APPENDIX H. FURTHER DETAILS OF MINE WATER BALANCE AND USE

Data Sources

The General Plan of Operations (GPO) describes an initial water budget for the mine, organized by three periods: construction (mine years 1–7), operations (mine years 8–36), and operations rampdown to closure (mine years 37–45) (Resolution Copper 2016d) (GPO figures 3.6-1a–c).

The initial water budget was later reproduced separately for each alternative (WestLand Resources Inc. 2018b). The tables included in this appendix reflect the later alternative water budgets. In some cases, minor differences in amount (within 5 percent) have been ignored for the purposes of simplicity. The water balance for each major mine component (East Plant Site, West Plant Site, filter plant and loadout facility, tailings storage facility, and the makeup water supply from the Desert Wellfield) is described separately.

For the purposes of the draft environmental impact statement (DEIS), a consistent terminology was selected for describing mine phases (Rigg 2017). The alternatives differ from the GPO in that active mining is estimated to only last 40 years, instead of 45 years as described in the GPO. Table H-1 shows the correlation between the various phases from different sources.

Table H-1. Comparison of mine life phases from different water balance data sources

GPO Water Use Phase	GPO Duration	GPO, Translated into EIS Terminology ("Mine Years")	WestLand 2018 Duration	WestLand 2018 Translated into EIS Terminology ("Mine Years")
Construction	9 years	Mine years 1–9		
Mine development/rampup	7 years	Mine years 6–12	7 years	Mine years 6–12
Peak mining	29 years	Mine years 13–41	24 years	Mine years 13–36
Mine rampdown	9 years	Mine years 42–50	10 years	Mine years 37–46

Sources: Resolution Copper (2016d), see table 1.8-1 and figures 3.6-1a–c; WestLand Resources Inc. (2018b), see page 1 and figures 1–15

East Plant Site Water Use

Water input at the East Plant Site would come from two major sources: (1) groundwater inflow, and (2) mine service water. All groundwater inflow into the East Plant Site would be pumped in order to dewater the underground mine infrastructure, and sent through a pipeline to be used in the West Plant Site through the Never Sweat Tunnel. The mine service water could consist of fresh water from the Central Arizona Project (CAP) and recovery wells, combined with filtrate return from the filter plant and loadout facility. Mine service water would be delivered from the West Plant Site through a pipeline in the Never Sweat Tunnel.

Water would leave the East Plant Site in four ways: (1) mine dewatering sent to the West Plant Site, (2) as ore moisture, (3) as water lost through the shaft and vent, and (4) as water lost through refrigerant evaporation. Table H-2 identifies the acre-feet per year (AF/year) of water inflow and outflow for the East Plant Site during the construction, operations, and operations rampdown to closure phases.

Table H-2. East Plant Site water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Groundwater inflow	2,118	1,772	1,298
Mine service water	5,874	6,944	4,081
Total AF/Year	**7,992**	**8,716**	**5,379**
Total AF/Phase	**55,944**	**209,184**	**53,790**
Outflow Sources			
Mine dewatering	4,967	3,992	2,979
Ore moisture	652	1,476	489
Evaporation from shaft, vent, and refrigeration	2,374	3,247	1,911
Total AF/year	**7,993**	**8,715**	**5,379**
Total AF/Phase	**55,951**	**209,160**	**53,790**

West Plant Site Water Use

The water balances for the West Plant Site and the tailings storage facility are closely related, and both change substantially based on the alternative and changes in tailings deposition and location. Water inputs at the West Plant Site that do not vary by alternative include the following: (1) dewatering from East Plant Site, (2) ore moisture, and (3) treated effluent. Water inputs at the West Plant Site that vary based on the tailings facility include the following: (1) process makeup water and (2) reclaimed water from tailings. Process makeup water would be delivered to the West Plant Site from the CAP recovery wells and recycled from the filter plant through a water pipeline in the Magma Arizona Railroad Company (MARRCO) corridor.

Similarly, some components of water leaving the West Plant Site do not vary by alternative and include the following: (1) evaporation and molybdenum plant losses, and (2) concentrate slurry to the filter plant. Water leaving as (3) tailings slurry (non-potentially acid generating [NPAG] and potentially acid generating [PAG] tailings) varies by alternative. Note that for Alternative 4 (filtered tailings), rather than requiring process water for the West Plant Site, an excess of process water is delivered back to the system.

Table H-3 identifies the AF/year of water inflow and outflow for the West Plant Site during the construction, operations, and operations rampdown to closure phases.

Table H-3. West Plant Site water inflow and outflow by source per mine phase

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources				
East Plant Site dewatering	All alternatives	4,967	3,992	2,979
Ore moisture	All alternatives	652	1,476	489
Treated effluent	All alternatives	36	36	36
Process makeup water	Alternative 2	3,400	13,757	752
Process makeup water	Alternative 3	1,646	10,076	1,592

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Process makeup water	Alternative 5	1,884	11,074	4,077
Process makeup water	Alternative 6	46	11,779	3,682
Tailings recycled water	Alternative 2	434	2,989	2,365
Tailings recycled water	Alternative 3	2,181	6,670	1,525
Tailings recycled water/collection pond	Alternative 4	7,365	17,017	4,923
Tailings recycled water	Alternative 5	3,850	9,315	1,724
Tailings recycled water	Alternative 6	5,378	8,598	464
Total AF In/Year	Alternative 2	**9,489**	**22,250**	**6,621**
Total AF Inflow/Phase	Alternative 2	**66,423**	**534,000**	**66,210**
Total AF In/Year	Alternative 3	**9,482**	**22,250**	**6,621**
Total AF Inflow/Phase	Alternative 3	**66,374**	**534,000**	**66,210**
Total AF In/Year	Alternative 4	**13,020**	**22,521**	**8,427**
Total AF Inflow/Phase	Alternative 4	**91,140**	**540,504**	**84,270**
Total AF In/Year	Alternative 5	**11,389**	**25,893**	**9,305**
Total AF Inflow/Phase	Alternative 5	**79,723**	**621,432**	**93,050**
Total AF In/Year	Alternative 6	**11,079**	**25,881**	**7,650**
Total AF Inflow/Phase	Alternative 6	**77,553**	**621,144**	**76,500**
Outflow Sources				
Concentrate slurry	All alternatives	416	942	312
Evaporation and molybdenum plant	All alternatives	490	497	488
Tailings slurry (PAG and NPAG)	Alternative 2	8,582	20,810	5,820
Tailings slurry (PAG and NPAG)	Alternative 3	8,575	20,810	5,820
Tailings slurry (PAG and NPAG)	Alternative 4	8,765	20,830	5,650
Tailings slurry (PAG and NPAG) plus makeup water	Alternative 5	10,481	24,454	8,503
Tailings slurry (PAG and NPAG)	Alternative 6	10,172	24,441	6,849
Process water back to system	Alternative 4 only	3,348	251	1,976
Total AF Out/Year	Alternative 2	**9,488**	**22,249**	**6,620**
Total AF Outflow/Phase	Alternative 2	**66,416**	**533,976**	**66,200**
Total AF Out/Year	Alternative 3	**9,481**	**22,249**	**6,620**
Total AF Outflow/Phase	Alternative 3	**66,367**	**533,976**	**66,200**
Total AF Out/Year	Alternative 4	**13,019**	**22,520**	**8,426**
Total AF Outflow/Phase	Alternative 4	**91,133**	**540,480**	**84,260**

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Total AF Out/Year	Alternative 5	**11,387**	**25,893**	**9,303**
Total AF Outflow/Phase	Alternative 5	**79,709**	**621,432**	**93,030**
Total AF Out/Year	Alternative 6	**11,078**	**25,880**	**7,649**
Total AF Outflow/Phase	Alternative 6	**77,546**	**621,120**	**76,490**

Tailings Storage Facility Water Use

Water input at the tailings storage facility would come from two sources: (1) delivered with tailings (NPAG and PAG) from the West Plant Site, or (2) as captured precipitation and stormwater runoff from the facility or collection ponds.

Water would leave the tailings storage facility in four ways: (1) water reclaimed and sent back to the West Plant Site, (2) water lost through evaporation, (3) water that is entrained with the tailings, and (4) seepage lost to the aquifer. One additional component—change in storage—reflects the fact that the tailings storage facility water balance is dynamic, and during the first two phases more water is coming into the facility than leaving, while during the last phase more water is leaving than coming in.

The inflows for Alternative 4 exceed the outflows by about 8,700 acre-feet during peak operations. This reflects the fact that more water is recovered than can be used. This water may require additional collection, treatment, and disposal.

Tables H-4 through H-8 identify the AF/year of water inflow and outflow for each tailings storage facility alternative during the construction, operations, and operations rampdown to closure phases.

Table H-4. Alternative 2 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,582	20,810	5,820
Precipitation and stormwater runoff	1,110	1,865	1,625
Change in storage	0	0	543
Total AF In/Year	**9,692**	**22,675**	**7,988**
Total AF Inflow/Phase	**67,844**	**544,200**	**79,980**
Outflow Sources			
Reclaim to West Plant Site	434	2,989	2,365
Evaporation	3,779	9,705	4,853
Entrainment	4,723	9,692	617
Lost seepage	77	153	153
Change in storage	679	136	0
Total AF Out/Year	**9,692**	**22,675**	**7,988**
Total AF Outflow/Phase	**67,844**	**544,200**	**79,880**

Table H-5. Alternative 3 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,575	20,810	5,820
Precipitation and stormwater runoff	1,007	1,573	1,573
Change in storage	0	0	256
Total AF In/Year	**9,582**	**22,383**	**7,649**
Total AF Inflow/Phase	**67,074**	**537,192**	**76,490**
Outflow Sources			
Reclaim to West Plant Site	2,181	6,670	1,525
Evaporation	2,296	5,270	3,219
Entrainment	4,421	10,259	2,828
Lost seepage	39	77	77
Change in storage	645	107	0
Total AF Out/Year	**9,582**	**22,383**	**7,649**
Total AF Outflow/Phase	**67,074**	**537,192**	**76,490**

Table H-6. Alternative 4 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	8,765	20,830	5,650
Precipitation and stormwater runoff	1,298	2,747	3,584
Total AF In/Year	**10,063**	**23,577**	**9,234**
Total AF Inflow/Phase	**70,441**	**565,848**	**92,340**
Outflow Sources			
Reclaim to West Plant Site, including collection ponds	7,562	17,197	5,370
Evaporation	1,414	3,911	3,134
Entrainment	1,021	2,390	651
Lost seepage	66	79	79
Total AF Out/Year	**10,063**	**23,577**	**9,234**
Total AF Outflow/Phase	**70,441**	**565,848**	**92,340**

Table H-7. Alternative 5 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site (plus makeup water)	10,481	24,454	8,503

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Precipitation and stormwater runoff	2,819	6,769	9,645
Change in storage	0	0	15
Total AF In/Year	**13,300**	**31,223**	**18,163**
Total AF Inflow/Phase	**93,100**	**749,352**	**181,630**
Outflow Sources			
Reclaim to West Plant Site	3,850	9,315	1,724
Evaporation	3,028	9,929	12,521
Entrainment	4,822	10,335	2,661
Lost seepage	1,218	1,337	1,257
Change in storage	383	308	0
Total AF Out/Year	**13,301**	**31,224**	**18,163**
Total AF Outflow/Phase	**93,107**	**749,376**	**181,630**

Table H-8. Alternative 6 tailings storage facility water inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Tailings from West Plant Site	10,172	24,441	6,849
Precipitation and stormwater runoff	2,589	5,111	6,451
Change in storage	0	0	306
Total AF In/Year	**12,761**	**29,552**	**13,606**
Total AF Inflow/Phase	**89,327**	**709,248**	**136,060**
Outflow Sources			
Reclaim to West Plant Site	5,378	8,598	464
Evaporation	3,221	11,110	9,524
Entrainment	3,600	9,275	2,991
Lost seepage	114	453	627
Change in storage	448	116	0
Total AF Out/Year	**12,761**	**29,552**	**13,606**
Total AF Outflow/Phase	**89,327**	**709,248**	**136,060**

Filter Plant and Loadout Facility Water Use

Water input at the filter plant and loadout facility would come from a single source: as copper thickener underflow delivered from the West Plant Site through the MARRCO corridor.

Water would leave the filter plant and loadout facility in two ways: (1) as filter return water sent back to the West Plant Site and East Plant Site, and (2) as water lost within concentrate.

Table H-9 identifies the AF/year of water inflow and outflow for the filter plant and loadout facility during the construction, operations, and operations rampdown to closure phases.

Table H-9. Filter plant and loadout facility inflow and outflow by source per mine phase

	Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)
Inflow Sources			
Copper thickener underflow	416	942	312
Total AF per Phase	**2,912**	**22,608**	**3,120**
Outflow Sources			
Filter return to West Plant Site and East Plant Site	342	774	257
Concentrate	74	168	56
Total AF/year	**416**	**942**	**313**
Total AF per Phase	**2,912**	**22,608**	**3,130**

Makeup Water Supply from Desert Wellfield

The overall water balances are complex, with the need to account for multiple reclaim/recycle loops and water sources. However, ultimately the mine water supply for each alternative can be reduced to the need for fresh groundwater to be pumped or recovered from the Desert Wellfield, as shown in table H-10. In the event Resolution Copper Mining, LLC, is successful in obtaining a Non-Indian Agriculture Central Arizona Project contract, this could offset groundwater pumping through direct delivery of water; however, this contract has not been approved or completed and therefore CAP water use is not considered in this appendix.

Table H-10. Fresh groundwater supply requirements per mine phase

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)	Total Water Use All Phases
Desert Wellfield pumping (AF/year)	Alternative 2	8,932	19,926	4,576	
Total AF per Phase	**Alternative 2**	**62,524**	**478,224**	**45,760**	**586,508**
Desert Wellfield pumping (AF/year)	Alternative 3	7,178	16,245	5,416	
Total AF per Phase	**Alternative 3**	**50,246**	**389,880**	**54,160**	**494,286**
Desert Wellfield pumping (AF/year)	Alternative 4	2,184	5,918	1,848	
Total AF per Phase	**Alternative 4**	**15,288**	**142,032**	**18,480**	**175,800**
Desert Wellfield pumping (AF/year)	Alternative 5	7,416	17,244	7,901	
Total AF per Phase	**Alternative 5**	**51,912**	**413,856**	**79,010**	**544,778**

		Operations Rampup (Mine Years 6–12)	Peak Operations (Mine Years 13–36)	Operations Rampdown to Closure (Mine Years 37–46)	Total Water Use All Phases
Desert Wellfield pumping (AF/year)	Alternative 6	5,578	17,948	7,506	
Total AF per Phase	**Alternative 6**	**39,046**	**430,752**	**75,060**	**544,858**