Annual Environmental Protection and Management Program Report

Olympic Dam

1 July 2019 – 30 June 2020

Distribution

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INTRODUCTION

Purpose and scope

This annual environmental protection and management program report (annual EPMP report) presents data relating to the environmental management of the BHP Olympic Dam operations for the period 1 July 2019 to 30 June 2020 (FY20).

The objectives are to:

- Meet the requirements of clause 11 of the Olympic Dam and Stuart Shelf Indenture (the Indenture).
- Report performance against environmental outcomes, compliance criteria and leading indicators presented in the 2019 Environmental Protection and Management Program (EPMP).
- Report performance against targets and continuous improvement actions also contained in the 2019 EPMP.
- Document the results of the deliverables presented in the Monitoring Programs (MPs) of the 2019 EPMP.

The 2019 EPMP was submitted to the Indenture Minister in May 2019 and subsequently approved.

Report structure

A description of the EPMP structure against which reporting is based is given below.

The reporting against outcomes is achieved through a hierarchy of data reporting (deliverables) and statements of compliance leading to an assessment of whether or not the environmental outcome has been met. The main chapters in the report are aligned to the key environmental aspect ID's contained within the EPMP.

The reporting hierarchy then takes the following form:

- Deliverables from the various MPs are included in the most relevant chapter, and a presentation of data and discussion of results is provided.
- The results of the deliverables contribute to the compliance statement for the compliance criteria under which they are reported (and in some cases to other compliance criteria, in which case appropriate cross-referencing is provided).
- These compliance criteria then provide a statement of achievement of the environmental outcome.

Performance against targets and continuous improvement actions is reported separately but still within the relevant ID chapter.

Table 1 contains a summary of each Environmental Management Program (EM Program) ID. This provides an overview of the outcomes and has the following elements:

- The environmental outcome to be achieved
- A 'traffic light' style indicator to indicate whether the outcome has been achieved.
- A statement that summarises whether or not the environmental outcome was achieved, and why.

EPMP STRUCTURE

Background

The structure of the EPMP report is closely aligned with the structure of the BHP Billiton Olympic Dam Corporation Pty Ltd (ODC) 2019 EPMP, and in particular the EM Program contained within that document. The EPMP consists of a number of documents which form a portion of the Environmental Management System (EMS) requirements. A brief summary of each document within the EPMP is shown in Table 1.

Table 1: EPMP Structure

Document	Content summary
EMM	General overview of the EPMP. Purpose and scope. Regulatory framework. Background information about Olympic Dam. Overview of the structure and requirements of the Environmental Management System. Glossary of defined terms. Cross-referencing of EPMP content to approval conditions and the requirements of the Mining Code.
EM Program	Addresses potentially significant environmental aspects and impacts, identified through analysis and prioritisation of environmental risks, legal obligations and community concerns. Documents the processes, systems and actions used to manage the prioritised aspects and impacts.
MP(s)	Address assessment and performance of the EM Program's outcomes, compliance criteria and targets, control mechanisms and legal and other requirements.
Actions, Targets and Major Changes	Captures continuous improvement opportunities and development opportunities identified that can assist in meeting compliance criteria and environmental outcomes and improving ODC's environmental performance, environmental improvement targets and the action plan to achieve such targets.
Mine Closure and Rehabilitation Plan	A plan for closure and rehabilitation of the mine, including the environmental outcomes expected to be achieved indefinitely, and options for progressive rehabilitation.

The EM Program documents the processes, systems and actions used to manage prioritised aspects and impacts, including the incorporation of:

- The environmental values that may be impacted, and the key risks to those values;
- The environmental outcomes that BHP aims to achieve;
- Clear, specific and measurable compliance criteria that demonstrate achievement of the outcome(s);
- Leading indicator(s) criteria, providing early warning of trends that indicate a compliance criteria may not be met;
- The management and operational controls in place to deal with the environmental risk (aspects and impacts), including any regulatory conditions; and
- Contingency options to be used in the event that identified risks are realised.

EXECUTIVE SUMMARY

Overview

The FY20 Annual EPMP Report demonstrates compliance and environmental improvements against the 2019 Environmental Protection and Management Program (EPMP).

Data from monitoring programs is presented as evidence against compliance criteria under the Environmental Management Program (EM Program) IDs.

Considerable progress against environmental outcomes and compliance criteria in the 2019 EMP and actions and targets was made during the reporting period.

Major Achievements

Major achievements for the reporting period include:

- Approximately 4,273 tonnes of recyclable material was transported offsite during FY20. Materials included plastics, metals, hydrocarbons, timber and tyres. This is the highest level achieved since operations commenced at Olympic Dam for the second consecutive year.
- The introduction of the Global Event Management System ((G)EMS) which has led to an increase in reporting of environmental events.
- Upgrades to the Cement Aggregate Fill (CAF) Plant scuttle ponds were successfully constructed and commissioned, resulting in improved containment of process materials during scuttling events.
- Sewage Lagoon Evaporation Pond 2 was successfully constructed, commissioned and brought into full operational use.
- The cyanide sparging project is currently in execution with construction works underway and a forecasted commissioning program to begin in October 2020. This project is a significant improvement with both environment and safety risks being managed through a hands off delivery of sodium cyanide to the Hydromet area to assist with product recovery.
- The second of two electric vehicles arrived on site for testing. This follows the successful testing and deployment of the first electric vehicle, which arrived on site in April 2018. Primary drivers for the trial are reductions in energy and greenhouse gas, and reductions in underground (UG) diesel particulate matter (DPM, which are nil for EVs). In addition, this is part of a longer term roadmap for decarbonisation across BHP, where the potential is for other UG equipment to be electrified.

Compliance summary

Table 2 lists the environmental outcomes for each EM Program ID. Next to each outcome 'traffic light' style indicators have been used to allow for overview assessment of achievement of the outcome, as follows:

- ● Environmental outcome achieved
- ▲ Significant progress towards achieving the Environmental outcome
- ● Environmental outcome not achieved.

The approved 2019 EMP contained 22 environmental outcomes, 25 compliance criteria and 15 leading indicators. Additional to these the EPMP contained 10 targets, and 16 actions, which are aspirational and support the environmental outcomes and compliance criteria against which ODC is assessed. 21 of the 22 environmental outcomes (and the associated compliance criteria) were achieved or were within prescribed limits and all targets and actions were achieved or significantly progressed.

The outcome for ID3.1 Particulate Emissions has been classified as demonstrating 'significant progress towards achieving the environmental outcome' as a result of PM_{10} results above the compliance criteria threshold on six occasions at Roxby Downs and three occasions at Olympic Dam Village. An investigation into these events indicated that they were not due to operational activity and rather a result of regional dust storms. ODC does not consider these events to have caused adverse impacts to public health attributable to its operations. Measured ground level concentrations of dust derived from operations at sensitive receptor sites were below the compliance criteria for PM_{10} at all other times during FY20.

In response to the high dust events in FY20 and subsequent investigations ODC will continue to work with the Environment Protection Authority to undertake a detailed review of its ambient dust monitoring program to ensure it is fit for purpose.

No leading indicators were triggered during the reporting period.

Table 2 provides a summary of the environmental outcomes assessed during FY20.

Table 2: FY20 Compliance Summary

ID 1 USE OF NATURAL RESOURCES	
ID 1.1 Land Disturbance and Rehabilitation	
Environmental outcome	Outcome Statement
● No significant adverse impacts to populations of listed species (South Australian, Commonwealth) as a result of the construction, operation and closure of Olympic Dam.	No significant adverse impacts to populations of listed species as a result of the construction and operation of Olympic Dam occurred. No closure activities were undertaken in FY20. No significant clearing of listed species or listed species potential habitat occurred in FY20. No significant adverse impact was detected for Eriocaulon carsonii as a result of aquifer level drawdown. The Banded Stilt (*Cladorhynchus leucocephalus*; N = 2), listed as Vulnerable under the National Parks and Wildlife Act 1972 (NPW Act), was observed interacting with the TRS during FY20. Due to the low number of individuals encountered at the TRS, no significant adverse impact to a population of listed species occurred as a result of the operation of Olympic Dam.

ID 1.2 Aquifer Level Drawdown	
Environmental outcome	Outcome Statement
● No significant adverse impacts to existing third-party users' right to access water from within the GAB wellfield Designated Areas for the proper development or management of the existing use of the lands as a result of ODC activities.	Drawdown and percentage wellhead pressure loss at pastoral bores remains less than the predicted long-term impact as presented in the EIS (Kinhill Engineers 1997, updated Golder Associates 2016), and significantly less than the maximum drawdown area defined within the 10 m contour.
● No significant adverse impacts to the availability and quality of groundwater to existing Stuart Shelf third-party users as a result of groundwater drawdown associated with ODC activities.	No significant impact to groundwater for existing Stuart Shelf third-party users has occurred. Regional groundwater levels are stable.
● No significant adverse impact on groundwater-dependent listed species or ecological communities as a result of groundwater drawdown associated with ODC activities.	Drawdown remains less than the predicted long-term impact and was within compliance criteria limits for FY20. Environmental flow rates at GAB springs remained above predicted long term impacts as presented in the EIS (Kinhill Engineers 1997, updated Golder Associates 2016). Monitoring showed no indication of a significant adverse impact on groundwater-dependent listed species or ecological communities as a result of groundwater drawdown associated with ODC activities.

ID 2 STORAGE, TRANSPORT AND HANDLING OF HAZARDOUS MATERIALS	
ID 2.1 Chemical and Hydrocarbon Spills	
Environmental outcome	Outcome Statement
● No significant site contamination of soils, surface water or groundwater, as a result of the transport, storage or handling of hazardous substances associated with ODC's activities.	No significant contamination of soils, surface water or groundwater leading to actual or potential environmental harm due to the transport, storage or use of hazardous substances associated with ODC activities occurred during FY20.

ID 2.2 Radioactive Process Material Spills	
Environmental outcome	Outcome Statement
● No adverse impacts to public health as a result of radioactive process material spills from ODC's activities.	ODC has consistently operated in a manner that limits radiation dose to members of the public, from operational activities and radioactive emissions, to less than a small fraction of the International Commission on Radiological Protection (ICRP) 1mSv/y limit. During FY20 there were no radioactive process material spills outside operational areas. As a result, there are no adverse radiation exposure impacts to the public from activities undertaken by ODC.
● No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive process material spills from ODC's activities.	No significant impacts to populations of listed species or ecological communities were recorded as a result of operational activities, including the effects from any radioactive process material spills. Impacts to listed species and ecological communities are avoided by ensuring that there is no uncontrolled loss of radioactive material to the natural environment. As there was no loss of radioactive material to the undisturbed environment in FY20, no impact to populations of listed species or ecological communities occurred.

ID 3 OPERATION OF INDUSTRIAL SYSTEMS

ID 3.1 Particulate Emissions

Environmental outcome	Outcome Statement
No adverse impacts to public health as a result of particulate emissions from ODC's activities.	No adverse impacts to public health as a result of particulate emissions from operations conducted by ODC occurred during FY20. A number of high dust events occurred during FY20 due to regional dust events. ODC is working with the EPA to review the dust monitoring program to be more representative of ODC's contribution to dust levels at nearby sensitive receptor sites of Olympic Village and Roxby Downs.

ID 3.2 Sulphur dioxide emissions

Environmental outcome	Outcome Statement
No adverse impacts to public health as a result of sulphur dioxide emissions from ODC's activities.	Environment Protection (Air Quality) Policy 2016 Ground Level Concentration (GLC), levels for ambient air quality are based on the protection of human health. Roxby Downs and Olympic Village ambient SO_2 analyser results for the reporting period showed no exceedance of the GLC for ambient air quality SO_2 at either Olympic Village or Roxby Downs Township. An annual review of monitoring data collected at sensitive receptors (ambient ground level concentrations) has shown there were no adverse impacts to public health as a result of sulphur dioxide (SO_2) emissions from ODC's activities during FY20.

ID 3.3 Saline aerosol emissions

Environmental outcome	Outcome Statement
No significant adverse impacts to populations of listed species (South Australian, Commonwealth) as a result of ODC's activities.	No significant adverse impact to populations of listed species from saline aerosol emissions was observed during FY20. Observations made during environmental inspections and supported by data collected during various flora and fauna monitoring programs, did not find any significant adverse impacts to listed species.

ID 3.4 Radioactive emissions

Environmental outcome	Outcome Statement
No adverse impacts to public health as a result of radioactive emissions from ODC's activities.	ODC has consistently operated in a manner that limits radiation dose to members of the public, from operational activities, to less than a small fraction of the 1 mSv/yr public dose limit prescribed by the International Commission on Radiological Protection (ICRP). As a result, there are no adverse radiation exposure impacts to the public from activities undertaken at ODC.
No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive emissions from ODC's activities.	There were no significant adverse impacts to populations of listed species or ecological communities as a result of ODCs activities. Monitoring of radiation doses to the public and the deposition of ^{238}U at non-human biota (NHB) assessment sites is used as an indicator of the potential exposure of listed species to radioactive emissions. Deposition of ^{238}U at non-human biota assessment sites was at a level which poses no significant adverse impacts to non-human biota.

ID 3.5 Greenhouse gas emissions

Environmental outcome	Outcome Statement

Contribute to stabilising global atmospheric greenhouse gas concentrations to minimise environmental impacts associated with climate change.	BHP's climate change strategy focuses on reducing our operational greenhouse gas (GHG) emissions, investing in low emissions technologies, promoting product stewardship, managing climate-related risk and opportunity and working with others to enhance the global policy and market response. As a BHP group asset, ODC operates under the BHP group strategy.

ID 4 GENERATION OF INDUSTRIAL WASTES

ID 4.1 Embankment stability of TSF

Environmental outcome	Outcome Statement
No significant TSF embankment failure.	During FY20 the Tailings Storage Facilities (TSFs) were managed in accordance with the TRS Operations, Maintenance and Surveillance Manual (BHP Olympic Dam 2019) and the Tailings Management Plan (BHP Olympic Dam 2020) and no embankment failures of any magnitude occurred.

ID 4.2 Tailings seepage

Environmental outcome	Outcome Statement
No significant adverse impact on vegetation as a result of seepage from the TSF.	No significant adverse impact to vegetation as a result of seepage from the TSF has occurred. Eighty metres AHD (20 m below ground level) is considered as the level below which groundwater cannot interact with the root zone of plants in the Olympic Dam region. Groundwater levels in the vicinity of the TSF remain below 80 mAHD.
No compromise of current and future land uses on the Special Mining Lease (SML) or adjoining areas as a result of seepage from the TSF.	No compromise of current and future land uses on the SML or adjoining areas has occurred. Groundwater levels in the vicinity of the TSF remain below 80 mAHD and sampling indicates that seepage is being attenuated.
No compromise of the environmental values of groundwater outside the SML as a result of seepage from the TSF.	No compromise of the environmental values of groundwater outside the SML has occurred. Sampling indicates that seepage is being attenuated within the SML, and groundwater levels of bores along the SML are consistent with other regional bores. Seepage modelling has been updated to demonstrate that there are no expected future offsite impacts.

ID 4.3 Fauna interaction with Tailings Retention System

Environmental outcome	Outcome Statement
No significant adverse impacts to listed species (South Australian, Commonwealth) as a result of interactions with the Olympic Dam TRS	No significant adverse impacts to listed species as a result of interactions with the Olympic Dam Tailings Retention System (TRS) have occurred. The Banded Stilt (*Cladorhynchus leucocephalus*; N = 2), listed as Vulnerable under the National Parks and Wildlife Act 1972 (NPW Act), was observed interacting with the TRS during FY20. Due to the low number of individuals encountered at the TRS, no significant adverse impact to a population of listed species occurred as a result of the operation of Olympic Dam.

ID 4.4 Solid waste disposal

Environmental outcome	Outcome Statement
No significant adverse impacts as a result of management of solid waste.	The Resource Recovery Centre (RRC) effectively manages solid waste as per the EPA approved Landfill Environmental Management Plan 2016 (LEMP). No evidence of actual or potential environmental harm was identified through routine auditing or based on the reporting of materials disposed of to the landfill. Therefore, it can be

concluded that no significant adverse impacts resulted from the management of solid waste at Olympic Dam during FY20.

ID 4.5 Radioactive waste	
Environmental outcome	Outcome Statement
No adverse impacts to public health as a result of radioactive waste from ODC's activities.	ODC has consistently operated in a manner that limits radiation dose to members of the public from radioactive waste, to less than a small fraction of the International Commission on Radiological Protection (ICRP) 1 mSv/yr limit. As a result, there are no adverse radiation exposure impacts to the public from activities undertaken at Olympic Dam.
No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive waste from ODC's activities.	There were no significant adverse impacts to populations of listed species or ecological communities as a result of ODCs activities. Monitoring of radiation doses to the public and the deposition of ^{238}U at non-human biota assessment sites is used as an indicator of the potential exposure of listed species to radioactive waste. Deposition of ^{238}U at non-human biota assessment sites was at a level which poses no significant adverse impacts to non-human biota.

ID 5 INTERACTION WITH COMMUNITIES **ID 5.1 Community interaction**	
Environmental outcome	Outcome Statement
Residents in Roxby Downs, Andamooka and Woomera have a favourable view of ODC.	Responses to the 2017 Olympic Dam Community Perception Survey indicate that ODC is a trusted organisation within its local communities. In addition to this, ODC provides employment to local and regional communities. The next Community Perception Survey is being undertaken from July to August 2020.

Note: Individual monitoring programs are referred to in this document with a two letter abbreviation as follows: Fauna – FA; Flora – FL; Great Artesian Basin – GA; Groundwater – GW; Environmental Radiation – ER; Airborne Emissions – AE; Energy Use and Greenhouse Gas (GHG) Emissions – EG; Waste – WA; Surface water – SW; Social Effects – SE

1 Use of natural resources

1.1 Land disturbance and rehabilitation

1.1.1 Environmental Outcome

No significant adverse impacts to populations of listed species (South Australian, Commonwealth) as a result of the construction, operation and closure of Olympic Dam.

No significant adverse impacts to populations of listed species as a result of the construction and operation of Olympic Dam occurred. No closure activities were undertaken in FY20.

No significant clearing of listed species occurred in FY20. Some clearing of listed species potential habitat occurred in FY20 with pre-clearance surveys finding no evidence of listed species.

No significant adverse impact was detected for *Eriocaulon carsonii* as a result of aquifer level drawdown.

No significant adverse impacts to listed species as a result of interactions with the Olympic Dam Tailings Retention System (TRS) have occurred.

The Banded Stilt (*Cladorhynchus leucocephalus*; N = 2), listed as Vulnerable under the National Parks and Wildlife Act 1972 (NPW Act), were observed interacting with the TRS during FY20. Due to the low number of listed species encountered at the TRS, no significant adverse impact to a population of listed birds occurred as a result of the operation of Olympic Dam.

1.1.2 Compliance criteria

No significant impact to the size of an important population of a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin, including *Eriocaulon carsonii*. *NOTE: Significant impact is as defined in the Significant Impact Guidelines and greater than predicted in the EIS.*

Potential impacts to communities of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB) are discussed in Chapter 1.2 on Aquifer Level Drawdown. Within the region studied, populations of *Eriocaulon carsonii* were restricted to 19 spring vents in the Hermit Hill, North East and Lake Eyre springs complexes in FY20. It was again absent from one spring (HHS074) where it was recorded in FY17. The average abundance of *Eriocaulon carsonii* observed in FY20 (15±2) was slightly higher than FY19 (14±3). Therefore, it is concluded that no significant impact to the size of an important population of a community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (GAB) has occurred in FY20.

No loss of an important population of Plains Rat (*Pseudomys australis*).

No loss of an important population of Plains Rat occurred as a result of land disturbed by ODC activities. No known critical habitat was cleared during FY20. Vegetation clearance was primarily restricted to the SML with small amounts of disturbance occurring in the near vicinity. A pre-clearance survey conducted for the Olympic Dam Airport found no evidence of Plains Rat.

Clearing of vegetation not to exceed the total area of 17,269 hectares as indicated in the EIS (DEIS and SEIS).

As the figure of 17,269 hectares is from the 2009 EIS for the Olympic Dam expansion project that did not proceed (BHP Billiton Olympic Dam 2009), BHP is currently reviewing this compliance criteria. For the purpose of addressing this compliance criteria, as at 30 June 2020, the total area of disturbance related to Olympic Dam activities was 5553.2 ha. Disturbance and offset activities are discussed in further detail in Section 1.1.6.

1.1.3 Deliverables (FA 2.1)

An annual report of monitoring and control actions for feral and abundant species undertaken within the SML and surrounding areas.

During FY20, a total of 90 cat traps were set with an average of 7 traps set per month. Over this period, six traps failed (i.e., trap closed without cat capture). A total of 18 cats were caught. Therefore, the overall trap success rate was 20%. Areas of focus included Roxby Downs Village, Olympic Dam Village, the Resource Recovery Centre and office buildings on the SML.

Throughout FY20 no wild dogs were observed opportunistically on the SML. ODC remains committed to work in conjunction with the South Australian Arid Lands Natural Resources Management Board (SAAL NRM) to opportunistically control wild dog numbers (see SA Arid Lands Wild Dog Management Plan 2015).

In FY16, ODC together with Arid Recovery re-established a historical spotlight transect program that monitors the density of rabbits, cats, foxes and kangaroos in the Olympic Dam region. ODC worked with the Department of Primary Industries and Resources South Australia (PIRSA) to facilitate the release of a Korean strain of rabbit haemorrhagic disease virus (RHDV) known as K5 in the Roxby Downs region in March FY16 (Figure 1). From July 2016 to March 2020, a significant decline in rabbit density has been observed at the Andamooka transect ($F_{1, 24}$ = 27.176, p <0.001; R^2 = 0.553) and at the Roxby Downs transect ($F_{1, 24}$ = 29.497, p <0.001; R^2 = 0.572; Figure 1). While it appears that the release of the K5 virus may have had a negative impact on rabbit densities in the region, it must be noted that no additional evidence was observed (e.g., no rabbit carcasses were observed that could have been laboratory tested for evidence of the K5 virus). It is more likely that a reduction in available resources as a consequence of low rainfall in the region may have resulted in fewer rabbit sightings.

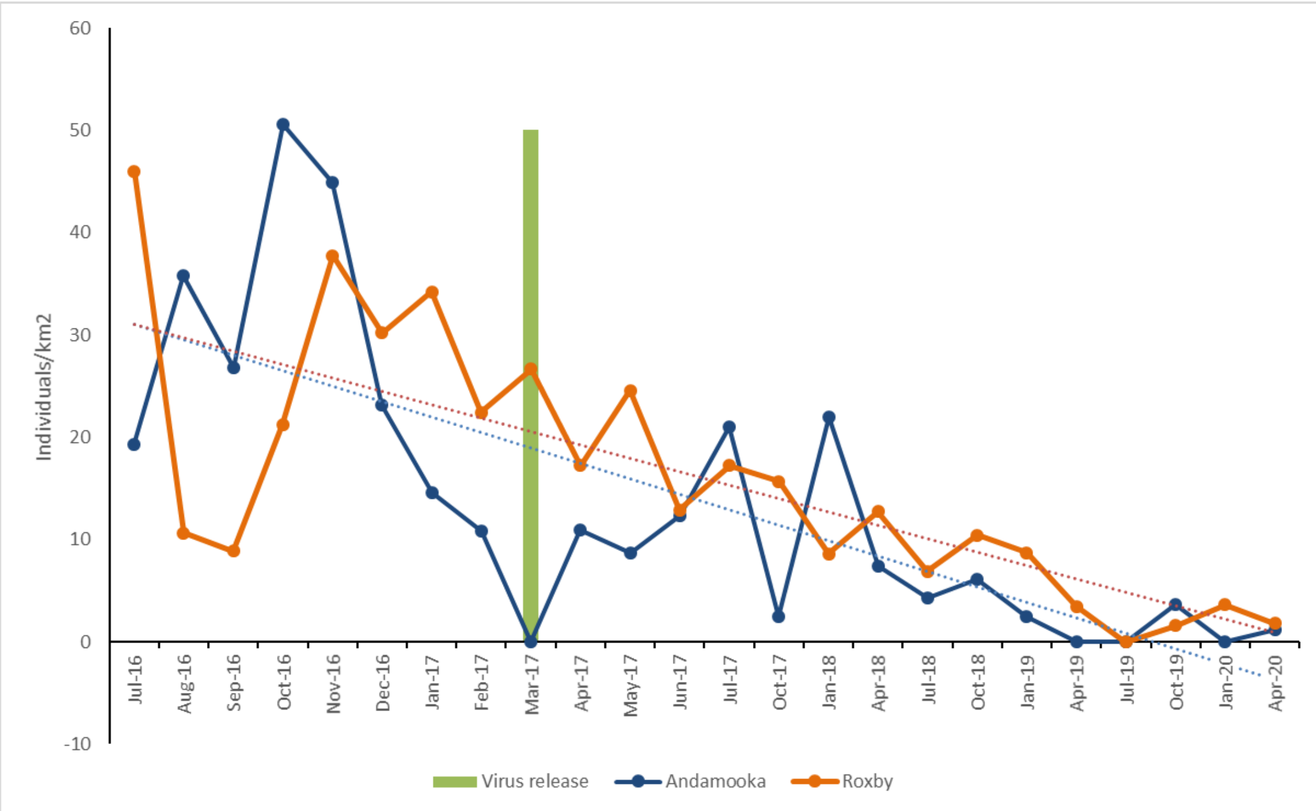


Figure 1: The density of rabbits observed pre- and post- K5 virus release.

An assessment of the abundance of specific feral and abundant species within the region.

Quarterly spotlight counts of two transects within the Olympic Dam region showed that rabbits and kangaroos existed in the highest density compared to other introduced or abundant species (i.e., foxes, cats and wild dogs) during FY20 (Figure 2). While kangaroo numbers remain stable, rabbit numbers have visibly declined and remain below pre-RHDV1 release in 1995 (Pedler et al. 2016). Due to the cautious nature of wild dogs, it is recognised that the spotlight transect method may not be the most effective for capturing wild dog abundance data.

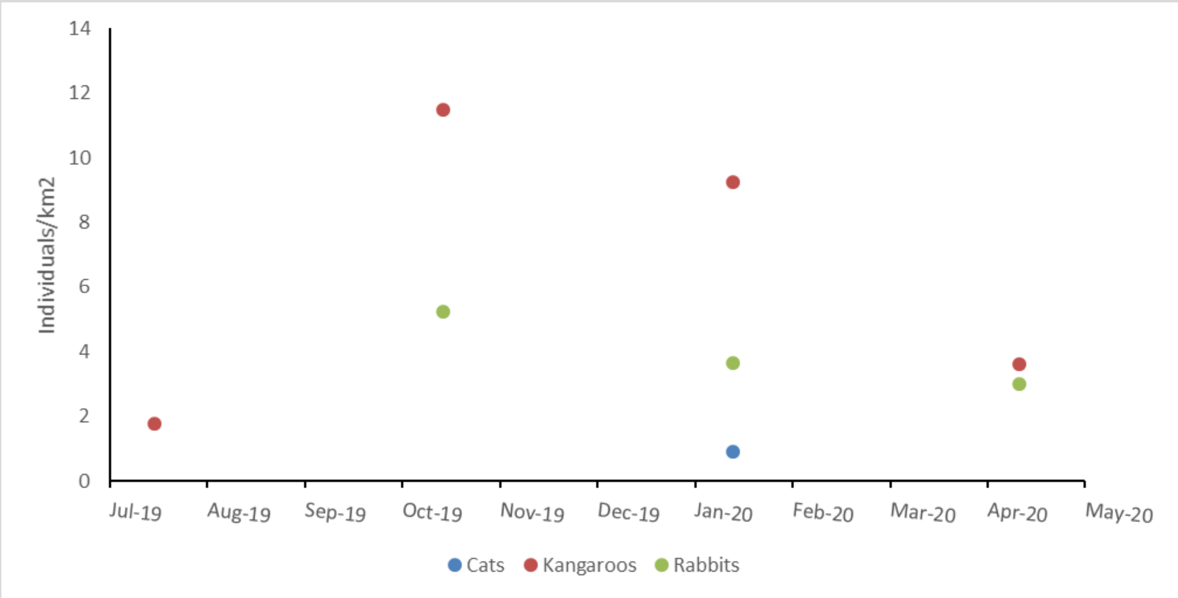


Figure 2: Density of rabbits, cats, and kangaroos observed in the Olympic Dam region in FY20.

1.1.4 Deliverables (FL 2.3)

Define and map the current distribution of extreme and high risk weed species within the Olympic Dam region, Roxby Downs Municipality, the expanded SML and Gosse Springs SEB areas.

Identification of whether measures are required to control declared weeds and plant pathogens in the operations area.

Routine and opportunistic observations were undertaken throughout the reporting period. A total of 12 pest plant species were recorded during FY20, including seven declared species. Control efforts for a number of these species were undertaken throughout FY20. After rains at the start of 2020 previously dormant Buffel grass infestations became active. Therefore, it was determined that control measures were still required for the continued management of pest plants.

A baseline weed assessment undertaken within the Gosse Springs SEB area during FY16 recorded no declared species and two species, Common sowthistle and Ruby dock, listed as 'significant' by the South Australian Arid Lands Natural Resources Management Board. No new pest plant species were recorded within the SEB area in FY20.

The FY20 distribution of declared and other high risk pest plant species, including infestations recorded since FY15 that are known to still be active, are shown in Figure 3- Figure 5. In many cases a single GPS location may reference a large infestation area, and as such distribution of weeds such as Ruby dock, Salvation Jane, Caltrop and Blackberry nightshade may be more extensive than appears on the map below.

Table 3: A list of declared and other high risk weed species observed in the SML, Municipal lease region during FY20.

Declared weed species	High risk weed species
Buffel grass	Blackberry nightshade
Caltrop	Couch grass
Fountain grass	Paddy melon
Innocent weed	Ruby dock
Noogoora Burr	Wards Weed
Prickly pear	
Salvation Jane	

Figure 3: Locations of declared and high risk weed species on the SML in FY20

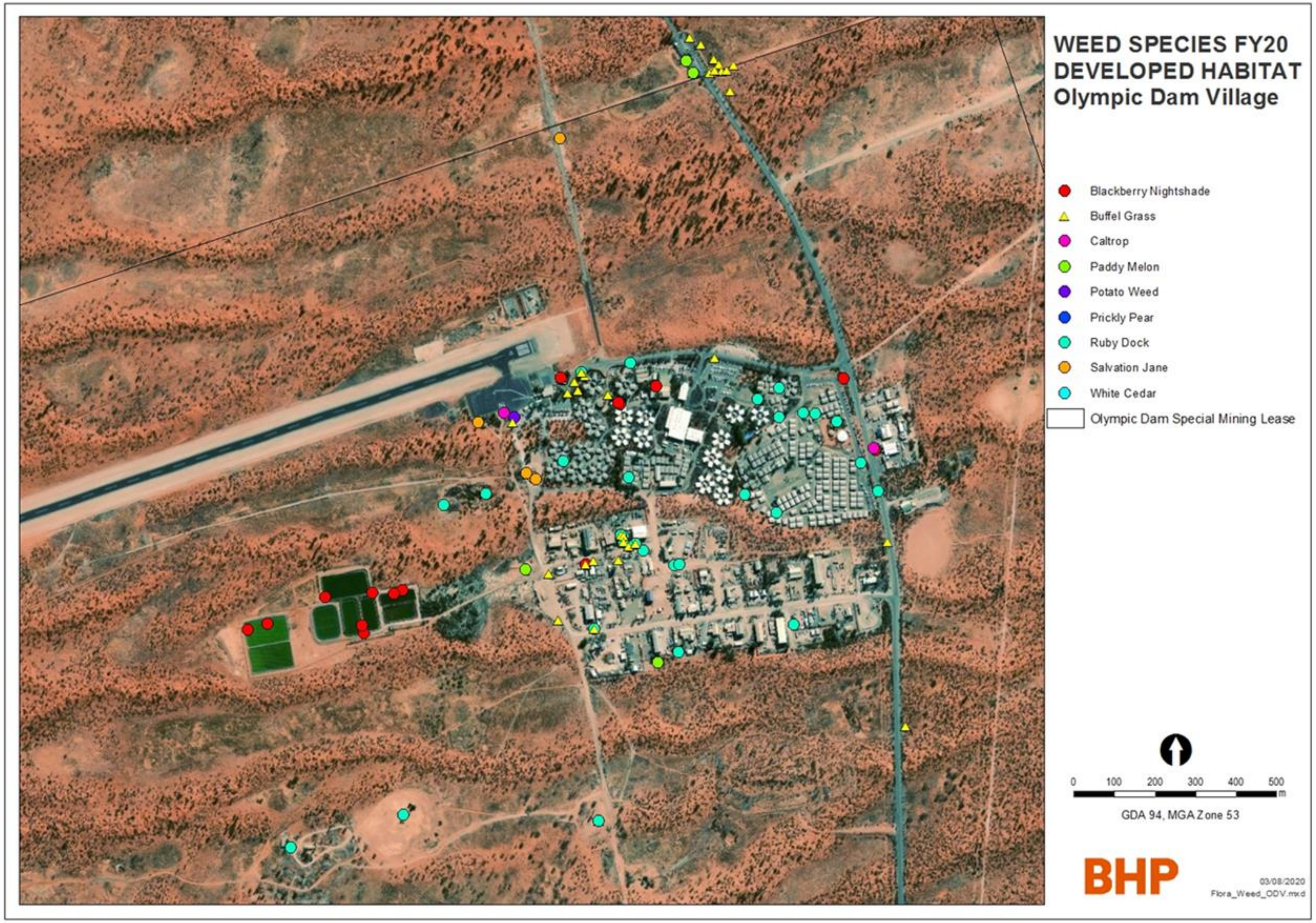


Figure 4: Locations of declared and high risk weed species at Olympic Dam Village (within the Municipal Lease) in FY20

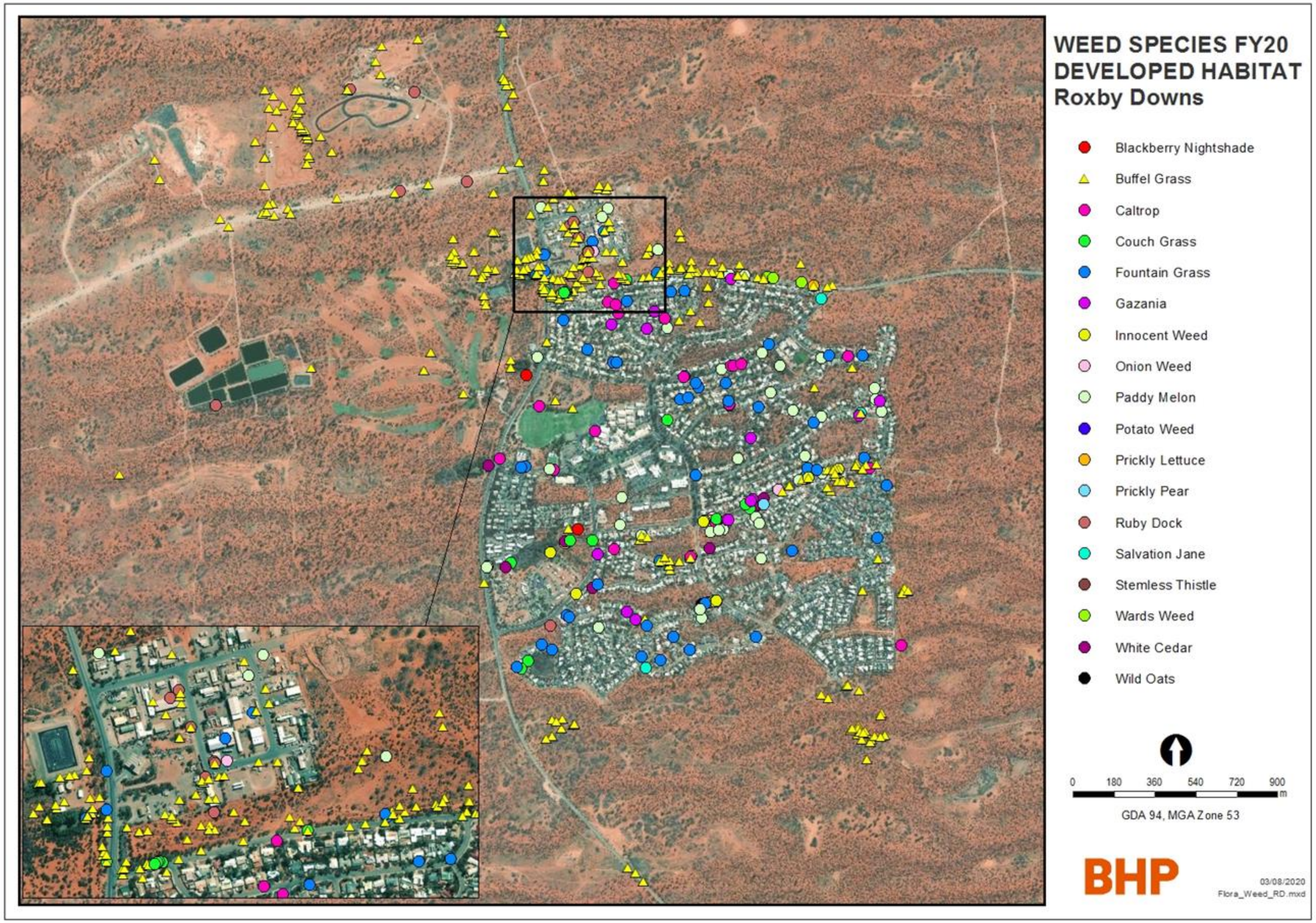


Figure 5: Locations of declared and high risk weed species in the Roxby Downs urban area (in the Municipal Lease) in FY20.

1.1.5 Deliverables (FL 2.4)

A map of the known locations of listed species within the impact area of the Olympic Dam operation.

A statement of impacts to, and measures undertaken to avoid listed species.

Listed species include species known to occur in the region that are either listed as threatened or greater under state, national and/or international legislation and have the potential to be adversely impacted by operations. This includes species that have a wider distribution within the state, interstate or overseas and are therefore not considered to be critically dependent on existing populations within the potential impact area.

An annual desktop assessment determined that no listed flora species of international significance, one listed flora species of national significance, and eleven listed flora species and one listed community of state significance were identified as potentially occurring in the impact area of the Olympic Dam operation. Western Tarvine (*Gilesia biniflora*), listed as Rare, and the threatened ecological community (TEC) Mulga (*Acacia aneura*) low woodland on sand plains, listed as Vulnerable under the NPW Act are known to exist on the SML (Figure 6). No known listed flora species were impacted by disturbance activities during FY20 (Figure 6). Efforts are made wherever possible to avoid these species during the Environmental Disturbance Permit (EDP) process.

The desktop assessment determined that three listed fauna species of international significance, four listed fauna species of national significance and seven listed fauna species of state significance were identified as potentially occurring in the impact area of the Olympic Dam operation. Fauna species re-introduced to Arid Recovery or species known to interact with the TRS were excluded from this assessment. Nomadic and migratory species known to interact with the TRS are discussed separately in chapter 4.3 Fauna Interaction with the Tailings Retention System. An important population of Plains Rat is known to inhabit the Arid Recovery reserve and during favourable conditions it is known to expand its population into the SML. Vegetation types that are considered potential habitat for the Plains Rat include, chenopod shrublands (*Atriplex vesicaria* / *Maireana astrotricha*), cotton bush (*Maireana aphylla*) gilgais, canegrass (*Eragrostis australasica*) swamps and ephemeral dominated plains (Figure 7). These vegetation types are often associated with large swale areas greater than $1km^2$ that have drainage lines and cracking clays, which constitutes critical habitat for the Plains Rat. To determine the presence of Plains Rat critical habitat and activity, two surveys were undertaken in FY19 in the footprint of major construction projects TSF6 and EP6. No evidence of Plains Rat was observed. Efforts are made wherever possible to avoid potential Plains Rat habitat using the EDP process.

Figure 6: Potential and confirmed habitats of listed flora species.

Figure 7: Listed fauna species potential and confirmed habitats.

1.1.6 Deliverables (FL 2.4)

A map of the direct disturbance impact footprint of ODC's Olympic Dam activities.

A statement of comparison between the impact footprint of ODC's Olympic Dam activities (i.e. within and outside the SML) and the offset areas under SEB processes, to track progress towards a life of mine ratio of 8 ha set aside for each hectare disturbed.

In 2010, the Gosse Springs Native Vegetation Management Plan was approved to establish a Significant Environmental Benefit (SEB) offset area of 10,963 ha. All land disturbance that is subject to an environmental offset under legislation is tracked though the EDP procedure and allocated an appropriate SEB offset ratio.

At the end of FY19 the remaining Gosse Springs SEB credit was converted to SEB points to align with to *Native Vegetation Regulations 2017*. The Gosse SEB balance remaining in reserve at the end of FY19, 4,424.3 ha was converted to 31,339 SEB Points. Therefore tracking the progress of disturbance and offset areas not longer involves the life of mine ratio of 8ha.

In 2019, the Emerald Springs SEB Native Vegetation Management Plan (Barron 2018a) was approved to establish an SEB offset area of 38,022 ha that is equivalent to 267,143 SEB points. The Native Vegetation Clearance Proposal for the SML accompanied the submission, which determined that 58.36 SEB points are required to be deducted from the Emerald Springs SEB credit for each hectare of native vegetation clearance (Barron 2018b).

Spatial analysis techniques were utilised on geo-referenced orthoimagery for FY20. During this reporting period, satellite imagery of the vast majority of the SML was captured on a quarterly basis (captured in September 2019, January 2020, March 2020 and June 2020), offering an accurate account of the timing of land disturbance. Disturbances identified as occurring between these dates were digitised and are represented in Figure 8. The total area of disturbance that occurred during FY20 is 687.6 ha (Table 4). The majority of disturbance for FY20 is attributed to works on major projects, including the construction of TSF6, EP6, Dam Barrier Wall and the Olympic Dam Airport Expansion.

As at June 30 all FY20 disturbance was offset. Disturbance which occurred on the SML was offset using the Emerald Springs SEB. Disturbance off the SML which in FY20 consisted of the Olympic Dam Airport Expansion was offset using the Gosse Springs SEB in accordance with the Native Vegetation Council Approval.

A balance of 229,008.4 points remains for Emerald Springs SEB, and 29,124.5 for Gosse Springs SEB (table 2). The total area of disturbance related to Olympic Dam activities is currently 5,553.2 ha. This figure is inclusive of rehabilitation areas, Roxby Downs town facilities, water pipelines and other associated infrastructure.

Table 4: Areas of Disturbance and SEB Offset Areas as at June 2020.

Pre -FY20	Gosse Springs SEB Points	31,339
	Emerald Springs SEB Points	267,143
FY20	FY20 Clearance (ha)*	687.6
	SEB points required for SML clearance**	38,134.6
	SEB points required for Olympic Dam Airport Expansion***	2,214.5
	Total land cleared (ha)****	5553.2
SEB Balance Remaining end of FY20	Gosse Springs SEB Points	29,124.5
	Emerald Springs SEB Points	229,008.4

*All land cleared in FY20 was subject to an offset.

** Vegetation on the SML that was assessed as a part of the 2018 SML Data Report (Barron 2018b) requires 58.3 SEB points per Ha. For projects off the SML the SEB points per ha value is determined in the approval by the Native Vegetation Council.

***Disturbance for the Airport works as of June 30, 33.5ha of approved 85.21 had been cleared.

***This figure includes all land cleared to date as a part of ODC activities since the commencement of operations. Slight variations will occur from year to year due to continuous improvement of the mapping layer.

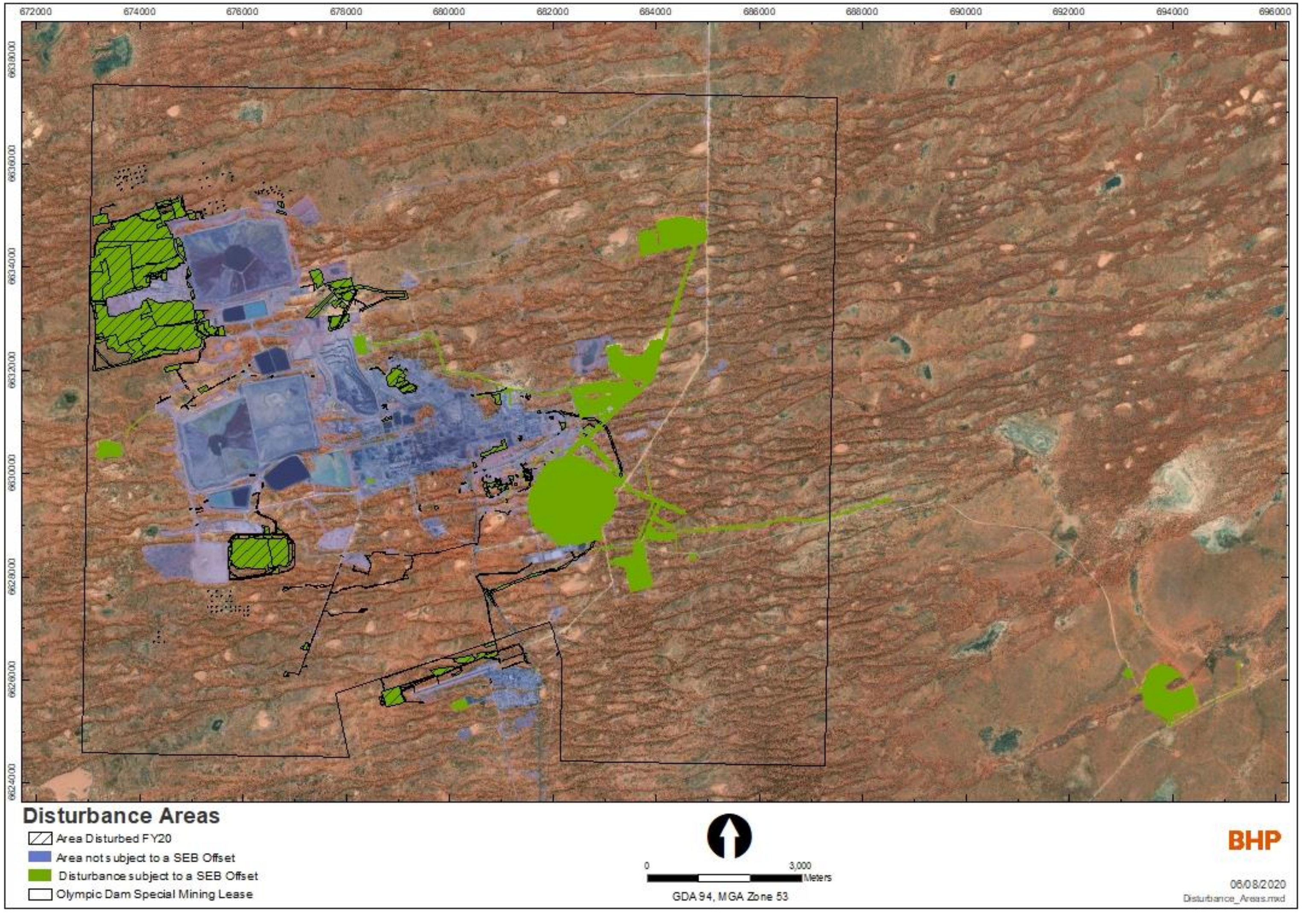


Figure 8: Areas of disturbance as at June 30 2020 (SML).

1.1.7 Deliverables (FL 2.5)

A summary of actions achieved from the SEB implementation plans within the fiscal year through the Annual EPMP Report.

An annual report to the government on SEB management outcomes through the Annual EPMP Report.

Shapefiles of the SEB areas for inclusion in relevant departmental databases.

Emerald Springs SEB

In FY19, ODC obtained approval for the Emerald Springs SEB in accordance with Schedule 1, Part 5 (Mining and petroleum activities), Division 1 – Mining Operations, 28 - Operations of the Native Vegetation Regulations 2017 under the Native Vegetation Act 1991. The Heritage Agreement has not yet been secured and is with the State for assessment. Table 3.2.1 of the Emerald Springs SEB Management Plan (Barron 2018a) outlines the management actions and timing of the agreed actions. Table 5 below outlines key once-off actions.

Ongoing management is captured through 1SAP Work Management. This entails quarterly inspection of the SEB areas, with a focus on fence maintenance, pest plant and pest animal control. In FY20 these inspections found no new pest plants. Significant maintenance was undertaken on the fence surrounding the Emerald Spring. No feral animals were observed in the Emerald Springs paddock.

Table 5: Once-off management actions required for the Emerald Springs SEB in FY20-21.

	Action	Timing
1.	Cattle are to be mustered and removed.	Completed FY20
2.	Fence along the northern side of the Oodnadatta Track (~50km), including behind the Curdimurka Siding, including a gate at the main access points for springs and monitoring bores.	FY20-21*
3.	Improved signage, including at the Lake Eyre Lookout, Curdimurka Siding and at regular intervals along the Oodnadatta Track to encourage tourists to remain in controlled areas	FY21

*This action is currently under review.

Gosse Springs SEB

During FY20 the Gosse Springs Native Vegetation Plan was followed and management actions undertaken.

As part of quarterly inspections feral animals were identified (camels, horses, cattle) and control actions were undertaken. The inspections found no new pest plants in the SEB area. Public access was managed through the installation of signs at the entry to the paddock and the ongoing maintenance of the carparks at Gosse, McLachlan and Fred Springs.

A section of the eastern boundary fence was repaired after quarterly inspections identified a hole. Monitoring of the cover and abundance of vegetation on the mound springs within the SEB area was undertaken as part of the vegetation monitoring programme for Olympic Dam.

A shapefile of both the Gosse Springs and Emerald Springs SEB area has been provided to the Native Vegetation and Biodiversity Management Unit of the South Australian Government. The shapefiles of existing and proposed SEB offset areas are available in a standard GIS format that can be made available for other departmental databases as required.

1.1.8 Leading Indicators

- None applicable.

1.1.9 Targets

- None applicable.

1.1.10 Actions FY20

Align pest plant and animal control with SA Arid Lands Landscape Group objectives.

ODC has worked with the SA Arid Lands Landscape Board (formally SAAL NRM Board) to align our pest plant and animal control efforts with SA Arid Lands Landscape Group regional objectives. As a result, ODC is working towards expanding its influence to pastoral lease holders in regards to pest plant and animal management (BHP Olympic Dam 2019a; BHP Olympic Dam 2019b). In FY20, an Environmental Management Plan specific to the Stuart Creek Pastoral lease was developed.

Continue to develop pest plant and animal management (monitoring and control) effort guidelines.

During FY20, the Pest Animal Monitoring and Control Work Instruction (BHP Olympic Dam 2019b) was updated in an annual process to ensure continuous improvement of processes. The Work Instruction encompasses an effort-based approach for feral cat management and targets problematic areas such as Roxby Downs Village, Olympic Village and the Resource Recovery Centre. Adherence to the strategy is measured through 1SAP to ensure that management targets are met.

Continue to implement actions and identify progressive rehabilitation opportunities in the site Rehabilitation Strategy.

Several actions associated with the cessation of the 2011 Olympic Dam expansion pre-commitment works continued throughout FY20. The Rehabilitation Strategy actions associated with these works are described in Table 6. Regular photo point monitoring has shown that in some areas where specific stabilisation measures were adopted, an increase in vegetation coverage has occurred. See Figure 9 to Figure 12 as examples. Areas where compaction and saline water were used to minimise passive dust generation have showed signs of natural re-vegetation.

The open pit area is now surrounded by works associated with the underground expansion of the Southern Mine Area. Therefore, no further rehabilitation plans are in place for areas associated with pre-commitment works. Access to the pit itself and the immediate surrounding areas remains restricted.

Due to the underground mining method used at Olympic Dam, large scale rehabilitation works were not required during FY20. The EDP process requires temporary disturbances (i.e. excavation for pipe maintenance and cable installations) to be remediated through topsoil replacement and scarification to promote natural re-vegetation.

Table 6: Rehabilitation Strategy actions undertaken in FY20.

Rehabilitation Strategy Action	Comment
Set-up photo monitoring points for the area cleared for the proposed contractor's village on Andamooka Station to visually monitor soil stability.	Six monitoring sites were established in May 2012 and continue to be monitored on a biannual basis through photo points. The area continues to show progressive re-establishment of local plant species (Figure 9 to Figure 12).
Regular inspection of proposed contractor's village area for erosion.	The site of the proposed contractor's village is inspected during biannual photo point monitoring and other time-in-field excursions. Minor erosion from high rainfall events is visible within the Hiltaba area but does not warrant corrective action.

Review closure risks and assumptions through annual workshop.

The FY20 Annual Closure and Rehabilitation Plan review included a Closure Planning Workshop in February 2020. This workshop was held with the relevant internal stakeholders.

The following were implemented to update the Closure Estimates for the Current and Life of Asset Disturbances and associated Closure Risk Register:

- Closure execution commences in FY2085. The mine closure date remained constant at FY2094;

- The Life of Asset 2022 (LoA22) Optimised Base Plan will update any changes.

Figure 9: Photo point ENV 492 at Hiltaba taken May 2013.

Figure 10: Photo Point ENV 492 at Hiltaba taken March 2020 showing natural re-vegetation is occurring.

Figure 11: Photo Point ENV 490 at Hiltaba taken May 2013.

Figure 12: Photo Point ENV490 at Hiltaba taken March 2020.

1.2 Aquifer level drawdown

1.2.1 Environmental Outcome

No significant adverse impacts to existing third-party users' right to access water from within the GAB wellfield Designated Areas for the proper development or management of the existing use of the lands as a result of ODC activities.

No significant impact to third-party users has occurred. Drawdown and percentage wellhead pressure loss at pastoral bores remains less than the predicted long-term impact as presented in the EIS (Kinhill Engineers 1997, updated Golder Associates 2016), and significantly less than the maximum drawdown area defined within the 10m contour.

No significant adverse impacts to the availability and quality of groundwater to existing Stuart Shelf third-party users as a result of groundwater drawdown associated with ODC activities.

No significant impact to groundwater for existing Stuart Shelf third-party users has occurred. Regional groundwater levels are stable.

No significant adverse impact on groundwater-dependent listed species or ecological communities as a result of groundwater drawdown associated with ODC activities.

Drawdown remains less than the predicted long-term impact and was within compliance criteria limits for FY20. Environmental flow rates at GAB springs remained above predicted long term impacts as presented in the EIS (Kinhill Engineers 1997, updated Golder Associates 2016). Monitoring showed no indication of a significant adverse impact on groundwater-dependent listed species or ecological communities as a result of groundwater drawdown associated with ODC activities (see Section 1.2.4).

1.2.2 Compliance criteria

A 4 m drawdown limit at the point on the designated area for Wellfield A that is mid-way between GAB8 and HH2 based on the 12-month moving average (GA 2.5).

At the end of FY20 average drawdown between GAB8 and HH2 was 1.45 m (BHP Olympic Dam 2020c).

A 4 m drawdown limit for Wellfield B at the point between monitoring bores S1 and S2 (measured as the average drawdown of the two bores) and based on the 12-month moving average (GA 2.5).

At the end of FY20, the average drawdown between S1 and S2 was 2.3m (BHP Olympic Dam 2020c). The rapid increase in drawdown to 4.8m at S1 is localised to the monitoring well. Other wells closer to Wellfield B do not record a similar response (OB1, OB3, OB6, and WCB2). The cause of the anomalous drawdown is under investigation but is suspected to be a partial failure of the well casing underground. A downhole assessment of the S1 well to identify any structural failure was planned in FY20 but was delayed due to Covid-19 restrictions. The work will be completed by mid FY21.

A drawdown footprint for Wellfield B, measured as the area contained within the 10 m drawdown contour, that is less than or equal to 4,450 km^2 (GA 2.5).

At the end of FY20, the area contained within the 10 m drawdown contour line was 2,740 km^2 (BHP Olympic Dam 2020c).

No material change in the availability and quality of groundwater at existing bores in the Stuart Shelf area operated by third-party users.

Monitored water levels and quality in the Stuart Shelf area are consistent with historical levels, and do not indicate any change in the availability of groundwater at existing bores (see sections 1.2.8 and 1.2.9).

1.2.3 Leading Indicators

No leading indicator trigger values were reached. Drawdown trends at monitoring bore S1 remain below threshold values, as does the drawdown footprint area for Wellfield B.

Flow and water quality parameters at GAB springs, and drawdown trends at GAB pastoral bores, are stable and remain within the predictions of the 1997 EIS (BHP Olympic Dam 2020c). Water quality in the Stuart Shelf area remains unaffected.

1.2.4 Deliverables (FL 2.2)

An evaluation of the composition of vegetated wetlands within the GAB springs.

In total, 23 flora species were observed, not including Atriplex (HOW025) and Frankenia (HOW009) that could not be identified down to a species level. The greatest number of species observed on one spring was 8 (HHS007 and HHS142), while the least number of plants observed on one spring was zero (WWS013).

The abundance of plant species observed was plotted against the occupancy, where occupancy is calculated as the percent of springs on which a species occurred and abundance is the percent of quadrats, for each spring, on which a species occurred, averaged over all springs (Figure 13). Similar to previous years monitoring results, *Cyperus laevigatus* and *Phragmites australis* were the most abundant species (Figure 13). Followed by *Fimbrostylis dichotoma*, *Sporobolus virginicus* and *Baumea juncea* (Figure 13). *Eriocaulon carsonii* was also moderately abundant, however, springs with *Eriocaulon carsonii* are targeted in this survey.

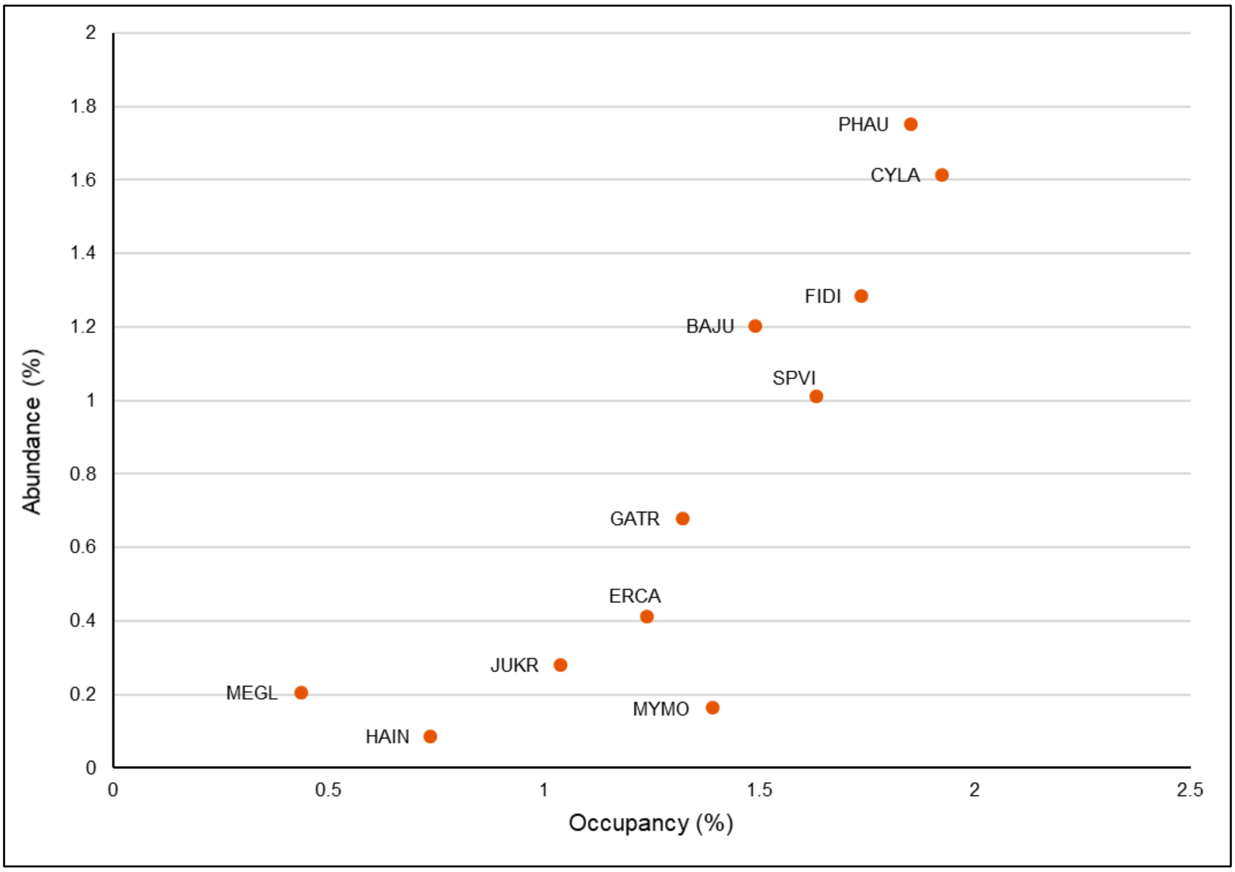


Figure 13: Distribution of 11 of the most abundant species recorded on all GAB springs monitored as a log function of the percent of springs occupied (x-axis) and the mean quadrat percent frequency (y-axis). The four letter codes refer to species names.

Using the Bray-Curtis dissimilarity metric, springs with a species composition greater than 50 % similarity were grouped together. Spring WWS013 was excluded from the analysis as it had no flora species present (FY16-FY20). Monitoring results from FY20 identified 9 dendrogram groups (Figure 14). In comparison, the FY16 analysis identified 10 dendrogram groups, the FY17 analysis identified 12 dendrogram groups and the FY18 and FY19 analysis identified 9 dendrogram groups. Modifications to the Bray-Curtis metric used by Datasticians (Griffin and Dunlop 2016) and GHD (2017) were not documented and are therefore impossible to recreate. This could then result in discrepancies in dissimilarities presented in years prior to FY18.

Spring LGS003, which constituted its own group in 2016 and 2017 was grouped with LGS006 in 2018, then constituted its own group again in FY20 (Table 7). For the first time, Spring LGS003 did not have any flora species present. Spring LGS003 usually has no standing water, but a high diversity of perennial and annual species. It is likely that these species have experienced dieback during recent drought conditions

The largest group was group 2 which was characterised by their relatively high species diversity and relatively high abundance of Phragmites australis (Table 7). In 2019, spring vents HHS125 and LWS016 were clustered together (Group 3) characterised by their relatively high abundance of *Sporobolus virginicus* compared to other species (Table 7). In 2019, Group 4 consisted of five spring vents clustered together on the basis of their relatively high abundance of Cyperus laevigatus, Sporobolus virginicus and Phragmites australis comparative to other species present (Table 7).

Groups 5 and 7 consist of one spring vent each, LWS015 and CBC001, respectively. Spring vent LWS015 was characterised by a relatively high abundance of *Melaleuca glometra* and *Phragmites australis* relative to other species present (Table 7). Spring vent CBC001 was characterised by a relatively high abundance of *Frankenia foliosa* relative to other species and across other clusters (Table 7). Spring vents LWS007 and LWS009 were clustered together (i.e., Group 6) on the basis of their relatively high abundance of Melaleuca glometra and Cyperus laevigatus relative to other species (Table 7).

Group 8 consisted of six spring vents characterised together by their relatively high abundance of Typha domingensis comparative to other species and across other clusters (Table 7). Group 9 consisted of 19 spring vents characterised together by their relatively high abundance of Cyperus laevigatus comparative to other species and across other clusters (Table 7).

Overall, Group 2 had the greatest species diversity (N=20), followed by Group 9 (N=14), and Group 4 (N=9; Table 7). In addition, *Eriocaulon carsonii* occurred in two groups, Group 2, and 9 (Table 7). The occurrence of *Eriocaulon carsonii* is explored further in the next section.

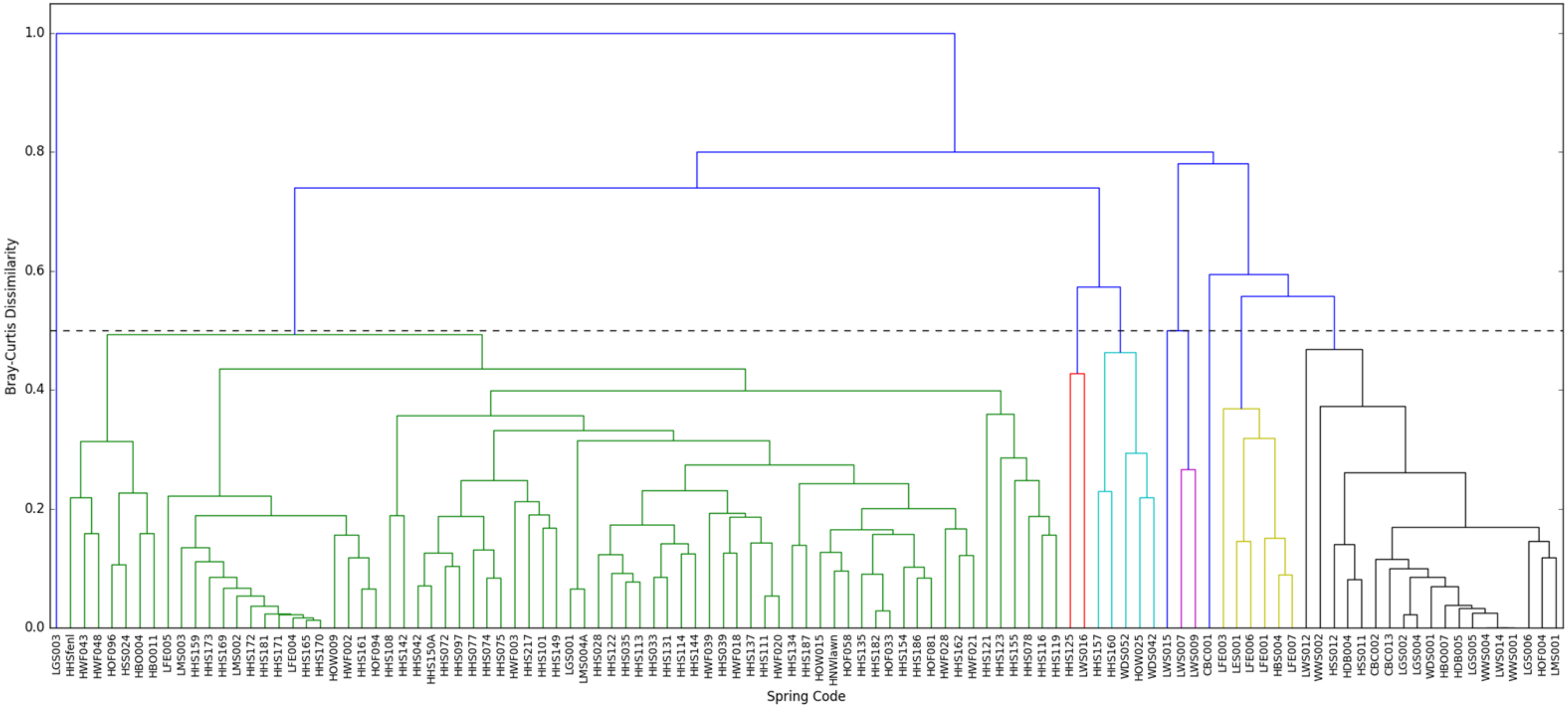


Figure 14: Springs grouped according to species composition (>50 % similarity) using hierarchal clustering. Springs groups are labelled from 1-9 from left to right.

Table 7. Average abundance (%) of species within each dendrogram group.

Species	Dendrogram groups (FY20) 1 LGS003	2 HHSfenl-HHS119	3 HHS125 – LWS016	4 HHS157-WDS042	5 LWS015	6 LWS007-LWS009	7 CBC001	8 HBS004-LFE007	9 CBC002-WWS004
Acacia stenophylla		0.6		4.4			2.7		
Atriplex limbata									
Atriplex holocarpa									
Atriplex nummularia		0.3		1.3				1.4	0.7
Atriplex sp.				0.6					
Baumea juncea		23.4	33.8						
Calocephalus platycephalus				0.6					1.5
Chenopodenia nitrariaceum							8.1		0.4
Cyperus laevigatus		27.5		39.9		36.7	51.4	54.4	99.2
Enchylaena tomentosa		0.4						0.4	1
Eragrostis dielsii									
Eriocaulon carsonii		3.5							1.8
Fimbrostylis dichotoma		27							9
Frankenia foliosa							62.2		
Frankenia sp.		0.1							
Gahnia trifida		7.3							
Halosarcia indica		0.2					10.8		5.8
Juncus kraussii		2	33.8						
Maireana tomentosa		0.2							
Melaleuca glometra					50	63.3			
Myoporum montanum		1.6		6.8			2.7	1	0.3
Osteocarpum sp.									
Phragmites australis		83.5		28.1	50			2.7	0.1
Salsola australis									
Schoenoplectus litoralis									0.3
Sclerolaena diacantha									

Species	Dendrogram groups (FY20)								
	1 LGS003	2 HHSfenl-HHS119	3 HHS125 – LWS016	4 HHS157-WDS042	5 LWS015	6 LWS007-LWS009	7 CBC001	8 HBS004-LFE007	9 CBC002-WWS004
Sclerolaena obliquicuspis									
Spergularia rubra								1.3	2.5
Sporobolus virginicus		7.9	97.1	60.8				10.7	
Stenopetalum nutans									0.1
Trianthema sp.		0.2		0.6					1
Typha domingensis								58	
Species diversity	0	20	3	9	2	2	6	8	14

A comparison of the abundance and distribution of *Eriocaulon carsonii*, per impact zone, with previously reported values, to determine impacts to the GAB springs.

Within the region studied, populations of *Eriocaulon carsonii* were restricted to 19 spring vents in the Hermit Hill, North East and Lake Eyre springs complexes in FY20. *Eriocaulon carsonii* occurred on the Hermit (14 springs), Gosse (2), West Finniss (1), North West (1) and Sulphuric (1) spring groups (Table 8). *Eriocaulon carsonii* was uncommon and limited in abundance where it did occur. It ranged in percentage abundance on any one spring vent on which it occurred from 2 – 38.9 %. *Eriocaulon carsonii* occurred on both spring mounds/springs and spring tails.

Using a Chi Square analysis for dependent samples, the average abundance of the 26 springs identified as suitable *Eriocaulon carsonii* habitat from FY16-FY20 has shown that there has been no significant negative impact to the size of an important population of *Eriocaulon carsonii* (X^2 = 5.103, df =4, p = 0.277; Figure 15). Rather differences observed between FY16 and other years is likely to do with a difference in observers.

Table 8: Comparison of *E. carsonii* results in FY15 – FY20.

Spring group	Spring vent	Units monitored in 2014[2]	2014 (cover class)	2015 (percent abundance)	2016 (percent abundance)	2017 (percent abundance)	2018 (percent abundance)	2019 (percent abundance)
Hermit Hill	HHS028	-	-	8.7	13.5	29.7	21.6	16.2
	HHS033	-	-	1.6	2.7	5.4	5.4	10.8
	HHS035	-	-	0.0	2.8	11.1	8.3	11.1
	HHS072	M	1	1.4	0.0	0.0	0.0	0.0
	HHS074	M	1	2.7	5.1	0.0	0.0	0.0
	HHS075	M	0	1.4	0.0	0.0	0.0	0.0
	HHS077	-	-	0.0	7.7	7.7	7.7	15.4
	HHS078	-	-	5.5	20.5	11.8	2.9	35.3
	HHS114	S	1	1.7	0.0	0.0	0.0	0.0
	HHS116	M	2	1.4	8.3	8.3	8.3	8.3

	HHS119	S	2	0.0	0.0	22.2	8.3	38.9
	HHS121	-	-	0.0	2.9	17.1	31.4	11.4
	HHS122	M	2	0.0	2.8	0.0	16.7	11.1
	HHS123	-	-	6.3	30.5	8.3	25	19.4
	HHS131	M	1	1.8	4.7	2.4	7.1	7.1
	HHS144	S	1	0.0	0.0	0.0	0.0	0.0
	HHS150A	M/S/T	1	2.6	5.4	8.1	10.8	5.4
	HHS154	T	1	0.0	0.0	0.0	0.0	0.0
	HHS155	-	-	3.9	15.0	17.5	20	20
	HHSfenl	T	6	13.0	10.5	17.5	7.1	14.3
North West	HNWlawn	T	1	1.7	0.0	2.9	2	2
Old Finniss	HOF058	S	1	0.0	0.0	0.0	0.0	0.0
Sulphuric	HSS012	M	2	3.2	2.7	5.4	5.4	5.4
West Finniss	HWF043	S/T	3	9.8	11.5	9.6	15.4	23.1
Gosse	LGS002	M/T	2	12.3	18.0	8.0	14	12
	LGS004	S/T	3	18.9	26.7	45.0	53.0	17

Notes:

1. Because of the change in monitoring program, not all of the results are directly comparable.
2. Up until (and including) 2014, springs units were monitored separately: A spring unit is a morphological component of a spring: the vent, mound, or tail. The vent is the source of most of the water. The vent is usually set in the top or side of the mound ('m') (if the spring has a mound). The tail ('t') is an area with an outflow of water away from the vent. A spring ('s') may possess some or all of these components. For monitoring *E. carsonii* and grazing impacts, the mound and tail have generally been treated separately (no monitoring occurs on the vent). Over 2005-2014, we followed the procedure established by Kinhill Stearns (1984) and Fatchen and Fatchen (1993). However, past monitoring has been inconsistent: PPK (2002) and Badman (2004; 2005) treat an "undifferentiated spring plus any tail" as a single unit (Badman, 2005:16).
3. Up until (and including) 2014, the monitoring was targeted at finding and recording *E. carsonii*. While the 2015 monitoring included all identifiable springs where *E. carsonii* has ever been recorded, the method quantifies species abundance for all species present on the site, rather than focussing on searching for the generally very small *E. carsonii* populations.
4. Up until (and including) 2014, cover was estimated using the Domin-Krajina rank score (see Griffin and Dunlop, 2014). In 2015 and 2016, abundance was calculated directly from the percentage of quadrats on which a species occurred.

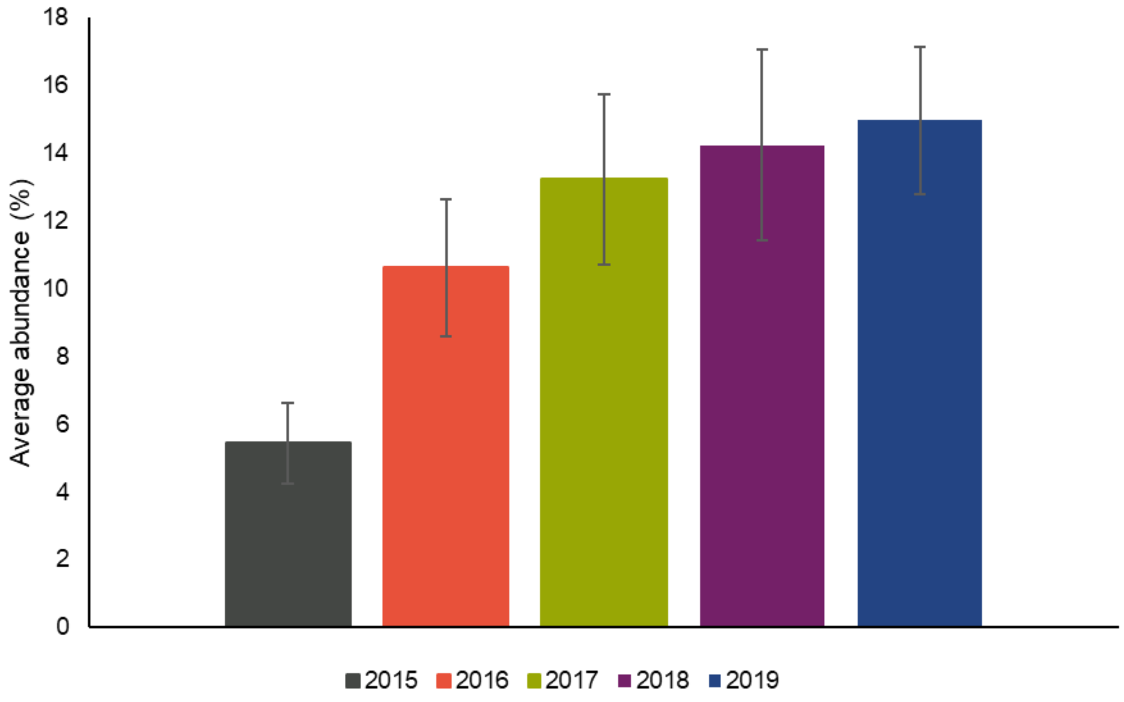


Figure 15: The abundance (mean ± SEM) of *Eriocaulon carsonii* from 2015-19 across the 26 springs identified as suitable *Eriocaulon carsonii* habitat.

Comparison of the abundance of Hydrobiid species against baseline data to quantify population change.

Completed in FY18. Will be reported again in FY21.

1.2.5 Deliverables (GA 2.5)

Collated domestic and industrial water use efficiency data, to assess performance against improvement targets.

In FY20 the GAB Industrial Water Efficiency of the operation was 1.16kL/t compared to the target of 1.18 kL/t and actual of 1.1kL/t for FY19. The increase in FY20 compared to FY19 was due to a number of factors, including:

- An increase in Smelter throughput and therefore water use, that was not accompanied by a proportional increase in material milled. This was due to higher plant copper grades, due to the recommencement of the treatment of high copper smelter slag, and higher mine grades which increased concentrate production.
- The use of process and potable water for airport runway and accommodation construction projects. Water quality requirements to meet engineering standards necessitated the use of high quality water for these projects.

Historical GAB industrial water efficiency is given in Figure 16.

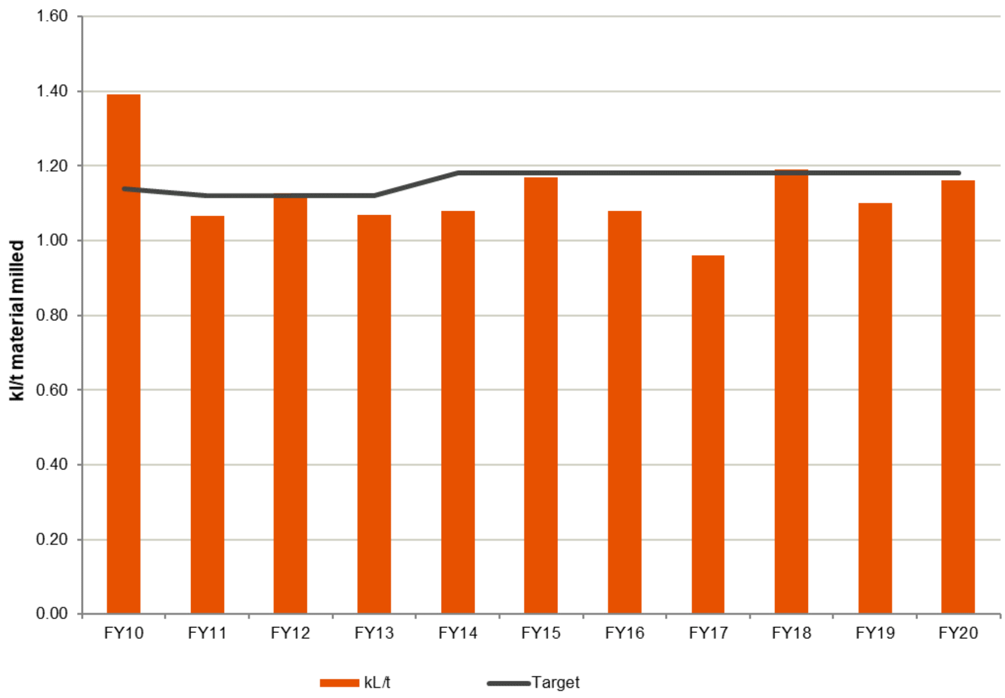


Figure 16: Historical industrial GAB water efficiency.

Domestic water use during FY20 averaged 2.48 ML/d compared to 2.4 ML/d in FY19, below the target of 3.2 ML/d. Historical domestic water use is given in Figure 17.

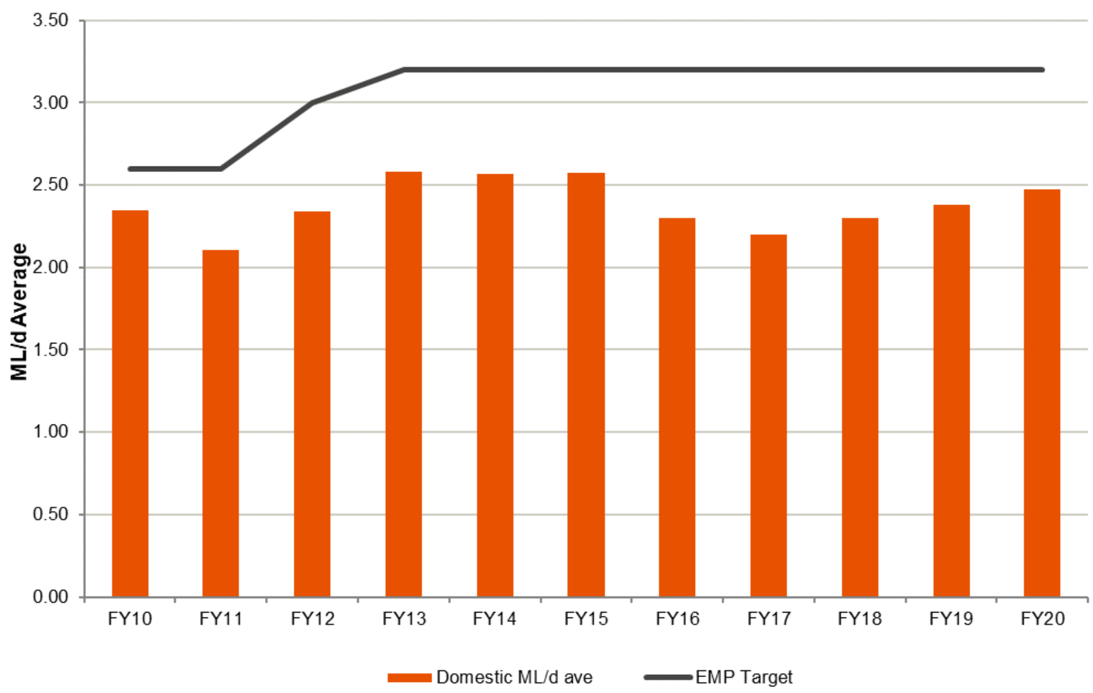


Figure 17: Historical domestic water use (note there was no target in FY09).

1.2.6 Deliverables (GA 2.5)

Ten-year water use schedule to be submitted to the Indenture Minister by 1 January annually.

The current 10-year water use schedule, as provided to the Minister for Energy and Mining in January 2020, is presented in Appendix 9 of the FY20 Annual Wellfields Report (BHP Olympic Dam 2020c). An updated schedule will be provided by 1 January 2021.

Further development of existing wellfield infrastructure may be required to supply additional capacity to the operation as part of the 10 year water forecast. The 10 year forecast includes current business as usual (Bau) operations only and includes the water demand of up to 42 ML/d being studied as part of the Olympic Dam Resource Development Strategy (OD-RDS).

The 10-year Bau forecast (Appendix 6) predicts total wellfield abstraction to reach 41.7 ML/day by 2023 and remain constant to 2030. Abstraction rates for Wellfield A are expected to remain at an annual average of 5 ML/d and at 36.7 ML/d for Wellfield B.

To realise the abstraction rate of 42 ML/d to support the OD-RDS additional production wells and associated pipeline infrastructure will be required. This additional water take is expected to come from Wellfield B and no exploration for additional wellfields is currently planned.

1.2.7 Deliverables (GW 2.1)

A review of abstraction rates and trends and an assessment with respect to groundwater levels.

Saline water was abstracted from the Arcoona Quartzite throughout FY20 from the Saline Wellfield located south of the Mine offices. Additional saline water was sourced from the Andamooka Limestone aquifer within the vicinity of the TRS facility to manage underground seepage rates.

Some of this saline water was used in construction projects throughout the operations, whilst the remainder was discharged to the mine water disposal pond for evaporation. An average of 1.5 ML/d was abstracted over the period, compared to 1.9 ML/d during the previous reporting period as shown in Figure 18.

Groundwater levels in the Saline Wellfield area and TRS area are shown in section 1.2.8, Figure 24 and Figure 25.

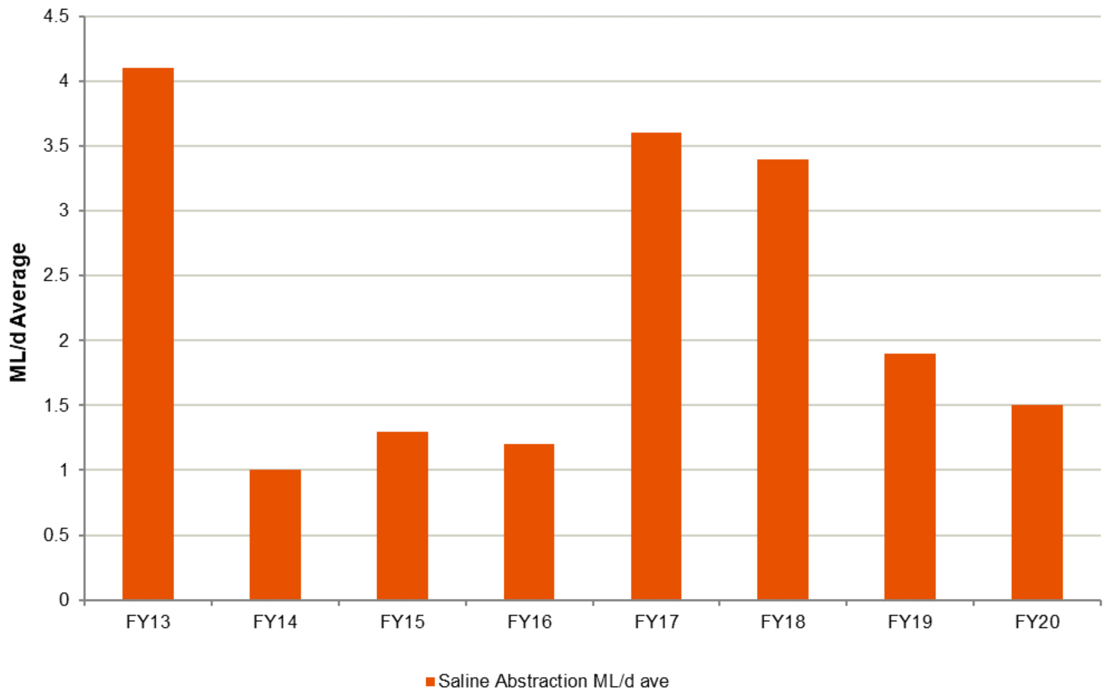


Figure 18 : Historical saline abstraction rates (ML/d)

A definition and map of the underground mine water balance.

The mine water balance is a summary of the volume of water going into and out of the underground mine. It includes saline water abstracted from local bores that is added to surface storages and used around site. The balance (presented in Figure 19) is generated from a combination of measured, derived and estimated data.

An estimate of the volume of groundwater discharge to underground.

Groundwater inflow to the mine occurs at several intersections with the underground operations (Figure 19). Total natural inflow is estimated to be approximately 3.9 ML/d, the majority entering via upcast raise bores. Additional natural inflow comes into the mine via other entry points, including downcast raise bores, exploration drill holes and shafts. Much of the total inflow to the mine is transported to the surface as ore content or exhausted to the atmosphere as saline aerosols or moisture-laden air via upcast raise bores, estimated at around 2.5 ML/d.

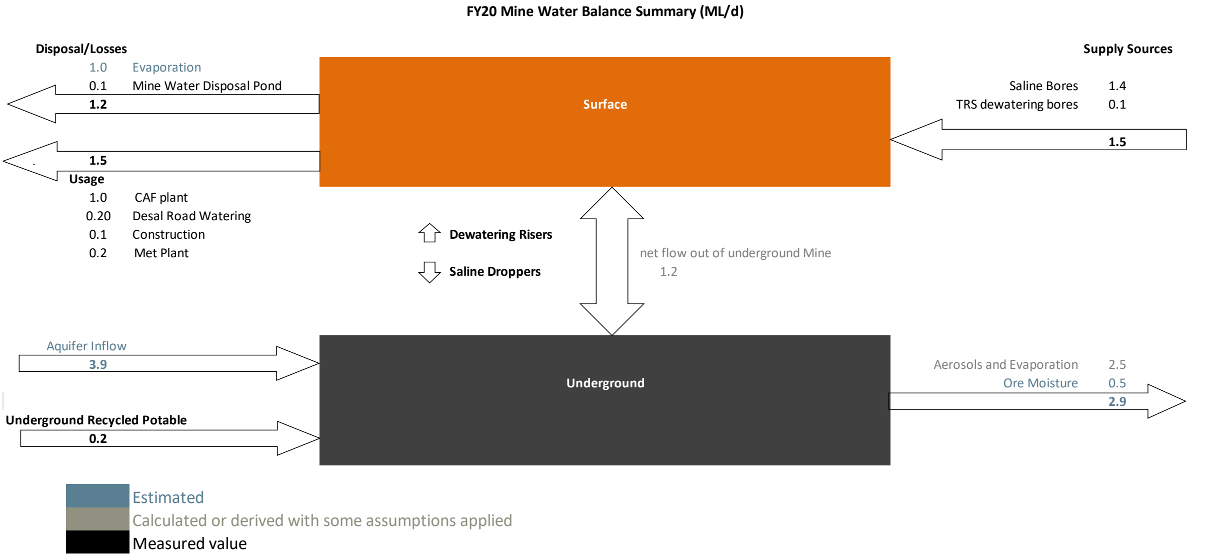


Figure 19: FY20 Saline (Mine) water balance summary (ML/d) (totals may differ from individual values due to rounding).

1.2.8 Deliverables (GW 2.2)

A review of the trends in local and regional groundwater levels and a comparison with historical groundwater levels.

The Olympic Dam groundwater monitoring network is shown in Figure 20. The groundwater cross section (Figure 21) and hydrograph (Figure 22) confirm the limited changes in groundwater levels beneath the TSF between June 2019 and June 2020. Monitoring bore LT18 has been decommissioned and redrilled with LT18A to the south-eastern of the original well which is reflected in the change in water level monitored.

The maximum groundwater level recorded below the TSF for the current reporting period was 66.62 mAHD at LT67 (Figure 24). The rising trend at LT67 has been addressed with the installation of a dewatering system and changed supernatant pond control which has stabilised the water rise. Groundwater levels are not expected to exceed the agreed limit of 20 m below the ground surface (80mAHD).

Groundwater level contours in the Andamooka limestone aquifer beneath the perimeter of the TSF (Figure 23) have generally remained stable during FY20. A continued stable area above 60 mAHD in TSF 1-4 and no groundwater level above 65 mAHD has been maintained. There is a continued rise in groundwater levels beneath TSF 5 (Figure 24) which can be attributed to the ongoing use of this facility. Levels are below compliance limits of 80 mAHD however wells LT65 and LT67 are rising at a rate greater than expected. As noted above, a dewatering system has been installed and the supernatant management in the TSF modified which has stabilised the rise. The water level in this area will continue to be managed to maintain compliance with agreed compliance levels.

Groundwater levels for bores in the vicinity of the underground mine (Figure 25) continue to show depressurisation of the geological units, consistent with ongoing mine depressurisation activities.

Limestone aquifer bores in the vicinity of Roxby Downs (Figure 26) demonstrate stable groundwater levels during FY20.

Historical level monitoring indicates steady groundwater levels over time with no overarching trends that would indicate material change in the availability at existing bores in the Stuart Shelf area operated by third-party users (section 1.2.3).

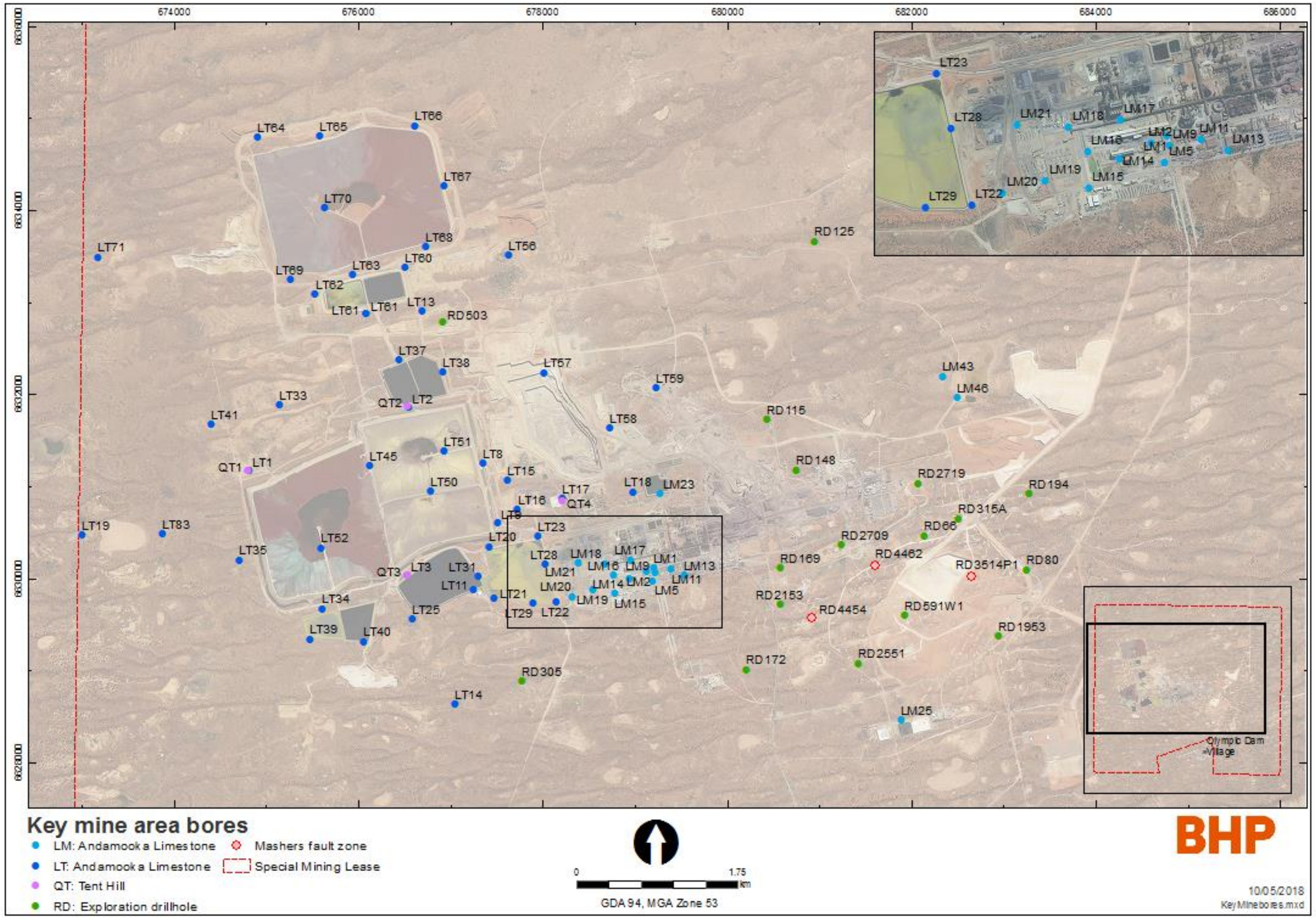


Figure 20: Location of key mine area bores.

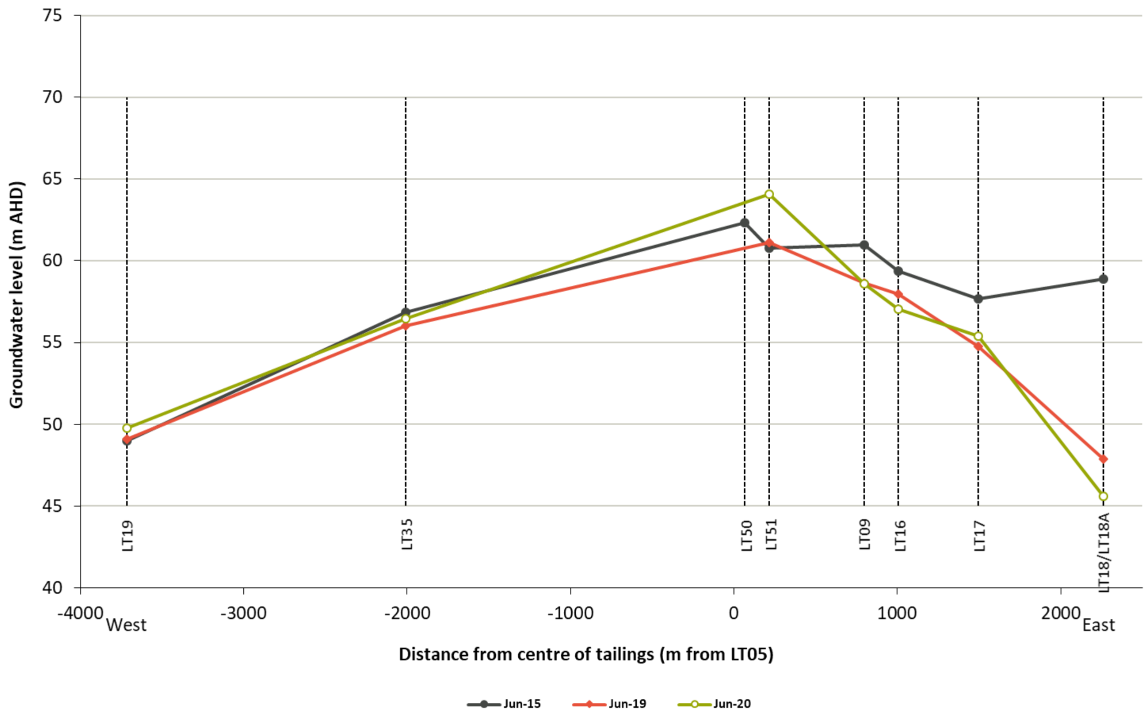


Figure 21: Change in groundwater elevation along an east-west cross-section from LT19 to LT18A, through the centre of the TSF.

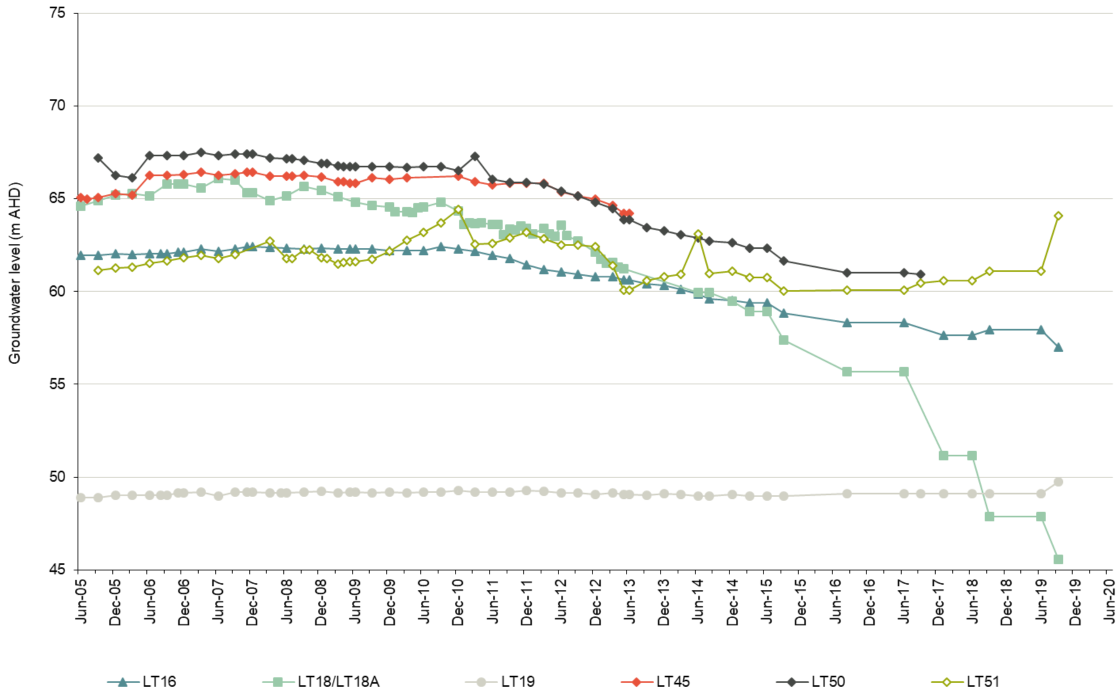
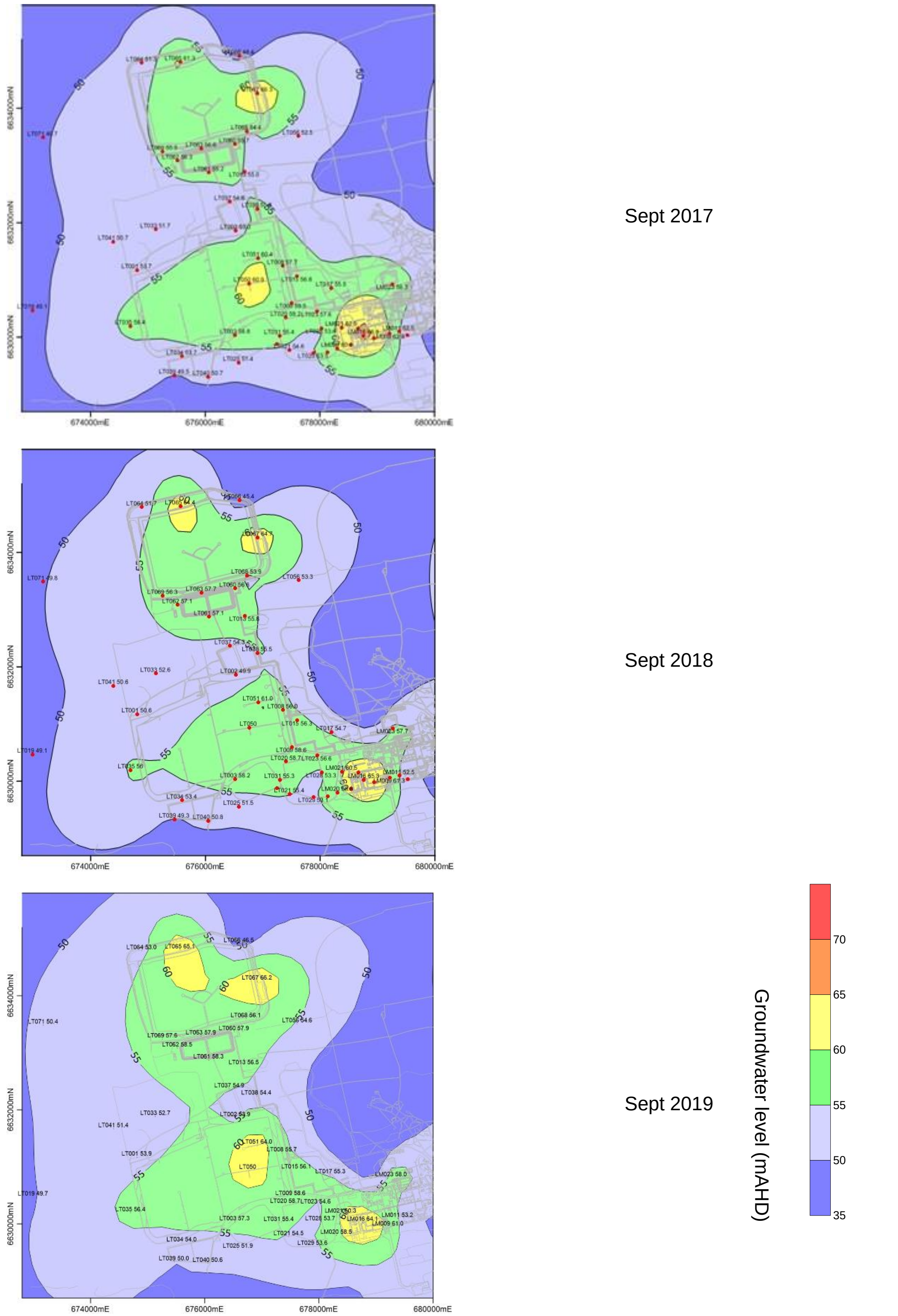


Figure 22: Groundwater levels for Andamooka Limestone bores in the vicinity of the TSF



Datum: GDA94

Projection: MGA94

Zone: 53

Figure 23: TRS area groundwater levels (mAHD) Andamooka Limestone Aquifer.

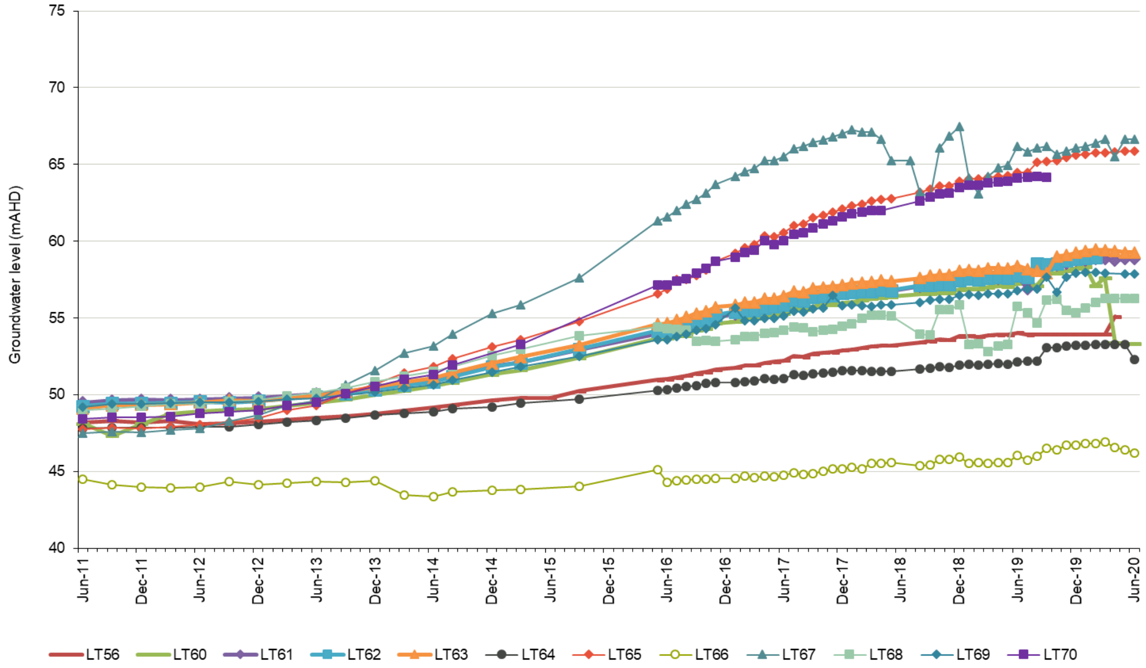


Figure 24: Groundwater levels for bores in the vicinity of TSF 5.

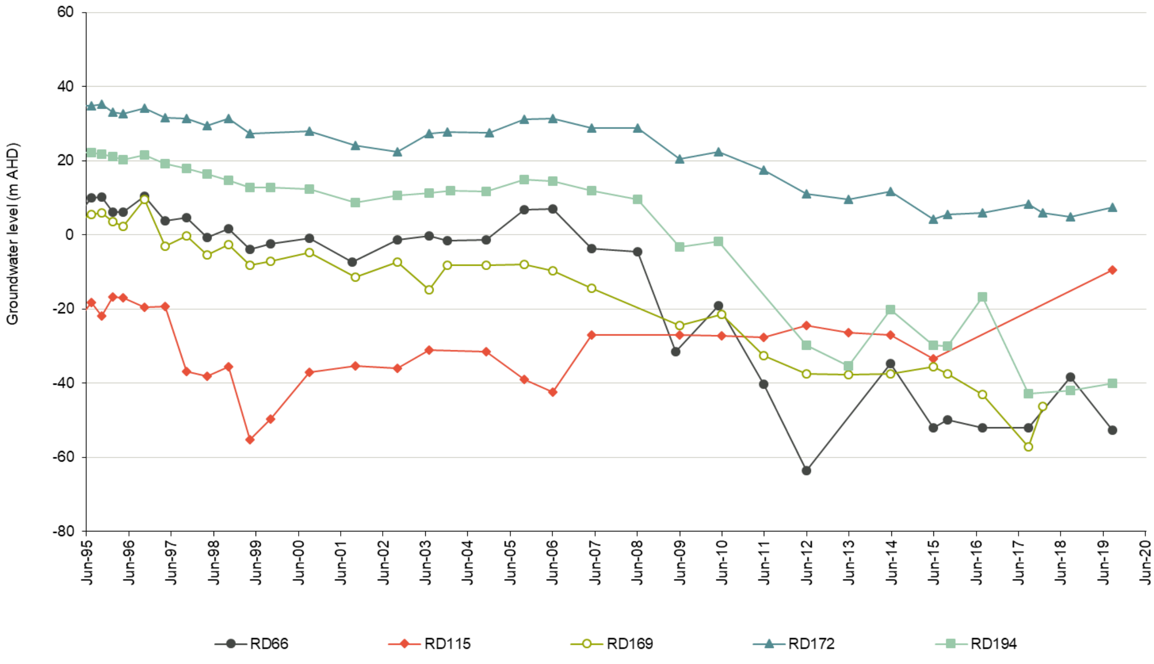


Figure 25: Groundwater levels for exploration drill holes in the vicinity of the underground mine.

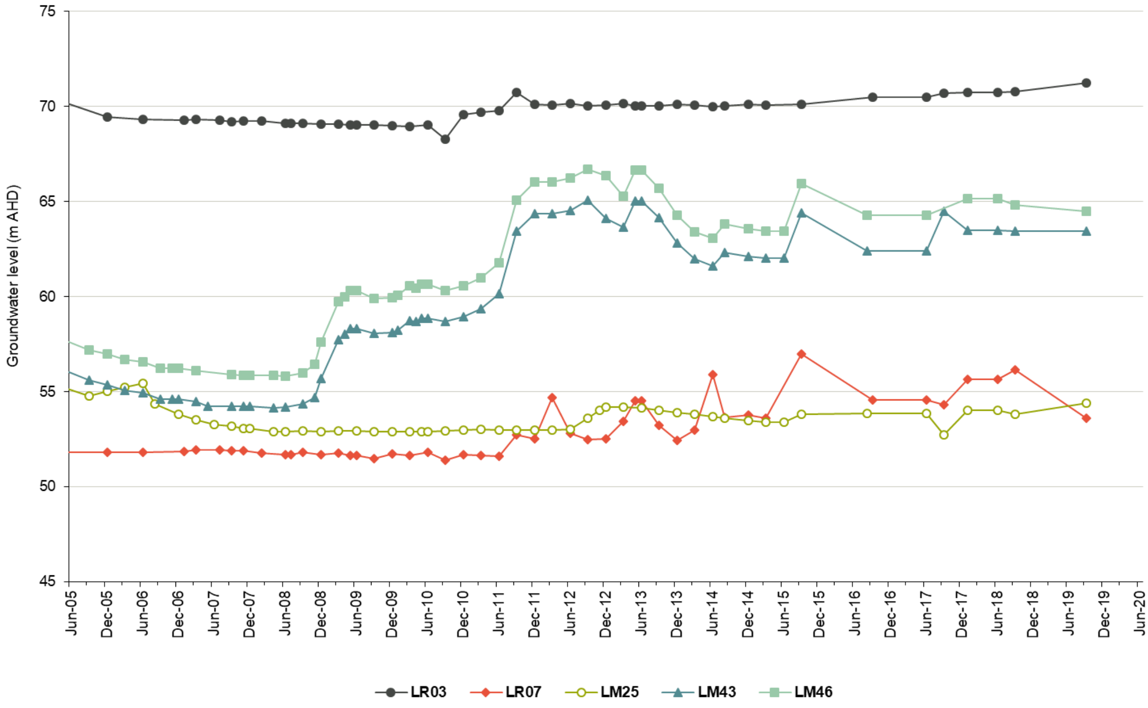


Figure 26: Groundwater levels for Andamooka Limestone bores in the vicinity of Roxby Downs (LR) and the Mine Water Pond (LM).

Data showing the tracking of trends towards leading indicators for groundwater impacts, and an alert to management when levels approach the leading indicators.

Data for groundwater level was collected, with a discussion of results in section 1.2.8. Leading indicator trigger levels were not reached.

1.2.9 Deliverables (GW 2.3)

A review of trends in groundwater quality and a comparison to ANZECC criteria.

Groundwater in the vicinity of the Olympic Dam Operation occurs at depth and is highly saline making it unsuitable for human or livestock consumption and largely inaccessible. The local groundwater does not meet any of the beneficial use categories listed under ANZECC guidelines.

Groundwater salinity has generally remained stable and within the range that could be reasonably expected for natural variation within the aquifer. TDS from monitoring wells around the base of the TRS facility ranged from 12,600 mg/L at LT22 to 38,500 mg/L at LT17. Regional wells TDS ranged from 7,680 mg/L at LR3 to 28,100 and 29,600 mg/L at LR9 and LR8. LR3 is located next to the Roxby Downs potable water dam and TDS is influenced by historical leakage from the dam of high quality water, LR9 is to the south west of the SML, is hydraulically up gradient of the mine and representative of aquifer background, LR8 is to the north of the SML, hydraulically down gradient of the mine.

Groundwater pH ranges from monitoring wells around the base of the TRS facility ranged from 6.63 at LT2 to 7.35 at LT22. Regional well pH ranged from 7.02 at LR9 (up-gradient background of the SML) to 7.56 in LR8 (down gradient of the SML) and 7.87 in LR3 (town potable water dam influenced), within the range of historical monitoring results.

Concentrations of copper in all groundwater monitoring bores sampled during the FY20 monitoring program were reported below ANZECC (2000) guidelines for livestock consumption of 0.4 mg/L (Figure 27).

While slightly elevated concentrations of uranium continue to be detected in the groundwater in the vicinity of evaporation pond two, uranium concentrations remain within historical limits in the majority of bores. Uranium concentrations are lower than the adopted ANZECC (2000) guidelines for livestock consumption of 0.2 mg/L in all except four bores (Figure 28).

A uranium concentration in excess of the ANZECC livestock guidelines has been detected at bores LT15 (0.543 mg/L) LT67 (0.297 mg/L), LT25 (0.585 mg/L) and LM46 (0.323 mg/L). LT15, LT25 and LT67 are located at the base of the tailings facility and are highly susceptible to changes in tailings pond use rates. LM46 is located at the mine water disposal pond and has historically shown fluctuating water quality.

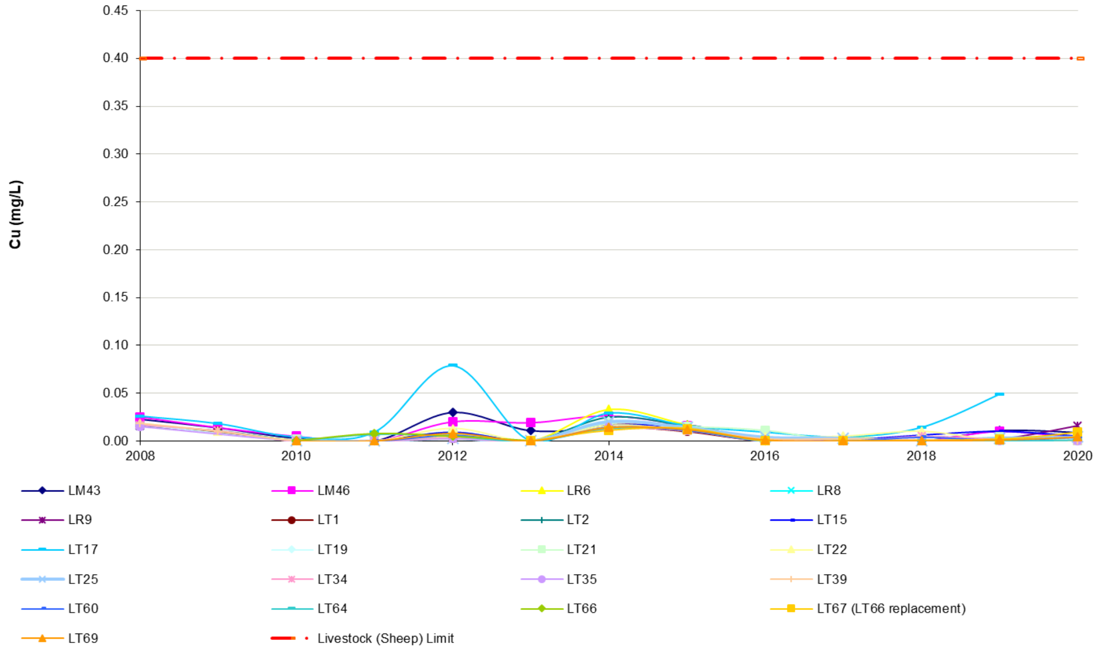


Figure 27: Olympic Dam on-site and regional groundwater monitoring bores: copper concentration.

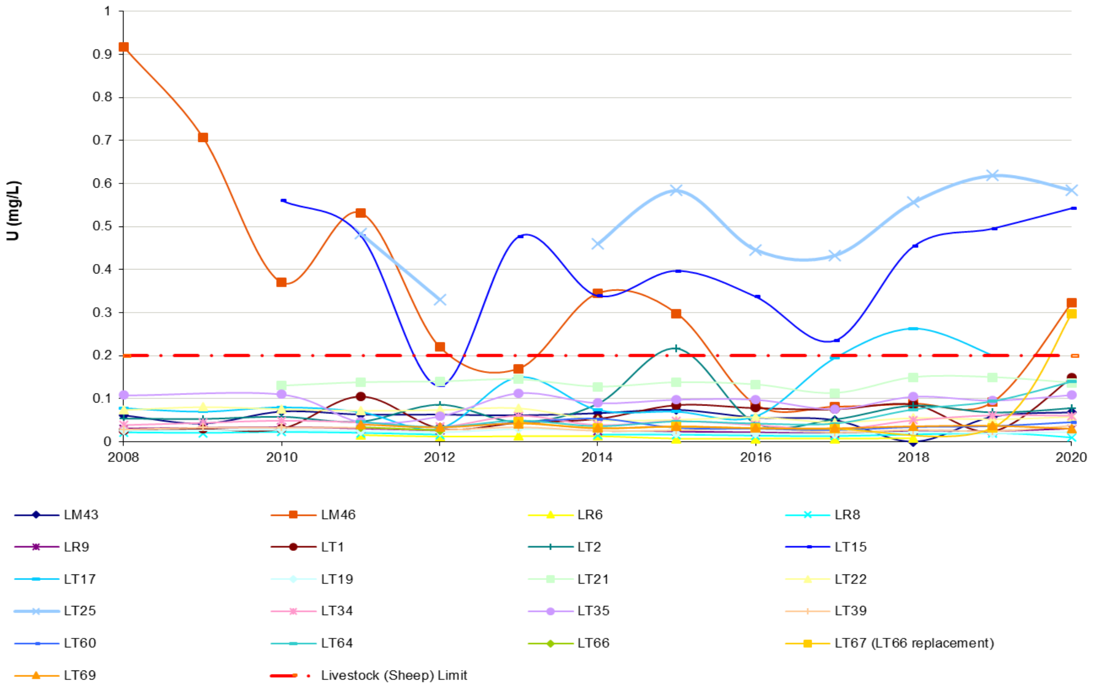


Figure 28: Olympic Dam on-site and regional groundwater monitoring bores: uranium concentration

1.2.10 Deliverables (WA 2.3)

Records of the water levels in the MWDP.

To determine any potential environmental impacts of the Mine Water Disposal Pond (MWDP), water levels were monitored via local groundwater bores. Stable groundwater levels at LM43 and LM46 were observed due to consistent water discharge rates into the pond during early FY20 (Figure 26).

Records of quantities of water disposed of into the MWDP.

Quantities of water disposed of into the MWDP were measured and recorded each day, and reconciled monthly as part of the Saline Water balance (see Figure 19). An average of 0.1 ML per day was disposed into the MWDP during FY20.

1.2.11 Deliverables (WA 2.4)

Records of pond levels and pond wall condition (sewer ponds).

Sewage waste generated by Olympic Village (OV) is gravity fed to three on site chambers and pumped to the OV treatment facility west of the camp. The treatment facility consists of primary and secondary storage ponds and a permanent evaporation pan. The secondary ponds are mechanically aerated. Testing and monitoring of water quality continued throughout the FY20 under 1SAP programmed maintenance, with results remaining within guideline thresholds. The OV treatment facility is inspected daily for security, inflow, wall integrity and available freeboard in storage ponds. Freeboard is reported daily and recorded. Inflow was recorded daily and averaged at ~401kL/day for FY20. Pond wall condition was maintained in good condition during the reporting period.

Sewage waste generated by the Mine and Process plant is treated onsite. The onsite facility consists of a lined primary lagoon and lined evaporation pond. Inflow for FY20 averaged at ~258kL/day which is greater than design capacity due to increased site activities. During FY20 construction was completed for sewage evaporation lagoon 2 (sewage EP2). The evaporation pond was successfully commissioned early in 2020 and remains in use. Olympic Dam has not undertaken any emergency onsite irrigation events since 30th September 2019, as per approvals.

1.2.12 Deliverables (GW 2.5)

Data demonstrating that radionuclide concentrations are below upper limits.

Surface ponds which hold groundwater used for road watering were monitored and analysed during FY20 for specific radionuclides. Results from samples analysed in September 2019 were below the upper limit for radionuclide ^{238}U and ^{226}Ra of 50 Bq/L and 5Bq/L respectively (Table 9, Figure 29, Figure 30).

Table 9: Radionuclide analysis for dust suppression water.

	Analyte	^{238}U (Bq/L)	^{230}Th (Bq/L)	^{226}Ra (Bq/L)	^{210}Pb (Bq/L)	^{210}Po (Bq/L)
Upper Limits		50		5		
Sample site	Date					
A Block	Sept 2019	10.6	0.020	0.10	-0.110	0.014
D Block	Sept 2019	21.5	0.04	0.4	-0.072	0.03
F Block	Sept 2019	26	0.67	0.19	0.79	0.42
SMA Saline Dam 1	Sept 2019	17.9	0.12	0.38	0.16	0.07
SMA Saline Dam 2	Sept 2019	24.3	0.32	0.20	0.63	0.17
EP Construction Pond	Sept 2019	46	0.04	0.37	0.90	0.015
TSF Construction Pond	Sept 2019	0.56	0.01	1.4	-0.025	0.007

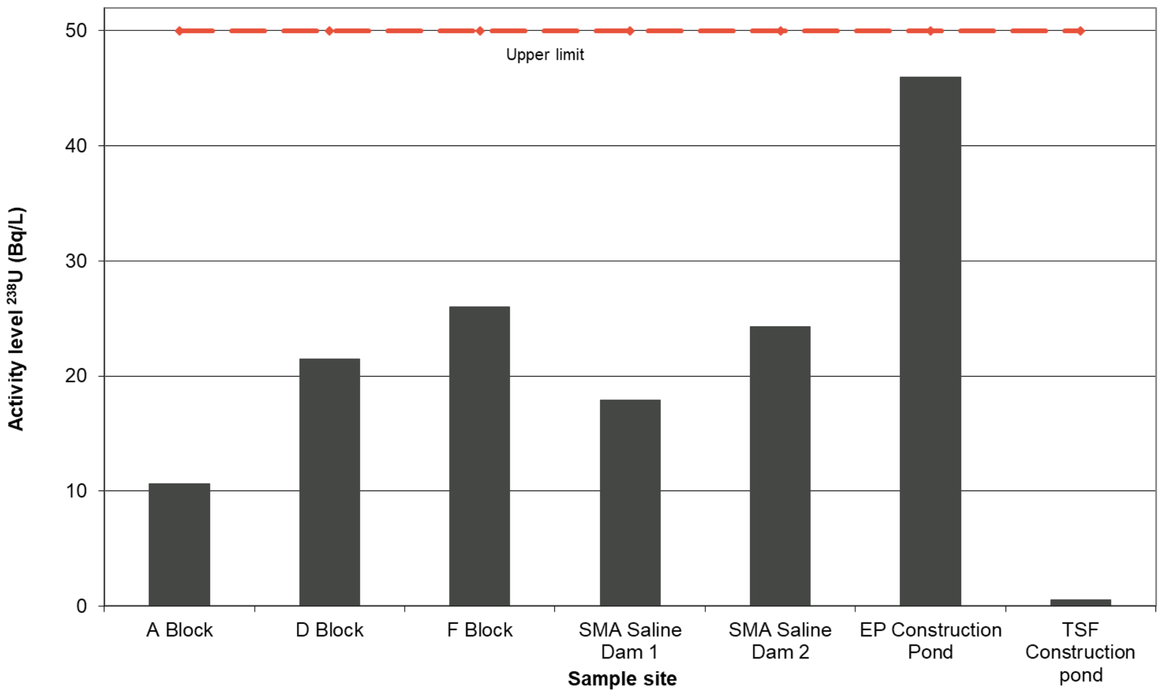


Figure 29: Mine water sample ^{238}U levels and upper limit FY20

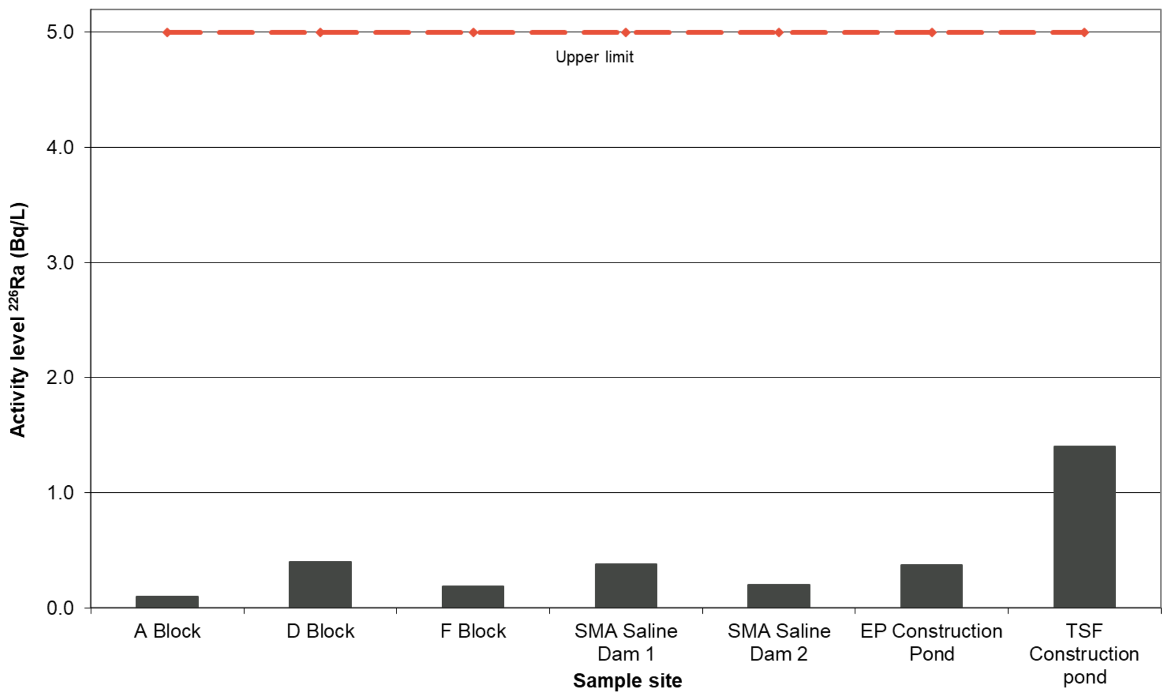


Figure 30: Mine water sample ^{226}R levels and upper limit FY20

A review of results and provision for increased monitoring frequency where concentrations are trending towards upper limits.

No samples collected during FY20 showed levels above upper limits. Sampling of the EP construction pond is being increased in FY21 to determine whether the high FY20 sample is representative of true pond conditions.

1.2.13 Targets FY20

Maintain an industrial water efficiency of 1.16kL/t at the budgeted production rate.

In FY20 the GAB Industrial Water Efficiency of the operation was 1.16 kL/t compared to the target of 1.16 kL/t and 1.1 kL/t for FY19. The increase in FY20 compared to FY19 was due to a number of factors, including:

- An increase in Smelter throughput and therefore water use, that was not accompanied by a proportional increase in material milled. This was due to higher plant copper grades, due to the recommencement of the treatment of high copper smelter slag, and higher mine grades which increased concentrate production.
- The use of process and potable water for airport runway and accommodation construction projects. Water quality requirements to meet engineering standards necessitated the use of high quality water for these projects.

Historical GAB industrial water efficiency is given in Figure 16.

Maintain a domestic water use target of 3.2 ML/d average

Domestic water use during FY20 averaged 2.5 ML/d, below the target of 3.2 ML/d, as outlined in the Great Artesian Basin Wellfields Report (BHP Olympic Dam 2020c).

1.2.14 Actions FY20

Continue implementation of water use conservation and recycling initiatives.

In FY20 ODC completed planning and budget allocation for a project to conduct downhole geophysical assessment of all BHP GAB wells during FY21/22. The project will provide a detailed condition assessment of BHP GAB assets to inform infrastructure maintenance and replacement strategy and will help prevent unplanned failure of wells and resultant waste of GAB water.

Continue substitution of saline water for high quality water where possible.

Saline water continues to be used in lieu of high quality water where feasible, including use in CAF, road watering, construction and underground drilling activities.

Saline water is not being used to augment the process water stream as this would result in an unacceptable increase in chloride in the system, which affects plant performance.

2 Storage, transport and handling of hazardous materials

2.1 Chemical / hydrocarbon spills

2.1.1 Environmental Outcome

No significant site contamination of soils, surface water or groundwater, as a result of the transport, storage or handling of hazardous substances associated with ODC's activities.

No significant contamination of soils, surface water or groundwater leading to actual or potential environmental harm due to the transport, storage or use of hazardous substances associated with ODC activities occurred in undisturbed areas of the SML during FY20.

Hazardous substance spills which occurred within the operational areas of the SML were appropriately contained and cleaned up as soon as practicable with each event captured in the Global Event Management System (EMS). Of the chemical and hydrocarbon spills recorded within the operational area in FY20, none triggered additional reporting under the Environment Protection Act 1993 for actual or potential environmental harm.

No hazardous substance spills occurred outside the SML or impacted environmental receptors such as flora, fauna or water bodies during FY20 as a result of transporting hazardous substances for ODC activities.

Active monitoring and management of legacy hydrocarbon sites was continued during FY20.

2.1.2 Compliance criteria

No site contamination leading to material environmental harm (as defined in the EMM) arising from hydrocarbon/chemicals spills within the SML and wellfields designated areas.

During the FY20 reporting period, 61 chemical/hydrocarbon spills were reported within EMS as having occurred within the SML and Wellfield designated areas. All spills were contained and cleaned up as soon as practicable. As a result, no chemical/hydrocarbon spills within the SML and Wellfield designated areas led to actual or potential environmental harm occurring as part of ODC activities.

Three legacy hydrocarbon spill sites exist (the 3ML tank on the SML; PS1 and PS6A in the Wellfields area), which are being actively monitored and managed. The hydrocarbon plume at the 3ML tank has been the subject of a Remediation Management Plan and subsequent Groundwater Management Plan (GMP) which requires 3 yearly monitoring between 2016 and 2025 to confirm plume stability. A monitoring event was conducted in FY20 and no contingency or trigger values were exceeded with the conclusion that no further action above the GMP plan is required at this time.

PS1 remediation has successfully treated a groundwater volume in excess of 4ML since commencing operation in late 2014. During FY20 the LNAPL hydrocarbon plume has not expanded, the TPH plume has not reached the passive remediation barrier or the potential surface expression of Gregory Creek and the dissolved phase plume has not changed in extent during FY20.

Finally, PS6A remediation has treated groundwater in excess of 12ML since commencing operation in mid-2014 and recovered approximately 39,800L of light non-aqueous phase liquid (LNAPL). The PS6A system remained inactive during FY20 and the rebound response monitored. An assessment of remediation effectiveness is being prepared for consideration during FY21.

Therefore, it is concluded that no new material environmental harm has arisen from hydrocarbon/chemical spills within the SML and wellfields designated areas.

2.1.3 Leading Indicators

- None Applicable

2.1.4 Targets FY20

Corrective actions for all reportable spills of chemicals and hydrocarbons are implemented in a timely manner and do not result in material environmental harm (as defined in the EMM). (Note: Spills are reportable if they result in potential or actual material environmental harm in accordance with the EP Act 1993)

Hydrocarbon/chemical spills which occurred within operational areas did not trigger additional external reporting requirements as outlined under the Environment Protection Act 1993. As a result of workplace bunding and containment measures, no spill events of a chemical or hydrocarbon substance led to actual or potential environmental harm occurring in FY20.

2.1.5 Actions FY20

Maintain a register of recordable chemical and hydrocarbon spills and corrective actions. (Note: An internally recordable spill of chemicals and/or hydrocarbons is defined as a spill of 10 litres or greater, outside of a bund, in a single event.)

During FY20 a register of recordable chemical and hydrocarbon spills and corrective actions was maintained through the EMS. In FY20 there were 61 internally recordable chemical and hydrocarbon spills across site. The increase from FY19 is believed to be at least partially due to the implementation of the (G)EMS which has raised awareness and aided in the capture and reporting of events. The majority (58) of the spills occurred above ground in the processing plant, with the remaining (3) reported at the accommodation villages.

A breakdown of the 61 recorded events shows fourteen were hydrocarbon spills with a majority of these spills resulting from loss of containment from plant equipment across site, nine were effluent spills at fill up points or from aging pipework on the SML and two effluent spills at Olympic Dam Village, one grease trap overflow at Roxby Downs Village at the point of transfer for disposal.

The remaining thirty-seven events were chemical related spills, consisting of mainly weak acid and electrolyte spills predominately from leaking pipe racks and instrumentation failures resulting in bund and tank overflows into secondary containment sections of the operational area.

Internally reportable chemical and hydrocarbon spills have increased compared with previous years as shown in Figure 31. The increase in effluent/sewerage spills across site is a result of aging equipment and system capacity. Substantial work was completed during FY20 including the construction and commissioning of the new sewer lagoon evaporation pond 2 in February. Further investigation and scoping works are continuing to map and assess the systems future capability.

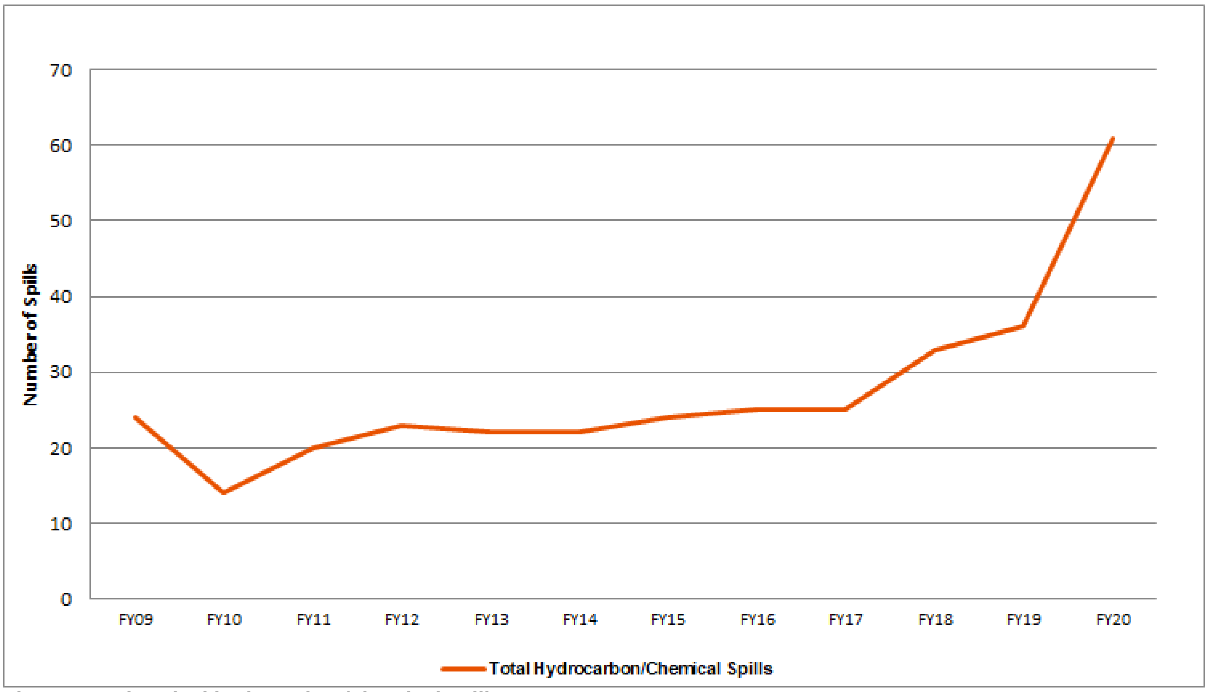


Figure 31: Historical hydrocarbon/chemical spills to FY20

Continue to implement environment improvement plans for areas of concern, as identified through the annual Aspect and Impact risk register review.

OD is continuing to implement inspections and maintenance on bunded areas to ensure spill management methodology is maintained. During FY20 bunding upgrades have been approved to increase holding capacities within some operational areas (example: CAF Plant scuttle ponds), while further operational areas for improvements have been highlighted for potential upgrading in the near future.

2.2 Radioactive process material spills

2.2.1 Environmental Outcome

No adverse impacts to public health as a result of radioactive process material spills from ODC's activities.

ODC has consistently operated in a manner that limits radiation dose to members of the public, from operational activities and radioactive emissions, to less than a small fraction of the International Commission on Radiological Protection (ICRP) 1mSv/y limit.

During FY20, one radioactive process material spill occurred within the USX operational area but outside of the designated bund. This spill was immediately cleaned up and resulted in no harm to human health, safety or the environment.

As a result, there were no adverse radiation exposure impacts to the public from activities undertaken by ODC.

No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive process material spills from ODC's activities.

No significant impacts to populations of listed species or ecological communities were recorded as a result of operational activities, including the effects from any radioactive process material spills. Impacts to listed species and ecological communities are avoided by ensuring that there is no uncontrolled loss of radioactive material to the natural environment. As there was no loss of radioactive material to the undisturbed environment in FY20, no impact to populations of listed species or ecological communities occurred.

2.2.2 Compliance criteria

A dose limit for radiation doses to members of the public of 1 mSv/y above natural background.

The total estimated dose (FY20) to members of the public at Roxby Downs Monitoring Site (RDMS) and Olympic Village Monitoring Site (OVMS) contributed by ODC operations was 0.060 mSv and 0.074 mSv respectively. For more detail refer to section 3.4 Radioactive Emissions.

No significant radioactive contamination arising from uncontrolled loss of radioactive material to the natural environment. *NOTE: Significant is defined as requiring assessment and remedial action in accordance with the NEPM 1999 or EPP 2015 and the Mining Code. Measurement and monitoring is carried out in response to a specific event.*

In FY20 there were 24 radioactive process material spills within the surface operational area. The majority of these spills were in the Concentrator, Feed prep, SX and Hydromet areas and were a result of leaking or failed pipes or instrument reading failure. Of the spills in FY20 none required assessment or remedial action in accordance with the National Environment Protection Measure (NEPM) 1999, Environment Protection (Water Quality) Policy (EPP) 2015 or the Code of Practice Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (the Mining Code).

As stated in section 2.2.1 above, there was no uncontrolled loss of radioactive material to the natural environment in FY20.

2.2.3 Leading Indicators

None applicable

2.2.4 Targets FY20

No spill of Radioactive Process Material into an undisturbed environment.

There was no uncontrolled loss of radioactive process material to the undisturbed environment in FY20.

Corrective actions resulting from a reportable spill of radioactive process material are executed in a timely manner to ensure no adverse impacts to human health.

One reportable spill occurred in FY20, which was contained within the operational area and did not impact on undisturbed areas.
The event occurred during the manual relocation of tubing from the USX area during routine housekeeping activities. The very small quantity of spilt ADU material was immediately collected and returned to the process.

2.2.5 Actions FY20

Maintain a register of recordable spills of radioactive process material resulting from operations at Olympic Dam. (Note: Reportable and recordable spills of radioactive process material as defined by the Criteria and Procedures for Recording and Reporting Incidents as SA Uranium Mines (DEM), known as 'Bachman Criteria'.

A register of recordable spills was maintained during FY20, there were 24 radioactive process material spills across site, which occurred at the SX, Hydromet, Concentrator and TRS (see Figure 32 below). The register was supported by the roll out of the Global Event Management Solution (G(EMS)), which has seen an improvement in reporting culture across multiple areas of the operation.

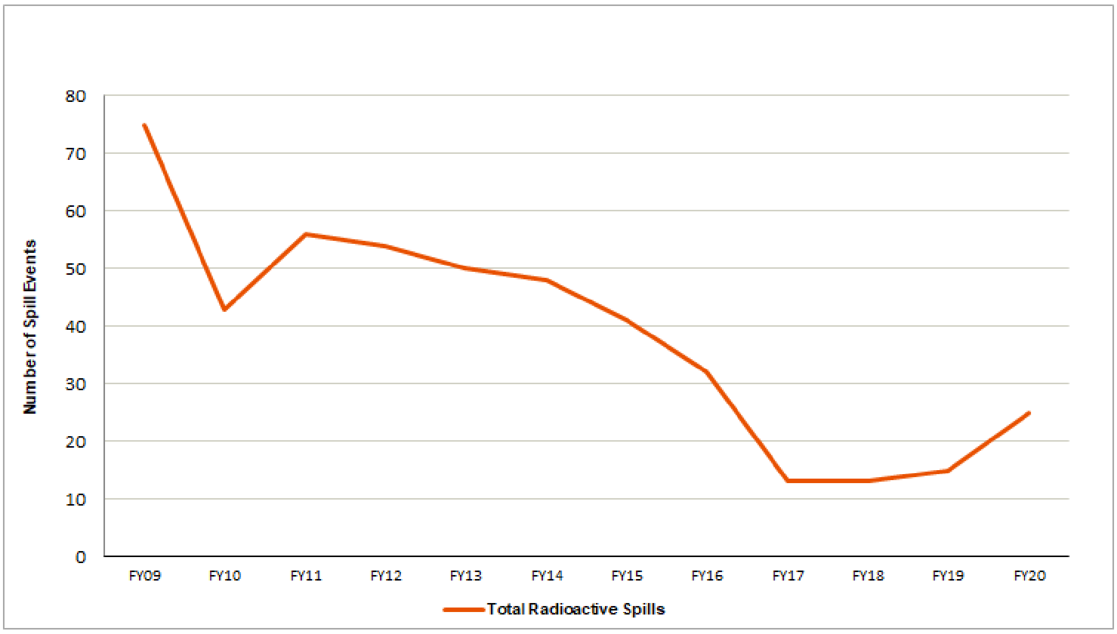


Figure 32: Historical radioactive process material spills to FY20

Continue to implement environment improvement plans for areas of concern as identified in the annual Aspects and Impacts risk register review.

All areas continued with planned maintenance tasks for tanks, pipes and bunds. These plans are captured and monitored through 1SAP. The adherence to planned maintenance ensures less radioactive process material spills as demonstrated in Figure 32.

3 Operation of industrial systems

3.1 Particulate emissions

3.1.1 Environmental Outcome

No adverse impacts to public health as a result of particulate emissions from ODC's activities.

No adverse impacts to public health occurred as a result of particulate emissions from ODC operations during FY20. Prolonged drought conditions within the greater Roxby Downs region continued in FY20, resulting in increased background particulate loadings and regional dust events. PM_{10} levels in the operational wind vector were greater than the trigger for further investigation on 6 occasions at Roxby Downs and three occasions at Olympic Village, with investigations concluding that the high particulate loadings were not caused by ODC activities. ODC does not consider these events to have caused adverse impacts on public health as a result of BHPs activities and no community complaints have been received in relation to dust emissions from BHPs activities.

3.1.2 Leading Indicators

- None applicable

3.1.3 Deliverables

Records of particulate emissions from Smelter 2 to assess compliance with the emission limits of EPA Licence 1301 and to compare against schedule 4 of the Environment Protection (Air Quality) Policy 2016 as shown in Table 2.1 of the Monitoring Program – Airborne Emissions. (AE 2.1)

Smelter stack emissions and analysis for particulate concentrations are undertaken periodically to assess the performance of gas cleaning systems. Particulate emissions from the Acid Plant Tails Stack (APTS), Concentrate Dryer Stack and Main Smelter Stack were tested during FY20 with results summarised below in Table 10 and Table 11.

As shown in Table 10, emissions tested by isokinetic testing from the Main Smelter Stack and the Acid Plant Stack met requirements of the Environment Protection (Air Quality) Policy 2016 and EPA Licence 1301 (condition U-1068) (100mg/Nm^3) during the reporting period. All stack bypass events were recorded and reported in the quarterly smelter emissions report as per EPA Licence condition U-1066.

Table 10: Measured particulate concentrations at the Main Smelter Stack and Acid Plant Stack (mg/Nm^3)

	Main Smelter Stack (mg/Nm^3)	Acid Plant Stack (mg/Nm^3)
Jan 2020	13	N/A
July 2019	9	<1

Table 11: Measured particulate concentrations at the Concentrate Dryer Stack (mg/Nm³)

	Concentrate Dryer Stack (mg/Nm³)
22nd April 2020	34
27th November 2019	7

Note: Environment Protection (Air Quality) Policy 1994 Limit was 250 mg/Nm³. The Environment Protection (Air Quality) Policy 2016 Schedule 4 is 100mg/Nm³.

Records of particulate emissions from Calciner A and B to assess against the relevant particulate pollutant level specified in Environment Protection (Air Quality) Policy 2016 (see Table 2.1 of the Monitoring Program – Airborne Emissions).

Particulate emission testing is managed through scheduled maintenance (1SAP), Calciner A and B are tested on a quarterly basis by isokinetic sampling. The isokinetic stack-sampling filters are used to capture particulates and are analysed for ^{238}U activity. Results from the uranium analysis, together with data obtained from the process control system, are used to estimate total uranium discharged from the stacks, and subsequently reported in the LM1 Radiation Annual Report.

Scheduled sampling of the Calciner gas cleaning systems occurred in August and November 2019, then again in March and June 2020. Results from this testing are summarised in Table 12. Point source emission results are assessed against Table 2.1 of the Monitoring Program – Airborne Emissions and did not exceed the compliance limit for ODC or 250mg/Nm3.

Table 12: Measured particulate concentrations in Calciner emissions (mg/Nm³)

	Calciner A (mg/Nm³)	Calciner B (mg/Nm³)
June 2020	74	20
March 2020	88	21
November 2019	*101	36
August 2019	41	60

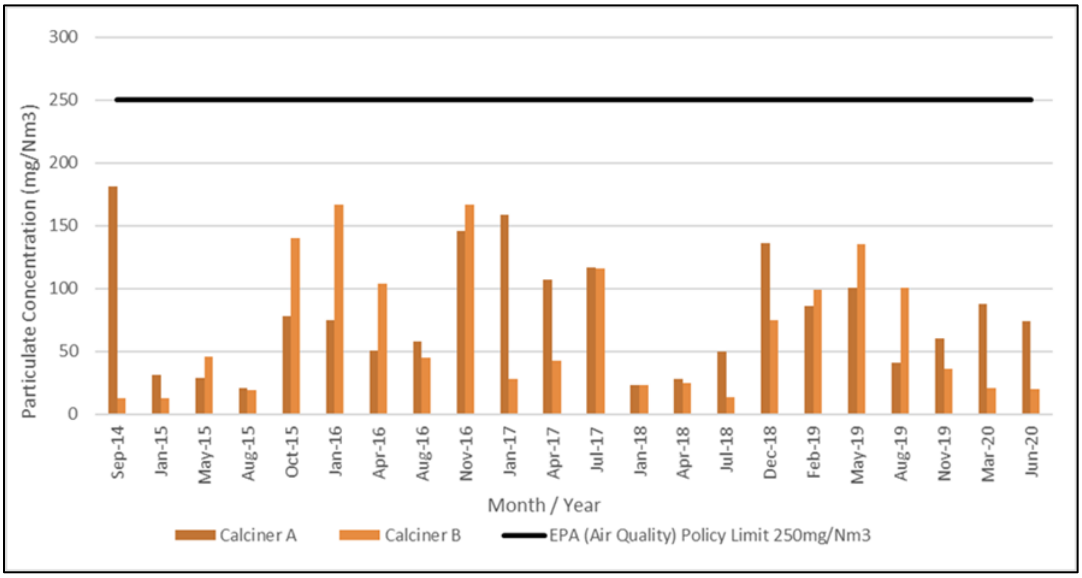


Figure 33: Historical calciner quarterly isokinetic particulate emissions (FY20)

Records of particulate and hydrogen sulphide emissions from the Slimes Treatment Plant to assess against the pollutant levels in the Environment Protection (Air Quality) Policy 2016 (see Table 2.1 of the Monitoring Program – Airborne Emissions) (AE 2.3).

Particulate and hydrogen sulphide emissions from the Slimes Treatment Plant are measured on a biannual and annual basis respectively by isokinetic sampling. Any measurement above 100 mg/Nm^3 for particulates from the Saunders Furnace roaster scrubber or above 5 mg/Nm^3 of hydrogen sulphide from the NOx Scrubber are to be reported to EPA and investigated.

These values were not exceeded during FY20 as shown in Table 13.

Table 13: Measured particulates and Hydrogen Sulphide concentrations (mg/Nm³)

	Saunders Furnace Particulates (mg/Nm³)	NOx Scrubber Hydrogen Sulphide (mg/Nm³)
May 2020	57	<0.02
October 2019	36	<0.03

Records of real-time monitoring of particulates to ensure that concentrations at Roxby Downs remain within the compliance criteria. (AE 2.6)

The real-time dust monitoring system records ground level dust concentration data at 10 minute intervals at Olympic Dam Village and Roxby Downs sensitive receptor sites. The real time operational dust concentration results for Roxby Downs and Olympic Village are shown in Figure 34 and Figure 35.The Northern Background control site is located to the north of the surface processing operations within the Arid Recovery Reserve with real time average background PM_{10} concentration for FY20 summarised in Figure 36.

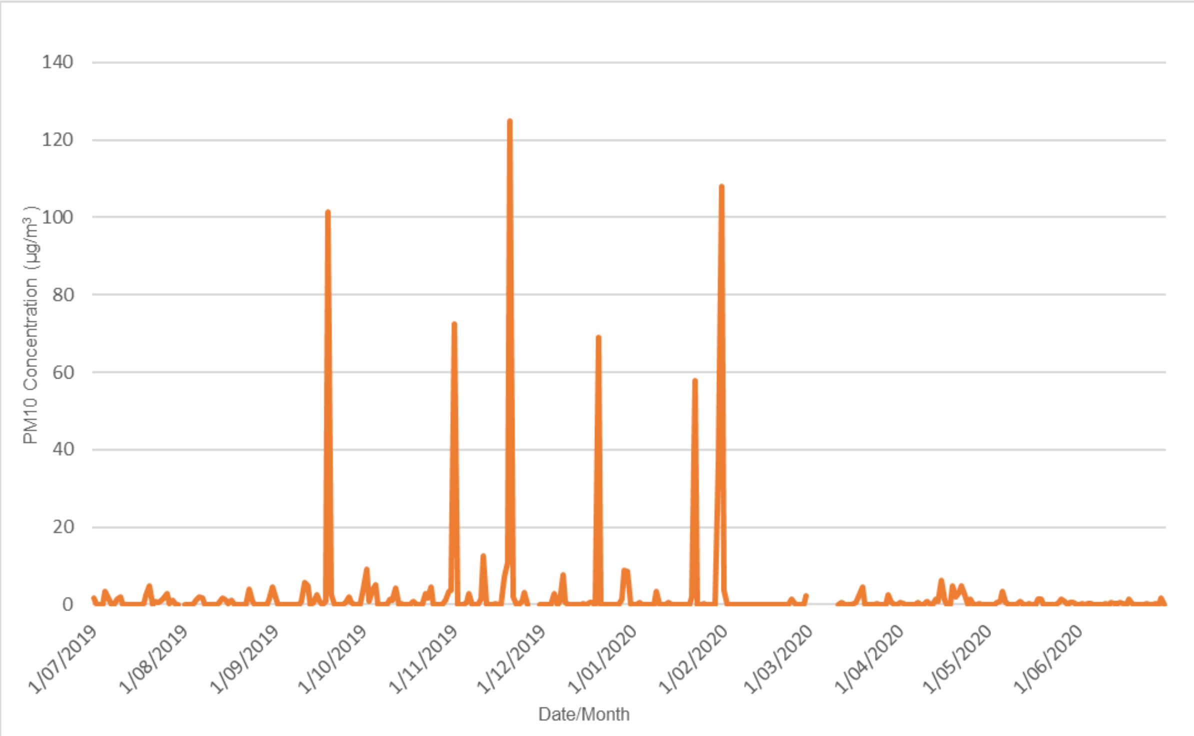


Figure 34: Real time PM_{10} 24-hour 'operational contribution' dust concentrations at Roxby Downs (FY20).

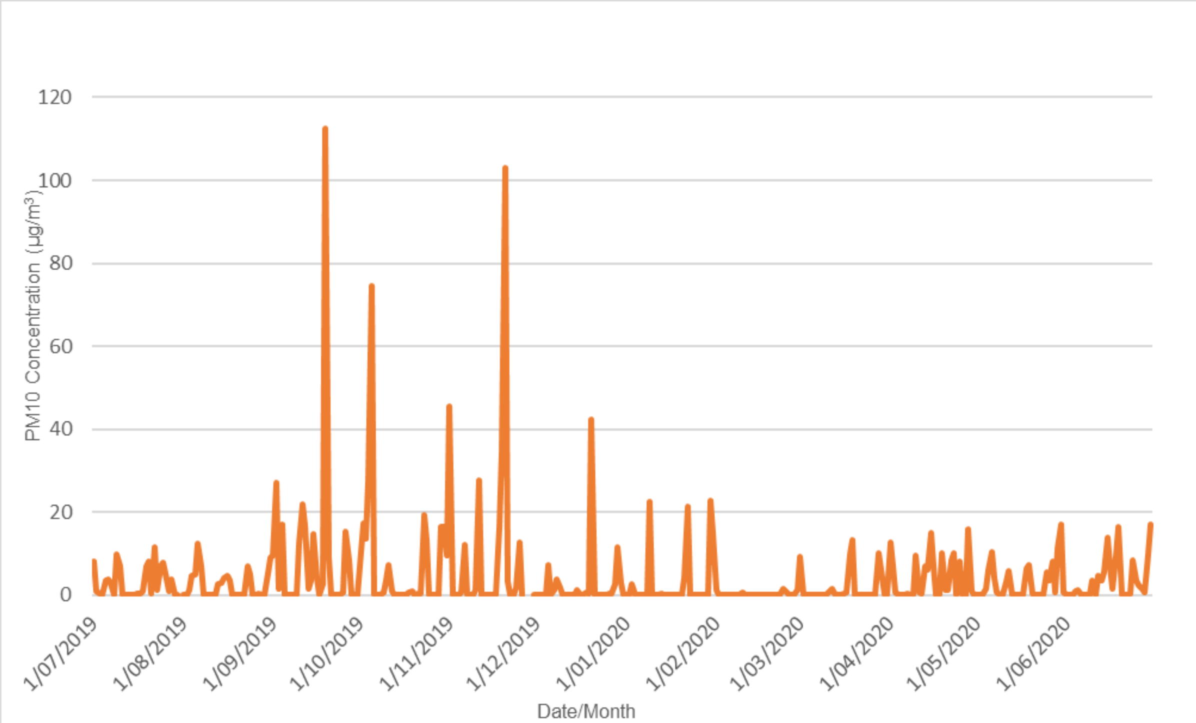


Figure 35: Real time PM_{10} 24-hour 'operational contribution' dust concentrations at Olympic Village (FY20).

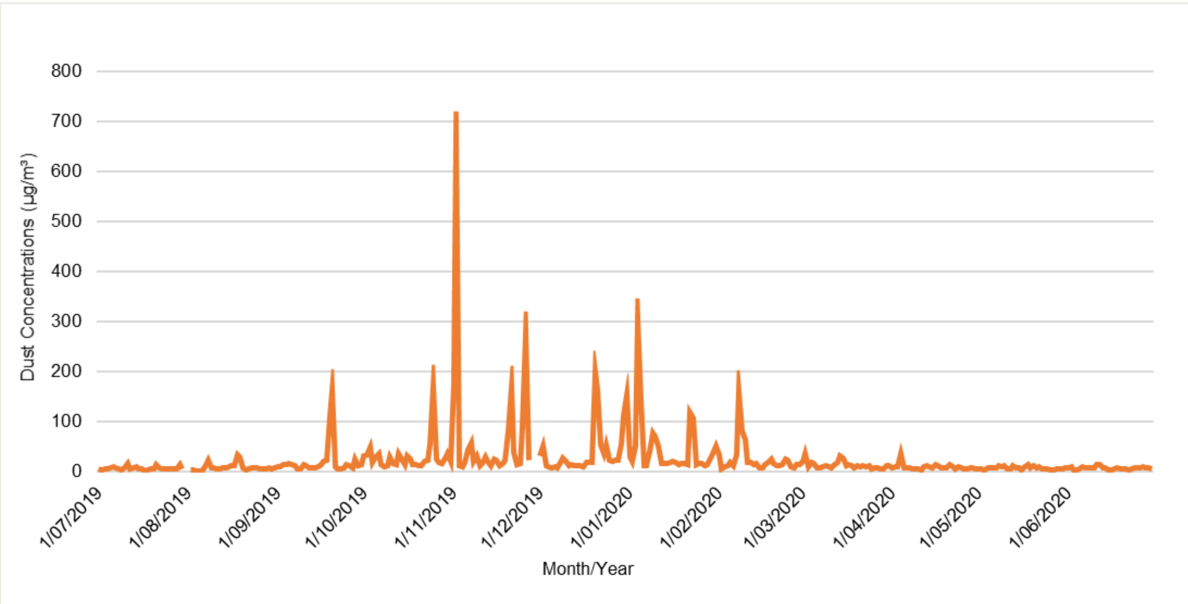


Figure 36: Real time dust concentrations at Northern Background Station (FY20).

To determine the PM_{10} contribution from Olympic Dam operations, the sensitive receivers at Roxby Downs and Olympic Village are given an operational wind vector, which defines the wind directions for which the sensitive receivers are deemed downwind of Olympic Dam operations (Figure 37). Dust concentrations measured at the Northern Background (control site) are then subtracted from the dust measurements recorded at the sensitive receptors for the wind directions within the operational wind vector.

A report is automatically generated daily to indicate whether the 24 hour PM_{10} average concentration from the OD wind vector has exceeded 50 ug/m3 at Olympic Village or Roxby Downs. This prompts an investigation by the Olympic Dam Environment Team to determine whether the dust event was due to construction or operational sources. In FY20, following this procedure, six dust events were identified at Roxby Downs and three at Olympic Village, refer to Table 14.

Table 14: FY20 high dust events

Date	Roxby Downs PM10 24hour Average contribution from OD wind vector (µg/m^3)	Olympic Village PM10 24hour Average contribution fromOD wind vector (µg/m^3)
19/09/2019	102	112
05/10/2019	N/A	75
1/11/2019	72	N/A
20/11/2019	125	103
20/12/2019	69	N/A
22/01/2020	58	N/A
31/01/2020	108	N/A

Upon receiving the daily report which alerted to dust events, investigations were launched to determine the source of the high dust events. These investigations found that the combination of lack of rainfall, lack of vegetation cover, absence of any material dust generating construction or operational activity at Olympic Dam and high winds experienced in the Roxby Downs region between September 2019 and January 2020 resulted in regional dust storms. The six dust events identified at Roxby Downs and three at Olympic Village were shown to have been significantly influenced by the unrepresentative location of the Northern Background Station when compared with the sensitive receptor monitoring sites.

For all events, it was concluded that the high dust events were not caused by operational contributions from Olympic Dam, but rather were caused by these regional dust events. High dust events ceased following rainfall in late January 2020.

At the time of writing this report BHP is working with the Environment Protection Authority on the conclusions of this investigation and a more detailed review of the dust monitoring program and compliance requirements to ensure that they are fit for purpose for Olympic Dam

Provision of real-time particulate information to inform the management of dust producing activities at the operation. (AE 2.6)

The real time dust monitoring stations record live data at 10minute intervals, with all information stored and managed on the Airodis air management database. A daily report is distributed to internal stakeholders which shows both background and operationally contributed PM_{10} dust levels for the previous 24 hours.

Weather warnings, issued by the Bureau of Meteorology (BOM) are distributed to all Olympic Dam staff in response to extreme weather events to assist operational areas in managing dust producing activities. Dust suppression is undertaken as per the site Dust and Emission Management Plan which describes fugitive source emission controls and measurement.

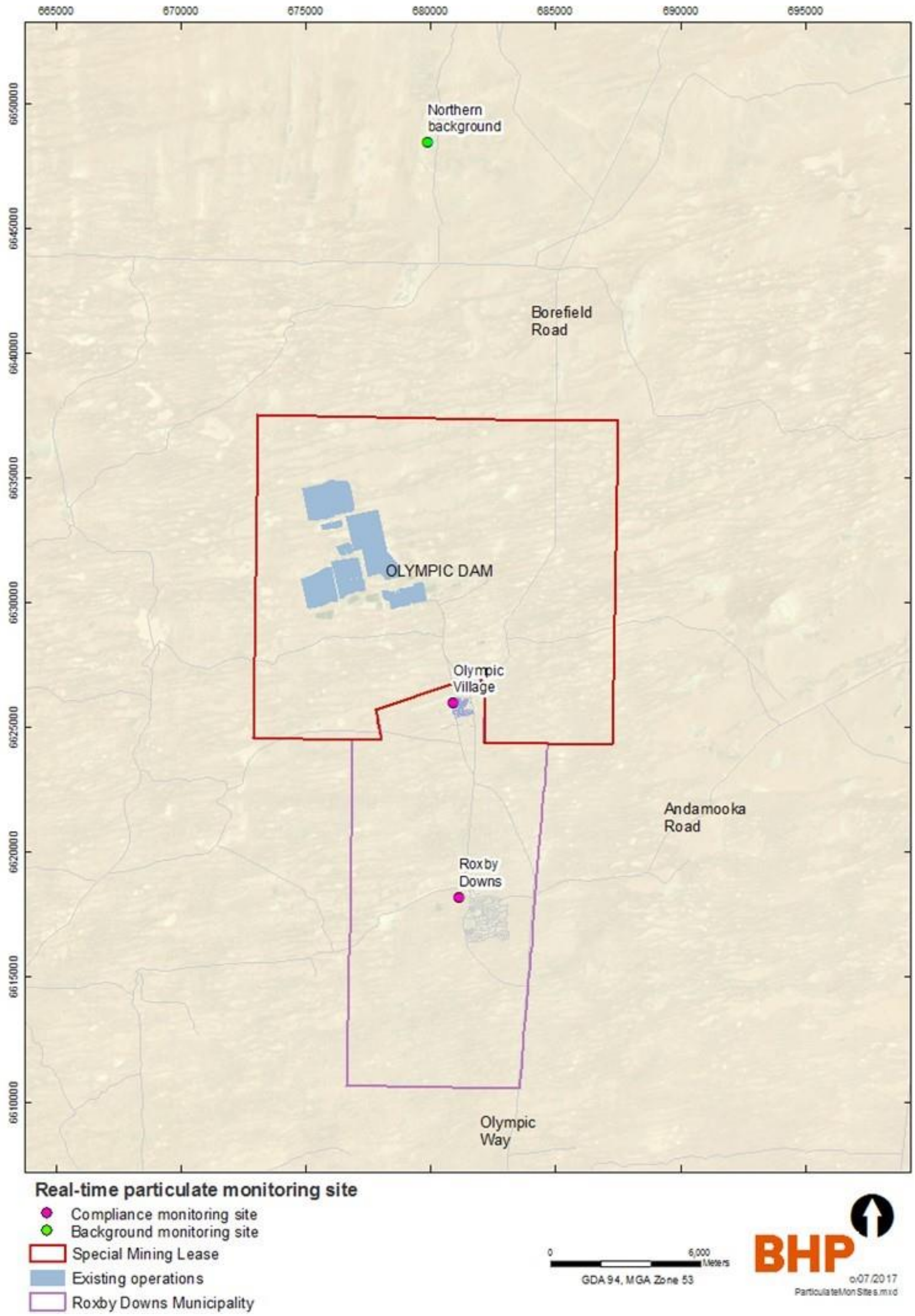


Figure 37: Location of real time dust monitoring sites.

3.1.4 Deliverables (FL 2.1)

A report on the annual changes in perennial communities within and surrounding the SML.

Provide a comparative assessment on perennial species existing at different distances from the Main Smelter Stack.

In FY20, 65 permanent quadrats (i.e., sites) were monitored for perennial vegetation (Figure 38). *Acacia ligulata* had the greatest relative abundance overall from 2011 to 2019, followed by *Dodonea viscosa*.

Similar to previous years, a linear regression analysis of Treatment and Control sites found that *Acacia ligulata* significantly decreased over time (Table 15) while *Dodonea viscosa* significantly increased over time (Table 15). In FY20, *Callitris glaucophylla* was again found to significantly decrease at both Treatment and Control sites (Table 15). In addition, *Acacia ramulosa* had significantly decreased at Treatment sites, while *Acacia aneura* had significantly increased at Control sites (Table 15).

Excluding relationships found in *Acacia ramulosa* and *Acacia aneura*, similar changes at both Treatment and Control sites indicates that changes in species composition are not due to impacts from the mine.

In addition, Simpson's index values averaged over a maximum of 12 years showed that plant diversity could not be linked to proximity of the mine. A regression analysis determined that plant species diversity averaged over 2006 to 2019 did not significantly change with distance from the operation (up to 27 km from the main smelter stack; $F_{1,65} = 0.133$, $p = 0.717$; $R^2 = 0.002$; Figure 39). Therefore, it can be concluded that the operation is not having a significant impact on the species diversity of surrounding perennial flora communities.

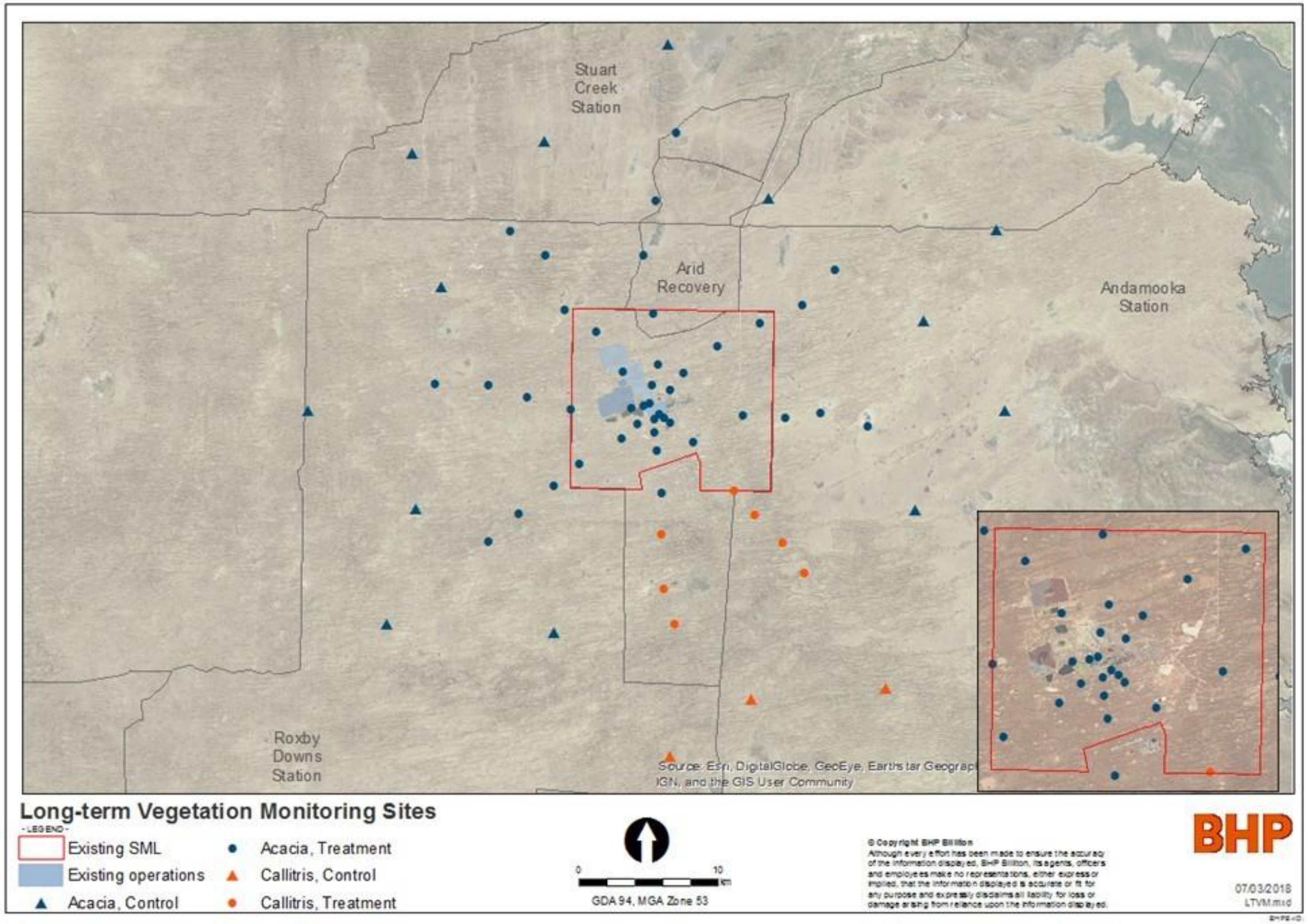


Figure 38: Location of radial sample sites monitored in FY20.

Table 15: Linear regression analysis results for all species in Treatment and Control sites from FY12 to FY20.

Species code	Treatment		Control	
ACAN	$F_{1,7}$ = 0.217, p = 0.656	R^2 = 0.030	**F_{176} = 13.720, p = 0.008**	**R^2 = 0.662**
ACLI	**$F_{1,7}$ = 35.630, p < 0.001**	**R^2 = 0.836**	**$F_{1,7}$ = 57.8906, p < 0.001**	**R^2 = 0.892**
ACOS	$F_{1,6}$= 0.779, p = 0.411	R^2 = 0.115	-	-
ACRA	**$F_{1,7}$ = 27.110, p = 0.001**	**R^2 = 0.795**	$F_{1,7}$ = 4.003, p = 0.086	R^2 = 0.364
ALOL	$F_{1,7}$ = 0.694, p = 0.432	R^2 = 0.090	$F_{1,7}$ = 0.186, p = 0.679	R^2 = 0.026
CAGL	**$F_{1,7}$ = 18.830, p = 0.003**	**R^2 = 0.729**	**$F_{1,7}$ = 35.160, p < 0.001**	**R^2 = 0.834**
DOVI	**$F_{1,7}$ = 62.260, p < 0.001**	**R^2 = 0.899**	**$F_{1,7}$ = 62.250, p < 0.001**	**R^2 = 0.899**
ERGL	$F_{1,1}$ = 15.300, p = 0.159	R^2 = 0.939	$F_{1,1}$ = 0.000, p = 1.000	R^2 = 0.000
ERLO	$F_{1,7}$ = 0.017, p = 0.900	R^2 = 0.002	-	-
ERMA	$F_{1,1}$ = 8.333, p = 0.212	R^2 = 0.893	-	-
GUQU	$F_{1,7}$ = 1.111, p = 0.327	R^2 = 0.137	-	-
HALE	$F_{1,5}$ = 0.008, p = 0.934	R^2 = 0.002	-	-
LYAU	$F_{1,7}$ = 4.108, p = 0.082	R^2 = 0.370	-	-
PIMI	$F_{1,5}$ = 1.916, p = 0.225	R^2 = 0.277	-	-
PIAN	$F_{1,7}$ = 0.008, p = 0.932	R^2 = 0.001	-	-
SAAC	$F_{1,3}$ = 3.000, p = 0.182	R^2 = 0.500	-	-
SALA	$F_{1,7}$ = 0.003, p = 0.960	R^2 = 0.000	-	-
SASP	-	-	-	-
SEPE	$F_{1,6}$ = 3.130, p = 0.120	R^2 = 0.309	$F_{1,7}$ = 0.242, p = 0.638	R^2 = 0.033

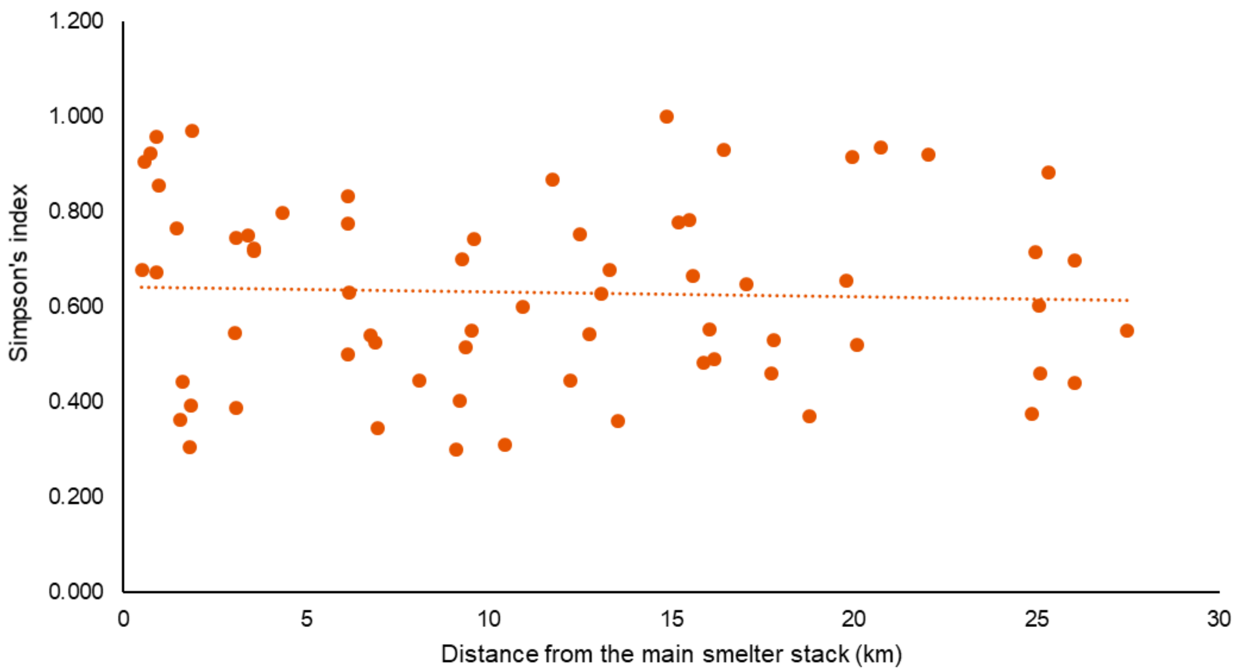


Figure 39: Simpson's index averaged over 2006 to 2019 for each site and plotted against the distance of the site from the main smelter stack.

3.1.5 Target FY20

- None applicable

3.1.6 Actions FY20

Implement an Environmental Improvement Plan should any significant increase of operationally contributed PM_{10} 24 hour average of 50µg/m^3 occur over the year.

In response to the high dust events in FY20 and subsequent investigation ODC will continue to work with the Environment Protection Authority to undertake a detailed review of is ambient dust monitoring program to ensure it is fit for purpose.

3.2 Sulphur dioxide emissions

3.2.1 Environmental Outcome

No adverse impacts to public health as a result of sulphur dioxide emissions from ODCs operations.

Environment Protection (Air Quality) Policy 2016, Ground Level Concentration (GLC) levels for ambient air quality are based on the protection of human health. Roxby Downs and Olympic Village ambient SO_2 analyser results for the reporting period showed no exceedance of the Environment Protection (Air Quality) Policy 2016 for ambient air quality SO_2 at either Olympic Village or Roxby Downs Township.

An annual review of monitoring data collected at sensitive receptors (ambient ground level concentrations) has shown there were no adverse impacts to public health as a result of sulphur dioxide (SO_2) emissions from ODC's activities during FY20.

3.2.2 Compliance criteria

Annual average SO_2 concentration of less than 0.02 ppm at sensitive receivers, Olympic Village and Roxby Downs.

The measured annual average SO_2 concentrations for the reporting period was 0.0002 ppm and 0.0003 ppm at Roxby Downs and Olympic Village respectively, which is less than the 0.02 ppm Environment Protection (Air Quality) Policy 2016 GLC limit.

24hour average SO_2 concentration of less than 0.08 ppm at sensitive receptors, Olympic Village and Roxby Downs

The measured maximum 24hour average SO_2 concentrations for the reporting period was 0.0046 ppm and 0.0032 ppm for Roxby Downs and Olympic Village respectively. This is below the 0.08 ppm Environment Protection (Air Quality) Policy 2016 GLC limit.

One hour average SO_2 concentration of less than 0.2 ppm at sensitive receptors, Olympic Village and Roxby Downs

The measured maximum hourly average SO_2 concentration for the reporting period was 0.0048 ppm and 0.0039 ppm for Roxby Downs and Olympic Village respectively, which is less than the 0.2 ppm Environment Protection (Air Quality) Policy 2016, GLC limit.

3.2.3 Leading Indicators

- None applicable

3.2.4 Deliverables

Calibration records for SO_2 analysers on the Main Smelter Stack and Acid Plant Tails Gas Stack (AE 2.1).

The Acid Plant Tails Gas Stack (APTS) and Main Smelter Stack (MSS) SO_2 analysers were maintained in accordance with site procedures and manufacturer's recommendations throughout the reporting period. Calibration maintenance plans (CMPs) are scheduled through 1SAP and are automatically generated. These CMPs are part of Olympic Dams' pollution control register and monitored for completion frequently. Currently, the in-stack real time SO_2 and particulate analysers on the MSS and the APTS are calibrated on a weekly and quarterly basis. All calibration maintenance plans were completed for FY20 and the calibration records are kept electronically.

Records of SO_2 emissions to assess compliance with the monitoring and reporting requirements of EPA Licence 1301 and the Environment Protection (Air Quality) Policy 2016 (AE 2.1).

Isokinetic sampling of the Main Smelter Stack and Acid Plant Tails Gas Stack was undertaken in July 2019 for sulphur trioxide and sulphur dioxide in January 2020. The results indicate continued compliance with the requirements of EPA Licence 1301 and the Environment Protection (Air Quality) Policy 2016. Table 16 and Table 17 display the results for FY20.

Table 16: Smelter 2 Main Smelter Stack sampling results FY20

Sampling Point Main Smelter Stack	Total acid gas emissions (mg/Nm^3)	Sulphur trioxide and acid mist emissions* (mg/Nm^3)	Sulphur dioxide emissions ** (mg/Nm^3)
Reporting Level	**3000**	**100**	**2400**
January 2020	**53**	**-**	**53**
July 2019	**38**	**1**	**37**

* Expressed as sulphur trioxide equivalent

** EPA Licence 1301 Licence requirement level without sulphur trioxide

Table 17: Smelter 2 Acid Plant Tails Stack sampling results FY20

Sampling Point Acid Plant Tails Gas Stack	Total acid gas emissions (mg/Nm^3)	Sulphur trioxide and acid mist emissions* (mg/Nm^3)	Sulphur dioxide emissions ** (mg/Nm^3)
Reporting Level	**3000**	**100**	**2400**
January 2020	**217**	**-**	**217**
July 2019	**1,206**	**1**	**1,205**

* Expressed as sulphur trioxide equivalent
** EPA Licence 1301 Licence requirement level without sulphur trioxide

Data to confirm that approximately 99 per cent of all SO_2 generated during the smelting process is captured. (AE 2.1)

The percentage of SO_2 recovery for the reporting period FY20 was 98.97 %. This recovery result has increased from 98.85% from FY19. It remains compliant with the required approximate of 99% SO_2 capture deliverable.

Records of ground level SO_2 concentrations at Olympic Village and Roxby Downs Township to assess compliance with the ground level SO_2 concentration requirements of the Ambient Air Quality NEPM and the values contained in schedule 2 of the Environment Protection (Air Quality) Policy 2016 (AE 2.4)

Ambient SO_2 1 hour, 24 hour, and 1 year average (mean) concentrations for FY20 at Olympic Dam Village and Roxby Downs were measured by real time continuous ambient SO_2 monitors in accordance with EPA Licence 1301 Condition (U-1072).

The measured maximum average 1 hour, 24 hour, and 1 year concentrations for Roxby Downs and Olympic Village results along with the applicable EPA (Air Quality) Policy 2016 Ground Level Concentration (GLC) values, are presented in Table 18 below. The results of the measured concentration for the FY20 reporting period show that no exceedance of the GLC for ambient air quality limits of SO_2 occurred at Olympic Village or Roxby Downs Township (Figure 40 - Figure 45) sensitive receiver monitoring locations.

Table 18: Measured maximum average (mean) ambient SO_2 concentrations at Roxby Downs and Olympic Village.

	Annual average concentration (ppm)	Maximum 24 hour average concentration (ppm)	Maximum Hourly average concentration (ppm)
EPA (Air Quality) Policy 2016	**0.02**	**0.08**	**0.2**
Roxby Downs	0.0002	0.0046	0.0048
Olympic Village	0.0003	0.0032	0.0039

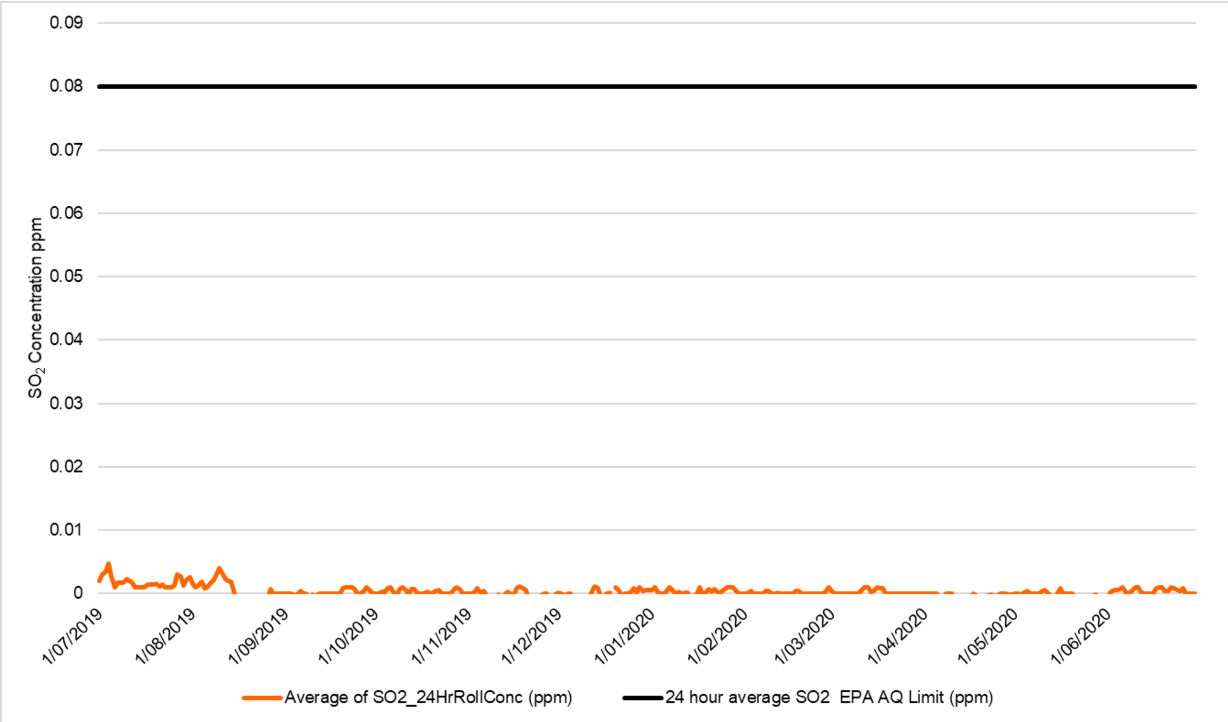


Figure 40**: Measured 24hr mean SO_2 concentration at sensitive receptor, Roxby Downs.**

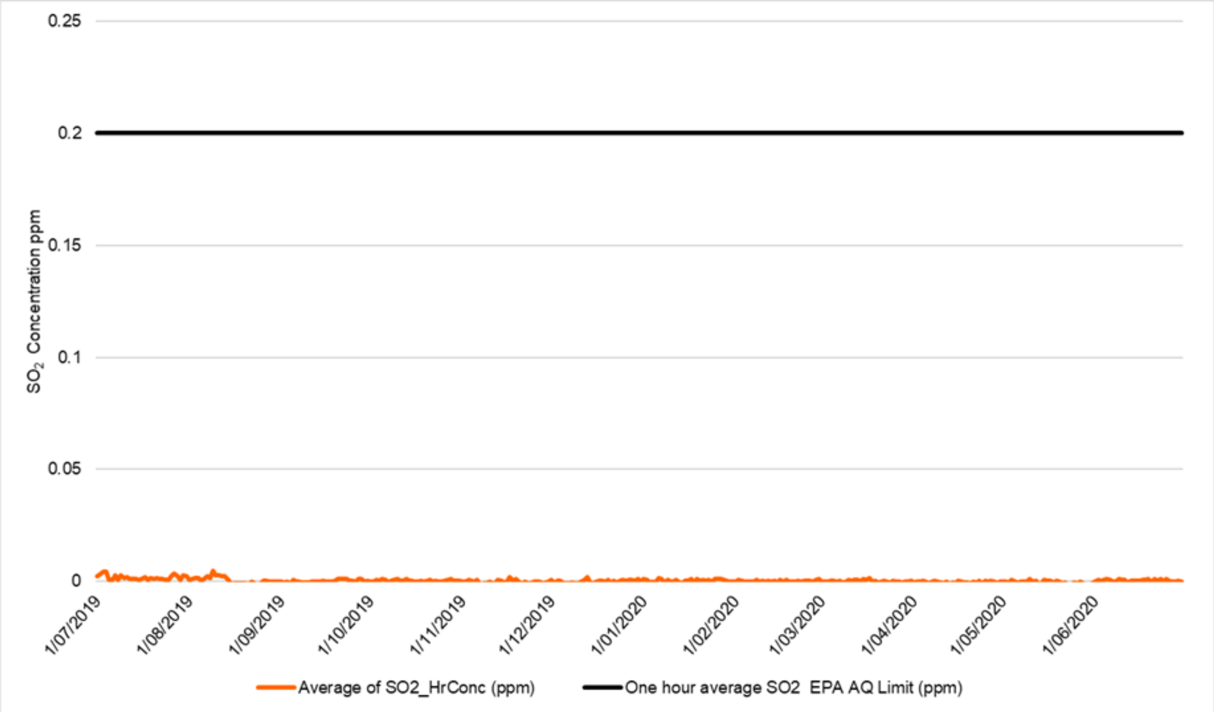


Figure 41: Measured hourly mean SO_2 concentration at sensitive receptor, Roxby Downs.

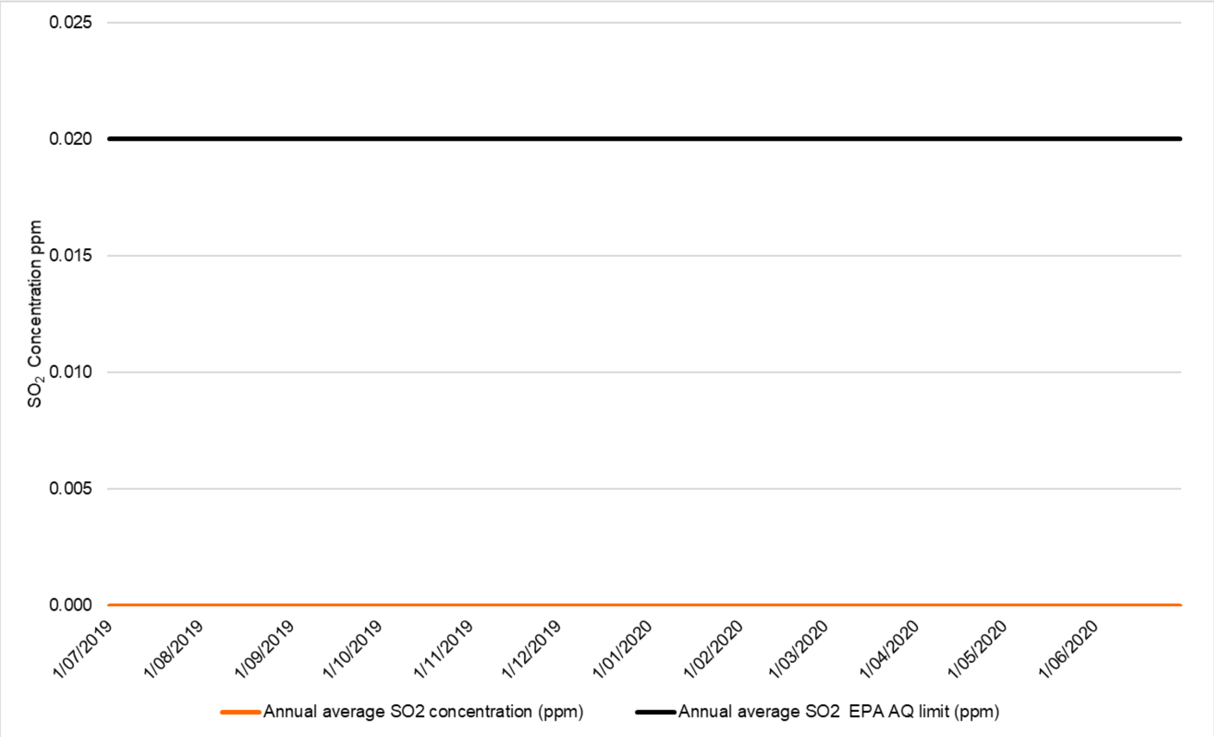


Figure 42: Measured annual mean SO2 concentration at sensitive receptor, Roxby Downs.

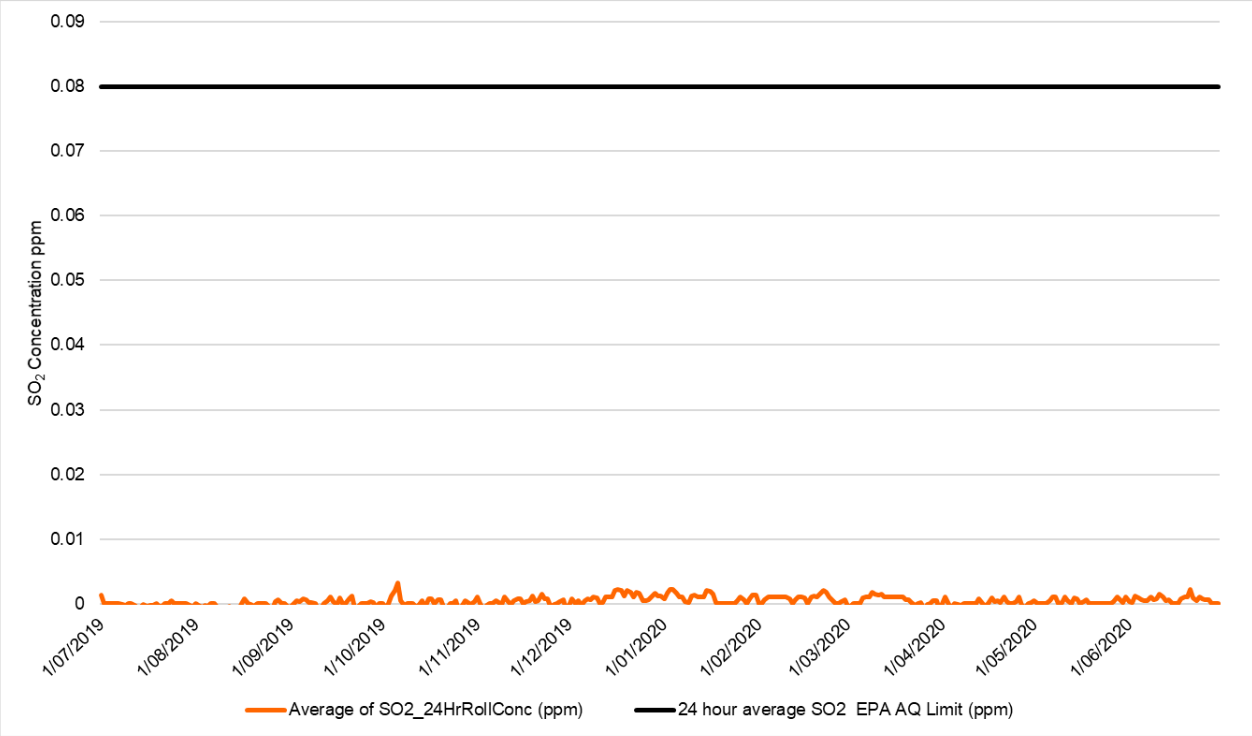


Figure 43: Measured 24hr mean SO_2 concentration at sensitive receptor, Olympic Dam.

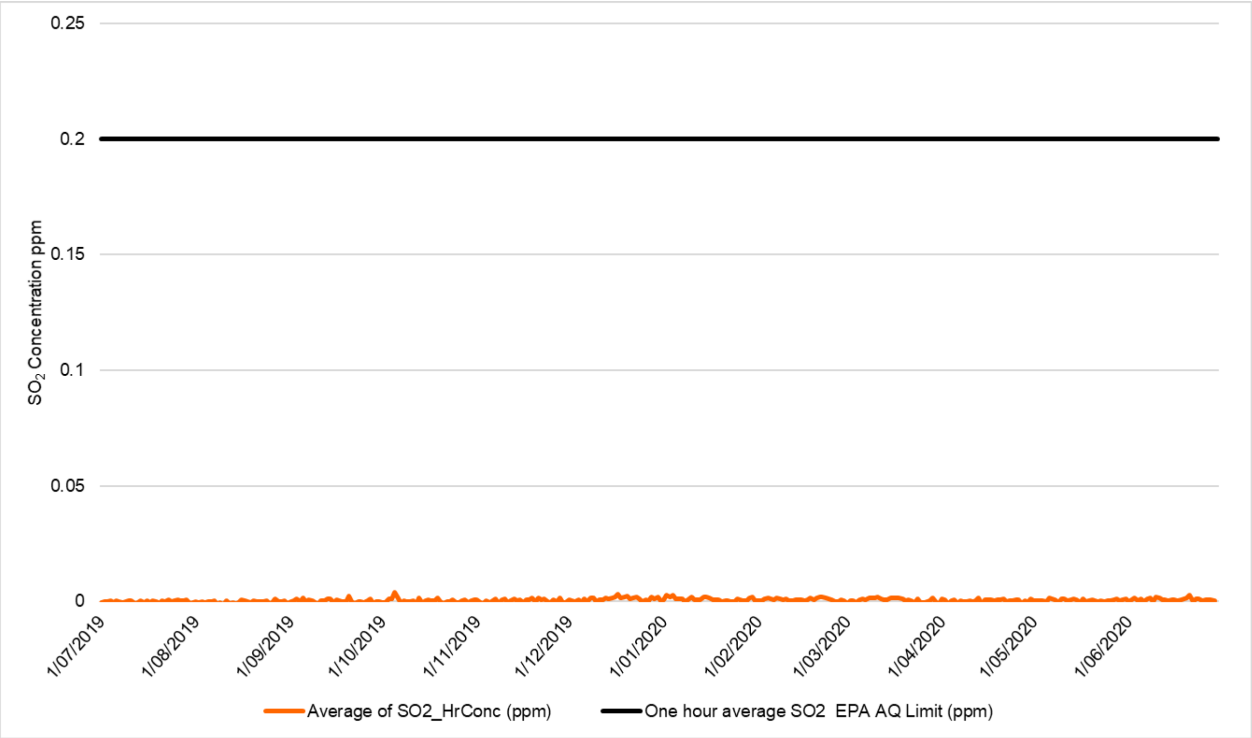


Figure 44: Measured hourly mean SO_2 concentration at sensitive receptor, Olympic Dam.

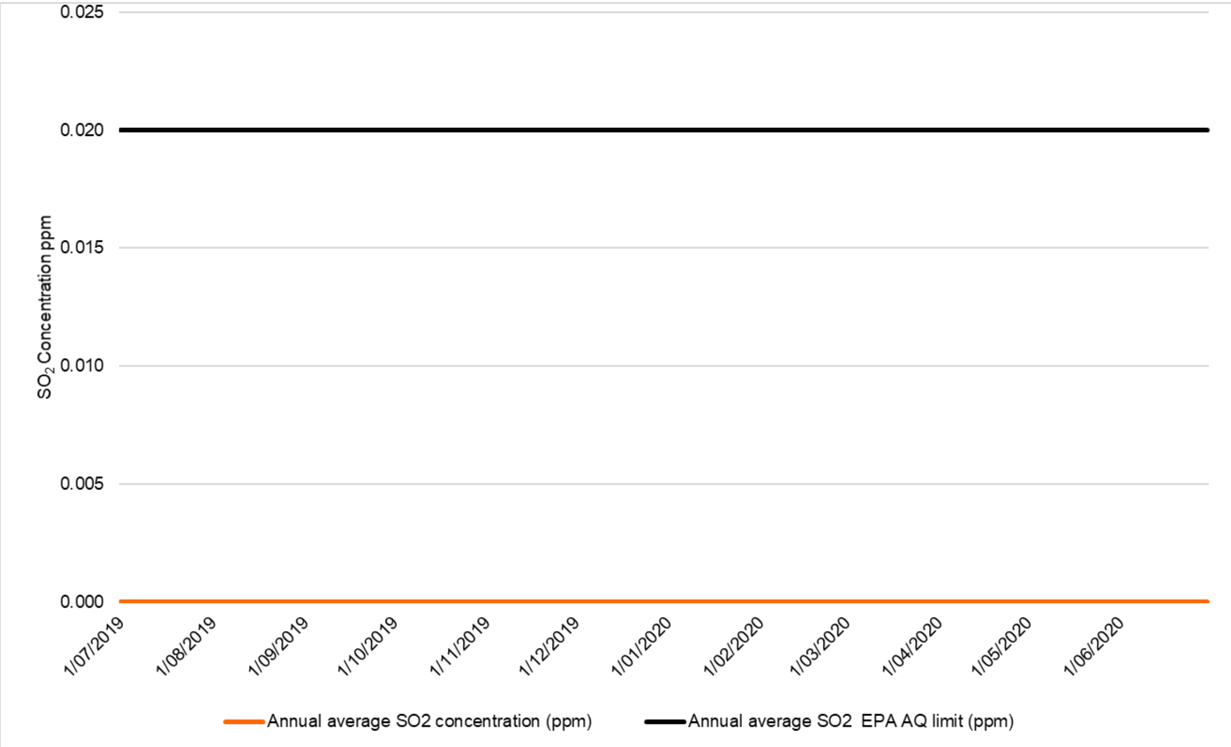


Figure 45: Measured annual mean SO_2 concentration at sensitive receptor, Olympic Dam.

3.2.5 Targets FY20

Approximately 99 percent of all SO_2 generated during the smelting process is captured.

This Target has been achieved for FY20, refer section 3.2.4 deliverables.

3.2.6 Actions FY20

- None applicable

3.2.7 Continuous Improvement

Continue a watching brief on sulphur dioxide emission reduction technology.

Olympic Dam continues to maintain and operate the acid plant to recover maximum possible sulphur emissions for reuse and will continue to implement new technology and techniques as they become available.

3.3 Saline aerosol emissions

3.3.1 Environmental Outcome

No significant adverse impacts to populations of listed species (South Australian, Commonwealth) as a result of ODC's activities.

No significant adverse impact to populations of listed species from saline aerosol emissions was observed during FY20. Observations made during environmental inspections and supported by data collected during various flora and fauna monitoring programs, did not find any significant adverse impacts to listed species.

3.3.2 Compliance criteria

No loss of an important population of Plains Rat (*Pseudomys australis*) due to habitat loss.

There was no loss of an important population of Plains Rat during FY20 as a result of saline aerosol emissions. No loss of habitat to support an important population of Plains Rat was observed during the annual monitoring of emission impacts to vegetation, which are used to assess impacts to flora within the potential impact area. Standards for raise bore design (see section 3.3.5) ensure pollution controls are applied consistently to all new raise bores, which ensures that the majority of the salt deposited is reduced to a small radius surrounding the raise bore.

3.3.3 Leading Indicators

- None applicable

Deliverables (AE 2.5) Records from background salt deposition monitoring jars at the edge of the SML against the background limit of 20mg/m^2/day. (AE 2.5).

A system of salt deposition monitoring jars is located on the edge of the SML, north, south, east and west (Figure 46). All saline emission monitoring results reported for FY20 have been reported below the target threshold of 20mg/m^2/day. Background salt deposition monitoring results, recorded at the edge of the SML, from the FY20 monitoring period are presented in Figure 47.

Figure 46: Salt Jar deposition monitoring locations FY20

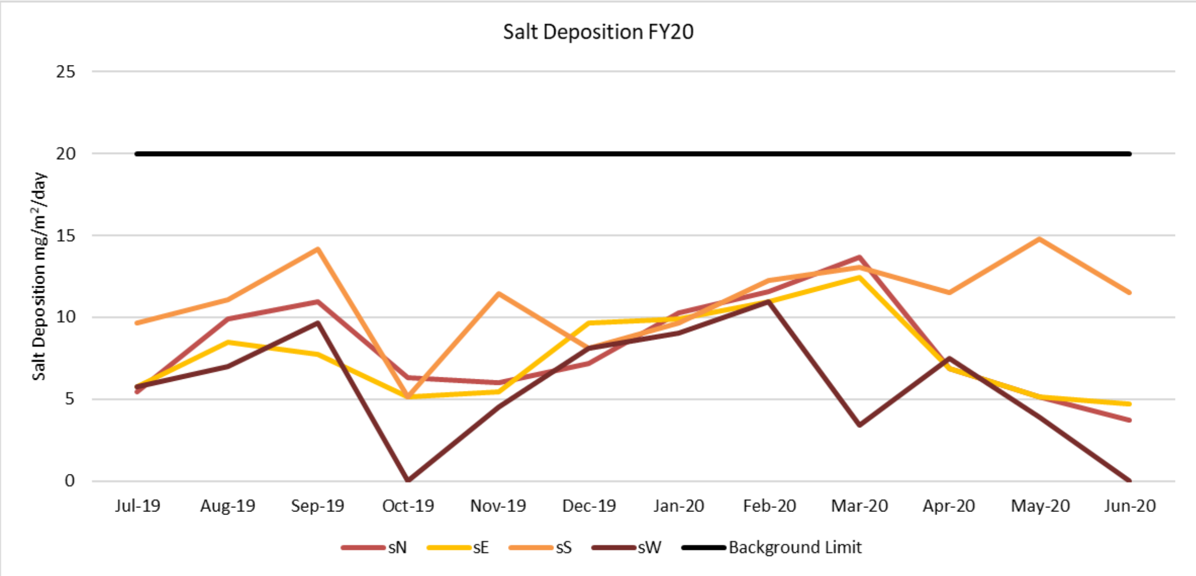


Figure 47: Salt deposition at all monitored raise bores for FY20.

A statement of impacts to the Plains Rat (AE 2.5).

Impacts to flora within the impact zone of the operation are modelled through monitoring of long term changes to perennial vegetation (see Chapter 3.1 Particulate Emissions). Results of these programs and historical fauna programs have demonstrated that the impact to flora and fauna is largely restricted to the vicinity of the operation and is rainfall dependent. No Plains Rats were observed to be impacted directly by saline emissions in FY20.

3.3.4 Target FY20

Monitor the deposition of salt from saline aerosol emissions at the edge of the SML against background levels of 20 mg/m^2/day.

Salt deposition monitoring as a result of saline emissions from raise bores occurs on a monthly basis as per the 1SAP scheduled maintenance plan. This management plan is part of ODC's pollution control register and monitored for completion frequently. All 1SAP maintenance plans were completed for FY20 with all reported records kept electronically. Results from this monitoring are shown in Figure 47.

3.3.5 Actions FY20

Install and maintain controls as per the design standard around raise bores.

Standards for raise bore design ensure controls are applied consistently to all new raise bores. Raise bores are designed and constructed with 20m splash ponds with surrounding barricades/walls. The exhaust outlet is inverted over the splash pond. This ensures that the majority of the salt deposited is reduced to a small radius surrounding the raise bore.

3.4 Radioactive emissions

3.4.1 Environmental Outcome

No adverse impacts to public health as a result of radioactive emissions from ODCs activities.

ODC has consistently operated in a manner that limits radiation dose to members of the public, from operational activities, to less than a small fraction of the 1mSv/yr public dose limit prescribed by the

International Commission on Radiological Protection (ICRP). As a result, there are no adverse radiation exposure impacts to the public from activities undertaken at ODC.

No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive emissions from ODCs activities.

There were no significant adverse impacts to populations of listed species or ecological communities as a result of ODCs activities. Monitoring of radiation doses to the public and the deposition of ^{238}U at non-human biota (NHB) assessment sites is used as an indicator of the potential exposure of listed species to radioactive emissions. Deposition of ^{238}U at non-human biota assessment sites was at a level which poses no significant adverse impacts to non-human biota.

3.4.2 Compliance criteria

Radiation doses to members of the public less than 1 mSv/y above natural background.

The total estimated dose (FY20) to members of the public at Roxby Downs Monitoring Site (RDMS) and Olympic Village Monitoring Site (OVMS) contributed by ODC operations was 0.060 mSv and 0.074 mSv respectively.

Deposition of project originated ^{238}U less than 25 Bq/m^2/y at non-human biota assessment sites.

The average deposition of U-238, calculated as an average of results at the four monitoring sites was determined to be 0.75 Bq/m^2/y, well below the 25 Bq/m^2/y compliance criteria.

3.4.3 Leading Indicators

Indications that a dose constraint of 0.3 mSv/y to members of the public above natural background will be exceeded.

Indications that a reference level of 10 µGy/h for impacts on non-human biota above natural background will be exceeded.

NOTE: The reference level for non-human biota is set as an interim criteria until an agreed national approach is determined.

No leading indicators were triggered. Doses to members of the public are below Olympic Dam's internal dose constraint of 0.3mSv/yr. Similarly the reference level of 10uGy/h for impacts on non-human biota has not been triggered.

3.4.4 Deliverables (ER 2.2)

Data leading to calculated estimates of annual radiation doses to members of the public in the critical groups identified.

The annual dose attributable to radon decay products (RDP) and radionuclides in dust is calculated and added to calculate the total annual effective dose for members of the public.

Radon Decay Products

Monthly RDP averages and the five year average for RDMS and OVMS during the reporting period are shown in Figure 48.

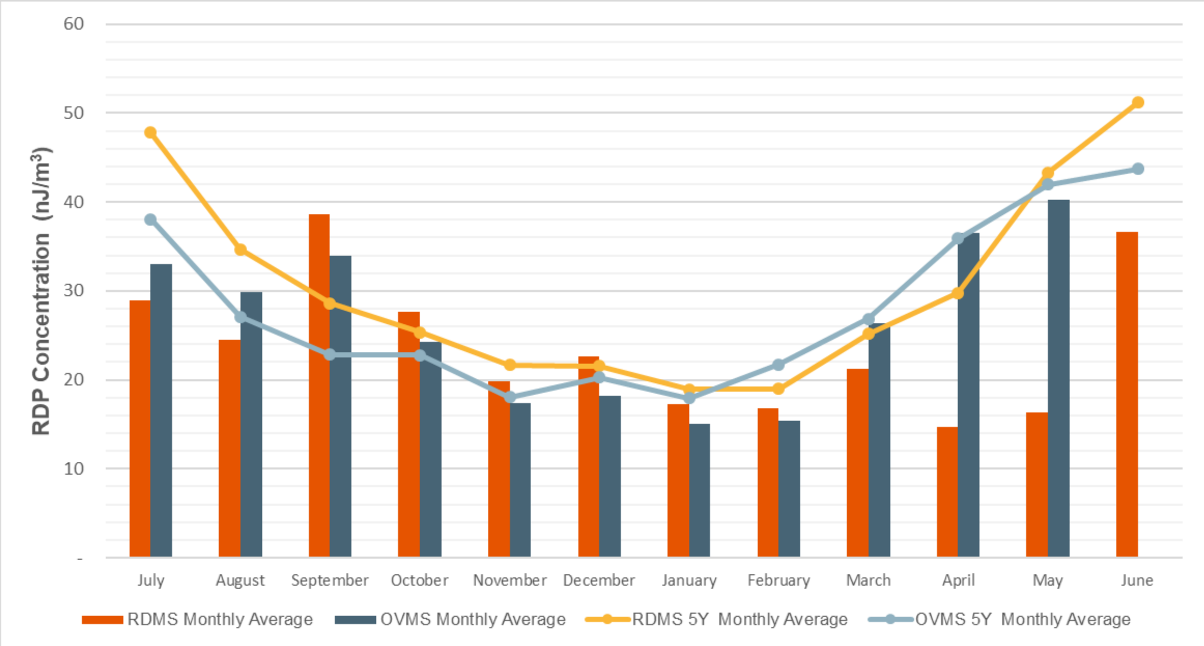


Figure 48: FY20 Radon Decay Products (RDP) monthly trends

The dose conversion factors (DCF) for occupational exposure to radon have been revised, however the factors for member of the public exposure are still being reviewed. For this report the most conservative value for DCF has been used, which is the value of 3.0 mSv.m^3/(mJ.h) used for occupational exposure. This is a significant increase on the previously used value of 1.1 mSv.m^3/(mJ.h) and results in an increased dose compared to previous years. The estimated dose (FY20) from radon decay products to members of the public at RDMS and OVMS contributed by ODC operations was 0.058 mSv and 0.072 mSv respectively. If the previous lower DCF was used the doses would have been 0.021 mSv and 0.026 mSv respectively, consistent with historical trends.

The dose results provided in section 3.4.2 demonstrate that the dose to members of the public (as measured at RDMS and OVMS) due to RDP resulting from ODC operations is a small fraction of the applicable dose limit.

Analysis of historical monitoring data suggests that there is little operation related RDP concentration at these monitoring sites and the main source of RDP exposure at both OVMS and RDMS is from natural radiation background which shows significant seasonal variations as seen in Figure 48 (above).

Radionuclides in Dust Dose Assessment

Monthly concentrations of the long-lived radionuclides, ^{238}U, ^{230}Th, ^{226}Ra, ^{210}Pb and ^{210}Po for the 5-year period FY16-FY20 are shown in Figure 49 to Figure 53 (includes environmental background).

The estimated FY20 radiation doses to members of the public at RDMS and OVMS due to long lived radionuclides in dust were 0.0013 mSv and 0.0021 mSv (adjusted for background) respectively. These correspond to 0.13 % and 0.21% of the public dose limit of 1 mSv respectively. These results indicate that the variation in radionuclide concentrations shown in Figure 49 to Figure 53 (inclusive) do not have a significant impact on the overall public radiation dose. It is to be noted that the dust sampling and the radionuclide analysis processes have inherent uncertainties which contribute to the fluctuations seen in the radionuclide trends.

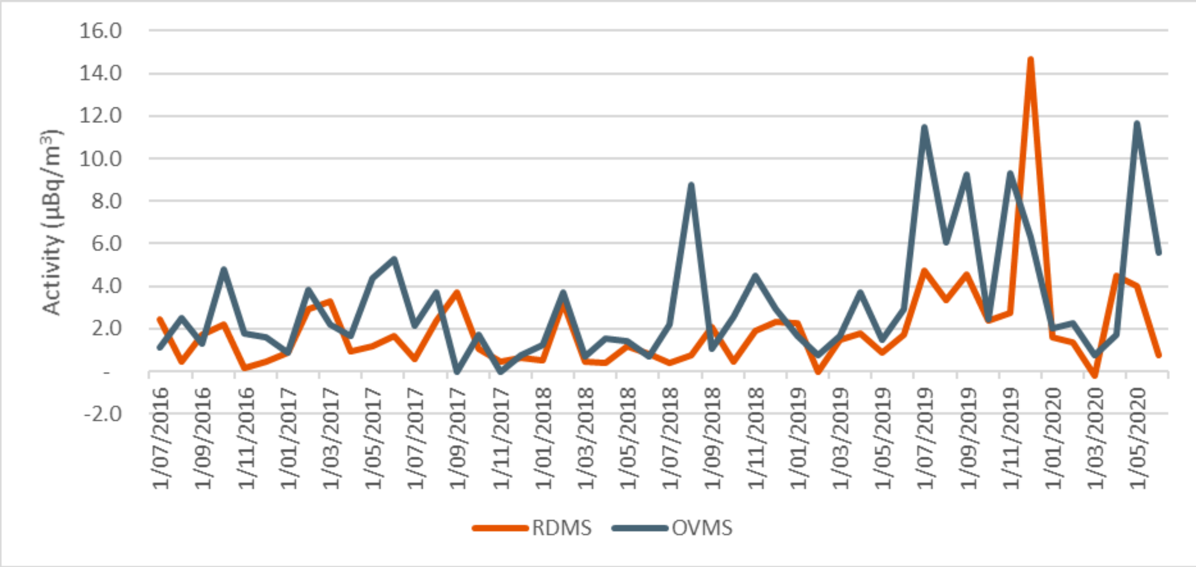


Figure 49: ^{238}U concentration for the 5-year period FY16-FY20 (PM_{10})

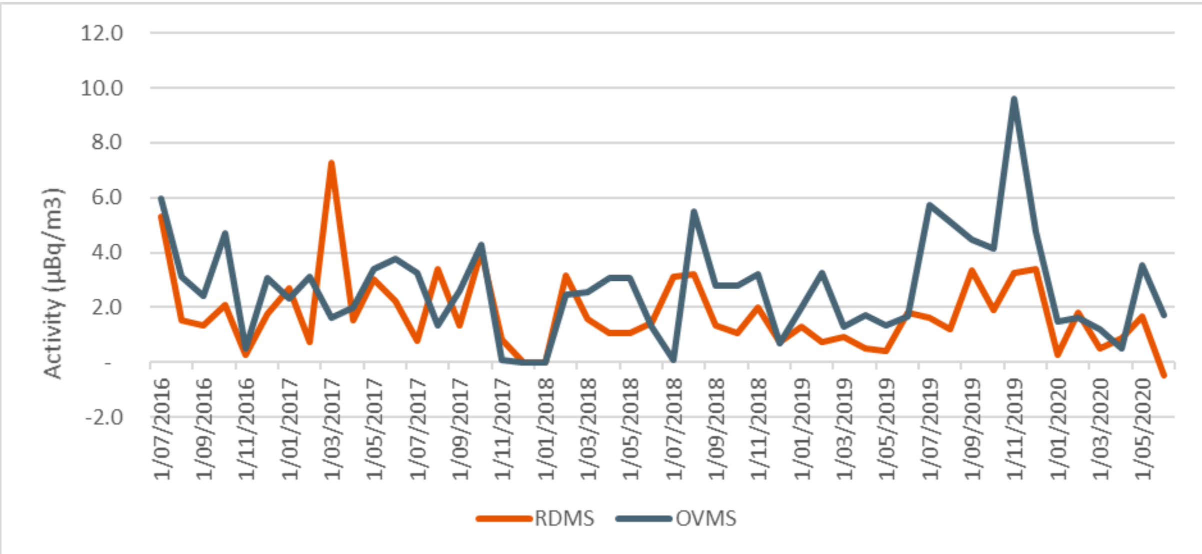


Figure 50: ^{230}Th concentration for the 5-year period FY16-FY20 (PM_{10})

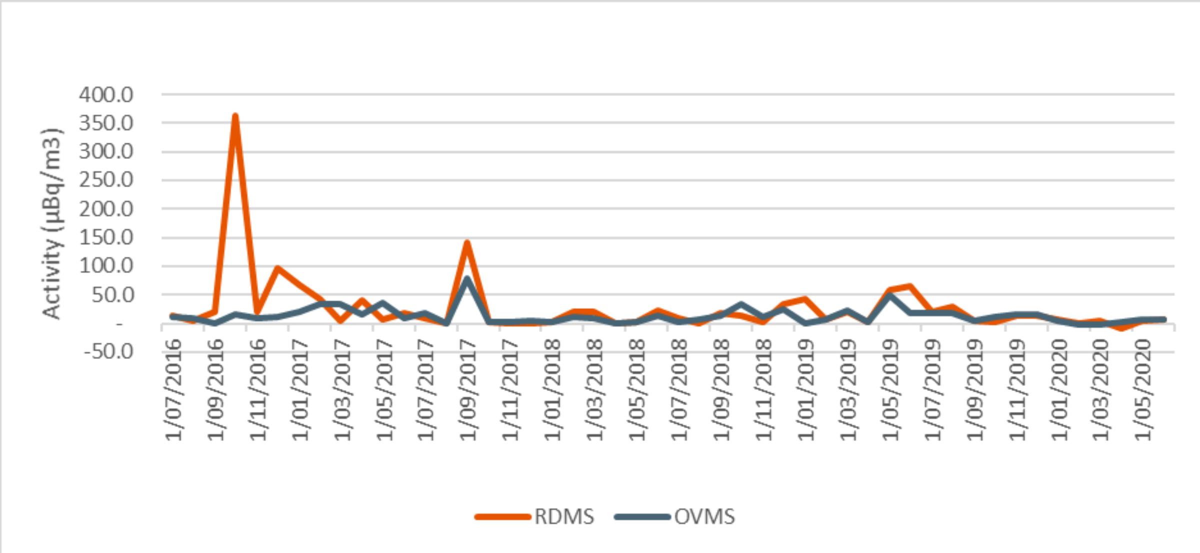


Figure 51: ^{226}Ra concentration for **the 5-year period FY16-FY20 (PM_{10})**

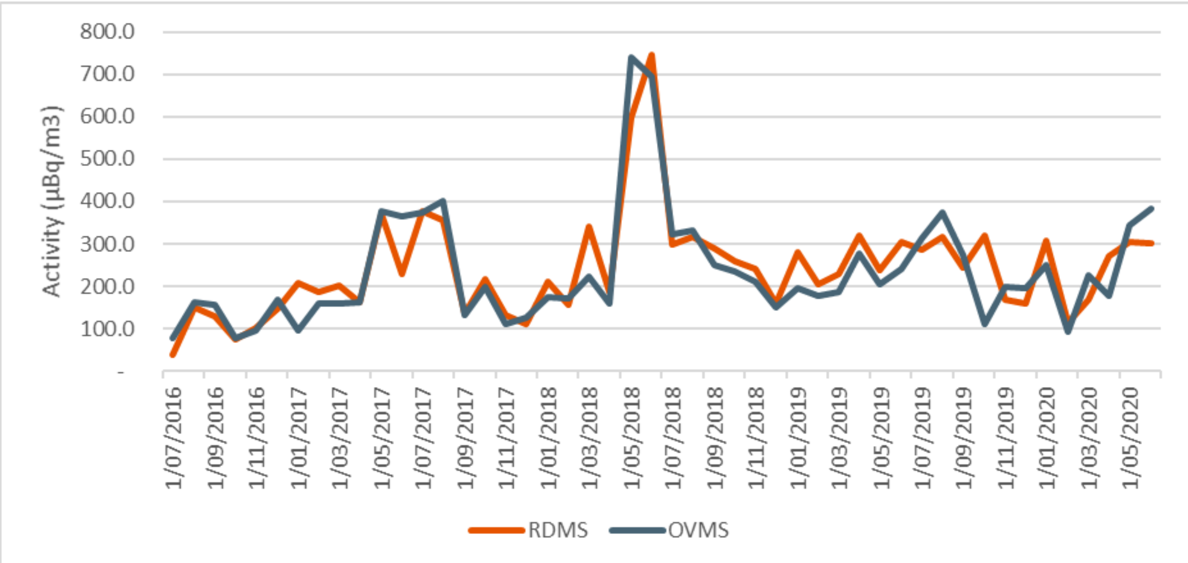


Figure 52: ^{210}Pb concentration for the 5-year period FY16-FY20 (PM_{10})

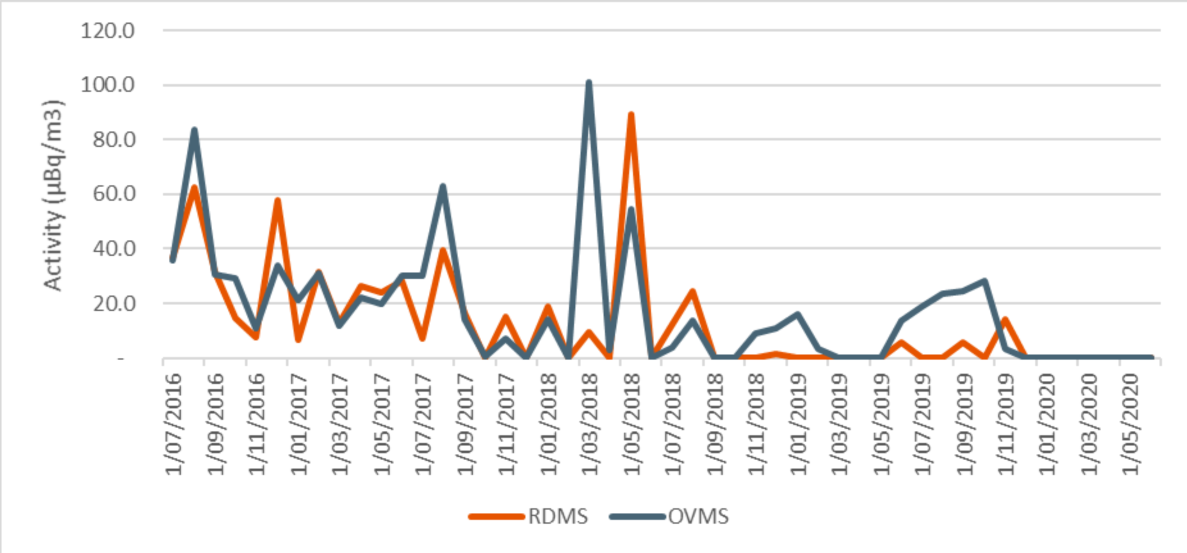


Figure 53: ^{210}Po concentration for the 5-year period FY16-FY20 (PM_{10})

Total Dose to Members of the Public

The total estimated dose (FY20) to members of the public at RDMS and OVMS contributed by ODC operations was 0.060 mSv and 0.074 mSv respectively, well below the 1 mSv/year public dose limit and Olympic Dam's internal dose constraint of 0.3mSv/yr. Figure 54 shows the annual trend of public doses at RDMS and OVMS.

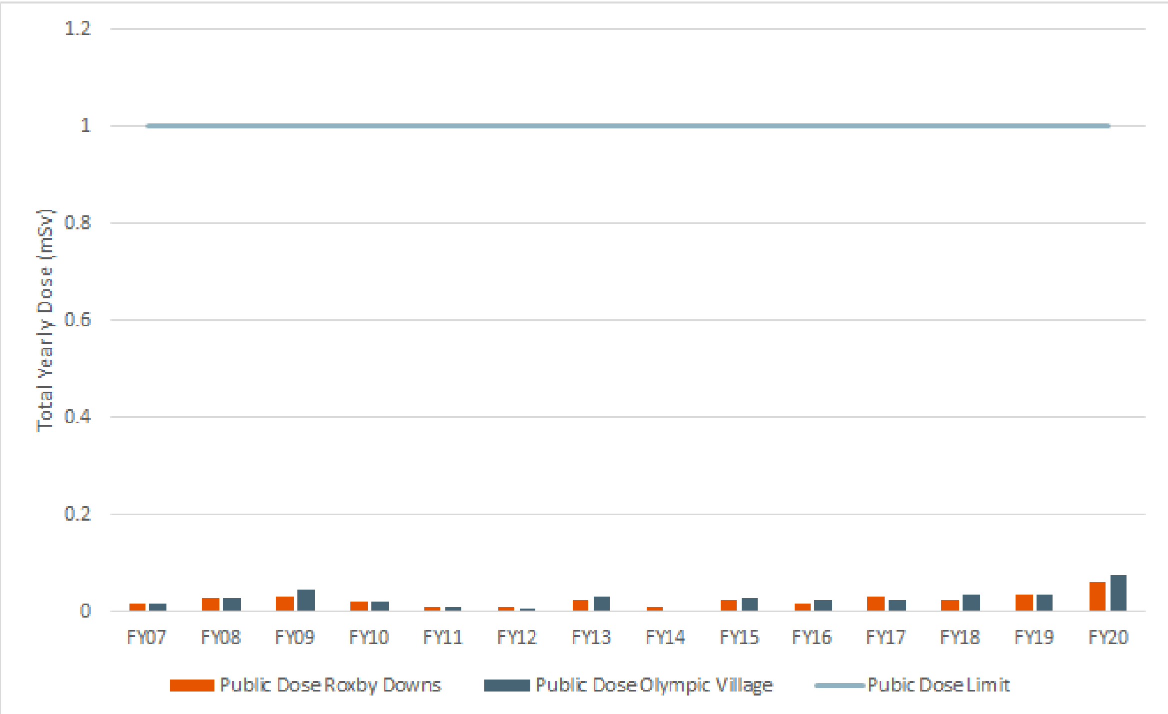


Figure 54: Yearly total effective dose trends for RDMS and OVMS. Note that a change in the RDP dose conversion factor has increased the dose in FY20 compared to previous years.

3.4.5 Deliverables (ER 2.3.3)

Records from passive dust deposition monitoring sites and comparison with the annual compliance rate of 25 Bq/m^2/y at the NHB monitoring sites.

An assessment of the impacts to reference plants and animals (ARPANSA 2010) for the appropriate ERICA Tier level, including as necessary comparison of the results with the reference level of 10 µGy/h.

Dust deposition

Passive dust monitoring data for FY20 indicated an average project-originated (after background subtraction) ^{238}U deposition rate of 0.75 Bq/m^2/yr. Passive dust (PD) monitoring sites PD1, PD4, PD8 and PD13 were used for this assessment (Figure 55), with site PD14 used as the background site. The results, shown in Table 19, are well below the criterion of 25 Bq/m^2/yr.

Table 19: FY20 - Project originated dust and ^{238}U deposition

Location	Project Originated Total Dust Deposition* (g/m^2/y)	Project Originated ^{238}U Deposition* (Bq/m^2/y)	Compliance Criteria (Bq/m^2/y)
PD1	-	1.94	25
PD4	-	0.40	25
PD8	-	0.06	25
PD13	-	0.73	25

* Cells left blank indicate that the results was less than background measurement

Dose rate reference level

The ERICA software tool (v1.2.1) was used to assess the significance of measured radionuclide dust deposition data, with a Tier 2 analysis conducted for all default terrestrial organisms. Table 20 shows the results of the ERICA analysis. It can be seen that dose rates for all organisms are less than 1% of the reference dose level of 10 µGy/h.

The risk quotient is a unit-less measure that compares the calculated NHB dose rate with the reference dose level.

Table 20: FY20 Erica screening dose level and risk quotients

Organism	Total Dose Rate (µGy/h)	Reference Level (µGy/h)	Risk Quotient
Bird	0.00000338	10	0.000000338
Grasses & Herbs	0.000233	10	0.0000233
Mammal - small-burrowing	0.00000141	10	0.000000141
Mammal - large	0.000000934	10	0.0000000934
Reptile	0.00000326	10	0.000000326
Shrub	0.0000899	10	0.00000899
Tree	0.0000227	10	0.00000227
Lichen & Bryophytes	0.000644	10	0.0000644

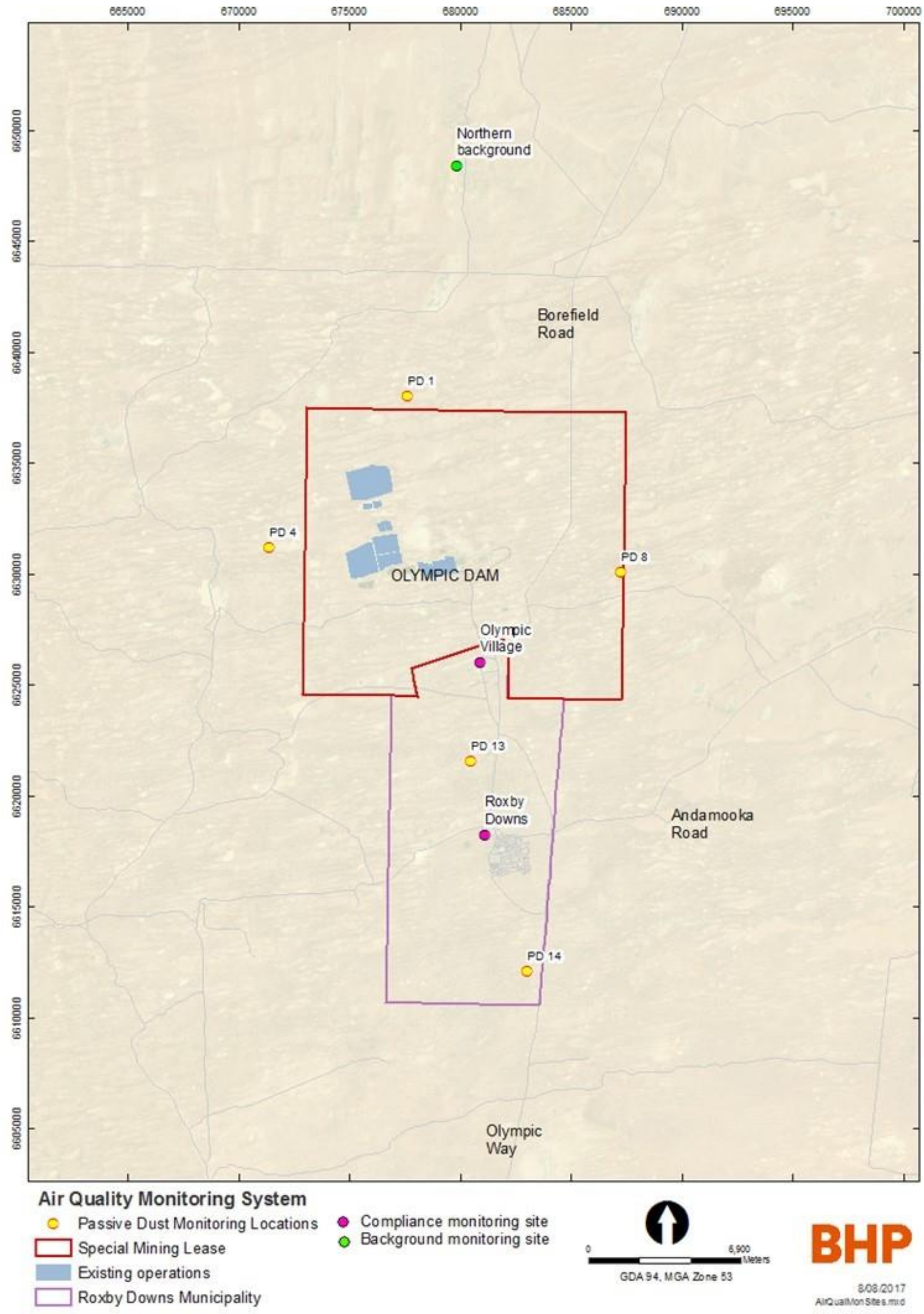


Figure 55: Location of dust deposition monitoring sites

3.4.6 Deliverables (ER 2.4)

A database of radionuclide concentrations in the environment over the long-term.

A database of radionuclide concentrations has been maintained since 2005. Figure 49 to Figure 53 show the monthly trends of radionuclide concentration at RDMS and OVMS.

3.4.7 Targets FY20

Maintain radiation doses as low as reasonably achievable, social and economic factors taken into account, as assessed through the annual Radiation Management Plan review.

The results of the monitoring program have shown operational contributions to radiation dose for members of public to be extremely low being less than 10% of the public dose limit of 1mSv/yr.

3.4.8 Actions FY20

None applicable.

3.5 Greenhouse gas emissions

3.5.1 Environmental Outcome

Contribute to stabilising global atmospheric greenhouse gas concentrations to minimise environmental impacts associated with climate change.

BHP's climate change strategy focuses on reducing our operational greenhouse gas (GHG) emissions, investing in low emissions technologies, promoting product stewardship, managing climate-related risk and opportunity and working with others to enhance the global policy and market response. As a BHP group asset, ODC operates under the BHP group strategy.

3.5.2 Compliance criteria

Progress on OD GHG reduction and abatement opportunities that contribute to BHP strategy and response to climate change, reported annually.

Reducing GHG emissions at our operated assets is a key component of our climate change strategy. Our current short-term target for FY2022 is to maintain our total operational GHG emissions at or below FY2017 levels while we continue to grow our business. While our annual emissions are currently higher than FY2017 levels, forecasts suggest we are on track to meet our FY2022 target. Our long-term goal is to achieve net-zero operational emissions by 2050.

We set a medium-term target to reduce operational GHG emissions (Scope 1 and Scope 2 from our operated assets) by at least 30% from FY2020 levels by FY2030. Our FY2030 target was informed by our Pathways to Net Zero (P2NZ) project which was established to understand opportunities to achieve and maintain net zero operational emissions by 2050. The P2NZ project has identified a range of options for decarbonisation of BHP's operated assets. The key areas of focus are renewable electricity, low or zero-carbon material movement (e.g. reducing diesel use in mining equipment), and reducing hard-to-abate emissions, including fugitive methane from coal mining and petroleum. We will focus on decarbonising our electricity supply by 2030 to facilitate electrification and decarbonisation of our mining equipment by 2040.

See section 3.5.4 for a discussion of emission reduction opportunities and achievements.

3.5.3 Deliverables (EG 2.1)

Calculation of the site-wide GHG emission intensities, expressed as carbon equivalent intensity (kg CO_{2-e}/t milled).

GHG emissions were calculated using the National Greenhouse and Energy Reporting guidelines and emissions intensity was calculated and reported internally within BHP in line with monthly corporate reporting requirements. The calculated GHG emission intensity in FY20 was 75.9 kg CO_{2-e}/t ore milled, compared to 84.4 kg CO_{2-e}/t ore milled in FY19. The lower intensity reflects improved efficiencies as a result of improved throughput (greater milled tonnes) and a lower South Australian electricity emissions grid factor compared to the FY19 financial year. The South Australian grid factor continued the reducing trend seen over a number of years as a result of the increased proportion of renewables in the State electricity grid. Increased Scope 1 emissions are largely due to increased trucking of waste and low grade material to surface as a result of development works being undertaken in the Southern Mine Area and the Whenan Shaft remaining out of service.

Table 21: GHG emissions and intensity

Financial year	Total emissions (kt CO_{2-e})	Scope 1 (kt CO_{2-e})	Scope 2 (kt CO_{2-e})	GHG intensity (kg CO_{2-e}/t ore milled)
FY20	682.0	229.1	452.6	75.9
FY19	672.3	202.8	469.5	84.4

3.5.4 Deliverables (EG 2.2)

An annual report on progress on OD GHG reduction and abatement opportunities that contribute to BHP strategy and response to climate change.

Olympic Dam relies on diesel equipment for development, production, ore handling and mine services. A trial is underway to deploy light electric vehicles (LEVs) powered by lithium ion batteries in Olympic Dam's underground (UG) fleet.

The first of two electric vehicles arrived on site in April 2018. This is a Toyota Landcruiser consistent with the rest of the UG fleet, fitted with a Voltra electric conversion. After subsequent installation and commissioning for site compliance, including fire suppression installation, driver training and initial testing, the first vehicle went into UG operation in January 2019. A second vehicle has recently arrived on site for testing.

Primary drivers for the trial are reductions in energy and greenhouse gas, and reductions in UG diesel particulate matter (DPM, which are nil for EVs). In addition, this is part of a longer term roadmap for decarbonisation across BHP, where the potential is for other UG equipment to be electrified. ODC continues to review and track progress in this area. At present some manufacturers and conversion companies are offering UG equipment such as loaders, haul trucks and drills but the technology is still in relative infancy and most offerings are smaller equipment than that currently operated.

Underground LEV technology is more advanced but is still a long way behind consumer electric vehicles, especially with efficiency.

3.5.5 Leading Indicators

- None applicable

3.5.6 Targets FY20

- None applicable

3.5.7 Actions FY20

- None applicable

4 Generation of industrial wastes

4.1 Embankment stability of TSF

4.1.1 Environmental Outcome

No significant TSF embankment failure.

During FY20 the Tailings Storage Facilities (TSFs) were managed in accordance with the TRS Operations, Maintenance and Surveillance Manual (BHP Olympic Dam 2019d) and the Tailings Management Plan (BHP Olympic Dam 2019e) and no embankment failures of any magnitude occurred.

4.1.2 Compliance Criteria

No significant radioactive contamination arising from uncontrolled loss of radioactive material as a result of an embankment failure to the natural environment.
NOTE: Any embankment failure that leads to a reportable spill under the Bachmann Criteria will be considered significant. Significant is defined as requiring assessment and remedial action in accordance with the NEPM or EPP and the Mining Code. Measurement and monitoring is carried out in response to a specific event.

No uncontrolled loss of radioactive material to the natural environment as a result of an embankment failure occurred during FY20. To manage the risk of embankment failure, the rate of rise was maintained below 2 m per annum and the supernatant pond area was maintained below the 71 ha target set for this purpose.

4.1.3 Leading Indicators

Rate of rise of tailings at an average of 2 m per annum or less.

The rate of rise of tailings has been limited to 2 m per annum or less for all cells to ensure consolidation of tailings material. During the reporting period, tailings were distributed to TSF Cells 4 and 5 with an average rate of rise of the perimeter tailings beach of 0.91 m per annum with TSF4 and TSF5 at 0.96 m and 0.86 m respectively in FY20.

The rate of rise of pore pressures within or adjacent to the TSF embankment is less than or equal to the rate of rise of tailings.

Assessing pore pressure against rate of rise provides an indication if excess pore pressures are developing in the embankment. The rise in phreatic level at VWP locations over the past year is less than or equal to the average rate of rise in tailings.

The maximum supernatant pond area of individual TSF cells does not exceed 15ha for TSF1, 23ha for TSF2/3, 90ha for TSF4 and 135ha for TSF5.
Note: Each TSF has been assigned a maximum supernatant pond size which is calculated using critical operating parameters, surface contours and an allowance for significant rainfall events. Operating beyond these ponds sizes may not result in embankment failure but are considered an appropriate leading indicator in which operational processes should be reviewed.

The supernatant ponds are visually checked against marker poles daily, surveyed monthly and checked quarterly. Over the period the recorded pond sizes have been below the leading indicator sizes.

4.1.4 Deliverables (WA 2.1)

The tailings stored at the TSF have a concentration over the 10 Bq/g exemption limit and also a total activity over the 10,000 Bq exemption limit for Radium, which defines it as a radioactive material under ARPANSA guidelines.

Monitoring of the TSF, including rate of rise of tailings, supernatant pond area, and pore pressure all contribute to management of the TSF to ensure no uncontrolled loss of radioactive material to the natural environment or significant embankment failure.

Monitoring data showing the size and location of the supernatant liquor ponds in each TSF cell on a monthly basis (EPA 31543.500-433).

Large supernatant liquor ponds have the potential to impact upon embankment stability by increasing the phreatic surface within the tailings and embankments, which in turn can lower the strength of the tailings and embankment materials. The TSF pond areas during FY20 are shown in Figure 56. The ponds have been consistent in size, reflecting the ongoing low rainfall.

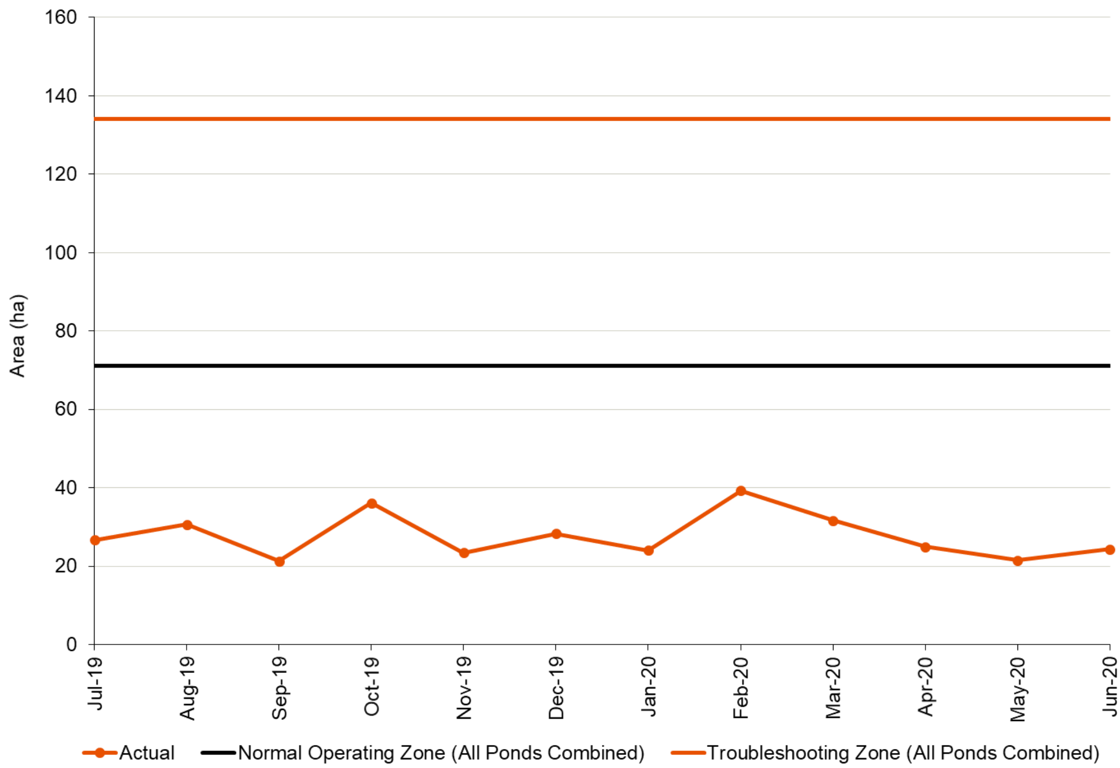


Figure 56: TSF Pond areas (ha) for FY20.

Monitoring data showing the rate of rise of tailings in each TSF cell.

At current processing rates, approximately 8 - 9 Mtpa of tailings, containing low levels of radioactivity are disposed of in the TSFs annually.

The rate of rise of tailings has been limited to 2 m per annum or less for all cells to ensure consolidation of tailings material. During the FY20 reporting period, tailings were distributed to TSF Cells 4 and 5 with an average rate of rise of the perimeter tailings beach of 0.91 m per annum. This is in line with FY19.

Tailings delivery to TSF Cell 4 prior to 2003 was biased towards the internal east wall as the availability of this wall for tailings deposition was largely unaffected by wall-raising activities, resulting in a higher beach level when compared to the external wall. A plan was initiated in 2003 to address this issue and bias the tailings delivery to TSF Cell 4 external walls. For FY20, the rate of rise along Cell 4 east wall increased to 1.1m, greater than the overall rate of rise for TSF4. This is largely due to the scheduling of the wall raises, with the east wall brought into operation early FY20, and remaining in use for the majority of the period, while the other walls were being raised.

No significant impacts have resulted from the difference in height between the internal east wall and external walls of TSF Cell 4. This issue will continue to be addressed by the program of reduced deposition to the east wall, gradually bringing it in line with other walls.

The elevation of tailings in the cells illustrated in Figure 57 gives an indication of the rate of rise of the perimeter tailings beaches.

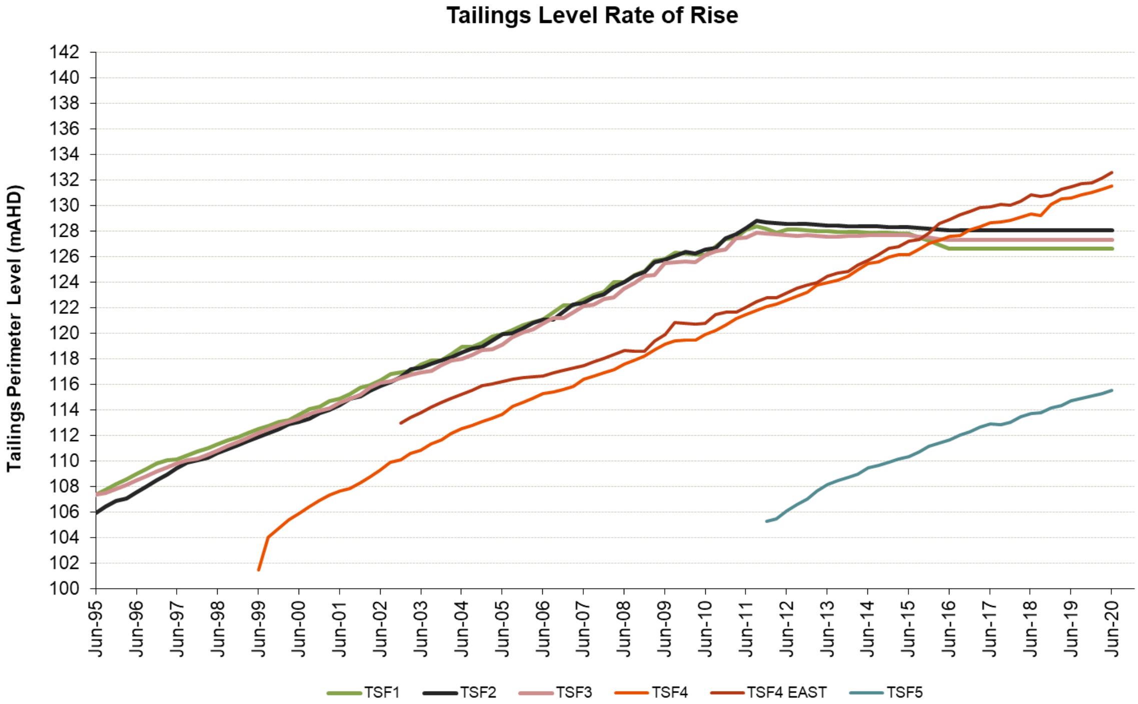


Figure 57: TSF rate of tailings rise.

Monitoring data showing the pore pressures within tailings adjacent to the external walls of the TSF.

Piezometers are monitored to assess the pore pressures within the tailings adjacent to the embankments of the TSFs. Piezometers installed at critical cross sections are monitored 3-weekly, whilst all other piezometers are monitored on a 9-weekly basis. Piezometers used include standpipe and vibrating wire piezometers.

ANCOLD provides minimum Factors of Safety (FoS) for different loading conditions. Results of the biennial stability analysis undertaken in FY19 meet or exceed the minimum levels recommended by ANCOLD. As TSF5 embankment increases in height, the FoS drops, and additional stability measures are required. Further assessment completed during this period (SRK 2019), refined the stability assessment and informed the design and staging of the additional measures. Buttressing of TSF5 has commenced, and will continue through the coming period.

Table 22: Stability Analysis Results (SRK, 2018)

Wall Section	Static Loading FoS (min – 1.5)	Post-Seismic FoS (min – 1.0)
Cell 2/3 East Wall	RL 130.5 m: 1.58	1.22
Cell 4 North Wall	RL 136* m: 1.85	1.3
Cell 4 West Wall	RL 136* m: 1.77	1.2

Cell 4 South Wall	RL 136* m: 1.78	1.2
Cell 5 North Wall	RL 118** m: 1.54	1.24
Cell 5 East Wall	RL 118** m: 1.52	1.17
Cell 5 South Wall	RL 118** m: 1.59	1.28
Cell 5 West Wall	RL 117 m: 1.60	1.28

* TSF4 assessment used finite element modelling and considered final heights.

** Based on report completed in November 2019

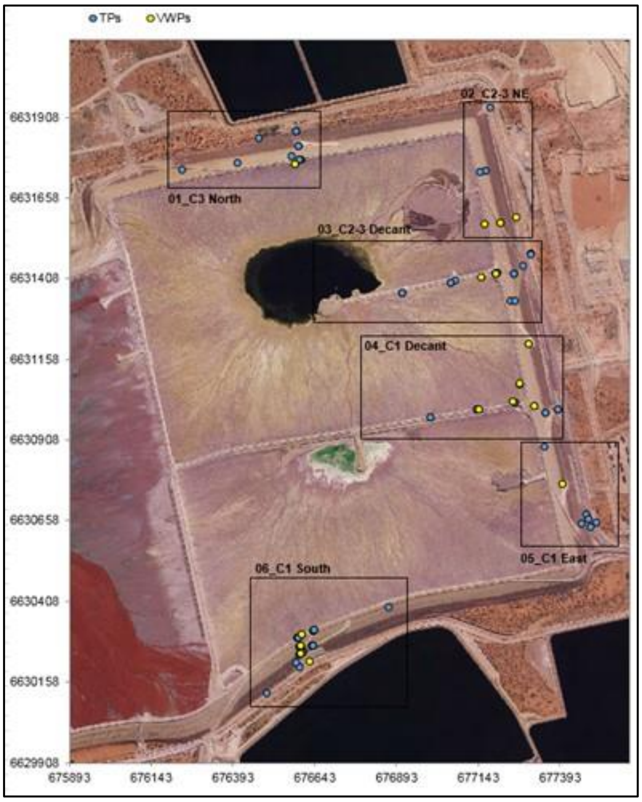


Figure 58: TSF 1-3 piezometer locations

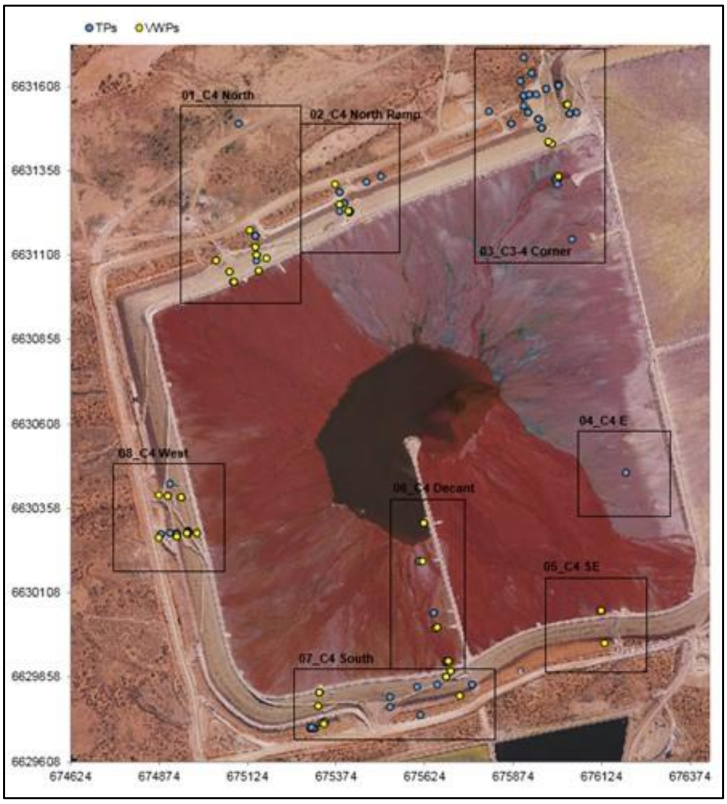


Figure 59: TSF 4 piezometer locations

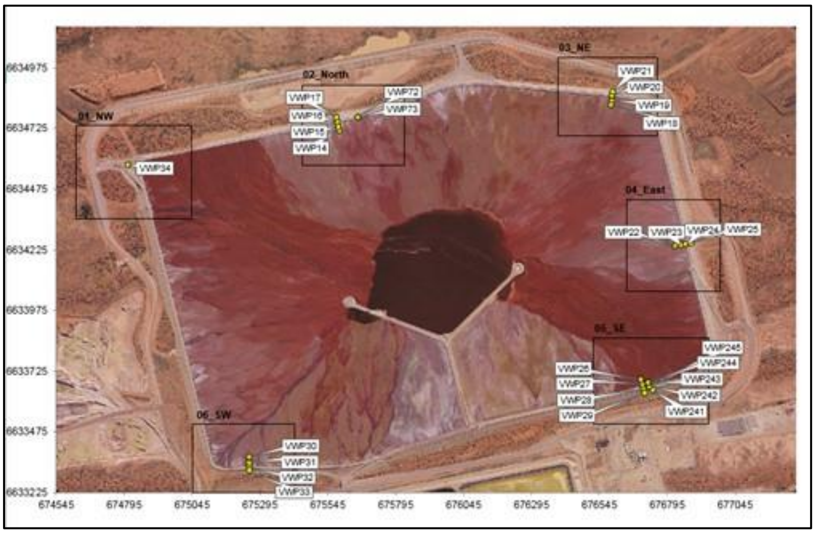


Figure 60: TSF 5 piezometer locations

Piezometers located in the East, North & South Wall of TSFs 1-3 generally show a gradual pressure drop consistent with the cessation of tailings deposition in October 2011. For example, the variation of VWP readings along East & South walls of TSF 1 are shown in Figure 61 and Figure 62. Note, negative pore pressures have been excluded.

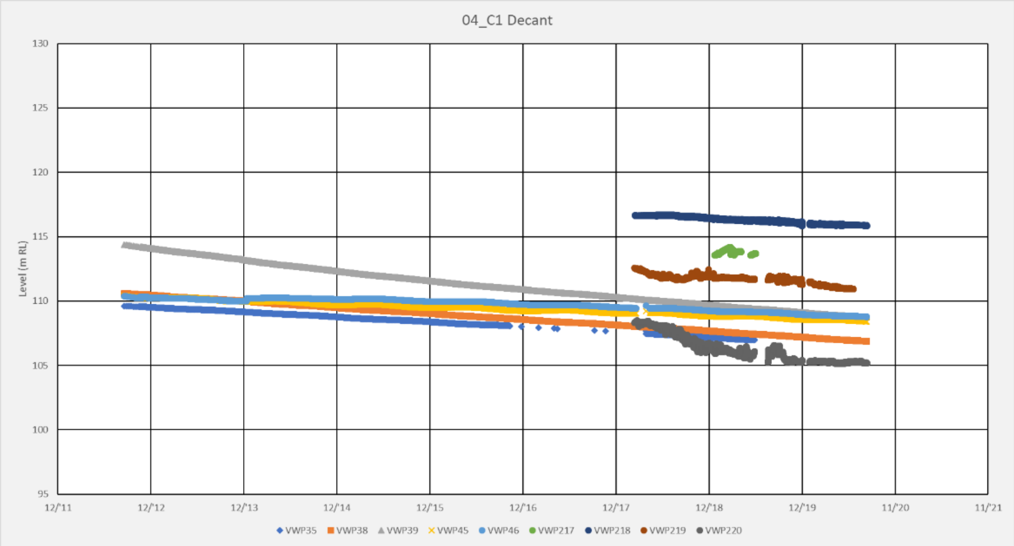


Figure 61: TSF 1 East Wall VWP readings

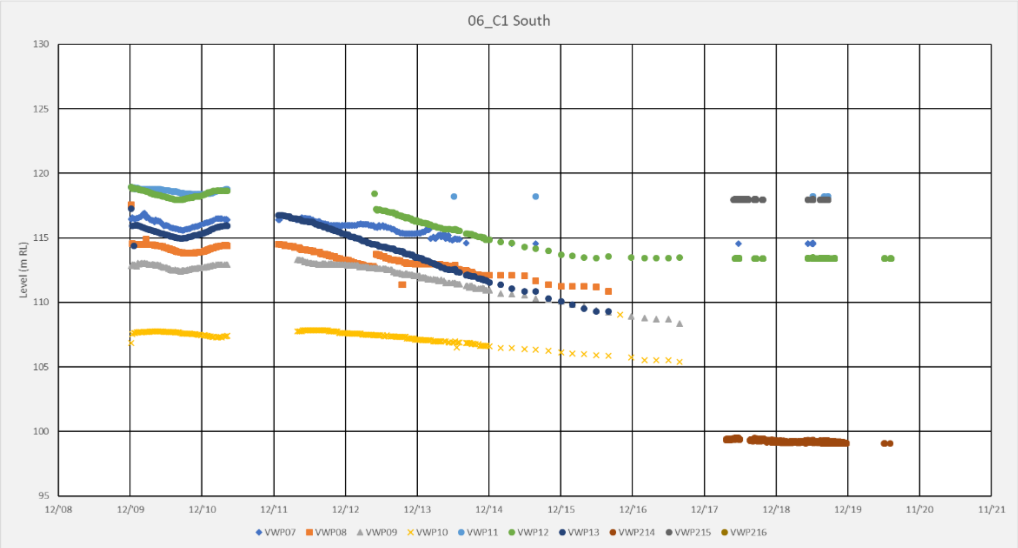


Figure 62: TSF 1 South Wall VWP readings

Piezometers installed in the tailings and upper embankment of TSF 4 show levels have been relatively constant over the period. A gradual rising trend can be seen in some of the VWP readings in Figure 63 and Figure 64, however this is normal given tailings deposition is still occurring on the cell.

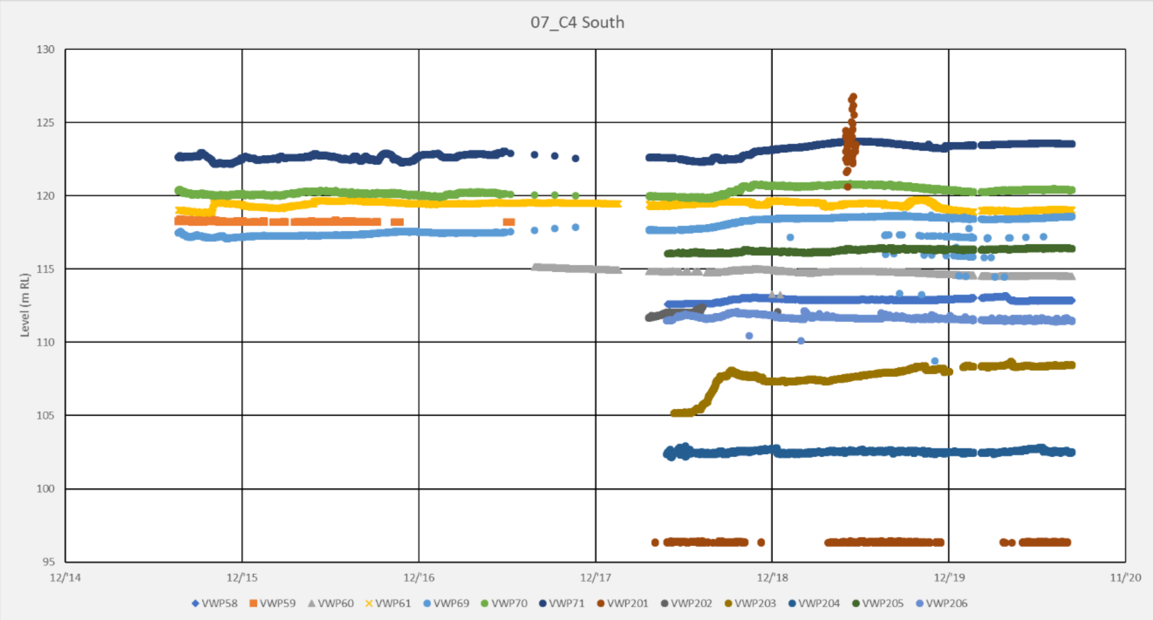


Figure 63: TSF 4 South Wall VWP readings

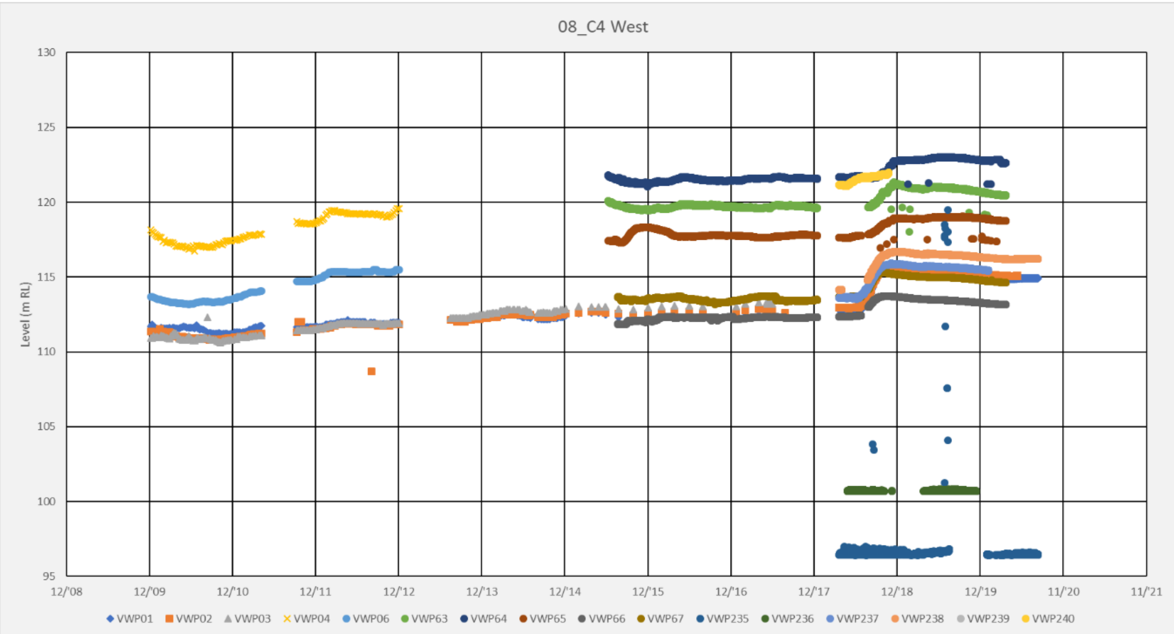


Figure 64: TSF 4 West Wall VWP readings

Piezometers installed in the tailings and upper embankment of TSF5 show levels have been relatively constant over the period, with minor fluctuations. A gradual increase can be discerned, which is as expected as tailings continue to be added in this TSF. For example, the variation of VWP readings along TSF 5 South-East & North-East walls are shown in Figure 65 and Figure 66.

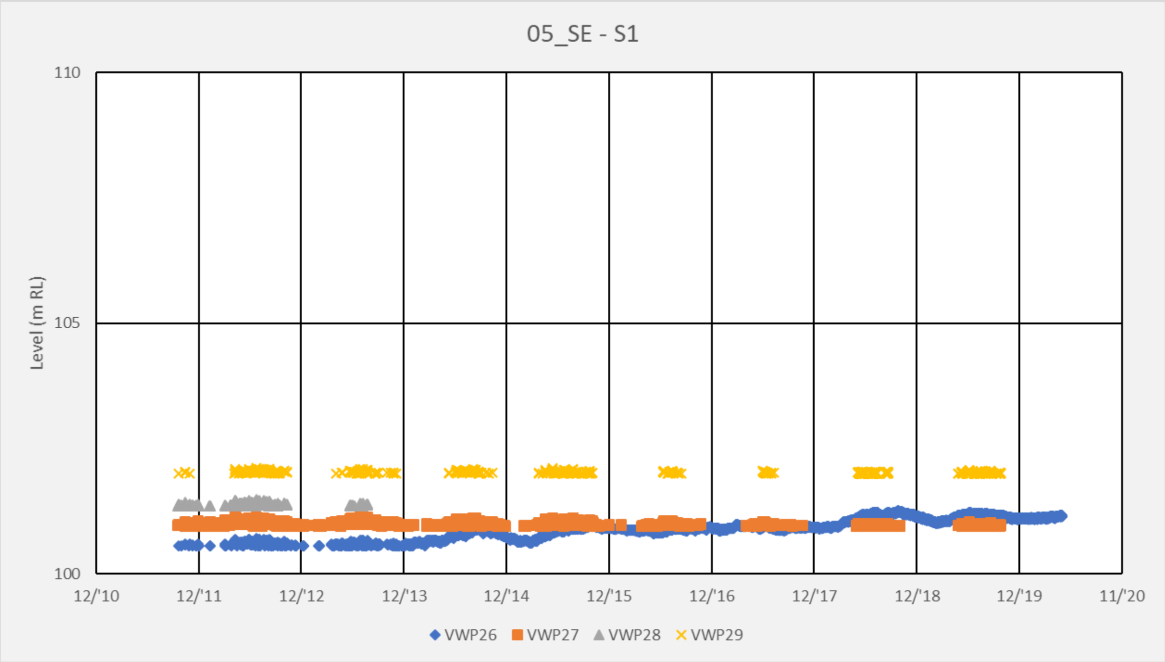


Figure 65: TSF 5 South East side VWP readings

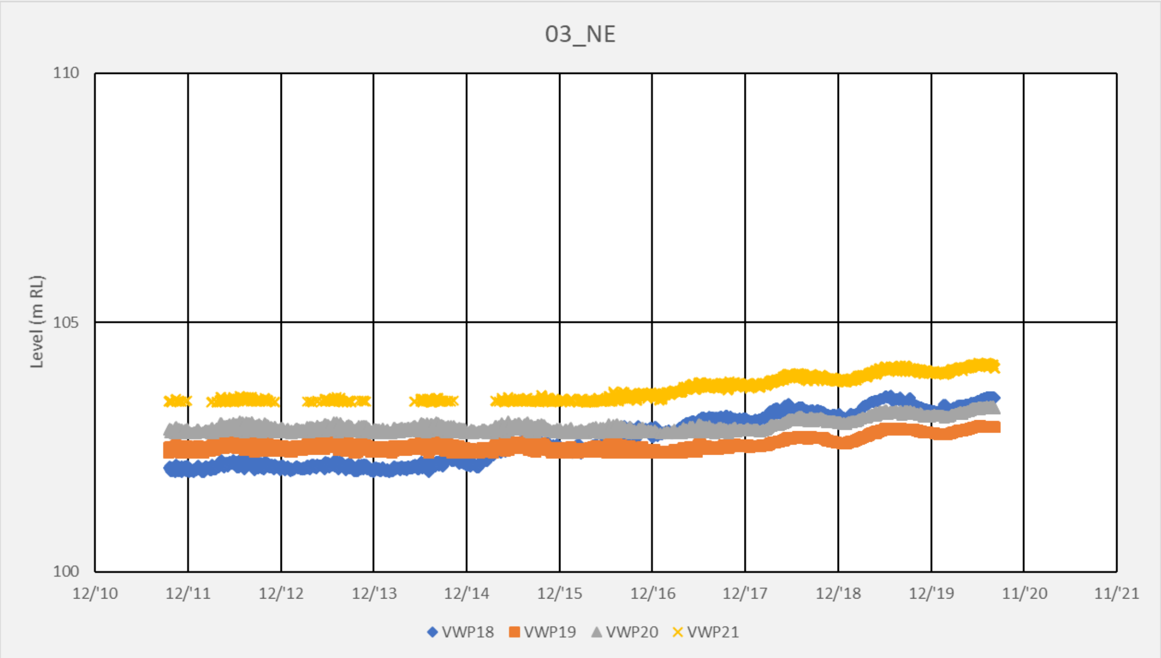


Figure 66: TSF 5 North East side VWP readings

During FY20 the TRS was reviewed by SRK, with two 6-monthly operational reviews of the TRS and one annual comprehensive review covering the period July 2018 - June 2019.

The reviews were carried out in accordance with BHP TSF Management Guidelines and ANCOLD Guidelines. All reviews confirmed that the Tailings Retention System, including the Tailings Storage Facilities and Evaporation Ponds, are in good condition and are well managed.

A review of the water balance on an annual basis (EPA 31543.500-435).

See section 4.2 Tailings seepage.

4.1.5 Targets FY20

None applicable.

4.1.6 Actions FY20

Undertake periodic (2-3 year) CPTu testing of tailings to confirm strength parameters used in stability analysis.

CPTu testing of all the TSFs was undertaken in August 2018. The results were used by SRK to assess the stability (reported above). A program of CPTu testing was completed in July 2020, and the results will be presented in the FY21 report.

4.2 Tailings seepage

4.2.1 Environmental Outcome

No significant adverse impact on vegetation as a result of seepage from the TSF.

No significant adverse impact to vegetation as a result of seepage from the TSF has occurred. Eighty metres AHD (20 m below ground level) is considered as the level below which groundwater cannot interact with the root zone of plants in the Olympic Dam region. Groundwater levels in the vicinity of the TSF remain below 80 mAHD.

No compromise of current and future land uses on the Special Mining Lease (SML) or adjoining areas as a result of seepage from the TSF.

No compromise of current and future land uses on the SML or adjoining areas has occurred. Groundwater levels in the vicinity of the TSF remain below 80 mAHD and sampling indicates that seepage is being attenuated.

No compromise of the environmental values of groundwater outside the SML as a result of seepage from the TSF.

No compromise of the environmental values of groundwater outside the SML has occurred. Sampling indicates that seepage is being attenuated within the SML, and groundwater levels of bores along the SML are consistent with other regional bores. Seepage modelling has been updated to demonstrate that there are no expected future offsite impacts.

4.2.2 Compliance criteria

Maintain groundwater level (attributable to seepage from the TSF) outside the external perimeter road of TSF Cells 1 to 5 to not higher than 80 mAHD (20 m below ground level).

Groundwater monitoring results indicate that the groundwater level has not reached a level higher than 80 mAHD beneath TSF Cells (refer Figure 23 in section 1.2 – Aquifer Level Drawdown). The maximum groundwater level recorded below the TSF for the current reporting period was 66.62 mAHD at LT67.

All TSF seepage attenuated within the SML, as demonstrated by a numerical geochemical model confirmed by monitoring.

Geochemical modelling was carried out for the Expansion EIS (BHP Billiton Olympic Dam 2009) and demonstrated that all TSF seepage would be attenuated within the SML. This modelling was updated in 2015 (SRK 2015) to account for the current mine configuration (underground only) following the suspension of the Olympic Dam Expansion. Within the timeframe assessed (10,000 years), the modelling results indicate that no impacts on baseline groundwater quality at the mine lease boundary (SML) would be expected as travel times are predicted to be well beyond this timeframe and there is expected to be significant attenuation of pollutants within the SML.

Laboratory analysis of on-site and regional groundwater monitoring bores confirms the attenuation of TSF seepage within the SML. Samples from regional monitoring bores contained analytical concentrations either below limits of reporting, or within concentrations previously reported (see 1.2 Aquifer level drawdown).

4.2.3 Leading Indicators

A measurement of groundwater level outside the external perimeter road of the TSF that exceeds 70 mAHD (30 m below ground level) as a result of seepage.

The leading indicator value was not reached. The maximum groundwater level recorded below the TSF for the current reporting period was 66.62 mAHD at LT67.

A numerical geochemical model trend that indicates that all TSF seepage may not be attenuated within the SML should the trend continue.

No geochemical seepage trend was noted. Laboratory analysis of on-site and regional groundwater monitoring bores, when combined with groundwater level data, confirms the validity of the 2015 geochemical modelling (SRK 2015) findings that all TSF seepage would be attenuated within the SML.

4.2.4 Deliverables (WA 2.1)

A review of the water balance on an annual basis (EPA 31543.500-435).

The water balance for TSF Cells 4 and 5 indicates that evaporation to dispose of liquor is approximately 39% of the total inputs. This is slightly lower than last year, although in line with FY16, FY17 and FY18.

Unaccounted liquor includes input liquor shown in Figure 67 (tailings liquor, rainfall, flushing liquor, and the decrease in supernatant pond inventory) minus liquor retained in tailings (moisture content assumed of 30 % by weight), liquor decanted to evaporation ponds, and estimated seepage from (supernatant liquor) ponds. Flushing liquor is liquor pumped out of the evaporation ponds to the TSF for the purpose of flushing lines and to enhance evaporation.

The total output liquor volume is equal to input liquor volume and is shown in Figure 68**.** Seepage from pond areas has been calculated based on the average supernatant pond areas for TSF Cells 1 – 5 (27.9 ha) and assumed tailings permeability ($2x10^{-8}$ m/s). Liquor retained in tailings was assumed to be 30 % of the weight of tailings solids deposited. This was based on previous testing of in-situ tailings.

The water balance shows 3 % of liquor input due to rainfall in FY20, with a continued trend of lower than average rainfall for the last 3 years now.

A discussion on groundwater levels in the vicinity of the TSF in FY20 is provided in section 1.2 - Aquifer Level Drawdown.

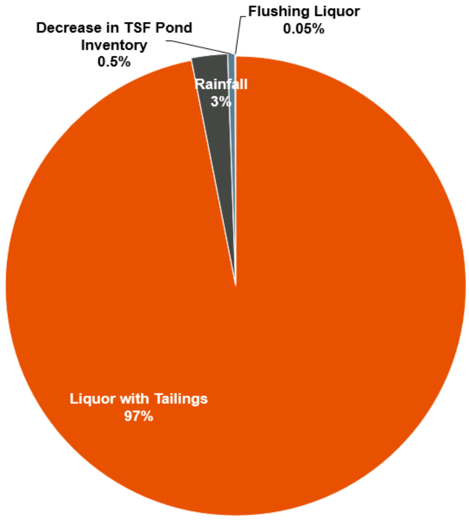


Figure 67: TSF Cells 4 & 5 Liquor Balance – Inputs FY20

Note: Liquor Inputs [Total 8,065 ML]

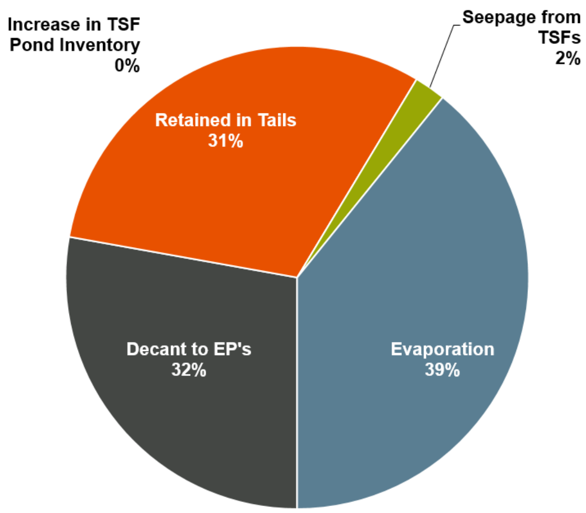


Figure 68: TSF Cells 4 & 5 Liquor Balance – Outputs, FY20

Note: Liquor Outputs [Total 8,065 ML]

4.2.5 Deliverables (WA 2.2)

Monitoring data showing the liquor level in each cell of the EPs.

Figure 69 shows the liquor levels in the evaporation ponds with respect to freeboard limits. Freeboard in the Evaporation Ponds (EPs) consists of allowances for wind, waves and rainfall runoff.

EP1 is close to the limit of its design capacity, and is used primarily as an evaporation area. EP2 solids level is at freeboard limit, and only receives occasional seepage flow pumped from the collection systems on the east side of TSF1 and 2, and pigging flows. EP3 was brought back into service, however due to the limits of the measuring system, records were only possible once the level rose above the old EP (4000 mm below freeboard). EP5B has been out of service for the period, while EP5A was taken out of service over the summer for repairs.

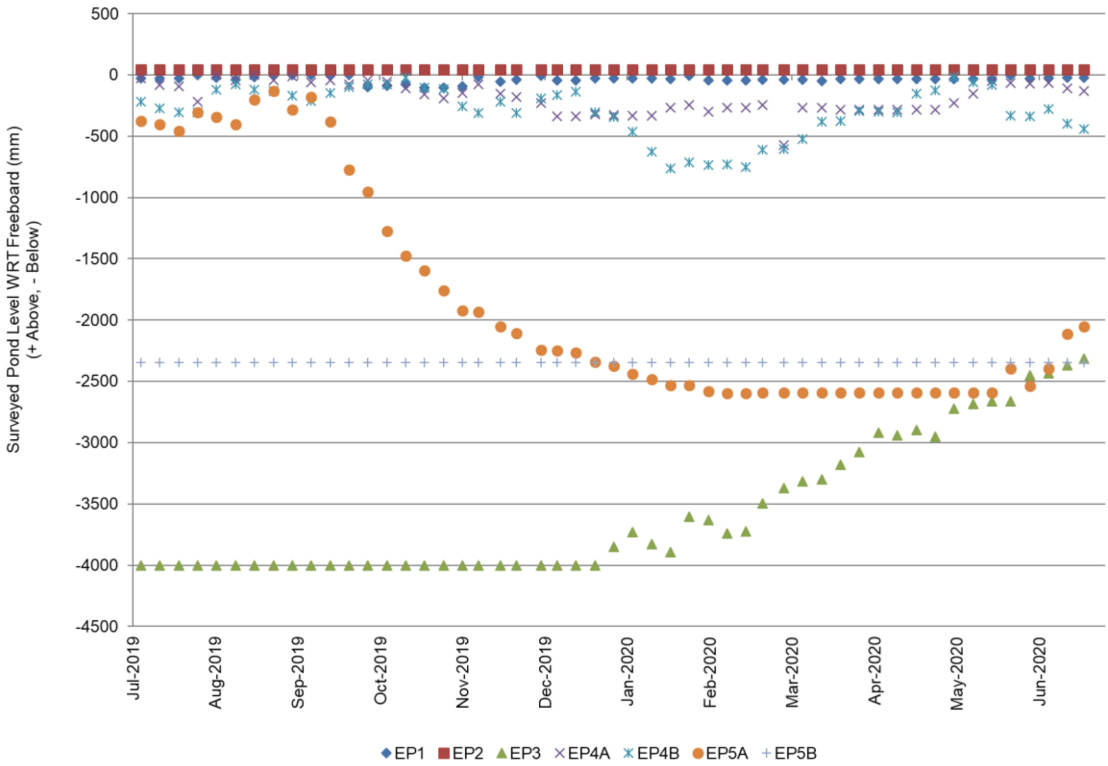


Figure 69: Evaporation Pond Liquor Levels.

Monitoring data showing the overall (solids and liquor) inventory in the EPs.

Figure 70 shows the evaporation pond capacity in relation to the normal maximum operational storage capacity. Additional pond capacity is available as a contingency to allow for large rainfall events.

Following the refurbishment of EP3 in FY19, the liquor inventory in the evaporation ponds as a proportion of storage capacity was within a normal range. EP5A was taken out of service for repairs over the summer, returning to service in May.

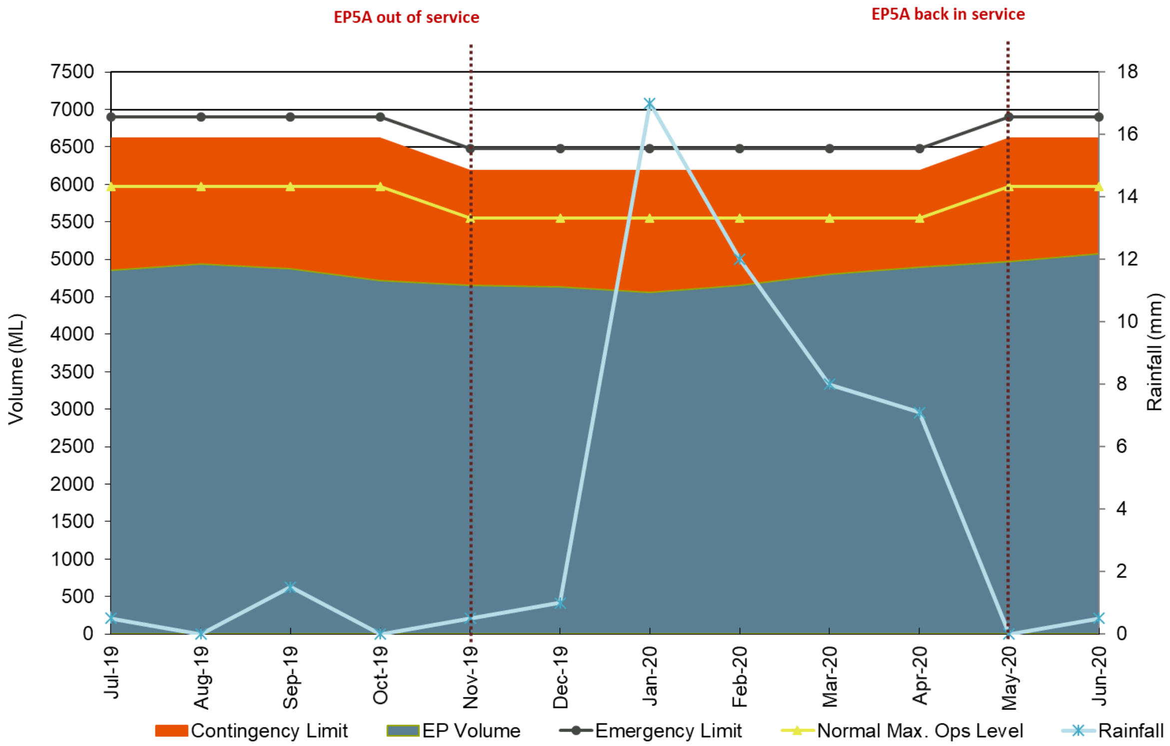


Figure 70: Evaporation pond capacity and rainfall.

Results of a liquor balance for each EP cell.

Figure 71 shows the cumulative evaporation trends for the Evaporation Ponds. A liquor balance is performed to highlight cells with potential significant leaks by comparison of the apparent evaporation from each cell of each EP. The comparison is carried out on a monthly basis.

EP3 was commissioned during this period. Initially this filling was sporadic while the optimal discharge arrangement was established. It wasn't until the beginning of 2020 that sustained use of EP3 commenced. As indicated above, limitations of the measuring system meant that regular levels weren't able to be recorded until the liquor level rose over crest of the old EP. For the next period, EP3 will be reported similar to the other ponds.

The evaporation response for each cell is broadly consistent, demonstrating that significant unexplained losses have not occurred. Variations between each pond can be attributed to usage, and the overall evaporation loss is consistent with previous years.

EP4B showed the highest evaporation rate, however this is consistent with higher usage than the other ponds, and in line with previous years. EP4A and EP5A were in limited use in the later portion of the period. For EP4A, the solids are approaching the freeboard limit, while EP5A was drained down for repairs that were completed in May.

Evaporation cells occasionally dry out when the free liquor is evaporated, exposing the surface of the precipitated solids built up in the cell. During these periods a liquor level is not able to be measured and the cumulative evaporation trends level out. Under these circumstances the water balance method is no longer effective in confirming cell integrity. However, as the cell is inactive there is minimal, if any, free liquor available and therefore very little potential for significant seepage from these cells.

EP1 and EP2 were used sporadically during the reporting period. EP5B was out of service during the period.

Groundwater level data collected in and around the ponds is used as an additional control to detect seepage from the Evaporation Ponds (discussed in more detail in Chapter 1.3 Aquifer level drawdown) and to support the liquor balance calculations.

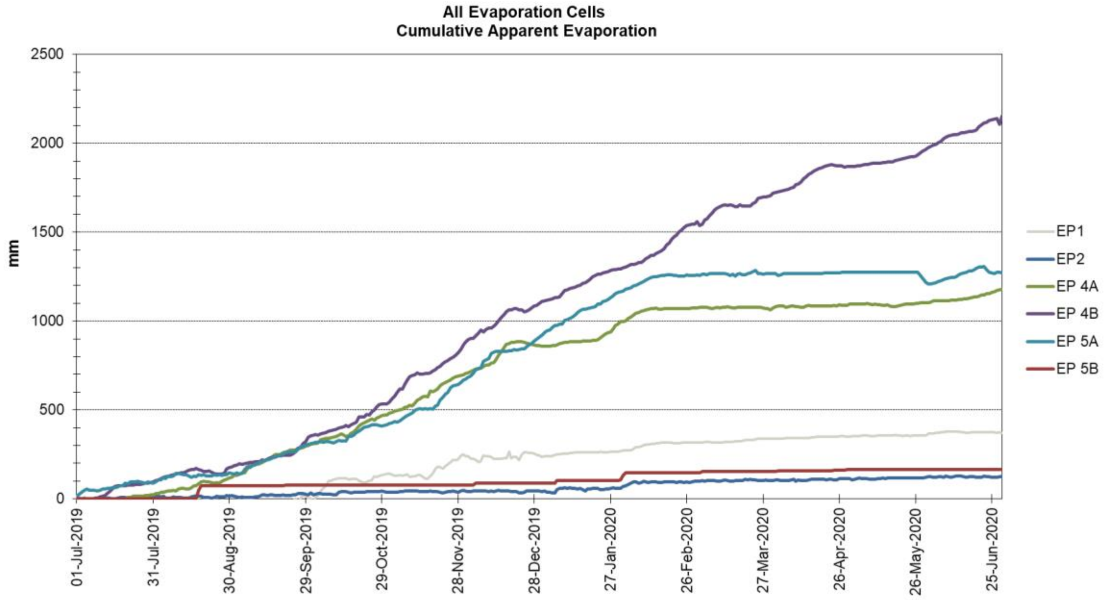


Figure 71: All EP Liquor Balance – cumulative apparent evaporation.

4.2.6 Targets FY20

- None applicable

4.2.7 Actions FY20

Identify and install additional liquor interception systems as required.

A seepage interception system was installed along the eastern wall of TSF3 at the end of FY19, and commissioned in FY20. This system remains in operation.

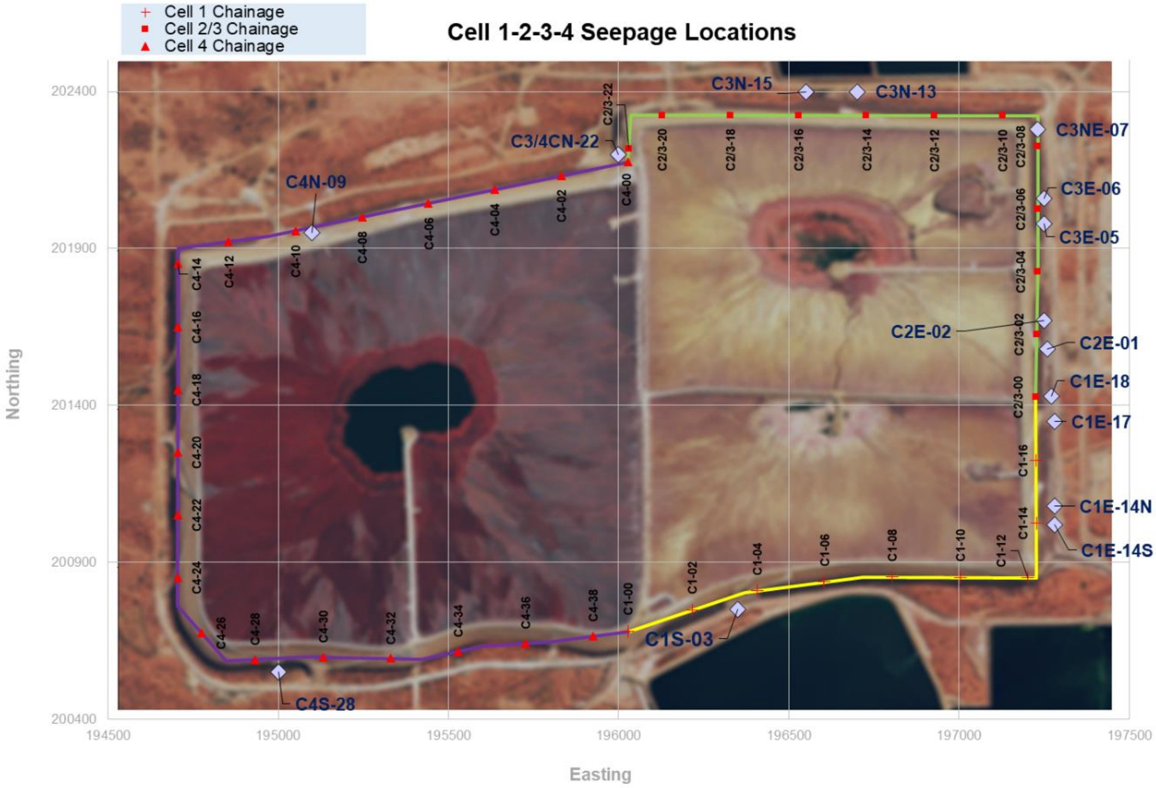
A second interception trench was installed along the west side of TSF5 (C5NW-54). Similar to the one installed at C5SW-61, this was a temporary measure. Both of these trenches have been replaced with a permanent drain constructed as part of the TSF6 works.

A summary of locations are shown in Table 23 with locations shown in Figure 72. One new seepage area was identified during the FY20 reporting period.

Table 23: List of monitored perimeter features.

Identifier	Location	Discovery Date	Summary of Status (FY19)
Cell 1			
C1S-03	South wall of TSF Cell 1 on the embankment face	Feb 2008	Filter Blanket installed over area. No change from previous reporting period.
C1E-14S	East wall of TSF Cell 1 at the toe and pipe corridor	2008	Interception drain, sump and pump to return seepage to EP2. Dampness extending south and east. Flow from this seepage has continued to be erratic, with fluctuations between 5 to 25 m3/day over period. A potential seasonal trend is developing, with higher flows in winter in comparison to summer.

C1E-14N	East wall of TSF Cell 1 at the toe	2008	Interception drain, sump and pump to return seepage to EP2. Mostly dry, damp after rain, seepage is continuing to slowly extend east. There has been a further decrease in the average daily over the reporting period.
C1E-17, C1E-18	Cell 1 crest of starter embankment and at toe	2009	Interception trench, sump and pump. Seepage extending slightly north beyond the filter blanket. An ongoing gradual decrease can be observed.
Cell 2			
C2E-01, C2E-02	East Wall of Cell 2 at the embankment toe	2009	Interception trench, sump and pump. Flow has reduced over period, and pump is no longer operated continuously. Instead pump is operated every 3-4 days.
Cell 3			
C3E-05 &06	East Wall of Cell 3 at the embankment toe	October 2016	Filter blanket, drain and pump system installed. Flows have fluctuated between 1 m^3 to 30 m^3 per day.
C3NE-07	Northeast corner of Cell 3	Dec 2010	Mainly dry.
C3N-13	North wall of TSF3	Sept 2018	Area covered by mini buttress.
C3N-15	North Wall of Cell 3 at the embankment toe	August 2016	Area covered by mini buttress. Some dampness evident at toe of mini buttress.
C3/4CN -22	Intersection of TSF Cell 3 and TSF Cell 4 at toe	Apr 2008	Beneath Cell 3-4 buttress. Flows into sump have stayed low over the period, around 1 m^3. The adjacent dewatering bore is still recording flows, and changes in flow in the bore coincide with changes in flow into the sump.
Cell4			
C4N-09	Eastern side of the north ramp of Cell 4	November 2012	New filter blanket installed over portions as part of the buttress works. Flow has continued to reduce since the buttress works and averages around 0.5-1 m^3 per week. .
C4S-28	South wall TSF4 adjacent ramp	2006	Damp patches at toe increasing over the period.
Cell 5			
C5S-12 to 14	South wall TSF5 towards eastern corner	January 2018	Damp strips in clay pan below sand dune, gradually expanding.
C5E - 28	Eastern wall towards northern corner	June 2019	Damp patches at toe of embankment, gradually expanding in area and intensity.
C5NE - 31	NE Corner TSF5	July 2019	Damp patches at toe of dam, gradually becoming damper.
C5N - 40	North wall of TSF5	April 2017	Damp zone along service track, becoming damper over the period.
C5NW-54	West Wall of Cell 5 at the embankment toe	June 2015	Damp areas expanded, temporary interception trench and pump installed. Permanent trench and pumping system under construction as part of TSF6.
C5SW-61	West Wall of Cell 5 at the embankment toe	May 2016	Ongoing pumping over period, with slow growth in dampness. Permanent trench and pumping system under construction as part of TSF6.



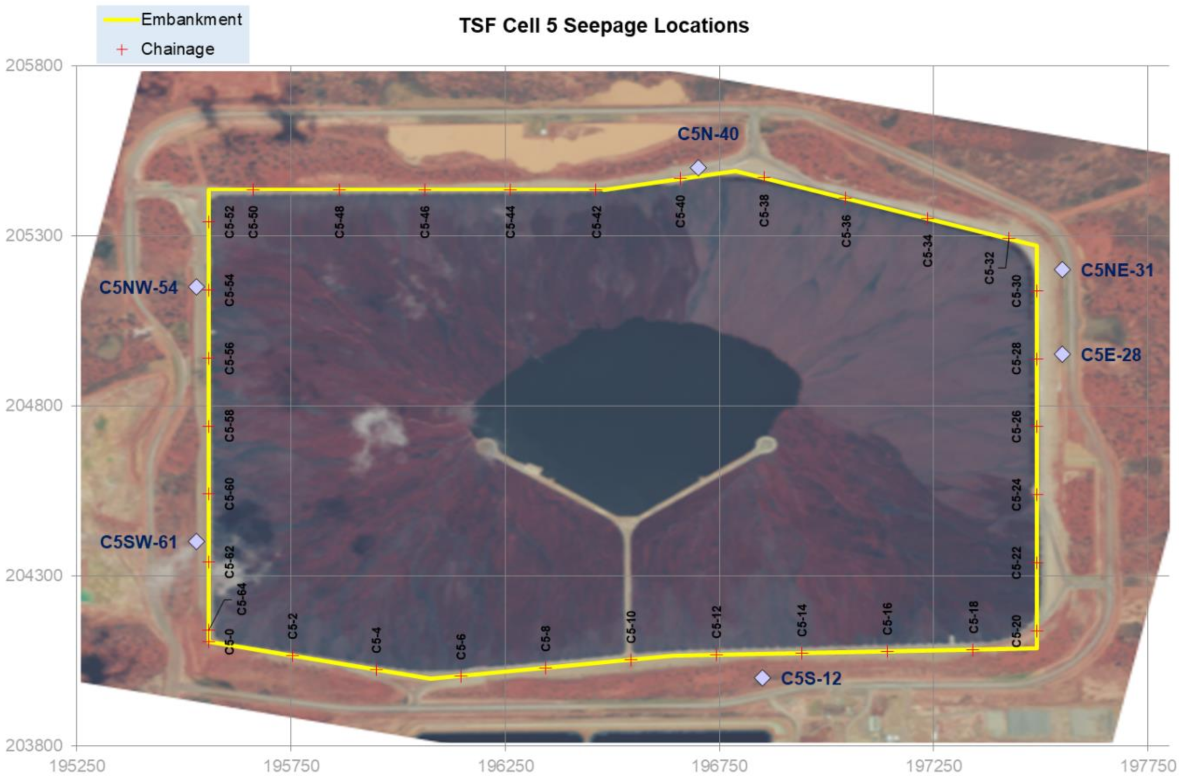


Figure 72: Location of perimeter features.

4.3 Fauna interaction with Tailings Retention System

4.3.1 Environmental Outcome

No significant adverse impacts to listed species (South Australian, Commonwealth) as a result of interactions with the Olympic Dam TRS.

No significant adverse impacts to listed species as a result of interactions with the Olympic Dam Tailings Retention System (TRS) occurred in FY20.

The Banded Stilt (*Cladorhynchus leucocephalus*; N = 2) listed as Vulnerable under the *National Parks and Wildlife Act 1972* (NPW Act), was observed interacting with the TRS during FY20.

These numbers are extremely low in terms of overall population and therefore, it is concluded that there were no significant adverse impacts to South Australian or Commonwealth listed species as a result of interactions with the TRS.

4.3.2 Compliance criteria

No significant adverse impact on the size of an important population of Banded Stilt (*Cladorhynchus leucocephalus*) as a result of interactions with the Olympic Dam TRS. *NOTE: Significant impact is as defined in the Significant Impact Guidelines as greater than predicted in the EIS* (FA 2.3).

The Banded Stilt listed under the NPW Act was observed within the TRS during routine weekly monitoring undertaken by trained Environment personnel in FY20. No Banded Stilts were observed in the opportunistic observations recorded by the TRS Technicians in FY20.

Given the low number of observations in FY20, it is concluded that there was no significant impact on the size of an important population of Banded Stilt as a result of interactions with the TRS.

4.3.3 Deliverables (FA 2.3)

An assessment of fauna activity and losses within the TRS.

An evaluation of the effectiveness of control measures and targets in reducing the number of listed migratory birds lost within the TRS.

During FY20, 24 different bird species and three other animal species were observed during the weekly monitoring of the TRS. A total of 163 live animals were observed throughout the year, with 11 showing signs of being affected by the TRS liquor, and 24 dead birds were observed. It is unclear whether all affected species died as a result of contact with, or ingestion of, liquor. The Australian Raven was recorded in the highest numbers during FY20, with a total of 43 recorded.

Overall, there has not been a significant increase or decrease in the number of alive and dead birds observed at the TRS from FY13 to FY20 (Alive: $F_{1, 32} = 3.376$ $p = 0.076$; $R^2 = 0.101$; Dead: $F_{1, 32} = 2.441$ $p = 0.129$, $R^2 = 0.075$; Figure 74). The variability in the numbers observed is most likely due to environmental factors, such as rainfall (Figure 73).

New controls are still being evaluated prior to undertaking further trials and therefore they cannot currently be analysed for their effectiveness at reducing listed migratory species.

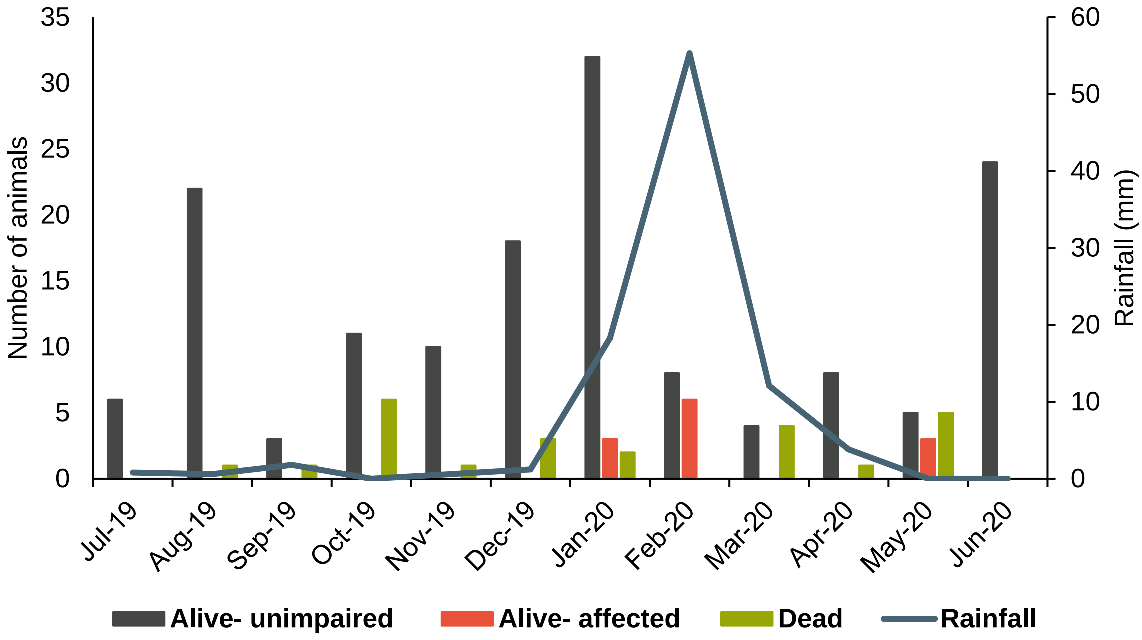


Figure 73: Monthly summary of weekly monitoring for FY20, showing total number of animals recorded as alive, yet unaffected, alive, but affected and confirmed as dead within the TRS. Rainfall data presented is collected from the Roxby Downs weather station.

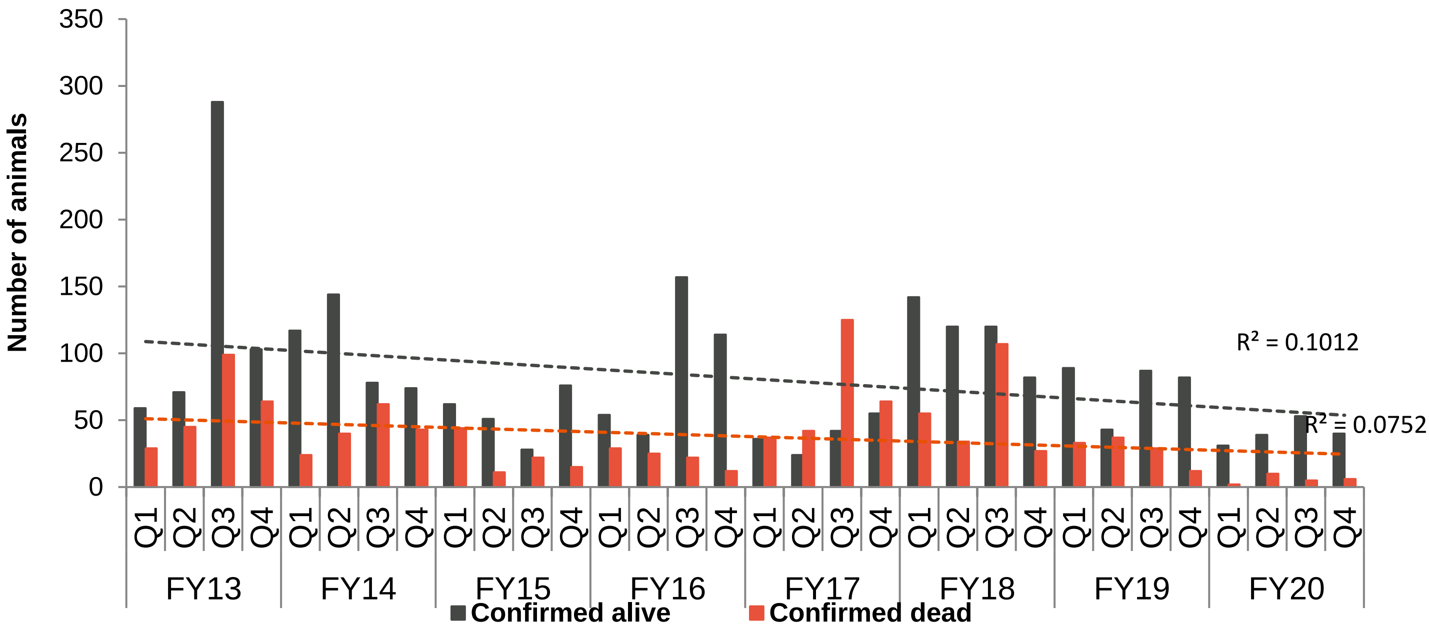


Figure 74: Quarterly summary of all weekly monitoring, showing total number of animals recorded within the TRS. Dashed lines represent linear trends. * Retrospective change made to FY19 data with incorrect numbers reported last year.

All fauna observed opportunistically (i.e. outside formal monitoring sessions) during FY20 are summarised in Figure 75. Opportunistic observations bias towards live animals, especially large flocks, hence more live animals than dead animals are usually observed.

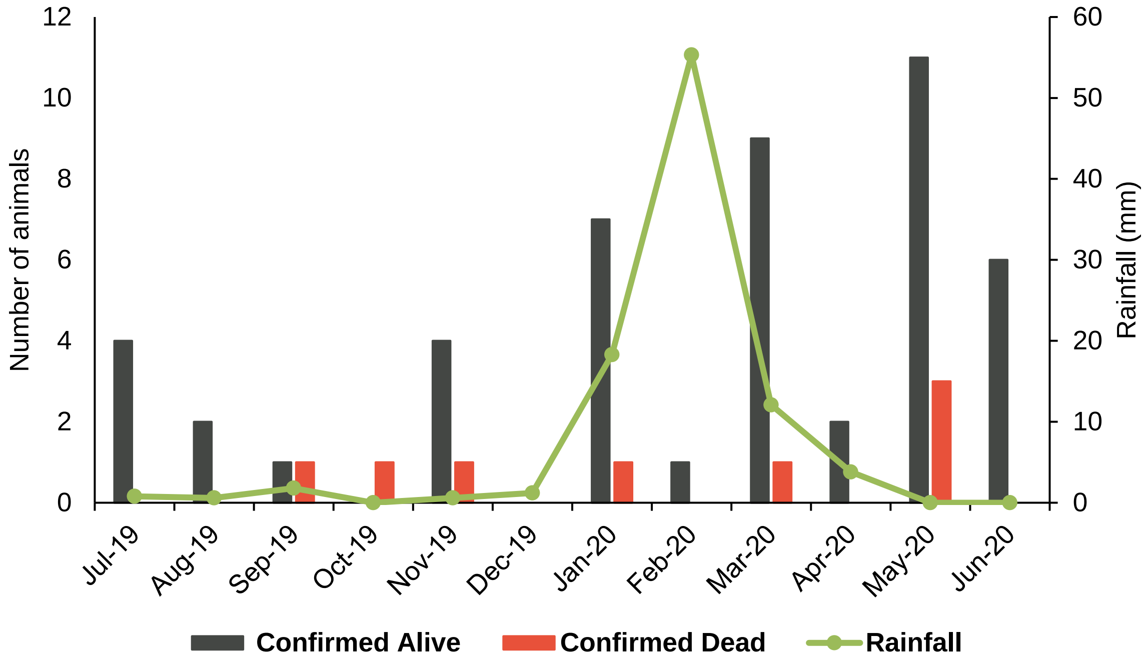


Figure 75: Monthly summary of opportunistic observations for FY20, showing total number of animals recorded within the TRS. Rainfall data presented is collected from the Roxby Downs weather station.

The data presented indicates the number of fauna counted and does not represent total numbers; they are presented as an index only. A number of factors are considered when interpreting and refining the monitoring and data analyses, these include:

- Birds may be seen and recorded as alive on one day and subsequently may be observed as dead. The total includes both observations, leading to a possible overestimate;
- Scavenging by birds of prey and corvids means that some carcasses may be removed from the system prior to an observation being made;
- Carcasses floating in the liquor may sink and disappear before being recorded; and,
- Some fauna species may leave the system and die elsewhere.

The number of birds recorded as dead at the TRS may represent a small proportion of those that visited. Preventing and deterring visitations by large flocks of birds, particularly Banded Stilts, remains a focus of management efforts at the TRS.

4.3.4 Leading Indicators

- None applicable

4.3.5 Targets FY20

- None applicable

4.3.6 Actions FY20

Continue investigating and trialling alternative deterrent technologies when they become available.

A summary of deterrents trialled to-date has been compiled and the process has derived a short-list of potential deterrent and offset options to be further explored based on their high feasibility, low cost and unknown effectiveness (e.g. most deterrent options only had anecdotal evidence available). As a result of this process, ODC has identified two plausible options to investigate further, both audio based deterrents. The results of this desk-top review will be used to inform relevant stakeholders of the identified best approaches for managing avian interaction with the TRS. Research into alternative deterrent technologies will continue in FY21.

4.4 Solid waste disposal

4.4.1 Environmental Outcome

No significant adverse impacts as a result of management of solid waste.

The Resource Recovery Centre (RRC) effectively manages solid waste as per the EPA approved Landfill Environmental Management Plan 2019 (LEMP). No evidence of material environmental harm was identified through routine auditing or based on the reporting of materials disposed of to the landfill. Therefore, it can be concluded that no significant adverse impacts resulted from the management of solid waste at Olympic Dam during FY20.

During August 2019, a small fire occurred on the landfill following the relocation of heavy equipment across the landfill surface. This was quickly resolved and was reported to the EPA in line with EPA Licence 1301 requirements. As a result of this event, the importance of waste segregation was raised within toolbox meetings across site.

4.4.2 Compliance criteria

No site contamination leading to material environmental harm arising from the operation of the Resource Recovery Centre (WA 2.5, 2.6).

Solid wastes which cannot be reused or recycled by the RRC and have not been contaminated by processing chemical wastes are disposed of into the general waste landfill facility. The RRC effectively manages solid waste as per the approved EPA Landfill Environmental Management Plan (LEMP) so that no actual or potential environmental harm is caused by the storage of non-chemical waste materials.

Waste is minimised, stored, transported and disposed of in a manner that controls the potential risk of adverse impacts to the environment and communities through implementation and maintenance of the LEMP. No evidence of actual or potential environmental harm was identified by the landfill based on routine auditing and reporting conducted during FY20.

4.4.3 Deliverables (WA 2.5)

Records of quantities of general and industrial waste disposed of to landfill.

Records of all waste delivered to the Resource Recovery Centre (RRC) were maintained by the waste management contractor during FY20. These records show a total amount of waste and recycling materials delivered to the RRC for further management and disposal equated to 22,057t in FY20. Of this total 6,298t was disposed of directly into the permanent landfill. A total of 15,759t of recyclable materials were collected from recycling points on site during FY20 (Table 1).

An annual monthly average of approximately 20.7% of recyclable materials were recovered through implementing point source segregation recovery streams during FY20. An overview of waste quantities and historical trends is displayed in Table 26 and Figure 76 as an overall percentage of total volumes.

During FY20 a weighbridge was installed and calibrated, this improvement will foster further improvements to the waste management of the Landfill and Total Recyclable Materials area.

Table 24: Waste quantities delivered to one of the delivery points within the RRC and total recyclables recovered and diverted to recycling stockpiles for off-site recycling.

	Quantity (tonnes)	Quantity (tonnes)
Total waste received at RRC FY20	**22,057**	
Disposed to permanent landfill		6,298
From recycling collection areas to recycle stockpile		15,759
Balance		**22,057**

**Note:* m^3 *converted to Tonnes using conversion factors. Balance may not equal sum of numbers due to rounding.*

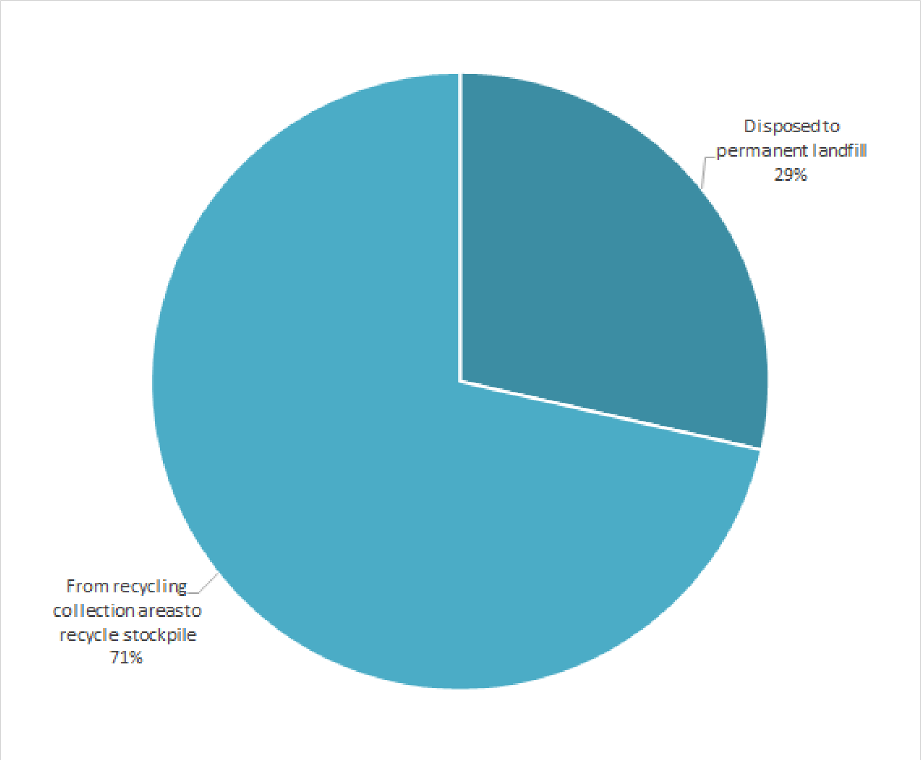


Figure 76: Overview of total waste as a percentage delivered to the RRC for FY20.

Historical waste volumes of landfill disposal and total recyclable materials sent offsite to a licenced facility for further processing between 2003 and 2020 are shown in Table 25. Figure 77 shows the estimated tonnage of waste disposed of to the landfill on an annual basis from 2003 to 2020 inclusive.

Table 25: Historical total waste received at the Resource Recovery Centre (2003-2020).

Year	Landfill Disposal (m^3)	Total Recycled Materials (Tonnes)
2003	30,622	193
2004	27,348	617
2005	14,578	510
2006	45,361	347

Year	Landfill Disposal (m^3)	Total Recycled Materials (Tonnes)
2007	47,964	685
2008	52,171	673
2009	40,898	936
2010	32,980	1,890
2011	37,511	1,735
2012	36,291	2,644
2013	17,739	1,248
2014	31, 433	1, 232
2015	34, 939	3, 073
2016	27, 355	2, 651
2017	30, 081	1, 957
2018	55, 254	1, 513
2019	59,608	3,145
2020	75,741	4,273

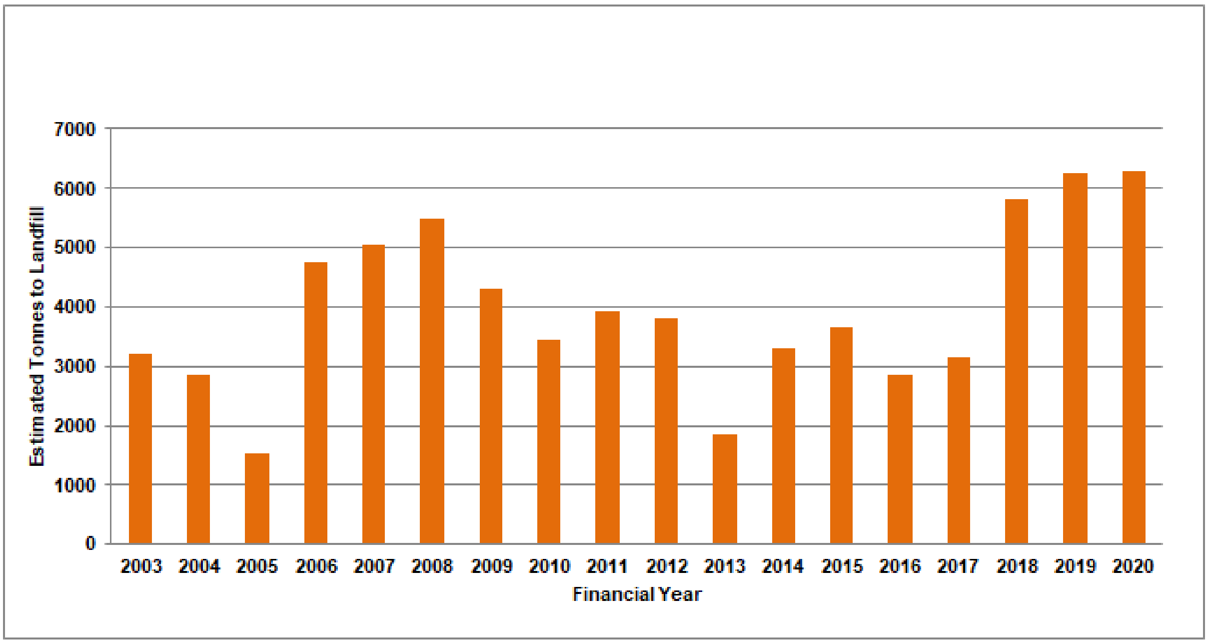


Figure 77: Historical overview of general waste quantities to landfill disposal 2003-2020.

**Note estimated tonnes is based on recorded cubic meters then by applying conversion factors..*

Records of quantities of material recovered for reuse and recycling.

Records maintained by the RRC waste management contractor show the total recyclable material transported off-site in FY20 equalled 4,273t, an increase of 30.14% on the previous year, being the highest level of removal of recycled material from Olympic Dam since commencement of operations.

Table 26 provides an overview of the recyclable materials captured and the quantity of each material removed from site during FY20 to licenced facilities for recycling.

Table 26: Recyclable material transported off-site for recycling in FY20.

Recycling removed from site	Quantity (Tonnes)	Quantity (Tonnes)
Total Recycling FY20	**4,273**	
Batteries		18
Hydrocarbons (Clean waste oil)		1,094
IBC's		96
Metal		1,995
Plastic		60
Timber		1,003
Tyres		5
Balance		**4,273**

**Note: Balance may not equal sum of numbers due to rounding.*

Figure 78 provides an overview of each recyclable category as a percentage during FY20 sent off-site and Figure 79 provides an overview of the historical off-site recycling trends to appropriately licenced facilities (2003-2020 inclusive).

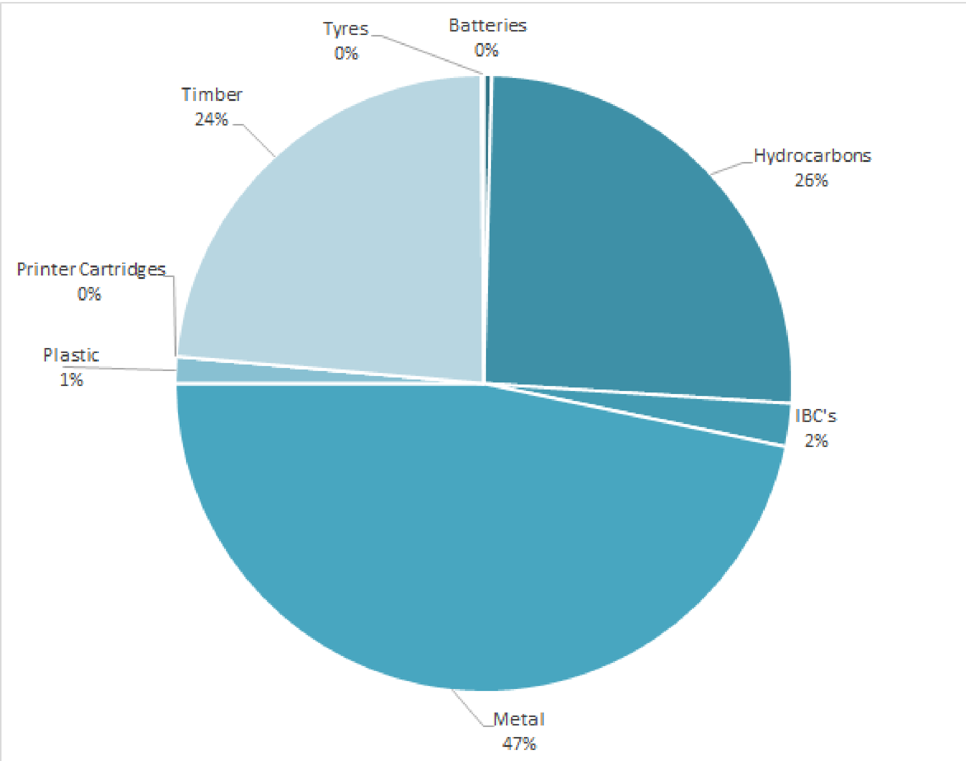


Figure 78: Category of recyclable materials transported offsite as a percentage during FY20.

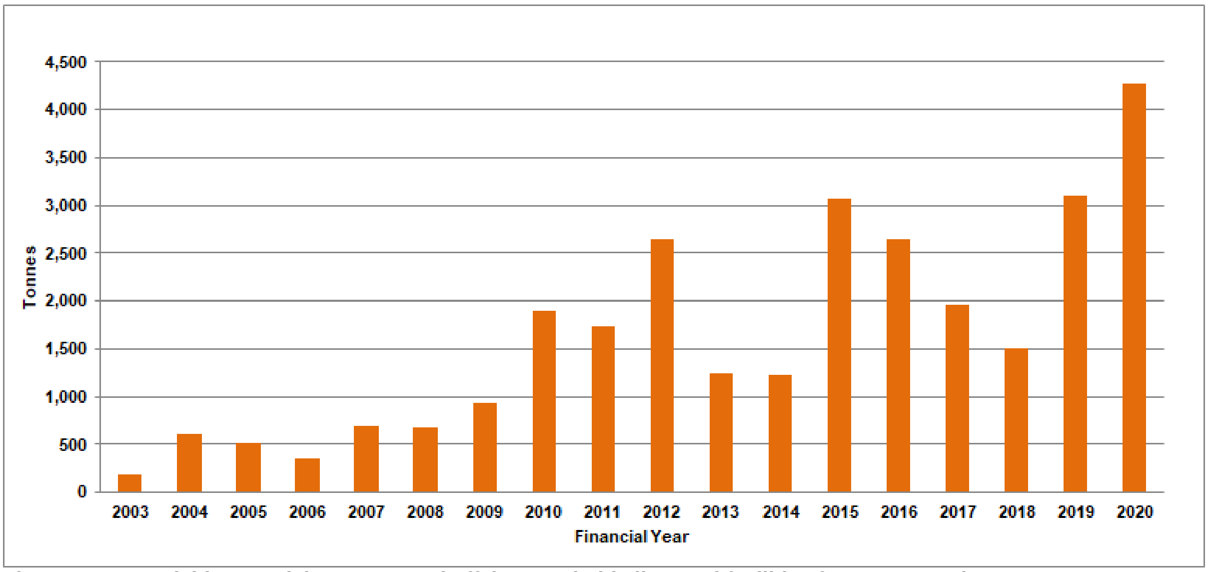


Figure 79: Recyclable materials transported offsite to suitably licenced facilities for re-processing 2003- 2020.

4.4.4 Deliverables (WA 2.6)

Records of categories, quantities and location of hazardous waste materials disposed of within the SML.

Depending on the type of hazardous or contaminated material, quantities are measured in cubic metres (m^3) or tonnes (t). Records of hazardous waste disposed of within the SML are shown in Table 27 .

Contaminated waste disposed within the SML is discussed within the Radioactive waste section of this report (Chapter 4.5), whilst disposal of hazardous waste is to the Tailings Storage Facility (TSF). Risk assessments of materials being disposed of to the TSF ensure that TSF integrity is not compromised.

Where possible, process waste is disposed of via bunded areas and directed to tails disposal. This reduces the amount of waste disposed of at the tailings waste finger.

Records provide evidence that listed waste is appropriately managed, specifically:

- that listed waste is stored, contained and treated in a manner that does not cause environmental harm or nuisance or present risks to human health and safety;
- that all listed waste storage containers are of a suitable strength and durability, are clearly marked and contain appropriate safety warnings;
- that all listed wastes do not contact soils or stormwater, and that measures to prevent and recover spillages are implemented as necessary.

The waste management contractor is responsible for maintaining all hazardous waste management records at the RRC. The location, type and quantity of hazardous waste is recorded in an electronic register, as per all relevant regulations and site procedures. The transport of hazardous waste off-site is documented through the EPA waste transport and tracking system, providing assurance that wastes are managed appropriately so as not to cause environmental harm or present a risk to human health and safety. Table 27 provides an overview of waste management streams which are approved under the Tailings Retention Storage Waste Management Plan for disposal to the TRS.

Table 27: Hazardous wastes disposed of within the SML's Tailings Retention Storage System FY20

Source of waste	Quantity of Waste (tonnes)
Total hazardous wastes to the TRS in FY20	**6,239**
Acid Plant	529
Concentrator and Hydromet	0.00
Electro Winning and Gold Room	108
Geometallurgy labs	2
Miscellaneous Waste cleared for TRS	4,748
Onsite laboratory	0.00
Process waste	690
Refinery	68
Smelter	19
SX Area	74
Balance	**6,239**

** Balance may not equal sum of numbers due to rounding.*

Other hazardous waste removed from site for disposal at licenced facilities consists of hydrocarbon waste such as oily rags, oily filters and waste acid as shown in Table 28.

ODC complies with the requirements of EPA Licence 1301 pertaining to listed and controlled waste by adhering to the approved Landfill Environmental Management Plan (LEMP), which meets government and ISO 14001 requirements. Spill kits are available at all collection and loading points for listed waste (e.g. Waste Oil Facility and Distribution Centre).

Table 28: Record of hazardous waste collected and removed off-site for further treatment during FY20.

Type of waste	Quantity of Waste	Units
Contaminated waste oil	1	Tonnes
Gasser solution	1	Tonnes
Mixed waste (wax/plastic)	40	Tonnes
Oily filters & hydrocarbons	133	Tonnes

**Note: Contaminated waste oil refers to spilt oil containing inclusions such as coolant, water, dirt, dust or plastic.*

4.4.5 Leading Indicators

- None applicable

4.4.6 Targets FY20

Increase at source waste segregation to reduce waste to landfill

All recycling stations across site have colour coded skip bins to assist with segregation at source. This has resulted in approximately 20% diversion of recyclable material at source during FY20. This improvement at the source has led to a reduction in second-hand sorting once received at the RRC tip-face. Additional skip bins will be provided at specific locations to facilitate at source segregation in FY21, including temporary areas such as Projects.

Reduce recycling stockpiles by 20 %

Following the site goal to reduce historical steel stockpiles to manageable levels the volume of these stockpiles greatly decreased in FY19 and further so in FY20. ODC will continue to work closely with the waste management contractor to continue maintaining recycling stockpiles in line with the EPA guideline for stockpile management: waste and waste derived products for recycling and reuse (2019).

A total increase of 30.4% (4,273t) in recyclable materials, received at off-site licenced recycling facilities in FY20, when compared to the total recycled volumes from FY19.

4.4.7 Actions FY20

Implement a plan for reducing stockpiles of recyclable material

Work continued during FY20 to reduce historical steel stockpiles with 1,995t of steel sent off site for recycling. Following from FY19 (~2,389t) this equates to 4,384t of steel recycled offsite in the past two years. This has led to a noticeable reduction in historical steel in stockpiles, with work continuing in FY21 with continued implementation of the waste contractors' annual stockpile management plan.

Implement a site wide paper/cardboard recycling programme with bailing and off-site removal/recycling

During FY20 a project to improve the sorting efficiencies at the RRC and processing of recovered materials (waste segregation project) was amalgamated with the paper and cardboard project described in the FY19 EPMP Report. Due to current market constraints the recycling of paper and cardboard project is currently on hold until a suitable end user for the captured material can be located within Australia.

The RRC sorting efficiencies project is continuing through the Project development phases. This will continue in FY21.

4.5 Radioactive waste

4.5.1 Environmental Outcome

No adverse impacts to public health as a result of radioactive waste from ODCs activities.

ODC has consistently operated in a manner that limits radiation dose to members of the public from radioactive waste, to less than a small fraction of the International Commission on Radiological Protection (ICRP) 1 mSv/yr limit. As a result, there are no adverse radiation exposure impacts to the public from activities undertaken at Olympic Dam.

No significant adverse impacts to populations of listed species or ecological communities as a result of radioactive waste from ODCs activities.

There were no significant adverse impacts to populations of listed species or ecological communities as a result of ODCs activities. Monitoring of radiation doses to the public and the deposition of ^{238}U at non-human biota assessment sites is used as an indicator of the potential exposure of listed species to radioactive waste.

Deposition of ^{238}U at non-human biota assessment sites was at a level which poses no significant adverse impacts to non-human biota (refer to chapter 3.4).

4.5.2 Compliance criteria

Radiation doses to members of the public less than 1mSv/y above natural background.

The total estimated dose (FY20) to members of the public at Roxby Downs Monitoring Site (RDMS) and Olympic Village Monitoring Site (OVMS) contributed by ODC operations was 0.060 mSv and 0.074 mSv respectively.

Deposition of project originated ^{238}U less than 25 Bq/m^2/y at the non-human biota assessment sites.

The average deposition of U-238, calculated as an average of results at the four monitoring sites was determined to be 0.75 Bq/m^2/y, well below the 25 Bq/m^2/y compliance criteria.

4.5.3 Deliverables (WA 2.7)

Records of the categories, quantities and location of LLRW and contaminated material disposed of within the SML.

A waste management register is maintained by site staff and the waste management contractor to track origin/s of the structural waste, including waste category, quantities, radiation testing results and final disposal or storage location.

Contaminated Waste is defined as structural waste from within the operational mining and processing areas which after surface cleaning retains a radiation surface area activity of greater than 4,000Bq/m^2 and a radiation activity level below 1Bq/g. Any structural waste which returns activity readings below these thresholds can be safely recycled, any cleaned materials which remain above these thresholds must remain onsite. Table 29 shows the total tonnage of structural waste which once cleaned has remained above the safe transport thresholds and therefore been placed into a purpose built Contaminated Waste Disposal Facility (CWDF 2017-2020 inclusive).

Table 29: Permanent Contaminated Waste Disposal Facility (CWDF).

CWDF Storage Location	Type of waste	FY	Quantity of Waste (tonnes)
Cell 1 Stage 1	Contaminated structural equipment	FY17	3,304
Cell 1 Stage 1 Cell 1 Stage 2	Contaminated structural equipment	FY18	2,088
Cell 1 Stage 2	Contaminated structural equipment	FY19	2,042
Cell 1 Stage 2	Contaminated structural equipment	FY20	1,566
Total in storage end FY20			**9,002**

The use and closure of each CWDF Cell stage is implemented through the requirements of the approved Contaminated Waste Management Plan. CWDF Cell 1 Stage 1 was approved and constructed adjacent to the Resource Recovery Centre during FY17 and was backfilled in FY18 once capacity was achieved. CWDF Cell 1 Stage 2 (Lift 1), directly above stage 1 was constructed in FY18 and currently remains in operation.

The regulatory framework for a CWDF is contained within the current licence conditions for the Olympic Dam Licence to Mine (LM1), which requires ODC to comply with the Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (ARPANSA 2005a). ODC is required to seek regulatory authorisation for various stages of the CWDF facility/cells and to have a Radioactive Waste Management Plan (RWMP) developed and maintained. Figure 80 provides and overview of the tonnages sent for storage and to which CWDF cell stage.

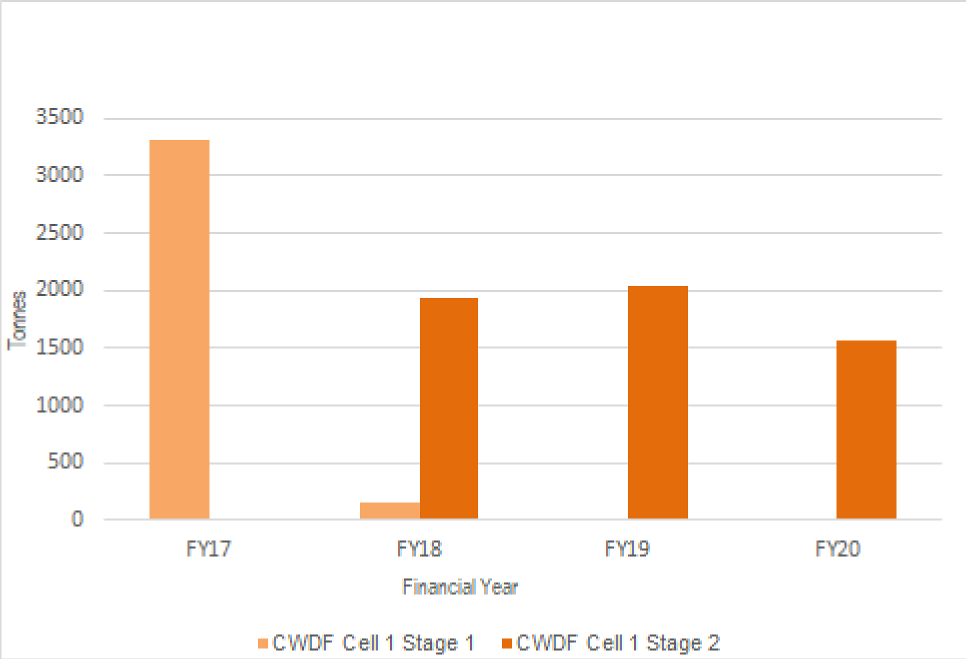


Figure 80: Overview of structural waste tonnage received at each of the CWDF cells currently utilised at OD.

Some structural waste materials return active radiation readings above >4,000Bq/m^2 and >1Bq/g after cleaning and decontamination processes have been implemented. These materials are classified as Low-Level Radioactive Waste (LLRW) and are therefore segregated away from other structural contaminated waste materials. Table 30 summarises the quantity of LLRW stored under pre-disposal management which currently meets the contaminated waste thresholds.

Table 30: Low Level Radioactive Waste currently in storage

Storage Location	Type of waste	FY	Quantity of waste stored (tonnes)
LLRW Area	Structural waste as LLRW	FY18	115
LLRW Area	Structural waste as LLRW	FY19	44
LLRW Area	Structural waste as LLRW	FY20	173
Total in storage end FY20			**332**

The cleaning of structural materials from processing and mining areas of the mine has proved to be a successful method for reducing the radiation levels, with the overall volumes of contaminated waste required to stay on site in a CDWF cell greatly reduced. The testing program has enabled OD to safely recycle a large quantity of metal waste.

4.5.4 Leading Indicators

Indications that a dose constraint of 0.3 mSv/y to members of the public above natural background will be exceeded.

Indications that a reference level of 10 µGy/h for impact on non-human biota above natural background will be exceeded.

No leading indicators were triggered. Doses to members of the public are below Olympic Dam's internal dose constraint of 0.3mSv/yr. Similarly the reference level of 10uGy/h for impacts on non-human biota has not been triggered.

4.5.5 Targets

Maintain radiation doses as low as reasonably achievable, as assessed through the annual Radiation Management Plan review.

Quarterly ODC radiation monitoring results, radiation dose calculations and occupational hygiene results are presented to the regulatory authorities for review. In addition, an annual adequacy and effectiveness review is completed each year confirming that doses are as low as reasonably achievable.

4.5.6 Actions FY20

None applicable.

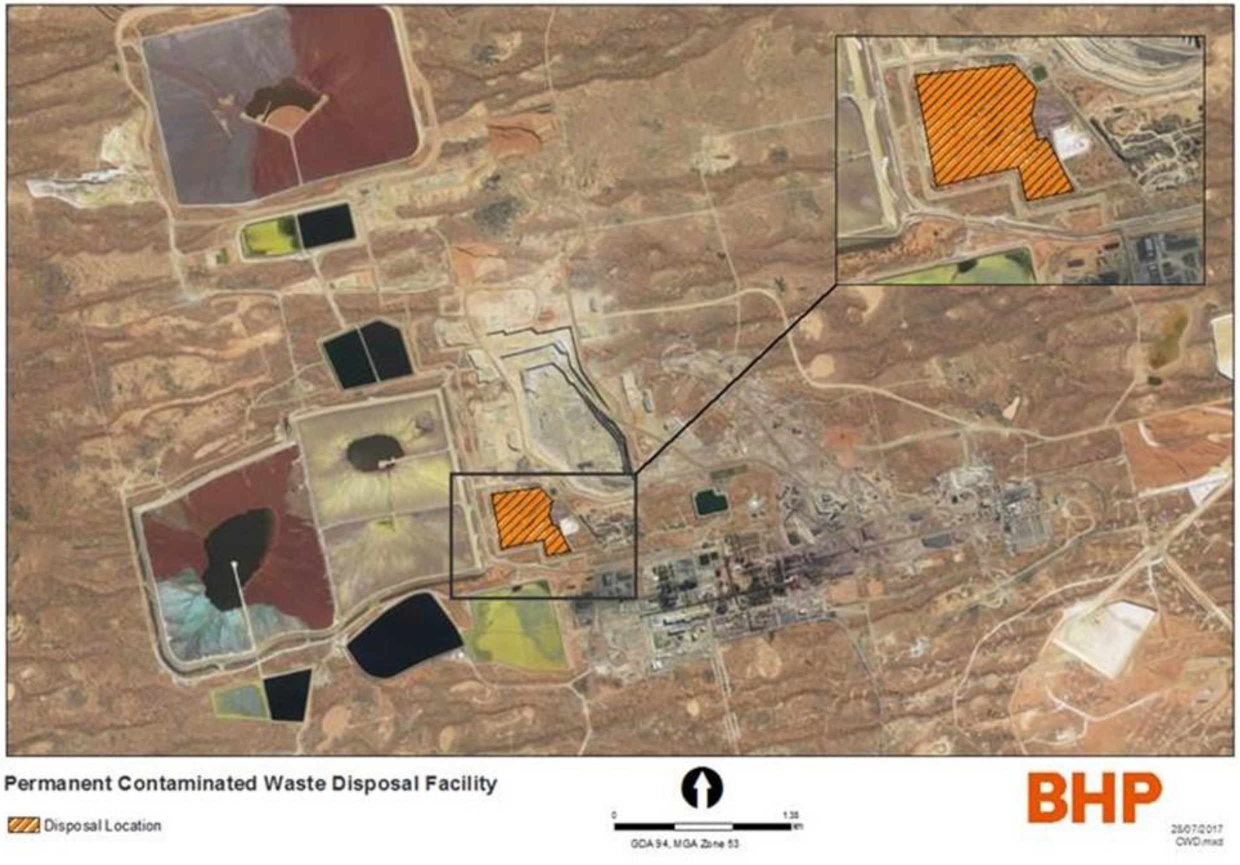


Figure 81: Approved Contaminated Waste Disposal Facility (CWDF).

Figure 82: Currently active disposal area within CWDF Cell 1 Stage 2

5 Interaction with communities

5.1 Community interaction

5.1.1 Environmental Outcome

Residents in Roxby Downs, Andamooka and Woomera have a favourable view of ODC.

Responses to the 2017 Olympic Dam Community Perception Survey indicate that ODC is a trusted organisation within its local communities. In addition to this, ODC provides employment to local and regional communities. The next Community Perception Survey is being undertaken in July-August 2020.

5.1.2 Compliance criteria

Community concerns are tracked and all reasonable complaints are addressed where reasonably practical.

ODC has a process to receive and track community enquiries, concerns, complaints and grievances through the company's complaints procedure and stakeholder engagement management plan. ODC received one complaint in FY20 relating to gates left open on a pastoral property.

5.1.3 Deliverables (SE 2.1)

A description of the extent to which residents in Roxby Downs, Andamooka and Woomera trust ODC to act in their best interest (calculated triennially).

Responses to the 2017 Olympic Dam Community Perception Survey indicate that ODC is viewed favourably within its local communities. In addition to this, ODC provides employment to local and regional communities. The next Community Perception Survey is being undertaken in July-August 2020.

In addition, BHP has engaged CSIRO to run the Local Voices community perception surveying in Minerals Australia host communities, including Olympic Dam, with monthly perception surveying underway since October 2019. Findings of the anchor (baseline) surveying (held over March-April 2019) were also provided to the community and key stakeholders in discussions facilitated by CSIRO in October 2019.

Local Voices measures the community's Trust in, and Acceptance of, BHP, and other key indicators, over the survey period.

Figure 83 shows outcomes across key indicators at three key points in time; during the Anchor (baseline) survey in March-April 2019; six months after the monthly perception survey began (March 2020), and during the 'peak' COVID-19 impact period (April/May 2020).

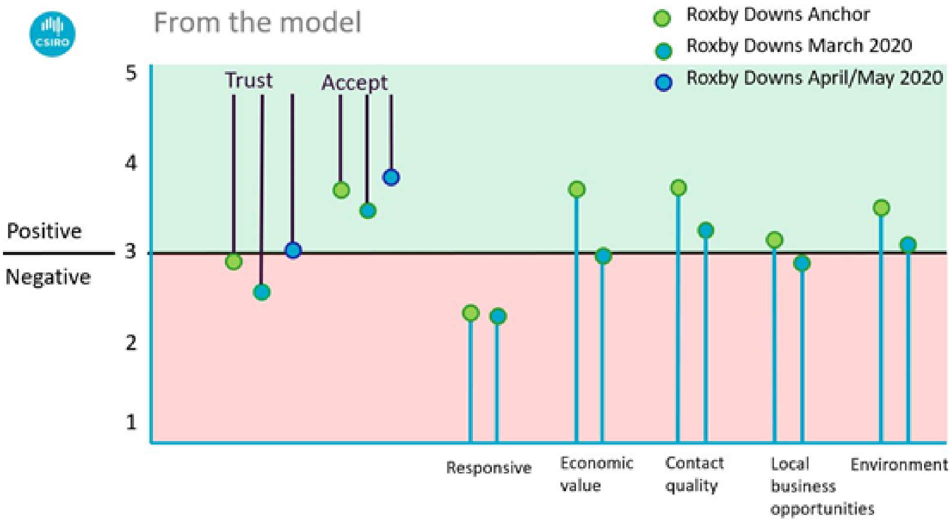


Figure 83: Local Voices key indicators

The data shows that in April-May 2020, Trust and Acceptance in BHP improved – reflecting that the community looked to and trusted BHP to help lead it through the challenges of COVID-19, and in response to BHP's increased engagement and communications efforts with key stakeholders and the broader community.

Other key indicators – responsiveness, economic value, contact quality, local business opportunities and environment - all declined between October 2019 and March 2020. Comments received by survey respondents indicate that these metrics could have been impacted by community perception about the changing nature of the town (including anti-FIFO sentiment), concerns about less BHP management living locally, BHP spending on Adelaide projects (potentially BHP's new Adelaide offices), BHP not "sticking" to plans, and job security.

5.1.4 Deliverables (SE 2.2)

A description of residents' perceptions about quality of life services and facilities, safety and social fabric in Roxby Downs, Andamooka and Woomera (reported triennially).

ODC undertook a Community Perception Survey in 2017. Perceptions amongst survey participants raised concerns regarding availability of retail stores, cost and reliable access to power, job security and access to increased medical facilities. The next Community Perception Survey is being undertaken in July-August 2020.

Furthermore, the CSIRO Local Voices survey (as mentioned above), which was launched in October 2019, provides additional monthly feedback on residents' perceptions about services, facilities, safety and social fabric in Roxby Downs.

Through the COVID-19 period, Local Voices data provided a specific insight into survey respondents' feelings, concerns and perceptions during the pandemic. In April-May 2020, respondents were particularly concerned about small business impacts, FIFO transmittal of COVID-19 into the community, the economic impact of cancellation of community events and activities, and employment impacts. In response, BHP implemented a number of additional tools to more proactively engage with the local community, including a weekly newsletter providing regular updates on BHP's response and management of potential and real COVID-19 impacts.

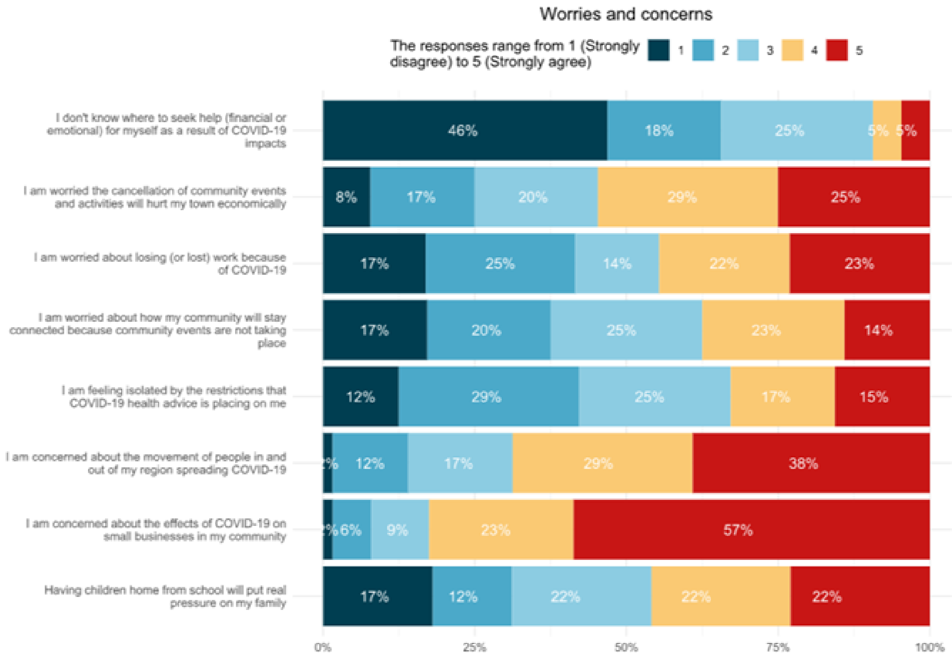


Figure 84: Local Voices April-May 2020 – key concerns

5.1.5 Leading Indicators

- None applicable

5.1.6 Targets

- None applicable

5.1.7 Actions FY20

Undertake the triennial Community Perception Survey to monitor local community perceptions of ODC, and of local services and facilities.

The triennial Community Perception Survey was undertaken in 2017 to monitor local community perceptions of ODC, and of local services and facilities. The next survey is being undertaken in July-August 2020.

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7 Glossary

ADU	Ammonium diuranate, commonly referred to as Yellowcake
AE	Monitoring Program – Airborne Emissions
AHD	Australian Height Datum, a measure of elevation referenced from approximate sea level
ANCOLD	Australian National Committee on Large Dams
ANZECC	Australian and New Zealand Environment and Conservation Council.
Aquifer	Porous water bearing formation of permeable rock, sand, or gravel capable of yielding significant quantities of water.
APTS	Acid Plant Tails Stack
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
Bq	Becquerel, a unit of radioactive decay
$Bq/m^2/y$	Becquerels per square metre per year
CEMP	Carbon Emissions Management Plan
Ca	Calcium
CAF	Cemented aggregate fill
Closure	Permanent cessation of operations at a mine or mineral processing site after completion of the decommissioning process, signified by tenement relinquishment
CD1, CD2	Concentrate Dryer 1, Concentrate Dryer 2
CO_2-e	Carbon dioxide equivalent
Cu	Copper
CWDF	Contaminated Waste Disposal Facility
DEM	Department for Energy and Mining
Domestic Water Use	Water used in the town of Roxby Downs or Olympic Dam Village
DSD	Department of State Development
ER	Monitoring Program – Environmental Radiation
ED	Effective dose
EG	Monitoring Program – Energy Use and Greenhouse Gas (GHG) Emissions

EDD	Effective dose attributable to radionuclides in dust
EEO	Energy Efficiency Opportunities – Federal government legislation
EDP	Environmental Disturbance Permit
EIP	Environmental Improvement Plan
EIS	Environmental Impact Statement
EMM	Environmental Management Manual
EMS	Environment Management System. The part of an organisation's management system used to develop and implement its environmental policy and manage its environmental aspects (Standards Australia / Standards New Zealand 2004). Note: A management system is a set of interrelated elements used to establish policy and objectives and to achieve those objectives. A management system includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources.
Environmental Aspect	An element of the organisation's activities or products or services that can interact with the environment (Standards Australia / Standards New Zealand 2004).
Environmental Impact	Any change to the environment, whether adverse or beneficial wholly or partially resulting from an organisation's environmental aspects (Standards Australia / Standards New Zealand 2004).
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth).
EPMP	Environmental Protection and Management Program. Describes the environmental management and monitoring activities undertaken by BHP Olympic Dam for the purpose of quantifying any change in the extent or significance of its impacts, assessing the performance of control measures employed to limit impacts, and/or to meet legal and other obligations.
EPP 1994	Environment Protection (Air Quality) Policy 1994
EPP 2015	Environment Protection (Water Quality) Policy 2015
Evaporation Pond EP	A containment pond to hold liquid wastes to assist with disposal of liquor via evaporation
FA	Monitoring Program - Fauna
FL	Monitoring Program - Flora
FoS	Factors of Safety
FY	Financial Year
GA	Monitoring Program – Great Artesian Basin
GAB	Great Artesian Basin

GEMS	Global Event Management Solution
GIS	Geographical Information System
GHG	Greenhouse Gas
GW	Monitoring Program – Groundwater
g/m^3	Grams per cubic metre – a measure of dust concentration in air
Gy/h	Grays per hour – a measure of absorbed radiation dose
ha	Hectare
ICRP	International Commission on Radiological Protection
ID	EMP chapter identification
Industrial Water use	Water used in mining or mineral processing operations and excluding domestic water use
kg CO_2-e	Kilograms of carbon dioxide equivalence – a standard measure of greenhouse gas emissions
kg CO_2-e/t	Kilograms of carbon dioxide equivalence per tonne of material milled – a measure of greenhouse gas emission intensity of ODC
kL/t	Kilolitres per tonne
kt	Kilotonne
Listed Species	Those species or communities that are listed as threatened or migratory under Commonwealth and/or relevant State or Territory legislation
LEMP	Landfill Environmental Management Plan
LNAPL	Light Non-Aqueous Phase Liquid
LLRW	Low level radioactive waste
mAHD	Elevation in metres with respect to the Australian Height Datum
mg/Nm^3	Milligrams per normal cubic metre
ML	Megalitres
ML/d	Megalitres per day
MP	Monitoring Program. A document which describes the environmental monitoring activities undertaken by ODC for the purpose of quantifying any change in the extent or significance of its impacts, assessing the performance of the control measures employed to limit its impacts, and/or to meet its legal and other obligations.
Mt	Million tonnes
mSv	Millisieverts, a measure of equivalent radiation dose
mSv/y	Millisieverts per year, a measure of equivalent radiation dose per year

MWDP	Mine water disposal pond
NaCl	Sodium chloride (salt)
NEPM 2011	National Environment Protection Measure. NEPM investigation levels (Health Investigation Level Scenario D: Industrial/Commercial land use; Schedule B1 - National Environmental Protection (2011)
NGER	National Greenhouse and Energy Reporting. Federal government reporting of greenhouse gas emissions and energy use and production
NHB	Non-human biota
Nm^3	Normal metres cubed, referring to volume at standard temperature and pressure
NO_x	Oxides of nitrogen
NPW Act	National Parks and Wildlife Act 1972 (SA)
NVMP	Native Vegetation Management Plan
ODC	BHP Billiton Olympic Dam Corporation Pty. Ltd.
OV	Olympic Village, the accommodation camp located at Olympic Dam township
OVMS	Olympic Village Monitoring Site
Pb	Lead
^{210}Pb	A naturally occurring isotope of lead, having atomic number 82, atomic mass 210 and half-life 22.3 years
pH	A measure of acidity and alkalinity
PM_{10}	Particulate matter with an effective aerodynamic diameter less than or equal to 10 µm
$PM_{2.5}$	Particulate matter with an effective aerodynamic diameter less than or equal to 2.5 µm
Po	Polonium
^{210}Po	A naturally occurring isotope of polonium, having atomic number 84, atomic mass 201 and half-life 138.38 day
ppm	Parts per million
PRH	Practical Reference Heads
Ra	Radium
^{226}Ra	A naturally occurring isotope of radium, having atomic number 88, atomic mass 226 and half-life 1599 years
RDMS	Roxby Downs Monitoring Site
Rehabilitation	The reclamation or repair, as far as practicable, of a facility to an appropriate or agreed state as required by law, or company self-regulation

Rn	Radon. Chemically inert radioactive gaseous element formed from the decay of ^{226}Ra as part of the ^{238}U decay chain
^{222}Rn	A naturally occurring isotope of radon, having atomic number of 86, atomic mass of 22 and half-life 3.8235 days
RRC	Resource Recovery Centre
RSF	Rock Storage Facility
SAP	Systems Applications Products
SE	Monitoring Program – Social Effects
SEB	Significant Environmental Benefit
SEIS	Supplementary Environmental Impact Statement
Significant aspect	An environmental aspect that has or can have a significant environmental impact. Significance is determined by risk assessment.
Significant Impact Guidelines	Australian Government, 2009, 'Matters of National Environmental Significance: Significant impact guidelines 1.1', *Environment Protection and Biodiversity Conservation Act 1999*.
SML	Special Mining Lease
SO_2	Sulphur dioxide
SO_4	Sulphate
SW	Monitoring Program – Surface Water
SX	Solvent Extraction
t	Tonnes
TDS	Total dissolved solids
TP	Tapered Piezometers, used to measure pore water pressure
TRS	Tailings Retention System. Incorporates all elements of the tailings delivery, deposition and storage system and elements associated with the collection and disposal or return of tailings liquor. The TRS includes the Tailings Storage Facility (TSF), Evaporation Ponds and Pipe Corridors including tailings delivery pipelines and liquor pipelines.
TSF	Tailings Storage Facility. Incorporates the tailings deposition and storage system, which currently comprises five storage cells.
Th	Thorium
^{230}Th	An isotope of thorium, having mass number 90 and half-life 7.54×10^4 years.
Total Industrial Water Use	Total water used including high quality (GAB) water and water recovered from other sources including abstraction of local saline water.
TSP	Total Suspended Particulates (dust)

U	Uranium
^{238}U	The most common isotope of uranium, having atomic number 92, atomic mass 238 and half-life 4.46 × 10^9 years
µGy/h	Micro gray per hour
VOC	Volatile organic compound
VWP	Vibrating Wire Piezometers, used to measure pore water pressure
WA	Monitoring Program – Waste