS595R-15		0.11	NAF
NS595R	111.00	114.00	3.00	Carb Siltstone		Roseville West		NS595R-16		0.07	NAF
NS595R	114.00	117.00	3.00	Sandstone		Roseville West		NS595R-17		0.08	NAF
NS595R	117.00	120.00	3.00	Sandstone		Roseville West		NS595R-18		0.09	NAF
NS591R	0.00	1.00	1.00	Soil		Roseville West		NS591R-1		0.01	NAF
NS591R	1.00	2.00	1.00	Siltstone		Roseville West		NS591R-2		<0.01	NAF
NS591R	2.00	5.00	3.00	Siltstone		Roseville West		NS591R-3		0.01	NAF
NS591R	5.00	7.00	2.00	Siltstone		Roseville West		NS591R-4		0.02	NAF
NS591R	7.00	9.00	2.00	Siltstone		Roseville West		NS591R-5		0.01	NAF
NS591R	9.00	11.00	2.00	Siltstone		Roseville West		NS591R-6		0.11	NAF
NS591R	11.00	13.00	2.00	Siltstone		Roseville West		NS591R-7		0.10	NAF
NS591R	13.00	16.00	3.00	Siltstone		Roseville West		NS591R-8		0.14	NAF
NS591R	16.00	18.00	2.00	Siltstone		Roseville West		NS591R-9		0.07	NAF
NS591R	18.00	19.00	1.00	Siltstone		Roseville West		NS591R-10		0.03	NAF
NS591R	19.00	20.00	1.00	Coal/Siltstone	M3	Roseville West		NS591R-11		0.21	UC(PAF/PAF-LC)
NS591R	20.00	21.00	1.00	Sandstone/Siltstone/Coal	M3L1	Roseville West		NS591R-12		0.07	NAF
NS591R	21.00	22.00	1.00	Sandstone		Roseville West		NS591R-13		0.05	NAF
NS591R	22.00	25.00	3.00	Coal/Sandstone/Carb Siltstone	M3L2	Roseville West		NS591R-14		0.12	NAF
NS591R	25.00	26.00	1.00	Siltstone		Roseville West		NS591R-15		0.04	NAF
NS591R	26.00	27.00	1.00	Sandstone		Roseville West		NS591R-16		0.01	NAF
NS591R	27.00	28.00	1.00	Siltstone		Roseville West		NS591R-17		0.14	NAF
NS591R	28.00	33.00	5.00	Sandstone		Roseville West		NS591R-18		0.30	UC(PAF/PAF-LC)
NS591R	33.00	36.00	3.00	Siltstone		Roseville West		NS591R-19		0.04	NAF
NS591R	36.00	37.00	1.00	Siltstone		Roseville West		NS591R-20		0.38	UC(PAF/PAF-LC)
NS591R	37.00	39.00	2.00	Coal/Sandstone/Siltstone	M8	Roseville West		NS591R-21		0.79	UC(PAF/PAF-LC)
NS591R	39.00	40.00	1.00	Siltstone/Carb Siltstone		Roseville West		NS591R-22		0.62	UC(PAF/PAF-LC)
NS591R	40.00	41.00	1.00	Siltstone/Coal	M8L1	Roseville West		NS591R-23		0.28	UC(PAF/PAF-LC)
NS591R	41.00	42.00	1.00	Siltstone		Roseville West		NS591R-24		0.05	NAF
NS591R	42.00	43.00	1.00	Sandstone		Roseville West		NS591R-25		0.05	NAF
NS591R	43.00	44.00	1.00	Siltstone		Roseville West		NS591R-26		0.07	NAF
NS591R	44.00	45.00	1.00	Coal/Siltstone	M8L2	Roseville West		NS591R-27		0.27	UC(PAF/PAF-LC)
NS591R	45.00	46.00	1.00	Siltstone		Roseville West		NS591R-28		0.12	NAF
NS591R	46.00	48.00	2.00	Siltstone		Roseville West		NS591R-29		0.12	NAF
NS591R	48.00	51.00	3.00	Siltstone		Roseville West		NS591R-30		0.05	NAF
NS591R	51.00	54.00	3.00	Sandstone		Roseville West		NS591R-31		0.12	NAF
NS591R	54.00	58.00	4.00	Sandstone		Roseville West		NS591R-32		0.09	NAF
NS591R	58.00	62.00	4.00	Sandstone		Roseville West		NS591R-33		0.08	NAF
NS591R	62.00	64.00	2.00	Siltstone		Roseville West		NS591R-34		0.02	NAF
NS591R	64.00	65.00	1.00	Sandstone		Roseville West		NS591R-35		0.03	NAF
NS591R	65.00	66.00	1.00	Siltstone		Roseville West		NS591R-36		0.01	NAF
NS591R	66.00	68.00	2.00	Sandstone		Roseville West		NS591R-37		0.02	NAF
NS591R	68.00	70.00	2.00	Sandstone		Roseville West		NS591R-38		<0.01	NAF
NS591R	70.00	71.00	1.00	Siltstone		Roseville West		NS591R-39		0.15	NAF
NS591R	71.00	73.00	2.00	Coal/Siltstone/Carb Siltstone	M8A	Roseville West	Calcite	NS591R-40		0.07	NAF
NS591R	73.00	74.00	1.00	Carb Siltstone		Roseville West		NS591R-41		0.08	NAF
NS591R	74.00	76.00	2.00	Sandstone		Roseville West		NS591R-42		0.06	NAF
NS591R	76.00	78.00	2.00	Sandstone		Roseville West		NS591R-43		0.08	NAF
NS591R	78.00	79.00	1.00	Carb Siltstone		Roseville West		NS591R-44		0.10	NAF
NS591R	79.00	80.00	1.00	Carb Siltstone		Roseville West		NS591R-45		0.26	UC(PAF/PAF-LC)

Table 2: Total S results for open holes from Roseville West Pit Extension and Stratford East Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	Total %S	Preliminary ARD Classification
	From	To	Interval								
NS591R	80.00	82.00	2.00	Siltstone/Coal	M1A	Roseville West		NS591R-46		0.10	NAF
NS591R	82.00	83.00	1.00	Sandstone		Roseville West		NS591R-47		<0.01	NAF
NS591R	83.00	85.00	2.00	Sandstone		Roseville West		NS591R-48		0.01	NAF
NS591R	85.00	86.00	1.00	Sandstone		Roseville West		NS591R-49		<0.01	NAF
NS591R	86.00	88.00	2.00	Coal/Siltstone	M1B	Roseville West		NS591R-50		0.16	NAF
NS591R	88.00	90.00	2.00	Coal/Siltstone	M1	Roseville West		NS591R-51		0.18	NAF
NS591R	90.00	91.00	1.00	Siltstone/Coal	M1L1	Roseville West		NS591R-52		0.25	UC(PAF/PAF-LC)
NS591R	91.00	93.00	2.00	Siltstone/Coal	M1L2	Roseville West		NS591R-53		0.06	NAF
NS591R	93.00	94.00	1.00	Siltstone		Roseville West		NS591R-54		0.02	NAF
NS591R	94.00	95.00	1.00	Siltstone	M1L3	Roseville West		NS591R-55		0.01	NAF
NS591R	95.00	96.00	1.00	Sandstone		Roseville West		NS591R-56		0.02	NAF
NS591R	96.00	97.00	1.00	Sandstone		Roseville West		NS591R-57		0.14	NAF
NS591R	97.00	98.00	1.00	Coal/Siltstone	M1C	Roseville West		NS591R-58		0.19	NAF
NS591R	98.00	99.00	1.00	Siltstone		Roseville West		NS591R-59		0.03	NAF
NS591R	99.00	100.00	1.00	Sandstone		Roseville West		NS591R-60		<0.01	NAF
NS591R	100.00	101.00	1.00	Carb Siltstone		Roseville West		NS591R-61		0.18	NAF
NS591R	101.00	103.00	2.00	Coal/Siltstone	M1D/M1DL	Roseville West		NS591R-62		0.18	NAF
NS591R	103.00	104.00	1.00	Siltstone		Roseville West		NS591R-63		0.05	NAF
NS591R	104.00	105.00	1.00	Siltstone		Roseville West		NS591R-64		0.02	NAF
NS591R	105.00	107.00	2.00	Sandstone		Roseville West		NS591R-65		<0.01	NAF
NS591R	107.00	110.00	3.00	Conglomerate		Roseville West		NS591R-66		0.08	NAF
NS594R	91.00	93.00	2.00	Coal	M1D	Roseville West		NS594R-1		0.25	UC(PAF/PAF-LC)
NS594R	93.00	94.00	1.00	Siltstone/Coal	M1DL	Roseville West		NS594R-2		0.05	NAF
NS594R	94.00	95.00	1.00	Siltstone		Roseville West		NS594R-3		0.03	NAF
NS594R	95.00	98.00	3.00	Sandstone		Roseville West		NS594R-4		0.04	NAF
NS594R	98.00	103.00	5.00	Conglomerate		Roseville West		NS594R-5		<0.01	NAF
NS594R	103.00	108.00	5.00	Conglomerate		Roseville West		NS594R-6		0.08	NAF
NS594R	108.00	111.00	3.00	Sandstone		Roseville West		NS594R-7		0.02	NAF
NS594R	111.00	115.00	4.00	Conglomerate		Roseville West		NS594R-8		0.10	NAF
NS594R	115.00	120.00	5.00	Conglomerate		Roseville West		NS594R-9		<0.01	NAF
NS594R	120.00	125.00	5.00	Conglomerate		Roseville West		NS594R-10		<0.01	NAF
NS594R	125.00	130.00	5.00	Conglomerate		Roseville West		NS594R-11		0.09	NAF
NS594R	130.00	135.00	5.00	Conglomerate		Roseville West		NS594R-12		0.18	NAF
NS594R	135.00	140.00	5.00	Conglomerate		Roseville West		NS594R-13		0.19	NAF
NS594R	140.00	142.00	2.00	Conglomerate		Roseville West		NS594R-14		0.05	NAF
NS594R	142.00	143.00	1.00	Siltstone		Roseville West		NS594R-15		0.05	NAF
NS594R	143.00	145.00	2.00	Coal	BR0	Roseville West		NS594R-16		0.29	UC(PAF/PAF-LC)
NS594R	145.00	146.00	1.00	Coal	BR1U	Roseville West		NS594R-17		0.32	UC(PAF/PAF-LC)
NS594R	146.00	148.00	2.00	Coal	BR1	Roseville West		NS594R-18		0.27	UC(PAF/PAF-LC)
NS594R	148.00	150.00	2.00	Coal	BR1L	Roseville West		NS594R-19		0.27	UC(PAF/PAF-LC)
NS594R	150.00	153.00	3.00	Coal	BR2	Roseville West		NS594R-20		<0.01	NAF
NS594R	153.00	160.00	7.00	Coal	BR3	Roseville West		NS594R-21		0.38	UC(PAF/PAF-LC)
NS594R	160.00	165.00	5.00	Coal	BR4	Roseville West		NS594R-22		0.20	NAF
NS594R	165.00	168.00	3.00	Coal	BR5	Roseville West		NS594R-23		0.65	UC(PAF/PAF-LC)
NS594R	168.00	170.00	2.00	Coal	BR5L	Roseville West		NS594R-24		0.13	NAF
NS594R	170.00	171.00	1.00	Coal	BR6U	Roseville West		NS594R-25		0.05	NAF
NS594R	171.00	172.00	1.00	Siltstone		Roseville West		NS594R-26		0.16	NAF
NS594R	172.00	173.00	1.00	Coal	BR6	Roseville West		NS594R-27		0.61	UC(PAF/PAF-LC)
NS594R	173.00	174.00	1.00	Siltstone		Roseville West		NS594R-28		0.54	UC(PAF/PAF-LC)
NS594R	174.00	176.00	2.00	Conglomerate		Roseville West		NS594R-29		0.09	NAF
NS594R	176.00	180.00	4.00	Conglomerate		Roseville West		NS594R-30		0.39	UC(PAF/PAF-LC)
NS587R	0.00	1.00	1.00	Soil/Clay		Stratford East		NS587R-1		<0.01	NAF
NS587R	1.00	3.00	2.00	Claystone		Stratford East		NS587R-2		<0.01	NAF
NS587R	3.00	7.00	4.00	Claystone		Stratford East		NS587R-3		<0.01	NAF
NS587R	7.00	8.00	1.00	Claystone		Stratford East	BOW	NS587R-4		<0.01	NAF
NS587R	8.00	11.00	3.00	Claystone		Stratford East		NS587R-5		0.01	NAF
NS587R	11.00	12.00	1.00	Siltstone		Stratford East		NS587R-6		0.33	UC(PAF/PAF-LC)
NS587R	12.00	15.00	3.00	Sandstone		Stratford East		NS587R-7		0.05	NAF
NS587R	15.00	18.00	3.00	Sandstone		Stratford East		NS587R-8		0.08	NAF
NS587R	18.00	19.00	1.00	Siltstone		Stratford East		NS587R-9		0.08	NAF
NS587R	19.00	21.00	2.00	Sandstone		Stratford East		NS587R-10		0.11	NAF
NS587R	21.00	24.00	3.00	Sandstone		Stratford East		NS587R-11		0.09	NAF
NS587R	24.00	28.00	4.00	Siltstone		Stratford East		NS587R-12		0.25	UC(PAF/PAF-LC)

Table 2: Total S results for open holes from Roseville West Pit Extension and Stratford East Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	Total %S	Preliminary ARD Classification
	From	To	Interval								
NS587R	28.00	31.00	3.00	Sandstone		Stratford East		NS587R-13		0.46	UC(PAF/PAF-LC)
NS587R	31.00	33.00	2.00	Siltstone		Stratford East		NS587R-14		0.01	NAF
NS587R	33.00	37.00	4.00	Sandstone		Stratford East		NS587R-15		0.02	NAF
NS587R	37.00	41.00	4.00	Sandstone		Stratford East		NS587R-16		<0.01	NAF
NS587R	41.00	45.00	4.00	Sandstone		Stratford East		NS587R-17		<0.01	NAF
NS587R	45.00	48.00	3.00	Sandstone		Stratford East		NS587R-18		0.09	NAF
NS587R	48.00	51.00	3.00	Sandstone		Stratford East		NS587R-19		0.10	NAF
NS587R	51.00	52.00	1.00	Siltstone		Stratford East		NS587R-20		0.05	NAF
NS587R	52.00	56.00	4.00	Sandstone		Stratford East		NS587R-21		0.09	NAF
NS587R	56.00	60.00	4.00	Sandstone		Stratford East		NS587R-22		0.31	UC(PAF/PAF-LC)
NS587R	60.00	63.00	3.00	Sandstone		Stratford East		NS587R-23		0.19	NAF
NS587R	63.00	65.00	2.00	Siltstone		Stratford East		NS587R-24		0.34	UC(PAF/PAF-LC)
NS587R	65.00	69.00	4.00	Sandstone		Stratford East		NS587R-25		0.19	NAF
NS587R	69.00	73.00	4.00	Sandstone		Stratford East		NS587R-26		0.66	UC(PAF/PAF-LC)
NS587R	73.00	77.00	4.00	Sandstone		Stratford East		NS587R-27		0.67	UC(PAF/PAF-LC)
NS587R	77.00	81.00	4.00	Sandstone		Stratford East		NS587R-28		0.44	UC(PAF/PAF-LC)
NS587R	81.00	85.00	4.00	Sandstone		Stratford East		NS587R-29		0.28	UC(PAF/PAF-LC)
NS587R	85.00	89.00	4.00	Sandstone		Stratford East		NS587R-30		0.32	UC(PAF/PAF-LC)
NS587R	89.00	93.00	4.00	Sandstone		Stratford East		NS587R-31		0.39	UC(PAF/PAF-LC)
NS587R	93.00	97.00	4.00	Sandstone		Stratford East		NS587R-32		0.40	UC(PAF/PAF-LC)
NS587R	97.00	101.00	4.00	Sandstone		Stratford East		NS587R-33		0.37	UC(PAF/PAF-LC)
NS587R	101.00	105.00	4.00	Sandstone		Stratford East		NS587R-34		0.15	NAF
NS587R	105.00	109.00	4.00	Sandstone		Stratford East		NS587R-35		0.21	UC(PAF/PAF-LC)
NS587R	109.00	113.00	4.00	Sandstone		Stratford East		NS587R-36		0.63	UC(PAF/PAF-LC)
NS587R	113.00	116.00	3.00	Sandstone		Stratford East		NS587R-37		0.43	UC(PAF/PAF-LC)
NS587R	116.00	118.00	2.00	Sandstone		Stratford East		NS587R-38		0.27	UC(PAF/PAF-LC)
NS587R	118.00	122.00	4.00	Siltstone		Stratford East		NS587R-39		0.74	UC(PAF/PAF-LC)
NS587R	122.00	125.00	3.00	Siltstone		Stratford East		NS587R-40		0.77	UC(PAF/PAF-LC)
NS587R	125.00	128.00	3.00	Siltstone		Stratford East		NS587R-41		0.37	UC(PAF/PAF-LC)
NS587R	128.00	130.00	2.00	Sandstone		Stratford East		NS587R-42		0.14	NAF
NS587R	130.00	132.00	2.00	Sandstone		Stratford East		NS587R-43		0.23	UC(PAF/PAF-LC)
NS587R	132.00	133.00	1.00	Sandstone		Stratford East		NS587R-44		0.21	UC(PAF/PAF-LC)
NS587R	133.00	134.00	1.00	Sandstone		Stratford East	Pyrite	NS587R-45		1.39	UC(PAF/PAF-LC)
NS587R	134.00	136.00	2.00	Sandstone		Stratford East	Pyrite	NS587R-46		0.78	UC(PAF/PAF-LC)
NS587R	136.00	138.00	2.00	Sandstone		Stratford East	Pyrite	NS587R-47		1.02	UC(PAF/PAF-LC)
NS587R	138.00	139.00	1.00	Sandstone		Stratford East	Calcite	NS587R-48		0.34	UC(PAF/PAF-LC)
NS587R	139.00	141.00	2.00	Sandstone		Stratford East		NS587R-49		0.64	UC(PAF/PAF-LC)
NS587R	141.00	145.00	4.00	Sandstone		Stratford East		NS587R-50		0.54	UC(PAF/PAF-LC)
NS587R	145.00	149.00	4.00	Sandstone		Stratford East		NS587R-51		0.52	UC(PAF/PAF-LC)
NS587R	149.00	153.00	4.00	Sandstone		Stratford East		NS587R-52		1.58	UC(PAF/PAF-LC)
NS587R	153.00	157.00	4.00	Sandstone		Stratford East		NS587R-53		0.28	UC(PAF/PAF-LC)
NS587R	157.00	161.00	4.00	Sandstone		Stratford East		NS587R-54		0.46	UC(PAF/PAF-LC)
NS587R	161.00	165.00	4.00	Sandstone		Stratford East		NS587R-55		0.94	UC(PAF/PAF-LC)
NS587R	165.00	169.00	4.00	Sandstone		Stratford East		NS587R-56		0.69	UC(PAF/PAF-LC)
NS587R	169.00	171.00	2.00	Sandstone		Stratford East		NS587R-57		0.55	UC(PAF/PAF-LC)
NS587R	171.00	172.00	1.00	Sandstone		Stratford East	Calcite	NS587R-58		0.51	UC(PAF/PAF-LC)
NS587R	172.00	175.00	3.00	Sandstone		Stratford East		NS587R-59		0.71	UC(PAF/PAF-LC)
NS587R	175.00	179.00	4.00	Sandstone		Stratford East		NS587R-60		0.57	UC(PAF/PAF-LC)
NS587R	179.00	183.00	4.00	Sandstone		Stratford East		NS587R-61		0.48	UC(PAF/PAF-LC)
NS587R	183.00	187.00	4.00	Sandstone		Stratford East		NS587R-62		0.59	UC(PAF/PAF-LC)
NS587R	187.00	190.00	3.00	Sandstone		Stratford East		NS587R-63		0.73	UC(PAF/PAF-LC)
NS587R	190.00	193.00	3.00	Siltstone		Stratford East		NS587R-64		0.49	UC(PAF/PAF-LC)
NS587R	193.00	196.00	3.00	Sandstone		Stratford East		NS587R-65		1.03	UC(PAF/PAF-LC)
NS587R	196.00	199.00	3.00	Sandstone		Stratford East		NS587R-66		1.30	UC(PAF/PAF-LC)
NS577R	0.00	1.00	1.00	Soil		Stratford East		NS577R-1		0.01	NAF
NS577R	1.00	3.00	2.00	Claystone		Stratford East		NS577R-2		0.03	NAF
NS577R	3.00	7.00	4.00	Claystone		Stratford East		NS577R-3		0.04	NAF
NS577R	7.00	8.00	1.00	Sandstone		Stratford East		NS577R-4		0.05	NAF
NS577R	8.00	9.00	1.00	No Sample		Stratford East					
NS577R	9.00	10.00	1.00	Sandstone		Stratford East	BOW	NS577R-5		0.47	UC(PAF/PAF-LC)
NS577R	10.00	14.00	4.00	Sandstone		Stratford East		NS577R-6		0.41	UC(PAF/PAF-LC)
NS577R	14.00	18.00	4.00	Sandstone		Stratford East		NS577R-7		0.47	UC(PAF/PAF-LC)
NS577R	18.00	22.00	4.00	Sandstone		Stratford East		NS577R-8		0.41	UC(PAF/PAF-LC)

Table 2: Total S results for open holes from Roseville West Pit Extension and Stratford East Open Cut.

Hole Name	Depth (m)			Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	Total %S	Preliminary ARD Classification
	From	To	Interval								
NS577R	22.00	26.00	4.00	Sandstone		Stratford East		NS577R-9		0.44	UC(PAF/PAF-LC)
NS577R	26.00	30.00	4.00	Sandstone		Stratford East		NS577R-10		0.36	UC(PAF/PAF-LC)
NS577R	30.00	34.00	4.00	Sandstone		Stratford East		NS577R-11		0.24	UC(PAF/PAF-LC)
NS577R	34.00	38.00	4.00	Sandstone		Stratford East		NS577R-12		0.12	NAF
NS577R	38.00	42.00	4.00	Sandstone		Stratford East		NS577R-13		0.16	NAF
NS577R	42.00	46.00	4.00	Sandstone		Stratford East		NS577R-14		0.80	UC(PAF/PAF-LC)
NS577R	46.00	50.00	4.00	Sandstone		Stratford East		NS577R-15		0.50	UC(PAF/PAF-LC)
NS577R	50.00	54.00	4.00	Sandstone		Stratford East		NS577R-16		0.85	UC(PAF/PAF-LC)
NS577R	54.00	58.00	4.00	Sandstone		Stratford East		NS577R-17		1.13	UC(PAF/PAF-LC)
NS577R	58.00	62.00	4.00	Sandstone		Stratford East		NS577R-18		0.51	UC(PAF/PAF-LC)
NS577R	62.00	66.00	4.00	Sandstone		Stratford East		NS577R-19		1.45	UC(PAF/PAF-LC)
NS577R	66.00	70.00	4.00	Sandstone		Stratford East		NS577R-20		0.88	UC(PAF/PAF-LC)
NS577R	70.00	74.00	4.00	Sandstone		Stratford East		NS577R-21		0.78	UC(PAF/PAF-LC)
NS577R	74.00	77.00	3.00	Sandstone		Stratford East		NS577R-22		0.33	UC(PAF/PAF-LC)
NS577R	77.00	79.00	2.00	Sandstone		Stratford East	Calcite	NS577R-23		0.75	UC(PAF/PAF-LC)
NS577R	79.00	83.00	4.00	Sandstone		Stratford East		NS577R-24		1.24	UC(PAF/PAF-LC)
NS577R	83.00	87.00	4.00	Sandstone		Stratford East		NS577R-25		0.44	UC(PAF/PAF-LC)
NS577R	87.00	91.00	4.00	Sandstone		Stratford East		NS577R-26		0.55	UC(PAF/PAF-LC)
NS577R	91.00	95.00	4.00	Sandstone		Stratford East		NS577R-27		0.69	UC(PAF/PAF-LC)
NS577R	95.00	99.00	4.00	Sandstone		Stratford East		NS577R-28		0.43	UC(PAF/PAF-LC)
NS577R	99.00	103.00	4.00	Sandstone		Stratford East		NS577R-29		0.55	UC(PAF/PAF-LC)
NS577R	103.00	107.00	4.00	Sandstone		Stratford East		NS577R-30		0.76	UC(PAF/PAF-LC)
NS577R	107.00	111.00	4.00	Sandstone		Stratford East		NS577R-31		0.91	UC(PAF/PAF-LC)
NS577R	111.00	115.00	4.00	Sandstone		Stratford East		NS577R-32		0.62	UC(PAF/PAF-LC)
NS577R	115.00	119.00	4.00	Sandstone		Stratford East		NS577R-33		0.80	UC(PAF/PAF-LC)
NS577R	119.00	123.00	4.00	Sandstone		Stratford East		NS577R-34		0.26	UC(PAF/PAF-LC)
NS577R	123.00	127.00	4.00	Sandstone		Stratford East		NS577R-35		0.95	UC(PAF/PAF-LC)
NS577R	127.00	129.00	2.00	Siltstone		Stratford East		NS577R-36		1.25	UC(PAF/PAF-LC)
NS577R	129.00	131.00	2.00	Sandstone		Stratford East		NS577R-37		0.28	UC(PAF/PAF-LC)
NS577R	131.00	132.00	1.00	Siltstone		Stratford East		NS577R-38		1.54	UC(PAF/PAF-LC)
NS577R	132.00	135.00	3.00	Sandstone		Stratford East		NS577R-39		1.00	UC(PAF/PAF-LC)
NS577R	135.00	139.00	4.00	Siltstone		Stratford East		NS577R-40		1.15	UC(PAF/PAF-LC)
NS577R	139.00	141.00	2.00	Sandstone		Stratford East		NS577R-41		1.07	UC(PAF/PAF-LC)
NS577R	141.00	144.00	3.00	Siltstone		Stratford East		NS577R-42		0.73	UC(PAF/PAF-LC)
NS577R	144.00	146.00	2.00	Siltstone		Stratford East		NS577R-43		1.01	UC(PAF/PAF-LC)
NS577R	146.00	148.00	2.00	Sandstone		Stratford East		NS577R-44		0.94	UC(PAF/PAF-LC)
NS577R	148.00	151.00	3.00	Siltstone		Stratford East		NS577R-45		2.33	UC(PAF/PAF-LC)
NS577R	151.00	154.00	3.00	Siltstone		Stratford East		NS577R-46		1.28	UC(PAF/PAF-LC)
NS577R	154.00	155.00	1.00	Siltstone		Stratford East		NS577R-47		0.59	UC(PAF/PAF-LC)
NS577R	155.00	156.00	1.00	Carb Siltstone		Stratford East		NS577R-48		0.60	UC(PAF/PAF-LC)
NS577R	156.00	157.00	1.00	Carb Siltstone		Stratford East		NS577R-49		1.66	UC(PAF/PAF-LC)
NS577R	157.00	158.00	1.00	Carb Siltstone		Stratford East		NS577R-50		0.61	UC(PAF/PAF-LC)
NS577R	158.00	159.00	1.00	Siltstone		Stratford East		NS577R-51		1.04	UC(PAF/PAF-LC)
NS577R	159.00	163.00	4.00	Siltstone		Stratford East		NS577R-52		0.51	UC(PAF/PAF-LC)
NS577R	163.00	167.00	4.00	Siltstone		Stratford East		NS577R-53		0.54	UC(PAF/PAF-LC)
NS577R	167.00	171.00	4.00	Siltstone		Stratford East		NS577R-54		1.10	UC(PAF/PAF-LC)
NS577R	171.00	175.00	4.00	Siltstone		Stratford East		NS577R-55		0.60	UC(PAF/PAF-LC)
NS577R	175.00	178.00	3.00	Siltstone		Stratford East		NS577R-56		0.17	NAF
NS577R	178.00	181.00	3.00	Siltstone		Stratford East		NS577R-57		0.73	UC(PAF/PAF-LC)
NS577R	181.00	183.00	2.00	Siltstone		Stratford East		NS577R-58		1.35	UC(PAF/PAF-LC)
NS577R	183.00	184.00	1.00	Siltstone		Stratford East		NS577R-59		2.12	UC(PAF/PAF-LC)
NS577R	184.00	195.00	11.00	Coal/Siltstone	CLM1	Stratford East		NS577R-60		0.70	UC(PAF/PAF-LC)
NS577R	195.00	199.00	4.00	Coal/Siltstone	CLM2	Stratford East		NS577R-61		0.29	UC(PAF/PAF-LC)
NS577R	199.00	200.00	1.00	Siltstone/Coal	BAND	Stratford East		NS577R-62		0.10	NAF
NS577R	200.00	201.00	1.00	Sandstone		Stratford East		NS577R-63		0.11	NAF
NS577R	201.00	202.00	1.00	Sandstone/Coal	BAND	Stratford East		NS577R-64		0.01	NAF
NS577R	202.00	203.00	1.00	Siltstone		Stratford East		NS577R-65		0.04	NAF
NS577R	203.00	205.00	2.00	Siltstone/Coal	CLML	Stratford East		NS577R-66		0.36	UC(PAF/PAF-LC)
NS577R	205.00	206.00	1.00	Siltstone/Coal	CLL1	Stratford East		NS577R-67		0.08	NAF
NS577R	206.00	207.00	1.00	Siltstone		Stratford East		NS577R-68		<0.01	NAF
NS577R	207.00	208.00	1.00	Siltstone		Stratford East		NS577R-69		0.04	NAF
NS577R	208.00	209.00	1.00	Siltstone/Coal	CLL2U	Stratford East		NS577R-70		0.04	NAF
NS577R	209.00	211.00	2.00	Siltstone/Coal	CLL2	Stratford East		NS577R-71		0.85	UC(PAF/PAF-LC)

Table 2: Total S results for open holes from Roseville West Pit Extension and Stratford East Open Cut.

Hole Name	Depth (m) From	Depth (m) To	Depth (m) Interval	Lithology	Seam	Deposit	Comments	Stratford Sample No	EGi Sample Number	Total %S	Preliminary ARD Classification
NS577R	211.00	212.00	1.00	Siltstone		Stratford East		NS577R-72		0.06	NAF
NS577R	212.00	214.00	2.00	Siltstone		Stratford East		NS577R-73		0.96	UC(PAF/PAF-LC)
NS577R	214.00	216.00	2.00	Siltstone		Stratford East		NS577R-74		0.05	NAF
NS577R	216.00	220.00	4.00	Sandstone		Stratford East		NS577R-75		0.31	UC(PAF/PAF-LC)
NS577R	220.00	221.00	1.00	Siltstone		Stratford East	Calcite	NS577R-76		0.11	NAF
NS577R	221.00	222.00	1.00	Sandstone		Stratford East		NS577R-77		<0.01	NAF
NS576R	0.00	1.00	1.00	Soil/Clay		Stratford East		NS576R-1		0.01	NAF
NS576R	1.00	4.00	3.00	Claystone		Stratford East		NS576R-2		0.02	NAF
NS576R	4.00	5.00	1.00	Coal/Claystone	CLL3	Stratford East		NS576R-3		0.08	NAF
NS576R	5.00	8.00	3.00	Claystone		Stratford East		NS576R-4		0.05	NAF
NS576R	8.00	9.00	1.00	Coal/Claystone	CLL4	Stratford East		NS576R-5		0.30	UC(PAF/PAF-LC)
NS576R	9.00	10.00	1.00	Claystone/Sandstone		Stratford East		NS576R-6		0.10	NAF
NS576R	10.00	12.00	2.00	Conglomerate		Stratford East	minor coaly fragments	NS576R-7		0.08	NAF
NS576R	12.00	13.00	1.00	Sandstone		Stratford East	BOW	NS576R-8		0.05	NAF
NS576R	13.00	14.00	1.00	Conglomerate		Stratford East		NS576R-9		0.11	NAF
NS576R	14.00	15.00	1.00	Carb Siltstone/Conglomerate	CLL4	Stratford East	conglomerate in part	NS576R-10		0.47	UC(PAF/PAF-LC)
NS576R	15.00	16.00	1.00	Conglomerate		Stratford East		NS576R-11		0.06	NAF
NS576R	16.00	18.00	2.00	Conglomerate		Stratford East		NS576R-12		0.04	NAF
NS576R	18.00	22.00	4.00	Conglomerate		Stratford East		NS576R-13		0.05	NAF
NS576R	22.00	25.00	3.00	Conglomerate		Stratford East		NS576R-14		0.04	NAF
NS576R	25.00	28.00	3.00	Conglomerate		Stratford East		NS576R-15		0.06	NAF
NS576R	28.00	29.00	1.00	Conglomerate		Stratford East	Calcite	NS576R-16		0.04	NAF
NS576R	29.00	30.00	1.00	Carb Siltstone/Conglomerate		Stratford East		NS576R-17		0.04	NAF
NS576R	30.00	31.00	1.00	Conglomerate		Stratford East		NS576R-18		0.03	NAF
NS576R	31.00	35.00	4.00	Conglomerate		Stratford East		NS576R-19		0.03	NAF
NS576R	35.00	36.00	1.00	Conglomerate		Stratford East	Calcite	NS576R-20		0.03	NAF
NS576R	36.00	37.00	1.00	Conglomerate		Stratford East		NS576R-21		0.03	NAF
NS576R	37.00	39.00	2.00	Conglomerate		Stratford East		NS576R-22		0.02	NAF
NS576R	39.00	40.00	1.00	Conglomerate		Stratford East		NS576R-23		0.02	NAF
NS576R	40.00	43.00	3.00	Coal/Sandstone	CLL5	Stratford East		NS576R-24		0.21	UC(PAF/PAF-LC)
NS576R	43.00	44.00	1.00	Conglomerate		Stratford East		NS576R-25		0.05	NAF
NS576R	44.00	47.00	3.00	Conglomerate		Stratford East		NS576R-26		0.06	NAF
NS576R	47.00	48.00	1.00	Conglomerate		Stratford East		NS576R-27		0.09	NAF
NS576R	48.00	51.00	3.00	Coal	CLL6	Stratford East		NS576R-28		0.27	UC(PAF/PAF-LC)
NS576R	51.00	52.00	1.00	Siltstone		Stratford East		NS576R-29		0.14	NAF
NS576R	52.00	54.00	2.00	Conglomerate		Stratford East		NS576R-30		0.08	NAF
NS576R	54.00	57.00	3.00	Conglomerate		Stratford East		NS576R-31		0.03	NAF
NS576R	57.00	59.00	2.00	Conglomerate		Stratford East		NS576R-32		0.01	NAF
NS576R	59.00	60.00	1.00	Conglomerate		Stratford East		NS576R-33		0.01	NAF
NS576R	60.00	61.00	1.00	Conglomerate	CLL6L?	Stratford East		NS576R-34		0.01	NAF
NS576R	61.00	62.00	1.00	Conglomerate		Stratford East		NS576R-35		0.02	NAF
NS576R	62.00	64.00	2.00	Conglomerate		Stratford East		NS576R-36		<0.01	NAF
NS576R	64.00	68.00	4.00	Conglomerate		Stratford East		NS576R-37		<0.01	NAF
NS576R	68.00	72.00	4.00	Conglomerate		Stratford East		NS576R-38		<0.01	NAF
NS576R	72.00	76.00	4.00	Conglomerate		Stratford East		NS576R-39		<0.01	NAF
NS576R	76.00	80.00	4.00	Conglomerate		Stratford East		NS576R-40		0.01	NAF
NS576R	80.00	84.00	4.00	Conglomerate		Stratford East		NS576R-41		0.02	NAF
NS576R	84.00	88.00	4.00	Conglomerate		Stratford East		NS576R-42		0.02	NAF
NS576R	88.00	92.00	4.00	Conglomerate		Stratford East		NS576R-43		0.01	NAF
NS576R	92.00	96.00	4.00	Conglomerate		Stratford East		NS576R-44		0.01	NAF
NS576R	96.00	100.00	4.00	Conglomerate		Stratford East		NS576R-45		0.01	NAF
NS576R	100.00	104.00	4.00	Conglomerate		Stratford East		NS576R-46		0.01	NAF
NS576R	104.00	106.00	2.00	Conglomerate		Stratford East		NS576R-47		0.04	NAF

KEY

Coal seam interval

Missing interval or sample not available

NAF = Non-Acid Forming

UC(PAF/PAF-LC) = Uncertain(Potentially Acid Forming or Potentially Acid Forming Low Capacity)

Table 3: Extended boil and Calculated NAG test results for selected samples.

EGi Sample Number	Deposit	Lithology	ACID-BASE ANALYSIS					STANDARD NAG TEST			Extended Boil NAGpH	Calculated NAG
			Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$		
45025	Roseville West	Coal	0.63	19	8	11	0.41	2.8	21	44	6.2	-4
45046	Roseville West	Carb Claystone	0.37	11	5	6	0.44	3.5	5	19	6.3	-1
45153	Roseville West	Tuff/Carb Siltstone	0.72	22	2	20	0.09	3.4	7	18	3.9	8
883	Roseville West	Carb Claystone/Coal	0.23	7	8	-1	1.14	3.3	10	32	6.9	-8
972	Roseville West	Carb Siltstone/Coal	0.13	4	6	-2	1.51	3.8	3	15	7.1	-8
1049	Roseville West	Siltstone/Carb Claystone/Coal	0.15	5	7	-2	1.53	4.0	2	14	7.3	-4
1059	Roseville West	Coal/Claystone	0.29	9	5	4	0.56	2.7	17.4	29	5.8	-4

KEY

$pH_{1:2}$ = pH of 1:2 extract

$EC_{1:2}$ = Electrical Conductivity of 1:2 extract (dS/m)

MPA = Maximum Potential Acidity (kgH_2SO_4/t)

ANC = Acid Neutralising Capacity (kgH_2SO_4/t)

NAPP = Net Acid Producing Potential (kgH_2SO_4/t)

NAGpH = pH of NAG liquor

$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)

$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

Extended Boil NAGpH = pH of NAG liquor after extended heating

Calculated NAG = The net acid potential based on assay of anions and cations released to the NAG solution (kgH_2SO_4/t)

Table 4: Sequential NAG test results for selected samples.

EGi Sample Number	Deposit	Lithology	Total S (%)	ANC	NAPP	Seq. NAG test Stage 1			Seq. NAG test Stage 2			Seq. NAG test Stage 3			Seq. NAG test Stage 4		
						NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$
				(kg H_2SO_4/t)			(kg H_2SO_4/t)			(kg H_2SO_4/t)			(kg H_2SO_4/t)			(kg H_2SO_4/t)	
1260	Stratford East	Sandstone	1.22	70	-33	7.6	0	0	7.9	0.0	0	8.1	0	0	8.2	0	0
1264	Stratford East	Sandstone	1.23	34	4	7.3	0	0	5.9	0.0	0	6.3	0	0	7.1	0	0
1269	Stratford East	Sandstone	2.41	85	-11	7.7	0	0	7.2	0.0	0	7.4	0	0	7.8	0	0

KEY:

NAGpH = pH of NAG liquor

$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)

$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

Table 5: Multi-element composition of selected sample solids (mg/kg except where shown).

Element	Detection Limit	Project Area/Lithology/Sample Number																						
		Roseville West														Stratford East								
		Siltstone	Siltstone	Sandstone	Carb Siltstone	Siltstone	Carb Claystone	Claystone	Carb Claystone	Sandstone	Carb Siltstone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Sandstone	Sandstone	Sandstone	Siltstone	Carb Siltstone	Siltstone	Sandstone	Sandstone
		45028	45072	45093	45119	45178	863	865	884	885	967	997	1023	1058	1067	1256	1262	1263	1265	1268	1280	1285	1290	1320
Ag	0.01	0.25	0.05	0.05	0.44	0.07	0.30	0.08	0.18	0.04	0.06	0.06	0.05	0.07	0.05	0.06	0.07	0.07	0.07	0.12	0.09	0.07	0.07	0.02
Al	0.01%	7.01%	7.47%	7.01%	6.88%	8.95%	8.34%	7.84%	7.25%	7.46%	5.59%	8.80%	8.64%	6.72%	7.05%	8.31%	6.86%	7.06%	7.48%	9.20%	8.48%	7.76%	9.28%	7.79%
As	0.2	7.6	5.7	6.6	181.0	7.9	6.8	11.5	2.6	4.3	6.2	16.5	6.7	7.8	15.8	5.2	6.4	7.8	7.4	10.6	10.8	6.0	22.3	2.6
Ba	10	970	340	330	610	800	300	1430	430	240	240	610	320	460	530	550	260	280	220	150	270	380	730	400
Be	0.05	1.72	2.31	1.77	1.92	2.53	1.88	2.18	1.84	1.55	1.51	2.37	2.35	1.52	2.31	2.48	1.51	1.72	1.74	1.97	1.74	1.83	1.43	1.64
Bi	0.01	0.28	0.33	0.29	0.45	0.42	0.42	0.42	0.39	0.24	0.33	0.42	0.31	0.23	0.36	0.13	0.13	0.2	0.19	0.29	0.3	0.18	0.24	0.22
Ca	0.01%	0.23%	0.58%	1.01%	0.22%	0.33%	0.24%	0.41%	0.23%	0.71%	0.53%	0.70%	1.82%	1.65%	0.23%	0.54%	6.33%	0.95%	1.67%	2.06%	1.13%	2.44%	0.29%	0.56%
Cd	0.02	0.05	0.11	0.11	0.12	0.15	0.17	0.11	0.13	0.08	0.06	0.14	0.11	0.08	0.15	0.11	0.13	0.09	0.1	0.24	0.13	0.14	0.13	0.07
Ce	0.01	38.6	68	54.9	46.9	86.5	73.2	74.5	35	59.2	36.8	82.1	71.3	51.1	58.4	53	50.6	48.8	48.9	68.9	62.4	53.7	77	79.3
Co	0.1	4.1	10.4	7.3	5.7	6.8	8.2	10.3	2.1	3	3.5	10.7	9.3	9.7	9.7	16.1	8.7	9.9	9.5	10.8	10.3	14.1	12.1	3.9
Cr	1	49	23	28	23	28	21	23	23	27	22	30	33	37	34	62	63	48	52	73	58	71	60	38
Cs	0.05	8.68	8.74	7.42	12.1	12.5	11.95	11	12.45	5.79	7.93	11.5	9.43	6.78	9.15	8.43	8	7.62	7.74	10.15	7.62	5.02	5.34	6.83
Cu	0.2	22.9	12.2	11.1	15	16.3	17	15.2	12.7	9.5	13.8	15.6	13.5	10.7	13.5	11.5	12.7	13.8	13.3	20.4	19.6	27.7	20.7	8.7
Fe	0.01%	3.39%	5.49%	2.23%	2.87%	2.51%	2.21%	6.37%	0.88%	0.95%	1.40%	5.22%	3.41%	4.05%	1.05%	2.31%	3.11%	3.37%	3.33%	4.70%	4.28%	7.46%	3.77%	1.50%
Ga	0.05	19.25	20.5	20.7	22.2	26.2	23.8	22.3	22.6	20.8	18.45	24.4	22.5	16.7	22.2	18.65	16.65	19.9	20	22.5	20.8	19.1	23.2	19.9
Ge	0.05	0.07	0.17	0.14	0.07	0.14	0.09	0.18	0.07	0.14	<0.05	0.14	0.15	0.09	0.13	0.12	0.16	0.19	0.16	0.21	0.21	0.24	0.21	0.14
Hf	0.1	3	3.2	3.1	3.3	4	3.4	3.6	3.2	3.2	2.7	3.9	3.6	2.4	3.5	2.7	3	3.7	3.6	4.2	3.9	3	4.5	4.8
Hg	0.005	0.023	0.02	0.031	0.081	0.019	0.048	0.032	0.049	0.03	0.017	0.029	0.016	0.014	0.03	0.005	0.021	0.026	0.024	0.043	0.045	0.015	0.217	0.015
In	0.005	0.064	0.064	0.058	0.068	0.08	0.074	0.072	0.067	0.05	0.059	0.076	0.063	0.043	0.071	0.042	0.052	0.062	0.059	0.077	0.071	0.06	0.079	0.058
K	0.01%	1.82%	2.33%	2.22%	2.63%	2.80%	2.33%	2.36%	2.56%	1.89%	1.82%	2.63%	2.48%	1.84%	2.62%	3.15%	2.04%	2.31%	1.99%	1.62%	1.81%	1.19%	1.01%	2.46%
La	1	16.9	33.5	26.6	19.7	42.2	31.6	35.2	15.1	30	16.8	40.7	35.9	23.5	26.7	25.3	23.7	21.1	21.6	31.9	28.8	24.7	38.1	35.7
Li	0.2	43.3	16	29.6	16.5	30	37.2	22.1	21.1	43.3	25.5	44.9	20	32.6	14.8	12.6	30.3	37.7	42	63.8	40.6	34.7	49.3	13.7
Mg	0.01%	0.58%	0.59%	0.56%	0.48%	0.65%	0.55%	0.59%	0.31%	0.38%	0.36%	0.66%	0.68%	0.56%	0.31%	0.51%	0.56%	0.68%	0.61%	0.61%	0.62%	0.92%	0.27%	0.33%
Mn	5	323	668	260	122	141	161	996	47	91	120	1340	670	1185	119	357	1100	210	252	337	230	1800	277	179
Mo	0.05	0.61	1.3	1.12	1.51	0.97	1.49	1.16	0.98	0.74	0.87	1.44	1.57	1.12	1.37	2.64	1.74	1.18	1.29	1.07	1.27	1.31	2.12	0.77
Na	0.01%	0.14%	0.90%	1.24%	0.54%	1.04%	0.43%	0.49%	0.47%	1.42%	0.25%	0.92%	1.61%	1.19%	0.87%	1.33%	0.66%	0.69%	0.53%	0.21%	0.34%	0.49%	0.05%	0.83%
Nb	0.1	8.5	8.3	8.1	9.7	10.5	9.5	9.2	10.1	8	8.4	10.1	9.2	7.1	9.2	5.7	6.7	7.7	7.1	8.6	8.1	11.4	8.4	9.1
Ni	0.2	15.8	11.5	9.5	11.1	12.2	11.7	12.9	7.5	5.9	8.6	14.5	13.2	10.2	11.2	29.7	21.2	18.5	18.5	24.4	23.8	34.7	31.2	8.1
P	10	450	830	330	200	310	400	560	150	300	570	590	370	370	260	270	390	450	450	430	480	920	350	110
Pb	0.5	17.8	19	19.3	25.3	26	24	20.6	21.3	17.6	17.7	23.4	20.7	17.8	21	14.9	12.5	15.1	15.2	19.8	20.4	13.5	17.3	17.2
Rb	0.1	86.4	134.5	116.5	124	159.5	137.5	144	124	101.5	73.6	158.5	141	84.1	137	147	103	101	89.7	95.5	102.5	61.2	60.5	117
Re	0.002	0.004	0.002	<0.002	0.002	0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002	0.002	<0.002	<0.002	0.007	0.004	0.003	0.004	0.003	0.004	0.003	0.003	0.002
S	0.01%	0.11%	0.04%	0.05%	0.71%	0.03%	0.19%	0.12%	0.05%	0.02%	0.12%	0.09%	0.08%	0.04%	0.05%	0.72%	1.16%	1.40%	1.45%	2.49%	1.66%	1.08%	2.33%	0.04%
Sb	0.05	0.66	0.62	0.6	1.13	0.77	0.76	0.72	0.78	0.48	0.65	0.86	0.83	0.77	0.7	0.52	0.52	0.61	0.55	0.55	0.61	0.46	0.7	0.48
Sc	0.1	13.2	12.3	10.1	12.5	15.8	14.8	15.1	11.6	9.4	9.4	14.7	13.1	8.7	11.2	10.6	11.1	11.9	12.6	17	15.2	14.6	14.5	8.9
Se	1	1	1	1	<1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	4	1
Sn	0.2	2.9	2.7	2.6	3.4	3.5	3.3	3.1	3.4	2.4	2.9	3.2	2.8	2.3	3	2	2.1	2.6	2.4	3	2.9	2.2	3.3	3.6
Sr	0.2	181.5	176.5	230	259	281	189.5	160.5	118	219	99.4	275	289	363	207	137	146.5	121.5	134.5	140.5	100.5	214	83.9	108.5
Ta	0.05	0.72	0.77	0.8	0.88	1.01	0.94	0.9	0.89	0.75	0.76	0.94	0.84	0.61	0.88	0.51	0.56	0.66	0.64	0.73	0.7	0.85	0.73	0.8
Te	0.05	<0.05	<0.05	0.06	0.15	0.05	<0.05	<0.05	<0.05	0.05	0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.07	0.06	<0.05
Th	0.2	7.9	13.4	12.1	9.4	16.8	14.6	15.2	9.6	13.2	7.9	16.5	14.7	10.1	12.7	9.5	8.9	8.9	9.2	12.6	11.8	9.1	11.9	13.8
Ti	0.005%	0.41%	0.34%	0.33%	0.37%	0.45%	0.38%	0.38%	0.40%	0.32%	0.33%	0.39%	0.37%	0.27%	0.39%	0.32%	0.35%	0.42%	0.42%	0.49%	0.44%	0.50%	0.49%	0.34%
Tl	0.02	0.55	0.56	0.61	1.67	0.69	0.78	0.64	0.66	0.46	0.64	0.76	0.62	0.51	0.74	0.83	0.47	0.46	0.43	0.63	0.51	0.53	0.66	0.5
U	0.10	2.2	3.7	3.7	3.8	4.7	4.5	4.3	3.4	3.6	3	4.5	3.9	2.9	4.1	2.7	2.2	2.5	2.5	2.6	2.5	2	2.6	3.4
V	1	93	67	62	90	85	79	80	85	55	72	83	78	57	71	76	74	98	95	125	110	115	104	46
W	0.1	1.7	1.9	1.9	2.1	2.4	2.3	2.2	2.2	1.8	1.9	2.3	2.1	1.5	2	1.3	1.3	1.6	1.5	1.8	1.7	1.4	2.5	1.8
Y	0.1	16.6	29.5	21.2	20.5	32.8	26.1	31.2	14.8	19.7	16	31.7	27.2	19	19.6	21.8	19.5	20.4	19.5	30.7	25.5	24.2	26.2	27.3
Zn	2	76	73	69	89	105	91	80	84	65	65	98	81	67	84	109	61	83	80	104	92	74	73	47
Zr	0.5	105	97.8	94.7	104.5	122	99.7	108.5	102.5	96.2	83.5	122	115.5	74.2	102.5	94.2	105.5	125	120	145.5	135.5	109.5	153	148.5

< element at or below analytical detection limit.

Table 6: Geochemical abundance indices (GAI) of selected sample solids. Values 3 and over are highlighted in yellow.

Element	Median Soil Abundance*	Project Area/Lithology/Sample Number																						
		Roseville West														Stratford East								
		Siltstone	Siltstone	Sandstone	Carb Siltstone	Siltstone	Carb Claystone	Claystone	Carb Claystone	Sandstone	Carb Siltstone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Sandstone	Sandstone	Sandstone	Siltstone	Carb Siltstone	Siltstone	Sandstone	Sandstone
		45028	45072	45093	45119	45178	863	865	884	885	967	997	1023	1058	1067	1256	1262	1263	1265	1268	1280	1285	1290	1320
Ag	0.05	2	-	-	3	-	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Al	7.1%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As	6	-	-	-	4	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	-
Ba	500	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Be	0.3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Bi	0.2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ca	1.5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Cd	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ce	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Co	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cr	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	4	1	1	-	1	1	1	1	1	-	-	1	1	-	1	-	-	-	-	1	-	-	-	-
Cu	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fe	4.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ga	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ge	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hf	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hg	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
In	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K	1.4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
La	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Li	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Mg	0.5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mo	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Na	0.5%	-	-	1	-	-	-	-	-	1	-	-	1	1	-	1	-	-	-	-	-	-	-	-
Nb	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ni	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pb	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rb	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Re																								
S	0.07%	-	-	-	3	-	1	-	-	-	-	-	-	-	-	3	3	4	4	5	4	3	4	-
Sb	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sc	7	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
Se	0.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	3	1
Sn	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sr	250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ta	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te																								
Th	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ti	0.50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tl	0.2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
U	2	-	-	-	-	1	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
V	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Y	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zn	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zr	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table 7: Chemical composition of water extracts.

Parameter		Detection Limit	Project Area/Lithology/Sample Number																						
			Roseville West														Stratford East								
			Siltstone	Siltstone	Sandstone	Carb Siltstone	Siltstone	Carb Claystone	Claystone	Carb Claystone	Sandstone	Carb Siltstone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Sandstone	Sandstone	Sandstone	Siltstone	Carb Siltstone	Siltstone	Sandstone	Sandstone
			45028	45072	45093	45119	45178	863	865	884	885	967	997	1023	1058	1067	1256	1262	1263	1265	1268	1280	1285	1290	1320
pH		0.01	7.5	7.9	6.8	6.5	7.8	5.7	7.4	8.3	8.9	7.8	8.2	7.8	8.8	8.4	4.5	7.4	7.6	7.7	7.5	6.8	7.4	3.7	7.2
EC	dS/m	0.01	0.218	0.114	0.245	0.829	0.121	0.616	0.346	0.148	0.154	0.246	0.161	0.224	0.208	0.234	1.34	1.16	1.12	1.21	1.75	1.24	1.29	1.98	0.169
Alkalinity ($CaCO_3$)	mg/l	1	26	43	46	24	128	44	70	30	73	66	92	63	96	96		35	44	32	65	76	101		27
Acidity ($CaCO_3$)	mg/l																116							702	
Ag	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Al	mg/l	0.01	0.05	0.10	0.01	<0.01	0.42	0.03	0.02	0.19	0.16	0.19	0.18	0.11	0.34	0.18	9.82	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	22.7	0.03
As	mg/l	0.001	0.001	0.004	0.002	<0.001	0.136	<0.001	<0.001	0.009	0.025	0.006	0.007	0.019	0.05	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001
B	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05
Ba	mg/l	0.001	0.356	0.366	0.515	0.075	0.088	0.114	0.34	0.239	0.241	0.301	0.324	0.383	0.182	0.185	0.054	0.114	0.094	0.117	0.093	0.082	0.101	0.067	0.328
Be	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.08	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.013	<0.001
Ca	mg/l	1	4	5	14	5	<1	27	5	<1	1	2	2	4	<1	<1	271	254	217	230	423	368	320	159	7
Cd	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0121	0.0002	<0.0001	<0.0001	0.0001	0.0006	0.0002	0.0089	<0.0001
Cl	mg/l	1	16	19	14	3	9	21	22	15	13	15	14	7	4	8	6	3	4	5	6	2	4	2	3
Co	mg/l	0.001	<0.001	<0.001	<0.001	0.014	<0.001	0.075	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.66	0.022	0.002	<0.001	0.006	0.123	0.018	1.06	0.005
Cr	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011	<0.001
Cu	mg/l	0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.016	0.002	0.002	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.319	0.01	0.008	0.006	0.007	0.004	0.002	0.447	0.003
F	mg/l	0.1	0.3	0.3	0.2	<0.1	0.2	<0.1	<0.4	0.4	0.3	0.4	0.2	0.2	0.2	0.3	1.2	0.3	0.2	0.3	0.2	0.2	0.2	0.8	0.4
Fe	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	7.43	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	25.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	75.7	<0.05
Hg	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
K	mg/l	1	2	5	6	3	1	5	3	1	1	1	2	4	2	2	6	14	13	16	13	18	10	<1	5
Mg	mg/l	1	3	2	4	1	<1	14	2	<1	<1	<1	<1	2	<1	<1	96	27	26	22	33	50	42	75	2
Mn	mg/l	0.001	0.009	0.002	0.008	0.022	<0.001	0.387	0.014	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	26.7	0.585	0.356	0.19	2.17	4.98	2.99	12.6	0.279
Mo	mg/l	0.001	0.001	0.081	0.036	0.001	0.052	<0.001	0.007	0.03	0.026	0.023	0.051	0.037	0.045	0.058	<0.001	0.003	<0.001	0.002	<0.001	<0.001	0.001	<0.001	0.01
Na	mg/l	1	33	26	28	118	43	64	63	24	30	30	33	43	50	38	15	32	37	34	29	24	32	2	20
Ni	mg/l	0.001	<0.001	0.001	<0.001	0.012	<0.001	0.055	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	2.62	0.037	0.003	<0.001	0.017	0.232	0.061	2.51	0.012
P	mg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sb	mg/l	0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	mg/l	0.01	<0.01	0.02	0.01	<0.01	0.02	0.01	0.01	0.02	0.03	0.01	0.02	0.02	0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Si	mg/l	0.1	1.0	13.6	3.8	2.5	12.8	2.03	1.03	2.14	2.96	1.5	2.68	2.38	4.19	3.77	3.7	1.57	1.33	1.71	1.35	1.51	2.08	2.38	2.08
Sn	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SO4	mg/l	1	56	28	56	261	9	229	72	14	12	26	12	46	6	33	1240	742	644	632	1010	1020	830	1300	40
Sr	mg/l	0.001	0.033	0.160	0.407	0.574	0.020	0.311	0.05	0.016	0.021	0.016	0.075	0.11	0.06	0.032	0.711	2.78	2.84	3.22	3.66	2.66	1.7	0.471	0.103
Th	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.004	0.003	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.018	<0.001
U	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.014	<0.001
Zn	mg/l	0.005	0.006	<0.005	<0.005	0.108	<0.005	0.349	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	9.67	0.12	0.04	0.021	0.075	0.137	0.078	4.05	<0.005

< element at or below analytical detection limit.

FIGURES 1 to 37

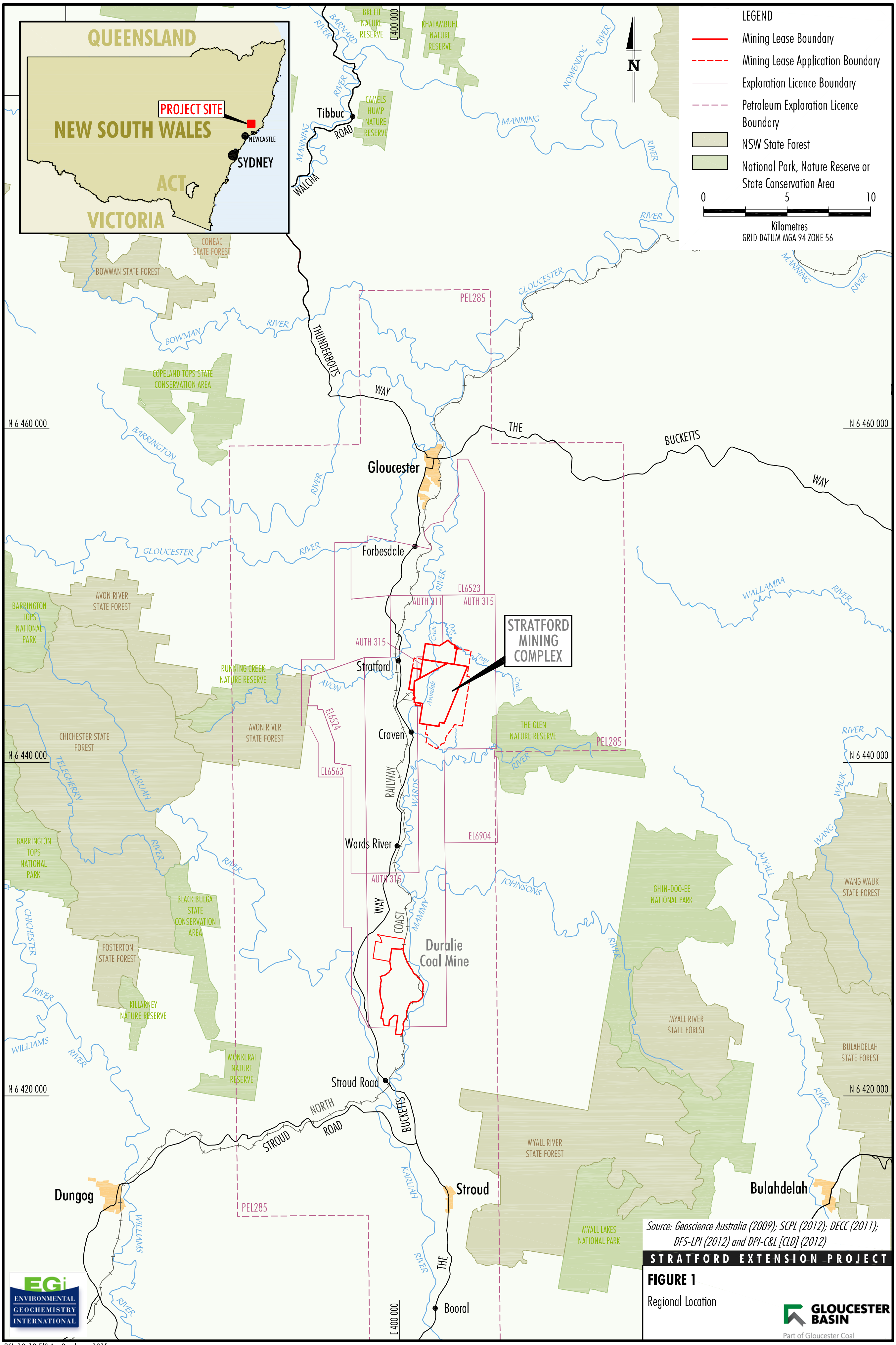


FIGURE 1
Regional Location

GCL-10-12 EIS AppGeochem_101E

BASIN	PERIOD	GROUP	SUB-GROUP	FORMATION	COAL SEAMS
GLOUCESTER	PERMIAN	GLOUCESTER COAL MEASURES	CRAVEN	Crowthers Road	[*Conglomerate*]
				Woods Road (Leloma)	*Linden, Marker (M6,M7[2]), Bindaboo[1,2], Deards[1,2]*
				Bucketts Way (Jilleon)	*Cloverdale[1,2], Roseville[1,2], Marker (M3, M8, M1)[1]*
				Wards River	[*Conglomerate*]
				Wenham	*Bowens Road[1,2], Bowens Road Lower[1]*
			SPELDON FORMATION		
			AVON	*Dog Trap Creek*	*Glenview, Marker 2*
				Waukivory Creek	*Avon[1,2], Triple[1], Rombo, Glen Road, Valley View, Parkers Road*
		DEWRANG GROUP		*Mammy Johnsons*	*Mammy Johnsons*
				Weismantel	*Weismantel*
				Duralie Road	*Cheer-up[2], Clareval[2]*
		ALUM MOUNTAIN VOLCANICS			

[1] Coal reserves currently/previously mined at the Stratford Mining Complex
[2] Coal reserves to be mined by the Project

Source: Tamplin Resources (2010), Stratford Coal (1994) and SCPL (2012)

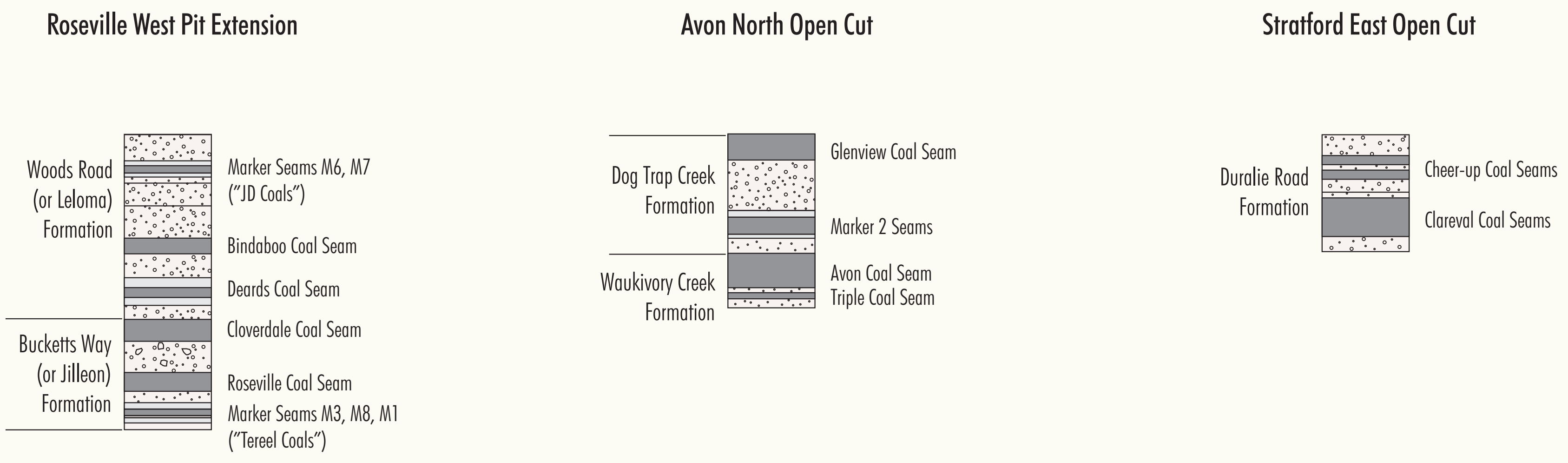
STRATFORD EXTENSION PROJECT

FIGURE 2
Stratigraphic Units of the Project Area

EGi ENVIRONMENTAL GEOCHEMISTRY INTERNATIONAL

GLOUCESTER BASIN
Part of Gloucester Coal

GCL-10-02 EIS AppGeochem_001G



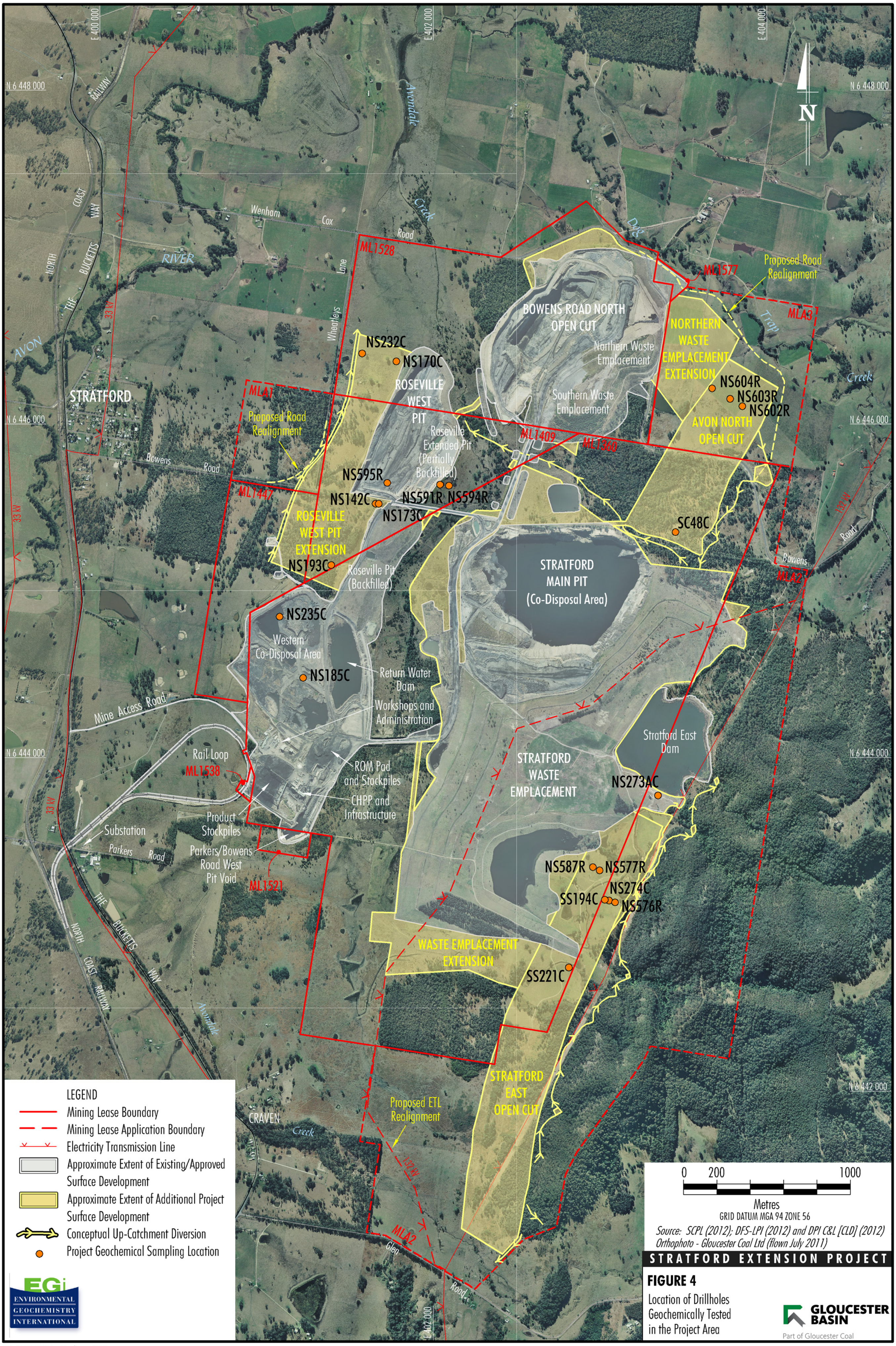
ENVIRONMENTAL GEOCHEMISTRY INTERNATIONAL

STRATFORD EXTENSION PROJECT

FIGURE 3
Stratigraphic Units of the Project Open Cuts

GLOUCESTER BASIN
Part of Gloucester Coal

GCL-10-02 EIS AppGeochem_002D



STRATFORD EXTENSION PROJECT

FIGURE 4

Location of Drillholes Geochemically Tested in the Project Area

GCL-10-12 EIS AppGeochem_102D

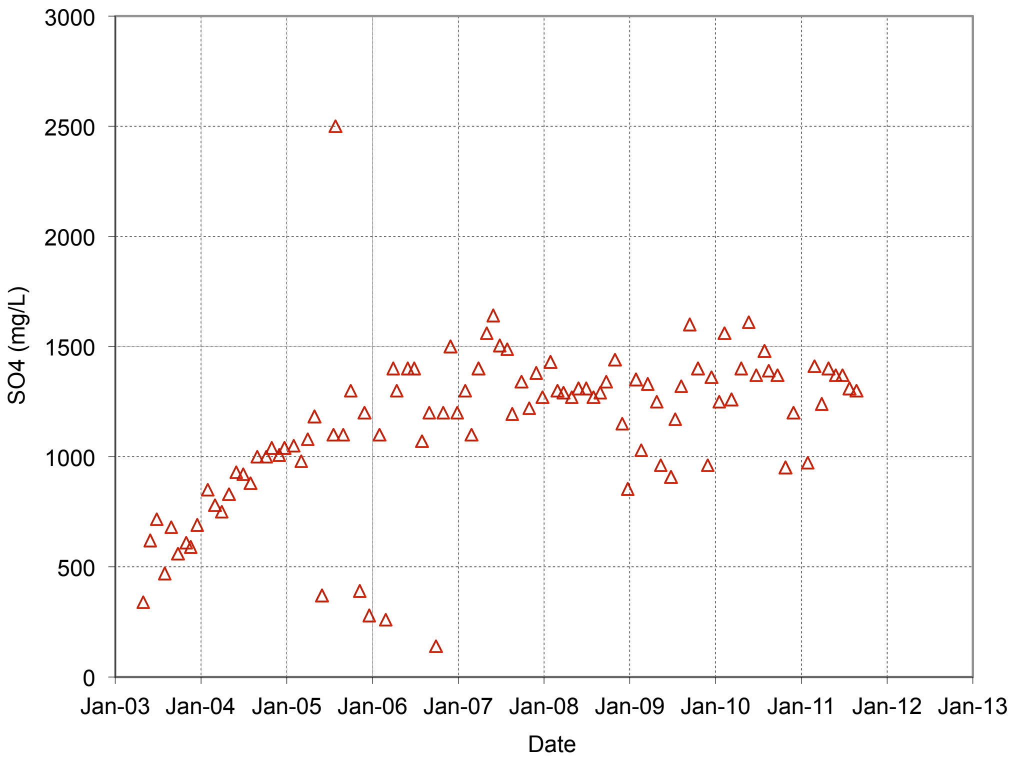


Figure 5: Results of SO_4 water quality monitoring of the Stratford Main Pit.

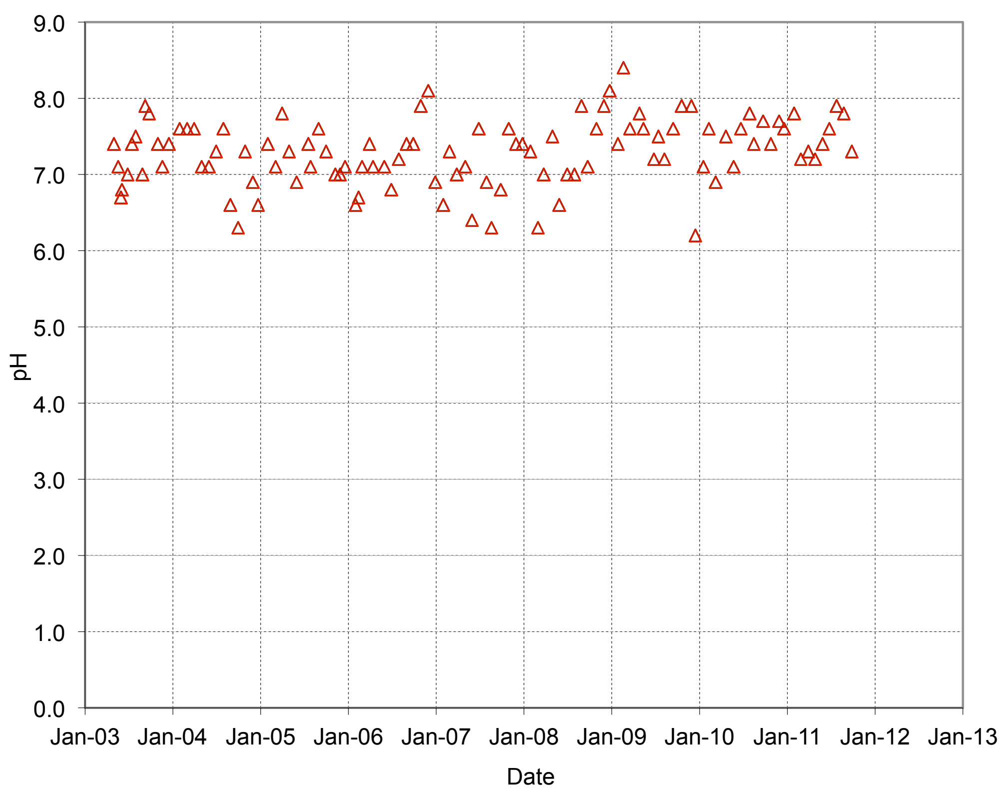


Figure 6: Results of pH water quality monitoring of the Stratford Main Pit.

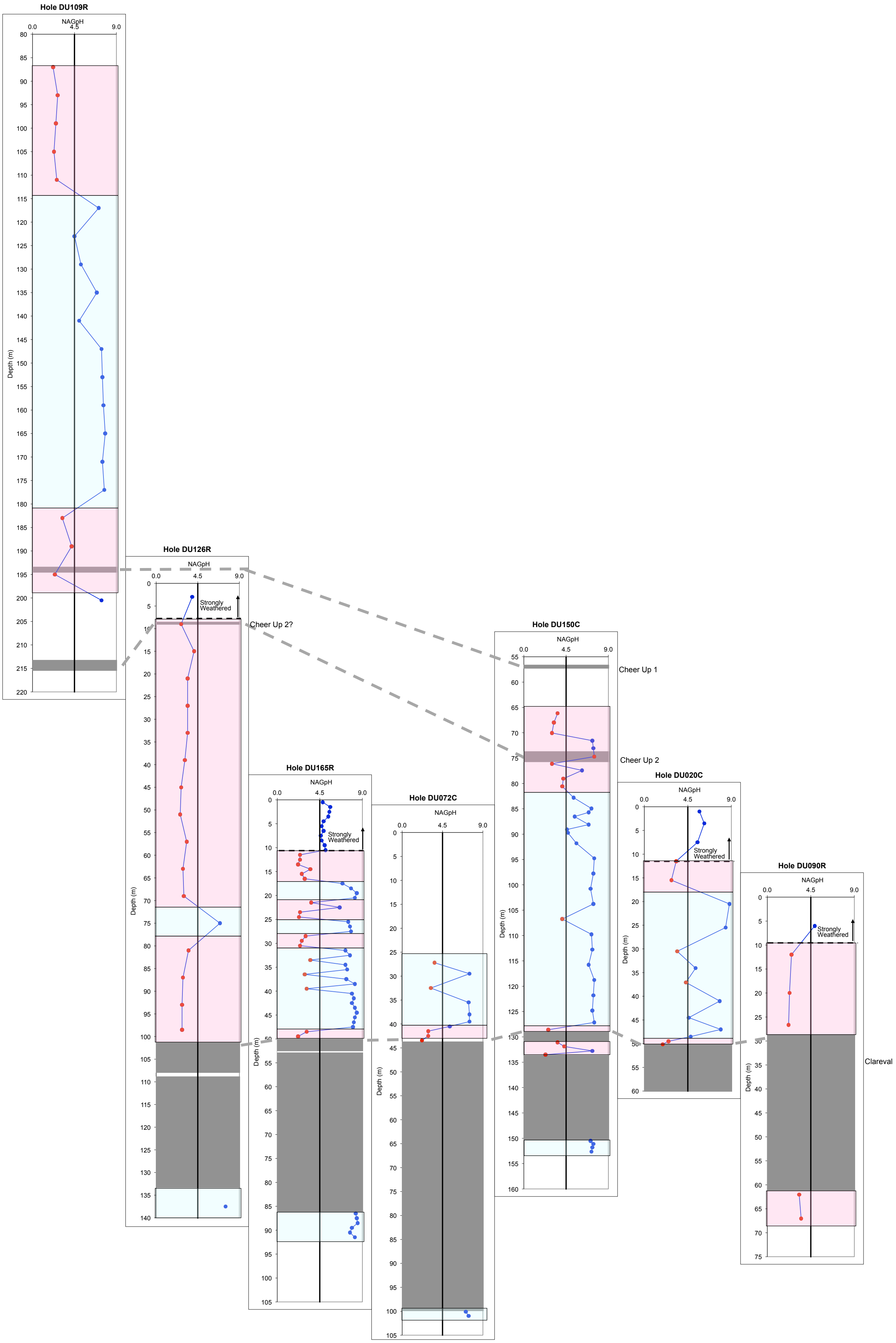


Figure 7: Plot of NAGpH profiles for the Clareval Seam drillholes. PAF and PAF-LC samples are shown as red symbols, and approximate zones of NAF are shown as blue shading and PAF as pink shading.

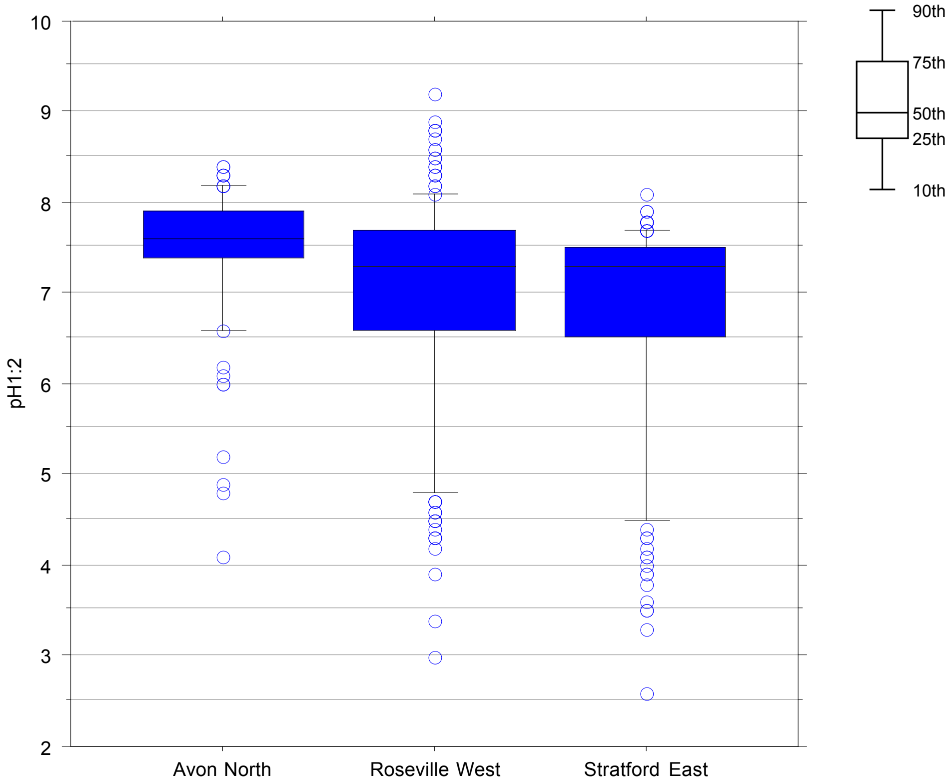


Figure 8: Box plot showing the distribution of $pH_{1:2}$ split by Project open cut. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

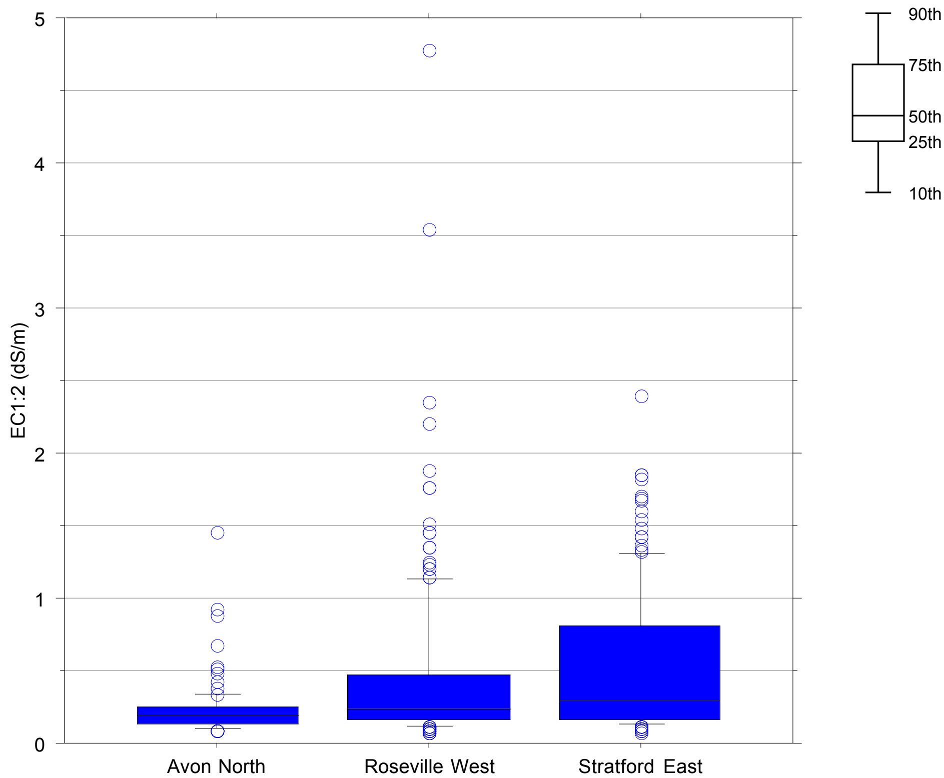


Figure 9: Box plot showing the distribution of $EC_{1:2}$ split by Project open cut. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

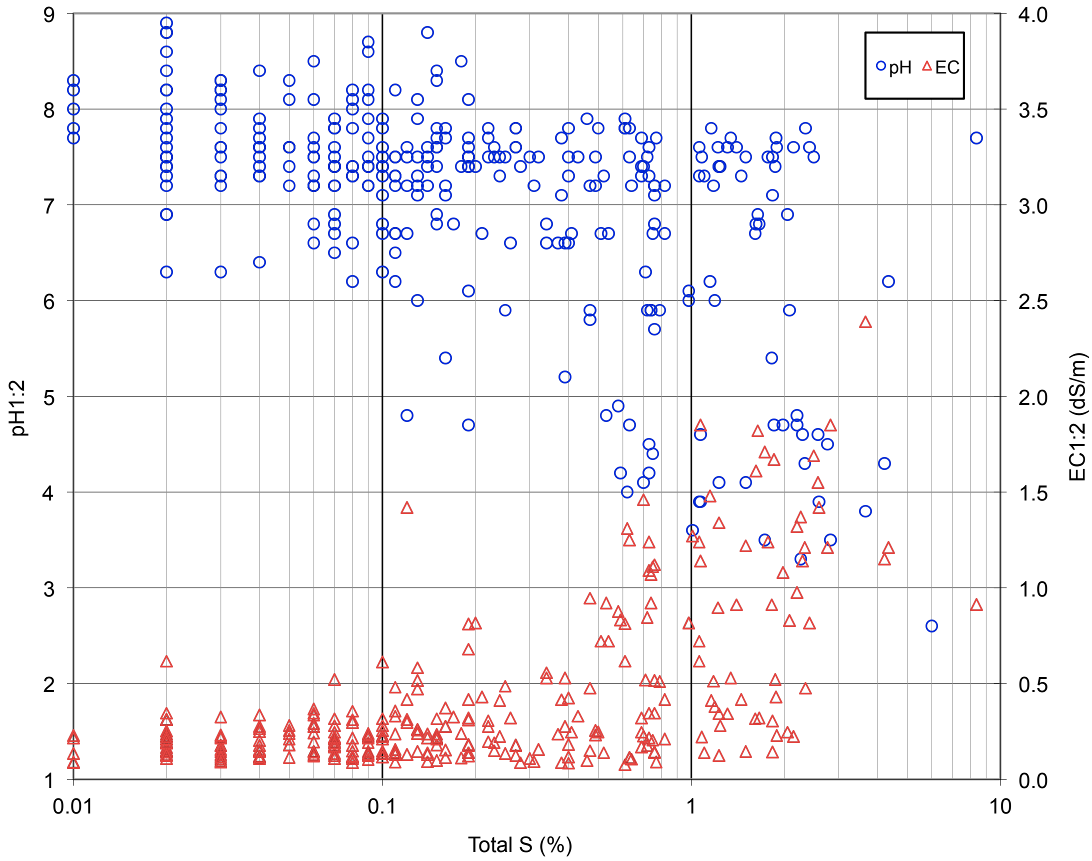


Figure 10: Plot showing $pH_{1:2}$ and $EC_{1:2}$ versus total S.

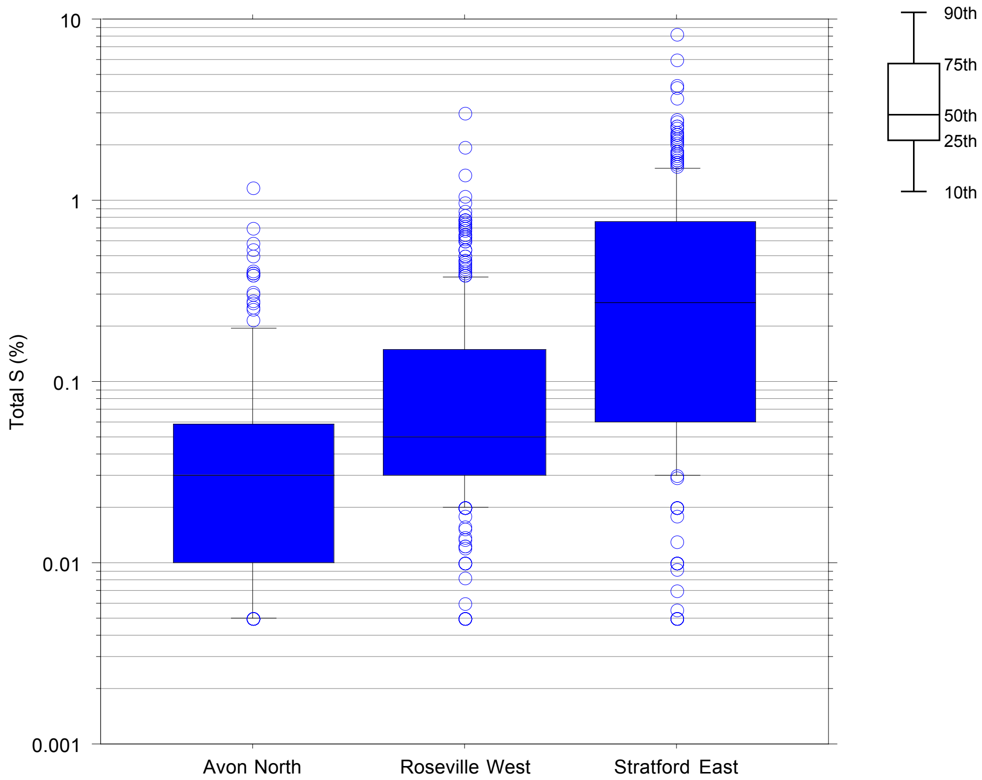


Figure 11: Box plot showing the distribution of S split by Project open cut. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

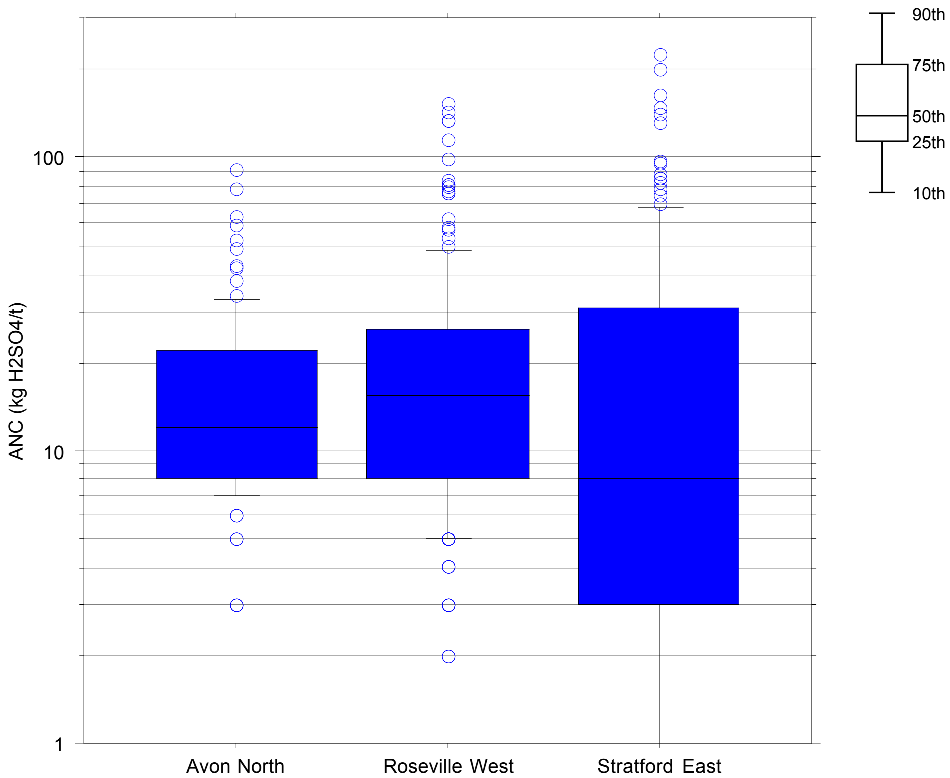


Figure 12: Box plot showing the distribution of ANC split by Project open cut. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

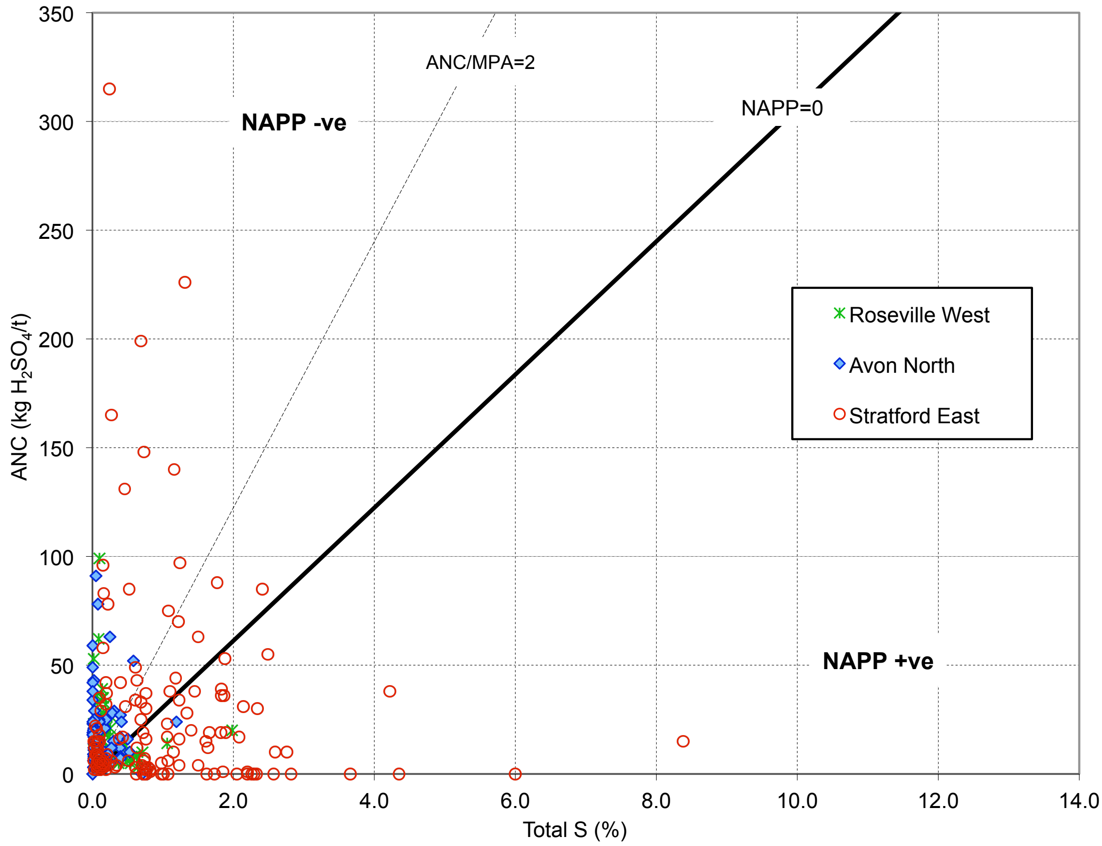


Figure13: Acid-base account (ABA) plot showing ANC versus total S split by Project open cut.

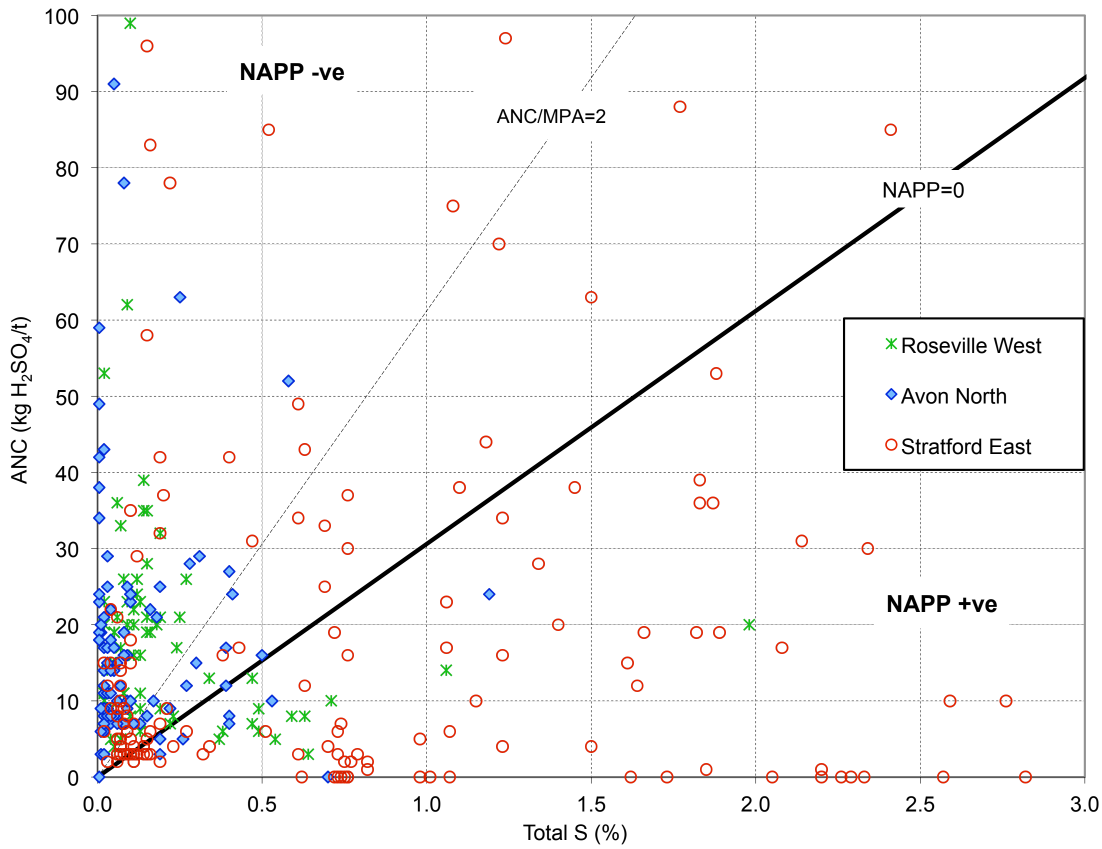


Figure 14: As for Figure 13 with expanded axes.

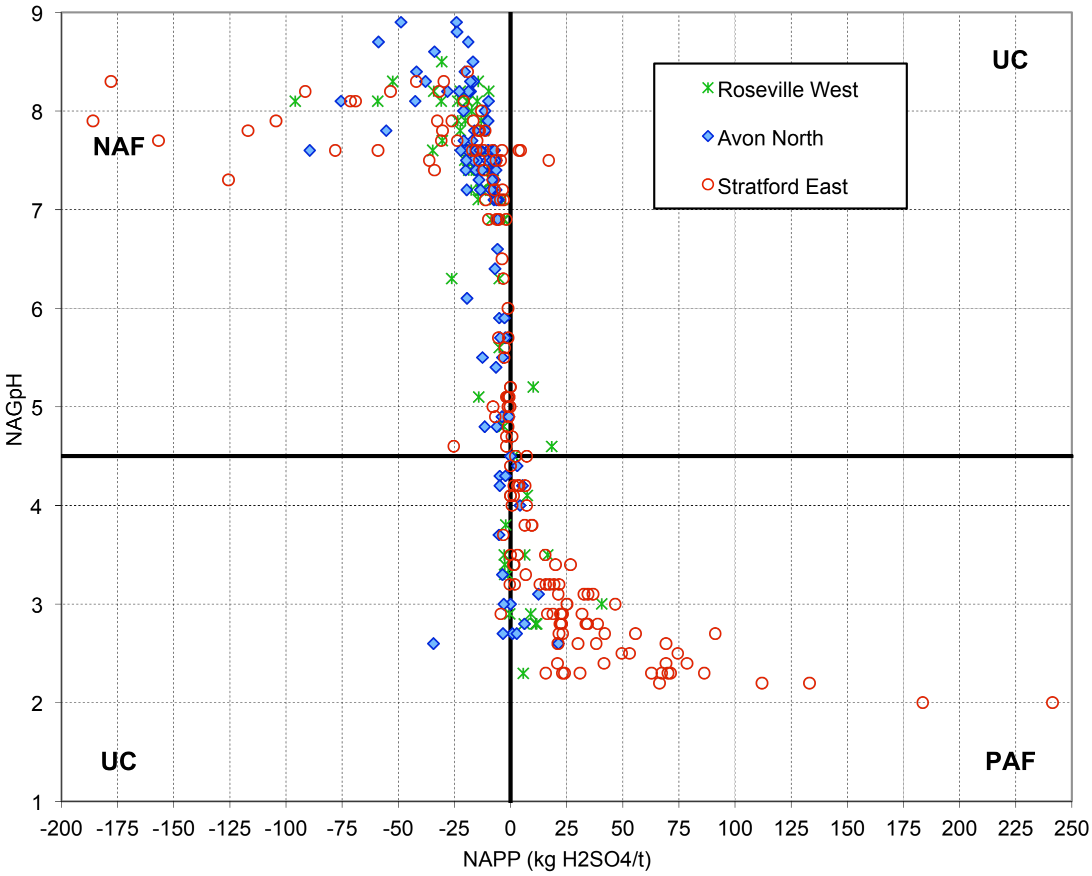


Figure 15: ARD classification plot showing NAGpH versus NAPP split by Project open cut, with ARD classification domains indicated.

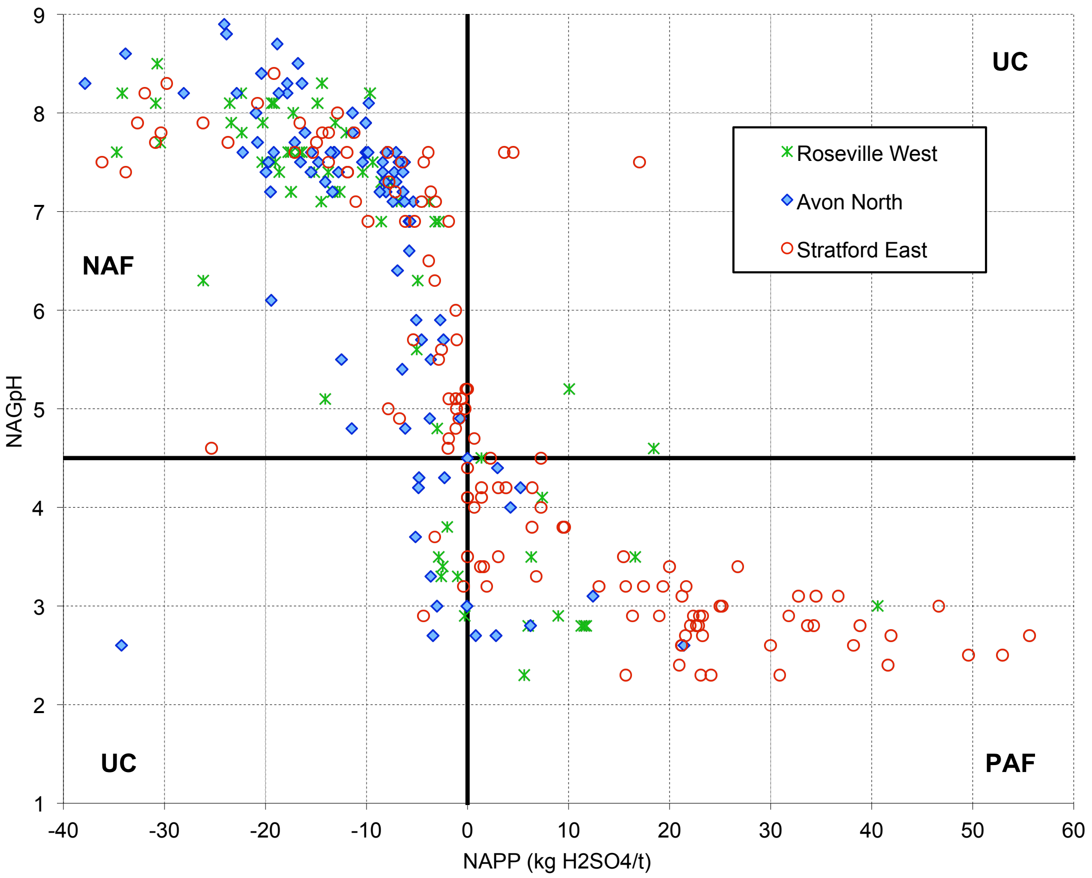


Figure 16: As for Figure 15 with an expanded NAPP axis.

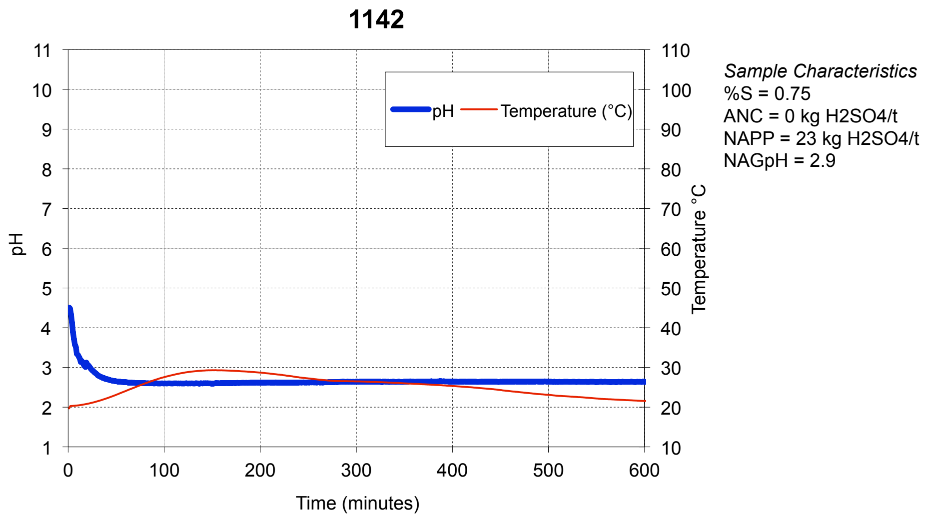


Figure 17: Kinetic NAG graph for Stratford East Open Cut sample 1142.

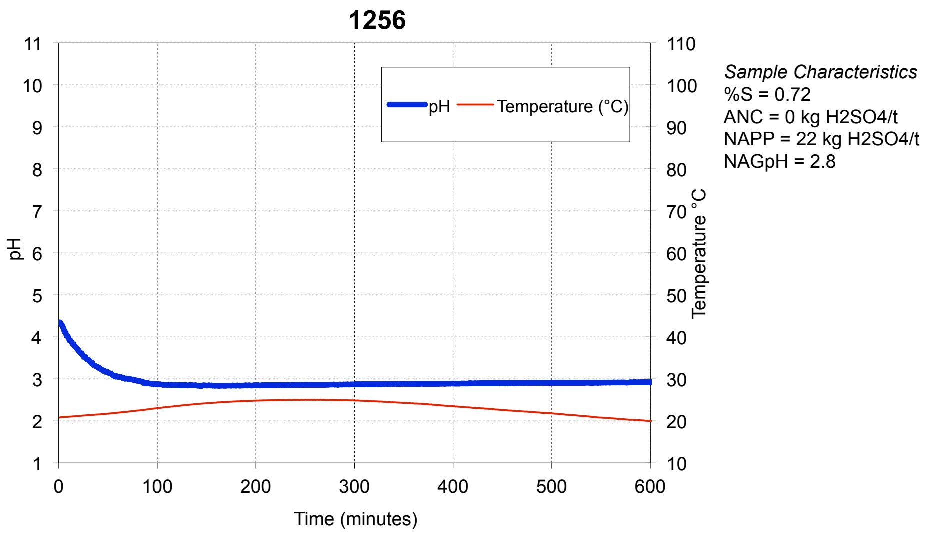


Figure 18: Kinetic NAG graph for Stratford East Open Cut sample 1256.

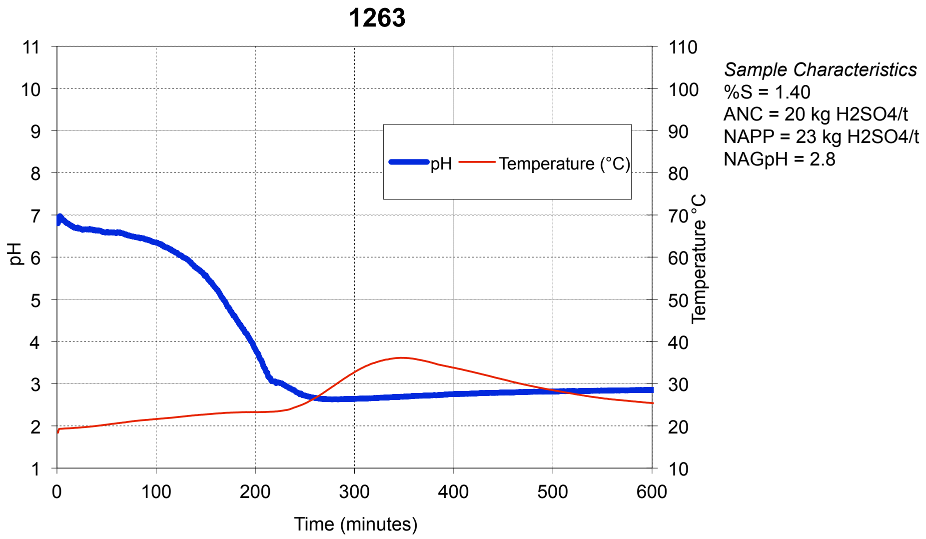
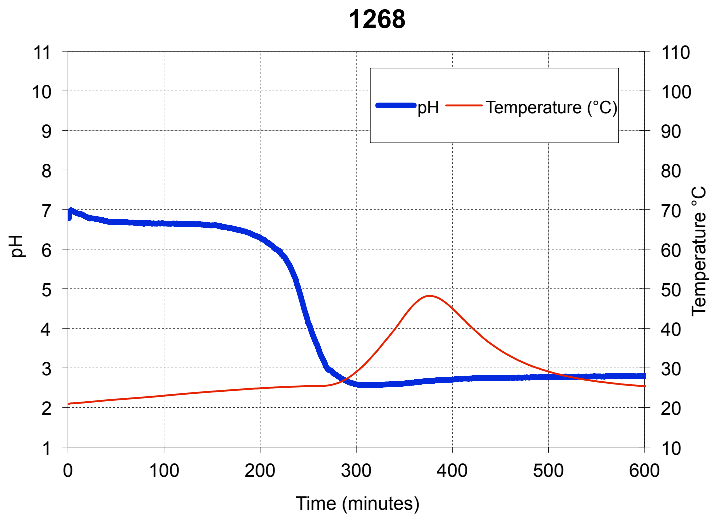
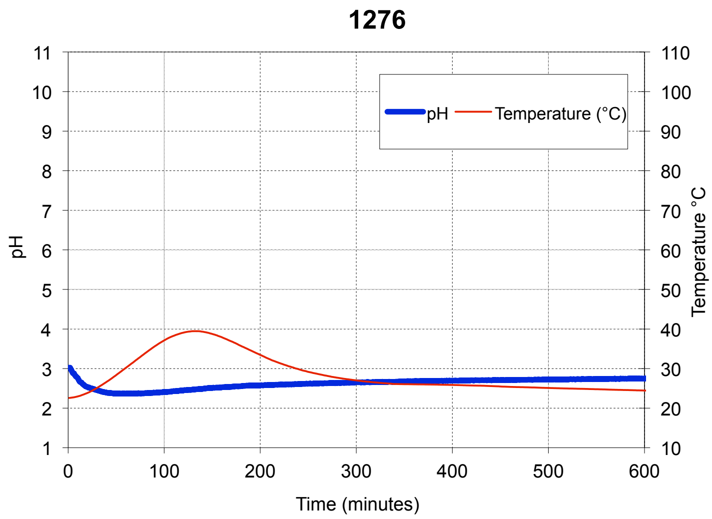


Figure 19: Kinetic NAG graph for Stratford East Open Cut sample 1263.



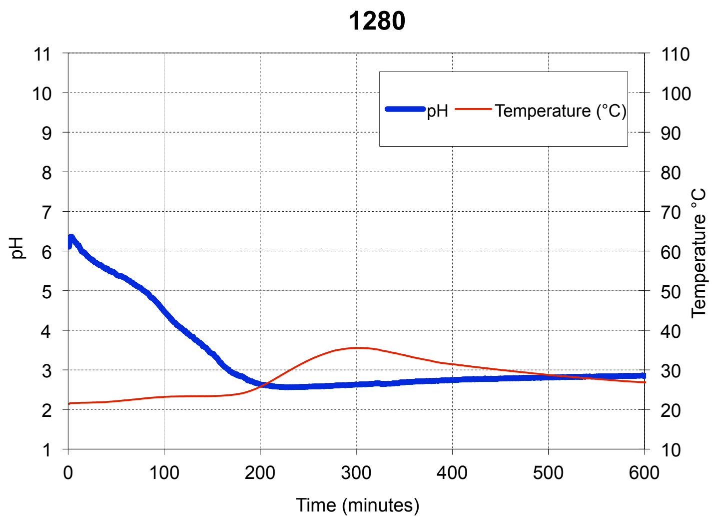
Sample Characteristics
%S = 2.49
ANC = 55 kg H2SO4/t
NAPP = 21 kg H2SO4/t
NAGpH = 2.6

Figure 20: Kinetic NAG graph for Stratford East Open Cut sample 1268.



Sample Characteristics
%S = 1.85
ANC = 1 kg H2SO4/t
NAPP = 56 kg H2SO4/t
NAGpH = 2.7

Figure 21: Kinetic NAG graph for Stratford East Open Cut sample 1276.



Sample Characteristics
%S = 1.66
ANC = 19 kg H2SO4/t
NAPP = 32 kg H2SO4/t
NAGpH = 2.9

Figure 22: Kinetic NAG graph for Stratford East Open Cut sample 1280.

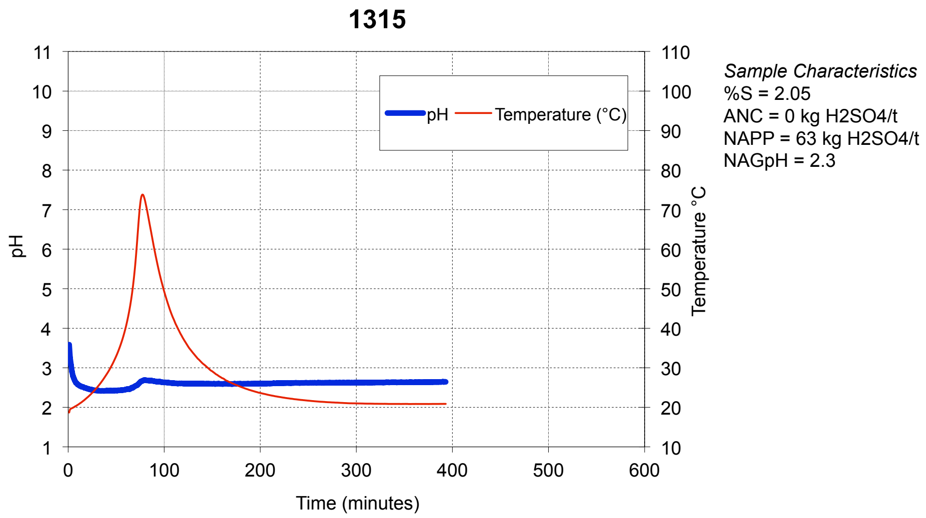


Figure 23: Kinetic NAG graph for Stratford East Open Cut sample 1315.

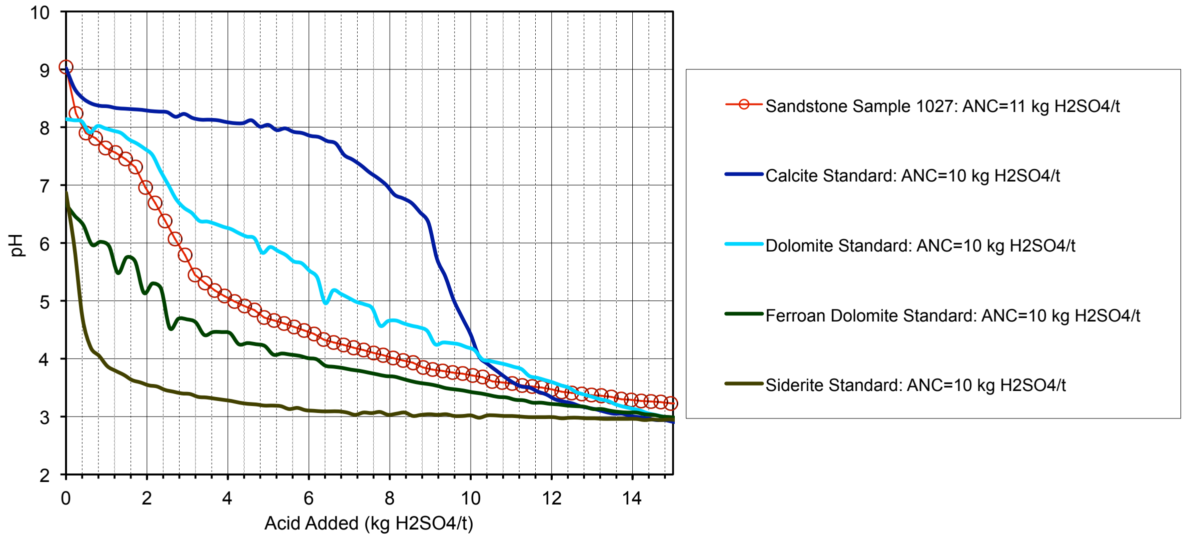


Figure 24: ABCC profile for sample 1027 with an ANC value close to 10 kg H_2SO_4/t. Carbonate standard curves are included for reference.

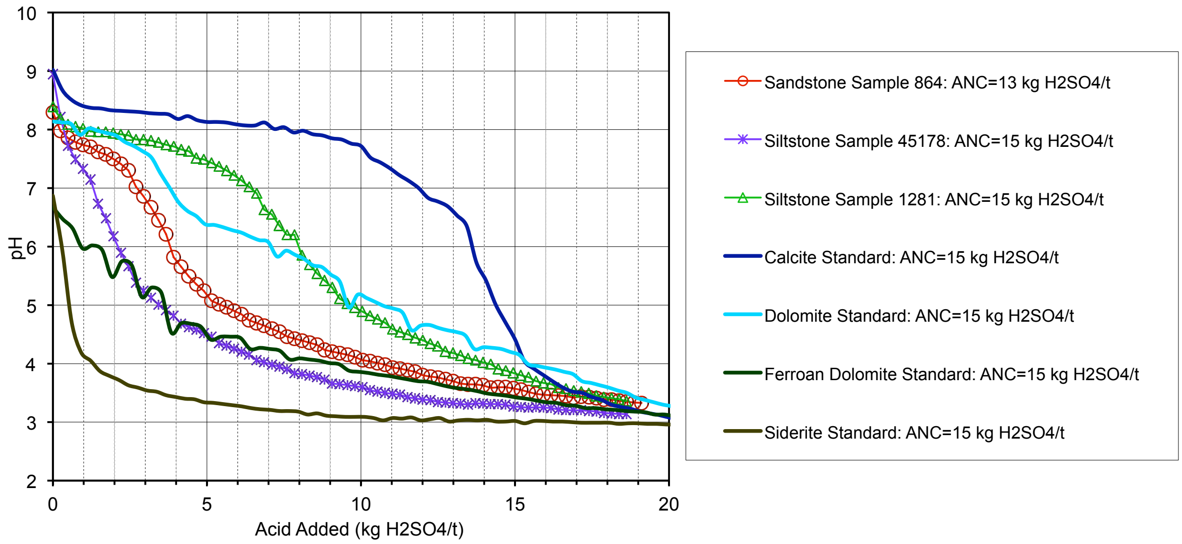


Figure 25: ABCC profile for samples with an ANC value of 15 kg H_2SO_4/t. Carbonate standard curves are included for reference.

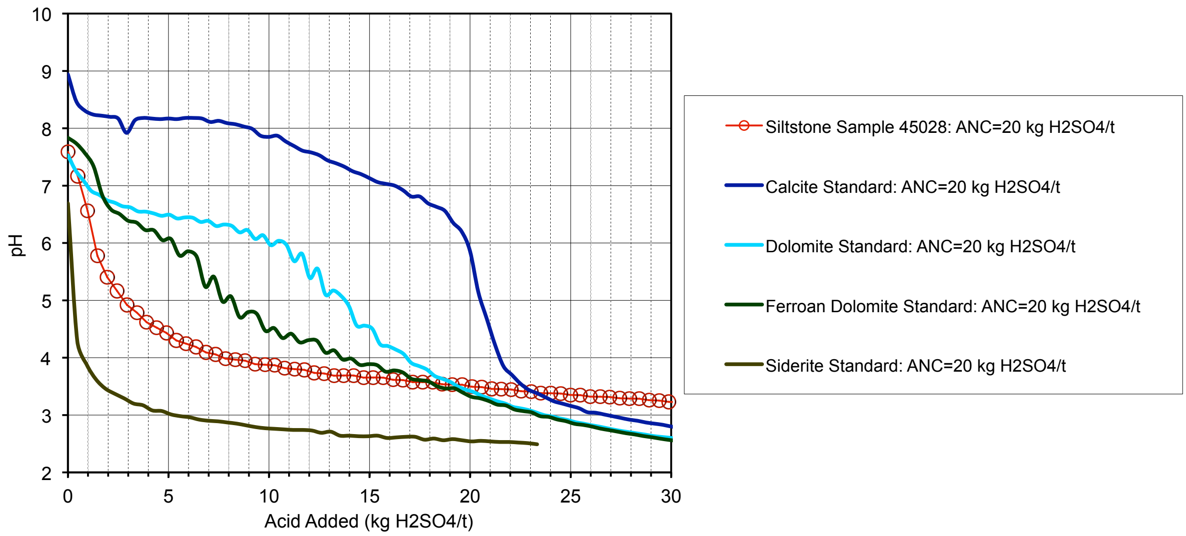


Figure 26: ABCC profile for sample 45028 with an ANC value close to 20 kg H_2SO_4/t. Carbonate standard curves are included for reference.

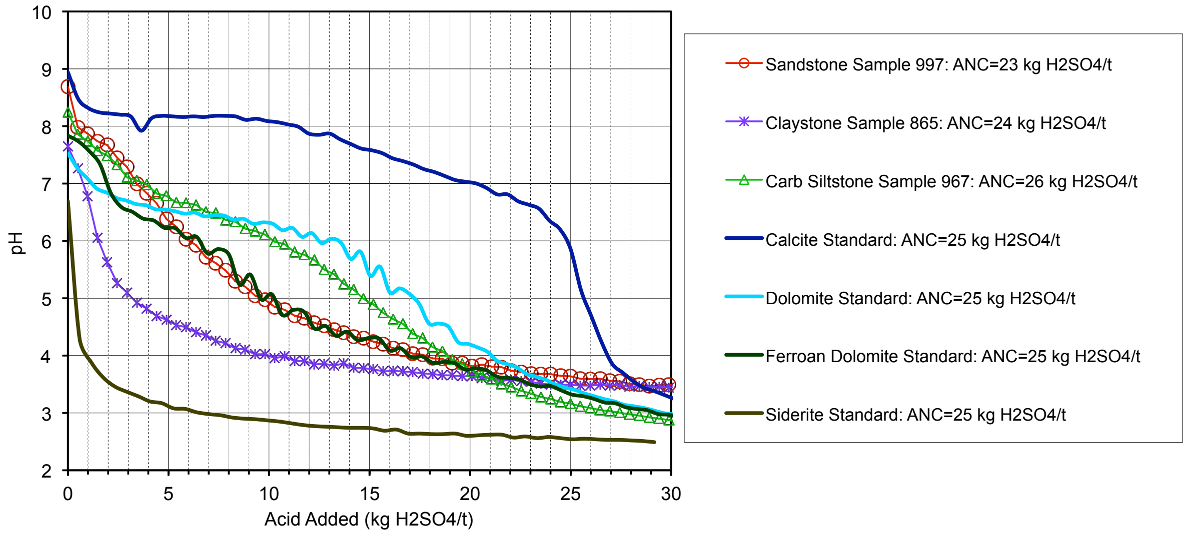


Figure 27: ABCC profile for samples with an ANC value close to 25 kg H_2SO_4/t. Carbonate standard curves are included for reference.

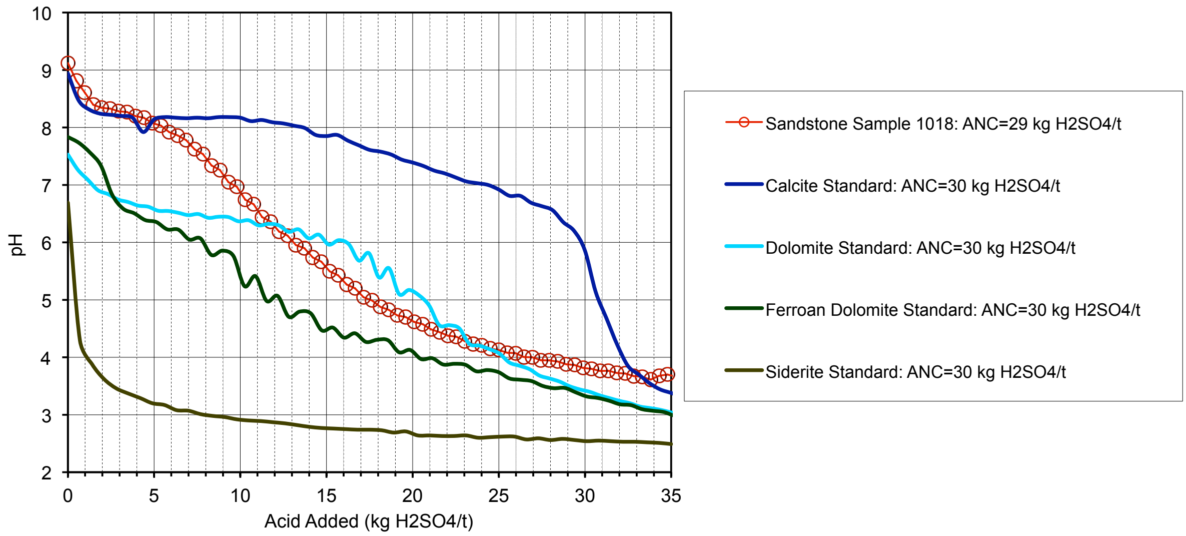


Figure 28: ABCC profile for sample 1018 with an ANC value close to 30 kg H_2SO_4/t. Carbonate standard curves are included for reference.

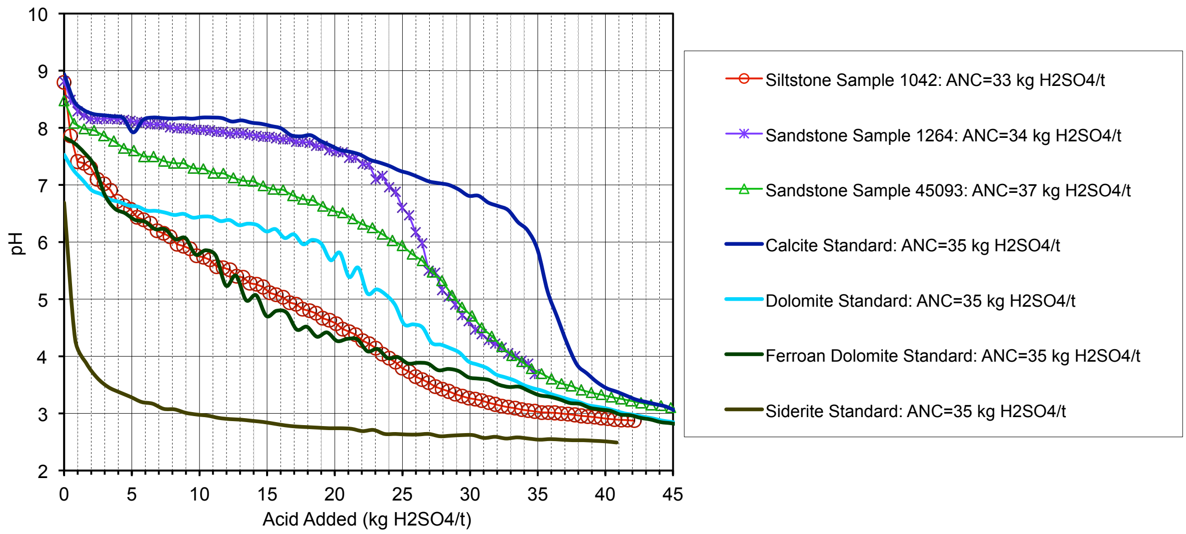


Figure 29: ABCC profile for samples with an ANC value close to 35 kg H_2SO_4/t. Carbonate standard curves are included for reference.

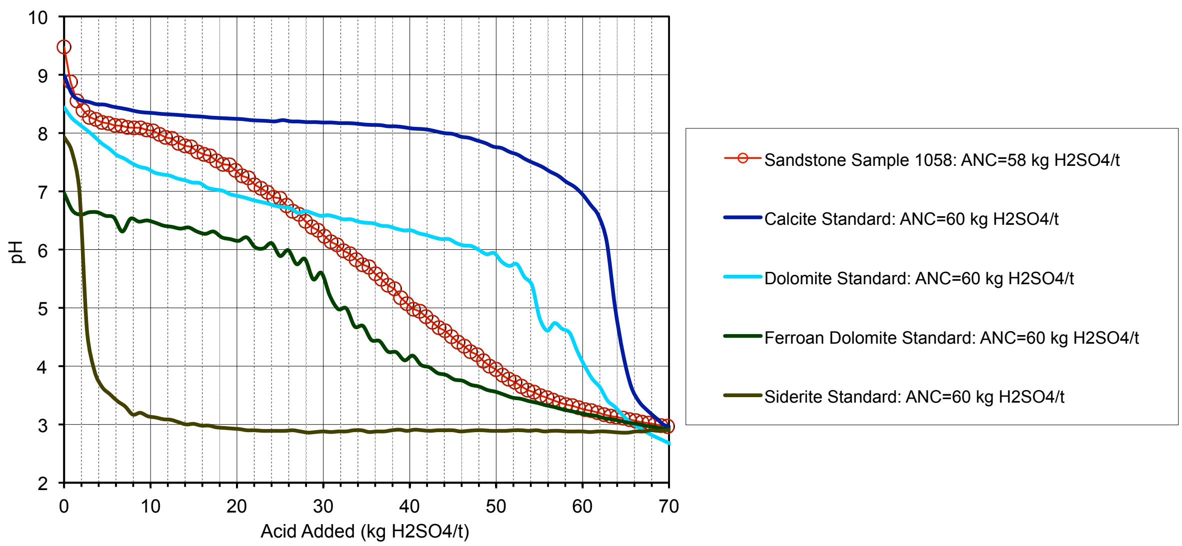


Figure 30: ABCC profile for sample 1058 with an ANC value close to 60 kg H_2SO_4/t. Carbonate standard curves are included for reference.

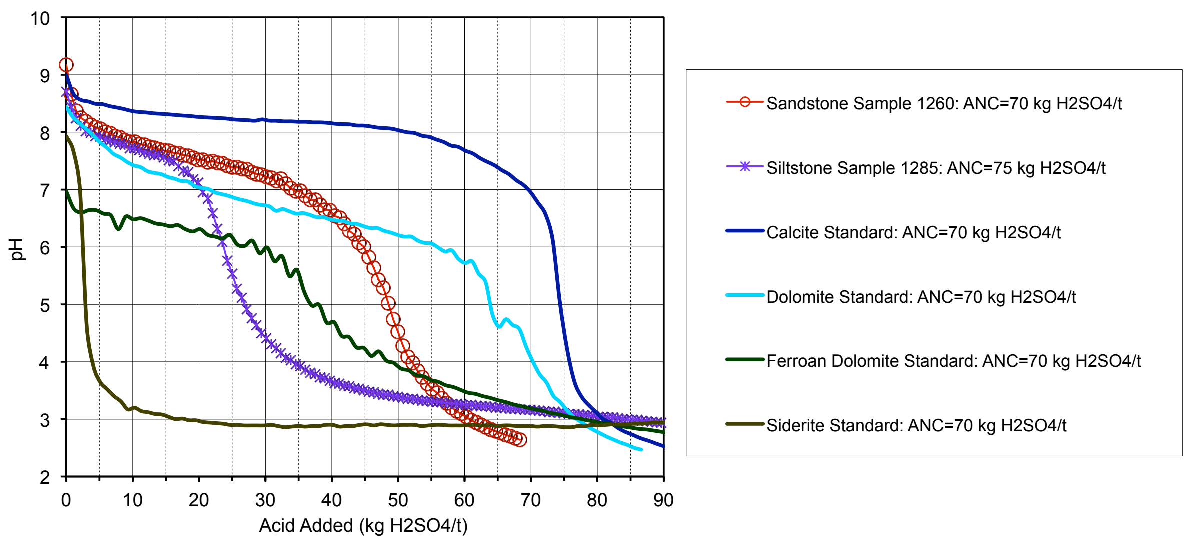


Figure 31: ABCC profile for samples with an ANC value close to 70 kg H_2SO_4/t. Carbonate standard curves are included for reference.

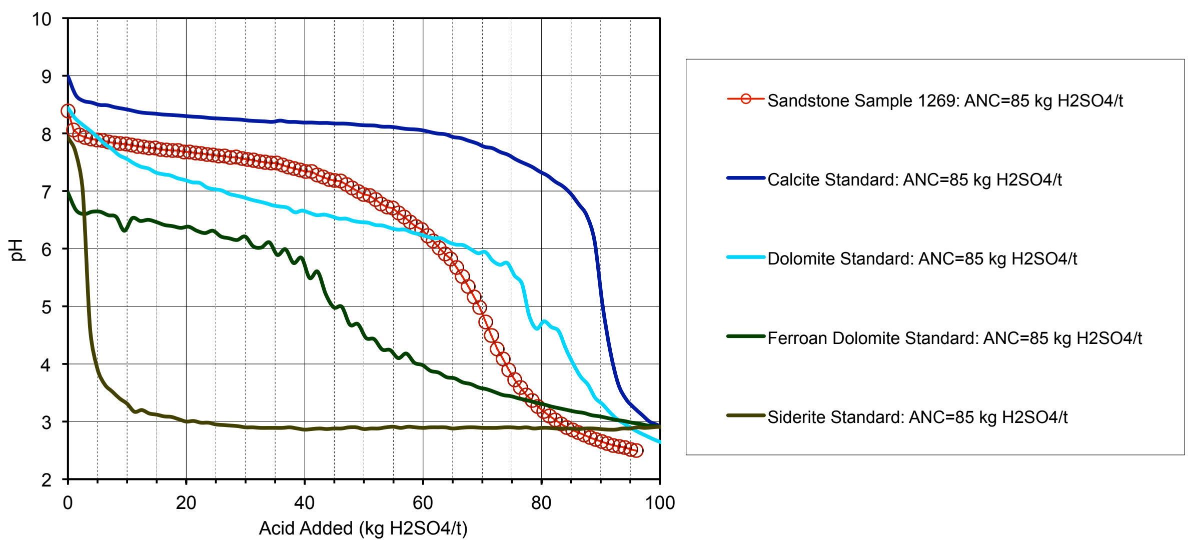


Figure 32: ABCC profile for sample 1269 with an ANC value of 85 kg H_2SO_4/t. Carbonate standard curves are included for reference.

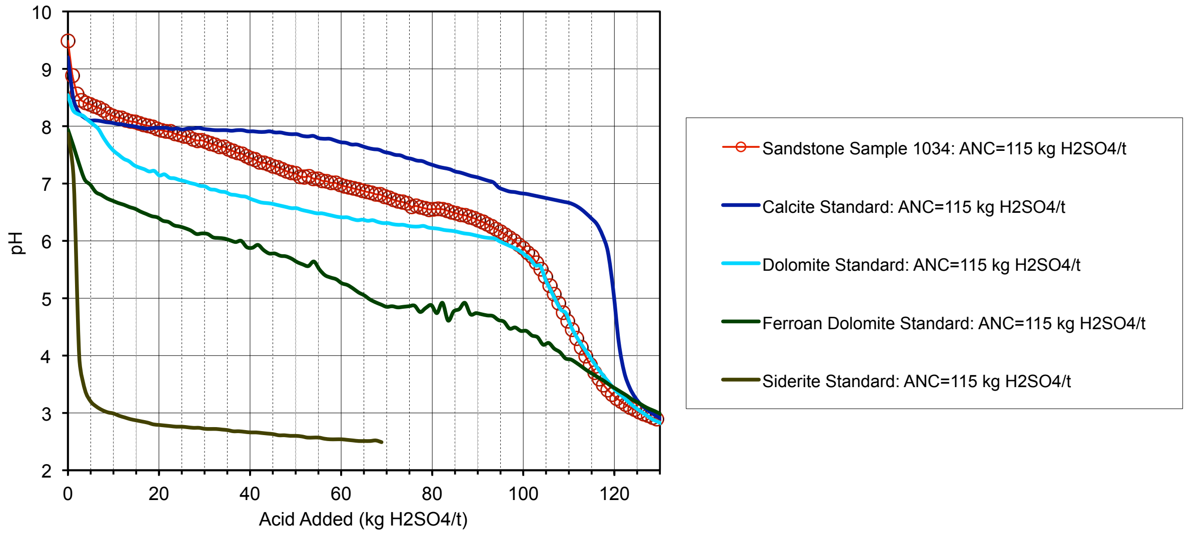


Figure 33: ABCC profile for sample 1034 with an ANC value of 115 kg H_2SO_4/t. Carbonate standard curves are included for reference.

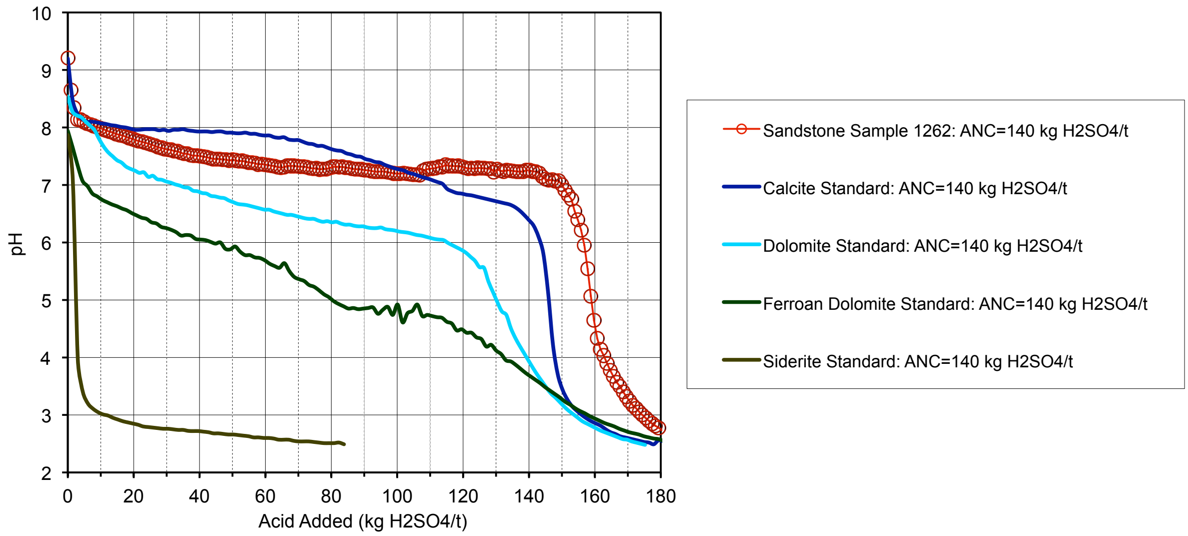


Figure 34: ABCC profile for sample 1262 with an ANC value of 140 kg H_2SO_4/t. Carbonate standard curves are included for reference.

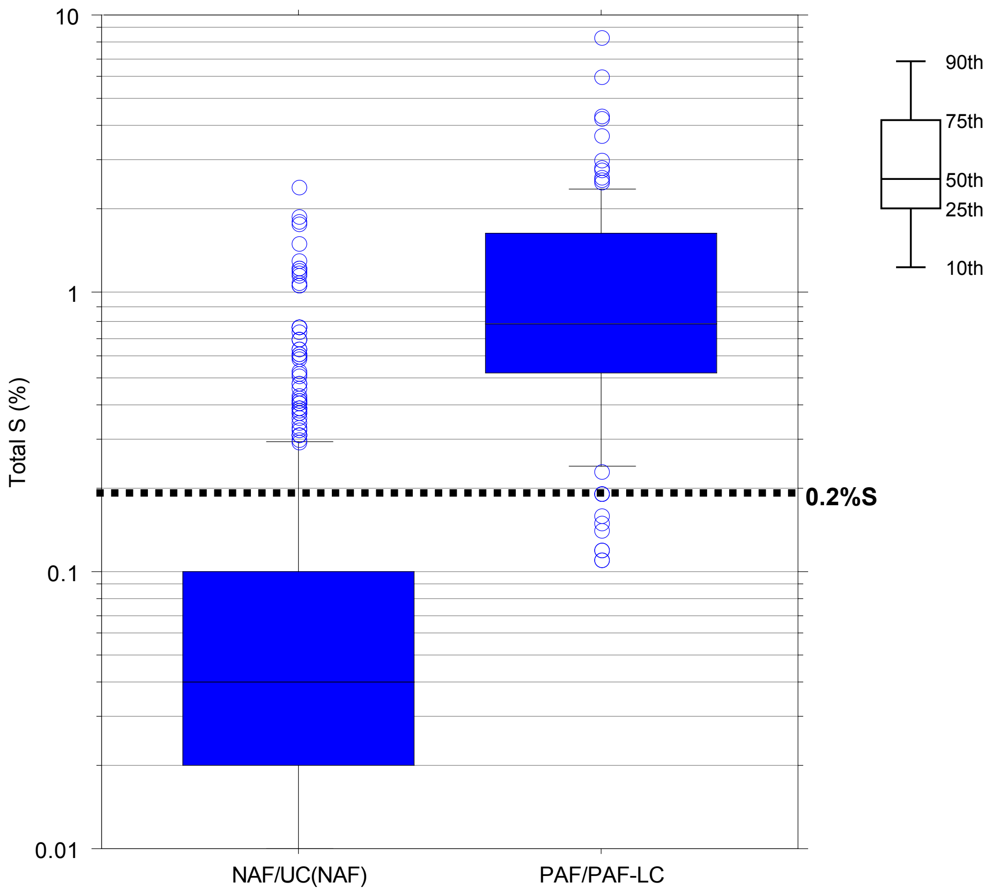


Figure 35: Box plot showing the distribution of total S by ARD classification. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

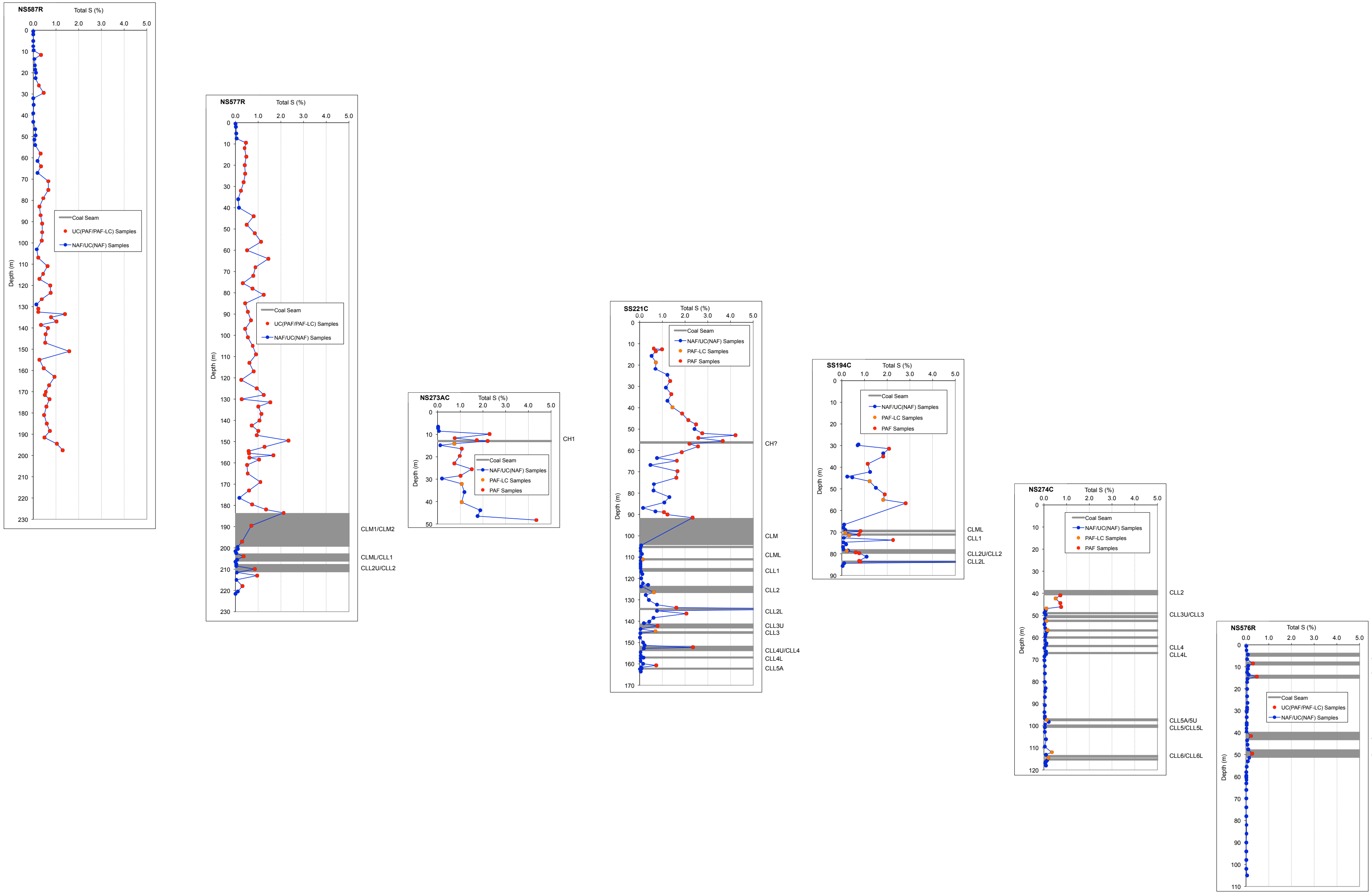


Figure 36: Plot of total S profiles for Stratford East Open Cut drillholes. PAF and UC(PAF/PAF-LC) samples are shown as red symbols, PAF-LC as orange symbols and NAF/UC(NAF) as blue symbols.

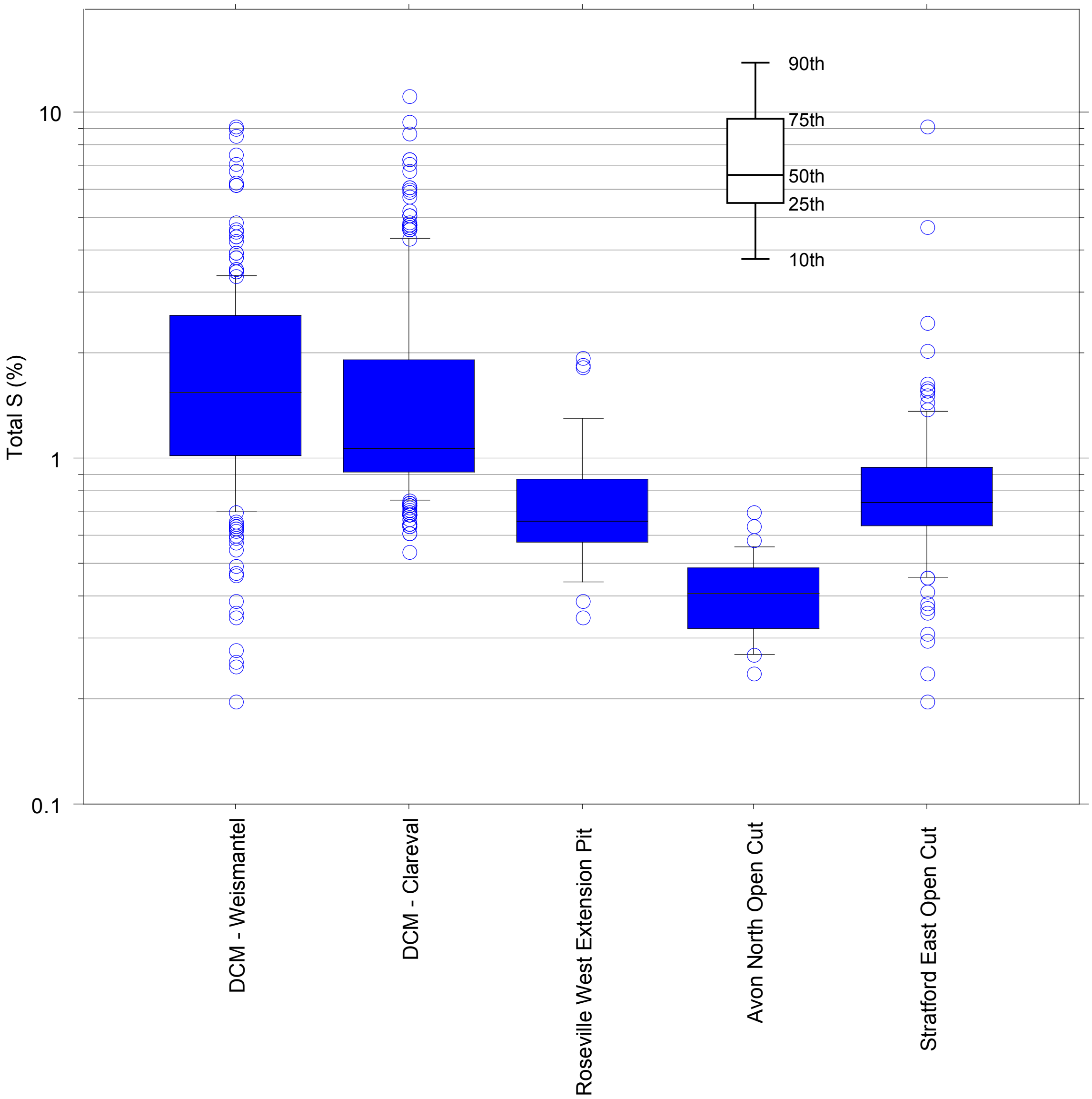


Figure 37: Box plot comparing the distribution of total S for DCM coal and the Project. Box plots have 10th, 25th, 50th (median), 75th and 90th percentiles marked.

ATTACHMENT A

Assessment of Acid Forming Characteristics

Assessment of Acid Forming Characteristics

Introduction

Acid rock drainage (ARD) is produced by the exposure of sulphide minerals such as pyrite to atmospheric oxygen and water. The ability to identify in advance any mine materials that could potentially produce ARD is essential for timely implementation of mine waste management strategies.

A number of procedures have been developed to assess the acid forming characteristics of mine waste materials. The most widely used methods are the Acid-Base Account (ABA) and the Net Acid Generation (NAG) test. These methods are referred to as static procedures because each involves a single measurement in time.

Acid-Base Account

The acid-base account (ABA) involves static laboratory procedures that evaluate the balance between acid generation processes (oxidation of sulphide minerals) and acid neutralising processes (dissolution of alkaline carbonates, displacement of exchangeable bases, and weathering of silicates).

The values arising from the ABA are referred to as the potential acidity and the acid neutralising capacity (ANC), respectively. The difference between the potential acidity and the acid neutralising capacity value is referred to as the net acid producing potential (NAPP).

The chemical and theoretical basis of the ABA are discussed below.

Potential Acidity

The potential acidity that can be generated by a sample is calculated from an estimate of the pyrite (FeS_2) content and assumes that the pyrite reacts under oxidising conditions to generate acid according to the following reaction:

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O \Rightarrow Fe(OH)_3 + 2\ H_2SO_4$$

Based on the above reaction, the potential acidity of a sample containing 1 %S as pyrite would be 30.6 kilograms of H_2SO_4 per tonne of material (i.e. kg H_2SO_4/t). The pyrite content estimate can be based on total sulphur (S) and the potential acidity determined from total S is referred to as the maximum potential acidity (MPA), and is calculated as follows:

$$MPA\ (kg\ H_2SO_4/t) = (Total\ \%S) \times 30.6$$

The use of an MPA calculated from total S is a conservative approach because some S may occur in forms other than pyrite; sulphate S, organic S and native S, for example, are non-acid generating S forms. Also, some S may occur as other metal sulphides (e.g. covellite, chalcocite, sphalerite, galena) which yield less acidity than pyrite when oxidised or, in some cases, may be non-acid generating.

The total S content is commonly used to assess potential acidity because of the difficulty, costs and uncertainty involved in routinely determining the speciation of S forms within samples, and determining reactive sulphide-sulphur contents. However, if the sulphide mineral forms are known then allowance can be made for non- and lesser acid generating forms to provide a better estimate of the potential acidity.

Acid Neutralising Capacity (ANC)

The acid formed from pyrite oxidation will to some extent react with acid neutralising minerals contained within the sample. This inherent acid buffering is quantified in terms of the ANC.

The ANC is commonly determined by the Modified Sobek method. This method involves the addition of a known amount of standardised hydrochloric acid (HCl) to an accurately weighed sample, allowing the sample time to react (with heating), then back-titrating the mixture with standardised sodium hydroxide (NaOH) to determine the amount of unreacted HCl. The amount of acid consumed by reaction with the sample is then calculated and expressed in the same units as the MPA (kg H_2SO_4/t).

Net Acid Producing Potential (NAPP)

The NAPP is a theoretical calculation commonly used to indicate if a material has potential to produce acidic drainage. It represents the balance between the capacity of a sample to generate acid (MPA) and its capacity to neutralise acid (ANC). The NAPP is also expressed in units of kg H_2SO_4/t and is calculated as follows:

$$\text{NAPP} = \text{MPA} - \text{ANC}$$

If the MPA is less than the ANC then the NAPP is negative, which indicates that the sample may have sufficient ANC to prevent acid generation. Conversely, if the MPA exceeds the ANC then the NAPP is positive, which indicates that the material may be acid generating.

ANC/MPA Ratio

The ANC/MPA ratio is frequently used as a means of assessing the risk of acid generation from mine waste materials. The ANC/MPA ratio is another way of looking at the acid base account. A positive NAPP is equivalent to an ANC/MPA ratio less than 1, and a negative NAPP is equivalent to an ANC/MPA ratio greater than 1. A NAPP of zero is equivalent to an ANC/MPA ratio of 1.

The purpose of the ANC/MPA ratio is to provide an indication of the relative margin of safety (or lack thereof) within a material. Various ANC/MPA values are reported in the literature for indicating safe values for prevention of acid generation. These values typically range from 1 to 3. As a general rule, an ANC/MPA ratio of 2 or more signifies that there is a high probability that the material will remain circum-neutral in pH and thereby should not be problematic with respect to ARD.

Acid-Base Account Plot

S and ANC data are often presented graphically in a format similar to that shown in Figure A-1. This figure includes a line indicating the division between NAPP positive samples from NAPP negative samples. Also shown are lines corresponding to ANC/MPA ratios of 2 and 3.

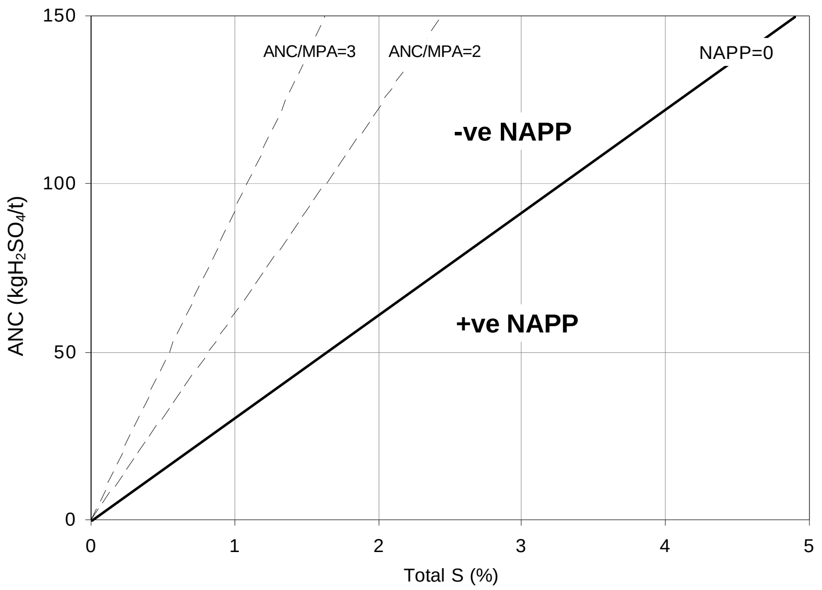


Figure A-1: Acid-base account (ABA) plot

Net Acid Generation (NAG) Test

The NAG test is used in association with the NAPP to classify the acid generating potential of a sample. The NAG test involves reaction of a sample with hydrogen peroxide to rapidly oxidise any sulphide minerals contained within a sample. During the NAG test both acid generation and acid neutralisation reactions can occur simultaneously. The end result represents a direct measurement of the net amount of acid generated by the sample. The final pH is referred to as the NAGpH and the amount of acid produced is commonly referred to as the NAG capacity, and is expressed in the same units as the NAPP (kg H_2SO_4/t).

Several variations of the NAG test have been developed to accommodate the wide geochemical variability of mine waste materials. The four main NAG test procedures currently used by EGi are the single addition NAG test, the sequential NAG test, the kinetic NAG test, and the extended boil and calculated NAG test.

Single Addition NAG Test

The single addition NAG test involves the addition of 250 millilitres (ml) of 15% hydrogen peroxide to 2.5 grams (g) of sample. The peroxide is allowed to react with the sample overnight and the following day the sample is gently heated to accelerate the oxidation of any remaining sulphides, then vigorously boiled for several minutes to decompose residual peroxide. When cool, the NAGpH and NAG capacity are measured.

An indication of the form of the acidity is provided by initially titrating the NAG liquor to pH 4.5, then continuing the titration up to pH 7. The titration value at pH 4.5 includes acidity due to free acid (i.e. sulphuric acid - H_2SO_4) as well as soluble iron and aluminium. The titration value at pH 7 also includes metallic ions that precipitate as hydroxides at between pH 4.5 and 7.

Sequential NAG Test

When testing samples with high sulphide contents it is not uncommon for oxidation to be incomplete in the single addition NAG test. This can sometimes occur when there is catalytic breakdown of the hydrogen peroxide before it has had a chance to oxidise all of the sulphides in a sample. To overcome this limitation, a sequential NAG test is often carried out. This test may also be used to assess the relative geochemical lag of PAF samples with high ANC.

The sequential NAG test is a multi-stage procedure involving a series of single addition NAG tests on the one sample (i.e. 2.5 g of sample is reacted two or more times with 250 ml aliquots of 15% hydrogen peroxide). At the end of each stage, the sample is filtered and the solution is used for measurement of NAGpH and NAG capacity. The NAG test is then repeated on the solid residue. The cycle is repeated until such time that there is no further catalytic decomposition of the peroxide, or when the NAGpH is greater than pH 4.5. The overall NAG capacity of the sample is then determined by summing the individual acid capacities from each stage.

Kinetic NAG Test

The kinetic NAG test is the same as the single addition NAG test except that the temperature and pH of the liquor are recorded. Variations in these parameters during the test provide an indication of the kinetics of sulphide oxidation and acid generation. This, in turn, can provide an insight into the behaviour of the material under field conditions. For example, the pH trend gives an estimate of relative reactivity and may be related to prediction of lag times and oxidation rates similar to those measured in leach columns. Also, sulphidic samples commonly produce a temperature excursion during the NAG test due to the decomposition of the peroxide solution, catalysed by sulphide surfaces and/or oxidation products.

Extended Boil and Calculated NAG Test

Organic acids may be generated in NAG tests due to partial oxidation of carbonaceous materials[1] such as coal washery wastes. This can lead to low NAGpH values and high acidities in standard single addition NAG tests unrelated to acid generation from sulphides. Organic acid effects can therefore result in misleading NAG values and misclassification of the acid forming potential of a sample.

The extended boil and calculated NAG tests can be used to account for the relative proportions of pyrite derived acidity and organic acidity in a given NAG solution, thus providing a more reliable measure of the acid forming potential of a sample. The procedure involves two steps to differentiating pyritic acid from organic derived acid:

Extended Boil NAG	decompose the organic acids and hence remove the influence of non-pyritic acidity on the NAG solution.
Calculated NAG	calculate the net acid potential based on the balance of cations and anions in the NAG solution, which will not be affected by organic acid.

The extended boiling test is carried out on the filtered liquor of a standard NAG test, and involves vigorous boiling of the solution on a hot plate for 3-4 hours. After the boiling step the solution is cooled and the pH measured. An extended boil NAGpH less than 4.5 confirms the sample is potentially acid forming (PAF), but a pH value greater than 4.5 does not necessarily mean that the sample is non acid forming (NAF), due to some loss of free acid during the extended boiling procedure. To address this issue, a split of the same filtered NAG solution is assayed for concentrations of S, calcium (Ca), magnesium (Mg), sodium (Na), potassium (K) and chlorine (Cl), from which a calculated NAG value is determined[2].

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[1] Stewart, W., Miller, S., Thomas, J.E., and Smart R. (2003), 'Evaluation of the Effects of Organic Matter on the Net Acid Generation (NAG) Test', in *Proceedings of the Sixth International Conference on Acid Rock drainage (ICARD), Cairns, 12-18th July 2003*, 211-222.

[2] Environmental Geochemistry International, Levay and Co. and ACeSSS, 2008. *ACARP Project C15034: Development of ARD Assessment for Coal Process Wastes*, EGi Document No. 3207/817, July 2008.

The concentration of dissolved S is used to calculate the amount of acid (as H_2SO_4) generated by the sample and the concentrations of Ca, Mg, Na and K are used to estimate the amount of acid neutralised (as H_2SO_4). The concentration of Cl is used to correct for soluble cations associated with Cl salts, which may be present in the sample and unrelated to acid generating and acid neutralising reactions.

The calculated NAG value is the amount of acid neutralised subtracted from the amount of acid generated. A positive value indicates that the sample has excess acid generation and is likely to be PAF, and a zero or negative value indicates that the sample has excess neutralising capacity and is likely to be NAF.

Sample Classification

The acid forming potential of a sample is classified on the basis of the acid-base and NAG test results into one of the following categories:

- Barren;
- NAF;
- PAF; and
- Uncertain (UC).

Barren

A sample classified as barren essentially has no acid generating capacity and no acid buffering capacity. This category is most likely to apply to highly weathered materials. In essence, it represents an 'inert' material with respect to acid generation. The criteria used to classify a sample as barren may vary between sites, but for hard rock mines it generally applies to materials with a total sulphur content less than or equal to 0.1 %S and an ANC less than or equal to 5 kg H_2SO_4/t.

Non-acid forming (NAF)

A sample classified as NAF may, or may not, have a significant S content but the availability of ANC within the sample is more than adequate to neutralise all the acid that theoretically could be produced by any contained sulphide minerals. As such, material classified as NAF is considered unlikely to be a source of acidic drainage. A sample is usually defined as NAF when it has a negative NAPP and the final NAG pH greater than or equal to 4.5.

Potentially acid forming (PAF)

A sample classified as PAF always has a significant S content, the acid generating potential of which exceeds the inherent acid neutralising capacity of the material. This means there is a high risk that such a material, even if pH circum-neutral when freshly mined or processed, could oxidise and generate acidic drainage if exposed to atmospheric conditions. A sample is usually defined as PAF when it has a positive NAPP and a final NAGpH less than 4.5.

Uncertain (UC)

An uncertain classification is used when there is an apparent conflict between the NAPP and NAG results (i.e. when the NAPP is positive and NAGpH > 4.5, or when the NAPP is negative and NAGpH less than 4.5). Uncertain samples are generally given a tentative classification that is shown in brackets e.g. UC(NAF).

Figure A-2 shows the format of the classification plot that is typically used for presentation of NAPP and NAG data. Marked on this plot are the quadrats representing the NAF, PAF and UC classifications.

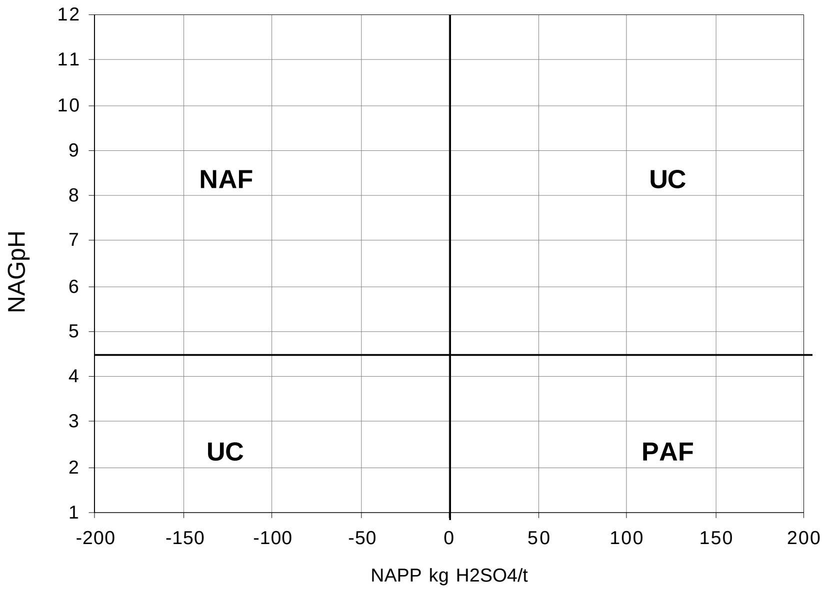

Figure A-2 ARD classification plot

Other Methods

Other test procedures may be used to define the acid forming characteristics of a sample.

pH and Electrical Conductivity

The pH and electrical conductivity of a sample is determined by equilibrating the sample in deionised water for a minimum of 12 hours (or overnight), typically at a solid to water ratio of 1:2 (by weight). This gives an indication of the inherent acidity and salinity of the waste material when initially exposed in a waste emplacement area.

Acid Buffering Characteristic Curve (ABCC) Test

The ABCC test involves slow titration of a sample with acid while continuously monitoring pH. These data provides an indication of the portion of ANC within a sample that is readily available for acid neutralisation.