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ENVIRONMENT
& HEALTH

Department of Planning, Industry and Environment
4 Parramatta Square
12 Darcy Street
Parramatta NSW 2150
Attention: Sheelagh Laguna
Email: sheelagh.laguna@planning.nsw.gov.au

Dear Sheelagh,

Date 30/07/2021

Hydro Kurri Kurri Aluminium Smelter Remediation-Mod-1 (SSD-6666-Mod-1): Additional Information

The purpose of this letter is to provide Hydro Aluminium Kurri Kurri Pty Ltd's (Hydro's) response to the following:

- The additional issues from the Department of Planning, Industry and Environment (the department) posted on the Project Portal dated 8 July 2021
- The issues from the department's Biodiversity and Conservation Division (BCD), Water Group and Hazards Group
- The issues from the Environment Protection Authority (EPA)

Table 1 lists these issues and how they are addressed. A revised version of the Modification Description (section 3 of the Statement of Environmental Effects) has also been provided.

We trust that these responses address these issues. Please feel free to give me a call to discuss.

Yours sincerely

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Table 1: Response to Agency Comments on SSD 6666 Modification 1

Agency Comments	Hydro Response
Department of Planning, Industry and Environment	
Diagrammatic representation of the proposed infrastructure (understood to be the revised Figure 3.2)	As noted by the Department, the revised Figure 3.2 shows the locations of the proposed Temporary Water Treatment Plant (TWTP) and associated infrastructure. This revised figure is attached.
The time period for operation of the TWTP infrastructure (both maximum and expected duration)	Attachment 1 is a revised version of Section 3 (Modification Description) from the Statement of Environmental Effects (SEE). This has been revised to address this and other relevant comments below. Section 3.6.4 of the Modification Description has been revised to describe the duration of the TWTP operation.
A direct comparison between the proposed and original approved infrastructure, noting the leachate ponds approved under SSD 6666	Attachment 2 shows the location of the TWTP infrastructure as approved under SSD 6666, and those proposed by Modification 1. The proposed location of the Containment Cell Leachate Pond and the Leachate Holding Pond are consistent with the locations shown in Appendix 1 of the development consent for SSD 6666. The proposed location of the TWTP is approximately 110 m to the east of the conceptual location shown in Appendix 1 of the development consent for SSD 6666.
Details of the route of the pipeline between the Containment Cell leachate pond and the TWTP, including how it would interact with and impact the Hunter Power Project site buffer lands and the remediation haul road	The revised Figure 3.2 shows the pipeline route. Attachment 2 (previously submitted to the Department) also shows the pipeline route and its relationship to the property (Lot 1) that would contain the Hunter Power Project. Section 3.5.2.2 of the Modification Description has been revised to describe how the pipeline would interact with the Hunter Power Project site buffer lands and the remediation haul road.

Agency Comments	Hydro Response
Details of safeguards for the pipeline along its route and access arrangements for monitoring the pipeline for leaks, including under Hart Road, for the duration of operation of the TWTP	Section 3.5.2.2 of the Modification Description in the submitted SEE described the safeguards for the pipeline and monitoring. Section 3.5.2.2 of the revised Modification Description has been revised to confirm that Hydro would retain access to the section of the pipeline that Hunter Power Project site buffer lands to undertake monitoring of the pipeline. Monitoring of the quantity of leachate discharged from the Containment Cell Leachate Pond to the Leachate Holding Pond would allow confirmation that there are no leaks, or assist in identifying if any leaks were present but not visible.
Update the relevant impact assessments, including mitigation measures, demonstrating clearly that the modification would have minimal environmental impact	No changes to the impact assessment or proposed mitigation measures nominated in the SEE are required for the modification to present a minimal environmental impact.
Department of Planning, Industry and Environment (Biodiversity and Conservation Division)	
The proposed transfer pipe crosses the proposed location of another major project. An updated route should be identified and assessed for impacts	The pipeline route remains within the approved Project footprint, and immediately adjacent to the Containment Cell haul road that is an inherent component of the approved Project. It is acknowledged that the haul road and pipeline routes cross the State Significant Infrastructure project - Hunter Power Project (Kurri Kurri Power Station) (SSI-12590060). Under a contractual agreement between Hydro and the future landowner (McCloy Group) this area would be dedicated for the duration of the Hydro Remediation Project for the remediation activities (including the haul road and the leachate transfer pipeline). Refer to the revised Figure 3.2 and Section 3.5.2.2 of the revised Modification Description regarding the pipeline route and its management where it crosses the proposed Hunter Power Project site.
The feasibility of off-site transfer of leachate when significant rainfall is predicted is not clear. Details on how significant rainfall would be predicted, how site and transport operations would be informed of this and how this operation would be managed should be provided. The definition of significant rainfall should be based on the storage capacity of the on-site storage systems.	Off site transfer of leachate for treatment forms part of the approved project, and there are no restrictions under the development consent on when such transfers can occur (such as weather conditions). However, Section 3.8 of the revised Modification Description has been revised to describe the conditions when leachate would be transported for off site treatment.

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Agency Comments	Hydro Response
Environment Protection Authority	
Additional information is required on the following: • A contemporary characterisation of the influent leachate quality (including the Capped Waste Stockpile, Containment Cell and Dickson Road South) and existing water in the North Dam for all pollutants likely to be present at non-trivial levels.	• Following discussions with the Remediation Contractor, Daracon, it has been concluded that leachate from Dickson Road South would be pumped out to a collection truck and taken for off site treatment. • Six samples have been collected and analysed from the North Dam and for TRH/BTEX/PAH and metals. This information is combined with the routine sampling of North Dams for PFAS, pH, EC, Fluoride and Cyanide and presented as an assessment of water quality conditions prior to receival of treated leachate as **Attachment 1** to this letter. Section 3.6.2.1 of the SEE presents the target values for the North East Dam. The SEE presents information of the pollutants that our assessment of the contaminants of concern concluded could be present at non-trivial levels. We have no evidence that shows any other pollutants could be present at non-trivial levels. • Eleven samples of the Capped Waste Stockpile leachate were collected and sampled on two occasions: in 2015 (to inform the Containment Cell Detailed Design) and 2019 (to inform the TWTP design). Section 3.1.1.1 of the SEE presents this data. A further four samples from four existing groundwater wells in the stockpile have now been collected and analysed in response to the EPA concerns. • The data indicates concentrations within the stockpile are variable between locations and over time. The landfill was capped in 1995 and has remained in a capped state since that time. Prior to 1995 the landfill was an open stockpile since creation in the 1970s. Whilst further sampling could be completed of the landfill this is unlikely to reduce the uncertainty in the concentrations expected to require treatment. The likely greatest impact on the concentrations present will occur once the stockpile is open and subject to rainfall. The stockpile does not generate leachate and leachate is derived from the runoff of rainfall on the waste surface. Furthermore, the concentrations in the actual leachate that will be treated are expected to be variable and depend on several factors including the waste types exposed during a rain event and the dilution effect of the rain event. It is expected that the average concentrations of the leachate collected from the Containment Cell and the uncapped Capped

Agency Comments	Hydro Response

	Waste Stockpile would be lower due to dilution from rainfall and comparatively short contact time of surface water with the waste materials.
	• Leachate from the Containment Cell would be consistent with that collected from the Capped Waste Stockpile, except for the following:
	  • The potential for pollutant concentrations to be diluted due to rainfall and stormwater collected within the cell
	  • Gypsum will be added to the material placed in the cell. This would reduce the fluoride levels in the leachate
	The current characterisation of leachate within the Capped Waste Stockpile, comprising all available data is present in **Attachment 2**.
	
	The TWTP is designed to accommodate a range of input characteristics and further sampling of leachate will change the WTP design. Sufficient information is available for the waste nature and the leachate characteristics to inform the types of contaminants requiring treatment design. We therefore conclude that contemporary characterisation of the influent leachate quality would not result in any changes to the TWTP design or its ability to effectively treat the leachate.

• The expected effluent quality from the Water Treatment Plant for all pollutants present at non-trivial levels within the influent	The TWTP discharge is batch based and water will be tested prior to release. Where water quality is not met, water will be either re-treated or taken off site by a licensed waste contractor for disposal. EPS has undertaken treatment trials of leachate collected from the Capped Waste Stockpile in 2020. We note that Section 3.6.2 of the SEE presents the treated leachate target values, and did not present the results of the trials undertaken by EPS in July 2019. **Attachment 5** presents the laboratory analysis results for non-trivial pollutants. It also presents the correlation between calcium levels (through the addition of CaCl2 flakes in the treatment process) and fluoride levels. This shows the discharge from the TWTP would be consistent with the water within the North East Dam. The following should be noted: • Gypsum would be added to the material placed in the Containment Cell. As such the fluoride levels in Containment Cell leachate would be much lower than that used for the treatment trial

Agency Comments	Hydro Response
	• One of the objectives of the treatment trial was to determine the amount of $CaCl_2$ flakes to use in the treatment process so as to reduce fluoride to the required levels. As a result the maximum calcium level correlated with the lowest fluoride level, and the minimum calcium correlates with the maximum fluoride level. These results will be used in the operation of the TWTP so the required quantity of $CaCl_2$ flakes is added.
• The expected combined water quality in the Northern Dam (including the treated effluent and the untreated Dickson Road perched aquifer) under a range of operational and climatic scenarios (e.g. wet weather, dry weather)	As previously noted the discharge quality from the TWTP would be consistent with the water quality in the North East Dam. During wet weather conditions: • Water within the North East Dam would be diluted by rainfall in the North East Dam and the catchment • Pollutant levels in the leachate from the Containment Cell and Capped Waste Stockpile going to the TWTP would also likely be diluted. During dry weather conditions the propriety for water would be its use for dust suppression within the Project site. Discharges to the irrigation area would occur during dry weather but only when the North East Dam is at 85% capacity and so has been diluted by rainfall during a preceding wet weather event. An uncontrolled discharge from the North East Dam would only occur in conditions equivalent to a 20% AEP event. During such events the water in the North East Dam, and the receiving waters, would be diluted.
• A contemporary characterisation of the downstream receiving environments	As noted in the SEE Hydro has undertaken surface water monitoring downstream of the Smelter for more than 25 years. As such we have a good understanding of the key pollutants from the Smelter and that would be present in any discharge from the North East Dam. Occasional sampling has also been completed for specific investigation purpose as part of the site investigation program. This data has been collated as **Attachment 3**. It must be noted that leachate from the Capped Waste Stockpile has been discharging to groundwater (and ultimately downstream surface water) since the 1970's. These discharges, and an assessment of the potential ecological and human health impacts, was reported to the EPA as required under the *Contaminated Land Management Act 1997*. The EPA concluded that the leachate did not have a detrimental effect on the receiving environment.

Agency Comments	Hydro Response
	The treated water from the TWTP and discharges from the North East Dam would have pollutant concentrations significantly lower than the untreated leachate that the EPA concluded was not having a detrimental effect on the receiving environment. We do propose, however, to undertake a baseline monitoring round prior to operation of the TWTP that includes the pollutants with nominated treated leachate target values.
• An updated water balance for the North Dam that	
• includes all water sources	The Stormwater Management Report (provided as Appendix 13 to the Response to Submissions and attached to this response) includes all the water sources for the North Dam. This includes leachate generated at the Containment Cell and treated on site prior to discharge to the existing water management system. The PCB report states that the Containment Cell leachate treatment adds up to 3% of inflow to the catchment of the North Dams which is minor. The quantity of leachate collected from the Capped Waste Stockpile for treatment prior to discharge to the existing water management system would have been captured by this existing water balance. This water would have been rainwater that fell on the capping and then draining to the existing water management system. Therefore it is concluded that the existing wate balance reflects what would occur with operation of the TWTP.
• the frequency and volume of controlled discharges via irrigation and dust suppression under a range of climatic scenarios	As noted above the water balance is expected to be unchanged from that in the approved project. As such the frequency and volume of controlled discharges via irrigation and dust suppression would be consistent with that for the approved project. Irrigation would also continue to be undertaken in accordance with Hydro's EPL.
• assesses the frequency and volume of uncontrolled discharges to receiving waters under a range of climatic scenarios	As noted above the water balance is expected to be unchanged from that in the approved project. As such the frequency and volume of uncontrolled discharges would be consistent with that for the approved project. Irrigation would also continue to be undertaken in accordance with Hydro's EPL.

Agency Comments	Hydro Response
• demonstrates that the North Dam is sized commensurate with the risk to the downstream receiving waters	As noted above the water balance is expected to be unchanged from that in the approved project. As such the risk to downstream receiving waters would be consistent with that for the approved project (which is a low to minimal risk). Irrigation would also continue to be undertaken in accordance with Hydro's EPL.
• An assessment of the potential impacts of continued irrigation including a characterisation of the expected irrigation water quality and sustainability of ongoing irrigation consistent with the relevant guidelines e.g. Environmental Guidelines: Use of Effluent by Irrigation (NSW DEC 2004), noting that irrigation has occurred for over 25 years	Irrigation has occurred for more than 30 years and no adverse impacts have been identified during this time. It is expected that use of the irrigation area would only continue for approximately another two years (through to completion of the remediation activities at the Smelter). As previously noted the water quality in the North East Dam would continue to be consistent with, or better than, the quality that has been previously irrigated. Hydro will continue to use the irrigation area in accordance with its EPL. Therefore Hydro concludes that there would be no adverse impacts from the continuation of irrigation. Soil quality data collected for site investigation purpose in the irrigation area is presented as **Attachment 4**.
• If the water balance indicates that uncontrolled discharges occur from the North Dam, an assessment of the potential impact to the downstream environment with reference to the appropriate guidelines, including the Australian & New Zealand Guidelines for Fresh and Marine Water Quality (ANZG (2018))	As noted above the TWTP treated effluent will be of a quality consistent with that in the North East Dam. The current water quality in the North East Dam is consistent with, or improved from, that shown by the water quality results collected from the North East Dam over more than 25 years. Given that any discharge from the North East Dam would only occur during rain events, the North East Dam discharge water quality will be further improved through dilution.

Agency Comments	Hydro Response
• A soil, surface and groundwater monitoring program that assesses controlled (via irrigation) and where applicable, uncontrolled overflows from the North Dam	As noted in our letter dated 8 April 2021 Hydro currently monitors and reports the water quality of the receiving environment in accordance with the Soil and Water Management Plan. This monitoring is proposed to continue throughout the construction program. As there are no additional impacts predicted from the discharge of treated water from the TWTP to the North East Dam the existing monitoring program, which has not identified any impacts from the historical use of the irrigation area, is considered an appropriate monitoring program for the proposal. As noted above we propose, however, to undertake a baseline monitoring round prior to operation of the TWTP that includes the pollutants with nominated treated leachate target values. Monitoring of batch discharge prior to release to the North East Dam will form part of the TWTP operation. Monitoring of EC, pH and Fluoride in the North East Dam will continue monthly in accordance with the current program.
• Identifies the practical measures that will be taken to prevent, control or mitigate pollution, including contingencies that will be implemented	The key measures to be implemented to prevent, control or mitigate pollution (as described in the SEE) are: • Implementation of the Remediation Works Environmental Management Plan as described in Section 3.2 of the revised Modification Description • The TWTP system construction methodology described in Section 3.5.2 of the revised Modification Description • The TWTP testing and commissioning process described in Section 3.5.3 of the revised Modification Description • The treated leachate testing, and re-treatment if required, prior to discharge described in Section 3.6.2 of the revised Modification Description • Continuation of the North East Dam and downstream surface water monitoring program discharge described in Section 3.6.2 of the revised Modification Description The leachate storage safeguards described in Section 3.6.3 of the revised Modification Description

Agency Comments	Hydro Response
Department of Planning, Industry and Environment (Hazards Group)	
It is requested that the Applicant to verify the quantities of dangerous goods to be stored for the proposed modification. If SEPP 33 is triggered, it is advised to prepare a Preliminary Hazard Analysis (PHA) be submitted in accordance with Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' and 'Multi-Level Risk Assessment'	The proposed operator of the TWTP, Enviropacific Services (EPS) has confirmed that the following chemicals would be used in the treatment process (along with the maximum quantities to be stored at one time): • Polymers – A makeup system will be installed to automatically make up polymer solution from a powder/emulsion concentrate. The maximum amount of made up polymer in the system at one time will be 1,000L • Coagulant (C_aCl_2) – 2,000kg of 74% CaCl2 flake • Hydrochloric acid – 3,000L • Potassium peroxymonosulfate • Sodium hydroxide These quantities do not trigger the relevant quantities in Table 3 (General Screening Threshold Quantities) of Applying SEPP 33, and therefore does not require a Preliminary Hazard Analysis. As noted in Section 3.1.6.1 of the revised Modification Description the chemicals would be stored in self-bunded intermediate bulk containers (IBC) and located within the bunding for the TWTP.

Agency Comments	Hydro Response
Department of Planning, Industry and Environment (Water Group) and Natural Resources Access Regulator	
The (leachate) pipeline is proposed to cross a second order watercourse. The proponent must provide the location of the crossing or confirmation that it will be on top of the existing culvert. If it will be through the watercourse, the proponent must provide details for method of crossing.	Figure 3.2 shows the proposed route of the pipeline, including its crossing of the unnamed watercourse. As noted in Section 3.5.2.2 the transfer pipe would be constructed of 100 mm internal diameter HDPE piping and would be butt welded and surface laid. Where the pipeline is required to cross an access road (the north-south road) the pipeline would be trenched and backfilled into the road pavement to provide uninterrupted access for road users. The pipeline would be installed at minimum of 600mm below the road surface and backfilled with dust or similar product to provide additional protection over the pipe. Where the pipe traverses the unnamed watercourse, it would be double skinned: the 125mm external diameter pipe would be placed within a 160mm HDPE pipe for an approximate length of 20 metres. It would cross the unnamed watercourse on the edge of the road crossing and not through the floor of the unnamed watercourse. The pipeline route would be clearly delineated and sign posted. It would be located outside of the signage and flagged star pickets that delineates the access road and: • A minimum of one metre to two metres from the delineated northern edge of the haul road between the Capped Waste Stockpile and the Containment Cell access road • A minimum off 600mm to 850mm from the delineated northern edge of the Containment Cell access road.

3. MODIFICATION DESCRIPTION

3.1 Overview

The development consent for SSD 6666 included the following elements of the leachate management system:

- A 1 ML leachate storage basin near the Containment Cell (the Containment Cell Leachate Pond)
- A 1 ML leachate storage basin near the TWTP (the Leachate Holding Pond)
- Collection of leachate from the ponds for off site treatment.

The location of the Containment Cell Leachate Pond and the Leachate Holding Pond are consistent with the locations shown on Figure 25A in Appendix 25 of the RtS and Appendix 1 of the development consent for SSD 6666.

The Modification is comprised of the following activities:

- Construction of:
  - A pipeline connecting the Containment Cell Leachate Pond to the Leachate Holding Pond
  - An onsite TWTP drawing leachate from the Leachate Holding Pond
  - Associated pipelines and infrastructure
- Operation and ongoing maintenance of the TWTS
- Discharge of treated leachate to the existing Smelter water management system
- Decommissioning of the TWTS.

The key components of the Modification are shown on **Figure 3-2**.

The proposed location of the TWTP is approximately 110 m to the east of the conceptual location shown in the RtS figure and Appendix 1 of the development consent for SSD 6666.

The TWTS has been designed to manage all the leachate expected to be generated during the Project. Offsite treatment of leachate (as described in the RtS) could still occur if required where volumes may exceed the capacity of the onsite TWTP, such as following or during heavy rain events.

3.1.1 Leachate characteristics

3.1.1.1 Quality

Eleven samples of the Capped Waste Stockpile leachate have been collected and sampled on two occasions: in 2015 (to inform the Containment Cell Detailed Design) and 2019 (to inform the TWTP design). **Table 3-1** attached summarises the results for the key parameters from the two sampling events.

The leachate quality and the concentrations of the various parameters would be variable: it is a large amount of heterogenous waste materials, and so concentrations would depend on what waste materials are in the area that samples were collected. This variability would be further exasperated during the removal and relocation of the Capped Waste Stockpile material: for example the waste types exposed during a rain event and the dilution effect of the rain event would be influential.

3.1.1.2 Modelled quantity

Appendix C (Leachate Management Options Assessment Report) of the Detailed Design Report (GHD, 2018) includes modelling of leachate generated during excavation of the Capped Waste Stockpile and the various stages of construction, filling and completion of the Containment Cell. The modelling considered two rainfall scenarios:

- A 50% Annual Exceedence Probability (AEP) rainfall year (mean rainfall)
- A 90% AEP rainfall year (high rainfall)

Leachate modelling estimates 11 ML of leachate will be generated over the 20 months of removing the Capped Waste Stockpile and filling the Containment Cell, with variability based on rainfall levels. **Figure 3-1** shows the predicted leachate modelling.

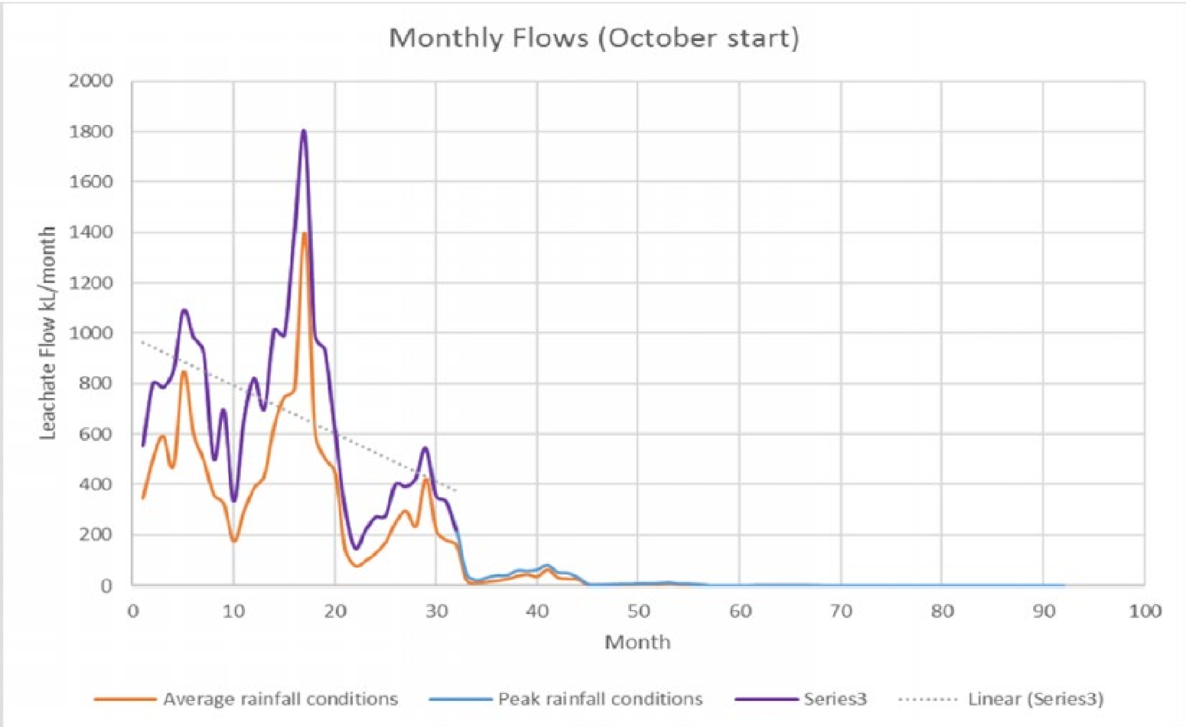

Figure 3-1: Estimated leachate generation (Source: GHD, 2018)

Figure 3-1 shows that leachate generation is rainfall dependent as the waste is non-leachate generating. Therefore, leachate generation occurs with rainfall. As the graph shows the estimated highest leachate generation rate is 1.8ML/ month. **Section 3.1.2** outlines how this leachate would be collected and stored.

3.1.2 Collection and storage of leachate

3.1.2.1 Containment Cell

As discussed in the EIS and the RtS, the material placed within the Containment Cell is expected to have retained moisture. In addition, any rain that falls within the Containment Cell would be managed as leachate. The RtS describes the Containment Cell leachate collection system that would be managed during material placement. This includes temporary in cell storage of one mega litre (1 ML) and a Leachate Pond with 1 ML capacity.

The location and design for the Containment Cell Leachate Pond is presented in Appendix J of the Containment Cell Detailed Design Report, which forms Appendix 3 of the RtS.

- Leachate within the Containment Cell Leachate Pond would be pumped out and transported to the Leachate Holding Pond via a HDPE pipe (as shown on **Figure 3-2**) when:
- The pond reaches 85% capacity
- A heavy rain event is forecast.

3.1.2.2 Capped Waste Stockpile

As discussed in the EIS and the RtS, the material within the CWS is expected to have retained moisture and potentially some perched water. In addition, any rain that falls within the opened CWS would be managed as leachate.

A Leachate Holding Pond is being constructed adjacent to the CWS in the location shown on **Figure 3-2**. The Leachate Holding Pond will have a 1 ML capacity.

As removal of material from the CWS progresses, a temporary storage basin (Leachate Storage Basin) would be established within the CWS footprint to capture leachate. The basin would also have a holding capacity of 1 ML.

When required, leachate from the Leachate Storage Basin would be pumped to the Leachate Holding Pond where it would be stored until treatment. A 100 mm diameter pipeline (transfer pipe) would be located as shown in **Figure 3-2** and would connect the Leachate Holding Pond to the TWTP.

3.1.2.3 Leachate storage capacity

As discussed in Section 3.1.2.1 and 3.1.2.2 storage for 4ML of untreated leachate would be constructed. During extreme event additional storage within the Containment Cell and Capped Waste Stockpile would be available, however this would mean flooding of waste within the Containment Cell.

The design of the Containment Cell Leachate Pond and Leachate Holding Pond form part of the Detailed Design Report prepared by GHD (2018). Appendix C of the report (Leachate Management Options Assessment Report) included consideration of predicted leachate quantity. This included modelling of leachate generated during excavation of the Capped Waste Stockpile and the various stages of construction, filling and completion of the Containment Cell. The modelling considered two rainfall scenarios:

- A 50% Annual Exceedence Probability (AEP) rainfall year (mean rainfall)
- A 90% AEP rainfall year (high rainfall)

The Detailed Design Report estimated that the highest leachate generation rate would be 1.8ML/month. As a result if there were operational issues with the TWTP, and leachate could not be transported for off site treatment, there would be more than two months of constructed storage of untreated leachate available at this maximum leachate generation rate. There would be additional storage capacity if leachate was allowed to flood material within the Containment Cell and the CWS.

3.1.3 Transfer of leachate

A surface-laid 100 mm diameter high-density polyethylene (HDPE) pipe would be installed to transfer leachate from the Containment Cell Leachate Pond to the Leachate Holding Pond as shown on **Figure 3-2**.

It would be adjacent to the northern side of the haul road, a minimum of 750 mm from the edge of the road and outside the signage and flagging that delineates the edge of the road. Further details on its construction and installation are provided in **Section 3.5.2.2**.

Leachate would be pumped from the Containment Cell Leachate Pond to the Leachate Holding Pond when the Containment Cell Leachate Pond reaches 85% capacity or a heavy rain event (greater than a 20% AEP event) is forecast.

3.1.4 Treatment of leachate

3.1.4.1 Onsite treatment – Temporary water treatment plant

The TWTP would be located as shown in **Figure 3-3**, within 20 m of the edge of the Leachate Holding Pond and would be powered by a diesel generator.

The plant is designed to treat and discharge a maximum of 2,400 kL/month (or approximately 79 kl/day). Based on estimates of leachate generation from the relevant Project elements the TWTP would require an estimated average capacity of 30 kL/day.

The TWTP would be comprised of the components summarised in **Table 3-2**. A process flow diagram for the TWTP is shown in **Figure 3-3**.

Table 3-1: Temporary Water Treatment System Key Components

Component	Description
Pre-Treatment System	The pre-treatment system would have a capacity of 3 litres per second (L/s) and is comprised of: • Flocculator • Lamella Dissolved Air Flocculation (DAF) • Sand filter feed tank. The purpose of the pre-treatment system is to undertake pH correction and to remove the bulk of suspended solids prior to passing through the filter vessels. Polymers, coagulant ($CaCl_2$) and sulfuric acid would be added to the flocculator to aid flocculation of the materials.
Sludge Dewatering Bags	Sludge would be produced in the form of settled solids within the DAF unit. Sludge would be pumped out from the bottom of DAF unit and pass through the sludge dewatering Geotube. The removed sludge would be dried and disposed of within the Containment Cell while available and to an offsite licensed waste facility when the Containment Cell has been capped. The filtered leachate would then pass back through the pre-treatment system.
Sand Filter	Following pre-treatment, the leachate would be pumped to the Sand Filter Feed Tank before passing through the Sand Filter to further remove any solid materials. The sand filter would be driven by pressure at a rate of up to 3 L/sec.
Zeolite Filter	Leachate from the Sand Filter would be passed through a Zeolite Filter. The zeolite filter acts as both a secondary filtration stage and an initial adsorption stage.

Component	Description
Granular Activated Carbon (GAC) Filter	After the Zeolite filtration, the water would be processed through the Granular Activated Carbon (GAC) filters. Treatment with GAC involves passing a liquid to be treated through a bed of GAC. GAC removes a range of compounds, especially dissolved phase hydrocarbons, Fluoride and Cyanide through the process of adsorption. Organic and inorganic compounds in the water are attracted to the surface of the activated carbon. Potassium peroxymonosulfate would be added as an oxidising agent.
Adsorption and Ion Exchange Module	A two stage Ion Exchange process using an anion base resin would be used after the GAC adsorption process. Anion resin would remove a range of compounds, especially Fluoride and Cyanide, through the process of Ion Exchange. Sodium hydroxide would be added to regenerate the resins.
Bag Filter	Following adsorption and ion exchange, leachate would be passed through a small bag made of filtering material with a pore size of 1 µm.
Treated Water Holding Tanks	The four Holding Tanks would store the treated leachate prior to discharge. Each tank has a 100 kL capacity.
Various pumps	Including leachate pumps, collection pumps, sludge transfer pumps, dewatering pumps, re-circulating pumps, GAC filter feed pumps, backwash pumps, treated water pumps and discharge pumps to transport liquid between each component.
Bunding	The TWTP (including all of the above elements) would be constructed inside a bund which would be designed to contain any spillage/ leaks if they are to occur. The bund would contain a sump from which any collected water can be transferred to the head of the plant for treatment.

3.1.5 Clean water discharge

The clean water discharge would be located to the north of the TWTP feeding upstream of an existing oil separator unit. Once leachate has been treated, tested (against the criteria described in **Section 3.6.2**) and approved for discharge, the water would be pumped into the Eastern Surge Pond and to the Smelter water management system.

Table 3-3 provides the analysis results of pollutants at non-trivial levels from treatment trials undertaken by EPS in July 2019. These results achieve compliance with the treated leachate target values for non-trivial pollutants presented in **Table 3-5**.

Table 3-2: Temporary Water Treatment System Treated Leachate Trial Results

Parameters		No. Samples	Min	Max	Mean
pH	pH units	10	7.1	9.9	8.39
Alkalinity					
Hydroxide Alkalinity as CaCO3	mg/L	10	20	20	20
Carbonate Alkalinity as CaCO3	mg/L	10	10	12000	2502
Bicarbonate Alkalinity as CaCO3	mg/L	10	260	9500	4163
Total Alkalinity as CaCO3	mg/L	10	430	15000	6683

Parameters		No. Samples	Min	Max	Mean
Calcium					
Calcium	mg/L	10	6	1100	219.95
Cyanide					
Total Cyanide	mg/L	10	97	230	133.6
Free Cyanide	mg/L	10	0.006	0.096	0.0322
Fluoride					
Fluoride	mg/L	10	5.4	550	143.34

Aerial photography by Nearmap, flown 15.06.2020

RAMBOLL AUSTRALIA - GIS MAP file : 318000737_GIS_P001_RemediationMod1 | F003_LeachateReport_V03 | 1/07/2021

Legend

Project site

Leachate management infrastructure

- Leachate storage dam
- Leachate treatment plant
- Leachate transfer pipeline
- Clean water discharge

A4

1:8,000

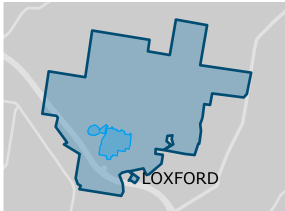

Figure 3.2 | Location of Leachate Management Infrastructure

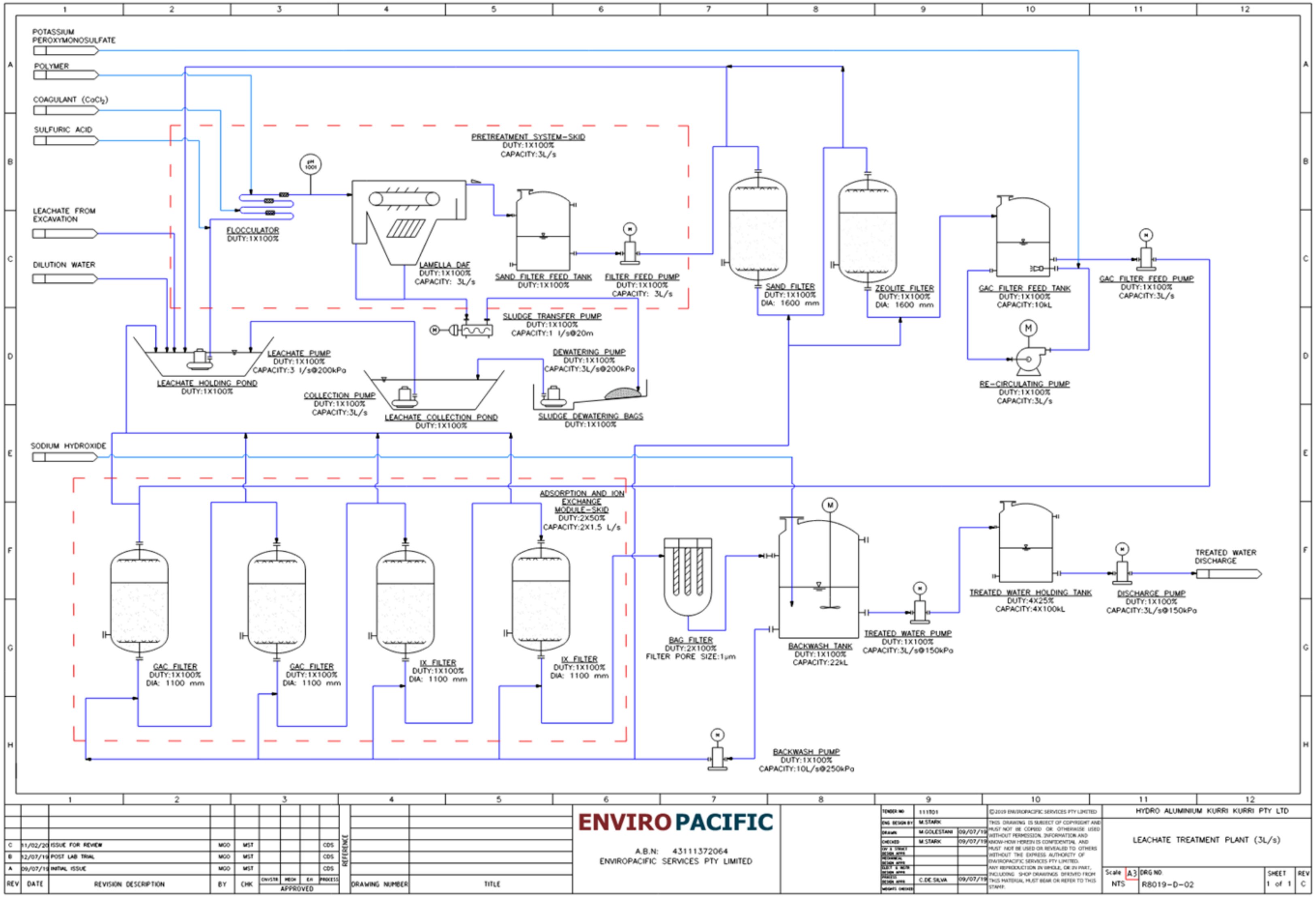

Figure 3-3: TWTP Process Diagram

3.1.6 Ancillary infrastructure

3.1.6.1 Chemical storage

As noted in **Table 3-2** a number of chemicals need to be used in the TWTP. The chemicals would be managed and stored within a facility designed in accordance with the:

- NSW Environmental Protection Authority *Storing and Handling of Liquids: Environmental Protection – Participants Manual* (Department of Environment and Climate Change, 2007)
- *Work Health and Safety Act 2011*
- SafeWork NSW *Storage and Handling of Dangerous Goods Code of Practice 2005*
- Australian Standard (AS) 1940-2017 *The storage and handling of flammable and combustible liquids*
- Safety Data Sheet (SDS) for each chemical.

A minimal amount of chemicals would be stored onsite: chemicals would be regularly transported to site as required. The chemicals would be stored in self-bunded intermediate bulk containers (IBC) and located within the bunding for the TWTP.

3.2 Environmental management

A Remediation Works Environmental Management Plan (RWEMP) has been prepared by Hydro and Ramboll and approved by the Department to describe how environmental management would be undertaken during the Project. It was prepared to address the requirements of Condition C2 of the development consent for SSD 6666, including the specialist management plans required by Condition C3 of the development consent. The RWEMP would apply to the construction, operation and decommissioning of the TWTS. The RWEMP would be amended as required to reflect the additional environmental management measures in Section 6.

Hydro prepared several specialist management plans as part of the RWEMP in addition to those required by Condition C3 of the development consent. This included a Soil and Water Management Plan (SWMP), which incorporates a Leachate Management Plan (LMP) that describes how leachate, and leachate infrastructure, would be managed to minimise the potential environmental impacts. A copy of the LMP is provided in **Appendix 1**.

3.3 Waste management

Table 3-4 outlines the waste streams that would be generated by operation and maintenance of the TWTS and outlines the proposed management method.

Table 3-3: Waste Streams and Management

Waste Stream	Management Method
Treated water	Treated water would be stored in the treated water storage tanks for testing to confirm it meets the criteria described in **Table 3-4** in **Section 3.6.2.** Treated water that meets these criteria would be discharged to the existing Smelter water management system or used as dust suppression.
Spent Filter Media	Spent filter media would be removed from the filter vessels using a vacuum tanker and transported to the onsite Containment Cell for placement in the cell. Any spent media generated following capping of the cell would be taken to an Environmental Protection Authority licensed facility for disposal.
Sludge	The sludge generated during the leachate treatment process would be transported to for placement in the Containment Cell. Any spent media generated following capping of the cell would be taken to an Environmental Protection Authority licensed facility for disposal.

The spent media would contain contaminants that are present within the Capped Waste Stockpile and other contaminated materials that will be placed in the Containment Cell. As the cell has been designed based on these contaminants the Containment Cell is designed to receive these wastes.

Waste generated during the construction and decommissioning of the Modification would be minimal. The TWTP would predominantly be modular with the majority of elements (apart from the consumables noted in **Table 3-3**) to be transported from the Project site for continued use. The other elements of the TWTS (the leachate storage and the transfer network) would either be disposed of to a licensed waste management facility (the HDPE pond lining and the HDPE pipe) or reused at the Project site (the excavated material used for the Leachate Holding Pond).

3.4 Quality control and assurance

Condition A5 of the development consent for SSD 6666 requires Hydro to enter into a Voluntary Planning Agreement (VPA) with the Minister for Planning. Under the VPA (and also required by condition A8 of the development consent for SSD 6666) t, an Independent Engineer (IE) is to be commissioned.

The VPA and the IE Deed describes the responsibilities of the IE. These responsibilities include the inspection and verification of the Containment Cell Leachate Pond and the Leachate Holding Pond, which have been approved under the development consent for SSD 6666. The IE would issue a Certificate of Compliance for the stage of the remediation works that includes the leachate storage ponds.

3.5 Construction

Construction for the Modification would be undertaken generally in the following stages:

- Site preparation
- Construction of the TWTS
- Testing and commissioning of the TWTP
- Construction demobilisation.

A description of each stage is included below.

3.5.1 Site preparation

Initial activities would be the establishment of environmental and safety controls. Environmental and safety controls for the construction of the TWTS would be consistent with that described in the EIS and the RtS including soil and water management and erosion and sediment controls.

The TWTP would be established at a location within 20 m of the edge of the Leachate Holding Pond. The plant would be modular and site preparation would be required prior to construction of the TWTP.

As noted in the EIS and RtS, the proposed location for the Leachate Holding Pond contained contaminated soils associated with the Anode Waste Pile that was previously in this location. The Anode Waste Pile was an area of environmental concern containing polycyclic aromatic hydrocarbon (PAH) contamination in surface soils to 0.2 m below ground surface. The extent and depth of contaminated material to be removed was determined (966 m^3). In May and June 2021 these materials were removed and stockpiled ahead of disposal within the Containment Cell. The remediated area has been validated and is suitable for construction of the Leachate Holding Pond.

The existing Construction Environmental Management Plan (CEMP) would be updated to include any specific controls required for construction of the TWTS.

3.5.2 Construction of the Temporary Water Treatment System

3.5.2.1 Leachate storage construction

The Containment Cell Leachate Pond and Leachate Holding Pond would be constructed utilising small to medium sized earthmoving equipment placed and compacted to specified requirements. They would be constructed using validated fill material sourced from the Smelter Site and lined with a clay-rich fill layer and 2 mm HDPE lining to contain the leachate. The ponds would be constructed in accordance with the designs in **Appendix 2**, and forms part of the project approved by the development consent for SSD 6666.

The HDPE 2mm lining will be the same as that to be used in the Containment Cell construction. As noted in Appendix E (Liner Degradation Assessment) of the Containment Cell Detailed Design Report (GHD, 2018) that was presented as Appendix 3 to the Response to Submissions Report, this liner was selected following extensive testing using leachate extracted from the Capped Waste Stockpile. As the Containment Cell Leachate Pond and Leachate Holding Pond would store such leachate, the HDPE lining would be adequate for leachate storage.

Section 1.3 (Reliance) of the Containment Cell Detailed Design Report noted that GHD referenced the *Environmental Guidelines: Solid Waste Landfills* (EPA, 2018) in preparing the report (including the leachate storage design).

3.5.2.2 Transfer pipe installation

As discussed in **Section 3.1.3** a transfer pipe would be constructed to transfer leachate from the Containment Cell Leachate Pond to the Leachate Holding Pond. The key elements of the pipeline are:

- It would be located as shown in **Figure 3.2**
- it would be constructed of 100 mm diameter HDPE piping and would be butt welded and surface laid
- Where the pipeline is required to cross an access road (the north-south road) the pipeline would be trenched and backfilled into the road pavement to provide uninterrupted access for road users. The pipeline would be installed at minimum of 600mm below the road surface and backfilled with dust or similar product to provide additional protection over the pipe
- Where the pipe traverses the unnamed watercourse, it would be double skinned: the 125mm external diameter pipe would be placed within a 160mm HDPE pipe for an approximate length of 20 metres. It would cross the unnamed watercourse on the edge of the road crossing and not through the floor of the unnamed watercourse
- The pipeline route would be clearly delineated and sign posted. It would be located outside of the signage and flagged star pickets that delineates the access road and:
    - A minimum of one metre to two metres from the delineated northern edge of the haul road between the Capped Waste Stockpile and the Containment Cell access road
    - A minimum off 600mm to 850mm from the delineated northern edge of the Containment Cell access road

The pipeline route remains within the approved Project footprint, and immediately adjacent to the Containment Cell haul road that is an inherent component of the approved Project.

The haul road and pipeline routes cross the State Significant Infrastructure project - Hunter Power Project (Kurri Kurri Power Station) (SSI-12590060). Under a contractual agreement between Hydro and the future landowner (McCloy Group) this area would be dedicated for the duration of the Hydro Remediation Project for the remediation activities (including the haul road and the leachate transfer pipeline).

The remediation contractor would therefore have access to the pipeline to undertake regular inspections and to undertake any maintenance where required. Hunter Power Project construction vehicles would cross the pipeline via the access road crossing described above.

3.5.2.3 Temporary Water Treatment Plant construction

All required components of the TWTP would be delivered to site and put in place using cranes and/or manitou. All pipework would be connected, and the electrical work would be completed by a licensed electrician.

The TWTP would be constructed inside a bund which would be designed to contain any spillage/ leaks if they are to occur. The bund would contain a sump from which any collected water can be transferred to the head of the plant for treatment.

The TWTP would be constructed in accordance with the design in **Appendix 3**.

3.5.3 Testing and commissioning

3.5.3.1 Wet and dry commissioning

Upon completion of construction of the TWTP (including all mechanical and electrical elements) commissioning of the TWTP would commence. The commissioning would dry test all drives, valves and instruments for correct functionality. Device sequencing would also be tested and verified. Inspection Test Plans (ITPs) and Inspection Test Reports (ITRs) would be used for verification.

Following completion of dry commissioning, wet commissioning of the system using clean water would be undertaken.

The leachate transfer pipe would also be pressure tested prior to commissioning.

3.5.3.2 Process proving

When the wet commissioning is complete, process proving process would commence. Process proving would include:

- Treatment of three batches of leachate (each batch would be approximately 20 kL)
- One sample of raw water (TWTP feed water) and treated water would be collected for each batch and analysed at a National Association of Testing Authorities (NATA) accredited laboratory
- If all three batch results consistently meet the discharge criteria, then the process proving period would complete and the plant would commence full operation.

3.5.4 Site demobilisation

Following completion and commissioning of the TWTP, any disturbed areas would be reinstated and all construction infrastructure such as fencing and environmental controls would be removed.

3.5.5 Hours, duration and workforce

Construction of the Modification would be undertaken during the hours described in the EIS:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm Saturday
- No construction works on Sunday or public holidays

Construction activities would commence immediately following this modification be granted consent. Construction would take approximately six to eight weeks: construction of the Leachate Holding Pond would take approximately two weeks, and the TWTP would take approximately six to eight weeks. A peak workforce of approximately 18 construction personnel would be required.

Testing and Commissioning of the TWTP, including process proving, would take approximately six weeks. Approximately six personnel would be required during this stage including licensed electricians and plumbers.

3.5.6 Equipment and materials

Plant and equipment to be used during the construction works would include:

- Excavators
- Dozers
- Rollers
- Trucks
- Handheld tools and equipment
- Mobile crane
- Telescopic handler (telehandler).

3.6 Operation

3.6.1 Temporary Water Treatment Plant

The TWTP would operate throughout Containment Cell base construction, material placement and capping of the Containment Cell. It is expected that the TWTP would primarily be in operation during and following rain events.

The TWTP would be inspected generally on a weekly basis whenever the TWTP is required to be operated, except during dry periods where there is no water to treat. The TWTP would be serviced as recommended by the manufacturer. In the event that the inspection identified potential operational issues, TWTP operation would be immediately suspended and serviced as soon as practicable.

3.6.1.1 Treated leachate testing and discharge

Leachate would be treated in batches to allow for storage and testing prior to discharge. In addition the leachate generation and pumping to the TWTP for treatment would not be continuous, and so batching allows for collection of suitable quantities for treatment.

Following leachate treatment, treated water from the treated water holding tanks would be tested for suspended solids, pH, fluoride and hydrocarbons to a level suitable to be discharged to the Smelter water management system, or additionally treated as required to comply with discharge requirements. The treated water would be reused during the Project for dust suppression and/or discharged (as authorised under the Hydro EPL) from the North East Dam.

The TWTP plant has been designed based on the leachate collected from the Capped Waste Stockpile (refer to Section 3.1.1) and for the contaminants outlined in **Table 3-5**. Compliance with these limits would mean that the treated leachate would be consistent with the water in the North East Dam, and therefore what has been discharged (via irrigation) under the Smelter water management system for more than 25 years.

Table 3-4: Treated Leachate Target Values

Parameter	Units	Limit	Frequency of Testing
Conductivity	µS/cm	4,000 [1]	Prior to discharge of each batch
Fluoride	mg/L	15 [2]	
Free cyanide	mg/L	<0.005	
Total oils and grease	-	No visual sheen [3]	
pH	-	6.5-8	
Total Suspended Solids (TSS)	mg/L	<50 [3]	
Total Dissolved Solids (TDS)	mg/L	None specified	
Total polyaromatic hydrocarbons (PAHs)	µg/L	LOR (<1)	
Total Recoverable Hydrocarbons (TRH)	µg/L	LOR (<100)	
Heavy metals:			
Aluminium	mg/L	5 [4]	
Arsenic	mg/L	0.1 [4]	
Beryllium	mg/L	0.1 [4]	
Boron	mg/L	0.5 [4]	
Cadmium	mg/L	0.01 [4]	
Chromium	mg/L	0.1 [4]	
Cobalt	mg/L	0.05 [4]	
Copper	mg/L	0.2 [4]	
Iron	mg/L	0.2 [4]	
Lead	mg/L	2 [4]	
Lithium	mg/L	2.5 [4]	
Manganese	mg/L	0.2 [4]	
Mercury	mg/L	0.002 [4]	
Molybdenum	mg/L	0.01 [4]	
Nickel	mg/L	0.2 [4]	
Selenium	mg/L	0.02 [4]	
Uranium	mg/L	0.01 [4]	
Vanadium	mg/L	0.1 [4]	
Zinc	mg/L	2 [4]	

[1] Use Of Effluent By Irrigation, Department of Local Government, 1998

[2] Historical value of F in North Dams

[3] Managing Urban Stormwater: Soils and Construction, 2004

[4] Long-term trigger values for heavy metals and metalloids in irrigation sourced from ANZECC, 2000.

3.6.2 North East Dam monitoring and management

Hydro continues to implement a long term surface water sampling program in accordance with its Soil and Water Management Plan (SWMP), which forms part of its Remediation Works Environmental Management Plan (RWEMP). This includes the North East Dam, other dams within the Project site, and upstream and downstream locations in adjoining waterbodies (including adjacent to the irrigation area). The monitoring includes the following:

- Monthly monitoring of all locations with analysis for pH, electrical conductivity, fluoride, free cyanide, TSS and TDS
- The monthly monitoring of the North East Dam will also include the additional parameters in **Table 3-6**
- Weekly monitoring of the North East Dam and Eastern Surge Pond for pH and fluoride
- Monthly monitoring of all dams and ponds within the Project site for pH, electrical conductivity and fluoride
- Visual monitoring of the irrigation area

Table 3-5: North East Dam Target Values

Parameter	Units	Limit	Frequency of Testing
Conductivity	µS/cm	4,000 [1]	Weekly
pH	-	6.5-8 [2]	
Fluoride	mg/L	15 [2]	Monthly or prior to irrigation
Free cyanide	mg/L	<0.005	
Total oils and grease	-	No visual sheen [3]	
Total Dissolved Solids (TDS)	mg/L	None specified	
Total Suspended Solids (TSS)	mg/L	<50 [3]	
Total polyaromatic hydrocarbons (PAHs)	µg/L	LOR (<1)	
Total Recoverable Hydrocarbons (TRH)	µg/L	LOR (<100)	
Heavy metals:			
Aluminium	mg/L	5 [4]	
Arsenic	mg/L	0.1 [4]	
Beryllium	mg/L	0.1 [4]	
Boron	mg/L	0.5 [4]	
Cadmium	mg/L	0.01 [4]	
Chromium	mg/L	0.1 [4]	
Cobalt	mg/L	0.05 [4]	
Copper	mg/L	0.2 [4]	
Iron	mg/L	0.2 [4]	
Lead	mg/L	2 [4]	
Lithium	mg/L	2.5 [4]	
Manganese	mg/L	0.2 [4]	
Mercury	mg/L	0.002 [4]	
Molybdenum	mg/L	0.01 [4]	
Nickel	mg/L	0.2 [4]	
Selenium	mg/L	0.02 [4]	
Uranium	mg/L	0.01 [4]	

Parameter	Units	Limit	Frequency of Testing
Vanadium	mg/L	0.1 [4]	
Zinc	mg/L	2 [4]	

[1] Use Of Effluent By Irrigation, Department of Local Government, 1998

[2] Historical value in North Dams

[3] Managing Urban Stormwater: Soils and Construction, 2004

[4] Long-term trigger values for heavy metals and metalloids in irrigation sourced from ANZECC, 2000.

This surface water monitoring is the continuation of monitoring that has been undertaken for more than 25 years, which has not identified significant adverse impacts from the historical use of the irrigation area.

3.6.3 Leachate storage safeguards

The TWTP is designed based on the modelled leachate generation for the site using peak rainfall conditions. However, additional leachate storage is incorporated in the waste cells themselves. The TWTP design includes two 1 ML leachate storage ponds. These are supplemented by in-cell holding capacity of 1ML at both the Containment Cell and the Capped Waste Stockpile.

The Detailed Design Report (GHD, 2018) estimated that the highest leachate generation rate would be 1.8ML/ month, resulting in more than two months of storage of untreated leachate available at this maximum rate.

Contingency leachate storage capacity would be available within the Containment Cell and Capped Waste Stockpile is available, however this would mean flooding of waste within the Containment Cell. As such this would only be undertaken when this is required to avoid leachate overflowing from the dedicated storage areas.

The TWTP is designed to treat 2.4ML/ month and would therefore have sufficient capacity to avoid the need to use the Containment Cell and Capped Waste Stockpile themselves for storage.

It is considered highly unlikely that the concurrent occurrence of climatic events and site conditions required for the Containment Cell and Capped Waste Stockpile additional storage to be used would occur. If a significant rain event (5% AEP or higher) is forecast, the following would be implemented (as required) to maintain storage capacity within the ponds, and avoid use of the contingency leachate storage:

- Continuous operation of the TWTP at its maximum available capacity
- Transport leachate for off site treatment as described in **Section 3.8**

3.6.4 Hours, duration and workforce

Remediation activities under condition B38 of SSD 6666 are permitted between the hours of:

- 7:00am to 6:00pm Monday to Friday
- 7:00am to 1:00pm Saturday.

Additionally, under condition B39 of SSD 6666, work outside these hours may occur in the following circumstances:

- Works that are inaudible at the nearest receivers
- Works agreed to in writing by the Planning Secretary
- Where it is required in an emergency to avoid the loss of lives, property of to prevent environmental harm.

No changes to the approved hours are required for the Modification. The TWTP would, however, have the ability to operate unmanned during the night-time via a programmable logic controller (PLC) and remote monitoring and control. Night-time operation of the TWTP would only be undertaken if heavy rain is forecast or occurring, and additional hours of treatment were required to restore leachate storage capacity.

In the event that night-time operation is required the noise sources would be a diesel generator and submersible pumps. This equipment is consistent with those identified in the Noise and Vibration Impact Assessment in the EIS that could operate (concurrently with numerous other equipment and machinery) outside standard construction hours without generating audible noise at the nearest sensitive receiver.

The TWTP would operate throughout the filling and capping of the Containment Cell, and for a period following completion of capping. The period of operation of the TWTP would be dependent on the amount of rainfall during the filling of the Containment Cell, and therefore how much leachate that is generated.

From the leachate generation modelling undertaken as part of the Containment Cell detailed design, it is expected that the TWTP would operate for approximately 12 months following completion of capping. At this point the TWTP would be decommissioned, and the leachate would be collected for off site treatment. Hydro would advise the Department and the EPA one month prior to the proposed decommissioning of the TWTP, and would provide information on the subsequent management of the leachate, including the nominated off site leachate treatment facility.

The leachate transfer pipeline and the leachate ponds would be decommissioned prior to capping of the Containment Cell, and contaminated materials would be placed within the cell. Following their removal leachate would be pumped out of the Containment Cell leachate storage and transported to the TWTP.

3.7 Decommissioning

The TWTS would be decommissioned upon completion of the Containment Cell and would involve the following:

- Dismantling of the TWTP. As noted in **Section 3.5.1** the TWTP would be modular
- Removal of the transfer pipeline connecting the TWTP to the Leachate Holding Pond
- Removal of the transfer pipeline connecting the Leachate Holding Pond to the Containment Cell Leachate Pond
- Removal of the Leachate Pond and the Leachate Holding Pond. The pond linings would be removed and disposed of either within the Containment Cell or at a licensed facility. The material used to construct the ponds (as described in **Section 3.5.2.1**) would be tested and analysed prior to excavation. It is expected that none of the leachate would have passed through the linings to impact on this material. As such, based on its current characteristics this material would be suitable for use within the Project Site
- The footprint of the Leachate Holding Pond would be formed consistent with the overall landform plan for the Site.

3.8 Offsite treatment – transport to licensed facility

Offsite treatment of leachate may also be considered in the following scenarios:

- In the unlikely event of leachate volumes exceeding the capacity of the onsite TWTP and the leachate storage capacity.
  As noted in Section 3.6.3 there is significant leachate storage capacity available at the Project site, with contingency capacity available within the Containment Cell and the Capped Waste Stockpile. It is unlikely that this contingency storage capacity would need to be used, and so the scenario where leachate generation would exceed storage capacity is highly unlikely and only in significant storm events (such as 5% AEP events or greater).
- If the TWTP (part or all) was unavailable for maintenance. Offsite treatment may be considered if the TWTP was unavailable during wet weather events and Hydro wanted to avoid using the contingency storage capacity (which necessitates waste materials being inundated with leachate).

Where offsite treatment is proposed the leachate would be removed and transported to a licensed facility for treatment as described in the Response to Submissions.

3.9 Comparison of the Approved Project to the Modification

3.9.1 Project components

Table 3-7 provides a summary of the key components of the Modification and comparison to the approved Project under SSD 6666 as relevant. SSD 6666 will remain substantially the same if the Modification is approved.

Table 3-6: Comparison of the Approved Project to the Modification

Parameter	Approved Project	Proposed Modification
Project life	Four years (to 2021 - 2024)	No change
Disturbance Area	As shown on Figure 3-2 of the EIS	No change
Hours of operation	Monday to Friday 7:00am to 6:00pm Saturdays 7:00am to 1:00pm Outside these hours provided inaudible at nearest receivers	No change. The TWTP would have the ability to operate unmanned during the night-time via a PLC and remote monitoring and control if required (refer to **Section 3.5.5**), and would be inaudible at nearest receivers
Equipment	• Excavators • Graders • Compactors / Rollers • Dump trucks • Forty tonne articulated trucks • Scrapers / Dozers / Front end loaders • Backhoes • Vibrating drum roller • Water truck • Machinery service vehicle • Refuelling vehicles • Various hand operated equipment • Concrete crushing plant • Jackhammers	The TWTS key components (as described in **Table 3-4**) and equipment listed in **Section 3.5.6** including: • Excavators (no change) • Dozers (no change) • Rollers (no change) • Trucks (no change) • Handheld tools and equipment (no change) • Mobile crane • Telescopic handler (telehandler)

Parameter	Approved Project	Proposed Modification
Leachate Management	• Offsite treatment of leachate at a licensed facility • Option to construct an onsite TWTP, to be used in conjunction with offsite treatment	Confirmation of construction and use of an onsite TWTP and associated infrastructure (with the option of offsite treatment if required) Consistent with the proposed location presented in the RtS Offsite treatment of leachate at a licensed facility may still be required
Water Management	• Water management system as shown on Figure 13-2 of the EIS • Subsurface and open surface drainage throughout the Smelter • Storage in the North East Dam and reused or irrigated to land north of the Site in accordance with the EPL • Wastewater discharge via the existing Hunter Water sewerage system or collection by a licensed contractor for disposal	Discharge of treated water to the existing water management system following confirmation that relevant water quality criteria are met

3.9.2 Development consent

A review of SSD 6666 was undertaken to:

- Consider compliance of the Modification with the existing conditions of consent
- Identify which conditions would require amendment to facilitate the Modification.

The Modification could be undertaken without changes to all but one condition (Condition A2) in the development consent for SSD 6666. The key conditions that would specifically apply to the Modification are described in **Table 3-8**.

Table 3-7: Conditions of Consent Relevant to the Modification

Condition No.	Condition Summary	Relevance
B5	Requirement for preparation of a Containment Cell Management Plan (CCMP)	The Modification would not impede the successful implementation of the CCMP
B10	Preparation of a Remediation Validation Report	The Modification would form part of the remediation works described in the report
B13, B14 and B15	Work health and safety requirements, including the need to prepare and implement a Health and Safety Plan (HSP)	Work health and safety requirements are to be implemented, and the HSP to be reviewed and amended to incorporate the Modification (if required)
B17	Requirement for an Erosion and Sediment Control Plan (ESCP)	An ESCP is to be prepared and implemented for construction of the Modification
B20	Traffic and access management	Vehicles importing materials and equipment for the Modification would comply with the Traffic Management Plan and Site Access Plan

Condition No.	Condition Summary	Relevance
B23 – B26	Waste management: statutory requirements	Any wastes from the TWTP are to be classified prior to placement in the Containment Cell or transported for off site management
B32	Avoidance of generation of offensive odour	The TWTP is designed and would be operated to avoid generation of offensive odours
B34 and B35	Hours of operation and requirements for works undertaken outside of standard construction hours	If the TWTP is required to operate outside of standard construction hours the requirements of Condition B35 would apply.
B44	Avoiding impacts from lighting	If the TWTP is required to operate at night time, it can do so unmanned. Therefore dedicated lighting is unlikely to be installed.
B47	Preparation of a Fire Safety Study and Construction Safety Study	The Modification would be incorporated into the plans and reports that have been prepared to address this requirement
B48	Emergency Plan and Safety Management System	The Modification would be incorporated into the plans and reports that have been prepared to address this requirement
B50	Safe storage of chemicals, fuels and oils	The TWTP would be located within a bunded area
C2	Requirement to prepare and implement the RWEMP	The RWEMP would apply to the Modification and would, where required, be amended to reflect the Modification

Table 3-9 identifies the existing conditions requiring amendment, and the proposed amendments.

Table 3-8: Proposed Revisions to the Conditions of Consent

Existing Condition		Proposed Revision/s
A2	The development may only be carried out:	N/A
	a) In compliance with the conditions of this consent;	No change
	b) In accordance with all written directions of the Planning Secretary;	No change
	c) In accordance with the EIS and Response to Submissions;	In accordance with the EIS**,** ~~**and**~~ Response to Submissions **and Modification 1**
	d) In accordance with the Development Layout in Appendix 1; and	**Update figure in Appendix 1 to include the TWTS components shown in Figure 3-2**
	e) In accordance with the management and mitigation measures in Appendix 2.	**Update Appendix 2 to include the additional management and mitigation measures described in Section 6 and Section 7 of this SEE**

3.9.3 Substantially the same project

The consent authority can grant consent for the Modification under Section 4.55(1A) of the EP&A Act if:

(a) *it is satisfied that the proposed modification is of minimal environmental impact, and*

(b) *it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all)*

The Modification is considered to present a minimal environmental impact, and be substantially the same development to the approved under SSD 6666 as:

- As concluded by the assessment in **Section** Error! Reference source not found. the Modification would provide a net environmental benefit for the Project, with mitigation measures to be implemented to minimise potential environmental impacts from the Modification
- The overall nature and scale of the Project remains similar to that approved in the development consent for SSD 6666. In addition, the TWTP is identified in "*Figure 1: Main Components of the Development*" of Appendix 1 to the development consent. As such the Modification represents an accepted element of the Project
- The majority of the Project remains unchanged to that approved.

The only element of the Project that changes is which form of leachate management is the primary option (on site over off site treatment). As discussed in **Section 3.10.1** the option of on site leachate treatment was described in both the EIS and the RtS. Only one condition (and three sub-conditions), one figure and one appendix to the development consent for SSD 6666 would require minor modifications.

3.10 Assessment of alternatives

The following options for leachate treatment were considered for the Project:

- Option 1: Onsite treatment
- Option 2: Offsite treatment with the option of onsite treatment if required
- Option 3: Primary onsite treatment with the option of offsite treatment if required.

3.10.1 Option 1: Onsite treatment

Onsite treatment of leachate was proposed as the leachate treatment method in the EIS. It was selected as it provides greater certainty regarding leachate management. Hydro and its Remediation Contractor would have direct control over the management of leachate, avoiding any potential issues that may occur at offsite treatment facilities.

3.10.2 Option 2: Offsite treatment with optional of onsite treatment

Offsite treatment of leachate with the option of onsite treatment if required, was proposed as the preferred method of treatment in the RtS. This was proposed as a review undertaken during development of the detailed design indicated that offsite treatment was the most cost-effective option and did not present an unacceptable environmental risk.

However on further review (as described in **Section 3.10.3**) it was concluded that having offsite treatment as the primary leachate management measure was not preferable based on economic, logistics and environmental factors.

3.10.3 Option 3: Primary onsite treatment with optional offsite treatment

Following preparation of the RtS the leachate management strategy was revisited. A combination of onsite and offsite treatment, with a priority for onsite treatment, is the preferred treatment strategy for the following reasons:

- Cost savings: additional review of the leachate management options identified that onsite treatment was more cost efficient than off site treatment.
- Reduced truck movements to/from the Site. Onsite treatment would remove approximately 120 truck movements per month (based on treating 2,400 kL/ month and 20 kL/tanker load)
- Increased security and environmental protection. Onsite treatment would allow Hydro to maintain sufficient leachate storage capacity at the Project site without dependency on the availability and capacity of the offsite treatment facilities.
- Increase flexibility and efficiencies in leachate treatment.

3.11 Need for and Justification of the Modification

Modelling of leachate generation within the Containment Cell prior to and following capping of the cell was undertaken as part of the *Containment Cell Detailed Design Report* prepared by GHD (2018) (Appendix 3C of the RtS). The modelling indicated that annual leachate generation is predicted to peak at approximately 1,948 kL per month during material placement, through to 3,884 kL in the first year following capping, before reducing to 388 L per year after five years of capping.

The EIS and RtS both included onsite leachate treatment as a management option. The RtS noted that offsite treatment was preferred with optional onsite treatment. The RtS states: "*In the event that Hydro decides to proceed with construction and operation of an onsite leachate treatment plant, Hydro would submit a detailed design for review and approval by the Department and the EPA*." (pg. 28).

Since preparation of the RtS, Hydro has undertaken further review of the environmental and economic factors associated with onsite versus offsite treatment methods of leachate and has determined that onsite treatment is preferred. The benefits are:

- Onsite treatment provides greater certainty regarding leachate management. Hydro and its Remediation Contractor would have direct control over the management of leachate, avoiding any potential issues that may occur at offsite treatment facilities
- It would provide a treatment plant technology specifically designed, constructed and operated for the chemical and physical characteristics of the leachate generated at the Smelter
- Onsite treatment is more cost effective than transporting for offsite treatment.

Offsite treatment would be retained as a potential leachate treatment option: it would, however, only be used when needed due to excessive leachate generation (actual or predicted), or if the onsite treatment plant was unavailable for maintenance.

The Modification is required to:

- Include onsite leachate treatment as the preferred approach to leachate management
- To provide the Department and the Environmental Protection Authority with sufficient information on the design, construction, operation and decommissioning of the TWTS so that the potential environmental issues and associated management measures can be understood, and that it can be appropriately regulated as part of the Project.

Attachment 1. North Dam Water Quality

Analyte	Location	Long term irrigation ANZECC 2000	n	Min	Max	Mean	80th per
pH							
	NE Dam		18	6.8	8.2	7.7	7.9
	NW Dam		18	7	8.4	7.9	8.06
Cond (µs/cm)							
	NE Dam		16	340	2000	818.1	830
	NW Dam		16	330	1700	727.5	730
Fluoride (mg/L)							
	NE Dam		17	7.8	28	15.9	21.2
	NW Dam		17	8	46	20.4	22
Metals (ug/L)							
Aluminium	NE&NW Dam	5000	6	870	1450	1206.7	--
Arsenic	NE&NW Dam	100	6	1	2	1.3	--
Cadmium	NE&NW Dam	10	6	<0.1	<0.1	<0.1	--
Chromium	NE&NW Dam	100	6	<1	2	1.5	--
Copper	NE&NW Dam	200	6	<1	<1	<1	--
Lead	NE&NW Dam	2000	6	<1	1	1	--
Nickel	NE&NW Dam	200	6	1	3	2.3	--
Zinc	NE&NW Dam	2000	6	7	12	9.3	--
Mercury	NE&NW Dam		6	<0.0001	<0.0001	<0.0001	--
Cyanide (mg/L)	NE Dam		24	<0.005	<0.005	<0.005	<0.005
Cyanide (mg/L)	NW Dam		24	<0.005	<0.005	<0.005	<0.005
Total Recoverable Hydrocarbons - NEPM 2013 Fractions µg/L							
C6 - C10 Fraction	NE&NW Dam		6	<20	<20	<20	--
C6 - C10 Fraction minus BTEX (F1)	NE&NW Dam		6	<20	<20	<20	--
>C10 - C16 Fraction	NE&NW Dam		6	<100	<100	<100	--
>C16 - C34 Fraction	NE&NW Dam		6	<100	<100	<100	--
>C34 - C40 Fraction	NE&NW Dam		6	<100	<100	<100	--
>C10 - C40 Fraction (sum)	NE&NW Dam		6	<100	<100	<100	--
>C10 - C16 Fraction minus Naphthalene (F2)	NE&NW Dam		6	<100	<100	<100	--
BTEXN µg/L							
Benzene	NE&NW Dam		6	<1	<1	<1	--
Toluene	NE&NW Dam		6	<2	<2	<2	--
Ethylbenzene	NE&NW Dam		6	<2	<2	<2	--
meta- & para-Xylene	NE&NW Dam		6	<2	<2	<2	--
ortho-Xylene	NE&NW Dam		6	<2	<2	<2	--
Total Xylenes	NE&NW Dam		6	<2	<2	<2	--
Sum of BTEX	NE&NW Dam		6	<1	<1	<1	--
Naphthalene	NE&NW Dam		6	<5	<5	<5	--
Polynuclear Aromatic Hydrocarbons µg/L							
3-Methylcholanthrene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
2-Methylnaphthalene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
7.12-Dimethylbenz(a)anthracene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Acenaphthene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Acenaphthylene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Anthracene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Benz(a)anthracene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Benzo(a)pyrene	NE&NW Dam		6	<0.05	<0.05	<0.05	--
Benzo(b+j)fluoranthene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Benzo(e)pyrene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Benzo(g.h.i)perylene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Benzo(k)fluoranthene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Chrysene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Coronene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Dibenz(a.h)anthracene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Fluoranthene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Fluorene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Indeno(1.2.3.cd)pyrene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Naphthalene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Perylene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Phenanthrene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Pyrene	NE&NW Dam		6	<0.1	<0.1	<0.1	--
Sum of PAHs	NE&NW Dam		6	<0.05	<0.05	<0.05	--
Benzo(a)pyrene TEQ (zero)	NE&NW Dam		6	<0.05	<0.05	<0.05	--
PFAS							
PFOS µg/L	NE Dam		27	0.081	0.33	0.16	0.21
	NW Dam		27	0.08	0.51	0.19	0.22
PFOA µg/L							
PFOA µg/L	NE Dam		28	0.004	0.013	0.01	0.01
	NW Dam		18	0.004	0.014	0.01	0.011

Attachment 2 - Capped Waste Stockpile Leachate Characteristics

			95% Protection for Aquatic Ecosystems	Irrigation (long-term trigger value)	No. of samples	Min	Max	Mean
	Units	LOR						
Physico-Chemical Paramaters								
pH	pH units	0.1			10	9.4	11	10.3
EC	µS/cm				7	25000	51600	43657
Alkalinity								
Hydroxide Alkalinity as CaCO3	mg/L	1			11	1	1	1
Carbonate Alkalinity as CaCO3	mg/L	1			12	360	26700	13080
Bicarbonate Alkalinity as CaCO3	mg/L	1			11	242	1800	847
Total Alkalinity as CaCO3	mg/L	1			14	940	48400	18340
Chloride								
Chloride	mg/L	1			14	460	2600	973
Sodium								
Sodium	mg/L	1			16	4800	20100	13167
Potassium								
Potassium	mg/L	1			16	13	168	72
Calcium								
Calcium	mg/L	0.8			10	0.8	30	8
Magnesium								
Magnesium	mg/L	1			10	0.2	49	14
Silicon								
Silicon	mg/L	1			3	25	47.5	36
Sulphur Compounds								
Sulfide as S2	mg/L	1			7	1	126	43
Sulfite as SO3 2-	mg/L				2	2	2	2
Thiosulfate as S2O3 2-	mg/L				6	20	20	20
Total Sulphur	mg/L							
Sulfate as SO4 - Turbidimetric	mg/L	1			10	1250	9460	6014
Total Anions	meq/L				2	723	723	723
total Cations	meq/L				2	877	877	877
Ionic Balance	%				2	9.56	9.56	10
Total Organic Carbon	mg/L				2	1890	2570	2230
Metals (disolved)	µg/L							
Aluminium	mg/L	10	55	5,000	8	200	7760	2183
Antimony	mg/L				4	0.01	0.2	0.1
Arsenic	mg/L		0.024	0.1	4	0.251	1	0.6
Barium	mg/L				2	0.034	0.239	0.1
Beryllium	mg/L			0.1	2	0.01	0.01	0.0
Bismuth	mg/L				4	0.1	0.15	0.1
Boron	mg/L			0.5	2	0.1	3.51	1.8
Bromine	mg/L				2	4.7	6.8	5.8
Cadmium	mg/L			0.01	4	0.001	0.05	0.02
Chromium	mg/L		0.0033	0.1	4	0.05	0.144	0.089
Cobalt	mg/L		0.0014	0.05	4	0.2	0.34	0.26
Copper	mg/L		0.0014	0.2	4	0.01	1.05	0.4
Iodine	mg/L				2	2.9	9.1	6
Iron	mg/L			0.2	5	14.6	79	36.0
Lead	mg/L		0.0034	2	4	0.01	0.3	0.1
Lithium	mg/L			2.5	2	0.01	0.01	0.01
Manganese	mg/L		1.9	0.2	4	0.02	0.54	0.2
Mercury	mg/L	0.1	0.0006	0.002	7	0.0001	0.1	0.06
Molybdenum	mg/L		0.034	0.01	4	1.14	1.5	1.3
Nickel	mg/L		0.011	0.2	4	0.115	2.1	1.0
Selenium	mg/L			0.02	2	0.01	0.1	0.1
Strontium	mg/L				2	0.038	0.199	0.12
Thallium	mg/L		0.00003		2	0.01	0.01	0.01
Tin	mg/L				4	0.01	0.1	0.1
Titanium	mg/L				2	0.1	0.1	0.1
Tungsten	mg/L				4	0.2	0.4	0.3
Vanadium	mg/L		0.006	0.1	4	0.25	7.4	3.55
Zinc	mg/L		0.008	2	4	0.05	0.35	0.144
Total Metals								
Aluminium	µg/L		55	5,000	2	7010	9020	8015
Antiomny	mg/L				2	0.01	0.01	0.01

Arsenic	mg/L		0.024	0.1	6	0.11	0.48	0.3
Beryllium	µg/L				6	0.01	0.012	0.01
Barium	mg/L			0.1	2	0.043	0.293	0.2
Boron	mg/L				4	0.56	3.6	1.9
Cadmium	mg/L			0.5	6	0.001	0.001	0.0
Chromium	mg/L				2	0.057	0.15	0.1
Cobalt	mg/L			0.01	6	0.17	0.375	0.28
Copper	mg/L		0.0033	0.1	6	0.01	0.035	0.024
Lead	mg/L		0.0014	0.05	6	0.01	0.052	0.02
Lithium	mg/L		0.0014	0.2	2	0.01	0.015	0.0
Manganese	mg/L				6	0.021	0.581	0.2408
Mercury	mg/L			0.2	6	0.0001	0.0122	0.004
Molybdenum	mg/L		0.0034	2	2	1.41	1.46	1.4
Nickel	mg/L			2.5	6	0.078	0.314	0.19
Selenium	mg/L		1.9	0.2	6	0.014	0.1	0.1
Silver	mg/L		0.0006	0.002	2	0.01	0.01	0.01
Strontium	µg/L		0.034	0.01	2	0.042	0.227	0.1
Thallium	mg/L		0.011	0.2	2	0.01	0.01	0.01
Tin	mg/L			0.02	2	0.01	0.023	0.02
Titanium	mg/L				2	0.1	0.1	0.10
Vanadium	mg/L		0.00003		2	0.39	1.92	1.155
Zinc	mg/L				6	0.052	0.86	0.3
boron	mg/L				2	0.1	3.87	1.985
Iron	mg/L				2	19.4	44.3	31.85
bromine	mg/L		0.006	0.1	2	4.19	6.08	5.14
Iodine	mg/L		0.008	2	2	2.56	7.49	5.025
Arsenious Acid , As (III)	µg/L				2	0.5	0.5	0.5
Arsenic Acid (As (V)	µg/L				2	72	310	191
Organoarenic compounds	mg/L				2	0.118	0.118	0.118
Hexavalent chromium (dissolved)	mg/L		0.001		2	0.5	0.5	0.5
Chlorine - Free	mg/L				2	1	1	1
Chlorine - Total residual	mg/L				2	1	1	1
Chemical Oxygen demand (COD)	mg/L				2	1700	1700	1700
Nonionic Surfactants as CTAS	mg/L				2	5	10	7.5
Anionic Surfactants as MBAS	mg/L				2	0.1	0.2	0.15
Uranium								
Uranium	mg/L		0.0005	0.01	8	0.1	3	1.042
Cyanide								
Total Cyanide	mg/L	0.004	-	-	17	7.81	227	117.9
Weak acid dissociable cyanide					2	0.4	0.4	0.4
Free Cyanide	mg/L	0.004	0.007		11	0.005	0.57	0.259
Fluoride					0			
Fluoride	mg/L	0.1		**1**	17	0.2	4200	1684.3875
Nitrogen								
Ammonia as N	mg/L		0.9		6	75	529	272.8
Nitrite as N	mg/L				6	0.01	0.01	0.01
Nitrate as N	mg/L				6	0.55	0.55	0.55
Nitrite + Nitrate as N	mg/L				6	0.55	0.55	0.55
Organic Nitrogen (as N)	mg/L				2			
Total Kjeldahl Nitrogen as N	mg/L				6	58	593	210.2
Total Nitrogen as N	mg/L				6	58	594	210.4
Phosphorus								
Total Phosphorus as P	mg/L				6	0.61	8.6	3.602
Reactive Phosphorus	mg/L				2	3.91	3.91	3.91
PCBs								
Total Polychlorinated biphenyls	µg/L	1			11	1	1	1
Polynuclear Aromatic Hydrocarbons					0			
Naphthalene	µg/L	1	16	-	11	1.4	38.8	14.34
Acenaphthylene	µg/L	1			11	1	2	1.4
Acenaphthene	µg/L	1			11	1	3.5	2.4
Fluorene	µg/L	1			11	1	2.1	1.78
Phenanthrene	µg/L	1	2	-	11	1	6	3.26
Anthracene	µg/L	1	0.01		11	1	2.7	1.98
Fluoranthene	µg/L	1	1	-	11	1	8.8	4.35
Pyrene	µg/L	1			11	1	8.7	4.78
Benz(a)anthracene	µg/L	1			11	1	9.2	4.72

Chrysene	µg/L	1			11	1	8.4	4.46
Benzo(b+j)fluoranthene	µg/L	1			11	1	17	7.94
Benzo(k)fluoranthene	µg/L	1			11	1	3.9	2.3
Benzo(a)pyrene	µg/L	0.5	0.1		11	0.5	10	5.24
Indeno(1.2.3.cd)pyrene	µg/L	1			11	1	7	3.56
Dibenz(a.h)anthracene	µg/L	1			11	1	2	1.54
Benzo(g.h.i)perylene	µg/L	1			11	1	8.2	4.08
Sum of polycyclic aromatic hydrocarbons	µg/L	0.5			11	2	122	58.46
Benzo(a)pyrene TEQ (zero)	µg/L	0.5			11	0.5	14.7	7.16
Total Petroleum Hydrocarbons								
C6 - C9 Fraction	µg/L	20			11	30	330	163
C10 - C14 Fraction	µg/L	50			11	50	200	116
C15 - C28 Fraction	µg/L	100			11	100	540	370
C29 - C36 Fraction	µg/L	50			11	50	240	117
C10 - C36 Fraction (sum)	µg/L	50			11	120	840	550
C6-C36 Fraction (sum)	µg/L	220			7	500	2010	1350
Total Recoverable Hydrocarbons								
C6 - C10 Fraction	µg/L	20			11	100	330	192
C6 - C10 Fraction minus BTEX (F1)	µg/L	20			11	90	320	182
>C10 - C16 Fraction	µg/L	100			11	100	330	192
>C16 - C34 Fraction	µg/L	100			11	340	540	446
>C34 - C40 Fraction	µg/L	100			11	100	200	128
>C10 - C40 Fraction (sum)	µg/L	100			11	540	870	666
>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100			11	100	280	166
BTEXN								
Benzene	µg/L	1	950	-	11	2	58	20
Toluene	µg/L	2	180 (LR)	-	11	2	10	5
Ethylbenzene	µg/L	2	80 (LR)	-	11	2	5	3
meta- & para-Xylene	µg/L	2			11	2	5	4
ortho-Xylene	µg/L	2			11	2	5	3
Total Xylenes	µg/L	2	200	-	11	2	5	4
Sum of BTEX	µg/L	1			7	5	54	22
Naphthalene	µg/L	5	16		11	5	70	36
OCPs								
OCPs	µg/L	2			2	2	2	2
OPPs								
OPPs	µg/L	2			2	2	2	2
Monocyclic Aromatic Hydrocarbons								
Benzene	µg/L	1	950		6	2	58	27
Toluene	µg/L	2	180 (LR)		6	2	11	6
Ethylbenzene	µg/L		80 (LR)		6	5	5	5
meta & para-Xylene	µg/L				6	10	10	10
Styrene	µg/L				6	5	5	5
ortho-Xylene	µg/L				6	5	5	5
Isopropylbenzene	µg/L				6	5	5	5
n-Propylbenzene	µg/L				6	5	5	5
1.3.5-Trimethylbenzene	µg/L				6	5	5	5
sec-Butylbenzene	µg/L				6	5	5	5
1.2.4-Trimethylbenzene	µg/L				6	5	5	5
tert-Butylbenzene	µg/L				6	5	5	5
p-Isopropyltoluene	µg/L				6	5	5	5
n-Butylbenzene	µg/L				6	5	5	5
Xylenes - Total	µg/L		200		6	5	5	5
Oxygenated Compounds								
2-Propanone (Acetone)	µg/L	50			6	50	340	195
Vinyl acetate	µg/L				6	50	50	50
2-Butanone (MEK)	µg/L				6	50	50	50
4-Methyl-2-pentanone (MIBK)	µg/L				6	50	50	50
2-Hexanone (MBK)	µg/L				6	50	50	50
Sulfonated Compounds								
Carbon Disulfide	µg/L	5			6	5	5	5
Fumigants								
Fumigants	µg/L	5			6	5	5	5
Halogenated Aliphatic Compounds								
Halogenated Aliphatic Compounds	µg/L	50			6	50	50	50

Halogenated Aromatic Compounds								
Halogenated Aromatic Compounds	µg/L	5			6	5	5	5
Trihalomethanes								
Chloroform	µg/L	5			6	8	19	13.5
Trihalomethanes	µg/L	5			6	5	5	5
Phenolic Compounds								
Phenolic Compounds	µg/L	2			6	2	12	7
3- &4-Methylphenol	µg/L	4			6	4	8	6
Pentachlorophenol	µg/L	4	3.6		6	4	4	4
Phenolic Compounds	µg/L	2			6	2	2	2
Phthalate Esters								
Phthalate Esters	µg/L	10	*1*		6	10	10	10
Nitrosamines								
Nitrosamines	µg/L	4			2	4	4	4
Nitroaromatics and Ketones								
Nitroaromatics and Ketones	µg/L	4			2	4	4	4
Haloethers								
Haloethers	µg/L	2			2	2	2	2
Chlorinated Hydrocarbons								
Chlorinated Hydrocarbons	µg/L	10			6	10	10	10
Anilines and Benzidines								
Carbazole	µg/L	2			2	2	4	3
Anilines and Benzidines	µg/L	4			2	4	4	4
Organotin Compounds (Soluble)								
Tributyltin	ngSn/L	2			2	15	15	15
Nitrogenated Compounds								
Acrylonitrile	µg/L	1			2	1	1	1
Aldehydes								
Formaldehyde	µg/L	2			2	168	423	295.5
Acetaldehyde	µg/L	2			2	10.1	19	14.55
Propionaldehyde	µg/L	2			2	2	2	2
Acrolein (Propenal)	µg/L	2			2	2	2	2
Butyraldehyde	µg/L	2			2	2	2.7	2.35
Phenolic Compounds								
Phenolic Compounds	µg/L	0.1			6	0.1	0.1	0.1
m-Cresol	µg/L	0.1			6	0.1	21.6	10.85
o-Cresol	µg/L	0.1			6	0.1	10.4	5.25
p-Cresol	µg/L	0.1			6	0.1	26	13.05
2.4-Dichlorophenol	µg/L	0.1			6	0.3	1.6	0.95
2.6-Dichlorophenol	µg/L	0.1			6	0.3	0.5	0.4
2.4-Dimethylphenol	µg/L	0.1			6	0.7	4.3	2.5
Pentachlorophenol	µg/L	0.05			6	0.05	0.39	0.22
Phenol	µg/L	0.1			6	0.1	123	61.55
2.4.5-Trichlorophenol	µg/L	0.1			6	0.1	0.1	0.1
2.4.6-Trichlorophenol	µg/L	0.1			6	0.1	0.3	0.2
Phenoxyacetic Acid Herbicides								
Phenoxyacetic Acid Herbicides	µg/L	10			2	10	10	10
Explosives								
Explosives	µg/L	20			2	20	20	20
Perfluorinated Compounds								
PFOS	µg/L	0.05	0.00023		6	0.05	0.05	0.05
PFOA	µg/L	0.05	19		6	0.05	0.05	0.05
PFAS Compounds	µg/L	0.5			6	0.5	0.5	0.5
Thiocarbamates and Carbamates								
Thiocarbamates and Carbamates	µg/L	0.1			2	0.1	0.1	0.1
Dinitroanilines								
Pendimethalin	µg/L	0.05			2	0.05	0.05	0.05
Trifluralin	µg/L	1			2	10	10	10
Triazinone Herbicides								
Hexazinone	µg/L	0.02			2	0.02	0.02	0.02
Metribuzin	µg/L	0.02			2	0.02	0.02	0.02
Conazole and Aminopyrimidine Fungicides								
Conazole and Aminopyrimidine Fungicides	µg/L	0.05			2	0.05	0.05	0.05
Phenylurea, Thizdiazolurea, Uracil and Sulfonylurea Herbicides								
Phenylurea, Thizdiazolurea, Uracil and Sulfonylurea	µg/L	0.2			2	0.2	0.2	0.2

Chloracetanilides								
Metolachlor	µg/L	0.01			2	0.01	0.01	0.01
Triazine Herbicides								
Triazine Herbicides	µg/L	0.05			2	0.05	0.05	0.05
Organochlorine Pesticides (OC)								
Organochlorine Pesticides (OC)	µg/L				6	0.5	0.5	0.5
Dibromo-DDE	%				2	62.6	70.6	66.6
Miscellaneous Pesticides								
Miscellaneous Pesticides	µg/L	1			2	1	1	1

Attachment 3 - Summary of Data for Surrounding Environment

		SUMMARY			
Parameters	**LOR**	**No. Samples**	**Min.**	**Max.**	**Mean**
pH		1641	3.4	8.8	6.77
Electrical Conductivity (uS/cm)		1641	39	8100	688.73
Fluoride	100	1641	50	81000	3074.31
TSS (mg/L)		666	0	5200	55.43
TDS (mg/L)		666	0	4800	660.15
Free Cyanide		110	0	5	3.58
Total Cyanide		0	0	0	0.00
Metals and Metalloids					
Aluminium	10	2	10	1500	755.00
Arsenic	1	5	1	15	5.50
Boron	5	2	138.55	160	149.28
Barium	1	2	29	69.405	49.20
Beryllium	0.5	2	0.5	0.5	0.50
Cadmium	0.1	5	0.1	0.6	0.22
Cobolt	1	2	1	9.05	5.03
Chromium	1	5	1	5	2.58
Copper	1	5	2	20	6.67
Mercury	0.05	5	0.05	0.4	0.13
Manganese	5	2	13	536.52	274.76
Molybdenum	1	2	1	1	1.00
Nickel	1	5	16	67	31.19
Lead	1	5	1	10	4.33
Antimony	1	2	1	1	1.00
Selenium	1	2	1	1	1.00
Tin	1	2	1	1	1.00
Zinc	1	5	2	210	80.00
Total Recoverable Hydrocarbons (TRH)					
TRH C6-C9	<10	2	10	10	10.00
TRH C10-C14	<50	2	50	50	50.00
TRH C15-C28	<100	2	100	100	100.00
TRH C29-C36	<100	2	100	100	100.00
TRH C10-C36	<250	2	250	250	250.00
Total Recoverable Hydrocarbons (TRH) NEPM (2013)					
TRH C6 - C10	<10	2	10	50	30.00
vTPH C6 - C10 less BTEX	<10	2	10	10	10.00
TRH >C10-C16	<50	2	50	50	50.00
TRH >C16-C34	<100	2	100	100	100.00
TRH >C34-C40	<100	2	100	100	100.00
BTEX					
Benzene	<1	2	1	1	1.00
Toluene	<1	2	1	1	1.00
Ethylbenzene	<1	2	1	1	1.00
m+p-xylene	<2	2	2	2	2.00
o-xylene	<1	2	1	1	1.00
Organochlorine Pesticides (OCP)					
alpha-BHC		3	10	10	10.00
HCB		3	10	10	10.00
delta-BHC		3	10	10	10.00
Heptachlor		3	10	10	10.00
Aldrin		3	10	10	10.00
Heptachlor epoxide		3	10	10	10.00
Chlordane		3	10	10	10.00

Endosulfan		3	10	10	10.00
Dieldrin		3	10	10	10.00
DDE		3	10	10	10.00
Endrin		3	10	10	10.00
DDD		3	10	10	10.00
Endrin aldehyde		3	10	10	10.00
Endosulfan sulfate		3	10	10	10.00
DDT		3	10	10	10.00
Organophosphorous Pesticides (OPP)					
Dichlorvos		3	10	10	10.00
Dimethoate		3	10	10	10.00
Diazinon		3	10	10	10.00
Chlorpyrifos-methyl		3	10	10	10.00
Malathion		3	10	10	10.00
Fenthion		3	10	10	10.00
Chlorpyrifos		3	10	10	10.00
Bromophos-ethyl		3	10	10	10.00
Chlorfenvinphos		3	10	10	10.00
Prothiofos		3	10	10	10.00
Ethion		3	10	10	10.00
Polynuclear Aromatic Hydrocarbons					
Naphthalene	<1	5	1	1	1.00
2-Methylnaphthalene		3	1	1	1.00
2-Chloronaphthalene		3	1	1	1.00
Acenaphthylene	<1	5	1	1	1.00
Acenaphthene	<1	5	1	1	1.00
Fluorene	<1	5	1	1	1.00
Phenanthrene	<1	5	1	1	1.00
Anthracene	<1	5	1	1	1.00
Fluoranthene	<1	5	1	1	1.00
Pyrene	<1	5	1	1	1.00
N-2-Fluorenyl Acetamide		3	1	1	1.00
Benz(a)anthracene	<1	5	1	1	1.00
Chrysene	<1	5	1	1	1.00
Benzo(b) & Benzo(k)fluoranthene	<2	5	2	2	2.00
7.12-Dimethylbenz(a)anthracene		3	1	1	1.00
Benzo(a)pyrene	<1	5	1	1	1.00
3-Methylcholanthrene		3	1	1	1.00
Indeno(1.2.3.cd)pyrene	<1	5	1	1	1.00
Dibenz(a.h)anthracene	<1	5	1	1	1.00
Benzo(g.h.i)perylene	<1	5	1	1	1.00
Benzo(a)pyrene TEQ	<5	2	5	5	5.00
Total +ve PAH		2	0	1.1	0.55
Phenols					
Total Phenolics		3	10	10	10.00
Phthalate Esthers					
Dimethylphthalate		3	10	10	10.00
Diethylephthalate		3	10	10	10.00
Nitrosamines					
Total Nitrosamines		3	10	10	10.00
Nitroaromatics and Ketones					
Total Nitroaromatics and Ketones		3	10	10	10.00
Haloethers					
Total Haloethers		3	10	10	10.00
Chlorinated Hydrocarbons					
Total Chlorinated Hydrocarbons		3	10	10	10.00
Anilines and Benzidines					

Total Anilines and Benzidines		3	10	10	10.00
Miscellaneous Compounds					
Total Misscellaneous Compounds		3	10	10	10.00
Cations & Anions (mg/L)					
Calcium - Dissolved		2	36	38	36.81
Potassium - Dissolved		2	11	13	12.22
Sodium - Dissolved		2	284	290	287.17
Magnesium - Dissolved		2	36	39	37.35
Hydroxide Alkalinity (OH-) as CaCO3		2	5	5	5.00
Bicarbonate Alkalinity as as CaCO3		2	13	47	29.85
Carbonate Alkalinity as as CaCO3		2	5	5	5.00
Total Alkalinity as CaCO3		2	13	47	29.85
Sulphate, SO4		2	220	279.89	249.95
Chloride, Cl		2	409	420	414.43
Ionic Balance (%)		2	-1	1.8	0.59
Water Hardness as CaCO3 (Calculation)*		2	236	255.49	245.72
PFAS					
PFOA		34	0	0.013	0.0044
PFOS		34	0	0.36	0.0664

All results in µg/L unless specified

Attachment 4: Irrigation Area Soil

			SUMMARY		
Parameters	**LOR**	**No. Samples**	**Min.**	**Max.**	**Mean**
Metals					
Aluminium	50	6	2210	14800	9245
Arsenic	1	6	0.6	6.2	3.9
Cadmium	0.1	6	0.1	0.5	0.3
Chromium	1	6	3.6	22.5	13.5
Copper	2	6	1.1	17.6	6.2
Nickel	1	6	2.5	30.9	13.9
Lead	2	6	6.2	23.3	15.6
Zinc	5	6	19.7	267	94
Mercury	0.05	6	<0.1	<0.1	<0.1
Fluoride	40	13	200	510	184.3
Total Petroleum Hydrocarbons (TPH)					
TPH C6-C9 (comparing against F1 and includes BTEX)	10	6	<10	<10	<10
TPH C10-C14 (comparing against F2 and includes naphathlene)	50	6	<50	<50	<50
TPH C15-C28	100	6	<100	280	174
TPH C29-C36	100	6	<100	130	<130
TPH C10-C36	--	6	<50	410	200
Polycyclic Aromatic Hydrocarbons (PAH)					
Naphthalene	0.5	1			<0.5
Acenaphthylene	0.5	1			<0.5
Acenaphthene	0.5	1			<0.5
Fluorene	0.5	1			<0.5
Phenanthrene	0.5	1			<0.5
Anthracene	0.5	1			<0.5
Fluoranthene	0.5	1			0.9
Pyrene	0.5	1			0.9
Benz(a)anthracene	0.5	1			1
Chrysene	0.5	1			1.5
Benzo(b)&(k)fluoranthene	1	1			3.3
Benzo(k)fluoranthene	0.5	1			0.8
Benzo(a) pyrene	0.5	1			1.2
Indeno(1,2,3-c,d)pyrene	0.5	1			0.8
Dibenz(a,h)anthracene	0.5	1			<0.5
Benzo(g,h,i)perylene	0.5	1			1.1
Sum of reported PAH	--	1			11.5

All results are in units of mg/kg.

Attachment 5: Leachate Treatment Trial Results

Parameters	No. Samples	Min	Max	Mean
	SUMMARY			
pH	10	7.1	9.9	8.39
Alkalinity				
Hydroxide Alkalinity as CaCO3	10	20	20	20
Carbonate Alkalinity as CaCO3	10	10	12000	2502
Bicarbonate Alkalinity as CaCO3	10	260	9500	4163
Total Alkalinity as CaCO3	10	430	15000	6683
Calcium				
Calcium	10	6	1100	219.95
Cyanide				
Total Cyanide	10	97	230	133.6
Weak acid dissociable cyanide				
Free Cyanide	10	0.006	0.096	0.0322
Fluoride				
Fluoride	Refer to response in Table 1			

Treatment Trial Results: Fluoride and Calcium

Sample Reference	Ca (mg/L)	F (mg/L)
CA15	15	550
CA20	21	290
CA15 PH8 ALUM30	50	98
CA15 PH8 ALUM15	110	54
CA25	380	29
CA20 PH8	230	14
CA15 PH8	280	13
CA25 PH8	1100	5.4