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Blackwater Mine

Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

Supporting information for the:

Progressive Rehabilitation and Closure Plan

Prepared for:

Whitehaven Blackwater Pty Ltd

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BLACKWATER MINE

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EXECUTIVE SUMMARY

This report serves to document and discuss the environmental geochemical characteristics of mineral waste materials associated with Blackwater Mine (BWM), as supporting information for the progressive rehabilitation and closure plan (PRCP) for BWM. Until April 2024, BWM was owned and operated by BHP companies, before transferring to Whitehaven Coal. Geochemical data presented herein was collected by BHP prior to April 2024, and Whitehaven Coal thereafter.

The objective of the assessment is to evaluate the geochemical nature of mineral waste currently at BWM and mineral waste likely to be present at closure, and identify relevant environmental issues/opportunities that may be associated with mining, handling and storing mineral waste to inform appropriate rehabilitation and management strategies.

BWM administration and industrial area is located approximately 75 kilometres (km) southeast of Emerald township and about 20 km south of Blackwater township, in central Queensland. BWM is flanked on the east, west and south by pastoral leases; and bounded to the north by Capricorn Highway and Blackwater township. BWM commenced operations in 1967.

BWM comprises typical open-pit coal mining facilities, such as open pits, waste rock (spoil) dumps, tailings storage facilities (TSFs), rejects dumps, coal stockpiles, coal processing facilities, rail loadout facilities, process water and raw water dams, surface water drains and administration areas. The southern area of BWM also contains historic (closed/inactive) underground mining areas.

Current activities of relevance to this waste characterisation report comprise:

- Disposal of spoil to in-pit spoil dumps behind the active mining face (in-pit low-wall spoil disposal);
- Run-of-mine (ROM) coal processing at the north coal handling and preparation plant (NCPP), which produces two mineral waste types:
- Tailings. Clay, silt and very fine to medium-grain sized sand material; disposed as a slurry.
- Rejects. Coarse sand to cobble-sized material.
- Thermal ROM coal processing at the thermal coal plant (TCP), which produces rejects.
- Disposal of tailings from NCPP to Bonnie Doon pit (now Bonnie Doon in-pit TSF); [active from late 2023];
- Disposal of rejects from NCPP and TCP to spoil dumps; Rejects from NCPP have been used in construction of TSF embankments and infrastructure pads;
- Short-term storage of ROM coal on the ROM Pad;
- Short-term storage of product coal on the product coal stockpile, awaiting off-site transport by rail;
- The operation of raw water and process water dams and sediment control structures as stipulated in the EA.

Historic activities of relevance to this waste characterisation report comprise:

- Disposal of tailings from NCPP to the above-ground NCPP TSF; [inactive since late 2023];
- Disposal of rejects from NCPP and TCP to rejects dumps (primarily Ramp 36 rejects dump and TCP rejects dump);
- ROM coal processing at the south coal handling and preparation plant (SCPP), which produced tailings and rejects similar to NCPP. The SCPP received ROM coal from open cut and underground

mining operations in the southern BWM area (what was then called South BWM). SCPP has been inactive since the early 2000s;

- Disposal of tailings from SCPP to the above-ground Laleham TSF, two in-pit TSFs (Kenmare pit - Ramp 72 TSF; and Ramp 74 pit - Ramp 74 TSF) and Bottom Dam TSF (gully southeast of the SCPP ROM 3 pad). Tailings from NCPP were also disposed into Ramp 74 TSF;
- Disposal (rehandling) of mixed 'aged' tailings and rejects (originally from SCPP) into the southern end of Kenmare pit (Ramp 72 pit);
- Disposal of rejects from SCPP onto ROM Pad 3 and into Bottom Dam area adjacent to Bottom Dam TSF.

Material types and quantities

BWM has three main types of mineral waste, and the geochemical characteristics and potential hazards associated with mineral waste materials on site are discussed by type:

- Spoil (overburden and interburden) currently comprises approximately 99% of all mineral waste at BWM and includes weathered waste (Tertiary and Permian-age) and fresh (unweathered) waste (all Permian-age). On average, approximately 40% of spoil is weathered/oxidised and the remaining (approximately 60%) is fresh, with the proportion of weathered to fresh spoil varying throughout the site. In the northern half of the site the proportion of weathered to fresh spoil is about 25% weathered to 75% fresh, whereas in the southern half of the site weathered and fresh spoil are present in approximately equal proportions.
- Tailings are generated at the NCPP (and previously also at the SCPP) from processing ROM coal and typically represent the clay, silt and fine sand fractions of ROM waste. Throughout operations at BWM, tailings has been disposed as a slurry into a number of TSFs – the current (active) TSF being Bonnie Doon in-pit TSF. Tailings comprises approximately 0.5% of all mineral waste at BWM – with this approximated proportion expected for the remaining life of asset mine plan.
- Rejects are generated at the NCPP (and previously also at the SCPP) from processing ROM coal and typically represents coarser and rockier seam roof, partings and floor material. Rejects are trucked to several locations for disposal into spoil. Historically, rejects were also disposed onto rejects dumps, such as Ramp 36 rejects dump and Bottom Dam TSF [mixed tailings and rejects]. Some rejects have been used in construction of TSF embankments and infrastructure pads (e.g. ROM and coal stockpile pads). Rejects comprise approximately 0.5% of all mineral waste at BWM – with this approximated proportion expected for the remaining life of asset mine plan.

Coal is also included in the assessment; however, coal is generally not considered mineral waste, with the exception of small quantities of sub-economic seams that may report to the spoil dumps, and remnant coal exposed on pit highwalls and end-walls (such as in residual voids).

AMD Potential of Mineral Waste and Coal

Mineral waste samples have undergone environmental geochemical characterisation and assessment with regard to their potential to generate acid and metalliferous drainage (AMD), which comprises acid drainage (AD), neutral and metalliferous drainage (NMD) and/or saline drainage (SD) [salinity due to sulfate derived from sulfide oxidation]. Additionally, samples have been assessed with regard to their potential to generate salinity (non-oxidative) and, for spoil materials, their sodicity and dispersion potential.

AMD potential of spoil – non-carbonaceous

Non-carbonaceous spoil, which comprises about 92% of spoil, is expected to generate pH-neutral to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin.

Based on the results from 4172 samples (657 weathered and 3515 fresh), non-carbonaceous spoil has a very low potential to generate AMD as either AD and/or NMD and/or SD, but for a small proportion that is assessed to have a higher potential to generate AMD (as AD, NMD and/or SD). However, in consideration of the mixing and dispersion of a small volume of waste at higher potential for AMD within the broader spoil material, the overall potential for non-carbonaceous spoil (and bulk spoil, generally) to generate AMD is assessed to be low.

The total sulfur (S) concentration of non-carbonaceous spoil is very low, with a 95th percentile total S concentration of 0.09%. As such, and combined with moderate to high acid neutralising capacity (ANC) values [median = 40 kilograms of sulfuric acid per tonne of rock (kg H_2SO_4/t)], which is significantly higher than the maximum potential acidity (MPA) [median 0.6 kg H_2SO_4/t], approximately 97% of non-carbonaceous spoil samples tested were classified as non-acid forming (NAF), with a further 1.3% (approximately) of samples classified as UC(NAF) [uncertain, but expected to be NAF]. Less than 1.5% of non-carbonaceous spoil samples were classified as potentially acid forming (PAF), PAF-LC [PAF, low capacity], UC(PAF) [uncertain, but expected to be PAF or PAF-LC] or NAF-S [NAF, but with total S greater than 1%]. Only one sample was classified as NAF-S.

The test-work has demonstrated that the ANC for the non-carbonaceous spoil is generally expected to be about 36-73% available under field conditions (based on 25th and 75th percentile values), with iron-dolomite/dolomite and calcite being the main carbonate minerals contributing to the acid buffering potential of the non-carbonaceous spoil. Overall, non-carbonaceous spoil has excess acid neutralising capacity and is expected to be bulk acid consuming.

Total metal and metalloid concentrations from 548 non-carbonaceous spoil samples tested are very low compared to average element abundance in soil in the earth's crust. Fourteen samples (<3% of samples) were significantly enriched with regard to one or more of arsenic (As), barium (Ba), cobalt (Co), chromium (Cr), mercury (Hg), S and/or selenium (Se). The enrichment in one or more of these elements in a small proportion of samples is not cause for concern. Of the samples displaying elemental enrichment, there was no correlation with AMD classifications of these samples. In summary, non-carbonaceous spoil has low enrichment in total metals and metalloids compared to un-mineralised rocks.

Soluble multi-element results (from 549 non-carbonaceous samples) indicate that leachate from this material is expected to contain low concentrations of soluble metals and metalloids under pH-neutral to alkaline conditions. About 6% of samples produced moderate soluble metal concentrations under pH-neutral to alkaline leaching conditions; and about 4% of samples (almost all weathered) produced low soluble metal concentrations under weakly acidic leaching conditions. The remaining 1% (approximately) of samples produced moderate to elevated metals under weakly acidic conditions. Peroxide leaching undertaken on 14 non-carbonaceous spoil samples showed that PAF material has the potential to generate low pH leachate (AD) with moderate sulfate and soluble metal and metalloid concentrations.

AMD potential of spoil – carbonaceous

Carbonaceous spoil represents less than 8% of spoil material at BWM and – as a bulk material – is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), similar to non-carbonaceous spoil.

Based on the results from 292 samples (nine weathered and 283 fresh), carbonaceous spoil has a generally low potential to generate AD and/or NMD and/or SD. Some carbonaceous spoil – mostly associated with coal seams – has a greater potential to generate low-level AD and/or NMD and/or SD.

The total S concentration of carbonaceous spoil is low, with 95th and 75th percentile total S concentrations of 0.59% and 0.25%, respectively. Approximately 85% of (248 out of 292) carbonaceous spoil samples were classified as NAF, with a further 4 samples (approximately 1.4% of samples) classified as UC(NAF). The remaining 14% (approximately) of samples were classified as PAF, PAF-LC, UC(PAF) or NAF-S and had a low-moderate 75th percentile total S value of 0.72%. Only two samples were classified as NAF-S. Most of the 'PAF' and NAF-S carbonaceous spoil samples were closely associated with coal seams.

The test-work undertaken has demonstrated that the ANC is generally expected to be about 17-41% available under field conditions (based on 25th and 75th percentile values), with iron-dolomite/dolomite and calcite being the main carbonate minerals contributing to the acid buffering potential of carbonaceous spoil. Overall, carbonaceous spoil has relatively modest acid neutralising capacity.

Total metal and metalloid concentrations from 69 carbonaceous spoil samples tested are very low compared to average element abundance in soil in the earth's crust, and very similar to the assay concentrations from non-carbonaceous spoil. Twelve samples were significantly enriched with regard to one or more of As, copper (Cu), Hg, S and/or uranium (U). Of the samples displaying elemental enrichment, there was no correlation with AMD classifications of these samples. In summary, carbonaceous spoil has low enrichment in total metals and metalloids compared to un-mineralised rocks.

Soluble multi-element results (from 69 samples) indicate that, with few exceptions, leachate from carbonaceous spoil is expected to contain low concentrations of soluble metals and metalloids – similar to non-carbonaceous spoil samples. Peroxide leaching undertaken on six carbonaceous spoil samples (mixed 'NAF' and 'PAF') showed that the PAF samples have the potential to generate low pH leachate (AD) with moderate sulfate and soluble metal and metalloid concentrations. Most of the 'NAF' samples that underwent peroxide leaching produced leachate with near-neutral to alkaline pH and with low to moderate soluble metals concentrations.

AMD potential of tailings

The geochemical characteristics differed between fresh tailings from the NCPP versus aged tailings from TSFs for different parameters – particularly total S (and, by inference, MPA), ANC and pH. However, the overall geochemical (AMD) hazard posed by tailings from the two sources (fresh vs aged) was generally similar. As such, the discussion that follows only differentiates between the two tailings sources where the differences between the two sources was significant for some parameters and worthy of discussion. Else, the AMD potential of tailings is discussed as a bulk material.

Based on the results from 703 samples, approximately 55% of tailings has a moderate to high potential to generate AMD as either AD and/or NMD and/or SD, and the remaining 45% (approximately) has a relatively low potential to generate AMD as either AD and/or NMD and/or SD.

Fresh tailings from the NCPP are expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage). Overall, aged tailings have lower pH compared to fresh tailings, however the pH in aged tailings ranged from moderately acidic to pH-alkaline. The difference in pH observed between fresh and aged tailings (and the differences within the aged tailings) may be due to a number of factors, however the most likely cause is oxidation processes consuming readily available neutralising minerals, leading to aged tailings generally having a low(er) acid neutralising potential.

The total S concentration of tailings is generally low-moderate, with median values of 0.76% and 0.52% for fresh and aged tailings, respectively. Overall, the total S concentration was higher in the fresh tailings compared to the aged tailings. The reasons for differences in total S between the fresh versus aged tailings is unclear and potential processes that could account for differences in total S concentration are:

- Sulfide oxidation and neutralisation reactions ongoing within the TSFs, which generate sparingly and / or readily soluble sulfate. Therefore, sulfur mass loss could have occurred from aged tailings due to leaching of sulfate minerals, such as jarosite, alunite and/or gypsum and/or readily soluble acid salts (e.g. iron sulfate 'salts' such as melanterite or copiapite).
- Change in geochemistry of ROM coal being processed. That is, ROM coal becoming more S-rich over time due to a change in the relative proportions of the various coal seams/plys being mined and processed.
- Addition of sulfate via salt precipitation within tailings during drying/evaporation of slurry water (liquor) [laboratory bias].

In the fresh tailings samples about 69% (median value) of the total S is present as sulfide (Scr). Comparatively, only 48% (median value) of the total S is present as Scr in the aged tailings samples. The difference in the proportion of total S as Scr between fresh versus aged tailings is typical and expected – supporting the suggestion that the aged tailings in the TSFs are being oxidised since deposition (sulfide oxidised to sulfate).

Just as there were notable differences between the total S concentrations in fresh versus aged tailings, so too with the ANC values of fresh versus aged tailings. Fresh tailings had generally moderate to high ANC values (median 32 kg H_2SO_4/t) compared to aged tailings, which had generally low to moderate ANC values (median 16 kg H_2SO_4/t). The reason behind the lower ANC observed in aged tailings (compared to fresh tailings) is not well understood. However, it is likely related to ANC being consumed via buffering of acidity generated by sulfide oxidation and/or sulfate leaching. Other processes that could account for a difference in ANC between fresh and aged tailings include inherent differences in the geochemical properties of the coal from earlier mining compared to recent mining, and/or – related to ROM coal differences; and it may also be partially due to differences in processing methods between the NCPP and the SCPP.

Based on the above generally low-moderate total S values (and, therefore, MPA values) combined with a wide range of ANC values resulted in approximately 55% of tailings samples being classified as PAF, PAF-LC, UC(PAF) or NAF-S – with the remaining 45% (approximately) classified as NAF or UC(NAF). Of the 'PAF' and NAF-S tailings samples, about 72% were classified as UC(PAF) or PAF-LC.

The test-work undertaken has demonstrated that the ANC in fresh tailings is expected to be about 47-67% available under field conditions, compared to about 12-63% available for aged tailings. Iron-dolomite/dolomite and calcite are expected to be the main carbonate minerals contributing to the acid buffering potential of tailings.

OxCon test-work undertaken on five fresh and one aged tailing samples found that two of the fresh tailings samples expected to be NAF or NAF-S were confirmed to be NAF and were unlikely to be generating AD or NMD. The remaining three fresh tailings samples, which were expected to be 'PAF' were confirmed to be PAF or PAF-LC and were found to pose a moderate to moderate-high risk of generating AD and low potential for SD. The aged tailings sample from NCPP TSF was confirmed as PAF and found to pose high potential for generating AD and low potential for SD.

With few exceptions, the total metal and metalloid concentrations from 56 tailings samples tested are generally low compared to average element abundance in soil in the earth's crust. About 26% of the fresh tailings samples and 29% of the aged tailings samples were significantly enriched with regard to S, which is consistent with the ABA data. Two aged tailings samples were significantly enriched with regard to silver (Ag). The GAI values also show that most of the tailings samples tested had minor enrichment (GAI = 1 or 2) with regard to S, which was consistent with the ABA data. There was no clear correlation found between AMD classifications of the tailings samples compared to elemental enrichment.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 73% of tailings samples have low soluble metals concentrations and have near-neutral to alkaline pH, including all 39 fresh NCPP tailings samples. The remaining 27% of tailings samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH conditions. Generally, the NCPP TSF and Laleham TSF tailings samples had similar soluble metals concentrations, however the Laleham TSF samples had lower pH compared to the aged tailings samples from NCPP TSF. Under saline leaching conditions fresh tailings produced low concentrations of soluble metals and metalloids.

Peroxide leaching undertaken on 48 tailings samples [about 60% classified as 'PAF' or NAF-S, and the remainder classified as NAF or UC(NAF)] showed that when exposed to highly oxidising conditions a significant proportion of tailings can produce weakly to highly acidic leachate with elevated soluble metals and metalloid concentrations. However, about one-third of tailings samples appeared to be influenced to some degree by the presence of organic acids, due to the samples' high organic carbon concentration. The presence of organic acids likely accounts, to some degree, for the acidity and 'elevated' soluble metals and metalloid concentrations evident in these tailings. Nevertheless, PAF tailings [including tailings classified as UC(PAF)] have typically produced moderate to elevated soluble metals and metalloid concentrations from the freshwater and peroxide leaching tests. These results indicate that PAF tailings have the potential to generate low pH leachate (AD), however the salinity (sulfate) loads are not expected to be high – due to generally low total S concentrations (with minor exceptions).

AMD potential of rejects

Based on the results of 398 samples, about 45% of the rejects have a moderate to high potential to generate AMD as either AD and/or NMD and/or SD, whereas the remaining 55% (approximately) of rejects has a relatively low to low-moderate potential to generate AMD as either AD and/or NMD and/or SD.

Fresh rejects from the NCPP are expected to generate highly pH-alkaline contact water (run-off and seepage). Aged rejects (from TSFs, Ramp 36 rejects dump and a small number of rejects in the Red Dam area) has lower pH compared to fresh rejects and is expected to generate weakly acidic to pH-alkaline contact water (run-off and seepage). The difference in pH observed between fresh and aged rejects – with the latter showing generally lower pH – may be due to a number of factors, however the most likely cause is oxidation processes consuming readily available neutralising minerals, leading to aged rejects having a low(er) acid neutralising potential.

The total S concentration of fresh rejects was generally low (median value = 0.28%) compared to aged rejects, which had low to low-moderate total S values (median value = 0.61%). Aged rejects have come from multiple pit locations (different ROM coal) and processed from different CHPPs (NCPP and SCPP).

In the fresh rejects samples about 74% (median value) of the total S is present as sulfide (Scr), and in the aged rejects samples about 59% (median value) of the total S is present as Scr. The difference in the proportion of total S as Scr between fresh versus aged rejects is typical and expected – supporting the

suggestion that the aged rejects in the TSFs and rejects dump(s) are being oxidised since deposition (sulfide oxidised to sulfate). Aged rejects may have been in place for nominally 5 to 30 years.

Just as there were notable differences between the total S concentrations in fresh versus aged rejects, so too with the ANC values of fresh versus aged rejects. Fresh (NCPP) rejects had generally moderate to very high ANC values (median 40 kg H_2SO_4/t) compared to aged rejects, which had generally low to high ANC values (median 18 kg H_2SO_4/t). The reason behind the lower ANC observed in aged rejects (compared to fresh rejects) is not well understood. However, it is likely related to ANC being consumed via buffering of acidity generated by sulfide oxidation and/or sulfate leaching. Other processes that could account for a difference in ANC between fresh and aged rejects include inherent differences in the geochemical properties of the coal from earlier mining compared to recent mining, and/or – related to ROM coal differences; and it may also be partially due to differences in processing methods between the NCPP and the SCPP.

Based on the above generally low to low-moderate total S values (and, therefore, MPA values) combined with a wide range of ANC values resulted in approximately 45% of rejects samples (all being aged rejects) being classified as PAF, PAF-LC, UC(PAF) or NAF-S – with the remaining 55% (approximately) classified as NAF or UC(NAF). All fresh rejects were classified as NAF.

The test-work undertaken has demonstrated that the ANC in fresh rejects is expected to be about 50-78% available under field conditions, compared to about 25-60% available for aged rejects. Iron-dolomite/dolomite and calcite are expected to be the main carbonate minerals contributing to the acid buffering potential of rejects.

No fresh rejects samples were significantly enriched with metals or metalloids. Four out of 17 aged rejects samples were significantly enriched with regard to S, which is consistent with ABA data for these samples. There was no correlation found between AMD classifications of the reject samples compared to elemental enrichment.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 65% of rejects samples have low soluble metals concentrations and have near-neutral to alkaline pH, including all 15 fresh NCPP rejects samples. The remaining 35% of rejects samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH conditions. Most of the aged rejects with lower pH and moderate to elevated soluble metals concentrations were from Ramp 72 (Kenmare pit rejects).

Peroxide leaching undertaken on 26 aged rejects samples of predominantly 'PAF' classifications showed that almost all rejects samples were weakly to highly acidic and had moderate to elevated metal and metalloid concentrations. The results suggest that under acid/acidic conditions, materials represented by these aged reject samples are capable of generating elevated metal and metalloid loads for several metals/metalloids, however the sulfate (and salinity) loads are not expected to be high – due to the generally low total S concentration (with some exceptions).

AMD potential of coal

Coal is not regarded as waste and run-of-mine (ROM) coal remains on-site for a relatively short period of time. However, some minor coal seams/plys will report directly as waste, and remnant coal (seams) will be exposed on the highwalls and end-walls of residual voids at closure.

Coal represents about 5% of all lithological material at BWM (i.e. about 2% to 7% of the highwall / end-wall meterage, depending on the void). Assuming the large majority of this will report as ROM coal, it is assumed that coal will represent a very small proportion of mineral waste (i.e. nominally 1-2%).

Based on the results of 381 samples, ROM coal is assessed as having a low-moderate to moderate potential to generate AMD as either AD, NMD and/or SD. A small proportion of coal would have a moderate to moderate-high potential to generate AMD. ROM coal, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage).

The total S concentration of coal is generally low (95th percentile total S concentration of 0.62%) and approximately 14% (median value) of the total S is present as sulfide (Scr), with the bulk of the total S likely present as organic S, which does not contribute to AMD. Coal samples have a wide range of ANC values; however, the median ANC is low (median = 11 kg H_2SO_4/t). As such, 64% of coal samples were classified as NAF or UC(NAF). One sample was classified as NAF-S. The remaining 35% (approximately) of samples were classified as PAF, PAF-LC or UC(PAF) and were from all seam groups. The AMD classification is based on total S, which for coal samples likely leads to highly conservative classification given that most sulfur in coal is organic S, not sulfidic S. These results suggest that coal stored on the ROM pad, coal located within pit walls and un-economic coal seam material reporting as spoil (mixed with non-coal spoil) would likely be bulk NAF.

Assay data for 72 coal samples show that the total metal and metalloid concentrations are generally low compared to average element abundance in soil in the earth's crust. Three coal samples were significantly enriched with regard to one or more of As and/or S.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 88% of the 72 coal samples tested have low soluble metals concentrations and have near-neutral to alkaline pH. The remaining 12% of coal samples have a wide range of soluble metals concentrations under a wide range of pH conditions (moderately acidic to alkaline). These results indicate that some ROM coal is capable of generating AD and/or SD/NMD.

Salinity, Sodicity and Dispersion Potential of Mineral Waste and Coal

Salinity, sodicity and dispersion potential of spoil – non-carbonaceous

Non-carbonaceous spoil has low median and 95th percentile $EC_{1:5}$ values of 344 and 569 microSiemens per centimetre (μS/cm), respectively, and has very low total S concentrations. On this basis, contact water (run-off and seepage) is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity). Weathered non-carbonaceous spoil generally has similar $EC_{1:5}$ values compared to fresh non-carbonaceous spoil.

Non-carbonaceous spoil has low cation exchange capacity (CEC) values and generally high exchangeable sodium percentage (ESP) values, resulting in approximately 91% of samples being classified as 'strongly sodic' or 'sodic' and, therefore, with potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, about 59% of the non-carbonaceous spoil samples displayed some degree of dispersion. Although not entirely consistent with the ESP results, the Emerson Class test results suggest a significant proportion of non-carbonaceous spoil would be dispersive.

Salinity, sodicity and dispersion potential of spoil – carbonaceous

Carbonaceous spoil has generally low median and 95th percentile $EC_{1:5}$ values of 328 and 574 μS/cm, respectively, and has low total S concentrations. On this basis, contact water (run-off and seepage) is expected to be similar to non-carbonaceous spoil. That is, generally non-saline to slightly saline, primarily as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity).

Carbonaceous spoil samples had comparable CEC and ESP values to non-carbonaceous spoil – with the main difference being the weathered carbonaceous samples having generally higher CEC and much lower ESP compared to the fresh carbonaceous samples. This resulted in most fresh carbonaceous samples being classified as 'strongly sodic' whereas the three weathered samples were all classified as 'non-sodic'. As such, and based solely on the moderate to high sodicity values, carbonaceous spoil is expected to be sodic (to some degree) with potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, about half of the samples displayed some degree of dispersion, suggest a significant proportion of carbonaceous spoil would be dispersive.

Salinity potential of tailings

Tailings samples (n=698) have $EC_{1:5}$ values ranging from 97 to 8900 μS/cm, with median, 75th and 95th percentile $EC_{1:5}$ values of 714, 1008 and 1976 μS/cm, respectively. There is generally little difference in $EC_{1:5}$ values between fresh and aged tailings, with both types being generally slightly to moderately saline. The generally low to low-moderate total S for aged tailings and low-moderate to moderate total S for fresh tailings conservatively suggests a low-moderate to moderate potential for SD (from sulfide oxidation).

Salinity potential of rejects

Rejects samples (n=398) have $EC_{1:5}$ values ranging from 123 to 2830 μS/cm, with median, 75th and 95th percentile $EC_{1:5}$ values of 797, 1398 and 2343 μS/cm, respectively. Fresh rejects samples were all generally non-saline whereas aged rejects were generally slightly to moderately saline. The generally low total S for fresh rejects and low to low-moderate total S for aged rejects conservatively suggests a low to low-moderate potential for SD (from sulfide oxidation).

Salinity potential of coal

Coal samples (n=381) have $EC_{1:5}$ values ranging from less than 10 to 722 μS/cm, with low median and 95th percentile $EC_{1:5}$ values of 99 and 332 μS/cm, respectively. Coal has generally low total S concentrations. On this basis, contact water (run-off and seepage) from coal, as a bulk material, is expected to be non-saline.

Geochemical Source Hazard Assessment of Mineral Waste and Coal

A geochemical source hazard assessment was applied to the source material types comprising carbonaceous and non-carbonaceous spoil, tailings, rejects and coal (where relevant). The source hazard score is a formula that takes into account the propensity to generate AMD, the AMD capacity (severity) and the quantity (volume) of material that could produce AMD. The AMD source hazard scores are as follows:

- Spoil – non-carbonaceous: AMD source hazard score = **Low**
- Spoil – carbonaceous: AMD source hazard score = **Low-Moderate**
- Tailings: AMD source hazard score = **Moderate-High** (score ranged from Moderate-High to High depending upon the TSF facility, but was generally Moderate-High)
- Rejects: AMD source hazard score = **Moderate to Moderate-High** (score ranged from Low-Moderate to Moderate-High depending upon the rejects facility, but was generally Moderate to Moderate-High)
- Coal: AMD source hazard score = **Low-Moderate**

When combined, and taking into account the proportion of material that could generate AMD relative to the total proportion of all materials in a final landform (spoil or TSF or rejects landform and residual voids), the AMD hazard score for the landforms, void highwalls / end-walls and void floors at closure has been determined.

Spoil landforms

There are 14 spoil landforms at BWM that will remain at closure:

- Ramp 8
- Bonnie Doon
- Mimosa-Besgrove
- Deep Creek
- Stewarton
- Tannyfoil
- Blackdown
- South Ballamoo
- Kenmare
- Ramp 74
- Togara-North Marshmead
- South Marshmead
- Kennedy
- Comet Downs East

Each landform will have a similar construction, comprising mined overburden and interburden disposed behind the active mining face to form a low-wall spoil dump, which will be reshaped to form a final spoil landform.

Mimosa-Besgrove, Deep Creek, Stewarton, Kenmare and Togara-North Marshmead spoil landforms contain a small proportion of existing or planned future rejects (between 0.2% and 1.9%, depending on the landform). Kenmare spoil landform also comprises approximately 1% existing tailings, located at Ramp 72 in-pit TSF.

Taking into account material quantities (proportions) and expected proportion of PAF and NAF-S materials reporting to each individual landform:

- Each of the 14 spoil landforms poses a **Low** AMD hazard, with AMD generation rated as **Highly Unlikely**.

The 'Low' AMD hazard is largely a result of less than 1.5% of non-carbonaceous spoil samples being classified as PAF of some type (or NAF-S) – and non-carbonaceous spoil comprises the overwhelming majority of mineral waste within each spoil landform.

Regarding Kenmare spoil landform specifically, the intrinsic AMD hazard of Ramp 72 TSF/tailings and rejects located at the southern end of the existing Kenmare pit – both of which will be contained (buried) within Kenmare spoil landform – is rated **Moderate-High to High** with the likelihood to generate AMD rated **Highly Likely** – due to AMD (as AD) having been observed from Ramp 72 TSF and from rejects within the existing Kenmare pit. Ramp 72 TSF and the rejects disposal area at the southern end of Kenmare pit are both within the Kenmare pit (void) shell. Rejects located near Ramp 70 within Kenmare spoil landform (at the northern end of the landform) pose a **Moderate** AMD hazard, with the likelihood to generate AMD rated **Probable/Likely**.

NCPP TSF landform

NCPP TSF is a large 'turkey's nest' style TSF with confining embankments on all sides, a base footprint of approximately 200 ha and has a total volume of approximately 26 Mm^3. NCPP TSF operated from approximately 1970 to 2023.

The source materials within NCPP TSF includes tailings, which are estimated to comprise approximately 80% of the landform; and rejects, which are estimated to comprise about 19% of the landform and form the basis of most of the embankments. The TSF landform also includes a small proportion (approximately 1 %) of spoil/fill material, predominantly within embankments.

Investigative drilling coupled with near-surface sampling has demonstrated that some tailings in the field at NCPP TSF are generating AMD (as AD and SD). Oxidation fronts are present in the TSF as demonstrated by decreasing sulfide concentrations from surface down, consumption of ANC, presence of secondary minerals generated through sulfide oxidation, and acid contact pH water.

The source hazard assessment for the mineral wastes within NCPP TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within NCPP TSF landform poses a **High** AMD source hazard; and rejects poses a **Low-Moderate** AMD source hazard. Fill material poses a low AMD source hazard. On this basis, and taking into account material quantities (proportions):

- NCPP TSF landform (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Highly Likely**, the highest landform AMD likelihood category under the applied scoring procedure – noting that AMD has already been observed at/from this TSF. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials is considered to be conservative and the landform domain AMD hazard score for NCPP TSF is also considered to be conservative.

Laleham TSF landform

Laleham TSF is largely constructed over spoil/fill (and also backfills a small pit). The TSF partly fills the upper reaches of a southeasterly plunging gully. The TSF abuts natural ground on the north and northwest, and overlies spoil/fill on the south and southeast. The TSF has a total area of approximately 12 ha and a total volume of approximately 4 Mm^3. The TSF operated from the late-1970s to the late-1980s, primarily receiving tailings from Laleham underground operation. Between 1990 and 1994 a thin spoil/soil cap was placed over the TSF and seeded/revegetated. This TSF has undergone rehabilitation and revegetation since decommissioning, however additional rehabilitation is assumed to be required prior to closure.

The source materials within Laleham TSF includes tailings, which are estimated to comprise approximately 90% of the landform; and rejects, which are estimated to comprise about 4% of the landform. The TSF embankments (main embankment and upper embankment) are predominantly constructed from spoil and fill material, which comprise about 6% of the TSF.

Investigative drilling has demonstrated that tailings in the field at Laleham TSF are generating AMD (as AD and SD). Oxidation fronts are present in the TSF as demonstrated by decreasing sulfide concentrations from surface down, consumption of ANC, presence of secondary minerals generated through sulfide oxidation, and acid contact pH water.

The source hazard assessment for the mineral wastes within Laleham TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within Laleham TSF landform poses a **Moderate-High** AMD source hazard; and rejects pose a **Moderate** AMD source hazard. Fill material poses a low AMD source hazard. Evidence of AMD (as AD) is present from over 30% of the tailings samples collected from within the TSF. On this basis, and taking into account material quantities (proportions):

- Laleham TSF landform (currently, without a final rehabilitation cover[1]) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials is considered to be conservative and the landform domain AMD hazard score for Laleham TSF is also considered to be conservative.

Bottom Dam TSF and rejects landform

Bottom Dam TSF is a small historic tailings dam south of ROM 3 near the SCPP in the southern area of BWM. Adjacent to the TSF, and in the general vicinity of the TSF (including on ROM 3), are rejects dumps. ROM 3 is an elevated natural ground area northwest of Bottom Dam TSF and situated approximately 37 m above (higher than) the TSF.

The TSF (specifically) occupies an area of approximately 1.6 ha (with an estimated total volume of approximately 0.2 Mm^3). The overall Bottom Dam TSF/rejects area is approximately 10 ha, with an overall tailings/rejects volume estimated at less than 1 Mm^3 (indicatively 0.6 to 0.8 Mm^3). The source materials within Bottom Dam TSF includes tailings, which are estimated to comprise approximately 95% of the landform; and rejects, which are estimated to comprise about 4% of the landform. The TSF landform is also assumed to include a small proportion (approximately 1 %) of spoil/fill material.

Tailings and rejects in Bottom Dam TSF/rejects were generated from the SCPP and are reasonably assumed to have environmental geochemical characteristics comparable to tailings and rejects located within Ramp 72 TSF, Kenmare pit and Laleham TSF. Preliminary investigative drilling and limited sampling has demonstrated that all tailings at Bottom Dam TSF are classified as 'PAF' of some type and most show evidence of generating AMD (as AD and SD).

The source hazard assessment for the mineral wastes within Bottom Dam TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within Bottom Dam TSF landform poses a **Moderate-High** AMD source hazard and rejects pose a **Moderate** AMD source hazard. Fill material poses a low AMD source hazard.

On this basis, and taking into account material quantities (proportions):

- Bottom Dam TSF landform (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials in Bottom Dam area is considered to be conservative and the landform domain AMD hazard score for Bottom Dam area (TSF and rejects combined) is also considered to be conservative.

Ramp 36 rejects landform

Ramp 36 rejects dump will remain as a 'stand-alone' rejects landform at closure. The dump is located approximately one km south of the NCPP and about 350 m southeast of NCPP TSF. The dump occupies an area of approximately 60 ha with a total estimated volume of approximately 10 Mm^3. The dump operated from approximately 1967 (start of mining at BWM) intermittently through until 2007. During

1 Laleham TSF currently has a spoil cover, however additional rehabilitation is expected to be required to meet post-closure rehabilitation criteria. As such, the AMD hazard assessment of Laleham TSF takes into consideration the existing cover material, however considers the facility to be 'unrehabilitated'.

this time, rejects have been taken (quarried) from the dump for use elsewhere on site – primarily for construction of the NCPP TSF embankments.

Ramp 36 rejects dump essentially comprises only rejects (approximately 98% by volume). A small amount of 'fill' (assume spoil) is also present and has been conservatively estimated to comprise about 2% of the landform.

The source hazard assessment for the mineral wastes within the rejects dump has utilised the same general methodology as applied to the spoil and TSF landforms. The source hazard assessment has found the rejects within the dump poses a **Moderate-High** AMD source hazard. Fill material has been assessed as posing a low AMD source hazard. Taking into account material quantities (proportions):

- Ramp 36 rejects dump (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard lies with the rejects, which comprise essentially all of the dump.

The AMD hazard score for the rejects materials is considered to be conservative and the landform domain AMD hazard score for the rejects dump is also considered to be conservative.

Residual voids

There are 15 existing and/or future pit areas at BWM that will remain at closure as residual voids. All except two correspond to the spoil landforms as previously identified. Stewarton pit will be mined into two voids (Stewarton North and Stewarton South). Blackdown pit (located between Tannyfoil and South Ballamoo pits) will be backfilled, and therefore has no associated residual void. Ramp 30S void is associated with Mimosa-Besgrove spoil landform:

- Ramp 8 void
- Bonnie Doon void (in-pit TSF)
- Mimosa-Besgrove void
- Ramp 30S void
- Deep Creek void
- Stewarton North void
- Stewarton South void
- Tannyfoil void
- South Ballamoo void
- Kenmare void (in-pit TSF)
- Ramp 74 [Laleham] void (in-pit TSF)
- Togara-North Marshmead void
- South Marshmead void
- Kennedy void
- Comet Downs East void

Excluding the Bonnie Doon and Ramp 74 residual voids that have tailings on the pit/void floor, the floor of all residual voids at closure will be the P & L Lower seam group, which is currently the floor of most/all existing pits.

Environmental geochemical data, coal quality data and drill-hole geological logs have been used to aid in the assessment of AMD risk associated with residual void highwalls / end-walls and floors.

The highwall /end-wall hazard assessment has found that approximately 3.5% to 6% of the void highwall and end-walls in all voids is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC and NAF-S. As such, the assessment has found that the likelihood of AMD generation from the void highwalls and end-walls is **Unlikely**, and any expression of AMD from the highwall / end-walls is likely to be localised.

Excluding Bonnie Doon and Ramp 74 voids, which have tailings on their floor, the floor of all other residual voids will be the P & L (lower) seam. On the highly conservative (if not overly conservative)

assumption that the floor of each of these non-tailings voids is all coal, the void floor AMD hazard assessment has found that approximately 3% of the floor of these voids where coal is exposed is estimated to be 'PAF', which includes material classified as PAF, UC(PAF), PAF-LC and NAF-S. As such, the conservative assessment has found that the likelihood of AMD generation from the floor of these voids where coal is exposed is **Unlikely**, until such time that the floor becomes submerged by groundwater (post-closure). In practice, mining takes all coal to the bottom of the seam, therefore very little coal would be expected to remain on the floor of these voids.

Bonnie Doon and Ramp 74 voids have tailings as the void floor and the source hazard assessment – based on the AMD hazard posed by tailings – has found that approximately 46% of the floor of Bonnie Doon void and 72% of the floor of Ramp 74 void is estimated to be 'PAF' [tailings], which includes tailings classified as PAF, PAF-LC, UC(PAF) and/or NAF-S. AMD generation from the floor of these TSF voids is **Probable/Likely**. The tailings within these voids will be capped/covered at end of mining and no tailings will be exposed post-closure. As such, the likelihood for AMD generation from the floor of these voids post-closure would be lower. Should these tailings floors become submerged by groundwater (post-closure), the likelihood for AMD generation from the tailings floor of these voids would be lower.

Geochemical Source-Pathway-Receptor (SPR) Assessment

The source-pathway-receptor (SPR) assessment includes the likelihood of the event occurring (e.g. the likelihood of AMD impacting a local creek), the severity of the event (should it occur) and the calculated risk rating (likelihood times severity). A risk rating was calculated for each spoil landform, each TSF landform, Ramp 36 rejects landform, and each residual void with respect to plausible surface water and groundwater receptors.

Conceptual site model and conceptual facility models

A post-mining conceptual site model (CSM), which applies generically to the spoil landforms and their respective residual voids at BWM, and the broader relationship these facilities have with surface water and groundwater in the district, has been produced by SLR Consulting Australia (SLR, 2026).

The CSM assists with the SPR assessment with regard to potential environmental geochemical impacts from mineral waste facilities. A key element of the CSM based on the SLR (2026) hydrogeological assessment (which included groundwater modelling with particle tracking) was that the residual voids at BWM will be groundwater 'sinks' (i.e. groundwater at BWM will flow into/towards the residual voids, and the voids will be the receptors of seepage from all BWM facilities).

A conceptual facility model (CFM) has been developed for each TSF and for Ramp 36 rejects dump to illustrate potential run-off and seepage pathways and surface water and groundwater receptors associated with these key mineral waste facilities.

Plausible pathways and receptors

Note: the assessment of shallow groundwater at BWM – particularly where shallow permeable strata may be not present in some areas, discontinuous and/or not interconnected – is limited by/to the distribution of the shallow bore network, which is sporadic. Therefore, despite the apparent low likelihood of substantial connection between shallow permeable strata and surface water features, the SPR assessment has adopted a highly conservative approach and assumed a plausible pathway may exist between shallow permeable strata and surface water features. All creeks at BWM are ephemeral. The surface water features (creeks) at BWM that are plausible receptors of run-off and/or seepage are:

- Bonnie Doon Creek west of Ramp 8 and Bonnie Doon spoil landforms, flowing north;

- Burngrove Creek and tributaries west of Mimosa-Besgrove spoil landform, flowing north;
- Deep Creek, flows west to east across the site between Mimosa-Besgrove and Deep Creek spoil landforms;
- Taurus Creek, flows west to east across the site between Deep Creek and Stewarton spoil landforms;
- Emu Creek and its' un-named tributaries, a collective of tributaries located west of Stewarton and Tannyfoil spoil landforms, which flow north into Taurus Creek;
- Sirius Creek, flows generally east to west across the site between Ramp 74 void and Togara-North Marshmead spoil landform. All of the minor un-named creeks on both sides of BWM between Blackdown spoil landform and Ramp 74 void drain into Sirius Creek; and
- Rockland Creek, flows east to west across the site between Togara-North Marshmead and South Marshmead spoil landforms, and northeast to southwest between Comet Downs East and Kennedy spoil landforms.

With regard to the spoil landforms, the plausible mechanisms for AMD affected water and/or non-oxidative salinity, if any, to report to receptors are:

- Surface water run-off from spoil landforms into nearby creeks;
- Seepage from spoil landforms via shallow permeable strata into nearby creeks;
- Seepage from spoil landforms into the residual voids; and
- Surface water run-off and seepage from void highwalls and end-walls into residual voids.

With regard to the TSF and rejects landforms, the plausible mechanisms for AMD affected water and/or non-oxidative salinity, if any, to report to receptors are:

- Surface water run-off from TSF or rejects landforms into nearby creeks;
- Seepage from TSF or rejects landforms via shallow permeable strata into nearby creeks; and
- Seepage from TSF or rejects landforms via groundwater into residual voids.

The SPR has conservatively assumed that shallow permeable strata are a plausible pathway linking a potential AMD source to deeper groundwater via downwards migration and linking a potential AMD source to nearby creeks via lateral migration. However, shallow permeable strata are assumed to be an implausible final receptor of run-off and seepage from final landforms and final voids. That is, the assumption based on information available is that AMD (source) entering shallow permeable strata (however (un)likely) will ultimately find its' way into deeper groundwater [residual voids] and/or local surface water features.

SPR risk rating of rehabilitated spoil landforms

There are plausible surface water and residual void receptors associated with final spoil landforms; and the run-off and seepage pathways linking the sources (final spoil landforms) to these receptors have been identified. With respect to AMD, the overall SPR risk rating from final spoil landforms is **Low**. With respect to non-oxidative salinity the overall SPR risk from final spoil landforms is also rated as **Low**.

Where landforms contain buried tailings and/or rejects, and especially if those buried tailings/rejects are located close to the edge of the landform and/or close to a creek, the risk rating with respect to AMD potentially making its way via shallow permeable strata into surface water features close to the buried tailings/rejects was rated as **Low to Medium**. This applies to Kenmare spoil landform (containing Ramp

72 tailings and Kenmare pit rejects) and Mimosa-Besgrove spoil landform (containing Deep Creek [Ramp 32] rejects dump).

SPR risk rating of rehabilitated NCPP TSF landform

There are plausible surface water and residual void receptors; and the run-off [and shallow seepage] pathways linking the source (NCPP TSF final landform) to these receptors have been identified. Groundwater modelling (SLR, 2026) shows that seepage from NCPP TSF landform would report to Deep Creek residual void. With respect to AMD, the overall SPR risk rating from the post-closure TSF final landform is **Low to Medium**. The 'Medium' risk rating applies to AD and SD associated with seepage via shallow permeable strata potentially impacting Deep Creek. With respect to non-oxidative salinity the overall SPR risk from NCPP TSF final landform is rated as **Low**.

SPR risk rating of rehabilitated Laleham TSF landform

There are plausible surface water and residual void receptors; and the run-off and shallow seepage pathways linking the source (Laleham TSF final landform) to these receptors have been identified. Groundwater modelling (SLR, 2026) shows that post-closure seepage from Laleham TSF landform would ultimately report to Togara-North Marshmead residual void via Ramp 74 void (seepage would likely report to Kenmare residual void via Ramp 74 void prior to long-term post-closure groundwater equilibrium). With respect to AMD, the overall SPR risk rating from the post-closure TSF final landform is **Low**. With respect to non-oxidative salinity the overall SPR risk from Laleham TSF final landform is also rated as **Low**.

SPR risk rating of rehabilitated Bottom Dam TSF and rejects landform

There are plausible surface water receptors; and the run-off and seepage pathways linking the source (Bottom Dam TSF/rejects final landform) to these receptors (Sirius Creek) have been identified. Groundwater modelling (SLR, 2026) shows that seepage from Bottom Dam TSF/rejects area would ultimately report to Togara-North Marshmead residual void via Ramp 74 void (seepage would likely report to Kenmare residual void via Ramp 74 void prior to long-term post-closure groundwater equilibrium). With respect to AMD, the overall SPR risk rating from the post-closure Bottom Dam final landform is **Low**. With respect to non-oxidative salinity the overall SPR risk from the post-closure Bottom Dam final landform is also rated as **Low**.

SPR risk rating of rehabilitated Ramp 36 rejects landform

There are plausible surface water and residual void receptors; and the run-off and shallow seepage pathways linking the source (Ramp 36 rejects final landform) to these receptors (Deep Creek) have been identified. Groundwater modelling (SLR, 2026) shows that seepage from Ramp 36 rejects landform would report to Deep Creek residual void. With respect to AMD, the overall SPR risk rating from the post-closure rejects final landform is **Low to Medium**. The 'Medium' risk rating applies to AD and SD associated with seepage via shallow permeable strata potentially impacting Deep Creek. With respect to non-oxidative salinity the overall SPR risk from the post-closure rejects final landform is also rated as **Low**.

SPR risk rating of residual voids

Modelling undertaken by SLR (2026) shows the final voids to be 'sinks' – receiving surface water run-off and seepage from spoil landforms and surface water run-off from void highwalls and end-walls. Each residual void is expected to receive inflow from the Permian groundwater aquifer.

The AMD assessment has found that it's unlikely that undiluted salinity or AMD from a flooded post-closure residual void floor (including covered tailings) would impact on residual void water quality to any significant degree, as other processes such as evapo-concentration are the key drivers of void lake water quality. Therefore, the AMD SPR risk rating on the overall water quality of the residual voids is **Low to Low-Medium**. A "Low to Medium" risk rating has been conservatively applied to the risk of AD and/or NMD/SD due to the AMD risk associated with tailings within Bonnie Doon and Ramp 74 voids.

Water reporting to residual voids is expected to remain within the voids (excluding evaporative loss). Modelling undertaken by SLR (2026) shows that seepage from the void lake (of each void) into groundwater, if any, would be limited.

Management and Rehabilitation Measures

The assessment has found that the environmental risks posed by spoil landforms likely to be present at closure are generally low. As such – for most spoil landforms – no specific AMD management measures (e.g. alkaline amendment or engineered capping systems) are expected to be required to manage mineral wastes during rehabilitation and closure – outside of operational mixing/burial of PAF waste amongst NAF waste, spoil placement and landform reshaping activities already proposed (refer below and to the main volume of the PRCP).

The AMD source hazard associated with Ramp 72 tailings and Kenmare pit rejects buried within Kenmare landform is high and, as such, rehabilitation of tailings and rejects within Kenmare ramp/pit will require specific AMD management measures – and the assessment program currently underway at Kenmare pit will address the rehabilitation requirements of these facilities. Once rehabilitated, the post-closure environmental risk posed by Kenmare spoil landform is expected to decrease.

The landform domain AMD hazard posed by NCPP TSF, Laleham TSF, Bottom Dam TSF and Ramp 36 rejects dump is moderate-high. These stand-alone landforms will require specific AMD management measures to manage these facilities post-closure.

The AMD hazard posed by tailings in Bonnie Doon in-pit TSF is moderate-high; and for tailings in Ramp 74 in-pit TSF is moderate. As such, in-pit tailings will also require specific AMD management measures to manage these voids post-closure.

Decommissioning and rehabilitation activities related to mineral waste will be addressed as part of the milestone criteria for infrastructure, remediation of contaminated land, landform design, surface preparation and revegetation, where necessary.

Proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report comprise the following actions. Refer to the main volume of the PRCP and Henderson Geotech (2024) for detailed information.

- Pits: will remain as residual voids under 15 groups (voids) as identified previously.
- Spoil dumps: will be reshaped into 14 final spoil landforms – mostly as related to their respective voids listed. Stewarton pit will be mined into two voids (Stewarton North and Stewarton South). Blackdown pit will be backfilled, leaving Blackdown spoil landform without an associated residual void. Spoil from Ramp 30S pit will form part of Mimosa-Besgrove spoil landform. After reshaping, all spoil dumps will be seeded.
- Bonnie Doon in-pit TSF will be covered by a spoil and water cover (hybrid cover). The optimal type and thickness of cover to manage the AMD hazard of Bonnie Doon in-pit TSF (tailings) will be determined following further assessment prior to covering.

- Ramp 74 in-pit TSF will be covered by a spoil and water cover (hybrid cover). The optimal design and thickness of cover to manage the AMD hazard of Ramp 74 in-pit TSF (tailings) will be determined following further assessment prior to covering.
- NCPP TSF (out-of-pit; above ground; stand-alone) will be covered by an engineered spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of the out-of-pit NCPP TSF will be determined following further assessment prior to covering.
- Laleham TSF (in-pit; above ground; stand-alone) will be covered by spoil. The optimal design and thickness of spoil cover to manage the AMD hazard of the TSF will be determined following further assessment prior to covering.
- Ramp 72 in-pit TSF will be covered by spoil within Kenmare spoil landform. The optimal design and thickness of spoil cover to manage the AMD hazard of the in-pit TSF will be determined following further assessment prior to covering.
- Bottom Dam TSF/rejects (out-of-pit; above ground; stand-alone). Rejects currently on ROM 3 will be relocated onto Bottom Dam TSF forming a rejects cap, which will then be covered by a spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of Bottom Dam TSF/rejects area will be determined following further assessment prior to covering.
- Kenmare in-pit rejects will be covered by spoil within Kenmare spoil landform. The optimal design and thickness of spoil cover to manage the AMD hazard of these in-pit rejects will be determined following further assessment prior to covering.
- Ramp 36 rejects (above ground; stand-alone) will be covered by a spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of the rejects dump will be determined following further assessment prior to covering.
- All other rejects (in-spoil disposal): Managed during operations (disposed within spoil) and progressively covered by spoil. No additional remediation for the rejects (at closure) is required. The optimal thickness of spoil cover to manage the AMD hazard of rejects will be determined following further assessment prior to covering.
- ROM pads: Remove remnant coal from ROM pads and dispose within spoil. All former ROM pads will be reshaped, covered with soil, ripped and seeded.
- Coal stockpiles: Remove remnant coal from coal stockpile pads and dispose within spoil. Cover with suitable soil material, rip and seed.

Blackwater Mine

Environmental Geochemical Characterisation and Risk Assessment of Mineral Waste

Executive Summary iii
Glossary of Terms xxv

TABLE of CONTENTS

1 Introduction and Context 1
1.1 Approach 1
1.2 Objective 1

2 Background 2
2.1 Site Overview 2
2.2 Mine Domains 6
2.3 Baseline Information 7

3 Potential Environmental Geochemical Hazards 16
3.1 Acid and Metalliferous Drainage 16
3.2 Salinity, Sodicity and Dispersion 16

4 Assessment Methodology 17
4.1 Information Review 17
4.2 Sample Collection 17
4.3 Sample Characterisation 19
4.4 Geochemical Source Hazard Assessment 21

5 Results 33
5.1 Mineralogy 33
5.2 Acid-Base Accounting (Potential for AMD) 35
5.3 Total Metals and Metalloids 48
5.4 Initial Solubility in Deionised Water 49
5.5 'Saline' Water Solubility of Tailings and Rejects 53
5.6 Characteristics of Tailings Liquor (Water) 54
5.7 Peroxide Leachate Solutions 54
5.8 Cation Exchange Capacity, Sodicity and Dispersion Potential of Spoil 56
5.9 Kinetic Column Leaching 57
5.10 OxCon Test-work 58

6 Summary of Geochemical Characteristics 61
6.1 AMD Potential of Mineral Wastes and Coal 61
6.2 Salinity, Sodicity and Dispersion Potential of Mineral Wastes and Coal 66

7 Risk Assessment 68
7.1 Geochemical source hazard assessment of material types 68
7.2 Geochemical source-pathway-receptor assessment 78

8 Management and Rehabilitation Measures 102

9 Forward Work Program 103

10 References 104

APPENDICES

Appendix A. Geological sections
Appendix B. AMD hazard scoring tables
Appendix C. SPR assessment tables

TABLES and FIGURES

Tables

Table 1. Hydrogeological units
Table 2. Preliminary AMD classification criteria
Table 3. Sulfur category
Table 4. ANC category
Table 5. Soil salinity classification
Table 6. Soil pH type
Table 7. Geochemical Abundance Index (GAI)
Table 8. Sodicity classification
Table 9. Emerson classifications
Table 10. AMD hazard scoring matrix for landforms
Table 11. AMD hazard ranking and landform/void AMD likelihood ranking
Table 12. ABA results statistics for spoil samples
Table 13. ABA results statistics for tailings, rejects and coal samples
Table 14. Scr as a proportion of total S
Table 15. Geochemical classification of samples
Table 16. Samples subjected to deionised water solubility tests
Table 17. Summary of OxCon results
Table 18. Source material proportions (%) within each spoil landform
Table 19. Estimated wall rock exposure as a function of material type for each residual void

Table 20. Sources, potential receptors and pathways between the source and receptor (post-closure) for spoil landforms

Table 21. Sources, potential receptors and pathways between the source and receptor (post-closure) for TSF and reject landforms

Table 22. Risk matrix for SPR assessment

Figures

Figure 1. Project layout, geochemical sample locations and locations of geological sections for the northern BWM area

Figure 2. Project layout, geochemical sample locations and locations of geological sections for the southern BWM area

Figure 3. Indicative stratigraphic column

Figure 4. Classification of soluble metals and metalloids as a function of pH

Figure 5. Mineral distribution within spoil samples

Figure 6. Mineral distribution within tailings and rejects samples

Figure 7. Sulfur (S) distribution

Figure 8. Sulfur (S) and sulfide (Scr) distribution of spoil samples

Figure 9. Sulfur (S) and sulfide (Scr) distribution of coal, tailings and rejects samples

Figure 10. Acid neutralising capacity (ANC) distribution

Figure 11. Distribution of acid neutralising capacity (ANC) [total], ANC at pH4.5 and proportion (%) of ANC expected to be readily available

Figure 12. Distribution of the ratio of acid neutralising capacity (ANC) to maximum potential acidity (MPA) [ANC/MPA ratio]

Figure 13. Distribution of net acid producing potential (NAPP)

Figure 14. Distribution of net acid generation pH (NAG single or NAG Extended or Stage 1 NAG Sequential)

Figure 15. Frequency distribution of geochemical abundance indices (GAI) of selected elements in spoil, coal, tailings and rejects)

Figure 16. Electrical conductivity (EC) and pH distribution

Figure 17. Sum of key environmental metals versus pH in deionised water extracts

Figure 18. Sum of key environmental metals versus pH in saline water extracts and tailings liquor

Figure 19. Sum of key environmental metals versus pH in peroxide (NAG) leachate solution

Figure 20. Cation exchange capacity (CEC) distribution and exchangeable sodium percentage (ESP) distribution of spoil

Figure 21. Sum of key environmental metals versus pH in kinetic column leachate solution

Figure 22. Sum of key environmental metals versus pH in OxCon leachate solution

Figure 23. Conceptual closure landform for the northern BWM area

Figure 24. Conceptual closure landform for the southern BWM area

Figure 25. Conceptual site model post-mining for the northern BWM area

Figure 26. Conceptual site model post-mining for the southern BWM area

Figure 27. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for NCPP TSF landform

Figure 28. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Laleham TSF landform

Figure 29. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Bottom Dam TSF and rejects landform

Figure 30. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 36 rejects landform

Figure 31. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 72 TSF buried within Kenmare spoil landform

Figure 32. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Deep Creek [Ramp 32] rejects buried within Mimosa-Besgrove spoil landform

Figure 33. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Bonnie Doon spoil landform and final void TSF (Bonnie Doon TSF)

Figure 34. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 74 spoil landform and final void TSF (Ramp 74 TSF)

GLOSSARY of TERMS

ABA	Acid-base account. Evaluation of the balance between acid generation and acid neutralisation processes. Generally determined by the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below. See also ANC and MPA.
Acid	A measure of hydrogen ion (H^+) concentration in water; generally expressed as pH.
Acidity	A measure of hydrogen concentration and latent acidity generated by metal hydroxylation, expressed as mg/L.
AMD	Acid and metalliferous drainage. AMD has three components: acid drainage (AD), pH-neutral and metalliferous drainage (NMD) and/or sulfide-derived saline drainage (SD) – and/or any combination of these, all generated by sulfide oxidation processes +/- neutralisation reactions.
ANC	Acid neutralising capacity, expressed as kg H_2SO_4 per tonne of rock/material. A measure of a sample's maximum potential ability to neutralise acid.
ANC/MPA ratio	Ratio of the acid neutralising capacity (ANC) to the maximum potential acidity (MPA) of a sample. Used to assess the risk of a sample generating acid conditions. See also ANC and MPA.
BWM	Blackwater mine. The name of the site subject to this PRCP.
CFM	Conceptual facility model.
CHPP	Coal handling and preparation plant. BWM has three CHPPs: the current (operational) CHPP, called NCPP, which is located near the BWM industrial area; a small thermal coal plant called TCP; and a disused (historic) CHPP called SCPP, which is located at the southern part of BWM [in the area referred to as South BWM].
Co-Disposal	The practice of disposing different waste types together. For example, disposing rejects and spoil together.
CSM	Conceptual site model.
EC	Electrical conductivity, expressed as μS/cm.
Interburden	Potential spoil material located between mined coal seams. See also Overburden, Mineral waste and Spoil.
Kinetic test	Procedure used to measure the geochemical/weathering behaviour of a sample of mine material over time.
Mineral waste	Material comprising mine spoil, ± coarse/fine reject, ± waste coal. Sometimes called 'mine waste' or 'mining waste'.
MPA	Maximum potential acidity. Calculated by multiplying the total sulfur (S) or sulfide-sulfur (Scr) content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne of rock/material.
NAF	Non-acid forming. Geochemical classification criterion for a sample that would not generate acid conditions. A sample classified as NAF may, or may not, have a significant sulfur content but the availability of neutralising material within the sample is more than adequate to neutralise all the acid that theoretically could be produced by any contained sulfide minerals. As such, material classified as NAF is considered unlikely to be a source of acid(ic) drainage, however NAF material may still develop NMD and/or SD, depending on sulfur concentration.

NAG	Net acid generating test. A pulp sample is reacted with hydrogen peroxide to encourage rapid oxidation. Any acid generated through oxidation may be consumed by neutralising components in the sample. Any remaining acidity (after neutralising material is consumed) is measured and expressed as kg H_2SO_4/t. At the conclusion of the NAG test the resulting liquor is called peroxide (NAG) leachate, and can be analysed for various parameters, such as soluble metals.
NAPP	Net acid producing potential, expressed as kg H_2SO_4 per tonne of rock/material. Calculated by subtracting the ANC from the MPA.
NCPP	North coal handling and preparation plant; the current (operational) CHPP located near the BWM industrial area.
NMD	Neutral and metalliferous drainage. A component of AMD, NMD occurs where drainage is pH-neutral or higher yet contains elevated trace metals and metalloids in solution.
Org S	Organic sulfur.
Overburden	Mineral (mining) waste located above (overburden proper) or between (interburden) coal seams and reports to spoil dumps. Typically comprises non-coaly and non-carbonaceous material, such as sandstone, siltstone and claystone/mudstone, but also includes a small percentage of carbonaceous material (e.g. carbonaceous siltstone) and sub-economic waste coal.
OxCon	Oxygen consumption test. A type of kinetic (dynamic) test for estimating the sulfide oxidation rates, acidity generation rates and carbonate neutralisation rates for sulfidic geological materials.
PAF	Potentially acid forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions. A sample classified as PAF has an acid generating potential (MPA) that exceeds the inherent acid neutralising capacity (ANC) of the material. This means that such a material is likely to generate acidic drainage (AD) if exposed to atmospheric conditions. See also PAF-LC.
PAF-LC	Potentially acid forming (low capacity). Geochemical classification criterion for a sample that has the potential to generate relatively low-level AD.
PRCP	Progressive rehabilitation and closure plan.
Product coal	Coal produced from the CHPP after being washed/processed. Coal that is ready for sale.
Rejects	Coarse sand to coarse gravel-sized rock material produced during coal processing. Rejects are typically associated with the roof, floor and partings of coal seams and are separated from ROM coal in the CHPP. Contemporary rejects produced at BWM are disposed within spoil dumps in the general vicinity of the NCPP. Historic rejects have been disposed into rejects dumps (stockpiles) and within disused pits. Rejects have also been used in construction activities, such as TSF embankments and used for capping/construction of pads.
Rejects dump	Out-of-pit landform containing rejects.
Residual void	The term given to an open-pit after mining has ceased and any rehabilitation of the pit has been undertaken (i.e. post-closure).
ROM	Run-of-mine. The term given to mined coal before being processed at the CHPP.
ROM pad	Location where ROM ore is temporarily stored pending processing at the CHPP.
S	Sulfur.

SCPP	South coal handling and preparation plant; a disused (historic) CHPP located at the southern part of BWM [in the area referred to as South BWM].
Scr	Chromium reducible sulfur. Analytical procedure to determine the sulfide-sulfur concentration in a sample. This typically represents the proportion of sulfur associated with sulfide (reactive) minerals.
SD	Saline drainage. A component of AMD, SD occurs where drainage is saline due to elevated sulfate as a result of sulfide oxidation and neutralisation reactions.
SO_4	Sulfate.
Spoil	Rock material overlying and between 'target' coal seams, which will report as waste. Waste rock overlying a coal seam is called overburden. Waste rock between mined coal seams is called interburden. See also Overburden and Interburden.
Spoil dump	In-pit or out-of-pit landform containing mineral waste.
SPR	Source-pathway-receptor.
Static test	Procedure for characterising the geochemical nature of a sample at one point in time. Static tests may include measurements of mineral and chemical composition of a sample and the Acid-Base Account.
Tailings	Very fine to medium grained sand, silt and clay-sized material, which is commonly coaly and carbonaceous, produced during coal washing. Tailings are associated with coal seams and are separated from ROM coal in the CHPP. Tailings produced at BWM are disposed within Tailings Storage Facilities (TSFs – also called tailings dams).
TCP	Thermal coal plant.
TSF	Tailings storage facility. A dam or pit used to dispose tailings. At BWM, tailings have been disposed into several above-ground and in-pit TSFs – the current (operational) TSF being Bonnie Doon in-pit TSF.
Uncertain	In the context of classifying a material (sample) as NAF or PAF. An 'Uncertain' (UC) classification applies when there is an apparent conflict in results such that neither NAF nor PAF classification can be given, or there is insufficient information to unequivocally classify as NAF or PAF. UC samples are given a tentative sub-classification as UC(NAF) or UC(PAF), where preliminary data suggests the sample may be NAF or PAF, respectively.
Waste coal	Sub-economical coal that reports directly to the spoil dumps as waste (i.e. not ROM coal). Waste coal can be fresh or weathered (oxidised). All weathered/oxidised and coked (cindered) coal is waste.
Water extract	A method to determine the water-soluble parameters in soil. Solid samples undergo a bottle leach method where 10 g of pulped solid (100% passing 212 μm) is combined with 50 grams of de-ionised water (leaching fluid) into a glass bottle. Depending on the type of leaching undertaken the leaching fluid may be deionised water (DI water extract) or saline water (saline water extract). The 1:5 solution (1 part solid to 5 parts water) is tumbled end-over-end for one hour. Solutes are leached from the soil by the continuous suspension and agitation. The water extract solution is measured for pH and electrical conductivity (EC) prior to filtering for solute analysis (e.g. metals/metalloids and major ions).

1 Introduction and Context

This report serves to document and discuss the environmental geochemical characteristics of mineral waste materials associated with Blackwater Mine (BWM), as defined under the current Environmental Authority (EA) EPML00717813. BWM is operated by Whitehaven Blackwater Pty Ltd. In this report the term 'mineral waste' refers to all geologic material generated by or associated with BWM during the course of mining, handling and processing coal.

It is a requirement of a Progressive Rehabilitation and Closure Plan (PRCP) that mineral waste is adequately characterised such that appropriate rehabilitation strategies can be selected and implemented. The PRCP guidance document: "Statutory g*uideline - Progressive rehabilitation and closure plan (PRC plans)*" (DESI, 2024) outlines the requirements and considerations for producing a PRCP, including documenting the relevant aspects of mineral waste characterisation for the purposes of PRCPs.

1.1 Approach

The general approach to mineral waste characterisation and assessment includes the following key steps:

- Briefly describe the current/existing background information for BWM of relevance to the generation and ultimate storage/disposal of mineral waste materials;
- Document the methodology used to characterise mineral waste materials (samples);
- Present and discuss the geochemical results;
- Describe the potential environmental geochemical hazards with respect to mineral waste materials;
- Present the conceptual site model (CSM), which illustrates the relationship between AMD and salinity sources, potential environmental and human health receptors and plausible pathways between the AMD and salinity sources and the receptors (Source-Pathway-Receptor [SPR]) at closure;
- Present the acid and metalliferous drainage (AMD) and salinity SPR risk assessment undertaken on the mineral waste materials;
- Outline the AMD specific management and rehabilitation measures proposed for mineral waste materials; and
- Outline a forward work plan to address any gaps identified from the assessment.

1.2 Objective

The objective of the assessment is to evaluate the geochemical nature of mineral waste currently at BWM and mineral waste likely to be present at closure, and identify relevant environmental issues/opportunities that may be associated with mining, handling and storing mineral waste to inform appropriate rehabilitation and management strategies.

2 Background

2.1 Site Overview

BWM is located within the Bowen Basin in Central Queensland. The administration and industrial areas are located approximately 75 kilometres (km) southeast of Emerald township. The northern end of the mine at Bonnie Doon pit is about 5 km southwest of Blackwater township. BWM is flanked on the east, west and south by pastoral leases; and bounded to the north by the Capricorn Highway. BWM is a very large mine with a strike length of approximately 65 km and is informally divided into two mining areas: north and south, based on historical ownership. The northern area of BWM is the current mining area - from Bonnie Doon pit south to Blackdown pit. The southern area includes existing (currently inactive) pits from South Ballamoo pit (also known as Terang pit) southwards to North Marshmead pit, plus proposed pit areas at South Marshmead, Kennedy and Comet Downs East.

BWM commenced operations in 1967 and comprises typical open-pit coal mining facilities, such as open pits, waste rock (spoil) dumps, tailings storage facilities (TSFs), rejects dumps, coal stockpiles, coal processing facilities, rail loadout facilities, process water and raw water dams, surface water drains and administration areas. There are also closed/inactive underground workings in the southern area of BWM. The key facilities and natural features at BWM of relevance to this waste characterisation report are shown on **Figure 1** (northern part of the mine) and **Figure 2** (southern part of the mine). [Also shown on Figures 1 and 2 are geochemical sampling locations and the locations of geological sections along and across each existing pit group and proposed new pit groups].

Current activities of relevance to this waste characterisation report comprise:

- Disposal of spoil to in-pit spoil dumps behind the active mining face (in-pit low-wall spoil disposal);
- Run-of-mine (ROM) coal processing at the north coal handling and preparation plant (NCPP), which produces two mineral waste types:
    - Tailings. Clay, silt and very fine to medium-grain sized sand material; disposed as a slurry.
    - Rejects. Coarse sand to cobble-sized material.
- Thermal ROM coal processing at the thermal coal plant (TCP), which produces a small amount of rejects.
- Disposal of tailings from NCPP to Bonnie Doon pit (Ramp 12 in-pit TSF); [active since late 2023];
- Disposal of rejects from NCPP and TCP to spoil dumps; Rejects from NCPP have been used in construction of TSF embankments and infrastructure pads;
- Short-term storage of ROM coal on the ROM Pad and product coal on the product coal stockpile.

Historic activities of relevance to this waste characterisation report comprise:

- Disposal of tailings from NCPP to the above-ground NCPP TSF; [inactive since late 2023];
- Disposal of rejects from NCPP and TCP to rejects dumps (primarily Ramp 36 and TCP rejects dump);
- ROM coal processing at the south coal handling and preparation plant (SCPP), which produced tailings and rejects similar to NCPP. The SCPP received ROM coal from open cut and underground mining operations in the southern BWM area (what was then called South BWM). SCPP has been inactive since the early 2000s.

- Disposal of tailings from SCPP to the above-ground Laleham TSF, two in-pit TSFs (Kenmare pit - Ramp 72 TSF; and Ramp 74 pit - Ramp 74 TSF) and Bottom Dam TSF (gully southeast of the SCPP ROM 3 pad). Tailings from NCPP were also disposed into Ramp 74 TSF;
- Disposal (rehandling) of mixed 'aged' tailings and rejects (originally from SCPP) into the southern end of Kenmare pit (Ramp 72 pit);
- Disposal of rejects from SCPP onto ROM Pad 3 and into Bottom Dam area adjacent to Bottom Dam TSF.

An overview of the proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report are outlined in **Section 8**. Refer to the main volume of the PRCP for detailed information.

Figure 1. Project layout, geochemical sample locations and locations of geological sections for the northern BWM area

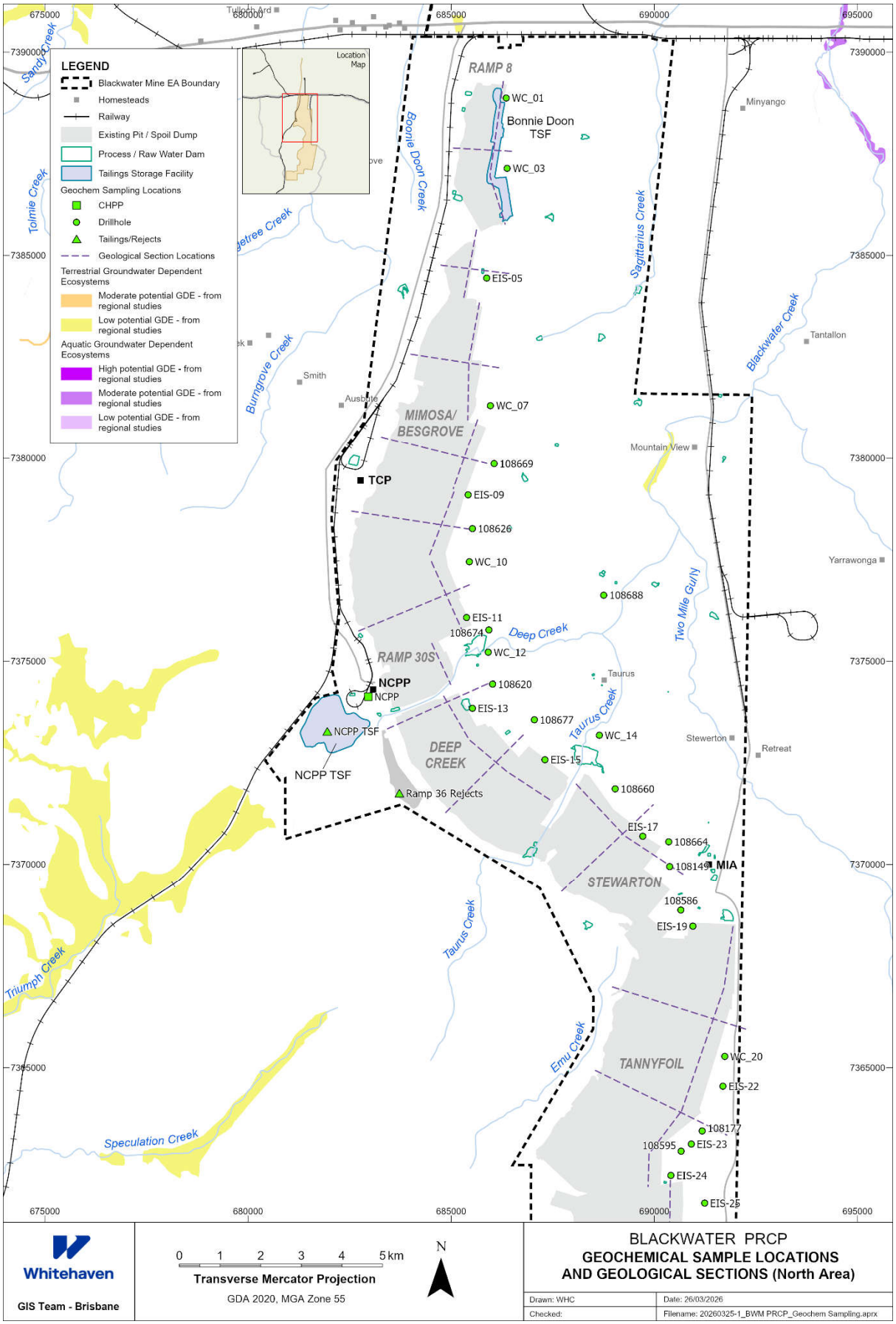
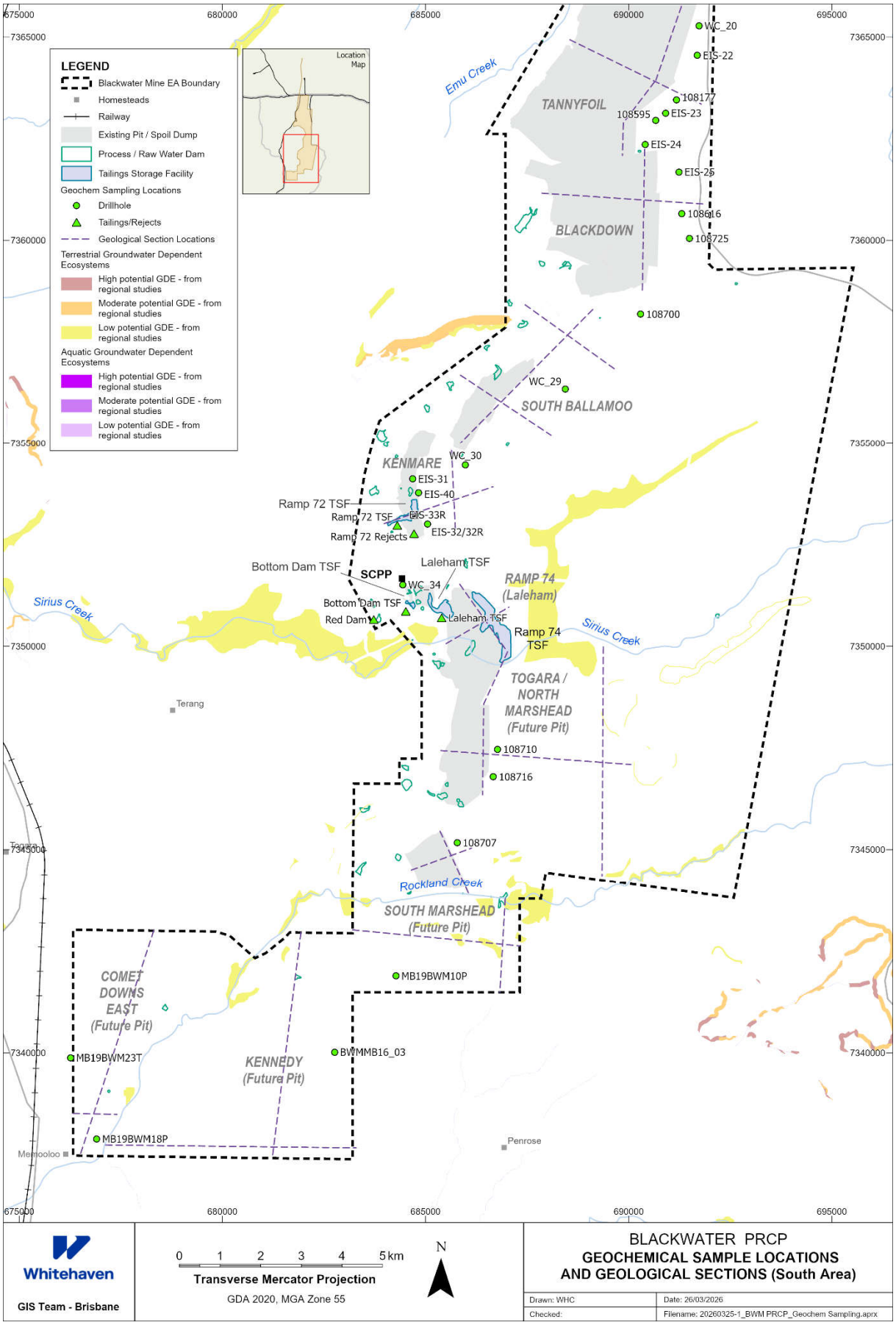


Figure 2. Project layout, geochemical sample locations and locations of geological sections for the southern BWM area



2.2 Mine Domains

The mine domains of direct relevance to mineral waste management at BWM at closure are:

- Spoil landforms and their corresponding residual voids (spoil dumps and/or pits remaining at end of mine life):
    - Ramp 8 spoil landform and residual void;
    - Bonnie Doon spoil landform and residual void, which will include Bonnie Doon TSF within the void;
    - Mimosa-Besgrove spoil landform and residual void, plus Ramp 30S residual void;
    - Deep Creek spoil landform and residual void;
    - Stewarton North spoil landform and residual void;
    - Stewarton South spoil landform and residual void;
    - Tannyfoil spoil landform and residual void;
    - Blackdown spoil landform. Blackdown pit will be backfilled (i.e. no Blackdown residual void);
    - South Ballamoo spoil landform (previously/historically called Terang) and residual void;
    - Kenmare spoil landform and residual void, which will include Ramp 72 TSF within the landform;
    - Ramp 74 spoil landform and residual void, which will include Laleham TSF within the northern edge of the Ramp 74 spoil landform and Ramp 74 TSF within Ramp 74 void;
    - Togara-North Marshmead spoil landform and residual void;
    - South Marshmead spoil landform and residual void;
    - Kennedy spoil landform and residual void; and
    - Comet Downs East spoil landform and residual void.

  Bonnie Doon TSF (the current/active TSF within Bonnie Doon pit) and Ramp 74 TSF (Ramp 74 pit) will remain within their respective residual voids. Ramp 72 TSF (within current Kenmare pit) will be buried by spoil during rehabilitation and will be incorporated by the Kenmare spoil landform.

  Note: most of the spoil landforms are not 'discrete' (completely stand-alone) features. Instead, they should be thought of as zones within a single landform with a hummocky, rolling topography - higher spoil areas behind (west of) each residual void, where mining occurred - and lower between voids, where pit ramps were located.

- TSF landforms:
    - NCPP TSF (inactive; above-ground facility);
    - Laleham TSF (inactive/decommissioned and partially rehabilitated; above-ground facility); and
    - Bottom Dam TSF (inactive/decommissioned; above-ground facility).
- Rejects landforms:
    - Ramp 36 rejects landform near Deep Creek (inactive/decommissioned; above-ground facility).
- TCP rejects will be relocated into the Mimosa-Besgrove spoil landform during rehabilitation of the TCP area and, as such, will not remain as a rejects landform post-closure.
- Coal stockpiles: ROM coal pad and stockpile; and Product coal pad and stockpile.

Material types and quantities

BWM has three main types of mineral waste, and the geochemical characteristics and potential hazards associated with mineral waste materials on site are discussed by type:

- Spoil (overburden and interburden) currently comprises approximately 99% of all mineral waste at BWM and includes weathered waste (Tertiary and Permian-age) and fresh (unweathered) waste (all Permian-age). On average, approximately 40% of spoil is weathered/oxidised and the remaining (approximately 60%) is fresh, with the proportion of weathered to fresh spoil varying throughout the site. In the northern half of the site the proportion of weathered to fresh spoil is about 25% weathered to 75% fresh, whereas in the southern half of the site the proportion of weathered to fresh spoil is about 49% weathered to 51% fresh.
- Tailings are generated at the NCPP (and previously also at the SCPP) from processing ROM coal and typically represent the clay, silt and fine sand fractions of ROM waste. Throughout operations at BWM, tailings have been disposed as a slurry into a number of TSFs – the current (active) TSF being Bonnie Doon in-pit TSF. Tailings comprises approximately 0.5% of all mineral waste at BWM – with this approximated proportion expected for the remaining life of asset mine plan.

Rejects are generated at the NCPP (and previously also at the SCPP) from processing ROM coal and typically represents coarser and rockier seam roof, partings and floor material. Rejects are trucked to several locations for disposal into spoil. Historically, rejects were also disposed onto rejects dumps, such as Ramp 36 rejects dump, TCP rejects dump and Bottom Dam TSF [mixed tailings and rejects]. Some rejects have been used in construction of TSF embankments and infrastructure pads (e.g. ROM and coal stockpile pads). Rejects comprise approximately 0.5% of all mineral waste at BWM – with this approximated proportion expected for the remaining life of asset mine plan.

Coal is also included in the assessment; however, coal is generally not considered mineral waste, with the exception of small quantities of sub-economic seams that may report to the spoil dumps, and remnant coal exposed on pit highwalls and end-walls (such as in residual voids).

2.3 Baseline Information

2.3.1 Topography

The most prominent topographic feature in the region is the Blackdown Tablelands (also known as the Blackdown Ranges) – a sandstone plateau situated about 10 km to the east of BWM mine, which rises abruptly from the surrounding plains to an elevation of approximately 900 metres Australian Height Datum (mAHD), however most of the Tablelands have an elevation of around 340 to 400 mAHD. The relatively steep slopes associated with the Blackdown Tablelands contrast with the generally lower relief areas west of the ranges at BWM, particularly throughout the northern half of the site.

Throughout the northern part of BWM the elevation is typically between 180 to 220 mAHD. Comparatively, the southern and southwestern area has much greater topographic relief, ranging from approximately 170 mAHD in the southwest of the PRCP area in the vicinity of Comet Downs East to approximately 390 mAHD at the eastern ML boundary between Blackdown and Terang pits (average approximately 300 mAHD for the southern area).

2.3.2 Climate

The following information about climate is general and provided for broad context. Refer to the main volume of the PRCP for detailed information about climate at BWM.

BWM is located within Queensland's semi-arid climatic zone, which is characterised by high summer temperatures, warm dry winters and generally distinct wet and dry seasons; with higher rainfall and higher evaporation occurring over the summer months (December to February).

Climate data is available from Bureau of Meteorology weather stations near Blackwater township [Blackwater water treatment plant (station ID 035290) and Blackwater airport (station ID 035134)], and from Emerald airport (station ID 035264) located about 70 km west of BWM.

Average maximum temperatures range from approximately 23°C in June/July to 34°C in December/January, with average minimum temperatures ranging from approximately 9°C in June/July to 22°C in January.

Average annual rainfall is approximately 547 mm at Blackwater township and about 561 mm at Emerald. Average annual evaporation is approximately 2000 mm for the district. As would be expected for the region, the evaporation rate is highest in the summer months (December/January) and lowest in the cooler months (June/July).

Rainfall events are often associated with thunderstorms, which are typically short-lived, intense and have variable coverage. Sustained rainfall over a large landscape area is experienced when tropical lows with cyclonic activity occur in coastal area. However, periods of prolonged drought do occur within the region.

2.3.3 Geology

The Blackwater sits on the eastern flanks of the Comet Ridge, a major regional anticline. Throughout most of BWM the sediments strike north-south and dip gently towards the east with average bedding dips of 3-5 degrees (although there are significantly steeper areas associated with faulting). In the far southern area the strike direction is west-east. The lithology at BWM is characterised by typical basin-fill sediments, comprising mudstone, claystone, siltstone, sandstone (typically fine- to medium-grained), carbonaceous sediments and coal seams.

In coal environments (i.e. at coal mines) fresh carbonaceous materials typically have higher sulfide concentrations compared with fresh non-carbonaceous materials and, as such, typically pose a greater environmental geochemical hazard compared with fresh non-carbonaceous material. Comparatively, non-carbonaceous lithologies are essentially void of (or have negligible) carbonaceous material and thus have low or nil sulfide mineral concentration. The key exception is that non-carbonaceous materials located within coal seams or immediately above and below (within, say, 0.5m of) coal seams tend to have a higher sulfide concentration compared to bulk overburden/interburden located away from seams.

Minor basalt is encountered within Tertiary-age material. Excluding the far southern area that has not been mined (and is subject to development approval), the depth to base of weathering averages about 23 m below natural surface throughout but ranges from about 10 m to 60 m below natural surface, depending on the local topography. Depth to base of weathering is generally highest in the far southern area (not currently mined), with an average depth to base of weathering of about 45 m below natural surface.

The economic coal seams in the Blackwater area are contained within the late Permian-age Rangal Coal Measures. The Rangal Coal Measures are underlain by the Burngrove Formation (which outcrops west of the site) and are overlain by the Early Triassic-age Rewan Formation. In some areas at the southern end of the mine the Rangal Coal Measures are unconformably overlain by up to 45 m of partially consolidated Cainozoic (Tertiary) sands, gravels, basalts and clays. Elsewhere on the mine, Tertiary cover

is usually much thinner. Most areas on the mine are also capped by thin veneer of Quaternary-age sediments (typically alluvial sediments).

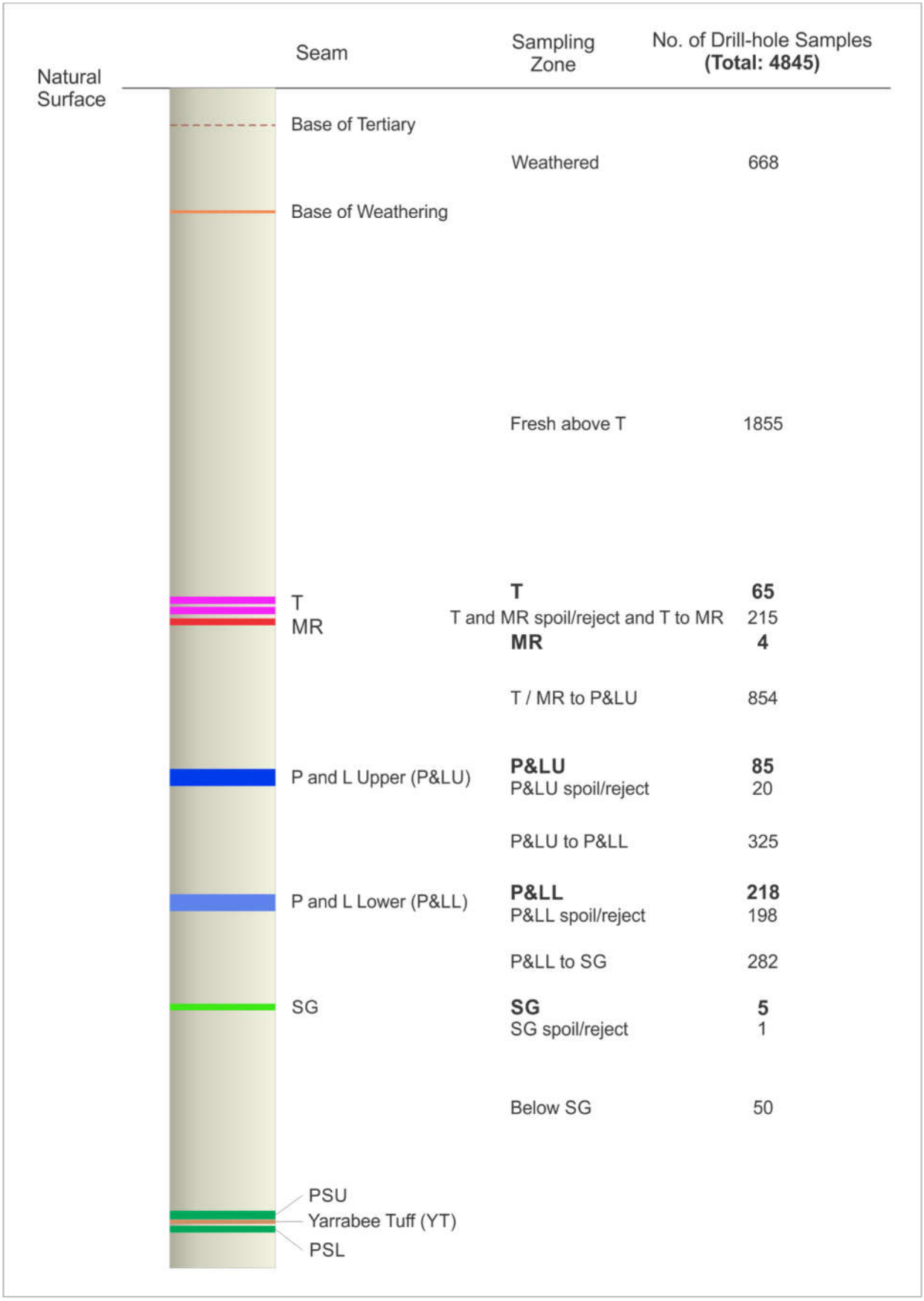
Blackwater mine currently exposes three principal seam groups from the Rangal Coal Measures – called the tops, middles and lowers [historically, the southern BWM area (what was once called South BWM) named these seam groups Aries (tops), Castor (middles), Pollux/Orion/Argo (lowers)]. The northern end of the mine predominately mines the lower seam group, whereas the central and southern areas mine all three seam groups. The seams split and re-join through the mine often creating upper and lower sub-sections of itself, typically called riders (e.g. Top Rider, Middle Rider).

An indicative stratigraphic column showing the seam groups is provided in **Figure 3**, which also includes the number of geochemical samples collected from each overburden and interburden zone, and also from within each seam group (refer to **Section 4.3** for information regarding sample collection). The intention of the stratigraphic column is not to show each specific sub-seam and ply, but rather to provide an indication of the availability of environmental geochemical information throughout the general stratigraphic sequence from natural surface down to approximate pit depth.

Geological long-sections along (or close to) the current highwall of the existing pits and the expected void highwalls of the proposed pits are provided at **Appendix A – Figures A1 to A7**. Geological cross-sections through the existing pits and proposed pit areas (including current topography) are provided at **Appendix A – Figures A8 to A14**. Refer to **Figures 1 and 2** for section locations. The seam groups are shown in the geological sections.

Due to the generally eastward dip of the seams (southward dip in the three southern-most pits) and the nature of the seams splitting and coalescing, the location of the weathered zone shown in the stratigraphic column (**Figure 3**) varies from pit to pit (north to south) and also from west (start of mining) to east (current and future mining). Refer to the geological long- and cross-sections in **Appendix A**.

Figure 3. Indicative stratigraphic column



2.3.4 Surface water / hydrology

The following information about surface water / hydrology is general and provided for broad context. Refer to the main volume of the PRCP for detailed information about surface water at BWM.

A topographic divide runs across the site approximately between Blackdown and South Ballamoo (Terang) pits, separating the mine into two distinct drainage catchments – a northern catchment area that drains east and north primarily to Blackwater Creek (and northwest via Burngrove Creek), and a southern area that predominantly flows south and west via Sirius Creek and Rockland Creek.

The surface drainage at BWM comprises a number of named and un-named ephemeral creeks that are tributaries of Blackwater Creek, Sirius Creek and Rockland Creek. To the north of the topographic divide the drainage direction is from south to north ultimately into the Mackenzie River, which is the main surface drainage in the region. To the south of the divide, creeks generally flow from north-east to south-west and then westward into the Comet River, which then drains into the Nogoa/McKenzie Rivers near the township of Comet, approximately 35 km west of Blackwater township.

All watercourses and tributaries within and in the vicinity of BWM are highly ephemeral and only flow briefly after rainfall. The creeks at BWM, from north to south, are shown on **Figures 1 and 2** and include:

Northern catchment creeks

- Burngrove Creek, flowing northwest from the Mimosa and Sagittarius pit area. All of the small un-named creeks west of Mimosa-Besgrove spoil landform drain north into Burngrove Creek (a tributary of McKenzie River);
- Various un-named creeks located in the highwall area between Bonnie-Doon pit and Sagittarius pit, which flow east and northeast into Sagittarius Creek (a tributary of Blackwater Creek);
- Various un-named creeks located in the highwall area between Burngrove pit and Besgrove pit, which flow east into Taurus Creek (a tributary of Blackwater Creek);
- Deep Creek, which flows west to east across the site between Besgrove/R30S and Deep Creek pits. Near the eastern ML boundary, Deep Creek flows into Taurus Creek (a tributary of Blackwater Creek). Small un-named creeks on the southern side of NCPP TSF (west of Deep Creek Rejects area) drain into Deep Creek;
- Taurus Creek, which flows west to east across the site between Deep Creek and Stewarton North pits. Most of the small un-named creeks on the south-western side of Deep Creek pit drain into Taurus Creek;
- Emu Creek and its' un-named tributaries, a collective of minor tributaries located west of Stewarton and Tannyfoil pits, which flow north into Taurus Creek; and
- Various un-named creeks located in the highwall area between Stewarton, Tannyfoil and Blackdown pits, which flow north into Two Mile Gully (a tributary of Taurus Creek).

Southern catchment creeks

- Sirius Creek, which flows generally east to west across the site near Ramp 74 pit. All of the minor un-named creeks on both sides of the mine between Blackdown pit and Ramp 74 pit drain into Sirius Creek; and

- Rockland Creek, which flows generally northeast to southwest across the site between Togara-North Marshmead and South Marshmead pits and between Comet Downs East and Kennedy pits.

Of the above creeks, Burngrove Creek, Deep Creek and Taurus Creek in the northern catchment and Sirius Creek and Rockland Creek in the southern catchment are the most significant watercourses within and surrounding BWM. All other minor and un-named tributaries flow into one of these five key watercourses.

2.3.5 Groundwater / hydrogeology

The following information about groundwater / hydrogeology is general and provided for broad context. Refer to the main volume of the PRCP for detailed information about groundwater at BWM.

An aquifer is defined as a groundwater bearing formation sufficiently permeable to transmit and yield water in usable quantities. The Quaternary alluvial formations, Tertiary sediment and basalt formations, Rewan Group (Triassic age) and the Permian coal measures generally yield low sustainable volumes of poor-quality water. As such, these formations are not recognised as 'true' aquifers in the area. However, for the purpose of the discussion, groundwater-bearing zones at BWM are referred to as aquifers. The hydrogeological units at BWM are outlined in **Table 1**.

Table 1. Hydrogeological units

Age	Geological Unit	Aquifer
Quaternary	Undifferentiated alluvium (mainly clay, silt, sand and gravels) associated with floodplains of the major drainage channels	Sand and gravel deposits within the alluvium forming unconfined aquifer; Predominantly localised in pockets close to creeks (i.e. not a continuous aquifer), therefore often dry during dry periods.
Tertiary & Triassic	Regolith: Undifferentiated colluvium and weathered units (clay, silt, sand, and weathered mudstone/siltstone/ sandstone. Basalt also present in the southern part of the site	Unconfined and largely unsaturated unit. Insignificant groundwater host.
Triassic	Rewan Group: Mudstones interbedded with siltstones and fine- to medium-grained sandstone.	Regional-scale aquitard (very low yielding)
Permian	Rangal Coal Measures: [overburden and interburden]. Mainly sandstone, siltstone and claystone	The low-permeability sandstone and siltstone interburden units (between coal seams) are typically dry or very low yielding (i.e. have aquitard properties).
	Rangal Coal Measures: [coal seams]	The coal seams are identified as the primary aquifer; associated with secondary porosity through coal seam cleats/cracks and fissures/fractures associated with faults intersecting coal seams. The coal measures are highly faulted, resulting in groundwater compartmentalisation. Recharge is via direct infiltration where seams outcrop or sub-crop.
	Burngrove Formation: mudstone, siltstone, sandstone, coal and tuff. Equivalent to the Foot Cooper Coal Measures elsewhere in the Bowen Basin.	Coal seams of this unit form a regional-scale aquifer in conjunction with low permeability overburden and interburden, that essentially form aquitards. Considered the 'basement' formation at BWM.

The main factors influencing natural groundwater levels are groundwater recharge, evapotranspiration and regional flow patterns. Due to the heterogeneity and discontinuity (and often dry condition) of the Quaternary alluvium aquifers and Tertiary sediment and basalt units, the groundwater flow direction in these 'aquifers' cannot be determined on a regional scale – and is likely to be very local and topographically controlled, flowing from higher elevations to lower elevations – particularly in the southern half of BWM where there is greater topographic relief. Regionally, the groundwater flow direction within the Permian coal seams generally mimics the surface water flow direction. Prior to mining, groundwater flow in the northern half of BWM would have been generally towards the north and groundwater flow in the southern half of BWM would have been generally towards the southwest. Locally, these groundwater flow directions have been interrupted by mining, with current groundwater flow directions in the vicinity of the mine being towards the pits (i.e. the pits are currently groundwater 'sinks'). Information available suggests the presence of impermeable faults at some locations have hydraulically compartmentalised the coal seams in these faulted areas. It is noted that Cook Underground Colliery (not part of BWM) located immediately east of BWM near Tannyfoil residual void is likely a localised groundwater 'sink'.

Potential for groundwater-surface water interaction

Based on hydrogeological studies and conceptualisation of groundwater flow (refer to groundwater section of the PRCP), groundwater interaction with ephemeral creeks is considered to be unlikely – with the exception of Sirius Creek in the southern area of the mine. The extent of alluvium is limited, both horizontally and vertically, suggesting dry conditions for most of that unit and water tables significantly below the creek beds. The regolith (i.e. weathered Tertiary sediments and weathered Rewan Group) is also unlikely to host significant groundwater. Where saturated, water levels in the regolith are several meters below the base of creek beds.

In the southern part of the site there is potential for intermittent hydraulic connectivity between the regolith and surface drainages during wet periods. However, the ephemeral nature of the creeks indicates a general lack of continual baseflow from groundwater into the creeks. Groundwater modelling with particle tracking (SLR, 2026) shows a hydrogeological connection between the Permian groundwater aquifer and shallow alluvium in the vicinity of Sirius Creek.

There is also the potential for interaction between mine surface water storages such as dams and pits (residual voids), and the hydrogeological units hydraulically connected to them.

Groundwater quality

The physico-chemical results from groundwater sampling at BWM indicate the water chemistry is typically pH-neutral for all geological formations where groundwater is encountered. Very limited data from the alluvial zone indicates a pH of approximately 5 to 6 – consistent with recent rainwater recharge.

Groundwater associated with most geological (and hydrogeological) units have salinity levels (measured as electrical conductivity (EC)), ranging from brackish to saline – median EC approximately 13,000 μS/cm in the non-coal zones of the Rangal Coal Measures; approximately 18,000 μS/cm in the coal seams of the Rangal Coal Measures; to nearly 34,000 μS/cm in the Rewan Group. The Tertiary sediments have the lowest salinity (median of approximately 7300 μS/cm). Major ions in groundwater at BWM are generally dominated by sodium and chloride. Very limited data from the alluvial zone indicates a sodium-calcium-chloride-bicarbonate water type – consistent with recent rainwater recharge.

The existing concentrations of some dissolved metals in the groundwater are above the water quality guidelines (95% protection) for freshwater ecosystems (ANZG, 2018; QWQG 2006). Slightly elevated

concentrations of some elements in groundwater in Permian coal measures in the Bowen Basin are not uncommon and are considered to be naturally occurring.

The water quality from the monitoring wells located at and close to BWM indicates that, generally, the water is unsuitable for human consumption as assessed against the Australian Drinking Water Guidelines (HMRC-NRMMC 2011). Local groundwater use is primarily for livestock purposes owing to the variable salinity levels and generally low yields.

2.3.6 Potential environmental and human health receptors

A conceptual environmental geochemical model (source-pathway-receptor (SPR) model) for BWM identified the potential environmental and human health receptors and are discussed within this report. Of relevance to this assessment (i.e. hazards and risks posed by AMD), the following potential receptors are noted.

Potential surface water receptors

The primary surface water features in the district are the Comet River, located approximately 30 km west of BWM; and the McKenzie River, located approximately 20 km northwest of the northern tip of BWM. Comet River flows north into McKenzie River. As explained in Section 2.3.4., the northern half of the site drains primarily east via Deep Creek and Taurus Creek (and lesser so northwest via Burngrove Creek), all of which eventually drain north into the McKenzie River. The southern half of the site drains west and southwest via Sirius Creek and Rockland Creek, which eventually drain into the Comet River, which flows north into the McKenzie River. Therefore, all of BWM eventually drains into the McKenzie River. BWM shares the McKenzie/Comet River Catchment with several other coal mines upstream of the Comet/McKenzie confluence (e.g. Ensham Mine) and downstream (e.g. Currah North, Jellinbah East and Yarrabee mines). The Comet and McKenzie rivers are implausible receptors for AMD due to their distance from BWM, however their tributaries proximal to the mine are potential receptors.

Potential groundwater receptors

Aquatic and terrestrial groundwater dependent ecosystems (from national assessment) are shown in Figures 1 and 2.

Potential domestic (human) receptors

There are a number of homesteads in the general vicinity of BWM, however none are close to any pits (residual voids), TSFs or spoil dumps and, as such, are considered to be implausible receptors of AMD. The nearest homestead to the current mining area is '*Ausbute*' located about 1.3 km west of Burngrove pit.

There are homesteads that are owned by Whitehaven that are located nearby or within current or future mining areas, or areas that may be impacted by mining. These include '*Memooloo*' homestead, located approximately one km southwest of Comet Downs East residual void (noting that Comet Downs East is a future mining area that has not commenced), '*Mountainview*' located inside the ML over 5 km east of Burngrove residual void and '*Taurus*' homestead, located inside the ML approximately 1.6 km east of Deep Creek residual void. These homesteads are all a significant distance from the residual voids as described are considered to be implausible receptors of AMD.

There are homes/homesteads at Blackwater township – the main township northeast of Bonnie Doon pit and a small group of properties on the northern side of Capricorn Highway northwest of Bonnie Doon pit. The closest homes in this far northern BWM area are located approximately 290 m northwest and

380 m northeast of the ML boundary and approximately 2.2 km northwest and 4.8 km northeast of Bonnie Doon pit. Bonnie Doon pit is the active TSF and will not be expanded (i.e. the 2.2 km / 4.8 km distance from Bonnie Boon pit to the nearest residences will remain the same post closure as it currently is). Blackwater township and properties north of Bonnie Doon pit are considered to be unlikely receptors for AMD from Bonnie Doon TSF (pit).

2.3.7 Acid and Metalliferous Drainage

Environmental geochemical information with regard to AMD from mineral waste materials at BWM has been sourced from the Coal Geochemical Database (hereafter called 'the geochemical database') and is presented and discussed within this report.

2.3.8 Salinity, Sodicity and Dispersion

Environmental geochemical information with regard to salinity, sodicity and dispersion of mineral waste materials at BWM has been sourced from the geochemical database and is presented and discussed within this report. Refer to the main volume of the PRCP for detailed information about soils and rehabilitation of spoil dumps at BWM.

3 Potential Environmental Geochemical Hazards

3.1 Acid and Metalliferous Drainage

The term 'AMD' is used to describe low-quality seepage or drainage (from soil and rock) that has been affected by the oxidation of sulfide minerals (e.g. pyrite) and/or by the dissolution of acid generating sulfate minerals (primarily alunite and jarosite) and associated neutralisation reactions, if any. The term AMD is used to describe any drainage type affected by this process.

AMD may be produced when sulfide minerals (such as pyrite) are exposed to oxygen and water. Oxidation of sulfide minerals may result in the production of acid(ity), sulfate (SO_4) and, depending on mineralogy, the release of metals and salinity. AMD comprises three key components, which are defined below as per recognised Australian and international guidelines (INAP, 2009; DIIS, 2016). This assessment has adopted these definitions:

- Acid drainage (AD): where contact water is acidic and, in most cases, also contains 'elevated' concentrations of metals and metalloids. This drainage type is generated when the acid generating capacity exceeds the acid neutralisation capacity of a sample.
- Neutral and metalliferous drainage (NMD): where contact water is pH-neutral/alkaline and contains 'elevated' concentrations of metals and metalloids. This drainage type is generated when the acid neutralising capacity exceeds the acid generating capacity of a sample.
- Saline drainage (SD): where contact water contains elevated sulfate concentration due to oxidation of sulfide minerals, and very low metal/metalloid concentration. This drainage type is generated when the acid neutralising capacity vastly exceeds the acid generating capacity of a sample with high sulfide concentration.

Whether contact water is impacted by AD, NMD and/or SD largely depends on the relative proportion of acid generating minerals (sulfide / sulfate) and acid neutralising minerals (carbonate) in the source materials.

3.2 Salinity, Sodicity and Dispersion

An assessment of salinity characteristics of mineral waste materials has been undertaken on materials using available EC data from the geochemical database. An assessment of sodicity and dispersion characteristics of spoil materials has also been undertaken using exchangeable cation and Emerson Class data from overburden/interburden samples (data obtained from the geochemical database). Salinity released from the dissolution of geogenic salts (non-oxidative) is a separate and distinct process from SD associated with sulfide oxidation.

4 Assessment Methodology

This section provides the methodology used for the geochemical characterisation and assessment of mineral wastes and coal at BWM.

4.1 Information Review

Sampling and laboratory test-work has been undertaken by throughout the development and operation of BWM. The geochemical database contains all available geochemical data for mineral waste samples. All data has been compiled and reviewed specifically to support the PRCP, to provide a unified and consistent interpretation of all available data. Past characterisation reports are superseded by this review and assessment undertaken to support the PRCP.

4.2 Sample Collection

Drill-hole Samples – representing spoil, ROM coal, pit walls and pit floor

All data used to assess spoil and ROM coal (and pit walls and floor) has been derived from drill-hole sampling. Drill-hole samples have been collected from 47 drill-holes located throughout BWM (shown in Figures 1 and 2) drilled and sampled between 2020-2025.

The drillholes are distributed along strike (approximately north-south) and, as such, intersect all mined geological units along the entire site, with sampling undertaken from surface to full drill-hole depth (approximately to below the lowest mined seam). As such, the drill-hole samples that have undergone test-work are representative of the geology/stratigraphy at BWM from existing mining (disturbance) areas.

The BWM coal resource model provides an estimate of coal resources from current pit highwall through to the eastern extent of the mine (as currently approved). The resource model indicates that – at closure – the proportion of coal versus non-coal in the highwall / end-walls of the residual voids is broadly consistent with the current proportions on the pit highwalls / end-walls. The model also shows that the proportion of each seam group is expected to be broadly similar to current seam group proportions on the highwall and end-walls of the current pits. As such, it is reasonable to assume that the mineral waste types assessed, and their relative proportions, are representative of the mineral waste types and proportions likely to be present at closure.

Geochemical data is available for 4845 drill-hole samples collected from 44 drill-holes. Geochemical samples collected and tested were sourced from the following key mineral waste domains:

- Weathered, non-carbonaceous spoil. 657 samples.
- Weathered, carbonaceous spoil, including weathered coal. 9 samples.
- Fresh, non-carbonaceous spoil. 3515 samples.
- Fresh, carbonaceous spoil. 283 samples. These samples typically include carbonaceous siltstone, carbonaceous sandstone, carbonaceous mudstone and coaly shale, but also includes similar coaly and carbonaceous materials other than coal.
- Fresh, coal. 381 samples.

All samples collected for geochemical analysis were collected from core-drilling. Most samples were collected as discrete samples – typically a 15-25 cm interval of core within targeted sampling zones. Most drill-core samples were collected semi-continuously across the entire stratigraphic sequence from

surface to full depth, with greater emphasis placed on those stratigraphy's posing a greater AMD hazard, such as carbonaceous spoil, plus material located within and very close to coal seams, which includes roof/parting/floor (carbonaceous and non-carbonaceous), and coal. Therefore, in most of the drill-holes, carbonaceous waste type is oversampled relative to its proportion in the stratigraphic sequence. For six (out of 47) drill-holes the entire drill-string was sampled (from surface to full depth), with sampled intervals ranging from approximately 0.1 m to 3.2 m based on lithological and seam boundaries.

It is understood that most fresh coal will report to ROM coal and be processed. A small fraction of coal will be mined as spoil (waste) due to coal quality and mining considerations, and a small proportion of coal will remain exposed in seams on pit walls and floor at closure. The coal samples discussed herein represent 'pure' coal and do not include associated roof, parting and floor samples that would ordinarily be mined with the seam as ROM coal. Carbonaceous roof, parting or floor samples are included in the 'fresh, carbonaceous' sample group.

The geochemical sampling locations are shown on **Figures 1 and 2** and the number of drill-hole samples from each stratigraphic zone is shown on **Figure 3** (indicative stratigraphic column).

Tailings Samples – representing very fine to fine-grained coal process waste

Geochemical data is available (within the geochemical database) for 704 tailings samples, comprising 312 'fresh' tailings samples collected from the NCPP and 392 'aged' tailings samples collected from geochemical and geotechnical investigation drillholes within several TSFs. Tailings data are presented and discussed as two groups being representative of:

- Fresh (NCPP) tailings samples; and
- Aged (TSF) tailings samples.

Tailings samples collected from the NCPP are deemed to be representative of 'fresh' tailings currently and recently produced at BWM. Tailings samples collected from TSFs are deemed to be representative of 'aged' tailings within the TSFs at BWM.

Most of the 'aged' tailings samples collected from TSFs were logged as 'dry to moist' or 'moist' at the time of sample collection.

Rejects Samples – representing mid- to very coarse coal process waste

Geochemical data is available (within the geochemical database) for 398 rejects samples, comprising 48 'fresh' rejects samples collected from the NCPP and 350 'aged' rejects samples collected from geochemical and geotechnical investigation drill-holes and test pits within the TSFs and rejects dumps at BWM. Rejects data are presented and discussed as two groups being representative of:

- Fresh rejects samples (from NCPP); and
- Aged rejects samples (from TSFs and rejects dumps). These samples were predominantly logged as 'dry' to 'moist' or 'moist' at the time of collection.

Rejects samples collected from the NCPP are deemed to be representative of 'fresh' rejects currently and recently produced at BWM. Rejects samples collected from TSFs and rejects dumps are deemed to be representative of 'aged' rejects that may be found in TSFs or at rejects disposal areas awaiting burial/rehabilitation.

Fill and Natural Ground Samples Associated with TSFs

Limited geochemical data is available for 64 'fill' (assumed spoil) samples collected from within TSFs; primarily from the spoil cap currently on Laleham TSF and 'fill' material (assumed spoil) within one of the NCPP TSF embankments. Limited geochemical data is also available for 33 'natural ground' samples collected from below (i.e. the base of) Laleham TSF, Ramp 36 rejects dump and NCPP TSF embankments. The geochemical characteristics of these samples are not presented and discussed in this assessment in detail, however are referred to where relevant.

4.3 Sample Characterisation

The aim of the environmental geochemical test-work is to understand the geochemical characteristics of the mineral waste materials with respect to AMD, geogenic salinity, erosion and dispersion potential; and to inform management and closure options for these materials.

A phased approach was implemented to define the geochemical behaviour of the key material types generated at BWM, as discussed below.

Solid Samples – Static Tests

Tailings, rejects and overburden (spoil) samples have generally undergone similar test-work methods. Test-work was generally undertaken in stages, with most samples being subjected to 'screening' tests followed by more detailed test-work undertaken on selected samples.

The vast majority of the samples have undergone 'screening' tests (stage 1 tests) for:

- pH and electrical conductivity (EC) on 1:5 w:v water extracts (on pulps [100% passing 212 microns]);
- Net acid producing potential (NAPP) test, which comprises total sulfur (total S) and acid neutralising capacity (ANC) determination. The NAPP test provides the fundamental information about the theoretical maximum amount of acid-producing and acid-neutralising material that a sample could produce.

Based on the results of the screening tests, selected samples were subjected to some or all of the following tests:

- Total carbon (total C), and organic carbon (C-org);
- Total sulfate (SO_4);
- Sulfide (chromium reducible sulfur – Scr) – a test to determine the proportion of total S present as sulfide;
- Acid buffering characterisation curve (ABCC) - a test to determine the proportion of ANC that's in a readily-available form and to provide an indication of the carbonate mineralogy of the neutralising material;
- Net Acid Generation (NAG) [single addition] - a test that encourages the oxidation of a sample to determine if acid can be produced, and how much acid could be produced;
- Sequential net acid generation test (S-NAG) – a refinement of the single addition NAG test to resolve potential issues associated with incomplete oxidation of samples with high sulfide concentrations;
- Extended boil net acid generation test (NAG Extended) – a refinement of the NAG test to resolve uncertainty due to potential organic acid interference (where non-acid generating organic acids can provide false positive results in the NAG test);

- Total metals and metalloids by 4-acid (mixed) or 2-acid (aqua regia) digest with analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and/or Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) and Flow Injection Mercury System (FIMS);
- Quantitative x-ray diffraction (QXRD) – to determine the mineralogical composition;
- Short-term leaching tests, including:
  - Deionised water extract leach procedure – a 1 hour end-over-end bottle leach at 1:5 w:v (solid:water) ratio using de-ionised water, with filtered leachate analysed for:
    - Major and minor ions [calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), SO_4, chloride (Cl) and fluoride (F)];
    - Alkalinity [total alkalinity, bicarbonate (HCO_3) and carbonate (CO_3)] and Acidity (pH dependent);
    - Soluble metals/metalloids [approximately 28 elements by ICP-MS, ICP-AES and FIMS].
  - Saline water extract leach procedure – a 1 hour end-over-end bottle leach at 1:5 w:v (solid:water) ratio using saline water (2 g/L NaCl), with filtered leachate analysed for the soluble analytes listed above.
  - Peroxide (NAG) leach – analysis of the solution on completion of the NAG or NAG Extended test, with filtered leachate analysed for the same (or similar) suite of soluble analytes as listed above.
- Exchangeable cations (Calcium [Ca], Magnesium [Mg], Sodium [Na], Potassium [K]) (with pre-treatment for salinity, if required). Results were used to calculate the cation exchange capacity (CEC);
- Emerson Aggregate Class testing.

Geochemical test work was undertaken by ALS Environmental (ALS) Brisbane, using National Association of Testing Authorities (NATA) accredited methods (where such accreditation exists). Mineralogical analysis (QXRD) was undertaken by a university (research) mineralogical laboratory in Melbourne (via Earth Systems Consulting).

Solid Samples – Kinetic OxCon Tests

Oxygen consumption and carbon dioxide (CO_2) generation (OxCon) test-work was undertaken by Earth Systems (Melbourne) on five 'fresh' tailings samples from NCPP, one 'aged' tailings sample collected from NCPP TSF, and three composite carbonaceous spoil samples from drill-cores. The samples were selected on the basis of earlier static test results.

OxCon is a laboratory-scale kinetic geochemical test for the estimation of sulfide oxidation rates, acidity generation rates and carbonate neutralisation rates for sulfidic geological materials.

Prior to the OxCon test the sample is 'washed' to remove any pre-existing salts and oxidation products (e.g. sulfate). Test-work then involves isolating a known mass of sulfide-bearing material in a known volume of oxygen inside a sealed vessel and allowing sulfide oxidation to proceed. Once the test is initiated, oxygen in the vessel is consumed via sulfide oxidation. Oxygen consumption is measured directly and logged over the test-work period (1-8 weeks, depending upon the sample). Carbon dioxide generation is measured directly and logged for estimation of the extent of acid neutralisation by carbonate minerals or the rate of biological organic carbon oxidation, if any, during testing. The test is run under low moisture conditions (8 wt.% gravimetric moisture content) and assumes full oxygen availability to support oxidation reactions (i.e. sample at surface).

At the conclusion of the OxCon test, the solid undergoes a bottle leaching procedure at a 1:2 solid:water ratio and the leachate was analysed to determine the pH, acidity/alkalinity and concentration of soluble metals/metalloids and salts.

Solid Samples – Kinetic Leaching Tests

Free-draining kinetic column leaching data is available for five fresh (NCPP) tailings samples and one 'aged' tailings sample collected from NCPP TSF. The samples were selected for column leaching test-work on the basis of earlier static test results. These are the same tailings samples that also underwent OxCon test-work.

Column leaching is a laboratory-scale kinetic geochemical test for the estimation of sulfide oxidation rates, acidity generation rates and element leaching – over time – for geological materials. The intent of the column leaching program was to characterise leachate from samples subjected to routine wetting and drying cycles, which simulates exposure to 'atmospheric conditions'. Crushed samples are loosely packed into a two litre funnel and a known quantity/mass of deionised water is slowly added to the top of each sample and the water allowed to slowly free-drain through the sample matrix and collected as 'column leachate'. The leachate collected from each column test was analysed to determine the pH, acidity/alkalinity and concentration of soluble metals/metalloids and salts. Between leaching (wetting) events the sample matrix was allowed to dry and oxidise using heat lamps. The column leaching test method was based upon a modified AMIRA (2002) method.

Tailings Liquor Samples

Tailings samples collected from the NCPP are collected as a slurry – representative of the tailings slurry that reports to TSFs for disposal. At the TSF the water drains to one end of the TSF – called a decant pond/area – and is collected for re-use in the NCPP. Geochemical data is available (in the geochemical database) for tailings liquor from 51 sampling events undertaken at the NCPP between August 2020 and August 2023. The liquor samples were analysed for a typical suite of water quality parameters, such as pH and EC, major cations and anions and soluble metals and metalloids.

4.4 Geochemical Source Hazard Assessment

Geochemical data was assessed with regard to the samples potential to generate AMD. Only after making such an assessment to understand the potential AMD hazard can appropriate AMD-specific management measures be formulated to adequately mitigate the risks, as required.

AMD classification

The Acid-Base Account (ABA) method was used to assess the acid-neutralising and acid-generating characteristics of the samples in order to determine an acid (AD) classification for the rejects.

The maximum potential acidity (MPA) and acid neutralising capacity (ANC) represent each side of the acid-base account. MPA is calculated from total S and is the theoretical maximum potential acidity that can be generated if all of the S, assumed to be associated entirely with pyritic sulfide, is able to oxidise and generate acid (H_2SO_4). ANC represents the theoretical maximum amount of acid-neutralising capacity of a sample assuming all neutralising material is in a readily available form. The net acid producing potential (NAPP) is the difference between the MPA and the ANC. In simple terms, a negative NAPP indicates an excess of ANC and the sample is likely to be non-acid forming (NAF) and a positive NAPP indicates an excess of MPA and the sample is likely to be potentially acid forming (PAF) – though there can be exceptions to this simplified interpretation. Note that NAF samples have the potential to generate NMD and SD, depending on the sulfur concentration.

Sample classification of mineral wastes follows some general rules. Samples were initially classified using Total S, NAPP and ANC/MPA ratio (and NAG data, where available), into three broad categories:

NAF Non-acid Forming;

PAF Potentially Acid Forming;

Uncertain Those samples with inconclusive results, leading to a degree of uncertainty about their ability to generate acid.

Where available, additional geochemical information such as pH, Scr, ABCC, NAG extended and NAG sequential results were used to resolve acid classification uncertainties. The general approach was to build in a level of conservatism in the preliminary classification, as shown in **Table 2**.

Table 2. Preliminary AMD classification criteria

Preliminary classification	Sulfur %	NAPP kg H2SO4/t	ANC/MPA ratio	NAGpH (if data available)
NAF	≤ 0.01	-	-	-
	≤ 1	< 0	≥ 2	-
	≤ 1	< 0	-	≥ 4.5
NAF-Sulfur (NAF-S)	> 1	< 0	≥ 2	-
	> 1	< 0	-	≥ 4.5
PAF – Low Capacity (PAF-LC)	≤ 1	≥ 0 and < 10	< 2	-
	-	≥ 0 and < 10	-	< 4.5
PAF	-	≥ 10	< 2	-
	-	≥ 10	-	< 4.5
Uncertain	Any result outside of the above criteria, or results that appear to significantly conflict with the expected result based on lithology or mineralogy			

Samples with an uncertain NAF or PAF classification are given a tentative sub-classification of UC(NAF) or UC(PAF), where preliminary data suggests the sample is expected to be NAF or PAF, respectively.

Sulfur category

To ensure a consistent approach to describe the geochemical characteristics of the sample, specific total S cut-off values were used to discuss sulfur data, as shown in **Table 3**.

Table 3. Sulfur category

Sulfur category	Total S (wt. %)	Sulfur category	Total S (wt. %)
Very low	< 0.1	Moderate	1.0 – 1.5
Low	0.1 – 0.5	High	> 1.5
Low-moderate	0.5 – 1.0		

ANC category

To ensure a consistent approach to describe the geochemical characteristics of the sample, specific ANC cut-off values were used to discuss ANC data, as shown in **Table 4**.

Table 4. ANC category

ANC category	ANC (kg H_2SO_4/t)	ANC category	ANC (kg H_2SO_4/t)
Very low	< 5	High	30 - 50
Low	5 - 15	Very high	> 50
Moderate	15 - 30		

Soil salinity

The term 'soil' salinity (and 'soil' pH – refer below) is an industry-adopted term to refer to the salinity and pH measured on any solid geologic matrix, such as soil, spoil, rock, sediment, tailings, reject, etc. That is, in this context, the term 'soil' applies to all solid samples, not just shallow surface (root zone) material.

Classifying whether a sample is non-saline, highly saline, or somewhere in between will depend upon the methods used to measure soil salinity. Soil salinity data is obtained from a 1:5 (w:v) water extract procedure typically on pulp samples. The soil salinity classes shown in **Table 5** are expressed in units of microSiemens per centimetre (μS/cm) and are used as an indicative guide. The classes are broadly based on soil salinity classes reported by DME (1995).

Table 5. Soil salinity classification

Soil salinity classification	EC1:5 (µS/cm)	Soil salinity classification	EC1:5 (µS/cm)
Non-saline	< 450	Saline	2000 - 4000
Slightly saline	450 - 900	Strongly saline	> 4000
Moderately saline	900 - 2000		

Soil pH type

Classifying whether a sample is acid, pH-neutral or alkaline or somewhere in between will depend upon the methods used to measure soil pH. Soil pH data is obtained from a 1:5 (w:v) water extract procedure on pulp samples. These soil pH types shown in **Table 6** are used as an indicative guide.

Table 6. Soil pH type

Soil pH type	pH1:5	Soil pH type	pH1:5
Highly acid	< 3.0	Near neutral	6.0 – 7.5
Moderately acid	3.0 – 4.5	Alkaline	7.5 – 9.0
Weakly acid	4.5 – 6.0	Highly alkaline	> 9.0

Mineralogy

Potential mineralogical data (QXRD) provides supporting information for the geochemical data, particularly with regard to sulfide and carbonate mineralogy of a sample, showing results for mineralogical forms (e.g. what sulfide or carbonate minerals are present) and their concentrations (reported in weight %). These data also assist with interpretation of the ABA data.

Element enrichment

The total concentration for each element were compared to average element abundance in soil in the Earth's crust (AusIMM 2011; Bowen 1979) to measure how the total elemental concentrations in the samples compare against average elemental concentrations in un-mineralised soil (worldwide). Such a comparison is undertaken to identify samples that contain what may be regarded as 'elevated' concentrations of metals and metalloids to identify potential element of concern. However, enrichment in any metals/metalloids in the solids, does not translate to enhanced leachability or mobilisation and/or bioavailability of that specific element.

Elements identified as enriched may not necessarily be a concern for revegetation and rehabilitation, human and animal health or drainage water quality. Similarly, if an element is not enriched it does not mean it would not be mobilised, because under some conditions (e.g. low pH, reducing conditions) the geochemical behaviour of metals/metalloids such as Al, As, Cu, Cd and Zn can change (i.e. become less or more mobile).

From the comparison with average crustal abundance in rocks a geochemical abundance index (GAI) was calculated. The GAI quantifies an assay result for a particular element in terms of the average abundance for that element (in sedimentary rocks). The index, based on a log 2 scale, is expressed in seven integer increments (0 to 6), which correspond to enrichment factors from 0 to over 96 times average crustal abundance, as shown in Table 7.

As a general rule, a GAI greater than or equal to three indicates enrichment compared to un-mineralised shale that may warrant further investigation to assess the mobility of these elements under laboratory conditions.

Table 7. Geochemical Abundance Index (GAI)

GAI	Enrichment factor	GAI	Enrichment factor
0	Less than 3-fold enrichment	4	24 to 48-fold enrichment
1	3 to 6-fold enrichment	5	48 to 96-fold enrichment
2	6 to 12-fold enrichment	6	Greater than 96-fold enrichment
3	12 to 24-fold enrichment		

It is important to note that determining average element abundance with any degree of accuracy on an Earth scale is difficult. As such, for any given element, there is a large range of average concentration values throughout the published literature dating back over 70 years. For many elements the published values differ by orders of magnitude. As such, the use of GAI values is simply an attempt to provide context to the assay data (total metals and metalloid results).

Solubility

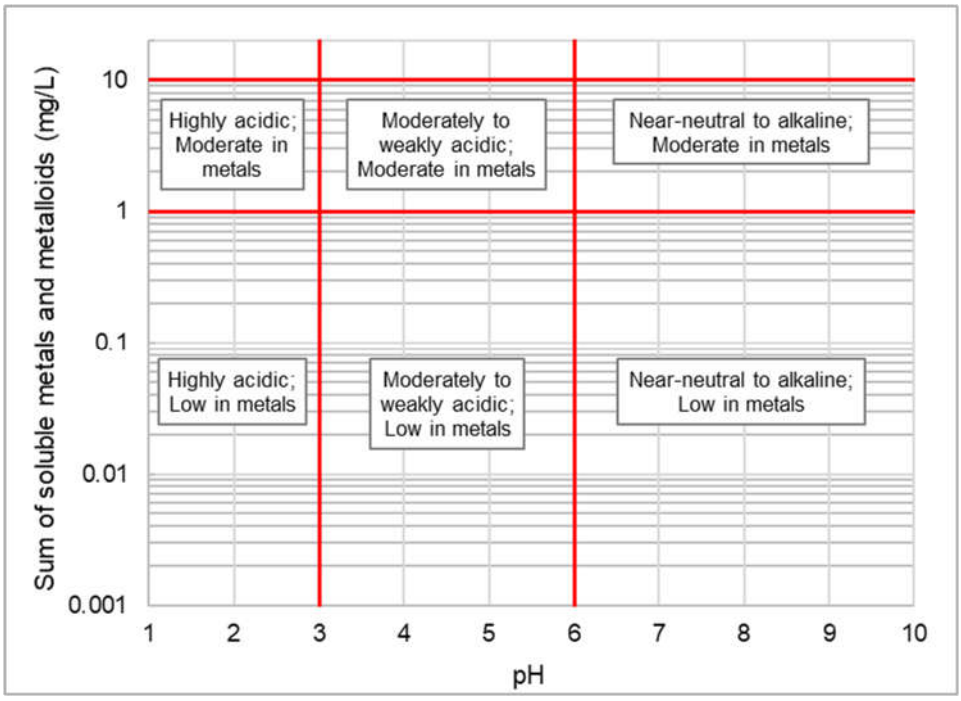
Metal/metalloid mobility from samples has been assessed using deionised water and peroxide (NAG) leaching methods. The deionised water leaches assess the initial solubility under fresh water conditions, whereas the peroxide leach assesses the solubility after the samples have been oxidised.

The solubility data from bottle leaching provides an indication of likely solubility/release of salt and metals/metalloids under field pH and redox (oxidation) conditions (and/or low-pH conditions, where applicable). Peroxide (NAG) leachate data provides an indication of potential acidity and concentrations

of metals and metalloids that could be released from samples that are fully and rapidly oxidised. This test provides an assumed 'worst case' scenario in term of metal/metalloid mobility.

A classification scheme initially developed by Ficklin *et al*. (1992) has been adapted to summarise major attributes of the solubility data by plotting pH against the summed soluble metal and metalloid concentrations for groups of elements, with the classification scheme shown in **Figure 4**. The soluble metal and metalloid concentrations are shown as the sum of soluble (dissolved) metal and metalloid concentrations for aluminium (Al), antimony (Sb), arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), manganese (Mn), molybdenum (Mo), nickel (Ni), selenium (Se), uranium (U) vanadium (V) and zinc (Zn). These elements are chosen because they're potentially environmentally important elements (as relevant to Permian coal deposits) and/or many of the elements remain in solution across a wide range of pH and are not only potentially associated with AD conditions, but also with NMD/SD conditions.

Figure 4. Classification of soluble metals and metalloids as a function of pH



No comparison is made between leachate results and water quality guideline values, such as ANZG (2018) (or the draft ANZG 2023 guidelines), as such a comparison is inappropriate. The guideline values provided in ANZG (2018/2023) are for receiving water environments (e.g. creeks), whereas the soluble element data in this assessment is 'point source' obtained from a finely pulped sample subjected to rigorous and artificial extraction to obtain a concentration approaching 'near maximum'. Furthermore, contact water will undergo a number of geochemical reactions along a pathway from source to receptor, including retardation, adsorption and precipitation – and also likely dilution, which will attenuate the concentration as seepage/contact water migrates from the source. These processes are not accounted for in a laboratory setting.

Sodicity and dispersion

Potential spoil samples (representing material that is likely to report to final landform surfaces) are broadly classified with respect to sodicity on the basis of the exchangeable sodium percentage (ESP) value, as shown in **Table 8** (after Northcote and Skene, 1972; Isbell, 2002).

Table 8. Sodicity classification

Sodicity classification	ESP (%)
Non-sodic	≤ 6
Sodic	6 - 14
Strongly sodic	> 14

The sodicity will depend upon a range of factors, such as clay mineralogy, soil sodium concentration, soil salinity and irrigation water (rainwater) chemistry, which may enhance or limit that potential for soil to be sodic or become sodic over time. Therefore, values of 6% ESP and 14% ESP to represent soils as being sodic or strongly sodic are used as a general guide only and should not be taken as definitive. Sodicity assessments only apply to materials likely to report to final landform surfaces, such as overburden/interburden (i.e. not tailings, rejects or waste coal).

Sodicity information is broadly used to understand potential revegetation and dispersion aspects, and is supported by Emerson Aggregate Class test information, which provides a direct measure of soil slaking and dispersion based on the Standards Australia (2017) classification. Soils are divided into classes on the basis of their coherence in water and presence (or absence) of calcium-rich minerals (Table 9). Slaking occurs when dry soil crumbs, after being immersed in deionised water, break up and run along the bottom of the beaker into a flat pile. Most dry soil crumbs slake when immersed in deionised water. Dispersion describes the tendency for the clay fraction of a soil to go into colloidal suspension in deionised water. Materials are generally regarded as being dispersive (or prone to dispersion) if they have an Emerson Class number of three or less.

Table 9. Emerson classifications

Class	Description	Class	Description
1	Slaking and complete dispersion	5	No calcite or gypsum present; dispersion
2	Slaking and some dispersion	6	No calcite or gypsum present; flocculation
3	Dispersion [remoulded]	7	Non-slaking and swelling
4	Calcite or gypsum present; no dispersion	8	Non-slaking and non-swelling

4.4.1 Using coal quality data for AMD classification

Coal quality data has been used to aid with the assessment of AMD hazard associated with coal seams. In particular, the BWM coal quality database was used to supplement the geochemical database and provide additional understanding of the AMD potential of likely ROM coal, remnant coal, waste coal and rejects. Coal plys were grouped into their respective seam groups on a per-pit basis, such as T, MR, P & L Upper, P & L Lower, etc. for each pit group.

Total S concentrations can be used conservatively to assess the AMD hazard for any given sample; thus, statistical analyses were conducted on total S as a function of seam group and for all seams combined to define the AMD hazard of coal. The data were used to understand the sulfur grade range for each seam group to gain an understanding of the potential AMD hazard posed by each coal seam group (and by inference, potential tailing and reject materials). The results were then compared with detailed geochemical data available for coal, rejects and tailings to 'calibrate' the coal quality total sulfur data.

Coal samples from less than 20m depth were assumed to be completely or predominantly oxidised and were interpreted as 'weathered carbonaceous spoil' and, therefore, excluded from the assessment of potential ROM coal. Acid producing sulfate minerals, such as jarosite, may be present within weathered coal and carbonaceous material, however, mineralogical data available from BWM shows that jarosite is an insignificant mineral at BWM.

4.4.2 Residual void highwall and end-walls assessment

An assessment of the AMD hazard associated with exposures of all lithological materials, such as remnant coal, weathered materials, fresh non-carbonaceous and carbonaceous overburden was undertaken – being representative of the highwall and end-walls of the residual void associated with a given pit group.

The frequency of occurrence of relevant material types within each pit was determined from the stratigraphic distribution within selected drill holes under the assumption that the frequency of distribution of each material type is broadly indicative of their respective surface exposures on current highwalls and end-walls. For example, if P & L Upper seam group had a frequency of occurrence (by meters) of 5% in the drill-hole data set, then the assumption is that the same coal seam group would represent approximately 5% of the surface exposure on the highwall and end-walls. This method - whilst being relatively simple - provides an acceptable approximation with regard to which seam groups or mineral waste types are most likely to be significantly present in pit walls versus those material types most likely present in relatively minor proportions.

To estimate the proportion of key material domains on the walls in each void, exploration drill-holes in proximity to the current/recent highwall/s (and future void highwalls for undeveloped pits) were selected by BWM Coal Geology Planners for each pit. Most holes extended to depths approximating future pit floor depths. For existing pit areas, many drillholes were used for the assessment of each pit/void area. For the proposed future pit areas where limited drillhole data is currently available (i.e. South Marshmead, Kennedy and Comet Downs East proposed pit areas) the assessment was supplemented by estimating depths (thicknesses) of each stratigraphic zone based on the geological model for the southern BWM area.

Stratigraphy, age, weathering, location with respect to the water table, and major stratigraphic horizons (as recorded in the BWM coal geology database) were used to assign individual (discrete) lithological units to a material domain as follows:

- Weathered non-carbonaceous;
- Weathered, carbonaceous [includes weathered coal];
- Fresh, non-carbonaceous;
- Fresh, carbonaceous;
- Fresh, coal.

Coal plys were grouped into their respective seam groups, such as T, MR, P & L Upper/ Lower, etc.

For each void highwall, a statistical assessment was conducted on each drill-hole sub-set (as applicable to each pit group) to summarise the frequency of occurrence of drill core intervals as a function of each of the material groups listed above.

The inherent AMD hazard of each material group listed above was inferred from the geochemical database and coal quality database for similar material types. The combined AMD hazard for the material groups likely to be exposed on the highwall was then used to estimate the AMD hazard of the highwall and end-walls at each pit.

4.4.3 Residual void floor assessment

An assessment of the AMD hazard associated with remnant coal exposed on the floor of each void was undertaken – being representative of the floor of the residual void associated with a given pit group.

As explained in Section 4.4.1 coal quality data was assessed to understand the potential AMD hazard associated with coal. For the task of assessing the AMD hazard specific to pit floors (on a pit-group basis), only the coal quality data from the seam group likely to form the pit floors at a given pit group was assessed. At BWM the P & L Lower seam group forms the floor of all pits except Ramp 74 pit.

At Ramp 74 pit the TR seam (T seam group) forms the floor of the pit, however Ramp 74 pit contains tailings from NCPP – therefore the floor of this pit is now tailings (Ramp 74 TSF). Bonnie Doon pit is currently the active TSF – therefore the floor of this pit is now tailings.

It is acknowledged that there are generally minor geochemical differences between the various plys of any given seam group. Also, the AMD hazard of the floor of a pit may change depending on whether a significant proportion of the pit floor resides on coal(ly) or non-carbonaceous material. Furthermore, the AMD hazard of any pit floor is not just associated with its surface exposure, but more so with the composition of the sub-drill zone, which represents an extensively fractured coal / interburden comprising the upper sections of a pit floor. For this assessment, the AMD hazard was estimated only for assumed surface exposures of coal / plys.

In practice, mining takes all coal to the bottom of the seam at the base of a pit, therefore very little coal would be expected to remain on the floor of the voids. As such, the assessment has adopted a highly conservative position assuming the floor of each void is all coal, and the coal is completely exposed.

4.4.4 TSF assessment

At closure, NCPP TSF will remain as a discrete facility (TSF landform). This TSF is non-operational (currently authorised for emergency tailings disposal) and will undergo rehabilitation prior to or during mine closure. Geochemical data from samples collected from within NCPP TSF were used to assess the geochemical AMD source hazard of this facility. The AMD source hazard was also assessed using tailings and rejects geochemical data from the NCPP representing 'fresh' tailings and 'fresh' rejects samples.

At closure, Laleham TSF will also remain as a TSF landform. This TSF has undergone preliminary rehabilitation and will undergo additional rehabilitation prior to or during mine closure. Geochemical data from samples collected from within Laleham TSF were used to assess the geochemical AMD source hazard of this facility. Very limited rejects data was available specifically from Laleham TSF. As such, the AMD source hazard was also assessed using rejects geochemical data from all of site.

Ramp 72 TSF will be buried by bulk spoil during mining operations and therefore, at closure, will not require specific remediation or rehabilitation as it will lie beneath the Kenmare spoil landform. Bonnie Doon pit and Ramp 74 pit (both containing tailings) are assessed as voids with tailings floor.

Bottom Dam TSF/rejects facility is located in a gully on the southeastern side of SCPP ROM 3 (**Figure 2**) – with the total volume conservatively estimated at approximately 0.2 Mm^3. Bottom Dam area is currently

undergoing an environmental and engineering assessment program and the results of this program will inform rehabilitation and closure planning.

4.4.5 Rejects dump assessment

At closure, Ramp 36 rejects dump will remain as a discrete facility (rejects landform). This facility is non-operational. Ramp 36 rejects dump will undergo rehabilitation prior to or during mine closure. The AMD source hazard assessment of this facility has utilised geochemical data from reject samples collected the Ramp 36 rejects dump.

TCP rejects (up to 0.1 Mm^3) will be relocated from the TCP into the Mimosa-Besgrove spoil landform during rehabilitation of the TCP area and, as such, will not remain as a rejects landform post-closure.

The southern end of Kenmare pit contains a mix of tailings and rejects that were excavated from the old TSF at Red Dam and Upper Red Dam (and disposed into Kenmare pit). These tailings/rejects are within the Kenmare spoil landform.

Rejects are disposed adjacent to, and in the general vicinity of, Bottom Dam TSF. These rejects will be incorporated into the rehabilitation of Bottom Dam TSF, before covering with spoil.

Other rejects disposal areas (e.g. Deep Creek rejects disposal area) are located within a spoil landform area and will be buried by spoil during mining operations.

4.4.6 AMD hazard scoring

Estimating the AMD hazard is the first step in estimating the geochemical risk associated with potential sulfide oxidation of mineral wastes. A procedure has been developed[2] to standardise the AMD hazard assessment across material domains, with the process described below.

AMD hazard scoring and the AMD geochemical likelihood describe the Geochemical Hazard. The former describes the hazard for AMD generation and the latter describes the likelihood of an AMD event to occur.

A source material is a distinct material type (e.g. non-carbonaceous spoil or rejects or tailings), whereas a landform is a domain comprising one or more source material types (e.g. rejects disposed within non-carbonaceous spoil). AMD hazard scorings are assigned for individual source materials reporting to a landform as well as to landforms as a whole (i.e. landform AMD hazard score).

The likelihood of a landform developing AMD was determined based on the landform AMD hazard score. AMD hazard scores (**Table 10**) are estimated by analysing three key components, which are used to describe the geochemical hazard of a source material/landform:

- Propensity to generate AMD;
- AMD capacity (i.e. the severity of the AMD, if generated); and
- AMD quantity (i.e. the amount of material that could generate AMD).

These three component terms are explained following **Table 10**.

2 The AMD hazard scoring matrix was developed by the author in conjunction with Dr. Marilena Stimpfl (BHP Closure Planning) for use in coal mining assessments.

Table 10. AMD hazard scoring matrix for landforms

Component	Rating		Definition
Propensity for AMD generation Per material type: - non-carb. - carb & coaly - rejects - tailings	1	Implausible	Geochemical properties suggest that the vast majority of the source material has a negligible potential for AMD generation (less than 5% of the samples classified as 'PAF' or NAF-S).
	5	Plausible	Geochemical properties suggest that a significant proportion of the source material may have potential for AMD generation (5-40% of the samples classified as 'PAF' or NAF-S).
	7	Expected	Geochemical properties suggest that the source material has a high potential for AMD generation, but AMD has not yet been observed in the field (due to lag time) - (>40% of the samples classified as 'PAF' or NAF-S).
	15	Certain	Evidence of AMD processes have been observed in the field from the source material.
AMD **Capacity** Per material type: - non-carb. - carb & coaly - rejects - tailings	1	Low	Source material has a negligible potential for AMD generation. 'PAF' and NAF-S samples have 75th percentile total S less than 0.1%.
	3	Low-Moderate	Assumed to be bulk NAF but sulfide bearing, with NAF samples having 75th percentile total S greater than 1% (i.e. the material is predominantly NAF-S). AMD generated will be NMD and/or SD (related to sulfide oxidation), not AD.
	5	Moderate	'PAF' and NAF-S samples have 75th percentile total S ranging from 0.1% to 1.0% and with potential to generate AD.
	7	Moderate-High	'PAF' and NAF-S samples have 75th percentile total S ranging from 1.0% to 1.5% and with potential to generate AD.
	10	High	'PAF' and NAF-S samples have 75th percentile total S greater than 1.5% and with potential to generate AD.
AMD **Quantity** Per material type: - non-carb. - carb & coaly - rejects - tailings	1	Low	Source material rated LOW for AMD capacity; or less than 5% of source material reporting to a landform is rated LOW-MODERATE for AMD Capacity.
	3	Low-Moderate	Less than 5% of source material (in the landform) rated as Moderate for AMD capacity.
	5	Moderate	Greater than 5% of source material (in the landform) rated as Low-Moderate or Moderate for AMD capacity.
	7	Moderate-High	Less than 5% of source material (in the landform) rated as Moderate-High or High for AMD capacity.
	10	High	Greater than 5% of source material (in the landform) rated as Moderate-High or High for AMD capacity.
AMD Quantity Per residual void. Per wall component. Per floor.	1	Low	Less than 10% of drill-hole meters of source material (or less than 10% of pit floor exposure) are classified as 'PAF' or NAF-S.
	5	Low-Moderate	Between 10% and 30% of drill-hole meters of source material (or 10-30% of pit floor exposure) are classified as 'PAF' or NAF-S.
	7	Moderate-High	Greater than 30% of drill-hole meters of source material (or greater than 30% of pit floor exposure) are classified as 'PAF' or NAF-S.
	15	High	Evidence of AMD on walls or floor of pit; or AMD affected water in pit.

In undertaking the AMD hazard assessment, the assumption is that the source materials within the landforms will predominantly be dry or moist, but not wet or saturated. That is, the landforms will be unsaturated. This assumption is realistic, since most spoil landforms, rejects landforms and aged/inactive TSF landforms are generally unsaturated, excluding the deeper zones of in-pit landforms that may interact with a void lake. This assumption is also conservative, since the potential for oxidation (to some degree) is assumed.

AMD Propensity is the tendency of a given material type to generate AMD. The propensity to generate AMD is determined based on the proportion of samples that have potential for AMD as determined from laboratory test-work and the subsequent assessment – the higher the percentage of materials that can generate AMD within a sample set, the greater the AMD propensity. This approach is conservative, since sampling is slightly skewed towards material types considered to pose a potentially higher AMD hazard, such as carbonaceous materials.

AMD Capacity represents the 'severity' of AMD generation, with total S concentrations used as a proxy for scoring this component, which represents a conservative approach as some sulfur is associated with non-acid generating minerals. For example, the higher the total S concentration in materials with potential for AMD, the higher the hazard, the higher the score. Furthermore, the AMD capacity also takes into account the type of drainage a source material can produce, i.e. AD, NMD and/or SD, where discrimination or prediction is possible. The various drainage types should be differentiated (where the data allows) to reflect the difference in impact severity and difficulty to manage or treat. For example, on an equal quantity basis, AD is likely going to cause more severe impacts than NMD or SD and therefore is assigned a higher score.

As a first approximation the AMD Capacity of each material type is estimated based on the 75th percentile value of the total S concentration for the samples classified as PAF and NAF-S. This is a conservative assumption, as not all total S is associated with reactive minerals and choosing the 75th percentile total S value of PAF and NAF-S samples to assess the AMD capacity will attract a higher AMD Capacity scoring. For example, if two material types had the same proportion of samples with the same propensity for AMD, but one has a higher total S concentration associated with PAF and NAF-S materials, then this sample would receive a higher AMD Capacity score.

Generally, amongst Bowen Basin Permian- and Tertiary-age materials, a very small number of samples are classified as NAF-S – almost all samples with high total S (>1%) are typically classified as 'PAF' of some type. Therefore, AMD Capacity does take into consideration potential NMD/SD by including NAF-S samples with PAF samples, however the very few NAF-S samples (compared to PAF samples) means that NAF-S samples typically have a negligent bearing on the AMD Capacity of a material. For example, of the 5949 samples (of all types) at BWM that underwent geochemical characterisation, only 38 samples were classified as NAF-S (approximately 0.6% of all samples) – and 34 of the 38 samples were tailings and rejects.

AMD Quantity is the amount of material (tonnage/volume) that has the potential to generate AMD. The greater the tonnage/volume of AMD generating material the greater the hazard scoring. The AMD Quantity scores are assigned to material types for each landform.

4.4.7 Landform AMD likelihood scoring

The likelihood of a landform generating AMD is estimated by analysing two key components:

- Source material AMD hazard score; and
- Landform AMD hazard score.

Source material AMD hazard score: Describes the potential for AMD generation by the respective material types within each landform. It is estimated from the weighted combined scores of each component used to describe the AMD source hazard:

  - Propensity to generate AMD. Assigned a 50% weighting (weighting = 1);
  - AMD capacity. Assigned a 25% weighting (weighting = 0.5); and
  - AMD quantity. Assigned a 25% weighting (weighting = 0.5).

Landform AMD hazard score: Describes the likelihood for AMD generation by each final landform and each residual void. It is estimated from the source material AMD hazard scores for each material type assumed to be present within that specific landform. At closure, BWM has 14 spoil landforms and 13 residual void domains, three TSF landform domains (NCPP TSF, Laleham TSF and Bottom Dam TSF [Bottom Dam TSF domain includes rejects]; and one rejects landform domain (Ramp 36 Rejects), as listed in Section 2.2.

- Landforms: the landform AMD hazard score is estimated from the weighted average of the source material AMD hazard and the proportion of PAF and NAF-S waste expected to report to the landform from each material type.
- Residual voids: the landform AMD hazard score is estimated from the average of the source material AMD hazard scores for each material type likely to be exposed on the walls or floor of each residual void.

To support the assessment of the AMD closure risks, the landform AMD hazard score is assigned a likelihood score (Table 11) as consistent as possible with Whitehaven Coal's risk management methodology, which is broadly aligned with ISO 31000. ISO 31000 is a family of standards relating to risk management codified by the International Organization for Standardization. For landforms and residual voids with AMD hazard scores between 10 and 20 a preliminary likelihood of 'Probable / Likely' is assigned unless/until kinetic data are available to provide a time frame for AMD generation. This likelihood can be revised as more data, such as kinetic or field data, becomes available.

Table 11. AMD hazard ranking and landform/void AMD likelihood ranking

Landform AMD hazard scores	Landform AMD likelihood
0 - 5	Highly Unlikely: Highly unusual; may occur in extreme circumstances
5 - 10	Unlikely: Known to occur, but only rarely
10 - 15	Probable: May reasonably occur
15 - 20	Likely: Could easily occur
>20	Highly Likely: Expected to occur

5 Results

Environmental geochemical data is available for 5947 samples – all of which have undergone a range of environmental geochemical tests. The samples are representative of the following mineral waste and coal groups:

Spoil

- Weathered Non-carbonaceous: Overburden. 657 drill-hole samples;
- Weathered Carbonaceous: Overburden/interburden [includes weath. coal]. 9 drill-hole samples;
- Fresh, Non-carbonaceous: Overburden/interburden. 3515 drill-hole samples;
- Fresh, Carbonaceous: Overburden/interburden. 283 drill-hole samples.

Coal

- Fresh Coal: Representative of ROM coal. 381 drill-hole samples

Tailings

- Fresh tailings from NCPP. 312 samples
- Aged tailings from the TSFs. 392 drill-hole samples

Rejects

- Fresh rejects from NCPP. 48 samples
- Aged rejects from various locations: 350 samples (in total) from NCPP TSF, Laleham TSF, Ramp 72 TSF, Ramp 36 rejects dump and Red Dam area.

5.1 Mineralogy

Data is available for 74 samples, comprising: 45 spoil samples, 22 tailings samples (9 fresh samples and 13 aged samples) and 7 rejects samples that underwent mineralogical analysis by QXRD.

The samples were selected to assess a broad range of mineral waste types. The results are summarised in **Figure 5** (spoil samples) and **Figure 6** (tailings and rejects samples). Most samples are dominated by clay, quartz minerals (silicate group minerals) and non-crystalline (amorphous) material, variable contributions of carbonate and other silicate minerals.

Figure 5. Mineral distribution within spoil samples

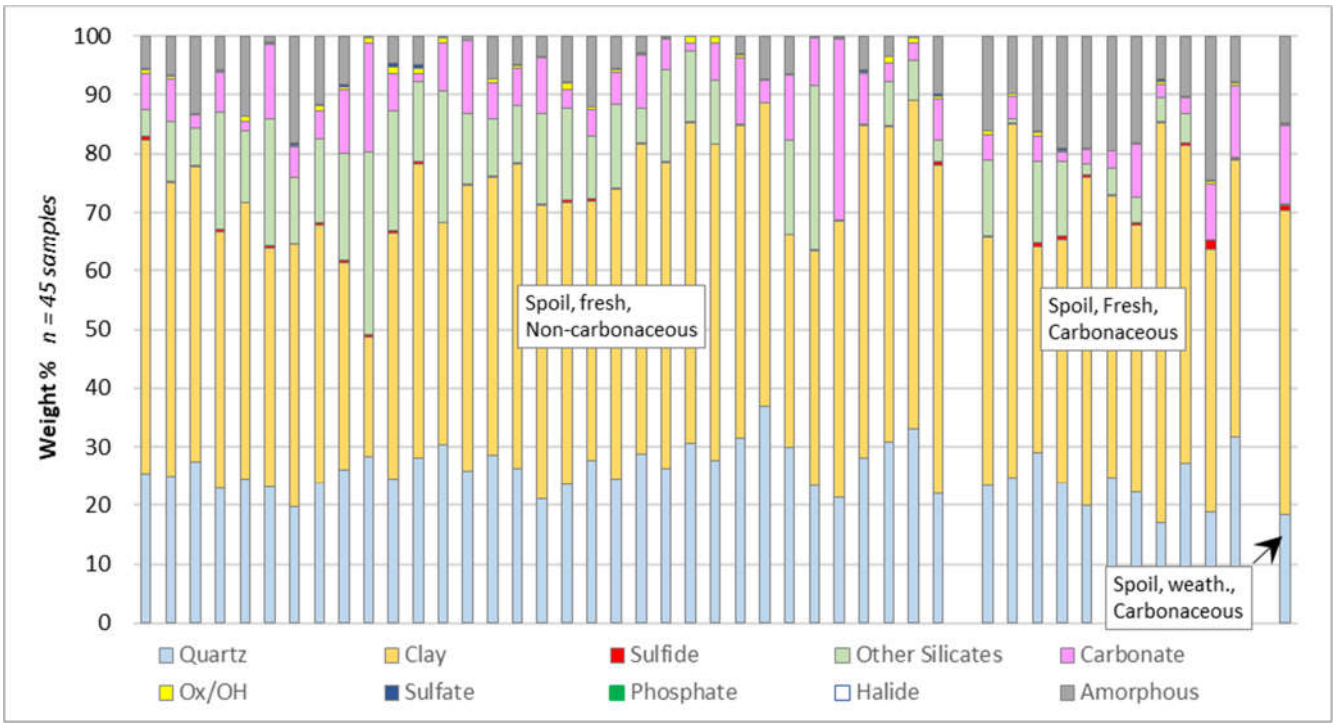
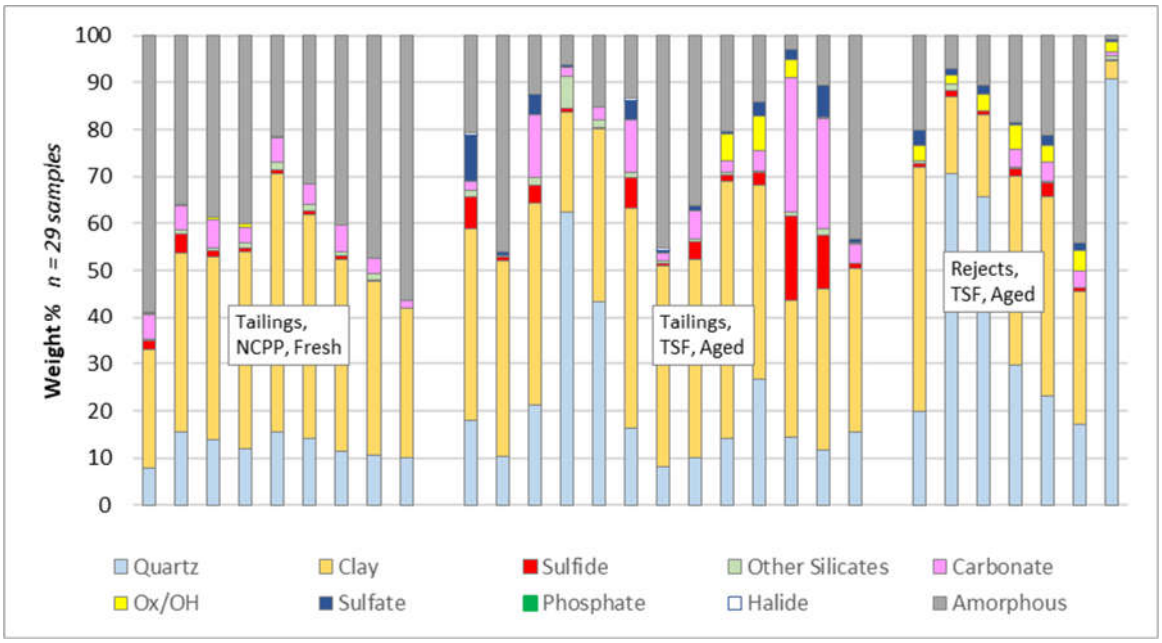


Figure 6. Mineral distribution within tailings and rejects samples



Most spoil samples have low sulfide mineral proportions as expected (median = 0.3%). Sulfide, where present, is present as pyrite and marcasite. Spoil samples have low sulfate concentrations ranging from less than 0.1% to 0.7% (median=0.2%) and tailings and rejects have slightly higher sulfate concentrations ranging from less than 0.1% to 9.9% (median = 0.5%). In spoil, the sulfate is mostly present as jarosite. In rejects the sulfate is a combination of jarosite and gypsum; and in tailings a combination of jarosite, gypsum, anhydrite and barite. The combination of jarosite and gypsum (+/- anhydrite) minerals in rejects and tailings is likely an indication of sulfide oxidation and naturalisation.

Amorphous (non-crystalline) material was detected in all samples, but generally present in greater proportions in the tailings and rejects samples (median = 21%) and carbonaceous spoil samples (median = 16%) compared to the non-carbonaceous spoil (median = 5%). The nature of the non-crystalline material is largely unknown, although for tailings, rejects and carbonaceous waste it is likely associated with organic carbon.

One carbonaceous 'spoil' sample – a seam roof sample – has high sulfide (pyrite) concentration (1.8%) and was specifically selected for mineralogical test-work because of its' high total S concentration. Given the proximity of this sample to coal, it's likely that this sample would be mined as part of ROM coal and, therefore, is likely to represent 'potential' reject more so than spoil. That is, this sample is likely representative of rejects and not typical spoil.

The tailings and rejects samples generally have higher sulfide concentrations compared to the spoil samples (median = 0.9% for tailings fresh and rejects aged; and median = 2.8% for tailings aged). Most fresh tailings samples have negligible sulfate concentrations. Comparatively, the aged tailings and rejects samples had higher sulfate concentrations, suggesting sulfide oxidation has occurred.

Across all material types, carbonate group minerals predominantly comprised calcite, ankerite (Fe-dolomite), siderite and rhodochrosite in variable proportions.

In summary, across all mineral types assessed, the key acid generating minerals are pyrite, marcasite and, to lesser extent, jarosite. The key acid neutralising minerals are iron-dolomite/dolomite and calcite. Although siderite is a carbonate, it provides no net acid neutralising capacity.

5.2 Acid-Base Accounting (Potential for AMD)

Acid-base accounting (ABA) is a theoretical balance between the potential for a sample to generate acid and neutralise acid, and is expressed in units of kilograms of sulfuric acid per tonne of sample (kg H_2SO_4/t). The ABA results for the spoil, tailings, rejects and coal samples that underwent geochemical characterisation are statistically summarised in **Table 12** (spoil) and **Table 13** (tailings, rejects and coal samples) and discussed in the following sections.

Table 12. ABA results statistics for spoil samples

		Total S[1]	Scr[2] (S)	ANC	MPA[3]	NAPP	ANC/MPA	NAGpH[4]
		%		kg H_2SO_4/t			ratio	pH units
Spoil Weath[5]., non-carb[6].	Count (*n*)	*657*	*239 (239)*	*657*	*657*	*657*	*657*	*70*
	Maximum	0.69	0.69 (0.69)	408	21	18	2266	10.0
	95th percentile	0.06	0.05 (0.13)	81	1.9	0.6	331	7.8
	75th percentile	0.02	0.02 (0.03)	21	0.6	-1.9	67	6.7
	Median	**0.01**	**0.01 (0.02)**	**7.2**	**0.3**	**-6.5**	**20**	**6.2**
	25th percentile	<0.01	<0.01 (0.01)	2.5	<0.3	-20	4.9	5.8
	5th percentile	<0.01	<0.01 (<0.01)	<0.5	<0.3	-80	0.4	4.6
	Minimum	<0.01	<0.01 (<0.01)	<0.5	<0.3	-406	<0.1	3.0
Spoil Weath., carb.	Count (*n*)	*9*	*8 (8)*	*9*	*9*	*9*	*9*	*5*
	Maximum	1.52	0.94 (1.52)	135	47	35	147	6.4
	95th percentile	1.19	0.80 (1.23)	89	36	24	96	6.4
	75th percentile	0.43	0.39 (0.50)	19	13	2.6	2.8	6.2
	Median	**0.38**	**0.13 (0.39)**	**14**	**12**	**-6.9**	**1.6**	**4.6**
	25th percentile	0.17	0.09 (0.18)	11	5.2	-10	0.8	3.7
	5th percentile	0.02	0.03 (0.07)	9.9	0.7	-85	0.4	2.7
	Minimum	0.02	0.01 (0.02)	9.0	0.6	-134	0.2	2.5
Spoil Fresh, non-carb.	Count (*n*)	*3515*	*1195 (1195)*	*3515*	*3515*	*3515*	*3515*	*104*
	Maximum	1.84	1.67 (1.84)	842	56	44	3546	11.2
	95th percentile	0.10	0.13 (0.18)	204	3.1	-12	389	10.6
	75th percentile	0.04	0.03 (0.05)	79	1.2	-25	121	8.8
	Median	**0.03**	**0.02 (0.03)**	**48**	**0.9**	**-47**	**61**	**7.6**
	25th percentile	0.02	0.02 (0.02)	26	0.6	-78	31	4.6
	5th percentile	<0.01	0.01 (0.01)	13	<0.3	-204	8.1	2.8
	Minimum	<0.01	<0.01 (<0.01)	<0.5	<0.3	-842	<0.1	2.6
Spoil Fresh, Carb.	Count (*n*)	*283*	*189 (189)*	*283*	*283*	*283*	*283*	*86*
	Maximum	2.58	1.79 (2.58)	300	79	61	456	9.4
	95th percentile	0.53	0.51 (0.72)	89	16	3.6	70	8.4
	75th percentile	0.25	0.20 (0.32)	35	7.5	-7.3	16	7.4
	Median	**0.12**	**0.10 (0.18)**	**20**	**3.7**	**-15**	**5.9**	**5.1**
	25th percentile	0.04	0.04 (0.12)	13	1.2	-30	2.6	3.8
	5th percentile	0.02	0.02 (0.03)	5.6	0.6	-78	0.7	2.6
	Minimum	<0.01	0.01 (0.01)	<0.5	<0.3	-296	<0.1	2.3
Spoil ALL	Count (*n*)	*4464*	*1631 (1631)*	*4464*	*4464*	*4464*	*4464*	*265*
	Maximum	2.58	1.79 (2.58)	842	79	61	3546	11.2
	95th percentile	0.15	0.22 (0.35)	185	4.6	-1.4	362	10.0
	75th percentile	0.04	0.04 (0.07)	72	1.2	-19	110	7.8
	Median	**0.02**	**0.02 (0.03)**	**38**	**0.6**	**-37**	**51**	**6.4**
	25th percentile	0.02	0.02 (0.02)	20	0.6	-70	21	4.6
	5th percentile	<0.01	0.01 (<0.01)	3.4	<0.3	-183	2.0	2.8
	Minimum	<0.01	<0.01 (<0.01)	<0.5	<0.3	-842	<0.1	2.3

[1] Total S values less than laboratory limit of reporting (LOR) were assigned a value of 0.5xLOR for statistical calculations.
[2] Scr was generally measured on potential spoil samples with total S greater than 0.1%. Values in parentheses are the total S statistics for samples with Scr results.
[3] MPA calculated from total S. [4] NAGpH is final pH as NAG single addition and/or NAG extended and/or Stage 1 Seq. NAG. NAG tests were generally undertaken on samples assigned a preliminary PAF, PAF-LC, UC(PAF) or 'Uncertain' classification.
[5] Weath.: weathered; [6] Carb.: carbonaceous.

Table 13. ABA results statistics for tailings, rejects and coal samples

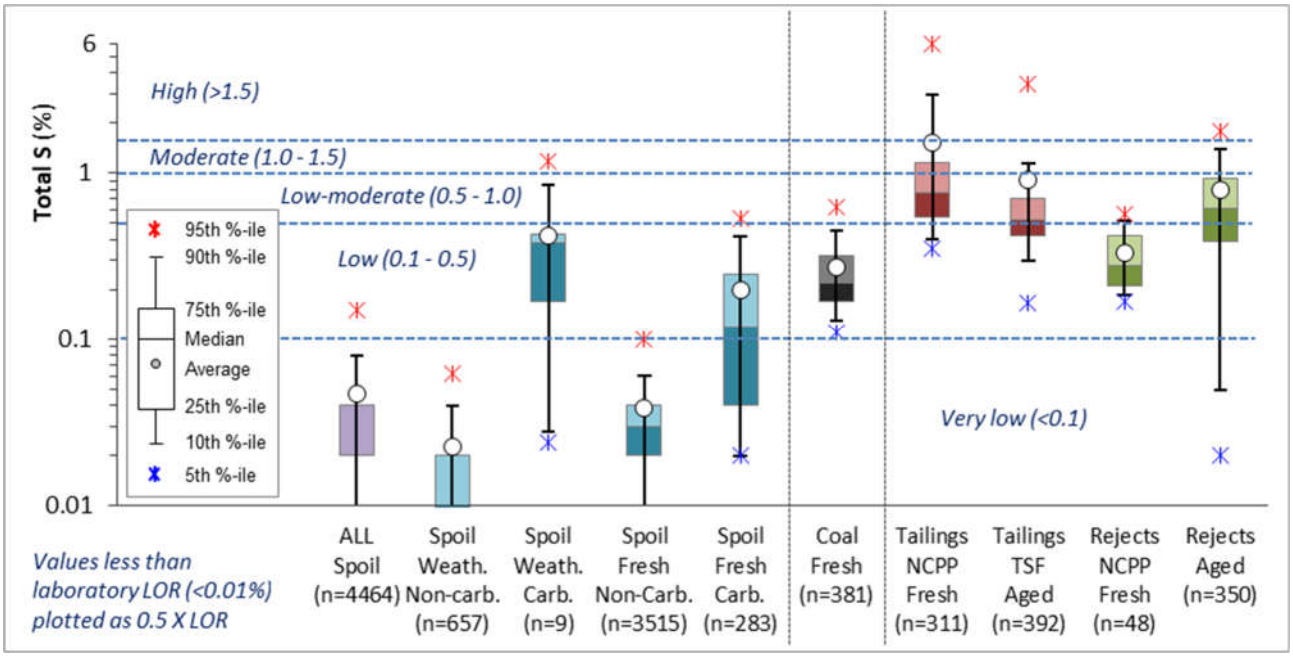
		Total S[1]	Scr[2] (S)	ANC	MPA[3]	NAPP	ANC/MPA	NAGpH[4]
		%		kg H_2SO_4/t			ratio	pH units
Tailings Fresh.	Count (*n*)	*311*	*309 (309)*	*309*	*311*	*309*	*309*	*293*
	Maximum	20.5	16.3 (20.5)	129	628	583	6.6	9.8
	95th percentile	5.93	5.30 (5.96)	65	181	110	3.2	9.0
	75th percentile	1.17	0.85 (1.17)	41	36	6.6	1.9	8.3
	Median	**0.76**	**0.54 (0.76)**	**32**	**23**	**-6.2**	**1.3**	**6.5**
	25th percentile	0.55	0.32 (0.55)	25	17	-16	0.8	3.4
	5th percentile	0.36	0.17 (0.35)	16	11	-29	0.3	2.5
	Minimum	0.20	0.08 (0.20)	<0.5	6.1	-54	<0.1	1.8
Tailings Aged	Count (*n*)	*392*	*348 (348)*	*390*	*392*	*390*	*390*	*130*
	Maximum	19.1	16.9 (19.1)	236	585	578	88	9.6
	95th percentile	3.44	1.93 (3.45)	35	105	54	2.7	6.8
	75th percentile	0.71	0.38 (0.70)	21	22	9.0	1.4	3.7
	Median	**0.52**	**0.24 (0.52)**	**16**	**16**	**1.8**	**0.9**	**3.1**
	25th percentile	0.42	0.15 (0.43)	10	13	-5.2	0.5	2.7
	5th percentile	0.17	0.03 (0.19)	2.0	5.1	-15	<0.1	2.3
	Minimum	0.02	<0.01 (0.03)	<0.5	0.6	-208	<0.1	1.9
Rejects Fresh	Count (*n*)	*48*	*48 (48)*	*48*	*48*	*48*	*48*	*48*
	Maximum	0.78	0.63 (0.78)	86	24	-1.3	17	9.4
	95th percentile	0.57	0.47 (0.57)	77	17	-7.8	8.6	9.3
	75th percentile	0.42	0.34 (0.42)	47	13	-24	5.7	8.8
	Median	**0.28**	**0.20 (0.28)**	**40**	**8.6**	**-29**	**4.4**	**8.6**
	25th percentile	0.21	0.14 (0.21)	34	6.4	-37	2.8	8.4
	5th percentile	0.17	0.10 (0.17)	20	5.2	-64	2.0	7.9
	Minimum	0.14	0.05 (0.14)	13	4.3	-81	1.1	6.3
Rejects Aged	Count (*n*)	*350*	*309 (309)*	*350*	*350*	*350*	*350*	*181*
	Maximum	8.93	7.19 (8.93)	104	273	234	101	9.2
	95th percentile	1.79	1.47 (1.92)	56	55	39	12	8.7
	75th percentile	0.93	0.65 (0.96)	30	28	9.8	2.0	7.8
	Median	**0.61**	**0.32 (0.64)**	**18**	**19**	**-3.6**	**1.2**	**6.0**
	25th percentile	0.39	0.07 (0.40)	7.8	12	-9.8	0.5	3.6
	5th percentile	0.02	0.01 (0.02)	<0.5	0.6	-30	<0.1	2.7
	Minimum	<0.01	<0.01 (<0.01)	<0.5	<0.3	-90	<0.1	2.1
Coal Fresh	Count (*n*)	*381*	*368 (368)*	*381*	*381*	*381*	*381*	*213*
	Maximum	1.60	1.12 (1.60)	339	49	41	158	11.1
	95th percentile	0.62	0.36 (0.63)	94	19	7.7	12	8.3
	75th percentile	0.32	0.09 (0.32)	20	9.8	-0.2	2.8	6.1
	Median	**0.22**	**0.03 (0.22)**	**11**	**6.7**	**-3.5**	**1.5**	**3.6**
	25th percentile	0.17	0.02 (0.17)	7.4	5.2	-11	1.0	2.8
	5th percentile	0.11	<0.01 (0.11)	0.6	3.4	-85	0.1	2.4
	Minimum	0.02	<0.01 (0.02)	<0.5	0.6	-337	<0.1	2.2

[1] Total S values less than laboratory limit of reporting (LOR) were assigned a value of 0.5xLOR for statistical calculations.
[2] Scr was generally measured on most tailings, rejects and coal samples. Values in parentheses are the total S statistics for samples with Scr results.
[3] MPA calculated from total S. [4] NAGpH is final pH as NAG single addition and/or NAG extended and/or Stage 1 Seq. NAG.

Sulfur and sulfide

The total sulfur (total S) distribution for all samples is presented in **Figure 7**. The total S concentration of spoil samples was generally very low to low – with a very low median value of 0.02% and low 95th percentile value of 0.15%. Carbonaceous spoil samples had higher total S values compared to non-carbonaceous spoil. Of the 4464 spoil samples, six samples (approximately 0.1% of all spoil samples) had high total S values (greater than 1.5%) and all were closely associated with seams (i.e. parting or thicker interburden between plys).

Figure 7. Sulfur (S) distribution



Total S concentration of most rejects and tailings samples was generally higher than most spoil samples (as expected) and also generally higher than most coal samples. NCPP tailings (fresh tailings) had slightly higher total S concentration overall compared to aged tailings samples from the TSFs. Comparatively, the total S concentration of the aged rejects from TSFs and reject dumps was higher compared to NCPP rejects (fresh rejects). Total S concentration within the aged tailings is generally consistent with depth and spatial distribution throughout the TSFs where samples were collected. Therefore, differences between total S in fresh (NCPP) tailings versus aged (TSF) tailings is likely due to ROM coal geochemistry. The reasons for aged rejects having higher total S concentration (generally) compared to fresh rejects – where the opposite occurs with aged and fresh tailings – is unclear, although is likely due to ROM coal geochemistry.

Coal samples selected for test-work had relatively low total S values, with median, 75th and 95th percentile total S values of 0.22%, 0.32%, and 0.62%, respectively. This sample subset has a total S distribution statistically equivalent to that of the larger BWM coal quality database. In particular, the 7495 coal samples from the BWM coal quality database have median, 75th and 95th percentile total S values of 0.39%, 0.48% and 0.67%, respectively. Thus, the total S distribution in coal from the smaller geochemical dataset (n=381) is broadly comparable to the total S distribution in coal from the much larger coal quality dataset (n=7495).

Chromium reducible sulfur (Scr) data is available for 1631 spoil samples, 657 tailings samples, 357 rejects samples and 368 coal samples. Scr was generally measured on samples with total S values greater than 0.1%. Where sulfide was measured in weathered samples, this was generally only in those

samples described as being 'slightly' weathered. The total S and Scr distribution for spoil samples is shown at **Figure 8** and for coal, tailings and rejects samples at **Figure 9**. Only total S values are shown for the same samples that underwent Scr tests.

Figure 8. Sulfur (S) and sulfide (Scr) distribution of spoil samples

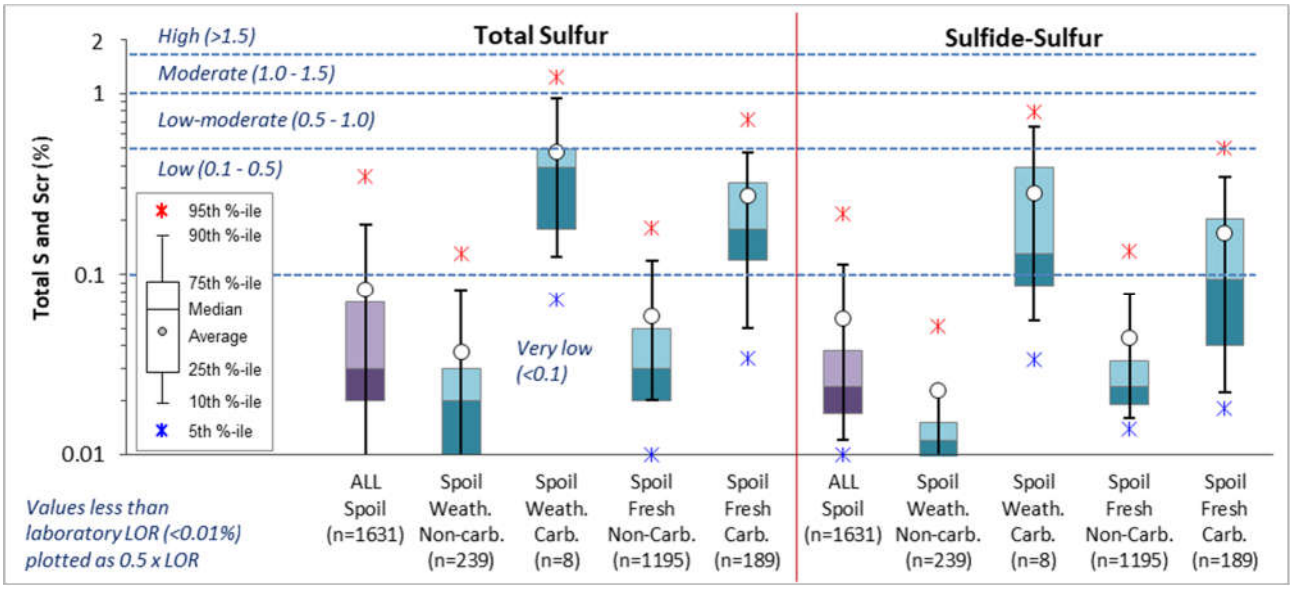
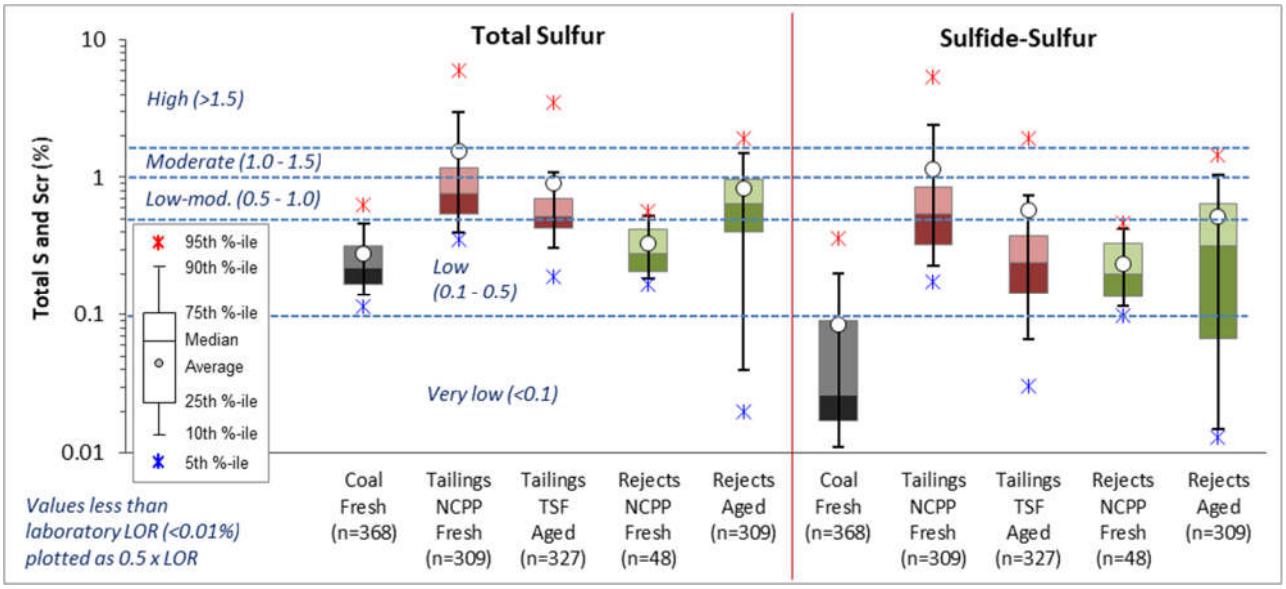


Figure 9. Sulfur (S) and sulfide (Scr) distribution of coal, tailings and rejects samples



Most spoil samples had Scr distributions only marginally lower than the total S distributions from the same group of samples. The Scr values for coal samples were generally lower compared to the total S values from the same samples.

Fresh (NCPP) tailings and rejects samples have Scr values only marginally lower than the total S values from the same samples. Comparatively, the Scr values for aged tailings and rejects are much lower, generally, than the total S values from the same samples – suggesting that the aged tailings and rejects samples have likely oxidised to some extent.

Scr as a proportion of total S for each material type is shown in **Table 14**. For the non-carbonaceous spoil samples, Scr accounts for most of the total S (83% to 87%, median value). Comparatively, the

carbonaceous spoil samples have a lower proportion of Scr (61% to 63% median value) due to a greater proportion of these samples likely containing organic sulfur, compared to the non-carbonaceous samples (of which most were fresh and unoxidised). Total S in the coal samples is expected to be mostly present as organic S, as evident by the low proportion of Scr (14%, median value).

Table 14. Scr as a proportion of total S

Material	Scr as a % of total S (median value)	Material	Scr as a % of total S (median value)
Spoil, weathered, non-carb. (n=239)	83%	Tailings, fresh, NCPP (n=308)	69%
Spoil, fresh, non-carb. (n=1195)	87%	Rejects, fresh, NCPP (n=48)	74%
Spoil, weathered, carb. (n=8)	61%	Tailings, aged (n=348)	48%
Spoil, fresh, carb. (n=189)	63%	Rejects, aged (n=309)	59%
ALL Spoil (n=1631)	85%	Coal (n=368)	14%

As a proportion of total S, Scr accounts for 69% (median value) of total S in fresh (NCPP) tailings samples and 74% in fresh (NCPP) rejects samples. Comparatively, as a proportion of total S, Scr accounts for 48% (median value) in aged tailings and 59% in aged rejects samples.

These results indicate that using total S as an indication of AMD hazard for all samples – but especially those samples containing a greater proportion of carbonaceous and coaly material – will result in a conservative outcome. For the aged tailings and rejects samples, and the weathered carbonaceous spoil samples, it is highly likely that some of the sulfide that may have been originally present in these aged samples when they were fresh has oxidised to sulfate.

Maximum potential acidity (MPA)

MPA is calculated from total S, therefore the MPA distribution for each material type mimics the total S distribution for the same samples (refer to **Figure 7**). Due to the generally very low to low total S (and Scr) values for spoil samples the MPA was correspondingly low, with 75th and 95th percentile MPA values of 1.2 and 4.6 kg H_2SO_4/t, respectively (n=4464 samples). As such, spoil represented by these samples is expected to have negligible potential to generate acid/acidity and negligible potential to release sulfate-derived salinity from sulfide oxidation. The small proportion of spoil with higher' MPA (as a result of the higher total S) would be well mixed throughout the bulk spoil and, as such, would not lead to spoil generating acid/acidity or sulfate-derived salinity.

Coal samples (n=381) produced MPA values generally higher than spoil – as expected by the higher total S values of coal samples. Coal samples had 75th and 95th percentile MPA values of 9.8 and 19 kg H_2SO_4/t, respectively. As discussed above, the proportion of total S associated with sulfide minerals in coal samples is low (14% of total S as Scr), with most sulfur likely associated with organic sulfur. Therefore, MPA values calculated from total S for coal samples is very conservative. By way of comparison, the 95th percentile MPA value for coal samples calculated from Scr (n=368) is 11 kg H_2SO_4/t – i.e. about 58% of the 95th percentile MPA value calculated from total S.

Tailings and rejects had a wide range of total S values – ranging from low to moderate – depending on the material sub-type, which resulted in a correspondingly wide range of MPA values. For example, fresh (NCPP) tailings had a 75th percentile MPA of 36 kg H_2SO_4/t (n=311 samples). Comparatively, aged tailings had a slightly lower 75th percentile MPA of 22 kg H_2SO_4/t (n=392). Fresh (NCPP) rejects had a 75th percentile MPA of 13 kg H_2SO_4/t (n=48) whereas aged rejects had a much higher 75th percentile MPA of 28 kg H_2SO_4/t (n=350).

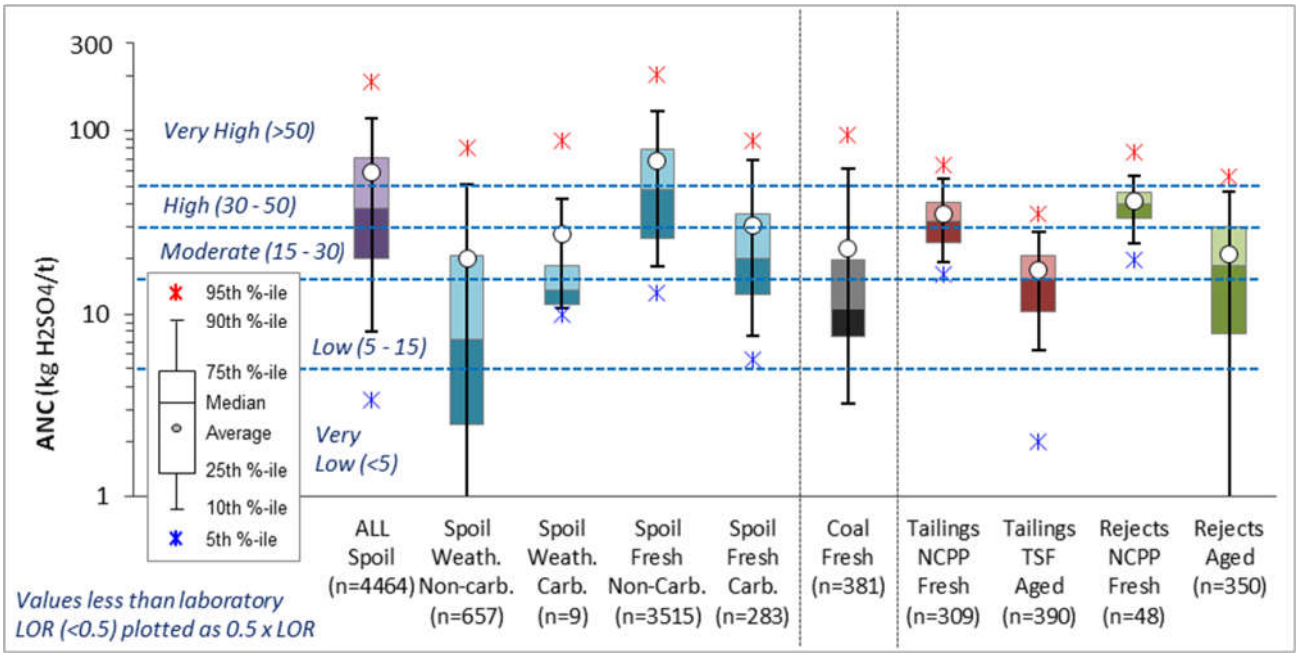
Acid neutralising capacity (ANC)

The ANC distribution for all samples is presented in **Figure 10**. The ANC values of spoil samples are typically well in excess of the MPA values and span a very large range, from less than 0.5 to 842 kg H_2SO_4/t, with a high median and 10th percentile ANC value for spoil samples of 38 kg H_2SO_4/t and 8.0 kg H_2SO_4/t, respectively. In other words, 90% of spoil samples have an ANC greater than 8.0 kg H_2SO_4/t which, if all ANC was readily available, would neutralise the acidity generated by material containing 0.26% S.

The ANC for the fresh (NCPP) tailings samples was generally moderate to high and for fresh (NCPP) rejects samples was generally high, with 10th percentile values of 19 and 25 kg H_2SO_4/t for fresh tailings and fresh rejects, respectively. Comparatively, aged tailings had generally low to moderate ANC distribution with a 10th percentile value of 6.3 kg H_2SO_4/t. Aged rejects had a wide range of ANC values – generally from very low to high.

Coal samples also had a wide range of ANC values from very low to high, but low to moderate overall with median and 10th percentile ANC values of 11 and 3.2 kg H_2SO_4/t, respectively.

Figure 10. Acid neutralising capacity (ANC) distribution



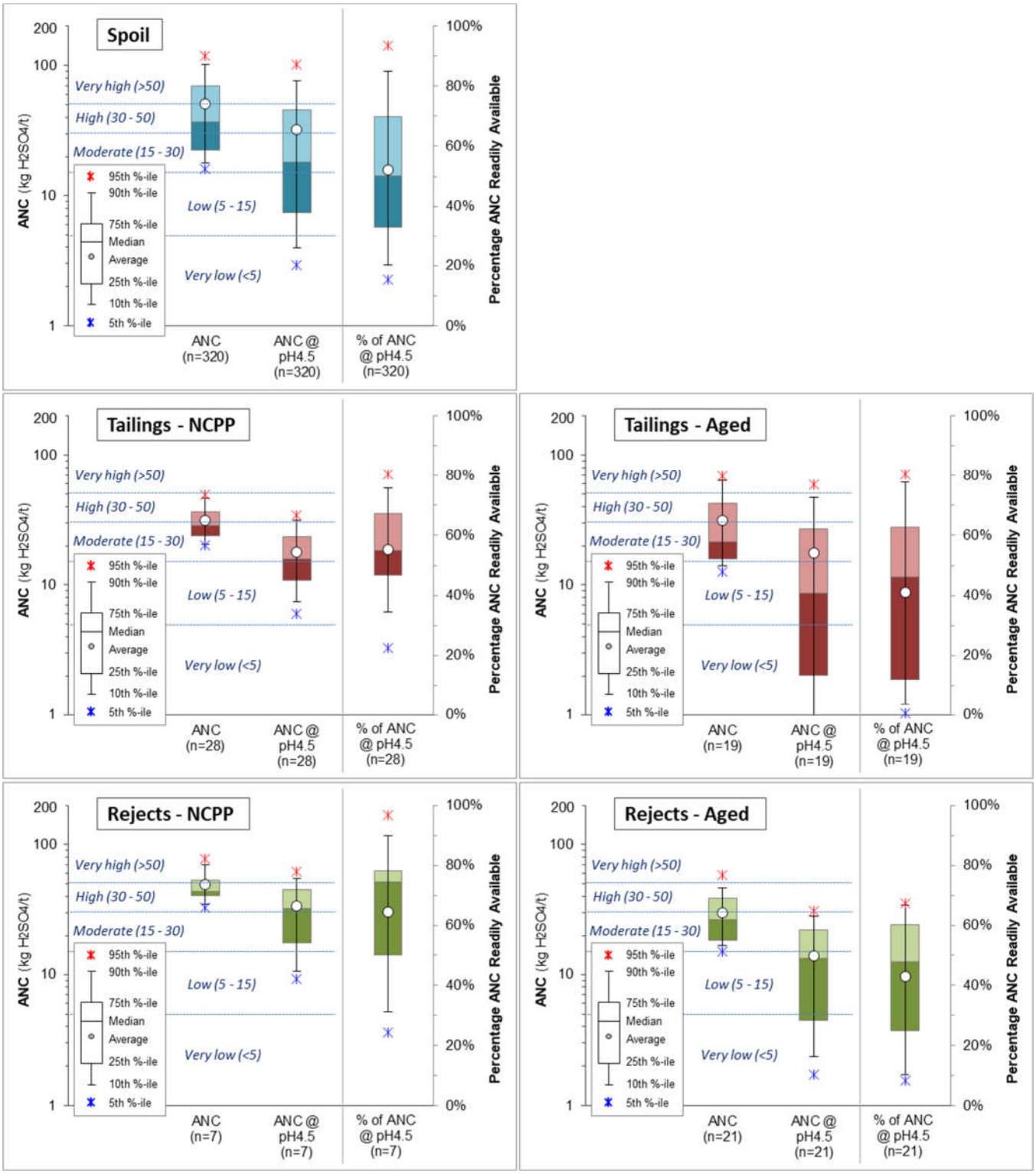
Available acid neutralising capacity

The availability of neutralising material is generally determined by the mineralogy of the sample – with calcite and dolomite (carbonate minerals) being more readily-available to neutralise acidity compared with, for example, silicates. Siderite, although a carbonate, has no net acid neutralising capacity. As such, ANC assumes that all ANC is readily available to neutralise acid, when this is rarely the case. Hence, ABCC (and mineralogical) test-work is undertaken to understand the effective ANC.

Acid buffering characterisation curve (ABCC) tests were undertaken on 320 spoil samples, 28 fresh (NCPP) tailings samples, 7 fresh (NCPP) rejects samples, 19 aged tailings samples and 21 aged rejects samples. ABCC results are used to assess the proportion of ANC that may be 'readily available' (i.e. short-acting) in these materials under field conditions and provide some indication of what carbonate minerals are providing the ANC. 'Ready availability' is regarded as the proportion of ANC that is

available for buffering reaction at pH 4.5. The results are summarised in Figure 11 for spoil, tailings and rejects samples.

Figure 11. Distribution of acid neutralising capacity (ANC) [total], ANC at pH4.5 and proportion (%) of ANC expected to be readily available



For the 320 spoil samples where ABCC data is available, the results showed that the proportion of ANC likely available under field conditions ranged from about 6% to nominally 100% of the ANC, with a median of approximately 50%. The results – based on the 25th and 75th percentile values – suggest that

about 33% to 70% of the ANC is expected to be available under field conditions from spoil material – which is typical for spoil material from the Bowen Basin.

For the fresh tailings and rejects samples, the results showed that the proportion of ANC likely available under field conditions ranged from approximately 20-90% of the ANC, but overall (and based on the 25th and 75th percentile values), about 50-75% of the ANC is expected to be available under field conditions – fairly typical for fresh tailings and rejects from the Rangal Coal Measures.

Comparatively, the availability of ANC under field conditions for the aged tailings and rejects samples is very broad – ranging from essentially zero to about 85% – suggesting that the amount of ANC that may have already been consumed in the aged samples varies considerably.

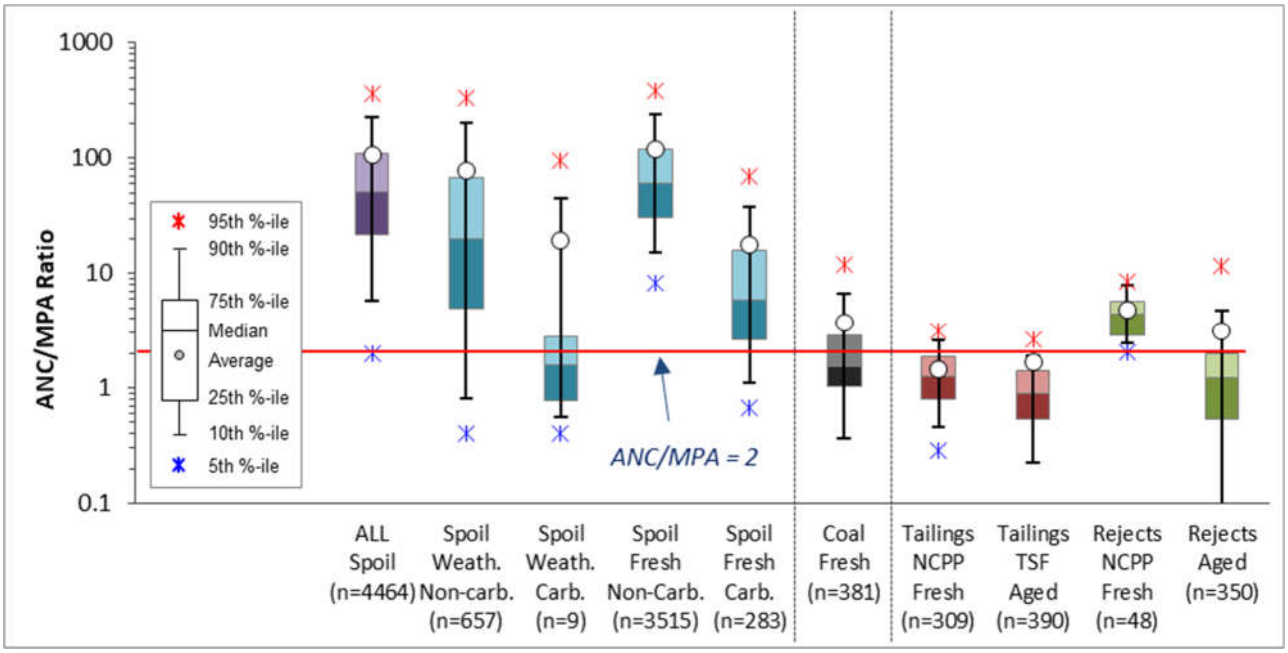
ANC / MPA ratio

Generally, those samples with an ANC/MPA ratio greater than two are considered to have a negligible/low risk of acid generation (DIIS, 2016; INAP, 2009[3]), especially where sulfide concentrations are very low and reactive ANC is moderate to high – as is the case with the potential spoil samples. The results, illustrated in **Figure 12**, show that:

- Ninety-nine per cent (95%) of 4464 spoil samples have an ANC/MPA ratio greater than two – noting that 79% of all spoil samples are fresh non-carbonaceous. Approximately 80% of fresh carbonaceous spoil samples (227 out of 283 samples) have an ANC/MPA ratio greater than two.
- Eighty-five percent (85%) of all tailings samples (597 of 699 samples) had ANC/MPA ratios less than or equal to two.
- Most of (76% of) the aged rejects samples had ANC/MPA ratios less than or equal to two. Comparatively, most of (94% of) the fresh (NCPP) rejects samples have ANC/MPA ratios greater than two.
- Sixty-one per cent (61%) of all coal samples had ANC/MPA ratios less than or equal to two.

3 INAP (2009) considers that mine materials with an ANC/MPA ratio greater than two are likely to be NAF unless significant preferential exposure of sulfide minerals occurs along fracture planes, in combination with insufficiently reactive ANC.

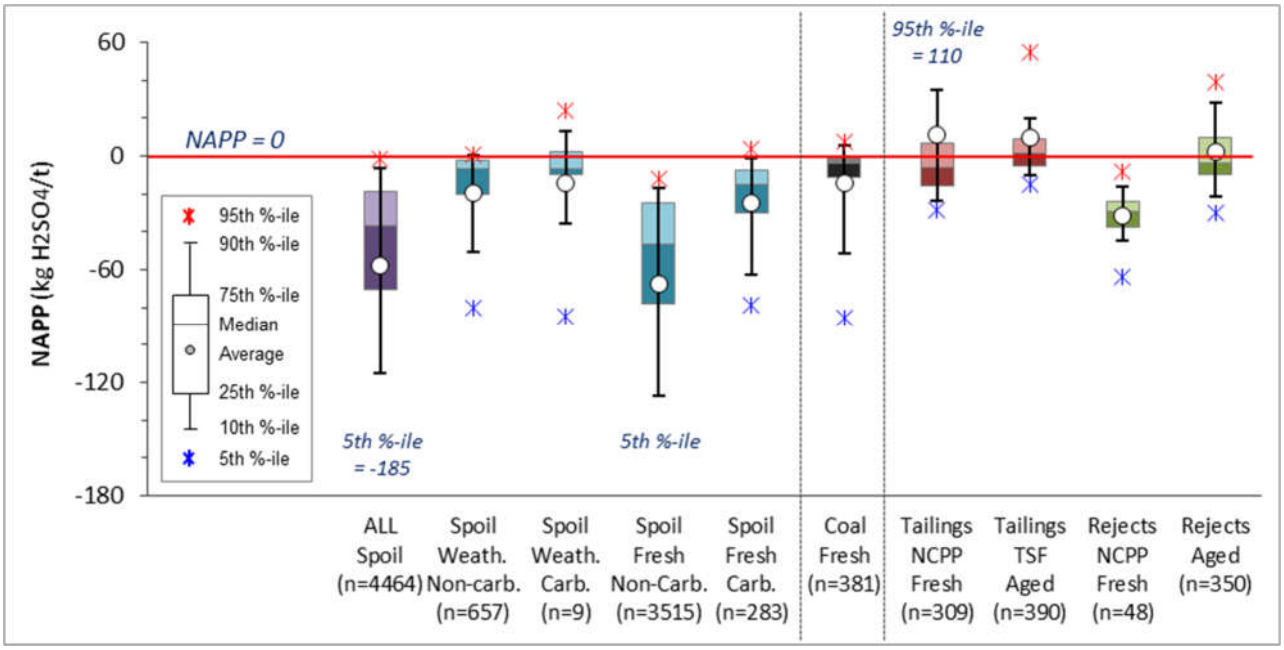
Figure 12. Distribution of the ratio of acid neutralising capacity (ANC) to maximum potential acidity (MPA) [ANC/MPA ratio]



Net acid producing potential (NAPP)

The NAPP distribution for all samples is presented in **Figure 13**. Based on the generally low MPA and higher ANC values (relative to the MPA), the calculated NAPP values are negative for the large majority of spoil samples. The results indicate that, overall, there is significantly excess neutralising capacity (ANC) compared to potential acidity (MPA) for spoil samples.

Figure 13. Distribution of net acid producing potential (NAPP)



Tailings samples (fresh and aged, combined) have a wide range of NAPP values from -24 to 104 kg H_2SO_4/t (5th and 95th percentile values, respectively), but overall range from low negative to low positive NAPP values (25th and 75th percentile values of -9.6 and 8.5 kg H_2SO_4/t, respectively). A similar trend

was observed in aged rejects samples. Comparatively, all fresh rejects samples reported negative NAPP values. As also evident in Figure 13, most of the coal samples reported negative NAPP values.

Net acid generation (NAG) capacity

NAG test results are used in conjunction with NAPP values in determining the acid classification of samples. The calculated NAPP value assumes that all sulfur (present as sulfide) will oxidise to generate acid (MPA) and that all neutralising material in a sample is in a readily available form to neutralise any acid that could be generated (ANC). Unlike the theoretical basis of the NAPP test, in a NAG test a sample is encouraged to oxidise by reaction with hydrogen peroxide and any acid generated through oxidation may be consumed by neutralising components in the sample. Any remaining acidity is measured and expressed as kg H_2SO_4/t.

Samples with NAGpH values greater than pH 4.5 are considered to be NAF. Samples with NAGpH values less than or equal to pH 4.5 (i.e. acid-generating) would also be expected to have measurable NAG capacity (i.e. NAG capacity greater than 0.1 kg H_2SO_4/t). As a guide, NAG capacity values between 0.1 and 5 kg H_2SO_4/t are considered 'low capacity' (AMIRA, 2002).

NAG test data is available for 265 spoil samples, 213 coal samples, 293 fresh tailings samples, 130 aged tailings samples, 48 fresh rejects samples, and 181 aged rejects samples with the NAGpH distribution for these samples shown in Figure 14. Of the samples tested; 77% of spoil, 59% of fresh (NCPP) tailings, 15% of aged tailings, all fresh (NCPP) rejects and 62% of aged rejects samples tested had NAGpH values greater than pH4.5. Of the coal samples, 39% had NAGpH values greater than pH4.5.

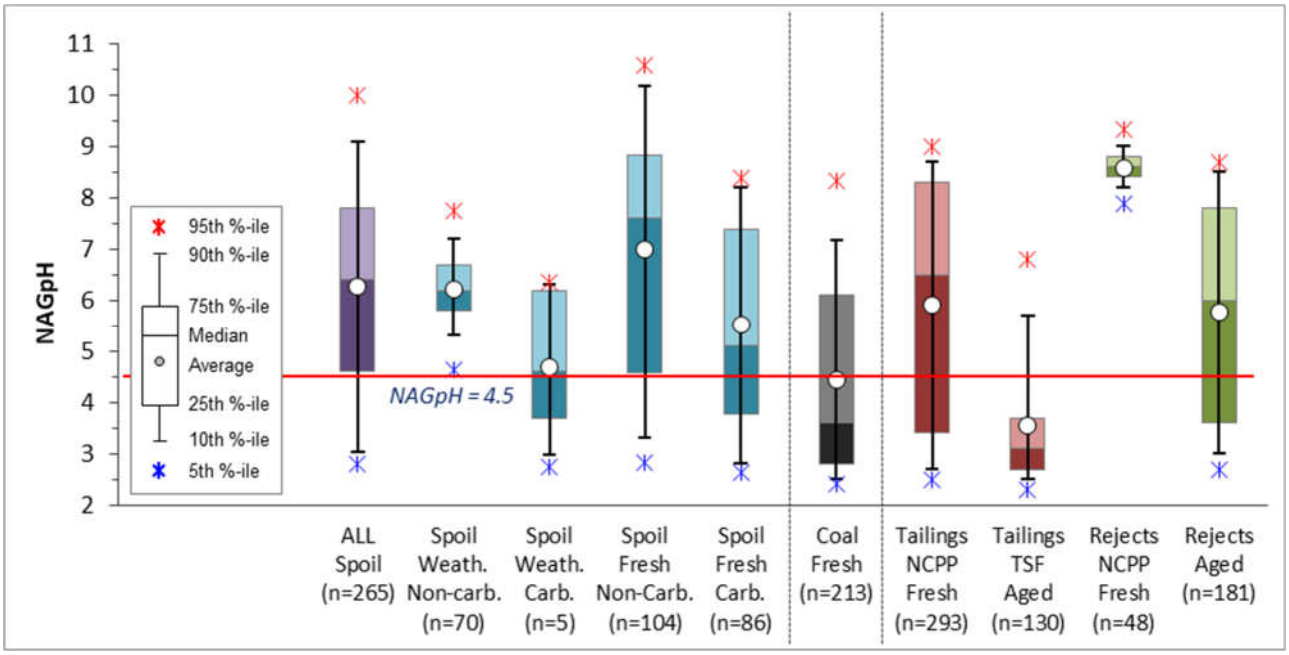
As per general practice, NAG tests tend to be undertaken on samples with higher total S values and/or those samples potentially considered to have a greater potential to generate AMD, such as samples closely associated with coal seams, or tailings and rejects samples. As such, the proportion of samples with NAGpH values less than pH4.5 is not representing the actual proportion of material in the field that can generate acid conditions, but is indicative of the type of material (based on total S and ANC concentrations) that may generate AD under field conditions.

The NAG test can be influenced by organic acid (i.e. organic acid can produce NAGpH between approximately pH 4 to 4.5, thus providing a 'false positive' for sulfuric acid). Organic acid is typically produced by samples with high organic carbon content – such as coal and highly carbonaceous samples.

To attempt to resolve some of the uncertainty with the 'single addition' NAG test for coaly and highly carbonaceous samples, 244 samples underwent an Extended Boil NAG method (NAG Extended). Samples included 204 coal, 3 non-carbonaceous spoil, 6 coaly and carbonaceous spoil, 26 tailings and five rejects samples.

Seventy (70) of these 244 samples (or 29% of samples) returned Extended NAGpH values greater than pH4.5, suggesting that for about one third of the mostly coal and tailings samples tested the acidity generated in the 'single addition' NAG test was associated with the oxidation of organic carbon and not with sulfide oxidation.

Figure 14. Distribution of net acid generation pH (NAG single or NAG Extended or Stage 1 NAG Sequential)



AMD classification

The ABA results presented in this section have been used to classify the acid forming nature of the samples following the classification criteria outlined in Section 4.4 (Table 2). Additional relevant data, such as ABCC and Extended NAG test results were used to aid in the classification of samples where there was uncertainty following the preliminary AMD classification. The acid forming nature of these samples is summarised in Table 15.

Spoil

The classifications in Table 15 show that 98% of spoil samples were classified as NAF or were expected to be NAF [and have been classified as UC(NAF)]. These spoil samples and spoil material represented by these samples have very low sulfur concentration, significant excess ANC (relative to the MPA) and clearly have negligible capacity to generate AMD. Approximately 2% of spoil samples (96 out of 4464 samples) were classified as PAF, PAF-LC or UC(PAF). Three samples were classified as NAF-S.

Data show that potential spoil, as a bulk material, would be overwhelmingly NAF – and essentially all spoil away from seams (which is the overwhelming bulk of spoil) is expected to be NAF. Furthermore, the very low sulfur concentrations in spoil indicates that the sulfate concentration that could be generated in spoil from sulfide oxidation (in addition to any salinity unrelated to sulfide oxidation) would also be very low.

PAF spoil is mostly closely associated with seams, as seam roof, parting or floor, which may largely report to a CHPP as ROM coal and leave the CHPP as rejects. PAF spoil is also likely to be associated with thicker interburden zones between seam plys of the same seam group. That is, PAF spoil is rarely encountered well away from seams.

Table 15. Geochemical classification of samples

Material Type	NAF	UC(NAF)	NAF-S	UC(PAF)	PAF-LC	PAF
	Number and (%) of samples					
Spoil, weath, non-carb. (n=657)	586 (89%)	43 (6.5%)	-	1 (<0.2%)	27 (4.1%)	-
Spoil, weathered carbonaceous (n=9)	6 (67%)	-	-	2 (22%)	-	1 (11%)
Spoil, fresh non-carbonaceous (n=3515)	3472 (99%)	12 (0.3%)	1 (<0.1%)	10 (0.3%)	16 (0.5%)	4 (0.1%)
Spoil, fresh carbonaceous (n=283)	242 (86%)	4 (1.4%)	2 (0.7%)	19 (6.7%)	13 (4.6%)	3 (1.1%)
Spoil [all] (n=4464)	***4306 (96%)***	***59 (1.3%)***	***3 (<0.1%)***	***32 (0.7%)***	***56 (1.3%)***	***8 (<0.2%)***
	4365 (98%)		***3 (<0.1%)***	***96 (2%)***		
Coal (n=381)	**231 (61%)**	**14 (3.7%)**	**1 (<0.3%)**	**3 (0.8%)**	**105 (28%)**	**27 (7.1%)**
	245 (64%)		***1 (<0.3%)***	***135 (35%)***		
Tailings, fresh, NCPP (n=311)	153 (49%)	15 (4.8%)	18 (5.8%)	52 (17%)	28 (9.0%)	45 (14%)
Tailings, aged, TSFs (n=392)	88 (22%)	57 (15%)	1 (0.3%)	83 (21%)	116 (30%)	47 (12%)
Tailings [all] (n=703)	***241 (34%)***	***72 (10%)***	***19 (2.7%)***	***135 (19%)***	***144 (20%)***	***92 (13%)***
	313 (45%)		***19 (<3%)***	***371 (53%)***		
Rejects, fresh, NCPP (n=48)	48 (100%)	-	-	-	-	-
Rejects, aged (n=350)	141 (40%)	29 (8.3%)	16 (4.6%)	54 (15%)	55 (16%)	55 (16%)
Rejects [all] (n=398)	**189 (47%)**	**29 (7.3%)**	**16 (4%)**	**54 (14%)**	**55 (14%)**	**55 (14%)**
	218 (55%)		***16 (4%)***	***164 (41%)***		

Tailings

Approximately 53% of 703 tailing samples were classified as UC(PAF), PAF-LC or PAF and, of these 'PAF' samples, approximately 75% were classified as UC(PAF) or PAF-LC. About 40% of fresh (NCPP) tailings samples and 63% of aged (TSF) tailings samples were classified as 'PAF' of some type. Most of the aged tailings samples were logged as moist to wet at time of collection (excluding near-surface samples), and are therefore assumed to have not been subjected to significant oxidation – assuming deeper tailings were buried by overlying tailings soon after deposition. Nineteen tailings samples (almost all from the NCPP) were classified as NAF-S.

From an acid generating perspective just over half (approximately 55%) of all tailings samples were classified as 'PAF' (of some type) or NAF-S and, therefore, pose a potential AMD source hazard with respect to AD and/or NMD/SD. The relatively high proportion of 'PAF' tailings samples classified as UC(PAF) or PAF-LC suggests that tailings, overall, are expected to generate low to moderate acidity loads if allowed to fully oxidise.

Rejects

The results show that all fresh rejects from the NCPP were classified as NAF; and approximately 49% of aged rejects were classified as NAF or UC(NAF). The remaining 51% of aged rejects had some type of broader 'PAF' classification, including 16 aged rejects samples classified as NAF-S. Therefore, from an

acid generating perspective, about half of the aged rejects pose a potential AMD source hazard with respect to AD and/or NMD/SD.

Coal

Compared to spoil, coal samples had marginally higher total S values and marginally lower ANC, which resulted in approximately 36% of coal samples being classified as PAF, PAF-LC or UC(PAF) – including one sample classified as NAF-S. The proportion of PAF, PAF-LC, UC(PAF) and NAF-S samples is comparable across all coal seam groups being mined at BWM. It is worth noting that approximately 80% of the coal samples classified as some form of 'PAF' [including the single sample classified as NAF-S] showed limited or uncertain capacity to generate acidity [classified as UC(PAF) or PAF-LC], suggesting that 'PAF' coal is unlikely to generate significant acid(ity). Furthermore, the Scr content of coal samples was generally low – comprising about 14% (median value) of the total S. This suggests that the 'PAF' (including PAF sub-groups) classification is conservative for most coal samples. On the other side of the acid-base account, it is recognised that ANC is likely an overestimate, however the AMD classification already takes this into account by assuming ANC is only 50% available (i.e. the classification uses an ANC/MPA ratio of 2).

Approximately 64% of coal samples tested (245 out of 381 samples) were classified as NAF or UC(NAF), and seam material represented by these samples has very low sulfur values, excess ANC (relative to the MPA) and clearly has no capacity to generate acidity or release significant sulfate from sulfide oxidation.

These results suggest that coal represented by these samples and stored on a ROM pad, or located within pit walls or un-economic coal seam material reporting as spoil (mixed with non-coal spoil) would likely be bulk NAF. A small proportion of coal (from all seam groups) poses a greater, but relatively low, AMD source hazard.

5.3 Total Metals and Metalloids

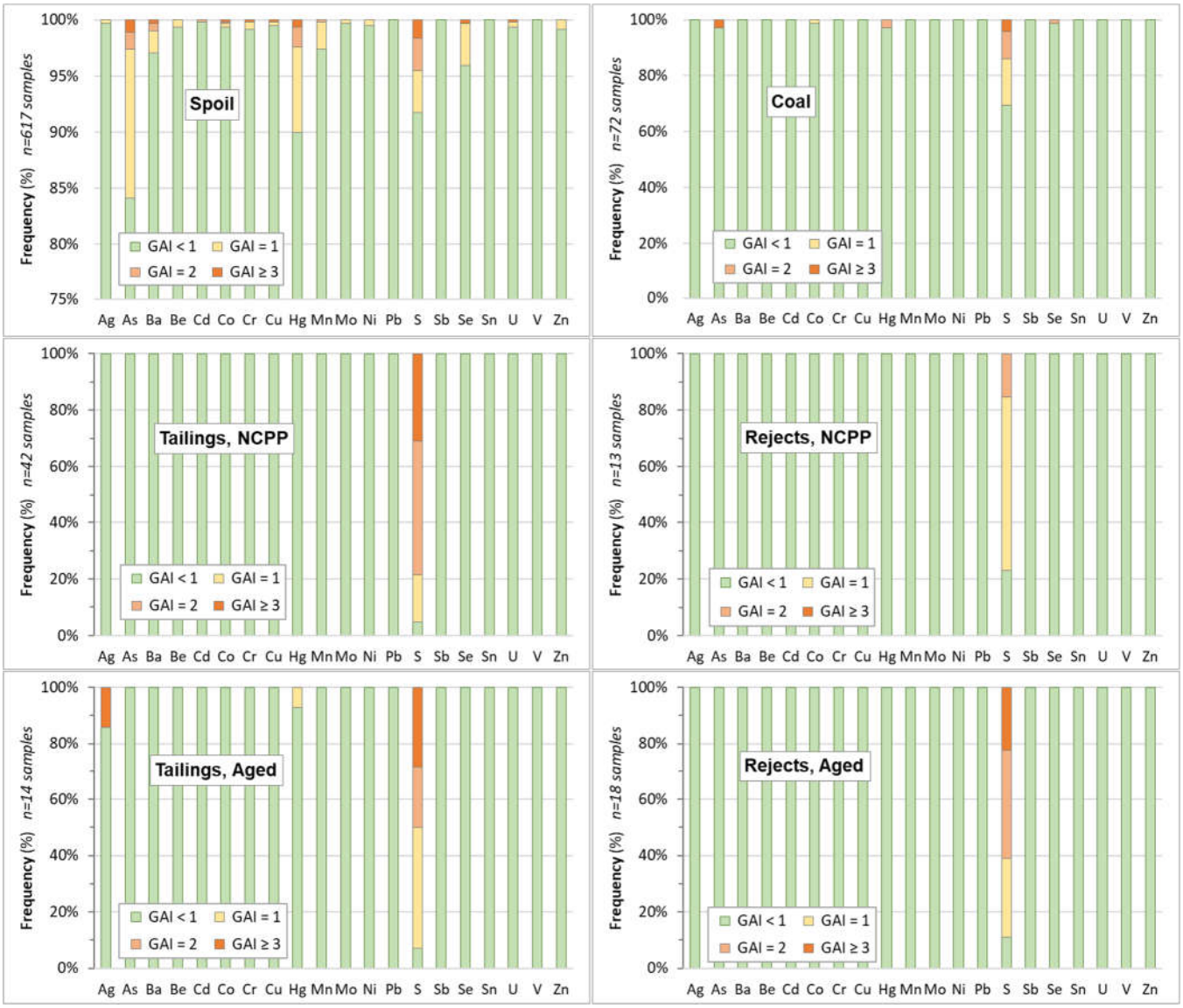
Multi-element (metal and metalloid) data is available for 776 samples, comprising 617 spoil samples [all four spoil groups represented], 72 coal samples, 31 rejects samples [13 fresh and 18 aged] and 56 tailings samples [42 fresh and 14 aged]. The degree of enrichment with respect to elements potentially of environmental interest for the spoil, coal, reject and tailings materials is shown in **Figure 15**.

The GAI values show that 26 (out of 617) spoil samples and three (out of 72) coal samples were significantly enriched [GAI ≥3] with regard to one or more of arsenic (As), barium (Ba), cobalt (Co), chromium (Cr), copper (Cu), mercury (Hg), selenium (Se), sulfur (S) and/or uranium (U). The level of S enrichment in these samples is consistent with the ABA data for these same samples. The enrichment in some elements in a small number of samples is not cause for concern.

With regard to the degree of element enrichment in tailings samples, 11 out of 42 fresh (NCPP) tailings samples and four (out of 14) aged tailings samples were significantly enriched in S, with the degree of enrichment consistent with the ABA data for these same samples. Two aged tailings samples were also significantly enriched in As. Comparatively, no fresh (NCPP) rejects samples were significantly enriched for any metals or metalloids. Four out of 17 aged rejects samples were significantly enriched with regard to S.

Overall, the results suggest that bulk mineral waste materials have generally low levels of metal and metalloid enrichment, which is consistent with Permian-age coal measures throughout Qld.

Figure 15. Frequency distribution of geochemical abundance indices (GAI) of selected elements in spoil, coal, tailings and rejects)



5.4 Initial Solubility in Deionised Water

Water extract test results are available for a wide range of samples, as outlined in Table 16. Therefore, a large dataset is available to assess the potential for leaching of salt and environmentally important elements from mineral wastes (spoil, tailings and rejects) and coal at BWM. Water extract tests provide a preliminary indication of the elements that may be readily mobilised from any given material type.

The samples underwent a 1:5 w:v (solid:water) deionised water bottle leach procedure on fine pulps. Note that the use of fine pulped materials in water extract tests will enable a high level of reaction and dissolution. The test-work has found that bulk spoil, generally, is pH-alkaline to highly alkaline, non-saline to slightly saline and has very low to low concentrations of soluble metals and metalloid concentrations – within the range typical for Tertiary and Permian overburden and interburden materials in Queensland. For most spoil samples, the soluble metals and metalloids are at concentrations below or marginally above the laboratory limit of reporting (LOR). Comparatively, tailings and rejects (fresh and aged) have a much wider range of solubility characteristics compared to spoil – as expected.

Table 16. Samples subjected to deionised water solubility tests

Material type	pH and EC	Soluble metals and metalloids
	Number of samples	
Spoil	4464, comprising: • 657 weathered non-carbonaceous • 9 weathered carbonaceous • 3515 fresh non-carbonaceous; and • 283 fresh carbonaceous	618, comprising: • 132 weathered non-carbonaceous • 3 weathered carbonaceous • 417 fresh non-carbonaceous; and • 66 fresh carbonaceous
Tailings	699, comprising: • 309 fresh tailings from the NCPP • 390 aged tailings from TSFs	73, comprising: • 39 fresh tailings from the NCPP • 34 aged tailings from TSFs
Rejects	398, comprising: • 48 fresh rejects from the NCPP • 350 aged rejects from TSFs and rejects dumps	54, comprising: • 15 fresh rejects from the NCPP • 39 aged rejects from TSFs and rejects dumps
Coal	381	72

Electrical conductivity (EC) and pH

EC and pH data is available for 5942 samples at 1:5 w:v on pulp (**Figure 16**).

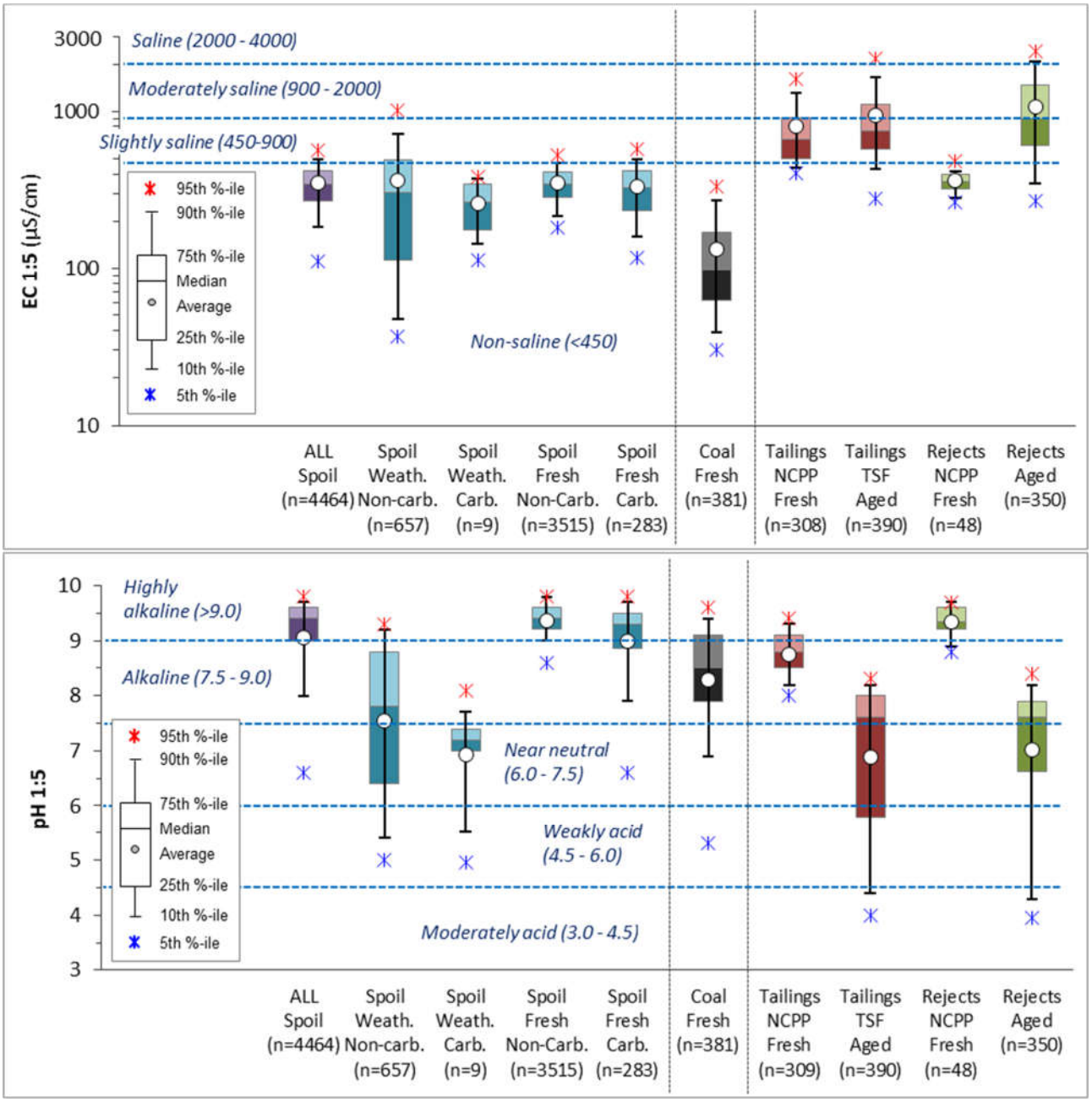
The $EC_{1:5}$ of 4464 spoil samples spanned a large range from less than 10 to 2790 μS/cm, with median, 75th and 95th percentile $EC_{1:5}$ values of 343, 418 and 571 μS/cm, respectively. As a bulk material, spoil is generally non-saline. These $EC_{1:5}$ results for spoil are common (if not typical) for Bowen Basin Permian and Tertiary material in the region.

There is generally little difference in $EC_{1:5}$ values between fresh and aged tailings, with fresh tailings (n=308) being slightly saline (median = 663 μS/cm) and aged tailings (n=390) being slightly to moderately saline (median = 748 μS/cm). Fresh rejects samples (n=48) were all generally non-saline whereas aged rejects (n=350) were generally slightly to moderately saline. Overall, bulk tailings and bulk rejects can be conservatively assumed to be slightly to moderately saline. Coal samples (n=381) are non-saline.

The $pH_{1:5}$ distribution by material type (**Figure 16**) shows bulk spoil, coal, fresh tailings and fresh rejects samples to be alkaline to highly alkaline. These pH results are common – if not typical – for Bowen Basin Permian and Tertiary material in the region. Some weathered spoil has naturally low $pH_{1:5}$ results (weakly acidic to near-neutral), which is typical for some weathered materials and is not due to AMD processes.

Approximately 27% of aged tailings and 23% of aged rejects samples were acidic to varying degrees – ranging from highly acidic through to weakly acidic. Of the 740 aged tailings and aged rejects samples (combined), 13% had $pH_{1:5}$ values between 4.5 and 6.0 (weakly acidic), 13% had $pH_{1:5}$ values between 3.0 and 4.5 (moderately acidic) and one aged tailings sample had $pH_{1:5}$ value less than pH 3.0 (pH 2.3 - highly acidic). In total, approximately 13% of all aged tailings and aged rejects samples had $pH_{1:5}$ values less than or equal to pH 4.5 and are classified as being moderately to highly acidic – evidence of sulfide oxidation and acid generation. Of these moderately to highly acidic aged tailings and aged rejects samples, almost all were from TSFs and reject areas located in the southern part of BWM, including Laleham TSF, Ramp 72 TSF, Bottom Dam TSF and from Red Dam area.

Figure 16. Electrical conductivity (EC) and pH distribution

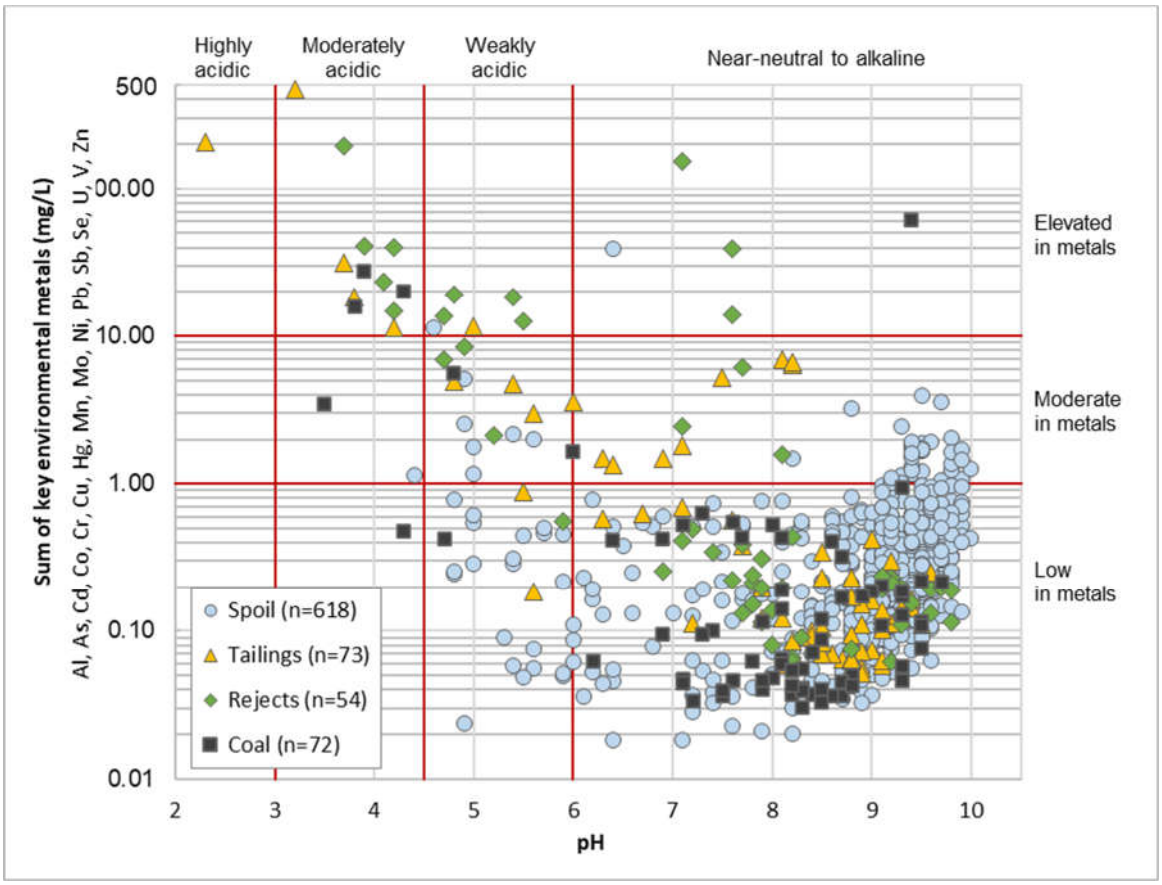


Soluble metals and metalloids

Deionised water extract (leaching) data for major ions and a broad suite of metals/metalloids are available for 817 samples (**Table 16**). All samples underwent a 1:5 w:v (solid:water) water extract procedure on pulps. All samples were analysed under ICP-MS method.

The sum of 16 environmentally important elements are plotted as a function of pH in **Figure 17**, in a modified version of what is referred to as a Ficklin plot (after Ficklin *et al.*, 1992). The 16 selected metals/metalloids comprise: aluminium (Al), antimony (Sb), As, cadmium (Cd), Co, Cr, Cu, lead (Pb), Hg, manganese (Mn), molybdenum (Mo), nickel (Ni), Se, U, vanadium (V) and zinc (Zn).

Figure 17. Sum of key environmental metals versus pH in deionised water extracts



The results, illustrated in **Figure 17**, show that:

- Eighty-six per cent (86%) of 817 samples – of all mineral waste types, including coal – have low soluble metals concentrations and have near-neutral to alkaline pH – indicating that under freshwater leaching conditions soluble metals concentrations are low for most mineral waste and coal materials.
- Over 89% of spoil samples have low soluble metals concentrations and have near-neutral to alkaline pH. Of the remaining 1% (approximately) of spoil samples:
  - Approximately 5% – mostly all fresh, non-carbonaceous – have near-neutral to alkaline pH but with moderate metals concentrations.
  - Approximately 4% – mostly all weathered, non-carbonaceous – are weakly acidic and with low metals concentrations.
  - Eight samples are weakly to moderately acidic and with moderate to elevated metals concentrations.
- Fifty-three (of 73) tailings samples (73%) have low soluble metals concentrations and have near-neutral to alkaline pH, including all 39 fresh NCPP tailings samples. The remaining 27% of tailings samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH conditions. Generally, the NCPP TSF and Laleham TSF tailings samples had similar soluble metals concentrations, however the Laleham TSF samples had lower pH compared to the aged tailings samples from NCPP TSF.
- Thirty-five (of 54) rejects samples (65%) have low soluble metals concentrations and have near-neutral to alkaline pH, including all 15 fresh NCPP rejects samples. The remaining 35% of rejects samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH

conditions. Most of the aged rejects with lower pH and moderate to elevated soluble metals concentrations were from Ramp 72 (Kenmare pit rejects).

- Sixty-three (of 72) coal samples (88%) have low soluble metals concentrations and have near-neutral to alkaline pH. The remaining 12% of coal samples have a wide range of soluble metals concentrations under a wide range of pH conditions.

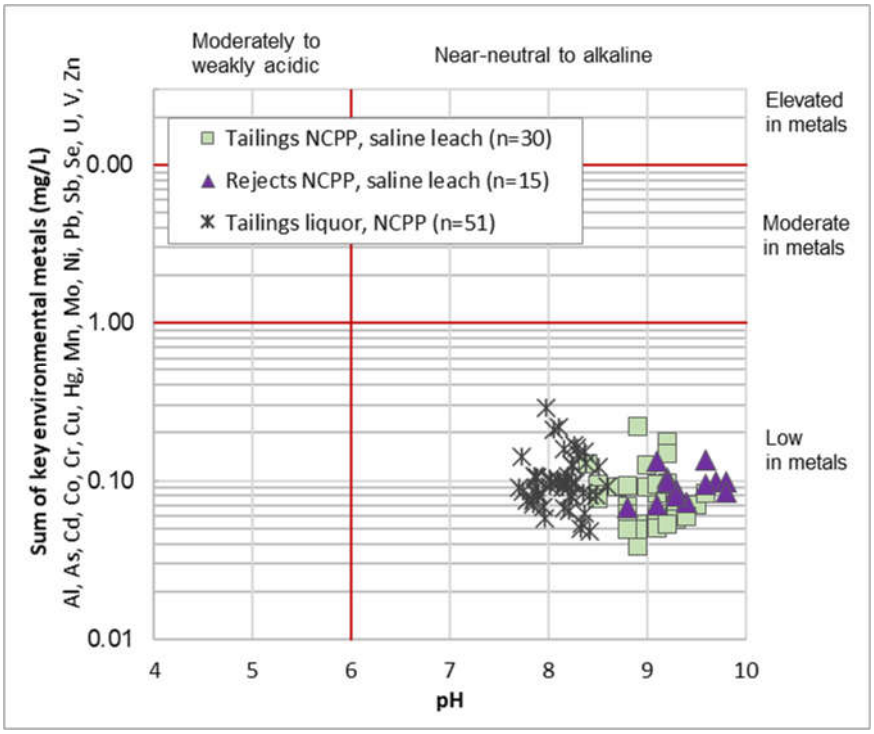
In pH-neutral to alkaline waters, many metals/metalloids cannot remain in solution and, thus, trace metal/metalloid concentrations are generally low. Comparatively, in acid(ic) waters, many metals/metalloids are highly soluble and remain in solution and, thus, trace metal/metalloid concentrations are generally high. Notable exceptions to these general rules include elements such as As, Mn, Sb and Se, which remain soluble through a wide pH range. Other trace metals that are somewhat soluble under pH-neutral to alkaline conditions include Cd, Cr, Mo and Zn. As such, under the pH-alkaline conditions of the leach, the mobility of these elements would not be inhibited.

5.5 'Saline' Water Solubility of Tailings and Rejects

Thirty (30) fresh tailings and 15 fresh rejects samples from NCPP underwent a 1:5 w:v (solid:water) mildly saline (brackish) water extract procedure on pulps using a 2 g/L sodium chloride (NaCl) leaching solution. This leach was undertaken to determine the solubility of metals and metalloids under 'brackish' conditions – which better simulate the normal (brackish) water quality of the NCPP process water. Note that the salinity of NCPP process water varies from fresh to brackish on a day-to-day basis depending upon the source of the water from within the mine water management system.

The sum of the concentration of 16 environmentally important elements are plotted as a function of pH from the saline leach solution for tailings and rejects in Figure 18 (along with the data for tailings liquor – see Section 5.6 below). The 16 selected metals/metalloids are the same elements as per the 1:5 deionised water leach. The results have shown that the solubility of tailings and rejects is low under 'brackish' leaching conditions.

Figure 18. Sum of key environmental metals versus pH in saline water extracts and tailings liquor



5.6 Characteristics of Tailings Liquor (Water)

Water quality data for tailings liquor is available for 51 tailings slurry samples collected from the NCPP (at the thickener underflow). The sum of the concentration of 16 environmentally important elements are plotted as a function of pH from the tailings liquor solution in **Figure 18** (along with the data for the saline leach solutions – **Section 5.5**). The 16 selected metals/metalloids are the same elements as per the 1:5 deionised water leach, saline water leach and peroxide leach.

All tailings liquor samples have near neutral to alkaline pH and low soluble metals concentrations. The liquor is highly saline, with EC values ranging from 2210 to 5410 μS/cm (median = 4220 μS/cm) and a median total dissolved solids (TDS) of 2700 mg/L. The dominant cation is Na and the dominant anions are Cl and SO_4 (equally dominant).

By comparison, the 2 g/L NaCl saline leach solution was less saline, with a median TDS for tailings and rejects 'saline' leach samples of 2113 mg/L and 2293 mg/L, respectively. The dominant cations and anions in the saline leach were Na and Cl, respectively, as expected due to the NaCl used to create the saline solution.

5.7 Peroxide Leachate Solutions

Peroxide leachate (NAG leach) data is available for 102 samples comprising:

- 5 weathered non-carbonaceous spoil samples – one classified as PAF-LC, one classified as UC(PAF) and three classified as NAF or UC(NAF).
- 9 fresh non-carbonaceous spoil samples: eight samples classified as UC(PAF) and one sample classified as PAF.
- 6 fresh carbonaceous samples: four samples classified as UC(NAF), one sample classified as UC(PAF) and one sample classified as PAF-LC.
- 8 coal samples: two samples classified as PAF and the remaining six samples classified as PAF-LC;
- 48 tailings samples (28 fresh and 20 aged) of mixed classifications (NAF to PAF, including UC(NAF) and UC(PAF)). Aged samples are from NCPP TSF and Laleham TSF;
- 26 aged rejects samples (6 samples from Ramp 36 rejects dump, 19 samples from Ramp 72 TSF and 1 sample from Laleham TSF) – mostly all 'PAF' classes, except for four samples classified as NAF and two samples classified as UC(NAF).

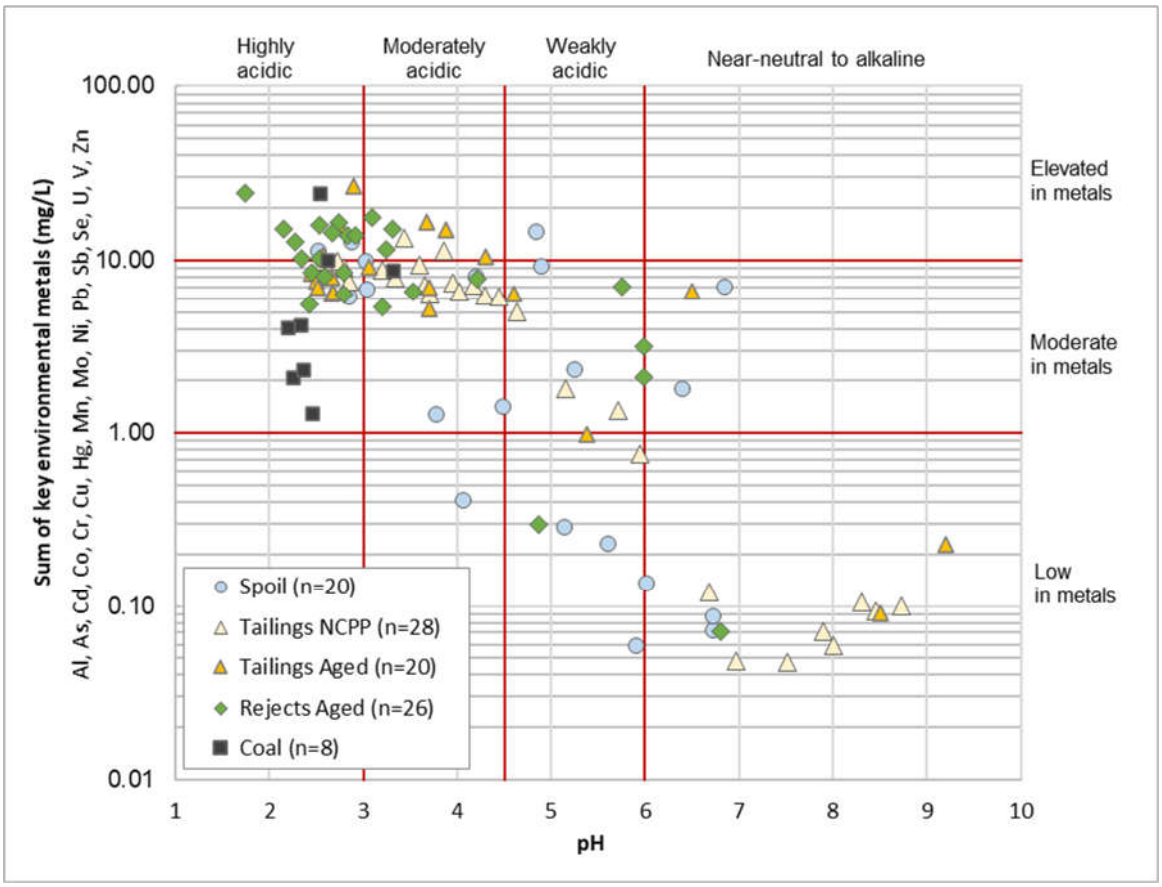
Peroxide leachate is the solution remaining from a single addition (standard) NAG test after the sample has been oxidised with peroxide to encourage oxidation and neutralising reactions, if ANC is available. The test encourages complete and rapid oxidation, with the resulting leach representing and assumed 'worse case' scenario in term of metal/metalloid mobility. The purpose of this test is to understand what metals/metalloids can be mobilised following full oxidation. The samples submitted for this test were selected to assess the hazard of similar waste type or to assist clarifying borderline geochemical properties.

It must be noted that samples with potentially high organic carbon concentrations, such as coal, some tailings and some reject samples, may be influenced by organic acids producing acidity and correspondingly elevated soluble metals concentrations unrelated to AMD. As such, the results for coaly and highly carbonaceous samples should be interpreted with this in mind.

The sum of the concentration of 16 environmentally important elements are plotted as a function of pH from the peroxide leachate solution in **Figure 19**. The 16 selected metals/metalloids are the same elements as per the 1:5 deionised water leach, saline leach and tailings liquor.

After undergoing a peroxide (NAG) leach a significant number of samples have acidic pH (ranging from weakly to highly acidic) and moderate to elevated soluble metals concentrations – primarily due to the low pH enhancing solubility.

Figure 19. Sum of key environmental metals versus pH in peroxide (NAG) leachate solution



Approximately 83% of samples (85 out of 102 samples) had pH less than 6.0 (i.e. acidic to some degree). Of the 17 samples plotting with near-neutral to alkaline pH (and mostly also with low soluble metals), 16 were classified as NAF or UC(NAF) and one sample classified as NAF-S – their classification being confirmed by the peroxide leach. Of the remaining (bulk of) samples producing some level of acidic pH, approximately 80% were classified as PAF, PAF-LC or UC(PAF) – their 'acidic' classification being confirmed by the peroxide leach.

All of the coal samples, almost all of the aged tailings and rejects samples and about three-quarters of the NCPP tailings samples were weakly to highly acidic and mostly had moderate to elevated metals concentrations. Extended NAG test results are available for three of the eight coal samples and 26 of the 48 tailings samples that underwent peroxide leaching. Of these, 13 tailings samples and all three coal samples had extended NAG test results that showed the presence of organic acids in these samples (i.e. producing extended NAGpH values greater than pH 4.5). Therefore, it's reasonable to conclude that many/most of these coaly and highly carbonaceous samples are likely producing elevated metals partially as a result of organic 'acidity', not necessarily from AMD.

The results suggest that under acid/acidic conditions, materials represented by these samples are capable of generating elevated metal and metalloid loads for several metals/metalloids, however the SO_4 (and salinity) loads are not expected to be high – due to the generally low total S concentrations (with exceptions for some tailings samples, and lesser so rejects). These data suggest that if PAF/PAF-LC material is allowed to oxidise without ANC available in the bulk media to buffer acidity, material similar to that tested might mobilise metals and metalloids at elevated concentrations, over time.

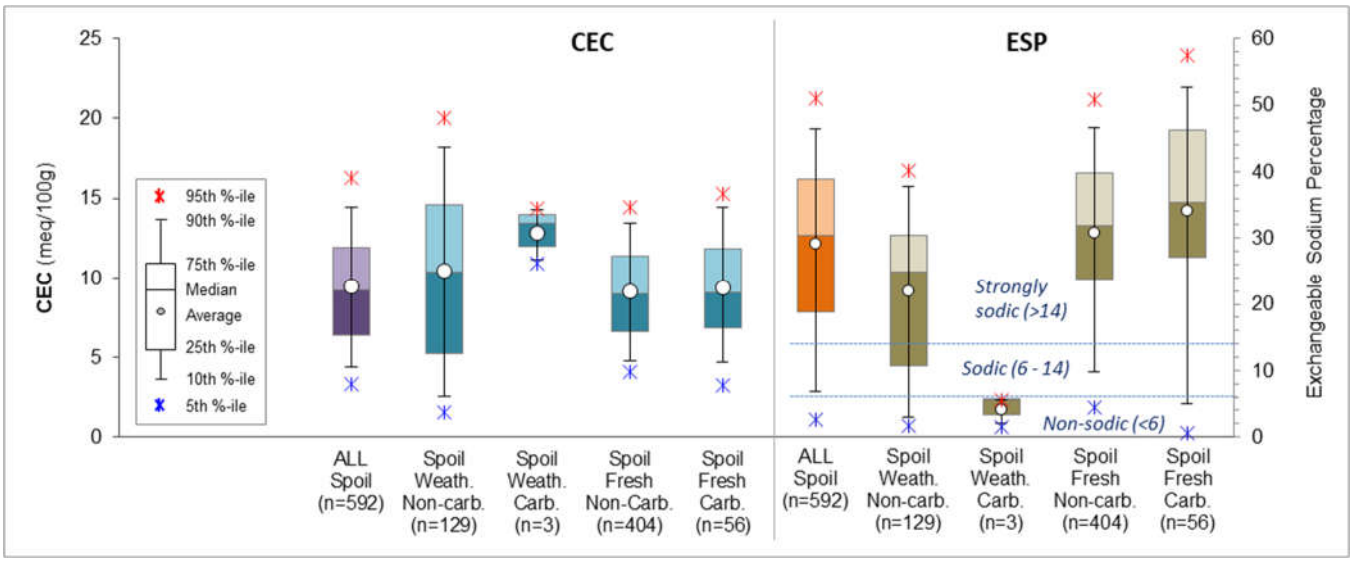
5.8 Cation Exchange Capacity, Sodicity and Dispersion Potential of Spoil

Exchangeable cation concentrations are used to evaluate the potential 'soil quality' of materials. Exchangeable cation data [as cation exchange capacity (CEC)] and exchangeable sodium percentage (ESP) is available for 592 spoil samples. The results are summarised in **Figure 20**.

The CEC spans a wide range from <1 to 31 milliequivalents per 100 grams (meq/100g), with low median and 75th percentile CEC values of 9.2 and 11 meq/100g, respectively. There was generally little difference between the CEC of the different spoil types (noting that data is available for only three weathered carbonaceous samples). Overall, spoil has low CEC values – meaning it has generally low capacity to hold and exchange cations and, as such, a low resistance to changes in soil chemistry.

The ESP results range from less than 1% to 100%, with a median ESP of 31%. Approximately 91% of spoil samples had ESP values greater than 6% and approximately 80% of spoil samples had ESP values greater than 14%. Therefore, based on the ESP values alone, essentially all spoil is regarded as being 'sodic' to 'strongly sodic' and, as such, a significant proportion of mine spoil at BWM can be expected to have potential for dispersion.

Figure 20. Cation exchange capacity (CEC) distribution and exchangeable sodium percentage (ESP) distribution of spoil



All 592 spoil samples tested for CEC and ESP also underwent Emerson aggregate class tests to determine whether these samples were dispersive. Emerson aggregate class tests are a direct measure of soil dispersion, whereas ESP values are used as an indirect measure of the *potential* for a sample to have structural stability problems and hence *may* be dispersive. The results show that about 58% of samples (346 out of 592 samples) displayed some degree of dispersion – either Class 1, 2, 3 or 5. The remaining 402 of samples (246 out of 592 samples) were non-dispersive, with Emerson Class numbers of 4, 6, 7

or 8. Refer to **Section 4.4** for class descriptions. Although not entirely consistent with the ESP results, the Emerson Class test results suggest a significant proportion of spoil would be dispersive.

Based on the CEC, ESP and Emerson aggregate class test results, a significant proportion of spoil at BWM is expected to be strongly sodic and dispersive.

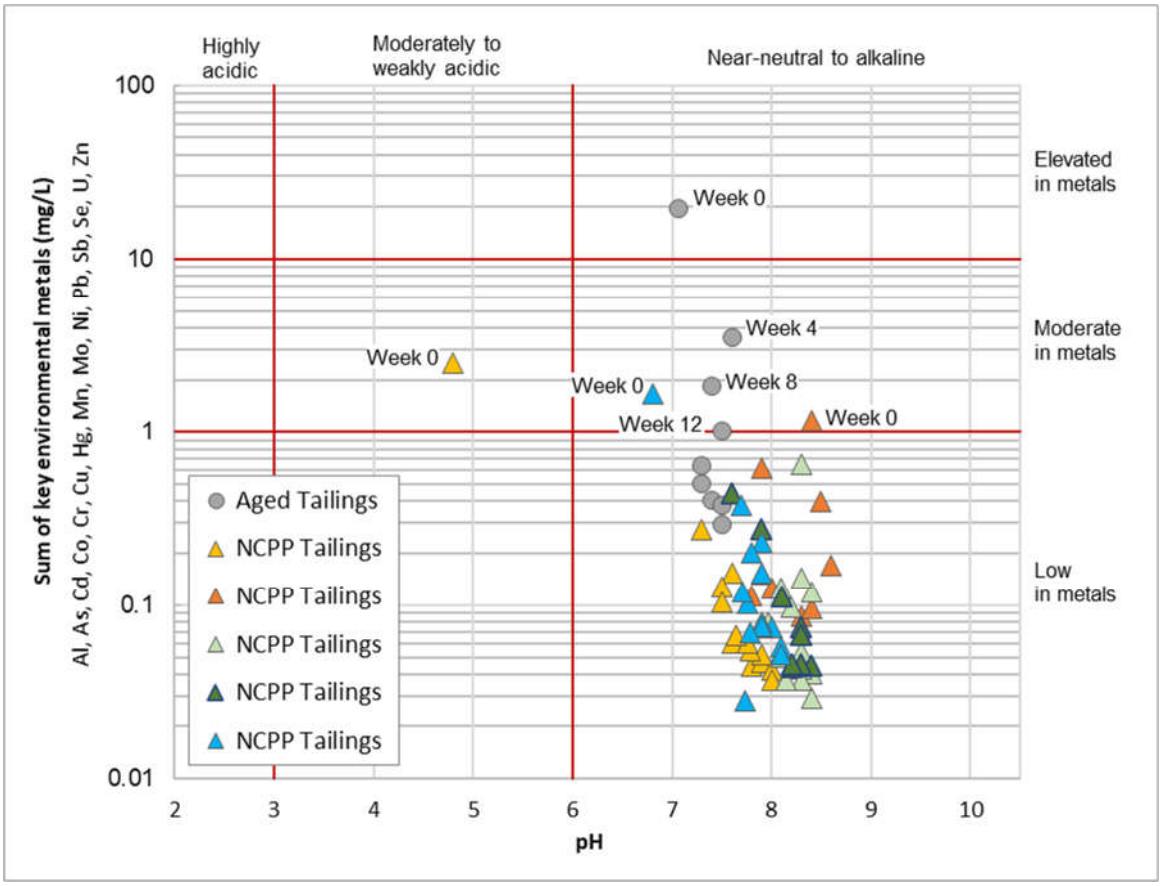
These exchangeable cation (and Emerson aggregate class) results are common for Bowen Basin Permian and Tertiary material in the region.

5.9 Kinetic Column Leaching

Free-draining kinetic column leaching test-work data is available for six samples, comprising five fresh (NCPP) tailings samples and one aged tailings sample from NCPP TSF. The samples were selected for column leaching test-work on the basis of static test results and had a range of AMD classifications from NAF to PAF (based on the static test-work). The column leaching method followed a modified AMIRA (2002) method (modifications to the 'standard' method were needed due to the very fine particle size of the samples) and samples were leached at four-weekly intervals with moistening and drying steps between the leaching events. The aged tailings sample and two of the fresh tailings samples were leached for 32 weeks (9 leach cycles including initial flush). The remaining three fresh tailings samples were leached for 52 weeks (14 leach cycles including initial flush).

The sum of the concentration of 16 environmentally important elements are plotted as a function of pH from the column leaching solutions in **Figure 21**. The 16 selected metals/metalloids are similar to the elements as per the 1:5 deionised water leach, saline leach and peroxide leach.

Figure 21. Sum of key environmental metals versus pH in kinetic column leachate solution



Most of the leachate from fresh tailings samples have low soluble metals concentration with the exception of three leaching events that had moderate soluble metals concentration and were associated with the initial flush (solute concentrations are typically higher in the initial flush as pre-existing salts are leached). All fresh tailings samples had near neutral to alkaline pH.

For aged tailings sample, the initial flush was elevated in metals, followed by moderate metals concentration during first three leach cycles (i.e. from week 0 to 12). Beyond the week 12 leach, the soluble metals concentration from aged tailings leachate was low. All aged tailings leachates were near-neutral to alkaline in pH.

The salinity of the samples (column leachate) for fresh tailings samples ranged from 563 to 9460 μS/cm with a moderately saline median value of 1230 μS/cm. The sulfate release rates for fresh tailings samples ranged from 22 mg/kg/week to 57 mg/kg/week.

For the aged tailings sample, the salinity ranged from 2110 to 6930 μS/cm with a saline median value of 2210 μS/cm. The aged tailings sample released sulfate at a rate of 147 mg/kg/week which was the highest among all samples leached.

The column leaching showed that none of the samples were acid forming (i.e. generating AD) throughout the leaching period. The aged tailings sample released higher levels of salts and elevated metals concentration compared to fresh samples.

5.10 OxCon Test-work

Data is available for OxCon test-work undertaken on five fresh (NCPP) tailings samples, one aged tailings sample from NCPP TSF and three carbonaceous spoil composite samples from drill-core. The tailings samples are the same samples that also underwent kinetic column leaching (Section 5.9). The test-work is summarised in Table 17 which also shows the preliminary AMD classification based on the static test-work alone (i.e. prior to the OxCon testing). The test-work found that:

- Two of the three spoil composite samples were confirmed to be NAF and are unlikely to generate AD or NMD (negligible risk) and are unlikely to be generating SD. One spoil composite spoil sample has a low potential to generate AD or NMD and is unlikely to be generating SD.
- Two of the five fresh (NCPP) tailing samples were confirmed to be NAF and are unlikely to generate AD or NMD (negligible risk) and with a low/negligible risk of generating SD. The remaining three fresh tailings samples were confirmed as PAF or PAF-LC and were found to pose a moderate to moderate-high risk of generating AD and low potential for SD.
- The aged tailings sample from NCPP TSF was confirmed as PAF and found to pose high potential for generating AD and low potential for SD.

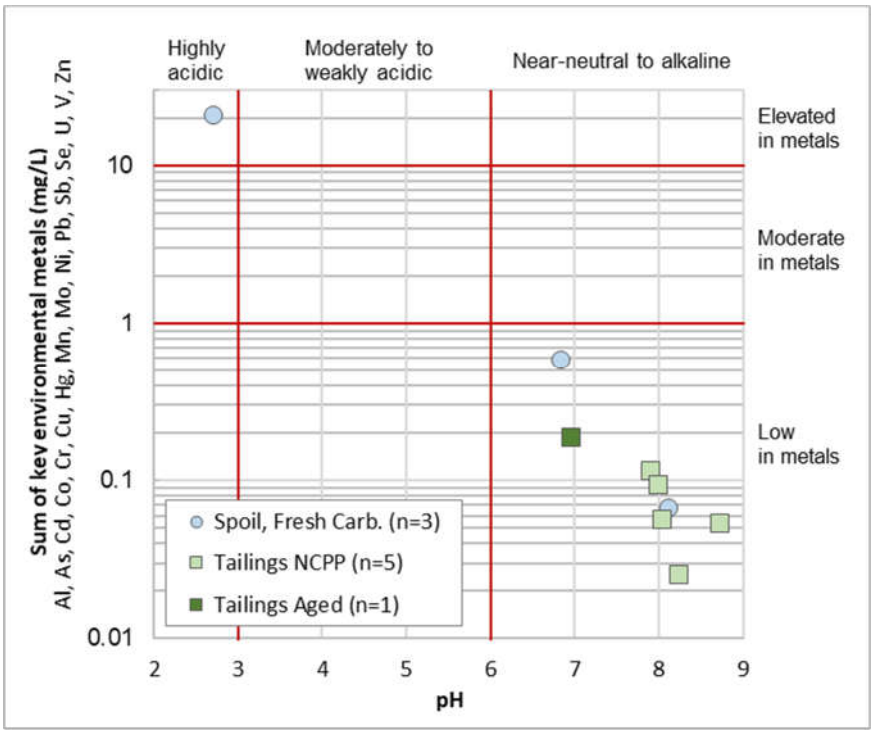
Table 17. Summary of OxCon results

Sample ID	Type / Source	Preliminary (pre-OxCon) AMD Classification	Avg. O2 consumption rate (mmol O2 /kg /day)	Max. acidity generation rate (kg H2SO4 /t /year)	Pyrite oxidation rate (wt.% pyrite /year)	Longevity of sulfide oxidation (years)	Lag time until ANC consumed (years)	Peak net acidity generation rate (kg H2SO4 /t /year)	AMD Classification based on OxCon Test
BWM_XTCM_Spoil	Spoil drillhole composites	UC(NAF) / PAF-LC	0.11	2.1	27	15	n/a	<0.1	NAF
BWM_EIS_13&31		PAF-LC	0.39	7.4	0.28	4	n/a	<0.1	NAF
BWM_EIS_31&33R		PAF-LC	0.60	12	0.34	4	~ 1.7	1.0	PAF-LC / UC(PAF)
BWM Tails 31-08-20	Tailings Fresh NCPP	PAF	0.48	9.3	55	10	~ 4	1.2	PAF-LC
BWM Tails 03-09-20		PAF	0.31	5.9	12	35	~ 9	2.1	PAF
BWM Tails 09-09-20		PAF-LC	0.51	9.7	80	5	< 1	8.3	PAF-LC
BWM Tails 04-09-20		NAF-S	0.60	11	53	10	n/a	<0.1	NAF
BWM Tails 18-10-20		NAF	0.43	8.2	0.57	2	n/a	<0.1	NAF
BWM-CPP-CPT51-INT06	Tailings aged NCPP TSF	PAF	0.63	12	11	38	~ 4	7.9	PAF

At the conclusion of the OxCon test, the solids underwent a bottle leaching procedure at a 1:2 solid:water ratio and the leachate was analysed to determine the pH, acidity/alkalinity and concentration of soluble metals/metalloids and salts. The sum of the concentration of 16 environmentally important elements are plotted as a function of pH from the post-OxCon leachate solution in **Figure 22**. The 16 selected metals/metalloids are the same elements as per the 1:5 deionised water leach, saline leach and peroxide leach.

As evident in **Figure 22**, all except one spoil sample produced low soluble metals/metalloid concentrations at near-neutral to alkaline pH. The PAF spoil sample produced highly acidic post-OxCon leachate with elevated soluble metals/metalloid concentrations.

Figure 22. Sum of key environmental metals versus pH in OxCon leachate solution



6 Summary of Geochemical Characteristics

The geochemical characteristics of mineral wastes (overburden/interburden [potential spoil], tailings and rejects) from BWM have been assessed – as have the characteristics of coal samples that may report as ROM coal or as waste to the spoil dumps. The assessment was undertaken to understand the environmental geochemical characteristics of these samples, as being representative of their respective mineral waste types.

Within the context of this PRCP, spoil comprises essentially all of (approximately 99% of) the mineral waste at BWM; and tailings and rejects comprise approximately 0.5% each. The proportions of spoil, tailings and rejects are expected to remain approximately the same for the expected life of the operation. Spoil is overwhelmingly comprised of non-carbonaceous material. Carbonaceous spoil (of which almost all is unweathered) comprises less than 8% of spoil.

6.1 AMD Potential of Mineral Wastes and Coal

AMD potential of spoil – non-carbonaceous

Non-carbonaceous spoil, which comprises about 92% of spoil, is expected to generate pH-neutral to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin.

Based on the results from 4172 samples (657 weathered and 3515 fresh), non-carbonaceous spoil has a very low potential to generate AMD as either AD and/or NMD and/or SD, but for a small proportion that is assessed to have a higher potential to generate AMD (as AD, NMD and/or SD). However, in consideration of the mixing and dispersion of a small volume of waste at higher potential for AMD within the broader spoil material, the overall potential for non-carbonaceous spoil (and bulk spoil, generally) to generate AMD is assessed to be low.

The total S concentration of non-carbonaceous spoil is very low, with a 95th percentile total S concentration of 0.09%. As such, and combined with moderate to high ANC values (median 40 kg H_2SO_4/t), which is significantly higher than the MPA (median 0.6 kg H_2SO_4/t), approximately 97% of non-carbonaceous spoil samples tested were classified as NAF, with a further 1.3% (approximately) of samples classified as UC(NAF). Less than 1.5% of non-carbonaceous spoil samples were classified as PAF, PAF-LC, UC(PAF) or NAF-S. Only one sample was classified as NAF-S.

The test-work has demonstrated that the ANC for the non-carbonaceous spoil is generally expected to be about 36-73% available under field conditions (based on 25th and 75th percentile values), with iron-dolomite/dolomite and calcite being the main carbonate minerals contributing to the acid buffering potential of the non-carbonaceous spoil. Overall, non-carbonaceous spoil has excess acid neutralising capacity and is expected to be bulk acid consuming.

Total metal and metalloid concentrations from 548 non-carbonaceous spoil samples tested are very low compared to average element abundance in soil in the earth's crust. Fourteen samples (<3% of samples) were significantly enriched with regard to one or more of As, Ba, Co, Cr, Hg, S and/or Se. The enrichment in one or more of these elements in a small proportion of samples is not cause for concern. Of the samples displaying elemental enrichment, there was no correlation with AMD classifications of these samples. In summary, non-carbonaceous spoil has low enrichment in total metals and metalloids compared to un-mineralised rocks.

Soluble multi-element results (from 549 non-carbonaceous samples) indicate that leachate from this material is expected to contain low concentrations of soluble metals and metalloids under pH-neutral to

alkaline conditions. About 6% of samples produced moderate soluble metal concentrations under pH-neutral to alkaline leaching conditions; and about 4% of samples (almost all weathered) produced low soluble metal concentrations under weakly acidic leaching conditions. The remaining 1% (approximately) of samples produced moderate to elevated metals under weakly acidic conditions. Peroxide leaching undertaken on 14 non-carbonaceous spoil samples showed that PAF material has the potential to generate low pH leachate (AD) with moderate sulfate and soluble metal and metalloid concentrations.

AMD potential of spoil – carbonaceous

Carbonaceous spoil represents less than 8% of spoil material at BWM and – as a bulk material – is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), similar to non-carbonaceous spoil.

Based on the results from 292 samples (nine weathered and 283 fresh), carbonaceous spoil has a generally low potential to generate AD and/or NMD and/or SD. Some carbonaceous spoil – mostly associated with coal seams – has a greater potential to generate low-level AD and/or NMD and/or SD.

The total S concentration of carbonaceous spoil is low, with 95th and 75th percentile total S concentrations of 0.59% and 0.25%, respectively. Approximately 85% of (248 out of 292) carbonaceous spoil samples were classified as NAF, with a further 4 samples (approximately 1.4% of samples) classified as UC(NAF). The remaining 14% (approximately) of samples were classified as PAF, PAF-LC, UC(PAF) or NAF-S and had a low-moderate 75th percentile total S value of 0.72%. Only two samples were classified as NAF-S. Most of the 'PAF' and NAF-S carbonaceous spoil samples were closely associated with coal seams.

The test-work undertaken has demonstrated that the ANC is generally expected to be about 17-41% available under field conditions (based on 25th and 75th percentile values), with iron-dolomite/dolomite and calcite being the main carbonate minerals contributing to the acid buffering potential of carbonaceous spoil. Overall, carbonaceous spoil has relatively modest acid neutralising capacity.

Total metal and metalloid concentrations from 69 carbonaceous spoil samples tested are very low compared to average element abundance in soil in the earth's crust, and very similar to the assay concentrations from non-carbonaceous spoil. Twelve samples were significantly enriched with regard to one or more of As, Cu, Hg, S and/or U. Of the samples displaying elemental enrichment, there was no correlation with AMD classifications of these samples. In summary, carbonaceous spoil has low enrichment in total metals and metalloids compared to un-mineralised rocks.

Soluble multi-element results (from 69 samples) indicate that, with few exceptions, leachate from carbonaceous spoil is expected to contain low concentrations of soluble metals and metalloids – similar to non-carbonaceous spoil samples. Peroxide leaching undertaken on six carbonaceous spoil samples (mixed 'NAF' and 'PAF') showed that the PAF samples have the potential to generate low pH leachate (AD) with moderate sulfate and soluble metal and metalloid concentrations. Most of the 'NAF' samples that underwent peroxide leaching produced leachate with near-neutral to alkaline pH and with low to moderate soluble metals concentrations.

AMD potential of tailings

The geochemical characteristics differed between fresh tailings from the NCPP versus aged tailings from TSFs for different parameters – particularly total S (and, by inference, MPA), ANC and pH. However, the overall geochemical (AMD) hazard posed by tailings from the two sources (fresh vs aged) was generally similar. As such, the discussion that follows only differentiates between the two tailings sources where the differences between the two sources was significant for some parameters and worthy of discussion. Else, the AMD potential of tailings is discussed as a bulk material.

Based on the results from 703 samples, approximately 55% of tailings has a moderate to high potential to generate AMD as either AD and/or NMD and/or SD, and the remaining 45% (approximately) has a relatively low potential to generate AMD as either AD and/or NMD and/or SD.

Fresh tailings from the NCPP are expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage). Overall, aged tailings have lower pH compared to fresh tailings, however the pH in aged tailings ranged from moderately acidic to pH-alkaline. The difference in pH observed between fresh and aged tailings (and the differences within the aged tailings) may be due to a number of factors, however the most likely cause is oxidation processes consuming readily available neutralising minerals, leading to aged tailings generally having a low(er) acid neutralising potential.

The total S concentration of tailings is generally low-moderate, with median values of 0.76% and 0.52% for fresh and aged tailings, respectively. Overall, the total S concentration was higher in the fresh tailings compared to the aged tailings. The reasons for differences in total S between the fresh versus aged tailings is unclear and potential processes that could account for differences in total S concentration are:

- Sulfide oxidation and neutralisation reactions ongoing within the TSFs, which generate sparingly and / or readily soluble sulfate. Therefore, sulfur mass loss could have occurred from aged tailings due to leaching of sulfate minerals, such as jarosite, alunite and/or gypsum and/or readily soluble acid salts (e.g. iron sulfate 'salts' such as melanterite or copiapite).
- Change in geochemistry of ROM coal being processed. That is, ROM coal becoming more S-rich over time due to a change in the relative proportions of the various coal seams/plys being mined and processed.
- Addition of sulfate via salt precipitation within tailings during drying/evaporation of slurry water (liquor) [laboratory bias].

In the fresh tailings samples about 69% (median value) of the total S is present as sulfide (Scr). Comparatively, only 48% (median value) of the total S is present as Scr in the aged tailings samples. The difference in the proportion of total S as Scr between fresh versus aged tailings is typical and expected – supporting the suggestion that the aged tailings in the TSFs are being oxidised since deposition (sulfide oxidised to sulfate).

Just as there were notable differences between the total S concentrations in fresh versus aged tailings, so too with the ANC values of fresh versus aged tailings. Fresh tailings had generally moderate to high ANC values (median 32 kg H_2SO_4/t) compared to aged tailings, which had generally low to moderate ANC values (median 16 kg H_2SO_4/t). The reason behind the lower ANC observed in aged tailings (compared to fresh tailings) is not well understood. However, it is likely related to ANC being consumed via buffering of acidity generated by sulfide oxidation and/or sulfate leaching. Other processes that could account for a difference in ANC between fresh and aged tailings include inherent differences in the geochemical properties of the coal from earlier mining compared to recent mining, and/or – related to ROM coal differences; and it may also be partially due to differences in processing methods between the NCPP and the SCPP.

Based on the above generally low-moderate total S values (and, therefore, MPA values) combined with a wide range of ANC values resulted in approximately 55% of tailings samples being classified as PAF, PAF-LC, UC(PAF) or NAF-S – with the remaining 45% (approximately) classified as NAF or UC(NAF). Of the 'PAF' and NAF-S tailings samples, about 72% were classified as UC(PAF) or PAF-LC.

The test-work undertaken has demonstrated that the ANC in fresh tailings is expected to be about 47-67% available under field conditions, compared to about 12-63% available for aged tailings – based on

25th and 75th percentile values. Iron-dolomite/dolomite and calcite are expected to be the main carbonate minerals contributing to the acid buffering potential of tailings.

OxCon test-work undertaken on five fresh and one aged tailing samples found that two of the fresh tailings samples expected to be NAF or NAF-S were confirmed to be NAF and were unlikely to be generating AD or NMD. The remaining three fresh tailings samples, which were expected to be 'PAF' were confirmed to be PAF or PAF-LC and were found to pose a moderate to moderate-high risk of generating AD and low potential for SD. The aged tailings sample from NCPP TSF was confirmed as PAF and found to pose high potential for generating AD and low potential for SD.

With few exceptions, the total metal and metalloid concentrations from 56 tailings samples tested are generally low compared to average element abundance in soil in the earth's crust. About 26% of the fresh tailings samples and 29% of the aged tailings samples were significantly enriched with regard to S, which is consistent with the ABA data. Two aged tailings samples were significantly enriched with regard to silver (Ag). The GAI values also show that most of the tailings samples tested had minor enrichment (GAI = 1 or 2) with regard to S, which was consistent with the ABA data. There was no clear correlation found between AMD classifications of the tailings samples compared to elemental enrichment.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 73% of tailings samples have low soluble metals concentrations and have near-neutral to alkaline pH, including all 39 fresh NCPP tailings samples. The remaining 27% of tailings samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH conditions. Generally, the NCPP TSF and Laleham TSF tailings samples had similar soluble metals concentrations, however the Laleham TSF samples had lower pH compared to the aged tailings samples from NCPP TSF. Under saline leaching conditions fresh tailings produced low concentrations of soluble metals and metalloids.

Peroxide leaching undertaken on 48 tailings samples [about 60% classified as 'PAF' or NAF-S, and the remainder classified as NAF or UC(NAF)] showed that when exposed to highly oxidising conditions a significant proportion of tailings can produce weakly to highly acidic leachate with elevated soluble metals and metalloid concentrations. However, about one-third of tailings samples appeared to be influenced to some degree by the presence of organic acids, due to the samples' high organic carbon concentration. The presence of organic acids likely accounts, to some degree, for the acidity and 'elevated' soluble metals and metalloid concentrations evident in these tailings. Nevertheless, PAF tailings [including tailings classified as UC(PAF)] have typically produced moderate to elevated soluble metals and metalloid concentrations from the freshwater and peroxide leaching tests. These results indicate that PAF tailings have the potential to generate low pH leachate (AD), however the salinity (sulfate) loads are not expected to be high – due to generally low total S concentrations (with minor exceptions).

AMD potential of rejects

Based on the results of 398 samples, about 45% of the rejects have a moderate to high potential to generate AMD as either AD and/or NMD and/or SD, whereas the remaining 55% (approximately) of rejects has a relatively low to low-moderate potential to generate AMD as either AD and/or NMD and/or SD.

Fresh rejects from the NCPP are expected to generate highly pH-alkaline contact water (run-off and seepage). Aged rejects (from TSFs, Ramp 36 rejects dump and a small number of rejects in the Red Dam area) has lower pH compared to fresh rejects and is expected to generate weakly acidic to pH-alkaline contact water (run-off and seepage). The difference in pH observed between fresh and aged rejects – with the latter showing generally lower pH – may be due to a number of factors, however the most likely

cause is oxidation processes consuming readily available neutralising minerals, leading to aged rejects having a low(er) acid neutralising potential.

The total S concentration of fresh rejects was generally low (median value = 0.28%) compared to aged rejects, which had low to low-moderate total S values (median value = 0.61%). Aged rejects have come from multiple pit locations (different ROM coal) and processed from different CHPPs (NCPP and SCPP).

In the fresh rejects samples about 74% (median value) of the total S is present as sulfide (Scr), and in the aged rejects samples about 59% (median value) of the total S is present as Scr. The difference in the proportion of total S as Scr between fresh versus aged rejects is typical and expected – supporting the suggestion that the aged rejects in the TSFs and rejects dump(s) are being oxidised since deposition (sulfide oxidised to sulfate). Aged rejects may have been in place for nominally 5 to 30 years.

Just as there were notable differences between the total S concentrations in fresh versus aged rejects, so too with the ANC values of fresh versus aged rejects. Fresh (NCPP) rejects had generally moderate to very high ANC values (median 40 kg H_2SO_4/t) compared to aged rejects, which had generally low to high ANC values (median 18 kg H_2SO_4/t). The reason behind the lower ANC observed in aged rejects (compared to fresh rejects) is not well understood. However, it is likely related to ANC being consumed via buffering of acidity generated by sulfide oxidation and/or sulfate leaching. Other processes that could account for a difference in ANC between fresh and aged rejects include inherent differences in the geochemical properties of the coal from earlier mining compared to recent mining, and/or – related to ROM coal differences; and it may also be partially due to differences in processing methods between the NCPP and the SCPP.

Based on the above generally low to low-moderate total S values (and, therefore, MPA values) combined with a wide range of ANC values resulted in approximately 45% of rejects samples (all being aged rejects) being classified as PAF, PAF-LC, UC(PAF) or NAF-S – with the remaining 55% (approximately) classified as NAF or UC(NAF). All fresh rejects were classified as NAF.

The test-work undertaken has demonstrated that the ANC in fresh rejects is expected to be about 50-78% available under field conditions, compared to about 25-60% available for aged rejects. Iron-dolomite/dolomite and calcite are expected to be the main carbonate minerals contributing to the acid buffering potential of rejects.

No fresh rejects samples were significantly enriched with metals or metalloids. Four out of 17 aged rejects samples were significantly enriched with regard to S, which is consistent with ABA data for these samples. There was no correlation found between AMD classifications of the reject samples compared to elemental enrichment.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 65% of rejects samples have low soluble metals concentrations and have near-neutral to alkaline pH, including all 15 fresh NCPP rejects samples. The remaining 35% of rejects samples – all aged – have a wide range of soluble metals concentrations under a wide range of pH conditions. Most of the aged rejects with lower pH and moderate to elevated soluble metals concentrations were from Ramp 72 (Kenmare pit rejects).

Peroxide leaching undertaken on 26 aged rejects samples of predominantly 'PAF' classifications showed that almost all rejects samples were weakly to highly acidic and had moderate to elevated metal and metalloid concentrations. The results suggest that under acid/acidic conditions, materials represented by these aged reject samples are capable of generating elevated metal and metalloid loads for several metals/metalloids, however the sulfate (and salinity) loads are not expected to be high – due to the generally low total S concentration (with some exceptions).

AMD potential of coal

Coal is not regarded as waste and ROM coal remains on-site for a relatively short period of time. However, some minor coal seams/plys will report directly as waste, and remnant coal (seams) will be exposed on the highwalls and end-walls of residual voids at closure.

Coal represents about 5% of all lithological material at BWM (i.e. about 2% to 7% of the highwall meterage, depending on the void; refer to **Section 7.1.4**, **Table 19**). Assuming the large majority of this will report as ROM coal, it is assumed that coal will represent a very small proportion of mineral waste (nominally 1-2%).

Based on the results of 381 samples, ROM coal is assessed as having a low-moderate to moderate potential to generate AMD as either AD, NMD and/or SD. A small proportion of coal would have a moderate to moderate-high potential to generate AMD. ROM coal, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage).

The total S concentration of coal is generally low (95th percentile total S concentration of 0.62%) and approximately 14% (median value) of the total S is present as sulfide (Scr), with the bulk of the total S likely present as organic S, which does not contribute to AMD. Coal samples have a wide range of ANC values; however, the median ANC is low (median = 11 kg H_2SO_4/t). As such, 64% of coal samples were classified as NAF or UC(NAF). One sample was classified as NAF-S. The remaining 35% (approximately) of samples were classified as PAF, PAF-LC or UC(PAF) and were from all seam groups. The AMD classification is based on total S, which for coal samples likely leads to highly conservative classification given that most sulfur in coal is organic S, not sulfidic S. These results suggest that coal stored on the ROM pad, coal located within pit walls and un-economic coal seam material reporting as spoil (mixed with non-coal spoil) would likely be bulk NAF.

Assay data for 72 coal samples show that the total metal and metalloid concentrations are generally low compared to average element abundance in soil in the earth's crust. Three coal samples were significantly enriched with regard to one or more of As and/or S.

Solubility data indicate that under freshwater (deionised water) leaching conditions about 88% of the 72 coal samples tested have low soluble metals concentrations and have near-neutral to alkaline pH. The remaining 12% of coal samples have a wide range of soluble metals concentrations under a wide range of pH conditions (moderately acidic to alkaline). These results indicate that some ROM coal is capable of generating AD and/or SD/NMD.

6.2 Salinity, Sodicity and Dispersion Potential of Mineral Wastes and Coal

Salinity, sodicity and dispersion potential of spoil – non-carbonaceous

Non-carbonaceous spoil has low median and 95th percentile $EC_{1:5}$ values of 344 and 569 μS/cm, respectively, and has very low total S concentrations. On this basis, contact water (run-off and seepage) is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity). Weathered non-carbonaceous spoil generally has similar $EC_{1:5}$ values compared to fresh non-carbonaceous spoil.

Non-carbonaceous spoil has low CEC values and generally high ESP values, resulting in approximately 91% of samples being classified as 'strongly sodic' or 'sodic' and, therefore, with potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, about 59% of the non-carbonaceous spoil samples displayed some degree of dispersion. Although not entirely consistent with

the ESP results, the Emerson Class test results suggest a significant proportion of non-carbonaceous spoil would be dispersive.

Salinity, sodicity and dispersion potential of spoil – carbonaceous

Carbonaceous spoil has generally low median and 95th percentile $EC_{1:5}$ values of 328 and 574 μS/cm, respectively, and has low total S concentrations. On this basis, contact water (run-off and seepage) is expected to be similar to non-carbonaceous spoil. That is, generally non-saline to slightly saline, primarily as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity).

Carbonaceous spoil samples had comparable CEC and ESP values to non-carbonaceous spoil – with the main difference being the weathered carbonaceous samples having generally higher CEC and much lower ESP compared to the fresh carbonaceous samples. This resulted in most fresh carbonaceous samples being classified as 'strongly sodic' whereas the three weathered samples were all classified as 'non-sodic'. As such, and based solely on the moderate to high sodicity values, carbonaceous spoil is expected to be sodic (to some degree) with potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, about half of the samples displayed some degree of dispersion, suggesting a significant proportion of carbonaceous spoil would be dispersive.

Salinity potential of tailings

Tailings samples (n=698) have $EC_{1:5}$ values ranging from 97 to 8900 μS/cm, with median, 75th and 95th percentile $EC_{1:5}$ values of 714, 1008 and 1976 μS/cm, respectively. There is generally little difference in $EC_{1:5}$ values between fresh and aged tailings, with both types being generally slightly to moderately saline. The generally low to low-moderate total S for aged tailings and low-moderate to moderate total S for fresh tailings conservatively suggests a low-moderate to moderate potential for SD (from sulfide oxidation).

Salinity potential of rejects

Rejects samples (n=398) have $EC_{1:5}$ values ranging from 123 to 2830 μS/cm, with median, 75th and 95th percentile $EC_{1:5}$ values of 797, 1398 and 2343 μS/cm, respectively. Fresh rejects samples were all generally non-saline whereas aged rejects were generally slightly to moderately saline. The generally low total S for fresh rejects and low to low-moderate total S for aged rejects conservatively suggests a low to low-moderate potential for SD (from sulfide oxidation).

Salinity potential of coal

Coal samples (n=381) have $EC_{1:5}$ values ranging from less than 10 to 722 μS/cm, with low median and 95th percentile $EC_{1:5}$ values of 99 and 332 μS/cm, respectively. Coal has generally low total S concentrations. On this basis, contact water (run-off and seepage) from coal, as a bulk material, is expected to be non-saline.

7 Risk Assessment

7.1 Geochemical source hazard assessment of material types

7.1.1 Spoil landforms

There are 14 spoil landforms at BWM that will remain at closure (listed below) – nine associated with existing (E) spoil dumps, four new landforms associated with future (F) mining areas and one landform comprising existing and future (EF) mining areas:

- Ramp 8 (F)
- Bonnie Doon (E)
- Mimosa-Besgrove (E)
- Deep Creek (E)
- Stewarton (E)
- Tannyfoil (E)
- Blackdown (E)
- South Ballamoo [Terang] (E)
- Kenmare (E)
- Ramp 74 [Laleham] (E)
- Togara-North Marshmead (EF)
- South Marshmead (F)
- Kennedy (F)
- Comet Downs East (F)

E = existing mining area; F = future mining area; EF = partial existing and future mining areas.

Each landform will have a similar construction, comprising mined overburden and interburden disposed behind the active mining face to form a low-wall spoil dump, which will be reshaped to form a final spoil landform.

Approximately 65% of all BWM rejects (to date) have been disposed into some of the spoil dumps during operations – primarily those spoil dumps located close to NCPP and SCPP. Of these, most (indicatively 90%) have been disposed into dedicated rejects disposal areas (e.g. Ramp 32 in-spoil rejects dump), with the remainder co-disposed (widely distributed) throughout general spoil at spoil dumps dump near NCPP. Where rejects are present in spoil landforms, they'll comprise between 0.2 and 1.9% (average 0.6%) of the spoil landform based on current rejects quantities, estimated future rejects quantities and assumed future rejects disposal practices. Rejects disposed into the southern end of Kenmare pit (Ramp 72 pit) are within the Kenmare spoil landform and comprise approximately 5% of all current/existing rejects [and about 0.5% of the Kenmare post-closure spoil landform].

Ramp 72 TSF is an in-ramp TSF located within the current Kenmare pit shell – and comprises approximately 1% of the Kenmare landform. Rejects located within the southern end of the current Kenmare pit also comprises approximately 0.5% of the Kenmare landform. Ramp 72 TSF and the rejects located in the southern end of Ramp 72 pit (Kenmare pit) are collectively comprised of about 70% tailings and 30% rejects (estimated proportions).

The conceptual layout of the spoil landforms (and residual voids) at closure is shown in **Figure 23** (northern part of the mine) and **Figure 24** (southern part of the mine); including the locations of existing TSFs and Ramp 36 rejects dump. At closure, the current (and future) spoil dumps will be reshaped and seeded (refer to the PRC Plan for spoil dump rehabilitation details).

Figure 23. Conceptual closure landform for the northern BWM area

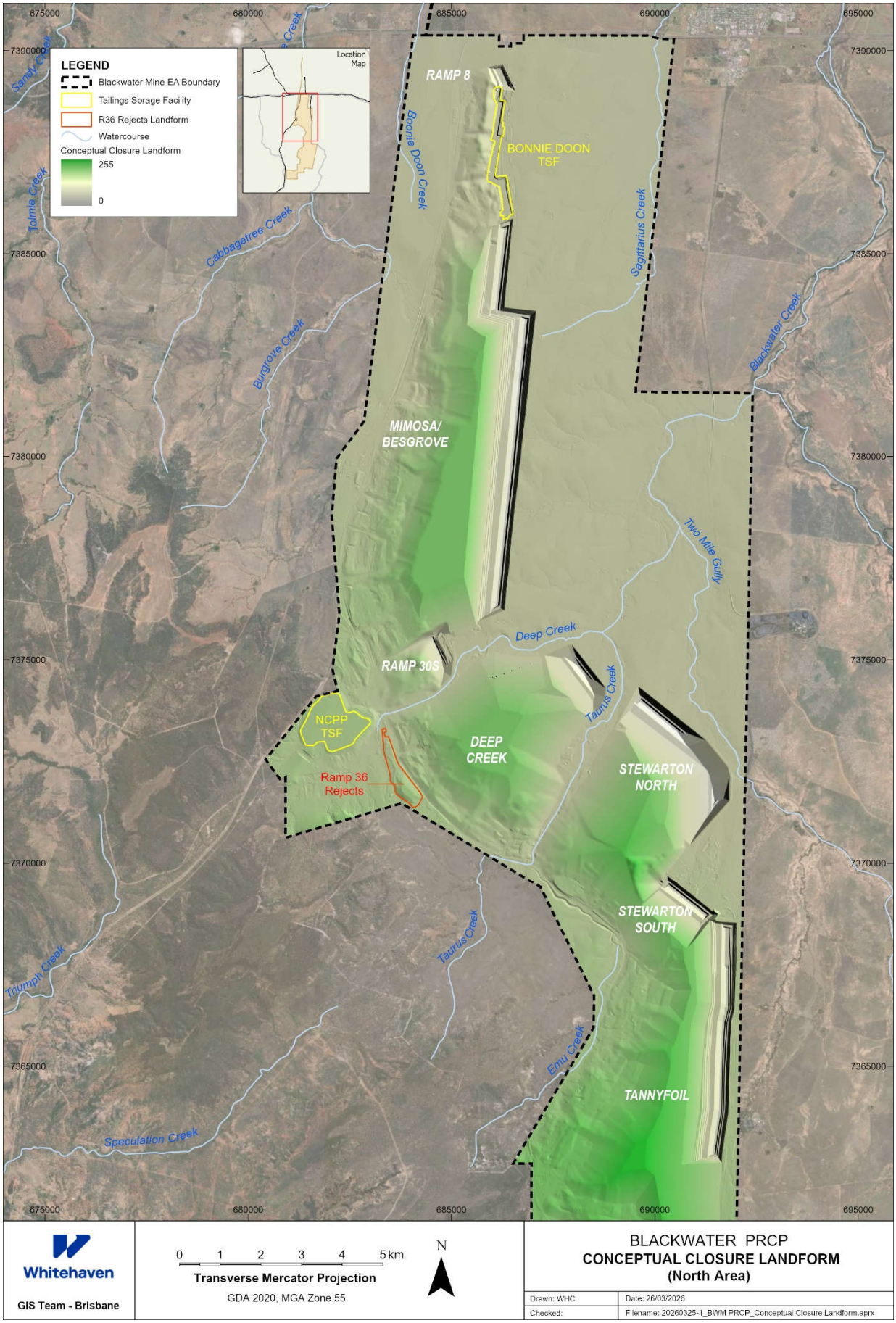
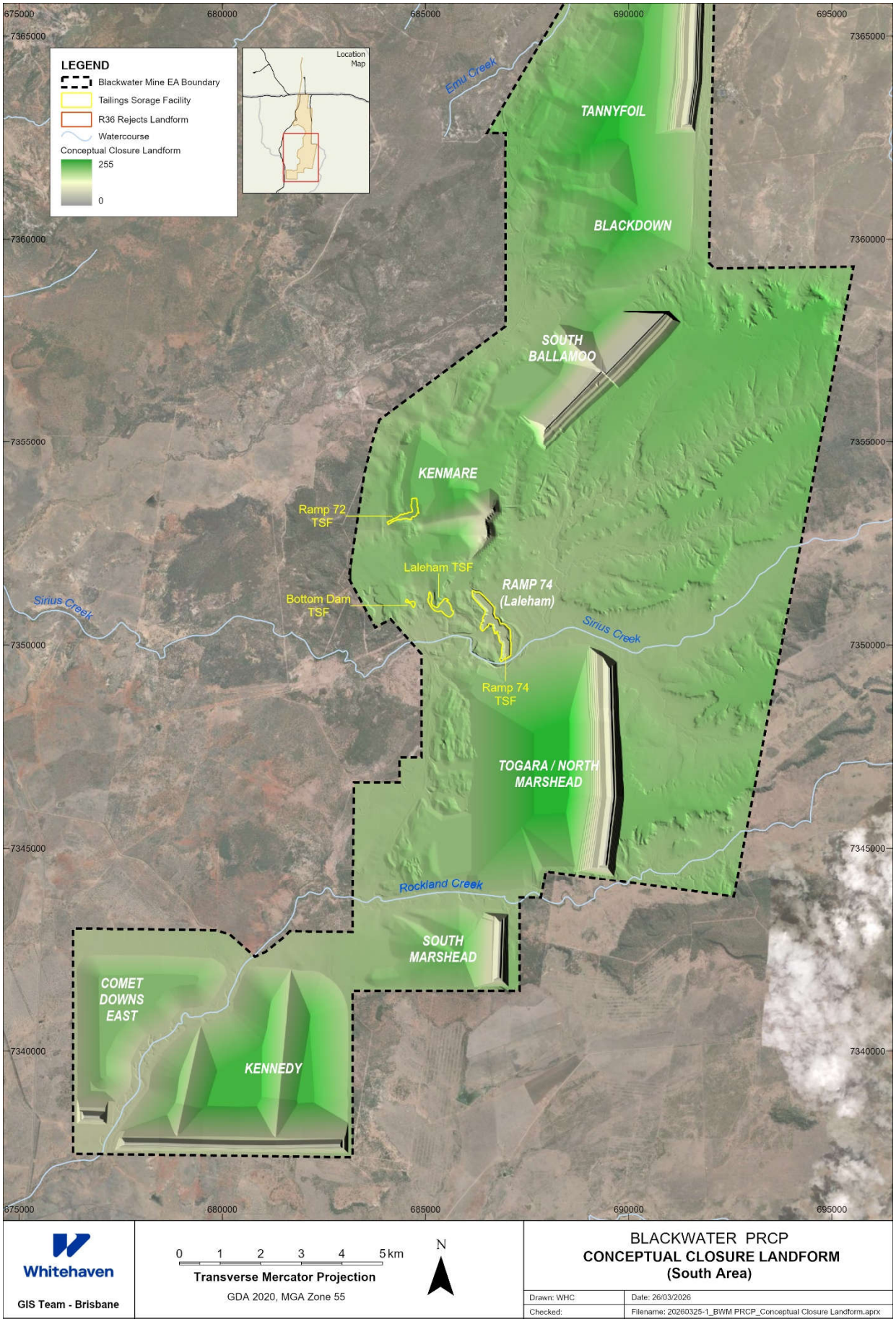


Figure 24. Conceptual closure landform for the southern BWM area



Approximately 30% of existing rejects are located at Ramp 36 rejects dump. Ramp 36 rejects dump is outside of a spoil landform and will remain as a stand-alone rejects landform at/post-closure.

TCP rejects (total volume less than 0.1 Mm^3) currently located near the TCP will be relocated into Mimosa-Besgrove spoil landform during rehabilitation of the TCP area.

The source materials within the spoil dumps predominantly comprise weathered and fresh spoil. The geochemical assessment has found that, from an environmental geochemical perspective, the geochemical differences between weathered and fresh materials are relatively minor. As such, the geochemical source hazard assessment has combined weathered and fresh non-carbonaceous spoil, and weathered and fresh carbonaceous spoil, as appropriate.

The source hazard assessment methodology outlined in **Section 4.4.6** (AMD hazard scoring) and **Section 4.4.7** (landform AMD likelihood scoring) has been applied to the spoil, rejects and tailings within each landform. Stratigraphic information from the BWM coal geology database was used to assess the proportion of carbonaceous lithologies relative to non-carbonaceous lithologies (and excluding coal) for each landform and void area – and from this, assign the same proportions to each spoil landform. The source materials, and their approximate proportions within each spoil landform, based on geological, mining and coal processing information, are summarised in **Table 18**.

Table 18. Source material proportions (%) within each spoil landform

Spoil landform	Spoil: Non-carbonaceous %	Spoil: Carbonaceous* %	Rejects %	Tailings %
Ramp 8**	96	4.0	none	none
Bonnie Doon	96	4.0	none	none
Mimosa-Besgrove	95	2.9	1.9	none
Deep Creek	96	3.0	0.8	none
Stewarton	96	4.0	<0.5	none
Tannyfoil	96	4.0	none	none
Blackdown	96	4.0	none	none
South Ballamoo [Terang]	95	4.0	0.8	none
Kenmare (includes Ramp 72 TSF and Kenmare pit rejects dump)	95	2.9	1.0	1.2
Ramp 74 [Laleham]***	99	1.0	none	none
Togara-North Marshmead	94	6.0	<0.5	none
South Marshmead	98	2.0	none	none
Kennedy	94	6.0	none	none
Comet Downs East	93	7.0	none	none

* Includes weathered coal and obvious waste coal lithologies (i.e. excludes potential ROM coal).

** Ramp 8 (future mining area) assessment was supplemented by data from Bonnie Doon.

*** Laleham TSF is located on the edge of (adjacent to) Ramp 74 spoil dump, but is not included as part of the Ramp 74 spoil landform. Laleham TSF is assessed as a 'stand-alone' TSF landform.

The assessment found that carbonaceous spoil (overburden/interburden) is estimated to comprise approximately 1% to 7% (average 4%) of spoil within each landform, with non-carbonaceous spoil estimated to comprise the remaining 96% (approximately, on average) of all spoil. Assuming some fresh coal material currently assigned as 'coal' is not mined as ROM coal but remains as waste coal, the proportion of coaly and carbonaceous overburden in each landform is likely to be slightly higher. However, coal comprises approximately 5% of the stratigraphy at BWM, therefore if a small amount of coal was to report as 'waste' the increase to the proportion of carbonaceous spoil would minimal.

The total rejects volume to date plus the estimated rejects volume for the remaining life of mine (i.e. total rejects producing for life of mine) ranges from approximately 0.2% to 1.9% of the total spoil landform volume at closure (as relevant to each specific landform). Overall, rejects currently comprise about 0.5% of all mineral waste at BWM and a similar proportion is expected for future rejects.

The source hazard assessment, which describes the AMD hazard of individual material domains within each landform (i.e. also takes into account material quantity), has found that non-carbonaceous spoil poses a **Low** AMD source hazard and carbonaceous spoil poses a **Low-Moderate** AMD source hazard. Where applicable, rejects generally pose a **Moderate** AMD source hazard within the spoil landforms – the AMD hazard score for rejects varied with location. Tailings are only located within Kenmare spoil landform and pose a **High** AMD source hazard. Rejects located within the southern end of Kenmare pit also pose a **High** AMD source hazard. The AMD hazard scoring tables for spoil landforms are provided in **Appendix B – Tables B1 to B14**.

Approximately 2% of spoil samples have been classified as PAF of some type (including NAF-S) (**Table 15**) – and most of this is from carbonaceous material, which comprises a minor proportion of spoil. Notably, most of the 'PAF'/NAF-S samples in overburden/interburden from drill-hole sampling were associated with seams as either roof, parting, floor or otherwise near-seam material (within about 1m above or below coal). As such, it is likely that a significant proportion of PAF spoil samples would be mined as part of ROM coal and would therefore end up as rejects instead of general spoil. Therefore, the AMD hazard score for spoil materials is considered to be conservative and consequently the final landform AMD hazard score also conservative.

On this basis, and taking into account material quantities (proportions) and expected proportion of PAF and NAF-S materials reporting to each individual landform, each of the 11 spoil landforms pose a **Low** AMD hazard, with AMD generation rated as **Highly Unlikely**. The 'Low' AMD hazard is largely a result of less than 1.5% of non-carbonaceous spoil samples being classified as PAF of some type (or NAF-S) – and non-carbonaceous spoil comprises the overwhelming majority of mineral waste within each spoil landform. Where rejects (and tailings) are present in specific landforms, their quantity (proportion of the landform) is very small and, as such, has a relatively minor affect on the overall landform AMD score.

Regarding Kenmare spoil landform specifically, the intrinsic AMD hazard of Ramp 72 TSF/tailings and rejects located at the southern end of the existing Kenmare pit – both of which will be contained (buried) within Kenmare spoil landform – is rated **Moderate-High to High** with the likelihood to generate AMD rated **Highly Likely** – due to AMD (as AD) having been observed from Ramp 72 TSF and from rejects within the existing Kenmare pit. Ramp 72 TSF and the rejects disposal area at the southern end of Kenmare pit are both within the Kenmare pit (void) shell. Rejects located near Ramp 70 within Kenmare spoil landform (at the northern end of the landform) pose a **Moderate** AMD hazard, with the likelihood to generate AMD rated **Probable/Likely**.

7.1.2 TSF landforms

NCPP TSF, Laleham TSF and Bottom Dam TSF/rejects will remain as stand-alone TSF landforms at closure and will not reside within a spoil landform. Ramp 72 TSF will be incorporated into Kenmare spoil landform. Refer to **Figure 1** and **Figure 23** for the location of NCPP TSF, and **Figure 2** and **Figure 24** for the location of Laleham TSF, Ramp 72 TSF and Bottom Dam TSF.

NCPP TSF

NCPP TSF is a large 'turkey's nest' style TSF with confining embankments on all sides, a base footprint of approximately 200 ha and has a total volume of approximately 26 Mm^3. NCPP TSF operated from approximately 1970 to 2023.

The source materials within NCPP TSF includes tailings, which are estimated to comprise approximately 80% of the landform; and rejects, which are estimated to comprise about 19% of the landform and form the basis of most of the embankments. The TSF landform also includes a small proportion (approximately 1 %) of spoil/fill material, predominantly within embankments.

Investigative drilling coupled with near-surface sampling has demonstrated that some tailings in the field at NCPP TSF are generating AMD (as AD and SD). Oxidation fronts are present in the TSF as demonstrated by decreasing sulfide concentrations from surface down, consumption of ANC, presence of secondary minerals generated through sulfide oxidation, and acid contact pH water.

The source hazard assessment for the mineral wastes within NCPP TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within NCPP TSF landform poses a **High** AMD source hazard; and rejects poses a **Low-Moderate** AMD source hazard. Fill material poses a low AMD source hazard, based on the low AMD hazard of general spoil. On this basis, and taking into account material quantities (proportions):

- NCPP TSF landform (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Highly Likely**, the highest landform AMD likelihood category under the applied scoring procedure – noting that AMD has already been observed at/from this TSF. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials is considered to be conservative and the landform domain AMD hazard score for NCPP TSF is also considered to be conservative. The AMD hazard scoring table for NCPP TSF landform is provided in **Appendix B – Table B15**.

Laleham TSF

Laleham TSF is largely constructed over spoil/fill (and also backfills a small pit). The TSF partly fills the upper reaches of a southeasterly plunging gully. The TSF abuts natural ground on the north and northwest, and overlies spoil/fill on the south and southeast. The TSF has a total area of approximately 12 ha and a total volume of approximately 4 Mm^3. The TSF operated from the late-1970s to the late-1980s, primarily receiving tailings from Laleham underground operation. Between 1990 and 1994 a thin spoil/soil cap was placed over the TSF and seeded/revegetated. This TSF has undergone rehabilitation and revegetation since decommissioning, however additional rehabilitation is assumed to be required prior to closure.

The source materials within Laleham TSF includes tailings, which are estimated to comprise approximately 90% of the landform; and rejects, which are estimated to comprise about 4% of the

landform. The TSF embankments (main embankment and upper embankment) are predominantly constructed from spoil/fill material, which comprise about 6% of the TSF.

Investigative drilling has demonstrated that tailings in the field at Laleham TSF are generating AMD (as AD and SD). Oxidation fronts are present in the TSF as demonstrated by decreasing sulfide concentrations from surface down, consumption of ANC, presence of secondary minerals generated through sulfide oxidation, and acid contact pH water.

The source hazard assessment for the mineral wastes within Laleham TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within Laleham TSF landform poses a **Moderate-High** AMD source hazard. Very little rejects data specific to Laleham TSF were available – therefore the AMD source hazard assessment for rejects at Laleham TSF utilised the aged rejects data from all rejects derived from SCPP, and found that rejects also pose a **Moderate** AMD source hazard. Fill material poses a low AMD source hazard, based on the low AMD hazard of general spoil. Evidence of AMD (as AD) is present from over 30% of the tailings samples collected from within the TSF. On this basis, and taking into account material quantities (proportions):

- Laleham TSF landform (currently, without a final rehabilitation cover[4]) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials is considered to be conservative and the landform domain AMD hazard score for Laleham TSF is also considered to be conservative. The AMD hazard scoring table for Laleham TSF landform is provided in **Appendix B – Table B16**.

Bottom Dam TSF (and rejects)

Bottom Dam TSF is a small historic tailings dam south of ROM 3 near the SCPP in the southern area of BWM (**Figure 2**). Adjacent to the TSF, and in the general vicinity of the TSF, are rejects dumps. Rejects currently occupy an area north of the TSF, on top of ROM 3, and also loosely dumped over the eastern and southeastern walls (escarpment) of ROM 3. ROM 3 is an elevated natural ground area northwest of Bottom Dam TSF and situated approximately 37 m above (higher than) the TSF.

The TSF (specifically) occupies an area of approximately 1.6 ha (with an estimated total volume of approximately 0.2 Mm^3). The overall Bottom Dam TSF/rejects area is approximately 10 ha, with an overall tailings/rejects volume estimated at less than 1 Mm^3 (indicatively 0.6 to 0.8 Mm^3).

The source materials within Bottom Dam TSF includes tailings, which are estimated to comprise approximately 95% of the landform; and rejects, which are estimated to comprise about 4% of the landform. The TSF landform is also assumed to include a small proportion (approximately 1 %) of spoil/fill material.

Tailings and rejects in Bottom Dam TSF/rejects were generated from the SCPP and are reasonably assumed to have environmental geochemical characteristics comparable to tailings and rejects located within Ramp 72 TSF, Kenmare pit and Laleham TSF. Preliminary investigative drilling and limited

4 Laleham TSF currently has a spoil cover, however additional rehabilitation will be required to meet post-closure rehabilitation criteria. As such, the AMD hazard assessment of Laleham TSF takes into consideration the existing cover material, however considers the facility to be 'unrehabilitated'.

sampling has demonstrated that all tailings at Bottom Dam TSF are classified as 'PAF' of some type and most show evidence of generating AMD (as AD and SD).

The source hazard assessment for the mineral wastes within Bottom Dam TSF landform has utilised the same general methodology as applied to the spoil landforms and other TSF and reject landforms. The source hazard assessment has found the tailings within Bottom Dam TSF landform poses a **Moderate-High** AMD source hazard. No rejects data specific to Bottom Dam TSF were available – therefore the AMD source hazard assessment for rejects at Bottom Dam TSF utilised the aged rejects data from all rejects derived from SCPP, and found that rejects pose a **Moderate** AMD source hazard. Fill material poses a low AMD source hazard, based on the low AMD hazard of general spoil. On this basis, and taking into account material quantities (proportions):

- Bottom Dam TSF landform (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard is considered to predominantly lie with the tailings, and lesser so the rejects.

The AMD hazard score for the tailings and rejects materials in Bottom Dam area is considered to be conservative and the landform domain AMD hazard score for Bottom Dam area (TSF and rejects combined) is also considered to be conservative. The AMD hazard scoring table for Bottom Dam TSF landform is provided in **Appendix B – Table B17**.

7.1.3 Rejects landforms

Ramp 36 rejects dump will remain as a 'stand-alone' rejects landform at closure. The dump is located approximately one km south of the NCPP and about 350 m southeast of NCPP TSF (**Figure 1** and **Figure 23**). The dump occupies an area of approximately 60 ha with a total estimated volume of approximately 10 Mm^3. The dump operated from approximately 1967 (start of mining at BWM) intermittently through until 2007. During this time, rejects have been taken (quarried) from the dump for use elsewhere on site – primarily for construction of the NCPP TSF embankments.

Ramp 36 rejects dump essentially comprises only rejects (approximately 98% by volume). A small amount of 'fill' (assume spoil) is also present and has been conservatively estimated (based on investigative drilling) to comprise about 2% of the landform.

The source hazard assessment for the mineral wastes within the rejects dump has utilised the same general methodology as applied to the spoil and TSF landforms. The source hazard assessment has found the rejects within the dump poses a **Moderate-High** AMD source hazard. Fill material has been assessed as posing a low AMD source hazard, based on the low AMD hazard of general spoil. Taking into account material quantities (proportions):

- Ramp 36 rejects dump (currently, without a rehabilitation cover) poses a **Moderate-High** AMD hazard, with AMD generation rated as **Probable/Likely**. The AMD hazard lies with the rejects, which comprise essentially all of the dump.

The AMD hazard score for the rejects materials is considered to be conservative and the landform domain AMD hazard score for the rejects dump is also considered to be conservative. The AMD hazard scoring table for Ramp 36 rejects dump is provided in **Appendix B – Table B18**.

7.1.4 Residual voids – exposed walls and floor

There are 15 existing and/or future pit areas at BWM that will remain at closure as residual voids. Some existing pits will merge with existing neighbouring pits to form larger consolidated pits/voids; some

existing pits will merge with future pits to also form larger consolidated pits/voids; and Blackdown pit (located between Tannyfoil and South Ballamoo pits/voids) will be backfilled. The voids don't have 'flat lying' floors and therefore the depth of each void varies along its length. The 15 residual voids remaining at closure are:

- Ramp 8 void approximately 0.6 km long and 60-85 m deep (at pit closure);
- Bonnie Doon void approximately 2.9 km long and 15-30 m deep (depth to tailings surface / spoil cap at pit closure). At closure, tailings thickness is expected to range from about 22 m thick at the southern end of the void to about 35 m thick at the northern end of the void;
- Mimosa-Besgrove void approximately 9.8 km long and 110-190 m deep (at pit closure);
- Ramp 30S void approximately 1.3 km long and 70 m deep (at pit closure);
- Deep Creek void approximately 1.7 km long and 150 m deep (at pit closure);
- Stewarton North void approximately 3.8 km long and 200-210 m deep (at pit closure);
- Stewarton South void approximately 1.5 km long and 130 m deep (at pit closure);
- Tannyfoil void approximately 5.9 km long and 100-130 m deep (at pit closure);
- South Ballamoo void approximately 4.5 km long and 200-270 m deep (at pit closure);
- Kenmare void approximately 1.6 km long and 120-150 m deep (at pit closure);
- Ramp 74 void approximately 1.8 km long and 25-30 m deep (depth to tailings surface / spoil cap at pit closure). Tailings thickness is about 25 m thick;
- Togara-North Marshmead void approximately 5.3 km long and 165-240 m deep (at closure);
- South Marshmead void approximately 1.7 km long and 160-205 m deep (at closure);
- Kennedy void approximately 5.6 km long and 90-175 m deep (at closure); and
- Comet Downs East void approximately 0.6 km long and 135 m deep (at closure).

Excluding the Bonnie Doon and Ramp 74 residual voids that have tailings on the pit/void floor, the floor of all residual voids at closure will be the P & L Lower seam group, which is currently the floor of most/all existing pits.

Environmental geochemical data, coal quality data and drill-hole geological logs have been used to aid in the assessment of AMD risk associated with residual void walls and floors, as explained in **Sections 4.4.1 to 4.4.3**.

The source materials within the walls and floor of each residual void comprise weathered and fresh materials. Excluding coal, on average, approximately 40% of the overburden/interburden on each highwall / end-wall is weathered/oxidised and the remaining (approximately 60%) is fresh, with the proportion of weathered to fresh overburden/interburden varying throughout the site. In the northern half of the site the proportion of weathered to fresh overburden/interburden is about 25% weathered to 75% fresh, whereas in the southern half of the site the proportion of weathered to fresh overburden/interburden is about 49% weathered to 51% fresh. As mining progresses the pits become only marginally deeper due to the generally low-angle dip of the seams. Therefore, the proportion of fresh material to weathered material at closure will remain broadly similar to current proportions.

The statistical distribution of residual void highwall / end-wall materials and the proportion of exposed coal seam (groups) is summarised in **Table 19**. Also shown is the composition (proportion) of each seam group exposed on the walls in each void (based on drill-hole data).

Table 19. Estimated wall rock exposure as a function of material type for each residual void

Voids	Weath, non-carb. %	Weath, carb./coal %	Fresh, non-carb. %	Fresh, carb./coal %	Unknown OB/IB %	Coal, fresh %	Coal seam groups Proportion of each seam group
Bonnie Doon (and Ramp 8[1])	17	0.1	73	3.5	-	6.7	T seam: 0.8% MR seam: <0.1% P&L seam: 5.9%
Mimosa-Besgrove (and Ramp 30S[1])	20	0.6	70	1.2	2.4	5.4	T seam:0.8% MR seam: 0.1% P&L seam: 4.5%
Deep Creek	22	1.0	68	1.2	0.6	7.1	T seam: 1.1% MR seam: 1.5% P&L seam: 4.5%
Stewarton Nth, Stewarton Sth, Tannyfoil and Sth Ballamoo[2]	23	1.6	65	1.1	1.7	7.2	T seam: 1.1% MR seam: 2.4% P&L seam: 3.7%
Kenmare	25	<0.1	65	1.2	4.1	5.1	T seam: 2.1% P&L seam: 3.0
Ramp 74	11	<0.1	82	0.8	-	6.0	T seam: 2.8% P&L seam: 3.2%
Togara-North Marshmead	73	5.6	19	0.4	-	2.0	T seam: 0.3% P&L seam: 1.7%
South Marshmead	59	1.3	37	0.7	-	2.6	T seam: 0.2% P&L seam: 2.4%
Kennedy	76	2.0	13	<0.1	6.8	1.9	T seam: - P&L seam: 1.9%
Comet Downs East	33	0.6	54	3.0	6.3	3.3	T seam: 1.0% P&L seam: 2.3%

1 Unable to undertake a specific void assessment for Ramp 8 and Ramp 30S voids due to insufficient data. Assume Ramp 8 void will have similar wall rock and seam proportions to Bonnie Doon void; and Ramp 30S void will have similar wall rock and seam proportions to the southern end of Mimosa-Besgrove void.

2 The void assessments for Stewarton North, Stewarton South, Tannyfoil and South Ballamoo voids were undertaken collectively (due to data limitations) and the values shown are averages for the three voids. However, the variation between each void is minor.

The T and P & L seam groups are the dominant seam groups at BWM (and colloquially referred to as the 'tops' and 'bottoms', respectively) and are present in every pit/void, whereas the MR seam group is a relatively minor seam group (overall) and is only present in the northern pits/voids from Ramp 8 through to South Ballamoo pit. The relative proportions of the T, MR and P & L seam groups are shown in **Table 19**. Overall, remnant coal (seams) are expected to comprise between 2% and 7% (vertical meterage) of the highwalls and end-walls in the residual voids.

Note that the source hazard assessment methodology outlined in **Section 4.4** has been applied to the materials expected to be exposed on the void walls and floor at closure.

The void walls hazard assessment has found that approximately 3.5% to 6% of the void highwall / end-walls in all voids is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC and NAF-S. As such, the assessment has found that the likelihood of AMD generation from the void walls is **Unlikely**, and any expression of AMD from the void walls is likely to be localised.

Excluding Bonnie Doon and Ramp 74 voids, which have tailings on their floor, the floor of all other residual voids will be the P & L (lower) seam. On the highly conservative (if not overly conservative) assumption that the floor of each of these non-tailings voids is all coal, the void floor AMD hazard assessment has found that approximately 3% of the floor of these voids where coal is exposed is estimated to be 'PAF', which includes material classified as PAF, UC(PAF), PAF-LC and NAF-S. As such, the conservative assessment has found that the likelihood of AMD generation from the floor of these voids where coal is exposed is **Unlikely**, until such time that the floor becomes submerged by groundwater (post-closure). In practice, mining takes all coal to the bottom of the seam, therefore very little coal would be expected to remain on the floor of these voids.

Bonnie Doon and Ramp 74 voids have tailings as the void floor and the source hazard assessment – based on the AMD hazard posed by tailings – has found that approximately 46% of the floor of Bonnie Doon void and 72% of the floor of Ramp 74 void is estimated to be 'PAF' [tailings], which includes tailings classified as PAF, PAF-LC, UC(PAF) and/or NAF-S. AMD generation from the floor of these TSF voids is **Probable/Likely**. The tailings within these voids will be capped/covered at end of mining and no tailings will be exposed post-closure. As such, the likelihood for AMD generation from the floor of these voids post-closure would be lower. Should these tailings floors become submerged by groundwater (post-closure), the likelihood for AMD generation from the tailings floor of these voids would be lower.

The AMD hazard scoring tables for the residual voids are provided in **Appendix B – Tables B19 to B29**.

7.2 Geochemical source-pathway-receptor assessment

7.2.1 Conceptual site model

A post-mining conceptual site model (CSM), which applies generically to the spoil landforms and their respective residual voids and the relationship these facilities have with surface water and groundwater in the district, has been produced by SLR Consulting Australia (SLR, 2026). The CSM for the northern part of the mine is provided in **Figure 25** and for the southern part of the mine in **Figure 26**.

The CSM assists with the source-pathway-receptor (SPR) assessment with regard to potential environmental geochemical impacts from mineral waste facilities. The CSM, which focuses on the relationship with surface water and groundwater (these being the most relevant pathways and receptors for AMD and salinity), is used to illustrate the relationship between potential sources of run-off and seepage (e.g. spoil, tailings, rejects), plausible receptors (e.g. creeks, groundwater) and the pathways between the two (e.g. seepage, drainage).

Figure 25. Conceptual site model post-mining for the northern BWM area
(SLR, 2026)

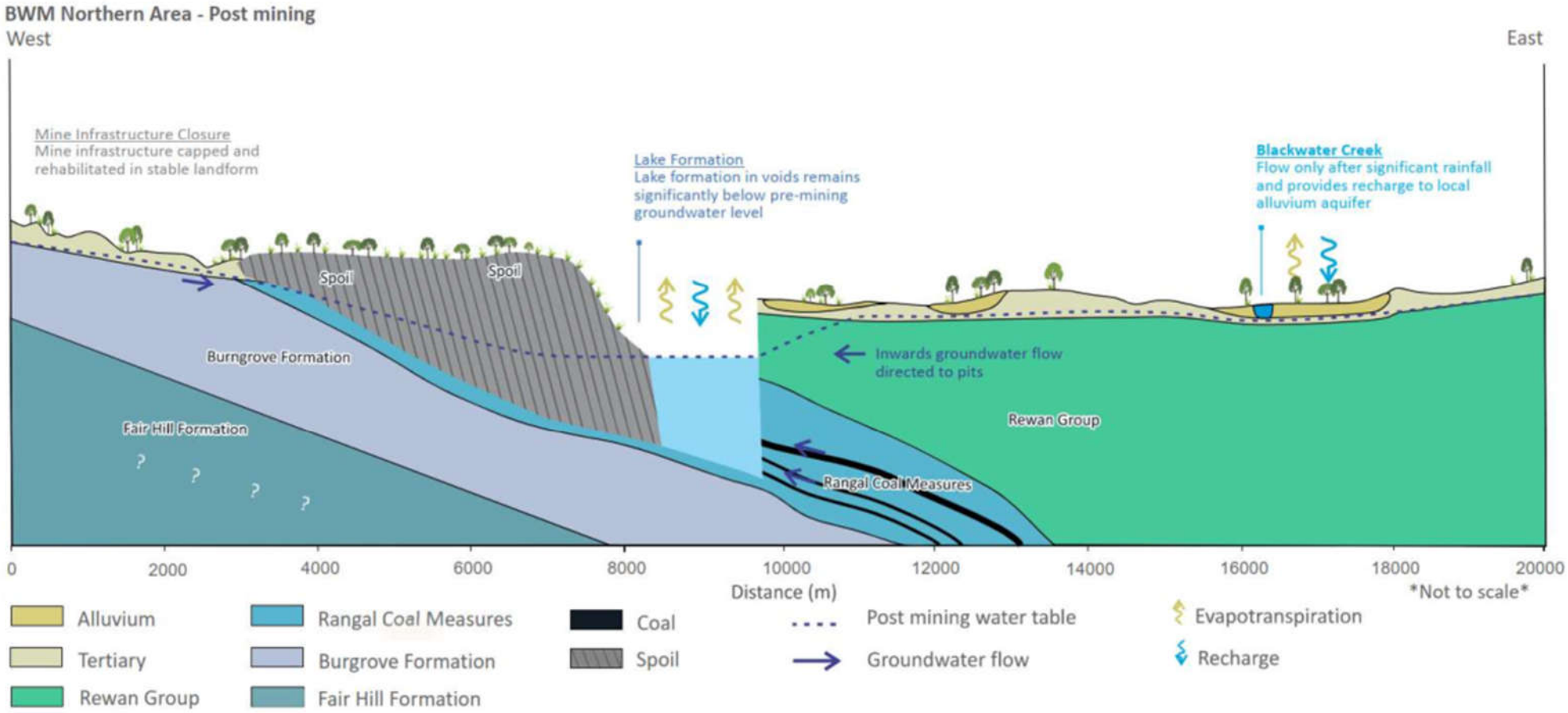
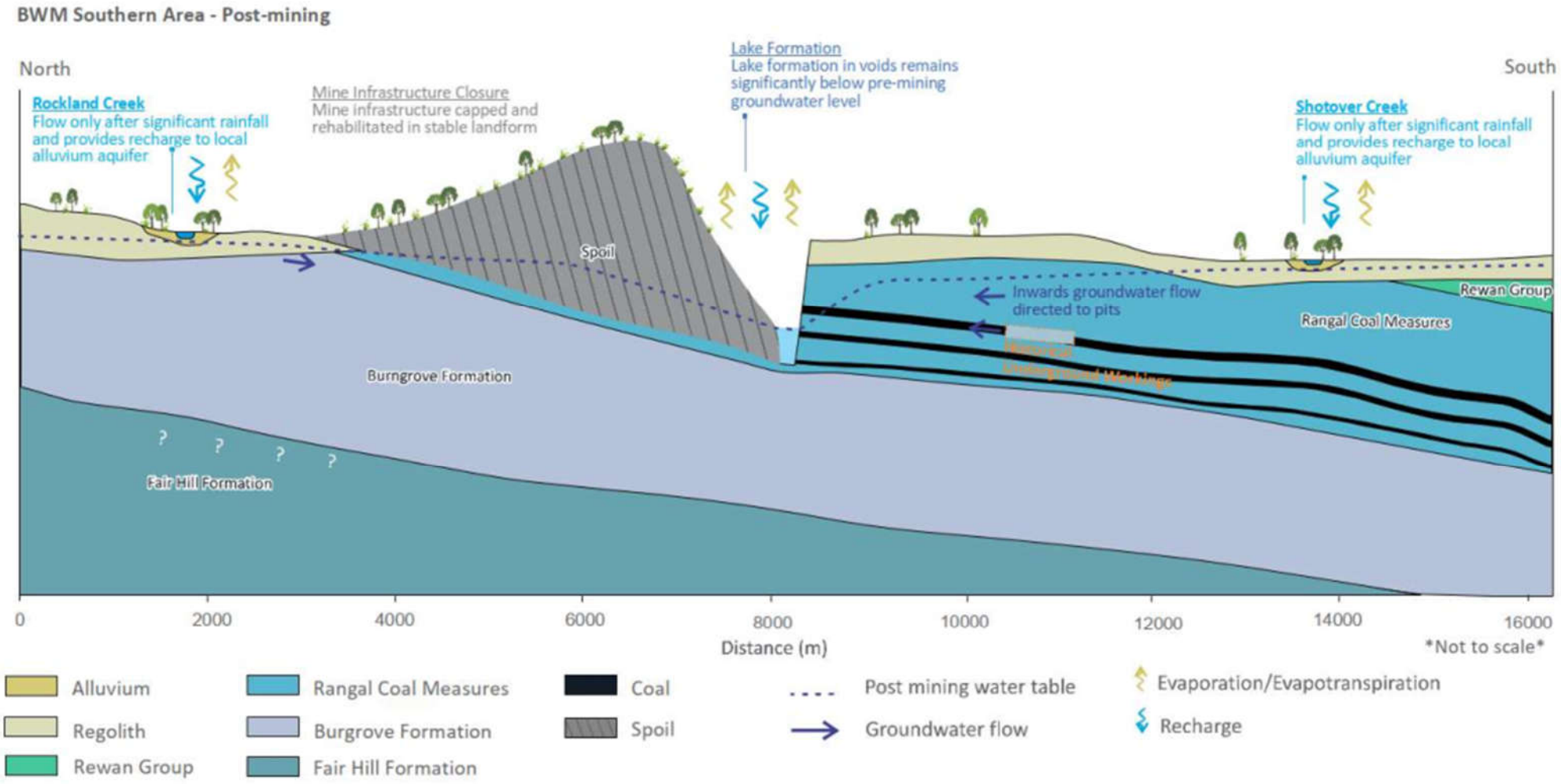


Figure 26. Conceptual site model post-mining for the southern BWM area
(SLR, 2026)



Prior to mining, groundwater flow in the northern half of BWM would have been generally towards the north and groundwater flow in the southern half of BWM would have been generally towards the southwest. Locally, these groundwater flow directions have been interrupted by mining, with current groundwater flow directions in the vicinity of the mine being towards the pits (i.e. the pits are currently groundwater 'sinks'). Permian groundwater flow at BWM largely follows the coal seams down-dip. Shallower groundwater that is likely associated with shallow permeable strata is likely to flow in a direction that broadly mimics surface topography.

Groundwater modelling undertaken by SLR (2026) shows the residual voids will ultimately be groundwater 'sinks' – that is, the residual voids will be receptors of run-off and seepage from the spoil landforms and run-off from void highwalls and end-walls, as illustrated in the CSM (**Figure 25** and **Figure 26**). The residual voids are classified as non-use management areas (NUMAs). The spoil landforms are located behind (generally west of) the residual voids and will drain into the voids. Seepage from the spoil landforms and the highwalls and end-walls of the residual voids reports to the residual void. As such, the floor of residual voids (including the floor of Bonnie Doon and Ramp 74 voids being tailings) are not likely AMD sources for groundwater receptors.

The hydrogeological assessment undertaken for the PRCP (SLR, 2026) indicates there may be shallow permeable strata present sporadically along (and/or near to) several creeks at BWM and – where present – shallow groundwater is expected to be below the base of all creeks in the area; suggesting that connectivity between shallow permeable strata and surface water features at BWM is unlikely. Furthermore, modelling (including particle tracking) undertaken by SLR for the PRCP found no evidence of post-closure connectivity between groundwater and surface water features. The model suggests that shallow groundwater (and by extension shallow seepage) migrating through the site will eventually report to the mine pits/voids. The general downward migration of shallow groundwater (and seepage) into deeper groundwater and towards the mine pits (residual voids) is logical, given the very large drawdown (sink) of the pits.

The assessment of shallow groundwater at BWM – particularly where shallow permeable strata may not be present in some areas or may be discontinuous – is limited by/to the distribution of the shallow bore network, which is sporadic. Therefore, despite the apparent low likelihood of substantial connection between shallow permeable strata and surface water features, the SPR assessment has adopted a highly conservative approach and assumed a plausible pathway *may exist* between shallow permeable strata and surface water features.

7.2.2 Conceptual facility models

A conceptual facility model (CFM) has been developed for each TSF and rejects landform to illustrate potential run-off and seepage pathways and surface water and groundwater receptors associated with these key mineral waste facilities post-closure.

- NCPP TSF – prior to rehabilitation – has a Moderate-High AMD source hazard with the likelihood of AMD generation from the landform rated as Highly Likely. CFM shown at **Figure 27**.
- Laleham TSF – prior to rehabilitation – has a Moderate-High AMD source hazard with the likelihood of AMD generation from the landform rated as Probably/Likely. CFM shown at **Figure 28**.
- Bottom Dam TSF and rejects area – prior to rehabilitation – has a Moderate-High AMD source hazard with the likelihood of AMD generation from the landform rated as Probable/Likely. CFM shown at **Figure 29**.

- Ramp 36 rejects dump – prior to rehabilitation – has a Moderate-High AMD source hazard with the likelihood of AMD generation from the landform rated as Probably/Likely. CFM shown at **Figure 30**.
- Ramp 72 TSF and Kenmare pit rejects dump will be buried within Kenmare spoil landform and will form tailings and rejects components of the spoil landform. The concentrated nature of Ramp 72 tailings and Kenmare pit rejects (which both have a High AMD source hazard) located at the base of the spoil landform warrants discussion with respect to SPR assessment. CFM shown at **Figure 31**.
- Deep Creek (Ramp 32) in-spoil rejects dump will be buried within the southern zone of Mimosa-Besgrove spoil landform. The concentrated nature of Deep Creek rejects (which has a Moderate AMD source hazard) located at the base of Ramp 32 and near the edge of the spoil landform close to Deep Creek warrants discussion with respect to SPR assessment. CFM shown at **Figure 32**.

Figure 27. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for NCPP TSF landform

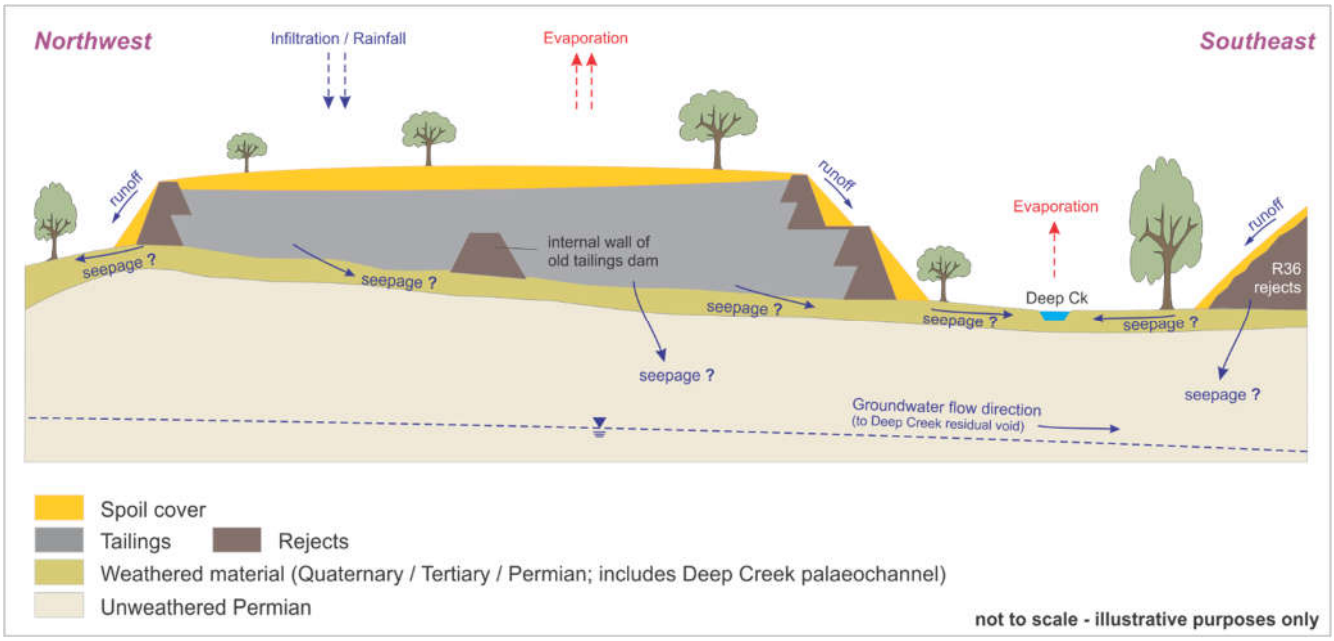


Figure 28. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Laleham TSF landform

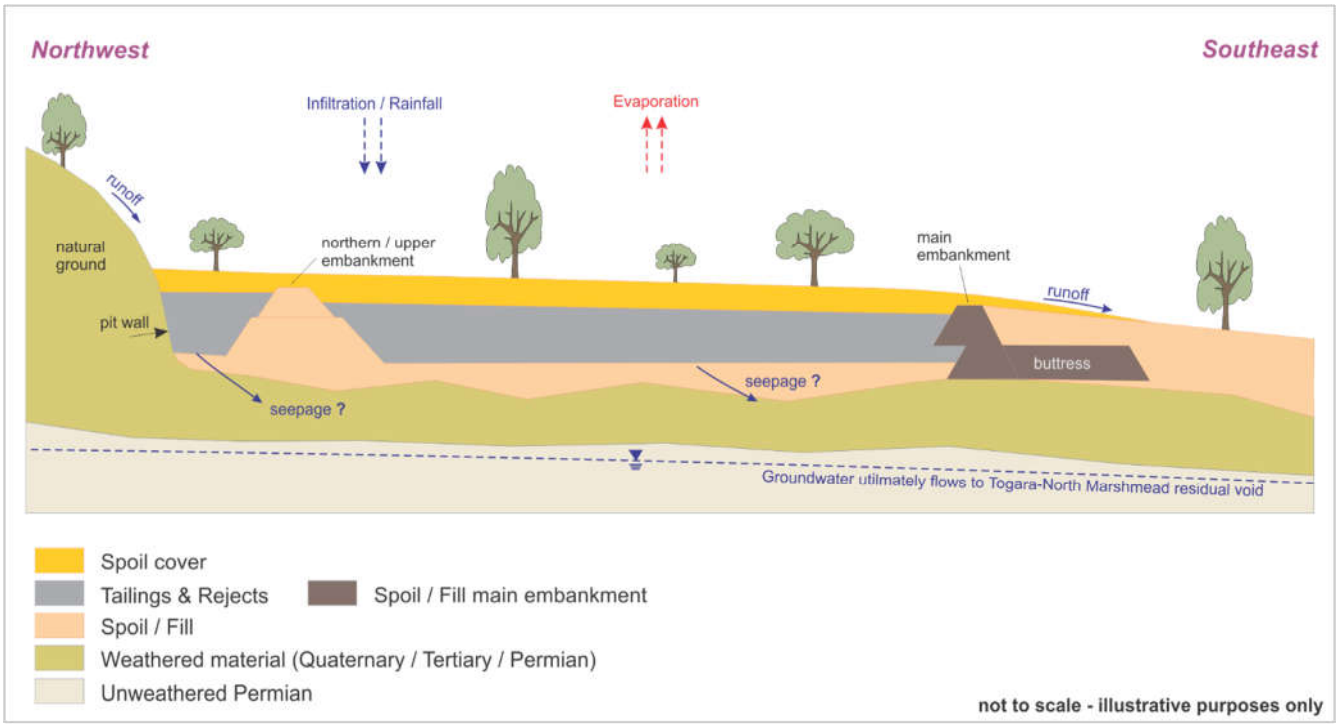


Figure 29. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Bottom Dam TSF and rejects landform

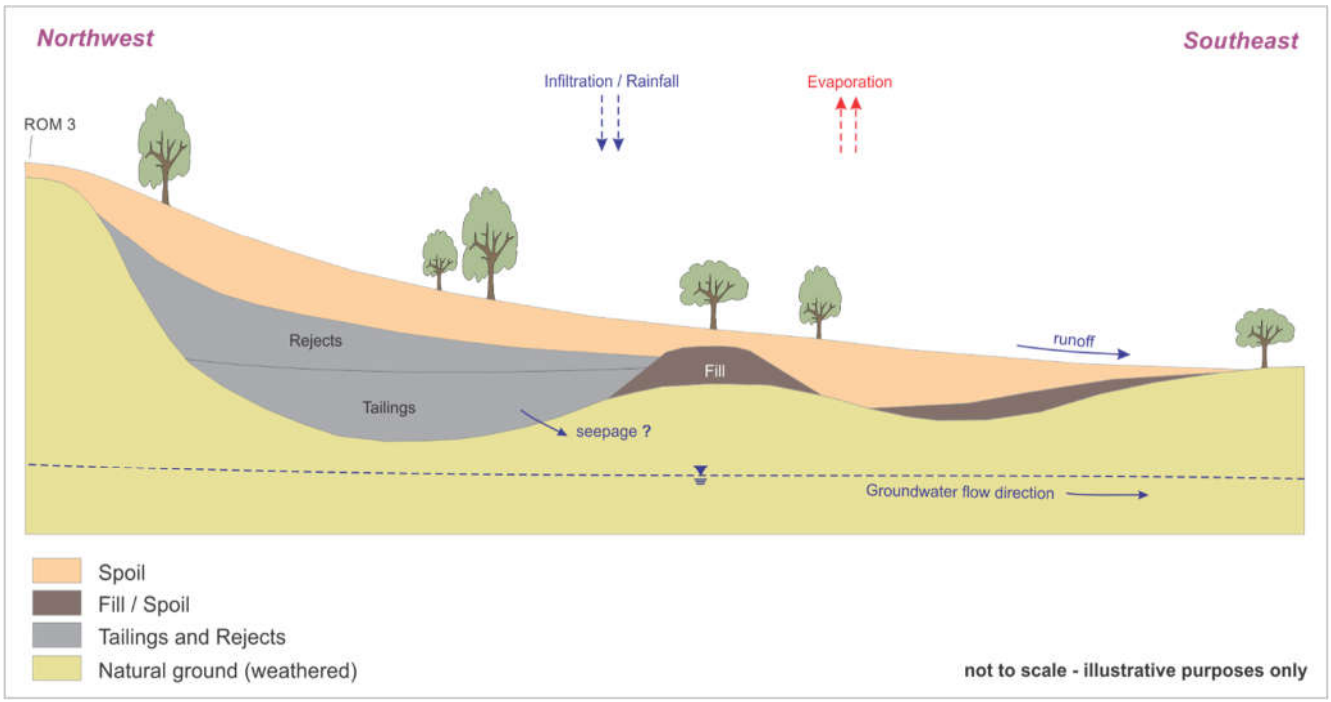


Figure 30. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 36 rejects landform

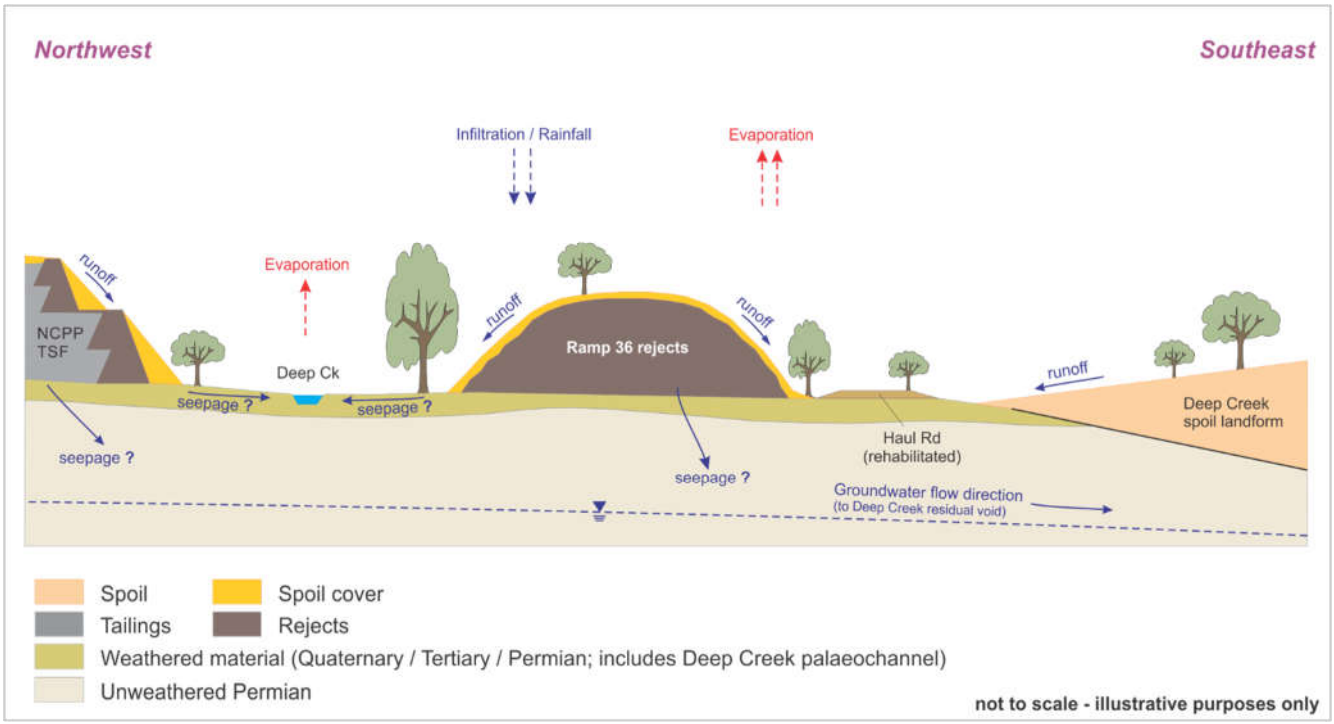


Figure 31. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 72 TSF buried within Kenmare spoil landform

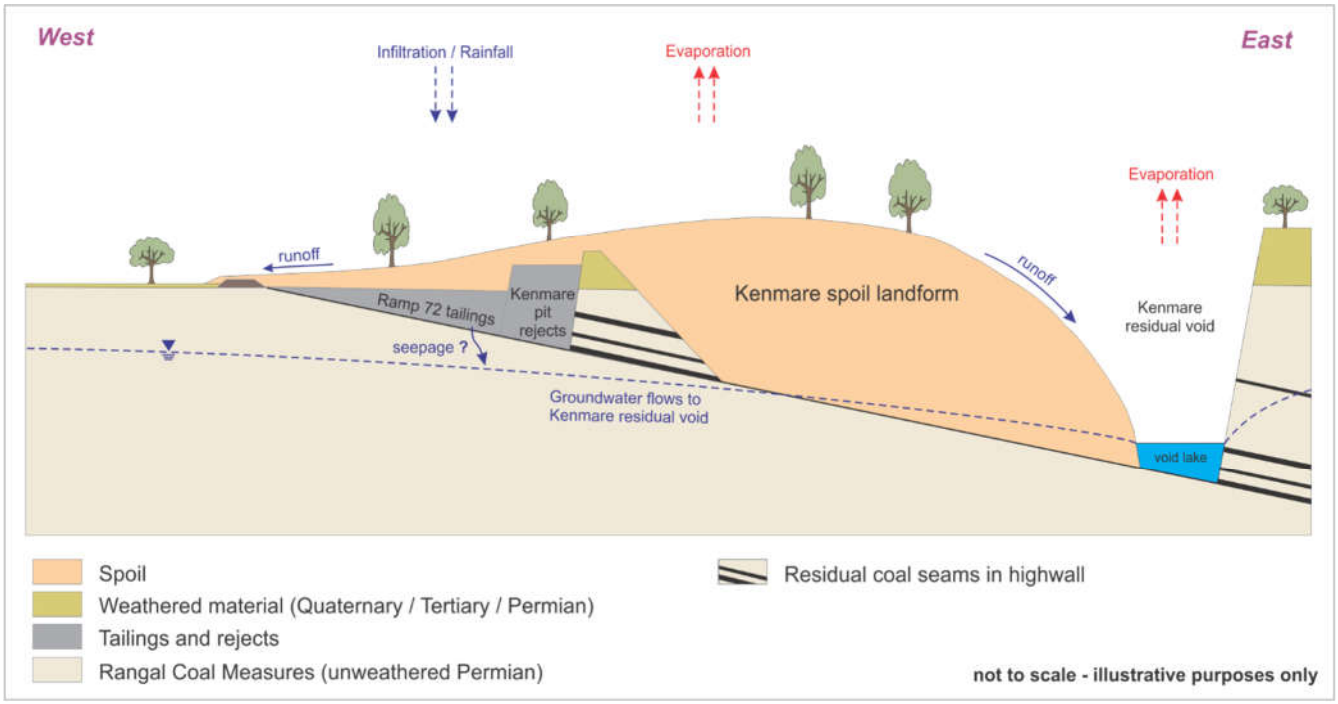
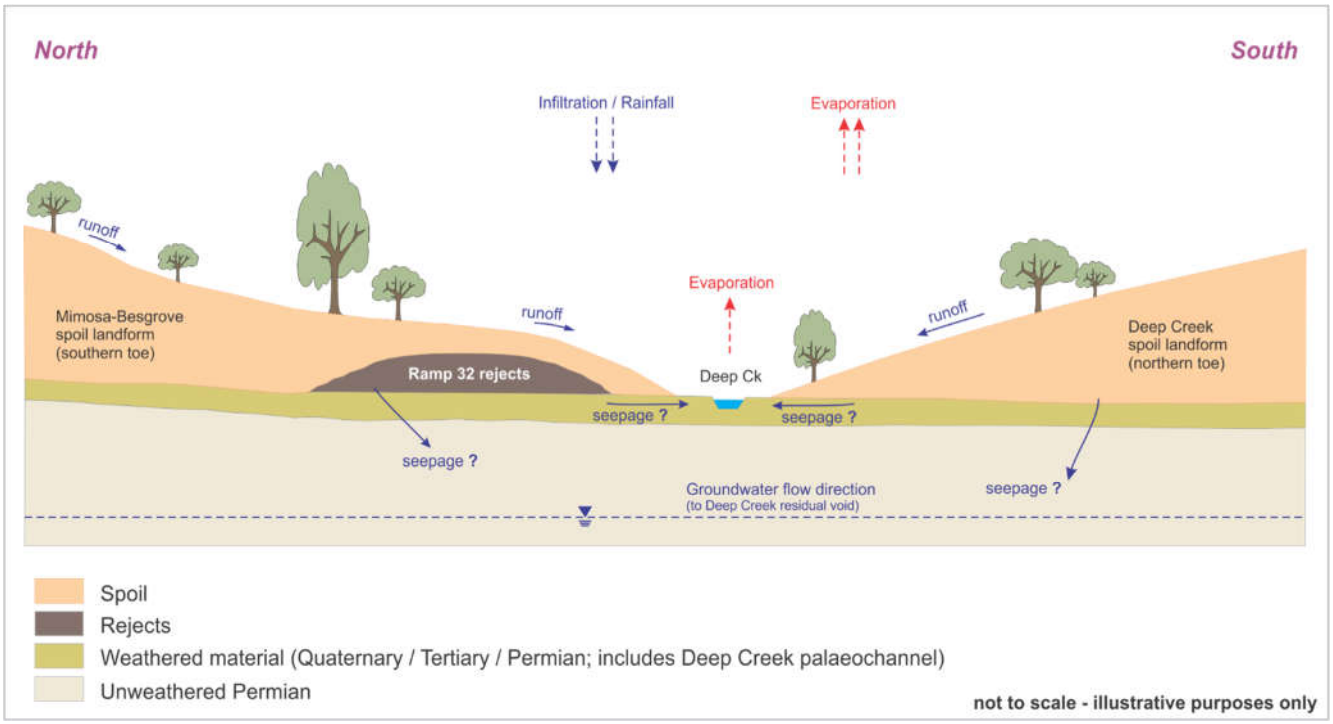


Figure 32. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Deep Creek [Ramp 32] rejects buried within Mimosa-Besgrove spoil landform



CFMs have also been produced for final void TSFs:

- Bonnie Doon spoil landform and residual void (TSF), with the likelihood of AMD generation from the unrehabilitated in-pit tailings rated as Probably/Likely. CFM shown at **Figure 33**.
- Ramp 74 spoil landform and residual void (Ramp 74 TSF), with the likelihood of AMD generation from the unrehabilitated in-pit tailings rated as Probably/Likely. CFM shown at **Figure 34**.

*Note: the intent of the simplified CFM illustrations shown as **Figures 27 to 34** are to conceptualise potential surface water run-off and seepage pathways between key landform domains and potential receptors. The CFM figures are not to scale and may not be a true representation of the system at each location.*

CFMs have not been developed for general rejects co-disposed (broadly distributed) throughout spoil dumps/ landforms.

Groundwater modelling, including particle tracking, shows seepage from Bonnie Doon spoil landform ultimately flows north into Ramp 8 residual void and south into Mimosa-Besgrove residual void, since these two voids are much deeper compared to Bonnie Doon void/TSF and, therefore, are much stronger groundwater sinks compared to Bonnie Doon void/TSF.

Groundwater modelling, including particle tracking, also shows seepage from Ramp74 pit area (including Ramp 74 (Laleham) spoil landform and Laleham TSF) ultimately flows southeast into Togara-North Marshmead residual void, since this void is much larger and deeper (approximately 4 times deeper) compared to Ramp 74 void and, therefore, is a much stronger groundwater sink compared to Ramp 74 void.

Figure 33. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Bonnie Doon spoil landform and final void TSF (Bonnie Doon TSF)

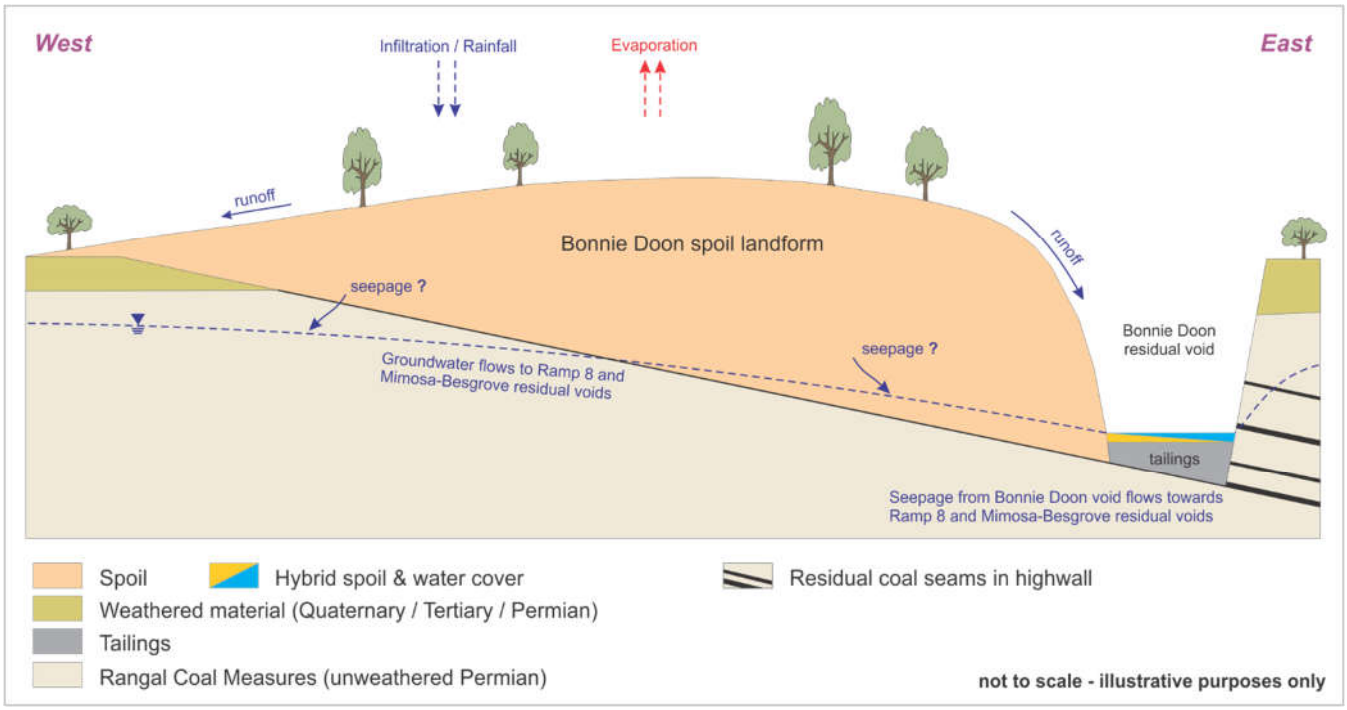
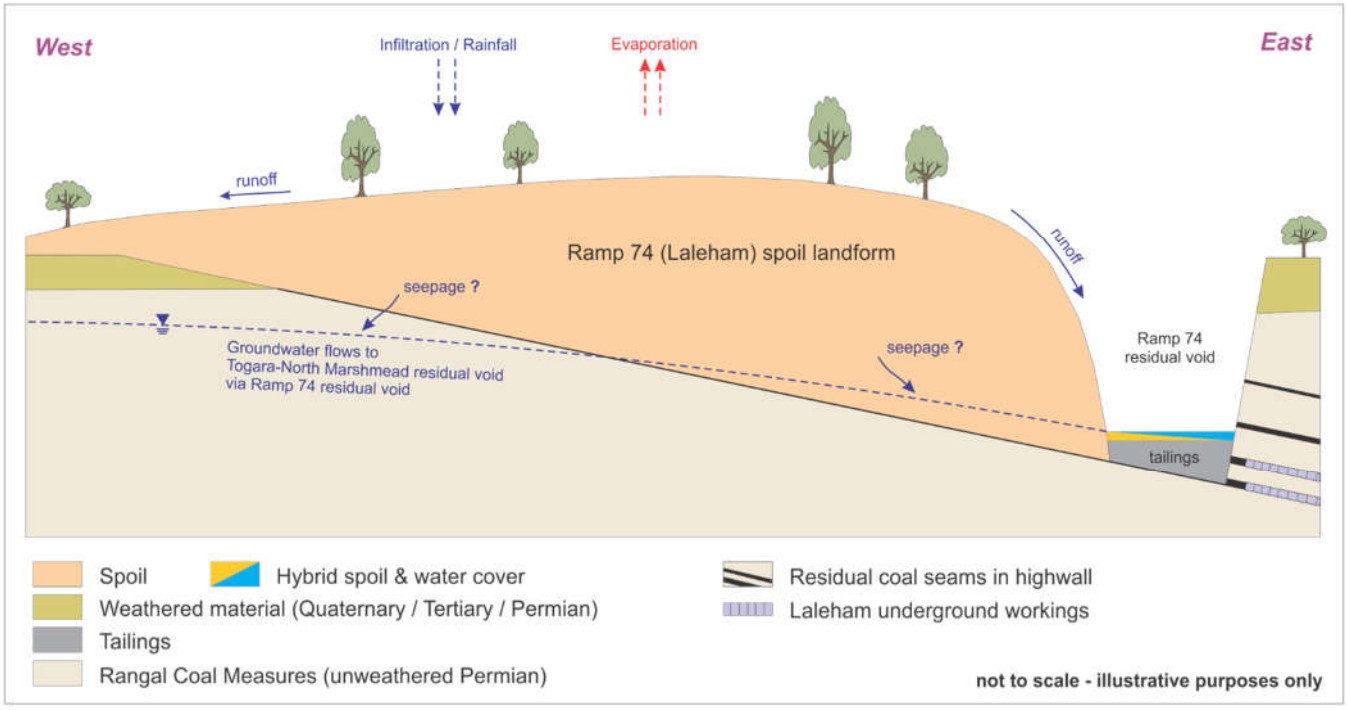


Figure 34. Post-closure Source-Pathway-Receptor (SPR) conceptual facility model (CFM) for Ramp 74 spoil landform and final void TSF (Ramp 74 TSF)



7.2.3 Summary of sources, pathways and receptors

With regard to the spoil landforms, the plausible mechanisms for AMD affected water and/or non-oxidative salinity to report to receptors are identified in Table 20.

Table 20. Sources, potential receptors and pathways between the source and receptor (post-closure) for spoil landforms

Source Landform	Potential Pathways from Source	Potential Receptors from Source
Ramp 8	Surface water [run-off]	Bonnie Doon Creek via tributary (west) / Ramp 8 residual void
	Seepage [shallow permeable strata]	Bonnie Doon Creek via tributary (west)
	Seepage [groundwater]	Ramp 8 residual void
Bonnie Doon	Surface water [run-off]	Bonnie Doon Creek via tributary (west) / Bonnie Doon residual void
	Seepage [shallow permeable strata]	Bonnie Doon Creek via tributary (west)
	Seepage [groundwater]	Primarily to Ramp 8 and Mimosa-Besgrove residual voids
Mimosa-Besgrove	Surface water [run-off]	Burngrove Creek via various tributaries (west) / Deep Creek (south) / Mimosa-Besgrove residual void
	Seepage [shallow permeable strata]	Burngrove Creek via various tributaries (west) / Deep Creek (south)
	Seepage [groundwater]	Mimosa-Besgrove residual void (+/- Ramp 30S residual void)
Deep Creek	Surface water [run-off]	Deep Creek +/- via tributaries (north and northwest) / Taurus Creek via tributaries (southwest) / Taurus Creek (south) / Deep Creek residual void
	Seepage [shallow permeable strata]	Deep Creek +/- via tributaries (north and northwest) / Taurus Creek via tributaries (southwest) / Taurus Creek (south)
	Seepage [groundwater]	Deep Creek residual void
Stewarton	Surface water [run-off]	Taurus Creek (north) / Emu Creek[1] (west) / Stewarton North residual void / Stewarton South residual void
	Seepage [shallow permeable strata]	Taurus Creek (north) / Emu Creek[1] (west)
	Seepage [groundwater]	Stewarton North residual void.
Tannyfoil	Surface water [run-off]	Emu Creek (west) / Tannyfoil residual void
	Seepage [shallow permeable strata]	Emu Creek (west)
	Seepage [groundwater]	Tannyfoil residual void (+/- to Stewarton South residual void)
Blackdown	Surface water [run-off]	Sirius Creek via western tributaries / Two Mile Gully via eastern tributaries
	Seepage [shallow permeable strata]	Sirius Creek via western tributaries / Two Mile Gully via eastern tributaries
	Seepage [groundwater]	Blackdown pit will be backfilled. Seepage via groundwater expected to report to Tannyfoil and South Ballamoo residual voids

Source Landform	Potential Pathways from Source	Potential Receptors from Source
South Ballamoo	Surface water [run-off]	Sirius Creek via western tributaries / South Ballamoo residual void
	Seepage [shallow permeable strata]	Sirius Creek via western tributaries
	Seepage [groundwater]	South Ballamoo residual void
Kenmare	Surface water [run-off]	Sirius Creek via western tributaries (west) / Kenmare residual void
	Seepage [shallow permeable strata]	Sirius Creek via western tributaries (west)
	Seepage [groundwater]	Kenmare residual void
Ramp 74	Surface water [run-off]	Sirius Creek +/- via tributaries (north and west) / Ramp 74 residual void
	Seepage [shallow permeable strata]	Sirius Creek +/- via tributaries (north and west)
	Seepage [groundwater]	Togara-North Marshmead residual void
Togara – North Marshmead	Surface water [run-off]	Sirius Creek (northwest and north) / Rockland Creek +/- tributaries (southwest and south) / Togara-North Marshmead residual void
	Seepage [shallow permeable strata]	Sirius Creek (north and west) / Rockland Creek +/- tributaries (west and south)
	Seepage [groundwater]	Togara-North Marshmead residual void
South Marshmead	Surface water [run-off]	Rockland Creek (north) / Shotover Creek tributary (south) / South Marshmead residual void
	Seepage [shallow permeable strata]	Rockland Creek (north) / Shotover Creek tributary (south)
	Seepage [groundwater]	South Marshmead residual void
Kennedy	Surface water [run-off]	Rockland Creek +/- tributaries (west and north) / Kennedy residual void
	Seepage [shallow permeable strata]	Rockland Creek +/- tributaries (west and north)
	Seepage [groundwater]	Kennedy residual void
Comet Downs East	Surface water [run-off]	Rockland Creek +/- tributaries (east and west) / Comet Downs East residual void
	Seepage [shallow permeable strata]	Rockland Creek +/- tributaries (east and west toe)
	Seepage [groundwater]	Comet Downs East residual void

With regard to the TSF and rejects landforms, the plausible mechanisms for AMD affected water and/or non-oxidative salinity to report to receptors are identified in **Table 21**.

With regard to void highwalls and end-walls as a potential source of AMD affected water and/or non-oxidative salinity, the only plausible receptor is the void, via surface water [run-off] from the void walls.

Table 21. Sources, potential receptors and pathways between the source and receptor (post-closure) for TSF and reject landforms

Sources	Potential Pathways from Source	Potential Receptors from Source
TSF landforms		
NCPP TSF	Surface water [run-off]	Deep Creek (south and east)
	Seepage [shallow permeable strata]	Deep Creek (south and east)
	Seepage [groundwater]	Deep Creek residual void
Laleham TSF	Surface water [run-off]	Sirius Creek (south)
	Seepage [shallow permeable strata]	Sirius Creek (south)
	Seepage [groundwater]	Kenmare residual void at end of mining and Togara-North Marshmead residual void post-mining (groundwater equilibrium)
Bottom Dam TSF [incl. rejects]	Surface water [run-off]	Sirius Creek (south)
	Seepage [shallow permeable strata]	Sirius Creek (south)
	Seepage [groundwater]	Kenmare residual void at end of mining and Togara-North Marshmead residual void at post-mining (groundwater equilibrium)
Rejects landform		
Ramp 36 Rejects Dump	Surface water [run-off]	Deep Creek (west and north)
	Seepage [shallow permeable strata]	Deep Creek (west and north)
	Seepage [groundwater]	Deep Creek residual void

Risk matrix and risk ratings

A residual risk rating 'heat map' (Table 22) has been adopted to assess the risks associated with SPR from the 14 spoil landforms, three TSF landforms and Ramp 36 rejects landform. In reference to the risk matrix, the SPR assessment includes the likelihood of the event occurring, the severity of the event (should it occur) and the calculated risk rating (likelihood X severity).

Table 22. Risk matrix for SPR assessment

Risk Rating = Likelihood x Severity		Severity				
		S1	S2	S3	S4	S5
Likelihood	Highly Likely	Medium	Medium to High	High	High	High
	Likely	Low to Medium	Medium	Medium to High	High	High
	Probable	Low	Low to Medium	Medium	Medium to High	High
	Unlikely	Low	Low	Low to Medium	Medium	Medium to High
	Highly Unlikely	Low	Low	Low	Low to Medium	Medium

The risk ratings for the mineral waste landforms with respect to plausible receptors is shown in **Appendix C** and report sections as follows:

Surface water receptors of landform sources

- Spoil landforms with respect to plausible surface water receptors: **Table 20** and **Appendix C Tables C1 to C14** and discussed in **Section 7.2.4**;
- TSF and rejects landforms with respect to plausible surface water receptors: **Table 21** and **Appendix C Tables C15 to C18** and discussed in **Sections 7.2.5 to 7.2.8**.

Residual void receptors of landform sources

Groundwater modelling (SLR, 2026) has shown that the residual voids will be groundwater 'sinks' in the long-term (post-closure). As such, seepage into the Permian groundwater system from any/all facilities at BWM will ultimately report into the residual voids.

- Spoil landforms with respect to residual void receptors: **Table 20** and **Appendix C Tables C19 to C22** and discussed in **Section 7.2.4**;
- TSF and rejects landforms with respect to residual void receptors: **Table 21** and **Appendix C Table C23** and discussed in **Sections 7.2.5 to 7.2.8**.

Residual void receptors of highwalls / end-walls and void floor sources

The risk ratings for the residual void highwall / end-walls and floor – for each void – with respect to final void receptors is shown in **Appendix C Table C24** and discussed in **Section 7.2.9**. The potential impact of seepage from the residual voids into the Permian groundwater aquifer is discussed in the void closure plan – refer to the main volume of the PRCP.

7.2.4 SPR assessment of spoil landforms

Source materials hazard

The spoil landforms are comprised of approximately 93 to 99% non-carbonaceous overburden/interburden with coaly and carbonaceous material (predominantly in the form of carbonaceous spoil and reject) comprising the remaining 1 to 7% of the spoil landforms. Non-

carbonaceous overburden/interburden in the Bowen Basin is widely recognised as posing a low AMD source hazard.

The AMD source hazard of rejects at BWM ranges from low to high, but overall, is generally moderate. Where rejects form part of a spoil landform they comprise less than 2% of the landform (in most cases less than 1%). Rejects within the southern end of Kenmare pit – and therefore within the Kenmare spoil landform – pose a high AMD source hazard. These rejects within the southern end of Kenmare pit are estimated to form approximately 0.5% of the Kenmare landform, however they are concentrated in a relatively small area at the base of the landform adjacent to Ramp 72 TSF.

Tailings at BWM generally pose a moderate-high to high AMD hazard and, with regard to spoil landforms, tailings will only be present in Kenmare landform (within Ramp 72 TSF). Overall, Ramp 72 tailings are estimated to comprise approximately 1.2% of the Kenmare landform, however they are concentrated in a relatively small area at the base of the landform.

Spoil materials generally have low EC values and are expected to produce non-saline to slightly saline run-off and seepage, with release of (non-oxidative) salinity rated as a low hazard. Fresh (unweathered) rejects and tailings have low to moderate EC values and are expected to produce slightly to moderately saline run-off and seepage, with release of (non-oxidative) salinity rated as a low-moderate hazard. The overall low total S and generally excess ANC of the combined mineral waste – for all spoil landforms – results in a 'Low' AMD hazard score, with AMD generation rated as 'Highly Unlikely'. Tailings and rejects specifically within Kenmare spoil landform have higher AMD hazards scores, with AMD generation rated as 'Highly Likely'. With respect to non-oxidative salinity, all spoil landforms have generally low salinity, with SD generation rated as 'Unlikely'.

Pathways

Pathways from spoil landforms to plausible surface water and groundwater (residual void) receptors are shown in **Figures 23 and 24** (Post-closure landform), **Table 20** and **Appendix C Tables C1 to C14; and C19 to C22**.

Surface water

Surface water receptors (ephemeral creeks) are located adjacent to each spoil landform – ranging from less than 100 m to approximately 600 m from landform edges. Most surface water receptors were less than 200 m from landform edges. It is plausible for surface water run-off from final rehabilitated landforms to reach these creeks. Surface water receptors greater than about 600 m from landforms were considered to be implausible receptors. Refer to **Figures 23 and 24** and **Table 20** for surface water receptors associated with each spoil landform. Tailings (e.g. Ramp 72 TSF) and rejects located within spoil landforms will be buried into spoil and therefore all run-off will likely be from general spoil (overburden/interburden) material and no tailings or rejects will be exposed to (or at risk of) surface water run-off.

Seepage / Groundwater)

The water table is expected to intersect the deeper zones of each in-pit spoil landform within the Permian coal measures (SLR, 2026). However, groundwater is captured by the residual void (as a groundwater sink). Therefore, although a direct connection is expected to exist between deeper parts of the final landforms and groundwater (the water table), this groundwater will report to the residual void – not to the broader aquifer.

As discussed in **Section 7.2.1**, it is plausible for seepage from the near-surface and unsaturated zone of the in-pit final landforms to migrate downwards into the water table. It is also plausible (however likely) that seepage may occur into discontinuous shallow permeable strata locally associated with existing creeks or palaeodrainage channels. Due to the highly discontinuous and/or not interconnected nature of shallow permeable strata at BWM, the understanding surrounding any potential link between shallow groundwater and surface water is limited. As such, whether seepage into shallow permeable strata would continue further downwards into deeper groundwater (primary aquifer) or, instead, report to nearby surface water features, is also somewhat unclear. Despite this potential limitation, the overall seepage gradient at BWM is downwards. Therefore, it is reasonably assumed that seepage from final landforms into shallow groundwater is 'Unlikely' to reach a surface water receptor.

In summary, the SPR has assumed a plausible (although unlikely) local seepage pathway may exist between a landform – such as seepage from a buried rejects dump or TSF – via shallow permeable strata into a nearby surface water receptor (ephemeral creek).

Receptors

Plausible receptors identified in this qualitative assessment include ephemeral creeks and the residual voids. Refer to **Appendix C Tables C1 to C14** for surface water receptors associated with each spoil landform and **Appendix C Tables C19 to C22** for residual void receptors.

Specific to buried Ramp 72 tailings/rejects in Kenmare spoil landform, refer to CFM **Figure 31**. Specific to buried Ramp 32 rejects in Mimosa-Besgrove spoil landform, refer to CFM **Figure 32**.

Due to the geochemical nature of the spoil landforms, the likelihood of AMD from spoil landforms to impact on the water quality of surface water receptors, residual voids or groundwater has been rated unlikely. The likelihood of non-oxidative salinity from spoil landforms to impact on the water quality of surface water receptors, residual voids or groundwater has also been rated unlikely. The overall risk rating is low.

Consideration was also made to people living in the homesteads near BWM. There are a number of homesteads in the general vicinity of BWM, however none are close to any pits or residual voids, TSFs or spoil dumps (final spoil landforms) and, as such, are considered to be implausible receptors of AMD or saline drainage for the final spoil landforms. The nearest homestead to the current mining area is '*Ausbute*' located about 1.3 km west of Burngrove pit and cannot receive run-off or seepage from Mimosa-Besgrove spoil landform.

SPR risk rating of final spoil landforms

There are plausible surface water and residual void receptors; and the run-off [and shallow seepage] pathways linking the sources (final spoil landforms) to these receptors have been identified. With respect to AMD, the overall SPR risk rating from all final spoil landforms is **Low**. With respect to non-oxidative salinity the overall SPR risk from final spoil landforms is also rated as **Low**.

Where landforms contain buried tailings and/or rejects, and especially if those buried tailings/rejects are located close to the edge of the landform and/or close to a creek, the risk rating with respect to AMD potentially making its way via shallow permeable strata into surface water features close to the buried tailings/rejects was rated as **Low to Medium**. This applies to Kenmare spoil landform (containing Ramp 72 tailings and Kenmare pit rejects) and Mimosa-Besgrove spoil landform (containing Deep Creek [Ramp 32] rejects dump).

7.2.5 SPR assessment of NCPP TSF landform

Source materials hazard

Excluding the final cover/cap to be installed over NCPP TSF, the TSF landform is currently comprised of approximately 80% tailings, with the remainder being rejects (about 19%, as embankment material) and fill material (about 1%, also as embankment material). Tailings within the TSF pose a high AMD hazard and rejects (embankments) pose a low-moderate AMD source hazard.

Source materials generally have low-moderate EC values and are expected to produce slightly to moderately saline run-off and seepage, with release of (non-oxidative) salinity rated as a low-moderate hazard. Overall, the hazard for AMD generation from the current NCPP TSF landform is 'Moderate-High' and the likelihood for AMD generation from the current landform is 'Highly Likely' (the highest 'likelihood' rating available under the applied AMD hazard scoring methodology) – noting that field evidence of AMD (as AD) exists at the facility. With respect to non-oxidative salinity, the TSF landform has a conservative hazard score of 'Probable/Likely'.

Pathways

Pathways from NCPP TSF landform to plausible surface water and groundwater (residual void) receptors are shown in **Figure 23** (Post-closure landform), **Figure 27** (CFM for NCPP TSF landform), **Table 21** and **Appendix C Table C15**.

Surface water

Deep Creek (an ephemeral creek) is located to the south and southeast of (and less than 100 m from) NCPP TSF landform and flows from west to east across the site. It is likely that surface water run-off from NCPP TSF landform will reach Deep Creek. The TSF will be covered with a spoil cover to manage the AMD source hazard, therefore all post-closure run-off from NCPP TSF landform will likely be from general spoil (overburden/interburden) material and no tailings or rejects will be exposed to (or at risk of) surface water run-off.

Shallow / Groundwater

As discussed earlier, this assessment has conservatively assumed it is plausible that seepage may occur into discontinuous shallow permeable strata associated with existing creeks or palaeodrainage channels. Whether seepage into shallow permeable strata would continue further downwards into the deeper (primary) aquifer or, instead, report through the shallow permeable strata into nearby surface water features (in this case, Deep Creek), is somewhat unclear. Despite this potential limitation, the overall seepage gradient at BWM is downwards and towards (into) residual voids – including from areas outside of a pit shell, such as NCPP TSF.

Groundwater modelling (SLR, 2026) shows that seepage from NCPP TSF landform would report to Deep Creek residual void. Therefore, it is reasonably assumed that the likelihood of seepage from NCPP TSF final landform reaching a surface water receptor (e.g. Deep Creek) via shallow groundwater is 'Unlikely'.

In summary, the SPR has assumed a plausible (although unlikely) local seepage pathway may exist between the NCPP TSF landform via shallow permeable strata into nearby ephemeral surface water receptors (such as Deep Creek).

Receptors

Plausible receptors of surface water run-off and seepage from NCPP TSF landform are shown in **Figure 23** (Post-closure landform), **Figure 27** (CFM for NCPP TSF landform), **Table 21** and **Appendix C Tables C15 and C23**.

Surface water

The only plausible surface water receptor identified in this qualitative assessment of NCPP TSF landform is ephemeral Deep Creek, located less than 100m from the TSF. This applies to potential surface water run-off and potential seepage through shallow permeable strata into the surface water receptor(s).

The rehabilitated TSF landform will have a spoil cover designed to manage the AMD hazard of the landform. The spoil cover has been conservatively assumed to pose a low-moderate AMD source hazard, based on a conservative AMD source hazard applied to general spoil. As such, the likelihood of AMD from the rehabilitated (post-closure) TSF landform to impact on the water quality of the surface water receptor(s) (via run-off or shallow seepage) has been rated unlikely. The likelihood of non-oxidative salinity from the TSF landform to impact on the water quality of the surface water receptor(s) has been rated unlikely.

Seepage / Groundwater

Seepage from NCPP TSF landform into groundwater will ultimately report to Deep Creek residual void. The likelihood of AMD and non-oxidative salinity from the rehabilitated (post-closure) TSF landform to impact on the water quality of Deep Creek residual void has been rated highly unlikely.

SPR risk rating of NCPP TSF landform

There are plausible surface water and residual void receptors; and the run-off [and shallow seepage] pathways linking the source (NCPP TSF final landform) to these receptors have been identified. Groundwater modelling (SLR, 2026) shows that seepage from NCPP TSF landform would report to Deep Creek residual void. With respect to AMD, the overall SPR risk rating from the post-closure TSF final landform is **Low to Medium**. The 'Medium' risk rating applies to AD and SD associated with seepage via shallow permeable strata. With respect to non-oxidative salinity the overall SPR risk from NCPP TSF final landform is rated as **Low**.

7.2.6 SPR assessment of Laleham TSF landform

Source materials hazard

Excluding the final cover/cap to be installed over Laleham TSF, the TSF landform is currently comprised of approximately 90% tailings, with the remainder being rejects (about 4%, partially as embankment material) and spoil/fill material (about 6%, as embankment material). The TSF has a thin spoil cover, which may require augmenting (thickening) with additional spoil during rehabilitation. Tailings and rejects within the current TSF pose a moderate-high AMD source hazard.

Source materials generally have moderate EC values and are expected to produce moderately saline run-off and seepage, with release of (non-oxidative) salinity rated as a moderate hazard. Overall, the hazard for AMD generation from the current Laleham TSF landform is 'Moderate-High' and the likelihood for AMD generation from the landform is 'Probable/Likely'. With respect to non-oxidative salinity, the TSF landform has a conservative hazard score of 'Probable/Likely'.

Pathways

Pathways from Laleham TSF landform to plausible surface water and groundwater (residual void) receptors are shown in **Figure 24** (Post-closure landform), **Figure 28** (CFM for Laleham TSF landform), **Table 21** and **Appendix C Tables C16 and C23**.

Surface water

Sirius Creek (an ephemeral creek) is located approximately 370 m south of Laleham TSF landform and flows from east to west across the site. It is plausible that surface water run-off from Laleham TSF landform could reach Sirius Creek.

The TSF is currently partially rehabilitated, however additional rehabilitation measures may be required. The rehabilitated TSF landform will have a spoil cover designed to manage the AMD hazard of the landform. Therefore, all post-closure run-off from the TSF landform will be from general spoil (overburden/interburden) material and no tailings or rejects will be exposed to (or at risk of) surface water run-off.

Seepage / Groundwater

As discussed earlier, this assessment has conservatively assumed it is plausible that seepage may occur into discontinuous shallow permeable strata associated with existing creeks or palaeodrainage channels. Whether seepage into shallow permeable strata would continue further downwards into the deeper (primary) aquifer or, instead, report through the shallow permeable strata into nearby surface water features (in this case, Sirius Creek), is somewhat unclear – especially given the distance to Sirius Creek (~370 m). Despite this potential limitation, the overall seepage gradient at BWM is downwards and towards (into) the residual voids. Therefore, it is reasonably assumed that the likelihood of seepage from Laleham TSF landform reaching a surface water feature via shallow groundwater is 'Unlikely'.

In summary, the SPR has assumed a plausible (although unlikely) local seepage pathway may exist between the Laleham TSF landform via shallow permeable strata into nearby surface water receptors (Sirius Creek).

Receptors

Plausible receptors of surface water run-off and seepage from Laleham TSF landform are shown in **Figure 24** (Post-closure landform), **Figure 28** (CFM for Laleham TSF landform), **Table 21** and **Appendix C Tables C16 and C23**.

Surface water

The only plausible surface water receptor identified in this qualitative assessment of Laleham TSF landform is ephemeral Sirius Creek, located approximately 370 m south of the TSF, with the Ramp 74 spoil landform between the TSF and the creek. This applies to potential surface water run-off and potential seepage through shallow permeable strata into Sirius Creek.

The moderate distance to Sirius Creek from the TSF landform would likely preclude surface water or shallow seepage from having any significant impact on the water quality of Sirius creek. As such, the likelihood of AMD or non-oxidative salinity from the rehabilitated TSF landform to impact on the water quality of Sirius Creek (via run-off or shallow seepage) has been rated highly unlikely.

Seepage / Groundwater

Seepage from Laleham TSF landform into groundwater will initially report to Kenmare void at the end of mining, but after groundwater levels equilibrate (well after post-closure), groundwater will ultimately report to Togara-North Marshmead residual void via Ramp 74 void. The likelihood of AMD and non-oxidative salinity from the rehabilitated (post-closure) TSF landform to impact on the water quality of Kenmare or Togara-North Marshmead residual voids has been rated highly unlikely.

SPR risk rating of Laleham TSF landform

There are plausible surface water and residual void receptors; and the run-off and shallow seepage pathways linking the source (Laleham TSF final landform) to these receptors have been identified. Groundwater modelling (SLR, 2026) shows that seepage from Laleham TSF landform would ultimately report to Togara-North Marshmead residual void via Ramp 74 void (seepage would likely report to Kenmare residual void via Ramp 74 void prior to long-term post-closure groundwater equilibrium). With respect to AMD, the overall SPR risk rating from the post-closure TSF final landform is **Low**. With respect to non-oxidative salinity the overall SPR risk from Laleham TSF final landform is also rated as **Low**.

7.2.7 SPR assessment of Bottom Dam TSF (and rejects) landform

Source materials hazard

Excluding the final cover/cap to be installed over Bottom Dam TSF (and rejects) landform, the source materials within the TSF includes tailings, which are estimated to comprise approximately 95% of the landform; and rejects, which are estimated to comprise about 4% of the landform. The TSF landform is also assumed to include a small proportion (approximately 1 %) of spoil/fill material.

Based on limited geochemical data from tailings and rejects samples obtained directly from Bottom Dam TSF, and supplemented by geochemical data for tailings and rejects samples from the broader southern BWM area (tailings and rejects originating from SCPP), tailings within the current TSF conservatively pose a moderate-high AMD source hazard and rejects conservatively pose a moderate AMD source hazard.

Source materials generally have moderate EC values and are expected to produce moderately saline run-off and seepage, with release of (non-oxidative) salinity rated as a moderate hazard. Overall, the hazard for AMD generation from the current Bottom Dam TSF landform is 'Moderate-High' and the likelihood for AMD generation from the landform is 'Probable/Likely'. With respect to non-oxidative salinity, the TSF landform has a conservative hazard score of 'Probable/Likely'.

Pathways

Pathways from Bottom Dam TSF/rejects landform to plausible surface water receptors are shown in **Figure 24** (Post-closure landform), **Figure 29** (CFM for Bottom Dam TSF/rejects landform), **Table 21** and **Appendix C Tables C17 and C23**.

Surface water

Sirius Creek (an ephemeral creek) is located approximately 750 m south of Bottom Dam area. Surface water run-off from the rehabilitated Bottom Dam TSF/rejects landform would be directed south. However – given the significant distance to Sirius Creek – it is highly unlikely that run-off and shallow seepage from the rehabilitated landform could reach Sirius Creek (most likely to infiltrate into the soil or be evaporated along the flow path).

Bottom Dam area will undergo rehabilitation, including the design and installation of a spoil cover to manage the AMD hazard of the tailings and rejects. Therefore, all post-closure run-off from the rehabilitated Bottom Dam landform will be from general spoil (overburden/interburden) material and no tailings or rejects will be exposed to (or at risk of) surface water run-off.

Seepage / Groundwater

As discussed earlier, this assessment has conservatively assumed it is plausible that seepage may occur into discontinuous shallow permeable strata associated with existing creeks or palaeodrainage channels. Whether seepage into shallow permeable strata would continue further downwards into the deeper (primary) aquifer or, instead, report through the shallow permeable strata into nearby surface water features (in this case, Sirius Creek), is somewhat unclear – especially given the distance to Sirius Creek (~750 m). Despite this potential limitation, the overall seepage gradient at BWM is downwards and towards (into) the residual voids. Therefore, it is reasonably assumed that the likelihood of seepage from Bottom Dam TSF/rejects landform reaching a surface water feature via shallow groundwater is 'Highly Unlikely'.

In summary, the SPR has assumed a plausible (although highly unlikely) local seepage pathway may exist between the Bottom Dam TSF/rejects landform via shallow permeable strata into surface water receptors (Sirius Creek).

Receptors

Plausible receptors of surface water run-off and seepage from Bottom Dam TSF/rejects landform are shown in **Figure 24** (Post-closure landform), **Figure 29** (CFM for Bottom Dam TSF/rejects landform), **Table 21** and **Appendix C Tables C17 and C23**.

Surface water

The only plausible surface water receptor identified in this qualitative assessment of Bottom Dam TSF/rejects landform is ephemeral Sirius Creek, located approximately 750 m south of Bottom Dam area. This applies to potential surface water run-off and potential seepage through shallow permeable strata into Sirius Creek.

The significant distance to Sirius Creek from the TSF/rejects landform would likely preclude surface water or shallow seepage (through shallow strata) from having any significant impact on the water quality of Sirius creek. As such, the likelihood of AMD or non-oxidative salinity from the rehabilitated TSF/rejects landform to impact on the water quality of Sirius Creek (via run-off) has been rated highly unlikely.

Seepage / Groundwater

Seepage from Bottom Dam TSF/rejects landform into groundwater will initially report to Kenmare void at the end of mining. After groundwater levels equilibrate (well after post-closure), groundwater will ultimately report to Togara-North Marshmead residual void via Ramp 74 void. The likelihood of AMD and non-oxidative salinity from the rehabilitated (post-closure) TSF/rejects landform to impact on the water quality of Kenmare, Ramp 74 or Togara-North Marshmead residual voids has been rated highly unlikely.

SPR risk rating of Bottom Dam TSF and rejects landform

There is a plausible surface water receptor (Sirius Creek); and the run-off and seepage pathways linking the source (Bottom Dam TSF/rejects final landform) to this receptor have been identified. Groundwater modelling (SLR, 2026) shows that seepage from Bottom Dam area would ultimately report to Togara-

North Marshmead residual void via Ramp 74 void (seepage would likely report to Kenmare residual void via Ramp 74 void prior to long-term post-closure groundwater equilibrium). With respect to AMD, the overall SPR risk rating from the post-closure TSF/rejects final landform is **Low**. With respect to non-oxidative salinity the overall SPR risk from Bottom Dam TSF/rejects final landform is also rated as **Low**.

7.2.8 SPR assessment of Ramp 36 rejects landform

Source materials hazard

Excluding the final cover/cap to be installed over Ramp 36 rejects dump, the rejects landform is currently comprised of approximately 98% rejects, with the remainder being fill material (estimated to be about 2%). Rejects within the dump pose a Moderate-High AMD hazard.

Source materials (essentially all rejects) have moderate EC values and are expected to produce moderately saline run-off and seepage, with release of (non-oxidative) salinity rated as a moderate hazard. Overall, the hazard for AMD generation from the current Ramp 36 rejects landform is 'Moderate-High' and the likelihood for AMD generation from the landform is 'Probable/Likely'. With respect to non-oxidative salinity, the TSF landform has a conservative hazard score of 'Probable/Likely'.

Pathways

Pathways from Ramp 36 rejects landform to plausible surface water and groundwater (residual void) receptors are shown in **Figure 23** (Post-closure landform), **Figure 30** (CFM for Ramp 36 rejects landform), **Table 21** and **Appendix C Tables C18 and C23**.

Surface water

Deep Creek (an ephemeral creek) is located to the north of (and less than 100 m from) Ramp 36 rejects landform and flows from west to east across the site. It is likely that surface water run-off from the rejects landform will reach Deep Creek. The rejects dump will be covered with a spoil cover to manage the AMD source hazard, therefore all post-closure run-off from the rejects landform will likely be from general spoil (overburden/interburden) material and no rejects will be exposed to (or at risk of) surface water run-off.

Shallow / Groundwater

As discussed earlier, this assessment has conservatively assumed it is plausible that seepage may occur into discontinuous shallow permeable strata associated with existing creeks or palaeodrainage channels. Whether seepage into shallow permeable strata would continue further downwards into the deeper (primary) aquifer or, instead, report through the shallow permeable strata into nearby surface water features (in this case, Deep Creek), is somewhat unclear. Despite this potential limitation, the overall seepage gradient at BWM is downwards and towards (into) residual voids – including from areas outside of a pit shell, such as Ramp 36 rejects landform.

Groundwater modelling (SLR, 2026) shows that seepage from Ramp 36 rejects landform would report to Deep Creek residual void. Therefore, it is reasonably assumed that the likelihood of seepage from the final rejects landform reaching a surface water receptor (e.g. Deep Creek) via shallow groundwater is 'Unlikely'.

In summary, the SPR has assumed a plausible (although unlikely) local seepage pathway may exist between Ramp 36 rejects landform via shallow permeable strata into nearby ephemeral surface water receptors (such as Deep Creek).

Receptors

Plausible receptors of surface water run-off and seepage from Ramp 36 rejects landform are shown in **Figure 23** (Post-closure landform), **Figure 30** (CFM for Ramp 36 rejects landform), **Table 21** and **Appendix C Tables C18 and C23**.

Surface water

The only plausible surface water receptor identified in this qualitative assessment of Ramp 36 rejects landform is ephemeral Deep Creek, located less than 100m from the TSF. This applies to potential surface water run-off and potential seepage through shallow permeable strata into the surface water receptor(s).

The rehabilitated rejects landform will have a spoil cover designed to manage the AMD hazard of the landform. The spoil cover has been conservatively assumed to pose a low-moderate AMD source hazard, based on a conservative AMD source hazard applied to general spoil. As such, the likelihood of AMD from the rehabilitated (post-closure) rejects landform to impact on the water quality of the surface water receptor(s) (via run-off or shallow seepage) has been rated unlikely. The likelihood of non-oxidative salinity from the rejects landform to impact on the water quality of the surface water receptor(s) has been rated unlikely.

Seepage / Groundwater

Seepage from Ramp 36 rejects landform into groundwater will ultimately report to Deep Creek residual void. The likelihood of AMD and non-oxidative salinity from the rehabilitated (post-closure) rejects landform to impact on the water quality of Deep Creek residual void has been rated highly unlikely.

SPR risk rating of Ramp 36 rejects landform

There are plausible surface water and residual void receptors; and the run-off and shallow seepage pathways linking the source (Ramp 36 rejects final landform) to these receptors (Deep Creek) have been identified. Groundwater modelling (SLR, 2026) shows that seepage from Ramp 36 rejects landform would report to Deep Creek residual void. With respect to AMD, the overall SPR risk rating from the post-closure rejects final landform is **Low to Medium**. The 'Medium' risk rating applies to AD and SD associated with seepage via shallow permeable strata. With respect to non-oxidative salinity the overall SPR risk from the post-closure rejects final landform is also rated as **Low**.

7.2.9 SPR assessment of residual voids

Source materials hazard

The surfaces of residual void walls are comprised of approximately 88% to 95% non-carbonaceous overburden/ interburden, less than 1% to 6% carbonaceous overburden/interburden (incl. sub-economic seams reporting to waste) and about 2% to 7% coal (seams). The proportion of weathered material in the current (and proposed future) pit/void walls varies throughout the site, ranging from approximately 17% to 25% in the northern pits/voids and approximately 11% to 79% in the southern pits/voids. Fresh and weathered non-carbonaceous overburden/interburden material in the Bowen Basin is widely recognised as posing a low AMD risk. Coal seams at BWM pose a low-moderate AMD risk.

Overall, the hazard for AMD generation from residual void walls is 'Low' and the likelihood for AMD generation from residual void walls is 'Unlikely'. The expression of AMD (if at all) from some highwall and end-wall material is likely to be localised.

Generally, void wall materials have low EC values, with release of (non-oxidative) salinity rated as a low hazard.

The floor of Bonnie Doon and Ramp 74 pits (voids) is tailings, of which approximately 46% (for Bonnie Doon) and 72% (for Ramp 74) is conservatively estimated to be PAF. These two in-pit TSFs (tailings voids) pose a moderate to moderate-high AMD hazard – which does not take into account likely AMD-mitigating factors, such as tailings flooding or the tailings being covered/capped with a suitable spoil and/or water cover. Assuming the tailings would be submerged/covered/capped as proposed, the void floor (tailings) would be expected to pose a low AMD hazard.

The floor of all other voids is comprised of P and L (Lower) seam and is conservatively estimated to comprise less than 5% PAF coal – assuming 100% of the floor is coal and not some other material. In reality, all or most of the coal will be mined out and the void floor would not be expected to be dominated by coal. The void floors, as conservatively described, pose a low-moderate AMD hazard – which does not take into account likely AMD-mitigating factors, such as void floor flooding. Assuming the void floors would be submerged (flooded) as predicted by groundwater modelling, the void floor would be expected to pose a low AMD hazard.

Pathways

Surface water

There are no plausible pathways between the residual voids and surface water. For each void, surface water run-off from the void walls will report to the void.

Seepage / Groundwater

The residual voids will act as groundwater sinks and the water table will intersect the deeper zones of the residual voids, resulting in the formation of a relatively small void lake in each void (SLR, 2026) that will submerge the void floor and lower section of the void walls. At Bonnie Doon and Ramp 74 voids (TSFs), the post-closure water table will intersect and submerge most of the tailings. These in-pit tailings will be capped/covered to manage the AMD source hazard. For each void, seepage from the spoil landform and run-off from the void walls will report to the residual void.

Receptors

Modelling undertaken by SLR (2026) shows the residual voids to be 'sinks' – receiving surface water run-off and seepage from spoil landforms and surface water run-off from void walls. Each residual void is expected to receive inflow from the Permian groundwater aquifer. The water quality of the void and potential impact of water seeping, if any, from the residual voids into the Permian groundwater aquifer is discussed in the void closure plan – refer to the main volume of the PRCP.

Excluding Bonnie Doon and Ramp 74 voids (TSFs), the 'coal' floor of all other residual voids will be covered post-closure by water as rainfall and groundwater reporting to the void will form a void lake. As such, PAF coal will no longer be exposed to atmospheric conditions and the risk of AMD being generated is greatly reduced.

Bonnie Doon and Ramp 74 voids contain tailings; and modelling shows the tailings will eventually be fully or partially covered post-closure by water as rainfall and groundwater report to the void. During rehabilitation, the tailings will be capped/covered such that tailings will no longer be exposed to atmospheric conditions and the risk of AMD being generated from tailings is greatly reduced – particularly during the early years post-closure as water levels in these two voids recover.

The likelihood of undiluted salinity or AMD from a flooded post-closure residual void floor (or covered/capped/flooded tailings floor) to impact on residual void water quality to any significant degree has been rated unlikely.

SPR risk rating of residual voids

The final receptor for seepage from the spoil landform (for each spoil landform) and run-off from the highwall / end-walls (of each void) is the void lake / residual void. The AMD assessment has found that it's unlikely that undiluted salinity or AMD from a flooded post-closure residual void floor (including capped/covered/flooded tailings floor) would impact on residual void water quality to any significant degree, as other processes such as evapo-concentration are the key drivers of void lake water quality. Therefore, the AMD SPR risk rating on the overall water quality of the residual voids is **Low to Low-Medium** [**Appendix C Table C24**]. A "Low to Medium" risk rating has been conservatively applied to the risk of AD and/or NMD/SD due to the AMD risk associated with tailings within Bonnie Doon and Ramp 74 voids.

Water reporting to residual voids is expected to remain within the residual voids (excluding evaporative loss). Modelling undertaken by SLR (2026) shows that seepage from the void lake (of each void) into groundwater, if any, would be limited.

8 Management and Rehabilitation Measures

The assessment has found that the environmental risks posed by spoil landforms likely to be present at closure are generally low. As such – for most spoil landforms – no specific AMD management measures (e.g. alkaline amendment or engineered capping systems) are expected to be required to manage mineral wastes during rehabilitation and closure – outside of operational mixing/burial of PAF waste amongst NAF waste, spoil placement and landform reshaping activities already proposed (refer below and to the main volume of the PRCP).

The AMD source hazard associated with Ramp 72 tailings and Kenmare pit rejects buried within Kenmare landform is moderate-high to high and, as such, rehabilitation of tailings and rejects within Kenmare ramp/pit will require specific AMD management measures during future mining and rehabilitation to manage the AMD hazard of these materials. Once rehabilitated, the post-closure environmental risk posed by Kenmare spoil landform is expected to decrease.

The landform domain AMD hazard posed by NCPP TSF, Laleham TSF and Bottom Dam TSF is moderate-high; and for Ramp 36 Rejects dump is also moderate-high. These stand-alone landforms will require specific AMD management measures to manage these facilities post-closure.

The AMD hazard posed by tailings in Bonnie Doon in-pit TSF is moderate-high and for Ramp 74 in-pit TSF is moderate. As such, in-pit tailings will also require specific AMD management measures to manage these voids post-closure.

Decommissioning and rehabilitation activities related to mineral waste will be addressed as part of the milestone criteria for infrastructure, remediation of contaminated land, landform design, surface preparation and revegetation, where necessary.

Proposed mineral waste management and rehabilitation activities of relevance to this waste characterisation report comprise the following actions. Refer to the main volume of the PRCP and Henderson Geotech (2024) for detailed information.

- Pits: most will remain as residual voids under 15 groups:
    - Ramp 8 void
    - Bonnie Doon void (in-pit TSF)
    - Mimosa-Besgrove void
    - Ramp 30S void
    - Deep Creek void
    - Stewarton North void
    - Stewarton South void
    - Tannyfoil void
    - South Ballamoo void
    - Kenmare void (in-pit TSF)
    - Ramp 74 [Laleham] void (in-pit TSF)
    - Togara-North Marshmead void
    - South Marshmead void
    - Kennedy void
    - Comet Downs East void
- Spoil dumps: will be reshaped into 14 final spoil landforms – mostly related to their respective voids listed. Stewarton pit will be mined into two voids (Stewarton North and Stewarton South). Blackdown pit will be backfilled, leaving Blackdown spoil landform without an associated residual void. Spoil from Ramp 30S pit will form part of Mimosa-Besgrove spoil landform. After reshaping, all spoil dumps will be seeded.
- Bonnie Doon in-pit TSF will be covered by a spoil and water cover (hybrid cover). The optimal design and thickness of cover to manage the AMD hazard of Bonnie Doon in-pit TSF (tailings) will be determined following further assessment prior to covering.

- Ramp 74 in-pit TSF will be covered by a spoil and water cover (hybrid cover). The optimal design and thickness of cover to manage the AMD hazard of Ramp 74 in-pit TSF (tailings) will be determined following further assessment prior to covering.
- NCPP TSF (out-of-pit; above ground; stand-alone) will be covered by an engineered spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of the out-of-pit NCPP TSF will be determined following further assessment prior to covering.
- Laleham TSF (in-pit; above ground; stand-alone) will be covered by spoil. The optimal design and thickness of spoil cover to manage the AMD hazard of the TSF will be determined following further assessment prior to covering.
- Ramp 72 in-pit TSF will be covered by spoil within Kenmare spoil landform. The optimal design and thickness of spoil cover to manage the AMD hazard of the in-pit TSF will be determined following further assessment prior to covering.
- Bottom Dam TSF/rejects (out-of-pit; above ground; stand-alone). Rejects currently on ROM 3 will be relocated onto Bottom Dam TSF forming a rejects cap, which will then be covered by a spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of Bottom Dam TSF/rejects area will be determined following further assessment prior to covering.
- Kenmare in-pit rejects will be covered by spoil within Kenmare spoil landform. The optimal design and thickness of spoil cover to manage the AMD hazard of these in-pit rejects will be determined following further assessment prior to covering.
- Ramp 36 rejects (above ground; stand-alone) will be covered by a spoil cover. The optimal design and thickness of spoil cover to manage the AMD hazard of the rejects dump will be determined following further assessment prior to covering.
- All other rejects (in-spoil disposal): Managed during operations (disposed within spoil) and progressively covered by spoil. No additional remediation for the rejects (at closure) is required. The optimal thickness of spoil cover to manage the AMD hazard of rejects will be determined following further assessment prior to covering.
- ROM pads: Remove remnant coal from ROM pads and dispose within spoil. All former ROM pads will be reshaped, covered with soil, ripped and seeded.
- Coal stockpiles: Remove remnant coal from coal stockpile pads and dispose within spoil. Cover with suitable soil material, rip and seed.

9 Forward Work Program

The environmental geochemical characterisation and assessment of mineral waste samples outlined in this report is representative of the mineral waste materials likely to require rehabilitation at closure. However, BWM will continue to undertake sampling of likely mineral waste materials (and subsequent characterisation and assessment of those samples) during operations and into decommissioning – to validate the findings of the current assessment, ensure the risks continue to be understood and the management measures proposed are commensurate with the risks. Where required, management measures will be revised and implemented.

Further work may also be required prior to closure to better understand the relationship between shallow and deeper groundwater at BWM and between shallow groundwater and surface water systems at BWM.

10 References

AMIRA (2002). *ARD Test Handbook – AMIRA Project P387A: Prediction & Kinetic Control of Acid Mine Drainage*. EGi and Ian Wark Research Institute.

ANZG (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT. Available at: http://www.waterquality.gov.au/anz-guidelines.

Bowen, H.J.M. (1979). *Environmental Geochemistry of the Elements*. Academic Press, New York.

DESI (2024) [Department of Environment, Science and Innovation] (Queensland). Statutory guideline, Progressive rehabilitation and closure plans (PRC plans), ERS/2019/4964 – Version 3.01. Last reviewed 16 September 2024.

DIIS (2016) [Department of Industry, Innovation and Science] (Commonwealth). Leading Practice Sustainable Development Program for the Mining Industry. Preventing Acid and Metalliferous Drainage. September 2016, Canberra ACT.

DME (1995) [Department of Minerals and Energy] (Queensland). *Draft Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Technical Guideline – Assessment and Management of Acid Drainage*. Part B – Section 13 – Assessment and Management of Saline/Sodic Wastes. January 1995.

Ficklin, W.H., Plumlee, G.S., Smith, K.S., and McHugh, J.B. (1992). Geochemical classification of mine drainages and natural drainages in mineralized areas: Proceedings, 7th Internal Water-Rock Interaction Conference, Park City, Utah, 1992, pp. 381–384.

Henderson Geotech (2024). Concept Cover Designs for Waste Storage Facilities at Blackwater Mine. Report prepared for Whitehaven Coal Limited, August 2024.

INAP (2009) [International Network on Acid Prevention]. Global Acid Rock Drainage Guide (GARD Guide). Available at: http://www.gardguide.com.

Isbell, R.F. (2002). *The Australian Soil Classification* (revised edition). CSIRO Publishing. Victoria.

HMRC, NRMMC (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

Northcote, K.H. and Skene, J.K.M. (1972). *Australian Soils with Saline and Sodic Properties*. CSIRO Australia, Soil Publication No. 27, Canberra.

SLR (2026) [SLR Consulting Australia]. Blackwater Mine - Transitional PRC Plan Hydrogeology Assessment – Revision 3. Prepared for Whitehaven Blackwater Pty Ltd. Report 620.040199.00017_R03_V2.0, May 2026.

Standards Australia (2017). *Methods of testing soils for engineering purposes - Soil classification tests - Determination of Emerson class number of a soil*. AS1289.3.8.1-2017. Standards Australia, 26 April 2017.

Appendix A – Geological Sections

Pit and void long-sections

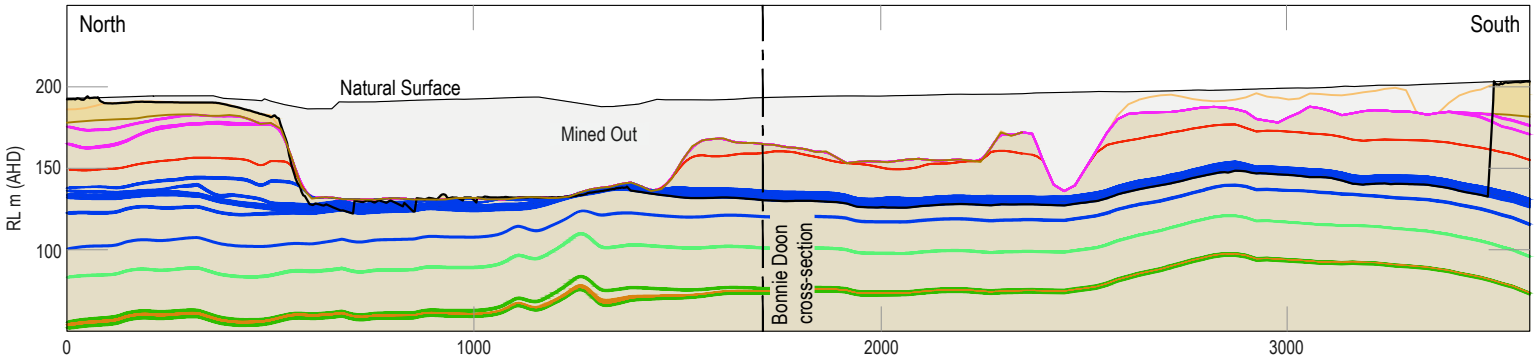
- Figure A1 Bonnie Doon, Mimosa and Sagittarius pits
- Figure A2 Burngrove, Airstrip and Besgrove North pits
- Figure A3 Ramp 30S, Deep Creek and Stewarton North pits
- Figure A4 Tannyfoil, Wilpeena and Blackdown pits
- Figure A5 Ballamoo North / Terang, Ramp 74 and Togara pits; and Kenmare highwall
- Figure A6 Marshmead pit and Togara-North Marshmead void
- Figure A7 South Marshmead, Kennedy and Comet Downs East voids

Pit and void cross-sections

- Figure A8 Bonnie Doon, Mimosa and Sagittarius pits
- Figure A9 Burngrove, Airstrip and Besgrove North pits
- Figure A10 Deep Creek pit at Ramp 34 and Ramp 38, and Stewarton North pit
- Figure A11 Tannyfoil, Wilpeena and Blackdown pits
- Figure A12 Ballamoo North, Terang pit and Kenmare pit
- Figure A13 Ramp 74 pit, Togara-North Marshmead pit/void and Marshmead pit
- Figure A14 Proposed pits: South Marshmead, Kennedy and Comet Downs East

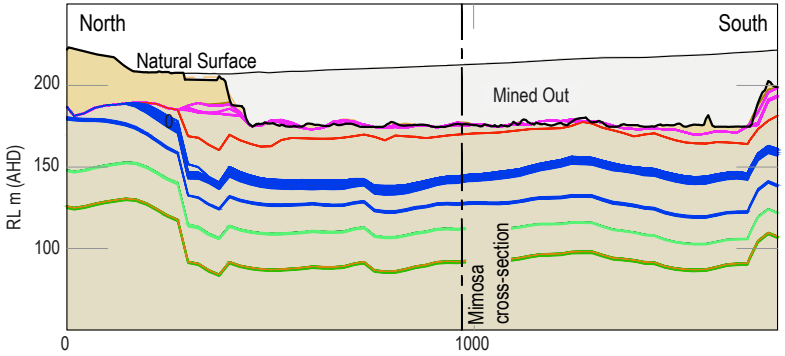
LONG-SECTION | Bonnie Doon Pit

Viewed Looking East (Vertical Exaggeration x4.0)



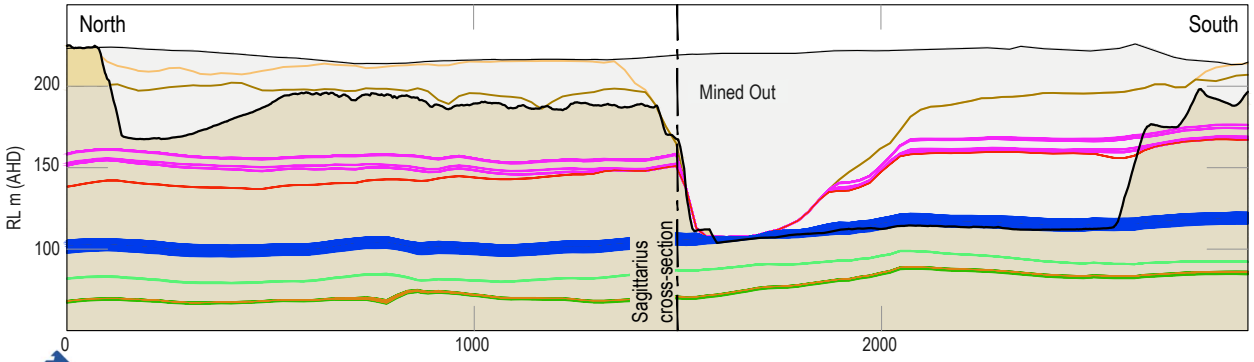
LONG-SECTION | Mimosa Pit

Viewed Looking East (Vertical Exaggeration x4.0)



LONG-SECTION | Sagittarius Pit

Viewed Looking East (Vertical Exaggeration x4.0)



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Vertical Scale

0 100m

Horizontal Scale

0 400m

(V/H = 4:1)

WHITEHAVEN

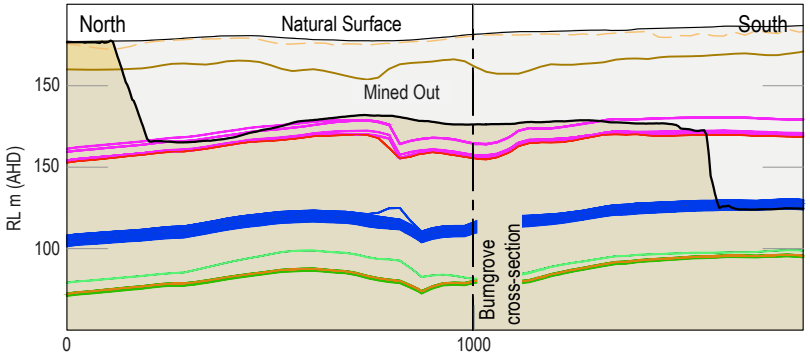
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Pit highwall long-sections

Figure **A1**

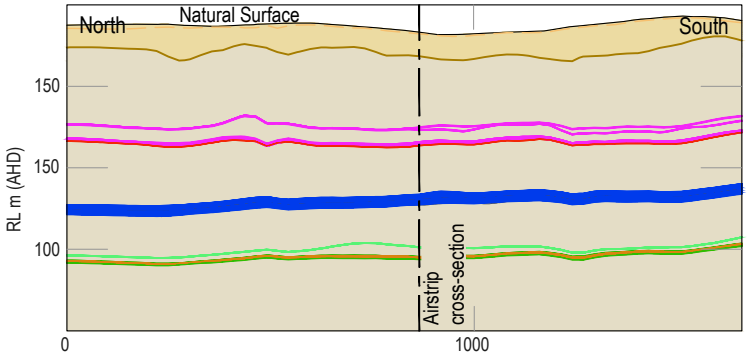
LONG-SECTION | Burngrove Pit

Viewed Looking East (Vertical Exaggeration x4.0)



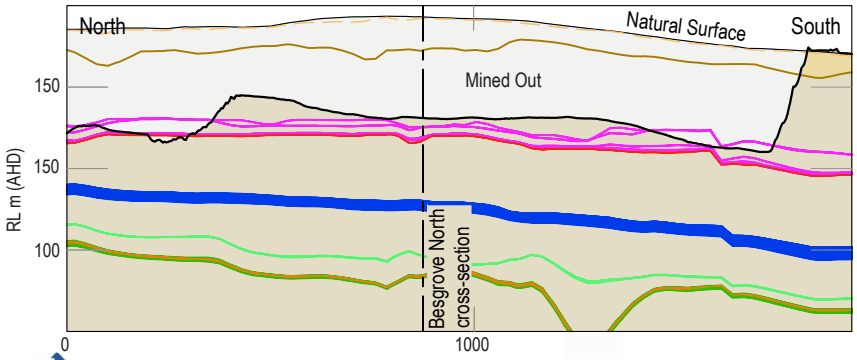
LONG-SECTION | Airstrip Pit

Viewed Looking East (Vertical Exaggeration x4.0)



LONG-SECTION | Besgrove North Pit

Viewed Looking East (Vertical Exaggeration x4.0)



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Vertical Scale

0 — 100m

Horizontal Scale

0 — 400m

(V/H = 4:1)

WHITEHAVEN

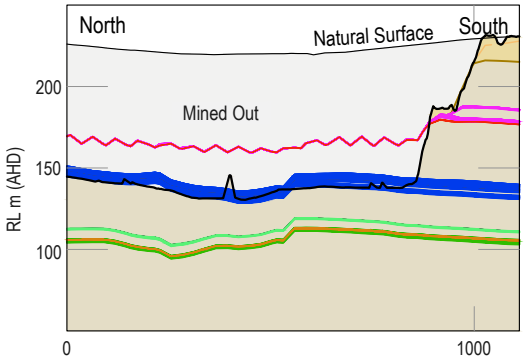
Minserve CAD File: Bhpb008m07.dwg

Pit highwall long-sections

Figure **A2**

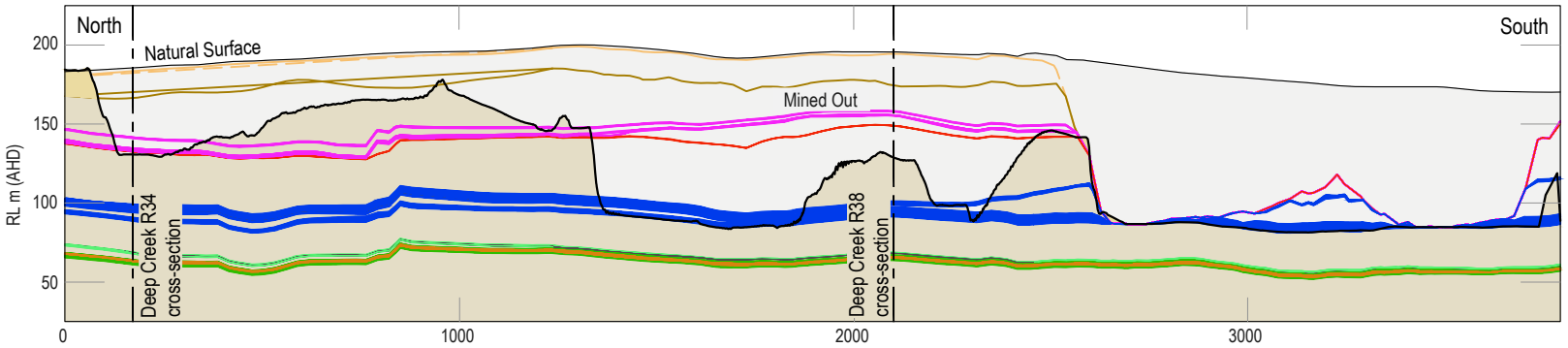
LONG-SECTION | Ramp 30S Pit

Viewed Looking East (Vertical Exaggeration x4.0)



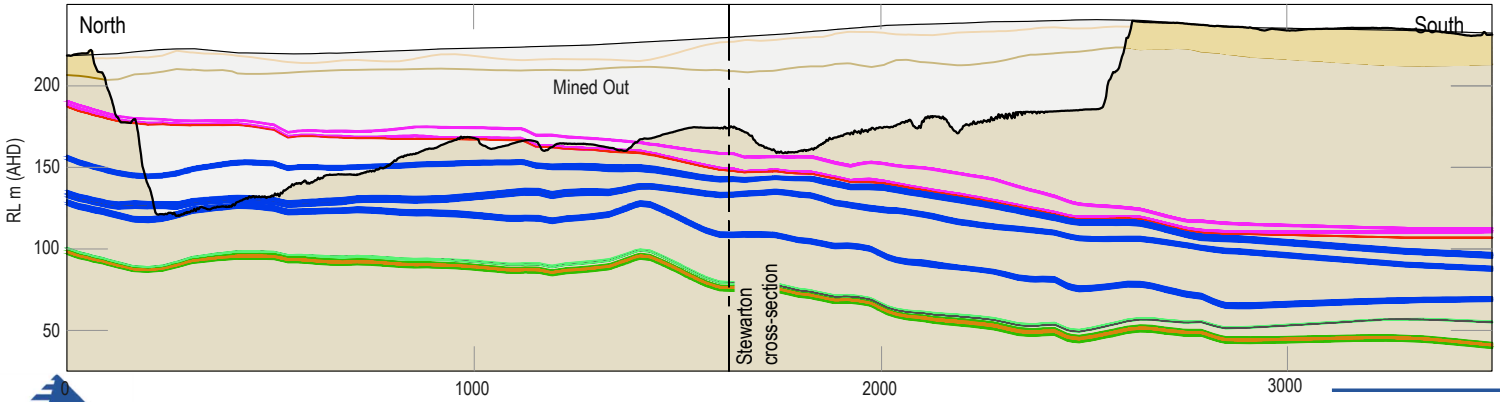
LONG-SECTION | Deep Creek Pit

Viewed Looking North East (Vertical Exaggeration x4.0)



LONG-SECTION | Stewarton Pit

Viewed Looking North East (Vertical Exaggeration x4.0)



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Vertical Scale

0 — 100m

Horizontal Scale

0 — 400m

(V/H = 4:1)

WHITEHAVEN

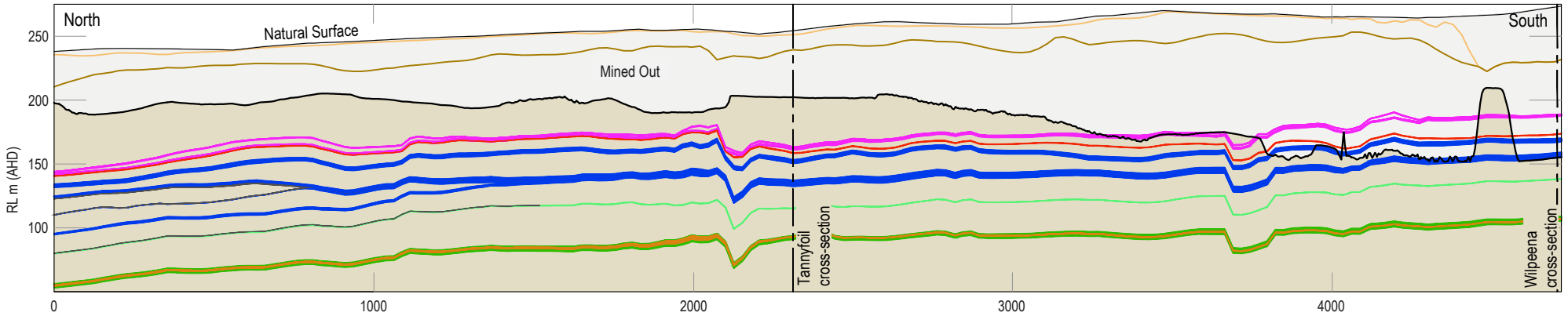
Minserve CAD File: Bhpb008m07.dwg

Pit highwall long-sections

Figure **A3**

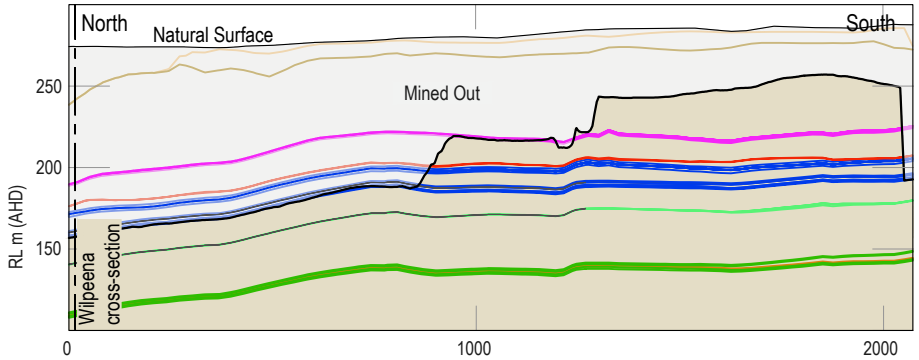
LONG-SECTION | Tannyfoil Pit

Viewed Looking East (Vertical Exaggeration x4.0)



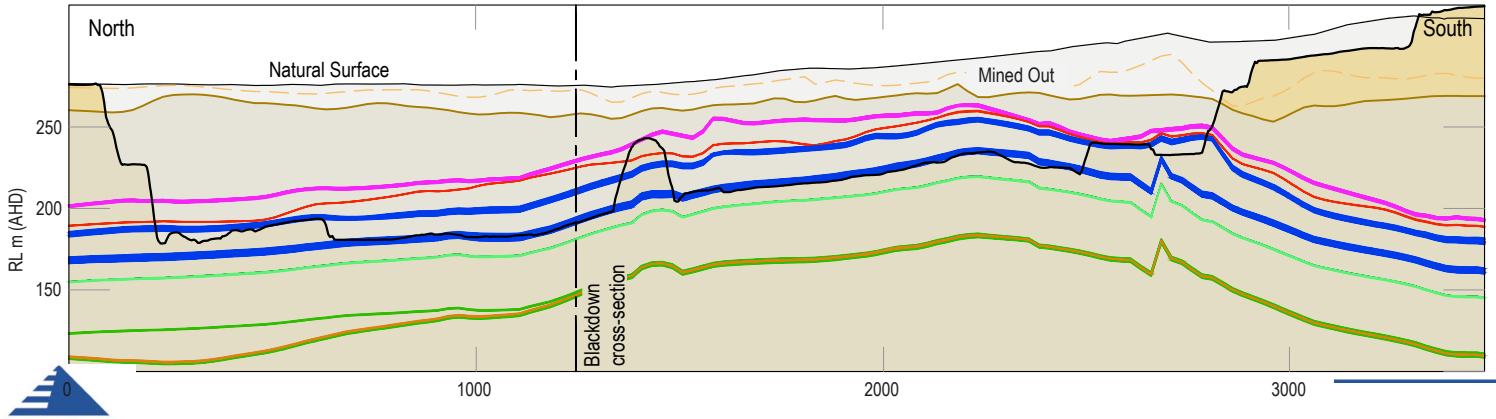
LONG-SECTION | Wilpeena Pit

Viewed Looking East (Vertical Exaggeration x4.0)



LONG-SECTION | Blackdown Pit

Viewed Looking East (Vertical Exaggeration x4.0)



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Vertical Scale

0 — 100m

Horizontal Scale

0 — 400m

(V/H = 4:1)

WHITEHAVEN

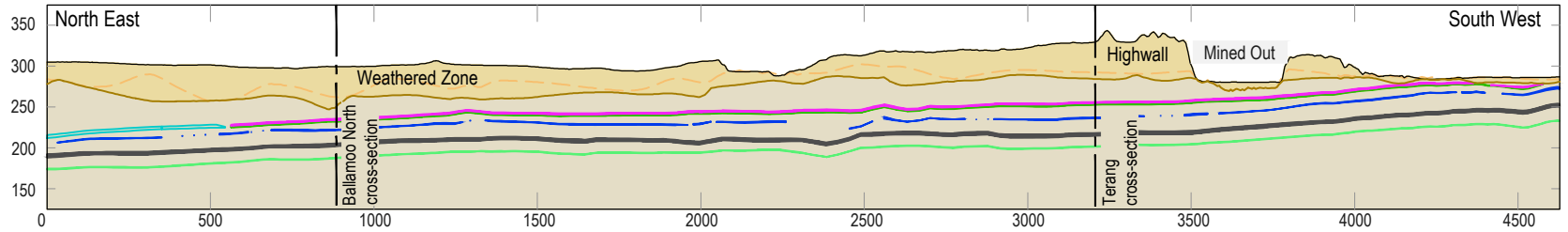
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Pit highwall long-sections

Figure **A4**

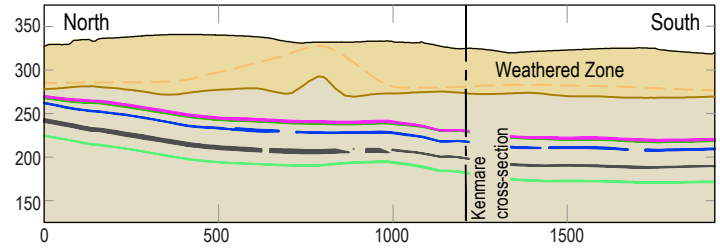
LONG-SECTION | Ballamoo North and Terang (Ballamoo South) Pit

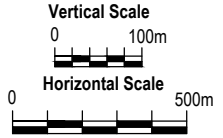
Viewed Looking South-East (Vertical Exaggeration x2.5)

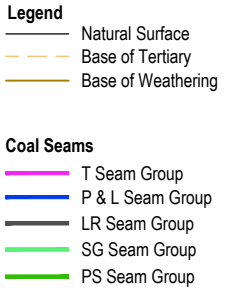


LONG-SECTION | Kenmare void

Viewed Looking East (Vertical Exaggeration x2.5)

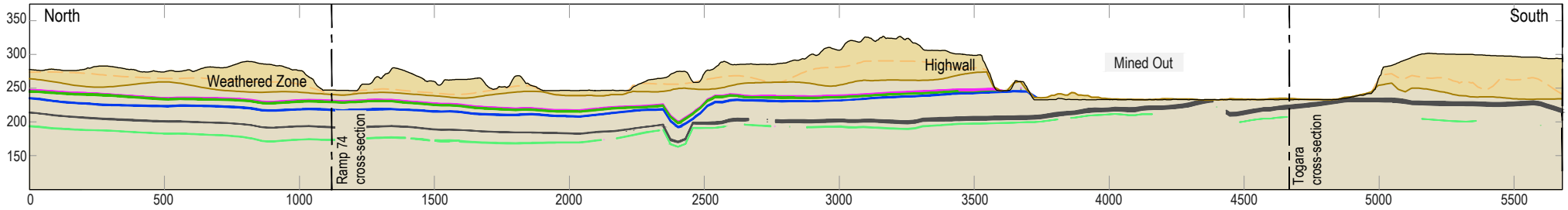






LONG-SECTION | Ramp 74 (Laleham) -Togara Pit

Viewed Looking East (Vertical Exaggeration x2.5)



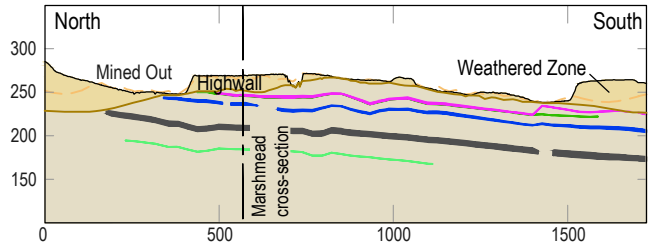
WHITEHAVEN

Minserve CAD File: Bhpb008m11 Blackwater - South.dwg

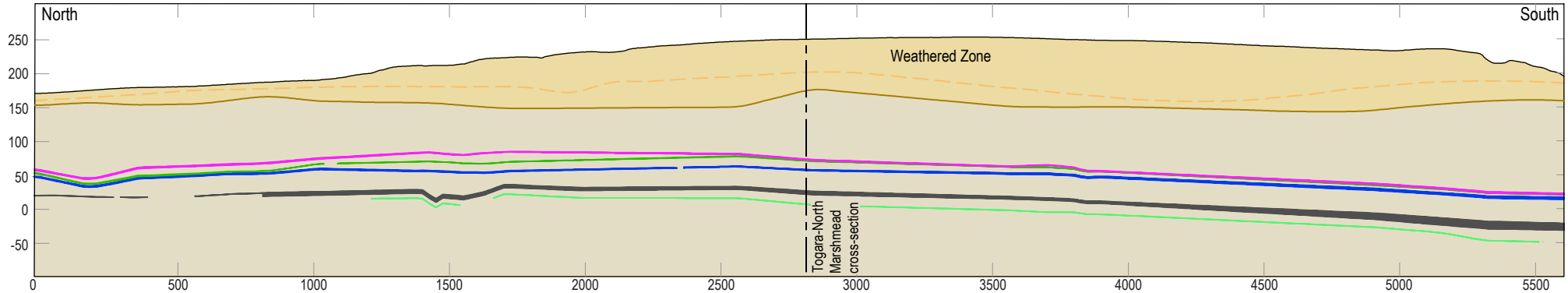
Pit highwall long-sections

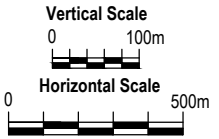
Figure **A5**

LONG-SECTION | Marshmead Pit
Viewed Looking North-East (Vertical Exaggeration x2.5)



LONG-SECTION | Togara-North Marshmead void
Viewed Looking East (Vertical Exaggeration x2.5)





Legend
- Natural Surface
- Base of Tertiary
- Base of Weathering

Coal Seams
- T Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- PS Seam Group

WHITEHAVEN

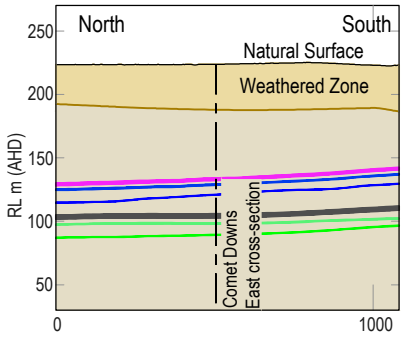
Minserve CAD File: Bhpb008m11 Blackwater - South.dwg

Pit highwall long-sections

Figure **A6**

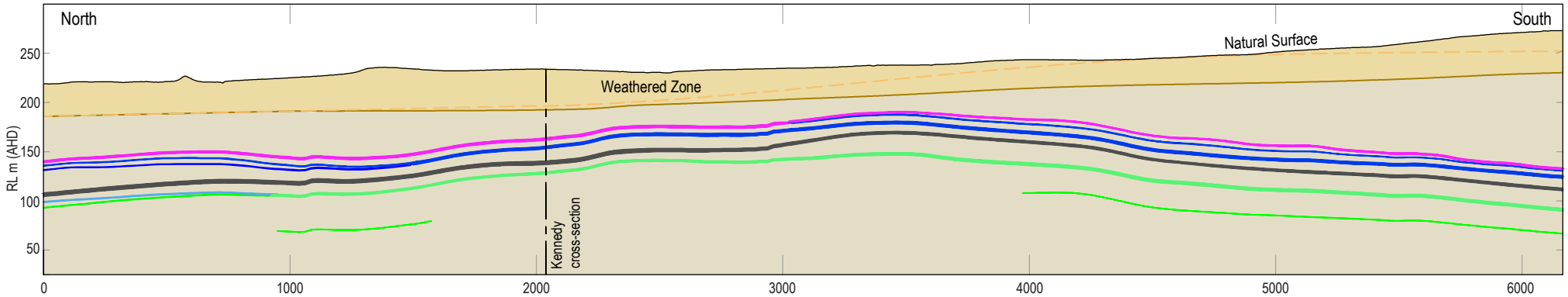
LONG-SECTION | Comet Downs East void

Viewed Looking East (Vertical Exaggeration x4.0)



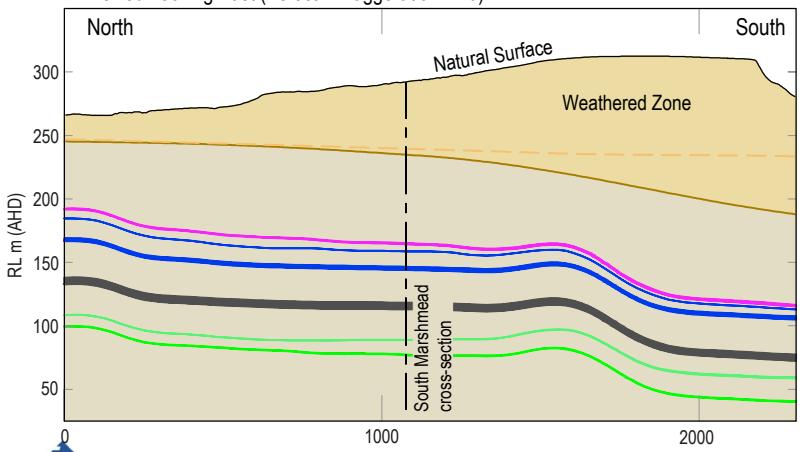
LONG-SECTION | Kennedy void

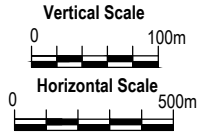
Viewed Looking East (Vertical Exaggeration x4.0)



LONG-SECTION | South Marshmead void

Viewed Looking East (Vertical Exaggeration x4.0)





Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering

Coal Seams

- T Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- PS Seam Group

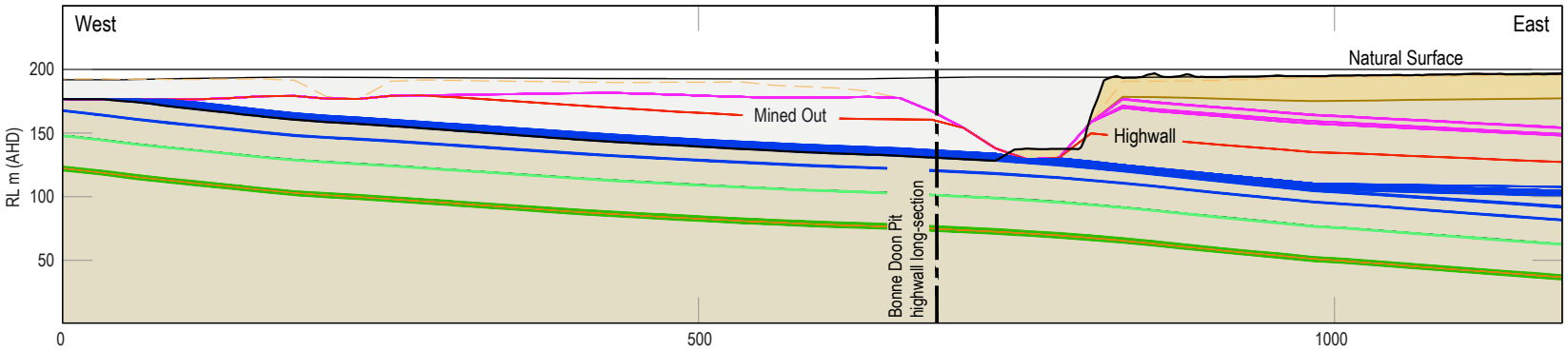
WHITEHAVEN

Minserve CAD File: Bhpb008m12-MDL Areas.dwg

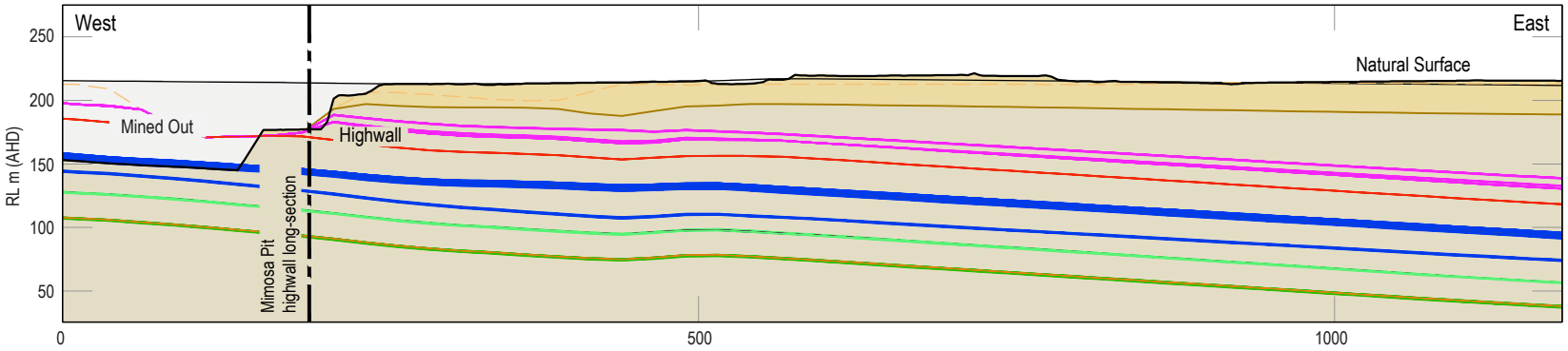
Void highwall long-sections

Figure **A7**

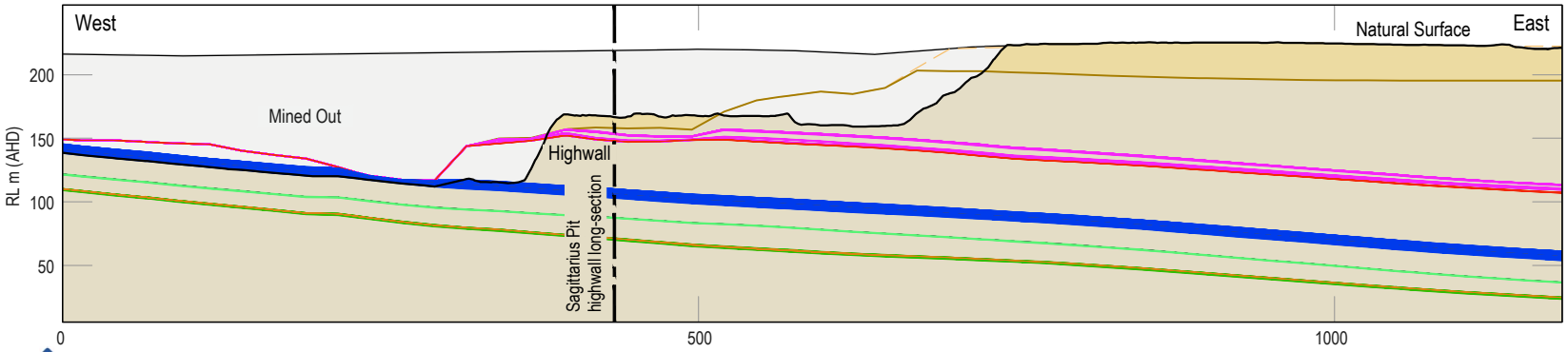
CROSS-SECTION | Bonnie Doon Pit
Viewed Looking North



CROSS-SECTION | Mimosa Pit
Viewed Looking North



CROSS-SECTION | Sagittarius Pit
Viewed Looking North



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Horizontal Scale
(V/H = 1)

0 100 200m

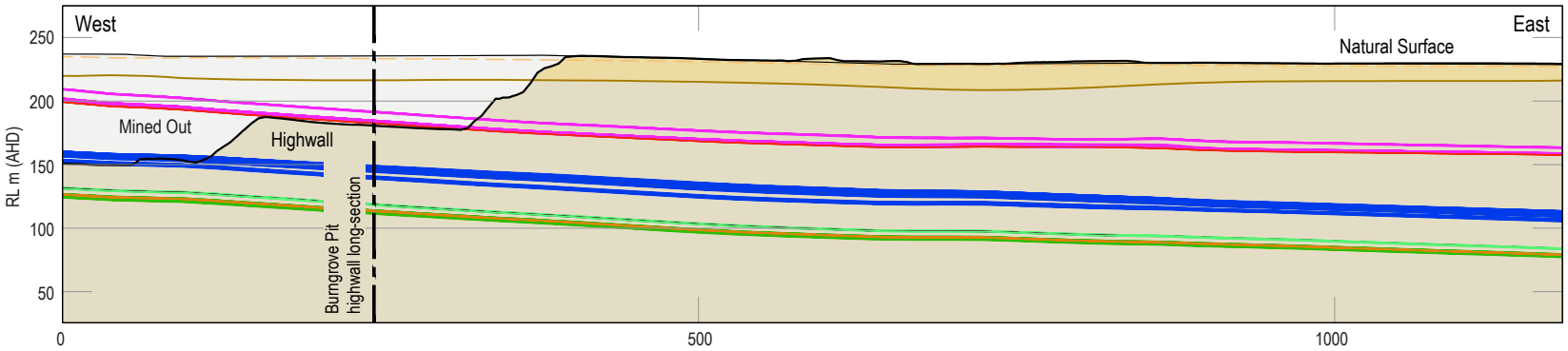
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Minserve CAD File: Bhpb008m07.dwg

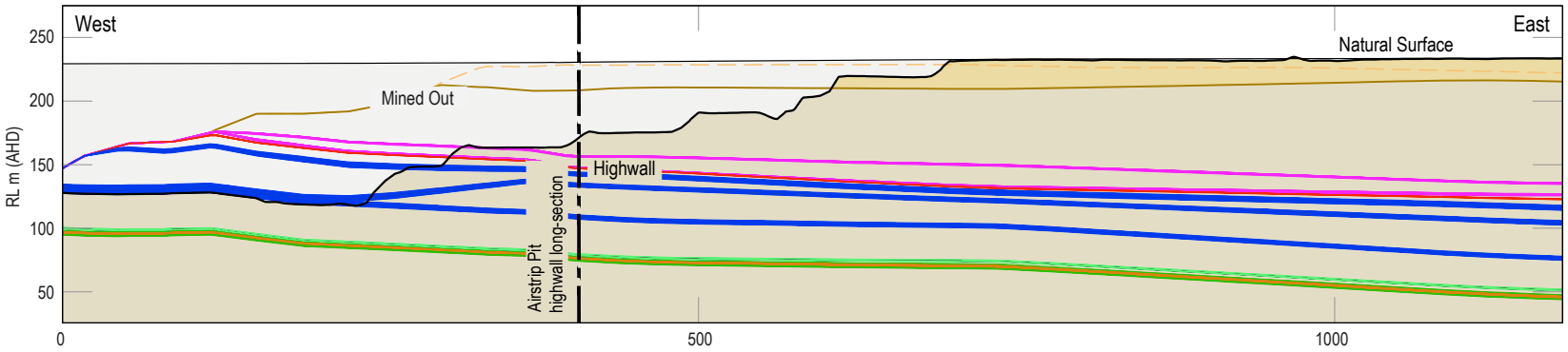
Pit cross-sections

Figure **A8**

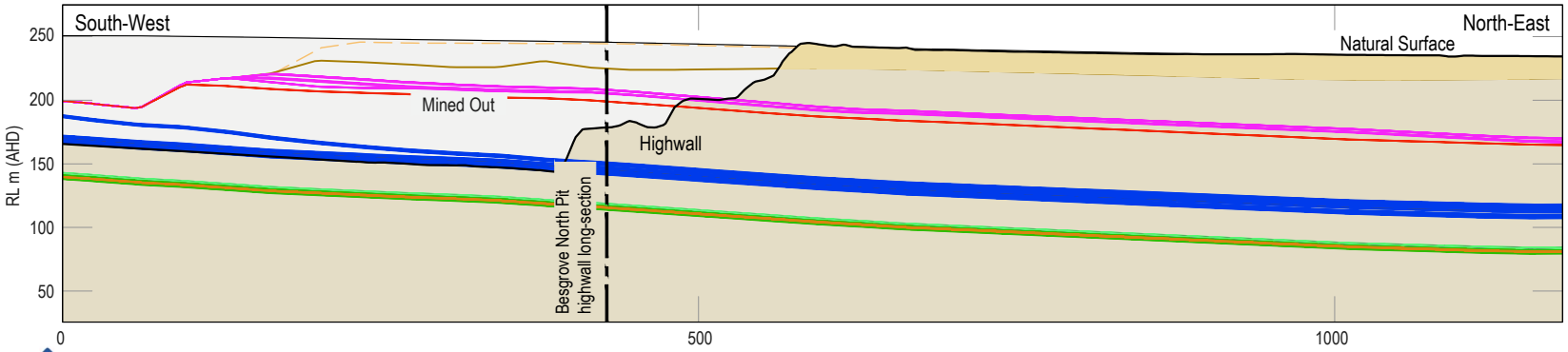
CROSS-SECTION | Burngrove Pit
Viewed Looking North



CROSS-SECTION | Airstrip Pit
Viewed Looking North



CROSS-SECTION | Besgrove North Pit
Viewed Looking North West



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Horizontal Scale
(V/H = 1)

0 100 200m

WHITEHAVEN

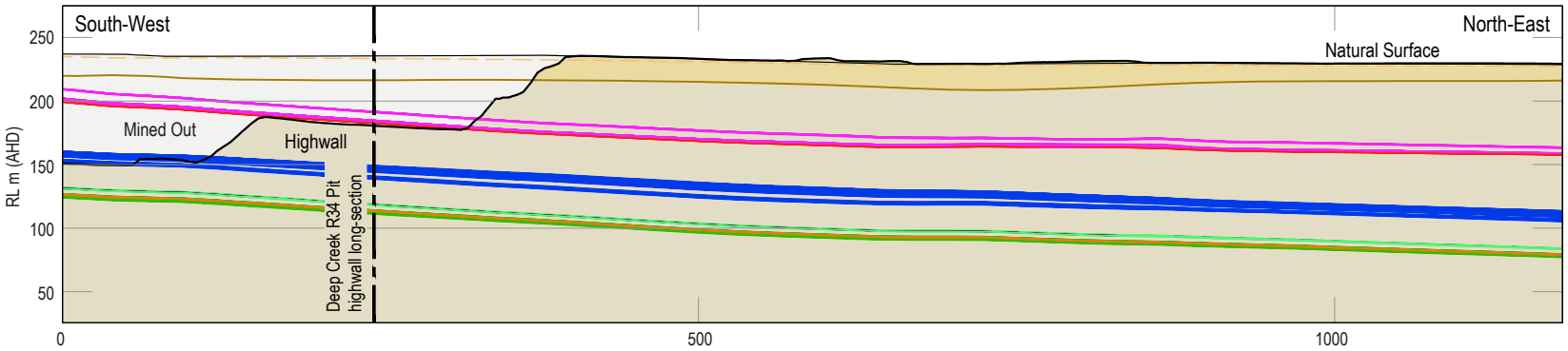
Minserve CAD File: Bhpb008m07.dwg

Pit cross-sections

Figure **A9**

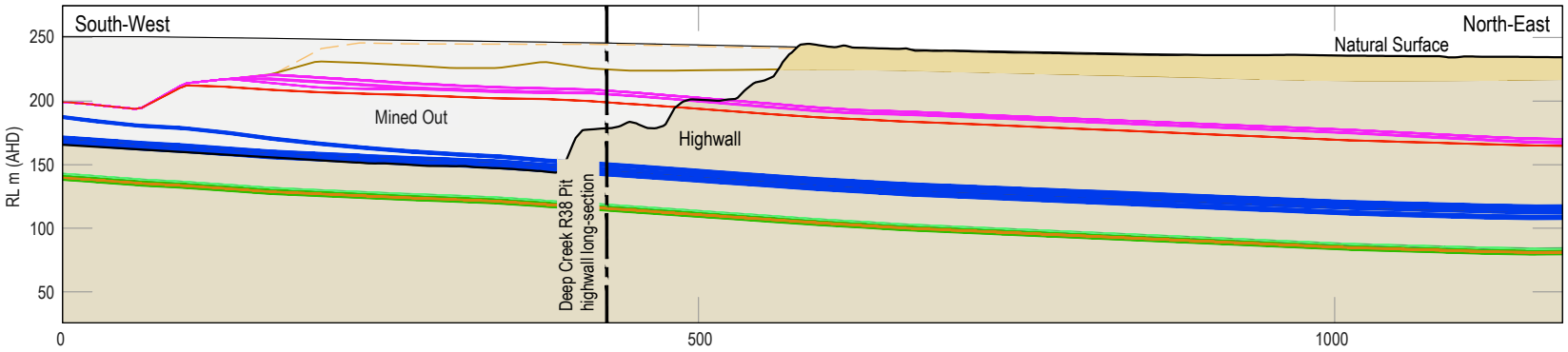
CROSS-SECTION | Deep Creek R34 Pit

Viewed Looking North



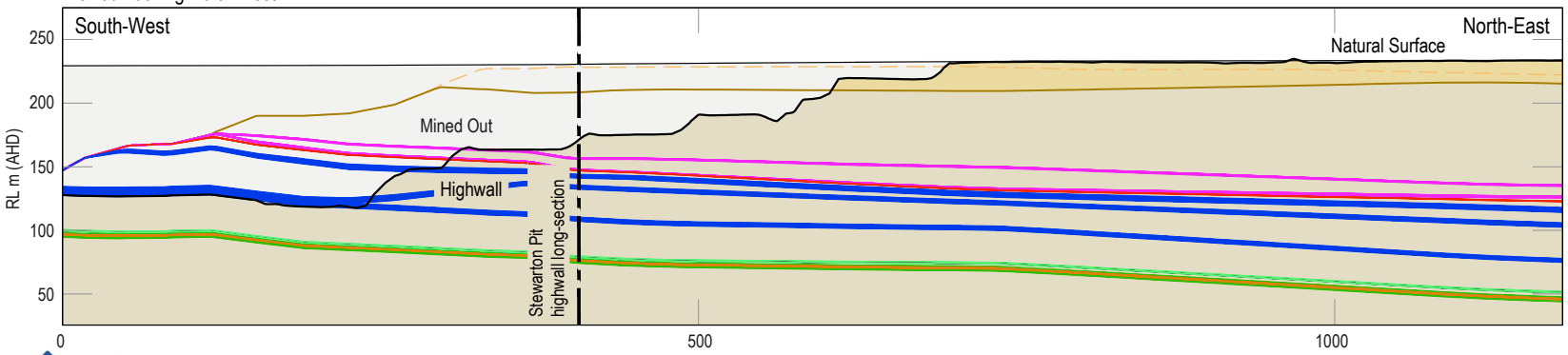
CROSS-SECTION | Deep Creek R38 Pit

Viewed Looking North



CROSS-SECTION | Stewarton North Pit

Viewed Looking North West



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Horizontal Scale

(V/H = 1)

0 100 200m

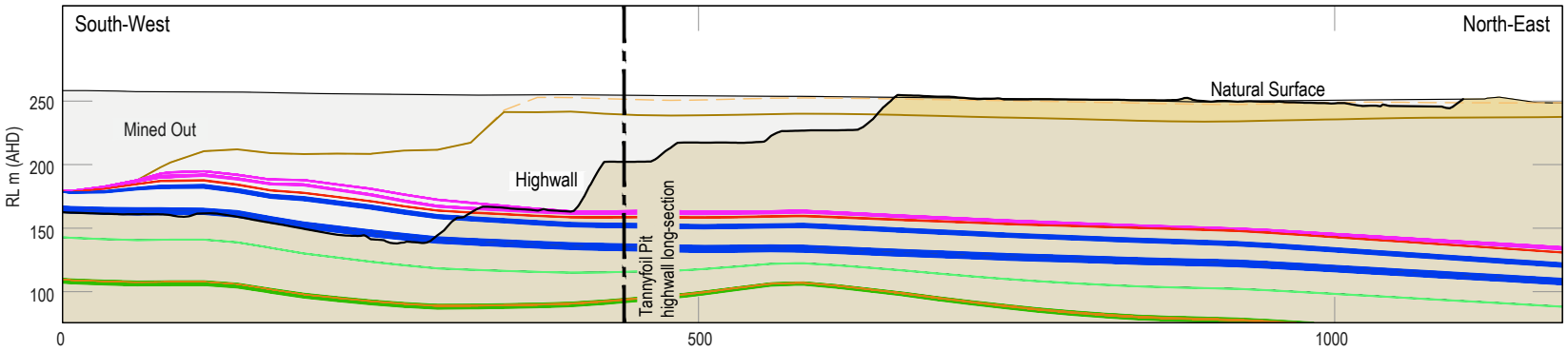
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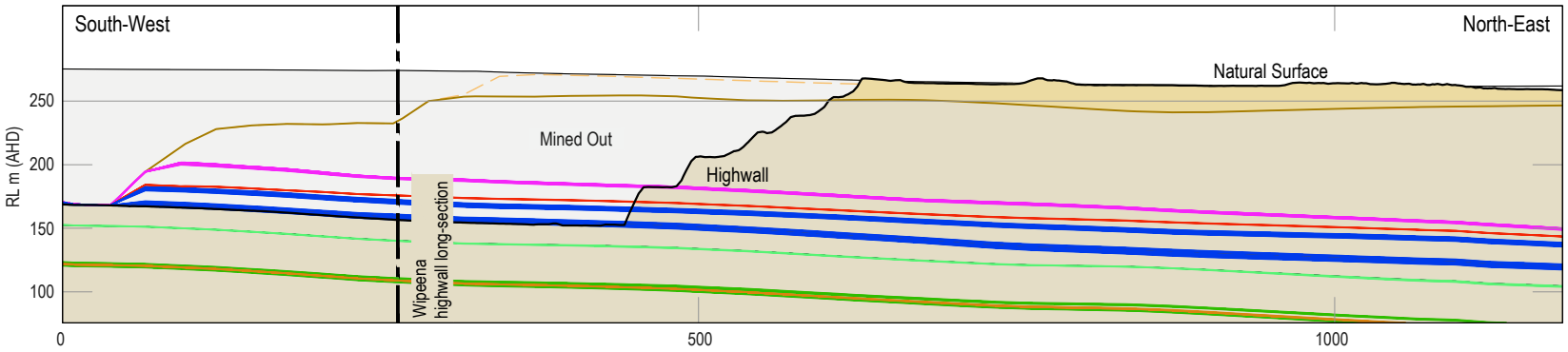
Pit cross-sections

Figure **A10**

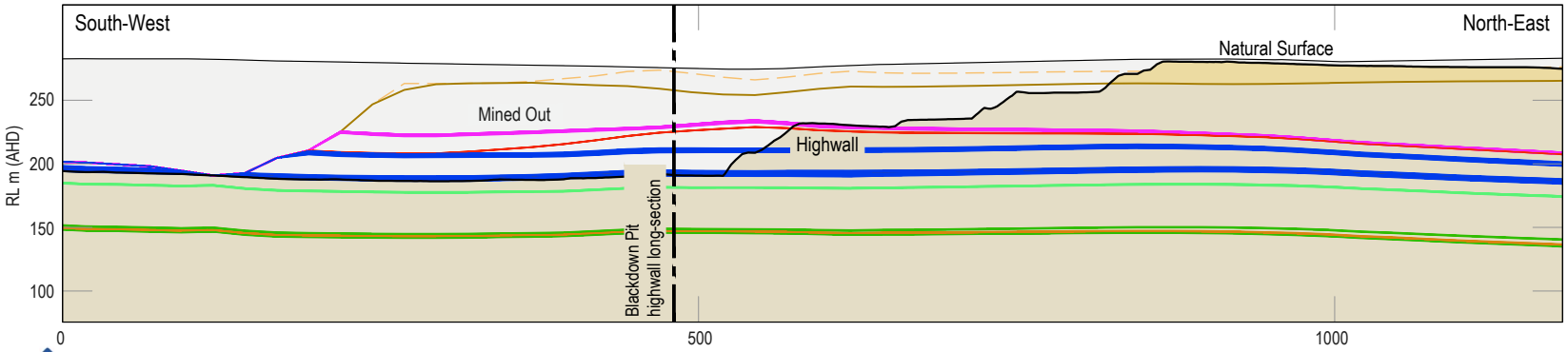
CROSS-SECTION | Tannyfoil Pit
Viewed Looking North



CROSS-SECTION | Wilpeena Pit
Viewed Looking North



CROSS-SECTION | Blackdown Pit
Viewed Looking North West



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering
- Current Pit Shell

Coal Seams

- T Seam Group
- MR Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- Yarabee Tuff
- PS Seam Group

Horizontal Scale
(V/H = 1)

0 100 200m

WHITEHAVEN

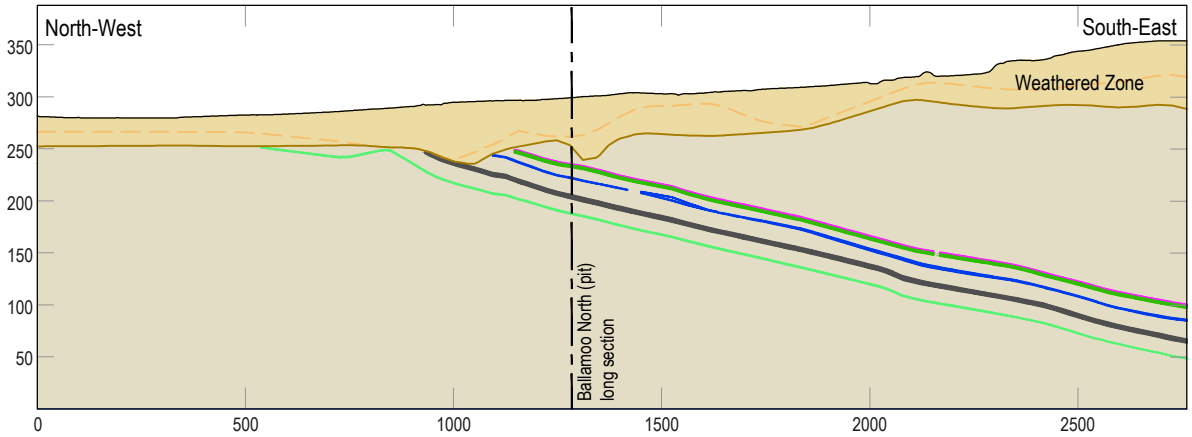
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Pit cross-sections

Figure **A11**

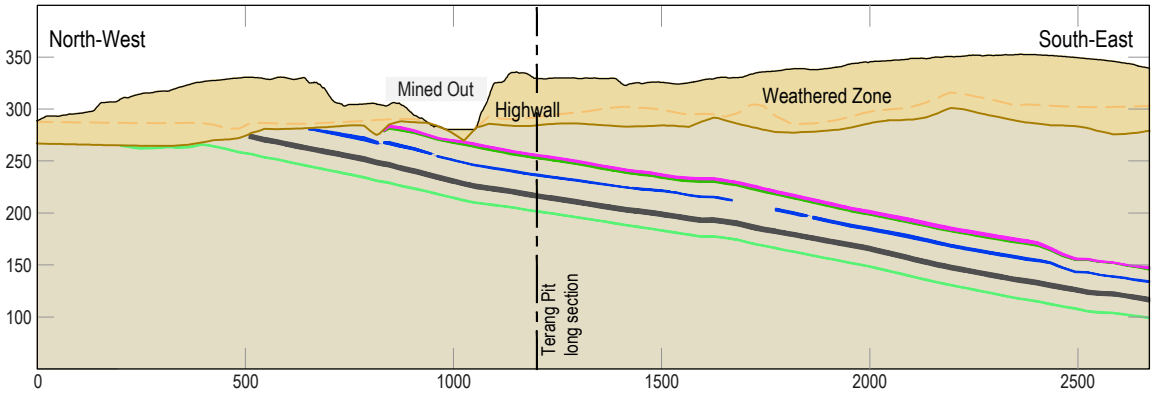
CROSS-SECTION | Ballamoo North

Viewed Looking North-East (Vertical Exaggeration x2.5)



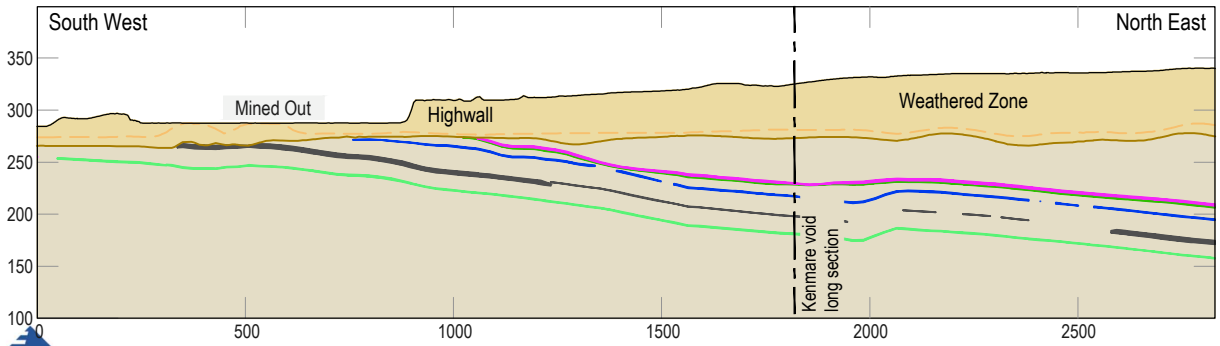
CROSS-SECTION | Terang Pit

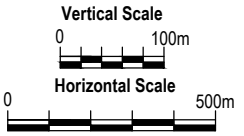
Viewed Looking North-East (Vertical Exaggeration x2.5)



CROSS-SECTION | Kenmare Pit

Viewed Looking North-West (Vertical Exaggeration x2.5)





Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering

Coal Seams

- T Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- PS Seam Group

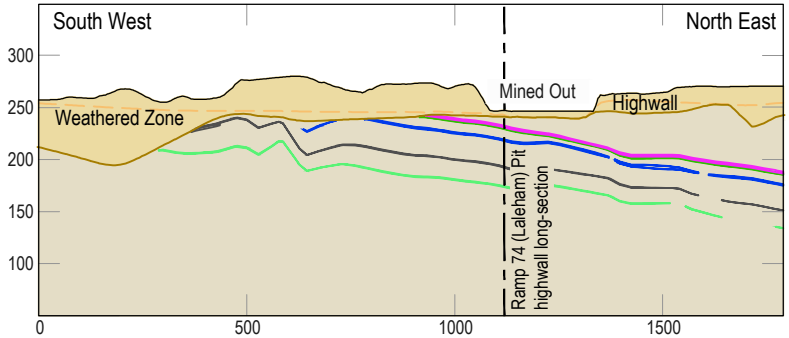
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Minserve CAD File: Bhpb008m11-South.dwg

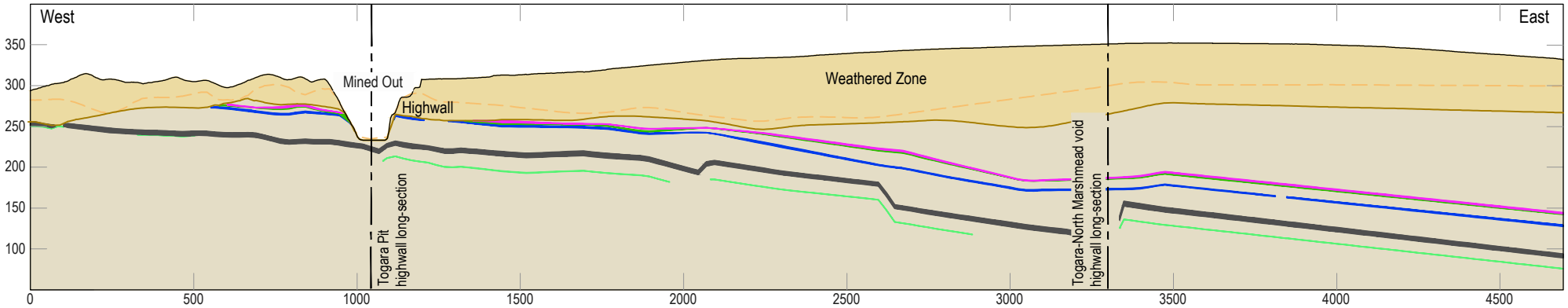
Pit cross-sections

Figure **A12**

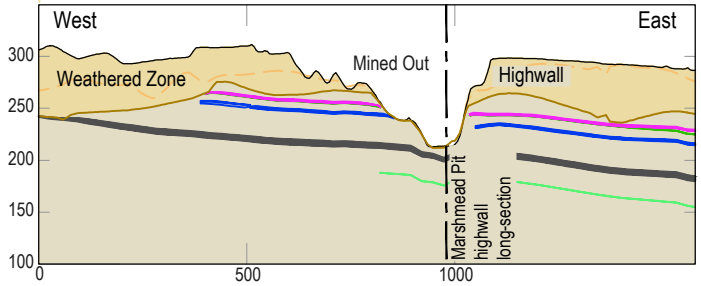
CROSS-SECTION | Ramp 74 (Laleham) Pit
Viewed Looking North-West (Vertical Exaggeration x2.5)



CROSS-SECTION | Togara Pit and Proposed Togara-North Marshmead Pit
Viewed Looking North (Vertical Exaggeration x2.5)



CROSS-SECTION | Marshmead Pit
Viewed Looking North-West (Vertical Exaggeration x2.5)



Legend
- Natural Surface
- Base of Tertiary
- Base of Weathering

Coal Seams
- T Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- PS Seam Group

Vertical Scale
0 — 100m

Horizontal Scale
0 — 500m

WHITEHAVEN

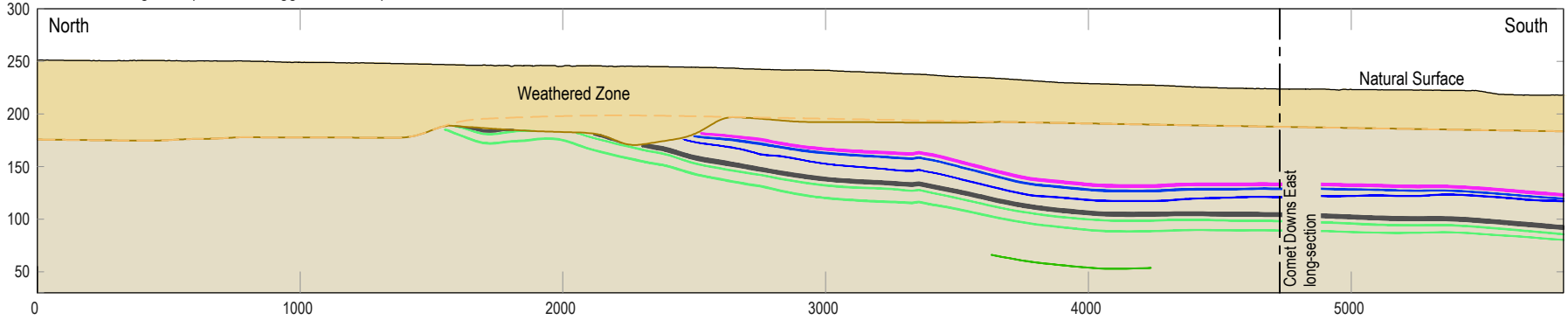
Minserve CAD File: Bhpb008m11 Blackwater - South.dwg

Pit cross-sections

Figure **A13**

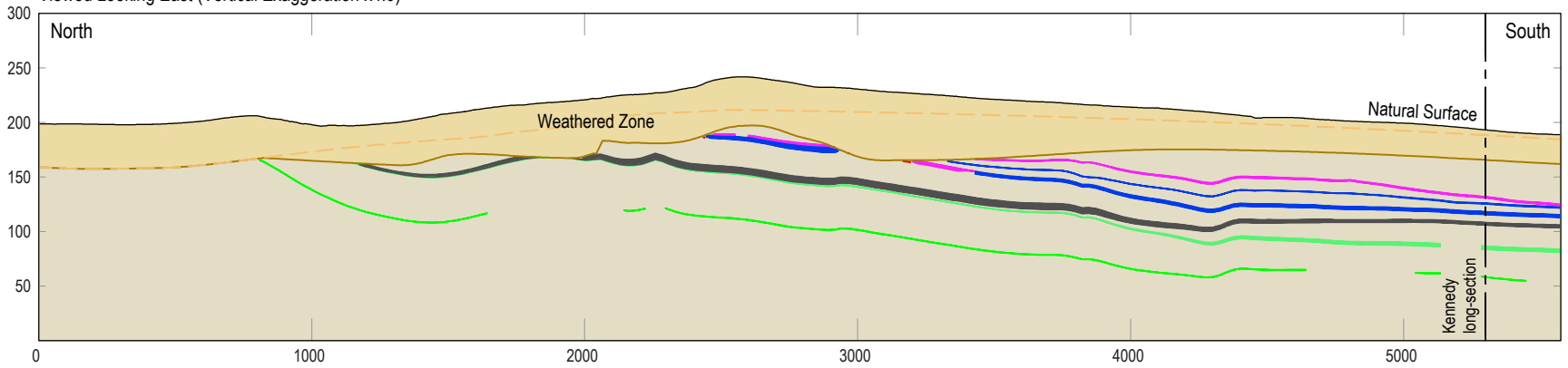
CROSS-SECTION | Comet Downs East Proposed Pit

Viewed Looking East (Vertical Exaggeration x4.0)



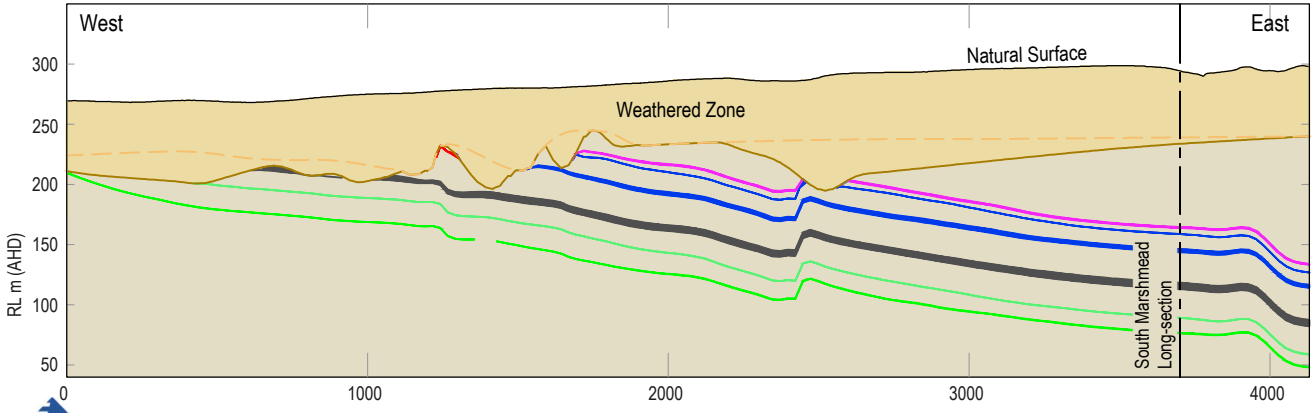
CROSS-SECTION | Kennedy Proposed Pit

Viewed Looking East (Vertical Exaggeration x4.0)



CROSS-SECTION | South Marshmead Proposed Pit

Viewed Looking North (Vertical Exaggeration x4.0)



Legend

- Natural Surface
- Base of Tertiary
- Base of Weathering

Coal Seams

- T Seam Group
- P & L Seam Group
- LR Seam Group
- SG Seam Group
- PS Seam Group

Vertical Scale

0 — 100m

Horizontal Scale

0 — 500m

WHITEHAVEN

Minserve CAD File: Bhpb008m12-MDL Areas.dwg

Pit cross-sections

Figure **A14**

Appendix B – AMD Hazard Scoring Tables

AMD hazard and likelihood of AMD generation from spoil landforms

- Table B1 Ramp 8 final landform
- Table B2 Bonnie Doon final landform
- Table B3 Mimosa-Besgrove final landform
- Table B4 Deep Creek final landform
- Table B5 Stewarton final landform
- Table B6 Tannyfoil final landform
- Table B7 Blackdown final landform
- Table B8 South Ballamoo (Terang) final landform
- Table B9 Kenmare final landform
- Table B10 Ramp 74 final landform
- Table B11 Togara-North Marshmead final landform
- Table B12 South Marshmead final landform
- Table B13 Kennedy final landform
- Table B14 Comet Downs East final landform

AMD hazard and likelihood of AMD generation from TSF landforms

- Table B15 NCPP TSF landform
- Table B16 Laleham TSF landform
- Table B17 Bottom Dam TSF (and rejects) landform

AMD hazard and likelihood of AMD generation from rejects landform

- Table B18 Ramp 36 rejects landform

AMD hazard and likelihood of AMD generation from residual voids

- Table B19 Ramp 8 residual void walls and floor
- Table B20 Bonnie Doon residual void walls and floor
- Table B21 Mimosa-Besgrove and Ramp 30S residual void walls and floor
- Table B22 Deep Creek and Stewarton North residual void walls and floor
- Table B23 Stewarton South , Tannyfoil and South Ballamoo residual void walls and floor
- Table B24 Kenmare residual void walls and floor
- Table B25 Ramp 74 residual void walls and floor
- Table B26 Togara-North Marshmead residual void walls and floor
- Table B27 South Marshmead residual void walls and floor
- Table B28 Kennedy residual void walls and floor
- Table B29 Comet Downs East residual void walls and floor

Table B1. AMD hazard scoring for source materials and likelihood for AMD generation from Ramp 8 final landform

Ramp 8: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Ramp 8 spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.5** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are mostly associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Ramp 8 landform contains no rejects or tailings. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Ramp 8 spoil landform is considered to be **LOW**. The likelihood for AMD generation from Ramp 8 spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No current or future rejects disposed into Ramp 8 landform.	0%	27%	0%	No current or future rejects located within Ramp 8 landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings No current or future tailings disposed into Ramp 8 landform.	0%	48%	0%	No current or future tailings located within Ramp 8 landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B2. AMD hazard scoring for source materials and likelihood for AMD generation from Bonnie Doon final landform

Bonnie Doon: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Bonnie Doon spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.5** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are mostly associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Bonnie Doon landform contains no rejects or tailings. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Bonnie Doon spoil landform is considered to be **LOW**. The likelihood for AMD generation from Bonnie Doon spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No / negligible current or future rejects disposed into Bonnie Doon landform.	0%	27%	0%	No (or negligible) current or future rejects located within Bonnie Doon landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings No current or future tailings disposed into Bonnie Doon landform	0%	48%	0%	No current or future tailings located within Bonnie Doon landform. (excludes tailings disposed into Bonnie Doon pit/void)	**n/a**	**n/a**	**n/a**	**n/a**		

Table B3. AMD hazard scoring for source materials and likelihood for AMD generation from Mimosa-Besgrove final landform

Mimosa-Besgrove: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Mimosa-Besgrove spoil landform
Non-carbonaceous spoil Distributed throughout	95%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 95% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**2.9** Low	General spoil, which comprises approximately 98% of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, about 2.3% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is mostly widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. Rejects - located within the pit shell at Ramp 32 rejects dump and throughout spoil between Ramps 22 to 26 - comprise a very small proportion of the landform (approximately 2%), however, approximately 27% of rejects samples have been conservatively classified as 'PAF' of some type and are assessed as posing a moderate AMD source hazard. Current and future rejects are disposed broadly within/amongst spoil and will be buried by overwhemingly NAF spoil. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 436 µS/cm. The hazard for AMD generation from Mimosa-Besgrove spoil landform is considered to be **LOW**. The likelihood for AMD generation from Mimosa-Besgrove spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	2.9%	14%	0.4%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 3% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Concentrated within the spoil dump area at Ramp 32 rejects dump; and broadly distributed between Ramps 22 to 26. Future rejects assumed to be broadly distributed throughout landform.	1.9%	27%	0.5%	Up to 27% of rejects (originating from NCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.38% ('PAF' samples). NAF samples have a 75th percentile S value of 0.65%. 75th percentile EC of rejects = 1390 µS/cm. Rejects comprise a very small proportion of mineral waste in the landform - approximately 2%. Approximately half of the current rejects are concentrated at Deep Creek (Ramp 32) rejects dump - the remaining half are disposed broadly within/amongst predominantly non-carbonaceous spoil. Future rejects will be broadly disposed amongst spoil.	**5** Plausible	**7** Moderate-High	**7** Moderate-High	**12** Moderate		
Tailings No current or future tailings disposed into Mimosa-Besgrove landform	0%	48%	0%	No current or future tailings located within Mimosa-Besgrove landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B4. AMD hazard scoring for source materials and likelihood for AMD generation from Deep Creek final landform

Deep Creek: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Deep Creek spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.4** Low	General spoil, which comprises approximately 99% of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. Current rejects are broadly distributed throughout spoil, and future rejects are expected to have similar broad distribution. Rejects comprise a very small proportion of the landform (<1%), however, approximately 27% of rejects samples have been conservatively classified as 'PAF' of some type and are assessed as posing a moderate AMD source hazard. Current and future rejects are disposed broadly within/amongst spoil and will be buried by overwhemingly NAF spoil. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 426 µS/cm. The hazard for AMD generation from Deep Creek spoil landform is considered to be **LOW**. The likelihood for AMD generation from Deep Creek spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	3.0%	14%	0.4%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 3% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Currently located broadly within the spoil dump area. Future rejects assumed to be broadly distributed throughout Deep Creek landform.	0.8%	27%	0.2%	Up to 27% of rejects (originating from NCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.38% (PAF sampes). NAF samples have a 75th percentile S value of 0.65%. 75th percentile EC of rejects = 1390 µS/cm. Rejects comprise a very small proportion of mineral waste in the landform - less than 1% - and are disposed within/amongst predominantly non-carbonaceous spoil. The final spoil landform will essentially be comprised of (mostly non-carbonaceous) spoil.	**5** Plausible	**7** Moderate-High	**7** Moderate-High	**12** Moderate		
Tailings No current or future tailings disposed into Deep Creek landform	0%	48%	0%	No current or future tailings located within Deep Creek landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B5. AMD hazard scoring for source materials and likelihood for AMD generation from Stewarton final landform

Stewarton: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Stewarton spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.4** Low	General spoil, which comprises essentially all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is mostly widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. No current rejects within the spoil dump. Future rejects are expected to comprise a very small proportion of the landform (up to 0.2%), however, approximately 27% of rejects samples have been conservatively classified as 'PAF' of some type and are assessed as posing a moderate AMD source hazard. Future rejects will be disposed broadly within/amongst spoil and will be buried by overwhemingly NAF spoil. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 420 µS/cm. The hazard for AMD generation from Stewarton spoil landform is considered to be **LOW**. The likelihood for AMD generation from Stewarton spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No rejects currently in Stewarton landform. Future rejects broadly disposed into Stewarton landform	0.2%	27%	0.06%	Up to 27% of rejects (originating from NCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.38% (PAF sampes). NAF samples have a 75th percentile S value of 0.65%. 75th percentile EC of rejects = 1390 µS/cm. Future rejects are estimated to comprise a very small proportion of mineral waste in the landform (up to 0.2%) - and are disposed within/amongst predominantly non-carbonaceous spoil. The final spoil landform will essentially be comprised of (mostly non-carbonaceous) spoil.	**5** Plausible	**7** Moderate-High	**7** Moderate-High	**12** Moderate		
Tailings No current or future tailings disposed into Stewarton landform	0%	48%	0%	No current or future tailings located within Stewarton landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B6. AMD hazard scoring for source materials and likelihood for AMD generation from Tannyfoil final landform

Tannyfoil: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Tannyfoil spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.5** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are mostly associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Tannyfoil landform contains no rejects or tailings. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Tannyfoil spoil landform is considered to be **LOW**. The likelihood for AMD generation from Tannyfoil spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No current or future rejects disposed into Tannyfoil landform	0%	27%	0%	No current or future rejects to be disposed into Tannyfoil landform	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings No current or future tailings disposed into Tannyfoil landform	0%	48%	0%	No current or future tailings located within Tannyfoil landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B7. AMD hazard scoring for source materials and likelihood for AMD generation from Blackdown final landform

Blackdown: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Blackdown spoil landform
Non-carbonaceous spoil Distributed throughout	96%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.5** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are mostly associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Blackdown landform contains no rejects or tailings. Overall, about 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Blackdown spoil landform is considered to be **LOW**. The likelihood for AMD generation from Blackdown spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No current or future rejects disposed into Blackdown landform	0%	27%	0%	No current or future rejects located within Blackdown landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings No current or future tailings disposed into Blackdown landform	0%	48%	0%	No current or future tailings located within Blackdown landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B8. AMD hazard scoring for source materials and likelihood for AMD generation from South Ballamoo (Terang) final landform

South Ballamoo (Terang): Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from South Ballamoo (Terang) spoil landform
Non-carbonaceous spoil Distributed throughout	95%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**2.7** Low	General spoil, which comprises essentially all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, about 2.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is mostly widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. Rejects - currently located at Ramp 64 rejects dump within the pit shell - comprise a very small proportion of the landform (less than 1%), however, approximately 71% of rejects (from SCPP) have been conservatively classified as 'PAF' of some type and are assessed as posing a moderate AMD source hazard. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 426 µS/cm. The hazard for AMD generation from South Ballamoo spoil landform is considered to be **LOW**. The likelihood for AMD generation from South Ballamoo spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	4.0%	14%	0.5%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 4% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Currently located at Ramp 64 (northern end of existing Terang pit [South Ballamoo pit]). No future rejects disposed into this landform	0.8%	71%	0.6%	Up to 71% of rejects (originating from the SCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.17% (PAF sampes). NAF samples have a 75th percentile S value of 0.10%. 75th percentile EC of rejects = 1410 µS/cm. Rejects, despite being prodominantly classified as 'PAF', comprise a very small proportion of mineral waste in the landform - less than 1% - and are disposed within/amongst predominantly non-carbonaceous spoil. The final spoil landform will essentially be comprised of (mostly non-carbonaceous) spoil.	**7** Expected	**7** Moderate-High	**7** Moderate-High	**14** Moderate		
Tailings No current or future tailings disposed into South Ballamoo landform	0%	72%	0%	No current or future tailings located within South Ballamoo landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B9. AMD hazard scoring for source materials and likelihood for AMD generation from Kenmare final landform

Kenmare: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Kenmare spoil landform
Non-carbonaceous spoil Distributed throughout	95%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**2.3** Low	General spoil, which comprises approximately 98% of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, less than 3.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, two-thirds of which is widely distributed throughout the bulk NAF spoil - and the remaining third as PAF rejects and tailings, which are concentrated at Ramp 72 (tailings) and at the southern end of the current Kenmare pit (rejects) and Ramp 70 (rejects). Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. Rejects located within the landform at Ramp 70; and rejects and tailings located within the landform in Kenmare pit (Ramp 72 pit) comprise a very small proportion of the landform (approximately 1% each for tailings and rejects). However, approximately 71% and 72% of rejects and tailings, respectively (and which originated from the SCPP), have been conservatively classified as 'PAF' of some type and are assessed as predominantly posing a high AMD source hazard. AMD (as AD) has been observed from Ramp 72 TSF and from rejects located in the southern end of Kenmare pit. No new (future) rejects or tailings are expected to be disposed into this landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 427 µS/cm. Overall, the hazard for AMD generation from Kenmare spoil landform is considered to be **LOW** and the likelihood for AMD generation from Kenmare spoil landform is rated **HIGHLY UNLIKELY.** However, the AMD source hazard for rejects located at Ramp 70 is **Moderate**; for buried rejects within the southern end of current Kenmare pit is **HIGH**; and for tailings within Ramp 72 TSF and the southern end of current Kenmare pit is **MODERATE-HIGH**. The likelihood for AMD generation from Ramp 70 rejects buried within the Kenmare spoil landform is **PROBABLE / LIKELY**, whereas the likelihood for AMD generation from buried rejects and tailings within Ramp 72 TSF and the southern end of current Kenmare pit is **LIKELY to HIGHLY LIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	2.9%	14%	0.4%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 3% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Within the spoil dump at Ramp 70. No future rejects disposed into Kenmare landform.	0.5%	71%	0.3%	Up to 71% of rejects (originating from the SCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.17% ('PAF' samples). NAF samples have a 75th percentile S value of 0.10%. 75th percentile EC of rejects = 1410 µS/cm. Rejects comprise a small proportion of mineral waste in the landform - approximately 1%, of which over half is disposed as mixed fine- and coarse rejects within the southern end of Kenmare pit (R72 pit). The spoil landform will predominantly be comprised of (mostly non-carbonaceous) spoil. AMD as AD has been observed from rejects in Kenmare pit.	**7** Expected	**7** Moderate-High	**7** Moderate-High	**14** Moderate		
Rejects Southern end of Kenmare pit. No future rejects disposed into Kenmare landform.	0.5%		0.3%		**15** Certain	**7** Moderate-High	**7** Moderate-High	**22** High		
Tailings Ramp 72 TSF at base of landform. No future tailings disposed into Kenmare landform.	1.2%	72%	0.8%	72% of tailings (originating from SCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. Tailings comprise a very small proportion of the overall spoil landform (approx. 1.2%) - however are concentrated in one area (Ramp 72 TSF). 75th percentile EC of tailings = 960 µS/cm. AMD capacity is based on a 75th percentile S value of 0.70%. Some tailings samples will generate AD. AMD quantity assumes proportion of PAF tailings samples approximates the proportion of tailings that are PAF. Tailings (TSF) will be buried by predominantly non-carbonaceous and NAF spoil. AMD as AD has been observed from Ramp 72 TSF.	**15** Certain	**5** Moderate	**3** Low-Moderate	**19** Moderate-High		

Table B10. AMD hazard scoring for source materials and likelihood for AMD generation from Ramp 74 final landform

Ramp 74 (Laleham): Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Ramp 74 (Laleham) spoil landform
Non-carbonaceous spoil Distributed throughout	99%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**4.5** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Ramp 74 landform contains no rejects or tailings. [Laleham TSF - located adjacent to the Ramp 74 spoil landform - is assessed as a 'stand alone' TSF landform.] Overall, about 1.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises only a small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Ramp 74 spoil landform is considered to be **LOW**. The likelihood for AMD generation from Ramp 74 spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	1.0%	14%	0.1%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 1% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects No current or future rejects disposed into Laleham landform.	0%	71%	0%	No current or future rejects located within Ramp 74 landform. Laleham TSF is assessed as a 'stand alone' TSF landform - refer to the AMD hazard assessment of Laleham TSF landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings No current or future tailings disposed into Laleham landform.	0%	72%	0%	No current or future tailings located within Ramp 74 landform. Laleham TSF is assessed as a 'stand alone' TSF landform - refer to the AMD hazard assessment of Laleham TSF landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B11. AMD hazard scoring for source materials and likelihood for AMD generation from Togara-North Marshmead final landform

Togara-North Marshmead: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Togara-North Marshmead spoil landform
Non-carbonaceous spoil Distributed throughout	94%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**2.9** Low	General spoil, which comprises essentially all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF spoil material is associated with seams - as parting or within 1.5m (typically) above and below seams. As such (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Overall, less than 2.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is mostly widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. Rejects - currently located within the landform at Ramps 76 and 84 - comprise a very small proportion of the landform (approximately 0.2%), however, approximately 71% of the rejects (originating from the SCPP) have been conservatively classified as 'PAF' of some type and are assessed as posing a moderate AMD source hazard. No new (future) rejects are expected to be disposed into this landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 419 µS/cm. The hazard for AMD generation from Togara-North Marshmead spoil landform is considered to be **LOW**. The likelihood for AMD generation from Togara-North Marshmead spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	6.0%	14%	0.8%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 6% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Currently located within the spoil dump area at Ramp 76 and Ramp 84. No future rejects disposed into Togara-North Marshmead landform.	0.2%	71%	0.1%	Up to 71% of rejects (originating from the SCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.17% (PAF sampes). NAF samples have a 75th percentile S value of 0.10%. 75th percentile EC of rejects = 1410 µS/cm. Rejects, despite being prodominantly classified as 'PAF', comprise a very small proportion of mineral waste in the landform - approximately 0.2% - and are disposed within/amongst predominantly non-carbonaceous spoil. The final spoil landform will essentially be comprised of (mostly non-carbonaceous) spoil.	**7** Expected	**7** Moderate-High	**7** Moderate-High	**14** Moderate		
Tailings No current or future tailings disposed into Togara-North Marshmead landform	0%	72%	0%	No current or future tailings located within Togara-North Marshmead landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B12. AMD hazard scoring for source materials and likelihood for AMD generation from South Marshmead final landform

South Marshmead: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from South Marshmead spoil landform
Non-carbonaceous spoil Distributed throughout	98%	1.4%	1.4%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**4.1** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. South Marshmead landform contains no rejects or tailings. Overall, less than 2% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from South Marshmead spoil landform is considered to be **LOW**. The likelihood for AMD generation from South Marshmead spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	2.0%	14%	0.3%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 2% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects South Marshmead is a proposed landform (currently doesn't exist). No future rejects disposed into South Marshmead landform.	0%	71%	0%	No current or future rejects located within South Marshmead landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings South Marshmead is a proposed landform (currently doesn't exist). No future tailings disposed into South Marshmead landform.	0%	72%	0%	No current or future tailings located within South Marshmead landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B13. AMD hazard scoring for source materials and likelihood for AMD generation from Kennedy final landform

Kennedy: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Kennedy spoil landform
Non-carbonaceous spoil Distributed throughout	94%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**3.1** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Kennedy landform contains no rejects or tailings. Overall, less than 2.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Kennedy spoil landform is considered to be **LOW**. The likelihood for AMD generation from Kennedy spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	6.0%	14%	0.8%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 6% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Kennedy is a proposed landform (currently doesn't exist). No future rejects disposed into Kennedy landform.	0%	71%	0%	No current or future rejects located within Kennedy landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings Kennedy is a proposed landform (currently doesn't exist). No future tailings disposed into Kennedy landform.	0%	72%	0%	No current or future tailings located within Kennedy landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B14. AMD hazard scoring for source materials and likelihood for AMD generation from Comet Downs East final landform

Comet Downs East: Landform components	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD hazard score	Landform AMD hazard score	Likelihood for AMD generation from Comet Downs East spoil landform
Non-carbonaceous spoil Distributed throughout	93%	1.4%	1.3%	Total S is low (75th percentile = 0.04%). NAF samples have a 75th percentile total S value of 0.04%. 'PAF' samples, which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S, have a 75th percentile total S value of 0.35% (and AMD capacity is based on this number). Less than 1.5% of non-carbonaceous spoil is conservatively classified as 'PAF'. 75th percentile EC of non-carbonaceous spoil = 418 µS/cm. Most of the PAF material is associated with seams - as parting or within 1.5m above and below seams. Non-carbonaceous spoil is estimated to comprise approximately 96% of mineral waste in the landform. ANC is largely available under field conditions.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low	**2.9** Low	General spoil, which comprises all of the landform, is overwhelmingly NAF with generally very low sulfur, excess neutralising capacity and low soluble metals concentration. Higher S materials are associated with seams and, as such, most PAF 'spoil' material is associated with seams - as parting or within 1.5m (typically) above and below seams and, as such, (and also due to seams being over-sampled) the percentage of 'PAF' spoil samples is not respresentative of the overall percentage of PAF in general spoil. Comet Downs East landform contains no rejects or tailings. Overall, less than 2.5% of the final landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material, which is widely distributed throughout the bulk NAF spoil. Non-carbonaceous and carbonaceous spoil are assigned low to low-moderate AMD capacity ratings based on the 75th percentile total S value for PAF samples, however PAF spoil comprises a very small proportion of the landform. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 418 µS/cm. The hazard for AMD generation from Comet Downs East spoil landform is considered to be **LOW**. The likelihood for AMD generation from Comet Downs East spoil landform is rated **HIGHLY UNLIKELY**.
Carbonaceous and/or coaly spoil Distributed throughout	7.0%	14%	1.0%	Up to 14% of carbonaceous spoil is conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. NAF samples have a 75th percentile total S value of 0.18%. 'PAF' samples have a 75th percentile total S value of 0.72% (and AMD capacity is based on this number). 75th percentile EC of carbonaceous spoil = 414 µS/cm. Carbonaceous spoil is estimated to comprise approximately 7% of mineral waste in the landform, and assumes all carbonaceous spoil is distributed amongst non-carbonaceous spoil. AMD quantity conservatively assumes proportion of PAF carbonaceous spoil samples approximates the proportion of carbonaceous spoil that is PAF.	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Rejects Comet Downs East is a proposed landform (currently doesn't exist). No future rejects disposed into Comet Downs East landform.	0%	71%	0%	No current or future rejects located within Comet Downs East landform.	**n/a**	**n/a**	**n/a**	**n/a**		
Tailings Comet Downs East is a proposed landform (currently doesn't exist). No future tailings disposed into Comet Downs East landform.	0%	72%	0%	No current or future tailings located within Comet Downs East landform.	**n/a**	**n/a**	**n/a**	**n/a**		

Table B15. AMD hazard scoring for source materials and likelihood for AMD generation from NCPP TSF landform (unrehabilitated)

NCPP TSF: Components (without cover)	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD source hazard score	Landform AMD hazard score (pre-rehabilitation)	Likelihood for AMD generation from NCPP TSF (before rehabilitation)
Tailings	80%	48%	38%	Based on data from 478 tailings samples from NCPP TSF and NCPP, up to 48% of tailings are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 2.16% ('PAF' samples). NAF samples have a 75th percentile S value of 0.69%. Conservatively assumes proportion of PAF tailings samples approximates the proportion of tailings in NCPP TSF that are PAF. Assumes equal distribution of PAF/NAF tailings throughout the TSF. AMD as AD has been observed from tailings at NCPP TSF.	**15** High	**10** High	**10** High	**25** High	**19** Moderate-High	The hazard for AMD generation in the landform is based on the large majority (approximately 80%) of the landform being tailings, of which 48% is conservatively estimated to be PAF (of some type). Of the 'PAF' samples, about 70% are UC(PAF) or PAF-LC and, as such, are considered to have a relatively moderate capacity to generate significant acidity. However, AMD is evident (as AD, with pH <4.5) in tailings samples located at the TSF and in seepage from the toe of the TSF. Overall, about 40% of the NCPP TSF landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material - most of which is tailings, which are assessed as posing a High AMD source hazard. Rejects are estimated to comprise about 19% of the TSF landform (almost entirely as embankment material) and are assessed as posing a low-moderate AMD source hazard. General fill (spoil) is assumed to comprise about 1% of the TSF and mostly located within embankments. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 961 µS/cm. The hazard for AMD generation from NCPP TSF landform is conservatively considered to be **MODERATE-HIGH**. The likelihood for AMD generation from NCPP TSF landform is conservatively rated as **HIGHLY LIKELY**, the highest likelihood category - noting that AMD has already been observed from this TSF.
Rejects Primarily located within embankments	19%	8%	1.4%	Based on data from 93 rejects samples from NCPP TSF and NCPP, up to 8% of rejects are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.65% (PAF samples). NAF samples have a 75th percentile S value of 0.50%. Conservatively assumes proportion of PAF rejects samples approximates the proportion of rejects in NCPP TSF that are PAF. Assumes equal distribution of PAF/NAF rejects throughout the areas of the TSF where rejects are located (primarily embankments).	**5** Plausible	**5** Moderate	**3** Low-Moderate	**9** Low-Moderate		
Fill / Spoil Fill (assumed spoil) within the TSF, including within embankments. Excludes existing spoil (if any) on the surface of the TSF.	1%	2%	0.0%	Proportion of fill in TSF is based on drillhole investigations. Based on data from all spoil samples - as a proxy for general fill commonly found in TSFs - up to 2% of fill is conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.52% ('PAF' samples). NAF samples have a 75th percentile S value of 0.04%. Conservatively assumes proportion of PAF spoil samples approximates the proportion of fill in the TSF that are PAF.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low		

Table B16. AMD hazard scoring for source materials and likelihood for AMD generation from Laleham TSF landform (unrehabilitated)

Laleham TSF: Components (without cover)	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD source hazard score	Landform AMD hazard score (pre-rehabilitation)	Likelihood for AMD generation from Laleham TSF (before rehabilitation)
Tailings	90%	84%	76%	Based on data from 95 tailings samples from Laleham TSF, up to 84% of tailings are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.72% ('PAF' samples). NAF samples have a 75th percentile S value of 0.17%. Conservatively assumes proportion of PAF tailings samples approximates the proportion of tailings in Laleham TSF that are PAF. Assumes equal distribution of PAF/NAF tailings throughout the TSF.	**15** High	**5** Moderate	**5** Moderate	**20** Moderate-High	**17** Moderate-High	The hazard for AMD generation in the landform is based on the majority (90%) of the landform being tailings of which 84% is conservatively estimated to be PAF. About 30% of tailings samples are displaying evidence of AD (pH <4.5), with associated evidence of sulfide oxidation (to sulfate) and consumption of ANC. Overall, about 79% of the Laleham TSF landform (excluding the existing spoil cover) is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material - most of which is tailings, which are assessed as posing a moderate-high AMD source hazard. Rejects are estimated to comprise about 4% of the TSF landform and are also assessed as posing a moderate AMD source hazard. Spoil/fill within the TSF is estimated to comprise about 6% of the landform (excluding the existing spoil cover) and is assessed as posing a low AMD source hazard. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 1139 µS/cm. The hazard for AMD generation from Laleham TSF landform is conservatively considered to be **MODERATE-HIGH**. The likelihood for AMD generation from Laleham TSF landform is conservatively rated as **PROBABLE / LIKELY**.
Rejects	4%	71%	2.9%	Only six rejects samples from Laleham TSF have geochemical data. Therefore, based on data from 161 aged rejects samples originating from SCPP, up to 71% of rejects are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.17% (PAF samples). NAF samples have a 75th percentile S value of 0.10%. Conservatively assumes proportion of PAF rejects samples approximates the proportion of rejects in Laleham TSF that are PAF. Assumes equal distribution of PAF/NAF rejects throughout the areas of the TSF where rejects are located.	**7** Expected	**7** Moderate-High	**7** Moderate-High	**14** Moderate		
Fill / Spoil Fill (assumed spoil) within the TSF, including within embankments. Excludes existing spoil (if any) on the surface of the TSF.	6%	2%	0.1%	Proportion of fill in TSF is based on drillhole investigations. Based on data from all spoil samples - as a proxy for general fill commonly found in TSFs - up to 2% of fill is conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.52% ('PAF' samples). NAF samples have a 75th percentile S value of 0.04%. Conservatively assumes proportion of PAF spoil samples approximates the proportion of fill in the TSF that are PAF.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low		

Table B17. AMD hazard scoring for source materials and likelihood for AMD generation from Bottom Dam TSF/reject landform (unrehabilitated)

Bottom Dam: Components (without cover)	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD source hazard score	Landform AMD hazard score (pre-rehabilitation)	Likelihood for AMD generation from Bottom Dam (before rehabilitation)
Tailings	95%	100%	95%	Based on limited data from 10 tailings samples from Bottom Dam TSF, all 10 tailings samples are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.90% ('PAF' samples). Conservatively assumes proportion of PAF tailings samples approximates the proportion of tailings in the TSF that are PAF. By way of comparison, based on data from 224 tailings samples originating from SCPP (ie. not just tailings sampled from Bottom Dam TSF), about 72% of SCPP tailings are classified as 'PAF', with 'PAF' samples having a 75th percentile S value of 0.70%. Therefore, the assessment - although based on only 10 samples - is conservative compared to the broader SCPP tailings database.	**15** High	**5** Moderate	**5** Moderate	**20** Moderate-High	**19** Moderate-High	The hazard for AMD generation in the landform is based on the majority (95%) of the landform being tailings of which all is conservatively estimated to be PAF. Most of the 10 tailings samples are displaying evidence of AD (pH <4.5) and/or with associated evidence of sulfide oxidation (to sulfate) and consumption of ANC. Overall, almost all of the current Bottom Dam TSF landform is conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material - almost all of which is tailings, which are assessed as posing a moderate-high AMD source hazard. Rejects are estimated to comprise about 4% of the TSF landform and are assessed as posing a moderate AMD source hazard. Spoil/fill is estimated to comprise about 1% of the landform and is assessed as posing a low AMD source hazard. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 1379 µS/cm. The hazard for AMD generation from Bottom Dam TSF landform is conservatively considered to be **MODERATE-HIGH**. The likelihood for AMD generation from Bottom Dam TSF landform is conservatively rated as **PROBABLE / LIKELY**.
Rejects	4%	71%	2.9%	No rejects samples available from Bottom Dam TSF - and it's unknown if any rejects are located within the TSF. Conservatively assumed rejects will comprise about 4% of the TSF. Based on the broader SCPP rejects database, up to 71% of rejects (originating from the SCPP) are conservatively classified as 'PAF', which includes samples classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.17% (PAF samples). NAF samples have a 75th percentile S value of 0.10%. 75th percentile EC of rejects = 1410 µS/cm. Rejects, despite being prodominantly classified as 'PAF', comprise an assumed small proportion (4%) of mineral waste in the landform and are assumed to be located within embankments.	**7** Expected	**7** Moderate-High	**7** Moderate-High	**14** Moderate		
Fill / Spoil Fill (assumed spoil) within the TSF, including within embankments. Excludes existing spoil (if any) on the surface of the TSF.	1%	2%	0.0%	Proportion of fill in TSF is uncertain; 1% is a conservative estimate. Based on data from all spoil samples - as a proxy for general fill commonly found in TSFs - up to 2% of fill is conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.52% ('PAF' samples). NAF samples have a 75th percentile S value of 0.04%. Conservatively assumes proportion of PAF spoil samples approximates the proportion of fill in the TSF that are PAF.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low		

Table B18. AMD hazard scoring for source materials and likelihood for AMD generation from Ramp 36 rejects landform (unrehabilitated)

Ramp 36 rejects dump: Components (without cover)	Estimated material proportion within landform	% of samples classified as PAF	% of material in landform estimated to be PAF	Comment	AMD propensity rating	AMD capacity rating	AMD quantity rating	AMD source hazard score	Landform AMD hazard score (pre-rehabilitation)	Likelihood for AMD generation from Ramp 36 rejects dump (before rehabilitation)
Tailings No tailings disposed into Ramp 36 rejects landform.	0%	0%	0%	No tailings located within Ramp 36 rejects landform.	n/a	n/a	n/a	n/a	**15** Moderate-High	The hazard for AMD generation in the landform is based on the landform being comprised almost entirely of rejects, of which 40% are conservatively estimated to be either PAF, PAF-LC, UC(PAF) or NAF-S material. The 75th percentile EC of the landform (based on the EC of the source materials proportionally represented) is estimated at 1508 µS/cm. The hazard for AMD generation from Ramp 36 Rejects landform is conservatively considered to be **MODERATE-HIGH**. The likelihood for AMD generation from Ramp 36 Rejects landform is conservatively rated as **PROBABLE / LIKELY**.
Rejects Essentially all of the landform is comprised of rejects	98%	40%	39%	The rejects dump is comprised almost entirely of rejects with a small proportion of fill material. Based on data from 144 rejects samples from Ramp 36 rejects dump, up to 40% of rejects are conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 1.40% ('PAF' samples). NAF samples have a 75th percentile S value of 0.79%. Conservatively assumes proportion of PAF and NAF-S rejects samples approximates the proportion of rejects in Ramp 36 rejects dump that are PAF and NAF-S. Assumes equal distribution of PAF/NAF rejects throughout the rejects dump.	**7** Expected	**7** Moderate-High	**10** High	**16** Moderate-High		
Fill / Spoil Fill (assumed spoil) within the rejects dump. Excludes existing spoil (if any) on the surface of the dump.	2%	2%	0%	Proportion of fill in rejects dump is uncertain; 2% is a conservative estimate, based on investigative drilling. Based on data from all spoil samples - as a proxy for general fill commonly found in old rejects dumps - up to 2% of fill is conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. AMD capacity is based on a 75th percentile S value of 0.52% ('PAF' samples). NAF samples have a 75th percentile S value of 0.04%. Conservatively assumes proportion of PAF spoil samples approximates the proportion of fill in the TSF that are PAF.	**1** Implausible	**5** Moderate	**3** Low-Moderate	**5** Low		

Table B19. AMD hazard scoring for source materials and likelihood for AMD generation from Ramp 8 residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Ramp 8 void highwall
Ramp 8 Void Highwall	Weathered, non-carbonaceous	17%	100% (where known)	0% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	0.7%	This material is expected to comprise approximately 17% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Highwall information is not available for Ramp 8, however the highwall is expected to be geologically comparable to Bonnie Doon Pit highwall. Based on Bonnie Doon highwall data, non-carb. rock is expected to have excess ANC, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage), with PAF domains expected to be largely confined to coal horizons/seams. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Ramp 8 void highwall = **LOW**. The likelihood for AMD generation from Ramp 8 void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.1%	100% (where known)	0% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	<0.1%	This material is expected to comprise approximately 0.1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	73%	82% (where known)	18% (where known)	73%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Based on Bonnie Doon drillhole data, assume approximately 82% of this material is currently above the water table and would be potentially subject to oxidation.	0.7%	This material is estimated to comprise approximately 73% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	3.5%	81% (where known)	19% (where known)	3.5%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 81% of this material is currently above the water table and would be potentially subject to oxidation.	0.5%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 4% of the void wall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	6.7%	64% (where known)	36% (where known)	6.7%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 64% of this material is currently above the water table and would be potentially subject to oxidation.	2.4%	Fresh coal is expected to comprise approximately 7% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T, MR and P & L seam groups.	5	5	1	8	
	Unknown	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							4.3%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Ramp 8 void floor	
Ramp 8 Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Ramp 8 void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B20. AMD hazard scoring for source materials and likelihood for AMD generation from Bonnie Doon residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Bonnie Doon void highwall
Bonnie Doon Void Highwall	Weathered, non-carbonaceous	17%	100% (where known)	0% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	0.7%	This material is expected to comprise approximately 17% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage). PAF domains are expected to be largely confined to coal horizons/seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Bonnie Doon void highwall = **LOW**. The likelihood for AMD generation from Bonnie Doon void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.1%	100% (where known)	0% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	<0.1%	This material is expected to comprise approximately 0.1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	73%	82% (where known)	18% (where known)	73%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 82% of this material is currently above the water table and would be potentially subject to oxidation.	0.7%	This material is estimated to comprise approximately 73% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	3.5%	81% (where known)	19% (where known)	3.5%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 81% of this material is currently above the water table and would be potentially subject to oxidation.	0.5%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 4% of the void wall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	6.7%	64% (where known)	36% (where known)	6.7%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 64% of this material is currently above the water table and would be potentially subject to oxidation.	2.4%	Fresh coal is expected to comprise approximately 7% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T, MR and P & L seam groups.	5	5	1	8	
	Unknown	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							4.3%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Bonnie Doon void floor
Bonnie Doon Void Floor	Tailings (from NCPP)	100%	0%	100%	100%	46%	No geochemical data is available from Bonnie Doon tailings specifically (Bonnie Doon Pit TSF). Based on geochemical data from NCPP tailings (being deposited into Bonnie Doon Pit), approximately 46% of tailings samples were 'PAF' or NAF-S (data from geochemical database) [143 out of 311 samples]. Assumes all tailings is below the post-closure water table and would become submerged after mining ceases - or would be capped/cover with a suitable thickness of spoil to minimise oxidation.	46%	The floor of Boonie Doon void is currently tailings and is expected to remain as such. 46% of NCPP tailings are conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. 75th percentile EC of NCPP tailings = 918 µS/cm. AMD capacity is based on a 75th percentile S value of 2.29 for 'PAF' tailings. Some tailings samples will generate AD. AMD quantity assumes proportion of PAF tailings samples approximates the proportion of tailings that are PAF. ANC of tailings is largely available under field conditions. No allowance for pit flooding or potential cover over tailings has been taken into account in this hazard assessment. Refer to report body for discussion regarding tailings cover or pit flooding.	7	10	7	16	Approximately 46% of the void floor may comprise 'PAF' or NAF-S tailings.The geochemical hazard for the void floor to develop AMD is moderate-high if the tailings remains exposed to air (plausible). The likelihood for AMD generation from tailings on Bonnie Doon void floor = **PROBABLE/LIKELY**

Table B21. AMD hazard scoring for source materials and likelihood for AMD generation from Mimosa-Besgrove and Ramp 30S residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Mimosa-Besgrove & Ramp 30S voids highwall
Mimosa-Besgrove & Ramp 30S Voids Highwall	Weathered, non-carbonaceous	20%	67% (where known)	33% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	0.9%	This material is expected to comprise approximately 20% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage). PAF domains are expected to be largely confined to coal horizons/seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from the highwall of Mimosa-Besgrove and Ramp 30 voids = **LOW**. The likelihood for AMD generation from the highwall of Mimosa-Besgrove and Ramp 30 voids = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.6%	8% (where known)	92% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.2%	This material is expected to comprise approximately 0.6% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	70%	64% (where known)	36% (where known)	70%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 64% of this material is currently above the water table and would be potentially subject to oxidation.	0.6%	This material is estimated to comprise approximately 70% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	1.2%	69% (where known)	31% (where known)	1.2%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 69% of this material is currently above the water table and would be potentially subject to oxidation.	0.2%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise approximately 1.2% of the void wall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	5.4%	20% (where known)	80% (where known)	5.4%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 20% of this material is currently above the water table and would be potentially subject to oxidation.	1.9%	Fresh coal is expected to comprise approximately 5.4% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T, MR and P & L seam groups.	5	5	1	8	
	Unknown	2.4%	44%	55%	0.4%	0%	Lithology unknown. Approximately 18% of this material is below base of weathering (ie. fresh)	<0.1%	Negligible proportion; approximately 82% of this material is within weathered zone. Assume negligible PAF. Conservatively assume 'Moderate-High' AMD capacity.	1	7	1	5	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							3.8%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Mimosa-Besgrove & Ramp 30S void floor	
Mimosa-Besgrove & Ramp 30S Voids Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Mimosa-Besgrove void and Ramp 30 void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B22. AMD hazard scoring for source materials and likelihood for AMD generation from Deep Creek and Stewarton North residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Deep Creek & Stewarton North void highwall
Deep Creek & Stewarton North Void Highwall	Weathered, non-carbonaceous	22%	82% (where known)	18% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	0.9%	This material is expected to comprise approximately 22% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 5% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Deep Creek void highwall = **LOW**. The likelihood for AMD generation from Deep Creek void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	1.0%	40% (where known)	60% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is prodominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.3%	This material is expected to comprise approximately 1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	68%	63% (where known)	37% (where known)	68%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 63% of this material is currently above the water table and would be potentially subject to oxidation.	0.6%	This material is estimated to comprise approximately 68% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	1.2%	45% (where known)	55% (where known)	1.2%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 45% of this material is currently above the water table and would be potentially subject to oxidation.	0.2%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 1.5% of the void wall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	7.1%	30% (where known)	70% (where known)	7.1%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 30% of this material is currently above the water table and would be potentially subject to oxidation.	2.5%	Fresh coal is expected to comprise approximately 7% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T, MR and P & L seam groups.	5	5	1	8	
	Unknown	0.6%	98%	2%	0%	0%	Lithology unknown. None of this material is below base of weathering (ie. all material is weathered)	<0.1%	Negligible proportion; all of this material is within weathered zone. Assume negligible PAF. Conservatively assume 'Moderate-High' AMD capacity.	1	7	1	5	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							4.6%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Deep Creek & Stewarton North void floor	
Deep Creek & Stewarton North Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Deep Creek and Stewarton North voids is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B23. AMD hazard scoring for source materials and likelihood for AMD generation from Stewarton South, Tannyfoil and South Ballamoo residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Stewarton South, Tannyfoil and South Ballamoo voids highwall
Stewarton South, Tannyfoil and South Ballamoo Voids Highwall	Weathered, non-carbonaceous	23%	64% (where known)	36% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	1.0%	This material is expected to comprise approximately 23% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 5% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from the highwall of Stewarton, Tannyfoil and South Ballamoo voids = **LOW**. The likelihood for AMD generation from the highwall of Stewarton, Tannyfoil and South Ballamoo voids = **UNLIKELY**
	Weathered, carbonaceous & coaly	1.6%	10% (where known)	90% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.5%	This material is expected to comprise approximately 1.6% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	65%	59% (where known)	41% (where known)	65%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 59% of this material is currently above the water table and would be potentially subject to oxidation.	0.6%	This material is estimated to comprise approximately 65% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	1.1%	43% (where known)	57% (where known)	1.1%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 43% of this material is currently above the water table and would be potentially subject to oxidation.	0.1%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise approximately 1% of the void wall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	7.2%	37% (where known)	63% (where known)	7.2%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 37% of this material is currently above the water table and would be potentially subject to oxidation.	2.6%	Fresh coal is expected to comprise approximately 7% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T, MR and P & L seam groups.	5	5	1	8	
	Unknown	1.7%	49%	51%	0.1%	0%	Lithology unknown. 7% of this material is below base of weathering (ie. fresh)	<0.1%	Negligible proportion; 93% of this material is within weathered zone. Assume negligible PAF. Conservatively assume 'Moderate-High' AMD capacity.	1	7	1	5	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							4.8%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Stewarton South, Tannyfoil and South Ballamoo void floor	
Stewarton South, Tannyfoil and South Ballamoo Voids Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Stewarton South, Tannyfoil and South Ballamoo voids is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B24. AMD hazard scoring for source materials and likelihood for AMD generation from Kenmare residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Kenmare void highwall
Kenmare Void Highwall	Weathered, non-carbonaceous	25%	94% (where known)	6% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	1.1%	This material is expected to comprise approximately 25% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Kenmare void highwall = **LOW**. The likelihood for AMD generation from Kenmare void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.01%	unk.	unk.	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	<0.1%	This material is expected to comprise less than 0.1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	65%	10% (where known)	90% (where known)	65%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 10% of this material is currently above the water table and would be potentially subject to oxidation.	0.6%	This material is estimated to comprise approximately 65% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	1.2%	12% (where known)	88% (where known)	1.2%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 12% of this material is currently above the water table and would be potentially subject to oxidation.	0.2%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 1.5% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	5.1%	16% (where known)	84% (where known)	5.1%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 16% of this material is currently above the water table and would be potentially subject to oxidation.	1.8%	Fresh coal is expected to comprise approximately 5% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	4.1%	99%	1%	1.7%	0%	Lithology unknown. 7% of this material is below base of weathering (ie. fresh)	<0.1%	Low proportion of the highwall; 55% of this material is within weathered zone. Assume negligible PAF. Conservatively assume 'Moderate-High' AMD capacity.	1	7	1	5	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							3.6%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Kenmare void floor	
Kenmare Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Kenmare void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B25. AMD hazard scoring for source materials and likelihood for AMD generation from Ramp 74 residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Ramp 74 (Laleham) void highwall
Ramp 74 (Laleham) Void Highwall	Weathered, non-carbonaceous	11%	100% (where known)	0% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	0.5%	This material is expected to comprise approximately 11% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent less than 4% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Ramp 74 void highwall = **LOW**. The likelihood for AMD generation from Ramp 74 void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.01%	unk.	unk.	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	<0.1%	This material is expected to comprise less than 0.1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	82%	19% (where known)	81% (where known)	82%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 19% of this material is currently above the water table and would be potentially subject to oxidation.	0.7%	This material is estimated to comprise approximately 82% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	0.8%	0% (where known)	100% (where known)	0.8%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, none of this material is currently above the water table and would be potentially subject to oxidation.	0.1%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 1% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	6.0%	0% (where known)	100% (where known)	6.0%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, none of this material is currently above the water table and would be potentially subject to oxidation.	2.1%	Fresh coal is expected to comprise approximately 6% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							3.5%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Ramp 74 (Laleham) void floor	
Ramp 74 (Laleham) Void Floor	Tailings (from SCPP)	100%	0%	100%	100%	72%	No geochemical data is available from Ramp 74 tailings (Laleham Pit TSF). Based on geochemical data from all tailings derived from SCPP, approximately 72% of tailings samples were PAF (data from geochemical database) [161 out of 224 samples]. Assumes all tailings is below the post-closure water table and would become submerged after mining ceases - or would be capped/cover with a suitable thickness of spoil and/or water cover to minimise oxidation.	72%	The floor of Ramp 74 void is currently tailings and is expected to remain as such. 72% of tailings derived from SCPP are conservatively classified as PAF, PAF-LC, UC(PAF) or NAF-S. 75th percentile EC of these tailings = 960 µS/cm. AMD capacity is based on a 75th percentile S value of 0.7% for 'PAF' samples from SCPP. Some tailings samples will generate AD. AMD quantity assumes proportion of PAF tailings samples approximates the proportion of tailings that are PAF. ANC of tailings is largely available under field conditions. No allowance for pit flooding or potential cover over tailings has been taken into account in this hazard assessment. Refer to report body for discussion regarding tailings cover or pit flooding.	7	5	7	13	Approximately 72% of the void floor may comprise PAF tailings.The geochemical hazard for the void floor to develop AMD is moderate if the tailings remains exposed to air (plausible). The likelihood for AMD generation from tailings on Ramp 74 void floor = **PROBABLE/LIKELY**

Table B26. AMD hazard scoring for source materials and likelihood for AMD generation from Togara-North Marshmead residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Togara-North Marshmead void highwall
Togara-North Marshmead Void Highwall	Weathered, non-carbonaceous	73%	21% (where known)	79% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	3.1%	This material is expected to comprise approximately 73% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. Approximately 80% of the void highwall is expected to be weathered material. The potential exposure of PAF materials on the highwall is estimated to represent approximately 6% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Togara-North Marshmead void highwall = **LOW**. The likelihood for AMD generation from Togara-North Marshmead void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	5.6%	8% (where known)	92% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	1.9%	This material is expected to comprise approximately 5.6% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	19%	26% (where known)	74% (where known)	19%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 26% of this material is currently above the water table and would be potentially subject to oxidation.	0.2%	This material is estimated to comprise approximately 19% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	0.4%	45% (where known)	55% (where known)	0.4%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 45% of this material is currently above the water table and would be potentially subject to oxidation.	<0.1%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 0.5% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	2.0%	47% (where known)	53% (where known)	2.0%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 47% of this material is currently above the water table and would be potentially subject to oxidation.	0.7%	Fresh coal is expected to comprise approximately 2% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**n/a**	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							5.9%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Togara-North Marshmead void floor	
Togara-North Marshmead Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Togara-North Marshmead void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B27. AMD hazard scoring for source materials and likelihood for AMD generation from South Marshmead residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from South Marshmead void highwall
South Marshmead Void Highwall	Weathered, non-carbonaceous	59%	100% (where known)	0% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	2.5%	This material is expected to comprise approximately 59% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from South Marshmead void highwall = **LOW**. The likelihood for AMD generation from South Marshmead void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	1.3%	100% (where known)	0% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is prodominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.4%	This material is expected to comprise approximately 1.3% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	37%	100% (where known)	0% (where known)	37%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, all of this material is currently above the water table and would be potentially subject to oxidation.	0.3%	This material is estimated to comprise approximately 37% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	0.7%	100% (where known)	0% (where known)	0.7%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, all of this material is currently above the water table and would be potentially subject to oxidation.	<0.1%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 1% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	2.5%	100% (where known)	0% (where known)	2.5%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, all of this material is currently above the water table and would be potentially subject to oxidation.	0.9%	Fresh coal is expected to comprise approximately 2.5% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							4.3%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed South Marshmead void floor
South Marshmead Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of South Marshmead void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B28. AMD hazard scoring for source materials and likelihood for AMD generation from Kennedy residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Kennedy void highwall
Kennedy Void Highwall	Weathered, non-carbonaceous	76%	99% (where known)	1% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	3.3%	This material is expected to comprise approximately 76% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 5% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Kennedy void highwall = **LOW**. The likelihood for AMD generation from Kennedy void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	2.0%	92% (where known)	8% (where known)	0%	33%	Very low proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is prodominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.7%	This material is expected to comprise approximately 2% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	13%	22% (where known)	78% (where known)	13%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 22% of this material is currently above the water table and would be potentially subject to oxidation.	0.1%	This material is estimated to comprise approximately 13% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	0.01%	unk.	unk.	0.01%	13%	Negligible proportion in highwall. Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database).	<0.1%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise less than 0.1% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	1.9%	0% (where known)	100% (where known)	1.9%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, all of this material is currently below the water table and would not be potentially subject to oxidation.	0.7%	Fresh coal is expected to comprise approximately 2% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	6.8%	100%	0%	1.7%	6%	Lithology unknown. All of this material is below base of weathering (ie. fresh). Assume %PAF based on average of fresh spoil materials	0.4%	All of this material is below base of weathering. Assume low PAF. Conservatively assume 'Moderate-High' AMD capacity. Conservative AMD hazard score.	5	5	1	8	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							5.1%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Kennedy void floor	
Kennedy Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Kennedy void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Table B29 AMD hazard scoring for source materials and likelihood for AMD generation from Comet Downs East residual void walls and floor

Material domain	Material type	Proportion of drill-hole meterage on highwall by material type %	Above current water table (where known)	Below current water table (where known)	Proportion of drill-hole meterage (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on highwall	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	AMD Source Material Hazard Score	Likelihood for AMD generation from Comet Downs East void highwall
Comet Downs East Void Highwall	Weathered, non-carbonaceous	33%	99% (where known)	1% (where known)	0%	4.3%	Less than 4.5% of weathered non-carbonaceous samples (n=624) were PAF-LC [no "PAF" samples] (data from geochemical database). It is expected that weathered material is completely or predominantly oxidised and, as such, this material is overwhelmingly NAF.	1.4%	This material is expected to comprise approximately 33% of the void wall material by meterage. Assumed to be non-mineralised, with very low concentrations of reactive sulfide minerals. Small proportion of samples may be PAF (if so, likely low capacity). The potential for AMD from acid sulfate minerals (e.g. jarosite) is very low or negligible. Likely source of ANC. The 75th percentile total S value is 0.02%. AMD capacity based on PAF samples 75th percentile total S of 0.03%.	1	1	1	2	Non-carbonaceous rock is expected to have excess acid neutralising capacity, which should be sufficient to buffer AMD released from potential AMD sources exposed on the highwall, if any. The potential exposure of PAF materials on the highwall is estimated to represent approximately 4% (vertical meterage). Most PAF domains are expected to be largely confined to coal horizons/ seams. However, these will be embedded in a matrix of NAF and ANC-rich materials. Void wall run-off reporting to the residual void is unlikely to produce acidity. The hazard for AMD generation from Comet Downs East void highwall = **LOW**. The likelihood for AMD generation from Comet Downs East void highwall = **UNLIKELY**
	Weathered, carbonaceous & coaly	0.6%	100% (where known)	0% (where known)	0%	33%	Negligible proportion in highwall. Three out of 9 weathered carbonaceous/coaly samples were 'PAF' of some type (data from geochemical database). It is expected that weathered material is predominantly oxidised and, as such, this material is predominantly NAF or would pose a low AMD hazard.	0.2%	This material is expected to comprise less than 1% of the void wall material by meterage. Three (out of 9) samples were UC(PAF), and do not contain significant sulfide minerals. Being weathered, PAF materials are likely to be low capacity (i.e. PAF-LC). The potential for AMD from acid sulfate salts is low. The 75th percentile total S value is 0.43%. AMD capacity based on PAF samples 75th percentile total S of 1.11%.	5	7	1	9	
	Fresh, non-carbonaceous	54%	88% (where known)	12% (where known)	54%	0.9%	Less than 1% of fresh, non-carbonaceous samples were PAF (data from geochemical database) [31 out of 3515 samples]. Water table depths are not available for some highwall drillholes, however where known, approximately 88% of this material is currently above the water table and would be potentially subject to oxidation.	0.5%	This material is estimated to comprise approximately 54% of the void wall material by meterage. Overall, fresh, non-carbonaceous spoil is overwhelmingly NAF with excess ANC. This material is likely to be an important source of ANC. Less than 1% of samples were PAF (of some type), and most were closely associated with coal seams (as roof, parting or floor). This material horizon is overwhelmingly NAF. The 75th percentile total S value for this material is 0.04%. AMD capacity based on PAF samples 75th percentile total S of 0.60%.	1	5	1	4	
	Fresh, carbonaceous	3.0%	47% (where known)	53% (where known)	3.0%	13%	Approximately 13% of fresh, carbonaceous samples (37 out of 283 samples) were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 47% of this material is currently above the water table and would be potentially subject to oxidation.	0.4%	Generation of AMD from fresh carbonaceous units cannot be excluded as 13% of the samples tested (all of BWM) were classed as PAF. However, this material is expected to comprise approximately 3% of the void highwall. Some carbonaceous overburden has excess ANC. The 75th percentile total S value for this material is 0.25%. AMD capacity based on PAF samples 75th percentile total S of 0.66%.	5	5	1	8	
	Coal (fresh)	3.3%	84% (where known)	16% (where known)	3.3%	36%	Approximately 36% of the 381 coal samples were 'PAF' of some type (data from geochemical database). Water table depths are not available for some highwall drillholes, however where known, approximately 84% of this material is currently above the water table and would be potentially subject to oxidation.	1.2%	Fresh coal is expected to comprise approximately 3.3% of the void wall material by meterage. Geochemical data is available for 381 coal samples sourced from across BWM seams, of which 136 samples were conservatively classified as 'PAF' of some type. Of these 'PAF' samples, 80% were classified as NAF-S, UC(PAF) or PAF-LC. The 75th percentile S value for PAF coal samples is 0.34% (and AMD capacity is based on this value). The 75th percentile S value for all coal samples is 0.32%. With regard to the coal quality database (n=7495 samples), the 75th percentile total S value is 0.48% - higher, but generally consistent with the smaller geochemical database. The seams/plys likely to be exposed on the highwall are predominantly the T and P & L seam groups.	5	5	1	8	
	Unknown	6.3%	100%	0%	0%	0%	Lithology unknown. None of this material is below base of weathering (ie. all material is weathered)	<0.1%	All of this material is within weathered zone. Assume negligible PAF. Conservatively assume 'Moderate-High' AMD capacity.	1	7	1	5	
	Estimated frequency of occurrence of PAF drill-hole intervals - assuming representativeness of surface exposure by drill-hole data							3.7%						

Material domain	Material type on void floor	Proportion of exposure on void floor % (assumed)	Above current water table	Below current water table	% Exposure (below base of weathering)	% of PAF sample by material type (environmental and/or coal database)	Comment	Estimated % PAF exposure on void floor	Comment	Geochemical Propensity for AMD	AMD Capacity Rating	AMD Quantity Rating	Likelihood for AMD generation from exposed Comet Downs East void floor
Comet Downs East Void Floor	Coal: P & L Lower seam	100%	0%	100%	100%	3%	PAF proportion estimated by applying a total S 'cut-off' of 0.67% to the coal quality data for P&L Lower seam samples (2792 samples). The S cut-off was based on the median total S value for PAF coal, tailings and rejects samples (combined) from the geochemical database. 86 out of 2792 P&L Lower samples had total S ≥0.67%. Based on the geochemical database, 36% of 381 coal samples were conservatively classifed as PAF. Whereas, based on the much larger coal quality database (2792 samples), only 3% of the void floor is estimated to be PAF. All void floor is below the water table and would become submerged shortly after mining ceases.	3%	The floor of Comet void is expected to be P&L Lower seam group materials (coaly and carbonaceous materials), which has a 75th percentile total S value of 0.43% (based on 2792 P&L Lower samples in the coal quality database). AMD capacity is based on 75th percentile total S value of 1.14% for PAF coal, tailings and rejects samples (combined) from the geochemical database. Approximately 3% of P&L Lower seam coal samples from BWM have been classified as PAF. Limited data is available to assess the availability of ANC in coal samples, however ANC is largely available under field conditions from tailings and rejects samples - therefore coal would be expected to have similar ANC availability. Regardless, the potential for AMD generation from a small proportion of the void floor cannot be excluded - assuming the entire void floor comprises purely coal material. No allowance for pit flooding has been taken into account in this hazard assessment. Refer to report body for discussion regarding pit flooding.	1	7	1	5	Approximately 3% of the void floor may comprise PAF coal. The geochemical hazard for the void floor to develop AMD is low if the entire void floor comprises purely coal material (unlikely) and if the coal floor remains exposed to air (unlikely). As such, the actual AMD hazard post-closure will likely be lower than indicated. The likelihood for AMD generation from exposed void floor = **UNLIKELY**

Appendix C – SPR Assessment Tables

SPR assessment of post-closure spoil landform (source) to surface water (receptor)

- Table C1 Ramp 8 spoil landform
- Table C2 Bonnie Doon spoil landform
- Table C3 Mimosa-Besgrove spoil landform
- Table C4 Deep Creek spoil landform
- Table C5 Stewarton spoil landform
- Table C6 Tannyfoil spoil landform
- Table C7 South Ballamoo (Terang) spoil landform
- Table C8 Blackdown spoil landform
- Table C9 Kenmare spoil landform
- Table C10 Ramp 74 spoil landform
- Table C11 Togara-North Marshmead spoil landform
- Table C12 South Marshmead spoil landform
- Table C13 Kennedy spoil landform
- Table C14 Comet Downs East spoil landform

SPR assessment of post-closure TSF and rejects landforms (source) to surface water (receptor)

- Table C15 NCPP TSF landform
- Table C16 Laleham TSF landform
- Table C17 Bottom Dam TSF (and rejects) landform
- Table C18 Ramp 36 rejects landform

SPR assessment of post-closure spoil landform (source) to residual void (receptor)

- Table C19 Ramp 8, Bonnie Doon, Mimosa-Besgrove and Deep Creek spoil landforms
- Table C20 Stewarton, Tannyfoil, Blackdown and South Ballamoo spoil landforms
- Table C21 Kenmare, Ramp 74 and Togara-North Marshmead spoil landforms
- Table C22 South Marshmead, Kennedy and Comet Downs East spoil landforms

SPR assessment of post-closure TSF and rejects landform (source) to residual void (receptor)

- Table C23 TSF landforms (NCPP, Laleham, Bottom Dam) and Ramp 36 rejects landform

SPR assessment of residual void walls and floor (source) to residual void (receptor)

- Table C24 All residual voids

Table C1. Source-Pathway-Receptor (SPR) assessment of Ramp 8 spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Ramp 8 spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Ramp 8 spoil landform via surface water run-off into ephemeral tributary of Bonnie Doon Creek. Distance <100m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): tributary of Bonnie Doon Creek @ western side of Ramp 8 spoil landform. *Potential for AMD to reach Bonnie Doon Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Bonnie Doon Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributary of Bonnie Doon Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributary of Bonnie Doon Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributary of Bonnie Doon Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributary of Bonnie Doon Creek [via run-off]	Unlikely	S1	**Low**
	From Ramp 8 spoil landform via seepage into shallow permeable strata then into ephemeral tributary of Bonnie Doon Creek. Distance <100m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: tributary of Bonnie Doon Creek @ western side of Ramp 8 spoil landform. *Potential for AMD to reach Bonnie Doon Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Bonnie Doon Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributary of Bonnie Doon Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributary of Bonnie Doon Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributary of Bonnie Doon Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributary of Bonnie Doon Creek [via seepage]	Unlikely	S1	**Low**

Table C2. Source-Pathway-Receptor (SPR) assessment of Bonnie Doon spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Bonnie Doon spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Bonnie Doon spoil landform via surface water run-off into ephemeral Bonnie Doon Creek (and tributary). Distance <100m to receptor (northwest) and ~900m (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Bonnie Doon Creek (and tributary) @ western side of Bonnie Doon spoil landform. *Potential for AMD to reach Bonnie Doon Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Bonnie Doon Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Bonnie Doon Creek and tributary [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Bonnie Doon Creek and tributary [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Bonnie Doon Creek and tributary [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Bonnie Doon Creek and tributary [via run-off]	Unlikely	S1	**Low**
	From Bonnie Doon spoil landform via seepage into shallow permeable strata then into ephemeral Bonnie Doon Creek (and tributary). Distance <100m to receptor (northwest) and ~900 (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Bonnie Doon Creek (and tributary) @ western side of Bonnie Doon spoil landform. *Potential for AMD to reach Bonnie Doon Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Bonnie Doon Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Bonnie Doon Creek and tributary [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Bonnie Doon Creek and tributary [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Bonnie Doon Creek and tributary [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Bonnie Doon Creek and tributary [via seepage]	Unlikely	S1	**Low**

Table C3. Source-Pathway-Receptor (SPR) assessment of Mimosa-Besgrove spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Mimosa-Besgrove spoil landform (post-closure) Comprised of approximately 95% non-carbonaceous spoil; approximately 2.9% carbonaceous spoil; and approximately 1.9% rejects. Deep Creek rejects dump (now buried within landform) is located <100m from southern toe of landform No tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform is* ***Low*** *[AMD source hazard of rejects alone is* ***Moderate****, which has implications, specifically, for buried rejects at Deep Creek (Ramp 32) rejects area [ie. largely concentrated in one area]. Buried Deep Creek rejects are located <100m from southern toe of landform, which is <100m from Deep Creek]* (***Figure 34***)	From Mimosa-Besgrove spoil landform via surface water run-off into ephemeral Burngrove Creek and tributaries. Distance <200m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): tributaries of Burngrove Creek @ western side of Mimosa-Besgrove spoil landform. *Potential for AMD to reach tributaries of Burngrove Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Burngrove Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Burngrove Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Burngrove Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Burngrove Ck [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Burngrove Creek [via run-off]	Unlikely	S1	**Low**
	From Mimosa-Besgrove spoil landform via seepage into shallow permeable strata then into ephemeral Burngrove Creek and tributaries. Distance <200m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: tributaries of Burngrove Creek @ western side of Mimosa-Besgrove spoil landform. *Potential for AMD to reach tributaries of Burngrove Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Burngrove Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Burngrove Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Burngrove Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Burngrove Ck [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Burngrove Creek [via seepage]	Unlikely	S1	**Low**
	From Mimosa-Besgrove spoil landform via surface water run-off into ephemeral Deep Creek. Distance <100m to receptor (south). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Deep Creek @ southern side of Mimosa-Besgrove spoil landform. *Potential for AMD to reach Deep Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via run-off]	Unlikely	S1	**Low**
	From Mimosa-Besgrove spoil landform via seepage into shallow permeable strata then into ephemeral Deep Creek. Distance <100m to receptor (south). *Potential for AMD to enter shallow groundwater:* ***Probable/Likely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Probable/Likely***	Ephemeral creek (via shallow permeable strata: Deep Creek @ southern side of Mimosa-Besgrove spoil landform. *Potential for AMD to reach Deep Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via seepage] Risk primarily lies with seepage from buried rejects concentrated at Deep Creek (R32) rejects area	Unlikely	S3	**Low to Medium**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via seepage] Risk primarily lies with seepage from buried rejects concentrated at Deep Creek (R32) rejects area	Unlikely	S3	**Low to Medium**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via seepage] Risk primarily lies with seepage from buried rejects concentrated at Deep Creek (R32) rejects area	Unlikely	S3	**Low to Medium**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via seepage] Risk primarily lies with seepage from buried rejects concentrated at Deep Creek (R32) rejects area	Unlikely	S2	**Low**

Table C4. Source-Pathway-Receptor (SPR) assessment of Deep Creek spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Deep Creek spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil; approximately 3% carbonaceous spoil; and approximately 1% rejects. No tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform is* ***Low*** *AMD source hazard of rejects alone is* ***Moderate****. Rejects are widely distributed throughout the landform and comprise a very low proportion of the landform.*	From Deep Creek spoil landform via surface water run-off into ephemeral Deep Creek. Distance <100m to receptor (north and northwest). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Deep Creek @ northern and northwestern side of Deep Creek spoil landform. *Potential for AMD to reach Deep Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via run-off]	Unlikely	S1	**Low**
	From Deep Creek spoil landform via seepage into shallow permeable strata then into ephemeral Deep Creek. Distance <100m to receptor (north and northwest). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Deep Creek @ northern and northwestern side of Deep Creek spoil landform. *Potential for AMD to reach Deep Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via seepage]	Unlikely	S1	**Low**
	From Deep Creek spoil landform via surface water run-off into ephemeral tributaries Taurus Creek. Distance ~400m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): tributaries of Taurus Creek @ western side of Deep Creek landform. *Potential for AMD to reach tributaries of Taurus Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Taurus Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Taurus Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals / metalloids impacting tributaries of Taurus Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Taurus Ck [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Taurus Creek [via run-off]	Unlikely	S1	**Low**
	From Deep Creek spoil landform via seepage into shallow permeable strata then into ephemeral tributaries of Taurus Creek. Distance ~400m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata): tributaries of Taurus Creek @ western side of Deep Creek landform. *Potential for AMD to reach tributaries of Taurus Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Taurus Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Taurus Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals / metalloids impacting tributaries of Taurus Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Taurus Ck [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Taurus Creek [via seepage]	Unlikely	S1	**Low**
	From Deep Creek spoil landform via surface water run-off into ephemeral Taurus Creek. Distance <100m to receptor (south and southwest). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Taurus Creek @ southern and southwestern side of Deep Creek spoil landform. *Potential for AMD to reach Taurus Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Taurus Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Taurus Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Taurus Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Taurus Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Taurus Creek [via run-off]	Unlikely	S1	**Low**
	From Deep Creek spoil landform via seepage into shallow permeable strata then into ephemeral Taurus Creek. Distance <100m to receptor (south and southwest). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Taurus Creek @ southern and southwestern side of Deep Creek spoil landform. *Potential for AMD to reach Taurus Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Taurus Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Taurus Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Taurus Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Taurus Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Taurus Creek [via seepage]	Unlikely	S1	**Low**

Table C5. Source-Pathway-Receptor (SPR) assessment of Stewarton spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Stewarton spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil; approximately 4% carbonaceous spoil; and approximately 0.2% rejects. No tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform is* ***Low*** *AMD source hazard of rejects alone is* ***Moderate****. No rejects are currently in the landform. Future rejects would be broadly distributed throughout the landform and comprise a very low proportion of the landform.*	From Stewarton spoil landform via surface water run-off into ephemeral Taurus Creek. Distance <100m to receptor (north and northwest). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Taurus Creek @ northern and northwestern side of Stewarton spoil landform. *Potential for AMD to reach Taurus Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Taurus Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Taurus Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Taurus Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Taurus Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Taurus Creek [via run-off]	Unlikely	S1	**Low**
	From Stewarton spoil landform via seepage into shallow permeable strata then into ephemeral Taurus Creek. Distance <100m to receptor (north and northwest). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Taurus Creek @ northern and northwestern side of Stewarton spoil landform. *Potential for AMD to reach Taurus Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Taurus Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Taurus Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Taurus Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Taurus Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Taurus Creek [via seepage]	Unlikely	S1	**Low**
	From Stewarton spoil landform via surface water run-off into ephemeral Emu Creek. Distance <100m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Emu Creek @ western side of Stewarton landform. *Potential for AMD to reach Emu Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Emu Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Emu Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Emu Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Emu Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Emu Creek [via run-off]	Unlikely	S1	**Low**
	From Stewarton spoil landform via seepage into shallow permeable strata then into ephemeral Emu Creek. Distance <100m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Emu Creek @ western side of Stewarton spoil landform. *Potential for AMD to reach Emu Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Emu Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Emu Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals / metalloids impacting Emu Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Emu Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Emu Creek [via seepage]	Unlikely	S1	**Low**

Table C6. Source-Pathway-Receptor (SPR) assessment of Tannyfoil spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Tannyfoil spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Tannyfoil spoil landform via surface water run-off into ephemeral Emu Creek. Distance <100m to receptor (west). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Emu Creek @ western side of Tannyfoil spoil landform. *Potential for AMD to reach Emu Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Emu Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Emu Creek [via run-off]	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Emu Creek [via run-off]	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Emu Creek [via run-off]	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Emu Creek [via run-off]	Unlikely	S1	Low
	From Tannyfoil spoil landform via seepage into shallow permeable strata then into ephemeral Emu Creek (and tributary). Distance <100m to receptor (west). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: Emu Creek @ western side of Tannyfoil spoil landform. *Potential for AMD to reach Emu Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Emu Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Emu Creek [via seepage]	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Emu Creek [via seepage]	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Emu Creek [via seepage]	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Emu Creek [via seepage]	Unlikely	S1	Low

Table C7. Source-Pathway-Receptor (SPR) assessment of South Ballamoo (Terang) spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
South Ballamoo (Terang) spoil landform (post-closure) Comprised of approximately 95% non-carbonaceous spoil, approximately 4% carbonaceous spoil and less than 1% (approximately) rejects. No tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low*** *AMD source hazard of rejects alone is **Moderate**. Rejects are currently in the landform at Terang pit and comprise a very low proportion of the landform. No future rejects proposed.*	From South Ballamoo (Terang) spoil landform via surface water run-off into ephemeral tributary of Sirius Creek. Distance <300m to receptor (west). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Tributary of Sirius Creek @ western side of South Ballamoo (Terang) spoil landform. *Potential for AMD to reach Sirius Creek tributary: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek tributary: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek tributary (or Sirius Creek) [via run-off]	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek tributary (or Sirius Creek) [via run-off]	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek tributary (or Sirius Creek) [via run-off]	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Sirius Creek tributary (or Sirius Creek) [via run-off]	Unlikely	S1	Low
	From South Ballamoo (Terang) spoil landform via seepage into shallow permeable strata then into ephemeral tributary of Sirius Creek. Distance <300m to receptor (west). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: Tributary of Sirius Creek @ western side of South Ballamoo spoil landform. *Potential for AMD to reach Sirius Creek tributary: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek tributary: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek tributary (or Sirius Creek) [via seepage]	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek tributary (or Sirius Creek) [via seepage]	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek tributary (or Sirius Creek) [via seepage]	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Sirius Creek tributary (or Sirius Creek) [via seepage]	Unlikely	S1	Low

Table C8. Source-Pathway-Receptor (SPR) assessment of Blackdown spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Blackdown spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil; approximately 4% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform is* ***Low***	From Blackdown spoil landform via surface water run-off into ephemeral tributaries of Sirius Creek. Distance >500m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): tributaries of Sirius Creek @ western side of Blackdown spoil landform. *Potential for AMD to reach tributaries of Sirius Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Sirius Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Sirius Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Sirius Creek [via run-off]	Unlikely	S1	**Low**
	From Blackdown spoil landform via seepage into shallow permeable strata then into ephemeral tributaries of Sirius Creek. Distance >500m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: tributaries of Sirius Creek @ western side of Blackdown spoil landform. *Potential for AMD to reach tributaries of Sirius Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Sirius Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Sirius Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Sirius Creek [via seepage]	Unlikely	S1	**Low**
	From Blackdown spoil landform via surface water run-off into ephemeral tributaries of Two Mile Gully. Distance >500m to receptor (east). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): tributaries of Two Mile Gully @ eastern side of Blackdown landform. *Potential for AMD to reach tributaries of Two Mile Gully:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Two Mile Gully:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Two Mile Gully [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Two Mile Gully [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Two Mile Gully [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Two Mile Gully [via run-off]	Unlikely	S1	**Low**
	From Blackdown spoil landform via seepage into shallow permeable strata then into ephemeral tributaries of Two Mile Gully. Distance >500m to receptor (east). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: tributaries of Two Mile Gully @ eastern side of Blackdown spoil landform. *Potential for AMD to reach tributaries of Two Mile Gully:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Two Mile Gully:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Two Mile Gully [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals / metalloids impacting tributaries of Two Mile Gully [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Two Mile Gully [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Two Mile Gully [via seepage]	Unlikely	S1	**Low**

Table C9. Source-Pathway-Receptor (SPR) assessment of Kenmare spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Kenmare spoil landform (post-closure) Comprised of approximately 95% non-carbonaceous spoil; approximately 3% carbonaceous spoil; approximately 1% rejects; and approximately 1% tailings. All tailings and about half of rejects are located at Ramp 72 TSF and southern end of Kenmare pit. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low*** *AMD source hazard of Ramp 72 tailings and rejects alone is **Moderate-High to High**. This has implications for potential seepage from buried tailings and rejects within Ramp 72 TSF and Kenmare pit (**Figure 31**).* *AMD source hazard from Ramp 70 rejects alone is **Moderate.***	From Kenmare spoil landform via surface water run-off into ephemeral tributaries of Sirius Creek. Distance <100m to receptor (west / south / southwest). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): tributaries of Sirius Creek @ west / south / southwestern side of Kenmare spoil landform. *Potential for AMD to reach tributaries of Sirius Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Sirius Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Sirius Creek [via run-off]	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting tributaries of Sirius Creek [via run-off]	Unlikely	S2	**Low**
	From Kenmare spoil landform via seepage into shallow permeable strata then into ephemeral tributaries of Sirius Creek. Distance <100m to receptor (west / south / southwest). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: tributaries of Sirius Creek @ west / south / southwestern side of Kenmare spoil landform. *Potential for AMD to reach tributaries of Sirius Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributaries of Sirius Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributaries of Sirius Creek [via seepage] Risk primarily lies with seepage from buried tailings at Ramp 72 TSF and rejects within the southern end of Kenmare pit	Unlikely	S3	**Low to Medium**
			Neutral metalliferous drainage: Metals and metalloids impacting tributaries of Sirius Creek [via seepage] Risk primarily lies with seepage from buried tailings at Ramp 72 TSF and rejects within the southern end of Kenmare pit	Unlikely	S3	**Low to Medium**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributaries of Sirius Creek [via seepage] Risk primarily lies with seepage from buried tailings at Ramp 72 TSF and rejects within the southern end of Kenmare pit	Unlikely	S3	**Low to Medium**
			Saline drainage (non-oxidative): Salt impacting tributaries of Sirius Creek [via seepage] Risk primarily lies with seepage from buried tailings at Ramp 72 TSF and rejects within the southern end of Kenmare pit	Unlikely	S2	**Low**

Table C10. Source-Pathway-Receptor (SPR) assessment of Ramp 74 spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Ramp 74 (Laleham) spoil landform (post-closure) Comprised of approximately 99% non-carbonaceous spoil and approximately 1% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Ramp 74 spoil landform via surface water run-off into ephemeral Sirius Creek. Distance <100m to receptor (south / southwest). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Sirius Creek @ south / southwestern side of Ramp 74 spoil landform. *Potential for AMD to reach Sirius Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via run-off]	Unlikely	S1	**Low**
	From Ramp 74 spoil landform via seepage into shallow permeable strata then into ephemeral Sirius Creek. Distance <100m to receptor (south / southwest). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Sirius Creek @ south / southwestern side of Ramp 74 spoil landform. *Potential for AMD to reach Sirius Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via seepage]	Unlikely	S1	**Low**

Laleham TSF is within the footprint and pit shell of Ramp 74 (Laleham) spoil landform, but is conservatively assessed as a stand-alone TSF landform due to its location at the edge of the spoil landform and the concentrated nature of tailings in one area of the spoil landform (i.e. the SPR assessment of Laleham TSF has been undertaken separate to Ramp 74 spoil landform). Refer to **Table C16**.

Table C11. Source-Pathway-Receptor (SPR) assessment of Togara-North Marshmead spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Togara-North Marshmead spoil landform (post-closure) Comprised of approximately 94% non-carbonaceous spoil; approximately 6% carbonaceous spoil; and approximately 0.2% rejects. No tailings *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low*** *AMD source hazard of rejects alone is **Moderate**. Rejects are widely distributed throughout the landform and comprise a very low proportion of the landform.*	From Togara-North Marshmead spoil landform via surface water run-off into ephemeral Sirius Creek. Distance <100m to receptor (north). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Sirius Creek @ northern side of Togara-North Marshmead spoil landform. *Potential for AMD to reach Sirius Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via run-off]	Unlikely	S1	**Low**
	From Togara-North Marshmead spoil landform via seepage into shallow permeable strata then into ephemeral Sirius Creek. Distance <100m to receptor (north). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: Sirius Creek @ northern side of Togara-North Marshmead spoil landform. *Potential for AMD to reach Sirius Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via seepage]	Unlikely	S1	**Low**
	From Togara-North Marshmead spoil landform via surface water run-off into ephemeral Rockland Creek. Distance <100m to receptor (south). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Rockland Creek @ southern side of Togara-North Marshmead spoil landform. *Potential for AMD to reach Rockland Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
	From Togara-North Marshmead spoil landform via seepage into shallow permeable strata then into ephemeral Rockland Creek. Distance <100m to receptor (south). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: Rockland Creek @ southern side of Togara-North Marshmead spoil landform. *Potential for AMD to reach Rockland Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**

Table C12. Source-Pathway-Receptor (SPR) assessment of South Marshmead spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
South Marshmead spoil landform (post-closure) Comprised of approximately 98% non-carbonaceous spoil and approximately 2% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low***	From South Marshmead spoil landform via surface water run-off into ephemeral Rockland Creek. Distance <100m to receptor (north). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Rockland Creek @ northern side of South Marshmead spoil landform. *Potential for AMD to reach Rockland Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
	From South Marshmead spoil landform via seepage into shallow permeable strata then into ephemeral Rockland Creek. Distance <100m to receptor (north). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: Rockland Creek @ northern side of South Marshmead spoil landform. *Potential for AMD to reach Rockland Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**
	From South Marshmead spoil landform via surface water run-off into ephemeral tributary of Shotover Creek. Distance ~600m to receptor (south). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): tributary of Shotover Creek @ southern side of South Marshmead spoil landform. *Potential for AMD to reach tributary of Shotover Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributary of Shotover Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributary of Shotover Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributary of Shotover Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributary of Shotover Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributary of Shotover Creek [via run-off]	Highly Unlikely	S1	**Low**
	From South Marshmead spoil landform via seepage into shallow permeable strata then into ephemeral tributary of Shotover Creek. Distance ~600m to receptor (south). *Potential for AMD to enter shallow groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Unlikely***	Ephemeral creek (via shallow permeable strata: tributary of Shotover Creek @ southern side of South Marshmead spoil landform. *Potential for AMD to reach tributary of Shotover Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach tributary of Shotover Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting tributary of Shotover Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting tributary of Shotover Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting tributary of Shotover Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting tributary of Shotover Creek [via seepage]	Highly Unlikely	S1	**Low**

Table C13. Source-Pathway-Receptor (SPR) assessment of Kennedy spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Kennedy spoil landform (post-closure) Comprised of approximately 94% non-carbonaceous spoil and approximately 6% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Kennedy spoil landform via surface water run-off into ephemeral Rockland Creek. Distance ~100m to receptor (west). *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Rockland Creek @ western side of Kennedy spoil landform. *Potential for AMD to reach Rockland Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
	From Kennedy spoil landform via seepage into shallow permeable strata then into ephemeral Rockland Creek. Distance ~100m to receptor (west). *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Rockland Creek @ western side of Kennedy spoil landform. *Potential for AMD to reach Rockland Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**

Table C14. Source-Pathway-Receptor (SPR) assessment of Comet Downs East spoil landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Comet Downs East spoil landform (post-closure) Comprised of approximately 93% non-carbonaceous spoil and approximately 7% carbonaceous spoil. No rejects or tailings *AMD source hazard of landform is* ***Low*** *Salinity (non-oxidative) source hazard of landform:* ***Low***	From Comet Downs East spoil landform via surface water run-off into ephemeral Rockland Creek. Distance ~100m to receptor (east) [and ~750m west to minor tributary]. *Potential for AMD to enter surface water run-off:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off:* ***Unlikely***	Ephemeral creek (via surface water run-off): Rockland Creek @ eastern side of Comet Downs East spoil landform [and ~750m west to minor tributary]. *Potential for AMD to reach Rockland Creek:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek:* ***Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via run-off]	Unlikely	S1	**Low**
	From Comet Downs East spoil landform via seepage into shallow permeable strata then into ephemeral Rockland Creek. Distance ~100m to receptor (east) [and ~750m west to minor tributary]. *Potential for AMD to enter shallow groundwater:* ***Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater:* ***Unlikely***	Ephemeral creek (via shallow permeable strata: Rockland Creek @ eastern side of Comet Downs East spoil landform [and ~750m west to minor tributary]. *Potential for AMD to reach Rockland Creek:* ***Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Rockland Creek:* ***Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Rockland Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Rockland Creek [via seepage]	Unlikely	S1	**Low**

Table C15. Source-Pathway-Receptor (SPR) assessment of NCPP TSF landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
NCPP TSF landform (post-closure) (**Figure 27**) Excluding cover, the TSF is comprised of approximately 80% tailings; approximately 19% rejects; and approximately 1% fill. *AMD source hazard of landform is **Moderate-High*** *Salinity (non-oxidative) source hazard of landform is **Moderate*** TSF will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low**.*	From NCPP TSF landform via surface water run-off into ephemeral Deep Creek. Distance <100m to receptor (south / southeast). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Deep Creek @ south / southeastern side of NCPP TSF landform. *Potential for AMD to reach Deep Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
	From NCPP TSF landform via seepage into shallow permeable strata then into ephemeral Deep Creek. Distance <100m to receptor (south / southeast). *Potential for AMD to enter shallow groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Probable***	Ephemeral creek (via shallow permeable strata: Deep Creek @ south / southeastern side of NCPP TSF landform. *Potential for AMD to reach Deep Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via seepage]	Unlikely	S3	**Low to Medium**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via seepage]	Unlikely	S3	**Low to Medium**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via seepage]	Unlikely	S3	**Low to Medium**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via seepage]	Unlikely	S2	**Low**

Table C16. Source-Pathway-Receptor (SPR) assessment of Laleham TSF landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Laleham TSF landform (post-closure) (**Figure 28**) Excluding cover, the TSF is comprised of approximately 90% tailings; approximately 4% rejects; and approximately 6% spoil/fill. *AMD source hazard of landform is **Moderate-High*** *Salinity (non-oxidative) source hazard of landform is **Moderate*** TSF will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low**.*	From Laleham TSF landform via surface water run-off into ephemeral Sirius Creek. Distance ~370m to receptor (south). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Sirius Creek @ southern side of Laleham TSF landform. *Potential for AMD to reach Sirius Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via run-off]	Highly Unlikely	S2	**Low**
	From Laleham TSF landform via seepage into shallow permeable strata then into ephemeral Sirius Creek. Distance ~370m to receptor (south). *Potential for AMD to enter shallow groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Probable***	Ephemeral creek (via shallow permeable strata: Sirius Creek @ southern side of Laleham TSF landform. *Potential for AMD to reach Sirius Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via seepage]	Highly Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via seepage]	Highly Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via seepage]	Highly Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via seepage]	Highly Unlikely	S2	**Low**

Table C17. Source-Pathway-Receptor (SPR) assessment of Bottom Dam TSF and rejects landform: surface water receptors via run-off and seepage/groundwater

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Bottom Dam TSF and rejects landform (post-closure) (**Figure 29**) The current TSF is comprised of about 95% tailings and 4% rejects. During rehabilitation, the TSF will be buried by rejects currently located adjacent to the TSF. As such, excluding spoil cover, the Bottom Dam area is estimated to be comprised of approximately 50% tailings and 50% rejects. *AMD source hazard of landform is assumed **Moderate-High*** *Salinity (non-oxidative) source hazard of landform is assumed **Moderate*** TSF/rejects area will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low**.*	From Bottom Dam TSF/rejects landform via surface water run-off into ephemeral Sirius Creek. Distance ~750m to receptor (south). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Sirius Creek ~750 m south of Bottom Dam landform. *Potential for AMD to reach Sirius Creek: **Highly Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Highly Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via run-off]	Highly Unlikely	S1	**Low**
	From Bottom Dam TSF/rejects landform via seepage into shallow permeable strata then into ephemeral Sirius Creek. Distance ~750m to receptor (south). *Potential for AMD to enter shallow groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Probable***	Ephemeral creek (via shallow permeable strata: Sirius Creek ~750 m south of Bottom Dam landform. *Potential for AMD to reach Sirius Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Sirius Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Sirius Creek [via seepage]	Highly Unlikely	S1	**Low**

Table C18. Source-Pathway-Receptor (SPR) assessment of Ramp 36 rejects landform: surface water receptors via run-off and via shallow permeable strata (shallow groundwater)

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Ramp 36 rejects landform (post-closure) (**Figure 30**) Excluding cover, the rejects landform is comprised of approximately 98% rejects; and approximately 2% fill. No tailings. *AMD source hazard of landform is **Moderate-High*** *Salinity (non-oxidative) source hazard of landform is **Moderate*** Rejects dump will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low**.*	From Ramp 36 rejects landform via surface water run-off into ephemeral Deep Creek. Distance <100m to receptor (north / northeast). *Potential for AMD to enter surface water run-off: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off: **Unlikely***	Ephemeral creek (via surface water run-off): Deep Creek @ north / northwestern side of Ramp 36 rejects landform. *Potential for AMD to reach Deep Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via run-off]	Unlikely	S2	**Low**
	From Ramp 36 rejects landform via seepage into shallow permeable strata then into ephemeral Deep Creek. Distance <100m to receptor (north / northwest). *Potential for AMD to enter shallow groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter shallow groundwater: **Probable***	Ephemeral creek (via shallow permeable strata: Deep Creek @ south / southeastern side of Ramp 36 rejects landform. *Potential for AMD to reach Deep Creek: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach Deep Creek: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek [via seepage]	Unlikely	S3	**Low to Medium**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek [via seepage]	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek [via seepage]	Unlikely	S3	**Low to Medium**
			Saline drainage (non-oxidative): Salt impacting Deep Creek [via seepage]	Unlikely	S2	**Low**

Table C19. Source-Pathway-Receptor (SPR) assessment of Ramp 8, Bonnie Doon, Mimosa-Besgrove and Deep Creek spoil landforms: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Ramp 8 spoil landform Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from Ramp 8 spoil landform into groundwater, which flows into Ramp 8 residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Ramp 8 residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Ramp 8 residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Ramp 8 residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Ramp 8 residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Ramp 8 residual void water quality	Unlikely	S1	**Low**
Bonnie Doon (BD) spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from BD spoil landform into groundwater, which flows into neighbouring Ramp 8 (R8) and Mimosa-Besgrove (MB) residual voids. Voids are expected to intersect the water table. Voids are groundwater 'sinks', drawing all groundwater within the void groundwater catchment towards these two residual voids. Groundwater seeping towards BD void will ultimately flow into R8 and MB voids, due to these two voids being much deeper than BD void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Ramp 8 and Mimosa-Besgrove residual voids (NUMAs). *Potential for AMD to reach residual voids: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual voids: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Ramp 8 and/or Mimosa-Besgrove residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Ramp 8 and/or Mimosa-Besgrove residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Ramp 8 and/or Mimosa-Besgrove residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Ramp 8 and/or Mimosa-Besgrove void water quality	Unlikely	S1	**Low**
Mimosa-Besgrove spoil landform (post-closure) Comprised of approx. 95% non-carb. spoil; approx. 2.9% carb. spoil; and approx. 1.9% rejects. No tailings. *AMD source hazard of landform is **Low** Salinity (non-oxidative) source hazard of landform is **Low*** *Rejects concentrated at R32 rejects dump, <100m from edge of spoil landform. AMD source hazard of rejects is **Moderate***	Seepage / percolation from Mimosa-Besgrove spoil landform into groundwater, which flows into Mimosa-Besgrove residual void (+/- Ramp 30S residual void). Residual voids are expected to intersect the water table. Residual voids are a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Mimosa-Besgrove and Ramp 30S residual voids (NUMAs) *Potential for AMD to reach residual voids: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual voids: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Mimosa-Besgrove or Ramp 30S residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Mimosa-Besgrove or Ramp 30S residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Mimosa-Besgrove or Ramp 30S residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Mimosa-Besgrove or Ramp 30S residual void water quality	Unlikely	S1	**Low**
Deep Creek spoil landform (post-closure) Comprised of approx. 96% non-carb. spoil; approx. 3% carb. spoil; and approx. 1% rejects. No tailings. *AMD source hazard of landform is **Low** Salinity (non-oxidative) source hazard of landform is **Low*** *AMD source hazard of rejects alone is **Moderate**. Rejects are distributed throughout the landform.*	Seepage / percolation from Deep Creek spoil landform into groundwater, which flows into Deep Creek residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Deep Creek residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek residual void water quality	Unlikely	S1	**Low**

Table C20. Source-Pathway-Receptor (SPR) assessment of Stewarton, Tannyfoil, Blackdown and South Ballamoo (Terang) spoil landforms: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Stewarton spoil landform Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from Stewarton spoil landform into groundwater, which flows into Stewarton North residual void (+/- via Stewarton South void, which is approximately half the depth of Stewarton North void). Stewarton North residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment (including from Stewarton South void) towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Stewarton North residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Stewarton North residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Stewarton North residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Stewarton North residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Stewarton North residual void water quality	Unlikely	S1	**Low**
Tannyfoil spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from Tannyfoil spoil landform into groundwater, which flows into Tannyfoil residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Tannyfoil residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Tannyfoil residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Tannyfoil residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Tannyfoil residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Tannyfoil void water quality	Unlikely	S1	**Low**
Blackdown spoil landform (post-closure) Comprised of approximately 96% non-carbonaceous spoil and approximately 4% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from Blackdown spoil landform into groundwater, which flows into Tannyfoil and South Ballamoo residual voids. Residual voids are expected to intersect the water table. Residual voids are a groundwater 'sink', drawing all groundwater within the voids' groundwater catchment towards the residual voids. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Tannyfoil and South Ballamoo residual voids (NUMA). *Potential for AMD to reach residual voids: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual voids: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Tannyfoil and South Ballamoo residual voids' water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Tannyfoil and South Ballamoo residual voids' water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Tannyfoil and South Ballamoo residual voids' water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Tannyfoil and South Ballamoo residual voids' water quality	Unlikely	S1	**Low**
South Ballamoo (Terang) spoil landform (post-closure) Comprised of approx. 95% non-carb. spoil; approx. 4% carb. spoil; and approx. 1% rejects. No tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low*** *AMD source hazard of rejects alone is **Moderate**. Rejects are located at Ramp 64 (northern end of existing Terang pit).*	Seepage / percolation from South Ballmoo (Terang) spoil landform into groundwater, which flows into South Ballamoo residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	South Ballamoo residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting South Ballamoo residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting South Ballamoo residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting South Ballamoo residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting South Ballamoo residual void water quality	Unlikely	S1	**Low**

Table C21. Source-Pathway-Receptor (SPR) assessment of Kenmare, Ramp 74 and Togara-North Marshmead spoil landforms: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Kenmare spoil landform (post-closure) Comprised of approximately 95% non-carbonaceous spoil; approximately 3% carbonaceous spoil; approximately 1% rejects; and approximately 1% tailings. *AMD source hazard of landform is **Low**.* *Salinity (non-oxidative) source hazard of landform is **Low**.* All tailings and about half of rejects are located at R72 TSF and southern end of Kenmare pit. *AMD source hazard of R72 tailings and rejects is **Moderate-High to High**.* *AMD source hazard of R70 rejects is **Moderate***	Seepage / percolation from Kenmare spoil landform into groundwater, which flows into Kenmare residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Kenmare residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Kenmare residual void water quality	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Kenmare residual void water quality	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Kenmare residual void water quality	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Kenmare void water quality	Unlikely	S1	Low
Ramp 74 (Laleham) spoil landform (post-closure) Comprised of approximately 99% non-carbonaceous spoil and approximately 1% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform: **Low***	Seepage / percolation from Ramp 74 spoil landform into groundwater, which flows into Togara-North Marshmead residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Togara-North Marshmead residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Togara-Nth Marshmead residual void water quality	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Togara-Nth Marshmead residual void water quality	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Togara-Nth Marshmead residual void water quality	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Togara-Nth Marshmead residual void water quality	Unlikely	S1	Low
Togara-North Marshmead spoil landform (post-closure) Comprised of approximately 94% non-carbonaceous spoil; approximately 6% carbonaceous spoil; and approximately 0.2% rejects. No tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low*** *AMD source hazard of rejects alone is **Moderate**.* *Rejects are distributed throughout the landform.*	Seepage / percolation from Togara-North Marshmead spoil landform into groundwater, which flows into Togara-North Marshmead residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Togara-North Marshmead residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Togara-Nth Marshmead residual void water quality	Highly Unlikely	S1	Low
			Neutral metalliferous drainage: Metals and metalloids impacting Togara-Nth Marshmead residual void water quality	Unlikely	S1	Low
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Togara-Nth Marshmead residual void water quality	Highly Unlikely	S1	Low
			Saline drainage (non-oxidative): Salt impacting Togara-Nth Marshmead residual void water quality	Unlikely	S1	Low

Table C22. Source-Pathway-Receptor (SPR) assessment of South Marshmead, Kennedy and Comet Downs East spoil landforms: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
South Marshmead spoil landform (post-closure) Comprised of approximately 98% non-carbonaceous spoil and approximately 2% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low***	Seepage / percolation from South Marshmead spoil landform into groundwater, which flows into South Marshmead residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	South Marshmead residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting South Marshmead residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting South Marshmead residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting South Marshmead residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting South Marshmead residual void water quality	Unlikely	S1	**Low**
Kennedy spoil landform (post-closure) Comprised of approximately 94% non-carbonaceous spoil and approximately 6% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low***	Seepage / percolation from Kennedy spoil landform into groundwater, which flows into Kennedy residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Kennedy West residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Kennedy West residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Kennedy West residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Kennedy West residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Kennedy West void water quality	Unlikely	S1	**Low**
Comet Downs East spoil landform (post-closure) Comprised of approximately 93% non-carbonaceous spoil and approximately 7% carbonaceous spoil. No rejects or tailings. *AMD source hazard of landform is **Low*** *Salinity (non-oxidative) source hazard of landform is **Low***	Seepage / percolation from Comet Downs East spoil landform into groundwater, which flows into Comet Downs East residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Unlikely***	Comet Downs East residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Comet Downs East residual void water quality	Highly Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Comet Downs East residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Comet Downs East residual void water quality	Highly Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting Comet Downs East residual void water quality	Unlikely	S1	**Low**

Table C23. Source-Pathway-Receptor (SPR) assessment of post-closure TSF and rejects landforms: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
NCPP TSF landform (post-closure) Excluding cover, the TSF is comprised of approx. 80% tailings, approx. 19% rejects, and approx. 1% fill. *AMD source hazard of landform is **Moderate-High**. Salinity (non-oxidative) source hazard of landform is **Moderate**.* TSF will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *Assume AMD source hazard of the spoil cover is **Low-Moderate***	Seepage / percolation from NCPP TSF landform into groundwater, which flows into Deep Creek residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Probable***	Deep Creek residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
Laleham TSF landform (post-closure) Excluding cover, the TSF is comprised of approx. 90% tailings, approx. 4% rejects, and approx. 6% spoil/fill. *AMD source hazard of landform is **Moderate-High**. Salinity (non-oxidative) source hazard of landform is **Moderate**.* TSF will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low-Moderate**.*	Seepage / percolation from Laleham TSF landform into groundwater, which flows into Togara-North Marshmead residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Probable***	Togara-North Marshmead residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Togara-Nth Marshmead void water quality	Unlikely	S2	**Low**
Bottom Dam TSF and rejects landform (post-closure) The current TSF is comprised of about 95% tailings and 4% rejects. During rehabilitation, the TSF will be buried by rejects currently located adjacent to the TSF. As such, excluding spoil cover, the Bottom Dam area is estimated to be comprised of approximately 50% tailings and 50% rejects. *AMD source hazard of landform is assumed **Moderate-High**. Salinity (non-oxidative) source hazard of landform is assumed **Moderate*** TSF/rejects area will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low**.*	Seepage / percolation from Bottom Dam TSF/rejects landform into groundwater, which flows into Togara-North Marshmead residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Probable***	Togara-North Marshmead residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Togara-Nth Marshmead residual void water quality	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Togara-Nth Marshmead void water quality	Unlikely	S2	**Low**
Ramp 36 rejects landform (post-closure) Excluding cover, the rejects landform is comprised of approx. 99% rejects and 1% fill. No tailings. *AMD source hazard of landform is **Moderate**. Salinity (non-oxidative) source hazard of landform is **Moderate**.* Rejects dump will have a spoil cover installed at an appropriate thickness to manage the AMD hazard of the landform. *AMD source hazard of the likely spoil cover is **Low-Moderate**.*	Seepage / percolation from Ramp 36 rejects landform into groundwater, which flows into Deep Creek residual void. Residual void is expected to intersect the water table. Residual void is a groundwater 'sink', drawing all groundwater within the void groundwater catchment towards the residual void. *Potential for AMD to enter groundwater: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter groundwater: **Probable***	Deep Creek residual void (NUMA). *Potential for AMD to reach residual void: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual void: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Deep Creek residual void water quality	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Deep Creek residual void water quality	Unlikely	S2	**Low**

Table C24. Source-Pathway-Receptor (SPR) assessment of residual void walls and floor: residual void receptors

Source	Pathway	Receptor	Event / potential harm	Likelihood of Event	Severity of Event	Risk Rating
Floor (tailings) and walls of Bonnie Doon and Ramp 74 residual voids (post-closure) Walls of these two voids are comprised of approximately: • 90% to 93% non-carbonaceous overburden/interburden; • <1% to 4% carbonaceous overburden/interburden; • 6% to 7% coal (residual coal seams). 'PAF' and NAF-S exposure on Bonnie Doon and Ramp 74 void walls conservatively estimated at approximately 4% (vertical meterage). A proportion of this will be in lower seams, which will be buried by tailings and/or submerged. 'PAF' or NAF-S exposure on pit floors (tailings) conservatively estimated at approximately 46% (Bonnie Doon) and 72% (Ramp 74), however tailings will be submerged or capped/covered. *AMD source hazard from exposed walls is **Low**.* *AMD source hazard from submerged or covered/capped tailings floor is **Moderate to Moderate-High**.* *Salinity (non-oxidative) source hazard of the exposed walls and submerged or covered/capped tailings floor is **Moderate**.*	Surface water run-off from highwalls of Bonnie Doon and Ramp 74 voids into their respective residual voids. *Potential for AMD to enter surface water run-off from void walls: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off from void walls: **Probable***	Bonnie Doon and Ramp 74 residual voids (NUMA). *Potential for AMD to reach residual voids: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual voids: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting Bonnie Doon residual void water quality Low pH and metalliferous water impacting Ramp 74 residual void water quality	Unlikely	S2	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting Bonnie Doon residual void water quality Metals and metalloids impacting Ramp 74 residual void water quality	Unlikely	S2	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting Bonnie Doon residual void water quality Salt (sulfate) impacting Ramp 74 residual void water quality	Unlikely	S2	**Low**
			Saline drainage (non-oxidative): Salt impacting Bonnie Doon residual void water quality Salt impacting Ramp 74 residual void water quality	Unlikely	S2	**Low**
Floor (coal) and walls of all residual voids except Bonnie Doon and Ramp 74 voids (post-closure) Walls of all non-tailings voids are comprised of approximately: • 87% to 95% non-carbonaceous overburden/interburden; • 1.2% to 6% carbonaceous overburden/interburden; • 2% to 7% coal (residual coal seams). 'PAF' and NAF-S exposure on walls conservatively estimated at between 3.6% to 6% (vertical meterage). A proportion of this will be in lower seams, which will be submerged. 'PAF' or NAF-S exposure on pit floors (coal) conservatively estimated at less than 5%, however pit floors will be submerged. *AMD source hazard from exposed walls is **Low**.* *AMD source hazard from submerged pit floors is **Low**.* *Salinity (non-oxidative) source hazard of the exposed walls and submerged pit floors is **Moderate**.*	Surface water run-off from walls of residual voids into residual voids. *Potential for AMD to enter surface water run-off from void walls: **Probable*** *Potential for salt (non-oxidative) >900 µS/cm to enter surface water run-off from void walls: **Probable***	All residual voids (NUMA). *Potential for AMD to reach residual voids: **Unlikely*** *Potential for salt (non-oxidative) >900 µS/cm to reach residual voids: **Unlikely***	**Acid/acidic drainage:** Low pH and metalliferous water impacting residual void water quality	Unlikely	S1	**Low**
			Neutral metalliferous drainage: Metals and metalloids impacting residual void water quality	Unlikely	S1	**Low**
			Saline drainage (from sulfide oxidation): Salt (sulfate) impacting residual void water quality	Unlikely	S1	**Low**
			Saline drainage (non-oxidative): Salt impacting residual void water quality	Unlikely	S1	**Low**

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