28th August 2021

For the attention:
Liam Jukes
Senior Planner – Major Assessment
City Development Branch
Council of City of Gold Coast

Dear **Liam Jukes,**

Objection submission COM/2019/81 -

Dewatering not permitted (and additional Stormwater concerns)

This development application, it would seem, intends to proliferate, what I believe to be, the ongoing illegal dumping of excess groundwater into the *'Environmental significant - wetlands and waterways'* of the freshwater part of the Coomera River. This, I believe illegal activity, is being perpetrated by the Nucrush operation, as part of what I believe is the illegal dewatering of their mine/quarry pit in Oxenford on an ongoing, continuous basis.

This development application would, if approved, be by far the most prolific dewatering development on the Gold Coast in its entire history (where dewatering, in its simplest definition, is the removal of excess waste water). However, I do not believe the Nucrush site has any legal right to dewater excess groundwater into the Coomera River as I believe is currently happening.

This dewatering of excess ground water from the mine/quarry pit into the Coomera River is, I believe, not permitted under:

- Their Current approval; and
- Their DES Environmental Authority EPPR00245613 (The current one); and
- Their DES Environmental Authority EA0002207 (Post development application); and
- The Environmental Protection Act.

All these aspects are discussed in this document below.

Current contamination of *'Environmental significant - wetlands and waterways'* freshwater part of the Coomera River?

Already, despite what I believe to be the relatively small scale of the current dewatering into the Coomera River, I believe this is having a marked effect on the local environment as shown in the *'Environmental significant - wetlands and waterways'* tributary to the Coomera River where the sediment /debris build up can be clearly seen just before it enters the Coomera River (via Stormwater drain) as shown in attachment A1. It is, I believe, clear to see the sediment/debris that has been carried down the Coomera River tributary (identified in attachment A2).

The photos referred to, in this section, were all taken on the 26th August 2021, in the vicinity delimited by the yellow circle on Attachment A2.

Other views of this same area are shown in attachment A3 and A4 that show the heinous contamination that is, I believe, a result of dewatering from the quarry pit that is being allowed to illegally enter the Coomera River.

The sediment build-up in the Coomera River, that is I believe already happening, can be clearly seen just below the surface of the lake in Attachment A5. Which is just beyond the outlet of the stormwater drainage tunnel shown in attachment A1).

The effect of this sediment build-up on the local ecosystem within these *'Environmental significant - wetlands and waterways'* does not bear thinking about.

The scale of the proposed dewatering

It would seem the current area affected by groundwater ingress is approximately 76 m^3 (judging by the Google maps overview picture as shown in attachment A6).

I believe the dewatering of this semi-subterranean area is via the pipe as shown in Attachment A7, A8 and A9). And, therefore, I can only assume this apparent link to the quarry is the root cause of the highly significant amount of the sediment build-up witnessed at the entrance to the stormwater drainage channel (attachment A1). I assume this is just a small percentage of the total outflow of sediment received by the *'Environmental significant - wetlands and waterways'* area of the freshwater section of the Coomera River (as can be seen by the sediment build up just beyond the exit of the stormwater drainage channel in attachment A5).

The total subterranean excavation proposed is, I believe, in the region of approximately forty million cubic metres (calculations shown in attachment A10).

Therefore, this is, it would seem, an area **over five hundred thousand times bigger** (Yes, that is 500,000 times bigger) than the current dewatering scenario!

Given, the seemingly devastating effect this is already having on the *'Environmental significant - wetlands and waterways'* area of the freshwater section of the Coomera River and the stormwater drainage channel (as demonstrated in attachments A1, A3, A4 and A5), what will be the effect of **over five hundred thousand times** more dewatering that will, I believe, have to take place constantly as an area of up to six million square metres (their figures) around the quarry has its groundwater drained into the open cut mine on a 24/7 basis (and subsequently, it would seem, dewatered into the *'Environmental significant - wetlands and waterways'* area of the freshwater section of the Coomera River)?

I hope the Gold Coast City Planners are aware of the scope of the proposed development and the hidden dangers of ANY subterranean mining (let alone this truly heinous scale that is proposed by this development application).

I strongly believe ANY approval to go below the existing water table would be clearly unacceptable and answerable in a Court of law.

Is this Nucrush quarry operation illegal?

I believe that the Nucrush quarry is already operating outside of their Current approval and illegally with respect to the dewatering.

Firstly, under the *'Current Approval'* (as stated in the 1992 Rezoning Agreement'): *"No extraction of the resource is to occur below RL 10.0 (Australian Height Datum) unless otherwise approved by the Council in accordance with concept plans for a specific and appropriate end use"* (Attachment B1).

However, as clearly seen on *'Google Maps'*, the quarry/mine pit is currently excavated to a depth below three metres (Attachment B2). This is clearly contra to their Current Approval.

The adjacent Coomera River is sitting at a depth of two metres (Attachment B3). Thus, as can easily be predicted, the quarry pit dug to an elevation equivalent to the level of the adjacent Coomera River already has a build-up of groundwater (as I believe can be clearly seen in Attachment B2).

It would seem the *'Current Approval'* condition: *"No extraction of the resource is to occur below RL 10.0 (Australian Height Datum) …"* (Attachment B1) was a very sensible condition in order to eliminate groundwater issues and ignoring this clear requirement has, it would seem, brought with it significant groundwater issues.

Secondly, under the *'Current Approval'* (as stated in the 1992 Rezoning Agreement'): *"The quarry floor must be self-draining and accessible by vehicles at all times during quarrying operation and on cessation of operations"* (Attachment B4). Clearly this breach in the extraction level has already severely compromised this clear requirement and has thus forced the quarry, it would seem, to dewater (despite, it would seem, no Environmental Authority to do so). Another sensible condition of the Current Approval that has been ignored at it would seem the severe detriment of the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River.

It seems to me, that the quarry has already outgrown its current location and its pushing of 'Current Approval' boundaries has caused, it would seem, a plethora of additional problems.

So where is this resultant build-up of groundwater (caused, I believe, by ignoring Current approval conditions) dewatered to in order that the mining can continue without flooding the pit?

Culpably, I believe, it is merely pumped into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River with no filtration or sediment basins or decontamination pits.

It appears that a dewatering pipe from the mine runs directly due North to the '*Overland Stormwater Flow Paths'* (this pipe is, I believe, clearly visible in *'Google Maps'* as reproduced in attachment A7, close up in attachment A8 for additional clarity).

An overview of the wider area is shown in attachment A9.

Unfortunately, it would seem this is already having a dire effect on this waterway. In attachment A1 you can see this waterway as it enters the Stormwater discharge point (as it goes under the Tamborine-Oxenford Road to the Coomera River) with a truly abhorrent build-up of sediment/debris accumulated at this point.

The close up views in attachments A3 and A4 shows the sediment build as it enters the Stormwater discharge point and the scum on top of this, what looks to be, highly contaminated water.

Attachment A5 shows the exit point from the Stormwater drain under the Tamborine Oxenford Road into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River. Already there can be seen, I believe, very clear build-ups of sediment in this area that is just below the surface of the lake. This is extremely concerning for the local ecosystem within the Lake.

Department of the Environment and Science (DES) Environmental Authority EA0002207

Within the Environmental Authority EA0002207, issued as part of this development application, there is, I believe, no permitted release of water other than *'Stormwater'*.

This is emphasised in in *'Agency Interest - Water'* (Schedule C), *'Condition C4'* which states: *"Contaminants must only be released to surface waters in Accordance with Table 1: Stormwater discharge (event flow) monitoring parameters, mandatory discharge limits and monitoring frequency. Monitoring must occur in accordance with Table 2: Stormwater discharge (event flow) monitoring parameters, mandatory discharge limits and monitoring frequency"* (Attachment F1).

It is I believe clear to see this is for *'Stormwater discharge (event flow)'* only.

This is also emphasised in *'Condition C1'* which states: *"Other than as permitted within this Environmental Authority, contaminants must not be released to any* ***waters****"* (Attachment F1). No mention of permissible dewatering (other than stormwater) is made in the Environmental Authority.

Department of the Environment and Science (DES) Environmental Authority EPPR00245613

The current DES Environmental Authority EPPR00245613 for the Nucrush quarry, Schedule C, *'Condition C1'* states: *"**Release of Contaminants to Waters** - Contaminants must not be directly or indirectly released from a site into any waters or to the bed or banks of any waters whereby environmental harm is caused except: (i) as permitted under the stormwater management schedule; or (ii) to a sewer as permitted or otherwise agreed to from time to time by the relevant local government authority"* (reproduced in attachment B5).

Clearly the current dewatering of excess groundwater, that appears to be taking place, is not, I believe, permitted under this Environmental Authority either.

Thus, it would seem the current dewatering is not permitted by the current Environmental Authority. So, I believe, the Nucrush quarry are already acting illegally with regard to their current dewatering practice.

Summary

I believe, as stated in the Environmental authorities, only stormwater is permitted to be discharged from the site and thus, it would seem, it is illegal to dewater leached contaminated groundwater into the Coomera River as I believe is currently happening and is, I believe, already contaminating the Coomera River (Attachment A1, A3 and A4 and A5).

It should be remembered the development application proposes, I believe, increasing the current subterranean pit by a factor of five hundred thousand times larger. Given, the already catastrophic effect this appears to be having on the Coomera River, how will this dramatic increase in dewatered groundwater, with no visible means of decontamination, affect the *'Environmental significant -*

wetlands and waterways' area of the adjacent freshwater lake within the Coomera River and its local dependant ecosystems and local residents using this area (swimming, fishing, etc.)?

Confirmation of dewatering

The proposed dewatering is confirmed by the development application in the submitted: *'Groundwater Impact Assessment'*, Section 7.1: *"It is understood that water that cannot be stored on-site is released to Water Polishing Pond at the Tamborine-Oxenford Rd site boundary, and to the water channel on the north eastern side of the Main Pit"* (Attachment F2). Thus, any *"water that cannot be stored on-site is released"* into *"the water channel on the north eastern side of the Main Pit"* or the *"Water Polishing Pond"* (which is already full as stated by *"water that cannot be stored on-site"*) results in dumping unwanted contaminated excess quarry ground water into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River with untold effects on the local ecosystems.

Other, than Stormwater discharge, it is clear from Environmental Authority EA0002207 that **NO OTHER CONTAMINANTS MAY BE RELEASED** into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River which is contra to the development application proposals which state: *"The quarry will require dewatering to remain dry. Any water that flows to the quarry would be available for use on site and any excess likely discharged"* and *"Post-closure, the groundwater flow regime will recover approximately back to its pre-development configuration, with the quarry pit only capturing a small portion of the groundwater flow that would have otherwise discharged to the Coomera River under current conditions"* (Attachment F3).

Dewatering Management Plan (DMP)

The requirements for a '*Dewatering Management Plan'* are outlined in the Gold Coast Council's: *'Guidelines for Dewatering Management Plan'*, dated March 2018, attachment C1).

It is noted that in the City of Gold Coast *'Guidelines for Dewatering Management Plan'* states: *"The DMP will be submitted with the development application"* (Attachment C2). This has not, I believe, been done and despite an over two years timeframe since the development application has been submitted and Council Planners consideration of it so far, I note no *'Dewatering Management Plan'* has been either submitted or requested by Gold Coast Council City Planners.

The failure to include a '*Dewatering Management Plan'*, as I believe is clearly required, means that areas such as *"Noise emanating from the plant such as pumps and diesel generators that is used in dewatering process can cause a noise nuisance to nearby noise sensitive places. During temporary dewatering activities in most cases the plant is required to be operated twenty four (24) hours per day, which can increase the intrusiveness of the noise particularly during later or early morning periods when the background noise levels are minimal"* are not covered in the development application (as shown in Attachment C3).

Given the extent of the Dewatering that is believed to be 30 litres per second (however, this is, I believe based on the applicants best case scenario therefore I believe it may well be up to 40 litres per second as discussed below) on a 24/7 basis with a claimed temporary duration of one hundred plus years, into an *'Environmental significant - wetlands and waterways'* area of the Coomera River (as shown on the City Plan, reproduced in Attachment C4) the failure to submit the required DMP would seem an extraordinary and glaring oversight.

** Please note I refer to it as 'Temporary' as per the development application description: "Post closure, the groundwater flow regime will recover approximately back to its pre-development configuration" (Attachment C5).*

This dewatering process will, I believe, be a 24/7 never ending continuous cycle throughout the one hundred plus years of mining the open cast pit as groundwater from the surrounding area (up to a *'Cone of Influence'* or radius of 1,418 m, which is over six million square metres, as shown in Attachment C6) will continually leach into the pit via the walls and floor, be contaminated by quarrying activity and will then be pumped out into the Coomera River to stop the pit flooding (as the submitted *'Groundwater Impact Assessment'* states: *"The quarry will require dewatering to remain dry"*, attachment C5), I believe this will have unknown consequences for the local residents, the local environment, the local water table and the Groundwater Dependent ecosystems (GDEs) within this affected area.

Please note, this is without any Stormwater contingency in these figures, purely leached groundwater from the subterranean mining method proposed.

It should also be realised from early stages onwards the existing stormwater sedimentation basins and containment pits, dams etc. (as shown in Attachment C7) are engulfed into the extractive footprint and appear to have no replacements planned (as shown in attachment C8) over and above the main sump in the floor of the quarry (as shown in Attachment C9). Therefore, it would seem, there is absolutely nowhere to store the excess water to ensure it is at a compliant level of contaminants prior to being pumped into the *'Environmental significant - wetlands and waterways'* area of the Coomera River.

This is, I believe (at a proposed duration of one hundred plus years), the longest and biggest dewatering project ever conceived on the Gold Coast yet, according to their Environmental Authority, I believe no dewatering of the site into the Coomera River is permitted making this an illegal action.

Is the questionable legality of the dewatering into the Coomera River by the applicant the reason why a '*Dewatering Management Plan'* was, in spite of the humungous scale of the required dewatering, in this case omitted from the development application?

Are the Gold Coast City Planner's aware of the clear requirement for a '*Dewatering Management Plan'* for this development application under their own guidelines? And, are the City Planners content to ignore this clear requirement to submit a '*Dewatering Management Plan'* despite this being, I believe, the most prolific dewatering project ever proposed in the entire history of the Gold Coast?

I hope the Gold Coast City Planner's will make the necessary checks to verify the legal status of the current and future dewatering of the Nucrush quarry before making a rash decision on this development application.

What is the required extent of dewatering into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River?

The extent of the discharge into the Coomera River is, I believe, shown within the submitted *'Stormwater Management Plan'*, Table C-8: *'Outflows from the site - Ultimate Site Conditions'*.

This shows that a *'Total outflow'* of between *'2,437'* cubic meters and *'2,554'* cubic metres (dependant on concrete production) will need to be discharged on a daily basis (Attachment D1).

Please note this discharge rate into the Coomera River is somewhat at odds with their submitted Table C-10: 'Flow distribution onsite - Ultimate Site Conditions' (Attachment D2) which states that the discharge is far higher at between 2,506 and 4,625 cubic metres. However, I am inclined to believe the 4,625 cubic metres (based on 'High' 'Concrete Production) is a typographical error where the 'Average Yearly flow' has been transposed from '890 ML/yr' in Table C8 to '1690 ML/yr' in Table C10. I will thus continue assuming Table C-8, the lesser of the two discharge rates, is correct.

Using the figures in *'Table C8'* (i.e. between *'2,437'* cubic meters and *'2,554'* cubic metres per day); this equates to between 102 and 106 cubic metres of water every hour. Which is up to 1.8 cubic meters per minute (or 1800 litres) **OR 30 litres of water per second** (approx) on a 24 hours a day, 7 days a week basis.

However, it should be noted that these figures, damning as they are, are based on their best case scenario of *'low bedrock conductivity'* as highlighted in Section C.5.1 of the submitted Stormwater Management Plan: *"To present a water balance model considered to represent the site (in lieu of comprehensive information), certain assumptions have been applied. These are outlined below: … As suggested in the Groundwater Impact Assessment - Oxenford Quarry Extractive Boundary Realignment Project (G1913)(AGE 2018) and supported by G1913A: Oxenford Quarry Response (AGE 2019): "The inflow predictions show that the inflows are dominated by groundwater entering through the pit floor. The inflows predicted by the low bedrock conductivity scenario (total of 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations"* and *"Based off this statement, the groundwater inflow as anticipated at being 4 L/s (345.6m^3/d) for the quarry Pit Sump C3 for the ultimate site conditions"* (Attachment D3).

Based on the *'low bedrock conductivity'* assumption above, a 'best case scenario' of 130 ML/yr inflow into the pit was, it seems, assumed. If it were subsequently found to be a *'high bedrock conductivity'* then up to 432 ML/yr would flow into the pit as per their Analytical results table (Table 7.2) of their Groundwater Impact Assessment shows (reproduced in Attachment D4). Thus, there would be an additional 302 ML/yr inflow into the quarry pit which would have to be discharged (which I believe equates to roughly an extra 10 litres per hour) as the quarry has, it would seem, no use for this additional ground water. Therefore, I believe, the *'Total outflow'* would increase to an estimated 40 litres per second (approx) on a 24/7 basis.

I believe it is culpable to use a best case scenario within the *'Stormwater Management Plan'* that should clearly be based on a worst case unless proof was available negating this worst case scenario. There appears to be no proof submitted. However, the mere fact *'high bedrock conductivity'* is presented as an option within the *'Stormwater Management Plan'* shows, I believe, this would have been more appropriate case to base calculations on. Especially when considering the possible devastating effect this DA could have on the local ground dependent ecosystems (GDEs) and the local environment when proposing discharging high volumes of contaminated water for a duration of over one hundred years.

It should also be realised that even this seemingly implausible figure of 40 litres per second, every single second, on a 24/7 basis does not allow for any additional stormwater that may be present.

With no settlement pits or containment pits (other than *'Sump C3'*) in the later stages of quarrying (as shown in attachment C9) if this discharged water is found to be contaminated as I believe is virtually guaranteed (for example by acid sulphates and/or pyrite) how is this going to be decontaminated before release? Where will this colossal volume of water be stored prior to release? It cannot be stored in *'Sump C3'* as this will be forever filling with yet more potentially contaminated groundwater. It is clear, I believe, there is no space for the required sedimentation basin(s) given the extractive footprint proposed on the site.

It is also pertinent to note that the total inflows and outflows discussed in the *'Stormwater Management Plan'* I believe fail to distinguish between groundwater ingress and stormwater appropriately. Thus, seemingly including the groundwater into the *'Stormwater Management Plan'*. However, the Environmental Authorities associated with this site i.e. EPPR00245613 (current) and EA0002207 (proposed) both permit stormwater to be discharged from the site (providing it is appropriately decontaminated prior if necessary) but do not permit dewatering of groundwater into the Coomera River. Is this why they are combined and no *'Dewatering Management Plan'* was submitted?

<u>Oxenford Overland Stormwater Flow Paths affected</u>

The Overland stormwater flow path's affected by the quarry are highlighted in the '*Oxenford LAP Map 18A.6 - Overland Stormwater Flow Paths'* (reproduced in attachment D5).

These are also shown on the Gold Coast Council City Plan *"Environmentally significant: Wetlands and Waterways"* (reproduced in Attachment C4).

The proposed location of the car and truck parking and concrete production / batching facility and the main processing area (crushers, screeners, etc.) as shown in attachment C8, is I believe directly in the path of the '*Overland Stormwater Flow Paths',* which is also an *"Environmentally significant: Wetlands and Waterways"* on the Gold Coast Council City Plan.

I do not believe the proposed layout can be permitted as it will interfere with the protected waterways and there has been, it would seem, no attempt to mitigate these proposed actions. And certainly, there is no sediment basin or containment pit to decontaminate stormwater that will continue to flow through this route including car and truck parking and concrete production / batching facility and the main processing area (crushers, screeners, etc.) that will, I believe, be undoubtedly contaminated as it passes through this highly contaminated extractive industry areas and it would seem straight into the *"Environmentally significant: Wetlands and Waterways"*.

<u>Oxenford Overland Stormwater Flow Path or 'Discharge Locations'?</u>

It can be seen, from the Nucrush development application's *'Stormwater Management Plan'* that where these *'Stormwater Flow Paths'* cross the public road these have been adopted by the applicant as *'Discharge Locations'* as identified by the applicant as red dots (as reproduced in attachment E1).

This is particularly concerning as it would seem the applicant intends to use these '*Overland Stormwater Flow Paths'* as *'Discharge Locations'* to continue to dewater their subterranean quarry pit to prevent it from flooding.

As discussed in above I believe the required dewatering, associated with their planned subterranean open cast mining method going down 110 metres below the level of the adjacent Coomera River (over and above the quarry's internal requirements for water usage) will result in an average of 30 to 40 litres per second of leached groundwater will have to be dewatered on an ongoing basis until the quarrying of the area is completed (one hundred plus years proposed in their development application) based on the applicants estimates in their submitted *'Groundwater Impact Assessment'*.

It should be remembered the *'Stormwater Flow Paths'* should be, as the name suggests, stormwater flow paths and they are clearly not *'Discharge Locations'* for dewatering a mine/quarry pit as appears to be the intention.

Ultimate Solution in four hundred years away?

If my maths is correct (and I have checked it a few times!) we will have to wait in the region of 400 years before our promised leisure lake is ready to use!

So here goes … For a final excavation pit size in the region of an area of 400,000 m^2 that is 100 metres deep gives a subterranean excavated pit in the region of forty million cubic metres (as shown in attachment A10).

Which at an excavation rate of one million tonnes per annum as planned give a total planned duration of 110 years which is roughly in line with the applicants claimed one hundred plus years (Attachment A10).

With an estimated inflow of 130 ML/pa, as per their assumption in attachment D3 (which is 130,000 cubic metres per annum), it will take approximately 307 years to fill (obviously as the pit fills the inflow will reduce so will slow the inflow however I have ignored this aspect for ease of calculations, as is rainfall).

Therefore, this development application is for a proposed duration of approximately 110 years and the resultant hole in the ground, that is sapping all the groundwater from the surrounding area for up to six million square metres and affecting all the surrounding groundwater dependent ecosystems (GDEs) could take another 307 years to stabilise the groundwater in the area (based on the submitted inflow estimates).

Either their estimated inflow (Attachment D3) is far, far lower than what the applicant has stated or we will have to wait a very long time before our promised 'Leisure Lake' is available to use at an estimated 417 years!

But seriously, I believe the estimated inflow should be thoroughly checked to see if this is a realistic estimate. I note that the estimated inflow is calculated based on Table 7.1 (reproduced in attachment F4). A cursory glance of this table reveals it is based on an ultimate quarry depth of -95 mAHD not the actual -110 mAHD. I also note it is based on an effective radius of the pit post-excavation of 300 metres, however with a pit length of 950 metres and width of 460 metres I wonder if this estimate is accurate enough. The other assumptions are beyond my understanding but I believe should be verified by an expert in the field.

Without an accurate prediction of the inflow that such an immense excavation will generate it is impossible to accurately predict the required dewatering into the Coomera River as appears to be proposed.

Groundwater Dependent ecosystems

The submitted: *'Groundwater Impact Assessment'* states: *"The Bureau of Meteorology (BoM, 2017) GDE Atlas shows ecosystems including springs, wetlands, rivers, and vegetation that interact with the subsurface presence of groundwater, or the surface expression of groundwater. Review of this mapping identifies there are no GDEs mapped within the extent of the proposed project boundaries. However, the proposed quarry extension will result in the mapped GDEs along the Coomera River, being within the radius influence from the quarry during its operational life. This radius of influence will only be present during active dewatering of the realigned pit"* (Attachment G1).

However, in the statement: *"This radius of influence will only be present during active dewatering of the realigned pit"* it culpably fails, in my opinion, to state that: *"This radius of influence will only be present during active dewatering"* will be an ongoing requirement for the next one hundred plus years. Therefore: *"the proposed quarry extension will result in the mapped GDEs along the Coomera River, being within the radius influence from the quarry during its operational life"*. i.e. The 'Groundwater Dependent ecosystems' within the *'radius of influence'* (up to 1,418 metres radius) and further along the Coomera River will be affected for the next one hundred plus years!

As stated by the Queensland Department of the Environments and Science (DES): *"Groundwater dependent ecosystems (GDEs) are ecosystems which requires access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services"* and *"Groundwater plays an important ecological role in directly and indirectly supporting terrestrial and aquatic ecosystems. Groundwater sustains terrestrial and aquatic ecosystems by supporting vegetation and providing discharge to channels, lacustrine and palustrine wetlands, and both estuarine and marine environment. Aquifer ecosystems are inherently groundwater dependent"*. Further: *"Groundwater also plays a critical role during extended dry periods in maintaining refuges for flora and fauna"* (Attachment G2).

In fact a more appropriate and less misleading statement in the *'Groundwater Impact Assessment'* would be: *"… the proposed quarry extension will result in the mapped GDEs along the Coomera River and within the radius of influence, being affected by the quarry operations for the whole of the quarry's operational life i.e. The next 100 plus years".*

So how will this *'radius of influence'* (or *'cone of depression'* as it is also known) affect the local area? Firstly, the area affected, according to the development application, is going to be up to 1.418 km radius (reproduced in Attachment G3) which is an immense area of approximately 6,300,000 square metres all around the mine.

Unfortunately the *"The Bureau of Meteorology (BoM 2017) GDE Atlas"* maps referred to in the development application have not been submitted by the applicant. Therefore, in order to clarify the effects, I have added the proposed extractive footprint and the radius of influence onto these Bureau of Meteorology GDE Atlas map for the *'Aquatic GDE'* as shown in Attachment G4. Similarly, I have done the same for the *'Terrestrial GDE'*, reproduced in Attachment G5. From these maps, it is clear to see that the radius of influence will have an extensive effect on a very large area and a highly significant number of Groundwater dependant ecosystems (GDEs) for the next one hundred plus years (or all our foreseeable futures!). It could also affect the many bores in the region (e.g. Movie world, etc.) and may have a significant effect on all homes as the water table is artificially lowered by ongoing quarry operations. The onset of emerging sink holes I believe cannot be ruled out either.

I therefore find the throwaway comment in the development application: *"This radius of influence will only be present during active dewatering of the realigned pit"* thoroughly inadequate and highly misleading (reproduced in attachment G1).

Moving on, in section 7.4, of the submitted *'Groundwater Impact Assessment'*, entitled: *'Radius of Influence'* the playing down of the radius of influence is continued here. It states: *"The radius of influence assuming high permeability bedrock and high permeability pit floor is estimated to be 1,418 m (Table 7.2). This scenario extends the radius of influence to include private water bore (RN 124033), a more extensive portion of the Coomera River and approximately 400 m of riparian wetland located upstream of the Gold Coast wave pork. Providing there is hydraulic connectivity between the Coomera River, the associated alluvium and the Nerangleigh-Fernvale Beds, the Coomera River will act as a flow boundary limiting the western extent of the radius of influence"* (Attachment G6). However, it should be noted the proposal is to quarry down to 110 metres below the Coomera River level. This adjacent section of the Coomera River (freshwater section) is believed to be in the region of four metres deep maximum. How can it ever be possible that *"the Coomera River will act as a flow boundary limiting the western extent of the radius of influence"* when there is such an immense difference in its depth compared to the quarry depth? I believe it is clear to see beyond the depth of the Coomera River (four metres approx) it will have absolutely no effect on the radius of influence. However, the perpetual draining of the ground water in the area may well have a significant influence on the Coomera River's ability to maintain its current water level for the foreseeable future (As will everything it would seem within the very large *'radius of influence'*).

The depth comparison between the quarry and the Coomera River is shown in attachment G7.

It is therefore particularly poignant that the next paragraph states: *"Regardless of the radius of influence and the inflows reporting to the quarry during operations, the groundwater levels in the vicinity of the quarry* ***void are assessed to recover once quarry development ceases and the quarry void is allowed to fill****"* (Attachment G6). So that's ok then! It would seem that after the hundred plus year's duration, of perpetually pumping the leached excess contaminated groundwater into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River, the local ecosystem are simply *"assessed to recover once quarry development ceases"*! I hope the City of Gold Coast Council Planners are not fooled by such rose tinted visionary statements!

Concerns for the 'Environmental significant - wetlands and waterways' during dry periods

The development application already raises strong concerns for the quality of the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake within the Coomera River when it states: *"Coomera River water west of the project site being generally fresh"* but: *"the river can become slightly brackish during periods of low rainfall when groundwater discharge from the alluvium and bedrock contributes a higher proportion of flow in the surface water system"* (Attachment G8).

It would seem obvious that the proposed lowering of the groundwater (for up to 1,418 metres radius) all around the quarry pit will compound this *'brackish'* effect as the area around becomes far drier than currently due to the far, far lower water table (as demonstrated in attachment G7) and therefore, as stated: *"when groundwater discharge from the alluvium and bedrock contributes a higher proportion of flow in the surface water system"*, as it undoubtedly will, when this groundwater is continually dumped into the *'Environmental significant - wetlands and waterways'* area of the freshwater section of the Coomera River, as it seems is proposed, there can be little doubt the quality of this area (and all the surrounding GDEs) will deteriorate as contaminated water is continually dumped into this protected area.

Obligations under the Environmental Protection Act 1994

In the EA it states: *"In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:*

- general environmental duty (section 319)

- duty to notify environmental harm (section 320-320G)

- offence of causing serious or material environmental harm (sections 437-439)

- offence of causing environmental nuisance (section 440)

- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)

***- offence to place contaminant where environmental harm or nuisance may be caused (section 443)**"* (reproduced in Attachment H1).

It would seem the dewatering into the Coomera River, potentially contaminated water, is clearly beyond the scope of the Stormwater section covered in the EA0002207 and thus, I believe, will breach the Environmental Protection Act 1994, Section 440: *"Offence of causing environmental nuisance (1) A person must not wilfully and unlawfully cause an environmental nuisance and (2) A person must not unlawfully cause an environmental nuisance"* (Attachment H2).

Similarly, I believe, it will breach the Environmental Protection Act 1994, Section 440ZG: *"A person must not … unlawfully deposit a prescribed water contaminant"* (Attachment H3).

Further, I believe, it will breach the Environmental Protection Act 1994, Section 443: *"Offence to place contaminant where serious or material environmental harm may be caused"* (Attachment H4).

All of these aspects of the Environmental Protection Act 1994 would, it would seem, be breached by the illegal dewatering into the Coomera River as it appears is proposed.

Stormwater and Environmentally relevant activities

It is noted that if you superimpose the *'Overland Stormwater flow path'* (as shown in Attachment D5) on to the development application proposals that the stormwater will roughly flow around the top of the pit through the truck and car parking area, through the processing area and then under the Tamborine Oxenford Road and straight in to the Coomera River (Attachment I1).

There can be very little doubt that under the proposals submitted, that the stormwater will follow the current path and thus enter into the proposed *'Extractive Industry area'* at the existing point. It is proposed, as part of the development application, to lower this area to RL 10m (As shown in attachment I1). However the stormwater exit path is located at approximately RL 5 m (despite it being shown, I believe, in the development application as RL 10 m) and thus the stormwater will invariably continue its current course to the Coomera River (albeit probably through the car park, the Concrete production / batching facility, the truck park and the processing area) obviously picking up contaminants as it courses through the area.

Under the DES Stormwater guideline for Environmentally Relevant Activities it is required that: *"Sediment basin(s) should be installed and maintained to collect and treat stormwater runoff from all the disturbed areas of the site(s) approved as part of the ERA application"* and *"a sediment basin must be designed, constructed and operated to retain the runoff at the site(s) approved as part of the ERA application"* (Attachment I2). It is noted there are no sediment basin(s), as are clearly required, between the quarry (including the concrete production / batching facility, the processing area, the truck and car parking areas) and the Coomera River (Attachment I1).

I do not see how it is possible to meet the requirement: *"the release stormwater from these sediment basins must achieve a total suspended solids (TSS) concentration of no more than 50mg/L"* (Attachment I2) when there is no sediment basin to control this output and the stormwater will flow straight through the site apparently completely unmanaged and uncontrolled (Attachment I1).

'Condition C2' of the Environmental Authority EA0002207 states: ***"Stormwater that is not contaminated by the activity*** *must be diverted away from areas where it may become contaminated by the activity"* (Attachment F1). I do not believe that there is any attempt for this Stormwater flow path to be diverted away from this area where it will with little doubt become contaminated by the activity.

'Condition C2' of the Environmental Authority EA0002207 goes on to state: *"Stormwater that is contaminated by the activity must be directed to a treatment system"* (Attachment F1). I do not believe that there is any attempt for this Stormwater that will, with very little doubt, be contaminated by the activity to be directed to a treatment system (as there does not appear to be any treatment system included in the development application at this stormwater outflow.

'Condition C5' of the Environmental Authority EA0002207 states: *"The release to waters permitted under condition C4 must not contain any other properties at a concentration capable of causing environmental harm"* (Attachment F1). I do not believe that there is any way of monitoring the output from the Stormwater outflow given the required treatment system does not appear to be available and the stormwater flows straight through the quarry (including the concrete production /batching facility, the processing area, the truck and car parking areas) and straight into the Coomera River apparently completely unmanaged and uncontrolled (Attachment I1).

'Condition C6' of the Environmental Authority EA0002207 states: *"The release to waters permitted under condition C4 must not produce any slick or other visible evidence of oil or grease, scum, litter or other visually objectionable matter"* (Attachment F1). However, pictures taken on the 26th August 2021 at the stormwater entry point under the Tamborine Oxenford Road (leading directly to the Coomera River) show that already *'Condition C6'* is, it would seem, being severely compromised at the extreme detriment to the *'Environmental significant - wetlands and waterways'* area of the freshwater section of the Coomera River (as reproduced in attachment A3).

Finally, it should be remembered, that an average annual rainfall of approximately 1150 mm for an extractive area of 54 hectares proposed (or 540,000 square metres) will give an annual rainfall of 621,000 m^3 per annum (or 621 ML per annum). This equates to 20 litres per second. So even without the required dewatering the site will have to handle an average of 20 litres per second on a 24/7 basis. With no visible sedimentation pits or containment pits in the development application once the extractive footprint is extended, as proposed, the effect on the local ecosystems of so much potentially contaminated water entering the local River does not bear thinking about.

Groundwater flows upwards?

It is remarkable that the *'Groundwater Impact Assessment'*, in a seeming desire to hide the proposed dewatering into the Coomera River that it's *'Conceptual Cross Section during operations'* (Figure 7.3) diagram appears to show the *"Existing groundwater flow in fresh bedrock"* as going upwards (Attachment J1).

Not only does this diagram, I believe, fail to show the extent of the quarry pit but it also fails to show how this leached ground water (from the mine walls and pit floor) will be dewatered from the quarry pit (other than appearing to show it as going upwards to the Coomera River!

Has this vital hydraulic link (or pump(s)) from the mine floor to the Coomera River been omitted as the applicant is fully aware that they are not permitted to dewater into the Coomera River despite this seemingly being an immense ongoing requirement?

Dewatering Management Guidelines 4.2.2 - Acid Sulphate soils (ASS)

The Gold Coast Council's *'Dewatering Management Guidelines',* Section 4.2.2', 'Acid sulphate soils (ASS)' section is reproduced in attachment L1.

This states: *"The occurrence of ASS in coastal areas is a common phenomenon. ASS contains iron sulphides, mostly pyrites and when they are exposed to the air they can generate large amounts of sulphuric acid. When iron sulphides have been exposed to oxygen, they become very acidic, that is with a pH less than or equal to four and can contaminate groundwater.*

In the past, large scale drainage of coastal flood plains for flood mitigation, urban expansion and agriculture has exposed significant areas of ASS. This disturbance has generated acidic water, through the generation of sulphuric acid, together with elevated concentrations of typically aluminium, iron and arsenic. The discharge of acidic 'slugs' of water into streams, rivers or estuaries have resulted in major fish kills in rivers along the Queensland coast." (Attachment L1).

Obviously in this particular case, given this is thought to be the biggest ever proposed dewatering project on the Gold Coast, that is proposing dewatering on a colossal scale into the *'Environmental significant - wetlands and waterways'* area of the Coomera River's local ecosystem then the Acid sulphate should be a serious consideration.

It is known that this is an acid sulphate region (as shown in the City Plan reproduced in attachment L2).

This is reinforced in the Main section of the development application where it says: *"The occurrence of acid sulphate soils has been addressed within the Groundwater Impact Assessment prepared by Australasian Groundwater and Environmental Consultants Pty Ltd."* in the (Attachment L3).

In the *'Groundwater Impact Assessment'* referred to, there is unfortunately very little mention of the acid sulphates and how it effects the local area. However, *'Section 6.2.6'*, confirms that sulphide minerals and sulphide-bearing carbonaceous rocks are found within this region and goes on to state: *"Weathering of sulphide minerals when exposed to moisture and oxygen has potential to result in acidic groundwater quality. Sulphide-bearing minerals exposed to oxygen can potentially lead to acid mine drainage and acid sulphate soils."* (Attachment L4).

Finally, in the *'Summary and Conclusions'* section it states: *"The understanding is the water level in the quarry void will recover back to an elevation that is consistent with the Coomera River post closure. Additionally, the water level recovery within the proposed development will saturate the exposed pit walls thereby limiting the potential for acid generation"* (Attachment L5).

This, relatively small coverage of the acid sulphates in the Groundwater Impact Assessment, confirms to me that this proposed development will *'result in acidic groundwater'* as predicted.

It is extremely concerning that the applicant is eventually relying on *"the water level recovery within the proposed development will saturate the exposed pit walls thereby limiting the potential for acid generation"*. What about the intervening one hundred plus years where the groundwater will be acidic and due to the lack of sedimentation pits and/or containment pits it will have to be, it would seem, pumped into the Coomera River even if levels are incorrect to avoid flooding the pit as there appears to be no other means of controlling the output?

Bogle-Chandler case

I believe the highly concerning case of Dr Bogle and Mrs Chandler should be considered. Their deaths are believed to be as a result of hydrogen sulphide poisoning whilst relaxing on a Sydney river bank. It would seem they were overcome by hydrogen sulphide gas from the adjacent river (Attachment L6).

It is compelling reading that years before this *"the local council received scores of letters from residents complaining of the smell of "rotten eggs" coming from the river, causing nausea and breathing difficulties. There was also a series of massive fish kills. With the residents facing permanent evacuation, the Maritime Services Board conducted a year-long study of the river. It found that the bottom muds were saturated to a depth of 50 centimetres with hydrogen sulphide and that the very rapid releases of hydrogen sulphide gas could occur from a section of the river impounded by the weir. The source was identified as a factory that had pumped its waste into the river since the 1890's. The worst affected location was within a quarter-mile of the weir, exactly where Bogle and Chandler died"* (Attachment L6).

Given this is a known acid sulphates affected area (Attachment L2) and subterranean quarrying activity will disturb the acid sulphates (Attachment L4), the stark parallels to this proposed development and the *'Bogle-Chandler'* case are unnerving.

Summary

The Coomera River Environmental Protection (Water) Policy 2009, for the Coomera River at the quarry's proposed discharge locations are a 'Suspended Solids' Limit of '<8 mg/L' (as shown in attachment L7). Whereas, the DES Environmental Authority 'EA0002207' is incredulously authorising a 'Maximum release limit' of '50 mg/L' (Attachment F1) which is over six times the limit of the receiving water.

Are Council Planners willing to risk a similar long-term build-up, as per the *'Bogle-Chandler'* case, happening here on the *Environmental significant - wetlands and waterways'* area of the Coomera River?

Are Council Planners willing to let this development application pollute the Coomera River and its local ecosystem for the next one hundred plus years with untold and ill-considered effects these proposals could have?

Could the case of *'Bogle-Chandler'* become a reality here on the Gold Coast also? Certainly the lack of Dewatering Management Plan and, in my opinion, ill-conceived and environmentally unsound, dewatering methods, could see this as a definite possibility.

<u>Dewatering Management Guidelines 4.2.3 - Geotechnical Issues</u>

The Gold Coast Council's *'Dewatering Management Guidelines',* Section 4.2.3', 'Geotechnical Issues' section is reproduced in attachment M1.

This states: *"The DMP should also include an assessment of the potential geotechnical and hydrological impacts of groundwater extraction. It should demonstrate that nearby structures and infrastructure will remain stable during and after dewatering. Consideration of groundwater recharge should be given. This may require groundwater modelling. Details of dewatering volume, rate, duration, equipment and procedures must be included in the DMP"* (Attachment M1). These clear and detailed requirements I believe have not been submitted as part of the development application and therefore I do not believe the Council Planners can adequately access the impact of the proposals in the development application without this essential information.

It then goes on to state: *"A geotechnical investigation shall be undertaken to determine the groundwater level and the absorption rate for all sites. The lowest value obtained from the geotechnical investigation shall be used in the absorption calculations"* (Attachment M1). However, it should be noted that the figures adopted in their *'Stormwater Management Plan'* are based on, I believe, a best case scenario as highlighted in Section C.5.1: *"To present a water balance model considered to represent the site (in lieu of comprehensive information), certain assumptions have been applied. These are outlined below: … As suggested in the Groundwater Impact Assessment - Oxenford Quarry Extractive Boundary Realignment Project (G1913)(AGE 2018) and supported by G1913A: Oxenford Quarry Response (AGE 2019): "The inflow predictions show that the inflows are dominated by groundwater entering through the pit floor. The inflows predicted by the low bedrock conductivity scenario (total of 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations"* and *"Based off this statement, the groundwater inflow as anticipated at being 4 L/s (345.6m^3/d) for the quarry Pit Sump C3 for the ultimate site conditions"* (Attachment M2).

Based on the *'low bedrock conductivity'* assumption above, a 'best case scenario' of 130 ML/yr inflow into the pit was, it seems, assumed. If it were found to be a *'high bedrock conductivity'* then up to 432 ML/yr would flow into the pit as per their Analytical results table (Table 7.2) of their Groundwater Impact Assessment shows (reproduced in Attachment N1). Thus, there would be an additional 302 ML/yr inflow into the quarry pit which would have to be pumped into the Coomera River (which I believe equates to roughly an extra 10 litres per hour) as the quarry has it would seem no use for this additional ground water. Therefore, I believe, the outflow would increase to an estimated 40 litres per second on a 24/7 basis (approx).

I believe it is culpable to use a best case scenario within the *'Stormwater Management Plan'* that should clearly be based on a worst case unless proof was available negating this worst case scenario. There appears to be no proof submitted. However, the mere fact *'high bedrock conductivity'* is presented as an option within their *'Stormwater Management Plan'* shows, I believe, this would have been more appropriate case to base calculations on. Especially when considering the possible devastating effect this DA could have on the local ecosystem and the local environment when discharging high volumes of potentially highly contaminated water into the *'Environmental significant - wetlands and waterways'* area of the Coomera River's local ecosystem.

The Gold Coast Council's *'Dewatering Management Guidelines',* Section 4.2.3', 'Geotechnical Issues' section goes on to say: *"The geotechnical investigation shall report the meteorological details of the test day, the general site condition and the level of the watertable applicable at the site"* and *"The report must identify and address the overall potential adverse effects of dewatering on the stability and integrity of any adjacent property or structure. The report shall assess the radius of influence of the draw-down cone on potential settlements and lateral movements of any adjacent structures, properties or services"* (Attachment M1). Although the radius of influence is evaluated in the *'Groundwater Impact Assessment'* (at up to 1,418 metres) it does not, despite encompassing thousands of homes, an environmentally significant river, many, many significant and sensitive structures, report on the: "*influence of the draw-down cone on potential settlements and lateral movements of any adjacent structures, properties or services"* as is, I believe, clearly required.

The Gold Coast Council's *'Dewatering Management Guidelines',* Section 4.2.3', 'Geotechnical Issues' section goes on to say: *"A minimum of two boreholes per site is required. One of the boreholes shall be within the proposed absorption area and others in various locations throughout the site. For developments where the gross site area (GSA) is greater than or equal to 1000 square metres, an additional borehole is required for every 400 square metres or part thereof over 1000 square metres. For example, a site with GSA of 1450 square metres, four boreholes are required. Copies of the borehole logs are to be attached to the report. Unless groundwater is encountered, borehole depth shall be a minimum of four metres from the existing ground level"* (Attachment M1). There appears to be just three bores used in the development application: *'MB-01', 'MB-03' and 'MB-04D' despite a requirement: "For developments where the gross site area (GSA) is greater than or equal to 1000 square metres, an additional borehole is required for every 400 square metres or part thereof over 1000 square metres."* I believe this development application falls far short of the required target.

Also, it should be noted these boreholes had a sample depth of only *'8'*, *'9'* and *'28'* metres below ground level (mbgl), as shown in Attachment M3, despite a target proposed depth of 110 mbgl. How can the results be adequately assessed when the boreholes are just a mere 13 percent of the target depth? How can the development application assume a best case scenario of *'low bedrock conductivity'* when the bedrock conductivity it would seem has not been adequately investigated?

Development Application Stormwater Management Plan Model assumptions

It should be noted that the *'Model Assumptions'* , in *'Section C.5.1'*, adopted in their *'Stormwater Management Plan'* are based on: *"To present a water balance model considered to represent the site (in lieu of comprehensive information), certain assumptions have been applied."* (Attachment M2).

Why is it that: *"in lieu of comprehensive information … certain assumptions have been applied."* ? With a development application of this immense scale and potential impact on the local environment, the local ecosystem and the local residents and for the next one hundred plus years, why has the *"comprehensive information"* not been obtained and therefore they would not need to rely on: *"certain assumptions have been applied."* ?

I believe their seemingly unfounded assumptions have enabled them to select a best case scenario, not the worst case as is surely required for a development application's *'Stormwater Management Plan'*. i.e Their assumptions are based on the *'low bedrock conductivity'* case, giving a best case scenario of 130 ML/yr inflow into the pit, whereas if it were a *'high bedrock conductivity'* then up to 432 ML/yr would flow into the pit (as shown in their Analytical results table (Table 7.2) of their Groundwater Impact Assessment shows, reproduced in Attachment N1).

Thus, it would seem, they are assuming less than a third of the worst case inflows into the quarry pit that could be expected. And, their *'Stormwater Management Plan'* is based on this apparent best case assumption which I belief nullifies their presented analysis.

Dewatering Management Guidelines 4.2.4 - Noise and vibration issues

The Gold Coast Council's *'Dewatering Management Guidelines', Section 4.2.4', 'Noise and vibration issues'* section is reproduced in attachment O1.

This states: *"The DMP should detail the type and location of equipment to be used and the duration of use. Potential noise/vibration issues and potential sensitive receivers should be identified within the DMP. It must detail any mitigation measures and how they will prevent any noise issues"* (Attachment O1). I do not believe these important details have been divulged anywhere within the development application. With the proposed reduction in buffers, down to 150 metres (from homes in the north) and in every lateral direction these are important issues that have been omitted.

It then goes on to state: "Treatment methods for the reduction of noise emitted from the mechanical plant involved in the dewatering process include, but are not limited to methods such as:

- installation of a fully acoustically attenuated enclosure around noise generating equipment, (for example, pumps and generators)

- the use of sound attenuating material such as hay bales to surround the plant

- installation and maintenance of mufflers and suitable exhaust systems for all noise generating plant and equipment

- operation of particularly noisy equipment within restricted time periods 7am – 6pm

- restriction of operating hours of the offending plant All noise emitted from the dewatering process is to comply with the provisions of the Environmental Protection Act 1994." (Attachment O1).

I do not believe any of these important aspects have been adequately covered anywhere in the development application.

However, the requirement of: *"operation of particularly noisy equipment within restricted time periods 7am – 6pm"* is particularly important given the believed magnitude of dewatering required. Is the applicant proposing dewatering on a 24/7 basis? Can they meet their environmental noise levels as specified in EA0002207? These highly important and concerning aspects of the development application appear to be culpably missing.

Dewatering Management Guidelines 4.2.5 Odour Issues

The Gold Coast Council's *'Dewatering Management Guidelines', Section 4.2.5', 'Odour issues'* section is reproduced in attachment P1.

This states: *"The presence of potential odour-causing gas hydrogen sulphide (H_2S) should be detailed in the DMP. The DMP should identify potential mitigation measures and demonstrate they will be effective. The proposed treatment methods for the dewatering process are required to be included within the DMP. The proximity of the residents should be considered when undertaking dewatering activities"* (Attachment P1).

Again, I do not believe these important details, despite the serious implications for residents, have been considered anywhere within the development application.

Dewatering Management Guidelines 4.3 Operational and monitoring requirements

The Gold Coast Council's *'Dewatering Management Guidelines', Section 4.3', 'Operational and monitoring requirements'* section is reproduced in attachment Q1.

This states: *"To avoid any environmental harm where water contains significant suspended solids and other harmful chemical and toxicants, the proponent should install and operate a settling basin/balance tank with a capacity to contain a minimum of two hours prior to release to the environment, depending on sediment characteristics. This is necessary to remove flocculating matters and also allow aeration and dissolved iron to precipitate and settle. It may be also necessary to apply chemical dosing such as lime to raise pH, metal salt to enhance removal of toxicants.*

Where it is not possible due to lack of space, the proponent must explore mobile tanks or other forms of solids reduction such as filtration or chemical coagulation" (Attachment Q1).

I believe there is a significant risk of potential environmental harm given the amount of dewatering required. Therefore, as stated: *"the proponent should install and operate a settling basin/balance tank with a capacity to contain a minimum of two hours prior to release to the environment, depending on sediment characteristics"* would seem a minimum requirement.

The lack of sedimentation basin and/or containment pits of adequate size in the later stages of development I believe is of great concern (Attachment C9).

The statement: *"It may be also necessary to apply chemical dosing such as lime to raise pH, metal salt to enhance removal of toxicants."* (Attachment Q1) is also highly concerning given the high rate of proposed discharge into an environmentally significant area of the Coomera River. How will this affect the local ecosystem? It seems the development application has not divulged this information.

The Gold Coast Council's *'Dewatering Management Guidelines', Section 4.3', 'Operational and monitoring requirements'* goes on to state: *"It is important that during construction and operational phases of a project,* ***the existing groundwater regime is maintained as close as possible to the pre-development condition****. In this regard, consideration should be given to the level and flow attributes of the groundwater regime, through appropriate monitoring. In general a minimum monthly for static water levels via piezometers in the surrounding watertable is required to assess draw-down effects."*.

Given the clear plans to destroy the existing groundwater regime and lower the water table for a radius of influence of up to 1,418 metres, down to a depth of 110 mbgl, I do not see how the following statement can be successfully achieved: ***"It is important that during construction and operational phases of a project the existing groundwater regime is maintained as close as possible to the pre-development condition"***.

Dewatering Management Guidelines 4.4 Dewatering Contingency Plan

The Gold Coast Council's *'Dewatering Management Guidelines', Section 4.4', 'Dewatering Contingency Plan'* section is reproduced in attachment R1.

This states: *"A key feature of the DMP is that it will identify risks at the planning stage before construction begins. Where problems are unlikely and are not accounted for in the general dewatering procedures, contingency plans must be prepared. Triggers that activate the contingency plans should also be detailed within the DMP. Contingency plans within the DMP are binding through conditions of approval. The DMP should identify management actions for scenarios including but not limited to the following:*

- *noise complaints*
- *odour complaints*
- *complaints about appearance of wastewater discharge*
- *unexpected contaminants found during monitoring*
- *failure of treatment methods*
- *failure of pumping systems*
- *groundwater seepage into construction area*
- *heavy rainfall*
- *impacts on the stability of adjacent structures*
- *release of any toxicant materials outside the trigger values in Tables 1, 2 and 3 Examples of contingency actions may include:*
- *consulting a professional*
- *stopping operations*
- *changing methods or equipment*
- *additional monitoring*

Contingency plans with a higher level of detail and foresight prove more useful if the situation arises." (Attachment R1).

I do not believe the required highly important and relevant Contingency plan for the dewatering has been submitted in any way shape or form.

Conclusion

I believe it is clear to see the DES Environmental Authority only permits Stormwater to exit the site into the Coomera River, and even then sufficient effort must be made to ensure this is not contaminated by the quarrying process. Potentially contaminated stormwater should be diverted into sedimentation basins, or the equivalent, to minimise chances of contamination into the Coomera River. However, without the required sediment basin(s), as would seem the case in these proposals, it would seem the contamination is impossible to control having passed down the ridge, then through areas such as the concrete production/batching facility, the processing area, the truck and car parking areas) and then straight into the Coomera River apparently completely unmanaged and uncontrolled (Attachment I1).

There appears to be no attempt to meet the Environmental Authority requirement: *"Stormwater that is contaminated by the activity must be directed to a treatment system"* (Attachment F1).

Further, there appears to be no attempt to satisfy the Environmental Authority requirement: *"Stormwater that is not contaminated by the activity must be diverted away from areas where it may become contaminated by the activity"* (Attachment F1).

Clearly, it would seem, the submitted *'Stormwater Management Plan'*, as part of the development application, does not meet the requirements of either the Environmental Authority EA0002207 or the Environmental Protection Act.

With an estimated 20 litres of rainfall every second (on average) having to be expelled from the site this is a herculean task that I believe has in no way been properly considered by this development application and its effects on the local ecosystem.

However, over and above this stormwater contamination problems, there is, it would seem, absolutely no allowance for any other water to enter the Coomera River by way of this Environmental Authority EA0002207 which states (in *'Condition C1'*): *"Other than as permitted within this Environmental Authority, contaminants must not be released to any* ***waters****"* (Attachment F1). Therefore, any form of dewatering is, I believe, illegal under this Environmental Authority and the Environmental Protection Act also.

Thus, the planned proposal to dewater vast amounts (30 to 40 litres per second?) of excess leached groundwater into the Coomera River for the next one hundred plus years is, I believe, fundamentally flawed and will, we can only assume, have dire consequences on all the groundwater dependent ecosystems within an area of over six million square metres around the open cut mine (based on their stated radius of influence) as the groundwater in the area diminishes on a 24/7 semi-permanent basis for the next one hundred plus years.

In conclusion, this development application's proposed dewatering into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake that is part of the Coomera River, is, I believe, morally wrong, completely reprehensible and I believe illegal too.

Given the scale of the groundwater that will be leached into the quarry pit on a 24/7 basis, by its proposed subterranean quarrying process, and the fact that it cannot, it would seem, be legally dumped into the *'Environmental significant - wetlands and waterways'* area of the adjacent freshwater lake that is part of the Coomera River, as I believe is proposed, I do not see how this development application can possibly be acceptable to the Gold Coast City Planners given there is seemingly absolutely no way of disposing of this immense amount of excess groundwater that is required to be dewatered for the next one hundred plus years.

I also believe this development application is wrongly combining the dewatering with the stormwater and using this as a cover to dump vast excesses of contaminated groundwater in the guise that it is stormwater. It would seem between 50 and 60 litres of combined rainfall (20 litres?) and groundwater (30 to 40 litres?) will need to be expelled from the site every single second on average, on a 24/7 basis, from the site from just two overland stormwater locations (as shown in attachment D5).

I do not believe the sheer scale and affects the proposed site expansion and extension will have on the local environment, the local ecosystems, the local residents, the water table and the groundwater dependent ecosystems (GDEs) has been fully explained and/or documented in the submitted development application that will affect all these aspects for the next one hundred and ten years at the very minimum.

Thank you in anticipation,

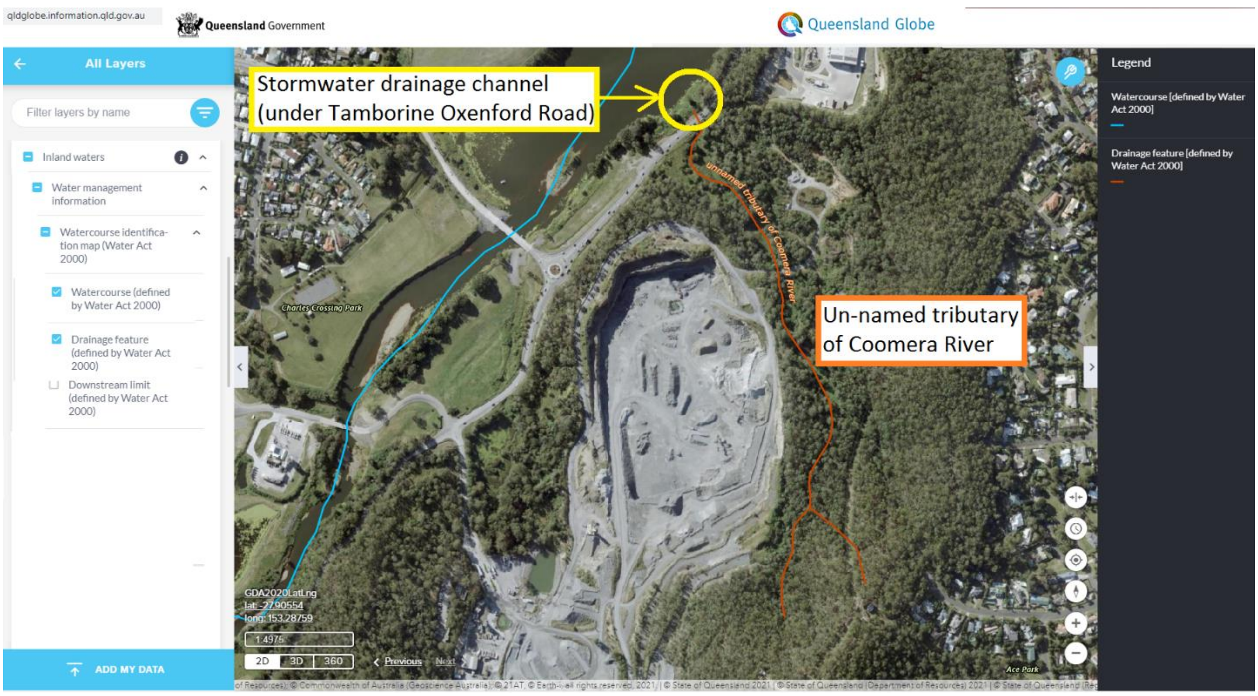
Kind regards

<u>Tony Potter</u>

* Disclaimer. Please note my findings are believed correct and are to the best of my ability. However, there may be errors and assumptions I have made that are incorrect. I do not believe this to be the case, but, realise with the vast amounted of submitted data from the applicant, errors and assumptions on my part may occur. Hopefully this is not the case, but please accept my apologises if this is so. Thank you.

Attachment A1 - Stormwater entry point leading under the Tamborine Oxenford Road to the Coomera River

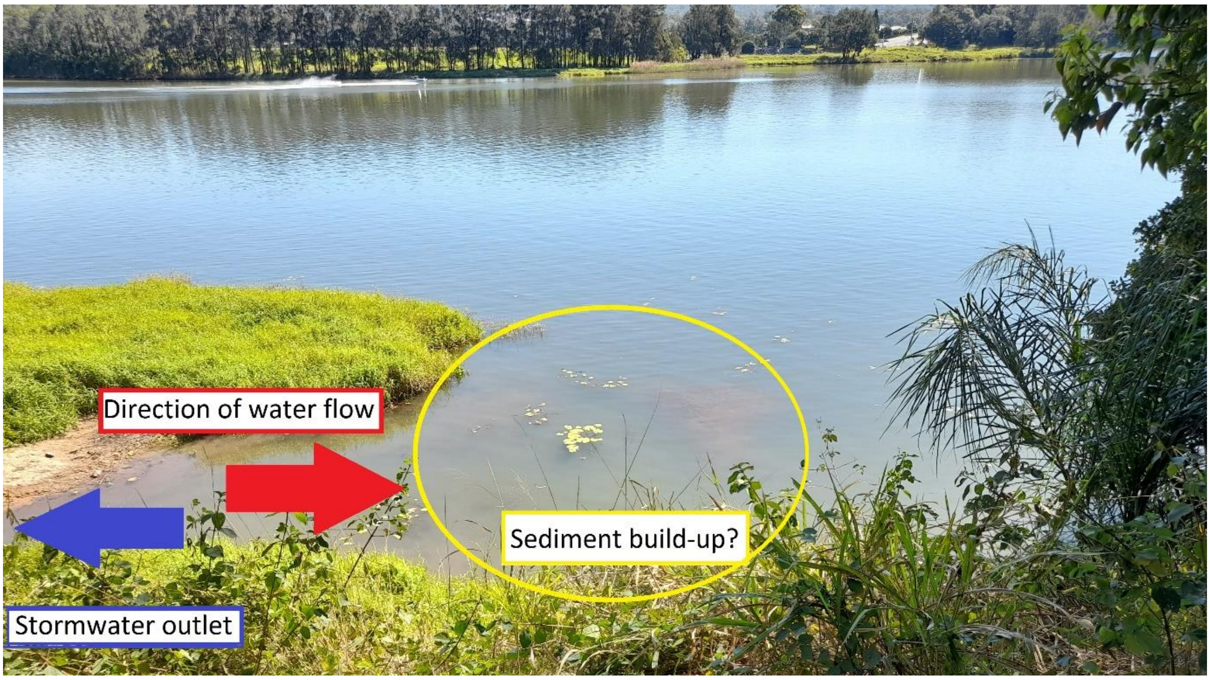
Attachment A2 - Tributary of Coomera River



Attachment A3 - Stormwater entry point leading under the Tamborine Oxenford Road to the Coomera River (Looking east from tunnel)

Attachment A4 - Stormwater outflow under Tamborine Oxenford Road to Coomera River

Attachment A5 - Sediment build-up? Just beyond stormwater outlet in the Coomera River

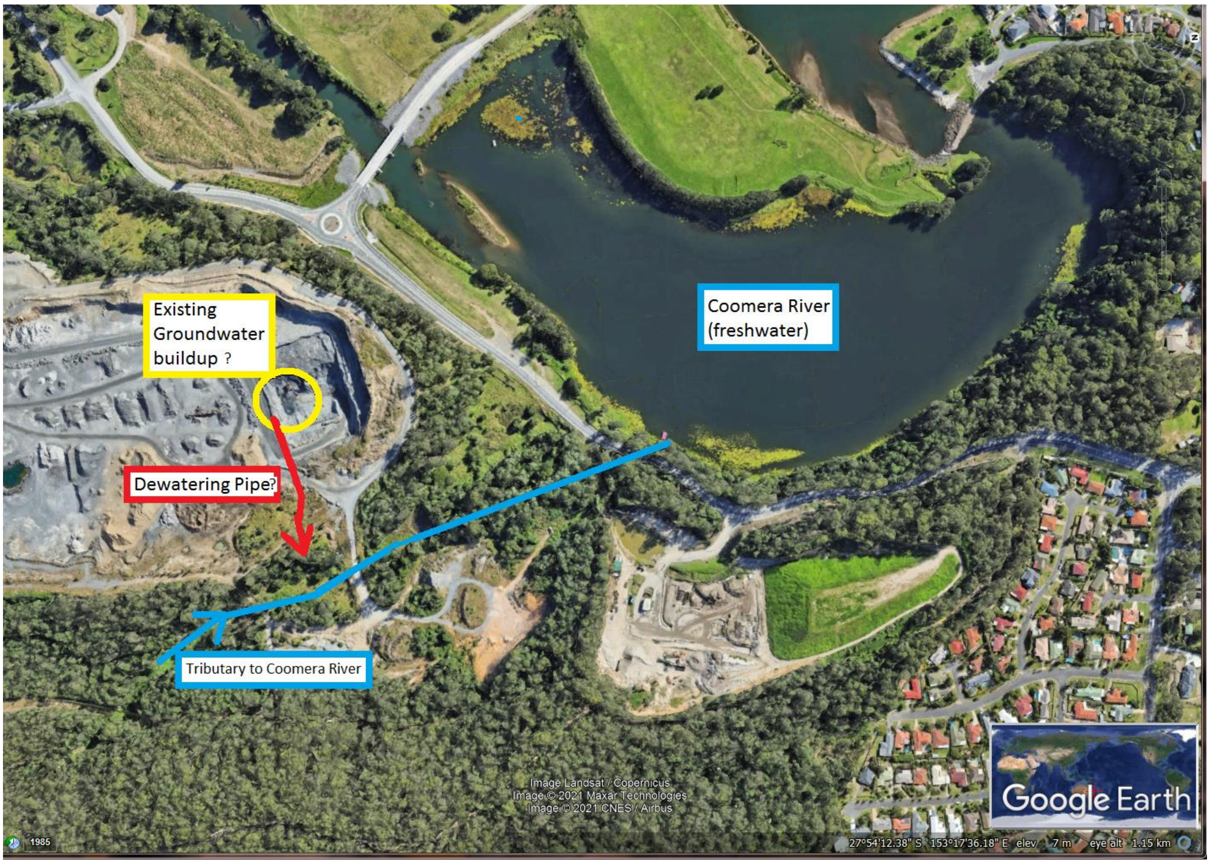


Attachment A6 - Current sump pit is approx 76 cubic metres

Attachment A7 - Dewatering pipe leading to the 'Overland Stormwater path'?

Attachment A8 - Dewatering pipe close up?

Attachment A9 - Overview of Dewatering pipe leading to the 'Overland Stormwater path' or 'Lower Coomera River?



Attachment A10 - Subterranean mining area is 40 million cubic metres (approx)

Attachment B1 - Minimum depth is RL 10 m (Australian Height Datum) (Current Approval 1992 Rezoning Agreement)

PART 3 - QUARRY OPERATIONS - GENERAL

11. The activities and operations permitted pursuant to this order may be carried out for a maximum of 25 years after the date of gazettal of the proposed rezoning and, subject to any further application made to or approved by the Council, shall cease after that time. The Council undertakes not to unreasonably withhold any further approval.

12. No extraction of the resource is to occur below RL 10.0 (Australian Height Datum) unless otherwise approved by the Council in accordance with concept plans for a specific and appropriate end use.

13. The method of quarrying is to be from east to west and designed so as to keep all quarry faces hidden from view by persons external to the subject site (other than persons occupying elevated properties and from whom it is impossible to hide the operations under any design) in as far as is practicable and subject to the requirements of the Department of Resource Industries. Trees and vegetation surrounding areas being extracted at a particular stage, may be removed only when extraction of that stage has been completed and it is necessary to commence a new stage (at a lower level and with a new shield of trees and vegetation around the fringes thereof).

Attachment B2 - Current depth of mine pit is below three metres

Attachment B3 - Coomera River elevation is two metres

Attachment B4- Quarry must be self draining (Current Approval 1992 Rezoning Agreement)

Original Rezoning agreement 29 / 39

41. The quarry floor must be self draining and accessible by vehicle at all times during quarry operation and on cessation of operations.

Attachment B5 - Environmental Authority EPPR00245613 Water Schedules C and D

Agency interest: Water Schedules C and D	
Condition number	**Condition**
C1.	**Release of Contaminants to Waters** Contaminants must not be directly or indirectly released from a site into any waters or to the bed or banks of any waters whereby environmental harm is caused except: (i) as permitted under the stormwater management schedule; or (ii) to a sewer as permitted or otherwise agreed to from time to time by the relevant local government authority.
D1.	**Maintenance and Clean up** The maintenance and cleaning of vehicles and any other earthmoving equipment must be carried out where resultant contaminants cannot be released into any waters, roadside gutter or stormwater drainage system.
D2.	Spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, sweeping or otherwise releasing wastes or contaminants into any waters, roadside gutter or stormwater drainage system.
D3.	**Bunding** All above ground tanks storing liquid chemical or petroleum products must be bunded so that the capacity of the bund is sufficient to contain at least one hundred percent (100%) of the largest tank volume plus ten percent (10%) of the second largest tank volume within the bund.
D4.	All empty drums must be stored in a closed state on a concrete hardstand area or similar impervious material.
D5.	All bunding must be constructed and maintained so as to be impervious and to allow retention and recovery of any liquids therein.
D6.	Where it is impractical to completely roof a bunded area, any stormwater captured within the bund must be uncontaminated prior to release.
D7.	A collection sump must be provided in the floor of a bunded area, and that floor area must be graded towards the sump.

Attachment C1 - City of Gold Coast Dewatering Management Plan

Dewatering Management Guidelines

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CITY OF GOLDCOAST.

Guidelines for Dewatering Management Plan

City Development

Economy Planning and Environment Directorate

March 2018

1

#42025522 v4

<u>Attachment C2 - City of Gold Coast Dewatering Management Plan - Preperation</u>

Dewatering Management Guidelines 5 / 13

CITY OF GOLDCOAST.

Dewatering management plan guidelines

4. PREPARATION OF DEWATERING MANAGEMENT PLAN (DMP)

The DMP will be submitted with the development application and must include details of who is carrying out the dewatering activities, who the developer is, and who the owner is. It will also state clearly where to address complaints or issues that may arise during dewatering activities.

For Council of the City of Gold Coast's assessment and approval, the applicant must provide the following information in the DMP.

1. Purpose of dewatering (that is, an explanation of why dewatering is necessary).
2. Dewatering technique (that is, wellpoint, deep well, open hole, etc.).
3. Anticipated dewatering flow rate and total dewatering duration.
4. Controls (that is, settling tank, turbidity curtain, etc.) and method of effluent discharge.
5. Measures and techniques to manage noise, vibration and odour issues.
6. Measures and techniques to manage geotechnical stability issues.
7. Contingency plan in case of any emergency situation.
8. If dewatering conducted in a contaminated area, engineering specifications for dewatering effluent treatment (that is, air-stripper, carbon filtration, etc.) and details for an analytical monitoring program to ensure that effluent will meet *water quality release standards* described in *Tables 1 and 2.*
9. A monitoring program to ensure that effluent will comply with applicable *water quality release standards* described in *Tables 1 and 2.*
10. Baseline assessment of the existing environment (for example, fauna and water quality) that will receive the discharge.
11. A strategy for monitoring and managing any impacts during the life and after the closure of the project.
12. The point of discharge to the stormwater system and to any waterway or water body.

Further, the proponent/operator may also be required to provide the following additional information in the DMP for any complicated site:

- a hydro geological and hydrological assessment of the project area to estimate quantity and quality of water to be discharged
- verification that the quality of discharge water will comply with the receiving water duration and frequency of the discharge
- seasonal variability of the receiving water quality
- assessment of the viability of treating or recycling the wastewater

Attachment C3 - City of Gold Coast Dewatering Management Plan - Introduction

1. INTRODUCTION

Dewatering is defined by the process of removal of water from a site that accumulates in earthwork excavations or underneath structures at or below the existing watertable. Dewatering activities are either permanent or temporary. Permanent discharges occur from sites that have structures at or below the existing watertable, (for example, underground car parks below buildings), although this practice is being phased out. Temporary discharges occur from construction sites that have water entering the earthwork excavation. A temporary discharge usually occurs for the duration of the construction phase. This document relates specifically to temporary dewatering activities.

Construction of basements or excavation below the existing groundwater level in coastal areas has the potential to create significant sedimentation, amenity issues and other water quality impacts on sensitive estuarine and fresh water receiving environments. The problem arises from the dewatering operations associated with the basement construction. The majority of high-rise developments that incorporate basements are also located in coastal areas where the natural surface levels are below five metres Australian height datum (AHD). These areas are likely to contain actual or potential acid sulphate soils. The dewatering required for the construction of these basements therefore often results in the extraction, through the use of groundwater spears, of low pH (acidic) groundwater.

The solubility of many metals is pH sensitive and in particular the solubility of iron and aluminium increases significantly at lower pH. Because of this property, acidic groundwater often contains high concentrations of soluble metals, which are virtually colourless while in a dissolved, soluble state. While present in a soluble form at low pH, these metals are also extremely toxic to many forms of aquatic life.

Dewatering that may lower the watertable near a coastal or estuarine environment should be assessed for potential saltwater intrusion of the aquifer. The operator should control dewatering to ensure there is no significant change in water quality or change in the natural watertable or flow regime of surface water.

If the extracted acidic groundwater is discharged untreated to estuarine or marine receiving waters a range of possible impacts is likely to occur, including direct mortality or injury to aquatic life, reduction in the pH buffering capacity of estuaries, damage to infrastructure, and loss of visual amenity from visual plumes and staining.

An assessment of the impact on local vegetation, springs, wetlands and groundwater bores used by others in the vicinity of the project should be made prior to dewatering. Where assessment indicates potential reduction in watertable or quality of groundwater, the operator should either design the dewatering system to overcome this threat or provide an acceptable alternative water supply to affected parties.

The monetary costs incurred to local authorities investigating or cleaning up when responding to the one of the abovementioned incidents can also be substantial.

Odour problems that emanate from dewatering activities can negatively impact on residents surrounding the site. If the groundwater is contaminated, gases such as hydrogen sulphide and hydrocarbon can be released during the dewatering process. These gases when released can cause severe odours that can be offensive to nearby residents.

Noise emanating from the plant such as pumps and diesel generators that is used in the dewatering process, can cause a noise nuisance to nearby noise sensitive places. During temporary dewatering activities in most cases the plant is required to be operated twenty four (24) hours per day, which can increase the intrusiveness of the noise particularly during later or early morning periods when the background noise levels are minimal.

Attachment C4 - City Plan - ‘Environmental significance - wetlands and waterways’

Attachment C5 - Conceptual model during and after extraction, Section 7.2

7.2 Conceptual model during and after extraction

A conceptual groundwater-flow model was developed to examine the groundwater flow during and following extraction by constructing two detailed cross sections. These sections run from the Coomera River, across Oxenford-Tamborine Rd, to the edge of the proposed quarry pit. The conceptual model considers a fully excavated and dewatered quarry, and a quarry post operations and post dewatering (Figure 7.3 and Figure 7.4).

The quarry extension will extend the pit depth to -95 mAHD, inverting the current topographic relationship between the quarry and the Coomera River. The conceptual models presented in Figure 7.1 and Figure 7.2 show groundwater moving from the site and discharging to the Coomera River. At full excavation, and when the pit is fully dewatered, the hydraulic gradient will shift from east-to-west (currently towards the Coomera River), to west-to-east (towards the quarry) (Figure 7.3 and Figure 7.4). Groundwater flow within the shallow Quaternary alluvium may also change from draining towards the Coomera River, to partially draining towards the quarry. The degree to which the water is captured is a function of the hydraulic gradient between the Coomera River and the dewatered quarry and the secondary porosity and hydraulic conductivity in the Neranleigh-Fernvale Beds between the Coomera River and the quarry. The proposed quarry design does not intersect any Quaternary alluvium associated with the Coomera River (Figure 7.5).

The quarry will require dewatering to remain dry. Any water that flows to the quarry would be available for use on site and any excess likely discharged. The conceptual flow diagrams depicted in Figure 7.3 and Figure 7.4 show that the pit will capture groundwater flow from the eastern and southern portion of the project site. The future excavation will capture groundwater all the way to the current divide running along the topographic high.

Extending the quarry eastwards towards the ridge crest along the topographic high will influence the volume of water discharged on-site and available for discharge downgradient from the site. This will due principally to a decrease in the gradient between the groundwater in the Neranleigh-Fernvale Beds along the more elevated eastern portion of the site relative to the elevation of the current receptor, that is the Coomera River. This change (decline) in gradient will decrease the volume of water that will flow to the Coomera River.

This decline in gradient will however be temporary. Removal of the secondary porosity bedrock for the project will minimise and cease groundwater flowing from the shallow bedrock. Groundwater flow will shift to the deeper, less permeable bedrock as the secondary porosity bedrock is removed. The deeper, less permeable bedrock is more likely to yield lower groundwater discharge rates. Development of the quarry will result in changes to the groundwater flow direction.

Figure 7.3 and Figure 7.4 illustrates the groundwater flow conditions following completion of quarrying and dewatering activities. The post-quarrying conceptual model shows that the water level in the quarry void will likely stabilise to approximately the same elevation as the current Coomera River (that is ~0 mAHD). However, the elevation at which the quarry void water level stabilises will be governed by the surface water balance of the post-closure landscape and the elevation of a spill point within the final pit void. The groundwater table within the alluvium will likely recover back to a level that is comparable to current conditions (Figure 7.3 and Figure 7.4). Post-closure, the groundwater flow regime will recover approximately back to its pre-development configuration, with the quarry pit only capturing a small portion of the groundwater flow that would have otherwise discharged to the Coomera River under current conditions.

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7.4 Radius of influence

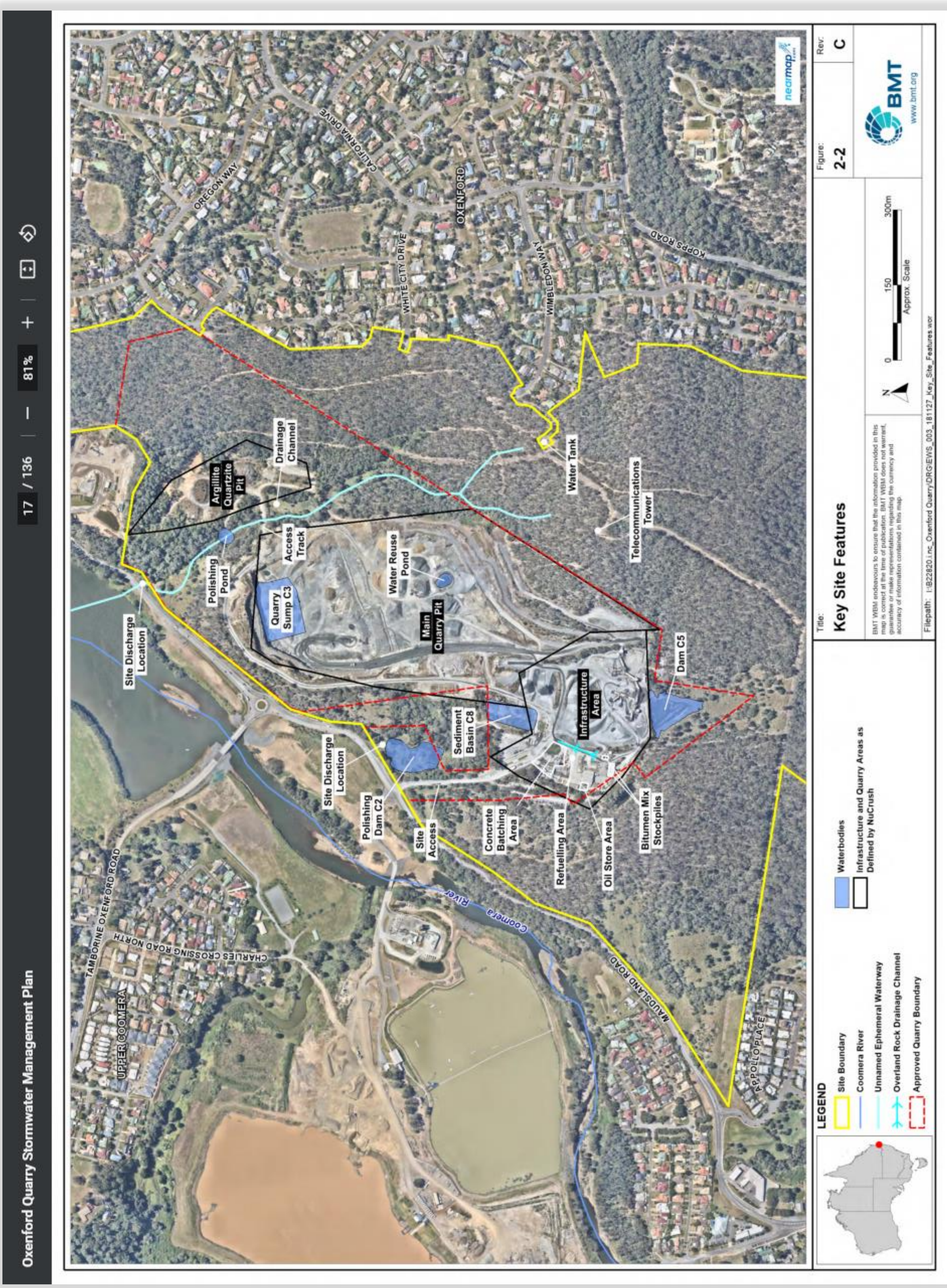
The actual radius of influence of the pit will be dependent upon the hydraulic parameters of the groundwater system (hydraulic conductivity and storage parameters) of which only hydraulic conductivity is considered in this equation, as it is a steady-state approximation only. Furthermore, the Marinelli and Niccoli (2000) analysis does not include any no flow boundaries, such as catchment boundaries, rivers, or geological structures, which can limit the radius of influence. The greatest magnitude of drawdown will occur closest to the quarry and will diminish with distance from the quarry walls.

The radius of influence based on low permeability bedrock in the pit wall is estimated to be 700 m (Table 7.2). The Coomera River and the Water Polishing Pond off Oxenford-Tamborine Rd are both located within this radius of influence and may therefore provide a source of water for quarry inflows. If there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary that will limit the western extent of the radius of influence.

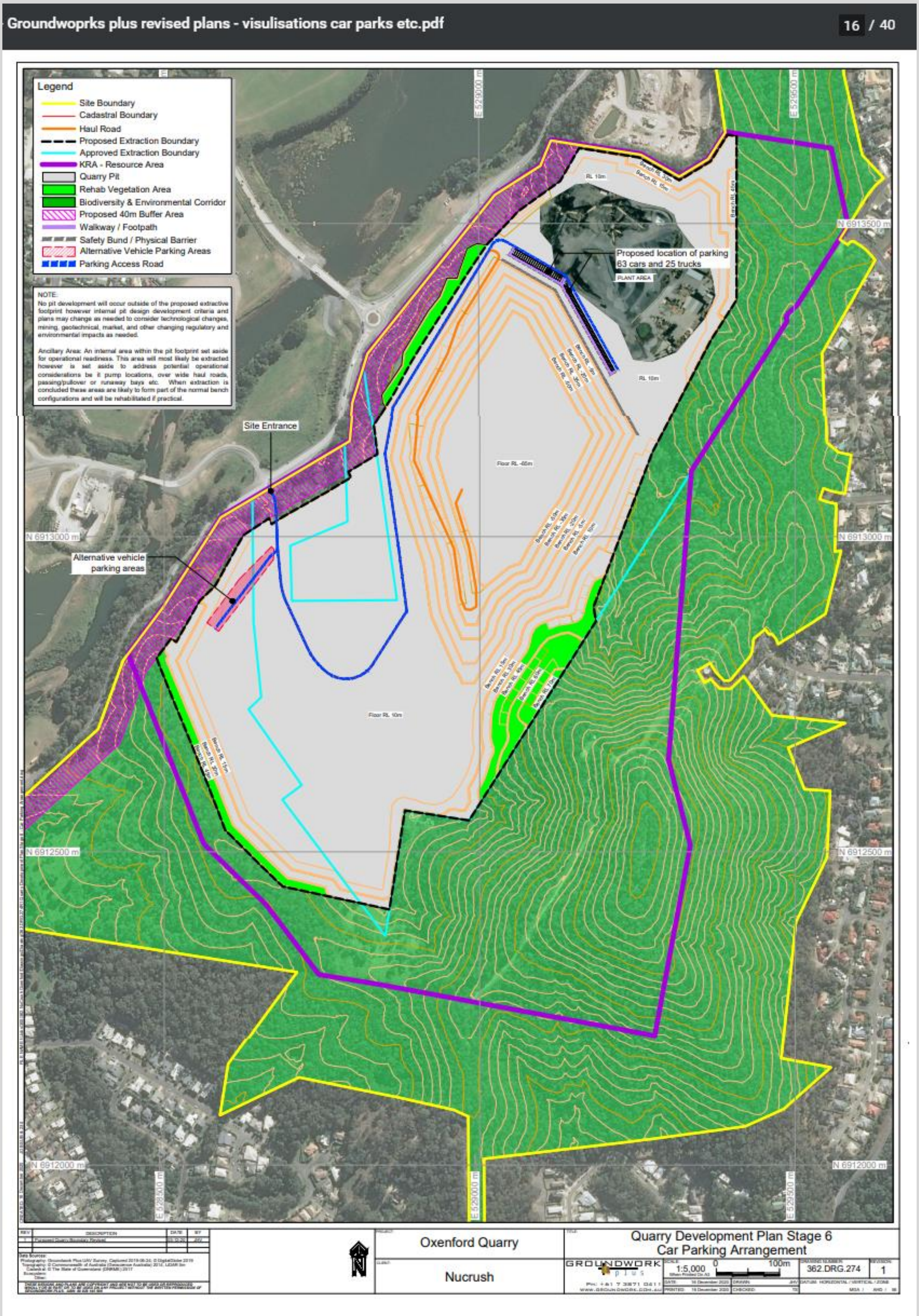
The radius of influence assuming high permeability bedrock and high permeability pit floor is estimated to be 1,418 m (Table 7.2). This scenario extends the radius of influence to include private water bore (RN 124033), a more extensive portion of the Coomera River and approximately 400 m of riparian wetland located upstream of the Gold Coast wave park. Providing there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary limiting the western extent of the radius of influence. The riparian wetland located upstream of the Gold Coast wave park is fed by surface water from the Coomera River originating upstream of the Oxenford Quarry. The low permeability scenario indicates quarrying operations will not impact surface water flow supplying these riparian wetlands, so they are highly unlikely to be impacted by the proposed development. Whilst groundwater level decline at the one private active water-supply bore (RN 124033) is located within the potential radius of influence, this is likely to be negligible.

Regardless of the radius of influence and the inflows reporting to the quarry during operations, the groundwater levels in the vicinity of the quarry void are assessed to recover once quarry development ceases and the quarry void is allowed to fill. The elevation at which the quarry void water level stabilises will be governed by the surface water balance of the post-closure landscape and the elevation of a spill point within the final pit void.

Attachment C7 - Existing Site Conditions Map (from Stormwater Management Plan)



Attachment C8 - Stage 6 - ‘Sediment Basin C8’, ‘Polishing Dam C2’, ‘Dam C5’ and ‘Water Reuse Pond’ engulfed in Extractive Footprint



Attachment C9 - Ultimate Site Conditions Map (from Stormwater Management Plan)

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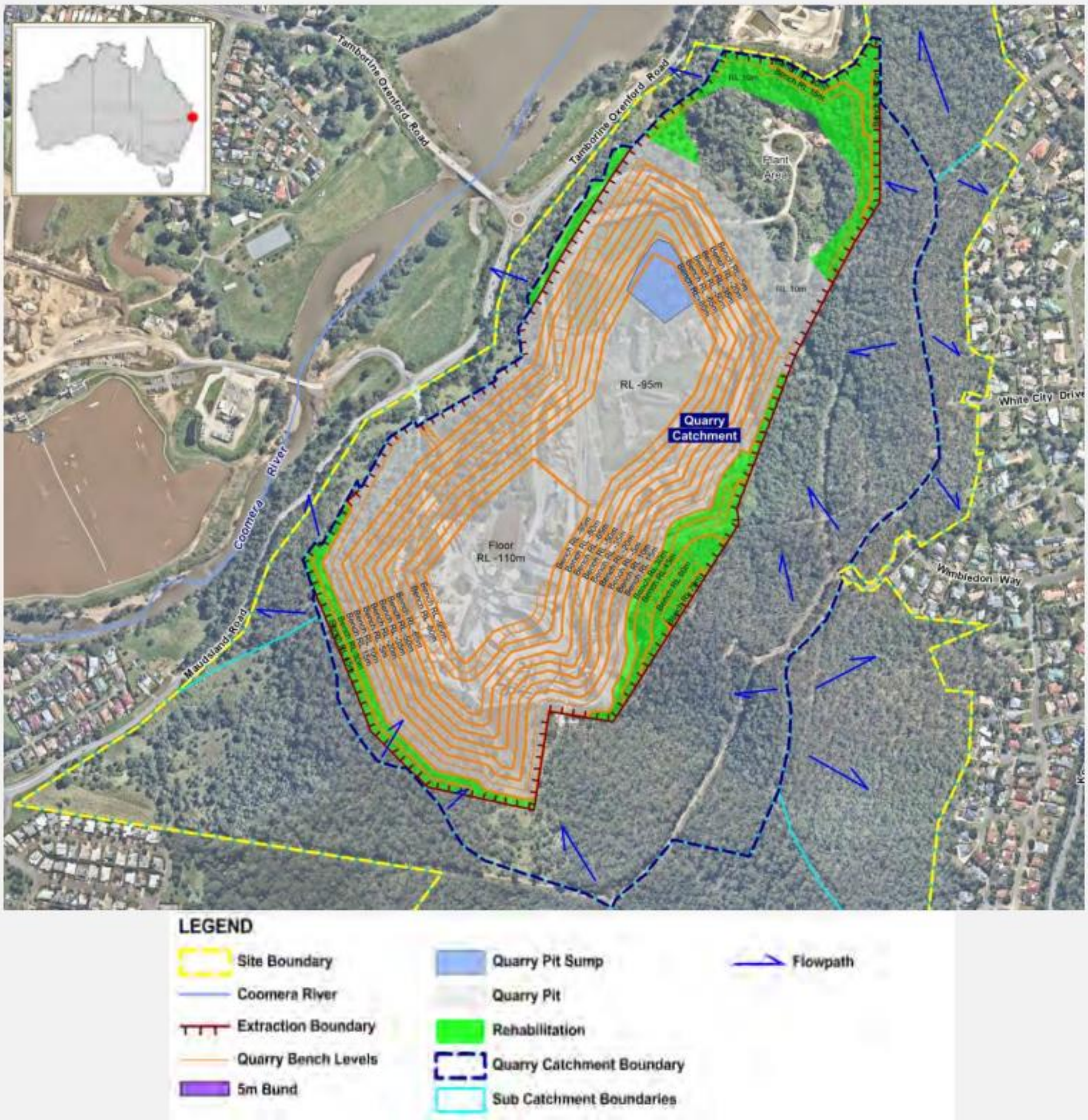
Ultimate Site Conditions - Nucrush Oxenford Quarry Daily Stormwater Management Plan

Figure 1: Map showing Ultimate Case Stormwater Management Strategy



Attachment D1 - Table C-8 Outflow from site - Ultimate Site Conditions (updated Stormwater Management Plan)

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Table C-8 Outflows from the site – Ultimate Site Conditions[4]

Scenario	Quarry Pit Sump C3 – Total outflow to polishing pond[5]		Sediment Basin C8 – Total outflow to polishing pond[5]		Total outflow	
	Average yearly flow (ML/yr)	Average daily flow (m³/day)	Average yearly flow (ML/yr)	Average daily flow (m³/day)	Average yearly flow (ML/yr)	Average daily flow (m³/day)
Ultimate Site Conditions – No alternate waterbodies						
Low Concrete Production						
Medium Concrete Production	923	2525	-	-	923	2525
High Concrete Production						
Ultimate Site Conditions – Alternately sourced from Quarry Pit Sump						
Low Concrete Production	933	2554			933	2554
Medium Concrete Production	915	2506	-	-	915	2506
High Concrete Production	890	2437			890	2437

[4] This metric provides the average outflow, and is not representative of the frequency of water discharging from the site.
[5] Actual discharge to Coomera River will be reliant on the capacity within the respective polishing ponds at the time of receiving outflow waters from the quarry (i.e. Quarry Pit Sump C3 and Sediment Basin C8).

Attachment D2 - Table C-10 Flow distribution onsite - Ultimate Site Conditions (updated Stormwater Management Plan)

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Table C-10 Flow distributions onsite – Ultimate Site Conditions[7]

Scenario	Concrete Production	Discharge		Use Onsite		Evaporation	
		Average yearly flow (ML/yr)	Average daily flow (m³/day)	Average yearly flow (ML/yr)	Average daily flow (m³/day)	Average yearly flow (ML/yr)	Average daily flow (m³/day)
Ultimate Site Conditions – No alternate waterbodies							
Quarry Pit Sump C3	Low/ Medium/ High	923	2525	143	387	17	47
Concrete Batching Pit	Low	0.3	0.7	1.9	5.1	0.2	0.4
	Medium	0.2	0.5	2.0	5.5	0.2	0.5
	High	0.3	0.7	1.9	5.1	0.2	0.4
Ultimate Site Conditions – Alternately sourced from Quarry Pit Sump							
Quarry Pit Sump C3	Low	933	2554	141	386	11	29
	Medium	915	2506	141	386	11	29
	High	1690	4625	141	386	11	29
Concrete Batching Pit	Low	0.3	0.8	3.6	9.8	0.2	0.5
	Medium	0.2	0.6	8.4	23	0.3	0.7
	High	0.2	0.6	15.1	41.2	0.3	0.9

[7] This metric provides the average outflow, and is not representative of the frequency of water discharging from the site.

Attachment D3 - 'C.5.1 Model Assumptions' - best case scenario adopted

Oxenford Quarry Stormwater Man... 54 / 136 80%

C.5.1 Model Assumptions

To present a water balance model considered to represent the site (in lieu of comprehensive information), certain assumptions have been applied. These are outlined below:

- It has been assumed that quarry operations occur for six days per week, i.e. from Monday to Saturday inclusive.
- No increase in water use demand (with the exception of the 3 concrete production use scenarios presented) is anticipated during the ultimate site conditions.
- Capacity is constantly provided within the concrete batching area to cater for the 'first flush' event in accordance with exiting approvals.
- All heights presented in reduced level (RL) m Australian Height Datum (AHD) are best estimates based on data provided.
- The capacity of the waterbodies supplied in the concrete batching area are amalgamated for the purposes of this water balance model, as it is assumed that both waterbodies are used for concrete production water use.
- As suggested in the Groundwater Impact Assessment – Oxenford Quarry Extractive Boundary Realignment Project (G1913) (AGE 2018) and supported by *G1913A: Oxenford Quarry Response* (AGE 2019):

  "The inflow predictions show that the inflows are dominated by groundwater entering through the pit floor. The inflows predicted by the low bedrock conductivity scenario (total of 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations."

  Based off this statement, the groundwater inflow as anticipated at being 4 L/s (345.6 m^3/d) for the Quarry Pit Sump C3 for the ultimate site conditions.

  Further advice given in *G1913A: Oxenford Quarry Response* (AGE 2019), identifies that the groundwater inflow for the existing site conditions is 0 L/s.
- The two categories of 'water leaving the site' from the Quarry Pit Sump C3 have been classified as "Discharge Offsite" and "Pumped from Sump", classified below:
  - ***Discharge Offsite*** – This parameter is based on the water usage details as identified in Table 2-1. This is noted as approximately 90.7 ML/year. Water is discharged using this parameter only if there is enough water for the remainder of the onsite activities.
  - ***Pumped from Sump*** – this parameter is engaged when the volume of water in the sump is greater than the nominated maximum volume (see Table C-3). If this occurs, the water is pumped out at a rate of 6624 m^3/day (that is, approximately 80 L/sec for 24 hrs/day until max volume is once again received).

Reduction in 'water leaving the site' is expected to be observed due to increased demand for increased concrete production. This reduction will be primarily observed in the "Pumped from Sump" parameter.

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BMT

Attachment D4 - 'Groundwater Impact Assessment' - showing best case and worst case scenarios

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The inflows from Zone 1, the pit walls, varies from 15.1 ML/yr to 72.4 ML/yr when the permeability of the bedrock is varied from 0.001 m/d to 0.01 m/d. The 0.001 m/d value represents the anticipated permeability of the rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.01 m/d value represents the permeability of the bedrock as measured in the monitoring bores completed for this project.

The inflows from Zone 2, the pit floor, varies from 113.6 ML/yr to 359.2 ML/yr when the permeability of the bedrock is varied from 0.0001 m/d to 0.001 m/d. The 0.0001 m/d value represents low permeability rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.001 m/d value represents the highest probable floor permeability.

The inflow predictions show that the inflows are predominately from groundwater entering through the pit floor where the Neranleigh_Fernvale Beds are saturated. The inflows predicted by the low bedrock conductivity scenario (i.e. 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations.

Table 7.2 Analytical results

Scenario	Zone	K_{h1} (m/day) / K_{h2} (m/day)	Radius of influence (m)	Q (L/s)	Q (ML/yr)	Total (ML/yr)
Low bedrock conductivity	1	0.001	700	0.5	15.1	130 (best case)
	2	0.0001	700	3.6	113.6	
High bedrock conductivity	1	0.01	1,418	2.3	72.4	186
	2	0.0001	1,418	3.6	113.6	
High bedrock wall and floor conductivity	1	0.01	1,418	2.3	72.4	432 (worst case)
	2	0.001	1,418	11.4	359.2	

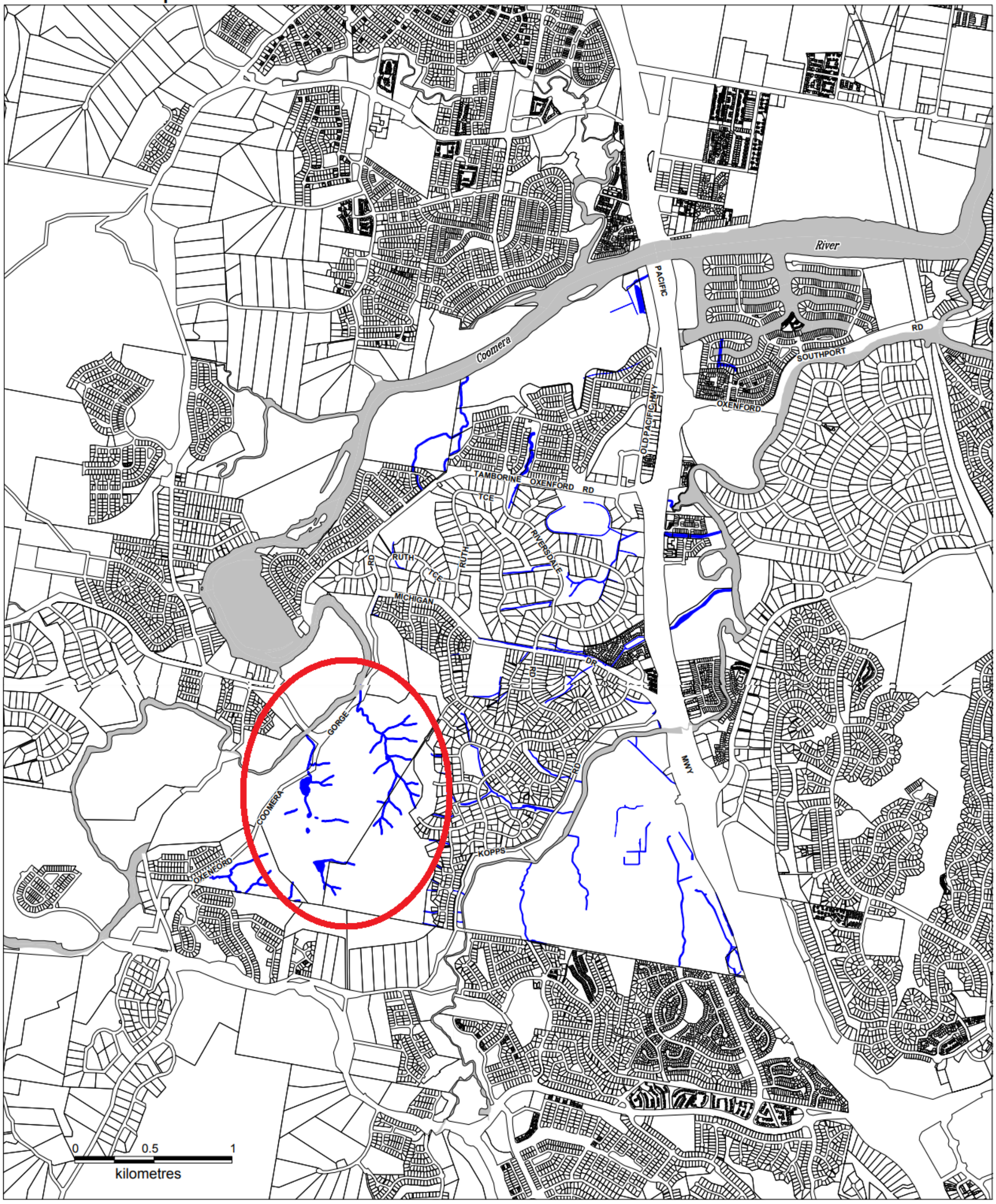
<u>Attachment D5 - Oxenford Overland Stormwater Flow Paths</u>

goldcoast.qld.gov.au/gcplanningscheme_1111/attachments/planning_scheme_maps/local_area_plans_maps/OXENFORD/LAP18A_6.pdf

Oxenford LAP Map 18A.6 - Overland Stormwater Flow Paths 1 / 1

Oxenford LAP Map 18A.6 - Overland Stormwater Flow Paths

Ver 1.2



Legend

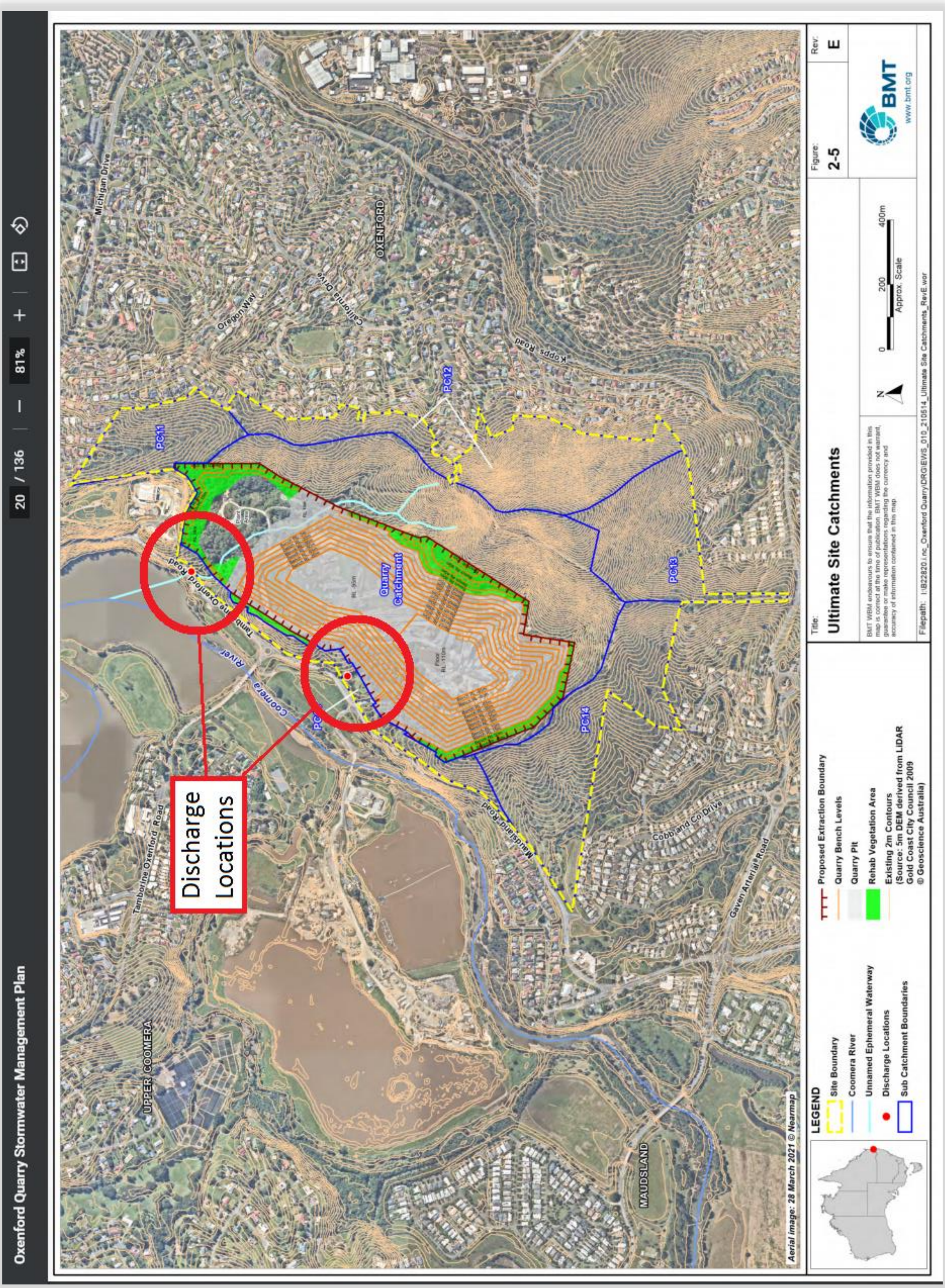
OVERLAND STORMWATER FLOW PATH

N

Gold Coast City Council

GDA

Attachment E1 - Nucrush 'Discharge Locations' (as per their 'Stormwater Management Plan')



Environmental authority EA0002207

Agency interest: Water
Schedule C

Condition	Condition
C1	Other than as permitted within this environmental authority, contaminants must not be released to any **waters**.
C2	**Stormwater that is not contaminated by the activity** must be diverted away from areas where it may become contaminated by the activity. Stormwater that is contaminated by the activity must be directed to a treatment system.
C3	Erosion and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment.
C4	Contaminants must only be released to surface waters in accordance with *Table 1: Stormwater discharge (event flow) monitoring parameters, mandatory discharge limits and monitoring frequency*. Monitoring must occur in accordance with *Table 2: Stormwater discharge (event flow) monitoring parameters, mandatory discharge limits and monitoring frequency.*

Table 2: Stormwater discharge (event flow) monitoring parameters, mandatory discharge limits and monitoring frequency

Monitoring site			Parameter	Maximum release limit	Monitoring frequency
Reference	Easting	Northing			
Discharge North	529079.343	6913586.952	Suspended Solids	50 mg/L[1]	Minimum of upon release[1]
Discharge South	528759.541	6913112.602			
Discharge North	529079.343	6913586.952	pH	6 – 8.5 (range)[2]	Minimum of upon release[1]
Discharge South	528759.541	6913112.602			
Discharge North	529079.343	6913586.952	Electrical Conductivity	520 µS	Minimum of upon release[1]
Discharge South	528759.541	6913112.602			
Upstream 1	528680.433	6913326.053	Total suspended solids and pH	N/A (monitoring only, not discharge site)	Minimum of upon release[1]
Downstream 1	528772.658	6914072.434			
Downstream 2	528495.650	6914537.878			

[1] Adopted from the *Guideline – Stormwater and environmentally relevant activities* (DES, 2019)
[2] Adopted from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000)

Condition	Condition
C5	The release to waters permitted under condition C4 must not contain any other properties at a concentration capable of causing environmental harm.
C6	The release to waters permitted under condition C4 must not produce any slick or other visible evidence of oil or grease, scum, litter or other visually objectionable matter.
C7	Chemicals and fuels in containers of greater than 15 litres must be stored within a **secondary containment system**.

Attachment F2 - Conceptual groundwater flow model, Section 7.1

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7 Impact assessment

7.1 Conceptual groundwater flow model

A hydrogeological conceptual model has been developed to understand the current groundwater flow conditions. The conceptual model is also used to inform both the analytical modelling and the impact assessment.

Groundwater flow at the Oxenford Quarry is dominated by two significant features, the large hill that forms the above sea-level resource (to be extracted) and the surface water of the Coomera River (Figure 6.1). The groundwater flow directions on the site are dominated by the topographic highs along the eastern and southern boundaries of the site. These groundwater flow directions are also influenced by drainage features (and associated Water Polishing Ponds) located along the western site boundary at Tamborine-Oxenford Rd and Maudsland Rd (Figure 6.1). The Water Polishing Ponds are expected to behave as local discharge features for groundwater within the boundaries of the site. However, under current conditions, all of the groundwater from the site will ultimately discharge into the Coomera River. The general groundwater flow directions on the site are depicted in plan view on Figure 6.1 and in cross-section on Figure 7.1 and Figure 7.2.

There are two exceptions to the above general conceptual model. Groundwater within the bedrock underlying the major topographic high along the eastern to southern site boundaries, will flow away from the project site towards the east and south. That is, groundwater flow from the eastern and southern portions of the site will be towards the residential developments located east and south of the quarry boundary.

The second exception to the general conceptual model occurs during periods of high rainfall, when the shallow secondary porosity becomes fully saturated and discharge would occur direct to the exposed pit walls of the existing quarry. Currently, water that discharges to the quarry pit is stored on-site for using in quarrying operations. It is understood that water that cannot be stored on-site is released to Water Polishing Pond at the Tamborine-Oxenford Rd site boundary, and to the water channel on the north eastern side of the Main Pit.

Attachment F3 - Conceptual model during and after extraction, Section 7.2

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7.2 Conceptual model during and after extraction

A conceptual groundwater-flow model was developed to examine the groundwater flow during and following extraction by constructing two detailed cross sections. These sections run from the Coomera River, across Oxenford-Tamborine Rd, to the edge of the proposed quarry pit. The conceptual model considers a fully excavated and dewatered quarry, and a quarry post operations and post dewatering (Figure 7.3 and Figure 7.4).

The quarry extension will extend the pit depth to -95 mAHD, inverting the current topographic relationship between the quarry and the Coomera River. The conceptual models presented in Figure 7.1 and Figure 7.2 show groundwater moving from the site and discharging to the Coomera River. At full excavation, and when the pit is fully dewatered, the hydraulic gradient will shift from east-to-west (currently towards the Coomera River), to west-to-east (towards the quarry) (Figure 7.3 and Figure 7.4). Groundwater flow within the shallow Quaternary alluvium may also change from draining towards the Coomera River, to partially draining towards the quarry. The degree to which the water is captured is a function of the hydraulic gradient between the Coomera River and the dewatered quarry and the secondary porosity and hydraulic conductivity in the Neranleigh-Fernvale Beds between the Coomera River and the quarry. The proposed quarry design does not intersect any Quaternary alluvium associated with the Coomera River (Figure 7.5).

The quarry will require dewatering to remain dry. Any water that flows to the quarry would be available for use on site and any excess likely discharged. The conceptual flow diagrams depicted in Figure 7.3 and Figure 7.4 show that the pit will capture groundwater flow from the eastern and southern portion of the project site. The future excavation will capture groundwater all the way to the current divide running along the topographic high.

Extending the quarry eastwards towards the ridge crest along the topographic high will influence the volume of water discharged on-site and available for discharge downgradient from the site. This will due principally to a decrease in the gradient between the groundwater in the Neranleigh-Fernvale Beds along the more elevated eastern portion of the site relative to the elevation of the current receptor, that is the Coomera River. This change (decline) in gradient will decrease the volume of water that will flow to the Coomera River.

This decline in gradient will however be temporary. Removal of the secondary porosity bedrock for the project will minimise and cease groundwater flowing from the shallow bedrock. Groundwater flow will shift to the deeper, less permeable bedrock as the secondary porosity bedrock is removed. The deeper, less permeable bedrock is more likely to yield lower groundwater discharge rates. Development of the quarry will result in changes to the groundwater flow direction.

Figure 7.3 and Figure 7.4 illustrates the groundwater flow conditions following completion of quarrying and dewatering activities. The post-quarrying conceptual model shows that the water level in the quarry void will likely stabilise to approximately the same elevation as the current Coomera River (that is ~0 mAHD). However, the elevation at which the quarry void water level stabilises will be governed by the surface water balance of the post-closure landscape and the elevation of a spill point within the final pit void. The groundwater table within the alluvium will likely recover back to a level that is comparable to current conditions (Figure 7.3 and Figure 7.4). Post-closure, the groundwater flow regime will recover approximately back to its pre-development configuration, with the quarry pit only capturing a small portion of the groundwater flow that would have otherwise discharged to the Coomera River under current conditions.

Attachment F4 - Ground Inflow parameters

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Table 7.1 Analytical inputs

Input	Description	Value	Comment
h_0	saturated thickness of Neranleigh-Fernvale Beds	84 m	This represents the elevation difference between the water table elevation at MB04d and -95 mAHD
h_p	saturated thickness at the pit wall	2 m	-
W	distributed recharge flux	3.5 x 10^{-5} $m^3/d/m^2$	1% of rainfall
k_{h1}	horizontal hydraulic conductivity of the Neranleigh-Fernvale Beds	0.01 m/day 0.001 m/day 0.0001 m/day	Measured for this investigation and derived from AGE 2004, 2006
k_{h2}	horizontal hydraulic conductivity of the Neranleigh-Fernvale Beds at depth	0.001 m/day 0.0001 m/day	Measured for this investigation and derived from AGE 2004, 2006
r_p	effective radius of the pit	Pre-excavation: 98 m Post-excavation: 300 m	based on wetted area of the current pit the floor area of the fully excavated pit
d	height of water in the active pit	1 m	water in the base of the pit during extraction

The estimated groundwater inflow and radius of influence based on the input data in Table 7.1 are summarised in Table 7.2.

Attachment G1 - Development Application: Groundwater dependent ecosystems

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2.3 Groundwater dependent ecosystems

The Queensland State Government has mapped ecosystems that are dependent on perennial or ephemeral groundwater to support floral or faunal communities and ecological processes and services. These systems are referred to as Groundwater Dependent Ecosystems (GDEs). Ecosystem dependence on groundwater may vary over time and GDEs may include aquifers, caves, lakes, wetlands, rivers and vegetative communities.

The Bureau of Meteorology (BoM, 2017) GDE Atlas shows ecosystems including springs, wetlands, rivers, and vegetation that interact with the subsurface presence of groundwater, or the surface expression of groundwater. Review of this mapping identifies there are no GDEs mapped within the extent of the proposed project boundaries. However, the proposed quarry extension will result in the mapped GDEs along the Coomera River, being within the radius influence from the quarry during its operational life. This radius of influence will only be present during active dewatering of the realigned pit.

<u>Attachment G2 - DES - Groundwater dependent ecosystems</u>

wetlandinfo.des.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/

Queensland Government | Site map | Contact us | Help | Enter text here | Search

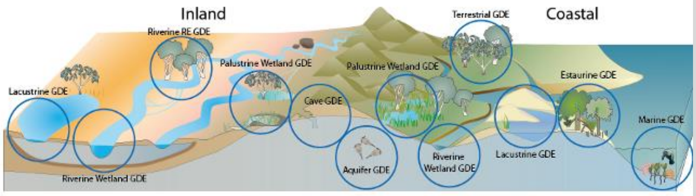
WetlandInfo

Department of Environment and Science

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services[1]. Ecosystem dependency on groundwater may vary temporally (over time) and spatially (depending on its location in the landscape).

GDEs include aquifers, caves, lakes, palustrine wetlands, lacustrine wetlands, rivers and vegetation.



Groundwater plays an important ecological role in directly and indirectly supporting terrestrial and aquatic ecosystems. Groundwater sustains terrestrial and aquatic ecosystems by supporting vegetation and providing discharge to channels, lacustrine and palustrine wetlands, and both the estuarine and marine environment. Aquifer ecosystems are inherently groundwater dependent.

Groundwater also plays a critical role during extended dry periods in maintaining refuges for flora and fauna.

<u>Attachment G3 - Submitted Groundwater Impact Assessment, Radius of Influence</u>

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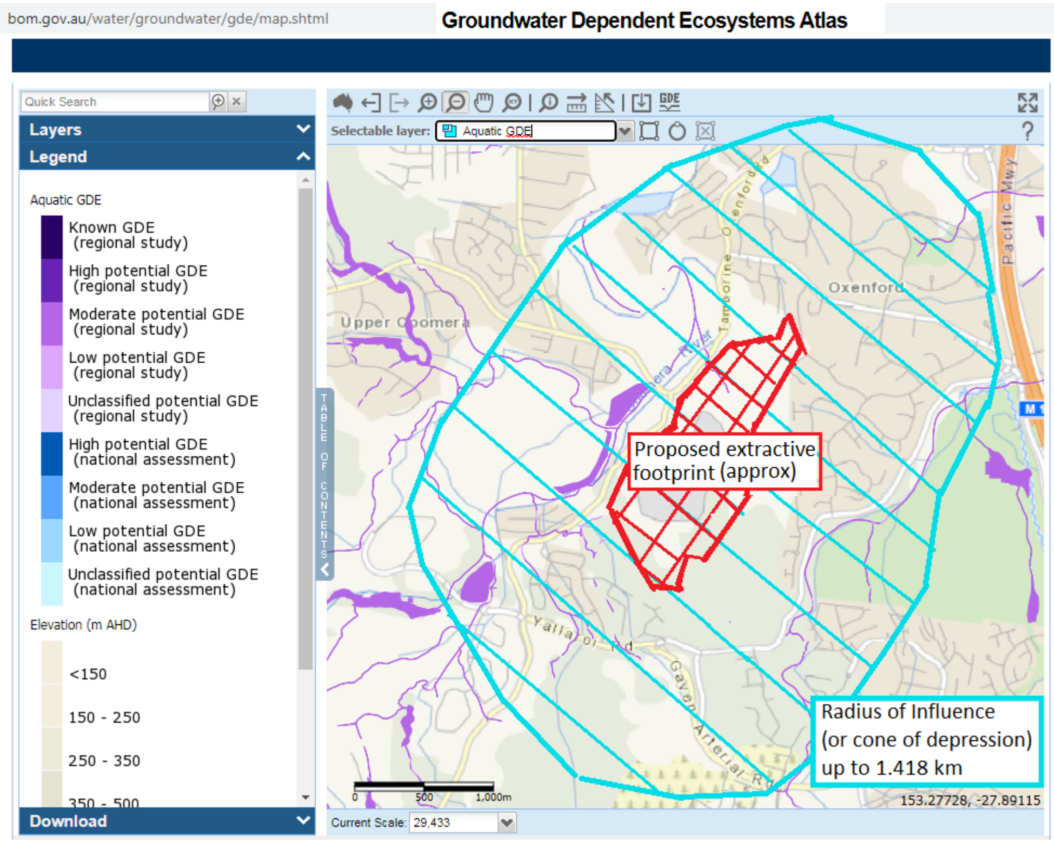
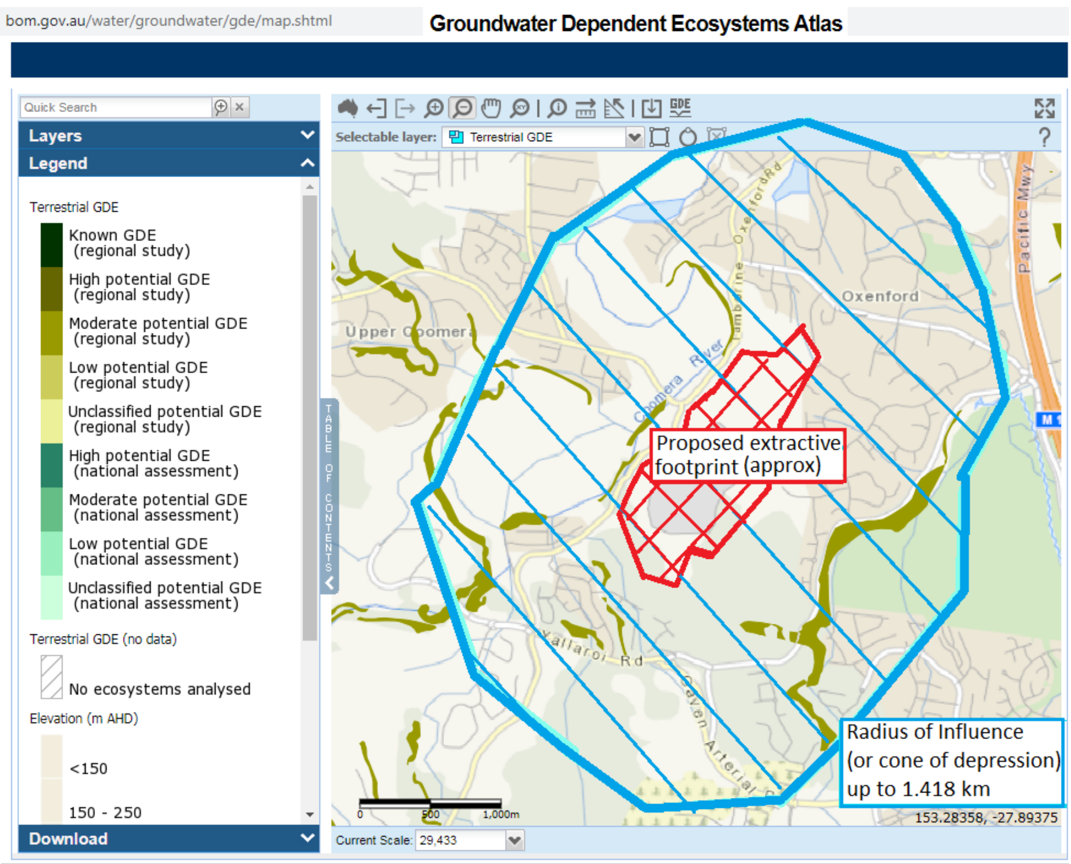
Table 7.2 Analytical results

Scenario	Zone	K_{h1} (m/day) / K_{h2} (m/day)	Radius of influence (m)	Q (L/s)	Q (ML/yr)
Low bedrock conductivity	1	0.001	700	0.5	15.1
	2	0.0001	700	3.6	113.6
High bedrock conductivity	1	0.01	1,418	2.3	72.4
	2	0.0001	1,418	3.6	113.6
High bedrock wall and floor conductivity	1	0.01	1,418	2.3	72.4
	2	0.001	1,418	11.4	359.2

Attachment G4 - Bureau of Meteorology - Groundwater Dependent Ecosystems Atlas (Aquatic)



Attachment G5 - Bureau of Meteorology - Groundwater Dependent Ecosystems Atlas (Terrestrial)



Attachment G6 - Submitted Groundwater Impact Assessment, Section 7.4, Radius of Influence

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7.4 Radius of influence

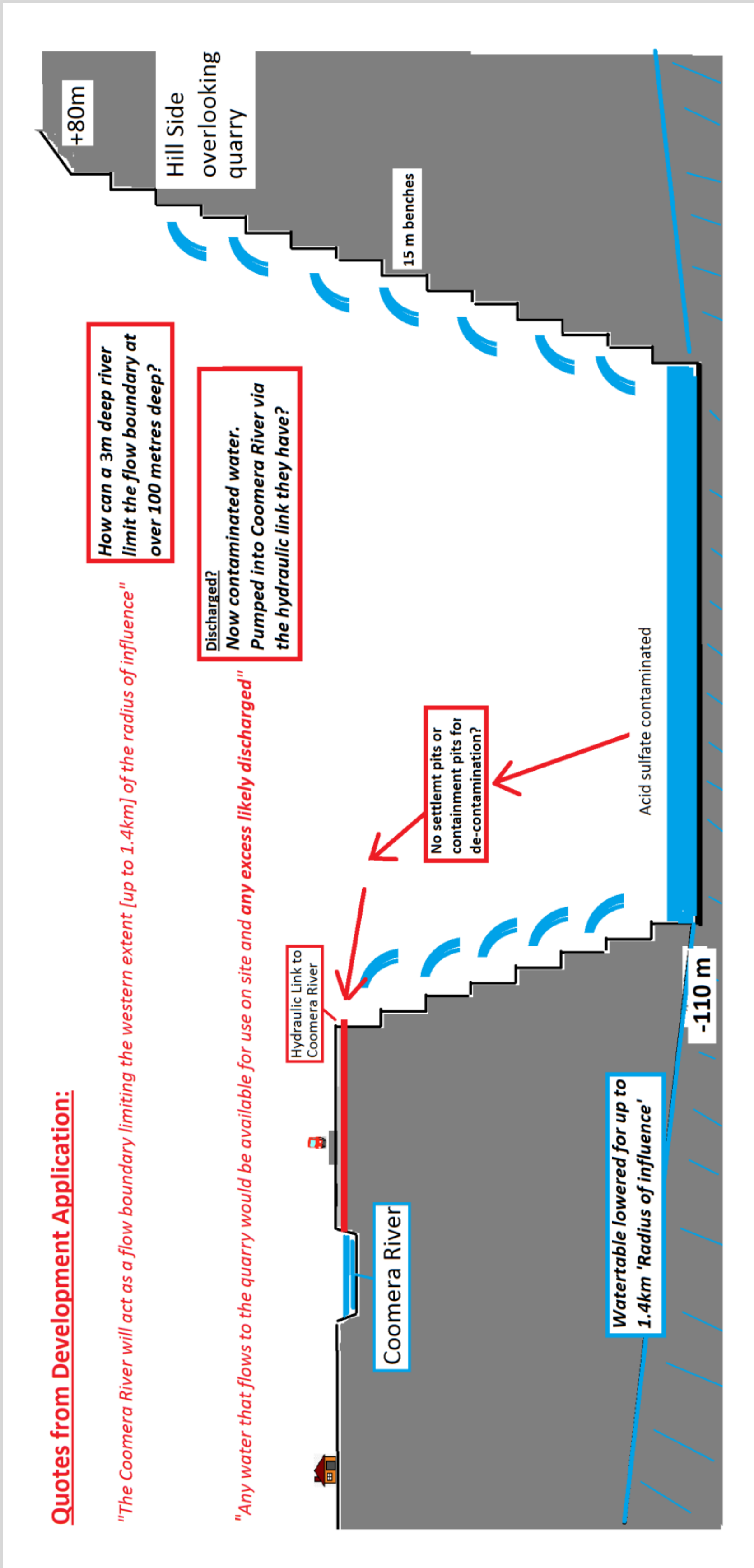
The actual radius of influence of the pit will be dependent upon the hydraulic parameters of the groundwater system (hydraulic conductivity and storage parameters) of which only hydraulic conductivity is considered in this equation, as it is a steady-state approximation only. Furthermore, the Marinelli and Niccoli (2000) analysis does not include any no flow boundaries, such as catchment boundaries, rivers, or geological structures, which can limit the radius of influence. The greatest magnitude of drawdown will occur closest to the quarry and will diminish with distance from the quarry walls.

The radius of influence based on low permeability bedrock in the pit wall is estimated to be 700 m (Table 7.2). The Coomera River and the Water Polishing Pond off Oxenford-Tamborine Rd are both located within this radius of influence and may therefore provide a source of water for quarry inflows. If there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary that will limit the western extent of the radius of influence.

The radius of influence assuming high permeability bedrock and high permeability pit floor is estimated to be 1,418 m (Table 7.2). This scenario extends the radius of influence to include private water bore (RN 124033), a more extensive portion of the Coomera River and approximately 400 m of riparian wetland located upstream of the Gold Coast wave park. Providing there is hydraulic connectivity between the Coomera River, the associated alluvium and the Neranleigh-Fernvale Beds, the Coomera River will act as a flow boundary limiting the western extent of the radius of influence. The riparian wetland located upstream of the Gold Coast wave park is fed by surface water from the Coomera River originating upstream of the Oxenford Quarry. The low permeability scenario indicates quarrying operations will not impact surface water flow supplying these riparian wetlands, so they are highly unlikely to be impacted by the proposed development. Whilst groundwater level decline at the one private active water-supply bore (RN 124033) is located within the potential radius of influence, this is likely to be negligible.

Regardless of the radius of influence and the inflows reporting to the quarry during operations, the groundwater levels in the vicinity of the quarry void are assessed to recover once quarry development ceases and the quarry void is allowed to fill. The elevation at which the quarry void water level stabilises will be governed by the surface water balance of the post-closure landscape and the elevation of a spill point within the final pit void.

Attachment G7 - Depth Comparison between quarry proposals and the Coomera River



Attachment G8 - Water quality concerns with reduced groundwater

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3.2 Terrain and drainage

Two features dominate the terrain and drainage of the project site and surrounds: the 150 m high hill that contains the extractive resource targeted by the project, and the Coomera River alluvial plain. The hill within the site is an erosional remnant composed of the Neranleigh-Fernvale Beds (see Section 4 below). The Coomera River lies in an extensive floodplain underlain by alluvial sediments derived from Neranleigh-Fernvale Beds bedrock and the volcanic rocks of the Gold Coast Hinterland.

The regional drainage is dominated by the northward flow of the Coomera River. Intrusion of salt water into the Coomera River reach adjacent to the site is limited by a small rock barrage located at the end of Old Tamborine Road at Oxenford. The barrage, in conjunction with the John Muntz Causeway, restricts the upstream movement of fish and other aquatic species (City of Gold Coast, 2008). These surface drainage features have resulted in the Coomera River water west of the project site being generally fresh when dominated by surface run-off. However, the river can become slightly brackish during periods of low rainfall when groundwater discharge from the alluvium and bedrock contributes a higher proportion of flow in the surface water system.

Locally, the drainage is dominated by the 150 m hill on the site. There are numerous small ephemeral drainage lines that drain in an approximately radial pattern into the surrounding residential developments. The site itself is drained by two ephemeral systems, one draining north then west between the quarry wall and one from the ridgeline. The drainage emanating from the ridgeline turns westward and flows between the existing quarry and the North End landfill to the north. The second system drains the summit area of the hill into the small dam on the southern side of the quarry (Figure 1.2). After flowing through the dam, this ephemeral drainage line flows north through the man-made Water Polishing Pond located at the site entrance before connecting with Coomera River. Both of these drainages support riparian vegetation within the quarry site near the western edge of the site. The Water Polishing Pond was constructed around 1993 as part of the water management infrastructure for the quarry.

Attachment H1 - Environmental Authority EA0002207 - Obligations under the EPA Act 1994

EA0002207; Environmental Authority issued to NUCRUSH PTY LTD 4 / 19

Permit

Environmental authority EA0002207

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Attachment H2 - Environmental Protection Act 1994 Section 440

ENVIRONMENTAL PROTECTION ACT 1994 - SECT 440

Offence of causing environmental nuisance

440 Offence of causing environmental nuisance

(1) A person must not wilfully and unlawfully cause an environmental nuisance.

Penalty—

Maximum penalty—1,665 penalty units.

(2) A person must not unlawfully cause an environmental nuisance.

Penalty—

Maximum penalty—600 penalty units.

(3) This section does not apply to an environmental nuisance mentioned in *schedule 1* , *part 1* .

(4) In a proceeding for an offence against *subsection (1)* , if the court is not satisfied the defendant is guilty of the offence charged but is satisfied the defendant is guilty of an offence against *subsection (2)* , the court may find the defendant guilty of the offence against *subsection (2)* .

Note—

See *section 493A* (When environmental harm or related acts are unlawful).

Attachment H3 - Environmental Protection Act 1994 Section 440ZG

ENVIRONMENTAL PROTECTION ACT 1994 - SECT 440ZG

Depositing prescribed water contaminants in waters and related matters

440ZG Depositing prescribed water contaminants in waters and related matters

A person must not—

(a) unlawfully deposit a prescribed water contaminant—

(i) in waters; or

(ii) in a roadside gutter or stormwater drainage; or

(iii) at another place, and in a way, so that the contaminant could reasonably be expected to wash, blow, fall or otherwise move into waters, a roadside gutter or stormwater drainage; or

Example of a place for subparagraph (iii)—

a building site where soil may be washed into an adjacent roadside gutter

(b) unlawfully release stormwater run-off into waters, a roadside gutter or stormwater drainage that results in the build-up of earth in waters, a roadside gutter or stormwater drainage.

Penalty—

Maximum penalty—

(a) if the deposit or release is done wilfully—1,665 penalty units; or

(b) otherwise—600 penalty units.

Note—

See *section 493A* (When environmental harm or related acts are unlawful).

Attachment H4 - Environmental Protection Act 1994 Section 443

ENVIRONMENTAL PROTECTION ACT 1994 - SECT

Offence of causing environmental nuisance

443 Offence to place contaminant where serious or material environmental harm may be caused

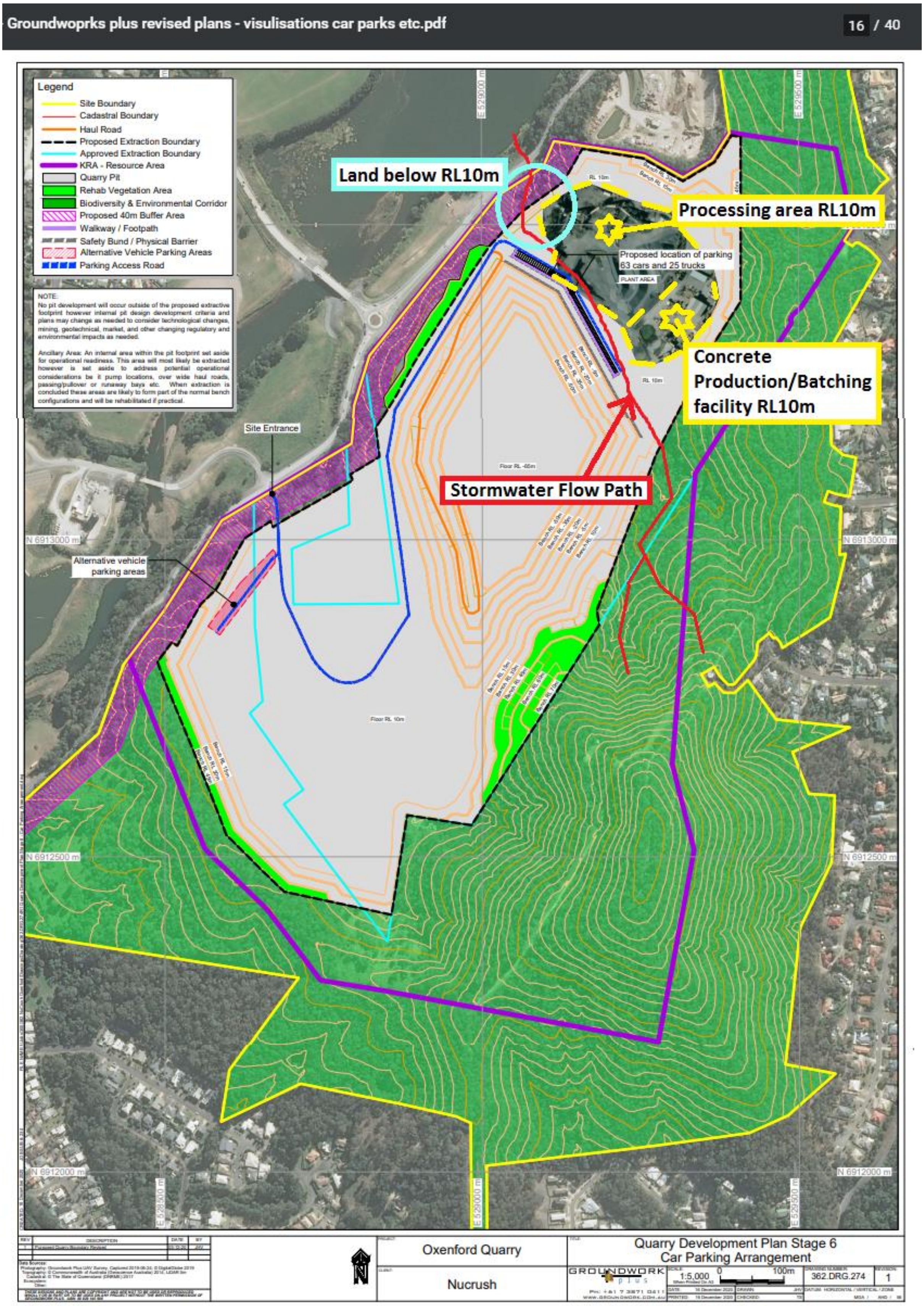
A person must not cause or allow a contaminant to be placed in a position where it could reasonably be expected to cause serious or material environmental harm.

Maximum penalty—

(a) if the offence is committed wilfully—4,500 penalty units or 2 years imprisonment; or

(b) otherwise—1,655 penalty units.

Attachment I1 - Stormwater flow path mapped against proposed layout



Attachment I2 - Stormwater requirements

environment.des.qld.gov.au/__data/assets/pdf_file/0028/89119/pr-gl-stormwater-guideline-era.pdf

(e) Sediment basin(s) should be installed and maintained to collect and treat stormwater runoff from all disturbed areas of the site(s) approved as part of the ERA application, and areas in which any earthen material is stored. ***Note**: allow provision of pits/drop cuts to be utilised for contaminated water storage.*

(f) For events up to and including a **24 hour storm event with an ARI of 1 in 10 years** (or a **24 hour storm event with an ARI of 1 in 5 years**[6] for quarries[7]), the following must be achieved
   i. a sediment basin must be designed, constructed and operated to retain the runoff at the site(s) approved as part of the ERA application;
   ii. the release stormwater from these sediment basins must achieve a total suspended solids (TSS) concentration of no more than 50mg/L[8] for events up to and including those mentioned above.

   For events larger than those stated above, all reasonable and practical measures must be taken to minimise the release of prescribed contaminants.

   Note: a number of contemporary erosion and sediment control guidelines include basin design standards that are much smaller than those listed in item (f) above. For temporary land disturbance works, those standards are considered appropriate, however for ERA activities that typically have a long operational life and subsequently a lengthy period of land disturbance, those basin standards are inadequate.

   An alternative basin design (such as a high efficiency basin) can be used provided it has been demonstrated that the contaminant load to be released to the receiving environment for the life of the project will be equal to or less than the standard design.

   The department supports high efficiency basin technology especially as it may lead to both flexibility for the site operator and if appropriately designed and managed, sound environmental outcomes.

   A high efficiency basin generally incorporates the following design features. The inlet and outlet structures and length to width ratios are designed to maximise hydraulic efficiency. Typically there will be a sediment fore bay for primary sediment removal (retain fast settling coarse material). The inlet structure is designed to promote laminar flow (often supported by a weir structure), and includes infrastructure to support automated chemical flocculation dosing.

(g) All sediment basins should have a spillway, designed, constructed and effectively armoured to convey anticipated flows. Design for a 50 year ARI critical event is considered a minimum. In some circumstances a more stringent design criteria may apply e.g. where there are structures that are referable dams under the *Water Supply (Safety and Reliability) Act 2008* or regulated structures under the EP Act.

(h) All sediment basins must minimise impacts to the natural waterway from releases to waters. This can be achieved by:
   i. maintaining the point(s) of discharge approved within the conditions of approval[9]
   ii. not increasing peak flows discharging from the site for events up to the 1 year ARI event; and
   iii. managing releases to prevent scouring in the receiving waters.

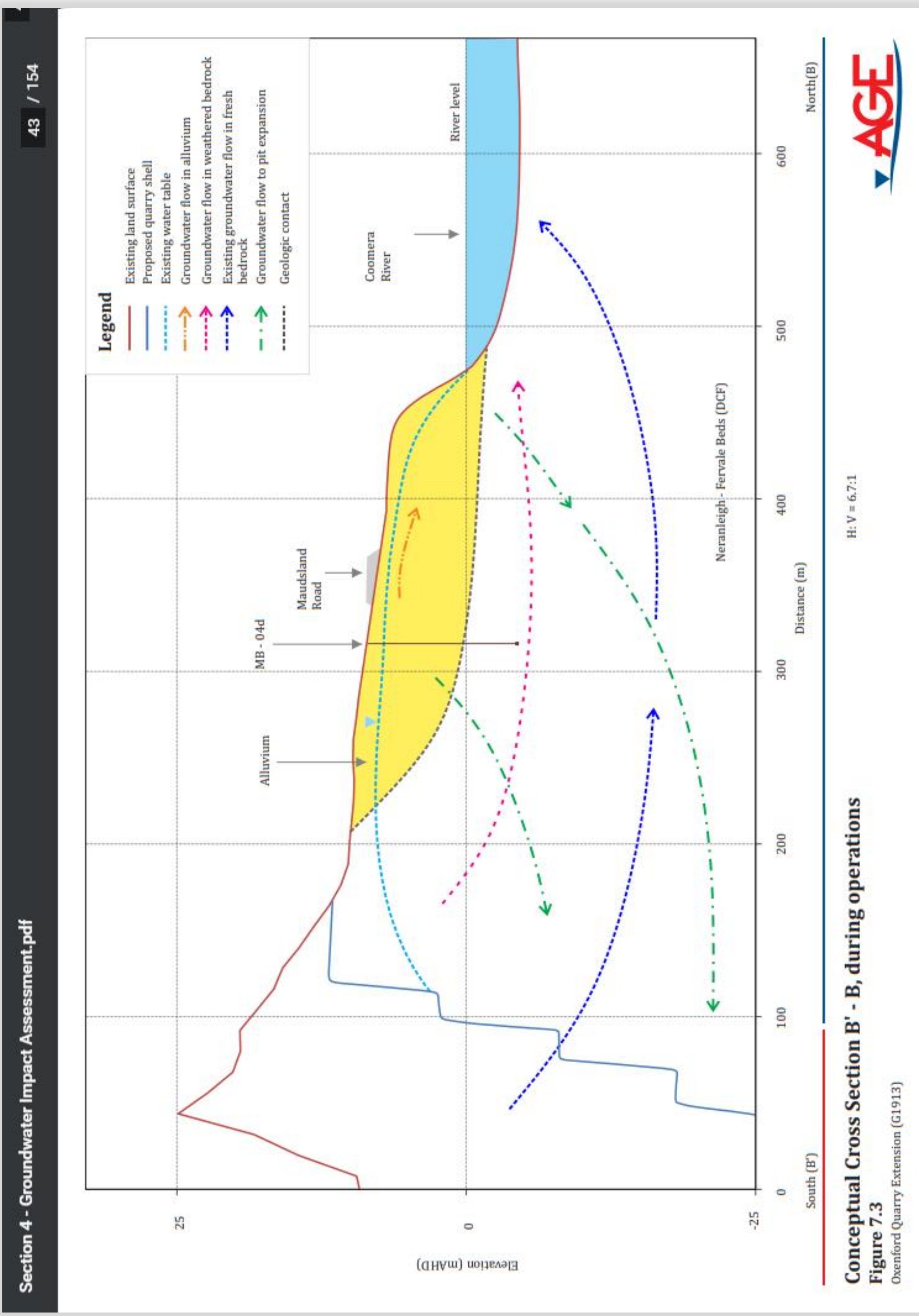
(i) Any sediment basin designed in accordance with item (f) of this list, must be operated in such a manner that within 120 hours of the most recent rainfall event, the required design capacity of the **upper settling volume** is available for capture and storage of stormwater runoff from the next rainfall event.

(j) In addition to the requirements of (f), any sediment basin should be also designed with a **sediment storage zone** equal to 50% of the **upper settling volume**[10].

(k) The use of a coagulant or flocculants to treat stormwater in a sediment pond design must not cause environmental harm to receiving waters.

(l) A monitoring program should be designed for implementation at the site that, at a minimum, meets the requirements of Table 1. The monitoring program should at a minimum address all of the following:
   i. water quality characteristics
   ii. monitoring locations
   iii. monitoring frequency
   iv. release limits.

Attachment J1 - Groundwater Impact assessment - Conceptual Cross Section - during operations



4.2.2 Acid sulphate soils (ASS)

The occurrence of ASS in coastal areas is a common phenomenon. ASS contains iron sulphides, mostly pyrites and when they are exposed to the air they can generate large amounts of sulphuric acid. When iron sulphides have been exposed to oxygen, they become very acidic, that is with a pH less than or equal to four and can contaminate groundwater.

In the past, large scale drainage of coastal flood plains for flood mitigation, urban expansion and agriculture has exposed significant areas of ASS. This disturbance has generated acidic water, through the generation of sulphuric acid, together with elevated concentrations of typically aluminium, iron and arsenic. The discharge of acidic 'slugs' of water into streams, rivers or estuaries have resulted in major fish kills in rivers along the Queensland coast.

Attachment L2 - City Plan - Acid sulphate overlay

Attachment L3 - Main application - Acid sulphates

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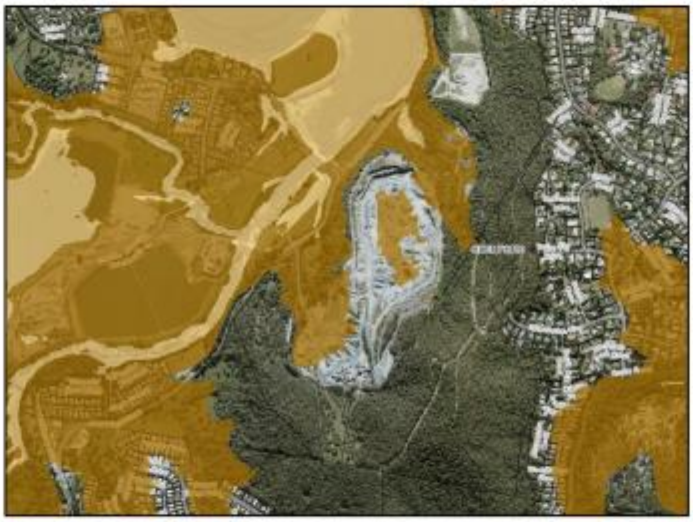
6.6 Overlay Maps

The subject sites have been identified on the following Overlay Maps within the Planning Scheme:

6.6.1 Acid sulfate soils

The subject sites are identified as being affected by land at below 5m and 20m AHD.



The occurrence of acid sulfate soils has been addressed within the Groundwater Impact Statement prepared by Australasian Groundwater and Environmental Consultants Pty Ltd.

Figure 9 – Excerpt from City Plan overlay mapping (Acid Sulfate Soils)

Attachment L4 - Groundwater Impact Assessment - Acid sulphates

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6.2.6 Rock chip sampling

Sulphide minerals and sulphide-bearing carbonaceous rocks have been identified to occur within the Neranleigh-Fernvale Beds. Weathering of sulphide minerals when exposed to moisture and oxygen has the potential to result in acidic groundwater quality. Sulphide-bearing minerals exposed to oxygen can potentially lead to acid mine drainage and acid sulphate soils.

Attachment L5 - Groundwater Impact Assessment - Acid sulphates contd.

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9 Summary and conclusions

There is potential to expose sulphur-bearing rocks within the quarry walls, however testing to date indicates that the sulphur was detected in minor concentrations in the weathered to fresh Neranleigh-Fernvale Beds samples obtained from the monitoring bores. Sulphur was reported in the rock chip samples collected from the bedrock penetrating bores at less than 0.04% at MB01, MB-03 and MB-04. Based on these laboratory test results, there is assessed to be low potential for acid rock drainage on site. The understanding is that the water level in the quarry void will recover back to an elevation that is consistent with the Coomera River post closure. Additionally, the water level recovery within the proposed development will saturate the exposed pit walls thereby limiting the potential for acid generation, should it occur.

Attachment L6 - Bogle-Chandler case

en.wikipedia.org/wiki/Bogle–Chandler_case

Bogle–Chandler case

From Wikipedia

The **Bogle–Chandler case** refers to the mysterious deaths of Gilbert Bogle and Margaret Chandler on the banks of the Lane Cove River in Sydney, Australia on 1 January 1963. The case became famous because of the circumstances in which the bodies were found and because the cause of death could not be established. In 2006 a filmmaker discovered evidence to suggest the cause of death was hydrogen sulphide gas. In the early hours of 1 January an eruption of gas from the polluted river bed may have occurred, causing the noxious fumes to pool in deadly quantities in the grove.

Hydrogen sulphide hypothesis

Main article: Hydrogen sulfide § Toxicity

Peter Butt's documentary *Who Killed Dr Bogle and Mrs Chandler?*, which was shown on the ABC in September 2006, suggests that the two deaths may have been caused by accidental hydrogen sulphide poisoning. Supporting evidence for this theory includes:

- In the 1940s and 50s, the local council received scores of letters from residents complaining of the smell of "rotten eggs" coming from the river, causing nausea and breathing difficulties. There was also a series of massive fish kills. With the residents facing permanent evacuation, the Maritime Services Board conducted a year-long study of the river. It found that the bottom muds were saturated to a depth of 50 centimetres (20 in) with hydrogen sulphide and that very large and rapid releases of hydrogen sulphide gas could occur from a section of the river impounded by the weir. The source was identified as a factory that had pumped its waste into the river since the 1890s. The worst affected location was within a quarter-mile of the weir, exactly where Bogle and Chandler died.
- On New Year's Day, police divers reported a great disturbance of black river-bed sediment. Although their search of the river was then delayed for 11 days, visibility remained poor.
- The very cool, still weather conditions at time of death would have allowed high concentrations of gas to accumulate.
- The location where the couple had sought privacy was at water-level in a slight depression, surrounded by a bank and mangroves, typical of where the heavier-than-air hydrogen sulphide would accumulate in calm conditions.
- Slight skin abrasions, shoe and knee prints suggest both victims were disorientated and had tried to leave the depression before collapsing.
- Both victims had been unable to correct their clothing, suggesting that the poison struck them down without warning, at the same time and with great speed.
- A pathology report, suppressed by the coroner at the time, revealed semen on Bogle's body and coat. This suggests sex was taking place and that both victims could not have been suffering earlier effects of poisoning before they were suddenly struck down.
- Most importantly, a purple discoloration was seen in the victims' blood which is characteristic of hydrogen sulphide poisoning (This phenomenon is not related to other colour changes in the blood such as cyanosis, or methaemoglobin/methemoglobinemia).
- The toxicologist who tested the victims' tissue samples claimed that had he known about the semen, it would have eliminated the majority of poisons he had tested for. This knowledge he claimed, along with the hint provided by the purple colouration of the blood, might have led him to suspect that the poison was hydrogen sulphide.
- A British forensic scientist contacted by the police suggested, after reading the case report, that the victims had been gassed.

With hydrogen sulphide (H_2S) at a level of 1 ppm, a victim will barely notice a bad smell; at 30+ ppm H_2S smells like rotten eggs but at 50-100 ppm it smells cloyingly sweet. At a level above 100 ppm, H_2S paralyses the olfactory nerve (sense of smell) almost instantly and, as the gas is effectively invisible, it would not be noticed despite it leading to vomiting and breathlessness. At 200 ppm respiratory failure occurs within seconds. At 1000 ppm a single breath causes instant cardiac arrest. Although no levels were measured at the river, there is anecdotal evidence of levels of up to 100 ppm being common in the area on still days. As H_2S is heavier than air, the gas tends to pool in hollows on calm days and needs a breeze in order to dissipate. If it is assumed that there was little or no gas around when Bogle and Chandler arrived and there was an eruption of gas upstream, the gas would seek the low points along the bank and at 100 - 150 ppm would be undetectable. The couple could remain for some time before feeling breathless and nauseous but would smell and see nothing to explain this. They would have become confused as a result of H_2S binding with haemoglobin in the blood and reducing its oxygen-carrying capacity, making an escape difficult.

Conclusions

It was the investigating detectives' belief that the victims' bodies were covered not by a murderer, but by a 'third person' who covered them for modesty after discovering the bodies. An initial suspect was a voyeur who contacted police twice, using different names. After interrogation, he was quickly dismissed. The prime suspect was a greyhound trainer who slipped his dogs daily on a path that passed the site where the bodies were found. He came forward only after his car was identified and, when interviewed by police, claimed to have used a different path that day and denied seeing the bodies. His obituary in 1977, however, claimed he had been the first to find the bodies. The theory regarding a motive of modesty for covering the bodies was supported by claims that the man was known to be a prude.

A woman who was a child at the time came forward at the time of the film's screening. She claimed she had found Mrs Chandler's handbag 4 km away in bushland between three houses. One of those houses was discovered to belong to a relative of the greyhound trainer and was near to his own home. A veteran greyhound racing steward also came forward and said that he received a call from the suspect soon after the deaths, during which he admitted that he had come across the bodies.[7] In August 2016, author Peter Butt published details of an alleged 1965 conversation between a Canberra psychologist and a woman who had claimed to be an eyewitness of the deaths. The parties were not identified but their claimed evidence appeared generally consistent with original "crime scene" data and a conclusion that the deaths were caused by hydrogen sulphide gas.[8]

Attachment L7 - Environmental Protection (Water Policy 2009 - Coomera River environmental values and water quality objectives)

Coomera River environmental values and water quality objectives 20 / 41

Environmental Protection (Water) Policy 2009

Coomera River environmental values and water quality objectives

Basin No. 146 (part), including all tributaries of the Coomera River

July 2010

Table 2 Water quality objectives to protect aquatic ecosystem environmental value (refer to Plan WQ1462 for location of waters)

Water area/type (refer Plan WQ1462)	Management intent (level of protection)	Water quality objectives to protect aquatic ecosystem EV [1-11]
Lowland freshwater (comprising lowland streams, wallum/tannin-stained streams and coastal streams)	Aquatic ecosystem – moderately disturbed	• turbidity: <6 NTU • suspended solids: <8 mg/L • chlorophyll a: <4 µg/L • total nitrogen: <400 µg/L • oxidised N: <80 µg/L • ammonia N: <20 µg/L • organic N: <320 µg/L • total phosphorus: <50 µg/L • filterable reactive phosphorus (FRP): <20 µg/L • dissolved oxygen: (20^{th}—>80^{th} percentile) % saturation 85% – 110% • pH: 6.5 – 8.0 Coombabah Creek ▪ turbidity:<30 NTU ▪ chlorophyll a: <5 µg/L ▪ total nitrogen: 500 µg/L ▪ total phosphorus; 50 µg/L ▪ dissolved oxygen: >6 mg/L ▪ pH range: 6.5 - 9 temperature (single measurement) <2 degrees Celsius between stations

Attachment M1 - Dewatering Management Plan - Geotechnical Issues

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4.2.3 Geotechnical issues

The DMP should also include an assessment of the potential geotechnical and hydrological impacts of groundwater extraction. It should demonstrate that nearby structures and infrastructure will remain stable during and after dewatering. Consideration of groundwater recharge should be given. This may require groundwater modelling. Details of dewatering volume, rate, duration, equipment and procedures must be included in the DMP.

A geotechnical investigation shall be undertaken to determine the groundwater level and the absorption rate for all sites. The lowest value obtained from the geotechnical investigation shall be used in the absorption calculations. The geotechnical investigation shall report the meteorological details of the test day, the general site condition and the level of the watertable applicable at the site.

The report must identify and address the overall potential adverse effects of dewatering on the stability and integrity of any adjacent property or structure. The report shall assess the radius of influence of the draw-down cone on potential settlements and lateral movements of any adjacent structures, properties or services.

A minimum of two boreholes per site is required. One of the boreholes shall be within the proposed absorption area and others in various locations throughout the site. For developments where the gross site area (GSA) is greater than or equal to 1000 square metres, an additional borehole is required for every 400 square metres or part thereof over 1000 square metres. For example, a site with GSA of 1450 square metres, four boreholes are required. Copies of the borehole logs are to be attached to the report. Unless groundwater is encountered, borehole depth shall be a minimum of four metres from the existing ground level.

Attachment M2 - Stormwater Management Plan - 'C.5.1 Model Assumptions' best case scenario

Oxenford Quarry Stormwater Man... 54 / 136 80%

C.5.1 Model Assumptions

To present a water balance model considered to represent the site (in lieu of comprehensive information), certain assumptions have been applied. These are outlined below:

- It has been assumed that quarry operations occur for six days per week, i.e. from Monday to Saturday inclusive.
- No increase in water use demand (with the exception of the 3 concrete production use scenarios presented) is anticipated during the ultimate site conditions.
- Capacity is constantly provided within the concrete batching area to cater for the 'first flush' event in accordance with exiting approvals.
- All heights presented in reduced level (RL) m Australian Height Datum (AHD) are best estimates based on data provided.
- The capacity of the waterbodies supplied in the concrete batching area are amalgamated for the purposes of this water balance model, as it is assumed that both waterbodies are used for concrete production water use.
- As suggested in the Groundwater Impact Assessment – Oxenford Quarry Extractive Boundary Realignment Project (G1913) (AGE 2018) and supported by *G1913A: Oxenford Quarry Response* (AGE 2019):

  "The inflow predictions show that the inflows are dominated by groundwater entering through the pit floor. The inflows predicted by the low bedrock conductivity scenario (total of 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations."

  Based off this statement, the groundwater inflow as anticipated at being 4 L/s (345.6 m^3/d) for the Quarry Pit Sump C3 for the ultimate site conditions.

  Further advice given in *G1913A: Oxenford Quarry Response* (AGE 2019), identifies that the groundwater inflow for the existing site conditions is 0 L/s.
- The two categories of 'water leaving the site' from the Quarry Pit Sump C3 have been classified as "Discharge Offsite" and "Pumped from Sump", classified below:
  - ***Discharge Offsite*** – This parameter is based on the water usage details as identified in Table 2-1. This is noted as approximately 90.7 ML/year. Water is discharged using this parameter only if there is enough water for the remainder of the onsite activities.
  - ***Pumped from Sump*** – this parameter is engaged when the volume of water in the sump is greater than the nominated maximum volume (see Table C-3). If this occurs, the water is pumped out at a rate of 6624 m^3/day (that is, approximately 80 L/sec for 24 hrs/day until max volume is once again received).

Reduction in 'water leaving the site' is expected to be observed due to increased demand for increased concrete production. This reduction will be primarily observed in the "Pumped from Sump" parameter.

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Attachment M3 - 'Groundwater Impact Assessment' - Borehole details

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6.2.6 Rock chip sampling

Sulphide minerals and sulphide-bearing carbonaceous rocks have been identified to occur within the Neranleigh-Fernvale Beds. Weathering of sulphide minerals when exposed to moisture and oxygen has the potential to result in acidic groundwater quality. Sulphide-bearing minerals exposed to oxygen can potentially lead to acid mine drainage and acid sulphate soils.

To assist in the identification of sulphide-bearing strata and to assess the potential for acid generation during the process of the proposed development, the rock chip (drill) cuttings were examined at 1 m intervals in all bore holes. A single trace of pyrite was identified in the drill cuttings at 25 mbgl at MB-01 and at 7 mbgl at MB-03.

In addition to the visual examination of the drill cuttings, a single sample was collected from each bore that intersected bedrock. The samples were submitted ALS under chain-of-custody for total sulphur analysis. The sampling results are presented in Table 6.3 and in the laboratory sheets attached in Appendix E.

Table 6.3 Soil sampling results

Parameter	Units	LOR#	MB-01	MB-03	MB-04d
Date sampled	-	-	27/02/2018	05/03/2018	06/03/2018
Sample depth	mbgl	-	28	8	9
Lithology	-	-	Slightly weathered to fresh Neranleigh-Fernvale Beds	Weathered Neranleigh-Fernvale Beds	Slightly weathered Neranleigh-Fernvale Beds
Sulphur - Total as S (LECO)	%	0.01	0.02	0.03	0.04

The rock chip sample collected from MB-01 was taken above the water table and the rock chip samples from MB-03 and MB-04d were collected from below the stabilised groundwater level in the bore (although the drill cuttings were dry at the time of collection). Sulphur is reported in percent and was detected in minor concentrations in the soil samples obtained from MB-03 and MB-04.

Attachment N1 - 'Groundwater Impact Assessment' - showing best case and worst case scenarios

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The inflows from Zone 1, the pit walls, varies from 15.1 ML/yr to 72.4 ML/yr when the permeability of the bedrock is varied from 0.001 m/d to 0.01 m/d. The 0.001 m/d value represents the anticipated permeability of the rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.01 m/d value represents the permeability of the bedrock as measured in the monitoring bores completed for this project.

The inflows from Zone 2, the pit floor, varies from 113.6 ML/yr to 359.2 ML/yr when the permeability of the bedrock is varied from 0.0001 m/d to 0.001 m/d. The 0.0001 m/d value represents low permeability rock at depth, due in large part to the closure of fractures from the overburden pressure. The 0.001 m/d value represents the highest probable floor permeability.

The inflow predictions show that the inflows are predominately from groundwater entering through the pit floor where the Neranleigh_Fernvale Beds are saturated. The inflows predicted by the low bedrock conductivity scenario (i.e. 4 L/s or 130 ML/yr) are considered more likely to be representative of the magnitude of inflows to be observed during operations.

Table 7.2 Analytical results

Scenario	Zone	K_{b1} (m/day) / K_{b2} (m/day)	Radius of influence (m)	Q (L/s)	Q (ML/yr)	Total (ML/yr)
Low bedrock conductivity	1	0.001	700	0.5	15.1	130 (best case)
	2	0.0001	700	3.6	113.6	
High bedrock conductivity	1	0.01	1,418	2.3	72.4	186
	2	0.0001	1,418	3.6	113.6	
High bedrock wall and floor conductivity	1	0.01	1,418	2.3	72.4	432 (worst case)
	2	0.001	1,418	11.4	359.2	

Attachment O1 - Dewatering Management Plan - Noise and vibration issues

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Dewatering management plan guidelines

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4.2.4 Noise and vibration issues

The DMP should detail the type and location of equipment to be used and the duration of use. Potential noise/vibration issues and potential sensitive receivers should be identified within the DMP. It must detail any mitigation measures and how they will prevent any noise issues.

Treatment methods for the reduction of noise emitted from the mechanical plant involved in the dewatering process include, but are not limited to methods such as:

- installation of a fully acoustically attenuated enclosure around noise generating equipment, (for example, pumps and generators)
- the use of sound attenuating material such as hay bales to surround the plant
- installation and maintenance of mufflers and suitable exhaust systems for all noise generating plant and equipment
- operation of particularly noisy equipment within restricted time periods 7am – 6pm
- restriction of operating hours of the offending plant

All noise emitted from the dewatering process is to comply with the provisions of the *Environmental Protection Act 1994.*

Attachment P1 - Dewatering Management Plan - Odour issues

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4.2.5 Odour issues

The presence of potential odour-causing gas hydrogen sulphide (H_2S) should be detailed in the DMP. The DMP should identify potential mitigation measures and demonstrate they will be effective. The proposed treatment methods for the dewatering process are required to be included within the DMP. The proximity of the residents should be considered when undertaking dewatering activities.

The treatment of reducing odours resulting from dewatering activities varies in complexity and effectiveness. Options range from simple methods such as placing the discharge point directly into stormwater gullies or traps, to more complex ones such as installing a surge tank with an activated carbon filter to arrest odours. The intensity of the odour arising from the dewatering process will determine the extent of the treatment method required to reduce the odour. The odour threshold for H_2S is 0.08 – 0.2ppm (parts per million), *IUE Commission Cape Town, 2001*.

Attachment Q1 - Dewatering Management Plan - Operational and monitoring requirements

Dewatering Management Guidelines 8 / 13 125%

4.3 Operational and monitoring requirements

Assessment during the design phase will assist in the determination of the most appropriate operational methodology, tanked or sump and pump, and the corresponding monitoring method. This will assist in compliance with legislative requirements and addressing potential impacts on the completed structure after construction.

To avoid any environmental harm where water contains significant suspended solids and other harmful chemical and toxicants, the proponent should install and operate a settling basin/balance tank with a capacity to contain a minimum of two hours prior to release to the environment, depending on sediment characteristics. This is necessary to remove flocculating matters and also allow aeration and dissolved iron to precipitate and settle. It may be also necessary to apply chemical dosing such as lime to raise pH, metal salt to enhance removal of toxicants.

Where it is not possible due to lack of space, the proponent must explore mobile tanks or other forms of solids reduction such as filtration or chemical coagulation.

To ensure that any potential environmental harm is managed correctly and to enable the proponent to demonstrate compliance, regular monitoring of water quality parameters must continue in a manner advised by professionals. The monitoring regime will depend on the wastewater quality, water treatment methods and point of discharge. The details of monitoring plans should be contained in the DMP, including:

- water quality parameters to be monitored
- frequency of monitoring during dewatering
- monitoring techniques and equipment
- availability of monitoring records

The operator should develop and maintain a program that monitors, records and reports on the effects of dewatering. The program should include:

- a record of the quantity of water discharge rate
- regular visual inspection of the dewatering system to confirm its integrity and note impacts at the point of release
- suitable monitoring facilities, (for example, bores to record the effects of pumping on the water table)
- relevant water quality analysis of the water discharged and the receiving environment
- periodic investigations of the impacts on vegetation and water resources
- photographic records of vegetation and other sensitive parameters should be included as appropriate

It is important that during construction and operational phases of a project, the existing groundwater regime is maintained as close as possible to the pre-development condition. In this regard, consideration should be given to the level and flow attributes of the groundwater regime, through appropriate monitoring. In general a minimum monthly for static water levels via piezometers in the surrounding watertable is required to assess draw-down effects.

4.4 Dewatering contingency plan

A key feature of the DMP is that it will identify risks at the planning stage before construction begins. Where problems are unlikely and are not accounted for in the general dewatering procedures, contingency plans must be prepared. Triggers that activate the contingency plans should also be detailed within the DMP. Contingency plans within the DMP are binding through conditions of approval. The DMP should identify management actions for scenarios including but not limited to the following:

- noise complaints
- odour complaints
- complaints about appearance of wastewater discharge
- unexpected contaminants found during monitoring
- failure of treatment methods
- failure of pumping systems
- groundwater seepage into construction area
- heavy rainfall
- impacts on the stability of adjacent structures
- release of any toxicant materials outside the trigger values in *Tables 1, 2 and 3*

Examples of contingency actions may include:

- consulting a professional
- stopping operations
- changing methods or equipment
- additional monitoring

Contingency plans with a higher level of detail and foresight prove more useful if the situation arises.