Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
New WWTP with discharge points further down the estuary – Ian Kidd	Likely not material.	It is self evident that relocating existing and future wastewater treatment plant discharges out of the upper estuary to a site(s) in the lower estuary would offer some scale of beneficial outcome to the upper estuary. A relocation distance of 10.8km downstream is suggested in the submission (although this appears to be based on rudimentary assumptions and calculations that would need testing). Such a relocation would also clearly present a new threat to lower estuarine water quality. The seriousness of this threat, and the commensurate benefits to the upper estuary could only reasonably be assessed using advanced numerical techniques. It has been assumed that the specification of the WWTP being sited at greater then 10mAHD is driven by consideration of sea level rise matters rather than water quality issues.	The risks to ambient water quality of introducing a WWTP discharge are real. Risks include exceedance of scheduled Toxicity Trigger Values (TTVs) directly around outfalls, and Water Quality Objectives (WQOs) further afield. Both would require proper numerical investigation. It is noted that a greater tidal prism in one location over another does not necessarily ensure better near or far field mixing. Other matters such as local hydrodynamics, outfall diffuser arrangements etc. need to also be considered in a proper analysis.	The benefits to ambient water quality of removing a WWTP discharge are potentially real, but would require proper investigation.	The sequential submission dot points beginning “Effluent…”, “Under the 12km scenario…“ and “The sewage fix…” do not seem to use logic this reviewer can follow, however numerical analyses could provide a robust assessment of the veracity of alternative discharge points. Discharge points should be investigated thoroughly in this manner. As an aside, phrases in the submission such as *dilution is the solution to pollution* are not generally looked on with high regard by decision makers (although triggers are mostly set as concentrations) as pollutant mass loads are often of equal interest in assessing impacts to environmental systems.	
Tertiary treatment WWTP – Ian Kidd, Jim Collier	Likely not material.	As above, it is self evident that improved treatment standards should result in improvements in the quality of water released from WWTPs and hence receiving water quality. The way in which any improvement manifests itself in changes in ambient receiving water quality must nonetheless be properly assessed. For example, the sediments in the vicinity of long term WWTP discharges are likely to contain large masses of nutrients and may therefore dominate local water quality dynamics for extended periods following discharge upgrade.	No material impacts during operation. Construction impacts not considered.	Localised improvement in ambient water quality, under the caveat however that responses are unlikely to be immediate or linear, and will require investigation. It is noted that economic impacts of this (or any other) option have not been considered.	Proper investigation of the potential time lag between WWTP upgrade and environmental responses. If treated effluent was at some future stage determined to be best returned to the estuary, then a proper near and far field analysis of environmental impacts would be required.	
Tailrace waterway returning Tailrace discharge along the Trevallyn foreshore to the Yacht basin – Ian Kidd, Mike Seward	This concept would redirect all Trevallyn flow through Yacht Basin and Home Reach. This represents a median discharge exceeding 40 m^3/s, compared with the current median discharge of 2.5 m^3/s. Such a significant increase in base flow would be likely to reduce sedimentation within the Yacht Basin in particular and to a lesser extent the Home Reach. Quantification of morphological response would require numerical modelling of this scenario.	Yacht Basin and to a lesser extent Home Reach water quality would be more representative of riverine inputs. Flushing timescale of these areas would be reduced due to constant through flow.	Would represent a substantive addition of engineered waterways to the system. The engineered waterway would likely include hard training walls and other protections to ensure its integrity over the full range of design flow conditions (including severe floods). The hydrodynamic and sedimentation/scour behaviour of this engineered waterway and its interaction with the existing waterways would need to be fully assessed in order to understand environmental risks related to long term operational behaviour (and maintenance	This concept would substantively increase riverine flushing of the Yacht Basin and Home Reach while maintaining electricity generation potential of Trevallyn Power station (subject to ability to cost-effectively engineer this concept).	HD, ST and WQ modelling to assess operational and flood behaviour / impacts / benefits. Assessment of engineering feasibility including integration with Trevallyn powerstation discharge, structural / geotechnical design, hydrodynamic design (operational and flood scenarios).	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
	The engineering feasibility and costs of this proposal are not immediately apparent based on the high-level concept outlined in the submission. This would need to be proven across the full range of operating conditions (including extreme flood events). Capital and ongoing operation and maintenance costs would need to be comprehensively evaluated.		requirements), including performance during flood events. Construction impacts would also need to be thoroughly assessed. It is noted that the upper Tamar has acid sulphate soils and this has posed an historical problem with excavation of material in the past. There is therefore a high risk during excavation works for heavy metals and/or low pH water to be released into system.			
Return North Esk tidal marshes to the estuary – Ian Kidd	This is the first of several proposals that sit under a category of increasing tidal prism within the estuarine system. Would increase tidal prism of North Esk and to a much lesser extent the Home Reach. There would be potential for reduced siltation potential in estuary where tidal prism is materially increased. This concept would be unlikely to benefit the Yacht Basin and may in fact increase siltation potential here due to higher energy currents in adjacent Home Reach / North Esk flowpath.	Increase in tidal flushing but unlikely to substantially change water quality.	Would re-introduce agricultural land to the estuarine system. Contamination risks would need to be assessed.	Return North Esk estuarine system closer to its natural state as measured by tidal prism volume and intertidal marsh area.	Quantification of morphological response would require numerical modelling of this scenario.	
Reinstatement of old North Esk meander system – Ian Kidd	May increase estuary tidal prism but line of effect is less obvious than reinstatement of tidal marshes concept. Otherwise see above for pertinent comments.	Increase in tidal flushing but unlikely to substantially change water quality.	Would re-introduce agricultural land to the estuarine system. Contamination risks would need to be assessed.	Return North Esk estuarine system closer to its natural state as measured by tidal prism volume and intertidal marsh area.	Quantification of morphological response would require numerical modelling of this scenario.	
Remove sluice gates near Henry st Bridge – Ian Kidd	Would reinstate off-channel tidal inundation and correspondingly increase tidal prism but the extent of this change is not able to be ascertained from information provided. See above for pertinent comments.	Increase in tidal flushing but unlikely to substantially change water quality.	Would re-introduce agricultural land to the estuarine system. Contamination risks would need to be assessed.	Return North Esk estuarine system closer to its natural state as measured by tidal prism volume and intertidal marsh area.	Quantification of morphological response would require numerical modelling of this scenario.	
Remove silt ponds and old WWTP at Ti Tree Bend and return to estuary – Ian Kidd	Would reinstate off-channel tidal inundation and correspondingly increase tidal prism. The extent of this change is not able to be ascertained from information provided but would appear to be only capable of a	It has been assumed that this removal refers to the buildings and other infrastructure at Ti Tree Bend, given that this proponent has elsewhere submitted that WWTP should be relocated at east 10.8km from Launceston. Therefore, likely not material, other than perhaps acid sulphate soil related issues during	Would re-introduce industrial land to the estuarine system. Contamination risks would need to be assessed.	Could help return upper Tamar estuarine system closer to its natural state. However, this option may only be a marginal improvement in tidal prism volume and intertidal marsh area.	Quantification of morphological response would require numerical modelling of this scenario.	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
	marginal tidal prism improvement based on the location. See above for pertinent comments.	construction (and operation if not properly managed)..				
Reduce nutrient runoff from the catchment utilising real time monitoring of the Esk rivers – Ian Kidd	Likely not material.	It is not clear in the submission as to how real time monitoring would be used to reduce catchment derived pollutant loads and therefore improve ambient water quality. Perhaps if real time data was used to better validate catchment models or identify pollutant hot-spots then it might be of use, however the submission provides insufficient detail on this measure to warrant further comment.	Likely not material.	Submission sufficiently unclear to provide comment.	The proponent's proposed link between monitoring and water quality improvement.	
Increased flow through Gorge - 8 cumec flow through the Gorge – Alan Birchmore LFA, Dick James, Jim Collier	This would represent a substantive increase (c.f. 2.5 m3/s currently) in freshwater base flow through the Yacht Basin and Home Reach upstream of the tailrace (but would obviously come at the expense of hydro-electricity generation capacity).	Yacht Basin and to a lesser extent Home Reach water quality would be more representative of riverine inputs.	Likely not material.	Increased riverine flushing of Yacht Basin and Home Reach. Such increased base flow has the potential to somewhat reduce siltation in the Yacht Basin but would only be a very minor change to the hydrodynamic regime in the Home Reach.	This specific scenario has not been assessed with the upgraded 3D HD, ST and WQ model. Quantification of morphological response would require numerical modelling of this scenario.	
Restoration of all flows, variable through the Gorge – William Griffiths	This scenario would be likely to very substantively change the siltation regime of the Yacht Basin, reducing siltation potential and increasing the equilibrium waterway area immediately downstream of Cataract Gorge. Siltation of the Home Reach would also likely be reduced (but to a lesser extent) and the bank/channel morphology could also adapt towards a different equilibrium due to higher low tide current speeds. The hydrodynamic regime downstream of the tailrace would not be substantively changed as this scenario represents the same overall base flow. Reduced siltation potential in the Home Reach would at some location be balanced by increased siltation downstream of the Tailrace.	Yacht Basin and to a lesser extent Home Reach water quality would be more representative of riverine inputs. Flushing timescale of these areas would be reduced due to constant through flow.	Substantive change to recent low flow hydrological regime for South Esk River, but more representative of "natural" condition. This hydrological change could result in some ecosystem adaptation. This scenario would obviously involve a very substantial reduction in Trevallyn power station generation potential.	Increased riverine flushing of Yacht Basin and Home Reach.	This specific scenario has not been assessed with the upgraded 3D HD, ST and WQ model. Quantification of morphological response would require numerical modelling of this scenario.	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
Upgrade Ti Tree as a single STP to tertiary treatment with no spills requiring a large settling basin/shallow lake at Riverside flats – Dick James	Likely not material.	As above, it is self evident that improved treatment standards should result in improvements in the quality of water released from the Ti Tree Bend WWTP and hence receiving water quality. The removal of the possibility of spills adds further to this view. Again, the way in which any improvement manifests itself in changes in ambient receiving water quality must nonetheless be properly assessed. For example, the sediments in the vicinity of the Ti Tree Bend WWTP discharge are likely to contain large masses of nutrients and may therefore dominate local water quality dynamics for extended periods following discharge upgrade.	The proposed detention basin/lake is unlikely to be free of its own water quality problems if it is fed primarily by (even tertiary) treated sewage. It is likely to have an increased propensity for suffering elevated algal activity and low dissolved oxygen states. These are undesirable outcomes and may present a risk to local environments. It is also unclear as to whether evaporation would be sufficient to produce dried solids, and any associated accumulation of waste may present its own environmental hazards.	Localised improvement in ambient water quality, under the caveat however that responses are unlikely to be immediate or linear. It is noted that economic impacts of this (or any other) option have not been considered.	Proper investigation of the potential time lag between WWTP upgrade and environmental responses. The interaction of the proposed basin/lake with its environment would need careful numerical investigation. Issues that could be considered include likely internal water quality dynamics (algal activity, dissolved oxygen dynamics), groundwater interactions, evaporative fluxes, odour, public safety and the like. This list is not exhaustive and other elements beyond the scope of this study may also warrant investigation.	
Tamar lake barrage proposal – Dick James, Tamar Lake Inc	The hydrodynamic and sedimentation regime would be drastically changed by the creation of a freshwater lake system upstream of Rowella. The change from an energetic tidal regime to a relatively quiescent lake regime would result in reduced suspended sediment concentrations upstream of the barrage. It is likely that Home Reach and Yacht basin sedimentation would be reduced due to: • Loss of tidal pumping mechanism; • Reduced flocculation potential in purely freshwater lake In the absence of tidal action, water levels upstream of the barrage would obviously be relatively static. This new regime would have the potential to improve visual amenity (lake levels will cover the mud flats) and improve navigation and access. Downstream of the barrage tidal currents would be substantively reduced due to the massive loss of tidal prism. This would represent a very substantive change to the existing high-energy tidal sediment transport regime.	The following is not a complete review of the TLI submission, as the consultancy brief seeks concise responses. It responds to some key aspects of the submission only, and further expansion can be provided if needed. The TLI submission presents the findings of a 3D modelling study of the proposed lake, where that study reports that there is a high risk of (S3.3.2, and acknowledged by TLI in S3.4.5): 1) Development of summertime thermal vertical stratification structures 2) This stratification generating low dissolved oxygen / anoxic bottom waters and consequent elevated sediment nutrient release rates 3) Enhanced (potentially harmful/toxic) algal growth 4) That this stratification / algal bloom water quality process within reservoirs/dams is known, and cites Lake Burley Griffin (amongst others) as an example (S2.1.4.2) 5) That destratification arrays are likely to be of significant scale (S3.4 and this was agreed by TLI, S3.4.1) S3.4.4 of the TLI submission includes BMT WBM correspondence verbatim on this matter, including where BMT WBM also pointed to the potential deleterious	In the area of this reviewer's expertise, some environmental risks that this proposal poses include: 1) Development of potentially toxic algal blooms within the proposed lake upstream of the barrage 2) Development of anoxic (and ecologically toxic) waters, also upstream of the barrage 3) Delivery of one/both of potentially toxic algae laden or anoxic waters to sensitive downstream environments 4) Very substantive reduction in tidal prism downstream of the barrage and associated increased risk of fine sediment siltation 5) Substantive imposed change to ecosystem character in lake system and also downstream of barrage	The submission does not present any material improvements to water quality, other than in Zone 1. This may offer some very minor and localised environmental benefit. This reviewer sees no other potential environmental benefits that relate to water quality. A substantive change in ecological character associated with construction of a man-made freshwater lake in a naturally estuarine environment could be argued to provide opportunities for new and beneficial ecosystems, however the very substantive loss of natural estuarine ecosystem character would potentially far outweigh these benefits.	Environmental modelling as quoted in the submission S3.5.1 is encouraged. A more detailed assessment of potential downstream (of the barrage) sedimentation and water quality impacts should also be considered given the ecological importance of these areas noted in the submission. The TLI submission describes some limitations of the 3D water quality modelling commissioned by the proponent in S3.4.6 and S3.5. One of the limitations discussed in the submission is the use of literature to specify sediment nutrient fluxes in the current (and future) model (S3.4.7). Peer review of the modelling report suggests that current sediment flux measurements should be made to improve model predictive capability (S3.4.7). Whilst this reviewer sees some merit in using such measurements to improve modelling of current conditions, it is not clear how doing so will improve the model's future predictive capability. This is because the composition and distribution of current sediments is not necessarily reflective of future sediment conditions. This is for (at least) two reasons: i) the benthic biogeochemical processes that result in dissolved oxygen depletion and nutrient release are likely to be driven by different mechanisms and organisms under estuarine (salty/brackish) and fresh (future) conditions, so are not comparable and ii) sediments that currently pass through the reaches of the	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
	Associated with this change there would be increased risk of fine sediment siltation due to increased quantities of fine sediment passing through the lake system but primarily due to the lower tidal energy downstream of the barrage. The Tamar Lake feasibility report made the claim that *"there will be no new silt accumulation in either the resultant reservoir or downstream of the barrage, with all new silt from the catchments flowing in suspension out to Bass Strait and the residual silt bed eroding with each major flood event."* This claim of *no new silt accumulation in the reservoir or downstream* is not consistent with advice provided in the 2012 BMT WBM Tamar Lake Preliminary Technical Assessment report. It would instead appear to be an erroneous interpretation / extrapolation of sedimentation impact figures reported in the January 2016 BMT WBM report M.B20921.008.Scenarios_Update. These figures have been reproduced in the Tamar Lake Feasibility Report (TMFR) to support the above assertion. Figures 2 to 6 in the TMFR show "sedimentation impacts" in the Home Reach. These figures show the effect that removal of the tidal regime would have on sedimentation in the Home Reach. It cannot be concluded from these figures that there would be no new silt accumulation in the entire resultant reservoir. It is inevitable that a substantive quantity of silt will be captured within a deep and relatively quiescent reservoir of the dimensions proposed. The spatial distribution of this deposition will be very different to the existing tidally driven situation, however a proportion of the new silt	impacts of releasing cold low dissolved oxygen water to downstream receiving environments. This review concurs with the position bulleted and described above. Further, water quality downstream of the proposed barrage is expected to also be impacted when waters of poor quality (e.g. anoxic bottom waters as noted above, or algal-laden surface waters) are released, either deliberately in an exchange system or during natural high flow events (some such scenarios were presented in S3.4.2 bullets 3 and 4, and S3.4.3 of the TLI submission). This is particularly important given that the submission notes the presence of valuable downstream ecosystems in S2.1.1. If any releases at depth were to occur from Tamar Lake (as were investigated in some of the modelling studies presented, S3.4.2 and S3.4.3) then there is a high risk that these releases will be of poor quality (being of low dissolved oxygen, high nutrient concentrations and cold). These would then be delivered to downstream environments and pose a threat to the ecosystems described in S2.1.1 of the proponent's submission. Finally, the TLI submission notes that rice grass infestations (S3.7) cover some 415 hectares of the estuarine fringes, and that they would *die off and decay* (last paragraph, p 37 of submission). If this were to be the case then it is this reviewer's opinion that this die off and decay could represent a material threat to the water quality of the proposed lake. Specifically, if these rice grass meadows do cover such an area and then die off, this will represent a significant initial loading to the lake (at a permanent high-water level) of nutrient-rich organic material. It is organic material such as this that supports bacterial remineralisation (decay) and therefore consumption of water column dissolved oxygen. This consumption can lead to reduced (and potentially anoxic) water			proposed lake (under tidal and inflow action) may not do so under the anticipated low energy lacustrine future conditions, therefore accumulating in different locations and to different thicknesses. In short, current estuarine and future lacustrine sediment conditions are likely to be unrelated, and using measurements of current conditions to inform future benthic oxygen and nutrient processes is, in the view of this reviewer, not appropriate. For a lake that does not exist (Tamar Lake) these processes obviously cannot be measured and so the best that can be done at this time is to populate the 3D model with literature values of sediment behaviour for comparable lake systems elsewhere. The modelling took this approach and showed subsequent significant deterioration of lake water quality. On a related matter, it is this reviewer's experience that in many cases, catchment derived inflows arrive at freshwater reservoirs/dams as underflows. That is, the catchment derived flows are generally colder than ambient reservoir waters and so are denser and transit through reservoirs along the bed, often via the drowned river thalweg. Sediments transported from catchments that are suspended in these inflows also increase inflow density. Any sediments carried with these inflows therefore also migrate along the bed, and can settle out either *en route* to, or on arrival at, the terminating impoundment structure. This process can be responsible for delivery of sediment loads to the bed of lakes/reservoirs, and in the case of Tamar Lake, would represent a new mechanism of sediment transport that was unable to previously operate in the estuarine condition. There exists, therefore, a mechanism by which new (not just redistributed existing) sediments can be delivered to the proposed lake bed, with a corresponding organic matter load. As such, it is suggested that the propensity for this potentially important underflow mechanism to operate in the proposed lake is investigated thoroughly using first principles and numerical tools. The TLI submission suggests that sediment nutrient release will decrease to catchment input levels over time as the replenishing catchment	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
	introduced from the catchment will deposit out in the lake environment, predominantly in the downstream deeper areas. Figures 7 to 8 in the TMFR show "sedimentation impacts" downstream of the estuary. These figures show the very substantial reduction in movement of coarse sediment in this region. While Figure 8 does not show widespread silt accretion at the contour scale which was necessary to show existing case coarse sediment redistribution, this figure is not able to support the assertion of no new silt accumulation downstream of the reservoir. The highly modified tidal regime downstream of the barrage will have much less energy to transport coarse grained sediments and will be more prone to fine sediment siltation for the following reasons: • this region would be the new salt/fresh mixing zone, which would enhance fine sediment flocculation and settling; and • the much lower current speeds would be more conducive to fine sediment deposition.	column dissolved oxygen concentrations, leading to the subsequent environmental impacts already described above. In effect, these rice grasses, as they died off and decayed (p 37) would provide a material threat to ambient lake water quality (especially if the grass extent is as significant as emphasised in the TLI submission) on closing the barrage for the first time. This mechanism would provide an immediate and ongoing impediment to the lake in terms of developing and maintaining satisfactory water quality. Similar situations might exist for other plant materials beyond rice grass that might also decay under the lake proposal In summary, this review sees that the Tamar Lake proposal, through a range of well-known mechanisms, presents a high risk of delivering severely deleterious water quality outcomes both upstream and downstream of the proposed barrage.			nutrient fluxes are less than sediment fluxes, and that therefore the sediments will become less and less important in the system's nutrient balance (S3.4.7). This reviewer notes the submission's reliance of this suggestion on a single set of annual mass fluxes, and therefore disagrees with using these estimates in this way. The Tamar is a dynamic system that receives catchment derived nutrient pollutant loads each year that have the potential to vary considerably, based on rainfall depths, patterns and intensities. It is not appropriate to quote or compare single number annual pollutant loads, and therefore infer a net depletion of sediment nutrient loading into the future. For example, it would take only one relatively large scale rainfall event to see the transfer of a significant mass of sediment and pollutants to Tamar Lake (likely as an underflow, see above). If such an event occurred soon after barrage construction then Tamar Lake would run the very real risk of enduring long term poor water quality via the mechanism bulleted above. As such, it is suggested that a proper and thorough analysis of the potential nutrient and sediment balance of the proposed lake be undertaken using numerical and other suitable tools. The majority of new sediment delivery from the catchment into the Tamar estuary system occurs during flood events rather than median flow conditions. The lake performance with respect to fine sediment bypassing would need to be assessed under flood scenarios in order to gain the necessary understanding of potential sedimentation impacts downstream of the barrage. The potential risks associated with siltation and redistribution of existing sediment deposits in the reservoir would need to be assessed thoroughly using quantitative numerical models, considering the full range of catchment flow conditions. These assessments should separately track the existing and new fine sediment introduced into the system. Sedimentation of fine sediment should be looked at separately from coarse sediment (particularly downstream) in order that potential impacts are identified.	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
					The quantitative modelling assessments should be used to develop a conceptual fine silt budget for the proposed lake system.	
Silt raking – Jim Collier, William Griffiths, Alan Birchmore LFA	This is the status quo siltation management option. It is proven to be reasonably effective at relocating silt from the Yacht Basin precinct when it can be undertaken in conjunction with release of Cataract Gorge flows. Other similar methods, such as water injection dredging, could offer similar benefits and may potentially have marginal improvements in cost and efficiency. Assessing any relative benefits of alternative methods would likely require field trials and competitive tendering in order to identify the best option/s.	Likely not material.	Generates short term turbid plumes and releases contaminants/nutrients from the sediment porewater.	The benefits of this management measure are probably more related to navigational and visual amenity, rather than purely environmental criteria. Relative to standard dredging operations, silt raking does not require on land disposal of sediments, which may reduce a potential environmental risk.	Potential studies could be related to assessing alternative operational methodologies (e.g. water injection dredging) to compare to status quo. Numerical modelling assessments have already been undertaken for LFA looking at complimentary short term flow releases down Cataract Gorge. These support the empirical finding that these can increase the effectiveness of raking operations. Further modelling could be undertaken in relation to other Trevallyn flow release options in order to assess costs/benefits.	
Reduce speed limits of boats to 5 knots in the upper estuary – Jim Collier	This might be a measure to improve bank stability (if this were a problem) but is unlikely to have a material effect on the estuarine sedimentation regime.	Likely not material.	Likely not material.	Likely not material.	Is bank stability a problem that needs to be addressed? This question probably would need to be looked at on a relatively localised scale (rather than a whole of upper estuary).	
Redirect North Esk inflows to the estuary away from South Esk inflows – Robert Crews	This proposal appears unlikely to substantially alter the broader Zone 1 hydrodynamic and sedimentation regimes. It would be unlikely to improve the fundamental siltation challenge facing the relatively poorly flushed Yacht Basin area.	Likely not material.	Further hard engineering of river system, with ongoing maintenance of associated river training infrastructure.	Likely not material.	HD and ST numerical modelling could be undertaken to assess the effects of this flow training.	
Silt detention ponds to capture sediment coming down the North Esk – Robert Crews	This scheme will not improve the estuarine (tidal) sedimentation regime that is responsible for delivering silt from further downstream back into the Home Reach and Yacht Basin. The proposed lock system would substantively reduce the tidal prism in the lower North Esk and Tamar Home Reach, which would decrease the equilibrium waterway dimensions in these areas, which would in turn be likely to increase the potential for silt deposition (delivered from downstream by tidal action). The vast majority of new sediment delivered into the estuary will enter during flood events and	The submission presents a means to hypothetically change an extensive stretch of the North Esk from tidal to freshwater, and remove flushing mechanisms. Given the scale of the change, it is likely that corresponding changes to water quality dynamics will be significant. It is likely that ambient waters will much more reflect catchment riverine water quality that is currently the case. Sediments may also drive water quality in the reaches with altered flushing. The creation of the new waterbody (which is effectively a shallow lake) will most likely bring its own water quality issues. Elevated nutrients, warmer water temperatures (due to its shallow nature)	Deterioration of water quality both within the newly estuarine reach and proposed shallow lake. Increased siltation potential in Zone 1 of Tamar estuary due to reduced tidal prism.	Likely not material.	All of the outcomes listed are potentially undesirable and warrant detailed investigation if this option is to be pursued. This is best investigated with numerical tools, supported by appropriate environmental data sets.	

Proposal	What, if any, impact the proposal would be likely to have on sedimentation in Zone 1 of the Tamar estuary?	What, if any, impact would the proposal have on general water quality (e.g. nutrients, pathogens, heavy metals) in the estuary (both the upper estuary and lower estuary)?	What, if any, potential environmental risks could be posed by the proposal?	What, if any, potential environmental benefits could be posed by the proposal?	What, if any, knowledge gaps are there that would need to be addressed to properly answer the above questions?	A list of relevant references which provide an assessment of the option
	therefore these silt detention ponds would need to be effective at retaining transported silt during high to extreme flows.	and light availability will most likely trigger elevated (bloom level) algal activity. This will in turn strongly impact oxygen dynamics. Faecal bacteria may also be present. Finally, if waters from the shallow lake are to be drained periodically, this presents a potential threat to receiving waters (which are not specified) given the water quality processes likely to occur in the shallow lake as noted above. It is noted that matters of public safety or amenity are not considered here.				
Land based disposal of sewage from Ti Tree bend on farmlands – Robert Crews	Likely not material.	It is self evident that diverting wastewater away from discharge to the Tamar should result in some improvements to receiving water quality. Again, the extent to which any such diversion manifests itself in changes in ambient receiving water quality must nonetheless be properly assessed. For example, the sediments in the vicinity of the Ti Tree Bend WWTP discharge are likely to contain large masses of nutrient and may therefore dominate local water quality dynamics for extended periods following discharge upgrade. It is noted that matters of public safety or health are not considered here.	No obvious impacts within the waterways, however there may be other impacts (e.g. to groundwater) that are beyond the scope of this review.	Localised improvement in ambient water quality, under the caveat however that responses are unlikely to be immediate or linear.	The interaction of the wastewater with other environmental systems and humans will require investigation, but is beyond the scope of this review.	