Appendix G

Pit Lake Filling Water Balance

Contents

Table index

Figure index

Attachments

G-1 Introduction

This appendix outlines modelling of pit lake filling after the completion of mining in Golden Bar, Coronation, Coronation North and Innes Mills Pits. It also describes the modelling of the cumulative water balances for these pits as part of the Macraes Phase 4 Fast Track Approvals project. Modelling is undertaken with the site wide water balance model (WBM) as described in Appendix E. An overview of the project description in relation to the surface and groundwater modelling is provided in Section 2 of the “Macraes Phase 4 FTA – Surface and Groundwater Assessment” of which this is appended to. Limitations and assumptions detailed in Section 1 of the “Surface and Groundwater Assessment” are applicable to this appendix.

G-1.1 Purpose of this Appendix

The purpose of this appendix is to document and describe the modelling of the development of the pit lakes associated with the Project. It provides the pit lake filling projections and corresponding water balances with a breakdown of the water sources and sinks.

G-1.2 Scope and Limitations

This document is an Appendix to GHD Report – Macraes Phase 4 FTA, Surface and Groundwater Assessment. Scope and Limitations apply as outlined in that document.

G-1.3 Assumptions

The following key assumptions apply to the pit lake filling assessments, and these are to be considered with other assumptions applied in the development of the water balance model.

– Backfill placed within the pits has a void ratio of 19%, and the phreatic surface within pit backfill will be equal to the visible lake surface.
– The surface area is calculated by dividing the incremental lake volume by the incremental height (see Pit stage volume relationships), based on the volume not occupied by backfill material. Evaporation and direct rainfall rates are applied to this surface.
– All other assumptions applicable to the WBM apply as outline in Appendix E.

G-2 Pit Lakes Filling

Pit lake filling rates were estimated using the site WBM. Pit lake filling rates are applied as a boundary condition in the groundwater modelling, which predicted the net inflow and outflow from the pits as the lakes developed (refer Appendix E). This process was iterated between the groundwater and surface water models to achieve alignment with final groundwater inflows and outflows being applied in the WBM to refine cumulative water balances for the pit lakes. In the sections below lake filling projections and the cumulative filling flows are described for Golden Bar (GB3), Coronation (CO6), Coronation North (CN6) and Innes Mills (IM13) pit lakes.

The cumulative water balance is the prediction of cumulative water inflows and outflows into the affected pit lakes. This includes direct rainfall, seepages, groundwater inflow & outflow, evaporation and overflow. To illustrate the water balance and groundwater to surface water interactions, conceptual site models are presented for the affected pits and are detailed in each sub section below.

The cumulative water balance was predicted over a 200-year time period for each pit. Inflows and outflows represented in the pit lake cumulative water balances include:

– Inflows:
  - **Runoff Natural** – rainfall runoff from natural surfaces not impacted by mining
  - **Runoff Pit** – rainfall runoff from pit walls above the lake surface
  - **Runoff, WRS, NonRehab** – rainfall runoff from unrehabilitated WRS surfaces
  - **Runoff, WRS, Rehab** – rainfall runoff from rehabbed WRS surfaces
  - **Rainfall Direct** – rainfall directly onto the pit lake surface
  - **Groundwater inflow** – net groundwater flowing into the pit (This includes groundwater inflow from specifically defined sources as represented by groundwater modelling)
  - **WRS Seepage** – water percolating through a WRS before discharging to the pit or being retained within the pits backfill
  - **Under Drain Returns** – drains underneath tailings storage facilities that are captured and discharged to a developing lake (Not implemented in current water management approach for MP4)
  - **Seepage Returns** – WRS seepage that is collected and pumped elsewhere (Not implemented in current water management approach for MP4)
– Outflows:
  - **Evaporation** – water that has evaporated off the pit lake surface at open water evaporation rates
  - **Groundwater outflow** – net water loss from the pit lake to ground
  - **Overflow** – Water that overflows from the pit once it reaches its overflow point

These flows are dynamically modelled and account for changes in contributing surface areas and changes in inflow rates as the lakes develop.

G-2.1 Golden Bar Pit

The proposed extension to the Golden Bar Pit (GB3) will result in an overall increase of the pit footprint of approximately 14 ha increasing the total pit footprint to approximately 29.2 ha. Stage volume relationships for the extended pit are presented in Table G-2.2 and plotted in Figure G-2.1 with a volume of 5.9 Mm^3 and water surface area of 16.55 ha at the future overflow level of 500 mRL. Note that the WBM applies an arbitrary volume and area extension above the overflow level of all pits to allow the model to function where the lake discharge weir is surcharged during high rainfall events.

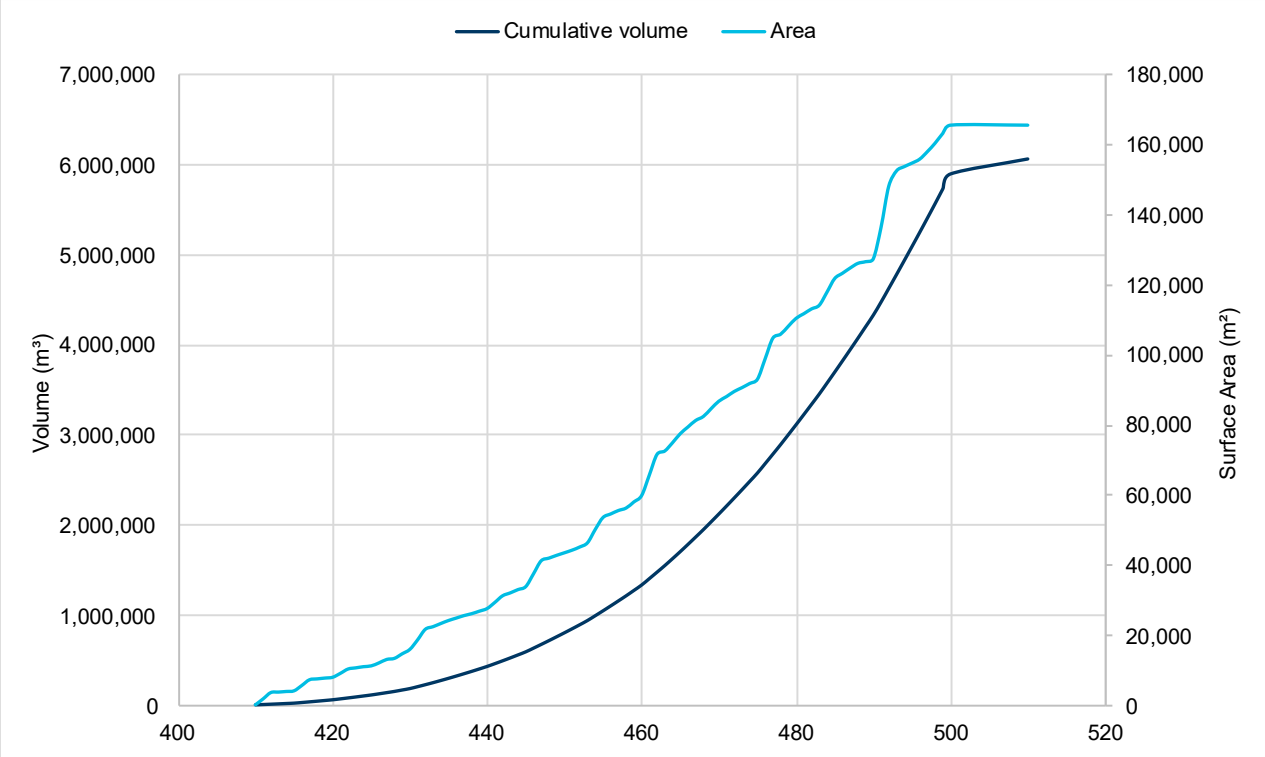

Figure G-2.1 Stage volume and area relationships for Golden Bar Pit

The conceptual site model for Golden Bar is presented in Figure G-2.2. Inflows and outflows for Golden Bar Pit include:

– Inflows
  - Runoff: Natural, Pit and WRS Rehab
  - Rainfall direct
  - Groundwater inflow
  - WRS seepage: Clydesdale WRS (GBWRS)
– Outflows
  - Evaporation
  - Groundwater outflow
  - Overflow from the pit lake.

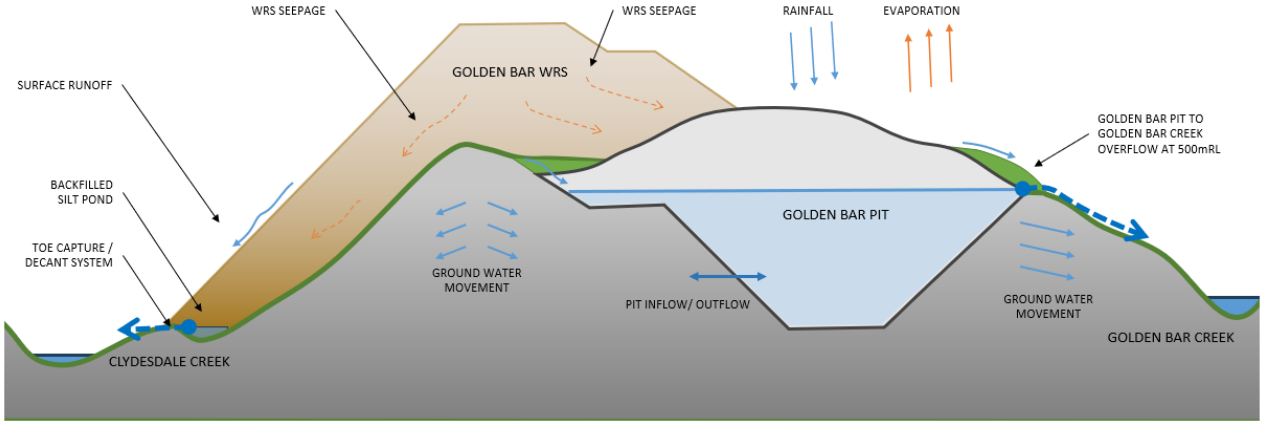

Figure G-2.2 Golden Bar conceptual site model

G-2.1.1 Pit Lake Filling

Mean lake levels in Golden Bar Pit Lake were predicted using Goldsim Montecarlo software and are presented in Figure G-2.3. Initially, the lake level increases rapidly with a low incremental volume and surface area at the bottom of the pit. The filling rate slows as the water level rises and evaporation effects increase with the larger surface area. The pit level recovery commences in 2034 and a median filling time of 58 years is modelled, reaching the overflow at 500 mRL in approximately 2091.

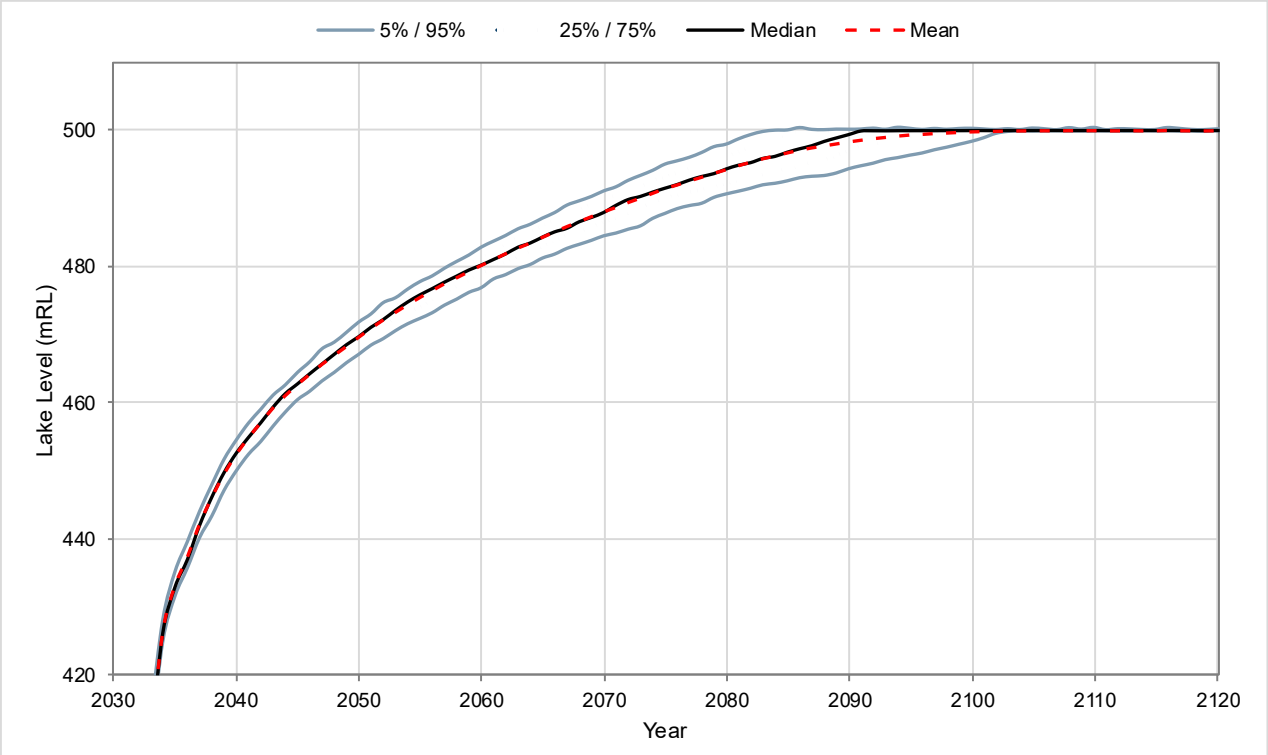

Figure G-2.3 Golden Bar Pit Lake filling curve

G-2.1.2 Golden Bar Water Balance

The corresponding mean annualised water balance for Golden Bar Pit is presented in Figure G-2.4 & Figure G-2.5 for water inflows and water outflows respectively. Total runoff is highest initially where lake levels are low and pit wall area (which contributes to the runoff) is relatively large. As the lake level rises, the proportion of direct rainfall increases as the pit walls are saturated and runoff decreases. WRS seepage and groundwater make up a much smaller proportion of the total inflow. Groundwater inflows are highest at lower pit lake levels before reducing and remaining relatively constant before and after the pit lake reaches the overflow level.

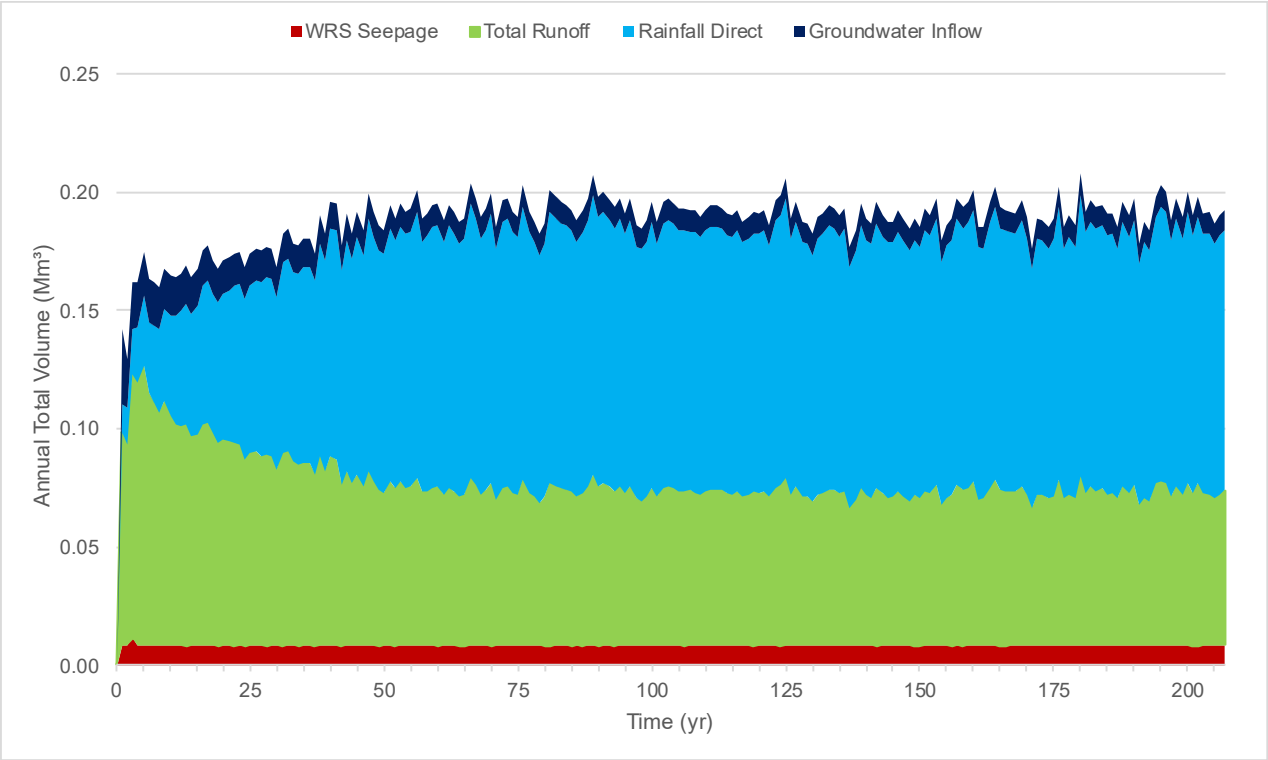

Figure G-2.4 Golden Bar Pit annualised water inflows

Evaporation effects are the only predicted to be the only pit lake outflow until overflows begin to occur in some of the model iterations at 50 years. The evaporation effects increase with the higher pit lake level due to the larger surface area. After the lake level reaches the overflow point, the evaporation rate remains largely constant. Overflows are predicted to begin as early as 50 years after filling commencing and reach a average maximum after 75 years.

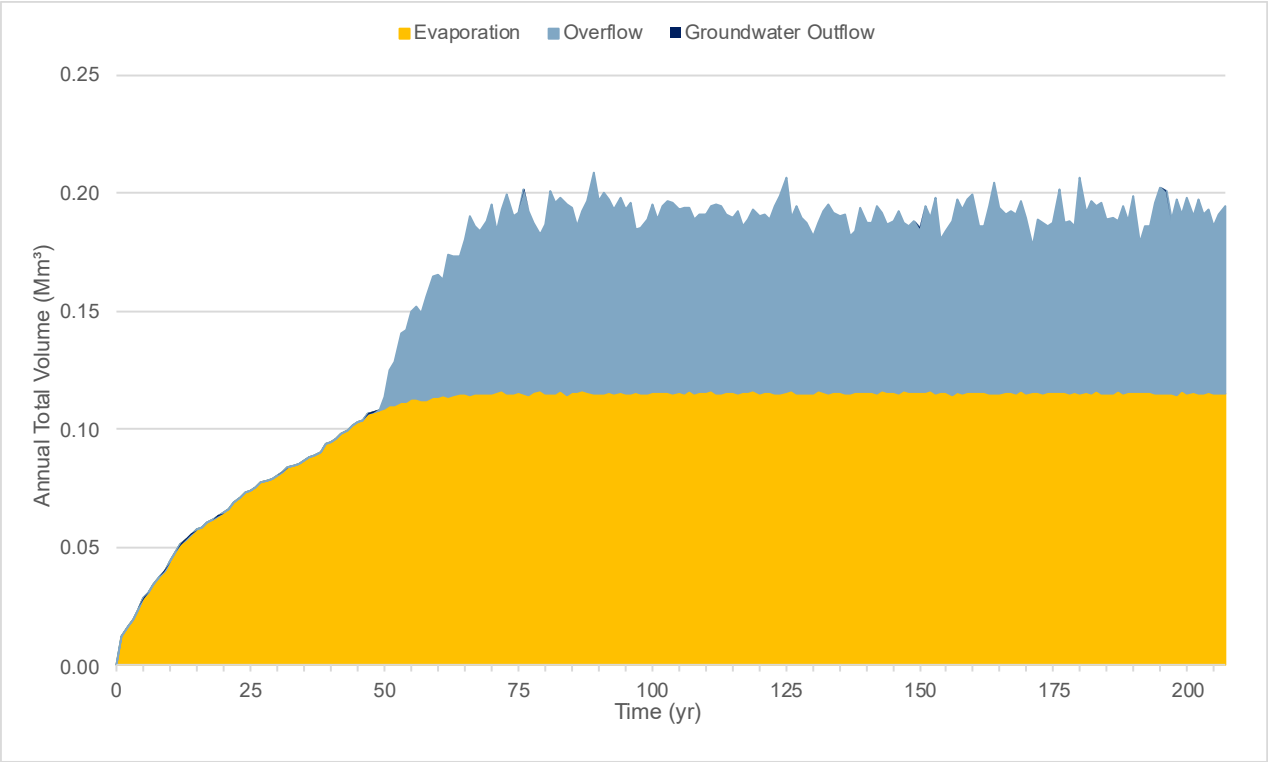

Figure G-2.5 Golden Bar Pit annualised water outflows

G-2.2 Coronation Pit

Coronation Pit will be extended in three stages, CO6, CO7 & CO8. The stage volume and area relationships for the whole pit void following completion of CO8 and backfilling are displayed in Figure G-2.6 with a sharp rise in both volume and surface area at 620 mRL due to the pit being backfilled with waste rock to this level. The cumulative volume for water storage is 5.5 Mm^3, including backfilled voids, and pit lake surface area is 34.2 ha at the overflow level of 625 mRL. The resultant pit lake will be shallow compared to others proposed on site with a maximum depth of approximately 5 m.

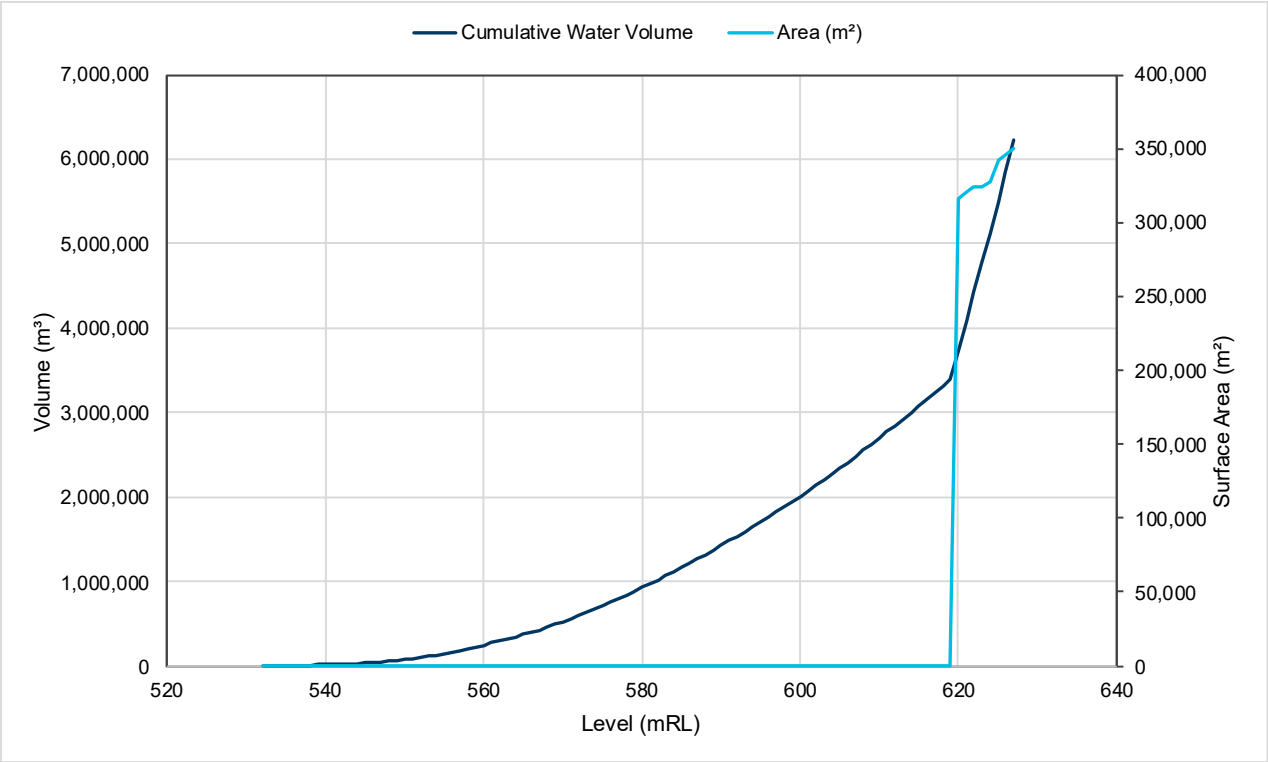

Figure G-2.6 Stage volume and area relationships for Coronation Pit – at closure

G-2.2.1 Pit Lake Filling

The pit lake filling curve is presented in Figure G-2.7. The pit water level initially rises rapidly through the backfill, occupying available void space before the fill rate slows slightly at 595 mRL as groundwater inflow rates reduce. At 620 mRL the pit lake level rises above the backfill which corresponds to the sharp increase in pit lake surface area in Figure G-2.6. The filling slows over the last 5 m due to the large volume available and greater surface area for evaporative losses. The median fill time is 23 years reaching the overflow at 625 mRL in approximately 2055.

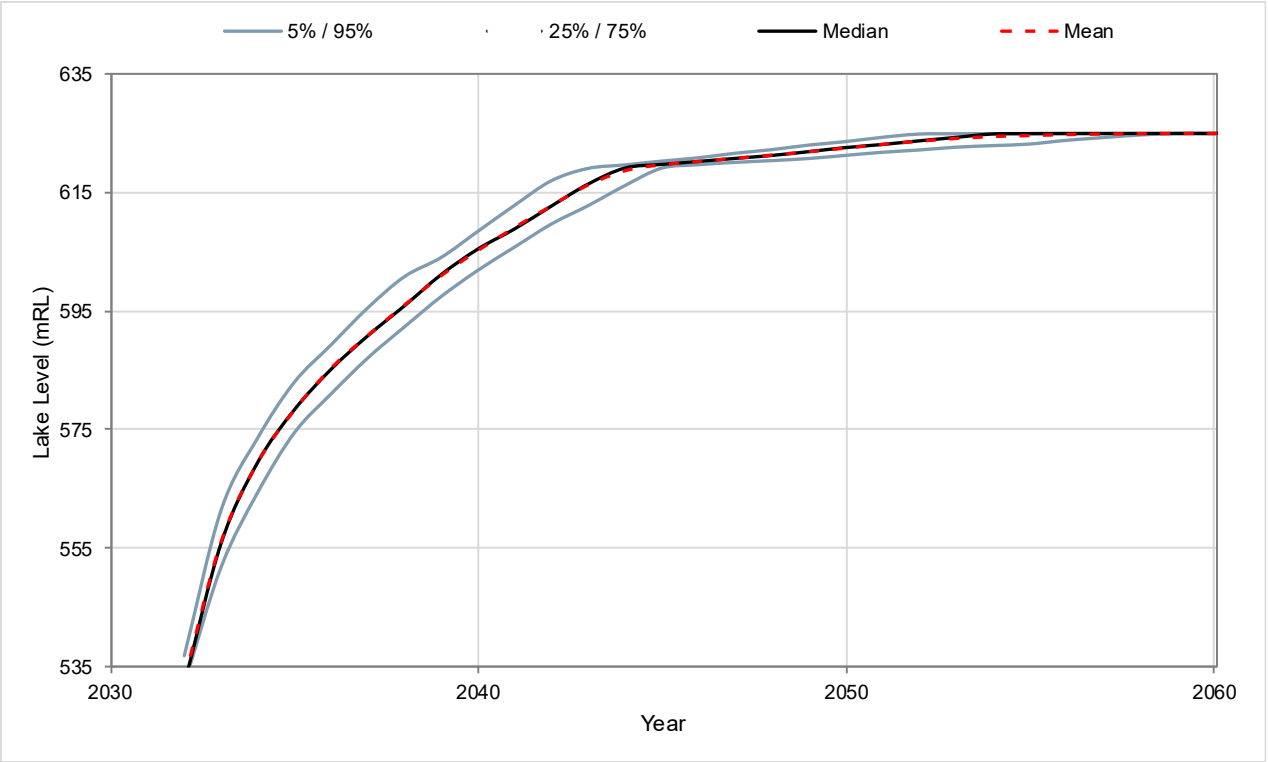

Figure G-2.7 Coronation Pit Lake filling curve

The coronation area conceptual site model is presented in Figure G-2.8. This model is applicable to both Coronation and Coronation North Pits.

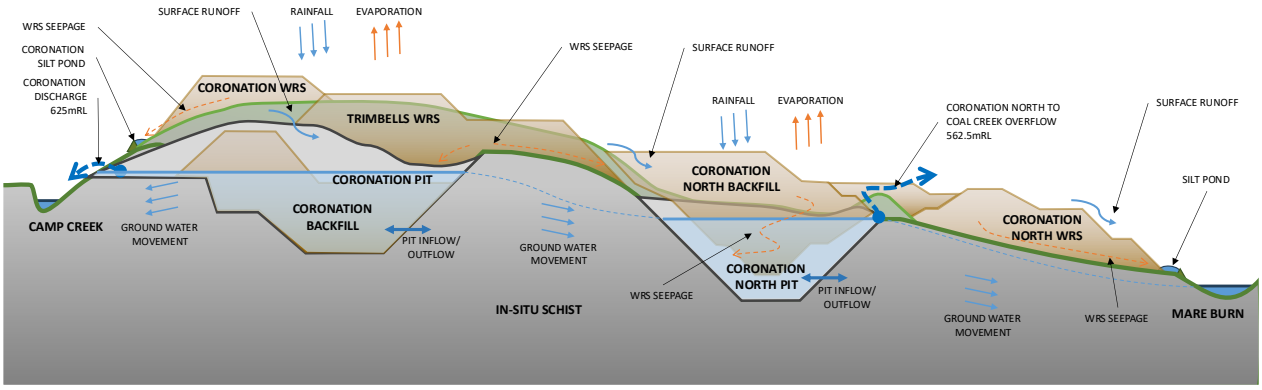

Figure G-2.8 Coronation area conceptual site model

Inflows and outflows to Coronation Pit are stated below and presented in Figure G-2.9 and Figure G-2.11.

– Inflows:
  - Runoff: Natural, Impacted Rehab, Pit and WRS Rehab
  - Rainfall direct
  - Groundwater inflow
  - WRS seepage: Coronation Backfill and Trimbells WRS
– Outflows
  - Evaporation
  - Groundwater outflow
  - Overflow from the pit lake.

G-2.2.2 Coronation Water Balance

Annualised pit inflows are presented in Figure G-2.9 based on mean flow rates. Initially inflows are high except for direct rainfall as there is no visible lake surface over the backfill material other than localised ponding, see Figure G-2.10 for an example of this from the rehabilitated surface of Trimbells WRS. When the pit lake rises above the level of the backfill, what was previously considered runoff becomes direct rainfall on the pit surface and is the mechanism behind the sharp increase in rainfall and drop-off in runoff. Note that modelling does not include coronation backfill (COBF) being in place immediately following cessation of dewatering, the initial steep rise in seepage inflows is attributed to the addition of the backfill from placement to complete submergence. Seepage and groundwater inflows reduce during the rise in pit lake level and are predicted to be steady after the pit lake has fully developed.

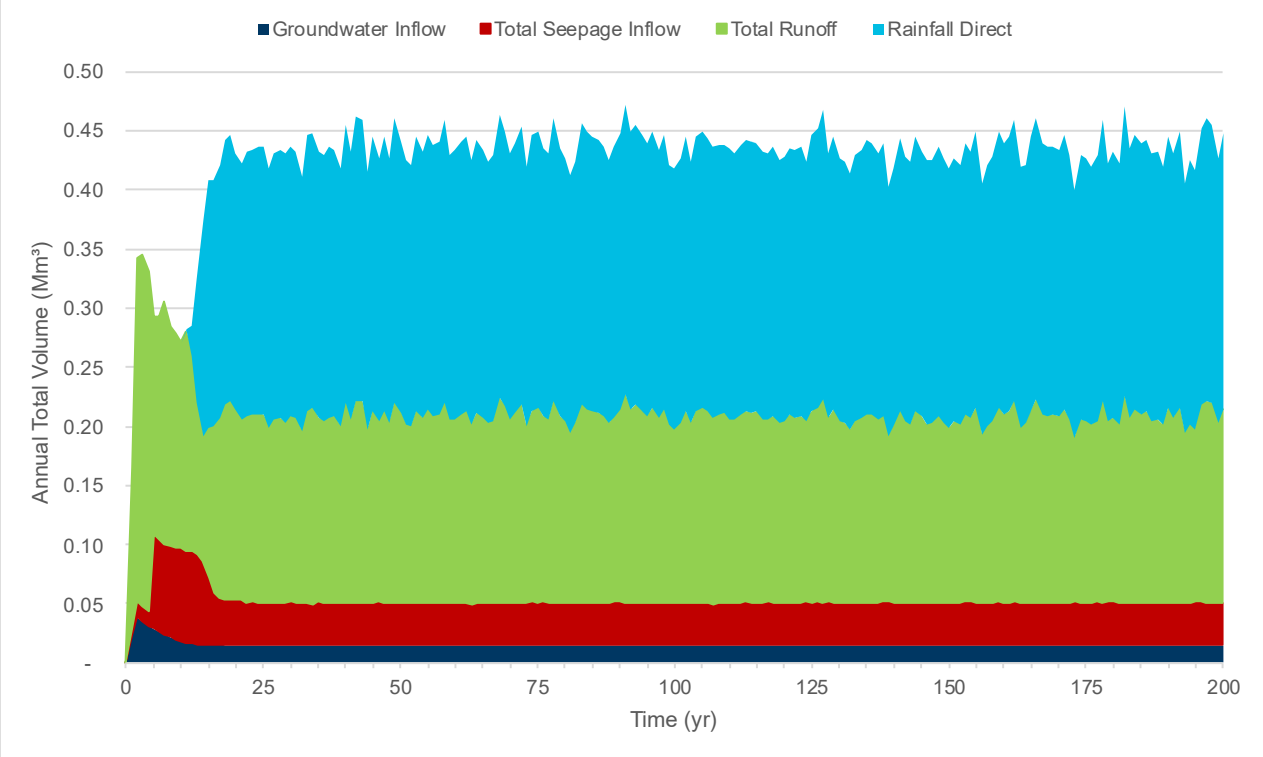

Figure G-2.9 Coronation Pit annualised water inflows

Figure G-2.10 Photo of Trimbells WRS surface showing localised ponding

Coronation Pit outflows are presented in Figure G-2.11. There are no outflows predicted initially until evaporation effects begin when the pit lake level rises above the backfill at 620 mRL. Shortly after this, overflows are predicted to occur in some iterations. Low groundwater outflow rates are predicted to occur during the course of the simulation and these predominantly flow towards Trimbells Gully. These outflows are represented in the contaminant mass balance within the Mare Burn.

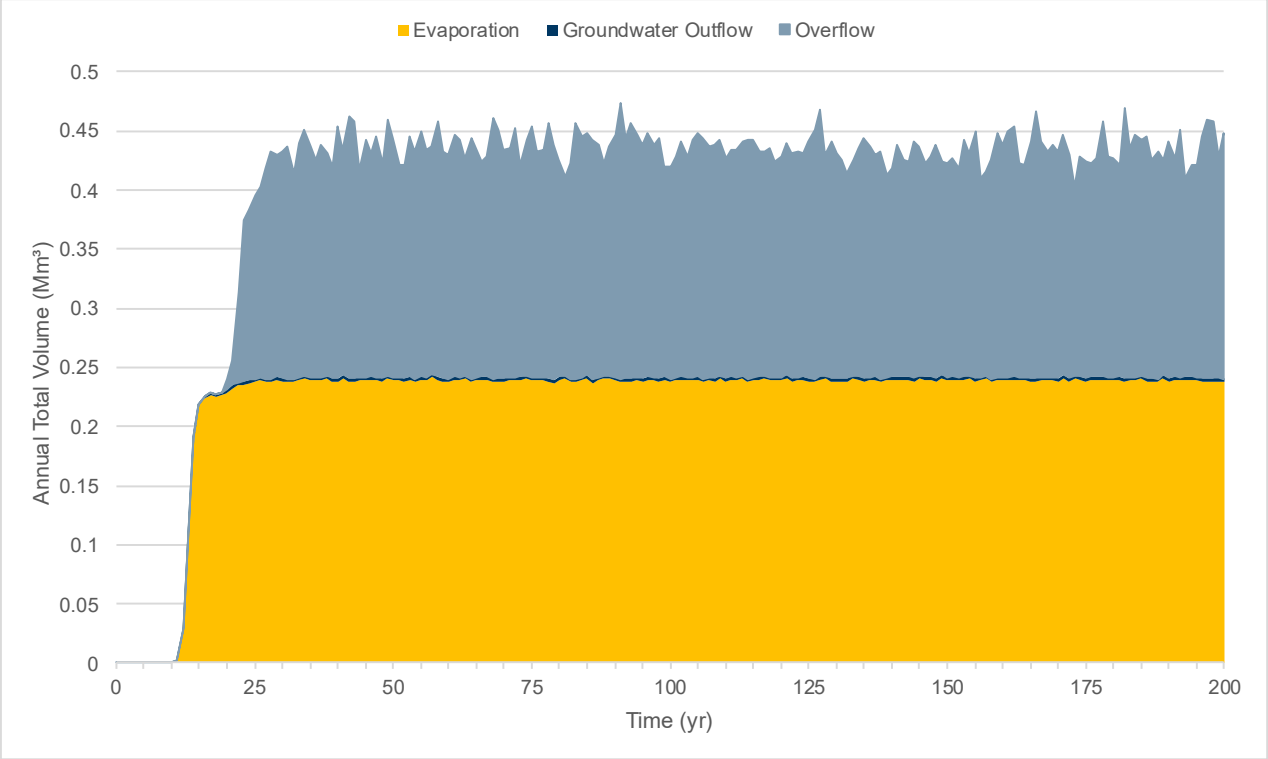

Figure G-2.11 Coronation Pit annualised water outflows

G-2.3 Coronation North Pit

The currently consented Coronation North Stage 5 (CN5) Pit has a footprint of 40 ha. The proposed extension to the Coronation North Pit will result in an overall increase to the pit footprint of approximately 17 ha, increasing the total pit footprint to approximately 57 ha for the final stage CN6. The Coronation North Pit stage, volume and area relationships are presented in Figure G-2.12. The pit extension results in a cumulative volume (for water storage) of 15.3 Mm^3 (including backfill void space) and a pit lake surface area of 26.9 ha at the overflow level of 562.5 mRL. Note that the area in Figure G-2.12 is shown to decrease as the level rises in some instances. It is recognised that this will not occur in practice and is a function of representing small 1m high lifts within a coarser block model of the pits and WRS. This is not expected to introduce excessive errors into the modelling.

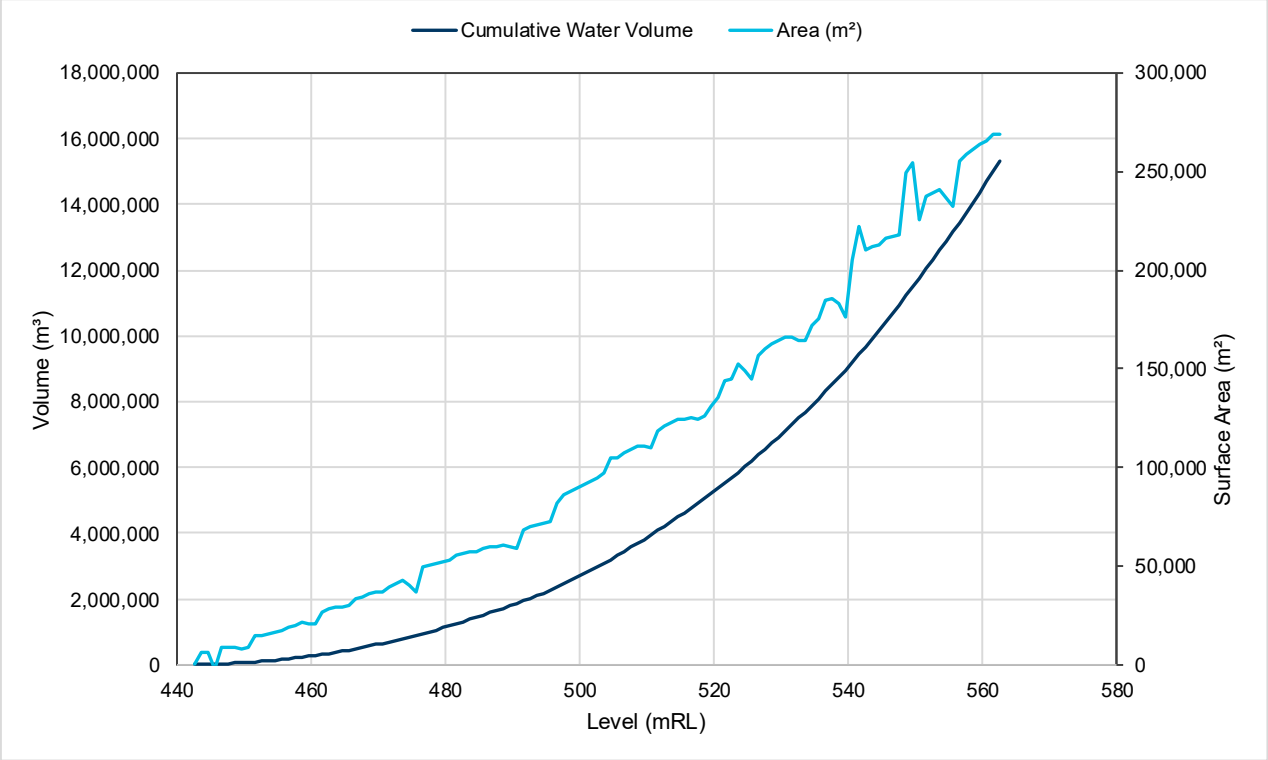

Figure G-2.12 Stage volume and area relationships for Coronation North Pit

G-2.3.1 Pit Lake Filling

The Coronation North Pit Lake filling curve is presented in Figure G-2.13. The WBM estimates a median filling time of approximately 64 years, reaching the overflow level of 562.5 mRL in 2099.

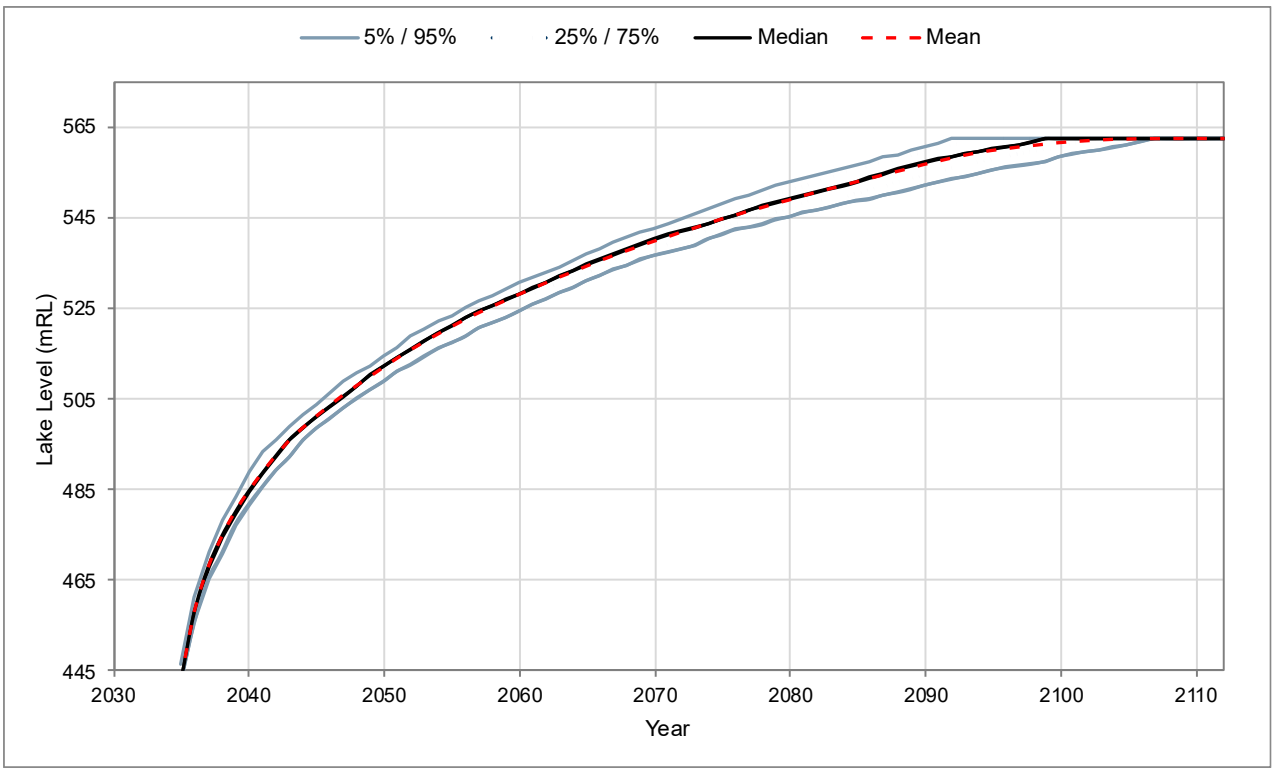

Figure G-2.13 Coronation North Pit Lake filling curve

G-2.3.2 Coronation North Water Balance

Refer to Figure G-2.8 for the Coronation area conceptual site model. Mean inflows and outflows to Coronation North Pit are stated below and presented in Figure G-2.9 and Figure G-2.11.

– Inflows
  - Runoff: Impacted Rehab, Pit and WRS Rehab
  - Rainfall direct
  - Groundwater inflow
  - WRS seepage: Coronation North Backfill, Coronation WRS and Trimbells WRS
– Outflows
  - Evaporation
  - Groundwater outflow
  - Overflow from the pit lake.

Initially total runoff inflows are high before the pit lake surface develops. As the pit lake level rises, direct rainfall inflows increase with the larger surface area before stabilising at the maximum pit lake level. WRS Seepage and Groundwater inflows remain largely constant after an initial peak at the commencement of the pit lake recovery.

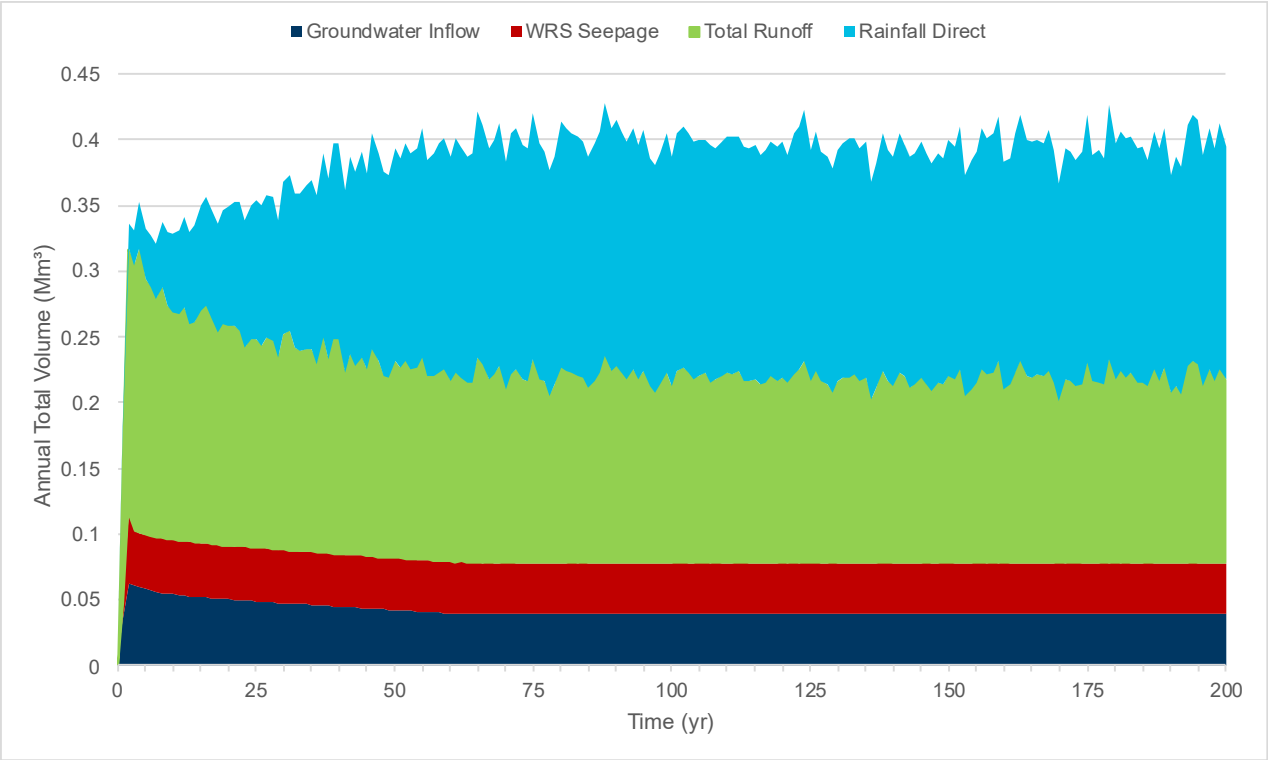

Figure G-2.14 Coronation North Pit cumulative water inflows

The water balance predicts low groundwater outflow rates until pit lake level nears the overflow point. From this point groundwater plume modelling indicates that the plume trends predominantly towards the Mare Burn below Coronation North WRS and to a lesser extent via Coal Creek. The discharge mass load is distributed between MB01 and MB02. Evaporation effects increase with the enlargement of the pit lake surface area before stabilising at the overflow point. Overflows have the potential to occur from 60 years onward before becoming more stable when the mean pit lake filling time has been reached.

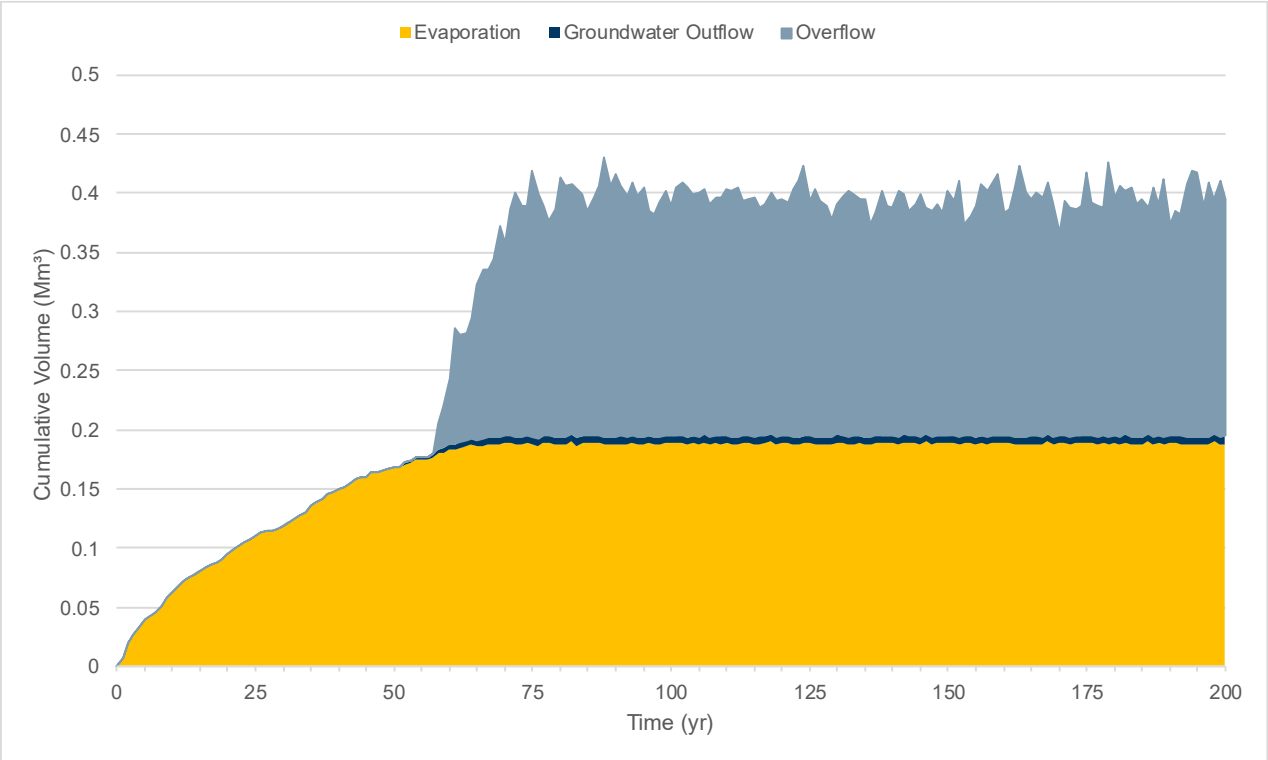

Figure G-2.15 Coronation North Pit annualised total water outflows

G-2.4 Innes Mills Pit

Innes Mills pit is proposed to be extended in MP4 with proposed IM11, IM12 and IM13 cutbacks. This will incorporate the area of the mined out SP11 TSF and result in an increase in the overall pit footprint of approximately 49 ha. The pit extension will result in a total void volume of 33.1 Mm^3 (including backfill void space) and an ultimate pit lake surface area of 44.7 ha at 487 mRL. Model outputs are based on an outlet being constructed from the lake at 473 mRL, where the total potential water storage volume is 25.8 Mm^3 and the surface area is 35.6 ha The stage volume and surface area relationships are displayed in Figure G-2.16. Note that the backfill within Innes Mills pit largely fills the void to 385 mRL.

The Innes Mills Pit scenario modelled did not include pump backs from the Mixed Tailings Impoundment and the Top Tipperary Tailings Storage Facility, which are intended to be routed to the water treatment plant. This changes the existing closure plan which utilised the Frasers – Innes Mills pit lake as a 'dirty lake' for disposal of select captured WRS seepage waters and TSF underdrain water.

The Innes Mills Pit has been modelled under with the assumption that it does not receive under drain pump backs from the Mixed Tailings Impoundment and the Top Tipperary Tailings Storage facility as were previously considered for the consented Frasers-Innes Mills Pit lake.

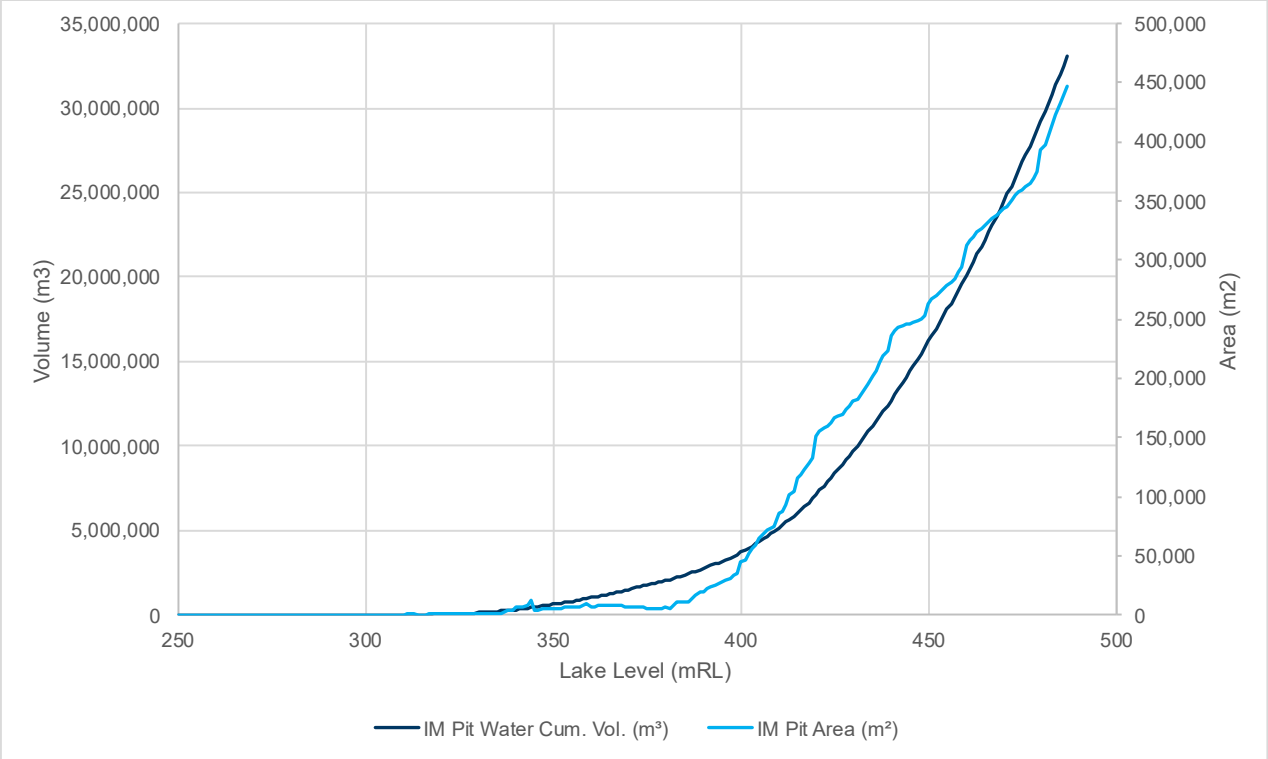

Figure G-2.16 Stage volume and area relationships for Innes Mills Pit

G-2.4.1 Pit Lake Filling

The Innes Mills Pit Lake filling curve is presented in Figure G-2.17. The median pit lake filling time is predicted to be approximately 62 years with the pit lake overflow level of 473 mRL being reached in approximately 2098.

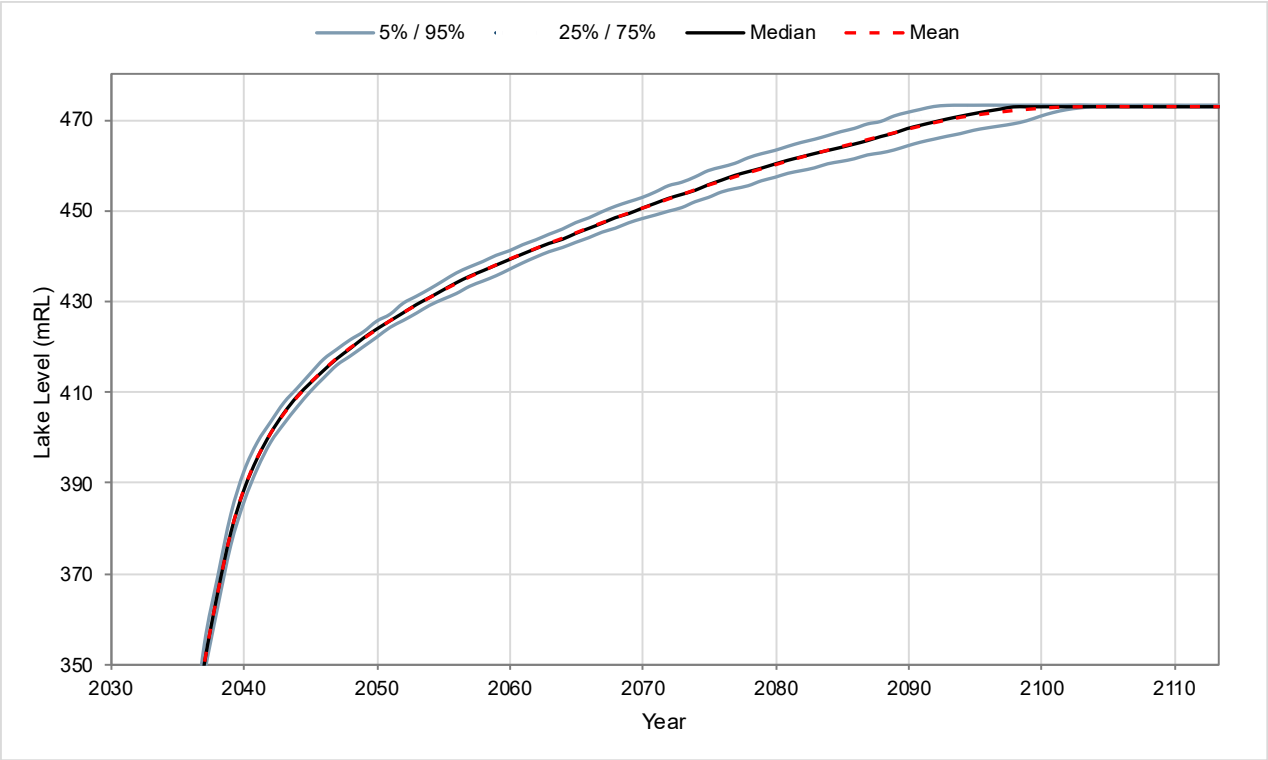

Figure G-2.17 IM Pit Lake filling curve

G-2.4.2 Innes Mills Pit Water Balance

The conceptual site model for the central mine site is presented in Figure G-2.18. This includes the key inflows and outflows for Innes Mills Pit.

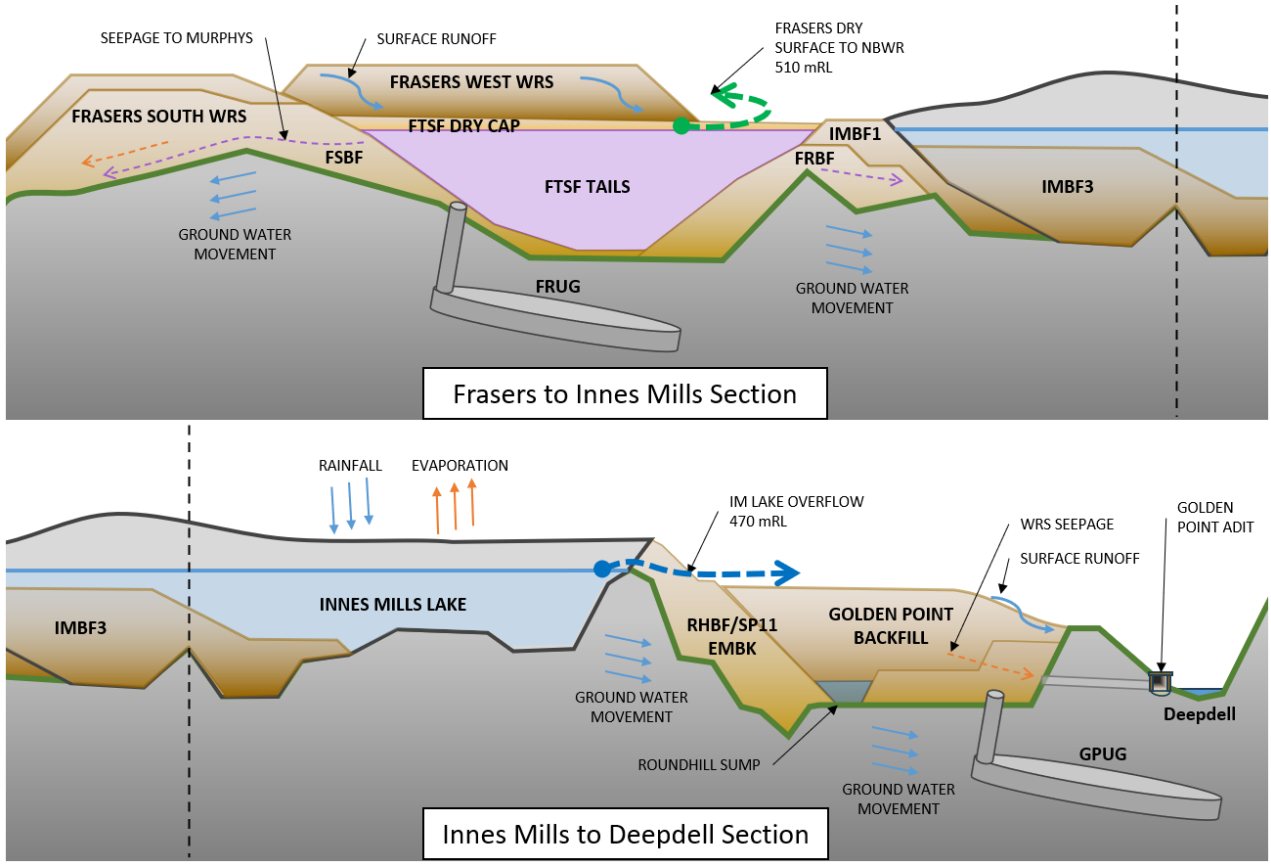

Figure G-2.18 Conceptual site model for the central mine site

Inflows for the Innes Mills Pit include:

– Runoff: Natural, Pit and WRS rehab
– Rainfall direct
– Groundwater inflow
– WRS seepages: Frasers Backfill, Innes Mills Backfill & Northern Gully East

Outflows for Innes Mills Pit include:

– Evaporation
– Groundwater outflow
– Pit overflow

Mean annualised inflows are presented in Figure G-2.19. Initially inflows are high due to the low pit lake level. Once the backfill is saturated and the pit lake surface becomes active, runoff decrease inversely to the direct rainfall. Direct rainfall increases with the widening pit lake surface area until the final level is reached after approximately 67 years. Inflows decrease rapidly at first before slowing and becoming relatively stable at the final pit lake level.

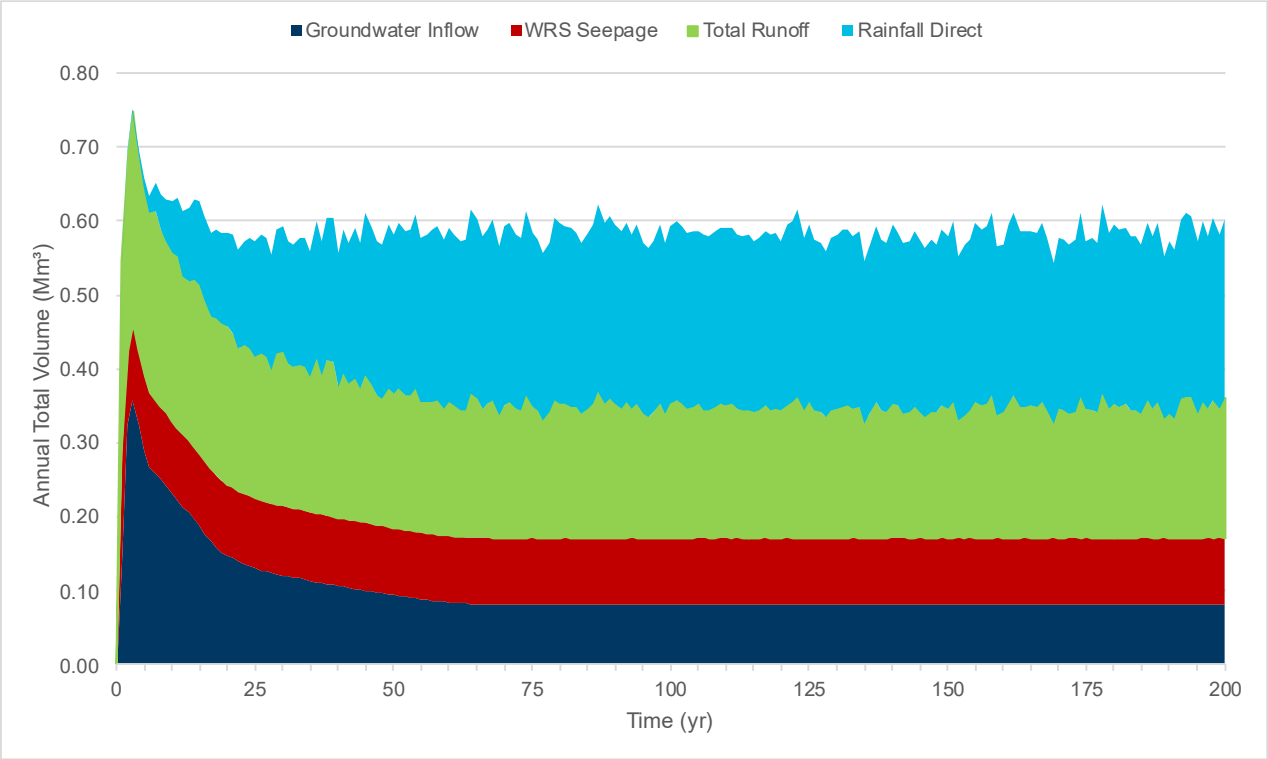

Figure G-2.19 Annualised inflows for the Innes Mills Pit

Mean annualised outflows are presented in Figure G-2.20, noting that overflow from Innes Mills Pit begins to appear in the model results after 57 years before stabilising across the model runs after a further 10 years.

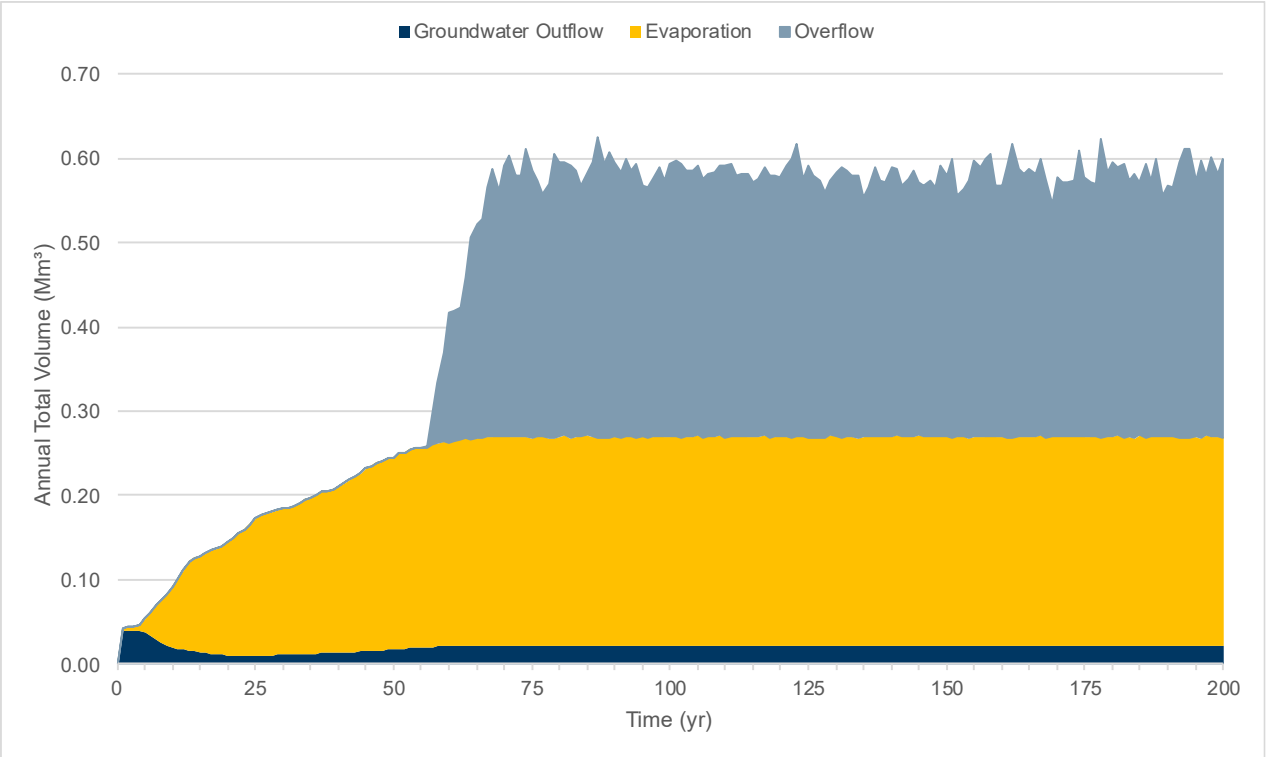

Figure G-2.20 Annualised outflows for the Innes Mills Pit Lake

Attachments

Attachment 1

Pit stage volume relationships

Stage-volume-area relationships are presented below in Table G-2.2,Table G-2.3,Table G-2.4 and Table G-2.5, they have been derived from information provided by OGL in Table G-2.1.

Table G-2.1 Source files for stage volume area relationships and calculations

Location	Source	Details
Golden Bar	GB3 Volume Summary.xlsx	Golden Bar pit lake volumes
Coronation	CO Volume Summary 2.xlsx	
260216_Coronation_pit_backfills_volume.xlsx	Coronation pit lake volumes and backfill	
Coronation North	260216_Coronation North pit and backfills for water modelling	Coronation North pit lake volumes and backfill
Innes Mills Pit	IM pit and backfills for water modelling_v2.xlsx	Innes Mills pit lake volumes and backfill

Table G-2.2 Stage-volume-area relationships for Golden Bar Pit

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
410	0	0	0	456	55110	1099200	54487
411	3402	3402	1701	457	55825	1155024	55467
412	3605	7007	3504	458	56536	1211560	56180
413	3675	10682	3640	459	59298	1270859	57917
414	3951	14634	3813	460	60141	1330999	59720
415	4044	18677	3998	461	71000	1401999	65570
416	6971	25648	5507	462	71994	1473993	71497
417	7332	32980	7151	463	72917	1546910	72456
418	7486	40465	7409	464	76700	1623610	74809
419	7790	48255	7638	465	78066	1701676	77383
420	7948	56203	7869	466	80566	1782242	79316
421	10022	66225	8985	467	81777	1864019	81172
422	10428	76653	10225	468	82871	1946890	82324
423	10689	87341	10558	469	86215	2033105	84543
424	11095	98436	10892	470	87124	2120229	86669
425	11157	109594	11126	471	88882	2209111	88003
426	12787	122380	11972	472	90047	2299158	89465
427	13126	135506	12956	473	91052	2390211	90550
428	13404	148910	13265	474	92419	2482630	91736
429	15719	164629	14562	475	93477	2576107	92948
430	15944	180573	15831	476	104118	2680225	98798
431	21137	201710	18540	477	105260	2785485	104689
432	21973	223683	21555	478	106338	2891823	105799
433	22648	246331	22310	479	109824	3001647	108081
434	23775	270106	23212	480	110824	3112471	110324
435	24363	294469	24069	481	112473	3224944	111649
436	25167	319636	24765	482	113572	3338516	113023
437	25769	345405	25468	483	114562	3453078	114067
438	26266	371671	26017	484	121034	3574113	117798
439	27203	398874	26735	485	122348	3696461	121691
440	27768	426643	27486	486	124033	3820494	123191
441	30701	457343	29234	487	125348	3945842	124690
442	31544	488888	31123	488	126699	4072541	126024
443	32374	521261	31959	489	128417	4200892	126504
444	33425	554686	32899	490	130668	4329918	127331
445	34060	588746	33742	491	146600	4474577	136280
446	40696	629442	37378	492	154121	4626827	148043
447	41532	670973	41114	493	155211	4780156	152406
448	42220	713193	41876	494	156899	4935275	153636
449	43130	756322	42675	495	158112	5091248	154636
450	43666	799989	43398	496	159531	5248270	155769
451	44639	844628	44153	497	161907	5407740	157911
452	45479	890107	45059	498	163197	5568825	160342
453	47053	937160	46266	499	165481	5732837	163138
454	53067	990226	50060	500	166712	5899072	165481
455	53864	1044090	53465	510		6065784	165481

Table G-2.3 Stage-volume-area relationships for Coronation Pit

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
532	0	0	0	580	44806	927499	10
533	865	865	10	581	45123	972622	10
534	952	1817	10	582	45536	1018158	10
535	1898	3714	10	583	46047	1064205	10
536	1902	5617	10	584	46510	1110715	10
537	2013	7629	10	585	51028	1161744	10
538	1980	9609	10	586	51875	1213618	10
539	2075	11685	10	587	52291	1265910	10
540	2982	14667	10	588	53089	1318999	10
541	2872	17538	10	589	53634	1372633	10
542	2953	20491	10	590	54394	1427027	10
543	2950	23442	10	591	54852	1481879	10
544	3044	26485	10	592	55497	1537376	10
545	5479	31964	10	593	56406	1593782	10
546	5624	37588	10	594	56893	1650675	10
547	5799	43387	10	595	57654	1708328	10
548	10234	53621	10	596	58029	1766358	10
549	10509	64131	10	597	58477	1824835	10
550	11209	75340	10	598	58891	1883726	10
551	11499	86839	10	599	59571	1943298	10
552	11818	98656	10	600	64409	2007707	10
553	13755	112411	10	601	65181	2072888	10
554	14099	126510	10	602	65706	2138594	10
555	19018	145528	10	603	66212	2204806	10
556	19429	164957	10	604	66736	2271541	10
557	19855	184812	10	605	69004	2340546	10
558	20467	205279	10	606	69731	2410277	10
559	20927	226206	10	607	70438	2480715	10
560	22232	248438	10	608	71773	2552488	10
561	22632	271070	10	609	72699	2625187	10
562	23074	294144	10	610	73625	2698812	10
563	24523	318667	10	611	73995	2772807	10
564	25010	343677	10	612	74486	2847293	10
565	26903	370580	10	613	75054	2922347	10
566	27897	398478	10	614	75516	2997863	10
567	28735	427213	10	615	78775	3076637	10
568	30492	457704	10	616	79918	3156555	10
569	30943	488648	10	617	80495	3237050	10
570	34757	523404	10	618	81041	3318092	10
571	35511	558915	10	619	81607	3399699	10
572	36225	595141	10	620	338757	3738456	316729
573	38604	633744	10	621	342460	4080916	320520
574	39112	672856	10	622	345935	4426852	324095
575	40694	713550	10	623	346711	4773562	324337
576	41235	754785	10	624	350227	5123790	327963
577	41741	796527	10	625	362022	5485811	341810
578	42789	839316	10	626	366087	5851898	346113
579	43377	882693	10	627	370147	6222045	350411

Table G-2.4 Stage-volume-area relationships for Coronation North Pit

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
442.5	0	0	0	503.5	110061	3084475	97081
443.5	6500	6500	6500	504.5	116816	3201291	104780
444.5	6616	13116	6616	505.5	117503	3318794	104961
445.5	0	12334	0	506.5	121181	3439975	107072
446.5	10252	22586	8400	507.5	123404	3563379	109234
447.5	10591	33177	8649	508.5	125265	3688644	111054
448.5	10604	43781	8494	509.5	125450	3814094	110786
449.5	10758	54539	8300	510.5	125414	3939508	110208
450.5	11736	66275	9006	511.5	133540	4073049	118131
451.5	17120	83395	14296	512.5	136271	4209320	120690
452.5	17959	101355	15018	513.5	138184	4347504	122439
453.5	18698	120052	15612	514.5	139988	4487492	124008
454.5	20009	140061	16775	515.5	141051	4628543	124738
455.5	21005	161066	17642	516.5	141606	4770149	124832
456.5	22331	183396	18871	517.5	141923	4912071	124545
457.5	23374	206771	19832	518.5	143878	5055950	125918
458.5	24718	231489	21108	519.5	148821	5204771	130884
459.5	24763	256252	20790	520.5	153522	5358293	135686
460.5	24632	280884	20280	521.5	161891	5520184	143702
461.5	31334	312218	26888	522.5	163164	5683348	144567
462.5	32458	344676	27920	523.5	171000	5854348	152003
463.5	33564	378240	28937	524.5	169003	6023352	148804
464.5	34398	412638	29583	525.5	166377	6189728	144760
465.5	35329	447967	30322	526.5	179293	6369021	157049
466.5	38731	486699	33626	527.5	182901	6551922	160213
467.5	39889	526588	34687	528.5	185786	6737708	162704
468.5	41049	567638	35750	529.5	187850	6925558	164375
469.5	41986	609624	36519	530.5	189948	7115506	166079
470.5	42845	652469	37192	531.5	190833	7306339	166301
471.5	45168	697636	39425	532.5	189838	7496177	164152
472.5	47032	744668	41219	533.5	191427	7687604	164662
473.5	48475	793143	42563	534.5	199672	7887275	172250
474.5	46601	839743	39871	535.5	203257	8090533	175350
475.5	44424	884168	36845	536.5	212836	8303369	184455
476.5	57498	941666	49733	537.5	214406	8517775	185466
477.5	58159	999825	50211	538.5	213235	8731010	183066
478.5	59333	1059158	51262	539.5	208833	8939843	176535
479.5	60248	1119406	52033	540.5	234691	9174534	205071
480.5	61048	1180454	52708	541.5	252425	9426959	221869
481.5	63490	1243944	55111	542.5	245568	9672528	209831
482.5	64590	1308534	56175	543.5	247997	9920525	211723
483.5	65436	1373969	56933	544.5	248748	10169273	212617
484.5	66172	1440141	57487	545.5	252654	10421927	216495
485.5	67302	1507443	58507	546.5	253692	10675618	216933
486.5	68384	1575827	59440	547.5	254958	10930576	217611
487.5	69124	1644951	59971	548.5	281571	11212147	249551
488.5	70078	1715029	60739	549.5	286959	11499106	254501
489.5	69476	1784505	59580	550.5	263950	11763056	225186
490.5	69124	1853629	58674	551.5	276170	12039226	237049
491.5	79202	1932830	68587	552.5	278570	12317796	239073

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
492.5	80693	2013523	69839	553.5	280434	12598231	240433
493.5	81963	2095486	70857	554.5	278339	12876570	236817
494.5	83354	2178839	72000	555.5	275801	13152370	232491
495.5	84425	2263264	72848	556.5	299234	13451604	255198
496.5	93579	2356843	81805	557.5	303273	13754877	258927
497.5	98272	2455115	86283	558.5	306185	14061062	261545
498.5	100139	2555253	87937	559.5	308434	14369496	263428
499.5	101657	2656910	89249	560.5	310557	14680053	265196
500.5	103934	2760844	91368	561.5	314954	14995007	269056
501.5	105866	2866710	93168	562.5	315780	15310787	269146
502.5	107703	2974413	94874				

Table G-2.5 Stage-volume-area relationships for Innes Mills Pit

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
261	0	0	0	375	51966	1757316	4671
262	2	2	2	376	53486	1810802	5515
263	12	15	12	377	54522	1865324	5810
264	12	27	12	378	55236	1920561	5835
265	17	44	17	379	55471	1976032	5624
266	19	63	19	380	59610	2035642	6167
267	19	81	19	381	59376	2095018	5296
268	26	108	26	382	62406	2157424	7353
269	56	163	56	383	66200	2223624	10231
270	56	220	56	384	67180	2290804	10740
271	56	276	56	385	68047	2358851	10976
272	56	332	56	386	68784	2427635	11172
273	56	388	56	387	71500	2499135	13332
274	56	445	56	388	75415	2574550	16530
275	56	501	56	389	78380	2652930	18684
276	56	557	56	390	80829	2733759	18948
277	56	613	56	391	84261	2818020	21541
278	56	670	56	392	87166	2905186	23483
279	56	726	56	393	89434	2994620	24974
280	56	782	56	394	91116	3085736	26104
281	56	838	56	395	93323	3179060	27219
282	56	895	56	396	95337	3274396	28707
283	56	951	56	397	98181	3372577	30983
284	56	1007	56	398	101625	3474202	33793
285	56	1063	56	399	103833	3578035	35385
286	56	1120	56	400	117770	3695804	45132
287	56	1176	56	401	119965	3815770	46539
288	56	1232	56	402	125472	3941242	51252
289	56	1288	56	403	131043	4072285	55830
290	56	1345	56	404	134674	4206960	58463
291	56	1401	56	405	144186	4351146	65280
292	56	1457	56	406	149517	4500663	69493
293	56	1513	56	407	152268	4652931	71330
294	56	1570	56	408	154150	4807081	72465
295	56	1626	56	409	156343	4963425	74028
296	56	1682	56	410	166430	5129854	85444
297	56	1738	56	411	168819	5298673	87351
298	56	1795	56	412	175128	5473802	93256
299	56	1851	56	413	183229	5657031	101031
300	56	1908	56	414	186821	5843852	104280
301	57	1965	57	415	196782	6040634	115353
302	59	2024	59	416	199598	6240233	117830
303	51	2075	51	417	204937	6445170	122784
304	51	2126	51	418	210987	6656157	128281
305	53	2179	53	419	215792	6871948	132410
306	59	2238	59	420	240792	7112740	151540
307	56	2295	56	421	244679	7357419	154657
308	56	2351	56	422	248151	7605570	157619
309	56	2407	56	423	250657	7856227	159781
310	92	2499	92	424	253086	8109313	161893

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
311	274	2774	274	425	258192	8367505	166871
312	578	3352	272	426	259821	8627327	168211
313	944	4295	260	427	261611	8888938	169687
314	934	5229	119	428	266292	9155229	174004
315	1591	6820	108	429	268514	9423743	175913
316	1735	8555	67	430	273296	9697039	180634
317	2533	11088	205	431	275153	9972191	182276
318	3432	14520	467	432	279394	10251585	186259
319	3696	18216	522	433	284368	10535953	190942
320	5735	23951	1089	434	288648	10824601	194974
321	5671	29622	716	435	296371	11120972	202390
322	6569	36191	990	436	301141	11422113	206867
323	7531	43722	1254	437	307554	11729667	213017
324	7883	51605	1236	438	313536	12043202	218615
325	9824	61429	540	439	318987	12362190	223554
326	10157	71585	442	440	334781	12696970	236087
327	10681	82266	425	441	339750	13036720	240471
328	11393	93659	488	442	342874	13379594	243219
329	11998	105657	454	443	344722	13724316	244826
330	14297	119954	569	444	346585	14070901	246476
331	15000	134954	692	445	346361	14417262	246062
332	15912	150865	1115	446	347473	14764735	246973
333	16631	167496	1378	447	349157	15113892	248469
334	17103	184599	1467	448	351176	15465067	250298
335	17481	202080	1447	449	354108	15819175	253044
336	18010	220090	1607	450	365516	16184691	263548
337	18951	239041	2143	451	369265	16553956	267084
338	20418	259459	3210	452	372538	16926495	270181
339	21390	280849	3762	453	375183	17301677	272645
340	26976	307825	6977	454	378147	17679824	275401
341	27170	334996	6556	455	381521	18061345	278510
342	27965	362961	6555	456	384224	18445569	281007
343	30106	393067	7546	457	388119	18833687	284654
344	36261	429328	12737	458	393408	19227095	289599
345	29037	458365	3236	459	398543	19625638	294270
346	30641	489006	4115	460	420425	20046063	312669
347	31730	520736	4655	461	424921	20470984	316469
348	32523	553259	4946	462	428740	20899724	319908
349	33223	586482	5188	463	433184	21332908	324044
350	33329	619811	4882	464	436239	21769148	326883
351	34415	654226	5506	465	439896	22209044	329757
352	35073	689299	5691	466	443269	22652313	332875
353	35741	725039	5887	467	446260	23098573	335617
354	36497	761536	6109	468	449089	23547661	338208
355	38037	799573	6358	469	451751	23999413	340669
356	38997	838570	6579	470	455968	24455381	343570
357	39861	878431	6867	471	458364	24913744	345600
358	41009	919441	7423	472	464396	25378140	351058
359	44367	963808	10017	473	469555	25847695	355684
360	44470	1008278	6105	474	472021	26319716	357776
361	46187	1054465	6984	475	474407	26794124	358880

RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)	RL (m)	Vol. (m^3)	Cum. Vol. (m^3)	Area (m^2)
362	47591	1102056	7696	476	478225	27272348	362317
363	48488	1150544	8068	477	481587	27753936	365352
364	49312	1199856	8407	478	486316	28240252	369549
365	49812	1249668	8457	479	491663	28731914	374256
366	49973	1299641	8200	480	514782	29246696	392943
367	50089	1349731	7898	481	520572	29767268	397912
368	50191	1399921	7541	482	530185	30297453	406030
369	50296	1450217	7188	483	539426	30836878	413905
370	50245	1500462	6703	484	548702	31385580	422752
371	50199	1550661	6232	485	561027	31946607	433473
372	50379	1601040	5912	486	567472	32514079	439640
373	51387	1652427	6401	487	575178	33089257	446891
374	52923	1705350	7222				