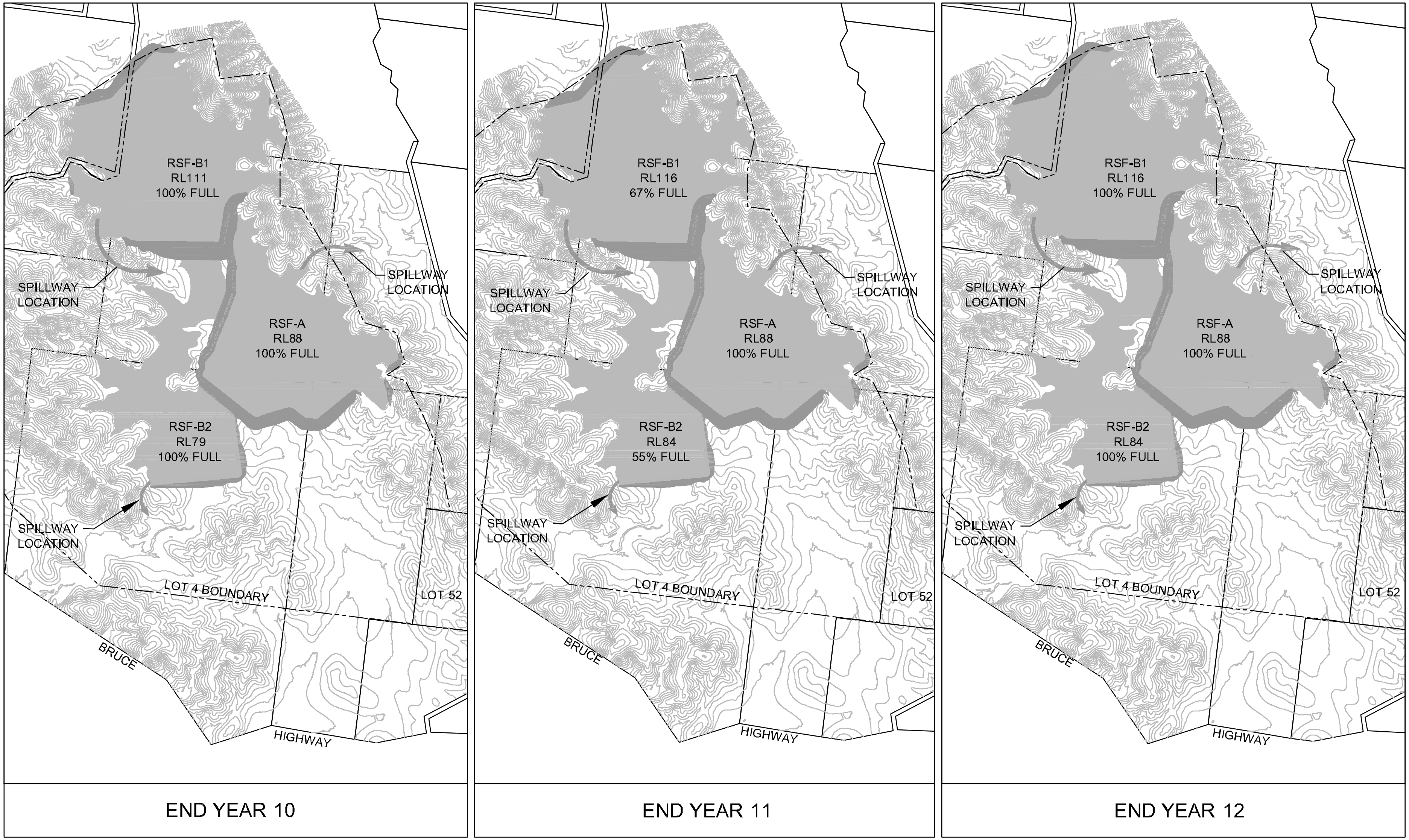


URS

Client: Gladstone Pacific Nickel Ltd

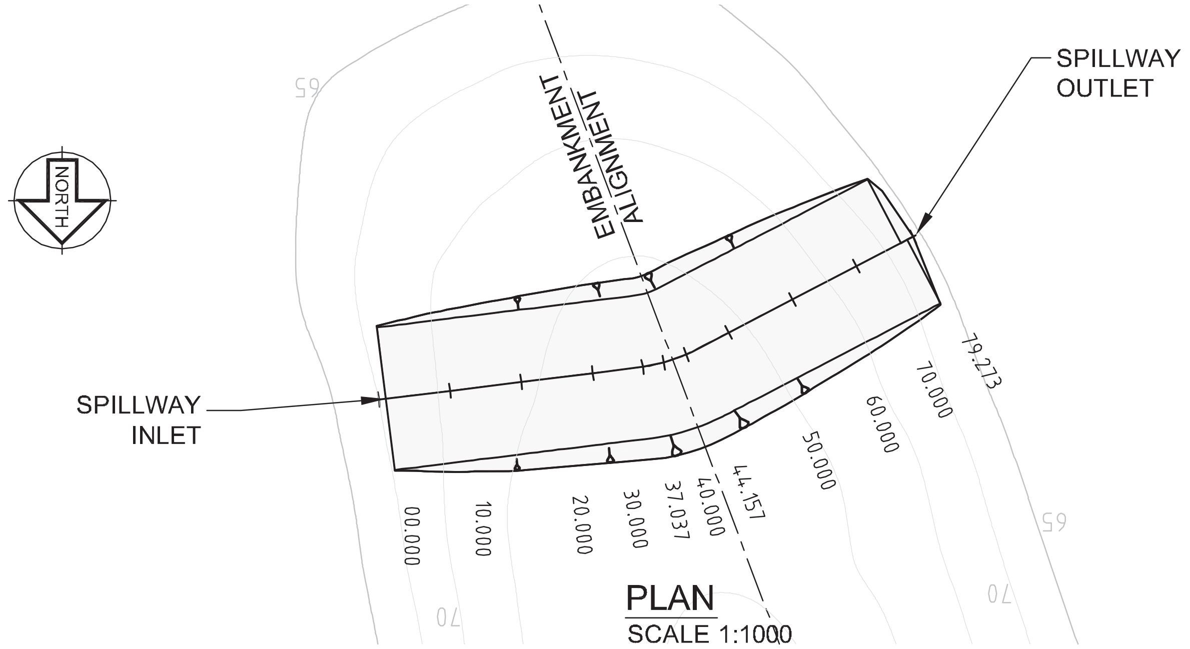
Project: GLADSTONE NICKEL PROJECT
ENVIRONMENTAL IMPACT STATEMENT
SUPPLEMENT

Title: RSF DEVELOPMENT PLAN
(TO END YEAR 12)

Drawn: VH | Approved: CDP | Date: 29/01/2008

Job No.: 4262 5791 | File No.: 42625791-g-266.dwg

Figure: 9.7 | Rev. A | A4



PLAN
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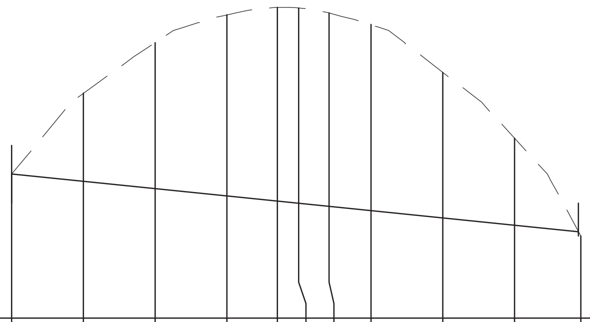


DATUM RL 69

INVERT LEVEL	71.000	70.899	70.797	70.696	70.625	70.595	70.552	70.493	70.392	70.291	
EXISTING SURFACE	71.000	72.125	72.831	73.220	73.320	73.315	73.243	73.082	72.421	71.503	70.138
DEPTH OF SPILLWAY	-0.000	1.226	2.034	2.524	2.695	2.721	2.691	2.589	2.029	1.213	
CHAINAGE	0.000	10.000	20.000	30.000	37.039	40.000	44.157	50.000	60.000	70.000	79.273

LONGITUDINAL SECTION
Horizontal scale 1:1000
Vertical scale 1:100

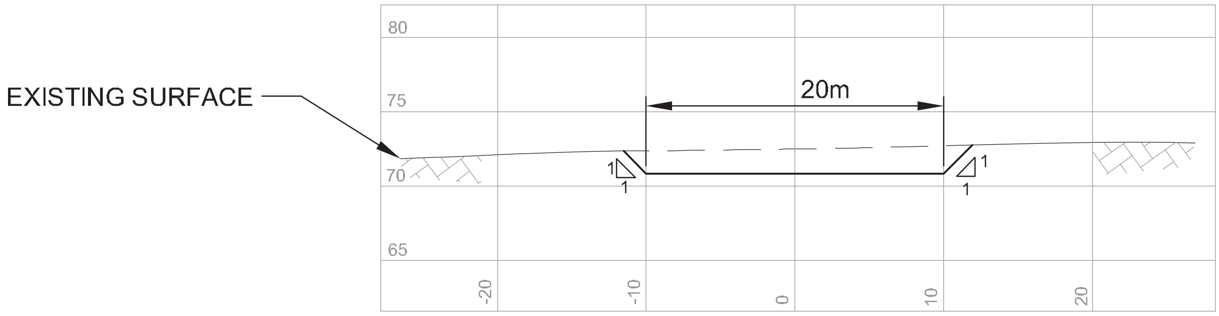
Client
Gladstone Pacific Nickel Ltd
URS

Project
GLADSTONE NICKEL PROJECT
ENVIRONMENTAL IMPACT STATEMENT
SUPPLEMENT

Title
RSF-A SPILLWAY
PLAN AND LONG SECTION

Drawn: VH | Approved: CDP | Date: 29-01-2008
Job No.: **4262 5791** | File No. 42625791-g-245.cdr

Figure: **9.8**
Rev. A
A4



CH 15
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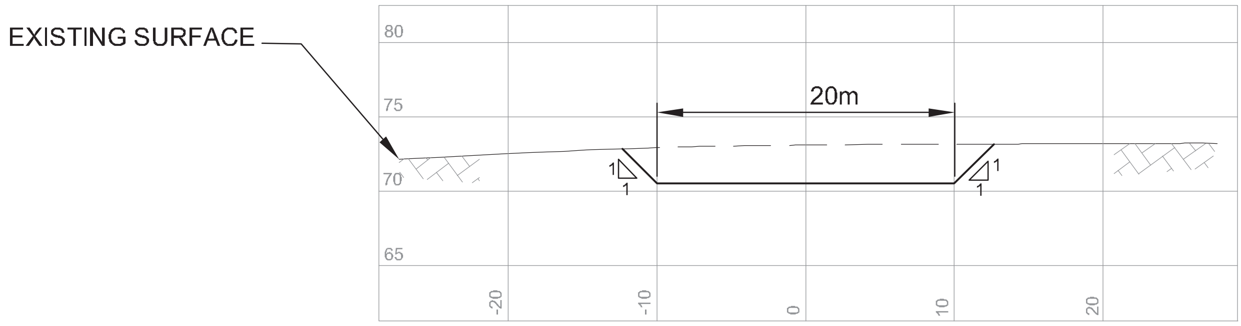
030



CH 50
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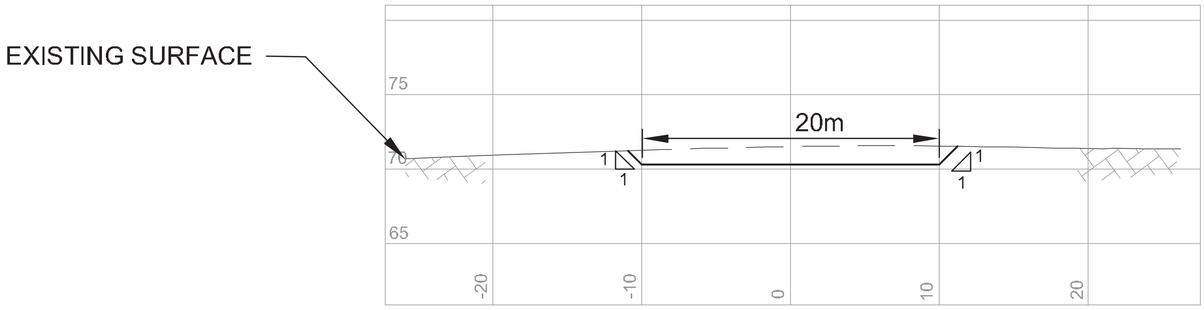

CH 70
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030

Client	Project	Title
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**RSF-A SPILLWAY CROSS SECTIONS**
URS	Drawn: VH / Approved: CDP / Date: 29-01-2008	Figure: **9.9** / Rev. A
	Job No.: **4262 5791** / File No. 42625791-g-246.cdr	A4

9.3.3 Embankment Design (1)

EPA advised that notes on Figures 9.3.3 and 9.3.4 should be altered as follows: For Zone 1- delete the option of using a 10t vibratory smooth drum roller, and specify 98% proctor MDD; and - specify a maximum lift thickness of 150 mm. For Zone 2A: specify a required filter criteria for the Filter Sand. For Zone 3A: specify a Maximum Lift Thickness of 500 mm.

The embankment design has been revised to meet or exceed the recommendations set forth by EPA. Figures 9.10 and 9.11 specify the following changes to the requirements for the RSF-A embankment fill placement:

- Zone 1: Compaction shall be by 10 t vibratory smooth drum roller, compacted to at least 98% proctor MDD; and the maximum lift thickness is set at 150 mm.
- Zone 2A: Filter sand shall comply with the "Filter Criteria for 2A" provided in Figure 9.10.
- Zone 3A: The maximum lift thickness is set at 500 mm.

9.3.4 Seepage Collection System (1)

EPA advised that data should be collected on the likely changes in ground water levels with wetter seasons. If ground water levels are likely to change significantly, modelling of seepage through the containment dams must be based on higher water levels and more extensive aquifers, and this information should be provided in the EIS.

Groundwater levels in alluvium have been measured between 2.96 m and 4.51 m below ground level, with some of the bores in alluvium being dry. Where the monitoring bores were dry the alluvium may not act as an aquifer, or the alluvial aquifers may be dry due to the extended dry conditions encountered during the field investigations. The groundwater level in the alluvium is generally above the piezometric water level in the bedrock at the same location which indicates groundwater movement may be downwards, with the alluvium recharging the bedrock aquifers. Due to the heterogeneity and discontinuity of the alluvial aquifers, the groundwater flow direction cannot be determined on a regional scale for these aquifers; however, locally groundwater flow is expected to be down gradient along the drainage lines.

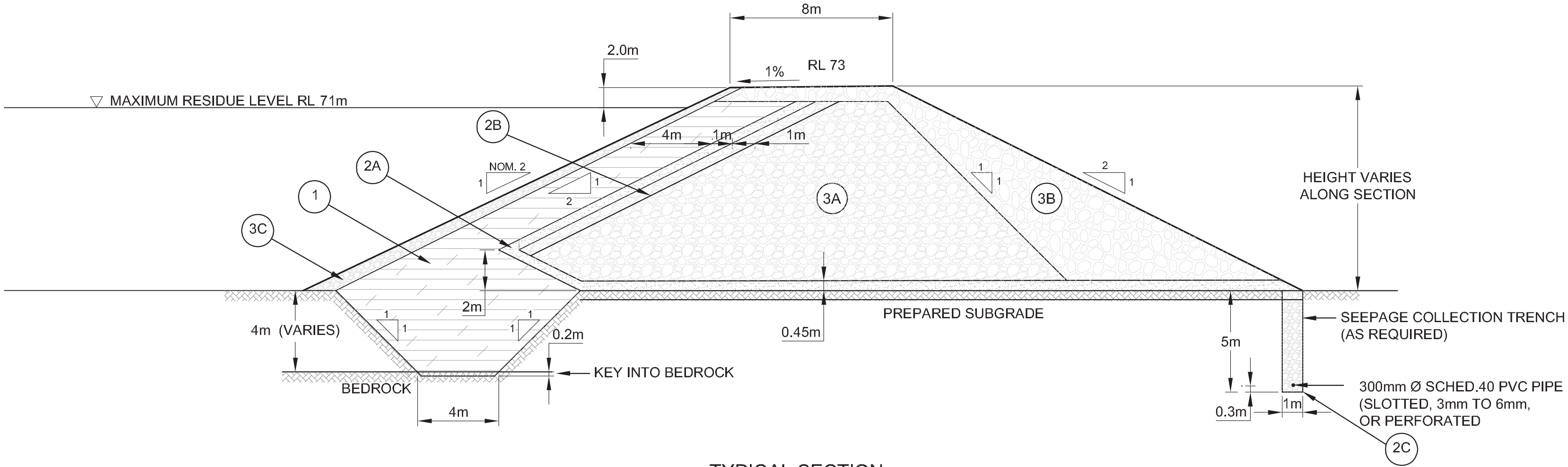
Due to the limited timeframe for the field investigations, seasonal variations in groundwater levels within the monitoring wells installed in the project area were not able to be determined. However, groundwater levels within monitoring wells installed in the Rockhampton Group for the Rio Tinto Aluminium Yarwun RSF (URS, 2007b) show a seasonal variation of 0.20 to 7.25 m with an average variation of 1.99 m and median variation of 1.18 m between July 2005 and February 2007 based on quarterly monitoring. Groundwater levels in the Rockhampton Group and Mount Alma Formation within the project area are expected to show a similar range of seasonal variation.

The initial seepage modelling undertaken for the EIS assumed a groundwater depth of approximately 40 m below ground level. To account for seasonal variations and the more recent groundwater level data, the revised seepage modelling reported in URS, 2007a assumed a groundwater depth of 8 m below ground level.

9.3.5 Spillway (20)

A respondent has advised that construction of the RSF as part of the GNP will prevent the flow of surface water into Farmer Creek as a result his right to irrigate on the land using water out of Farmer Creek will be lost even though he holds water licenses to allow him to irrigate out of Farmer Creek. Numerous details are provided to back up this comment.

Refer to response in Section 9.



TYPICAL SECTION
SCALE 1:200

NOTES:

1. COMPACTED CLAY - NATIVE CLAYEY SOILS. MOISTURE CONDITIONED AT OR ±2% OF OMC. COMPACTION BY 1 0t VIBRATORY SMOOTH DRUM ROLLER OR SHEEPSFOOT TO 98% PROCTOR MDD. MAX. LIFT THICKNESS: 150mm

2A. FILTER SAND (QUARRY SOURCE) - MOISTURE CONDITIONED AND COMPAC TED BY 10t VIBRATORY SMOOTH DRUM ROLLER. MAX. LIFT THICKNESS: 150mm

2B. TRANSITION ZONE TO MAINTAIN FILTER CAPABILITY,COMPACT PER 2A

2C. DRAINAGE AGGREGATE - HARD,DURABLE (D50 = 20mm)

3A. ROLLER COMPACTED ROCKFILL - NATIVE OR QUARRIED ROCK (D50 = 300mm), COMPACTION BY 1 5t VIBRATORY SMOOTH DRUM ROLLER. MAX. LIFT THICKNESS: 500 mm, MIN. 5 PASSES

3B. TRUCK COMPACTED ROCKFILL - NATIVE OR QUARRIED ROCK (D50 = 550mm), COMPACTION BY HAUL TRUCK TRAFFICKING. MAX. LIFT THICKNESS: 2m

3C. EROSION LAYER - QUARRIED ROCK (D50 = 600mm), COMPACTION BY HAUL TRUCK TRAFFICKING. MAX. LIFT THICKNESS: 2m

FILTER CRITERIA FOR 2A

GRAIN SIZE (mm)	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
% PASSING	100	95 - 100	75 -100	50 - 85	25 - 60	5 - 30	0 - 12	0 - 5

Client: Gladstone Pacific Nickel Ltd

URS

Project: GLADSTONE NICKEL PROJECT
ENVIRONMENTAL IMPACT STATEMENT
SUPPLEMENT

Drawn: VH | Approved: CDP | Date: 29-01-2008

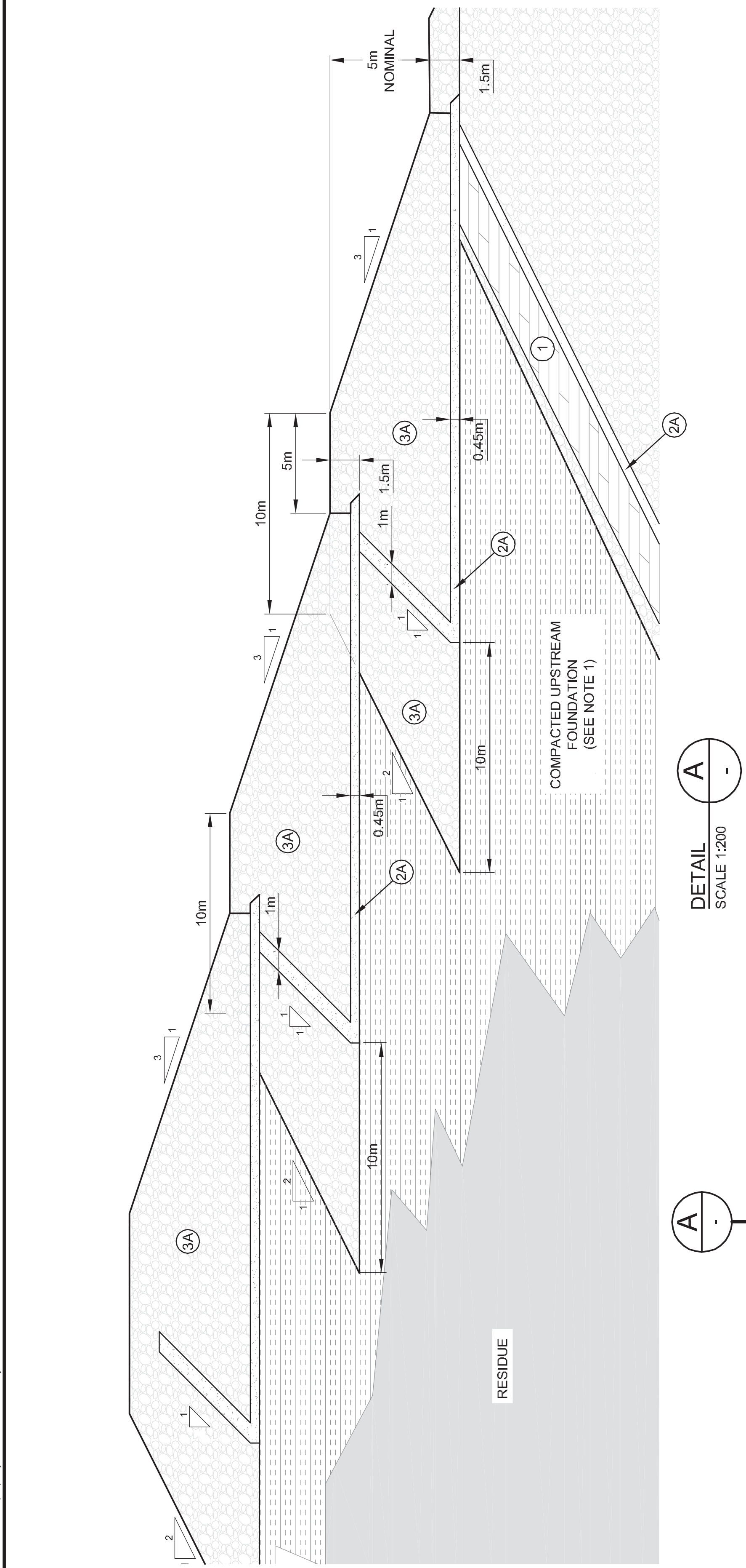
Job No.: 4262 5791 | File No. 42625791-g-247.cdr

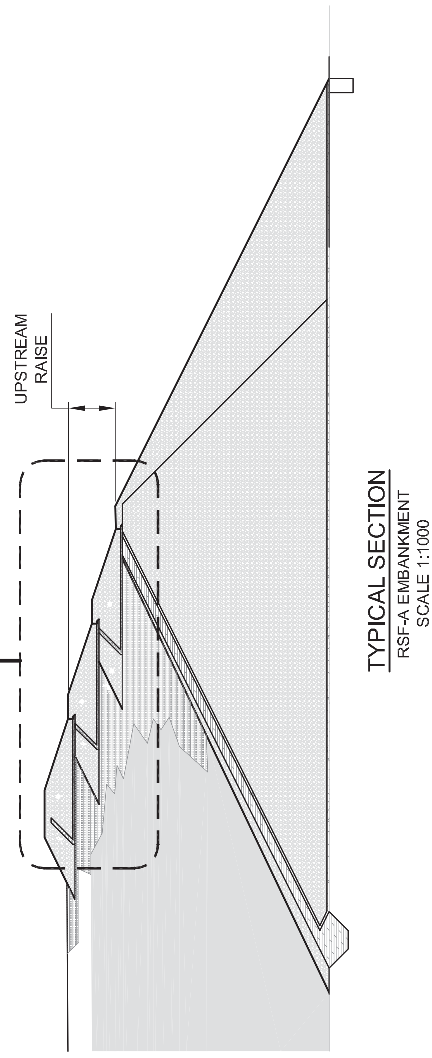
Title: TYPICAL CONTAINMENT DAM SECTION RSF-A

Figure: 9.10

Rev. A

A4





NOTES:

1. UPSTREAM FOUNDATION MAY CONSIST OF ROCKFILL, COMPACTED RESIDUE AND/OR AMENDED RESIDUE.

LEGEND:

1 COMPACTED CLAY - NATIVE CLAYEY SOILS. MOISTURE CONDITIONED AT OR ±2% OF OMC. COMPACTION BY 1 0t VIBRATORY SMOOTH DRUM ROLLER OR SHEEPSFOOT TO 9 8% PROCTOR MDD. MAX. LIFT THICKNESS: 150mm

2A FILTER SAND (QUARRY SOURCE) - MOISTURE CONDITIONED AND COMPACT ED BY 10t VIBRATORY SMOOTH DRUM ROLLER. MAX. LIFT THICKNESS: 150mm. REFER TO DRAWING NO. 42626071-004

2B TRANSITION ZONE TO MAINTAIN FILTER CAPABILITY,COMPACT PER 2A

2C DRAINAGE AGGREGATE - HARD,DURABLE (D50 = 20mm)

3A ROLLER COMPACTED ROCKFILL - NATIVE OR QUARRIED ROCK (D50 = 300mm), COMPACTION BY 1 5t VIBRATORY SMOOTH DRUM ROLLER. MAX. LIFT THICKNESS: 500 mm. MIN. 5 PASSES

3B TRUCK COMPACTED ROCKFILL - NATIVE OR QUARRIED ROCK (D50 = 550mm), COMPACTION BY HAUL TRUCK TRAFFICKING. MAX. LIFT THICKNESS: 2m

3C EROSION LAYER - QUARRIED ROCK (D50 = 600mm), COMPACTION BY HAUL TRUCK TRAFFICKING. MAX. LIFT THICKNESS: 2m

Client	Project	Title	
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**CONCEPTUAL UPSTREAM RAISE DETAIL RSF-A**	
URS	Drawn: VH / Approved: CDP / Date: 29-01-2008	Figure: **9.11**	Rev. A
	Job No.: **4262 5791** / File No. 42625791-g-248.cdr		A4

A respondent has indicated that the discharge of excess water from the RSF will cause irreversible contamination in Farmer Creek and thus cause contamination of "Fairview". This will result in environmental and economic impacts on downstream properties.

Under normal operational conditions, excess water is not discharged from the RSF. Excess water in the RSF will be collected and returned to the refinery at Yarwun. No sediment will be released from the RSF during normal operations.

In the early life of the cells, there will be relatively small volumes of residue in them. Hence the freeboard will be significant with virtually no risk of overflow. Once the cell has been filled, it will be covered and rehabilitated so that surface runoff will not be contaminated by residue. The spillway will be wide to reduce flow velocities and to minimise the risk of erosion.

A risk assessment has been undertaken to assess the potential for a significant rainfall event to occur that could result in an unplanned discharge from the RSF just prior to completion before it is covered and rehabilitated. The assessment considered the following scenarios:

- Scenario 1 = RSF-A Stage 1 (just prior to completion)
- Scenario 2 = RSF-A Stage 4 + RSF-B1 Stage 6 (just prior to completion)
- Scenario 3 = RSF-A Stage 4 + RSF-B1 Stage 6 + RSF-B2 Stage 4 (just prior to completion)
- Scenario 4 = RSF-A Stage 4 + RSF-B1 Stage 6 + RSF-B2 Stage 4 (with no residue addition and no extraction to refinery).

The main objective was to determine the probability of overflow from the RSF cells to the downstream environment. Historical rainfall data for the site for the period 1906 to 2006 were used to undertake the assessment. These data were input into the stochastic climate library to generate 1,000 years of stochastic rainfall data (random numbers that are modified so that they have the same characteristics, mean, variance, skew, long-term persistency, as the historical data from which they are based). The results of the assessment are given in the following table.

Risk of One or More Spillway Discharges in Any One Year

Scenario	Storage	Approximate Annual Exceedence Probability		Discharge Location
		(%)	(1 in X years)	
Scenario 1	RSF-A	0.1	1,000	Farmer Creek
Scenario 2	RSF-A	0.1	1,000	Gravel Creek
	RSF-B1	0.1	1,000	RSF-B2
Scenario 3	RSF-A	0.1	1,000	Gravel Creek
	RSF-B1	0.1	1,000	RSF-B2
	RSF-B2	0.1	1,000	Farmer Creek
Scenario 4	RSF-A	0.1	1,000	Gravel Creek
	RSF-B1	0.1	1,000	RSF-B2
	RSF-B2	0.2	500	Farmer Creek

In the event that an overflow did occur, the dilution from the large volumes of water flowing in the creek system under the influence of a 1 in 500 or a 1 in 1,000 year storm would be so great that the effect of any runoff from the RSF would be negligible.

During construction, there is a potential for sediment to be transported downgradient. To prevent this, sediment runoff controls will be installed. A detailed construction environmental management plan specific to the RSF will be prepared and will include controls to prevent any significant sedimentation in runoff to Farmer Creek or Six Mile Creek.

9.4 RSF Operations (1)

EPA asked that the EIS include information on the operational aspects of the thickeners and return liquor tanks. Specifically the EIS must include information on:

- *the 'footprint' of the thickener complex;*
- *infrastructure requirements;*
- *thickener number and capacity;*
- *size and location of return liquor tanks;*
- *bunding of thickeners and tanks; and*
- *water/effluent management plans.*

In addition, contingency plans for spills must be documented. The EIS must include plans for how the residues will be managed in the event of thickeners going offline. It must include details of how the effluent from the thickeners will be managed.

Location

The residue thickeners are situated in the residue thickening area at the southern side of the residue storage facility (RSF) area. The residue thickening area is approximately 1 km south of the initial residue storage bunded area.

For Stage 1 it is proposed to construct two high rate process thickeners, flocculant addition system and a return liquor tank. They will all be located within a bunded concrete pad with an area sump pump which will return spillage and washings to thickener feed / deaeration tanks at the thickener feed launders.

A switchroom will be located adjacent the thickener pad to supply power to and allow isolation of the electric motors located on pumps and thickeners as well as the reclaim water pumps and pond and bore instruments and sampling devices used in the RSF.

Operation

The process thickeners will act to partially de-water the residue slurry which originates from the leach plant in the refinery, prior to the thickened slurry being disposed of into the residue storage bunded area. Neutralised slurry flowing at 2,740 m^3/h and containing 26.5% solids will be treated through the facility.

Each thickener will be 54 m in diameter with a conical base and a working slurry volume of 10,200 m^3. The overflow tank, servicing both thickeners will have a working volume of 600 m^3.

A flocculant will be added to the slurry prior to it being pumped into the process thickeners. The flocculant will assist with the settling of the solids in the thickener.

Supernatant water will discharge from the thickener overflows and be returned to the refinery for reuse via the return liquor (overflow) tank which will act as a collection tank for clear water and also as a header tank for the return liquor pumps.

Spillage

The contained bunded area will have an area of 10,000 m^2. A bund height of 1.15 m will provide for 110% of the volume of one thickener (the largest tank). This area will capture the contents of up to one full thickener which then can then be returned to the system through the existing operating thickener.

Spillage from piping and equipment within the bunded area will remain within the bunded area and will be washed to the area sump and pumped back into the thickener feed. Such spills could occur during regular pump or tank maintenance, or in the improbable event of a leak or overflow from a pipe, pump, thickener or tank.

In the event of the known requirement to take one thickener out of service, the contents of the thickener would be pumped to the second thickener prior to opening the decanted thickener into the bunded area.

Under a normal operating regime only one thickener would be taken out of service at any time, with the second thickener remaining in service. If the flow capacity can not be handled by the operating thickener, then the slurry would be sent through a bypass to the RSF. In the unusual situation where both thickeners are taken off-line simultaneously then all the residue slurry would bypass to the RSF, unless the leach plant was simultaneously taken off line.

Any spill from equipment and piping located in the thickening area should remain within the bunded concrete pad, until it is returned to the operating system.

Leaks from pipelines should not normally occur and would be cleaned up, together with pipe repair, when detected. Flow meters installed with comparators at the start and finish of the long pipeline lengths would provide warning of any major flow excursions, allowing rapid detection and containment of anomalies.

EPA advised that the EIS should address potential dust issues at the RSF and the potential for impacts on the environment and dust sensitive locations. If dust is likely to be a problem, the EIS should discuss and present dust reduction and mitigation measures.

Dust is unlikely to be an issue at the RSF. After thickening, slurry residue will be discharged via spigot disposal along the RSF perimeter. The residue will form a beach as it flows away from the spigots and settles. The liquor entrained in the slurried residue will flow to a low point at the end of the residue beach and collect in a reclaim pond. Residue discharge will be managed so that the reclaim pond is located away from the embankment towards the centre of the RSF. In addition, alternating spigotting points will be employed to promote thin-layer deposition, thereby enhancing consolidation and increasing the residue dry density. This will result in alternating discharge points around the RSF ensuring that there will be limited time for the residue to dry out and become a dust hazard before another layer of moist residue overlays it. Given the use of smaller multiple cells compared to larger single cell proposed in the EIS, there will be less opportunity for dust generation as the surface area of the exposed residue will be significantly reduced.

In the unlikely event that the residue surface does dry out, it is not likely to produce dust. This statement is based on residue drying tests performed in the laboratory that indicate the residue forms a hard, cohesive crust on drying, which is resistant to wind erosion.

9.4.3 Water Balance (1)

EPA advised that as the RSF will be used to manage residue liquor quality prior to discharge, the EIS should take into consideration the impacts on liquor volumes and required pond capacities in the event that discharge to Port Curtis is prevented. For example, this situation could arise if process problems lead to changes in effluent quality and discharge is disallowed by licence conditions.

Water management issues for RSF-A, i.e. storage capacity and balance status, were analysed in URS (2007a) using a probabilistic water balance model, simulating the month by month operation. The basic model was developed using the following governing inflow equal outflow equation:

Inflows + Previous Storage – Outflows = New Storage

The RSF-A solution balance simulation model considered the following sources of input to the system:

- Precipitation into the RSF
- Runoff from surrounding catchments
- Process water deposited as part of the residue

Outflows from the water balance are:

- Evaporation from the RSF water pool
- Reclaim water from the RSF
- Evaporation from the beach slope.

Seepage is not considered significant enough to the overall water balance to be modelled and, as discussed below, no losses associated with overflows were simulated to occur.

In order to accurately represent the site-specific interaction between inflows and outflows, 100 years of rainfall and evaporation data from 1906-2006 were acquired using the Department of Natural Resources and Water (NRW) data drill facility. By using such a long record, it was possible to account for variability in the amount of precipitation and evaporation and model real sequences of events. This is particularly important for the consideration of long-term 'wet' or 'dry' periods.

The following table provides a summary of the annual average inflows and outflows for RSF-A.

Summary of Average Inflows and Outflows for RSF-A

Inflow	Average Volume (ML/yr)	Outflow	Average Volume (ML/yr)
Direct Rainfall	1,130	Evaporation from Pond	600
Runoff	645	Evaporation from Beach	785
Process water in residue	19,850	Reclaim water	20,245
Total	21,630	Total	21,630

Reclaim water is proposed to be decanted from the RSF-A using four (4) 162.5 L/s decant pumps. The optimum water level for management of residue and to provide sufficient water to allow the pumps to operate was defined as being between 1.5 m – 6.0 m depth. Pumps were therefore switched on whenever the water depth was greater than 1.5 m.

The volume of water in the RSF-A generally fluctuates between a minimum of approximately 13 ML and a maximum of approximately 2,432 ML. The water level fluctuates frequently after rainfall events as does the depth of water in the pond. This can generally be managed between 1.5 m – 5.7 m depth.

The total volume of water contained in the RSF (roughly 2,400 ML) will be 12% of the annual average volume of water to be returned to the refinery (20,245 ML). That means that if the RSF pond is low in the event that discharge to Port Curtis is prevented there would be some months of storage capacity before the refinery's operations would be affected. Should the RSF be high when the Port Curtis discharge is prevented, the refinery's operational time would be less. If the RSF's capacity to store water is reached and discharge to Port Curtis was still prevented, the refinery would need to be shut down until the discharge can recommence.

9.4.4 RSF Monitoring (1)

EPA advised that the EIS should include detailed monitoring plans for the operation of the RSF. Timelines and analytes in particular need to be detailed and monitoring locations should be based on fundamental information about groundwater dynamics under and around the RSF.

Groundwater monitoring bores will be established at strategic locations throughout the RSF site, including but not limited to the monitoring bores installed for the EIS studies. The monitoring program will be initiated prior to the operational phase and continued for the life of the RSF and after closure until impacts have been mitigated. The monitoring will be conducted on a quarterly basis. An annual review of the monitoring program will be conducted to evaluate the effectiveness of each monitoring location to assess where new locations and modifications to the monitoring program may be needed, and to evaluate what impacts may be occurring. A special monitoring round will also be undertaken in the event of a significant environmental incident.

Regular monitoring of the network will continue to enable an understanding of seasonal water table fluctuations and will include groundwater depth and groundwater quality measurements. The objectives of the groundwater monitoring program will be to:

- Detect potential groundwater impacts early, so that effective mitigation procedures can be developed and instigated.
- Determine the characteristics and trends of any contaminated groundwater flowing outside and downgradient of the RSF embankment.
- Identify whether any potential contaminants are varying in concentration or extent.

This monitoring bore network will consist of:

- Shallow monitoring bores situated within each alluvial aquifer which intersects the site and at all locations where surface drainage lines intersect the RSF boundary.
- Monitoring bores (to intersect Mount Alma Formation and Rockhampton Group aquifers) spaced appropriately around the perimeter of the RSF at varying depths.
- Monitoring bores in clusters within 100 m of the toe of the embankment of the RSF to monitor groundwater at varying depths/aquifers.
- Background bores to be situated significantly up- and down- hydrogeologic gradient of the RSF (screened within the local bedrock aquifer) to enable differentiation between groundwater rises associated with natural recharge and rises associated with any mounding of the aquifer attributed to seepage from the RSF.

The monitoring program will include the following minimum parameters:

- Water depth.
- pH, electrical conductivity, TDS.
- Dissolved heavy metals (National Environment Protection Measure (NEPM) 13 metal scan).
- Major ions: sodium, magnesium, calcium, potassium, chloride, sulphate, fluoride and bicarbonate.

Monitoring of water levels and water quality will commence prior to construction of the RSF to obtain baseline data at each monitoring location. This data will be used to determine the natural variability in the groundwater system. Evaluation of the baseline monitoring data will be used to establish trigger levels of key parameters which can be used as a quantitative method of determining whether unexpected impacts are occurring during construction or operation. Where monitoring results indicate levels in excess of the trigger values, an investigation appropriate for the situation will be conducted to assess the need to implement management/mitigation/remedial measures.

Annual variation in groundwater level may be defined as acceptable when the levels are within the historical background variation. Annual variation in groundwater quality may be defined acceptable when the groundwater quality characteristics are equal to or better than the historical background variation.

9.4.5 Risk Management (1)

EPA advised that the EIS should include seepage in the water balance and discuss any potential impacts of this volume of seepage on the groundwater system, given the characteristics and composition of the supernatant liquor and potential leaching from residue solids.

During the operation of the RSF, seepage will likely occur through the containment dam and through the base of the RSF. On the basis of ANCOLD (1999), the following design objectives have been adopted for seepage at the RSF:

- Surface expression of seepage discharge downstream of the RSF should not occur.
- No significant impact should occur on the environmental quality of receiving waters.

- The potential beneficial uses of surface and groundwater downstream of the RSF should not be compromised.

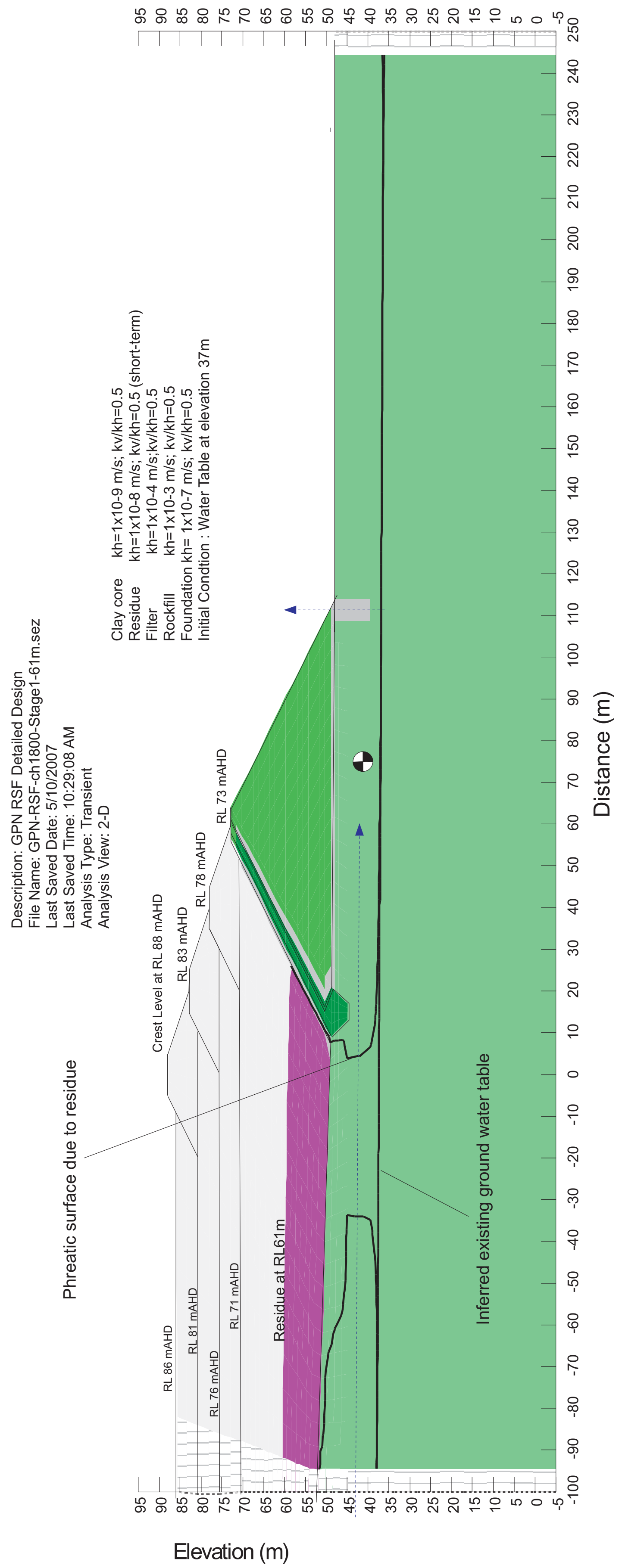
For the RSF-A, a seepage analysis was conducted to quantify the amount of seepage reporting to the collection system. URS, 2007a reports the results of a seepage analysis that was conducted using SEEP/W (Geoslope, 2006b), a commercially available computer code that is designed to analyse steady-state and transient seepage under saturated and partially saturated conditions. Seepage was modelled both during operations (6 year life) and after closure of the RSF-A. A summary of the results for the proposed scenario of pumping from the collection trench after RSF closure is provided in Figures 9.12-9.16 and in the following table.

Summary of Seepage Analysis for RSF-A

Years	Estimated Seepage Volume (l/day/m width)	
	Through Foundation (Bedrock Aquifer)	Through Collection Trench (Alluvial Aquifer)
Operations		
1	147	0.001
3	302	0.05
4	242	0.16
5	276	0.42
6	6900	0.60
Closure		
0	6900	0.6
5	302	11
10	242	59
20	130	26
30	78	19
40	61	15
50	49	13

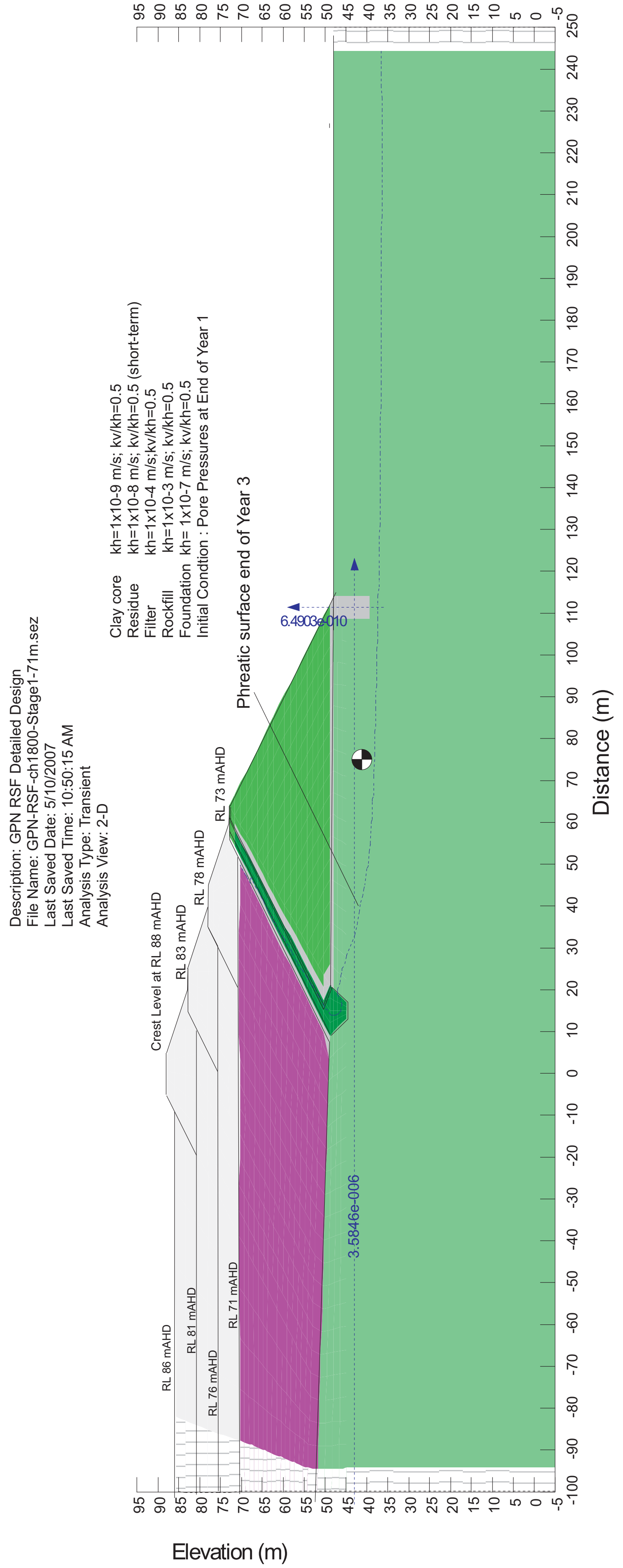
The results of seepage analysis show that the majority of the seepage will occur through the base of the RSF into the bedrock aquifer. This will increase annually as the depth of residue (and driving head) in the RSF increases. During this time the seepage to the alluvial aquifer will be minimal. Once residue deposition ceases and the top of the RSF is covered with a low permeability cover, the seepage rate to the bedrock aquifer will reduce as the phreatic surface in the RSF slowly drops. Correspondingly post closure there will be an initial increase in seepage to the alluvial aquifer as the phreatic surface rises to intercept the recovery trench. This will gradually reduce over time as the volume of water stored in the RSF reduces.

As discussed in Section 9.3, the hydraulic conductivity of the bedrock aquifer is low and the estimated groundwater flow velocities could vary from 0.2 m/y to 9.9 m/y. On this basis it would take 500 years for water seeping through the bedrock aquifer to reach the Calliope River, and approximately 100 years for seepage to travel from the proposed cell locations to the boundary of the RSF site bordering ‘Fairview’. This time could reduce if a preferential flow path was found via a fault or fracture in the bedrock. The hydraulic conductivity of the alluvial aquifer is variable. However seepage in this aquifer would be intercepted by the recovery trench and removed.



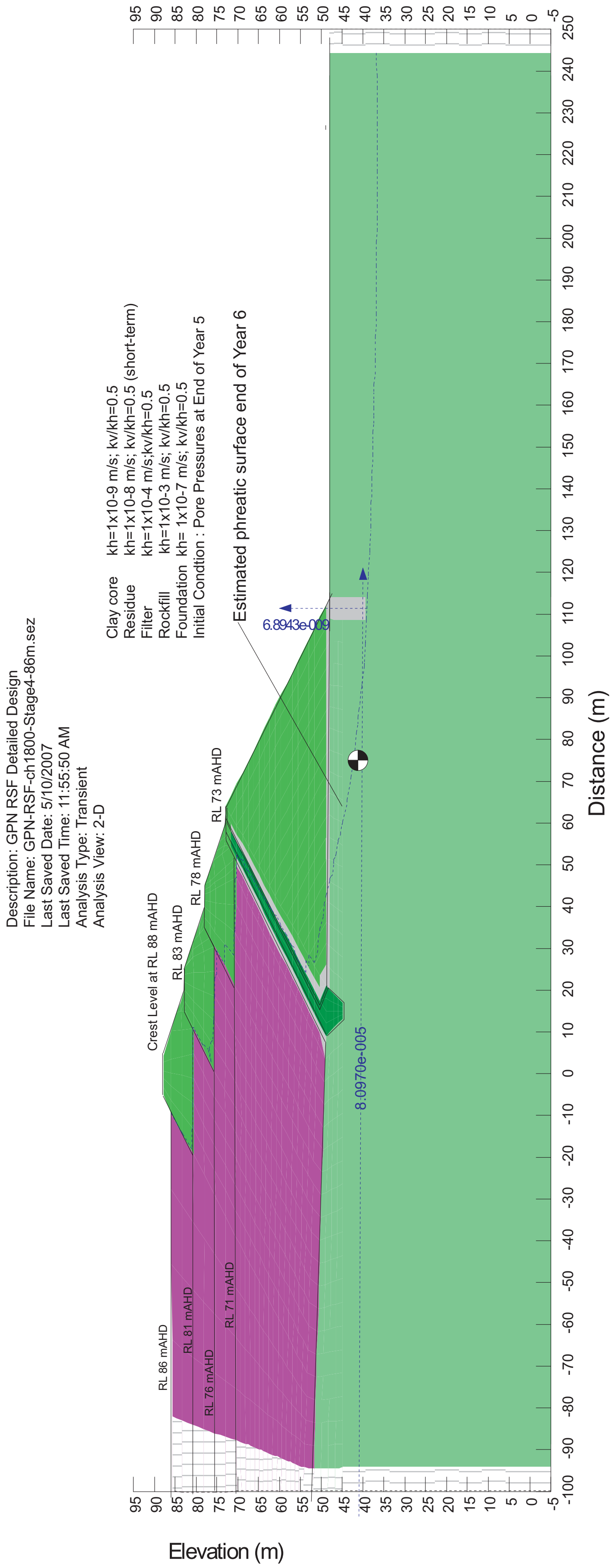
Client	Project	Title
Gladstone Pacific Nickel Ltd URS	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	PHREATIC SURFACE OF RSF-A AT END OF YEAR 1

Drawn: VH	Approved: CDP	Date: 29-01-2008	Figure: 9.12	Rev. A
Job No.: 4262 5791	File No. 42625791-g-249.cdr			A4

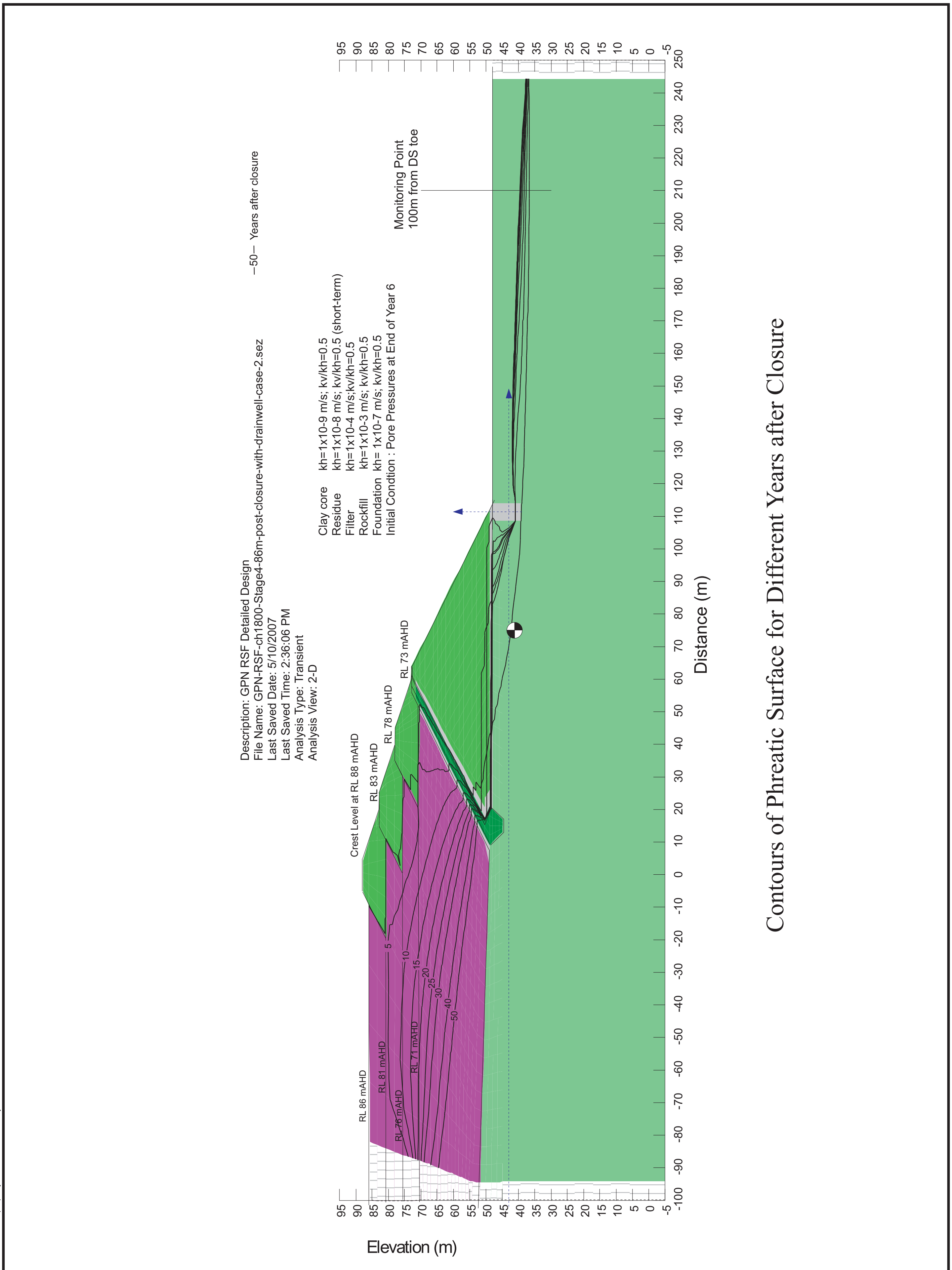


Client Gladstone Pacific Nickel Ltd URS	Project GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	Title **PHREATIC SURFACE OF RSF-A AT END OF YEAR 3**

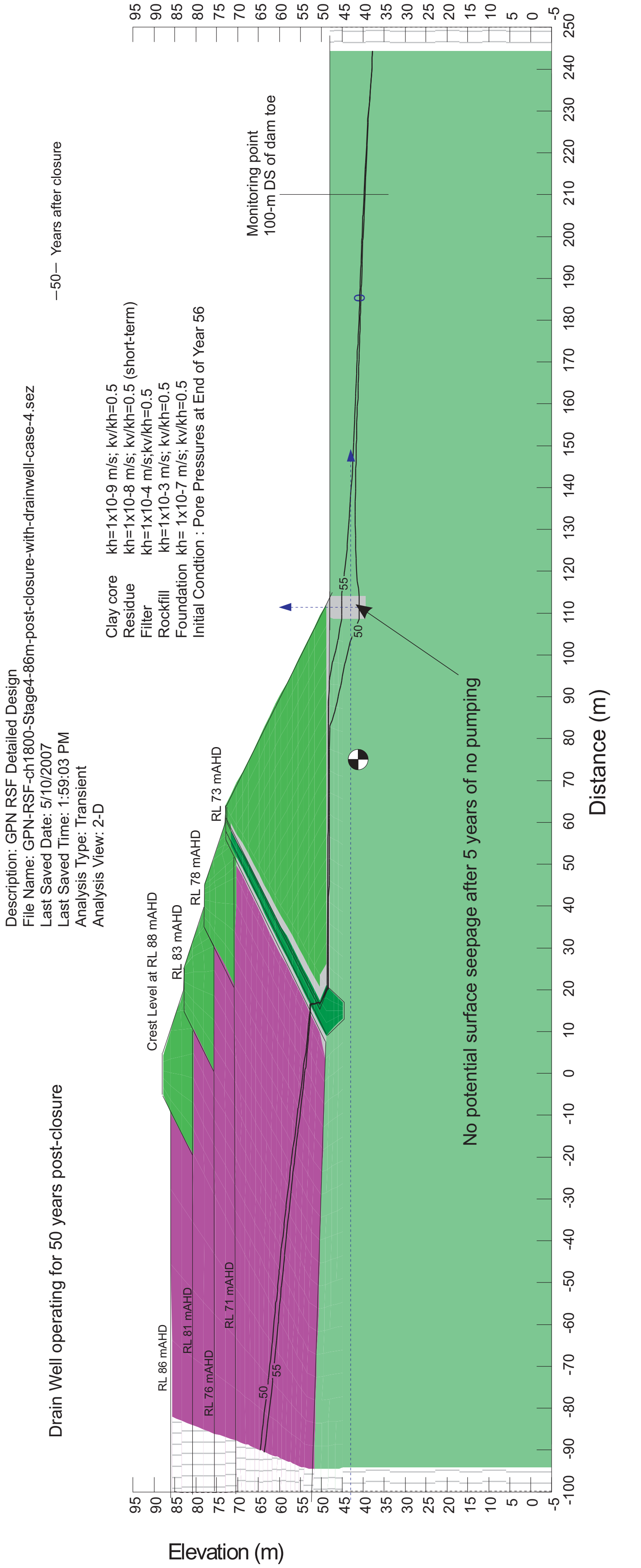
Drawn: VH	Approved: CDP	Date: 29-01-2008	Figure: **9.13** Rev. A
Job No.: **4262 5791**	File No. 42625791-g-250.cdr		A4



Client	Project	Title
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**PHREATIC SURFACE OF RSF-A AT END OF YEAR 6**
URS	Drawn: VH / Approved: CDP / Date: 29-01-2008	Figure: **9.14** / Rev. A
	Job No.: **4262 5791** / File No. 42625791-g-251.cdr	A4



Client	Project	Title
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**CASE 2 - PUMP STARTS OPERATING FOLLOWING CLOSURE OF RSF-A FOR 50 YEARS**
URS	Drawn: VH / Approved: CDP / Date: 29-01-2008	Figure: **9.15** / Rev. A
	Job No.: **4262 5791** / File No. 42625791-g-252.cdr	A4



Contours of Phreatic Surface at 50 Years and 55 Years after Closure

Client	Project	Title
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**CASE 4 - PUMP STARTS OPERATING FOLLOWING CLOSURE OF RSF-A FOR 50 YEARS ONLY**
URS	Drawn: VH · Approved: CDP · Date: 29-01-2008	Figure: **9.16** · Rev. A
	Job No.: **4262 5791** · File No. 42625791-g-253.cdr	A4

Any leachate that entered the groundwater system would increase the salinity of the groundwater as the salinity of the leachate is approximately double that of the groundwater below the RSF site. The concentration of dissolved metals in the leachate is expected to be low and less than the concentrations in groundwater, apart from manganese and to a lesser extent nickel and chromium. However, any increase in the concentration of dissolved nickel or chromium is expected to remain below the livestock drinking water and irrigation guideline values. Any increase in the manganese concentration may exceed the long term irrigation guideline depending on the relative proportions of leachate and groundwater mixing, however the groundwater from two of the monitoring bores (RSF13 and RSF17) already contains manganese at concentrations greater than the guideline value.

The SEEP modelling reported in URS, 2007a assumed that pumping from the collection trench continued for 50 years after closure. After 50 years the pumping was stopped and the modelling showed that the phreatic surface stabilised in 5 years and surface seepage would not occur.

9.5.1 RSF Closure Overview (1)

EPA advised that the wording of the last two dot points in section 9.5.1 be changed and expanded as follows:-

- *Maintain and operate the seepage collection system at the downstream toe of the main embankment until seepage into the collection system has stopped.*
- *Monitoring bores and water recovery wells downstream of the RSF must be operated and maintained until the groundwater level along a line 100 metres downstream of the toe of the dam embankment is stable at a nominated depth below the surface. Stability is defined as a situation where groundwater levels remain steady for one year without pumping. Stability must be achieved at all points along the line, and the stable level achieved must be 30 metres or more below ground level at all points. This must include a point under the bed of Farmer's Creek.*
- *Monitor groundwater levels around the perimeter of the RSF to ensure that surface expression of seepage discharge does not occur, and that stock watering facilities and water supply bores are not contaminated.*

Extensive investigations were carried out at the RSF site during August 2007 to measure groundwater levels and permeability. A perched water table was identified at RL 37 m in the vicinity of the RSF-A containment dam. This translates into a groundwater depth of roughly 10 m. Hydrogeological and geotechnical data were compiled to analyse seepage through the dam and through the foundation. Results of these analyses and the associated recommendations and discussions regarding the seepage collection system are presented in URS, 2007a. As a general summary, seepage through the RSF will be controlled in the following ways:

- Low permeability residue
- Low permeability clay core and liner in the containment dam
- Seepage cut-off trench below the core of the containment dam
- Seepage collection trench below the toe of the dam, from which seepage can be pumped back to the RSF
- Monitoring wells located 100 m downstream of the seepage collection trench

Based on the results of seepage analyses presented in URS (2007a), it is proposed that the seepage collection system be maintained and operated for a period of 25-50 years, or until it can be demonstrated that seepage into the collection system has stopped.

The seepage collection system is designed to prevent surface expression of seepage.

It is also proposed that 10 wells be positioned along a line 100 m downstream of the containment dam to monitor groundwater levels. Decommissioning of the seepage collection system shall not occur until it can be demonstrated that fluctuations of water level are comparable to monitoring wells located either up-gradient of the RSF, or in a similar position (elevation) in an adjacent catchment.

After closure, the seepage water collected from the collection system will no longer be able to be disposed of into the RSF. It is proposed that following closure, collected seepage waters will be pumped to an evaporation pond located on the RSF cover. The location will be selected at the highest possible elevation contours to limit run-on. The evaporation pond would be lined (HDPE) and sized to accommodate the observed seepage rates during facility operation and precipitation during significant rainfall events.

9.5.2 Cover Design (1)

EPA advised that further investigations should be undertaken to identify sufficient material to enable construction of a suitable cover on the RSF at closure. Steps should then be taken to secure that material in place where it is now so that it will be available for use at closure

As discussed in Section 9.1.2, there are enough topsoil and subsoil resources available within the footprints of the three RSF cells (A, B1 and B2) to cover the closed RSF to a depth of 0.4 m. This material will be stripped and stockpiled prior to operations commencing.

While sources of material that would be suitable for the capillary break layer, barrier layer, and drainage layer are available within the footprints of RSF-A, B1 and B2, there is not enough to satisfy the requirement for the RSF cover design. Further geotechnical investigations are required to quantify the amount available. It is expected that additional material will be required either from within the footprints of future RSF cells or from external sources. Quantifying and sourcing of the necessary quantities of cover materials will be undertaken as part of the detailed design to ensure that no useable resources are sterilised by the RSF construction.

9.5.4 Stormwater Management (1)

EPA has requested the amendment of the design of the runoff management facilities to include the following specifications:

1) Contour drains on the surface of the RSF after closure should be designed for a 1 in 200 AEP rainfall event.

2) Contour drains across the crest of the RSF embankment should be designed for a 1 in 2000 AEP rainfall intensity. This is because of the danger of cascade failure in the berm drains between embankment raises, which would lead to exposure and cutting out of the residue material.

3) Rock lined channels and chutes carrying water from the contour drains across the crest should be designed for a 1 in 500 AEP intensity of runoff because the consequences of overtopping and possible failure of the channels and chutes should not threaten the RSF structure itself.

4) Other contour drains should also be designed for a 1 in 200 AEP event.

GPNL will adopt the above-mentioned design criteria suggested by the EPA subject to experience gained from the initial RSF cells being applied to improve the design of runoff management for subsequent cells and evolving best practice.

9.6 Surface Water (13, 14)

***(13)** DNRW advised that the EIS indicates that the storage will result in a reduction of mean annual flow within the Farmer Creek catchment. The Department has serious concerns regarding what impacts this will have on the catchment with particular reference to entitlement holders downstream. The EIS recognises that the one entitlement holder on Farmer Creek will be seriously affected and that an alternate water supply may be required, however the EIS does not adequately address this issue and does not outline any options for mitigation.*

As discussed in Section 9, as each RSF cell is constructed it will remove a portion of the Farmer Creek catchment and potentially affect Farmer Creek flows at Fairview, the property of the downstream entitlement holder. This loss of catchment area will last for the operational life of each cell. Once the cells are full, they will be covered and rehabilitated with the surface runoff being discharged back into Farmer Creek thus restoring most of the pre-RSF flows.

The following table summarises the loss of catchment area from each of the three RSF cells and the percentage they represent of the total Farmer Creek and Six Mile Creek catchment area at Fairview. The loss of catchment area approximates to the potential loss of water flow in Farmer Creek although that would depend on the extent of storm flow throughout the catchment. It can be seen from the following assessment that the maximum catchment loss is only 20%.

Catchment Areas Affected by RSF

RSF Development	Area of Farmer Creek and Six Mile Creek Catchment at Fairview (km^2)	Percentage of Total Catchment Remaining
Before RSF	48.2	100
After RSF-A	45.4	94
After RSF-B1	42.2	88
After RSF-B2	38.4	80

Should this 20% loss of catchment area result in an appreciable loss of water supply at Fairview, GPNL will enter into an agreement with the entitlement holder for alternative supplies.

GNPL is also studying the use of the land to the south of the currently proposed cells, which could lead to an estimated additional 11% loss of catchment. A possible footprint for an additional cell in this area is shown on Figure 9.17. This is conceptual only and its feasibility and design are yet to be confirmed. No approvals are currently being sought for this possible future cell.

9.6.5 Surface Water Quality (1)

EPA advised that water quality samples should be taken and analysed from pools which apparently exist in Farmer Creek south of the Bruce Highway.

Ponded water within Farmer Creek south of the Bruce Highway will contain runoff contaminants from existing farming operations, the Bruce Highway and other local sources. Its quality will vary according to ambient conditions and is not expected to be a reliable control to measure effects from the RSF. The GNP surface water monitoring program will include the establishment of a monitoring site downstream of the RSF but upstream of the Bruce Highway to eliminated the variables that will be introduced from the highway runoff and downstream farming operations.

9.6.9.1 Changes to Flow Regime (16)

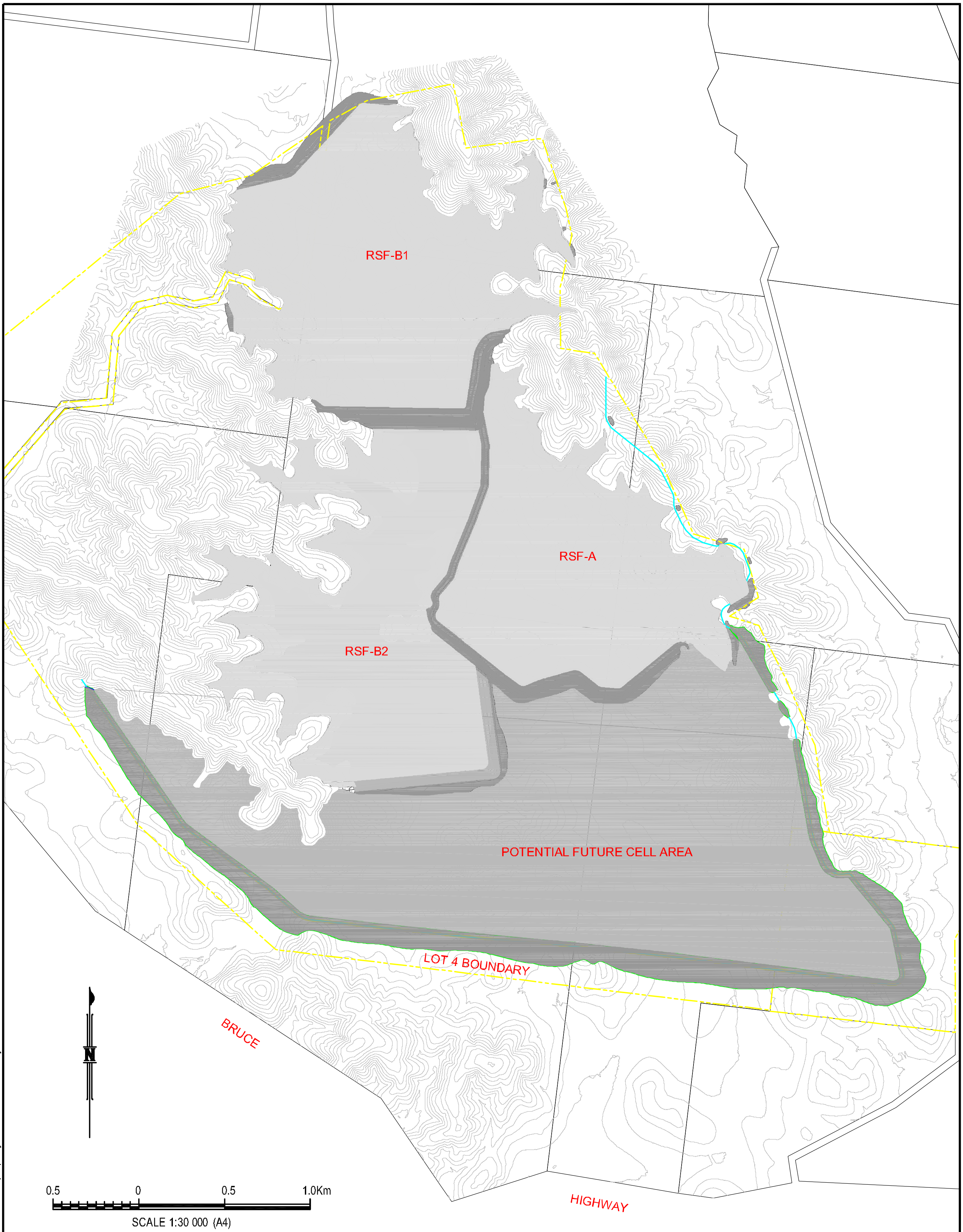
CSC/GCC considers that the EIS should provide further analysis of the downstream impacts of flow reduction and identify alternate supplies for the directly impacted allocation.

See Sections 9 and 9.6.

9.7 Groundwater (1)

EPA advised that the EIS should show the locations of the DNRW Registered bores on Figure 9.7.1 Also show on the same figure the locations of the unregistered windmill bores mentioned in section 9.7.6 of the EIS.

There is limited groundwater usage registered on the DNRW groundwater database. There are only four registered groundwater bores within a 3 km radius of the RSF site. Detailed DNRW bore cards are provided in Appendix K. Two of these bores (RN111019 and RN91090) are situated within 2 km of the



Client	Project	Title
Gladstone Pacific Nickel Ltd	GLADSTONE NICKEL PROJECT ENVIRONMENTAL IMPACT STATEMENT SUPPLEMENT	**CONCEPTUAL FUTURE RSF CELL AREA**
URS	Drawn: VH / Approved: CDP / Date: 29/01/2008	Figure: 9.17 / Rev. A
	Job No.: 4262 5791 / File No.: 42625791-g-267.dwg	A4

western boundary of the RSF, and one is situated south of the RSF (RN122599). The locations of these bores are shown on Figure 9.1. A summary of the bore details is included below:

- RN111019 is a low-yield windmill bore (0.63 L/s air lift yield) established in September 1995, that intersects the Mount Alma Formation beds. An initial standing water level of 1.5 mbgl was recorded for this bore, but no recent data has been collected for comparison with historic water levels. An initial water quality of 1600 mg/L TDS was recorded for this bore.
- RN91090 has a better recorded air lift yield (4.5 L/s) with a water quality of 1050 mg/L TDS, and an initial standing water level of 3 mbgl, measured in April 1993. This bore is screened in both the Farmer Creek alluvium and a fractured andesite (3 m thick) immediately below the alluvium.
- RN122599 is installed into the Mount Alma Formation. It had an initial water level of 4.1 mbgl, a yield of 0.95 L/s and water quality (electrical conductivity) of 1,300 μs/cm in November 2005
- RN111795 is situated approximately 2.5 km to the east of the proposed RSF. It intersects the Yarwun Beds, a separate geological unit to the Rockhampton Group and Mount Alma Formation of the project area.

A survey of properties within 2 km of the RSF was conducted by analysis of aerial photos and questionnaires sent to landowners to determine the location, construction and use of unregistered bores around the site. A number of unregistered windmill bores and solar powered pump bores were identified during this survey. These bores are dedicated stock watering facilities, with low extraction yields. The location of the unregistered bores is shown on Figure 9.1, with the survey response forms received included in Appendix K. The two windmills on-site were gauged during the field works in August 2007. The windmill bore in the south of the site located near RSF10 and RSF11 had a water level of 5.44 mbgl, while the water level in the windmill bore in the centre of the site west of RSF17 was 6.78 mbgl.

The Rio Tinto Alumina Yarwun (RTAY) refinery residue management area (RMA) is situated within approximately 3 km of the north-eastern boundary of the RSF. The RMA does not use abstraction bores, but RTAY has installed a monitoring bore network for the RMA to observe spatial and temporal variations in both water quality and physical aquifer parameters.

EPA advised that groundwater level contours should be established as should the likely directions of groundwater flow underneath, and adjacent to, the RSF site.

Groundwater contours and groundwater flow directions at the RSF site are shown on Figure 9.2.

9.7.3 Groundwater Levels and Flow (1)

EPA advised that the EIS should provide additional supporting information as to groundwater occurrence and aquifer type and locations. A groundwater contour map is required that defines the aquifer(s) under and around the RSF including the subsurface orientation and inclination of the aquifer bedding units so as to facilitate the assessment of potential impacts of the RSF on groundwater resources.

Section 9.1.1.2 provides additional information on groundwater occurrence and aquifer types and locations. A groundwater contour map is shown on Figure 9.2. Further details are given in Appendix K.

9.7.8 Potential Groundwater Impacts - Operations (1)

EPA advised that the EIS should consider travel times for seepage to surface waters or shallow aquifers after more effectively identifying and describing groundwater dynamics under the RSF.

There is potential for seepage water to enter the deeper bedrock aquifers by direct seepage through the base of the RSF. Taking into account the maximum calculated travel time for groundwater in the bedrock of 9.9 m/y and a minimum distance of 5 km to the Calliope River (assuming that the bedrock aquifer flows towards the river, the aquifer is continuous, and that the Calliope River is a gaining river at this location), it would take approximately 500 years for water seeping through the bedrock aquifer to reach the river, and approximately 100 years for seepage to travel from the proposed cell locations to the boundary of the

RSF site bordering 'Fairview'. This time could reduce if a preferential flow path was found via a fault or fracture in the bedrock.

If seepage was to occur through the alluvium for the length of Farmer Creek, the travel time would be in the order of 500 years if the alluvium was consistently like that at monitoring bores RSF17 or RSF 3 (silty sand and sandy clay). However there are areas where sandy and gravely alluvium is present (such as at monitoring bore RSF13). In these areas seepage travel time would be much shorter. It is for this reason (the variability of the hydraulic conductivity of the alluvial aquifer) that a recovery trench is proposed to intercept any seepage in the alluvial aquifer.

9.7.8.1 Seepage from the RSF (1)

EPA advised that the EIS should provide estimations of the quantity and movement of seepage of neutralised residue liquor across the full extent of the dam floor and its impacts on the groundwater system. Although monitoring of the groundwater system potentially impacted by the RSF will indicate when the groundwater system has been impacted, measures must be developed in the EIS that will prevent or reduce seepage from the groundwater system before impacts can occur.

Refer to Sections 9.3 and 9.4.5 and Appendix K.

9.8.3 RSF Rehabilitation (1)

EPA respondent has advised that the EIS must include vegetation management strategies to ensure the integrity of the capping system over time and the establishment of sustainable vegetation cover post-closure.

The surface of the RSF cover will be protected against long-term erosion by the establishment of a self-sustaining vegetative cover. The vegetation to be established across the covered surface of the RSF will comprise native grasses and shallow rooted tree species such as suitable Acacias. Silk Sorghum is proposed as the dominant initial cover crop species because it is suitable for rapid and aggressive establishment for erosion control and mulching of perennial species in the mix.

The topsoil surface of the cover will be susceptible to erosion from wind and rain immediately after construction and during the vegetation establishment period. Erosion protection will be provided to minimise erosion and the loss of seed and fertiliser from the surface of the cover. A range of options is available to provide erosion protection including a number of proprietary surface mat products, straw mulching or hydro-mulching.

Hydro-mulching is a technique that involves mixing a slurry containing, for example, selected seed varieties, fertiliser, hay mulch, water and an adhesive. The slurry is pumped from a large tanker through a high-pressure spray, over the area to be treated. The seed generally adheres to the mulch, which improves the microclimate for germination and establishment. Hay mulch in the slurry provides cover for the soil to improve pasture growth, modifies the soil surface to assist in erosion control, and improves moisture availability to establishing pasture. The mulch protects the soil surface against raindrop impact, improving the micro-environment for seed germination/establishment by reducing evaporation loss and assisting in the control of surface erosion caused by raindrop impact and overland water flow.

GPNL will undertake on-site rehabilitation trials to determine the most appropriate mix of rehabilitation species, fertilisers, topsoil mix, and management strategies to achieve a sustainable cover for the RSF. These trials will be undertaken during the initial years of the operation of RSF-A so that an acceptable strategy has been developed in time for its closure. Following closure of RSF-A, lessons from its rehabilitation efforts will be applied to subsequent RSF cells.

GPNL will prepare a detailed RSF closure strategy during its initial years of operations so that it can be implemented for the closure of the initial cell. The strategy will include provision for plot trials, species mix, fertiliser mix, management requirements, and monitoring programs.

9.9 Terrestrial Flora (13)

DNRW advised that the EIS does not clearly delineate how the proposed clearing meets the Performance Requirements in Part S of the Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions 20 November 2006 and the Regional Vegetation Management Code for Southeast Queensland Bioregion 20 November 2006.

In addition to the above, in order to adequately assess the clearing of vegetation as a result of this project, DNRW requires a detailed spatial plan of the proposed clearing application area and the provision of details on the method of clearing.

Figure 9.9.1 of the EIS (and associated tables) summarises the vegetation communities that will be disturbed as a result of the proposed RSF footprint. Table 9.9.1 includes a list of vegetation communities and areas (ha) proposed for disturbance. An outline flora management plan is included in section 14.10.8 of the draft EIS.

During the detailed design phase and prior to construction, GPNL will submit a vegetation clearance application to DNRW in accordance with the requirements of the *Vegetation Management Act 1999*. This application will be accompanied by a detailed analysis of how the proposed clearing will meet the performance requirements of the relevant regional management codes. It will also include a detailed spatial plan of the proposed clearing application area and details on the method of clearing.

9.11 Freshwater Ecology (2)

DPIF advised that it is vital that the RSF is appropriately designed and managed to ensure downstream fish habitats are not impacted by contaminants. It is possible that the containment walls for the RSF may be considered to be waterway barrier works and if so a development approval for the construction would be required. DPI&F would request an opportunity to provide comments on the detailed design plans of the RSF.

Generally the macroinvertebrate fauna of Farmer Creek comprise taxonomic groups that commonly inhabit still to slow-flowing fresh waterbodies and are adapted to ephemeral conditions. When compared with larger and more permanent freshwater streams in tropical Australia, the communities in the creek are relatively poor in terms of species numbers. The creek has been impacted by agricultural pollution and drought conditions.

None of the fish species recorded in surveys of Farmer Creek are listed as Endangered, Vulnerable or Poorly Known (Wager, 1993). The fish species recorded are generally common and widely distributed in eastern Australia. None of the freshwater fish species recorded are especially significant angling targets,

Farmer Creek is considered to have conservation value only at a local level, since the fish species present are all common. In addition habitat diversity is generally low due to the ephemeral nature of the stream and its close proximity to the coast. It is not pristine, as it generally flows through highly disturbed cattle grazing country. However, it does represent typical freshwater habitats of the region.

The modified RSF design of using smaller multiple cells rather than one large cell will result in less initial disturbance to Farmer Creek than was indicated in the EIS and the loss of less catchment area during the early years.

During the detailed design process, discussion will be held with DPIF as to whether or not the RSF is considered to be a waterway barrier and, if so, what approvals will be required.