

# Appendix B4

## Construction Soil and Water Management Plan

**Project: Keepit Dam Work Package 2 - Post Tensioning Works**

**Location: Keepit Dam, Namoi River, Northern NSW**

**Client: WaterNSW**

**Contract: 04532F31**



# Construction Soil and Water Management Plan

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(for acceptance)

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ACCEPTED:

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# Construction Soil and Water Management Plan

## Abbreviations

Term	Definition
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
CTP	Compliance Tracking Program
DPE	Department of Planning and Environment
EA	Environmental Assessment
EMR	Environmental Management Representative
EMS	Environmental Management System
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPA	Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation 1999</i>
ESCP	Erosion and Sediment Control Plan
EWMS/WMS	Environmental Work Method Statement / Work Method Statement
IBC	Intermediate Bulk Container
NSW	New South Wales
PESCP	Progressive Erosion and Sediment Control Plan
Project, the	Keepit Dam Work Package 2 – Post Tensioning Works
SoC	Statement of Commitments
SRG	SRG Limited
SWMP	Construction Soil and Water Management Plan
WaterNSW	The client

# Construction Soil and Water Management Plan

## 1. Introduction

### 1.1. Context

This Construction Soil and Water Management Plan (SWMP or Plan) is a Sub plan of the Construction Environmental Management Plan (CEMP) for the Keepit Dam Stage 2, Work Package 2 – Post Tensioning Works project (Keepit Dam Post Tensioning Works) (the Project).

This SWMP has been prepared to address the requirements of the *Keepit Dam Upgrade Environmental Assessment* (PB, 2007), the *Keepit Dam Upgrade Submissions Report and Preferred Project Report* (PB, 2008), the resulting Project Approval (06\_0155) issued for upgrade of Keepit Dam, and all applicable legislation.

### 1.2. Background

Keepit Dam is situated on the Namoi River, 13 km upstream of its confluence with the Peel River in the north-west of NSW.

The NSW Dams Safety Committee requires that Keepit Dam be upgraded to be able to safely pass the probable maximum flood and to withstand earthquake events. WaterNSW is therefore undertaking dam safety upgrade works to Keepit Dam to comply with the requirements of the NSW Dams Safety Committee.

WaterNSW has adopted a two stage approach to upgrading Keepit Dam:

- Stage 1 - Construction of two fuse plug spillways – completed in 2011.
- Stage 2 - Electrical relocation, post tensioning of the main dam wall and raising of the dam concrete monoliths and the main embankment.

The Stage 2 works have been procured into three separate contract work packages, these being;

1. Electrical relocation works – completed in 2015.
2. Post tensioning the main dam wall.
3. Raising of the dam concrete monoliths and main embankment.

This Construction Soil and Water Management Plan (SWMP) has been prepared for the Keepit Dam Stage 2, Work Package 2 - Post Tensioning Works project.

### 1.3. Environmental Management System Overview

The overall Environmental Management System for the Project is described in the Construction Environmental Management Plan (CEMP).

The SWMP is part of the SRG Limited (SRG) environmental management framework for the Project, as described in Section 4.1 of the CEMP. Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMSs) or Work Method Statements (WMSs) where relevant.

EWMSs / WMSs will be developed and signed off by environment and management representatives prior to associated works, and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Used together, the CEMP, strategies, procedures and EWMSs / WMSs form management guides that clearly identify required environmental management actions for reference by SRG personnel and contractors.

The review and document control processes for this Plan are described in Section 9 of the CEMP.

# Construction Soil and Water Management Plan

## 2. Purpose and objective

### 2.1. Purpose

This Construction Soil and Water Management Plan describes how SRG will minimise and manage soil and water impacts during construction of the Keepit Dam Stage 2, Work Package 2 – Post Tensioning Works project.

### 2.2. Objectives

The objectives of the SWMP include:

- To describe the measures to be implemented to minimise soil and water quality impacts.
- Ensure appropriate measures are implemented to address the relevant requirements of the Conditions of Approval outlined in Table 3.1 and Statement of Commitments in Table 3-2.
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

# Construction Soil and Water Management Plan

## 3. Environmental Requirements

### 3.1. Legislation

Legislation relevant to soil and water management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act).
- *Environmental Planning and Assessment Regulation 2000*.
- *Protection of the Environment Operations Act 1997* (POEO Act).
- *Water Management Act 2000*.
- *Fisheries Management Act 1994*.
- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.
- *Water Act 1912*.

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in the CEMP.

### 3.2. Guidelines and Standards

The main guidelines, specifications and policy documents relevant to this Plan include:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ 2000).
- *Managing Urban Stormwater: Soils and Construction*. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2.
- Department of Environment and Conservation (DEC): *Bunding & Spill Management, November 1997*.
- Fairfull, S. and Witheridge, G. (2003) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*. NSW Fisheries, Cronulla, 16 pp.
- NSW Fisheries, November 2003. *Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings* (Ref: NSWF – 1181).

### 3.3. Conditions of Approval

The SWMP has been prepared as a requirement of CoA 6.3(d). All Conditions of Approval addressing soil and water management, which are relevant to Stage 2, Package 2 works, are detailed in Table 3-1.

**Table 3-1 Conditions relevant to soil and water management**

CoA No.	Condition	Where addressed
2.14	Except as may be expressly provided by an Environment Protection Licence for the project, the Proponent shall comply with section 120 of the <i>Protection of the Environment Operations Act 1997</i> which prohibits the pollution of waters.	Table 6-1
2.15	Soil and water management controls shall be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters, in accordance with Lancom’s <i>Managing Urban Stormwater: Soils and Conservation</i> .	Table 6-1 Appendix C

## Construction Soil and Water Management Plan

CoA No.	Condition	Where addressed
6.2(c)(iii)	The Proponent shall prepare and implement a <b>Construction Environmental Management Plan</b> to outline environmental management practices and procedures to be followed during construction of the project. The CEMP shall be consistent with <i>Guideline for the Preparation of Environmental Management Plans</i> (DIPNR 2004) and shall include, but not necessarily be limited to:  Measures to monitor and minimise soil erosion and the discharge of sediment and other pollutants to lands and / or waters during construction.	Table 6-1 Section 7.3
6.3	As part of the Construction Environmental Management Plan for the project, required under condition 6.2 of this approval, the Proponent shall prepare and implement the following:	CEMP
(d)	A Water Management Plan to outline measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to lands and / or waters throughout the construction stage of the project.	This document

### 3.4. Statement of Commitments

Statement of Commitments from the Submissions and Preferred Project Report relevant to soil and water quality are detailed in Table 3-2.

**Table 3-2 Statement of Commitments relevant to soil and water quality**

SoC No.	Condition	Where addressed
34.1	A Soil and Water Quality Management Sub Plan will be prepared as part of the CEMP. The Sub Plan will be prepared in consultation with the DECC, Department of Natural Resources and Relevant Councils. The Sub Plan will:	
	a) where relevant, be consistent with the Department of Housing's guideline "Managing Urban Stormwater - Soils and Construction" and the RTA's "Guidelines for the Control of Erosion and Sedimentation in Roadworks";	Table 6-1
	b) identify the Construction activities that could cause soil erosion or discharge sediment or water pollutants from the site;	Section 5, Appendix A
	c) describe management methods to minimise soil erosion or discharge of sediment or water pollutants from the site including:	
	i. a strategy to minimise the area of bare surfaces during construction;	Table 6-1
	ii. placing sediment fences or bunding or other erosion prevention devices between construction work areas and waterbodies to prevent sediment runoff. Sediment fencing at sediment ponds is not required.	Table 6-1
	iii. using a floating silt curtain or other techniques to prevent sediment dispersal for works occurring below the waterline of Lake Keepit;	Not relevant to this stage
	iv. revegetation of disturbed areas following the completion of construction;	Not relevant to this stage
	d) describe the location and capacity of erosion and sediment control measures;	Table 6-1



## Construction Soil and Water Management Plan

SoC No.	Condition	Where addressed
	e) identify the timing and conditions under which Construction stage controls will be decommissioned;	Table 6-1
	f) include contingency plans to be implemented for events such as fuel spills; and	CEMP Section 7
	g) identify how the effectiveness of the sediment and erosion control system will be monitored, reviewed and updated.	Section 7

## Construction Soil and Water Management Plan

### 4. Existing Environment

The overall health of the Namoi River valley was assessed in the Environmental Assessment and it was found that:

- Riparian zones were degraded.
- Dams and river regulation have impacted the physical and biological environments.
- Water quality was poor due to high levels of nutrients, turbidity and salinity.
- Native fisheries were poor with low species diversity and abundance.

Forty-six macroinvertebrate species were recorded, 44 from the Namoi River and 27 from the Peel River.

Nine species of fish were recorded comprising six native and three exotic species. Of the native species, two were threatened. These included:

- The Murray Cod (*Maccullochella peelii*) which is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*; and
- The Silver Perch (*Bidyanus bidyanus*) which is listed as Vulnerable under the *Fisheries Management Act 1994*.

The Murray-Darling Basin population of Eel-Tailed Catfish is also found within the Namoi and Peel Rivers.

The Environmental Assessment found that the potential impacts due to the project may include:

- Reduced water quality due to increased turbidity and nutrient levels.
- Increased turbidity resulting in reduction in aquatic habitat quality.
- Increased sedimentation within watercourses.

These impacts can be effectively managed by management and mitigation measures.

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## 5. Aspects and Impacts

### 5.1. Construction Activities

Key aspects of the Project that could result in adverse impacts to soils and water include:

- Use of plant and equipment.
- Refuelling plant and equipment and maintenance.
- Concrete drilling, cutting and coring.
- Washing down strand anchors.
- Anchor grouting.
- Site mobilisation and disturbance of topsoils and surface materials.
- Flooding.

### 5.2. Impacts

Stage 2, Package 2 involves very limited works which may result in potential erosion and sedimentation issues. The extent of impact will occur predominantly in the site establishment phase and will include stripping of topsoils to enable installation of a concrete slab in the fabrication and storage beds compound. The majority (approximately 60-70%) of this compound is already sealed. Further to this, the collection ponds will require excavation to enable use.

The primary risk will occur through the drilling of vertical holes for cable anchors in the dam wall. The drilling, coring and concrete cutting process will generate wastewaters containing concrete silts and slurry. This may also result in reduced pH of the wastewaters due to the presence of concrete fines. The grouting process, which occurs following installation of the anchors, also has the potential to impact water quality through the release of concrete grout into waterways.

The anchor assembly process in the fabrication yard involves the use of oils and grease which may potentially impact soils and water quality in the event of a spill or from stormwater runoff during a rain event.

Potential impacts include:

- Spilling or leaking of fuels and oils into water courses and onto exposed surfaces.
- Loss of concrete slurry into water courses.
- Loss of concrete grout into water courses.
- Release of oils or grease due to spill or wet weather events.
- Release of hazardous materials into the water during flood events.
- Exposure of soils during establishment of the compound, fabrication bed and collection ponds.

Refer also to the Environmental Risk Assessment included in Appendix C of the CEMP.

Environmental mitigation measures to address and minimise these potential impacts have been detailed within Section 6 of this Plan.



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### 6. Environmental Mitigation Measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EA, Submissions and Preferred Project Report and Conditions of Approval. Specific measures and requirements to address impacts from soil and water are outlined in Table 6-1.

## Construction Soil and Water Management Plan

Table 6-1 Environmental management measures

ID	Environmental Management Measure	When to implement	Responsibility	Reference
SW1	Construction activities are to be undertaken in accordance with the Construction Soil and Water Management Sub Plan.	Construction	SRG's Project Manager / WaterNSW's Project Manager	SoC 34.1
SW2	Training will be provided to all project personnel, including relevant sub-contractors on sound wastewater management and erosion and sediment control practices and the requirements from this plan through inductions, toolboxes and targeted training. The location of wastewater lines and collection ponds is detailed in Appendix B. A concept erosion and sediment control plan is provided in Appendix C.	Construction	Site SQE Representative	Good Practice
SW3	An erosion and sediment control plan will be developed and submitted to the WaterNSW prior to any site disturbance for the construction of the site compound area. As site changes occur, the plan is to be updated progressively.	Construction	Site SQE Representative	Good Practice
SW4	The following Environmental Work Method Statements (EWMSs) or Work Method Statements (WMSs) will be prepared and implemented to manage soil and water impact: <ul style="list-style-type: none"> <li>• Coring and drilling.</li> <li>• Concrete grouting including grout mixing.</li> <li>• Dewatering and management of wastewater basins.</li> <li>• Maintaining and refuelling plant and equipment.</li> </ul> EWMS / WMS for activities identified as having high environmental risk will undergo a period of review with WaterNSW.	Construction	Site SQE Representative	Good Practice
SW5	Except as may be expressly provided by an Environment Protection Licence for the project, section 120 of the <i>Protection of the Environmental Operations Act 1997</i> is to be complied with, which prohibits the pollution of waters.	Construction	SRG's Project Manager / WaterNSW's Project Manager	CoA 2.14
SW6	Soil and water management controls will be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters, in accordance with Landcom's <i>Managing Urban Stormwater: Soils and Conservation</i> . A concept erosion and sediment control plan is provided in Appendix C.	Construction	Project Manager, Site SQE Representative, Superintendent	CoA 2.15



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ID	Environmental Management Measure	When to implement	Responsibility	Reference
SW7	The storage of chemicals, fuels or oils on the dam crest is to be minimised where possible. The crest it to be kept clear of materials that maybe washed or blown into the water.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW8	Designated impervious bunded facilities will be provided for washout of concrete trucks and cleaning and/or maintenance of other vehicles, plant or equipment.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW9	A procedure for the management of wastewaters is provided in Appendix A and will be complied with during delivery of the project. Prior to the commencement of coring, drilling and grouting, an EWMS / WMS will be developed and implemented based on this procedure. The EWMS / WMS will document how work areas are to be sealed off to prevent loss of slurry and the control of slurry disposal and will be toolboxed to relevant personnel prior to commencement of these works.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW10	As outlined in Appendix A, a series of three collection ponds will be installed to collect wastewater produced from project works. The first pond will be used predominantly for settlement of solids. Water will be recycled as much as possible to limit volumes produced. Monitoring of the wastewaters within the final pond will occur on a weekly basis (when full). Monitoring will include in-situ monitoring of pH, turbidity and visible oil and grease.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW11	The collection ponds will be positioned above the 1:100-year tail water flood level and established such that surface water runoff is diverted around them. Prior to forecast heavy rainfall events liquids contained in the ponds will be treated to discharge criteria levels and the volume reduced to the minimum possible.	Construction	Project Manager, Superintendent	Good Practice
SW12	All chemicals and fuels associated with construction will be stored in roofed and bunded areas. Spill kits will be provided at all chemical storage facilities/compound sites.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW13	Prior to accessing the dam wall, drilling equipment will be checked for fuel and oil leaks and fitted with new hoses as appropriate. Equipment identified with leaks will be required to be rectified prior to accessing the dam wall.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW14	Plant and equipment is to be checked daily for leaks and kept well maintained.	Construction	Superintendent	Good Practice



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ID	Environmental Management Measure	When to implement	Responsibility	Reference
SW15	Rainfall forecasts will be monitored daily and the site managed to avoid erosion and sedimentation, and to minimise the impact of heavy rainfall and flood events. In the event of expected flooding through the working spillway all materials are to be removed, the site secured, core/drill holes sealed off to allow water to pass over the top. Further detail is included in the SRG Dam Failure Procedure.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice
SW16	Spill kits will be kept on site and used as required in the event of a spill. Hydrocarbon booms will be stored on the dam wall and readily available to be deployed in the event of a leak discharging to the waterway.	Construction	SRG / WaterNSW	Good Practice
SW17	The surrounding waterways will be visually monitored regularly during the day to ensure that any issues are identified and remedied as early as possible. Hydrocarbon booms will be stored onsite and readily available in the event of a spill either upstream or downstream of the dam wall for the duration of the project.	Construction	Site SQE Representative	Good Practice
SW18	A triple interceptor pit will be installed at the fabrication yard to collect oil and grease that maybe washed from the steel strand. The triple interceptor will be maintained in accordance with manufacturer's requirements and specifications, with collection and disposal of wastes from the triple interceptor undertaken by a licensed waste transport company. Sedimentation will skirt the downslope perimeter of the fabrication yard as a further control.	Construction	Project Manager, Site SQE Representative, Superintendent	Good Practice

# Construction Soil and Water Management Plan

## 7. Compliance Management

### 7.1. Roles and Responsibilities

The organisational structure and overall roles and responsibilities are outlined in the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 4 of this Plan.

### 7.2. Training

All employees and contractors working on site will undergo site induction training relating to air quality management issues. The induction training will address elements related to air quality management including:

- Existence and requirements of this sub-plan.
- Relevant legislation.
- Soil and water quality mitigation and management measures.
- Procedure to be implemented in the event of an incident.

Further details regarding staff induction and training are outlined in Section 5 of the CEMP.

### 7.3. Monitoring and Inspections

Weekly inspections will be undertaken with the inspection form provided in Appendix D of the CEMP completed. Weekly inspections will include inspections of the following:

- The collection ponds;
- The wastewater management system – visual monitoring of any potential leaks or discharges in the pipes;
- Spill kits – ensuring they are being maintained;
- Erosion and sediment controls.

Water quality monitoring of the final discharge pond will occur prior to any required discharge. Waters within the final settlement pond will be required to meet the water quality parameters in Table 7-1 prior to release. Where these criteria cannot be met, waters within the settlement pond will be treated and retested prior to discharge.

**Table 7-1 Water quality parameters**

Parameter	Concentration limit
pH	6.5 – 8.5
Turbidity	<50mg/L (or equivalent NTU)
Oil and grease	None visible

### 7.4. Non-conformances

Non-conformances will be managed in accordance with Section 8.5 of the CEMP.

### 7.5. Audits

Audit requirements are detailed in Section 8 of the CEMP.

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### 8. Review and Improvement of the SWMP

#### 8.1. Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

#### 8.2. SWMP update and amendment

The processes described in Section 8 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

Only the Environmental Site Representative, or delegate, has the authority to change any of the environmental management documentation. In terms of approval of updates or amendments to this Plan, this is to be carried out by the Environmental Management Representative (EMR), with the EMR verifying that the amendments are consistent (or not) with the Project Approval.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 9 of the CEMP.



## **Construction Soil and Water Management Plan**

### **Appendix A – Water Discharge and Collection Procedure**

# Construction Soil and Water Management Plan

## Water Discharge and Collection Procedure

### Introduction

This procedure provides an overview of how SRG intend to manage wastewater produced from the coring, drilling and grouting processes undertaken as part of the project works.

A detailed Environmental Work Method Statement will be prepared for these works, taking relevant requirements from this procedure and subplan and providing it in documents which will be toolboxed to relevant personnel. The Environmental Work Method Statement will provide detail relating to wastewater collection and management of the collection ponds.

All drilling and grouting waste will be managed as described in the following procedure.

### Blockage of drains and scuppers

When working on the dam, SRG will temporarily block drains and scuppers which would divert rainwater, wash-down water and spillages to waterways or lower galleries of the dam.

These areas, whether on the dam wall, spillway crest or in the galleries will be locally dammed up to collect potentially contaminated water prior to diverting it by pump via a pipe to the main system of collection ponds.

### Wastewater discharge and collection

The initial drilling and the re-drilling of the cable anchors will produce at least 1,000 m<sup>3</sup> of bulk solid waste as well as significant volumes of water from drill cuttings, groundwater, hole flushing and water testing.

At all times during anchor hole drilling, coring and associated works, this procedure will be implemented to collect and contain wastewater produced from the Keepit Dam Post Tensioning Works.

The item collecting wastewater will be a pipe (main discharge pipe) laid along the crest level to the left abutment, from where it will turn down the left embankment, under the access road and into the first of three-lined settlement ponds on the southern downstream bank.

For works on the pier anchors, wastewater will initially be directed into a storage vessel located below the drill rig. From there, the wastewater will be pumped into the main discharge pipe installed on the spillway. The main discharge pipe will discharge to the collection ponds. Detail relating to the management of wastewaters within the collection ponds is provided in the 'Collection ponds' section of this procedure.

For coring locations on the dam crest, the waste will be contained by waterproof bunding and wet-vacuumed into intermediate bulk containers (IBCs) or lined skip bins, which will then be directed into the collection ponds. For head block excavation within the upper galleries, each gallery room will be fully bunded and ply hoardings erected to protect existing infrastructure such as electrical boards. Slurry will be collected by wet vacuuming and pumped to an IBC / lined skip bin on the crest.

For coring operations on the spillway ogee, a purpose made waterproof collection reservoir, integral with the access platform will be sealed to the concrete face. The slurry collected will again be wet vacuumed and pumped up to the IBC / lined skip bin for subsequent disposal. Disposal will occur through pumping to the collection ponds or collection by a licensed waste transporter in accordance with the Waste Management Plan.

Drilling operations for non-overflow anchors with head blocks located well below crest level (eg anchors 7-14) will be conducted from the crest level. Waste control will be achieved by bunding the complete area around the hole (ie the whole gallery room) be bunded with waterproof membrane. In addition, the anchor hole will be

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extended by a 380 mm OD steel casing from the gallery floor to the crest level. The cuttings will be captured via the stuffing box and pipe discharge system at crest level and directed into the main wastewater collection network.

Drilling operations for the spillway anchors will be conducted on the spillway ogee, and will have all cuttings and wastewater directed to the crest level via an extension 380 mm OD steel casing, in a manner similar to the above.

Drilling and coring operations for the inclined holes on the spillway piers will incorporate a water tight reservoir platform to catch all waste. The top half of the hole will be cored and the slurry pumped to the IBC / lined skip bin on the crest. A DHH will be fitted to the same rig to drill the lower portion of the holes. In this instance, the drill cuttings will be collected by a steel stuffing box sealed to the concrete wall and pneumatically lifted to a container on the crest for subsequent transfer to the ponds.

### Collection ponds

A series of three collection ponds will be installed on the southern downstream bank. As much as possible, wastewater from the collection ponds will be captured and reused in the construction process.

The ponds will be positioned above the 1:100-year tail water flood level and established such that surface water runoff is diverted around them. Prior to forecast heavy rainfall events liquids contained in the ponds will be treated to discharge criteria levels and the volume reduced to the minimum possible.

The first collection pond will be approximately 1 m deep, concrete lined and of 35 m<sup>3</sup> capacity. It will have sloping sides to allow it to be emptied periodically by a bob-cat loader, which will load the solids onto trucks.

The second and third ponds will be of similar size to Pond 1 and constructed of concrete on natural earth. It will accept discharge from Pond 1 via a connecting gate.

Liquids are then directed to the third pond which will be concrete lined on natural ground.

The actual arrangement for all ponds will be designed to fit into the natural slope of the riverbank with minimal earthworks and will also avoid the removal of trees as far as possible.

In accordance with Section 7.3 of this Plan, water quality monitoring of the final pond will occur prior to discharge. Waters within the final settlement pond will be required to meet the water quality parameters in Table 1 prior to release. Where these criteria cannot be met, waters within the settlement pond will be treated and retested prior to discharge.

**Table 1 Water quality parameters**

Parameter	Concentration limit
pH	6.5 – 8.5
Turbidity	<50mg/L (or equivalent NTU)
Oil and grease	None visible

Release will occur to grassed areas on the southern downstream bank.

Should any oils or greases visibly appear on the surface of the collection ponds, the ponds will be skimmed through the use of absorbent materials available in the spill equipment.

Solid wastes removed from the ponds would be:

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- stockpiled on site for future reuse in a secure location where any runoff would be contained and or managed through appropriate controls. A progressive erosion and sediment control plan would be prepared for these works;
- collected by a licensed waste transporter for disposal and / or reuse at a facility licensed to accept the waste.

Erosion and sediment controls for the collection ponds will be installed in accordance with Appendix C – Erosion and sediment control plan.

The proposed location and arrangement of the collection/settling ponds is as shown on the attached marked up drawing C003 attached.

### Drain interception - monitoring

During anchor hole drilling and/or waterproof grouting operations, there is the possibility that drill holes will intersect with the dam's drainage network, leading to leakage of drill fluids and/or grout into the drains. This situation will be monitored for as set out below:

- The dam has a full-length grouting and drainage gallery located at approx. EL290 and detailed on project drawing 3001521-C375.
- Drainage systems accessible from this gallery include:
  - Vertical 4.5" drains from the upper dam structure along the upstream side
  - 4" to 3" inclined drain holes into the rock foundation along the downstream side
  - A full-length 12" floor trench drain collecting both of the above.
- The inclined foundation drain holes discharge into the trench drain via individual 2" cross-drains under the gallery floor.
- During drilling, each cross-drain discharge point within the monolith being drilled and those monoliths immediately adjacent will be monitored for evidence of drill air and/or water.
- Should air or water be observed, the cap of the affected foundation drain hole(s) will be removed and a standpipe with closed relief valve sealed into the hole.
- Drilling will continue until the hole is completed, after which the relief valve is to be opened and the anchor hole flushed with water until clean water emerges from the foundation drain hole(s).
- The relief valve is then to be closed for water testing of the anchor hole.
- Similar monitoring will be done during all waterproof grouting, looking for evidence of grout discharging from the foundation drain holes.
- During waterproof grouting, the relief valve in any installed foundation drain hole standpipe(s) will be set open.

Should grout be observed discharging from a standpipe, its relief valve will remain open until grout of equal consistency to that being injected into the anchor hole is seen to discharge from the standpipe. The relief valve will then be closed and the anchor hole grouting completed.

# Construction Soil and Water Management Plan

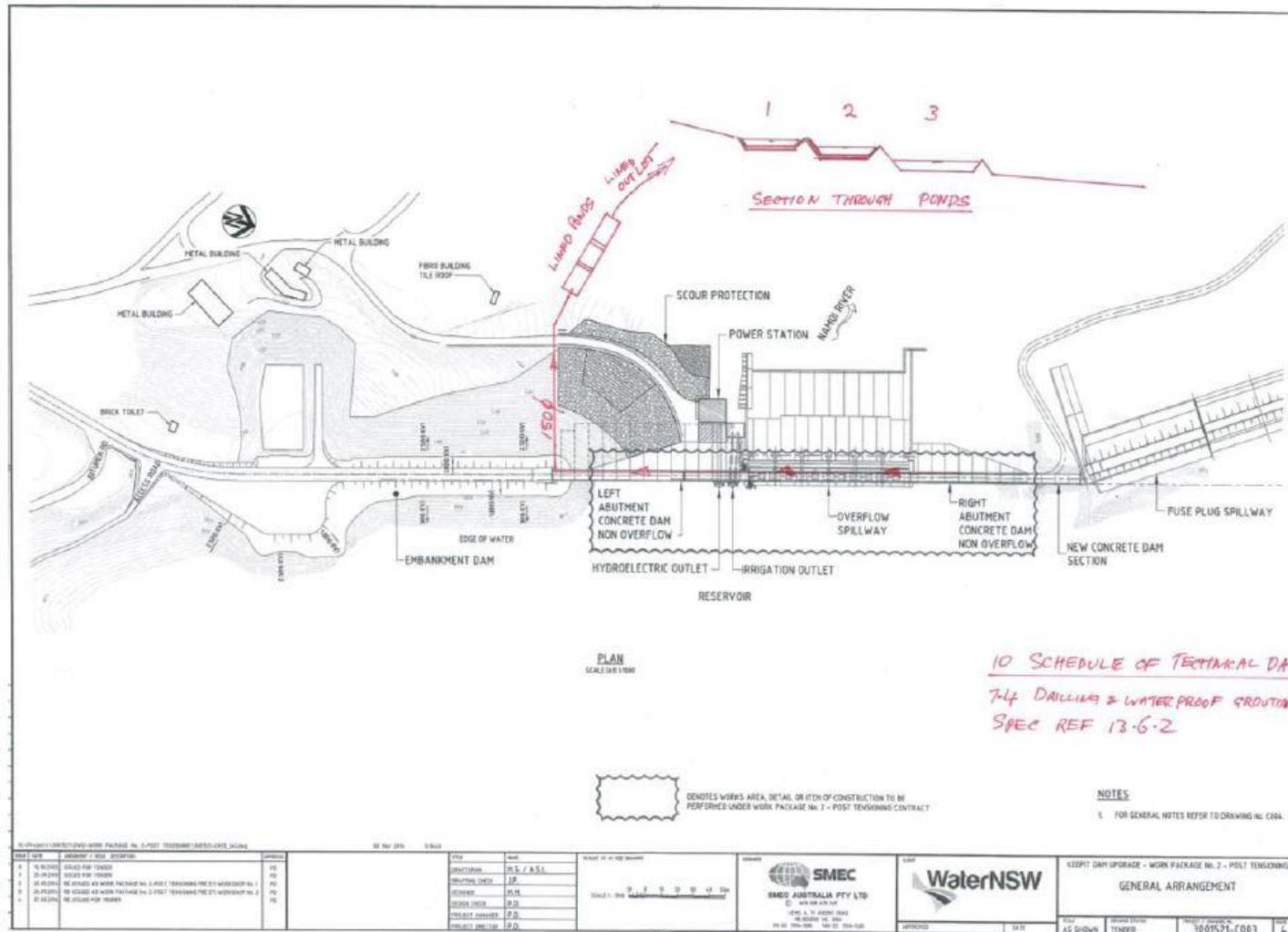


Figure A-1 Drawing C003 - Collection ponds



## **Construction Soil and Water Management Plan**

**Appendix B – Wastewater lines and collection ponds**

# Construction Soil and Water Management Plan





## Construction Soil and Water Management Plan

Figure B-1 Wastewater lines and collection ponds



# Construction Soil and Water Management Plan

**Appendix C – Concept Erosion and Sediment Control Plan**

# Construction Soil and Water Management Plan

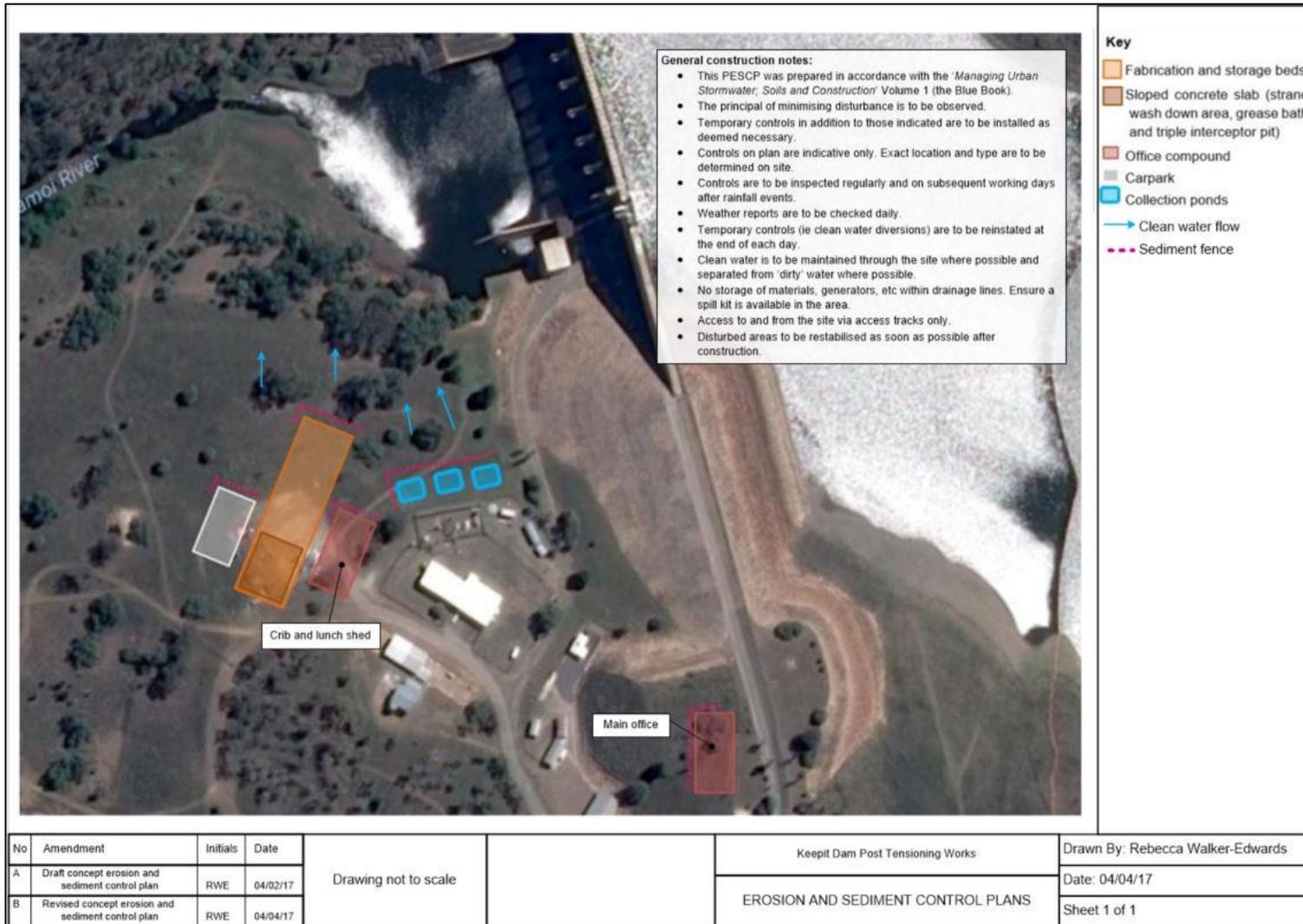


Figure C-1 Concept erosion and sediment control plan. \*Sediment fence around collection ponds was not required.