Erosion and Sediment Control Adaptive Management Plan Guidance Document

Report to support preparation of Adaptive Management Plans

RC 3.2.22
July 2020

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Erosion and sediment control
Adaptive Management Plan Discussion Document

Report to support completion of Adaptive Management Plan exemplar

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Executive summary

Excess sedimentation of our waterways is a major environmental issue across Aotearoa/New Zealand. It is a complex issue to resolve as there are multiple sources of sediment, which are difficult to accurately separate and attribute to a single cause. One known potential source is from land-disturbing activities (earthworks) associated with development.

The water quality impact of sediment discharges from earthworks is of concern in Tāmaki Makaurau/Auckland. Auckland Council (council) staff are working proactively to minimise this impact through several initiatives, including the Strategic Approach to Sediment programme and implementation of the National Policy Statement for Freshwater Management (NPS-FM).

In July 2019 council staff were tasked by the then Environment and Community Committee with assessing whether it would be possible to impose a mandatory requirement for an Adaptive Management Plan (AMP) on all consent applications over one hectare[1].

Investigations concluded that the one-hectare threshold was not appropriate. Adaptive management should be the exception not the norm, applying to the most significant scale works or specifically sensitive receiving environments. Adaptive management should not mask what is simply best practice site management that is required to maintain consistency with Auckland Council Guideline Document 2016/005 Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region (GD05) and any other relevant consent conditions. Nor should the AMP become the primary mechanism for implementing and monitoring site management by the contractor and Council.

Most consents granted should be based on a well understood scale of effects and appropriate management systems. An AMP should be based on **additional** measures and for that reason, the requirement for an AMP is recommended to be limited to the most significant and / or long-term earthworks activities.

This document provides guidance to clarify and ensure consistency as to when an AMP process should be followed, based on appropriate risk criteria. Specifically, it provides:

- commentary on opportunities and constraints for the applicability and implementation of AMPs on various sites and locations
- an exemplar AMP, which can be used by applicants as a template for monitoring and managing erosion and sediment control on consented earthworks sites.

It should be read in conjunction with the Land Disturbance Practice and Guidance Note which provides guidance on how the land disturbance provisions within various Auckland Unitary Plan (Operative in Part) (AUP (OP)) chapters are to be applied. Together, these documents should improve the quality of resource consent applications through consistent interpretation and application of the land disturbance provisions of the AUP (OP) and the requirement for additional adaptive management measures where appropriate. In turn, this should improve on site practice and reduce environmental impacts for all scales of earthworks.

[1] Resolution (e) of Environment & Community Committee Resolution ENV/2019/122

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1. Introduction

Chapter J of the Auckland Unitary Plan (AUP (OP)) defines adaptive management as *"a systematic, iterative process of decision making in the face of uncertainty, with an aim of reducing uncertainty over time through system monitoring and changes to management in response to the results of monitoring".* More simply put, adaptive management is a structured process of 'learning by doing'. In a regulatory context, management plans are a useful tool to provide flexibility for both the consent holder and Auckland Council (Council) by providing for matters of detail to be dealt with after the consent application has been granted, particularly for larger and more complex proposals, including regional earthworks.

Adaptive management plans (AMPs) enable the management of a particular activity or effect to evolve and adapt in response to measured data.

Adaptive management only applies to activities after the consenting process has determined, based on the assessment of the proposed activity and management system, that the likely adverse effects will be maintained at an acceptable level. Where that determination is influenced by some uncertainty in the assumed performance of the management system, adaptive management provides a plan-do-check-revise mechanism to ensure the effects are maintained within the assessed envelope.

Adaptive management applies in addition to, and not instead of, basic consent compliance. It is not a proxy for compliance monitoring. In the context of earthworks consented under Chapter E11 (Land disturbance – regional) of the Auckland Unitary Plan (Operative in Part) (AUP (OP)), basic compliance with the approved erosion and sediment control plans is required at all times. Earthworks that do not trigger consent under Chapter E11 are still required to comply with permitted activity standard E11.6.2(2) which requires the implementation of Auckland Council Guideline Document 2016/005 Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region (GD05) as best practice erosion and sediment control (ESC).

The AUP (OP) adopts a best management practice approach to managing the sediment-related effects of earthworks through s9(2) Resource Management Act 1991 (RMA) land use rules and consents[2]. In simple terms this means that adequately minimising off-site effects is achieved by implementing and monitoring the permitted or approved standard of ESC practices on-site, rather than meeting a specific discharge standard. To date, AMPs have been imposed where the level of uncertainty extends beyond the normal assumed relationship between on-site compliance and off-site effects.

2. Application

Achieving compliance with consent conditions and permitted standards, which are all based on GD05 or better, should in most circumstances ensure that adverse effects are adequately minimised. Adaptive management is a back up to that day-to-day compliance to identify where effects exceed the level anticipated by the consent when full compliance is achieved. It provides a process for modification of the ESC methodology to keep the adverse effects within the range anticipated by the consent. If the effects cannot be maintained at that level, the consent should be formally reviewed

[2] The alternative adopted by some other regions is to manage these effects through s15(1) RMA discharge consents.

by the consent authority under s128 of the RMA, or a change of consent sought by the consent holder under s127 of the RMA.

Adaptive management should be the exception not the norm, applying to the most significant scale works or specifically sensitive receiving environments. Most consents granted should be based on a well-understood scale of effects and appropriate management systems. The s92 RMA process allows the consent authority to seek clarification or changes to applications to achieve sufficient certainty on the management of effects, prior to the consent being granted.

It is also important to note that the approach taken to adaptive management of erosion and sediment control on earthworks sites differs somewhat from the traditional adaptive management concept developed under the RMA. The traditional approach is to impose conditions that require the activity to commence on a lesser scale to that for which consent has been sought, and monitor to prove that it can be managed within the predicted envelope of effects before allowing it to expand. As applied to earthworks activities in the Auckland region, consent allows the activity to commence at its full scale, monitor site performance and effects and reduce the scale if effects exceed those predicted.

To date, Auckland Council has imposed conditions on a limited number of more significant earthworks projects to require the development and implementation of AMPs. Those AMPs typically require a range of monitoring based on various triggers, responses to identified effects, and reporting. The council has now sought to provide applicants with an exemplar AMP that can be used as a template by applicants when an AMP is required. This document provides the discussion on the development of the exemplar, which is provided in **Appendix A**.

A significant risk with the adoption of an AMP is that it masks what is simply best practice site management that is required to maintain consistency with GD05 and any other relevant consent conditions, and that the AMP becomes the primary mechanism for implementing and monitoring site management by the contractor and Council. An AMP should be based on additional measures and for that reason, the requirement for an AMP is recommended to be limited to the most significant and / or long-term earthworks activities.

3. Pre-Construction Baseline Monitoring

Pre-construction baseline monitoring of the receiving environment must be completed prior to the earthworks commencing, to confirm pre-construction environmental conditions.

Generally, projects of a scale that is significant enough to warrant the adoption of an AMP should have undertaken an assessment of the receiving environment to support the consent process. The pre-construction baseline monitoring then provides a more detailed understanding of receiving environment characteristics over a range of weather conditions and / or seasons. The details and content of that monitoring will be specific to each site and cannot be easily represented in a template. Rather, those details should be addressed through the consent process and listed as parameters to be included through a consent condition, or a draft AMP that is prepared through the consent process and prior to consent being issued.

For freshwater environments, baseline monitoring sites will depend on the project site location. Where a stream passes a site, upstream and downstream monitoring provides an understanding of the variability of parameters that are influenced by upstream activities and runoff from the site. For sites that do not have any meaningful extent of

upstream channel and flows, the monitoring will establish the baseline of parameters immediately downstream that are influenced by the site.

A pre-construction baseline monitoring methodology should be included in the AMP to indicate the locations of the proposed monitoring sites and the type of monitoring to be undertaken. That methodology should be prepared under the advice of a suitably qualified and experienced freshwater ecology, water quality and earthworks specialists. Typical parameters to be monitored will be:

- turbidity and clarity
- sediment deposition
- channel morphology and substrate composition.

Based on advice received from ecologists when preparing AMPs to date, macroinvertebrate monitoring is likely to be a poor measure of the effects of sediment discharge. MCI scores are already low across many lowland soft substrate streams and as such, macroinvertebrate community present is likely to represent species that are tolerant to higher sediment loads and are unlikely to be sensitive to elevated loads from construction sites. Therefore, a Quantitative Macroinvertebrate Community Index sampling following a rainfall event will likely show a temporary reduction in MCI score but not an enduring impact. Therefore, subject to site specific assessments, MCI monitoring is not recommended as a standard requirement in the AMP template.

Suspended sediment monitoring is also commonly measured, but is subject to the limitations discussed later in this document.

Unless automated monitoring devices are installed for an appropriately representative period prior to construction, pre-construction monitoring will only provide a snapshot of the receiving environment quality, which can be highly variable under natural conditions. If manual grab samples are proposed, then multiple sampling is required across numerous rain events to build up a dataset and overview. For that reason, continuous monitoring of a parameter such as turbidity provides the most reliable reference of the baseline water quality of the receiving environment. That not only provides an opportunity for real-time data acquisition but allows a continuous data record during a range of weather events and receiving environment conditions.

Results obtained through pre-construction monitoring may become invalid if conditions change upstream of the site. For example, if a land use change occurs upstream it may affect the water quality discharging through the stream and thus make the pre-construction monitoring invalid or misrepresent the current catchment conditions.

Receiving environment conditions can change over the course of baseline monitoring, or during construction, sometimes as a result of other earthworks commencing in the catchment. These factors must be identified and considered during all monitoring and reporting.

4. Total Suspended Solids / Turbidity / Clarity

4.1. What are these measures?

The monitoring of baseline and construction phase water quality has typically recorded Total Suspended Solids (TSS), turbidity and / or clarity. The following provides a brief explanation of those parameters and their applicability in an AMP.

TSS is a direct measurement of the amount of suspended sediment in a water sample. It has been required as a baseline and construction monitoring parameter in some construction sites within Auckland and other regions. TSS monitoring is typically required through manual grab sampling taken from the outlet (and sometimes inlet) of sediment retention ponds (SRPs) during discharge, and from streams at a range of flow conditions, including antecedent flows, during and post storm events. In rare cases automated continuous grab sampling has been required from the outlet of SRPs such as in the Ara Tūhono – Pūhoi to Warkworth motorway project.

Turbidity is an index of light scattering by suspended particles and is a measure of water clarity. It is commonly used in monitoring water quality discharging from earthworks sites. In this regard it has been applied as an approximate proxy for the potential amount of sediment that is discharged but it is not representative of that unless calibrated against TSS. Turbidity has been reported to be a better indicator than black disc clarity measurements in the "muddy water" end of the spectrum (when water clarity <0.5m)[3]. Turbidity can be measured on site under a wide range of conditions, as well as in a sample submitted to a laboratory. In the Auckland region, turbidity is measured using hand held and continuous samplers, the latter either recording on a data logger and/or transmitting directly to real-time cloud-based storage. Turbidity can be affected by dissolved contaminants such as tannins leached from peat soils which adversely impact water clarity but do not cause elevated sediment loads.

Clarity is a measure of how far sunlight will penetrate directly into the water column. It is an on-site measure typically undertaken using a black disc or clarity tube. Black disc is typically a 50-80mm diameter disc attached to a 1m long stick with a centimetre scale starting at the disc is lowered vertically into the water to be tested until it disappears, and then is raised until it just reappears. The depth of reappearance is recorded as the clarity of the water. Clarity tube is a tube including a magnetic back disc filled with water from the device or receiving environment. The tube is laid horizontal and the disc is moved down the tube until it disappears and then raised until it re-appears, and the distance is recorded. The biggest limitation to back disc or clarity tube measurement is the ambient light conditions i.e. it is not suitable for very low light or night conditions.

4.2. TSS Limitations

Manual grab sampling will only represent TSS at a point in time. For antecedent conditions, grab samples may be typical of the stream characteristic under those conditions. However, during a storm event, TSS will be highly variable and a single (or small number of samples) has limited applicability to estimating the sediment load carried during the event, either in a stream or in the discharge from a treatment device such as a Sediment Retention Pond (SRP).

This limitation is compounded when taking account of the function of GD05 compliant SRPs. GD05 compliant SRPs comprise floating decants, a primary spillway (upstand pipe) and an emergency spillway (stabilised flow path over the wall of the SRP). Efficiencies progressively drop as each of those discharge components are activated. Emergency spillways are rarely activated and are provided to make sure flows are safely conveyed during very large storms up to the 100 year AEP event. They are not part of the water quality component of the pond. Chemically treated SRPs have been researched and monitored to provide an average sediment retention efficiency of 95%

[3] Horizons Regional Council, Report No: 2007/EXT/806 *Recommended Water Quality Standards for the Manawatu-Wanganui Region: Technical Report to Support Policy Development*

over a range of rainfall events, with small events having the highest efficiency and largest events the lowest, on average. Performance within any given event will be variable, based on a range of factors including:

- intensity and duration of the rainfall event
- antecedent ground conditions – dry ground will soak up more runoff than saturated soils; and the extent of roughness or compaction will influence of the volume of sediment entrained by runoff and carried to the SRP
- the sediment load within the SRP at the time of the event – where a SRP holds accumulated sediment, its efficiency will be compromised to a variable extent. This can occur if consecutive rainfalls prevent desilting between events.

Even when achieving 95% efficiency as an average across a single rainfall event, the TSS within the SRP discharge will be highly variable throughout the event and sampling at some point or points during the event will have limited applicability to determining the sediment load.

Other factors that influence the timing of manual grab sampling are:

- weather and site conditions that may impose health and safety access limitations within the site
- the timing of the rainfall e.g. if it occurs at night
- the predictability of the rainfall – which can occur at short notice or at intensities not predicted before the event
- availability of monitoring personnel.

Automated TSS sampling systems can be implemented within streams and SRPs but are frequently unreliable. Reporting on TSS sampling requires laboratory analysis, typically over a period of 3 – 5 days, and at a cost of approximately $24 per sample. TSS can be calibrated against turbidity to establish a relationship for estimating sediment load. However, variability in soil characteristics across and site and throughout the duration of an earthworks project significantly limits the applicability of such a relationship.

While a comprehensive TSS sampling programme combined with inflow and outflow water volume measurement could provide a sound representation of the total sediment load entering and discharging from a sediment retention device, in practice on a typical earthworks site it is costly and impractical.

4.3. Recommendation

As a result of the limitations of TSS, it is recommended that site monitoring required by an AMP be based on clarity and turbidity. Clarity is a simple measure that can be recorded against a performance standard or trigger. Turbidity can be effectively measured on site using hand-held devices or continuously and monitored remotely.

While still a potentially significant cost in establishing the monitoring equipment on site, continuous automated monitoring provides immediately available data that reflects the variability of turbidity across all rainfall events and or stream conditions. It also provides the opportunity to report and analyse the data in real-time through telemetry and send alert triggers to various devices such as mobile phones.

5. Weather Monitoring

5.1. Rain Forecast

Rain forecasts relevant to the site should be checked daily using online forecasting systems such as MetService and MetVuw. Close monitoring of the rain forecast will be necessary to ensure the appropriate site works can be implemented prior to rainfall events. This is a normal day-to-day site management requirement and is not unique to a site that is implementing an AMP.

As a pre-curser to a likely or possible trigger event, if forecasts indicate >20mm over 24 hours of rainfall, additional pre-rain event inspections should be undertaken by an Erosion and Sediment Control Specialist in conjunction with the contractor. The aim of the inspection will be targeted at additional ESC that are required to be installed to ensure that the site's ESC devices perform effectively.

5.2. Rain Gauges

Where an AMP is required, rainfall intensity and volume must be recorded.

Due to Auckland's variable rainfall and limited number of online Auckland Council weather stations, it is a useful to establish an onsite weather station or rainfall tipping bucket to accurately measure rainfall. For larger sites it is also useful to include a telemetered system that provides email/text notifications of rainfall triggers events.

If the subject site is located within the vicinity of an Auckland Council online rainfall monitoring station (<5km) then this may be used, although these will not provide the opportunity for email/text alerts when rainfall intensities and volumes are to be linked to rainfall monitoring triggers and will not provide the necessary data points to interrogate rainfall against SRP performance and stream water quality.

Additionally, weather stations may measure wind speed and direction. These are useful when managing dust. A rainfall tipping bucket can be linked to other data loggers and telemetry equipment on site.

5.3. Rainfall Response Triggers

AMPs typically include rainfall triggers to initiate specific responses if exceeded, as detailed below. Rainfall trigger levels will need to be established prior to earthworks commencing.

In the Auckland Region the typically accepted key rainfall event triggers driving monitoring are as follows:

- >25mm rainfall over any 24-hour period, and
- >15mm rainfall within an hour,

These triggers represent events that are likely to result in runoff volumes that cause SRPs and decanting earth bunds to 'work hard' i.e. at or about the discharge level of the primary spillway, subject to the various factors that influence device performance in any given rainfall event.

6. Construction Monitoring

For all sites, regardless of size or programme, **ongoing erosion and sediment control construction, monitoring and maintenance** should be continuously undertaken in accordance with GD05. This is **business as usual** monitoring and

maintenance to ensure that adverse sediment effects on the receiving environment, infrastructure and safety are adequately minimised, and consent requirements are met. **It is not part of adaptive management**.

For the purpose of this discussion small to medium sites are considered those of up to 5ha in total area. It is often impractical and unnecessary to require the adoption of an AMP for small to medium sites as the earthworks effects for that scale of activity should be understood with sufficient certainty at the time of consenting.

However, even small sites require a competent level of understanding, design, construction and management to ensure that the erosion and sediment controls are appropriate for the work proposed and operate in accordance with GD05 throughout the duration of the project.

Where the site is located in particularly high-risk or environmentally sensitive areas, additional monitoring and management may be required.

Daily ESC management should be regarded as 'business as usual' and requires the consent holder to design, construct and maintain all erosion and sediment controls in accordance with GD05 as a minimum standard, or as otherwise required by consent conditions. This may also include a detailed ESC management and monitoring plan, as distinct from an AMP.

The site should be regularly inspected during the works and as-built certification should be undertaken for all ESC devices once constructed. The aim of the inspections is to ensure that all ESC devices are installed correctly and then are appropriately maintained to operate effectively.

The inspection regime should keep ESC management at the forefront of works on site. Any potential problems should be identified immediately and remedied as soon as practicable to prevent uncontrolled discharges from the site. A typical 'business as usual' monitoring procedure will include:

- Daily: Remedy any issues with ESC measures that have been noticed during the daily works.
- Weekly: Site walkovers to inspect and maintain all ESC devices. This should be undertaken by the person with key responsibility for erosion and sediment control.
- Pre-rain event: Prior to all forecast rainfall events irrespective of projected intensity, ESC measures should be inspected to ensure that they are fully functional.
- Post-rain event: Following all rainfall events inspections will be made of ESC measures to ensure that all controls have performed as expected, identify and complete any maintenance requirements, and make any modifications to the ESCP that may be necessary.

Monitoring over and above the business as usual requirements is addressed in an AMP, as discussed below.

7. Determining When an AMP is Required

Criteria to determine when an AMP is required / necessary will be discretionary but should include following factors:

- the area of works

- the site location and proximity to receiving environment
- sensitivity of receiving environment
- topography and gradient
- the number of sites and cumulative area of earthworks being undertaken within a catchment at a given time.

As noted above, small to medium sites are those that require ≤5ha of total earthworks. Medium to large sites are considered as those >5ha to 15ha, and large sites >15ha.

Consistent consent and GD05 compliance on most earthworks sites, particularly small sites, are considered to avoid and adequately minimise identified off-site effects Consequently, an AMP may not be necessary to achieve adequate performance on small sites, or indeed many other sites. However, it is considered that medium to large sites are potentially suitable for the adoption of an AMP, subject to specific criteria, while large sites are most likely to be suitable (consistent with current practice). In addition, any application for resource consent would need to be assessed on a case by case basis.

7.1. Medium to large sites (>5ha up to 15ha)

Medium to large sites may be defined as sites that are greater than 5ha in area up to 15ha. Earthworks on these sites would typically be undertaken across 1-2 earthworks seasons and may include work through winter, if approved by Auckland Council.

In addition to the 'business as usual' monitoring outlined above in Section 4.1, these sites may also employ receiving environment monitoring and potentially turbidity monitoring, where possible.

Current turbidity triggers adopted to date for some Auckland sites are:

- a gross exceedance trigger of >50% difference at the downstream monitoring station when compared to the upstream water quality', and / or
- an elevated level trigger of >20% difference at the downstream monitoring station when compared to the upstream water quality.

If the gross exceedance trigger is exceeded in any monitoring, or if the elevated level trigger is exceeded at the 48-hour monitoring then the following occurs:

- Within 24hrs of a threshold breach, an ESC Specialist is required to carry out and record in writing a full audit of the condition of all ESC measures within the earthworks area discharging to the monitored waterway.
- Causes on site that may have contributed to a threshold breach are required to be remedied and recorded as soon as practicable.
- Auckland Council Compliance Monitoring Officer is to be notified by email within one working day of a threshold breach, including providing details of the percentage change in turbidity and any remedial measures taken.
- If the turbidity remains generally elevated above either threshold for more than 48hrs, a visual quantitative survey of baseline monitoring sites is to be undertaken to determine if other receiving environment impacts have occurred, identity what additional assessment may be required, and report to Auckland Council accordingly.

- A Trigger Level Exceedance Report is to be submitted to Auckland Council within 10 working days.

For sites discharging directly to the coast, turbidity monitoring may not be practical. In these locations, visual inspections and responses to rainfall triggers may be more suitable, as discussed later.

Medium to large site may not require this additional AMP monitoring if, for example, the receiving environment is not sensitive, the project is located far enough away from watercourses or the coast, or the land has a low gradient and low risk of elevated sediment discharges. The applicability of the additional monitoring described above should be determined through the consent process.

7.2. Large sites (>15ha)

In addition to the potential turbidity monitoring discussed in section 7.1, specific erosion and sediment control device monitoring may be required for larger sites; nominally those greater than 15ha in size of open area, which are likely to span over multiple earthwork seasons, and where risks to the receiving environment justify this approach.

Rainfall Trigger Responses

For large sites, additional site management responses are typically applied through an AMP. The rainfall triggers adopted in Auckland, usually via on-site telemetered weather stations, are the 15mm/hour or 25mm/24 hours. If one of these events is predicted and / or occur, the following actions have been required:

- Pre forecasted rainfall inspections and maintenance are to be undertaken in accordance with business as usual site management.
- Rainfall Trigger Inspections: As soon as practicable and no longer than 12 hours after the event, inspect all ESC devices and undertake sampling as described below.
- Record and undertake any maintenance undertaken.

Discharge Monitoring

Continuous turbidity monitoring of inlet and outlet water quality has been required in previously developed AMPs for at least one sediment retention pond per stream catchment area or coastal discharge catchment.

This should comprise continuous turbidity monitoring to understand the sediment related water quality entering and discharging from the pond. This provides an understanding of the efficiency of the device through the duration of each rain event. One-off manual sampling alone cannot represent the overall efficiency of the device through a rain event. Acknowledging the current cost of this technology, generally only one or two ponds are monitored per site, with that data used a proxy for the performance of other devices. Event-based manual turbidity and clarity sampling can supplement continuous sampling and provide a broader understanding of discharges form the device.

Continuous monitoring of turbidity provides the most accessible data source for site management. Data collected continuously for stream flows and device inflows and outflows is immediately available online and does not incur any additional cost over the monthly data service fee (see below).

Depending on the sample frequency, automated sediment grab sampling can provide good data on actual sediment concentrations and loads during a storm. However, the samplers are frequently unreliable, and samples require laboratory analysis which incurs delay and cost.

Continuous flow monitoring can also be installed and is beneficial where sediment loading on the receiving environment is required to be calculated and reported on. This is achieved by combining a turbidity sensor or water sampler with a v-notch weir fitted with a pressure transducer or similar equipment at the outlet to measure the discharge from a sediment control device. Where the set-up includes continuous inflow and outflow turbidity measurement, multiple grab samples must be obtained from the site during rainfall events (and tested for turbidity and TSS at an accredited lab) to develop a turbidity/TSS relationship. However, as noted earlier, the variability of soil characteristics across and site and during a project does limit the applicability of such a relationship, unless frequently re-assessed.

Treatment efficiencies of the sediment control devices have been referenced against a 90% efficiency threshold for 2-year 1hr duration event which, for example, equates to 26.1mm of rainfall at sites around Silverdale. When this treatment efficiency is not achieved the actions listed in section 7.1 above should be required.

The treatment efficiency thresholds should also be used to assist in the identification of catchments that are higher risk. If efficiency thresholds are breached, then that sediment control device can be deemed to be 'high risk' for the next rainfall trigger event. Sediment retention devices servicing high risk areas can then be subjected to additional scrutiny during pre-forecast inspections to ensure that repeat breaches do not occur.

Manual Sampling

Manual water sampling (grab sampling) may be required to compare concentration levels discharged from the automated monitoring system to the rest of a site's sediment control devices.

Manual sampling should be analysed for TSS and turbidity at an accredited laboratory. The timing of the sample is important, and should be aligned with a data point from the continuous sampler to maximise its relevance to the continuous data.

Turbidity can also be recorded on-site during the inspection using handheld devices.

All data should be compiled, analysed and reported on to fully understand the ESC efficiency of the site.

8. Reporting

8.1. Freshwater Baseline

Pre-construction monitoring as detailed in Section 2 should be completed with a freshwater baseline report to be provided to Auckland Council.

8.2. Rainfall Triggers

Following a rainfall trigger event, a range of information is obtained including data from continuous monitoring devices, manual water sample test results and notes regarding site performance.

A rainfall trigger event report should contain at a minimum:

- Rainfall intensity (mm/hr), event and daily totals.
- An overview of the data recorded by the instream monitoring devices including data recorded 24hrs and 48hrs after the rainfall trigger event.
- An overview of the data acquired from the continuous monitoring set up on any sediment control devices during the rain event. Sediment control performance is often determined as an average across the rain event.
- Results from any manual water samples that have been tested and a description of how these compare with the continuous monitoring results.
- Identification of any turbidity threshold exceedance.
- If a threshold exceedance occurred, the additional matters listed below.
- Recommendations for the site adaptation.

8.3. Turbidity Thresholds

A Trigger Level Exceedance Report can be produced where an exceedance occurs that is not associated with a rainfall trigger event.

This report will outline what exceedance occurred, the extent of the exceedance, any actions taken to mitigate the effects of the event and a proposed management response if required.

Auckland Council should be notified by email within one working day of any threshold exceedance. A report will be provided within 10 days of the exceedance that includes:

- Rainfall intensity (mm/hr), event and daily totals.
- An overview of the data recorded by the instream monitoring devices including data recorded 24hrs and 48hrs after the rainfall trigger event.
- An overview of the data acquired from the continuous monitoring set up on any sediment control devices during the rain event. Pond performance is often determined as an average across the rain event.
- Results from any manual water samples that have been tested and a description of how these compare with the continuous monitoring results.
- An analysis of the results indicating where, when and why the threshold exceedance(s) occurred and the potential and/or actual effect on the receiving environment.
- Identification of maintenance and management responses/actions that have or will be undertaken to improve site performance.
- Conclusions and any recommendations for the site to improve.

8.4. Clarity Thresholds

Clarity has not been imposed as a performance standard for sediment retention devices. As for other potential discharge standards, doing so would not be consistent with the design and function of sediment retention ponds and decanting earth bunds (refer to Section 4.2 above).

However, Chemical Treatment Management Plans generally include guidance towards achieving 100mm clarity before discharging. GD05 also references this in relation to dewatering (pumping).

When undertaking monitoring of sediment retention ponds and decanting earth bunds, clarity is a simple measure to gain a general understanding of the water quality discharging. It can also be used as a guide to suspend discharges after inflow stops to allow greater settlement before resuming the discharge.

It is possible to establish a relationship between clarity and turbidity on a given site and soil type. This can assist in the utilisation of continuous turbidity data collected on individual devices to understand overall site performance.

8.5. Annual Report

An annual report containing sampling and monitoring results and an assessment of discharge compliance may be required by Auckland Council. This report would contain the following details:

- the results of all monitoring within that period
- a summary of receiving environment effects, including any ecological changes and subsequent ecological response
- a summary of any event trigger levels exceedance that occurred and any subsequent change of the AMP.

9. Management Responses

Management responses/actions should be identified when a trigger event occurs. These responses should not be mistaken for business as usual site management and maintenance.

In some instances, responses will be discussed and agreed with multiple stakeholders to ensure the most appropriate outcomes are achieved. General actions to be undertaken during trigger events are as follows:

- Investigate whether the elevated turbidity has occurred as a result of a natural process or discharge from devices.
- Investigate whether there have been any device failures that could have caused the discharge.
- Ensure all site controls are operating in accordance with approved plans and best practice.
- Determine if the discharge is an isolated case or is likely to be repeated.
- Investigate and implement modifications, which may include:
    - alterations to erosion and sediment control measures and methodologies
    - additional ESC measures
    - refinement of chemical treatment systems
    - progressive stabilisation in sub catchments
    - increase maintenance of controls
    - amendments to methodologies and sequencing of works and refinement of controls necessary
    - reduction of open area limits of earthworks.

If any rain event results in either:

- a high risk SRP not meeting the efficiency trigger, or
- an in-stream trigger (>50% or >20% over 48hours) and an SRP trigger is not met

the default position may be to stabilise some or all the contributing catchment unless the reporting and investigations demonstrate that there are other / better solutions than a catchment shut down, and there is agreement with Auckland Council.

Appendix A: Erosion and Sediment Control Adaptive Management Plan Exemplar

Erosion and Sediment Control Adaptive Management Plan (ESCAMP)

Exemplar

This document is intended to provide the user with an example of the content and level of detail that a suitably prepared Erosion and Sediment Control Adaptive Management Plan (ESCAMP) would be expected to provide. Each site will have different characteristics and requirements, requiring an individual ESCAMP, however not all sites will require the same content – prompts (yellow text) are provided to assist in developing the ESCAMP, and additional guidance is provided in the Erosion and Sediment Control Adaptive Management Plan Discussion Document.

.....	Date:	
	Document No:	
	Revision:	
	Status	Draft

Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
01					Draft

Revision Details

Revision	Details
01	Initial document.

Document Details

Document Name:	Erosion and Sediment Control Monitoring Plan
Status:	
Document No:	
Author:	

Contents

1. Introduction

Chapter J of the Auckland Unitary Plan (AUP(OP)) defines adaptive management as *"a systematic, iterative process of decision making in the face of uncertainty, with an aim of reducing uncertainty over time through system monitoring and changes to management in response to the results of monitoring".* More simply put, adaptive management is a structured process of 'learning by doing'. In a regulatory context, management plans are a useful tool to provide flexibility for both the consent holder and Auckland Council (Council) by providing for matters of detail to be dealt with after the consent application has been granted, particularly for larger and more complex proposals, including regional earthworks.

The Erosion and Sediment Control Adaptive Management Plan (ESCAMP) is a management and monitoring system that will be implemented for the duration of the earthworks period of the [insert project name] (the Project) that will assist the management of sediment related effects where those effects could be greater than those anticipated through the consenting of the Project.

The purpose of this ESCAMP is supplementary to the erosion and sediment control plan (ESCP) prepared for an earthworks site.The ESCAMP does not replace day-to-day Erosion and Sediment Control (ESC) management which is required on all sites in accordance with Auckland Council Guideline Document 2016/005 *Erosion and Sediment Control Guideline for Land Disturbing Activities in the Auckland Region* (GD05) or better if that is required by consent conditions. Nor does it apply to compliance with consented ESC methodologies. It addresses the management of sediment-related effects that may still occur when full compliance with the consent is maintained in order to avoid or minimise adverse effects on the receiving environment[4].

The ESCAMP includes details of processes and procedures that will be followed and confirms how the ESC management, monitoring and reporting will be undertaken. It also includes the methods that will be used during construction to ensure that performances are managed appropriately, that all conditions of consent [insert consent number] are complied with and that adverse environmental effects remain within the range anticipated by the consent. It will provide rapid and real time information and control to the project team to create a continuous feedback loop of the performance of the project ESC site and device management.

Any changes to this document will be agreed upon by all parties involved, involved (including but not limited to Auckland Council's ESC technical specialist and compliance monitoring officer as well as the consent holder's technical specialist and project manager, see Section 2 for further details), with appropriate certification by Council. Any changes to the ESCAMP will remain consistent with the intent of the relevant conditions and achieve the required environmental outcomes.

The ESCAMP covers:

- Site management structures, practices and procedures.
- Baseline Monitoring
- Weather Monitoring
    - Prior to commencement of construction works an automated weather station will be installed onsite.
- ESC Monitoring

[4] As per, Assessment criteria E11.8.2(1)(b), Chapter E11 Land disturbance – Regional, AUP(OP)

- Scheduled site visits, pre, during and post rain event monitoring and water sampling.
- Automated turbidity recording on [insert number] selected Sediment Retention Ponds and rainfall event triggered manual turbidity monitoring.
- Chemical treatment will be monitored in accordance with the Project's Chemical Treatment Management Plan

- Reporting
  - Rainfall trigger event reporting following a rainfall trigger event (as defined in Section 3.1).
  - Recommendations of changes that need to be implemented onsite and modifications to any ESC will also be included.
- Annual Reporting
  - A Monitoring and Maintenance annual report will be completed and issued to Council by the end of June after the completion of each earthworks season. This report will contain all the monitoring results and interpretation of the fluctuations and observations recorded over the previous year, as well as any changes or modifications that are proposed to the ESCMP.

2. Erosion and Sediment Control Plan Implementation

The construction of all erosion and sediment controls will be managed as follows:

- The ESC Technical Specialist will prepare [select - a Site Specific ESC Plan (SSESCP) / the approved ESCP] in conjunction with the [insert role of Project team member who has responsibility for ESC] or nominated person.
- The ESCP will be approved by the [insert role of Project team member who has responsibility for ESC] or nominated person and then submitted to Council for certification against GD05 / consent conditions.
- Once certified, the [insert role of Project team member who has responsibility for ESC] or nominated person will issue an approved ESCP to the earthworks Project staff responsible for the implementation.
- A pre-construction meeting will be held with Council where the sediment controls to be built will be discussed and specific direction given on construction.
- The location of the controls and requirements of the relevant ESCP will be confirmed on site with the construction team.
- The construction of the controls will be overseen by the [insert role of Project team member who has responsibility for ESC] or nominated person.
- Hold points for construction will be established for each control whereby the [insert role of Project team member who has responsibility for ESC] or nominated person will inspect the work completed, for example the installation of anti-seep collars or the installation of primary outlet.
- Each control will be 'as built' certified by the [insert role of Project team member who has responsibility for ESC] to confirm compliance with the ESCP prior to bulk earthworks commencing in the catchment of the device(s).
- Copies of the "as-built" certifications will be submitted to Council.

2.1 Erosion and Sediment Control Inspections

The [insert role of Project team member who has responsibility for ESC] or nominated person will conduct routine (minimum weekly) inspections of the site. These inspections will take place with adequate time allocated and will be thorough and systematic (see section 5.1).

Communication is critical to the successful implementation of ESCPs. Internal inspections will cover all areas of the Project, even those that may have been dormant for some time, to ensure that the controls are still operating properly. These internal inspections will be captured in writing and will include actions and timeframes for close out if the controls are found not to be operating correctly.

3. Receiving Environment Monitoring

3.1 Baseline Monitoring

In some circumstances, establishing an understanding of the typical state of the receiving environment is an important aspect to setting thresholds and response for construction monitoring. The applicability of baseline monitoring varies between sites, and may comprise freshwater or coastal ecological assessments, sediment deposition and water quality at a point in time or variability across a range of climate conditions or events.

Baseline monitoring, if required, should be completed prior to earthworks commencing to confirm pre-construction conditions and to support the consenting process in establishing the acceptability of the project and proposed approach to ESC. Appropriate thresholds can then be derived to be implemented during the construction phase.

Where baseline monitoring has derived thresholds, these should be included here as well as pre-construction baseline monitoring methodologies.

3.1.1 Freshwater

Upstream / Downstream

Where the site discharges to a stream or to land adjacent to a stream, instream turbidity monitoring will be undertaken immediately upstream and downstream of the site to determine the extent that the site works are influencing the stream. Instream monitoring will be undertaken using instream continuous monitoring equipment that will record turbidity (at minimum during a rainfall trigger event). [describe methodology - telemetry (live data - data automatically uploaded to a database) or self-logging (live data not available - data stored within a device and downloaded periodically)].

At a minimum, stream monitoring will be undertaken during rainfall trigger events and be repeated 24 and 48 hours after that exceedance. Instream monitoring responses will be based on the following two triggers:

- a gross exceedance trigger of >50% increase in turbidity at the downstream monitoring station when compared to the upstream site; and
- an elevated exceedance trigger of >20% increase in turbidity at the downstream site when compared to the upstream site.

Downstream

Where there is no upstream extent but the site discharges to a freshwater environment, monitoring is based on visual inspections in response to trigger events, as detailed in Section 7.

3.1.2 Coastal

[Insert content based on the guidance below].

Where the site discharges to a coastal environment, the monitoring will be based on visual inspections and measurements in response to rainfall and turbidity triggers described above, and additional triggers specific to coastal values. These should be described here.

The coastal triggers must be determined by a marine ecologist, and should be based on visual inspections and depth and extent of sedimentation within the vicinity of the discharge point of the site, or of a stream that carries sediment from the site where that stream mouth is close enough to the coast to result in a potential effect on the coast. However, where multiple sites discharge to a stream then it may not be reasonable to attribute coastal effects to a specific site. These matters must be taken into account within the ESCAMP.

Coastal triggers are site specific and it is useful to discuss coastal triggers with the Council during the development of the ESCAMP.

4. Weather Monitoring

4.1 Rain Forecast

Rain forecasts relevant to the site will be checked daily using MetService / MetVuw online forecasting system. Close monitoring of the rain forecast will be necessary to ensure the appropriate site works can be implemented prior to rainfall trigger events.

The daily weather forecast checks will be forwarded to relevant Project staff every morning and will be recorded in the daily prestart job sheets.

If the forecasts show more than 20mm of rainfall over a 24-hour period, then this will trigger the pre-rain event environmental team inspections as outlined in section 5.1 (pre-rain event with forecast >20mm over 24 hours). This is in addition to the routine pre -rain event detailed in section 5.1 below. Note the pre-rain forecast trigger of >20mm over 24 hours is less than the rainfall trigger monitoring (referred to in section 5.1 below) to provide a buffer and to ensure no actual rain event of greater than 25mm is “missed” by the construction team.

4.2 Rain Gauges (Weather Stations)

A telemetered rainfall monitoring station will be installed on site to provide real-time continuous rainfall intensity and volume data which will be able to be observed online by Project personnel. Email and/or text notifications will be programmed to ensure relevant staff, including the [insert role of Project team member who has responsibility for ESC] or nominated person, are alerted when rainfall trigger events occur onsite.

5. Erosion and Sediment Control Device Monitoring

5.1 Site inspections

Routine inspections are undertaken during and post construction of ESC devices. During construction certain stages are identified for inspection, such as during the installation of anti-seep collars, level spreaders, and T-bars.

Post construction monitoring is undertaken once a Sediment Retention Pond (SRP) or Decanting Earth Bund (DEB) is operational and the rainfall activated chemical treatment system is operational for the first time. Monitoring will take place as soon as practicable

following the first rainfall event that generates a discharge. This is to assess the performance of the device and chemical treatment system and the resulting quality of treated water being discharged from the site.

The site will be inspected weekly as a minimum by the [insert role of Project team member who has responsibility for ESC] or nominated person and an ESC Technical Specialist during the course of the works. These inspections will ensure that all ESC devices are installed correctly and then operate effectively throughout the duration of the works. This inspection programme will provide certainty to all parties that appropriate measures are being undertaken to ensure compliance with conditions of consent and the ESCPs. The inspection regime will keep ESC management at the forefront of works on site. Any potential problems will be identified immediately, and remedial works will be promptly carried out.

The inspection programme shall consist of:

Weekly site walkovers involving the environmental team to inspect all ESC measures, identify any maintenance or corrective actions necessary, assign timeframes for completion, and identify any devices that are not performing as anticipated through the ESCP.

Pre-rain event: Prior to all forecast rainfall events, additional inspections will be made of ESC devices, including chemical treatment systems and automated monitoring devices, to ensure that they are fully functioning in preparation for the forecast event. These will be undertaken by the [insert role of Project team member who has responsibility for ESC] or nominated person.

Pre-rain event with forecast > [e.g. 20mm over 24 hours]: Prior to forecast rainfall "trigger" events the site will be inspected by the [insert role of Project team member who has responsibility for ESC] or nominated person. The aim of the inspection will be targeted at any additional ESC measures that are required to be installed to ensure that the sites ESC management system performs effectively during an expected larger event.

Rainfall Trigger Inspections: In addition to the general post rainfall event monitoring, during or immediately after rainfall trigger events additional actions will be undertaken in accordance with Section 7.1 below. The purpose of this response is to confirm the performance of devices under the stress of heavy rainfall, obtain a spot check efficiency of the device and to compare the field results with the results gained from the automated turbidity monitoring stations.

The key rainfall event triggers driving specific device monitoring are as follows:

[Insert the proposed triggers. In the Auckland Region these are typically:

- >25mm rainfall over any 24-hour period; and
- >15mm over any 1-hour period.]

Post-rain event: Following all rainfall events including rainfall trigger events, inspections will be made of all ESC measures to ensure that all controls have performed as expected and to identify any maintenance requirements. Any remedial works will be documented during these monitoring inspections and immediately addressed.

When rainfall triggers are exceeded the following will occur:

- Within 24hrs of a rainfall trigger, carry out and record in writing a full audit of the condition of all ESCs;

- Remedy any causes on site that may have contributed to a device not achieving 90% efficiency as soon as practicable, and record what remedial measures were undertaken;

5.2 Sediment Retention Pond Monitoring

5.2.1 Turbidity Monitoring

Automated Monitoring

Continuous turbidity monitoring will be undertaken at the inlet and outlet of [insert number] SRPs to observe live real time data and formulate decisions based on data obtained throughout the entire rain event. The location of these SRPs will be determined in consultation with Council. The purpose of this automated monitoring is to provide real time and entire event performance indicator of the treatment efficiency of the device for all rainfall events that result in a discharge. This information will inform the overall likely performance of the devices across the site, when used in conjunction with manual turbidity monitoring undertaken during rainfall trigger events.

The inlet sensor will be located upstream of the SRP forebay and chemical application point.

The outlet sensor will be located within the discharge manhole or an alternative location at the discharge point of the SRP.

This data will be accessible online in real-time.

Manual

Manual turbidity monitoring of the inlet and outlet flows of all SRPs will be undertaken during rainfall trigger event site walkovers to provide a snapshot of the ESC performance. Manual turbidity monitoring will be undertaken using a handheld water quality field instrument used to measure both inflow and outflow turbidity of discharging SRPs.

5.2.2 Turbidity Triggers

A treatment efficiency benchmark for the SRPs will be set at an average 90% efficiency (2-year 1hr duration – [insert depth of specific storm for the site in mm]).

5.3 Clarity Monitoring

As well as manual turbidity recording, manual clarity checks will be made at each SRP and DEB, using one of the following procedures:

Black disc

- A 50-80mm diameter is attached to a 1m long stick with a centimetre scale starting at the disc is lowered vertically into the water to be tested until it disappears, and then is raised until it just reappears. The depth of reappearance is recorded as the clarity of the water; or

Clarity Tube

- A clarity tube including a magnetic back disc will be filled with water from the device. The tube will be laid horizontal and disc is moved down the tube until it disappears and the distance is recorded. The disc is then moved back until it reappears and the distance is recorded.

- Readings should be taken in diffuse sunlight or shade. If it is impossible to avoid bright sunlight, work with the tube perpendicular to the sun's plane.
- Readings will not be taken in very low light conditions (insufficient for colour perception)

5.4 pH Monitoring

pH will be recorded at each device receiving chemical treatment, using the following procedure:

1. Ensure that the pH meter has been calibrated and that the calibration has not expired.
2. Use the pond water (or water that is to be discharged) to rinse out a small container then half fill with water from the same source.
3. Immerse the pH meter in the water and leave for up to 1 minute or until the reading stabilises and doesn't change. Place the container in a shaded place (out of direct sunlight) while it stabilises.
4. Record the pH reading given on the meter along with the date, time, and source of the water.

6. Data Interpretation

All data will be compiled to allow for the analysis of device efficiency in relation to rainfall, earthworks area and overall ESC management. This will also inform potential for modification of site ESC practices to better retain sediment within the site, if that is deemed necessary.

7. Management Responses

Management responses / actions will be identified when a trigger event occurs. These responses should not be mistaken for general site management and maintenance that will be ongoing.

In some instances, responses will be discussed and agreed with Council to ensure the most appropriate outcomes are achieved. General actions to be undertaken during trigger events are as follows:

Investigate whether the thresholds have been exceeded as a result of a natural process.

Investigate whether there have been any significant events or failures that could have caused the discharge.

Ensure all site controls are operating in accordance with approved plans and best practice

Determine if the discharge is an isolated case or is likely to be repeated.

Investigate and implement modifications, including:

- Investigate ESC measures to determine whether there has been a discharge from the devices;
- Make alterations to ESC measures and methodologies; (check that a further approval is not required from Council)
- Consider additional ESC;
- Refinement of chemical treatment systems;
- Progressive stabilisation in sub-catchments;
- Increase maintenance of controls;

- Amendments to methodologies and sequencing of works and refinement of controls necessary. (check that a further approval is not required from Council) and
- Reduction of open area limits of earthworks.

7.1 Rainfall Trigger Event Reponses

Whenever a rainfall trigger event occurs (≥ 25mm rainfall over any 24-hour period or ≥15mm over any 1-hour period) the actions listed in Sections 5.2, 5.3 and 5.4 will be undertaken (subject to health and safety restrictions):

Within 24hrs of a rainfall trigger, carry out and record in writing a full audit of the condition of all ESC within the earthworks. All SRPs and DEBs and their catchments will be inspected in accordance with Section 5;

Manual turbidity readings will be recorded at inlet and outlet flows of SRPs and DEBs;

pH will be recorded at the inlet and outlet flows of all chemically treated devices;

Clarity of the water within the device adjacent to the decant outlet will be measured and recorded using a clarity tube or secchi disk;

Remedy any causes on site that may have contributed to a threshold exceedance as soon as practicable, and record what remedial measures were undertaken;

Notify Council by email within 1 working day if any threshold exceedance;

Undertake stream monitoring as per Section 7.3 or coastal monitoring per Section 7.4 as appropriate);

Record an assessment of the success of each remedial work in reducing ongoing sediment discharge; and

Prepare and provide to the Council an Adaptive Management Response Report, within 10 working days.

7.2 Sediment Efficiency Trigger Responses

If an exceedance of the 90% threshold (2-year 1-hour event) is identified through automated rainfall and turbidity monitoring, then the following will occur:

- Within 24hrs of a threshold exceedance, carry out and record in writing a full audit of the condition of all ESC within the earthworks;
- Remedy any causes on site that may have contributed to a threshold exceedance as soon as practicable, and record what remedial measures were undertaken;
- Notify the Council by email within 1 working day of a threshold exceedance;
- Undertake receiving environment monitoring as per Section 7 (as applicable);
- Record an assessment of the success of each remedial work in reducing ongoing sediment discharge; and

- Prepare and provide to the Council an Adaptive Management Response Report within 10 working days.

The treatment efficiency trigger will also be used to identify catchments that are deemed higher risk. If efficiency triggers are breached, then that SRP will be deemed to be 'high risk' for the next rainfall trigger event.

High risk SRPs will be subjected to additional scrutiny during pre-forecast inspections (forecasts of >20mm/24 hrs) to ensure that repeat breaches do not occur.

7.3 Stream Trigger Responses

If the gross exceedance trigger referred to in section 3.1.1 is exceeded in any monitoring, or if the elevated level trigger referred to in section 3.1.1 is exceeded at the 48-hour monitoring then the following will occur:

- Within 24hrs of a threshold breach, an ESC Specialist is to carry out and record in writing a full audit of the condition of all ESCs within the earthworks area discharging to the monitored waterway;
- Remedy any causes on site that may have contributed to a threshold breach as soon as practicable, and record what remedial measures were undertaken;
- Notify the Council by email within one working day of a threshold breach, including providing details of the percentage change in turbidity and any remedial measures taken;
- If the turbidity remains generally elevated above either exceedance trigger for more than 48hrs, then an ecologist is to undertake visual quantitative survey of the downstream environment / baseline monitoring sites to determine what effects have occurred (if any);
- Consult with the Auckland Council Compliance Monitoring Officer, detail what mitigation measures are proposed and the timeframes for implementing these, subject to approval by the Council;
- Implement the mitigation measures approved by Council;
- Prepare and provide to Council a Rainfall Trigger Event Report or Trigger Level Exceedance Report within 10 working days.

7.4 Coastal Trigger Responses

Where effects of concern are identified in the coastal environment [5], the responses on site will be the same as for terrestrial effects. In addition to any refinement of existing treatment measures, measures will include reducing open areas and / or installing additional controls. These potential responses need to be identified in the ESCAMP. Any actual responses that are necessary must be described in the relevant Rainfall Trigger Report.

[5] Effects of concern in the coastal environment will be determined based on the relevant provisions located in the AUP(OP) including those within Chapter B8 Toitū te taiwhenua - Coastal environment and Chapter F Coastal.

Where exceedances of sediment deposition or loss of aquatic organisms are identified then the following will occur:

- Notify Council by email [within 24 hours];
- A marine ecologist is to be called in within 24 hours to review deposition, investigate effects and report in writing;
- Investigate if the loss is a result of sediment discharge or other change in water quality, including an effect not associated with the project;
- Investigate the extent of the ecological effects;
- Where the loss is downstream of the discharge point and appears attributable to the site discharges investigate whether the discharges from the site have been in accordance within anticipated site management (GD05);
- An ESC Specialist is to carry out and record in writing a full audit of the condition of all ESCs within the earthworks area discharging to the [coastal environment] as soon as practicable;
- Remedy any causes on site that may have contributed to a threshold breach as soon as practicable, and record what remedial measures were undertaken, including changes that can be made to the ESC devices and/or to reduce the discharge volume;
- Where the ecologist determines that the adverse effects on the receiving environment are more than minor and not temporary, consult with the Auckland Council Compliance Monitoring Officer, detail what mitigation measures are proposed and the timeframes for implementing these, subject to approval by Council;
- Implement the mitigation measures approved by Council;
- Prepare and provide to the Council an Adaptive Management Response Report within 10 working days.

8. Reporting

8.1 Site Auditing

Daily inspections will be undertaken by the [insert role of Project team member who has responsibility for ESC] or nominated person.

An internal audit will be undertaken by the [insert role of Project team member who has responsibility for ESC] or nominated person at least weekly. Any maintenance actions will be undertaken that day, or at least acknowledged to the Council Compliance Monitoring Officer during their audit.

Actions will be loaded into the Environmental Management system and Work Instructions with details and timeframes will be issued by the [insert role of Project team member who has responsibility for ESC] or nominated person, with specific actions and closeout timeframes.

For programmed Council inspections, the [insert role of Project team member who has responsibility for ESC] or nominated person will accompany the Council Monitoring Officer in all audits. Usually a member of the construction team will also be present.

As for internal audits, all ESC maintenance actions identified by the Council Monitoring Officer will be recorded into the Project ESC recording management system. Instructions with details and timeframes will be issued to the [insert role of Project team member who has responsibility for ESC] or nominated person, based on the Council's instruction. The [insert role of Project team member who has responsibility for ESC] or nominated person will report back the completion of those actions to the Project Manager and the works will be inspected

and confirmed by the [insert role of Project team member who has responsibility for ESC] or nominated person. Confirmation will be emailed to the Council.

8.2 Rainfall Trigger Event Report

Following a rainfall trigger event, a report will be produced that will provide to Council [and key stakeholders if required by consent conditions] a summary of the performance of SRPs, DEBs and overall ESC system observed during the rainfall event. The report will include:

- A summary of the rainfall (total and intensity)
- A summary of the data acquired from the automated turbidity monitors from the [insert number] SRPs.
- A summary of the manual monitoring undertaken and comparison of manual monitoring results with automated results.
- Identification if a threshold exceedance occurred. This will outline what exceedance occurred, the extent of the exceedance, any actions taken to mitigate the effects of the event and a proposed management response if required.
- A record of any other matters which may have compromised the overall ESC performance during the rain event and the identified mitigation, maintenance and management response.

The rainfall trigger event report will be provided to Council and key stakeholders within 10 days of the rainfall trigger event.

8.3 Annual Report

An annual report containing monitoring results and an assessment of discharge compliance will be provided to Council [and key stakeholders if required by consent conditions] by June 30 of each year. This report will contain the following details.

- A summary of the results of all monitoring within that period.
- A summary of any threshold exceedances that occurred and the response actioned.
- Any proposed changes or updates to the ESCMP to be submitted to the Council for certification [in accordance with consent conditions]. Certification from Council must be provided prior to any changes to the ESCAMP being implemented.