Sunshine Coast Council Technical Note - Changes to Stormwater Management Requirements for Construction Sites

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1 What are the Changes?

On the 3rd July 2017 the *State Planning Policy 2017* (*SPP 2017*) came into effect. The SPP 2017 introduces a new stormwater management design objective for sediment control on construction sites. The new design objective is applicable to all new Operational Works applications which are for urban purposes and which involve disturbing a land area of 2500m^2 or greater in size.

All new OPW applications which fall into the above category are required to achieve the new stormwater management design objective for sediment control. The design objective states:

> All exposed areas greater than 2500 m^2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrologic effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5)

The purpose of this technical note is to assist all parties involved in the land development process to understand the reason for the new design objective and provide practical tools to assist with implementing the change.

2 Why are the changes considered necessary?

For many years, Erosion and Sediment Control practitioners in Queensland have observed that sediment basins designed and operated to the previous design standard (which was to capture the runoff volume generated by a 5-day 80th %ile rainfall event and to treat and release that volume within five days from the last runoff event into the basin) would regularly result in the un-controlled discharge of highly-turbid water, particularly during the wet season. This lead a number of practitioners to questioning how effectiveness these sediment basins are at protecting downstream water quality from fine sediment and turbidity.

Analysis has demonstrated that sediment basins designed to the previous design standard were largely ineffective (Rowlands and Leinster, 2015; Robson, 2015), with basins at Caloundra only able to capture and treat approximately **34%** of the annual average runoff

volume, and basins at Nambour only managing to treat approximately **33%**. This means that on the Sunshine Coast, sediment basins designed to the old standard were at best allowing 2/3 of the annual runoff to discharge without appropriate treatment of fine sediment and turbidity.

The reason traditional sediment basins designed and operated to the previous standard are so ineffective is because they operate as a 'batch' process, whereby runoff fills the basin, the basin is then treated with a chemical flocculant/coagulant before allowing time for the entire volume in the basin to settle. Once acceptable water quality is achieved in the basin the basin is then emptied in readiness for the next event. Such a process is inherently unsuitable for coastal regions of Queensland, where rainfall often occurs in consecutive events which do not allow sufficient time for the above treatment and dewatering process to occur. Additional inefficiencies are also caused by the fact the above process is reliant on human management interventions at a number of points in the process.

The new design objective essentially requires that instead of treating only 33% of the average annual runoff (as was achieved under the old design objective), measures are implemented which can treat 80% of the average annual runoff volume from the site.

The new design standard recognises there are alternative technologies available and proven in the Queensland context (particularly on landfill and quarry sites) that can achieve the new design standard without necessarily increasing cost or land area requirements beyond traditional sediment basin approaches. These alternative technologies operate to treat turbid runoff on a 'continuous flow' basis rather than as a 'batch' process thereby overcoming many of the identified deficiencies of traditional sediment basins in the Queensland context.

3 Demonstrating Compliance – Design

The new stormwater management design objective for sediment control differs significantly from previous design objectives as it is entirely performance-based and not linked to any one specific technology. This provides industry with the flexibility to innovate whilst also having a clear performance outcome which is required to be achieved. However, for many smaller developments, a simple deemed-to-comply solution which can be readily adopted may be preferred. A discussion on the range of possible compliance approaches as well as simpler deemed-to-comply approaches are provided below.

3.1 A Range of Flexible Compliance Approaches

There are a range of available technologies and approaches which may be utilised and which are accepted as achieving compliance with this design objective as follows:

1. **High Efficiency Sediment (HES) Basins:**
   Install and operate Type-A or Type-B sediment basins designed in accordance with IECA (2016 addendum), described as High-Efficiency Sediment (HES) basins. These are sediment basins which have automated dosing of chemicals which assist flocculation/coagulation of fine and dispersive sediment and which operate on a continuous-flow basis. Type-A basins incorporate a floating decant as the primary outlet while Type-B basins can remain full between events and have only a spillway outlet. These basins are described more fully in Section 3.3.

2. **Large Batch Basins:**
   Batch sediment basins (Type D) designed in accordance with IECA (2008) will not comply with this design objective. Modified batch basin designs may be possible for some sites, however for most sites the batch basins would need to be impractically large or require impractical treatment and dewatering strategies to meet the design objective. If the batch basin is proposed to be treated and emptied within 2 day of rainfall ceasing, then the required basin settling volume is **775m^3/Ha** for coastal sites and **1200m^3/Ha** for hinterland sites. Sediment storage volumes need to be provided in addition to the above volumes, consistent with IECA (2016

addendum)

3. **Total Capture:**
   For flat sites, with no external catchment, perimeter bunding may be appropriate where it can be shown that the bund height is sufficient to capture the anticipated (average) wet season rainfall completely (i.e. total capture). A simple water-balance calculation and earthworks sections showing the bund arrangements and capture volumes will be sufficient to show that this strategy can be implemented. However careful consideration will be required for how this strategy can continue to operate beyond earthworks stage to when civil construction is being undertaken or nearing completion

4. **Alternative Innovative Measures:**
   Alternative measures may be implemented where it can be shown through long-term water-balance modelling that the measures will achieve the release criteria of 50mg/L TSS for at least 80% of the average annual runoff volume. This would need to be documented and justified in the ESC Plan (see case study in Section 3.4)

5. **Erosion Control:**
   Effective erosion control can be implemented in lieu of requiring sediment control specified above. For small areas, which are unable to drain to a basin, this could be achieved by implementing contingency measures prior to rainfall, such as covering exposed soil with blankets (mulch or synthetic) or spray-on soil binders. In these circumstances the erosion controls must result in an effectively stabilised surface prior to rainfall to justify the exclusion of sediment controls

The ESC plan must clearly state which compliance approach is proposed to meet the new sediment control design objective and supporting calculations are to be provided. The practicality of each approach should be carefully considered – especially where approaches (2) or (5) are proposed. Additionally, the ESC Plan should include an operating strategy that clearly outlines the methods and resources that will be employed to successfully operate the identified controls to achieve the new sediment control design standard. The operating strategy should be practicable and achievable.

3.2 Simple Deemed-to-Comply Approach (Catchment <2Ha)

For sites with total disturbance area less than 2Ha and where all inflows can be directed to a single point, a simple deemed-to-comply solution can be implemented. This procedure is based on the IECA (2016 Addendum) Type-B HES basin but has been simplified in recognition of the lower-risk and fewer design resources available to smaller sites.

Such sites are to be provided with simplified HES basins designed and operated as follows:

a) Provide basin settling volume sized as 350m^3/Ha of the contributing catchment area and with average depth of 1-2m. All other aspects such as sediment storage volume (30% of settling volume), length-width ratio (3:1), and spillway design as per IECA (2016 Addendum)

b) Augment basin with a forebay sized as 10% of the settling zone volume and with flow-distribution weir (level-spreader) set 100-200mm above outflow spillway level and configured as per IECA (2016 Addendum) – refer Figure 3.2

c) Provide rainfall-activated flocculant/coagulant dosing system on the single inflow point to the basin forebay. The dosing system is to be re-supplied with flocculant/coagulant after each rain event to ensure subsequent events will be treated

d) Select and supply a flocculant/coagulant determined through jar test conducted as per IECA (2016 addendum) Section B3 which achieves a minimum settlement clarity of 150mm within 15 minutes

The key design components of the deemed-to-comply solution are shown in Figure 3.1 and 3.2. Sites which are unable to meet the above deemed-to-comply parameters should either follow the full Type-B or Type-A design procedure documented in IECA (2016 Addendum) and as modified by Section 3.4 below, or consider one of the other compliance approaches documented in Section 3.1.

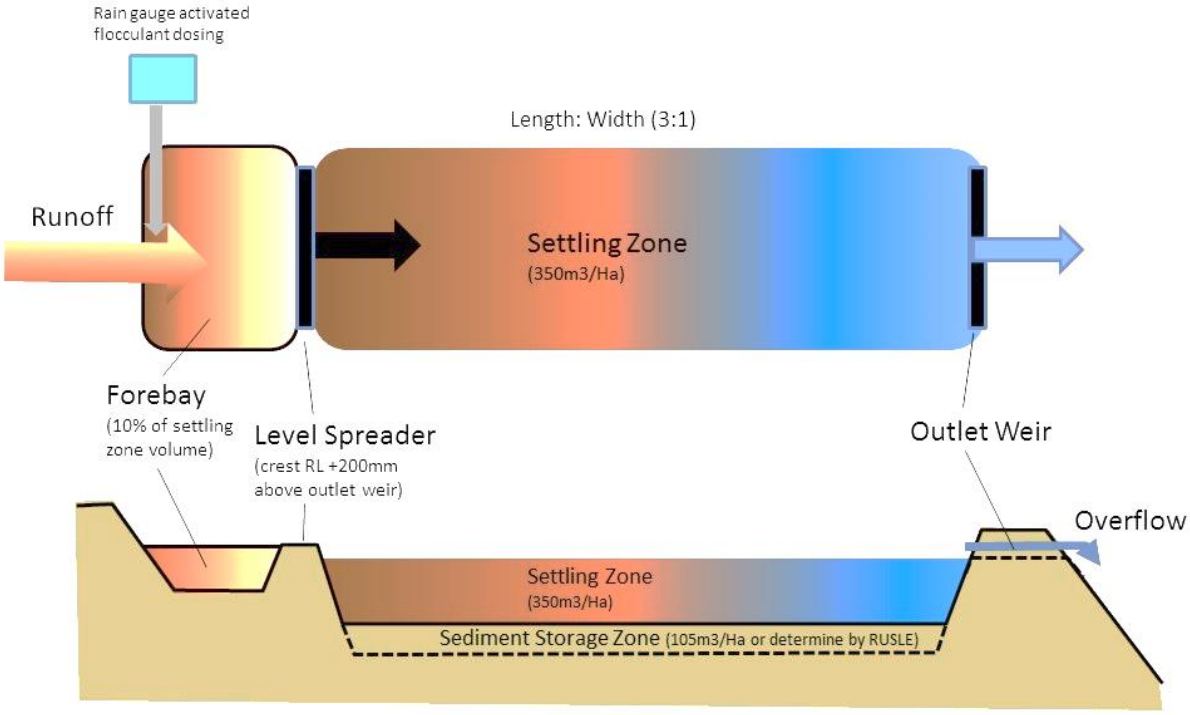


Figure 3.1 - Deemed to Comply Components

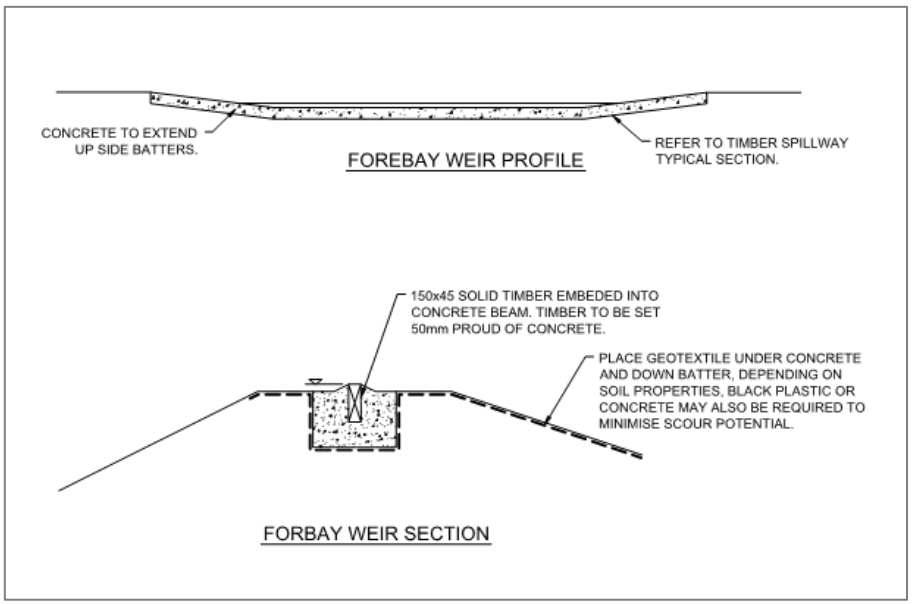


Figure 3.2 - Level Spreader details

3.3 Type A and Type B HES Basins

The design procedures for Type A and Type B HES basins are documented in IECA (2016 Addendum). It should be noted however this is a national guideline so is not specifically aimed at meeting the design objective of the Queensland SPP.

Modelling has therefore been undertaken and it has been confirmed that Type A and Type B basins designed in accordance with IECA (2016) will acheive the SPP design objective so are a suitable solution to achieve compliance with this policy. Design Spreadsheets to assist with the implementation of Type A and Type B basins have been developed by Topo and are available to access at the following address:

https://www.topo.com.au/resources/

In undertaking the design of Type B basins for catchments greater than the 2Ha deemed-to-comply option, the following modifications should be made to the IECA (2016 Addendum) procedures in order to account for Queensland conditions:

1. The design settling rate (laboratory settling rate) must be set at no more than 0.6m/hr. This is to provide a degree of safety in the sizing of the settling zone volume. The flocculant selected to be actually used in the basin is to meet or exceed this design settling rate.
2. The scour velocity checks (steps 5B, 6B in IECA, 2016 Addendum) be undertaken as informative only. If resuspension through scour is identified as a potential issue, then this is best addressed through monitoring basin performance and retrofitting permeable baffles if resuspension is observed.
3. Type B basins should only be provided for a maximum catchment area of 5Ha or a design treatment flowrate of 250L/s. Where greater catchment areas are involved, consideration should be given to implementing a number of distributed systems or implementing an alternative arrangement where flow into the settling zone can be regulated to below 250L/s (see Section 3.4). If neither of these options is available then specialist advice should be sought on dosing and flow management.

3.4 Case Study on Innovative Approaches

The benefit of the new sediment control design objective is that it is intended to encourage innovations which find more efficient or effective ways to achieve the required outcome. The following case study is an example of an alternative method which is not documented in IECA (2016 Addendum) and how such an innovation could be designed to demonstrate compliance with the design objective.

Concept

One of the challenges with Type-B HES basins is that the flocculant dosing system and the settlement zone must be sized to deal with the treatment flowrate which for larger catchments can result in large flowrates and large dosing and settlement volume requirements. The dosing equipment also must be able to respond to highly variable inflows and accurately dose for the conditions which exist at each point in time.

An alternative arrangement has been proposed based on process engineering principles, where variations in inflow are addressed by providing a buffer tank to regulate flow to the unit processes. The concept for a new type of HES basin (nominally Type-E) is to split the basin into 2 cells as follows:

- Cell 1 – Buffer Cell: This cell acts as a detention storage to temporarily store runoff and slowly release it to the treatment cell at a controlled flowrate. When the buffer cell fills, overflows are discharged via a high-flow weir to a bypass channel

- Cell 2 – Treatment Cell: This cell is essentially a Type-B basin however it is able to be drastically reduced in size compared to a normal Type B basin due to the restricted treatment flowrate delivered to this cell from the buffer cell. The flocculant dosing occurs to the inflow point to the treatment cell and the restricted flowrate allows the dosing system to operate more optimally and in a narrower range of flowrates than would otherwise occur

The conceptual arrangements for the proposed Type-E HES are shown in Figure 3.3 below.

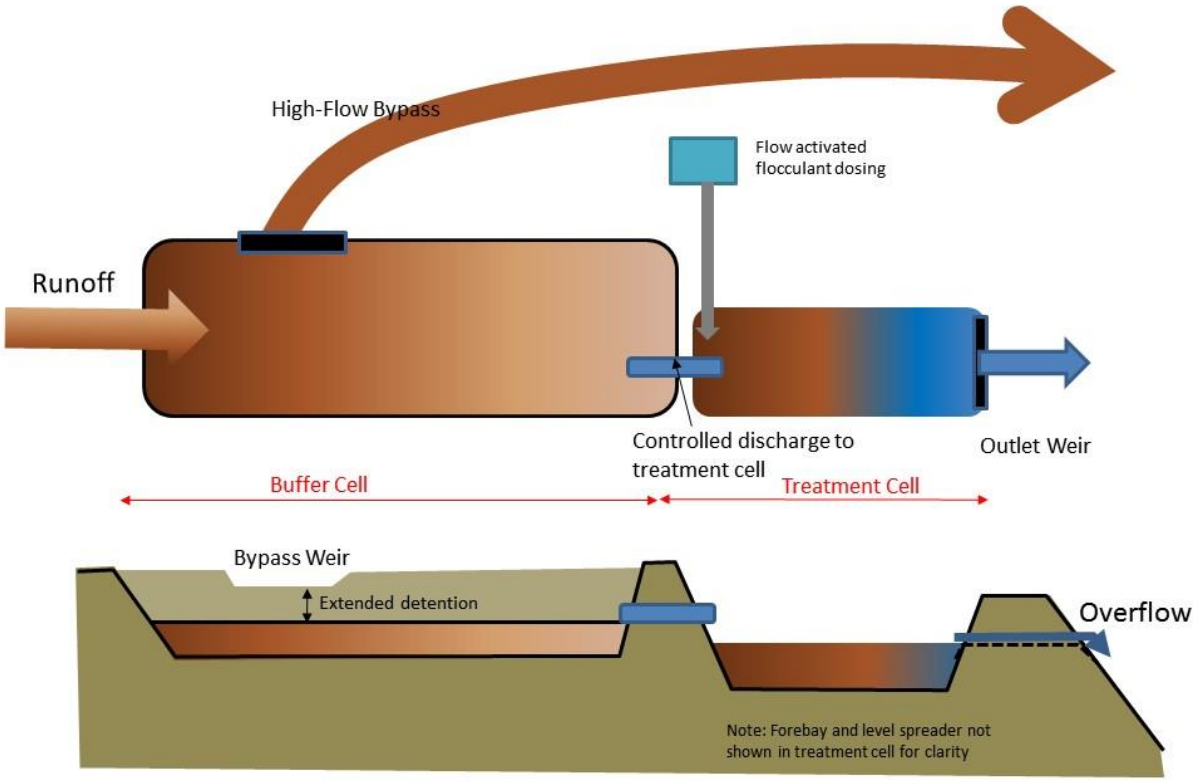


Figure 3.3 – Type-E HES Conceptual Arrangement

The advantages of this arrangement are as follows:

- Flows to the treatment cell are buffered and controlled by the storage cell and hence are a more uniform flowrate which allows the coagulant dosing system to operate optimally;
- High flows (above design flows) can be effectively bypassed around the treatment cell thereby mitigating the risk of potential scour and re-suspension of flocculated sediments in the treatment cell;
- The treatment cell is able to be reduced in size compared to a Type A/B HES system as the storage cell reduces the peak flowrate to the treatment cell and hence the required volume to achieve the nominated residence time is also reduced;
- Construction water is able to be stored (untreated) in the buffer cell by over-excavating this cell below the extended detention level. This means that water that is used for construction purposes is not being unnecessarily treated – saving in flocculant costs
- The smaller size of the treatment cell allows this cell to be cost-effectively lined to prevent groundwater inflows and therefore the cell is not required to be above natural surface levels in high groundwater environments

Design Methodology

In this example, there is a future constructed wetland which is proposed to be bulked-out and used as the buffer cell. A MUSIC model already exists for the design of this future wetland and examination of the pre and post construction contours revealed that this model setup represents the worst-case in terms of catchment extent and imperviousness. The following steps were therefore undertaken to design the HES system:

1. Working backwards from the receiving water level, the extended detention available within the wetland during construction was determined (refer Figure 3.5)
2. The MUSIC model was modified to represent the available extended detention. The weir overflow from the wetland was kept as per the ultimate design but it may have been possible to use a higher level during the construction-phase in order to improve the extended detention storage had it been necessary
3. The MUSIC model was run and a number of orifice outlet sizes were trialled. The node water balance was checked after each run and the iterations were carried out until the water balance showed that 80% of the runoff was conveyed through the primary (orifice) outlet and only 20% over the high-flow weir (i.e. 80% hydrologic effectiveness was achieved)
4. The orifice flowrate when the buffer storage water level is at the top of the extended detention was used as the treatment flowrate passing to the treatment cell
5. The treatment cell was sized following the Type-B procedure documented in IECA (2016 Addendum) except that the treatment flowrate determined in Step (4) was used as the design flowrate rather than the Q_{3month} documented in IECA (2016 Addendum)
6. The resulting treatment cell footprint was compared to the space available to determine if the cell can fit. If inadequate space was available, then options to increase the ephemeral storage in the buffer cell (such as raising the overflow weir) would have been investigated

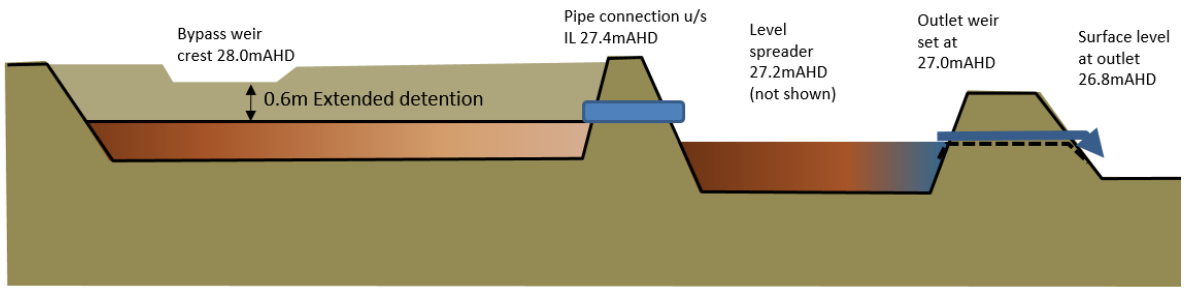


Figure 3.5 – Levels available during construction

Results

The resulting treatment system comprised a 1ha buffer cell (being the ultimate wetland footprint) combined with a 300m2 treatment cell, resulting in an ultimate footprint of 2.6% of catchment area. The concept design of the system is shown in Figure 3.5 below.

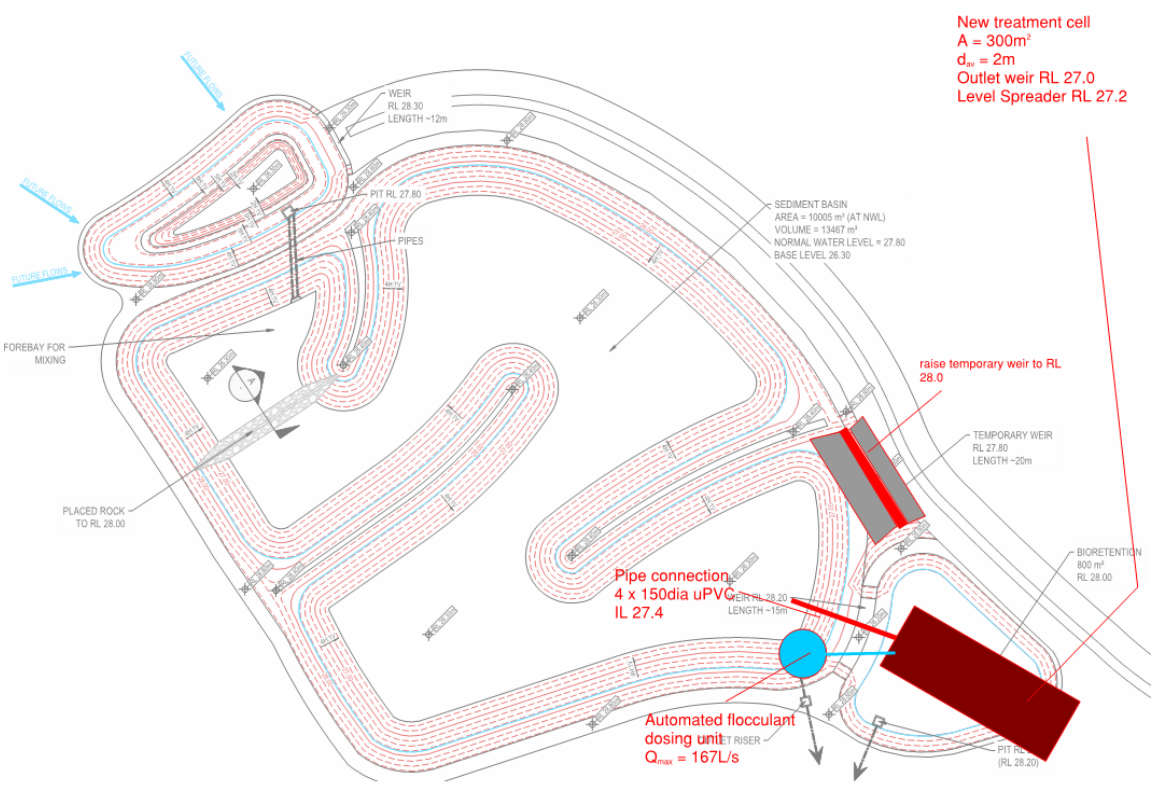


Figure 3.5 – Concept Design – Type E HES

4 Demonstrating Compliance – In the Field

Successful implementation of the new sediment control stormwater management design objectives will require the commitment of all parties undertaking land development, including Developers, Consultants and Contractors. SCC do not intend to take punitive actions on those parties acting in good faith and making genuine effort to adaptively manage their sites to achieve compliance. However, it is important in the interests of creating a level-playing-field that Council does actively regulate sites during this transition period and take action in relation to those sites which are not complying or not actively adapting measures to achieve compliance.

The *Department of Environment and Heritage Protection* has produced *Standard Work Method Statements* which are used by the Department and may be referred to by Local Government in the field to determine if construction sites are meeting environmental obligations under the *Environmental Protection Act 1994*. The Department has updated their Work Method Statement to reflect the new sediment design objective and it is available for download here:
https://www.ehp.qld.gov.au/water/policy/erosion-sediment-control-construction-sites.html#updated_procedural_guides_for_consultation

The DEHP Work Method Statements may be of interest to industry in that it provides a series of questions intended to prompt regulators in terms of scope and performance standards of ESC and potential for unlawful water contamination. On sites regulated by SCC, compliance will be assessed against the development permit conditions, however SCC makes every effort to achieve consistency between the development permit conditions and the Work Method Statements in order to provide consistent requirements for industry under both the *Environmental Protection Act 1994* and *Planning Act 2016*.

Where innovative alternative measures are proposed for achieving the deign objective, then the method of determining compliance in the field should be identified on the ESC plan to provide clarity for all parties. For example, in the case study noted in Section 3.4, all flows through the treatment cell should comply with the release criteria of 50mg/L TSS, while the presence of flows over the bypass weir indicate that the design event has been exceeded and the water quality over this weir is not required to meet the release criteria.

5 Draft Standard Conditions

REC and MCU

> *In conjunction with the development application for Operational Works, provide a concept ESC plan prepared in accordance with the Planning Scheme Policy for Development Works and which specifically identifies how the Construction-Phase stormwater management design objectives of the State Planning Policy 2016 (Appendix 2 Table A) will be achieved*

OPW

Prior to commencement of works

> *A Construction Phase Stormwater Management Program (including Erosion and Sediment Control Plans), a completed Design Certificate for Erosion and Sediment Control and a schedule of registered business names must be provided to Council's delegate in accordance with the requirements of the Planning Scheme Policy for Development Works prior to the onsite prestart meeting and prior to works commencing. The program must additionally contain measures to comply with the Construction-Phase stormwater management design objectives of the State Planning Policy 2016 (Appendix 2 Table A)*

During Construction

> *Information is to be provided and all works undertaken in accordance with the requirements of the Planning Scheme Policy for Development Works (SC6.14.6.5 Protecting waters from the impacts of developments) at all times from when land disturbing activities commence until such time as the site is effectively stabilised. This is to include, but is not limited to, the following specific actions in accordance with the Planning Scheme Policy for Development Works:*
>
> *(a) Inspection certification is to be provided in the form and frequency specified in the Planning Scheme Policy for Development Works*
>
> *(b) All actions are to be taken to avoid and minimise releases, flow and discharges of prescribed water contaminants in accordance with the requirements of the Development Works Planning Scheme Policy;*
>
> *(c) Prior to the sealing of the plan of survey for the subdivision OR prior to the commencement of use, the site is required to be effectively stabilised; and*
>
> *(d) The actions required by the Planning Scheme Policy for Development Works are to be augmented as necessary to ensure the measures implemented confirm to the Construction-Phase stormwater management design objectives of the State Planning Policy 2016 (Appendix 2 Table A)*

> Advice Note: Refer to *SCC Technical Note – Changes to Stormwater*

Management Requirements on Construction Sites for specific advice on how to achieve compliance with the new Construction-Phase stormwater management design objectives of the State Planning Policy 2016 (Appendix 2 Table A)

6 References

International Erosion Control Association (2008) *Best Practice Erosion and Sediment Control*

International Erosion Control Association (2016 Addendum) *Appendix B – Sediment basin design and operation (draft)*

Robson., K. (2015) *An assessment of the performance of current best practice sediment basins vs. high efficiency sediment basins based on modelling and field studies*. Stormwater Queensland Conference. Toowoomba

Rowlands., L. and Leinster., S. (2015) *Sediment basin performance – is it as good as you think and does it really matter?* Stormwater Queensland Conference. Toowoomba