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Collins Cap Quarry

Quarry Intensification Water Quality Responses

Prepared for

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Client representative

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Rev00

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Revision History

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A	Draft - Stormwater Quality Report	HP	JC	HP	25/09/2023
00	Stormwater Quality Report	HP	JC	HP	09/10/2023

1. Background

An intensification of red gravel quarrying activities is proposed at 685 Collins Cap Road, Collinsvale. As part of the proposal the Environmental Protection Authority requires an Environmental Effects Report and supporting documentation / recommendations to ensure stormwater quality runoff is managed appropriately. The primary pollutant of concern is suspended sediment entrained in surface water runoff.

This report addresses point 31 from the EPA table of Issues (see Figure 1) by reviewing the existing site surface water management operations against best practice guidelines and providing recommendations where appropriate to improve surface water management to an acceptable standard. This report does not address the slope stability queries.

31	2. Water quality	19	Surface water is seen pooling in the EER photos in many locations on site. Surface water management needs appropriate engineering to address hazards associated with offsite water discharge and overall slope stability management. It is advised that a copy of the drainage and catchment plan prepared by the geological engineer and referred to in the EER is included as an appendix to clarify the location of the drainage works and control measures implemented to manage the stormwater run-off from the site. Further information is required confirming the landslip hazard at the site has been adequately addressed and potential impacts to the water quality in the Glen Dhu Rivulet catchment are mitigated. The assessment must be in accordance with the Australian
			Geomechanics Landslide Risk Guidelines https://landsliderisk.org/wp-content/uploads/2017/04/ags_2007c2.pdf. For sediment basins, provide the sediment capture particle size, settling volume and surface area calculations and design rationale. Refer to the EER Guidelines for more information and reference for suitable design approaches. Sufficient information is required to demonstrate the sumps are located and designed following best practice design principles. The EER notes that 'overflow from this sediment trap flows into the roadside culvert' (page 19). This has the potential to result in off-site discharge of total suspended soils. Please confirm the location of the overflow and the water quality entering the culvert. The EER states that 'there is to be a 300mm overflow pipe installed to direct excess water to the perimeter sediment pond on the lower side of the site.'. Please confirm if this pipe has been installed and whether this solution has been successful. Please clarify how overflow from the sediment pond is currently managed if these works have not been undertaken. Describe the potential impacts of stormwater to the receiving environment, including the neighbouring dams.

Figure 1: EPA Table of Issues (Point 31)

2. Primary site drainage features

With reference to Figure 2 the red gravel quarry has and is proposed to have two main catchments with the following features:

- A catch drain on the southern edge (top of the quarry) is currently in place and is proposed to be extended to capture “clean” surface water from above the site and divert it west around the quarry area
- Bunding and drains are present through the quarry and direct surface water to two sediment basins as seen in Figure 1
- Overflow from the sediment basins are proposed to discharge to:
    - The existing eastern basin near the entrance discharges into a road drain on Collins Cap Road (immediately north of the basin)
    - An additional sediment basin is recommended in the eastern catchment as the existing basin is not adequately sized to meet best practice
    - The existing western basin overflow discharges via a 300mm overflow pipe to the north and into an existing level spread discharge basin; and
- Contours presented are derived from LiDAR surveyed in 2019 (WellingtonRange2019-DEM-1m), noting that changes have occurred due to quarrying activities in the period since.

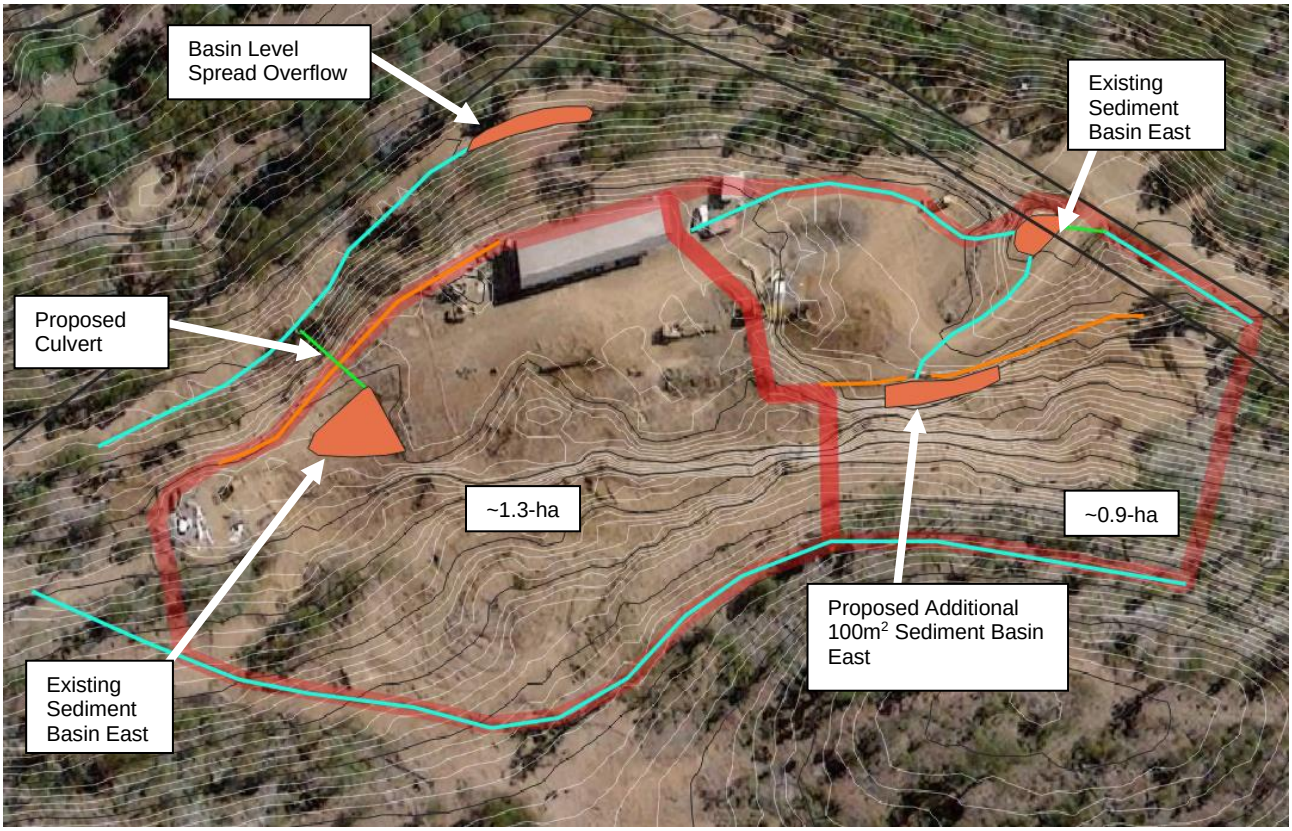

Figure 2: Major Site Drainage Features (drains blue, culverts green, bunding orange lines, catchments red)

3. Best Practice Sediment Basin Requirements

An estimate of the sediment basin (sizes) required has been undertaken to check conformance against best practice guidelines - the International Erosion Control Association (Australasia) guidelines. The sizing has been compared to minimum requirements for a Type C basin which fundamentally requires the calculation of the required surface area for the arrangement shown below (see Figure 3. The general calculation is:

$A_s = K_s * H_e * Q$, where

- A_s = Minimum average surface area required
- K_s = Sediment Settlement Coefficient (based on critical particle diameter and water temperature)
- H_e = Hydraulic efficiency correction factor (pertaining to the geometry of the basin and its impact on flow velocities/behaviour within the basin); and
- Q = Peak flow rate for 0.5 * 1-year annual recurrence interval storm.

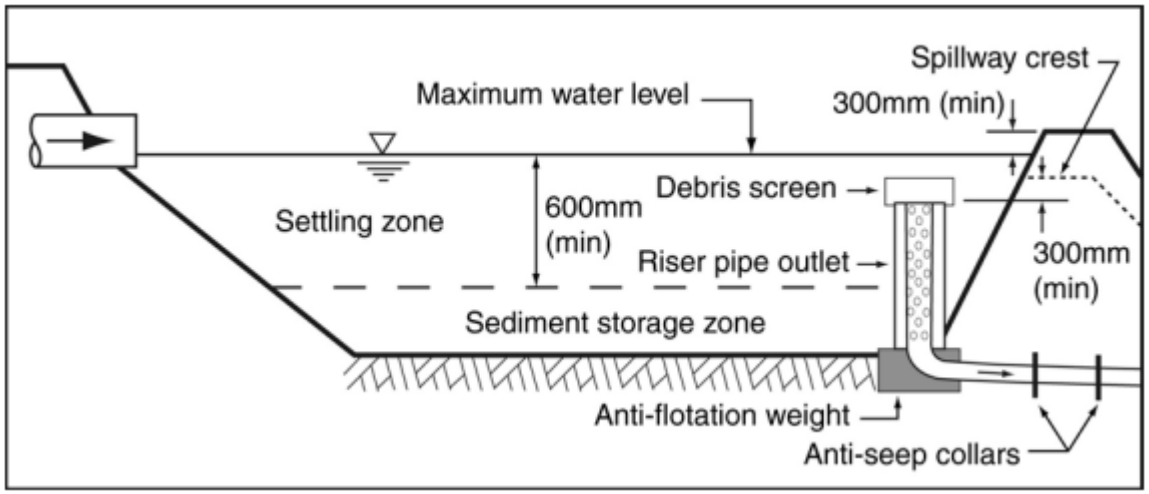

Figure 3: Indictive Arrangement Type C Basin (International Erosion Control Association, 2018)

The following assumptions have been made for each basin:

- Hydraulic efficiency factor of 1.5 corresponding to a basin with a single concentrated inflow not spread evenly and a basin shape with a width to length ratio of 1:1. A value of 1.5 is the most conservative factor in the guide and is appropriate for the current arrangement
- Less than 33% of soil finer than 0.02mm, and no more than 10% of soil dispersive (key criteria for using type C basin). This assumption is consistent with sediment particle distributions from analysis of other red gravel quarry floor samples
- Critical particle characteristics; specific density of 2.6, and diameter 0.02mm corresponding to Sediment settlement coefficient (Ks) 3740 at 10 degrees Celsius
- Peak flow estimates have been calculated in line with recommended procedures within Australian Rainfall and Runoff: A Guide to Flood Estimation, 2019 (ARR19) with the following assumptions:
    - The catchments have been assumed to present a relatively impervious surface whereby limited infiltration of rainfall into the surface occurs
    - 80% red gravel surface type with initial loss of 5mm and continuing loss of 1mm/hr
    - 20% natural surface type with initial loss of 25mm and 4.1mm/hr, and
    - Rainfall data obtained from the Bureau of Meteorology's Intensity Frequency Duration webpage and Australian Rainfall and Runoff datahub (see Figure 4 for design rainfall depths).

Table 1: Recommended Minimum Basin Surface Area (Type C IECA Basin)

	Approximate Catchment Area (hectares)	Estimated 1-year Peak Flow (m^3/s)	Minimum Recommended Basin Surface Area (m^2)	Existing Basin Surface Area (m^2)	Proposed Additional Basin Surface Area (m^2)
Catchment 1 (east)	0.9	0.046	130	~60	100
Catchment 2 (west)	1.3	0.066	185	~300	-

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.04	1.18	1.66	2.01	2.38	2.89	3.32
2 min	1.80	2.03	2.78	3.30	3.82	4.47	4.96
3 min	2.39	2.70	3.72	4.44	5.16	6.08	6.80
4 min	2.87	3.25	4.51	5.40	6.32	7.53	8.50
5 min	3.27	3.71	5.18	6.23	7.32	8.82	10.0
10 min	4.71	5.36	7.56	9.19	10.9	13.4	15.5
15 min	5.70	6.49	9.16	11.2	13.3	16.3	18.9
20 min	6.50	7.39	10.4	12.7	15.0	18.5	21.3
25 min	7.18	8.17	11.5	13.9	16.5	20.2	23.2
30 min	7.80	8.87	12.4	15.1	17.8	21.7	24.9
45 min	9.41	10.7	14.9	17.9	21.0	25.3	28.7
1 hour	10.8	12.2	17.0	20.3	23.7	28.3	31.9
1.5 hour	13.2	15.0	20.6	24.5	28.4	33.4	37.4
2 hour	15.3	17.4	23.8	28.2	32.5	38.1	42.3
3 hour	19.0	21.6	29.5	34.8	39.9	46.5	51.4
4.5 hour	23.7	26.9	36.9	43.4	49.7	57.8	63.9
6 hour	27.6	31.5	43.3	51.0	58.4	68.1	75.3
9 hour	34.1	39.0	54.0	63.9	73.3	86.1	95.8
12 hour	39.3	45.1	62.8	74.6	85.9	102	114
18 hour	47.2	54.3	76.4	91.4	106	126	142
24 hour	52.9	60.9	86.4	104	121	146	165
30 hour	57.3	66.0	94.1	114	133	160	182
36 hour	60.7	70.0	100	121	142	172	196
48 hour	65.8	75.9	109	132	156	189	215
72 hour	72.4	83.2	119	145	171	207	236
96 hour	76.7	88.0	125	152	179	216	245
120 hour	80.2	91.8	130	157	184	220	249
144 hour	83.4	95.2	133	160	188	223	252
168 hour	86.6	98.6	137	164	191	226	254

Figure 4: Design Rainfall Depth Data (latitude -42.8368, longitude 147.1303)[1]

[1] http://www.bom.gov.au/water/designRainfalls/revised-ifd/

4. Surface water quality control recommendations

Sediment Basin 1 (East Catchment)

- The existing sediment basin for catchment 1 has a size and geometry that is not adequate in surface area when compared to best practice guidelines (currently ~60m^2 vs recommended 130m^2). It recommended that either:
    - The basin surface is increased to 130m^2
    - An additional basin of 100m^2 is provided in a suitable location (recommended location and size presented in Figure 2), geotechnical input must be provided pertaining to the final location of the basin to ensure the stability of adjoining areas, and / or
    - Drains on upper benching are redirected to sediment basin 2 and the effective catchment area 1 is reduced; and
    - Additionally, internal drainage paths must be directed through the basin particularly near the Collins Cap Road entrance.

Sediment Basin 2 (West Catchment)

- The existing sediment basin for catchment 2 has a size and geometry consistent with best practice guidelines for the proposed intensification of quarrying activities; and
- The overflow pipe from this sediment basin should be constructed to direct flow north into the existing catch drain. A rock lined chute is recommended at the culvert outlet to protect the existing embankment, engineering input for the culvert and chute design is recommended to ensure the existing embankment is appropriately protected.

General

- Sediment basins in this environment require frequent maintenance to ensure the basin maintains operational capacity and reduces the likelihood of sediment re-suspension during large storm events. Cleaning should be undertaken preferably in the absence of rain and spoil from basin cleaning should be located away from concentrated flow paths
- The overflow spillway from sediment basin east should be provided with rock lining transitioning into the roadside drain on Collins Cap Road
- Rock pitching and widening of approach drains is recommended where possible to promote shallow and low velocity flow entry into basins
- All primary flow paths/drains should be rock lined to lower velocities and capture sediment and reduce loads on sediment basins. Steep concentrated flow paths should be avoided where possible
- Despite a basin being sized in line with best practice guidelines this does not ensure that the quality of discharge will meet targets. If issues remain present options available include:
    - Further increase the basin size (space is available); and/or
    - Use of flocculants and/or coagulants.

5. Response to EPA Table of Issues Point 31

- A review of necessary infrastructure to manage surface water has been provided including recommended minimum sediment basin sizes and general surface water management infrastructure
- The sediment basin nearest Collins Cap Road has been assessed with the current arrangement not adequate to meet best practice guidelines. A recommendation to increase the size or add additional basin upstream has been provided along with recommendation to ensure the entire catchment is directed into the existing or additional basin and overflow is via a rock lined spillway onto Collins Cap Road
- If not already installed, an overflow pipe from the western sediment basin is recommended to provide a controlled outflow; and
- The proposed arrangement will have minimal impact on the two small dams immediately north of the quarry when compared to the existing arrangement. The current site drainage outfalls are not directed into these dams and the proposed arrangement does not alter this. Flow will eventually migrate to other farm dams via Collins cap Road drains and culverts however best practice management is proposed to control the quality of the discharge.

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Collins Cap Quarry

Quarry Intensification Water Quality Responses

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