

## APPENDIX 4

### Report on Quarry Resource Assessment Investigations

## 6. DIAMOND DRILLING

### 6.1 Background and Objectives

Following interpretation of data produced by detailed geological mapping, an initial campaign of drilling comprising eight (8) diamond holes was undertaken at Stone Ridge to inform the geological and structural interpretation of the Project Area and obtain material for geotechnical testing and petrographic assessment. Following encouraging results from initial drilling and testing, a second drilling campaign comprising an additional twelve (12) diamond holes was undertaken to facilitate further for geotechnical testing and petrographic assessment and enable the hard rock quarry resource potential of the Project Area to be fully assessed.

Whereas the initial phase of drilling was guided solely by the results of surface mapping, the second campaign was guided by the results of previous drilling, the recently completed ground magnetic survey and an iterative program of preliminary quarry design work.

The collar location and trace in plan-view of all drill holes completed within the Project Area is illustrated by **Figure 10**. A summary of critical drill hole location, orientation and drilling contractor information for each drill hole is presented in **Table 6-1**.

### 6.2 Drilling Methodology

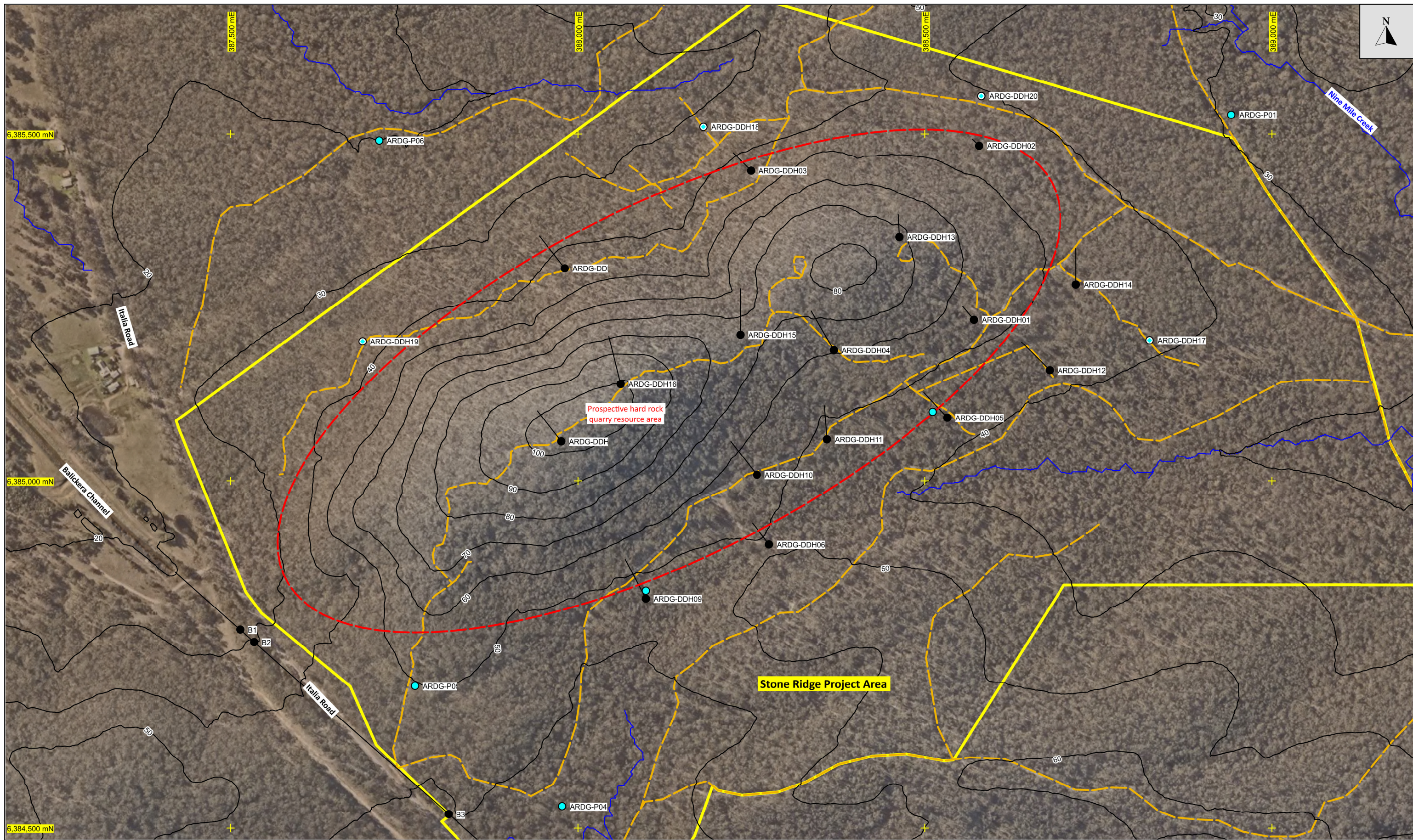
The diamond drilling campaigns at Stone Ridge were undertaken by Blacklaws Drilling Pty Ltd from Elphinstone, Victoria, using two track-mounted multi-purpose drilling rigs. The first three holes of the initial campaign (ARDG-DDH01 to 03) were completed using a Wallis Mantis 300 drill rig (**Plate 9**). All subsequent holes were completed using a larger Hanjin D&B-35Multi drill rig supported by a Hanjin 10CR track-mounted rod carrier (**Plate 10**). All holes were completed using HQ3 (61.1mm core diameter triple tube) equipment, in order to obtain enough material for bulk core geotechnical testing.

The initial campaign was undertaken from 12 January 2018 to 28 April 2018 and involved the completion of (8) angled diamond drill holes (ARDG-DDH01 to 08) for a combined total of 684.7 metres of drilling. All holes were drilled inclined at  $-60^{\circ}$  from horizontal, on azimuths ranging from  $315^{\circ}$ - $330^{\circ}$  grid, thereby aiming to intersect the geology at a high angle normal to interpreted bedding.

The second campaign was undertaken from 11 November 2018 to 10 April 2019 and involved the completion of an additional eight (8) angled holes (ARDG-DDH09 to 16) for a combined total of 897.4 metres of drilling. All angled holes were drilled inclined at  $-60^{\circ}$  from horizontal, on azimuths ranging from  $315^{\circ}$ - $360^{\circ}$  grid.

A further four (4) vertical diamond drill holes (ARDG-DDH017 to 20) were completed for a combined total of 166.8 metres of drilling. At the completion of drilling, these holes were converted to groundwater monitoring bores through insertion of slotted casing, supported by a 10/14-millimetre aggregate gravel pack sealed with bentonite.

Holes were drilled by coring from the surface and given the generally shallow weathering profile and/or near-surface competency of the ground, did not require the insertion of PVC casing to support the hole collar. A short length of 125-millimetre PVC casing was inserted into the collars of several drill holes (ARDG-DDH09-14) at the completion of drilling to enable downhole geophysical logging to be undertaken.



Legend	
	Stone Ridge Project Area Boundary
	Forest tracks
	Topographic contour (10m contour interval)
	Drainage line (ephemeral)
	Diamond drill hole collar location
	Diamond drill hole collar location - hole converted to water monitoring bore
	Diamond drill hole path

<b>Australian Resource Development Group</b> <small>130 Young St, Carrington, NSW, 2294          E: admin@ardg.com.au          W: www.ardg.com.au</small>	<b>Project: STONE RIDGE QUARRY PROJECT</b>			<b>Figure 10</b>
	<b>Title: Diamond Drill Hole Collars and Hole Paths</b>			
	<b>Author: DMB</b>	<b>Date: December 2019</b>	<b>Scale: 1:5,000 @ A3</b>	<b>Grid: MGA Zone 56 (GDA94)</b>
	<b>Source:</b> Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Diamond Drilling: Blacklaws Drilling - 2018-2019			

**TABLE 6-1**  
**Diamond Drill Hole Collar Information**

Hole ID	Easting (MGA56)	Northing (MGA56)	Elevation (mAHD)	Azimuth (degrees grid)	Dip	Depth (m)	Hole Type	Date Commenced	Date Completed	Drilling Contractor	Drill Rig	Driller
ARDG-DDH01	388,571	6,385,233	54.1	320	-60	50.5	HQIII	12-Jan-18	30-Jan-18	Blacklaws Drilling	Mantis 300	Graeme Noble
ARDG-DDH02	388,580	6,385,481	45.4	315	-60	26.4	HQIII	13-Feb-18	14-Feb-18	Blacklaws Drilling	Mantis 300	Richard Brydon
ARDG-DDH03	388,252	6,385,440	44.3	315	-60	71.8	HQIII	15-Feb-18	19-Feb-18	Blacklaws Drilling	Mantis 300	Richard Brydon
ARDG-DDH04	388,369	6,385,188	60.6	330	-60	130.4	HQIII	21-Feb-18	8-Apr-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH05	388,543	6,385,091	43.1	317	-60	98.9	HQIII	9-Apr-18	12-Apr-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH06	388,277	6,384,906	49.5	322	-60	78.2	HQIII	13-Apr-18	15-Apr-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH07	387,976	6,385,057	103.4	322	-60	111.2	HQIII	18-Apr-18	22-Apr-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH08	387,981	6,385,306	43.2	322	-60	117.3	HQIII	24-Apr-18	28-Apr-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH09	388,096	6,384,828	45.1	332	-57.9	119.8	HQIII	11-Nov-18	18-Nov-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH10	388,258	6,385,009	54.7	322	-59.6	120.5	HQIII	18-Nov-18	22-Nov-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH11	388,360	6,385,068	48.0	356	-60.6	98.9	HQIII	23-Nov-18	26-Nov-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH12	388,683	6,385,162	42.7	315	-60	114.3	HQIII	6-Dec-18	9-Dec-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH13	388,479	6,385,347	69.3	357	-60	66.2	HQIII	10-Dec-18	12-Dec-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH14	388,719	6,385,286	47.4	360	-60	104.2	HQIII	13-Dec-18	16-Dec-18	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH15	388,237	6,385,209	73.9	360	-60	132.2	HQIII	20-Mar-19	25-Mar-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH16	388,063	6,385,145	100.0	346	-60	141.3	HQIII	26-Mar-19	1-Apr-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH17*	388,825	6,385,205	41.5	0	-90	39.6	HQIII	2-Apr-19	4-Apr-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH18*	388,181	6,385,515	31.9	0	-90	54.7	HQIII	5-Apr-19	6-Apr-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH19*	387,692	6,385,205	36.7	0	90	36.0	HQIII	8-Apr-19	8-Apr-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon
ARDG-DDH20*	388,583	6,385,561	40.0	0	90	36.5	HQIII	9-Apr-19	10-Apr-19	Blacklaws Drilling	Hanjin D&B35	Richard Brydon



**Plate 9 – Wallis Mantis 300 track mounted drill rig supported by track-mounted rod carrier with air compressor. Drill hole ARDG-DDH01 – January 2018**



**Plate 10 – Hanjin D&B-35 Multi drill rig with Hanjin 10CR track-mounted rod carrier (foreground). Drill hole ARDG-DDH06 – April 2018**

Water for drilling was obtained with the permission of FCNSW from a surface water management dam located on FCNSW land near the Nine Mile Creek Rest Area. Water was pumped from the dam into a 2000 litre tank located on the back of the drilling contractor’s support truck, and transported to the Project Area, where it was either despatched directly into an above ground clean water tank at the drill site, or in the case of more distant or harder to reach drill sites, pumped via a network of 50 millimetre (2 inch) diameter polyethylene pipe to the above ground clean water tank. Water returned from the drill hole during drilling was pumped directly into a second above ground tank, to assist with settling of suspended drilling cuttings, prior to reuse of the water.

As diamond core drilling requires the hole to be flushed continuously with a water-based drilling mud, a biodegradable liquid polymer was added to drilling water to increase viscosity and lubricate the wall of the hole. The polymer dosage rate was adjusted according to the ground conditions encountered during drilling. Standing water levels within completed drill holes remained high upon completion of drilling, thereby facilitating later down-hole geophysical logging without the need to top up the water level.

Drill core obtained from the drilling program was placed by the driller’s offsideers into reusable plastic core trays. Timber core blocks showing hole depth, the interval drilled and core recovery, were placed in the core trays at the completion of each drill run.

### 6.3 Diamond Core Logging and Sampling

Diamond core from each drill hole was removed from site to ARDG’s core processing facility in Belmont, where it was repositioned in each core tray to enable it to be marked at 1 metre depth intervals to facilitate logging. Each individual core tray was then photographed dry and wet, with core photographs cropped and compiled into high-resolution A3-size pdf files for each drill hole. These files provide a visual record of the geology intersected by each hole and will be a critical future reference given that most of the drill core will be destroyed for geotechnical testing.

Core from each drill hole was then logged in detail with data recorded directly into csv files using Microsoft Excel to enable the data to be plotted using Datamine Discover. Core logging involved the preparation of the following data logs for diamond core from the Project Area.

- Lithology log – records the type and depth interval of different lithologies identified in diamond core from each drill hole. The rock types and their respective codes are summarised in **Table 6-2**.

<b>TABLE 6-2</b>				
<b>Diamond Core Logging – Lithology and Codes</b>				
<b>Geological Formation</b>	<b>Lithology</b>	<b>Lithology Code</b>	<b>Lithology</b>	<b>Lithology Code</b>
Undifferentiated	Clay	CY	Soil	SL
Undifferentiated Tertiary Volcanics	Dolerite	DL		
<i>Eagleton Volcanics</i>	Conglomerate	CG	Rhyolite (vitric-crystal tuff)	RT
	Sandstone	SS	Rhyodacite (ignimbrite)	RD
	Siltstone	ST	Dacite (ignimbrite)	DC
	Hematitic sandstone / siltstone	MD	Volcanic breccia	VB
	Tuff (undifferentiated)	TF	Andesite (lithic-crystal tuff)	AD

- Structural log – records the type and depth interval of structures identified in diamond core from each drill hole. The structures and their respective codes are summarised in **Table 6-3**.

<b>TABLE 6-3</b>	
<b>Diamond Core Logging – Structure and Codes</b>	
<b>Structure</b>	<b>Structure Code</b>
Fault	FLT
Fault breccia	FBX
Shear	SHR
Breccia - healed	BXH
Dyke – fault related	FDK

- Structural measurement log – records both oriented and non-oriented structural data obtained during logging and from the Groundsearch downhole acoustic televiewer reports (refer **Section 4.4.4**).
- Weathering log – a subjective record of the intensity and depth interval of weathering identified in diamond core from each drill hole. Weathering intensity classifications and their respective codes are summarised in **Table 6-4**.

<b>TABLE 6-4</b>	
<b>Diamond Core Logging – Weathering Intensity and Codes</b>	
<b>Weathering Intensity</b>	<b>Weathering Code</b>
Extremely weathered	XW
Highly weathered	HW
Moderately weathered	MW
Slightly weathered	SW
Unweathered / fresh	F

- Fracture log – a subjective record of the intensity and depth interval of fracturing identified in diamond core from each drill hole. Fracture intensity classifications and their respective codes are summarised in **Table 6-5**.

<b>TABLE 6-5</b>	
<b>Diamond Core Logging – Fracture Intensity and Codes</b>	
<b>Fracture Intensity</b>	<b>Fracturing Code</b>
Intensely fractured	I
Strongly fractured	S
Moderately fractured	M
Weakly fractured	W

- Rock Quality Designation (RQD) log – a quantitative measure of the degree to which the core is fractured, measured as a percentage of the drill core in lengths of 10cm or more. High-quality

rock is generally considered to have an **RQD** of more than 75%, whereas low quality rock has an RQD less than 50%. RQD measurements were calculated for each metre of drill core.

- Magnetic Susceptibility log – measurements of magnetic susceptibility were undertaken for each metre of drill core at 1m depth intervals using a hand-held Terraplus KT10 magnetic susceptibility meter. Measurements were recorded in  $10^{-3}$  SI units and adjusted to  $10^{-5}$  SI units for interpretation purposes.
- Rock Quality log – a subjective initial assessment of the suitability of drill hole geology for producing either high quality aggregates (*i.e.* concrete, asphalt and sealing aggregates), concrete aggregates only, or roadbase and crushed rock products. This log also identified material likely to constitute overburden and interburden.

Following completion of logging, intervals of core from several drill holes were nominated for geotechnical testing based on a range of factors, including geological and structural characteristics; interpreted rock quality; and minimum length / sample size for bulk testing. Core from the selected test intervals was then manually broken down into 10-15 centimetre lengths using a rock hammer, prior to being double-bagged ready for despatch to the testing laboratory.

Detail relating to the drill core samples, geotechnical tests and results is presented in **Section 9**.

#### 6.4 Downhole Geophysics

Groundsearch Australia Pty Limited was commissioned to undertake downhole geophysical surveys of six (6) completed drill holes (ARDG-DDH09 to ARDG-DDH14), primarily to obtain oriented structural data to inform a geotechnical slope stability assessment for quarry pit design purposes. The surveys were undertaken within 2 weeks of the completion of each drill hole using Century Geophysical LLC downhole 9804 acoustic televiewer (ATV) and 9239 density tools. The ATV creates an oriented acoustic image of the wall of a fluid (water) filled drill hole using high-resolution sound waves. The 360° acoustic image reflects amplitude variations and can be used to detect structural features like lithotype boundaries, fractures and other anomalies, using interpretation software.

#### 6.5 Petrography

Fifty-two (52) diamond core samples were selected for hand specimen and thin section petrographic assessment to inform the geological interpretation of the Project Area. Samples were photographed dry and wet, then despatched to Dr Paul Ashley who arranged for thin section preparation, prior to petrographic assessment.

#### 6.6 Drilling Results

**Tables 6-7 to 6-26** summarise the objectives and critical results of each diamond hole based on logging information and consideration of surface geological information. They also include the petrographic summary descriptions for all diamond core petrographic samples, as well as an interpretation of 'rock quality' as it pertains to source rock for production of quarry products.

**Figure 11a** illustrates the logged data suite for each drill hole in plan-view, whereas **Figure 11b** illustrates this data with respect to the TMI image.

**Figures 12a – 12e** present in greater detail the logged data suite for each drill hole in cross-sectional format.

<b>TABLE 6-7</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH01</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Initial short drill hole designed to test area of outcropping rhyodacite. The hole was drilled on an azimuth of 320° grid, approximately normal to the regional strike and dip. It was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 3 (MD3).</p> <p>The hole was drilled over an extended period due to difficulties experienced by a new driller unfamiliar with the rig. It was terminated prematurely to save on cost until a new driller could be found.</p>	<p><b>Lithology and Alteration</b></p> <p><b>Rhyodacite:</b> 0m - 50.5m (end-of-hole)</p> <ul style="list-style-type: none"> <li>extremely weathered from surface to 3.5m, then moderately weathered to 18.5m</li> <li>generally slightly weathered to unweathered / fresh from 18.5m to 50.5m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>14m - 50m: 120 - 1200 x 10<sup>-5</sup> SI with average of 951 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>3.5m - 18.5m: moderately to strongly fractured</li> <li>18.5m - 50.5m: generally weakly to moderately fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 4.0m</p> <p><b>Roadbase quality:</b> 4.0m - 13.0m</p> <p><b>Aggregate quality (CA):</b> 13.0m - 19.0m</p> <p><b>Aggregate quality:</b> 19.0m - 50.5m</p>	<p>The rhyodacite intersected by the hole exhibits the typical near surface oxidation that results in the pinkish colour of surface samples. With depth, the rhyodacite becomes grey in colour.</p> <p>No evidence of any faulting or shearing.</p>	
<b>Thin Section Petrography</b>		
<p><b>ARDG-DDH01      28.56-28.65 m</b></p> <p><b>Summary:</b> Strongly porphyritic rhyodacite, possibly ignimbritic, showing a colour change across the sample that is most likely due to the presence of an oxidation front, as a result of locally imposed weathering (supergene) effects. The interpreted “fresh” part of the sample is largely grey, whereas the slightly oxidised part is pink-brown. There is no compositional or textural variation across the colour change. The rock contains scattered phenocrysts of quartz, plagioclase and K-feldspar, with less common and smaller grains of biotite (now mostly altered) and FeTi oxide (titanomagnetite). Phenocrystal phases occur in a fluidal texture groundmass that also hosts a few small felsic volcanic lithic fragments. Textures suggest that the rock originally had abundant vitriclastic material and that it was probably welded. Former glassy material was subsequently replaced by abundant fine grained alkali feldspar and minor quartz, and the rock has slight development of sericite, a clay phase (illite-smectite), chlorite and hematite. No planar discontinuities occur, there is no strong alignment of flow foliation and the amount of fine grained layer silicate material is trivial. Consequently, the rock remains strong and competent, and would be of high quality for construction purposes.</p>		

**ARDG-DDH01**      **49.85-49.95 m**

Summary: Strongly porphyritic ignimbritic rhyodacite. The rock is massive and contains abundantly scattered phenocrysts of quartz, plagioclase and K-feldspar, with a few smaller hornblende and biotite phenocrysts, and microphenocrysts of FeTi oxide (titanomagnetite). The phenocrysts are hosted in a fluidal mass occupying about 50% of the sample, with this most likely representing welded vitriclastic material, including a few larger elongate vitric fragments. Although there is considerable alignment in the fluidal texture of vitriclasts, there is no preferred parting or fracturing in the rock. Former vitric material was completely replaced by very fine grained feldspars (probably K-feldspar > albite) and minor quartz. Minor alteration was also imposed on feldspar and ferromagnesian phenocrysts and in the groundmass with development of a little fine grained chlorite, sericite, carbonate and hematite. There is no alignment of the minor amounts of alteration-derived layer silicates and there are no veins or fractures. Consequently, the rock remains strong and competent, and would be of high quality for construction purposes.

<b>TABLE 6-8</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH02</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Short drill hole designed to confirm geology beyond the mapped northeast limit of outcropping rhyodacite. The hole was drilled on an azimuth of 315° grid and was oriented to test the geology normal to the regional strike and dip.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared on the interpreted position of Magnetic Lineament 4 (ML4) where it defines the approximate boundary between Magnetic Domain 3 (MD3) and Magnetic Domain 5 (MD5).</p>	<p><b>Lithology and Alteration</b></p> <p><b>Hematitic sandstone:</b> 0m - 26.4m (end-of-hole)</p> <ul style="list-style-type: none"> <li>extremely weathered from surface to 10.9m, then highly weathered to 26.4m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>1m - 26m: 3.5 - 765 x 10<sup>-5</sup> SI with average of 307 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>22.3 - 24.1m: healed fault brecciation oriented at low angle to core axis</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0m - 26.4m: generally moderately to locally strongly fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 26.4m</p>	<p>The occurrence of fractured and locally brecciated sandstone in this hole and in close proximity to rhyodacite (confirmed by later drilling to extend to significant depth), suggests that Magnetic Lineament 4 is structural in nature. It is believed to represent the southern extent of a major fault zone (Nine Mile Creek Fault Zones) that has resulted in the dextral offset of the stratigraphy by 700-800 metres.</p> <p>The hematitic nature of the sandstone encountered in this hole suggests it may be affiliated with the lower units of the <i>Eagleton Volcanics</i>.</p>	
<b>Thin Section Petrography</b>		
<p>No Petrography</p>		

<b>TABLE 6-9</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH03</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Drill hole designed to test area of uniform high magnetic intensity that is coincident with extensive dacite outcrop, west of the northeast end of Stone Ridge. The hole was drilled on azimuth of 315° grid, approximately normal to the regional strike and dip.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 1A (MD1A).</p>	<p><b>Lithology and Alteration</b></p> <p><b>Clay</b> (extremely weathered dacite): 0m - 3.4m</p> <p><b>Dacite</b>: 3.4m - 71.8m (end-of-hole)</p> <ul style="list-style-type: none"> <li>• variably weathered from 3.4m to 9.92m depth</li> <li>• from 9.92m to 18.68m the dacite is generally slightly weathered, with narrow zones of fracture-controlled alteration and weathering. Below 18.68m depth the dacite is unweathered / fresh</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>• 10m - 71.8m: 239 - 2940 x 10<sup>-5</sup> SI with average of 1853 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>• generally weakly fractured, massive and competent</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden</b>: 0m - 3.4m</p> <p><b>Roadbase quality</b>: 3.4m - 9.92m</p> <p><b>Aggregate quality (CA)</b>: 9.92m - 18.68m</p> <p><b>Aggregate quality</b>: 18.68m - 71.8m</p>	<p>The dacite intersected in this hole represents some of the most massive material intersected by drilling within the Project Area. No evidence of any faulting, shearing or brecciation.</p> <p>Magnetic susceptibility measurements for the dacite are notably higher than for other units within the <i>Eagleton Volcanics</i>. The weakly fractured character of the dacite and abundance of magnetite is believed to explain the uniform magnetic signature observed on the TMI imagery.</p>	
<b>Thin Section Petrography</b>		
<p><b>ARDG-DDH03      38.60-38.70 m</b></p> <p><b>Summary</b>: Crystal-vitric-lithic felsic tuff, probably of dacite-rhyodacite composition and having a large component (50-60%) of phenocrystal grains. The rock is massive, with largely well-preserved primary minerals, with no indication of fracturing or veining. The phenocrystal component is dominated by plagioclase, with subordinate quartz, hornblende and biotite (with the last mostly altered) and sparse microphenocrysts of FeTi oxide (titanomagnetite). The phenocrystal phases and sparse felsic volcanic lithic fragments, are enclosed by a former finely vitriclastic matrix. Imposed diagenetic alteration caused replacement of all vitric material, mostly by alkali feldspar and minor quartz. Plagioclase phenocrystal grains show minor replacement by chlorite, sericite, carbonate and zeolite, and ferromagnesian phases (particularly biotite) show replacement by hematite, sericite and chlorite. There is no alignment or concentration of alteration minerals and the rock remains massive, hard and competent. It would be suitable for construction purposes.</p>		
<p><b>ARDG-DDH03      41.70-41.80 m</b></p>		

Summary: Crystal-vitric felsic tuff, probably of dacite composition and having a large component (at least 50%) of phenocrystal grains. The rock is massive, containing phenocrystal grains of plagioclase, quartz, hornblende and biotite, and smaller grains of FeTi oxide (titanomagnetite) in a former fine vitriclastic matrix. The latter also hosts a few elongate, large vitriclastic fragments. The rock experienced diagenetic alteration causing replacement of vitriclastic material, largely by very fine alkali feldspar and minor quartz, and the rock also developed minor fine grained sericite, chlorite and hematite, commonly at ferromagnesian sites. There is no fracturing or veining, or alignment or concentration of alteration minerals and the rock remains massive, hard and competent. It would be suitable for construction purposes.

<b>TABLE 6-10</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH04</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Drill hole collared directly east of the Stone Ridge saddle with the key objective of explaining the controls influencing variations in rhyodacite outcrop. The hole was drilled on an azimuth of 330° grid, which is oblique to the regional strike. It was collared in an area devoid of outcrop and drilled towards an area of extensive rhyodacite outcrop that forms the northeast hill on Stone Ridge.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 3 (MD3), approximately 22m east of Magnetic Lineament 1 (ML1) – <i>i.e.</i> just beyond the axis of the Central Fault.</p>	<p><b>Lithology and Alteration</b></p> <p><b>Clay</b> (extremely weathered rhyodacite): 0m - 2.25m</p> <p><b>Rhyodacite</b>: 2.25m - 130.4m (end-of-hole)</p> <ul style="list-style-type: none"> <li>• moderately to highly weathered from 2.25m - 7.6m depth</li> <li>• slightly weathered from 7.6m - 40.3m, and characterised by the presence of fracture-controlled laumontite veining</li> <li>• unweathered / fresh from 40.3m - 130.4m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>• 8m - 130m: 30 - 1650 x 10<sup>-5</sup> SI with average of 944 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>• 21.3 - 29.0m: internally brecciated rhyodacite healed by infill laumontite veining</li> <li>• minor zones of internal brecciation healed by infill laumontite veining occur from 76.74m - 77.44m and 119.05m - 119.72m</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>• 2.25m - 40.3m: moderately to strongly fractured with fracture-controlled laumontite veining</li> <li>• 40.3m - 130.4m: generally weakly fractured, with minor localised zones of strong fracturing</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden</b>: 0m - 2.25m</p> <p><b>Roadbase quality</b>: 2.25m - 4.22m</p> <p><b>Aggregate quality (CA)</b>: 4.22m - 21.3m</p> <p><b>Roadbase quality</b>: 21.3m - 29.0m</p> <p><b>Aggregate quality (CA)</b>: 29.0m - 40.3m</p> <p><b>Aggregate quality</b>: 40.3m - 130.4m</p>	<p>With the exception of zones of brecciation partially healed by laumontite veining, the rhyodacite intersected by this hole appears relatively uniform in composition and texture.</p> <p>An absence of intense faulting, fault brecciation and dyke rocks suggests that the hole was collared outside the main zone of deformation / displacement associated with the interpreted Central Fault. Moderately to strongly fractured, laumontite-veined rhyodacite intersected from surface to 40m depth, is likely to have developed proximal to the Central Fault and broadly correlates with the area at surface near the drill hole collar that is devoid of outcrop. Below 40m, less fractured and more competent rhyodacite broadly correlates with extensive rhyodacite observed upslope of the drill collar. The greater competency of this material may be reflective of greater distance from the Central Fault.</p>	
<b>Thin Section Petrography</b>		
<p><b>ARDG-DDH04 20.95-21.00 m</b></p> <p><b>Summary</b>: Rhyodacite composition welded crystal-vitric tuff (ignimbrite), cut by a few laumontite veins. The rock has well preserved primary characteristics and contains rather abundant phenocrystal grains of plagioclase, quartz and K-feldspar, and with less common (and smaller) biotite grains being mostly altered. There are also a few small, silicified felsic volcanic lithic grains, all enclosed in a chaotically fluidal texture, originally welded vitriclastic matrix. Imposed diagenetic alteration caused all former vitric material to be replaced by very fine grained alkali feldspar, minor quartz and a little sericite, chlorite and zeolite (laumontite). Plagioclase and biotite phenocrysts are locally replaced by sericite, chlorite and zeolite, with hematite at the latter sites. Veins are sub-planar to anastomosing and contain fine to medium grained zeolite. The rock is generally hard and competent and there is little indication of preferred orientation of alteration-derived layer silicates. However, zones with considerable zeolite veining should be avoided.</p>		
<p><b>ARDG-DDH04 22.70-22.79 m</b></p>		

**Summary:** Porphyritic felsic volcanic rock, perhaps initially of rhyodacite type, but with strongly imposed veining and alteration, and in places, evidence of brittle deformation. The original rock contained scattered quartz and plagioclase phenocrysts, along with a few smaller biotite grains, set in a fine grained vitric or vitriclastic groundmass, in places showing fluidal texture. It is unclear due to the imposed processes as to whether the rock represented a coherent lava or was a welded pyroclastic. Local brittle deformation was imposed, manifest as zones of fracturing and cataclasis. Pervasive alteration led to albitisation of plagioclase phenocrysts as well as local development of zeolite (laumontite) and chlorite at these sites and in the former vitric groundmass, which was also replaced by abundant very fine grained alkali feldspar (probably albite) and minor quartz. Most former biotite was also replaced by laumontite, chlorite and hematite. Several veins cut the altered rock, with these containing fine through to rather coarse grained laumontite. The locally deformed nature of the rock and its strong development of laumontite veins and pervasive alteration, suggests that primary rock property characteristics would be significantly degraded and as such, this material

**ARDG-DDH04 49.54-49.59 m**

**Summary:** Rhyodacite composition ignimbrite (welded crystal-vitric tuff) that has experienced diagenetic alteration but is essentially little fractured or veined. There are rather abundant phenocrystal grains of quartz and feldspars, minor biotite and trace hornblende and FeTi oxide (titanomagnetite) in a matrix that was vitriclastic, but welded to form a fluidal texture. There is little preferred orientation of the fluidal fabric. Devitrification led to replacement by very fine grained alkali feldspar, plus minor quartz. Plagioclase and biotite grains are partly altered, with development of minor sericite and chlorite, and with a little hematite at biotite sites. The rock is also cut by a couple of thin laumontite veins. Overall, the rock is massive and hard and there is little indication of planar concentrations of the minor layer silicate components. The rock would be largely suitable for construction purposes.

**ARDG-DDH04 59.4-59.5 m**

**Summary:** Coarse lithic-crystal breccia of rhyodacite composition. The rock is massive and unfractured and contains scattered large irregular to elongate fragments of coherent porphyritic rhyodacite, originally with a flow foliated vitric groundmass and containing phenocrysts of quartz, plagioclase, K-feldspar and minor hornblende and biotite. The fragments are enclosed in a finer grained tuffaceous matrix with a crystal, lithic and fine vitriclastic component. The rock experienced low grade alteration, *e.g.* due to diagenesis and all former vitric material was replaced by fine grained alkali feldspar and quartz, with traces of sericite, carbonate, celadonite and hematite. All former hornblende and most biotite grains were also replaced, with development of the same alteration phases as well as a trace of epidote. There is no significant concentration of the alteration minerals, whose volume is modest, no alignment and no veining. The rock remains hard and competent and would be suitable for engineering and construction purposes.

**ARDG-DDH04 75.6-75.72 m**

**Summary:** Porphyritic rhyodacite with a flow foliated, formerly glassy groundmass. This rock type is similar to the rhyodacite fragments in sample DDH04/59.4 m. It contains scattered phenocrysts of quartz, sodic plagioclase and K-feldspar, with a few smaller, largely altered grains of biotite and hornblende, and a few microphenocrysts of FeTi oxide (titanomagnetite) and trace associated apatite and zircon. The groundmass has prominent "swirly" flow banding and constitutes about half of the rock. Mild pervasive diagenetic alteration was imposed, leading to replacement of the glassy groundmass by fine grained alkali feldspar, minor quartz and trace sericite. There has also been development of a little sericite and trace carbonate, chlorite and hematite as alteration phases elsewhere. A few sub-planar veins cut the rock, containing carbonate and laumontite. The rock remains hard and massive, with no significant concentration of alteration minerals, whose volume is minor, but there are a few veins and the abundance of these structures would need to be monitored for their influence on rock quality.

**ARDG-DDH04 107.76-107.86 m**

**Summary:** Sample displays a contact between a flow foliated former glassy, sparsely porphyritic felsic volcanic rock of rhyolitic type, with a coarse rhyodacitic fragmental. The latter is a lithic-crystal-vitric type, containing fragments of flow foliated porphyritic rock, and another type without flow foliation, as well as individual mineral grains (K-feldspar, plagioclase, quartz) and interstitial former vitriclastic material. The rhyodacite fragments in the coarse pyroclastic rock typically contain phenocrysts of quartz, K-feldspar, plagioclase, a little biotite (mostly altered) and traces of hornblende and FeTi oxide (titanomagnetite) in a formerly glassy groundmass. Pervasive diagenetic alteration was imposed on the rock, causing replacement of all former vitric material by fine grained alkali feldspar and minor quartz, with the rock also developing a little chlorite, sericite, hematite and trace celadonite and carbonate within former vitric material and at feldspar and biotite sites. A few thin sub-planar veins cut the rock, with these mostly containing fine grained quartz and later-emplaced laumontite. The rock remains hard, massive and competent, and since there is little development of alteration minerals and veining, it would probably be suitable for construction purposes.

**TABLE 6-11**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH05**

Drilling Objectives	Geology Summary	Structure Summary
<p>Drill hole collared beyond the southeast limit of rhyodacite outcrop, with the objective of confirming the geology in an area devoid of outcrop. The hole was drilled on an azimuth of 317° grid, approximately normal to the regional strike and dip.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 3 (MD3) and drilled across Magnetic Lineament 1 (ML1).</p>	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 0.4m</p> <p><b>Rhyodacite:</b> 0.4m - 41.0m</p> <ul style="list-style-type: none"> <li>extremely weathered to 8.0m</li> <li>moderately to locally highly weathered from 8.0 - 37.5m</li> <li>slightly weathered to unweathered / fresh from 37.5m - 41.0m</li> </ul> <p><b>Dolerite:</b> 41.0m - 57.59m</p> <ul style="list-style-type: none"> <li>slightly weathered to unweathered / fresh</li> </ul> <p><b>Rhyodacite:</b> 57.59m - 98.9m</p> <ul style="list-style-type: none"> <li>slightly weathered to unweathered / fresh</li> <li>infill laumontite veining oriented at low angles to the core axis</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>41m - 57m (dolerite): 818 - 4170 x 10<sup>-5</sup> SI with average of 3207 x 10<sup>-5</sup> SI</li> <li>58m - 98m (rhyodacite): 238 - 1290 x 10<sup>-5</sup> SI with average of 636 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>0.4m - 18.7m: moderate to intense fracturing that is likely to be fault related</li> <li>18.7m - 20.0m: the rhyodacite is sheared at 20-30° to the core axis</li> <li>27.0m - 41.0m: the rhyodacite has been internally brecciated but healed by infill laumontite veining oriented at a very low angle to the core axis</li> <li>41.0m - 57.59m: a dolerite dyke defines a major fault zone. The upper contact of the dyke is intensely fractured, but there is evidence that the contact was oriented at 8° to the core axis. The lower contact is less fractured and oriented at 10° to the core axis.</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.4m - 23.0m: strongly to intensely fractured</li> <li>23.0m - 39.8m: typically moderately fractured</li> <li>39.8m - 54.3m: strongly to intensely fractured</li> <li>54.3m - 98.9m: generally weak to moderately fractured</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m – 7.9m</p> <p><b>Roadbase quality:</b> 7.9m – 20.0m</p> <p><b>Aggregate quality (CA):</b> 20.0m – 41.0m</p> <p><b>Roadbase quality:</b> 41.0m – 57.59m</p> <p><b>Aggregate quality:</b> 57.59m – 98.9m</p>	<p>Significant faulting, shearing and brecciation suggests this hole was collared within the Central Fault. The laumontite veined rhyodacite in this hole exhibits many similarities to the rhyodacite intersected by drill hole ARDG-DD04, which was also drilled close to the Central Fault.</p> <p>ARDG-DD04 was drilled at a low angle to the interpreted axis of the Central Fault. This was highlighted by dolerite dyke contacts and laumontite veining that are oriented at low angles / sub-parallel to the core axis. As a result, the apparent width of structural features intersected by this hole (<i>i.e.</i> fracturing, faulting, dolerite dyke rocks) is significantly greater than the true width. For example, the apparent width of the dolerite dyke from 41m depth is 16.5m, whereas the calculated true width is likely to be only 2.6m.</p>	

	<p>The contrast between the high magnetic susceptibility of the dolerite dyke, and much lower susceptibility of rhyodacite, is not evident in the TMI imagery, and the generally low magnetic signature of the Central Fault suggests that any dyke rocks are likely to have reversed magnetic polarity.</p>
<p><b>Thin Section Petrography</b></p>	
<p><b>ARDG-DDH05      21.0-21.08 m</b>  <u>Summary:</u> Strongly porphyritic rhyodacite, with moderate pervasive alteration, but with the rock remaining hard and competent. The sample contains abundant phenocrysts of quartz, plagioclase and K-feldspar, each locally showing fracturing and shattering, as well as a few smaller altered phenocrysts of biotite. There are also a few altered microphenocrysts of FeTi oxide. A formerly glassy groundmass constitutes about half of the sample, with this having sustained complete replacement by fine grained alkali feldspar and minor quartz, due to imposition of low grade (e.g. diagenetic) alteration. Commonly, alkali feldspar forms radiating, spherulitic aggregates. Alteration is also manifest in the rock in fractured feldspar phenocrysts by local replacement by fine grained sericite and chlorite, and throughout the groundmass and in fractured feldspars, by laumontite replacement aggregates. Despite the alteration, there is no significant concentration of the replacement phases on planar structures and the rock could remain suitable for construction purposes.</p> <p><b>ARDG-DDH05      27.17-27.27 m</b>  <u>Summary:</u> Porphyritic rhyodacite, with moderate pervasive alteration and hosting a few thin veins. Generally, the rock is massive and contains scattered phenocrysts of quartz, K-feldspar and plagioclase, as well as a few smaller grains of biotite (now mostly altered) in a fine grained quartzofeldspathic groundmass. The latter was originally aphanitic or glassy and locally preserves randomly oriented flow foliation. Mild alteration, probably a result of diagenesis, led to replacement of the groundmass by abundant very fine grained alkali feldspar, minor quartz, a little chlorite and trace hematite, with a little overprinting laumontite. Feldspar phenocrysts (mainly plagioclase) shows minor, fractured-controlled replacement by chlorite, sericite and laumontite, and most biotite is replaced by laumontite, sericite, chlorite and hematite. The rock is cut by a few thin, commonly sub-parallel veins of laumontite. The overall amount of alteration minerals is modest and apart from the minor veining, there is little concentration of alteration phases on planar structures. Although the rock would probably be hard and competent, increased veining would reduce its quality.</p> <p><b>ARDG-DDH05      28.02-28.12 m</b>  <u>Summary:</u> Strongly altered felsic tuff, probably of vitric-crystal type. Due to imposed alteration, relict texture is only moderately preserved. The rock might have contained scattered lithic/vitric fragments, as well as phenocrystal grains of quartz and possible feldspar in a finer grained vitriclastic matrix. Pervasive alteration is of hydrothermal type and led to replacement of all vitric, lithic and feldspar material to fine grained laumontite, subordinate quartz, minor irregularly distributed chlorite and a little hematite and pyrite. A few laumontite veins also cut the rock. Minor hematite pigmentation occurs throughout. Due to the pervasive alteration, it is likely that there would be some degradation of rock properties, even though the sample remains rather hard and competent. This type of material should be avoided in quarrying.</p> <p><b>ARDG-DDH05      30.77-30.87 m</b>  <u>Summary:</u> Porphyritic rhyodacite, containing scattered phenocrysts of quartz, plagioclase and K-feldspar, but with all former biotite grains being altered. There are also a few microphenocrysts of altered FeTi oxide, all hosted in what was originally a fine grained (aphanitic or glassy) groundmass of quartzofeldspathic composition. Pervasive moderate to strong alteration was imposed, along with emplacement of several veins, with this process probably occurring due to diagenesis, but also involving hydrothermal fluid flux. Initial alteration affected the groundmass, with replacement by fine grained alkali feldspar (commonly in sub-radiating aggregates), with minor quartz and chlorite. Plagioclase could have been albitised and also developed a little chlorite and sericite. The rock appears to have been subsequently variably replaced by laumontite, affecting feldspar phenocrysts, biotite grains (where it is associated with hematite) and the groundmass. Igneous FeTi oxide grains were replaced by hematite. Veining was by fine to medium grained laumontite, with the rock being more altered adjacent to the veins. Due to the laumontite veining and patchy replacement of the rock, it is inferred that quality of the rock would be partly degraded and that it should be avoided during quarrying.</p> <p><b>ARDG-DDH05      47.45-47.59 m</b></p>	

**Summary:** Pervasively altered, medium to coarse grained, sparsely amygdaloidal dolerite. There is considerable preservation of primary minerals, with plagioclase laths intergrown ophitically with clinopyroxene. There is also minor disseminated FeTi oxide (titanomagnetite > ilmenite). Properties of clinopyroxene suggest it is a Ti-bearing augite, locally transitional to aegirine-augite, and hence the dolerite could have alkaline affinities. A few amygdules occur, filled by zeolite, analcime and rimmed by smectite-chlorite. Pervasive alteration of the rock could be a diagenetic product, with replacement, mostly of plagioclase, but fine grained smectite-chlorite. Although there is no concentration of smectite-chlorite on planar structures, the volume (~30%) of this phase and its likelihood to have swelling properties, would make the use of this type of rock unsuitable.

**ARDG-DDH05      56.5-56.55 m**

**Summary:** Pervasively altered, fine to medium grained dolerite, probably with alkaline affinities and similar to sample DDH05/47.45 m, but finer grained. There is considerable preservation of primary igneous minerals, with laths of plagioclase intergrown with pink-brown clinopyroxene (*e.g.* titanaugite) and with the rock containing disseminated fine grained FeTi oxide (titanomagnetite), Sparse small amygdules also occur. Strong alteration was imposed, probably caused by diagenesis, with replacement of much plagioclase by fine grained chlorite, grading to smectite-chlorite. Clinopyroxene is only mildly altered, with amygdules containing chlorite and minor carbonate. There is a trace of pyrite as part of the alteration. The rock is cut by a few sub-planar, locally intersecting veins, containing carbonate, chlorite, local zeolite and a trace of very fine pyrite. Due to the abundance of fine grained layer silicates and presence of veins containing “weak” minerals, this rock type should not be used for construction purposes and should be avoided during quarrying.

**TABLE 6-12**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH06**

Drilling Objectives	Geology Summary	Structure Summary
<p>Hole was collared southeast of Stone Ridge in an area devoid of outcrop near the major zone of rhyolitic tuff. The hole was drilled on azimuth of 322° grid, approximately normal to the regional strike and dip, with the objective of confirming the nature of the geology overlying the rhyodacite and underlying the rhyolitic tuff.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 4 (MD4).</p> <p>During the drilling of this hole, the soft ground surrounding the hole collar became heavily eroded. This resulted in downward sag in the inclined drill rod string, ultimately resulting in the breakoff and loss of the barrel and a significant number of drill rods. Despite extensive efforts, the barrel and drill rods could not be recovered, and the hole was abandoned prematurely.</p>	<p><b>Lithology and Alteration</b>  <b>Soil / Clay:</b> 0m - 3.54m  <b>Volcanic sandstone, siltstone, tuff:</b> 3.54m - 25.06m</p> <ul style="list-style-type: none"> <li>generally highly weathered to 20.7m, then slightly weathered to 25.06m</li> </ul> <p><b>Rhyodacite:</b> 25.06m - 78.2m (end-of-hole)</p> <ul style="list-style-type: none"> <li>slightly weathered to 30.0m, then fresh to 78.2m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>4m - 25m (sandstone, siltstone, tuff rhyodacite): 20 - 446 x 10<sup>-5</sup> SI with average of 135 x 10<sup>-5</sup> SI</li> <li>25m - 78m (rhyodacite): 150 - 880 x 10<sup>-5</sup> SI with average of 329 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>typically weakly fractured throughout, with minor narrow intervals of moderate or strong fracturing</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m - 3.54m</p> <p><b>Roadbase blendable:</b> 3.54m - 25.06m</p> <p><b>Aggregate quality:</b> 25.06m - 78.2m</p>	<p>The hole intersected a strongly interbedded sequence of volcanic sandstone, siltstone and tuff, including several thin bands of vitric-crystal rhyolitic tuff before transitioning into the rhyodacite. The rhyolitic tuff band that outcrops near the drill collar is likely to represent the very top of this sequence (<i>i.e.</i> the top of the <i>Eagleton Volcanics</i>). The top of the underlying rhyodacite is coarsely lithic fragmental and has a greenish tinge reflecting the presence of minor secondary sericite. At depth, the rhyodacite becomes less fragmental and is more similar with that encountered elsewhere.</p> <p>The highly weathered nature of the bedded volcanic sedimentary sequence, combined with sericite-alteration associated with the top of the rhyodacite, is likely to explain the absence of outcrop at surface.</p> <p>No evidence of any faulting, shearing or brecciation.</p> <p>Bedding in the volcanic sandstone and tuff is typically oriented at a high angle to the core axis (<i>i.e.</i> 76-86°) as is the contact between the rhyodacite and overlying volcanic sediments which is oriented at 85° to the core axis. This is consistent with the interpreted 30-35° easterly dip of the <i>Eagleton Volcanics</i>.</p>	

### Thin Section Petrography

**ARDG DDH06 23.0-23.1 m**

Summary: Crystal-lithic-vitric tuff of rhyolitic composition, showing moderate to strong pervasive alteration. Relict characteristics are rather well preserved, with former phenocrystal grains of quartz, minor K-feldspar and a little plagioclase and altered biotite, associated with lithic grains of porphyritic, but formerly partly glassy felsic volcanic material and interstitial matrix of former finer, vitriclastic material. Due to imposition of diagenetic alteration, all former glassy material was replaced by fine grained alkali feldspar (locally in sub-radiating aggregates), minor quartz, sericite, turbid clay (*e.g.* kaolinite) and trace hematite. Biotite was completely altered to sericite and trace leucoxene and hematite, and K-feldspar grains are also slightly altered to sericite. The volume of alteration-derived layer silicates is modest and there is no concentration on to planar structures. Consequently, the rock remains hard and massive, and would be probably suitable for construction purposes.

**ARDG DDH06 25.92-26.02 m**

Summary: Rather coarse crystal-lithic-vitric tuff of rhyolitic composition, showing moderate to pervasive alteration, probably as a result of imposed diagenesis. The rock retains scattered phenocrystal grains of quartz, K-feldspar, minor plagioclase and altered biotite, and a little FeTi oxide, as well as lithic grains of porphyritic, but formerly partly glassy felsic volcanic material, and interstitial matrix of former vitriclastic material. Imposed alteration caused all former glassy material to be replaced by fine grained alkali feldspar (locally in sub-radiating aggregates), minor quartz and sericite, and trace hematite. Biotite was completely altered to sericite and trace leucoxene and hematite, and feldspar grains are slightly altered to sericite. The volume of alteration-derived sericite is modest and there is no concentration on to planar structures. Consequently, the rock remains hard and massive, and would be probably suitable for construction purposes.

**ARDG DDH06 30.0-30.07 m**

Summary: Massive crystal-vitric-lithic tuff of rhyolitic to rhyodacitic composition. It contains scattered quartz, K-feldspar and plagioclase phenocrystal grains, less common and completely altered biotite and a few smaller FeTi oxide grains. There are a few possible porphyritic and formerly glassy felsic volcanic lithic fragments and an abundant matrix component that was originally vitriclastic. Moderate to strong pervasive alteration was imposed, *e.g.* due to diagnosis and all former vitric material was replaced by fine grained alkali feldspar, plus minor quartz and sericite. Feldspar grains are mildly altered to sericite and a little clay, and all biotite was replaced by sericite and trace leucoxene and hematite. Although altered, there rock has developed only a small amount of fine grained layer silicates and these are not concentrated on to planar structures. Consequently, the rock remains hard and massive and should be suitable for construction purposes.

**ARDG-DDH06 40.01-40.09 m**

Summary: Massive porphyritic biotite rhyodacite, with moderate pervasive alteration. The rock contains abundant phenocrysts of quartz, K-feldspar and plagioclase, with less common, and smaller phenocrysts of biotite and FeTi oxide (titanomagnetite). The phenocrysts appear to be enclosed in a coherent groundmass that could have been aphanitic/glassy, with local flow foliation. There is little evidence that the rock is of pyroclastic type, although in a small zone, there is micro-brecciation. Imposed alteration could be due to diagenesis and resulted in replacement of groundmass material by abundant fine grained alkali feldspar, commonly in sub-radiating aggregates. There has also been minor development of sericite, a clay phase (*e.g.* kaolinite), chlorite, hematite and trace leucoxene. Clay is locally more prevalent in the micro-brecciated zone, but overall, there is no planar concentration of the layer silicate minerals and the rock remains hard and competent. It has little fracturing or veining and should be generally suitable for construction purposes.

**ARDG-DDH06 49.92-50.01 m**

Summary: Massive coarse fragmental volcanic rock, or rhyodacitic composition. It contains scattered large fragments of flow foliated, porphyritic rhyodacite in an apparent matrix with abundant individual mineral grains and finer vitriclastic-dominated matrix. Compositionally, the large fragments and enclosing material are much the same. There are abundant phenocrystal grains of quartz, K-feldspar and plagioclase, and less common and smaller grains of biotite, along with FeTi oxide (titanomagnetite) and trace apatite and zircon. The groundmass of the coherent fragments was probably glassy originally and has randomly-oriented flow foliation. The rock was subject to pervasive alteration, probably a result of diagenesis, causing replacement of groundmass and matrix material by fine grained alkali feldspar (commonly forming sub-radiating aggregates). Throughout the rock, there is also minor replacement by sericite, clay (*e.g.* kaolinite, in a few microbrecciated zones), and traces of hematite, laumontite, chlorite and carbonate. The rock remains hard and competent, and there is little indication of concentration of alteration minerals on planar structures. Consequently, it would probably be suitable for construction purposes.

**ARDG-DDH06      60.32-60.42 m**

Summary: Massive, strongly porphyritic rhyodacite. The rock contains scattered phenocrysts of quartz, K-feldspar, plagioclase and biotite, with the last phase being mostly altered. There are also a few microphenocrysts of FeTi oxide (titanomagnetite) and a few medium grained feldspar grain clusters. Phenocrystal phases occur in a fine grained, perhaps originally aphanitic or glassy quartzofeldspathic composition groundmass in which relict flow foliation is locally preserved. Pervasive moderate alteration was imposed on the rock, with replacement of the groundmass by fine grained alkali feldspar. Small amounts of sericite, clay (*e.g.*, kaolinite), hematite and trace chlorite, carbonate and laumontite have also formed by alteration, but their volumes are minor and there are no concentrations on to planar structures. The rock remains hard and competent and as a consequence, it should be suitable for construction purposes.

<b>TABLE 6-13</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH07</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Hole was collared at the crest of the southwest hill on Stone Ridge, with the objective of confirming the nature of the underlying rhyodacite. The hole was drilled on an azimuth of 322° grid, approximately normal to the regional strike and dip.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 3 (MD3).</p>	<p><b><u>Lithology and Alteration</u></b>  <b>Rhyodacite:</b> 0.1m - 111.2m (end-of-hole)</p> <ul style="list-style-type: none"> <li>moderately weathered to 3.0m, then slightly weathered to unweathered / fresh to 111.2m</li> </ul> <p><b><u>Magnetic Susceptibility</u></b></p> <ul style="list-style-type: none"> <li>3m - 111m: 34.1 - 1340 x 10<sup>-5</sup> SI with average of 790 x 10<sup>-5</sup> SI</li> </ul>	<p><b><u>Faulting / Shearing / Brecciation</u></b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b><u>Fracturing</u></b></p> <ul style="list-style-type: none"> <li>0.1m - 12.1m: generally moderately fractured</li> <li>12.1m - 111.2m: generally weakly fractured with minor narrow zones of more intense fracturing</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Aggregate quality:</b> 0.10m - 111.2m</p>	<p>The hole intersected a remarkably consistent, generally massive body of unaltered rhyodacite from surface to the end-of-hole. Weak oxidation of the top 17m resulted in the pink-brown colour that characterises the rhyodacite at, or near surface. Below 17m, the rhyodacite is grey in colour.</p> <p>No evidence of any faulting, shearing or brecciation.</p> <p>The hole was terminated in rhyodacite.</p>	
<b>Thin Section Petrography</b>		
<p>No Petrography</p>		

**TABLE 6-14**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH08**

Drilling Objectives	Geology Summary	Structure Summary
<p>Hole was collared directly northwest of Stone Ridge saddle and directly west of the saddle. The hole was drilled on an azimuth of 322° grid, approximately normal to the regional strike and was designed to confirm the nature of sub-surface geology in the vicinity of subcrop and float of lithic-crystal andesitic volcanic rocks.</p> <p>The hole was drilled prior to ground magnetic surveying but was collared in Magnetic Domain 2 (MD2), at the approximate location of Magnetic Lineament 1 (ML1) (the Central Fault). It was drilled at a low angle to the orientation of the Central Fault.</p>	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 0.5m</p> <p><b>Volcanic breccia:</b> 0.5m - 54.48m</p> <ul style="list-style-type: none"> <li>highly weathered to 17.7m, then moderately to highly weathered to 23.02m</li> <li>generally slightly weathered from 23.02m - 54.48m</li> </ul> <p><b>Rhyolitic vitric tuff:</b> 54.48m - 57.93m</p> <ul style="list-style-type: none"> <li>slightly weathered</li> </ul> <p><b>Volcanic breccia / Andesite:</b> 57.93m - 69.12m</p> <ul style="list-style-type: none"> <li>slightly weathered</li> </ul> <p><b>Rhyolitic vitric tuff:</b> 69.12m - 70.45m</p> <ul style="list-style-type: none"> <li>slightly weathered</li> </ul> <p><b>Volcanic breccia / Andesite:</b> 70.45m - 89.46m</p> <ul style="list-style-type: none"> <li>slightly weathered</li> </ul> <p><b>Rhyolitic vitric tuff:</b> 89.46m - 89.90m</p> <ul style="list-style-type: none"> <li>slightly weathered</li> </ul> <p><b>Volcanic breccia / Andesite:</b> 89.90m - 99.15m</p> <ul style="list-style-type: none"> <li>slightly weathered to 92.0m, then unweathered / fresh to 99.15m</li> </ul> <p><b>Dolerite:</b> 99.15m - 117.3m (end of hole)</p> <ul style="list-style-type: none"> <li>unweathered / fresh</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>48 readings between 23m and 92m (volcanic breccia): 26.5 - 2080 x 10<sup>-5</sup> SI with average of 1197 x 10<sup>-5</sup> SI</li> <li>14 readings between 61m and 99m (andesitic volcanics): 866 - 2600 x 10<sup>-5</sup> SI with average of 1735 x 10<sup>-5</sup> SI</li> <li>4 readings between 55m and 70m (rhyolitic tuff): 154 - 214 x 10<sup>-5</sup> SI with average of 180 x 10<sup>-5</sup> SI</li> <li>99m - 117m (dolerite): 2600 - 4210 x 10<sup>-5</sup> SI with average of 3483 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>0.5m - 13.7m: the breccia is fractured due to ?faulting</li> <li>99.15m - 117.3m: the dolerite dyke defines a fault zone</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.5m - 29.0m: generally strongly to intensely fractured</li> <li>29.0m - 117.3m: generally weakly fractured, with occasional narrow zones of more intense fracturing</li> </ul>

Rock Quality	Comments
<p><b>Overburden:</b> 0m - 117.03m</p>	<p>The hole intersected a coarsely fragmental volcanic breccia from surface to 99.15m depth, comprised of rounded to sub-angular clasts of predominantly andesitic volcanic composition, with minor rhyolitic tuff, supported within a fine grained hematitic matrix. Clast size varies significantly, and several broad intervals of andesite and rhyolite within the breccia may represent large clasts within the breccia. The breccia is interpreted to be representative of the dominant geology within Magnetic Domain 2.</p> <p>Strong fracturing at the top of the hole is believed to be associated with the Central Fault.</p> <p>The contact of the dolerite dyke with the volcanic breccia is planar and oriented at 13° to the core axis. This is consistent with the expected orientation of structural-related features associated with the Central Fault, given the orientation of the hole.</p>
<b>Thin Section Petrography</b>	
<p><b>ARDG-DDH08      30.4-30.65 m</b></p> <p><u>Summary:</u> Coarse volcanic breccia containing scattered large sub-rounded to angular fragments of porphyritic pyroxene andesite enclosed in a matrix of smaller fragments, individual mineral grains and finer, interstitial tuffaceous material. Fragments have phenocrysts of plagioclase, less common clinopyroxene, an altered ferromagnesian phase (perhaps formerly orthopyroxene) and minor magnetite, set in a fine grained/glassy groundmass. The breccia matrix contains smaller, disaggregated fragments and individual mineral grains. Pervasive moderate alteration was imposed, with development of a smectite phase from former orthopyroxene, as well as minor amounts in matrix/groundmass material and from plagioclase. There are also small amounts of hematite, chlorite, laumontite and sericite formed from matrix/groundmass material, and from plagioclase. A couple of thin, irregular veins of laumontite and chlorite occur. Although the rock remains massive, hard and competent, the presence of significant smectite as an alteration product could cause rock quality degradation.</p> <p><b>ARDG-DDH08      36.29-36.41 m</b></p> <p><u>Summary:</u> Coarse volcanic breccia containing a single large fragment of porphyritic pyroxene andesite, as well as smaller fragments of the same rock type. These constitute over half of the rock and are enclosed by tuffaceous material (lithic-crystal tuff) of broadly andesitic composition. Pervasive, rather strong alteration affects the entire rock, probably as a result of diagenetic processes. In the andesite fragments, interpreted original orthopyroxene was replaced by fine grained smectite-chlorite and chlorite, and plagioclase is partly replaced by laumontite. Chlorite, laumontite, albite and a little hematite have formed in the original fine grained, perhaps glassy, groundmass. In the enclosing tuff, there was also pervasive development of fine grained chlorite, laumontite, albite and hematite. Although the rock is massive and probably hard and competent, the amount of alteration minerals (especially the layer silicates) would probably impact on rock quality for construction purposes.</p> <p><b>ARDG-DDH08      40.58-40.68 m</b></p> <p><u>Summary:</u> Porphyritic pyroxene andesite, with pervasive, moderate to strong alteration. The rock retains plagioclase and minor clinopyroxene phenocrysts, as well as microphenocrysts of magnetite, but all formerly quite abundant orthopyroxene phenocrysts are altered. A large groundmass component was originally glassy or aphanitic, and was of feldspathic composition. Alteration was probably due to diagenesis (burial metamorphism) and resulted in complete replacement of orthopyroxene and part replacement of plagioclase, clinopyroxene and magnetite. The groundmass was recrystallised to fine grained alkali feldspar, minor chlorite and trace hematite. The replacement of the phenocryst phases resulted in development of considerable chlorite and related layer silicate phases (e.g. chlorite-smectite and chlorite-celadonite) as well as a little hematite, laumontite and trace epidote. A few thin irregular veins occur, containing carbonate, chlorite, analcime and chlorite-celadonite. Although the rock is massive, hard, competent and largely un-fractured, the amount of alteration minerals (especially the layer silicates) could have deleterious effects on rock quality.</p> <p><b>ARDG-DDH08      44.06-44.21 m</b></p>	

**Summary:** Massive, coarse, matrix-supported volcanic breccia, similar to the sample at 36.29-36.41 m, containing scattered porphyritic pyroxene andesite fragments in a tuffaceous matrix. The andesite retains phenocrysts of plagioclase, minor clinopyroxene and magnetite, and originally contained orthopyroxene (now altered) in a fine grained groundmass. The tuffaceous matrix has scattered smaller andesite fragments, isolated individual mineral grains (*e.g.* plagioclase, altered orthopyroxene, clinopyroxene, quartz) and interstitial fine grained altered material. The rock overall has moderate to strong pervasive alteration, with considerable replacement of groundmass/matrix material, plagioclase phenocrysts and all orthopyroxene grains, with development of laumontite, chlorite, minor chlorite-smectite and hematite. A couple of thin laumontite veins occur. Although the rock is massive, hard, competent and largely unfractured, the amount of alteration minerals (especially the layer silicates) present (~40%) would probably impact on rock quality for construction purposes.

**ARDG-DDH08 44.34-44.42 m**

**Summary:** Massive, strongly porphyritic pyroxene andesite abutting against matrix-supported lithic-crystal tuff. Both rock types have moderate to strong pervasive alteration. In the tuff, there are fragments of andesite (similar to the main occurrence) as well as isolated (liberated) grains of plagioclase, minor clinopyroxene, altered orthopyroxene, quartz and magnetite, enclosed in a fine grained, altered matrix. The andesite retains phenocrysts of plagioclase, altered orthopyroxene, and a little clinopyroxene and magnetite microphenocrysts in what was a formerly glassy groundmass. Imposed alteration, probably a consequence of burial metamorphism, has produced considerable chlorite (replacement of orthopyroxene, andesite groundmass, tuff matrix and plagioclase) and accompanied by minor chlorite-smectite, laumontite, hematite and a little sericite and epidote. A single thin laumontite vein occurs, but overall, the rock is unfractured. It is hard and competent, but the proportion of alteration minerals (especially layer silicates) is substantial, and this might have deleterious effects on rock quality.

**ARDG-DDH08 50.27-50.34 m**

**Summary:** Porphyritic pyroxene andesite, showing imposed zones of disaggregation and comminution (microbrecciation), and with pervasive, rather strong alteration. Coherent domains in the rock preserve scattered plagioclase phenocrysts, along with a few grains of clinopyroxene and microphenocrysts of magnetite, but all former grains of interpreted orthopyroxene are altered. The rock formerly had a fine grained, perhaps glassy, groundmass. Zones of microbrecciation show shattering of plagioclase grains and stronger alteration. There was considerable replacement of former groundmass material by fine grained alkali feldspar (albite) and chlorite, with patchy hematite and a little laumontite. All interpreted orthopyroxene was altered, mostly to chlorite and minor chlorite-smectite. There was also minor development of chlorite, hematite, laumontite and sericite from plagioclase. The rock remains hard and competent, and there are few later fractures or veins, but the proportion of alteration minerals (especially layer silicates) is substantial, and this could negatively affect rock quality.

**ARDG-DDH08 52.4-52.49 m**

**Summary:** Matrix-supported volcanic breccia, containing scattered porphyritic andesite fragments in a lithic-crystal-vitric tuff matrix, with strong pervasive alteration being imposed on the main components of the rock. Andesite fragments originally has plagioclase, orthopyroxene and clinopyroxene phenocrysts, as well as a few magnetite microphenocrysts, in a fine grained, possibly glassy groundmass. The enclosing tuff also has smaller andesite fragments, individual (liberated) grains of plagioclase, minor quartz, clinopyroxene, altered orthopyroxene and traces of magnetite, K-feldspar, muscovite and hornblende, as well as abundant vitriclastic material. Alteration could be a result of imposed diagenesis (burial metamorphism) and has caused significant development of laumontite, a clay phase (*e.g.* kaolinite), chlorite and alkali feldspar (*e.g.* albite) as well as minor hematite. Although the rock is little-fractured, the amount of alteration minerals (estimated at > 50%) could cause significant degradation of rock quality.

**ARDG-DDH08 56.01-56.09 m**

**Summary:** Fine grained rhyodacite composition vitric-crystal tuff, possibly ignimbritic, with mild pervasive alteration. The rock is largely massive and preserves rather sparsely distributed phenocrysts of feldspars, quartz and biotite, with a few grains of magnetite, apatite and zircon and pseudomorphs after another ferromagnesian phase (*e.g.* pyroxene). These phases occur in a fine grained, formerly vitriclastic matrix, in places preserving glass shard texture. Imposed alteration led to replacement of vitriclastic material by fine grained alkali feldspar and quartz, with slight dusting by clay (*e.g.* kaolinite) and trace hematite. Feldspar phenocrysts

are also slightly altered to clay and chlorite, with biotite being partly replaced by chlorite and hematite. No significant fracturing occurs and the rock is hard and competent, with no concentration of alteration phases on planar structures. The rock would probably be suitable for construction purposes.

**ARDG-DDH08 78.97-79.06 m**

**Summary:** Moderately to strongly altered, massive coarse andesite fragmental. It contains variably disaggregated fragments of porphyritic andesite, in a matrix of individual mineral grains and interstitial fine grained tuffaceous material. There are phenocrystal grains of plagioclase, minor clinopyroxene and magnetite, and pseudomorphs after former interpreted orthopyroxene grains, in a fine grained groundmass. There was replacement of groundmass and finer matrix material by alkali feldspar (*e.g.* albite), minor chlorite and patchy hematite, as well as a minor amount of clay (*e.g.* kaolinite). All former orthopyroxene was replaced by chlorite and plagioclase shows minor alteration to sericite and chlorite. The rock is unfractured, hard and competent, but the rather high proportion of alteration minerals (layer silicates mainly) could cause degradation of rock quality.

**ARDG-DDH08 87.07-87.27 m**

**Summary:** Coarse, matrix-supported volcanic breccia, with pervasive moderate to strong alteration. The rock contains scattered volcanic fragments including porphyritic pyroxene andesite and felsic vitriclastic-dominated felsic tuff in a tuffaceous material consisting of small volcanic lithic fragments, abundant individual (liberated) mineral grains (including plagioclase, minor quartz, clinopyroxene, altered orthopyroxene, K-feldspar, hornblende and magnetite) and interstitial tuffaceous (perhaps including vitriclastic) material. Alteration could be due to burial metamorphism and has resulted in development of fine grained alkali feldspar (*e.g.* albite) in the groundmass of andesite fragments, in felsic fragments and in interstitial tuffaceous material. There was also considerable development of laumontite (mostly in andesite fragments), minor chlorite, chlorite-smectite (*e.g.* from former orthopyroxene), hematite and sericite. A couple of thin veins cut the rock, with these containing carbonate or laumontite.

**ARDG-DDH08 95.09-95.19 m**

**Summary:** Porphyritic pyroxene andesite showing patchy development of microbrecciation and local invasion by irregular and veinlike microbreccia zones. The rock originally contained phenocrysts of plagioclase, orthopyroxene (now altered), clinopyroxene and a little magnetite in a fine grained groundmass. A single gabbroic mass could represent a micro-enclave. The rock was subject to pervasive, moderate to strong alteration with development of fine grained alkali feldspar (albite) in groundmass domains, along with chlorite and minor chlorite-smectite, laumontite and hematite. Cross-cutting microbreccia zones have increased interstitial amounts of fine grained hematite and chlorite. The rock was also cut by a couple of later, sub-planar veins containing fine grained laumontite and carbonate. Although the rock is massive, and apparently hard and competent, the amount of alteration minerals (especially layer silicates) and presence of a few veins, could lead to degradation of rock quality.

**ARDG-DDH08 100.94-101.02 m**

**Summary:** Massive, sparsely porphyritic and locally amygdular medium grained dolerite, with moderate to strong, pervasive alteration. The rock contains sparse plagioclase phenocrysts in a finer grained, intergrown mass of plagioclase, clinopyroxene (augite) and minor disseminated magnetite, and hosts a few sub-spheroidal amygdules. Alteration is probably due to burial metamorphism and has led to significant replacement of plagioclase and interstitial infillings by fine grained chlorite, with locally common prehnite, and a little epidote. Amygdules are filled mostly by chlorite, although there are small amounts of albite, prehnite, quartz and carbonate. The rock is essentially unfractured, and is hard and competent, but the amount of alteration minerals developed, especially chlorite, could cause degradation of rock quality.

**ARDG-DDH08 105.3-105.36 m**

**Summary:** Sparsely porphyritic and amygdaloidal dolerite, with moderate to strong alteration. The rock retains a few plagioclase phenocrysts, hosted in a medium grained, intergrown aggregate of plagioclase and clinopyroxene (augite) and a little disseminated magnetite. Scattered amygdules occur throughout. Pervasive alteration might be a result of imposed burial metamorphism and has led to development of considerable chlorite, with minor laumontite and a little epidote, carbonate, pyrite and titanite. Amygdules are filled by chlorite, with locally abundant laumontite. Although the rock is massive and hard, the amount of alteration minerals that have formed (especially chlorite) could lead to reduction in rock quality.

**ARDG-DDH08**      **111.14-111.27 m**

Summary: Sparsely porphyritic, medium grained dolerite, with pervasive, medium to strong alteration. Igneous texture and mineralogy are rather well preserved, with abundant plagioclase and subordinate clinopyroxene (augite), locally forming phenocrysts, and a little disseminated magnetite. The rock is cut by a narrow veinlike mass of fine grained, plagioclase-rich igneous rock that could represent a more feldspathic differentiate. Alteration is probably due to imposition of burial metamorphism and has resulted in rather extensive development of fine grained chlorite from primary igneous silicates, along with minor epidote and laumontite, and traces of titanite, carbonate and pyrite. The rock remains massive and hard, and could be suitable for construction purposes, although the amount of alteration minerals (especially chlorite) might be deleterious.

<b>TABLE 6-15</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH09</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
Hole was collared within Magnetic Domain 4 (MD4), approximately 35m southeast of the limit of rhyodacite outcrop. The hole was drilled on an azimuth of 332° grid, approximately normal to the regional strike and dip, with the objective of testing the upper rhyodacite stratigraphy on the southeast side of Stone Ridge, towards Italia Road.	<p><b>Lithology and Alteration</b></p> <p><b>Soil / Clay:</b> 0m - 0.5m</p> <p><b>Volcanic sandstone, siltstone, clay:</b> 0.5m - 3.77m</p> <ul style="list-style-type: none"> <li>extremely to highly weathered</li> </ul> <p><b>Rhyodacite:</b> 3.77m - 119.8m</p> <ul style="list-style-type: none"> <li>moderately weathered to 8.4m, then slightly weathered to unweathered / fresh to 119.8m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>9m - 119m: 20.1 - 876 x 10<sup>-5</sup> SI with average of 442 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.5m - 7.5m: variably fractured</li> <li>7.5m - 119.8m: generally weakly fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 3.77m</p> <p><b>Roadbase quality:</b> 3.77m - 8.4m</p> <p><b>Aggregate quality (CA):</b> 8.4m - 13.0m</p> <p><b>Aggregate quality:</b> 13.0m - 119.8m</p>	<p>The hole was fortuitously collared at the contact between rhyodacite and the overlying volcanic sedimentary sequence. The volcanic sediments intersected by the hole are similar to those intersected in hole ARDG-DDH06. The upper 15m of the rhyodacite is pink-brown in colour as a result of oxidation, but generally very competent. The rhyodacite has a pale pink hue to around 60m depth which may be related to the presence of alteration hematite – presumably after magnetite. The rhyodacite near the contact lacks the obvious lithic fragments seen in ARDG-DDH06, although at deeper levels there are localised zones of fragmental-looking rhyodacite that appear enhanced by alteration.</p> <p>No evidence of any faulting, shearing or brecciation.</p> <p>Bedding within the short interval of volcanic sediments, along with the contact with underlying rhyodacite, is oriented at a high angle to the core axis and is consistent with the interpreted 30-35° southeast dip of the <i>Eagleton Volcanics</i>.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was possible below 23.8m, and logging of lithotype boundaries (<i>i.e.</i> interpreted bedding-related features) show a strong concentration of features that dip from 25° - 40° towards 130° - 140° magnetic (<i>i.e.</i> 142° - 152° grid). This is again consistent with the southeast dip of the <i>Eagleton Volcanics</i>. The data also show a strong concentration of open fractures that dip at moderate to steep angles towards 340° - 020° magnetic (<i>i.e.</i> 352° - 032° grid).</p>	
<b>Thin Section Petrography</b>		
No Petrography		

<b>TABLE 6-16</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH10</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
Hole was collared within Magnetic Domain 3 (MD3), on the eastern side of Stone Ridge. The hole was located near the limit of outcropping rhyodacite and was drilled on azimuth of 322° grid, with the objective of testing the rhyodacite directly west of hole ARDG-DDH06.	<p><b>Lithology and Alteration</b></p> <p><b>Soil / Clay:</b> 0m - 1.36m</p> <p><b>Rhyodacite:</b> 1.36m - 120.5m (end-of-hole)</p> <ul style="list-style-type: none"> <li>moderately weathered to 18.5m, then slightly weathered to 39.0m</li> <li>unweathered / fresh from 39.0m - 120.5m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>19m - 120m: 65.8 - 628 x 10<sup>-5</sup> SI with average of 336 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>the rhyodacite is brecciated but healed by laumontite veining from 9.85m - 18.5m, 22.8m - 24.57m, 29.03m - 32.0m, 34.2m - 36.6m and 59.45m - 64.3m</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>1.36m - 64.3m: generally moderately to strongly fractured</li> <li>64.3m - 120.5m: generally weak to moderately fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 2.62m</p> <p><b>Aggregate quality (CA):</b> 2.62m - 39.0m</p> <p><b>Aggregate quality:</b> 39.0m - 120.5m</p>	<p>The hole intersected moderately to local strongly fractured rhyodacite to around 64m depth, containing numerous zones of internal brecciation healed by laumontite veining. These veins are oriented sub-parallel to the core axis, indicating that their true width would be substantially narrower than the apparent width present in core. As a result, it is believed that this hole may have been collared in a relatively narrow structural zone that is oriented parallel or sub-parallel to the Central Fault.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was possible below 25.8m, although interpreted bedding information in the most fractured part of this hole above 60m is believed unreliable. Below 60m depth bedding features dip from 15° - 35° towards 90° - 135° grid (<i>i.e.</i> 112° - 147° magnetic). The data also indicates that in the most fractured upper part of the hole to 60m depth, there is a strong concentration of fractures that dip at shallow to moderate angles to grid west. There is also a concentration of open fractures that dip at shallow to moderate angles to grid north to northeast.</p>	
<b>Thin Section Petrography</b>		
No Petrography		

<b>TABLE 6-17</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH11</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
Hole was collared within Magnetic Domain 3 (MD3), in an ephemeral drainage channel on the southeast side of Stone Ridge. The hole was located beyond the limit of outcropping rhyodacite and was drilled on azimuth of 356° grid, with the objective of testing Magnetic Lineament 2 (ML2).	<p><b>Lithology and Alteration</b></p> <p><b>Soil / Clay:</b> 0m - 0.71m</p> <p><b>Rhyodacite:</b> 0.71m - 98.9m (end-of-hole)</p> <ul style="list-style-type: none"> <li>highly weathered to 4.26m, then moderately weathered to 6.0m</li> <li>slightly weathered from 6.0m - 13.03m, then unweathered / fresh to 98.9m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>6m - 98m: 52.3 - 1310 x 10<sup>-5</sup> SI with average of 583 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.71m - 13.85m: generally variably fractured</li> <li>13.85 - 98.9m: weakly fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 4.26m</p> <p><b>Aggregate quality (CA):</b> 4.26m - 6.0m</p> <p><b>Aggregate quality:</b> 6.0m - 98.9m</p>	<p>The hole intersected massive competent rhyodacite from 6m depth, with no sign of any major structures or fracturing indicative of a structural zone. The hole confirmed the presence of a significant mass of 'high quality' rhyodacite southeast of the main ridge and beneath an area devoid of outcrop.</p> <p>No evidence of any faulting, shearing or brecciation.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was possible below 21.6m. A strong concentration of lithotype boundaries (<i>i.e.</i> bedding) dip at 17° - 33° towards 120° - 160° magnetic (<i>i.e.</i> 132° - 172° grid). Open fractures in this hole are also similarly oriented, suggesting they may be related to bedding or rock fabric.</p>	
<b>Thin Section Petrography</b>		
No Petrography		

**TABLE 6-18**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH12**

Drilling Objectives	Geology Summary	Structure Summary
<p>Hole was collared in Magnetic Domain 3 (MD3), very close to the boundary with Magnetic Domain 4 (MD4). The hole was drilled on azimuth of 315° grid, approximately normal to the regional strike and dip, with the objective of testing the upper rhyodacite stratigraphy east of the northeast end of Stone Ridge, beyond the limit of outcropping rhyodacite.</p>	<p><b>Lithology and Alteration</b>  <b>Soil / Clay:</b> 0m - 7.0m                      Volcanic siltstone (weathered/clay): 7.0m - 15.12m</p> <ul style="list-style-type: none"> <li>extremely weathered</li> </ul> <p><b>Rhyodacite:</b> 15.12m - 114.3m (end-of-hole)</p> <ul style="list-style-type: none"> <li>generally moderately weathered to 36.2m, with slightly weathered interval from 18.0 - 34.0m</li> <li>slightly weathered from 36.2m - 59.5m, then unweathered / fresh to 114.3m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>18m - 114m: 48.4 - 1350 x 10<sup>-5</sup> SI with average of 461 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>15.12m - 64.0m: generally moderately to strongly fractured</li> <li>64.0 - 114.3m: weak to moderately fractured</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m - 15.26m</p> <p><b>Aggregate quality (CA):</b> 15.26m - 18.0m</p> <p><b>Aggregate quality:</b> 18.0m - 114.3m</p>	<p>The hole was collared in extremely weathered volcanic siltstone which directly overlies the rhyodacite. Bedding in the weathered siltstone and the contact with underlying rhyodacite are oriented at a high angle to the core axis. The rhyodacite has a characteristic pink hue due to oxidation to around 21m, after which it becomes mostly grey and relatively uniform in character.</p> <p>No evidence of any significant faulting, shearing or brecciation. Localised zones of stronger fracturing mostly appear to be associated with fractures oriented sub-parallel to the core axis – several of which have been filled by secondary laumontite.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was possible below 18.0m. Lithotype boundaries (<i>i.e.</i> bedding) dip from 25° - 38° towards 120° magnetic (<i>i.e.</i> 132° grid), which is consistent with the interpreted dip of the stratigraphy.</p>	
Thin Section Petrography		
<p>No Petrography</p>		

<b>TABLE 6-19</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH13</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Hole was drilled at the northeast end of Stone Ridge within Magnetic Domain 3 (MD3). The hole was drilled in an area of abundant rhyodacite outcrop and on an azimuth of 357° with the objective of testing the rhyodacite towards Magnetic Lineament 4 (ML4) and the Nine Mile Creek Fault Zone.</p> <p>The hole was prematurely abandoned due to the loss of a core barrel and several drill rods.</p>	<p><b><u>Lithology and Alteration</u></b></p> <p><b>Clay:</b> 0m - 0.3m</p> <p><b>Rhyodacite:</b> 0.3m - 66.2m (end-of-hole)</p> <ul style="list-style-type: none"> <li>• moderately to slightly weathered from 0.3m - 38.48m</li> <li>• slightly weathered to unweathered / fresh from 38.48m - 66.2m</li> </ul> <p><b><u>Magnetic Susceptibility</u></b></p> <ul style="list-style-type: none"> <li>• 9m - 66m: 303 - 1330 x 10<sup>-5</sup> SI with average of 1022 x 10<sup>-5</sup> SI</li> </ul>	<p><b><u>Faulting / Shearing / Brecciation</u></b></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul> <p><b><u>Fracturing</u></b></p> <ul style="list-style-type: none"> <li>• 0.3m - 66.2m: generally moderately to strongly fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 0.3m</p> <p><b>Roadbase quality:</b> 0.3m - 8.27m</p> <p><b>Aggregate quality (CA):</b> 8.27m - 31.8m</p> <p><b>Roadbase quality:</b> 31.8m - 38.48m</p> <p><b>Aggregate quality:</b> 38.48 - 66.2m</p>	<p>The hole intersected rhyodacite with several prominent zone of fracture-controlled oxidation to 39m. Occasional late narrow laumontite veins cut the rhyodacite, with the most prominent oriented at a low angle to the core axis.</p> <p>The hole did not intersect any faulting, shearing or brecciation.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was only possible below 49.0m and indicates lithotype boundaries (<i>i.e.</i> bedding) dip from 13° to 51° towards 75° - 135° magnetic (<i>i.e.</i> 87° - 147° grid).</p>	
<b>Thin Section Petrography</b>		
No Petrography		

<b>TABLE 6-20</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH14</b>		
<b>Drilling Objectives</b>	<b>Geology Summary / Comments</b>	<b>Structure Summary / Comments</b>
Hole was drilled at the northeastern end of Stone Ridge within Magnetic Domain 3 (MD3). The hole was drilled in an area devoid of outcrop and on an azimuth of 360° with the objective of testing the upper rhyodacite stratigraphy beyond the limit of outcropping rhyodacite and close to Magnetic Lineament 4 (ML4).	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 0.15m</p> <p><b>Rhyodacite:</b> 0.15 - 104.2m (end-of-hole)</p> <ul style="list-style-type: none"> <li>extremely to highly weathered to 2.62m, then moderately weathered to 19.5m</li> <li>slightly weathered 25.5m, then unweathered / fresh to 104.2m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>20m - 104m: 175 - 1500 x 10<sup>-5</sup> SI with average of 1062 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.15 - 36.82m: generally moderately to strongly fractured</li> <li>36.82m - 104.2m: generally weak to moderately fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 0.3m</p> <p><b>Roadbase quality:</b> 0.3m - 8.27m</p> <p><b>Aggregate quality (CA):</b> 8.27m - 31.8m</p>	<p>The hole intersected oxidised pinkish-brown rhyodacite from surface to approximately 20m depth, after which it becomes grey, uniform and relatively massive. Occasional low angle laumontite veins cut the rhyodacite.</p> <p>The hole did not intersect any evidence of faulting, shearing or brecciation.</p> <p>Downhole acoustic televiewer logging was undertaken on this hole by Groundsearch in order to obtain oriented structural data for slope stability assessment. Data collection was only possible below 25.8m and indicates lithotype boundaries (<i>i.e.</i> bedding) dip from 8° to 42° towards 70° - 180° magnetic (<i>i.e.</i> 82° - 192° grid). The spread of bedding data in this hole is atypical and may be attributable to movement along the nearby Nine Mile Creek Fault.</p>	
<b>Thin Section Petrography</b>		
No Petrography		

<b>TABLE 6-21</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH15</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
<p>Hole was collared on Stone Ridge, directly south of the Stone Ridge saddle in Magnetic Domain 3 (MD3). The hole was drilled on azimuth of 360° grid with the objective of testing the geology beneath the saddles at the confluence of Magnetic Lineament 1 (ML1) and Magnetic Lineament 2 (ML2).</p>	<p><b><u>Lithology and Alteration</u></b></p> <p><b>Clay:</b> 0m - 0.4m</p> <p><b>Rhyodacite:</b> 0.4m - 113.02m</p> <ul style="list-style-type: none"> <li>moderately weathered to 44.75m, then generally slightly weathered to 51.5m</li> <li>generally unweathered / fresh from 51.5m - 61.1m</li> <li>moderately weathered from 61.1m - 64.0m, then unweathered / fresh to 113.02m</li> </ul> <p><b>Dacite:</b> 113.02m - 132.2m (end-of-hole)</p> <ul style="list-style-type: none"> <li>unweathered / fresh</li> </ul> <p><b><u>Magnetic Susceptibility</u></b></p> <ul style="list-style-type: none"> <li>45m - 113m (rhyodacite): 26.3 - 1840 x 10<sup>-5</sup> SI with average of 1264 x 10<sup>-5</sup> SI</li> <li>114m - 129m (dacite): 906 - 3640 x 10<sup>-5</sup> SI with average of 2846 x 10<sup>-5</sup> SI</li> </ul>	<p><b><u>Faulting / Shearing / Brecciation</u></b></p> <ul style="list-style-type: none"> <li>42.9m - 44.68m: a zone of fault brecciation containing angular to sub-rounded fragments of dark grey basalt and ?dacite, healed by laumontite veining. Breccia clasts range in size up to several centimetres</li> <li>44.68m - 48.75m: the rhyodacite is internally brecciated and partially healed by laumontite veining</li> <li>48.75m - 49.47m: narrow laumontite-veined shear zone containing small brecciated fragments of basalt dyke material. At 49.1m, the upper contact of a small shear-controlled dyke is oriented at 39° to the core axis, whereas the lower contact at 49.25m is oriented at 45° to the core axis</li> <li>49.47m - 51.5m: strongly fractured rhyodacite defines the down-hole limit of faulting</li> <li>61.3m - 64.0m: the rhyodacite is strongly fractured with prominent laumontite veins oriented at a low angle to the core axis</li> <li>129.1m - 132.2m: the dacite is strongly internally brecciated, sheared and hematite altered</li> </ul> <p><b><u>Fracturing</u></b></p> <ul style="list-style-type: none"> <li>0m - 67.0m: generally moderately to strongly fractured, with localised zone of more intense fracturing</li> <li>67.0m - 132.2m: generally weakly fractured and massive</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Aggregate quality (CA):</b> 0.9m - 43.0m</p> <p><b>Interburden:</b> 43.0m - 56.0m</p> <p><b>Aggregate quality:</b> 56.0m - 111.2m</p>	<p>The hole intersected fractured, brecciated and locally sheared rhyodacite, from surface to approximately 67.0m, at the interpreted intersection of the two magnetic lineaments (<i>i.e.</i> faults). Below 67.0m, the rhyodacite becomes massive and competent.</p>	

<p><b>Interburden:</b> 111.2m - 132.2m</p>	<p>From approximately 96.0m the rhyodacite becomes increasingly more hematite altered approaching the contact with underlying dacite. At 113.02m, the rhyodacite is in direct contact with dark grey massive dacite. From 127.0m, the dacite becomes increasingly hematite altered and then brecciated, sheared and hematite-laumontite altered from 129.1m to the end of hole.</p> <p>The position of the contact between rhyodacite and underlying dacite is consistent with the down-dip projection of the mapped contact at surface (on the northwest side of Stone Ridge and north of ML1), assuming the geology dips at approximately 35° to the southeast.</p> <p>At 111.35m and 111.46m, two pale grey ash bands near the base of the rhyodacite sequence are oriented at 75° and 78° to the core axis, respectively.</p> <p>The contact at 113.02m between rhyodacite and underlying dacite is sub-planar and oriented at 59° to the core axis.</p>
<p><b>Thin Section Petrography</b></p>	
<p><b>ARDG-DDH15 91.56-91.61 m</b>  <u>Summary:</u> Massive crystal-vitric felsic tuff, probably of rhyodacite composition. The rock contains scattered, rather large vitriclasts, some of which are porphyritic, as well as a large phenocrystal grain component (plagioclase, quartz, K-feldspar and minor biotite, hornblende and titanomagnetite) and a few volcanic lithic fragments. A finer grained, probably vitriclastic-dominated matrix encloses the above components. Pervasive alteration has occurred, probably as a result of diagenesis, with replacement of all vitric material by varying amounts of alkali feldspar, hematite-pigmented laumontite and minor quartz and chlorite. Most biotite and some hornblende were also altered, with formation of chlorite and laumontite. Although there is considerable development of alteration minerals, there is no concentration of these on planar structures. The rock only has minor fracturing and remains hard and competent, and would be suitable for construction purposes.</p> <p><b>ARDG-DDH15 100.04-100.12 m</b>  <u>Summary:</u> Massive crystal-vitric felsic tuff, probably of rhyodacite composition. It has scattered vitriclasts, some of which are porphyritic as well as having perlitic cracking and local flow foliation. There is also a large population of phenocrystal grains including plagioclase, K-feldspar, quartz, minor hornblende, biotite and FeTi oxide (titanomagnetite). A finer grained vitriclastic matrix encloses the phenocrystal and vitriclastic grains. The rock was probably subject to diagenetic alteration that led to part to complete replacement of vitric material, mostly by alkali feldspar, but also by minor chlorite, and patchy hematite pigmentation. Biotite and hornblende also show minor replacement by chlorite. The rock has little or no fracturing or veining, and although there are local discontinuous zones of micro-cataclasis, overall, there are no planar discontinuities in the rock and no significant concentrations of soft alteration phases. The rock remains hard and competent and should be suitable for construction purposes.</p> <p><b>ARDG-DDH15 104.51-104.64 m</b>  <u>Summary:</u> Massive crystal-vitric felsic tuff, probably of dacite composition, cut by a narrow zone of shearing and micro-cataclasis. Away from this zone, the rock contains abundant phenocrystal grains of plagioclase and quartz, with less common, smaller grains of biotite and hornblende, as well as scattered, irregular vitriclastic fragments and a single small fragment of microporphyritic andesite. These components are enclosed by a fine grained vitriclastic matrix. Although originally glassy material could be partly preserved, it is likely that much was replaced by ultrafine alkali feldspar (maybe dominated by albite), as well as minor chlorite, quartz and hematite dusting. The zone of shearing and micro-cataclasis is dominated by fine grained alkali feldspar and hence it does not constitute a plane of weakness. Overall, the rock has no fractures or veins, and no significant concentrations of soft alteration minerals (e.g. chlorite) and it remains hard and competent and should be suitable for construction purposes.</p> <p><b>ARDG-DDH15 105.58-105.68 m</b>  <u>Summary:</u> Massive crystal-vitric-lithic felsic tuff, of likely dacite composition. It contains a large population of phenocrystal grains (dominant plagioclase and quartz, with smaller amounts of hornblende, biotite, altered pyroxene and FeTi oxide), along with scattered vitriclastic and porphyritic felsic volcanic fragments, all enclosed in a finer grained, vitriclastic-dominated matrix. Although it is possible that some glass remains, it is</p>	

likely that most was replaced by ultrafine alkali feldspar, along with minor chlorite and a little quartz, laumontite and hematite. Ferromagnesian phases also have variable alteration to chlorite. The rock has no fractures or veins, and no significant concentrations of soft alteration minerals. Consequently, it remains hard and competent and should be suitable for construction purposes.

**ARDG-DDH15**      **108.21-108.29 m**

**Summary:** Massive crystal-vitric felsic tuff, of likely dacite composition and hosting a single fragment of hornblende granodiorite. The rock has a large population of phenocrystal grains, including dominant plagioclase and quartz, with minor biotite and hornblende and a little K-feldspar and FeTi oxide (titanomagnetite). There are also scattered vitriclasts and a matrix dominated by smaller vitriclastic particles and mineral grains. The granodiorite fragment has medium to coarse plagioclase and quartz, hornblende locally forming aggregates, and minor biotite and K-feldspar. The sample shows pervasive alteration, probably as a result of diagenesis, with replacement of vitriclastic material by considerable amounts of fine grained alkali feldspar and medium grained laumontite. There is also minor chlorite and dusty hematite developed. Biotite, hornblende and plagioclase are also partly altered with formation of minor chlorite, a clay phase (*e.g.* kaolinite), laumontite and carbonate. A couple of thin veins occur containing laumontite and chlorite, or carbonate, but otherwise the rock is little-fractured and there are no significant planar concentrations of soft alteration minerals. The rock is hard and competent and should be suitable for construction purposes, although monitoring of veining and laumontite content is advised.

**ARDG-DDH15**      **113.15-113.23 m**

**Summary:** Massive crystal-lithic-vitric felsic tuff of rhyodacite composition, overprinted by mild effects of diagenetic alteration. The rock has a considerable population of phenocrystal grains of plagioclase and quartz, with less common biotite and hornblende and a little FeTi oxide (titanomagnetite) and trace clinopyroxene. There are also scattered felsic volcanic lithic fragments, typically with a glassy groundmass, with all these components hosted in a finely vitriclastic matrix in which there are a few amygdules. Imposed alteration led to replacement of all former vitric material by fine grained alkali feldspar, plus minor quartz and chlorite. Ferromagnesian phases show variable alteration to illite-sericite, chlorite, magnetite and hematite. There is little indication for any concentration of alteration phases on planar structures and little veining, hence the rock is hard and competent, and should be suitable for construction purposes.

**TABLE 6-22**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH16**

Drilling Objectives	Geology Summary	Structure Summary
<p>Hole was collared on the crest of Stone Ridge within Magnetic Domain 3 (MD3). The hole was drilled on azimuth of 346° grid with the objective of targeting the contact between rhyodacite and underlying volcanic breccia beneath the western flank of the ridge and in the vicinity of Magnetic Lineament 2 (ML2) – <i>i.e.</i> the Central Fracture.</p>	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 0.8m</p> <p><b>Rhyodacite:</b> 0.8m - 9.85m</p> <ul style="list-style-type: none"> <li>• variably weathered</li> </ul> <p><b>Dolerite:</b> 9.85m - 10.07m</p> <ul style="list-style-type: none"> <li>• extremely weathered</li> </ul> <p><b>Rhyodacite:</b> 10.07m - 14.52m</p> <ul style="list-style-type: none"> <li>• moderately to slightly weathered</li> </ul> <p><b>Dolerite:</b> 14.52m - 16.12m</p> <ul style="list-style-type: none"> <li>• slightly weathered</li> </ul> <p><b>Rhyodacite:</b> 16.12m - 134.19m</p> <ul style="list-style-type: none"> <li>• slightly weathered to unweathered / fresh</li> </ul> <p><b>Volcanic breccia:</b> 134.19m - 139.9m</p> <ul style="list-style-type: none"> <li>• unweathered / fresh</li> </ul> <p><b>Dolerite:</b> 139.9m - 141.3m (end-of-hole)</p> <ul style="list-style-type: none"> <li>• unweathered / fresh</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>• 17m - 134m (rhyodacite): 59.5 - 1210 x 10<sup>-5</sup> SI with average of 757 x 10<sup>-5</sup> SI</li> <li>• 135 - 139m (volcanic breccia): 544 - 1280 x 10<sup>-5</sup> SI with average of 930 x 10<sup>-5</sup> SI</li> <li>• 140m (dolerite): 10200 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>• 9.85m - 10.07m: dolerite dyke that defines the up-hole limit of a narrow fault zone. The dyke contacts are oriented at 14° and 24° to the core axis</li> <li>• 10.07m - 14.52m: strong to intense fracturing is associated with faulting</li> <li>• 14.52m - 16.12m: dolerite dyke defines the downhole limit of the fault zone. The dyke contacts are oriented at 19° and 23° to the core axis</li> <li>• 134.19m - 141.3m: sheared contact between rhyodacite and volcanic breccia, with shear fabric oriented approximately 90° (normal) to the core axis</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>• 0.8m - 16.75m: strongly to intensely fractured</li> <li>• 16.75m - 141.3m: generally weak to locally moderately fractured</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m - 0.8m</p> <p><b>Roadbase quality:</b> 0.8m - 16.5m</p> <p><b>Aggregate quality (CA):</b> 16.5m - 129.0m</p> <p><b>Interburden:</b> 129.0m - 141.3m</p>	<p>Drill core indicates that the hole was collared in a structural zone, with the top 16-17m of rhyodacite strongly to intensely fractured and locally subjected to faulting and dolerite dyke emplacement. This zone correlates with the approximate position of ML2 – <i>i.e.</i> the Central Fracture and suggests that at least locally, ML2 has been subjected to some movement and deformation.</p> <p>Below 16.75m, the rhyodacite is typically grey and competent, but from approximately 139m becomes lithic fragmental (including possible clasts of dacite) and altered approaching the sheared contact with underlying volcanic breccia at 134.19m. The volcanic breccia that</p>	

	<p>underlies the rhyodacite is similar in appearance to the breccia intersected in hole ARDG-DDH08 and contains significant hematite in the matrix.</p> <p>The position of the contact between rhyodacite and underlying volcanic breccia is consistent with the down-dip projection of the mapped contact at surface (<i>i.e.</i> between MD2 and MD3 and south of the Central Fault), assuming the geology dips at approximately 35° to the southeast.</p> <p>At 139.9m, a dolerite dyke with a clear chilled margin is in contact with volcanic breccia. The contact is planar and oriented at 34° to the core axis.</p>
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### Thin Section Petrography

**ARDG-DDH16      18.83-18.93 m**

Summary: Massive, strongly porphyritic rhyodacite. The rock contains abundantly scattered phenocrysts of plagioclase, K-feldspar and quartz, with less common biotite and a little FeTi oxide (titanomagnetite) in a formerly glassy, flow-foliated groundmass. The rock sustained diagenetic alteration leading to glass being replaced by very fine alkali feldspar, plus a little quartz, chlorite, clay and local hematite. Phenocrystal grains also show minor replacement by phases including illite-sericite, chlorite, hematite, leucoxene and clay. There is no evidence for significant fracturing, veining or concentrations of alteration minerals, so the rock is hard and competent, and should be suitable for construction purposes.

**ARDG-DDH16      25.60-25.71 m**

Summary: Massive, strongly porphyritic rhyodacite, containing scattered phenocrysts of plagioclase, K-feldspar and quartz, with less common biotite and a little FeTi oxide (titanomagnetite) in a formerly glassy groundmass that locally has flow foliation. There are a couple of large fragments of similar rock enclosed, with these being texturally different in not having flow-foliated groundmass. Diagenetic alteration was evidently imposed, causing replacement of glass by very fine alkali feldspar, plus a little quartz, chlorite and clay. Phenocrystal grains also show minor replacement by phases including illite-sericite, chlorite, hematite, leucoxene and clay. The rock does not have any fracturing, veining or concentrations of alteration minerals, so it remains hard and competent, and should be suitable for construction purposes.

**ARDG-DDH16      55.77-55.91 m**

Summary: Massive, strongly porphyritic rhyodacite, containing scattered phenocrysts of plagioclase, K-feldspar and quartz, with less common biotite and a little FeTi oxide (titanomagnetite) in a formerly glassy and flow-foliated groundmass. The imposition of diagenetic alteration was evidently imposed, causing replacement of glass by very fine alkali feldspar, plus a little quartz, clay (kaolinite) and trace chlorite. Feldspar grains also show slight alteration to clay, illite-sericite and chlorite, and biotite to illite-sericite, hematite and leucoxene. The rock does not have any fracturing, veining or concentrations of alteration minerals, being hard and competent, and should be suitable for construction purposes.

**ARDG-DDH16      59.00-59.12 m**

Summary: Massive, strongly porphyritic rhyodacite, containing scattered phenocrysts of quartz, K-feldspar and plagioclase, with less common biotite and hornblende, and a little FeTi oxide (titanomagnetite) in a formerly glassy and flow-foliated groundmass. Diagenetic alteration was evidently imposed, leading to replacement of groundmass material by very fine alkali feldspar, plus a little quartz, chlorite and clay (kaolinite). Biotite is commonly altered to chlorite, illite-sericite, hematite and leucoxene, and feldspars show local alteration to chlorite and trace illite-sericite, carbonate and clay. The rock does not have any fracturing, veining or concentrations of alteration minerals. It remains hard and competent, and should be suitable for construction purposes.

**ARDG-DDH16      129.61-129.72 m**

Summary: Massive, strongly porphyritic rhyodacite, with apparent fragments of porphyritic dacite, with the latter showing considerable alteration. The rhyodacite contains scattered phenocrysts of quartz, K-feldspar and plagioclase, with less common biotite and hornblende, and a little FeTi oxide (titanomagnetite) in a formerly glassy and flow-foliated groundmass. The dacite contains phenocrysts of plagioclase and quartz, with

a few small phenocrysts of hornblende and biotite, all enclosed in a fine grained groundmass that was perhaps, in part glassy, but also contained scattered microphenocrysts (mainly plagioclase) and small amygdules. Pervasive alteration, probably due to diagenetic processes, has affected both rock types, but in the rhyodacite, is largely restricted to the groundmass, where there was replacement of former glass by alkali feldspar, plus a little quartz, chlorite and clay (kaolinite). Small amounts of chlorite, illite-sericite and clay have formed from the phenocrysts. In contrast, the dacite has strong replacement of the groundmass by dominant laumontite, plus subordinate alkali feldspar and chlorite, with laumontite and chlorite also forming from alteration of phenocrysts. The sample has a couple of thin veins containing laumontite, carbonate, chlorite and hematite. Despite the patchy alteration, the sample overall is hard and competent, and would probably be mostly suitable for construction purposes, especially with avoidance of strongly laumontite-altered zones.

**ARDG-DDH16 132.72-132.79 m**

Summary: Massive, strongly porphyritic rhyodacite, containing scattered phenocrysts of quartz and plagioclase, and less common K-feldspar, biotite and hornblende, and a little FeTi oxide (titanomagnetite) in a formerly glassy groundmass that commonly shows relict perlitic cracking and local flow foliation. The imposition of diagenetic alteration may have led to considerable replacement of former glass by alkali feldspar, quartz, illite-sericite and chlorite, with patchy dusting by hematite. Biotite is also partly altered to chlorite and hematite, and the rock is cut by a couple of thin carbonate veins. Overall, however, the rock has little or no fracturing, or concentrations of alteration minerals. It remains hard and competent, and should be suitable for construction purposes.

**ARDG-DDH16 132.84-132.89 m**

Summary: Massive, strongly porphyritic rhyodacite, with patchy stronger alteration zones and minor veining. The rock retains scattered phenocrysts of quartz, plagioclase, K-feldspar and minor biotite and hornblende, in what would have been a glassy groundmass, commonly showing relict flow foliation. Pervasive alteration was probably due to imposed diagenetic processes, with much of the rock having groundmass replacement by very fine grained alkali feldspar. Zones with stronger alteration show groundmass replacement by fine grained quartz, patchy chlorite, laumontite and hematite. Throughout the rock, there is variable replacement of biotite by chlorite, laumontite, celadonite and hematite, and plagioclase shows slight replacement by illite-sericite and clay (*e.g.* kaolinite). A few veins occur, containing laumontite and trace carbonate. Although the rock is largely hard and competent, and could be suitable for construction purposes, zones of increased alteration and veining should be avoided.

<b>TABLE 6-23</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH17</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
Vertical hole drilled primarily for groundwater monitoring purposes. The hole was collared in area devoid of outcrop within the projected extent of Magnetic Domain 4 (MD4).	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 4.7m</p> <p><b>Sandstone:</b> 4.7m - 6.4m</p> <p><b>Clay:</b> 6.4m - 12.6m</p> <p><b>Sandstone/siltstone:</b> 12.6m - 29.47m</p> <p><b>Conglomerate:</b> 29.47m - 33.96m</p> <p><b>Sandstone/siltstone:</b> 33.96m - 39.6m (end-of-hole)</p> <ul style="list-style-type: none"> <li>extremely to highly weathered to 16.65m, then moderately weathered to 39.6m</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>13m - 39m: 3.1 - 2340 x 10<sup>-5</sup> SI with average of 300 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>generally moderately, to locally strongly or intensely, fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 12.6m</p> <p><b>Roadbase blendable:</b> 12.6 - 39.6m</p>	<p>The hole intersected strongly interbedded volcanic sedimentary units that directly overlie rhyodacite at the top of the <i>Eagleton Volcanics</i>. The hole did not intersect underlying rhyodacite, although the contact is projected to be within several metres of the base of the hole.</p> <p>No evidence of any faulting, shearing or brecciation. Well-developed sedimentary bedding, often defined by thin concentrations of magnetite, is oriented at low to moderate angles to the core axis. This is consistent with the regional dip of the stratigraphy mapped by Rattigan (1966).</p>	
<b>Thin Section Petrography</b>		
No Petrography		

**TABLE 6-24**

**Summary Geology Log and Petrography – Drill Hole ARDG-DDH18**

Drilling Objectives	Geology Summary	Structure Summary
<p>Vertical hole drilled primarily for groundwater monitoring purposes. The hole was collared close to outcropping dacitic volcanics, within Magnetic Domain 1A (MD1A) and west of hole ARDG-DDH03.</p>	<p><b>Lithology and Alteration</b>  <b>Clay:</b> 0m - 1.0m  <b>Dacite:</b> 1.0m - 49.98m, similar to that encountered in hole ARDG-DDH03</p> <ul style="list-style-type: none"> <li>slightly weathered to unweathered / fresh</li> <li>alteration hematite increases in intensity from 47m depth towards the contact with the breccia</li> </ul> <p><b>Volcanic breccia:</b> 49.98m - 54.65m (end-of-hole)</p> <ul style="list-style-type: none"> <li>unweathered / fresh</li> <li>significant hematite within the breccia matrix</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>4m - 49m (dacite): 353 - 2820 x 10<sup>-5</sup> SI with average of 1584 x 10<sup>-5</sup> SI</li> <li>50m - 54m (volcanic breccia): 38 - 1880 x 10<sup>-5</sup> SI with average of 1296 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>N/A</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>1.0m - 49.98m: generally weakly fractured and massive throughout</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m - 1.0m  <b>Roadbase quality:</b> 1.0m - 1.5m  <b>Aggregate quality (CA):</b> 1.5m - 2.4m  <b>Aggregate quality:</b> 2.4m - 47.0m  <b>Roadbase quality:</b> 47.0m - 49.98m  <b>Interburden:</b> 49.98m - 54.65m</p>	<p>The hole intersected competent dacite to approximately 50m before intersecting volcanic breccia. There was no evidence of any faulting, shearing or brecciation.</p> <p>The position of the contact between dacite and underlying volcanic breccia is consistent with the down-dip projection of the interpreted contact at surface (<i>i.e.</i> the drainage line approximately 70m to the northwest of the hole collar), assuming the geology dips at approximately 35° to the southeast.</p> <p>This hole together with hole ARDG-DDH03 and surface mapping, has confirmed that the dacite associated with MD1A is relatively massive and competent and has a true thickness of approximately 117.0m. Although the measured orientation of the dacite – volcanic breccia contact in the core (<i>i.e.</i> 54° to the core axis) is unlikely to represent the overall dip, if it does, then the true thickness of the dacite would be substantially greater and increase with depth.</p>	

### Thin Section Petrography

**ARDG-DDH18 48.42-48.50 m**

Summary: Crystal-vitric-lithic felsic pyroclastic rock, of broadly dacitic composition, with pervasive moderate alteration. The rock is weakly layered and contains a large phenocrystal population of grains including plagioclase, quartz, hornblende and lesser amounts of biotite and FeTi oxide (titanomagnetite). There are also fragments of porphyritic hornblende dacite, hornblende andesite and minor andesitic tuff and altered rhyolite. A finer grained matrix consists of alteration vitric material and small individual mineral grains. Imposed alteration has affected matrix material and the groundmasses of volcanic fragments, with replacement by varying proportions of fine grained alkali feldspar, quartz, a chlorite-smectite phase, clay (kaolinite), illite-sericite and hematite. A few thin veins of carbonate and trace laumontite also occur. Although the rock is largely hard and competent, and could be suitable for construction purposes, the proportion of pervasive alteration minerals is likely to degrade the product.

<b>TABLE 6-25</b>		
<b>Summary Geology Log and Petrography – Drill Hole ARDG-DDH19</b>		
<b>Drilling Objectives</b>	<b>Geology Summary</b>	<b>Structure Summary</b>
Vertical hole drilled primarily for groundwater monitoring purposes. The hole was collared close to outcropping dacitic volcanics, within Magnetic Domain 1B (MD1B).	<p><b>Lithology and Alteration</b></p> <p><b>Clay:</b> 0m - 0.2m</p> <p><b>Dacite:</b> 0.2m - 26.3m</p> <ul style="list-style-type: none"> <li>slightly to moderately weathered to 11m, then slightly weathered to unweathered / fresh</li> </ul> <p><b>Volcanic breccia:</b> 26.3m - 36.0m (end-of-hole)</p> <ul style="list-style-type: none"> <li>slightly weathered to unweathered / fresh</li> <li>significant hematite within the breccia matrix</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>5m - 26m (dacite): 724 - 3620 x 10<sup>-5</sup> SI with average of 2835 x 10<sup>-5</sup> SI</li> <li>27m - 36m (volcanic breccia): 767 - 2330 x 10<sup>-5</sup> SI with average of 1487 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>narrow shear zones from 26.3m - 27.0m (32 - 34° ACA), 28.0m - 28.5m (24 - 29° ACA) and 35.24m - 35.39m (56° ACA)</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0.2m - 36.0m: generally variably fractured</li> </ul>
<b>Rock Quality</b>	<b>Comments</b>	
<p><b>Overburden:</b> 0m - 2.2m</p> <p><b>Roadbase quality:</b> 2.2m - 4.4m</p> <p><b>Aggregate quality (CA):</b> 4.4m - 6.6m</p> <p><b>Roadbase quality:</b> 6.6m - 11.0m</p> <p><b>Aggregate quality:</b> 11.0m - 26.05m</p> <p><b>Interburden:</b> 26.05m - 36.0m</p>	<p>As with hole ARDG-DDH18, the dacite intersected in this hole is underlain by volcanic breccia that may represent the basal stratigraphic unit of the <i>Eagleton Volcanics</i>.</p> <p>The contact between the dacite and volcanic breccia is sheared, intact and oriented at 33° to the core axis.</p>	
<b>Thin Section Petrography</b>		
No Petrography		

**TABLE 6-26**

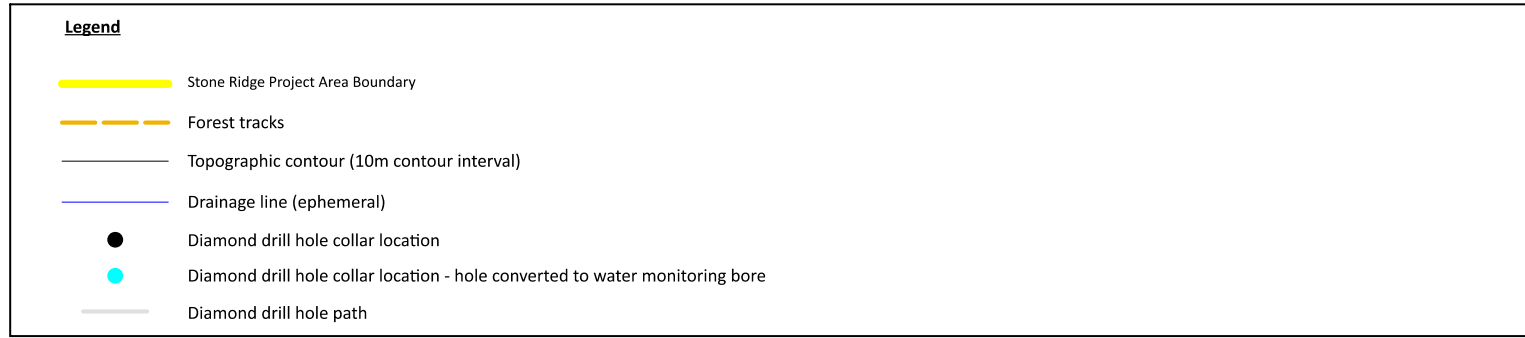
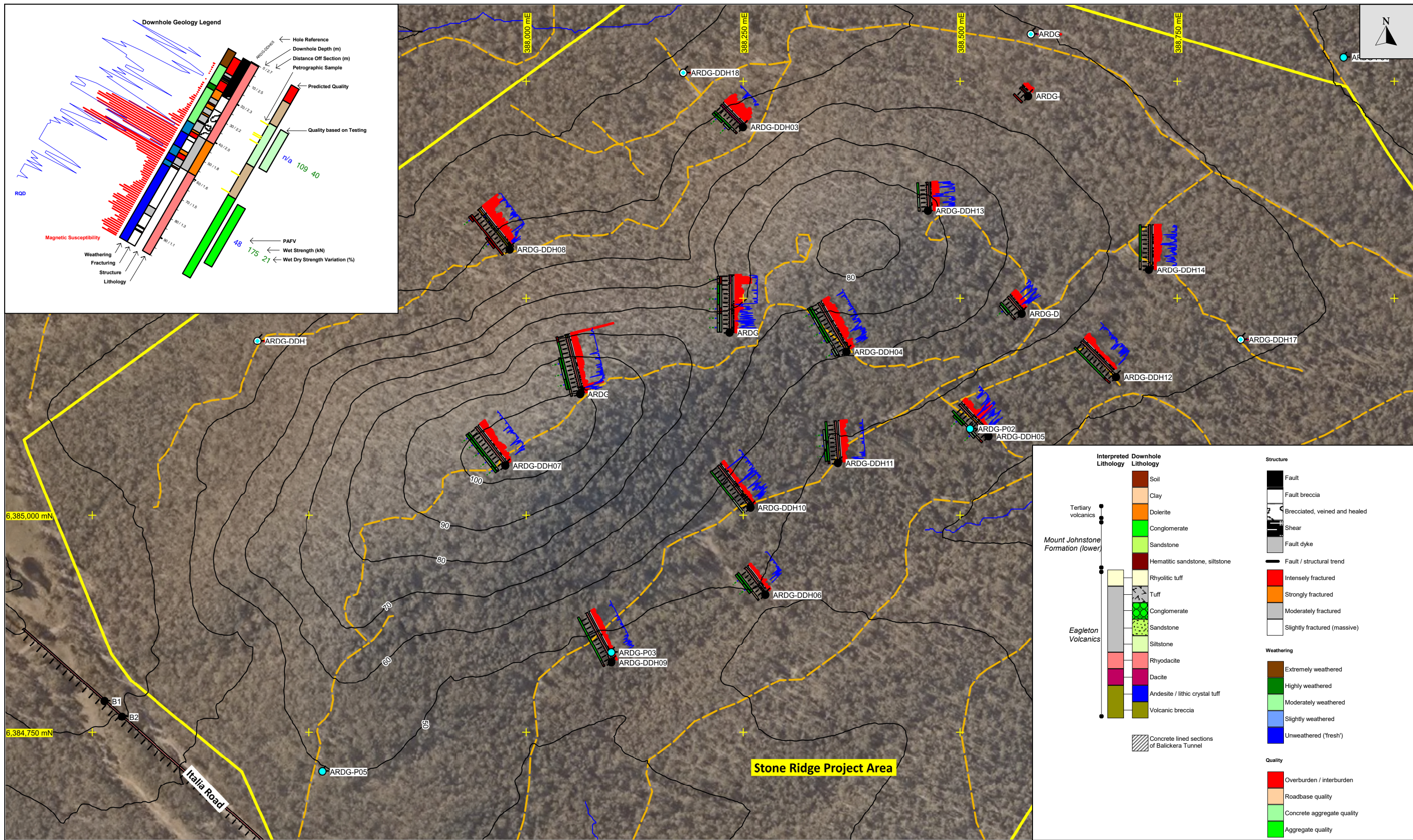
**Summary Geology Log and Petrography – Drill Hole ARDG-DDH20**

Drilling Objectives	Geology Summary / Comments	Structure Summary / Comments
<p>Vertical hole drilled primarily for groundwater monitoring purposes. Hole collared north of mapped extent of rhyodacite outcrop, within Magnetic Domain 5 (MD5) and north of Magnetic Lineament 4 (ML4) within the southern part of the Nine Mile Creek Fault Zone.</p>	<p><b>Lithology and Alteration</b></p> <p><b>Sandstone:</b> 0m - 8.9m</p> <ul style="list-style-type: none"> <li>Extremely to highly weathered</li> </ul> <p><b>Conglomerate:</b> 8.9m - 12.9m</p> <ul style="list-style-type: none"> <li>Extremely to highly weathered</li> </ul> <p><b>Sandstone:</b> 12.9m - 14.8m</p> <ul style="list-style-type: none"> <li>Extremely to highly weathered</li> </ul> <p><b>Dolerite / Basalt:</b> 14.8m - 25.0m</p> <ul style="list-style-type: none"> <li>Highly weathered to 16.2m, thereafter slightly weathered to fresh</li> </ul> <p><b>Hematitic mudstone, sandstone, siltstone:</b> 25.0m - 36.5m (end-of-hole)</p> <ul style="list-style-type: none"> <li>Slightly weathered to fresh, but moderately to extremely weathered from 27.2m - 29.6m</li> <li>Strongly hematitic in contrast to previous interval of sandstone</li> </ul> <p><b>Magnetic Susceptibility</b></p> <ul style="list-style-type: none"> <li>1m - 14m (sandstone, conglomerate): 19.6 - 1190 x 10<sup>-5</sup> SI with average of 267 x 10<sup>-5</sup> SI</li> <li>15m - 25m (dolerite): 35.8 - 5750 x 10<sup>-5</sup> SI with average of 2120 x 10<sup>-5</sup> SI</li> <li>27m - 36m (hematitic mudstone): 4.7 - 1990 x 10<sup>-5</sup> SI with average of 608 x 10<sup>-5</sup> SI</li> </ul>	<p><b>Faulting / Shearing / Brecciation</b></p> <ul style="list-style-type: none"> <li>10.0m - 29.6m: prominent fault zone associated with strong to intense fracturing and dolerite / basalt dyke emplacement</li> <li>16.0m - 16.13m: narrow shear oriented at 37° ACA</li> </ul> <p><b>Fracturing</b></p> <ul style="list-style-type: none"> <li>0m - 29.59m: generally strongly to intensely fractured</li> <li>29.59m - 36.5m: weakly fractured</li> </ul>
Rock Quality	Comments	
<p><b>Overburden:</b> 0m - 36.5m</p>	<p>The geology intersected by this hole was similar to nearby hole ARDG-DDH02 and consistent with what would be expected in a significant structural zone.</p>	

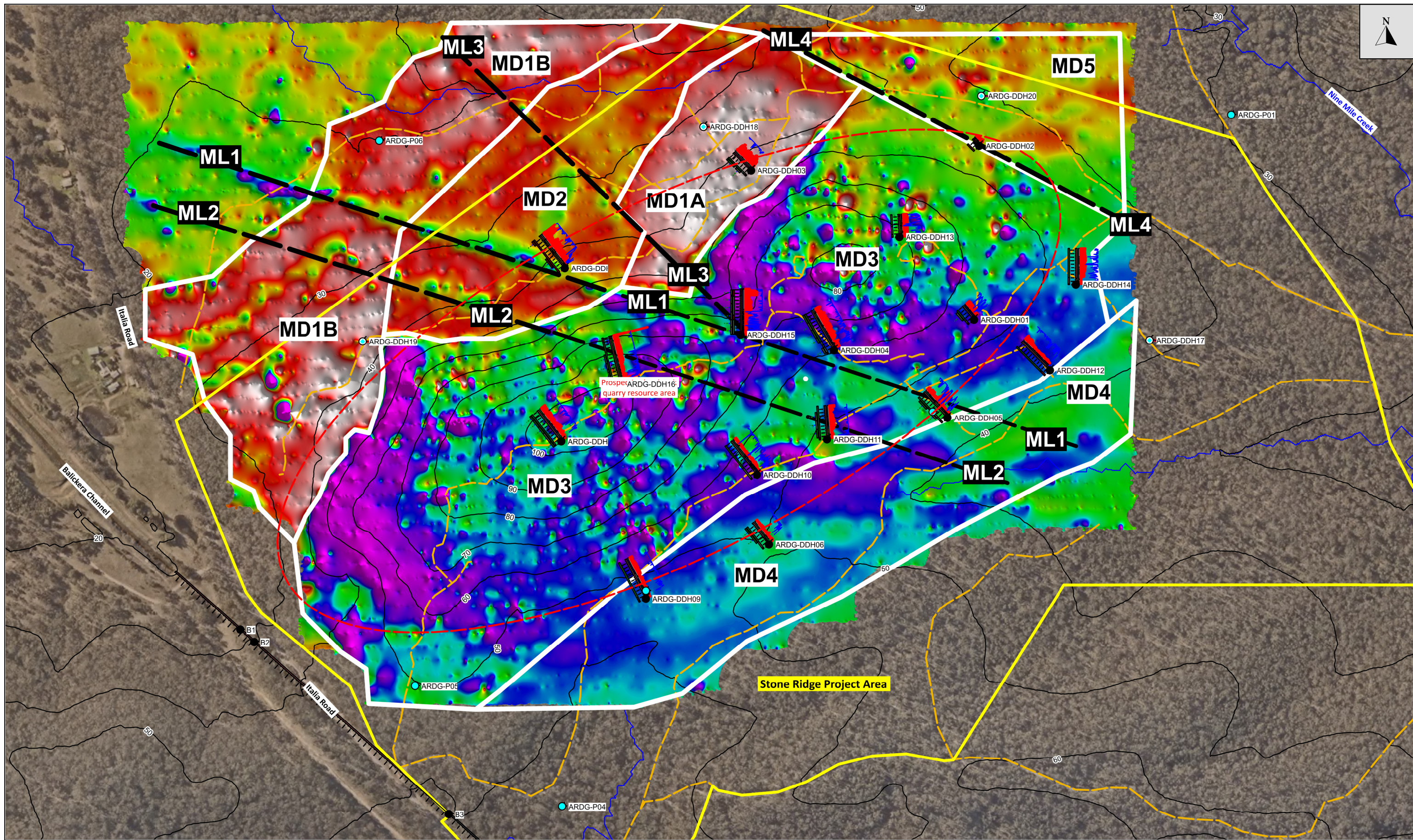
### Thin Section Petrography

**ARDG-DDH20      21.75 m**

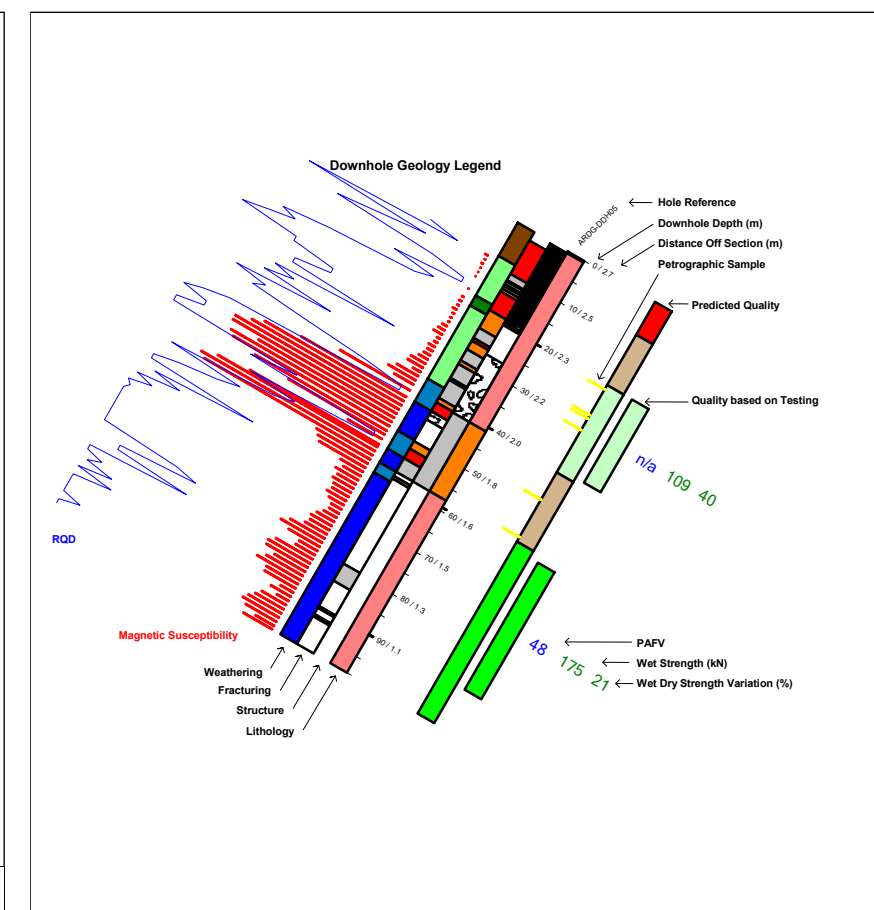
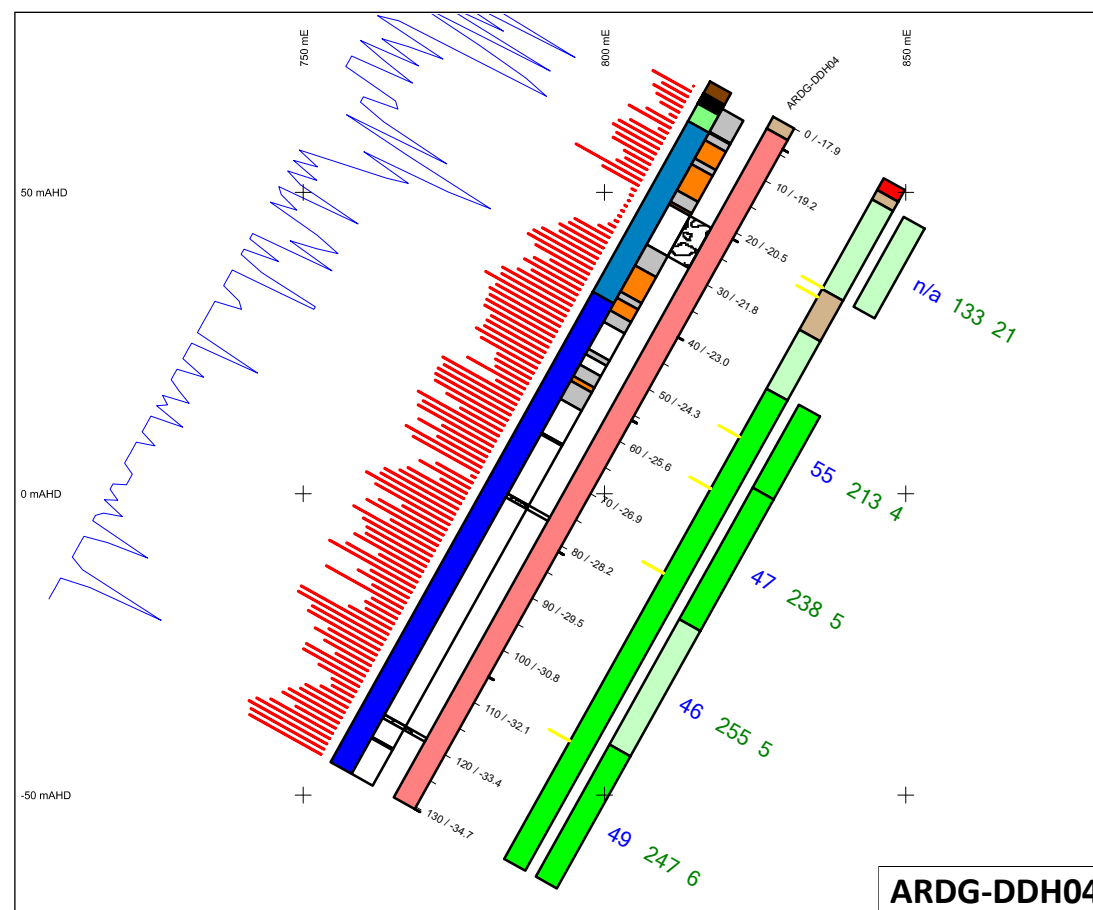
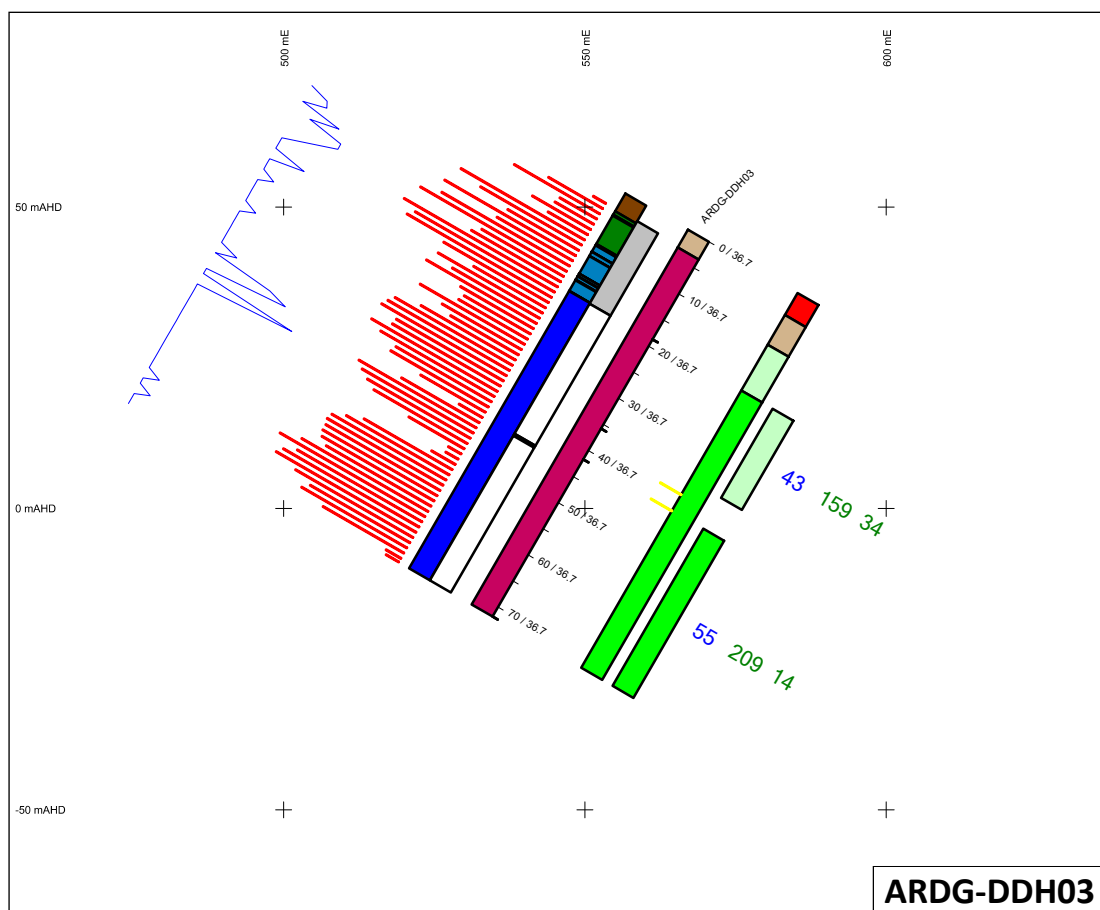
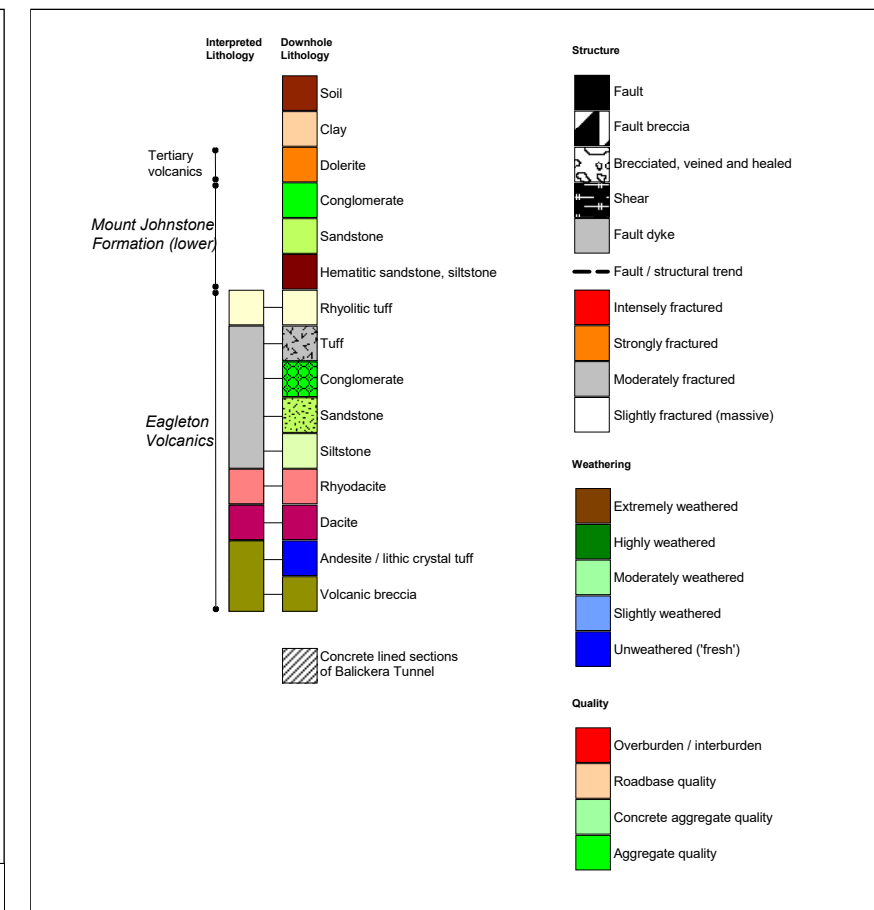
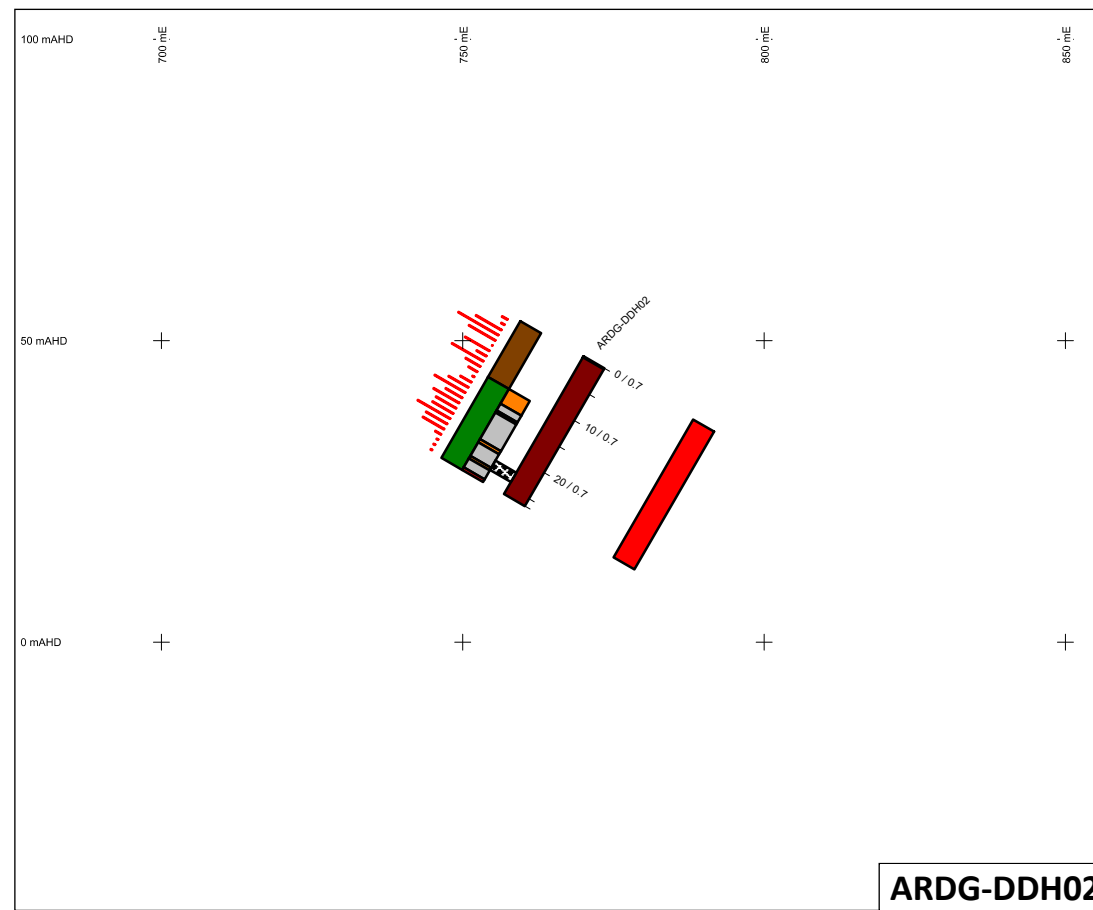
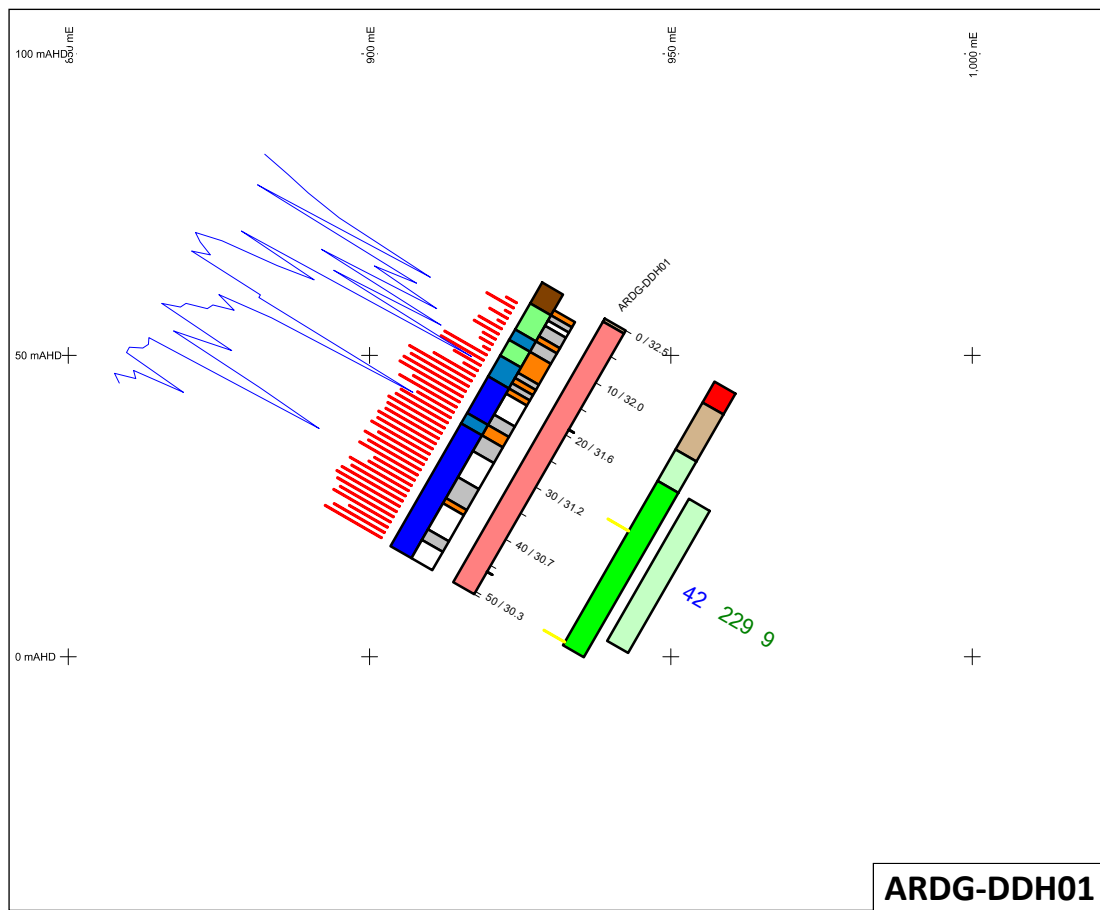
Summary: Massive, porphyritic and amygdaloidal basalt, with strong pervasive alteration that is probably due to diagenesis (very low grade metamorphism). The rock retains sparsely scattered phenocrysts of plagioclase and a few microphenocrysts of FeTi oxide (titanomagnetite) and clinopyroxene. The groundmass has a slight sub-trachytic texture and contains abundant small plagioclase laths, with interstitial altered ferromagnesian material and disseminated finely granular FeTi oxide. Amygdules are filled mainly by laumontite, with a little local carbonate. Pervasive alteration led to replacement of groundmass ferromagnesian material and formation of abundant chlorite, with a little celadonite, carbonate and titanite. Plagioclase also shows variable replacement by albite and laumontite. A few laumontite veins are present in the handspecimen but were not encountered in the section. Although the rock is hard and competent, the large proportion of alteration-derived chlorite and laumontite could lead to degradation of rock quality.



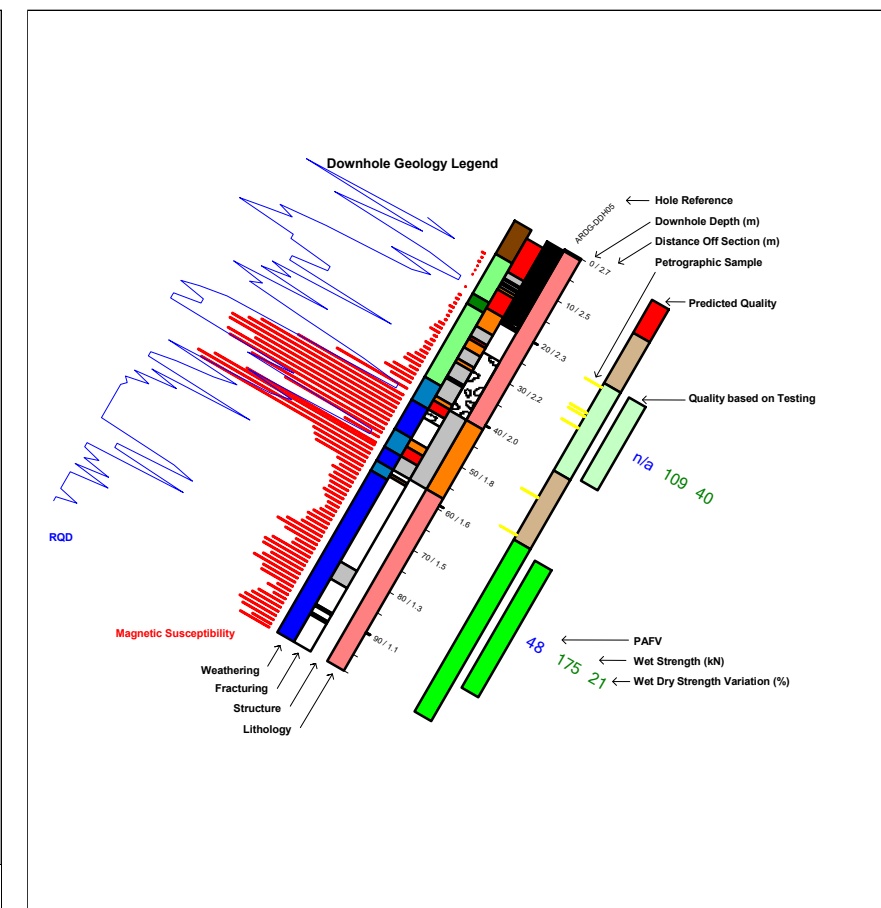
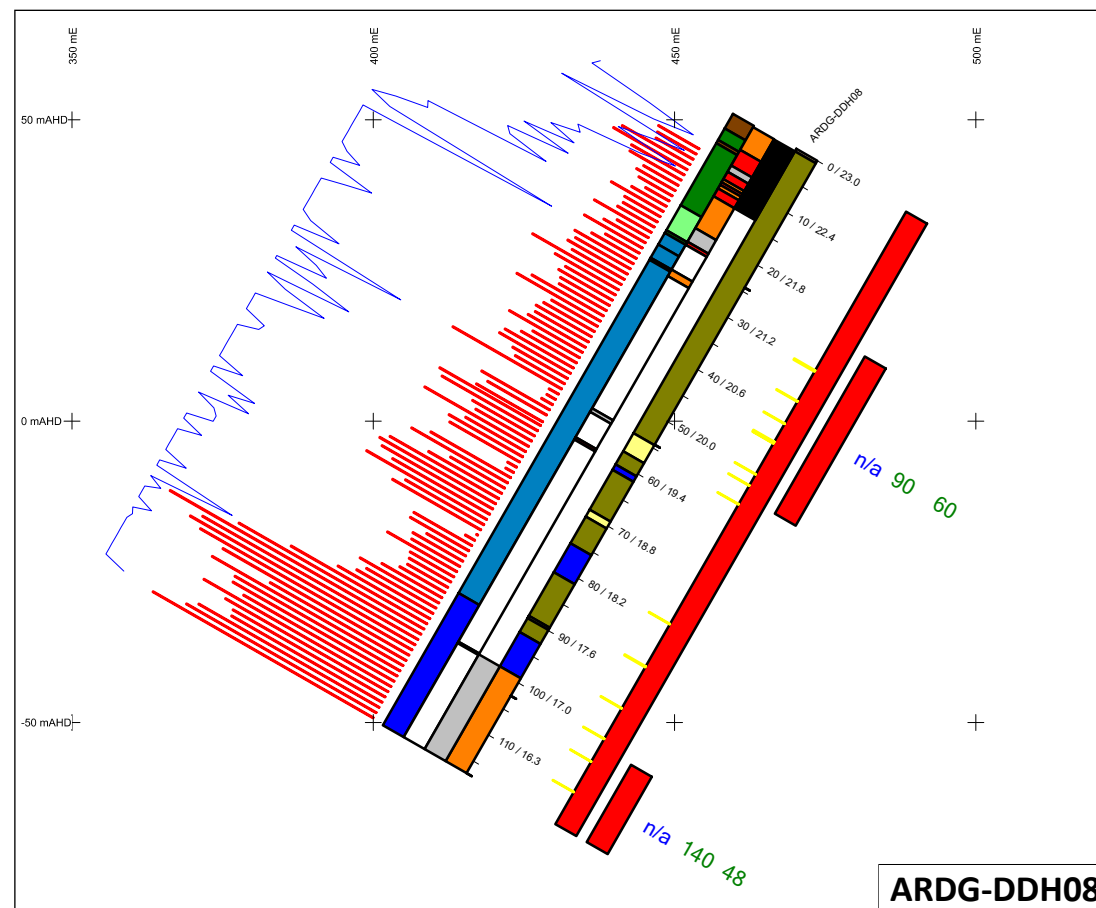
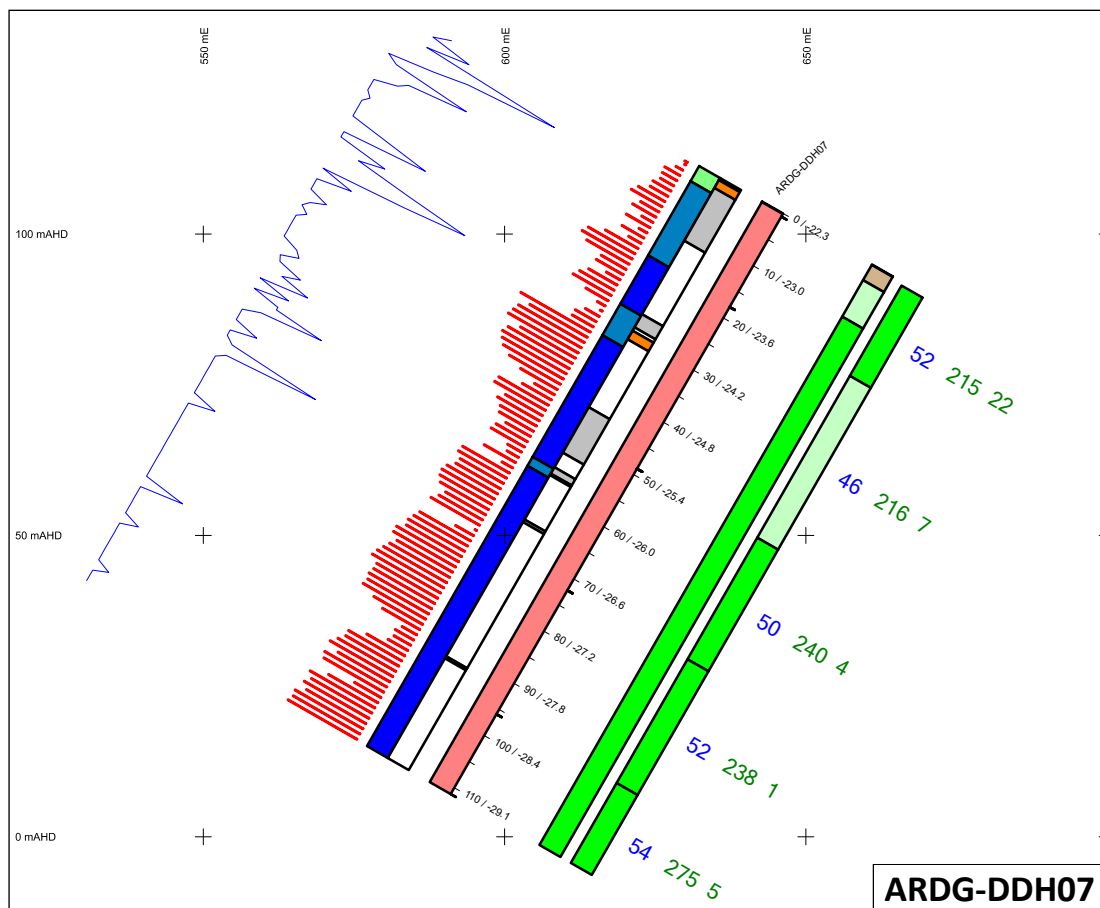
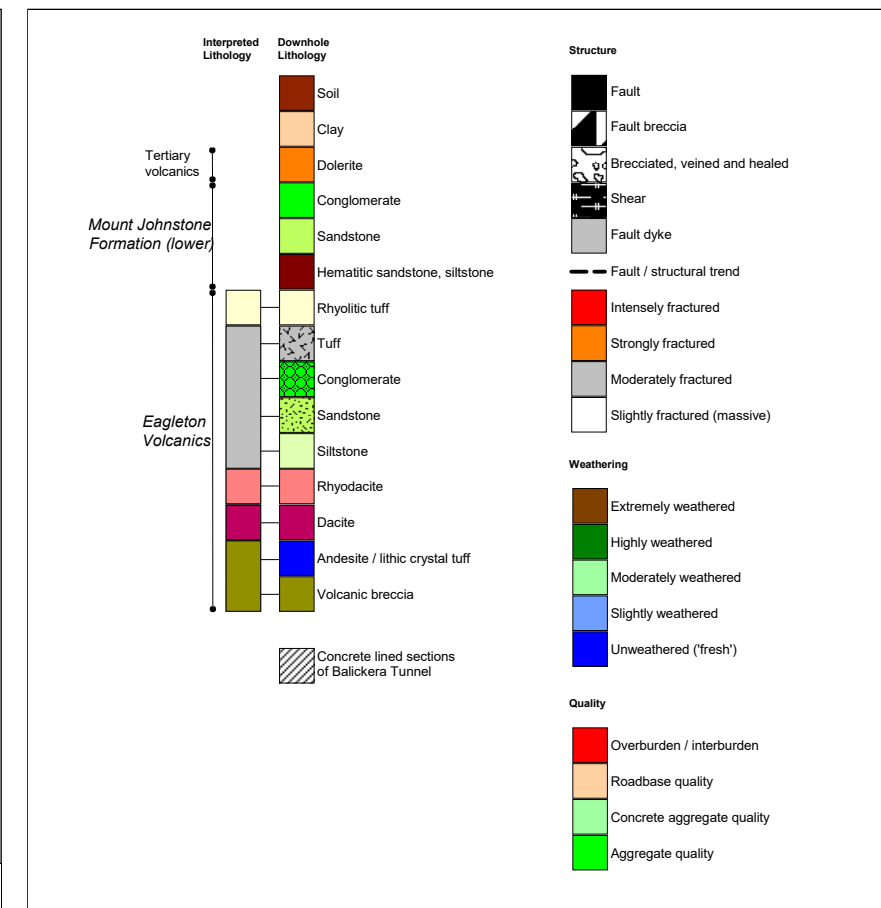
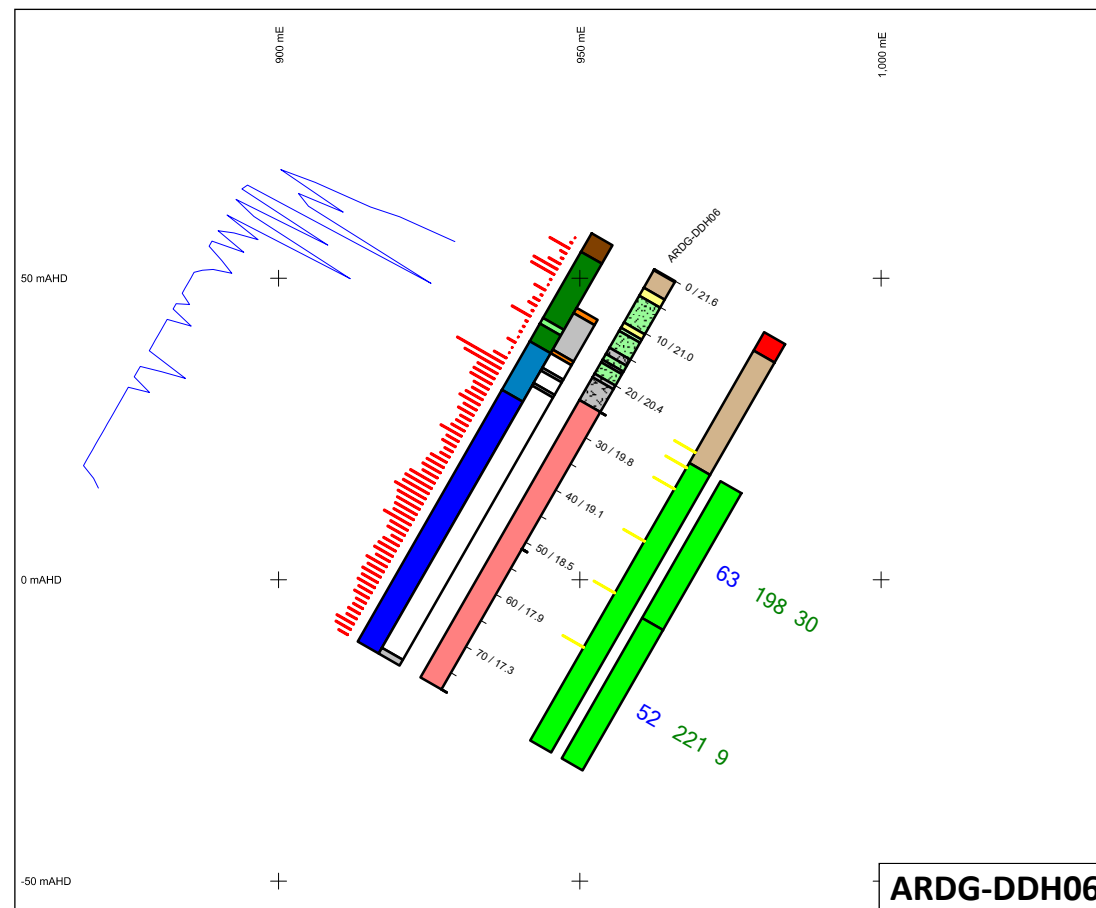
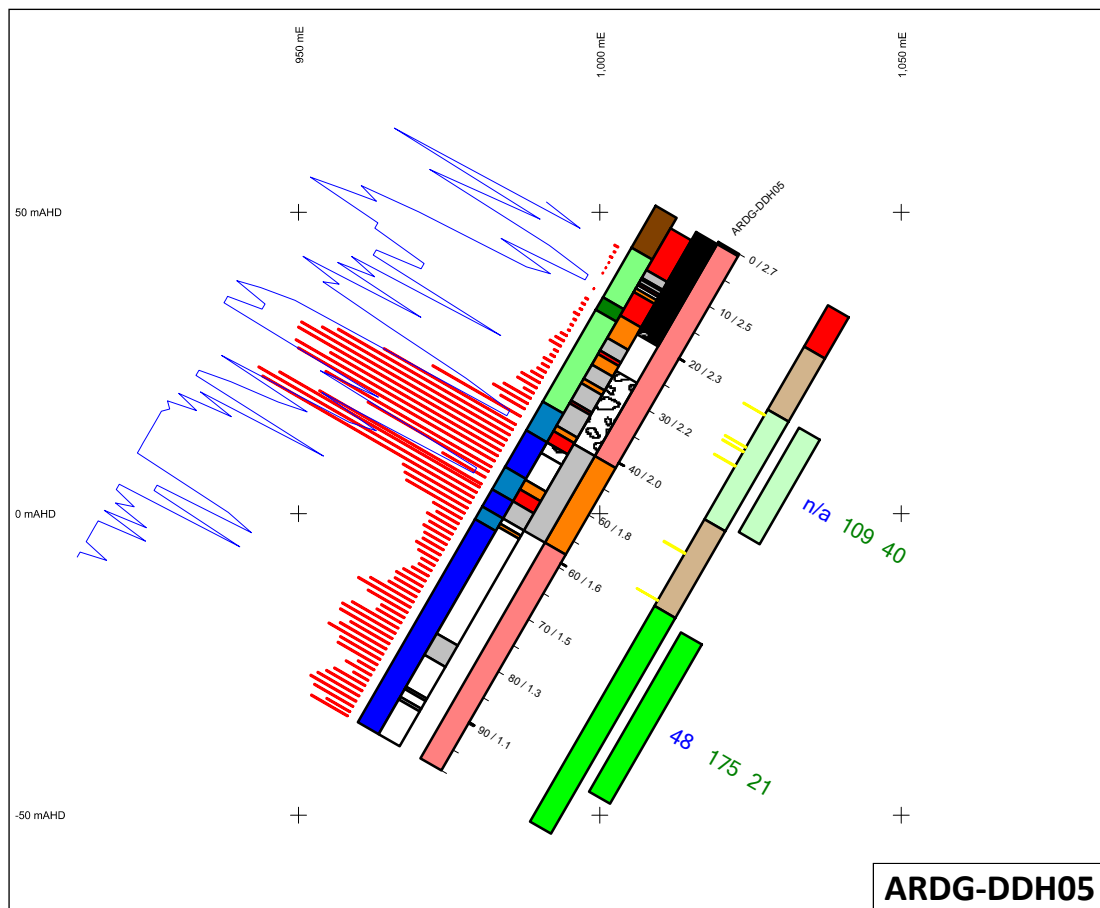
<b>Australian Resource Development Group</b> <small>130 Young St, Carrington, NSW, 2294          E: admin@ardg.com.au          W: www.ardg.com.au</small>	<b>Project: STONE RIDGE QUARRY PROJECT</b>			<b>Figure 11a</b>
	<b>Title: Diamond Drill Hole Downhole Data</b>			
<b>Author: DMB</b>	<b>Date: December 2019</b>	<b>Scale: 1:4000 @ A3</b>	<b>Grid: MGA Zone 56 (GDA94)</b>	
<b>Source:</b> Aerial Photograph: NearMap Image - 9 September 2018 Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates); Geological Interpretation: Damon Bird (ARDG)				



<b>Legend</b> 		<b>Australian Resource Development Group</b> <small>130 Young St, Carrington, NSW, 2294          E: admin@ardg.com.au          W: www.ardg.com.au</small>		<b>Project: STONE RIDGE QUARRY PROJECT</b>			<b>Figure 11b</b>	
		<b>Title: Diamond Drill Hole Downhole Data over Interpreted TMI Image</b>						
		<b>Author: DMB</b>		<b>Date: December 2019</b>		<b>Scale: 1:5,000 @ A3</b>		<b>Grid: MGA Zone 56 (GDA94)</b>
		<b>Source:</b> Aerial Photograph: NearMap Image - 9 September 2018 Digital Elevation Model: Generated from LIDAR 0.5m contour data Topographic Contours: 10m contour interval - generated from LIDAR 0.5m contour data Ground Magnetic Survey: Fender Geophysics - 2018						



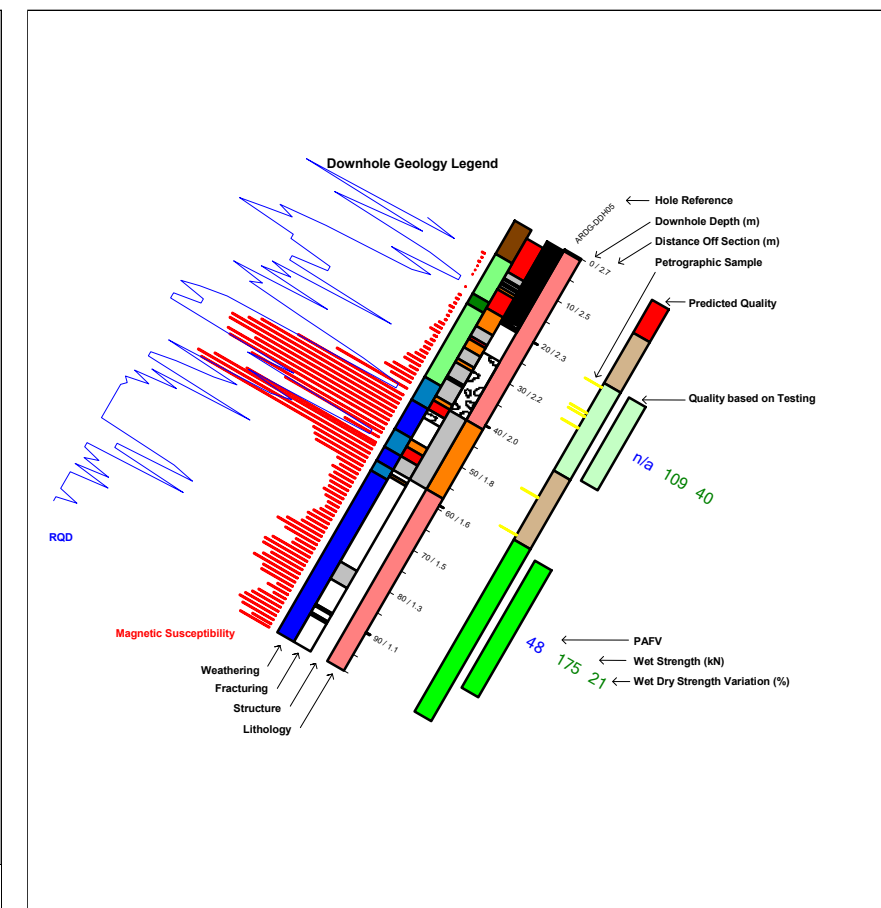
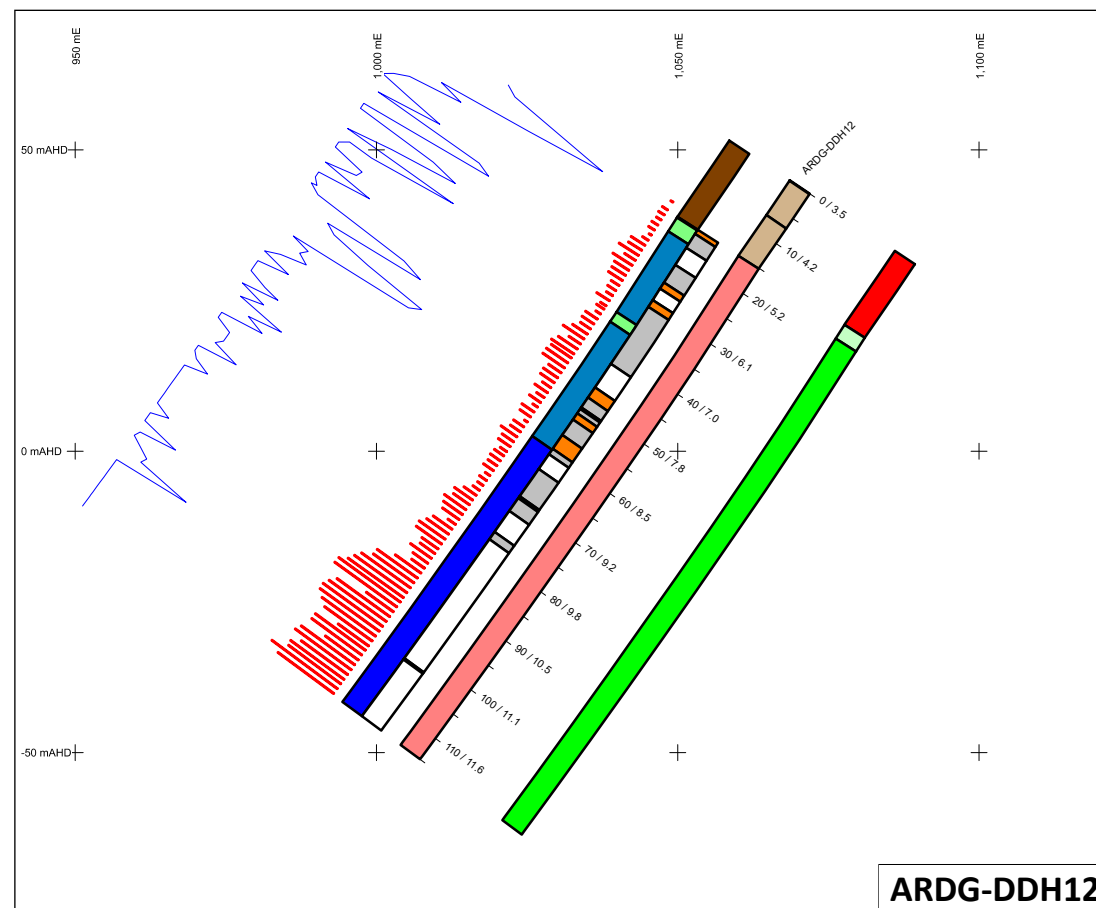
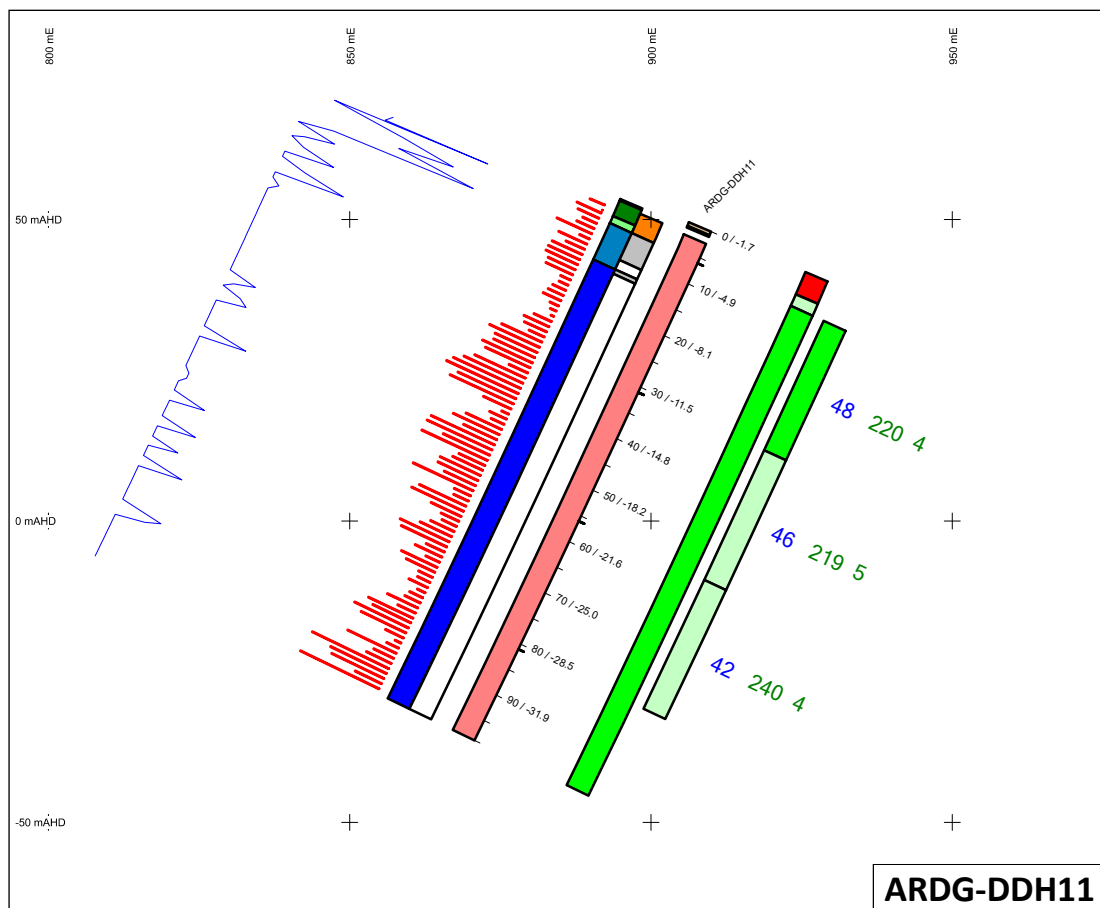
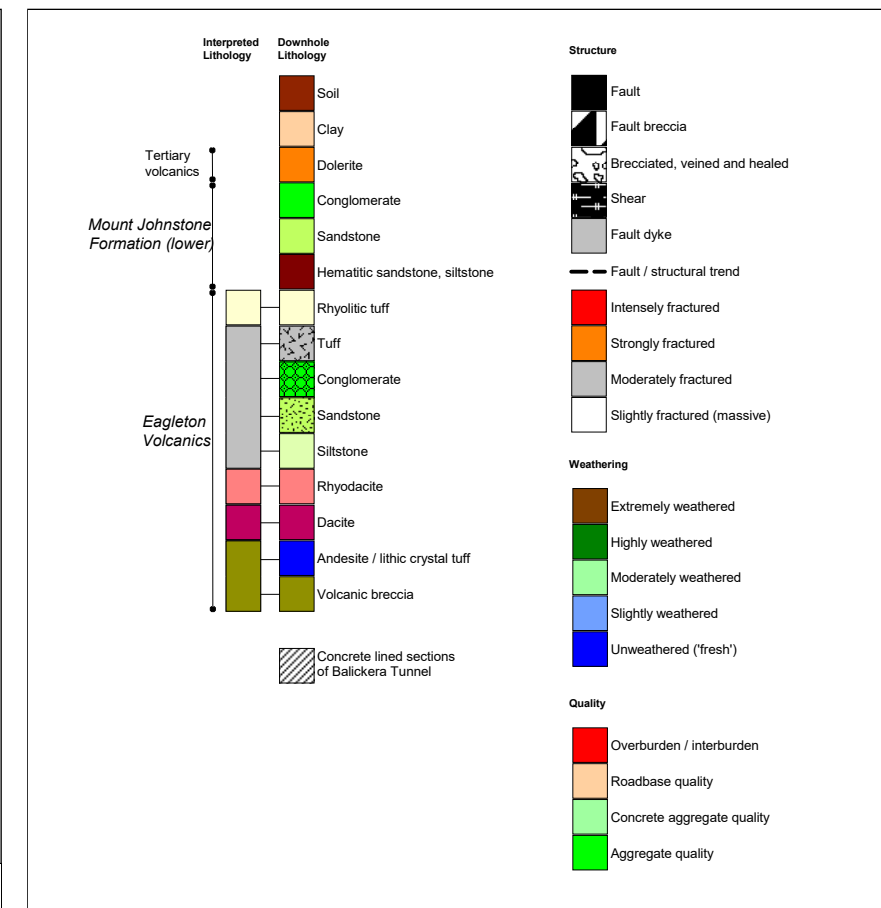
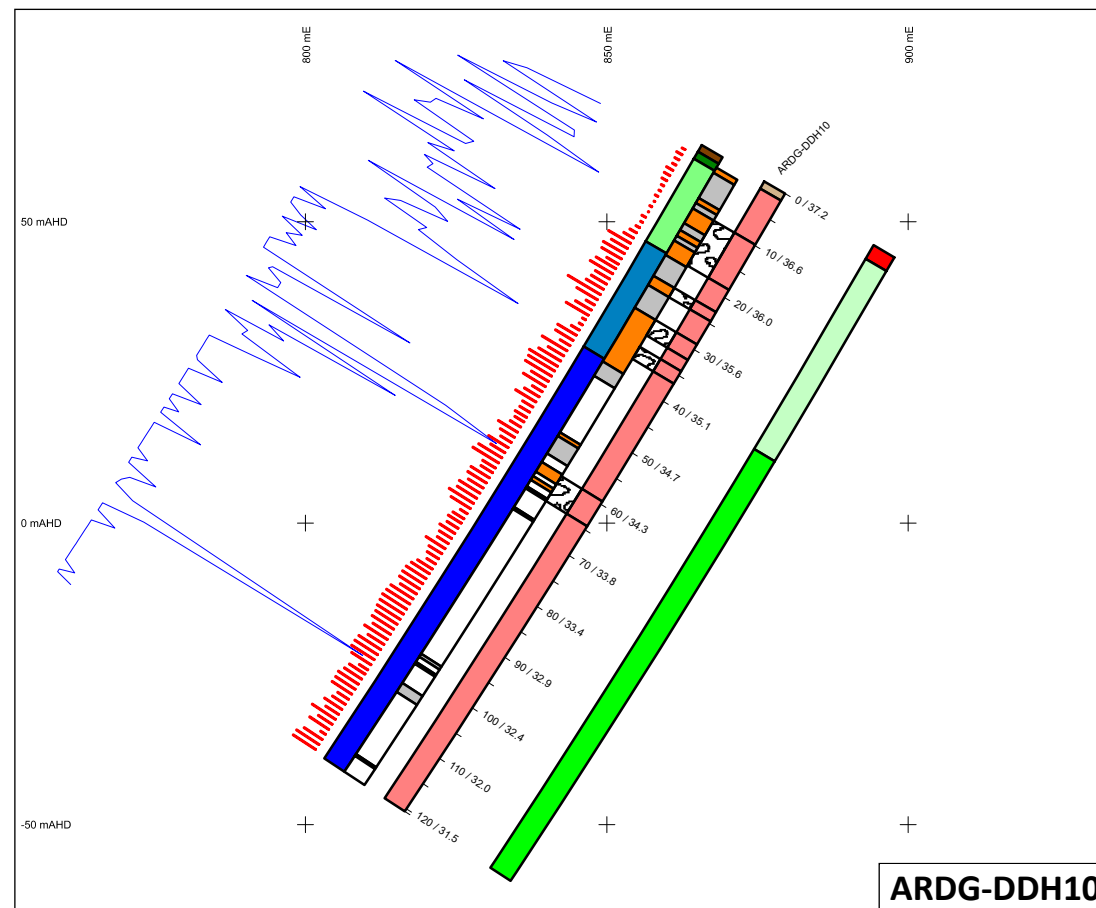
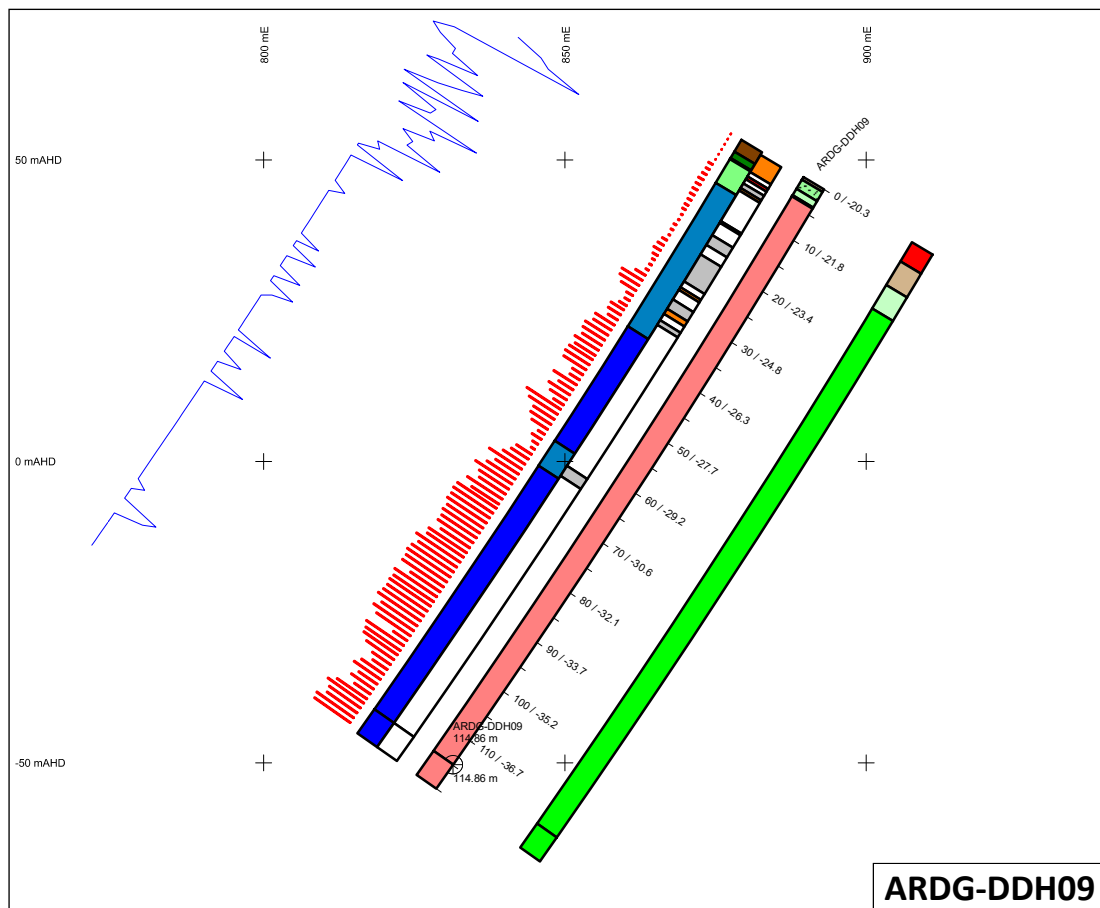
<b>Australian Resource Development Group</b> 130 Young St, Carrington, NSW, 2294 E: admin@ardg.com.au W: www.ardg.com.au	<b>Project: STONE RIDGE QUARRY PROJECT</b>		<b>Figure 12a</b>	
	<b>Title: Diamond Drill Hole Downhole Data - ARDG-DDH01, 02, 03, 04</b>			
	<b>Author:</b> DMB	<b>Date:</b> December 2019	<b>Scale:</b> 1:1250 @ A3	<b>Grid:</b>
	<b>Source:</b> Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)			



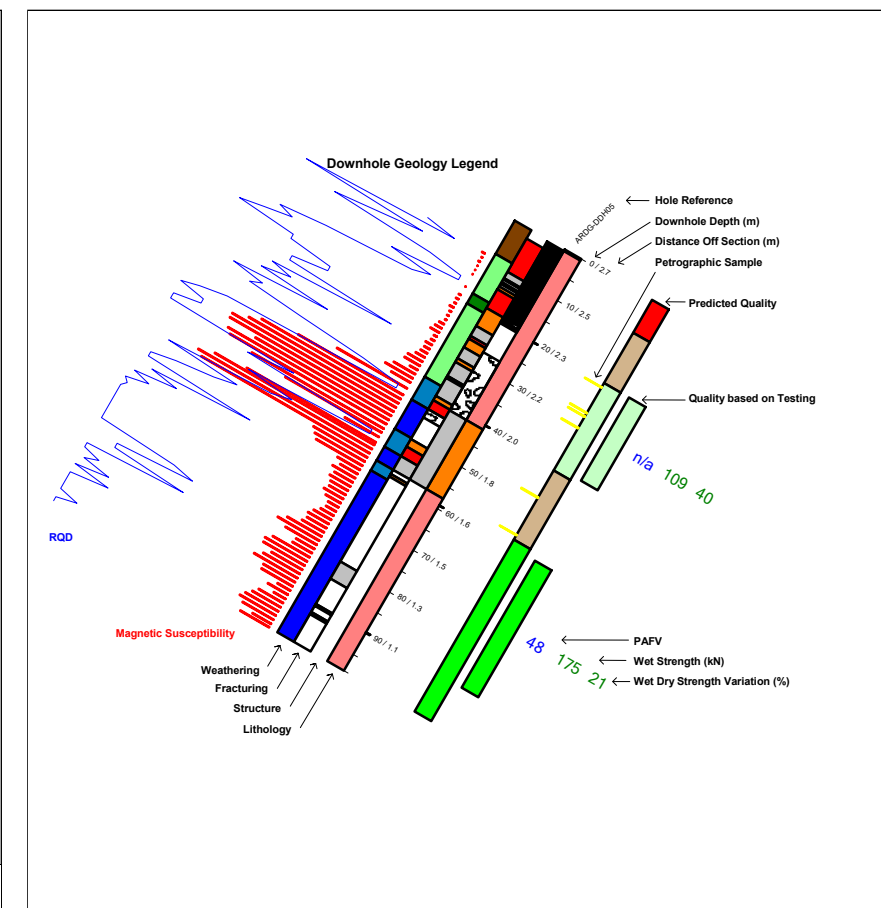
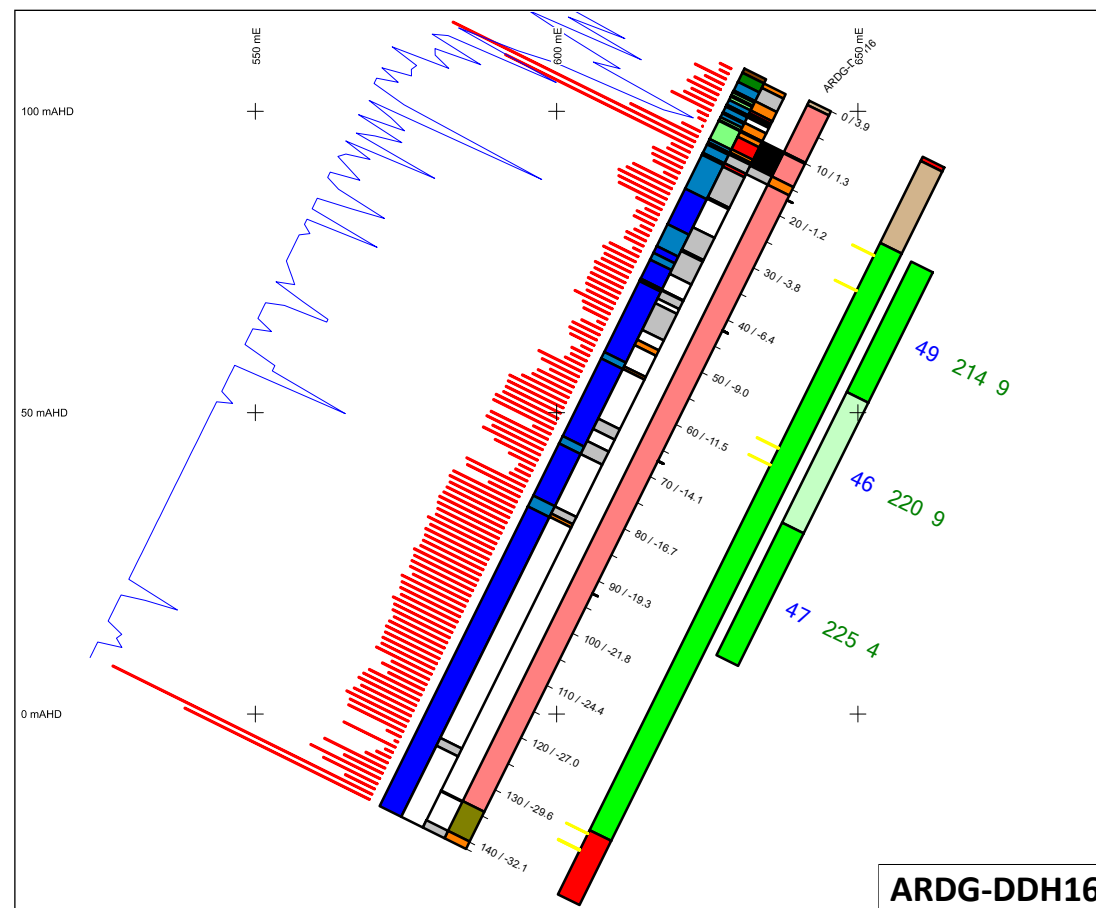
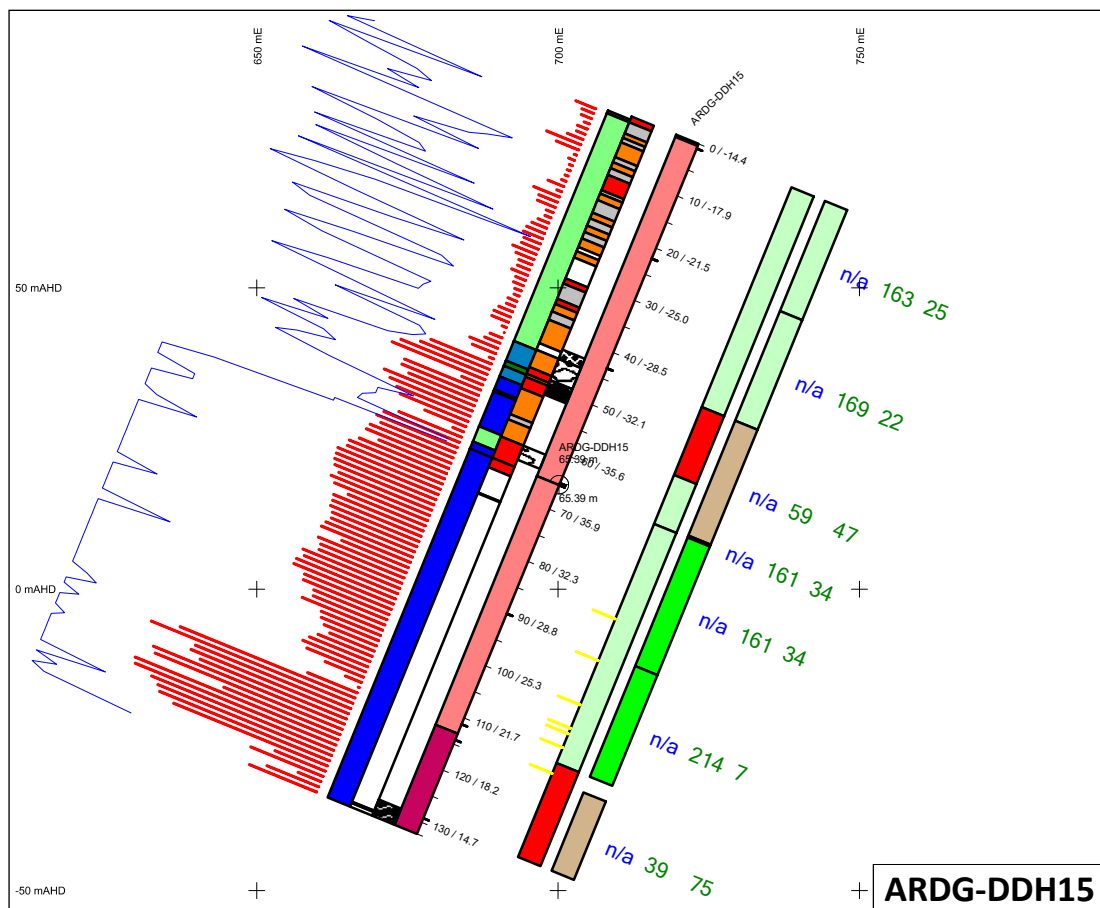
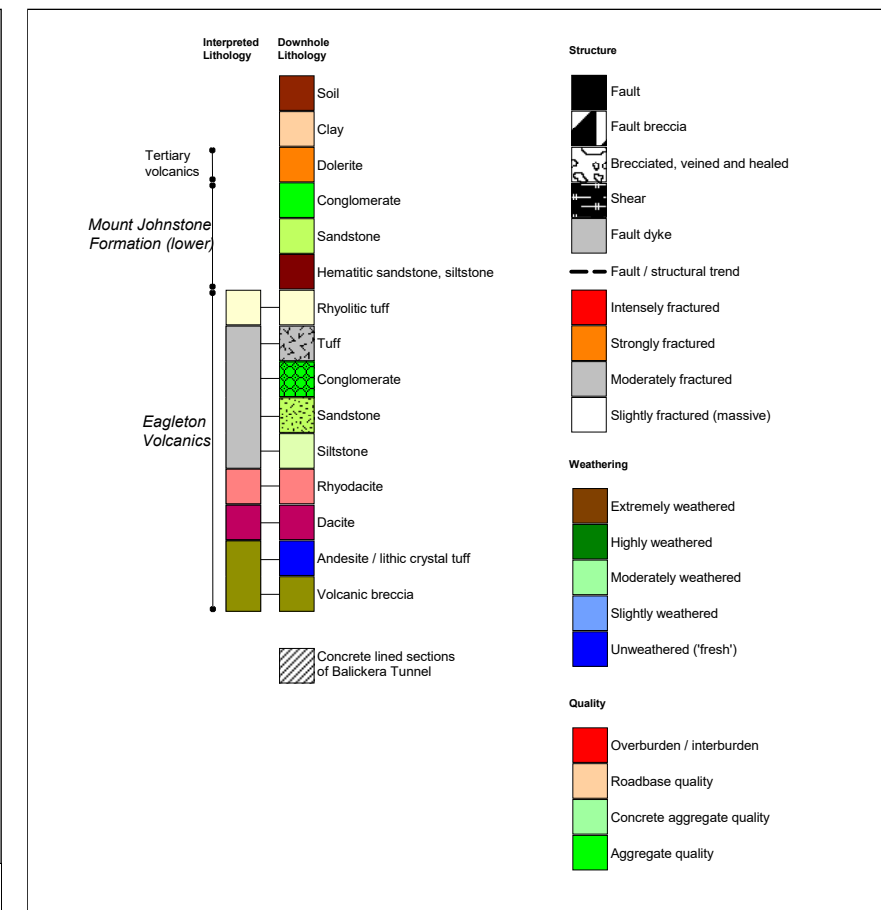
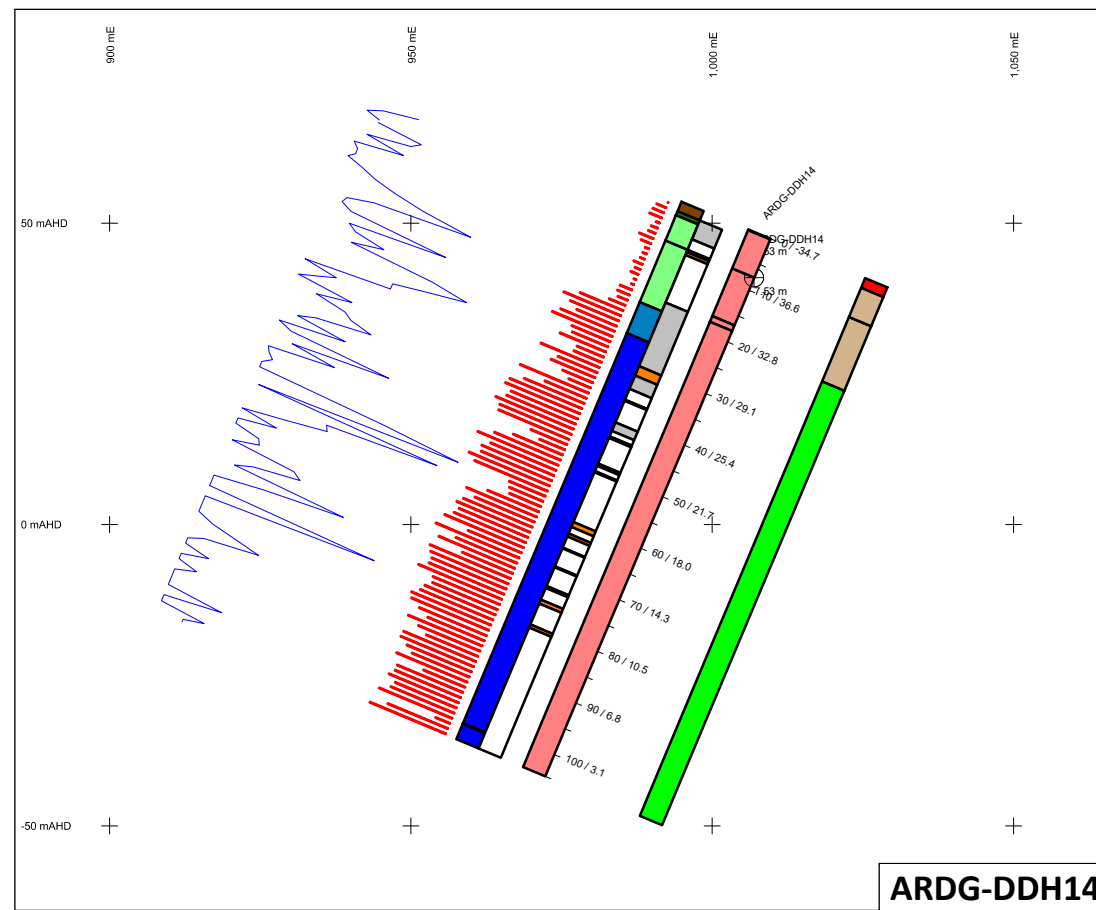
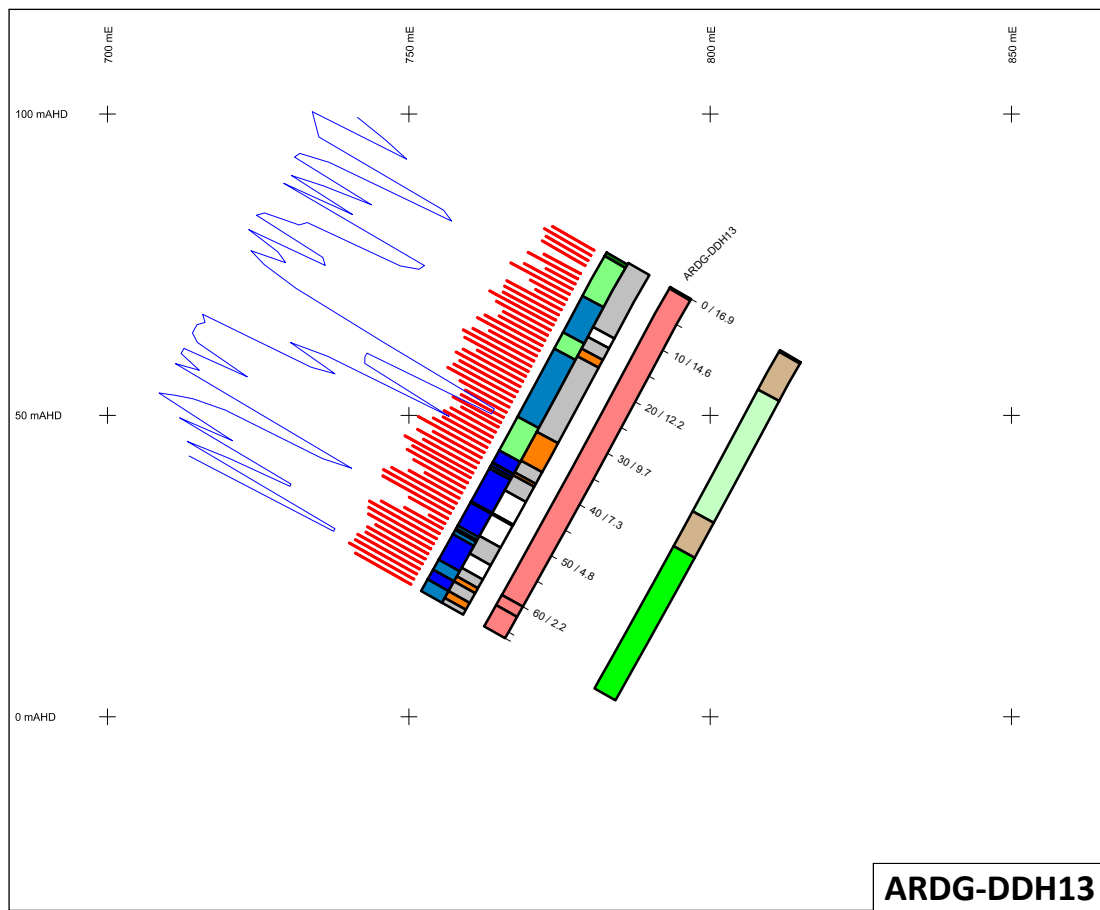
**Australian Resource Development Group**

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<b>Project:</b> STONE RIDGE QUARRY PROJECT		<b>Figure 12b</b>	
<b>Title:</b> Diamond Drill Hole Downhole Data - ARDG-DDH05, 06, 07, 08			
<b>Author:</b> DMB	<b>Date:</b> December 2019	<b>Scale:</b> 1:1250 @ A3	<b>Grid:</b>
<b>Source:</b> Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)			



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	<b>Title: Diamond Drill Hole Downhole Data - ARDG-DDH09, 10, 11, 12</b>			
	<b>Author: DMB</b>	<b>Date: December 2019</b>	<b>Scale: 1:1250 @ A3</b>	<b>Grid:</b>
	<b>Source: Diamond Drilling: Blacklaws Drilling - 2018-2019          Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)</b>			



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	<b>Title: Diamond Drill Hole Downhole Data - ARDG-DDH13, 14, 15, 16</b>			
<b>Author:</b> DMB	<b>Date:</b> December 2019	<b>Scale:</b> 1:1250 @ A3	<b>Grid:</b>	
<b>Source:</b> Diamond Drilling: Blacklaws Drilling - 2018-2019 Geological Logging: Damon Bird (ARDG) and Graham Lee (Graham Lee and Associates)				