

# Annual Technical Report

## **GR499 AMALGAMATED REPORT**

*TITLES MLN582, MLN1121, MLN1122,  
MLN1123, MLN1124 AND MLN1125*

Title Holder: Mount Isa Mines Limited  
Operator: McArthur River Mining Pty Ltd  
Commodities: Zn & Pb  
For the period 5 January 2018 – 4 January 2019

**Bauhinia Downs 1:250,000, SE53-3  
Borroloola and Glyde 1:100,000, 6165 and 6164**

Date, Version	15 <sup>th</sup> February 2019, GR449-18_2019_GA
Department, Area	Mining Technical Services, Geology
Prepared by	MRM Geology

## Disclaimer

Amalgamated reporting was approved on 12 April 2017 and has been assigned the reporting code GR449. This amalgamated report includes the Mineral Leases; MLN582, MLN1121, MLN1122, MLN1123, MLN1124 and MLN1125, which is owned by Mount Isa Mines Pty Ltd and operated by McArthur River Mining Pty Ltd.

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# Abstract

The McArthur River mine is one of the world's largest zinc, lead and silver mines, situated approximately 65km south-west of Borroloola, near the Gulf of Carpentaria in the Northern Territory. It is operated by McArthur River Mining (MRM), a subsidiary of the Swiss mining company Glencore. Although discovered in 1955, when it was originally named the HYC ("Here's Your Chance") deposit, mining operations did not commence until 1995. Initially an underground mining operation, the mine transitioned across to an open-cut operation in 2006. The sediment-hosted stratiform HYC deposit is approximately 1.5km long and 1km wide with an average thickness of 55m. The HYC deposit has similarities with orebodies at Mount Isa in Queensland. The mine site is contained within five contiguous leases (MLN1121, MLN1122, MLN1123, MLN1124 and MLN1125), located on McArthur River Station Pastoral Lease, with MLN582 located west of these contiguous leases by a distance of approximately 4.5km. During the reporting period a series of drilling programmes was completed across MLN1121, MLN1122, MLN1123 and MLN1124 for the purpose of resource development, waste characterisation and determine groundwater interaction within the South Extension and Lower Fold Zone (LFZ) areas; to identify the geometry and spatial location of suitable clay material for waste dump construction, and identification of coarse gravels and cobbles acting as conduits for groundwater inflows to the mine operations; to determine and quantify groundwater flow interaction with geological structures near waste rock dump stockpiles (WOEF and NOEF), and containment structures (ELS, SEPROD, SPROD and TSF); and, to confirm the groundwater relationship between the NOEF and Emu Creek alluvial system. The 2018 reporting period consisted of 38 diamond drillholes totalling 4,902m, 29 RC drillholes totalling 1,261m, and 290 AC drillholes totalling 4,557m. The findings from the drilling programmes are highlighted by; a reduction in orebody thickness within the LFZ, and discontinuity of mineralisation observed east of the LFZ; South Extension drilling confirmed lower quality (nodular) mineralisation in all orebodies with exception to orebodies 2 and 8; South Extension drilling showed a slight increase in orebody thickness with a significant change in the location of the orebody when compared to the current geology model; South Extension drilling shows no palaeochannel recharge of sediments east of the current J stage and that palaeochannel water reports to the southern wall adjacent to the Southern Ramp; Alluvium Definition drilling showed suitable clays can be sourced from within the first 2-3m of the cover sequence; identification of karstic features within the Barney Hill anticline – especially related to the western side/FWQ and along the McArthur Road. Hydraulic testing of the Barney Karstic zone indicates highly permeable ground, which is related to north-south, structures (Cooley contact, Whelan's and Myrtle Fault); mineralisation between the western side of WOEf and the Barney Diversion; identification of karstic areas near the ELS, and drillcore observations, coupled with assay results have identified significant natural mineralisation, which has the potential to influence groundwater quality; hydraulic tests identified a semi-regional geological structure, which strikes beneath Cell 2 and the proposed WMD facility; and, hydraulic tests indicated a very massive and hard siliceous boundary between the HYC basin and the Emu Fault. Hydraulically, there is little to no evidence of water transmitting through this structure, which indicates the KCB model assumption is valid. No drilling activities were conducted on MLN582 or MLN1125, as they are located outside the current operational area.

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# 1. Location and Lease Details

The McArthur River mine is located 65km south-west of the township of Borroloola in the Gulf Region of the Northern Territory, approximately 900km south-east of Darwin as shown below in Figure 1.

The mine site is contained within five contiguous leases (MLN1121, MLN1122, MLN1123, MLN1124 and MLN1125), located on McArthur River Station Pastoral Lease, with MLN582 located west of these contiguous leases by a distance of approximately 4.5km. The bulk of the mines infrastructure is located on Barney Hill, on the western end of MLN1122. The McArthur River mine site lease boundaries are shown below in Figure 2 using an aerial photography overlay, with Figure 3 displaying the pit location relative to the boundaries of MLN1121. Table 1 below summarises the lease details.

TABLE 1. MCARTHUR RIVER MINING LEASE DETAILS.

Lease Type	Lease Name	Lease Number	Owner	Date Granted	Expiry Date
MLN	REWARD	MLN582	MIM	01/09/1958	31/12/2019
MLN	HYC	MLN1121	MIM	05/01/1993	04/01/2043
MLN	GLYDE	MLN1122	MIM	05/01/1993	04/01/2043
MLN	BUFFALO	MLN1123	MIM	05/01/1993	04/01/2043
MLN	EMU	MLN1124	MIM	05/01/1993	04/01/2043
MLN	EMU EAST	MLN1125	MIM	05/01/1993	04/01/2043

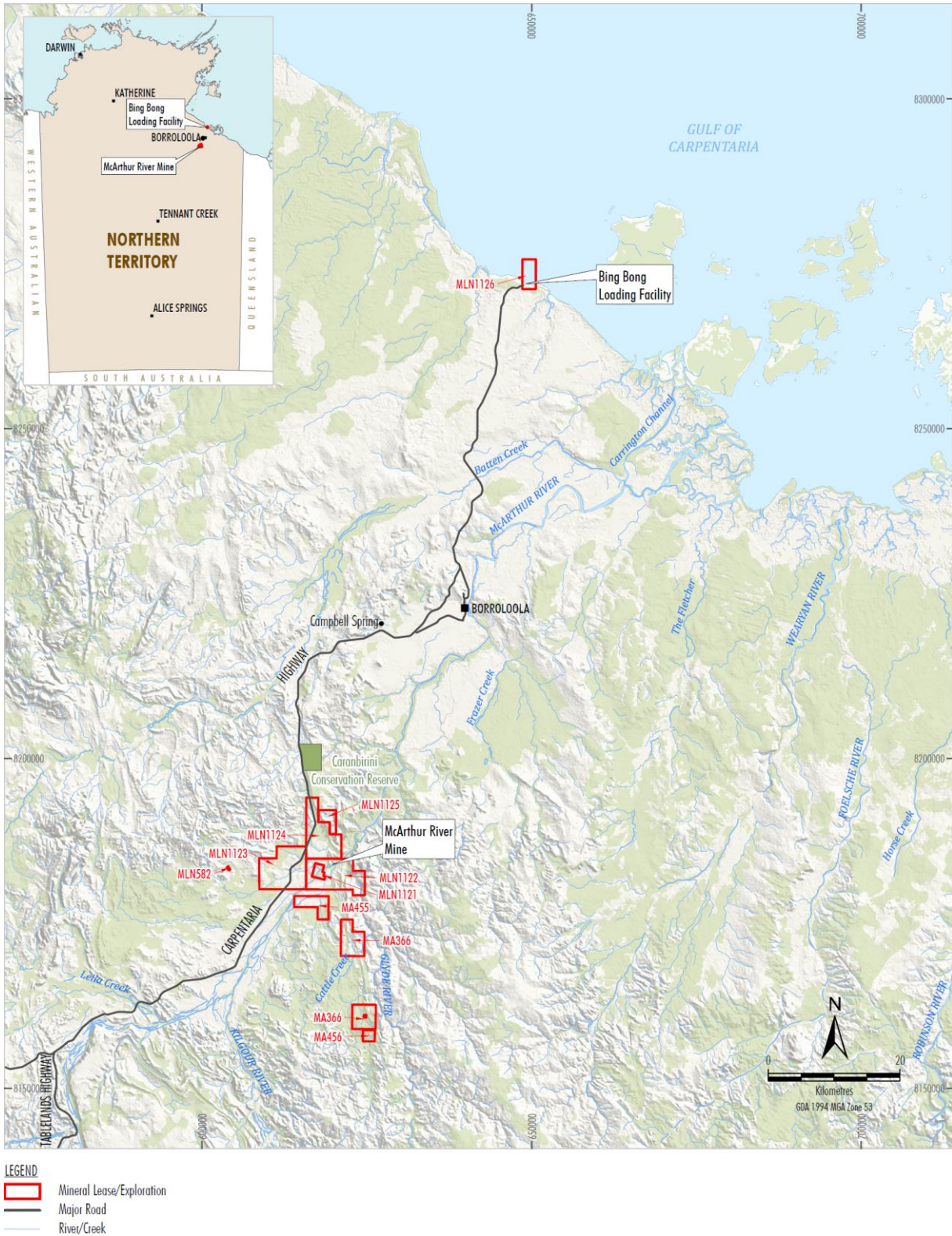


FIGURE 1. BING BONG AND MCARTHUR RIVER MINE SITE LOCATION.



FIGURE 2. MCARTHUR RIVER MINING MINERAL LEASE WITH 2013 AERIAL PHOTOGRAPHY OVERLAY.



FIGURE 3. MLN1121 OVERLAY WITH 2013 AERIAL PHOTOGRAPHY OVERLAY.

## 2. History

The orebody, which is located within MLN1121 is named Here's Your Chance (HYC) and was discovered by Mount Isa Mines Limited geologists in 1955, but development did not commence until 1995. This gap in time between the deposit's discovery and development resulted from the unusual structure and extensive faulting of the orebodies and the extremely fine-grained nature of the ore, which combined to make commercial exploitation of the resource unfeasible for many years. A number of technological advancements in mining, ore treatment and concentrate transport, were necessary before the project could proceed on an economic basis. Trial work failed to develop an economically viable technique of ore beneficiation in the 1960's and 1970's.

A small decline and pilot plant were constructed on site in 1975, with the subsequent preparation of a feasibility study and environmental report in 1979. That study was based on a high-tonnage, open-pit operation. In addition to poor recovery rates, no market existed at that time for the low-grade lead and zinc concentrates produced by the pilot plant. Subsequent metallurgical developments in fine grinding technology and the emergence of a market for high-grade bulk concentrate suitable for feeding Imperial Smelting Process smelters, allowed the project to be re-evaluated in 1989.

Construction of the project commenced in 1994, with the first shipment of concentrate loaded in mid-1995. In 2005, MRM announced its intention to convert the underground Zn-Pb-Ag mine to an open pit operation to enable the mine to continue production. Approval from the NT Government was granted in 2006 and a test pit was developed and later expanded. In March 2007, MRM announced an AUD \$50 million expansion of its concentrator to increase its capacity from an annual throughput of 1.8 million tonnes of ore to 2.5 million tonnes.

On 17 December 2008, a decision by the Full Bench of the Australian Federal Court invalidated the original approval granted for the MRM expansion due to a procedural error by the Federal Government. As a result, all mining and civil works were suspended. MRM resubmitted its application to the Federal Environment Minister shortly after this judgement and on 22 January 2009, the Minister gave preliminary conditional approval for the expansion subject to a 10-day consultation period. Stockpiled ore was processed at the site while mining was suspended but was depleted by 23 January 2009 at which time the operation was placed into care and maintenance. On 20 February 2009, the Minister approved MRM's open pit development and operations, and mining recommenced.

In March 2011, Xstrata Zinc announced it was investigating an integrated development plan involving its European and Canadian smelters to increase capacity at MRM. The plan would secure the long-term future of the operation in the face of a decline in the traditional international markets for the bulk zinc-lead concentrate produced by the mine.

A draft Environmental Impact Statement (EIS) was lodged in January 2012 followed by a Supplementary EIS in May 2012. On 17 July 2012, the Northern Territory Government released an environmental assessment report, which recommended the project can be managed without unacceptable environmental impacts and could proceed subject to commitments on seven operational issues being enforced under an approved Mining Management Plan.

In 2013, the NT Government approved the MRM Phase 3 Development, which increased ore production capacity from 2.5 million tonnes to 5.5 million tonnes per annum and improved the ore processing facilities to increase throughput from 360,000 dry metric tonnes to 800,000 dry metric tonnes per annum.

## 3. Geology

The McArthur Basin comprises Carpentarian and Adelaidean rocks extending from the Alligator River in the Northern Territory to the Queensland border including the greater part of Arnhem Land and the Gulf of Carpentaria drainage region.

The sediment hosted stratiform HYC deposit has similarities with ore-bodies at Mount Isa and Hilton in Queensland. It is about 1.5km long and 1km wide with an average thickness of 55m.

The sediment hosted stratiform HYC deposit occurs near the base of the HYC pyritic shale member, within the Middle Proterozoic McArthur Group. The member comprises a sequence of inter-bedded pyritic bituminous dolomitic siltstones, sedimentary breccias and volcanic tuffs.

The HYC deposit has been folded and eroded along its western margin, which is covered with 30m of soil. The western margin contains the Hinge Zone, which is sub-vertical with a strike length of 1km and vertical height of 200m. The northern margins inter-finger with sedimentary breccias and the southern margin grades into thinned nodular barren pyritic siltstone. On the eastern margin, the ore-body thickens and is folded to form the Lower Fold Zone, which has a strike length of over 600m. The south-eastern corner is down faulted 110m by the north-eastern trending Woyzbun Fault.

## 4. Physiography and Hydrology

The mine site is situated adjacent to the McArthur River, in the middle reaches of the river's catchment, between the confluences of the Kilgour and Glyde Rivers. The catchment area of the river above the mine site is approximately 10,000km<sup>2</sup>. The 100 year average recurrence interval (ARI) flood level at the mine site is 39.5m. All major infrastructure on the site is located above this level. With the exception of some spring fed tributaries, most of the flow of the McArthur River comes from wet season rains. The river ceases to flow in some dry seasons, and most stretches, particularly in the vicinity of the mine area, can dry to a series of large isolated pools. During the wet season the river can become extremely turbid when in flood. Flow data for the McArthur River in terms of ARI is 7,250 (m<sup>3</sup>/s) for 1 in 100 year event (RL 40m), whilst 1,000 (m<sup>3</sup>/s) for 1 in 2 year event (DEIS, 1992).

The main creek systems which bound the tailings and mine site, are Barney and Surprise Creeks. Barney Creek has a catchment area of 600km<sup>2</sup> at the mine site. The creeks are dry throughout most of the year. This is particularly the case for Surprise Creek, which has a catchment size of only 85km<sup>2</sup>, and normally flows for only a few days each wet season.

McArthur River mine site has two main aquifers in the immediate vicinity, the alluvial aquifer and the lower fault aquifer. The alluvial aquifer is readily linked to the McArthur River and contains good quality fresh water. The faults in the dolomite and shales contain groundwater that is linked to the alluvial aquifer in part.

The dominant relief is low escarpments, plateaux and ridges, with limestone or dolomite rocks of Palaeozoic age or older in the western part of the McArthur River catchment upstream of the project site, and sandstone and conglomerate rocks in the eastern sub-catchments, including the Kilgour and Glyde Rivers.

The Tailings Storage Facility (TSF) is located adjacent to the Carpentaria Highway. This structure stands approximately 17m high over 200 hectares. Current disturbance for McArthur River Mining Leases totals 1,994 hectares, which represents 17% of the mining lease area.

## 5. Climate

The climate of the McArthur River region is tropical monsoonal, with a pronounced wet season between December and March and generally dry conditions for the remainder of the year, although a build-up to the wet season with some rain often occurs during November.

Mean annual rainfall for the mine site is 715mm with the area around the port at Bing Bong receiving a mean annual total of 1,040mm. Mean annual evaporation varies from 3,000mm at the mine site to around 2,300mm at the coast. Average daily minimum and maximum temperatures for McArthur River are 12°C to 29°C in June whilst in December they range from 25°C to 38°C.

Winds during the dry season blow predominantly from the south-east to south in the morning and change to blow from the east to north-east in the afternoon. During the wet season, there is no trending wind direction in the morning, whilst in the afternoon winds trend from the north to east. McArthur River has more calm observations than those in coastal locations (DEIS, 1992).

Extreme events include cyclones, floods, droughts and fire. Cyclones are an annual threat to coastal areas in the Gulf region. The McArthur River mine site is outside the cyclone risk area but is affected by the tropical low-pressure systems that can result in flooding. Flooding is an annual risk at McArthur River. Gross departures from the normal annual cycle are possible.

## 6. Land Use

Land use is predominantly cattle grazing on large pastoral properties and the occasional mining activity. Encompassing all mining leases is McArthur River Station, which is 100% owned by Colinta Holdings, an MIM Holdings subsidiary. Other regional pastoral enterprises are owned by private persons, companies, and Aboriginal groups.

McArthur River Station stocks approximately 10,000 head of cattle over 8,000 square kilometres, utilising approximately one third of the area for grazing. Cattle have been excluded from the Barney Hill mining and processing areas.

McArthur River Mine is located in one of the more sparsely populated areas of Northern Australia. Populations of townships fluctuate with people leaving outstations in the wet season.

## 7. Drilling

The following section outlines drilling activities undertaken during the 2018 reporting period, with each Mineral Lease presented separately.

### 7.1. MLN582

No drilling activities were conducted on MLN582 and no drilling activities are scheduled for the forthcoming year. The area will continue to be used for mining operations.

### 7.2. MLN1121

Eight diamond, 13 reverse circulation (RC), and 181 aircore (AC) drillholes were drilled within MLN1121 (Figure 4), and is summarised below in Table 2.

TABLE 2. SUMMARY OF MLN1121 DRILLING.

Hole Purpose	Hole Type	Hole Number Range	No. of Holes	Total Metres
Resource	Diamond	GE18006-008	3	1,104
Groundwater	Diamond/RC	GW18003, 005, 005S, 006-008, 009D, 009S, 012-013, 016D, 016S, 031, 031B, 035D, 036, 042-043	18	1,084
Alluvium Def.	AC	RG_J_017, 020, RG_K_001-005, 007, 009-041, 043-074, 076-091, 093-095, 097-100, 103-108, 113, 200-209, RG_WZQE_001-025, 027-049, 051-056, 061-064, 068-069, RG_WZQW_010, 014-015, 018-020, 023, 024	181	3,534
<b>Total</b>			<b>202</b>	<b>5,722</b>

#### 7.2.1. Resource Development

Three resource development drillholes were drilled within the life of mine open pit footprint, targeting the hangingwall sediments and the Lower Fold Zone (LFZ) of the orebody, totalling 1,104m. The purpose of the drilling was to help identify the following:

- Waste characterisation of the hangingwall sediments to identify zones of hangingwall pyrite (sulphur > 20%);
- Improve confidence in grade continuity (or conversely discontinuity of grade) east of the LFZ; and
- Improve confidence of orebody thickness within the LFZ.

Drillholes were logged and samples were collected from drillcore for analysis of metals and acid base accounting (ABA). The significant mineralised intersections for GE18006 is summarised below in Table 3. Analysis results for GE18007 and GE18008 are expected to be available by the end of Q1 2019.

Drillhole logs from GE18007 and GE18008 show a reduction in orebody thickness compared to the current geology model.

TABLE 3. TOTAL SIGNIFICANT INTERSECTIONS FOR RESOURCE DEVELOPMENT DRILLHOLES, SHOWING TOTAL WEIGHTED SAMPLE LENGTHS &gt;4% ZN.

Hole Information			Location MGA			Drilling Sample Statistics			
Hole ID	Hole Dip	Hole Azimuth	Zone	Easting (m)	Northing (m)	Sample Interval (m)	Total Significant Intersections		Total Depth (m)
							From (m)	>4% Zn	
GE18006	-82	270	53	618,337	8,182,530	1	282.2	38.9m @ 9.75% Zn	370

### 7.2.2. Groundwater Investigations

Eighteen drillholes totalling 1,084m were drilled for the following groundwater investigation objectives:

- Determine flow directions, volumes and qualities from the Western Overburden Emplacement Facility (WOEF);
- Quantify the flows to the underground and/or the direction groundwater moves through the Barney channel karstic structure; and
- Quantify the impacts the palaeochannel and alluvial material will have on the proposed South Extension.

A combination of vibrating wire piezometers (VWP's) and piezometers were installed downhole, and hydraulic tests conducted, which identified the following:

- Karstic features within the Barney Hill anticline – especially related to the western side/FWQ and along the McArthur Road;
- Mineralisation between the western side of WOEf and the Barney Diversion;
- No palaeochannel recharges sediments east of the current J stage; and
- Palaeochannel water reports to the southern wall adjacent to the Southern Ramp.

### 7.2.3. Alluvium Definition

One-hundred and eighty-one AC drillholes were drilled on a 50m x 50m grid within the life of mine open pit footprint targeting the cover sequence. The purpose of this definition drilling was to determine the following:

- Geometry and spatial location of suitable clay material for waste dump construction; and
- Identify the coarse gravels and cobbles acting as conduits for groundwater inflows to the mine operations, so data on the location of these palaeochannels and depth to water can be obtained for water management planning.

The drillhole information was used to construct a geological model, which showed primary clays (suitable) could be sourced from within the first 2-3m of the cover sequence.

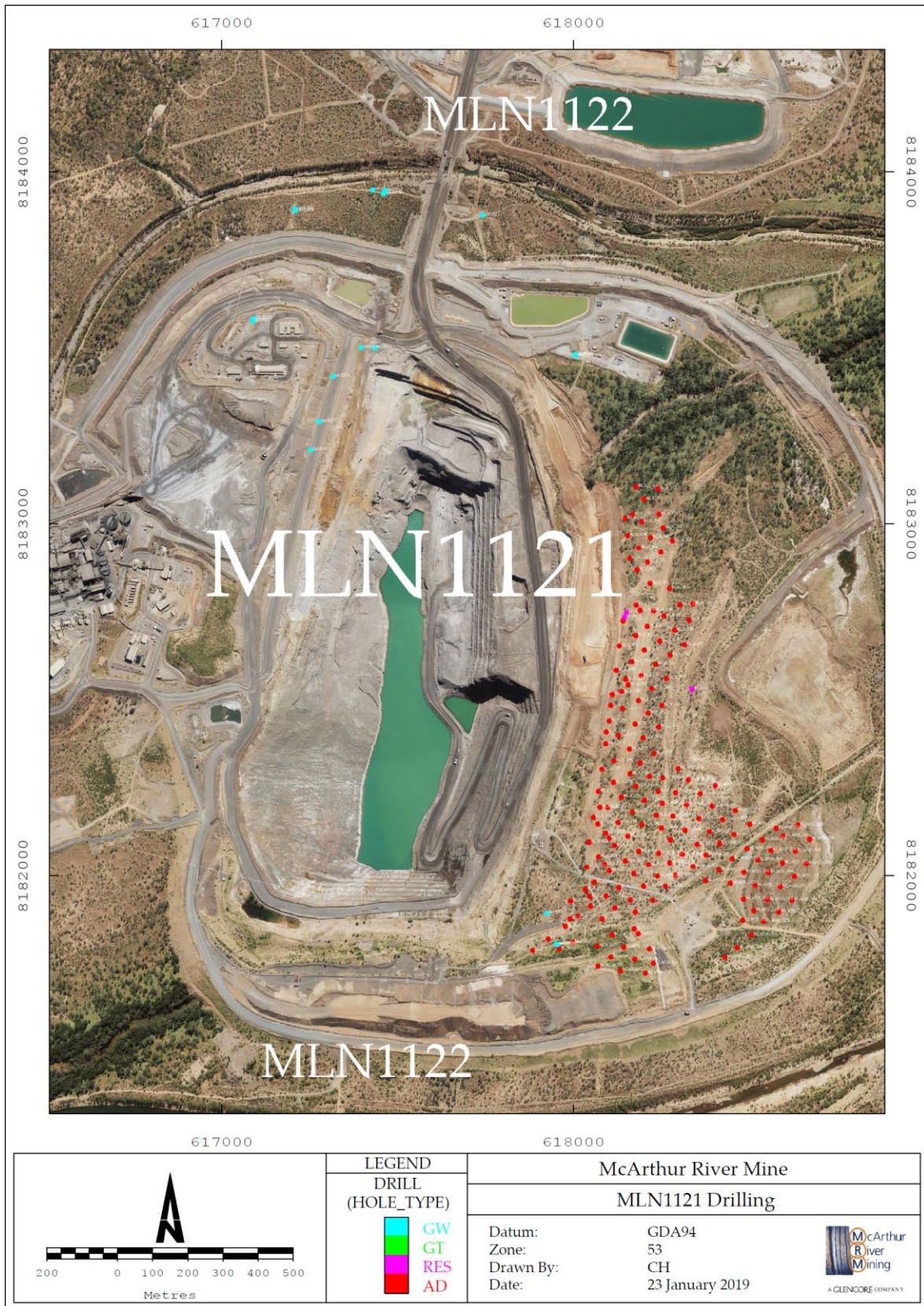


FIGURE 4. MLN1121 DRILLHOLE LOCATIONS. GW = GROUNDWATER, GT = GEOTECHNICAL, RES = RESOURCE, AD = ALLUVIUM DEFINITION.

## 7.3. MLN1122

Eighteen diamond, 13 RC, and 109 AC drillholes were drilled within MLN1122 (Figure 5), and is summarised below in Table 4.

TABLE 4. SUMMARY OF MLN1122 DRILLING.

Hole Purpose	Hole Type	Hole Number Range	No. of Holes	Total Metres
Resource	Diamond	GE17011-012, GE18001-005, GT18001	8	1,229
Groundwater	Diamond/RC	DW18001-002, GW18001-002, 004, 010D, 010S, 011D, 011S, 014, 017-21, 025, 027, 032-034, 037-039	23	1,596
Alluvium Def.	AC	RG_EOEF_001-003, 005-007, 009-015, 017-020, 022-026, 029-030, 032-033, 037-040, 043, 045-047, 049-078, 080-099, 101-105, RG_J_022, RG_WZQE_050, 057-060, 065-067, 070-071, RG_WZQW_002-003, 006-007, 012-013, 016-017, 021	109	1,023
<b>Total</b>			<b>140</b>	<b>3,848</b>

### 7.3.1. Resource Development

Seven resource development drillholes totalling 854m was drilled south of the open pit as part of the South Extension technical investigation. The purpose of the investigation was to improve confidence with the following:

- Grade;
- Geology model (ore geometry and spatial thickness);
- Geometallurgy; and
- Geotechnical assessment of pit wall stability.

One resource development drillhole was drilled within the life of mine open pit footprint, targeting the hangingwall sediments and the Lower Fold Zone (LFZ) of the orebody, totalling 375m. The purpose of the drilling was to help identify the following:

- Waste characterisation of the hangingwall sediments to identify zones of hangingwall pyrite (sulphur > 20%), and
- Improve confidence in grade continuity (or conversely discontinuity of grade) east of the LFZ.

Drillholes were logged and samples were collected from drillcore for analysis of metals and acid base accounting (ABA). The significant mineralised intersections are summarised below in Table 5 and include results from the 2017 reporting period, which were returned during 2018.

Drillhole logs and sample analysis results highlighted the following:

- South Extension drilling confirmed lower quality (nodular) mineralisation in all orebodies with exception to orebodies 2 and 8;
- South Extension drilling showed a slight increase in orebody thickness with a significant change in the location of the orebody when compared to the currently geology model; and
- GE18005 indicates a discontinuity of mineralisation east of the LFZ.

TABLE 5. TOTAL SIGNIFICANT INTERSECTIONS FOR RESOURCE DEVELOPMENT DRILLHOLES, SHOWING TOTAL WEIGHTED SAMPLE LENGTHS &gt;4% ZN.

Hole Information			Location MGA			Drilling Sample Statistics			
Hole ID	Hole Dip	Hole Azimuth	Zone	Easting (m)	Northing (m)	Sample Interval (m)	Total Significant Intersections		Total Depth (m)
							From (m)	>4% Zn	
GE17001	-70	265	53	617,176	8,181,819	1	28.4	9.3m @ 8.99% Zn	55
GE17003	-70	265	53	617,338	8,181,813	1	70.2	22.2m @ 8.75% Zn	151
GE17005	-70	265	53	617,470	8,181,811	1	109.2	19.8m @ 8.63% Zn	166
GE17006	-70	265	53	617,175	8,181,790	1	15.9	11.7m @ 8.85% Zn	58
GE17010	-70	265	53	617,449	8,181,759	1	121.9	15.9m @ 8.16% Zn	184
GE17011	-70	266	53	617,155	8,181,740	1	30.6	11.8m @ 7.33% Zn	82
GE17012	-70	271	53	617,215	8,181,737	1	40.7	13.4m @ 7.60% Zn	115
GE17015	-70	265	53	617,443	8,181,738	1	126.1	11.8m @ 8.53% Zn	202
GE18001	-70	265	53	617,271	8,181,814	1	38.1	19.8m @ 8.35% Zn	94
GE18002	-70	270	53	617,403	8,181,812	1	89.9	14.0m @ 9.56% Zn	142
GE18003	-70	265	53	617,292	8,181,743	1	72.1	8.5m @ 9.49% Zn	133
GE18004	-70	265	53	617,367	8,181,737	1	92.6	15.9m @ 7.81% Zn	157
GE18005	-70	265	53	618,372	8,182,831	1	295.7	5.7m @ 6.03% Zn	375
GT18001	-60	175	53	617,218	8,181,736	1	58.4	10.5m @ 6.45% Zn	133

### 7.3.2. Groundwater Investigations

Twenty-three drillholes totalling 1,596m were drilled for the following groundwater investigation objectives:

- Determine flow directions, volumes and qualities from the WOEF;
- Provide information to assist in the hydrogeochemical characterisation of the soil/rock in the areas located downgradient (in groundwater flow) from the South East Perimeter Run-off Dam (SEPROD) and South Perimeter Run-off Dam (SPROD);
- Quantify the flows to the underground and/or the direction groundwater moves through the Barney channel karstic structure;
- Determine the impacts of stored Eastern Levee Storage (ELS) water has on surrounding ground and surface water;
- Quantify the volume of groundwater, which will be made once the proposed South Extension intersects alluvial and related geological structure.

A combination of vibrating wire piezometers (VWP's) and piezometers were installed downhole, and hydraulic tests conducted, which identified the following:

- Karstic features within the Barney Hill anticline – especially related to the western side/FWQ and along the McArthur Road;
- Hydraulic testing of the Barney Karstic zone indicates highly permeable ground, which is related to north-south, structures (Cooley contact, Whelan's and Myrtle Fault);
- Mineralisation between the western side of WOEF and the Barney Diversion;
- No palaeochannel recharges sediments east of the current J stage;
- Palaeochannel water reports to the southern wall adjacent to the Southern Ramp;
- Identification of karstic areas near the ELS, and drillcore observations, coupled with assay results have identified significant natural mineralisation, which has the potential to influence groundwater quality;

Two drillholes from the South Extension technical investigation intersected the orebody. The significant intersections from these two drillholes is summarised below in Table 6.

TABLE 6. TOTAL SIGNIFICANT INTERSECTIONS FOR GROUNDWATER DRILLHOLES, SHOWING TOTAL WEIGHTED SAMPLE LENGTHS >4% ZN.

Hole Information			Location MGA			Drilling Sample Statistics			
Hole ID	Hole Dip	Hole Azimuth	Zone	Easting (m)	Northing (m)	Sample Interval (m)	Total Significant Intersections		Total Depth (m)
							From (m)	>4% Zn	
GW18002	-80	135	53	617,136	8,181,696	1	21.7	17.8m @ 6.00% Zn	112
GW18033	-60	130	53	617,359	8,181,729	1	166.4	17.6m @ 7.85% Zn	258

### 7.3.3. Alluvium Definition

One-hundred and nine AC drillholes were drilled on a 50m x 50m grid within the life of mine open pit footprint targeting the cover sequence. The purpose of this definition drilling was to determine the following:

- Geometry and spatial location of suitable clay material for waste dump construction; and
- Identify the coarse gravels and cobbles acting as conduits for groundwater inflows to the mine operations, so data on the location of these palaeochannels and depth to water can be obtained for water management planning.

The drillhole information was used to construct a geological model, which showed primary clays (suitable) could be sourced from within the first 2-3m of the cover sequence.



FIGURE 5. MLN1122 DRILLHOLE LOCATIONS. GW = GROUNDWATER, GT = GEOTECHNICAL, RES = RESOURCE, AD = ALLUVIUM DEFINITION.

## 7.4. MLN1123

Nine diamond drillholes were drilled within MLN1123 (Figure 6), and is summarised below in Table 7.

TABLE 7. SUMMARY OF MLN1123 DRILLING.

Hole Purpose	Hole Type	Hole Number Range	No. of Holes	Total Metres
Groundwater	Diamond	GW18044-052	9	831
<b>Total</b>			<b>9</b>	<b>831</b>

### 7.4.1. Groundwater Investigations

Nine drillholes totalling 831m were drilled around the Tailings Storage Facility (TSF) for the following groundwater investigation objectives:

- To confirm the presence and characterise the presence of Barney Trend and related geological structures; and
- Provide important information relating to the proposed changes in the TSF Cell 3.

A combination of vibrating wire piezometers (VWP's) and piezometers were installed downhole, and hydraulic tests conducted, which identified a semi-regional geological structure, which strikes beneath Cell 2 and the proposed Water Management Dam (WMD) facility. If hydraulically connected to shallow elluviual and alluvial sediments, this structure has the potential to transport seepage water from the TSF.

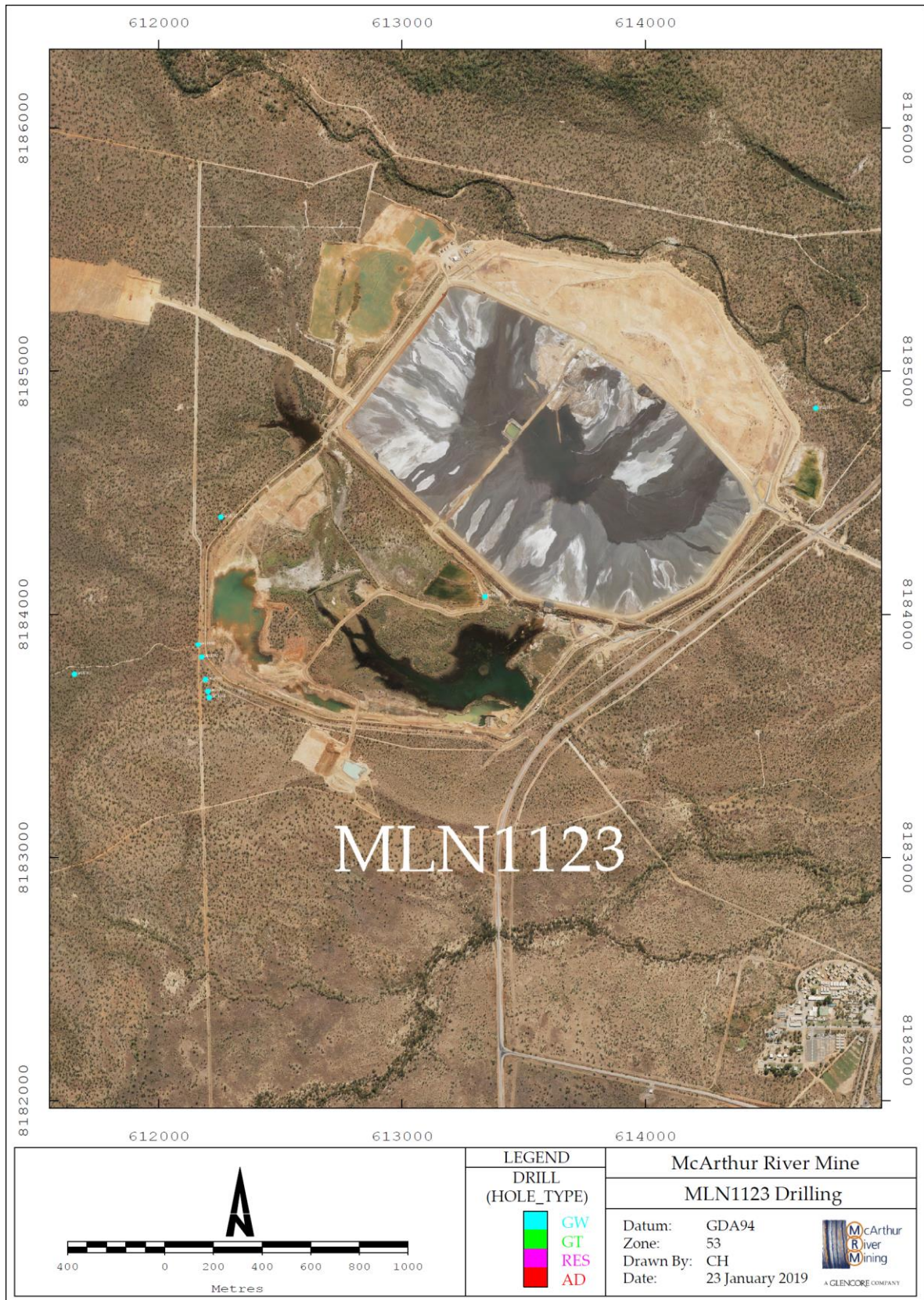


FIGURE 6. MLN1123 DRILLHOLE LOCATIONS. GW = GROUNDWATER, GT = GEOTECHNICAL, RES = RESOURCE, AD = ALLUVIUM DEFINITION.

## 7.5. MLN1124

Three diamond, and 3 RC drillholes were drilled within MLN1124 (Figure 7), and is summarised below in Table 8.

TABLE 8. SUMMARY OF MLN1124 DRILLING.

Hole Purpose	Hole Type	Hole Number Range	No. of Holes	Total Metres
Groundwater	Diamond/RC	GW18022-023, 023A, 040D, 040S, 041	6	318
<b>Total</b>			<b>6</b>	<b>318</b>

### 7.5.1. Groundwater Investigations

Six drillholes totalling 318m were drilled as part of the Emu Fault and Creek Investigation to confirm the groundwater relationship between the Northern Overburden Emplacement Facility (NOEF) and Emu Creek alluvial system.

A combination of vibrating wire piezometers (VWP's) and piezometers were installed adjacent to the northern exposure of the inferred Emu Fault, with hydraulic tests conducted, which indicated a very massive and hard siliceous boundary between the HYC basin and the Emu Fault. Hydraulically, there is little to no evidence of water transmitting through this structure, which indicates the KCB model assumption is valid.

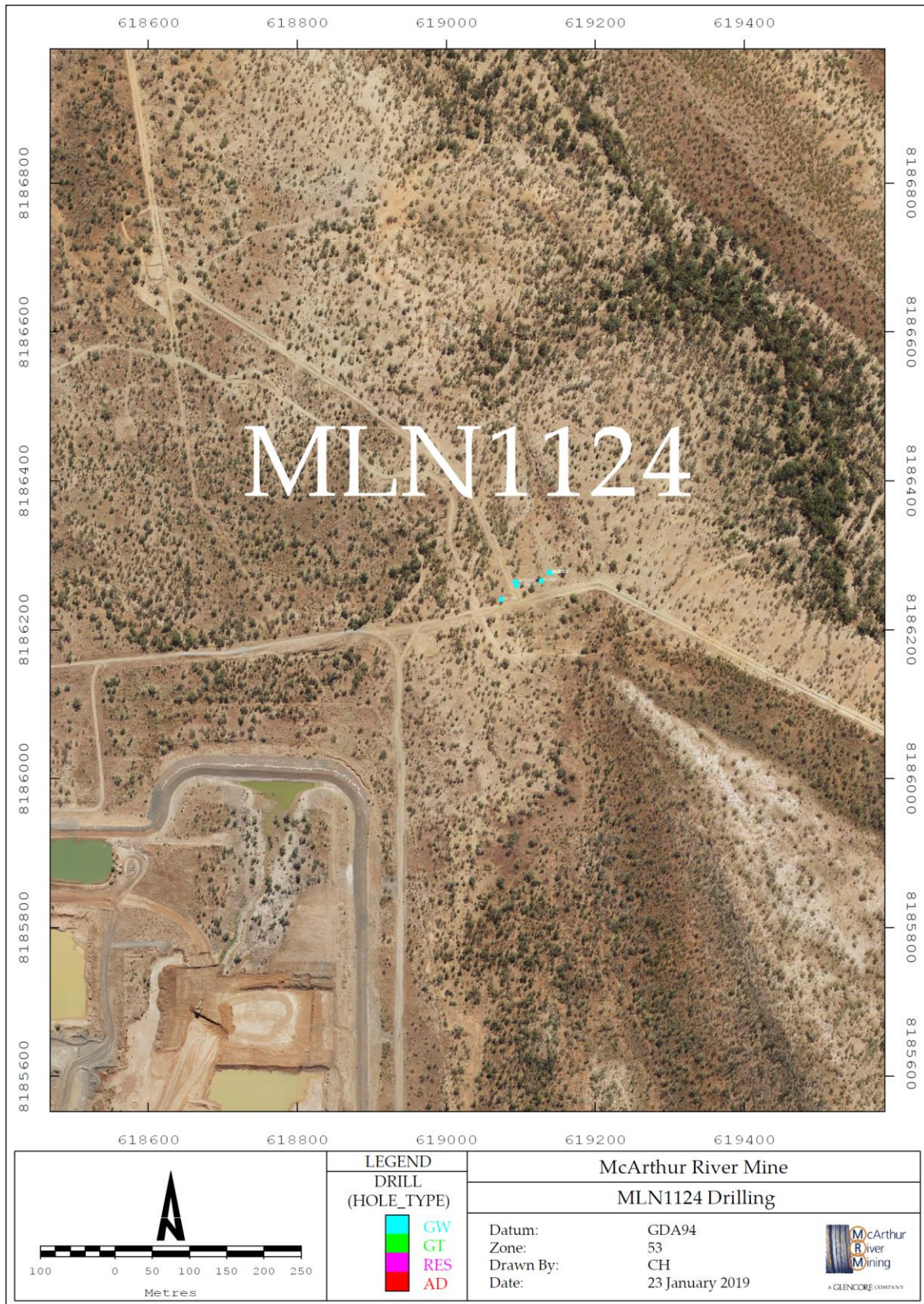


FIGURE 7. MLN1124 DRILLHOLE LOCATIONS. GW = GROUNDWATER, GT = GEOTECHNICAL, RES = RESOURCE, AD = ALLUVIUM DEFINITION.

## 7.6. MLN1125

No drilling activities were conducted on MLN1125 and no drilling activities are scheduled for the forthcoming year. The area will continue to be used for mining operations.

## 8. Conclusions and Recommendations

In conjunction with normal mining operations, a series of drilling programmes were completed across MLN1121, MLN1122, MLN1123 and MLN1124. The purpose of these drilling programmes include the following:

- Resource development, waste characterisation and determine groundwater interaction within the South Extension and LFZ areas;
- Identify the geometry and spatial location of suitable clay material for waste dump construction, and identification of coarse gravels and cobbles acting as conduits for groundwater inflows to the mine operations;
- Determine and quantify groundwater flow interaction with geological structures near waste rock dump stockpiles (WOF and NOEF), and containment structures (ELS, SEPROD, SPROD and TSF).; and
- Confirm the groundwater relationship between the NOEF and Emu Creek alluvial system.

The 2018 reporting period consisted of 38 diamond drillholes totalling 4,902m, 29 RC drillholes totalling 1,261m, and 290 AC drillholes totalling 4,557m. The findings from the drilling programmes are highlighted by the following:

- A reduction in orebody thickness within the LFZ, and discontinuity of mineralisation observed east of the LFZ.
- South Extension drilling confirmed lower quality (nodular) mineralisation in all orebodies with exception to orebodies 2 and 8.
- South Extension drilling showed a slight increase in orebody thickness with a significant change in the location of the orebody when compared to the current geology model.
- South Extension drilling shows no palaeochannel recharge of sediments east of the current J stage and that palaeochannel water reports to the southern wall adjacent to the Southern Ramp.
- Alluvium Definition drilling showed suitable clays can be sourced from within the first 2-3m of the cover sequence.
- Identification of karstic features within the Barney Hill anticline – especially related to the western side/FWQ and along the McArthur Road. Hydraulic testing of the Barney Karstic zone indicates highly permeable ground, which is related to north-south, structures (Cooley contact, Whelan's and Myrtle Fault).
- Mineralisation between the western side of WOF and the Barney Diversion.
- Identification of karstic areas near the ELS, and drillcore observations, coupled with assay results have identified significant natural mineralisation, which has the potential to influence groundwater quality.
- Hydraulic tests identified a semi-regional geological structure, which strikes beneath Cell 2 and the proposed WMD facility.
- Hydraulic tests indicated a very massive and hard siliceous boundary between the HYC basin and the Emu Fault. Hydraulically, there is little to no evidence of water transmitting through this structure, which indicates the KCB model assumption is valid.

The assay results from resource development drillholes (GE18007 and GE18008) are expected to be available by the end of Q1 2019.

Further drilling and/or exploration activities within the mining lease may be completed in the forthcoming reporting period, pending budget approvals.

## References

Raggatt, L., 2018. Alluvium Drilling 2018. Internal McArthur River Mining report.

Rathbone, S. & Kent, C., 2018. 2018 Drilling and Field Campaign, MRM Groundwater Characterisation. Internal McArthur River Mining report.



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