APPENDIX 2-B

Alternative Studies

APPENDIX 2-B-1

Waste Rock Alternatives Assessment:

Goldcorp Coffee Project

(February 2 and 3, 2017)


Waste Rock Alternatives Assessment: Goldcorp Coffee Project

February 2 & 3, 2017

GOLDCORP

Agenda

- **Introductions**
- **Waste Rock Alternatives assessment**
  - Rationale
  - Process
- **Review of preferred alternatives**
- **Questions and Discussion**

Introductions

- **Round Table Introductions**
- **Workshop Objectives**
  - Provide the rationale for the mine plan alternatives
  - Articulate the process Goldcorp followed to arrive at the preferred alternatives
  - Inform Goldcorp's First Nation partners of the considerations and details of each Waste Rock Storage Facility (WRSF) scenario
  - Receive feedback from Goldcorp's First Nation partners on the proposed mine plan alternatives to inform the final mine plan layout decision
  - Review the formal feedback process and timeline; future workshops.

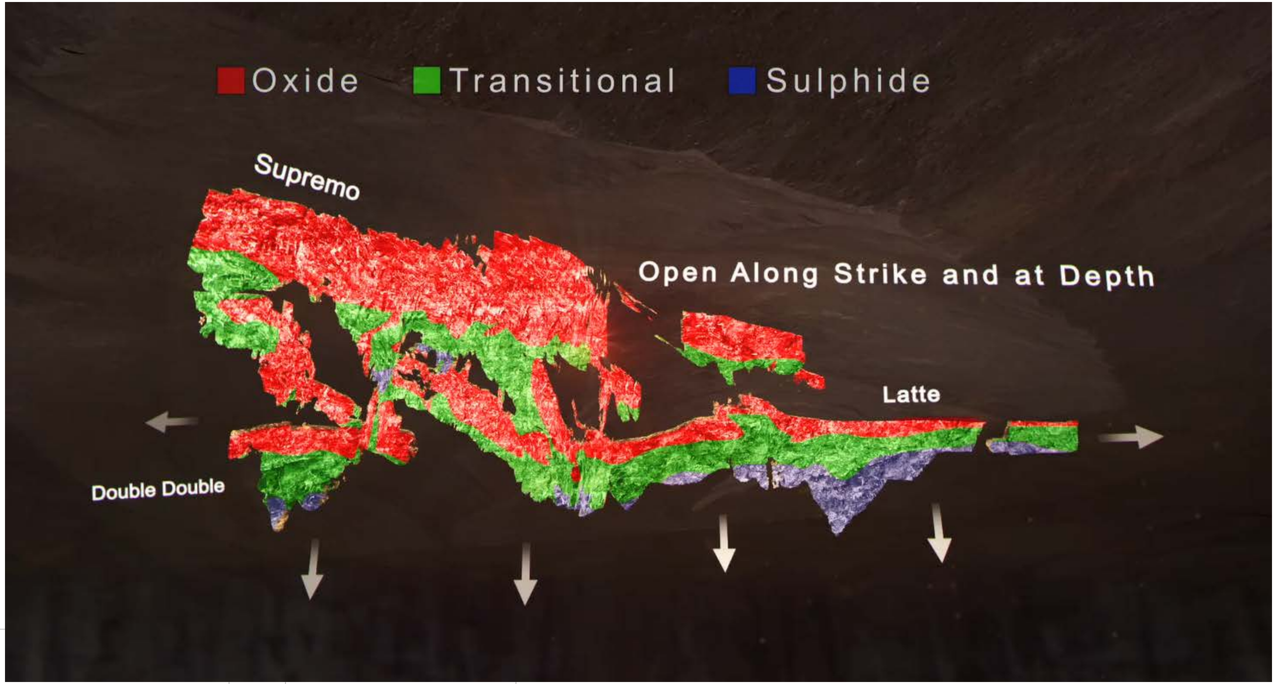
Waste Rock Alternatives Assessment

Kaminak Feasibility Study Mine Plan

Technical

- 46 million tonnes ore, 265 million tonnes waste
- Designed to minimize cost/maximize returns at $1200 gold price
- Three waste rock storage facilities (WRSF's) in 3 separate drainages
- 6 contact water discharge points into 3 drainages
- No WRSF regrading or remediation
- Completed prior to receipt of water impact assessment

Coffee Project Ore Body

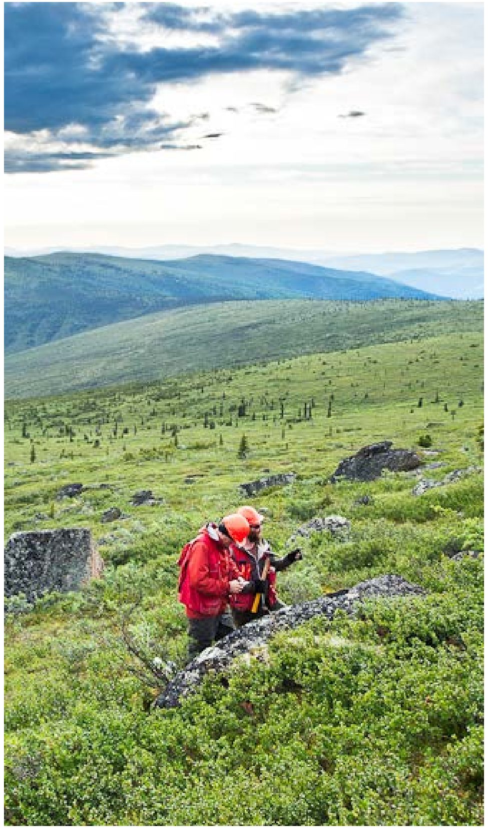


- The mine Goldcorp is currently proposing is focused on mining near surface oxides and some transitional ore. Kaminak did not perform exploration drilling at depth, but we do know that the ore body continues beyond the extent of current drill results
- There is potential for a future proposal to mine more transitional and sulfide material, depending on drilling and process evaluation results that will be undertaken while the mine is operating
- Goldcorp is not yet willing to commit to backfilling the pits and sterilizing these resources

Post-Acquisition Learnings

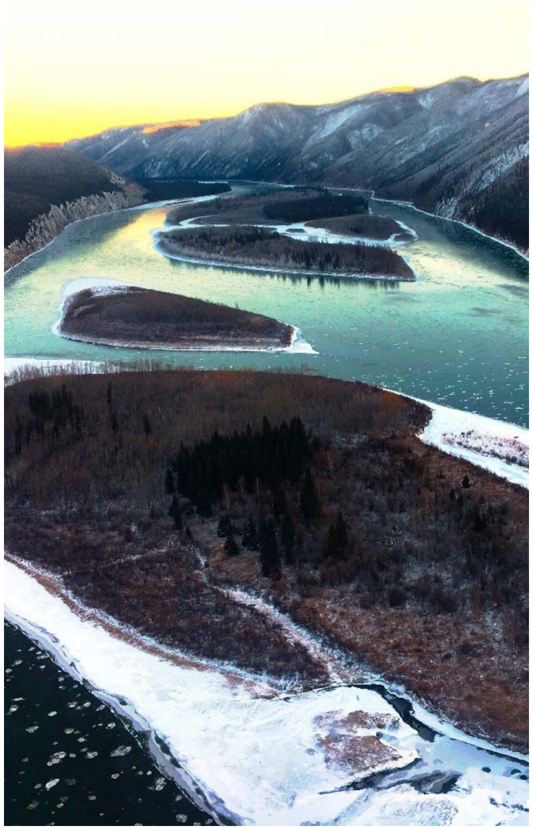
Technical

- Water impact assessment indicates water quality challenges, particularly for YT-24
- The Kaminak FS Mine Plan did not provide any heap leach or WRSF volume flexibility around gold price, geologic model, or dilution variability from the FS assumptions.
- Carbon tax impacts
- Potential requirement for additional water management related costs



Waste Alternatives Ask

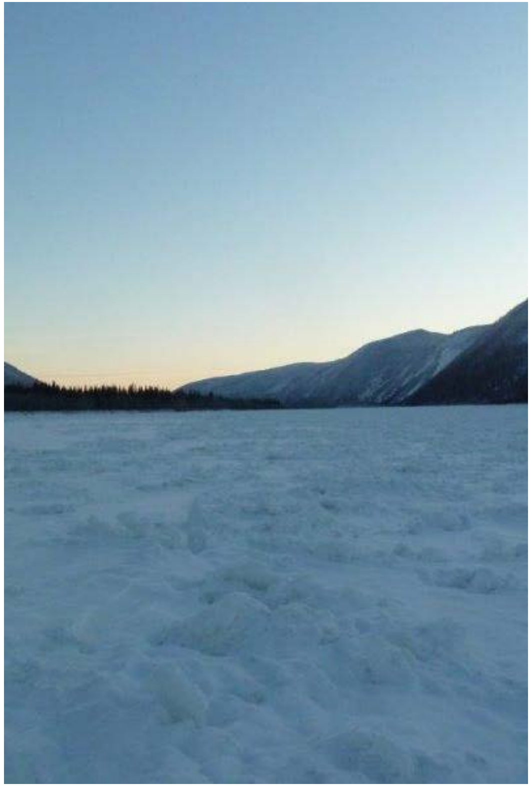
- ***Goldcorp has completed an evaluation of seven different dump scenarios, and from these has come up with two viable alternatives***
- ***Goldcorp is seeking input from our First Nations partners on the waste rock configuration for the mine, and selection of the preferred waste rock configuration from between the two options***



Opportunities

Technical

- Adjust the mine plan, for the YESAB application, to provide greater flexibility around modeling errors and future unknowns
- Seek ways of reducing select water related environmental impacts and risks
- Seek ways of reducing carbon footprint
- Comply with Goldcorp standards and strategy around water, energy, and closure



60 Million Tonnes Heap Leach Option

Technical

- **The Kaminak FS HLSF design already anticipated Phase 5, resulting in up to 61.5M tonnes total capacity**
- **Seek to obtain an EA that provides some level of operational flexibility as actual conditions vary from modeling assumptions**

Social

- **Indicate the very real potential for a longer mine life**

60 Mt Option Summary

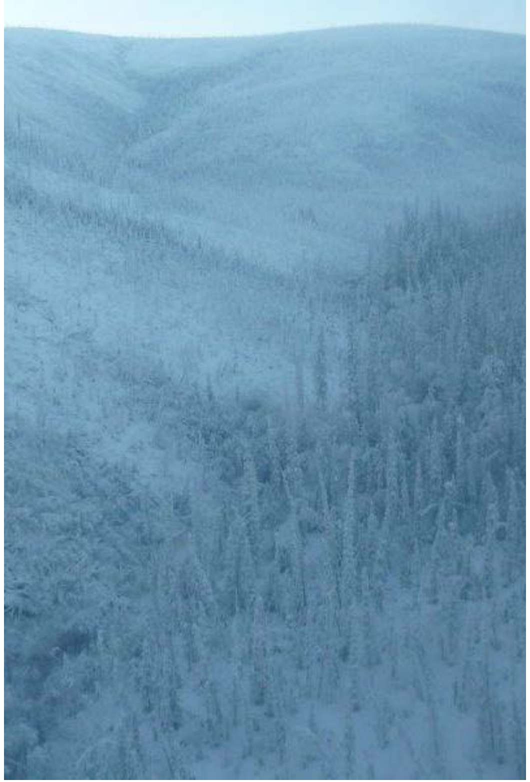
	Kaminak 2016 FS	YESAB Application
LOM Heap Leach (Mt)	46.4	60.1
Waste (Mt)	265	300*
Mine Life (yrs)	10	12

*** Based on Whittle shell results**

WRSF Options

Technical

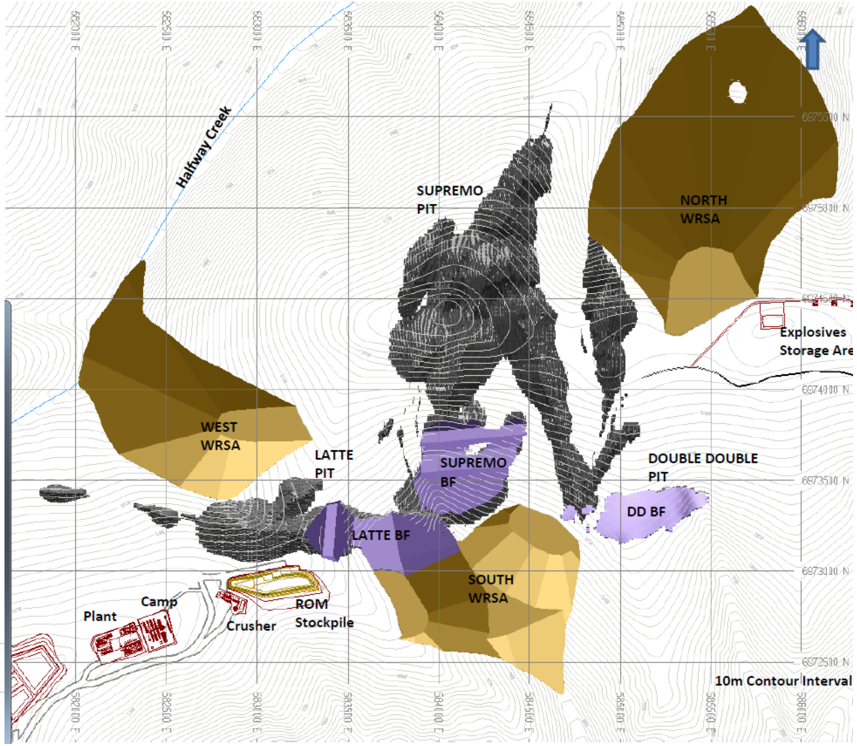
- **Utilized JDS, Lorax, and SRK to evaluate 7 different WRSF options at a high level**
- **All utilized the Kaminak Feasibility Study mine sequencing, so no optimization around the WRSF haulage**
- **Based on the 60Mt heap leach, 300M tonnes WRSF option**
- **Utilized 3:1 WRSF slope assumption in this review. But note that Goldcorp will request 2.5:1 slopes in our application to minimize footprint and contact water.**
- **The WRSF configurations in this evaluation are conceptual designs, so the detailed design geometry of the selected solution will likely vary somewhat from what is currently shown.**



WRSF Options

Trade-off Scenario	Description
Base Case	Waste Rock Storage Areas optimized for minimal cost for haulage (given 2016 FS backfill strategy)
Scenario #1	Costs outweigh benefits
Scenario #2	Attractive from technical and financial perspectives, but Goldcorp expects Scenario 3 to be preferred.
Scenario #3	In-Pit backfill to be evaluated and optimized during operation.
Scenario #4	Expensive + value of buried resources unknown
Scenario #5	Will be evaluated during operation for all WRSF options
Scenario #6	Costs outweigh benefits

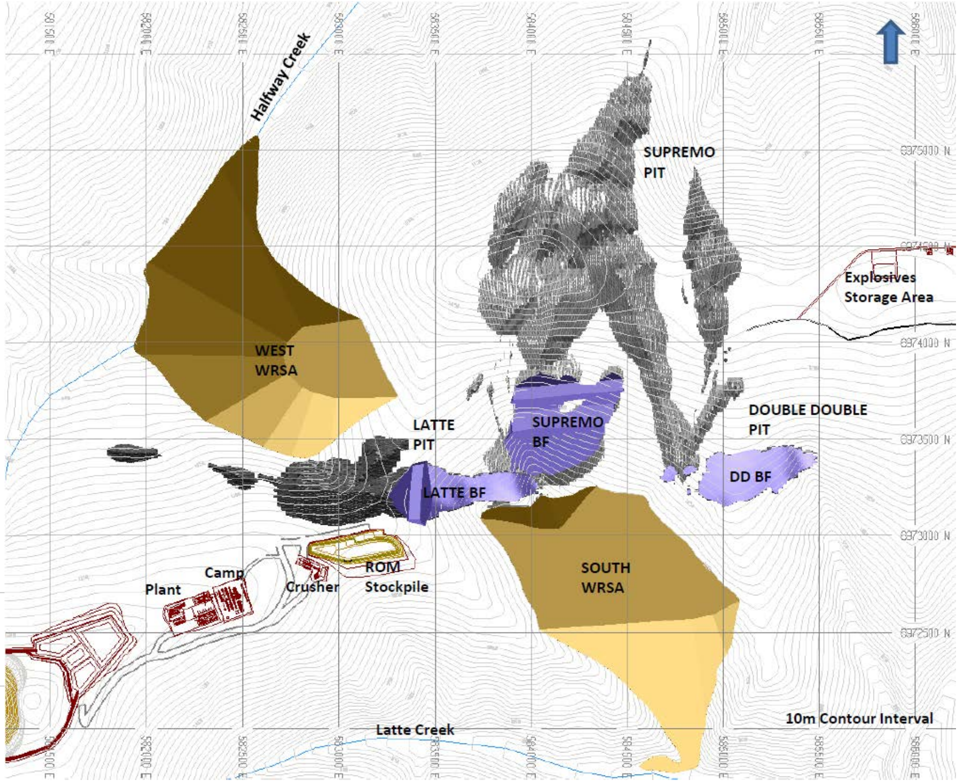
WRSF Options – 60MT with 3 WRSF's (Base Case)



300Mt waste rock at 3:1 final slope

310 ha footprint, 0 additional trucks, $0 incremental LOM cost

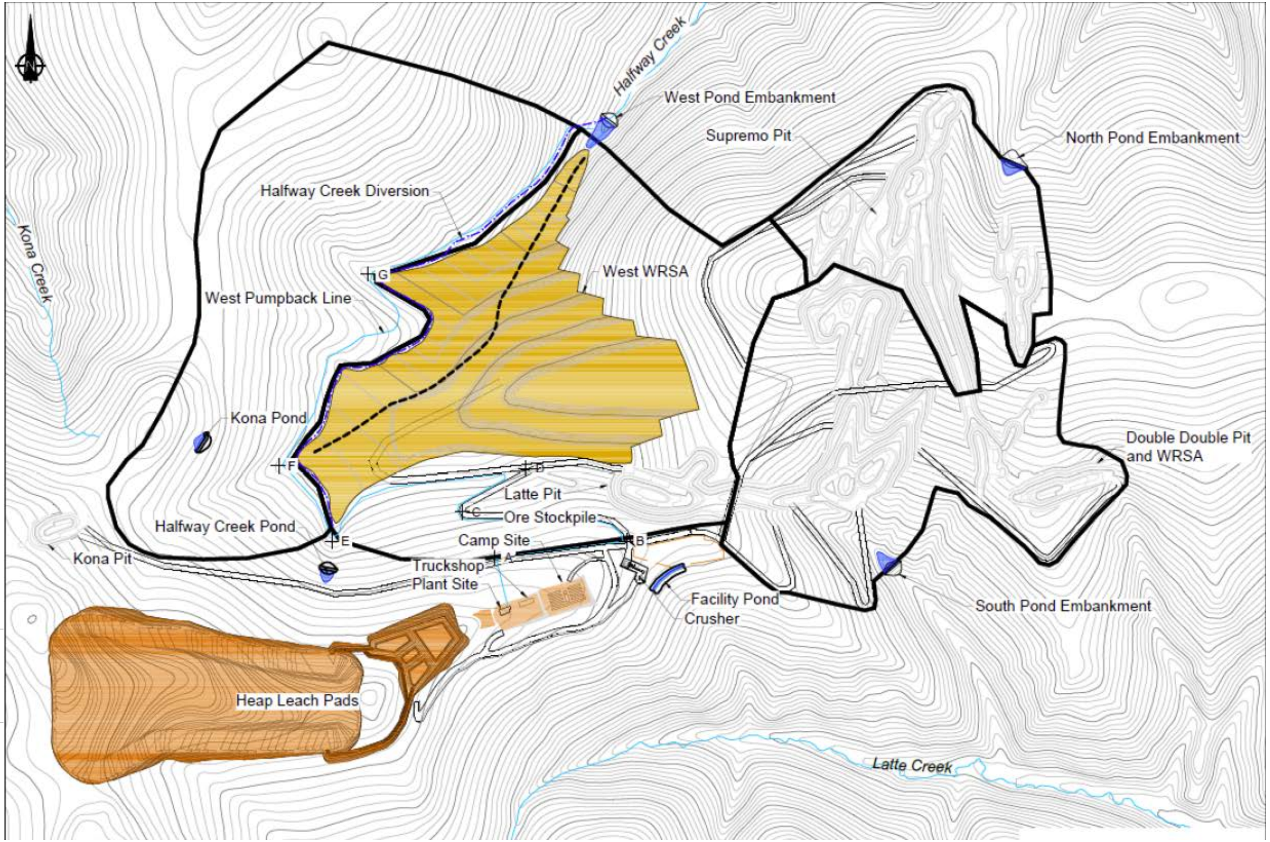
WRSF Options – 60MT with 2 WRSF's (Scenario 2)



300Mt waste rock at 3:1 final slope

215 ha footprint,
3 additional trucks,
≈ $20M incremental LOM cost

WRSF Options – 60MT with 1 WRSF (Scenario 3)



300Mt waste rock
Low slope valley fill

< 200ha footprint,
4 additional trucks,
≈ $33M incremental LOM cost

Coffee Project Waste Alternatives Water Quality Assessment Approach

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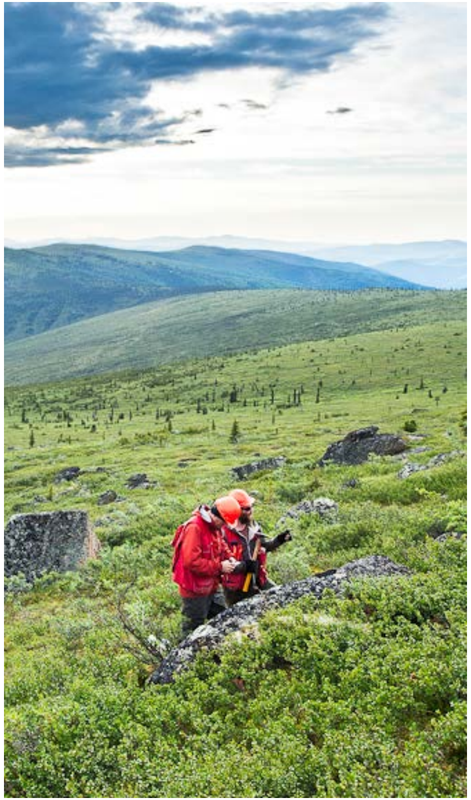
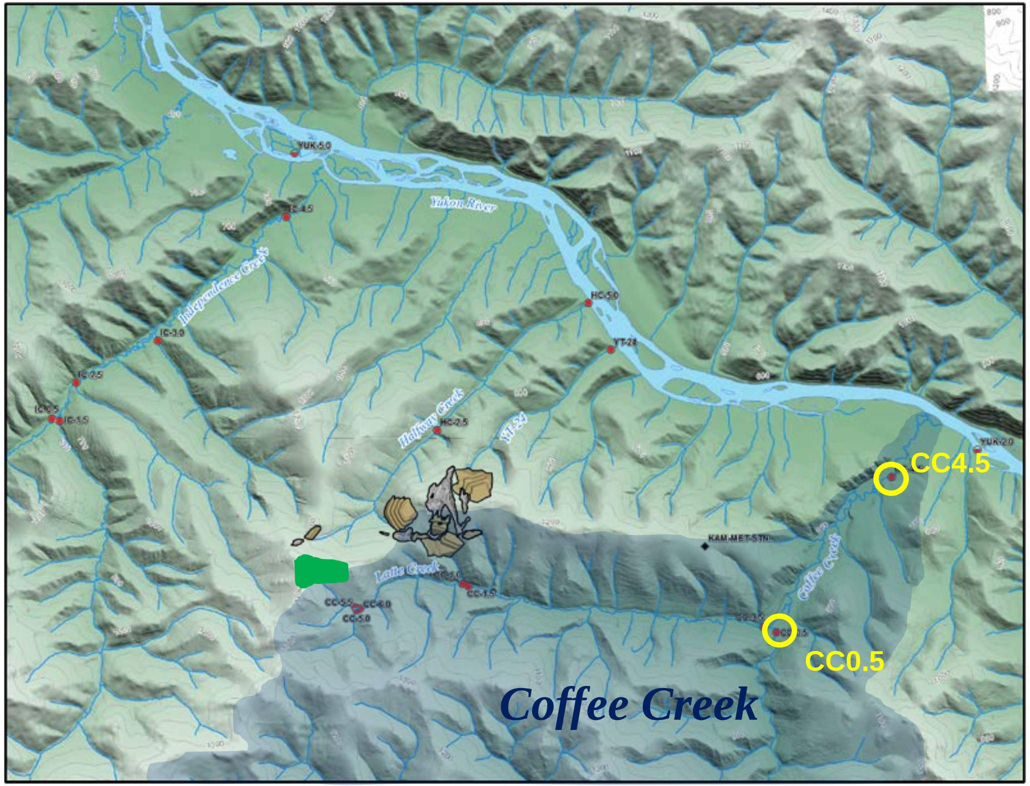
Presentation Outline

- Animation illustrating Base Case Setting
- Discuss key baseline conditions for water quality for context in alternatives evaluation
- Water quality objectives discussion
  - U background concentration approach
  - Overview of toxicity results supporting proposed objective
- Comparison and discussion of alternatives assessment results for water quality predictions

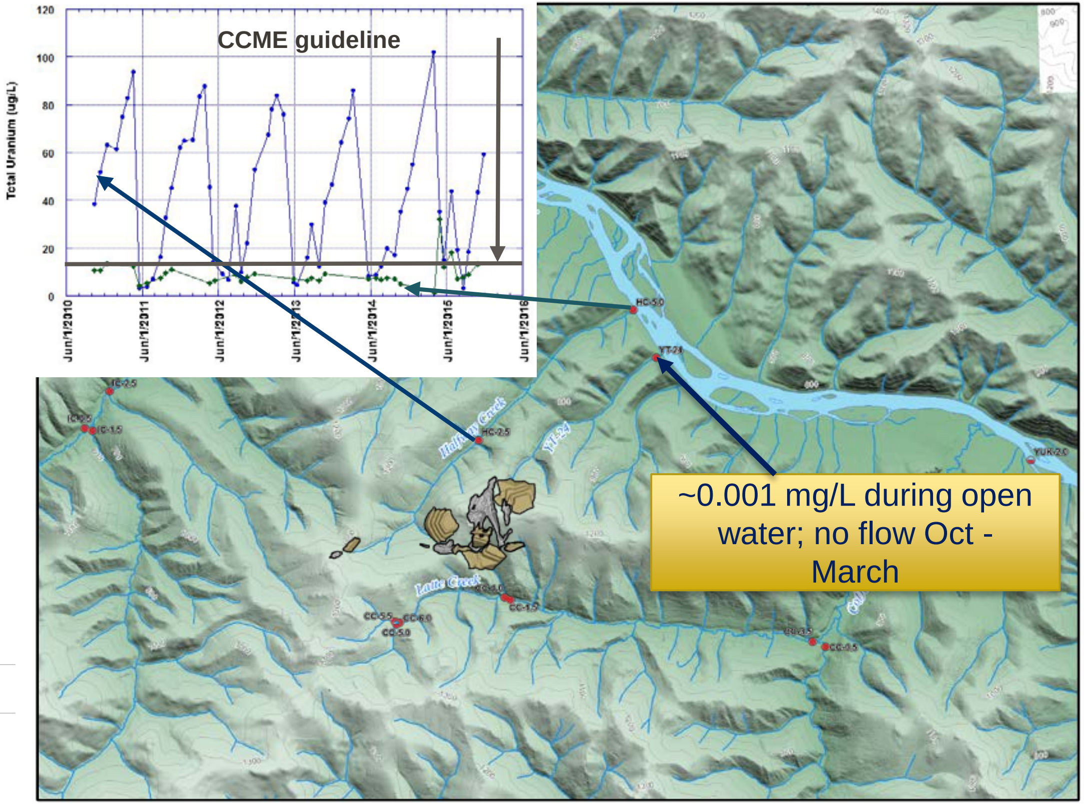


Three key catchments containing project components

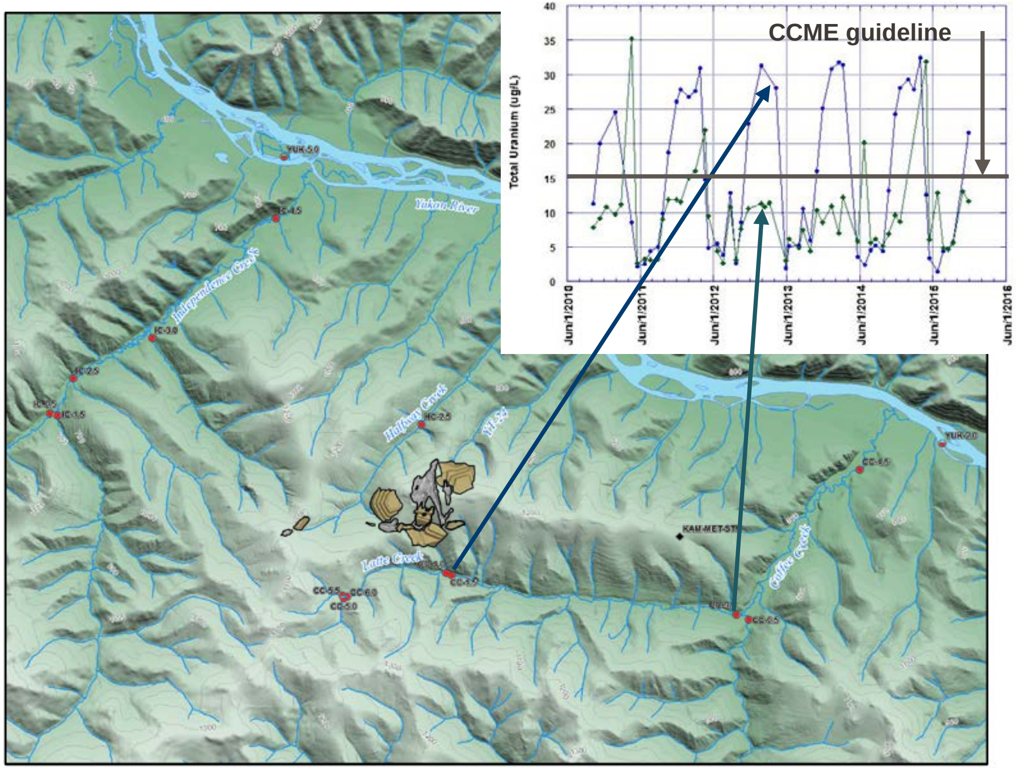
Coffee Creek basin indirectly contains project components



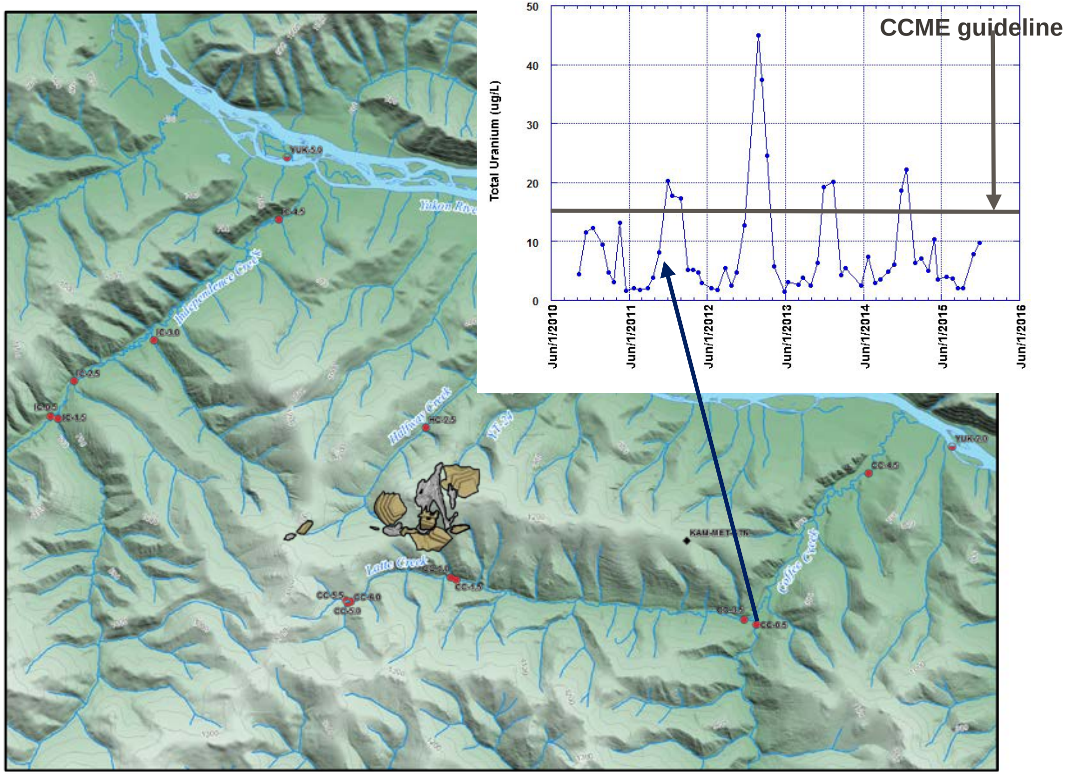
Baseline U Concentrations



Baseline U Concentrations

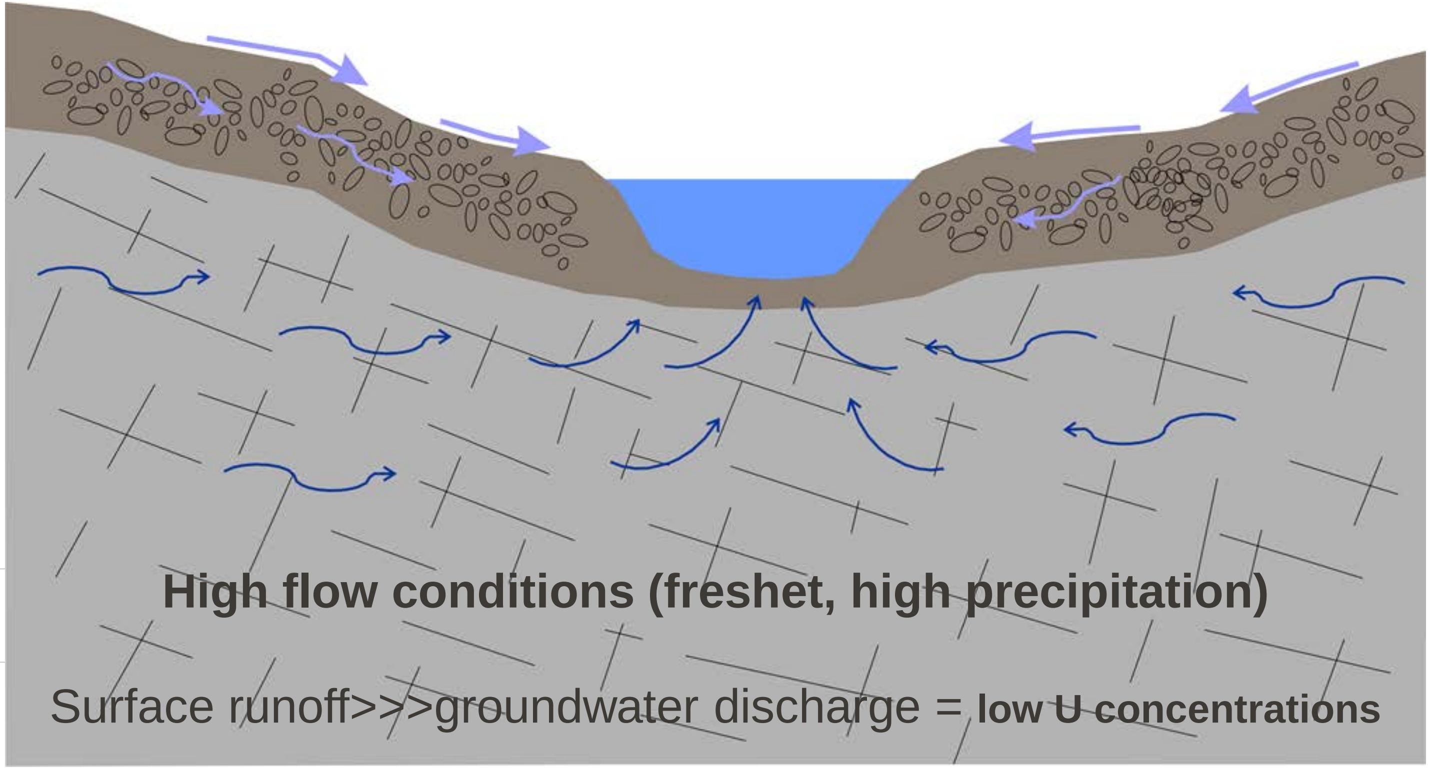


Baseline U Concentrations



What Causes Fluctuations in U Concentrations?

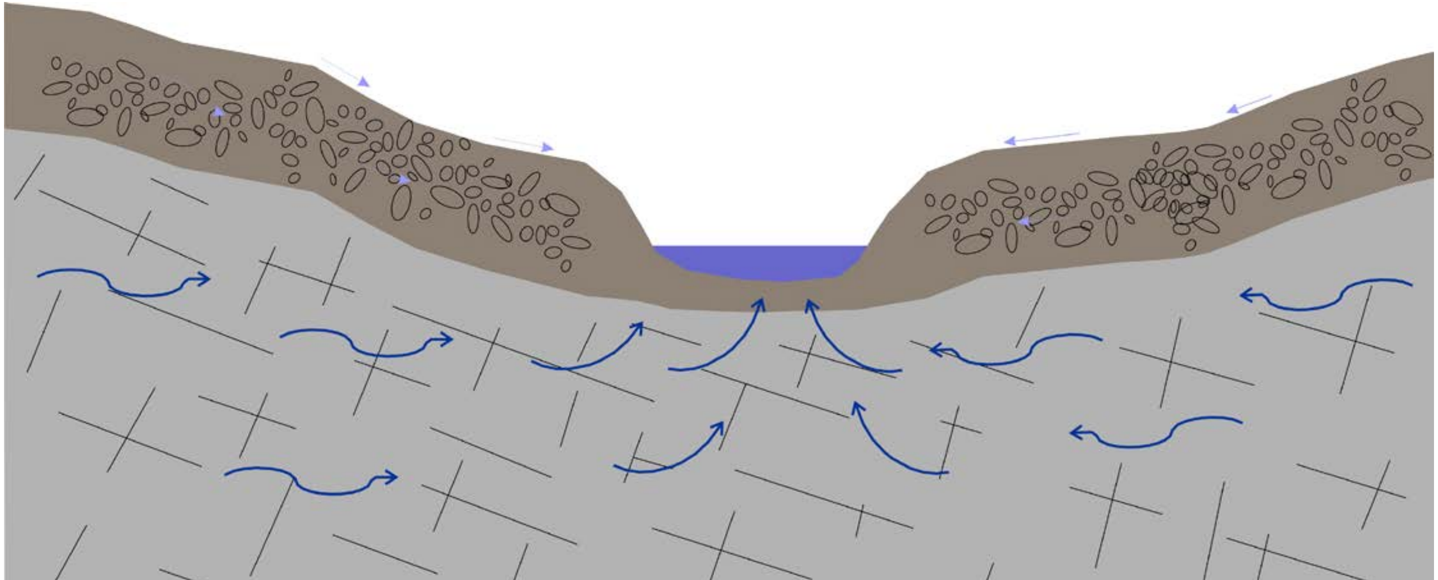
Changes in relative contributions of surface flow to groundwater discharge



High flow conditions (freshet, high precipitation)

Surface runoff>>>groundwater discharge = **low U concentrations**

What Causes Fluctuations in U Concentrations?

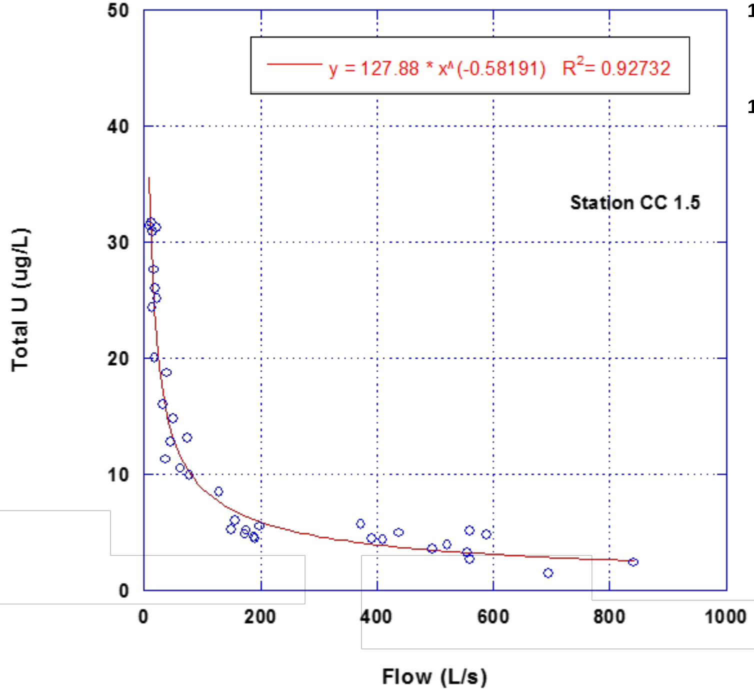


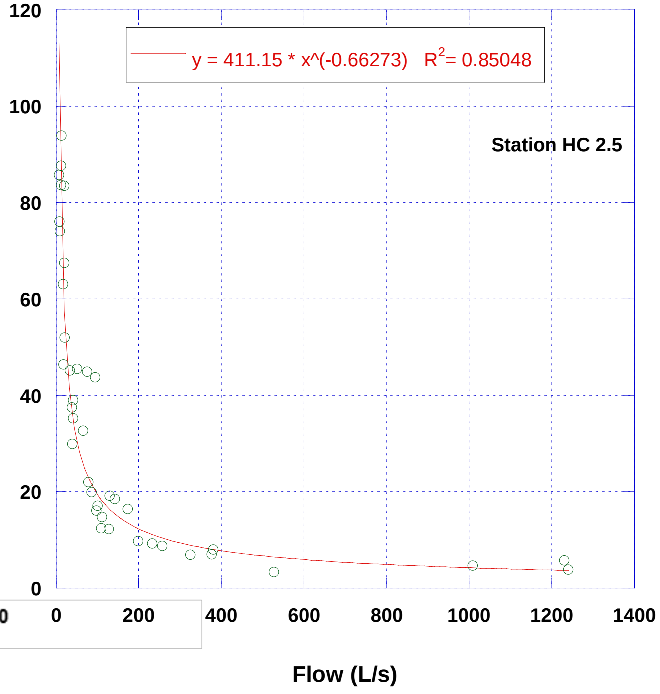
Low flow conditions (winter, lack of precipitation)

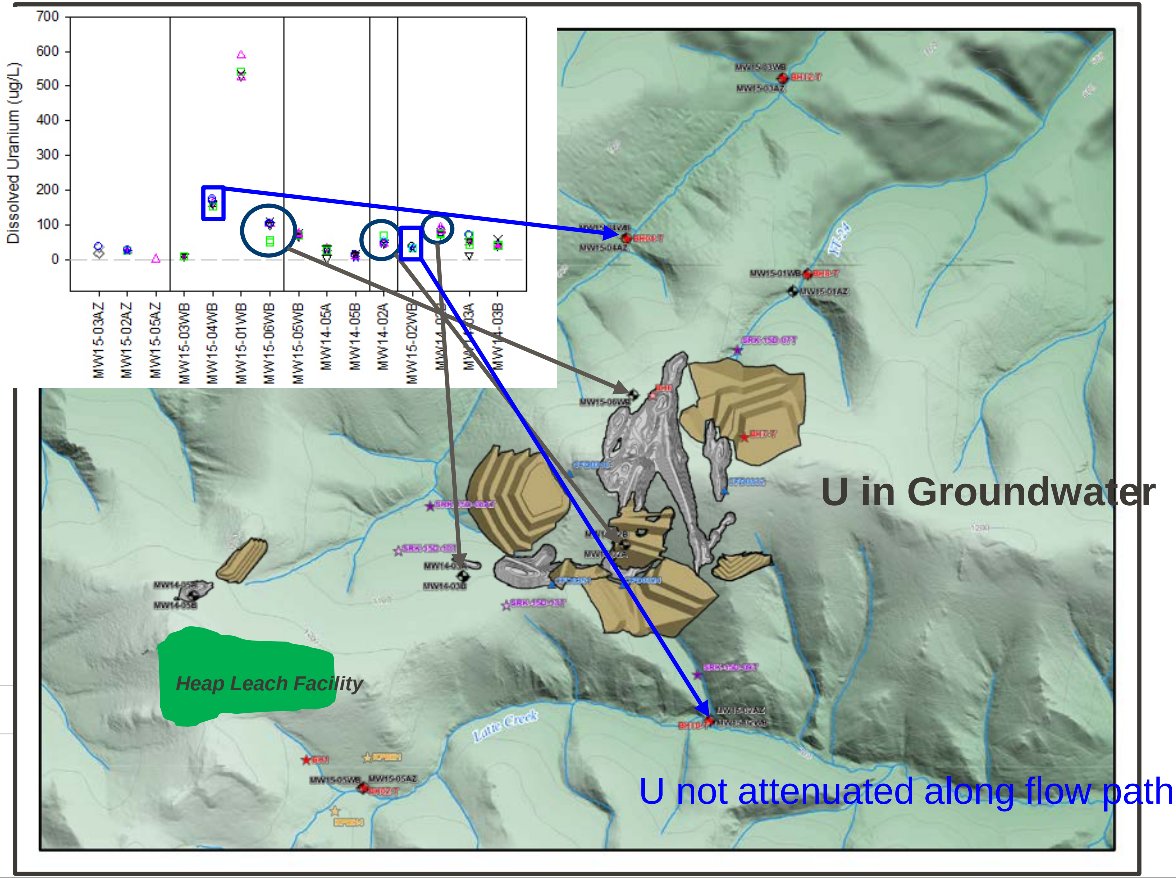
Surface runoff<<<groundwater discharge = **elevated U concentrations**

Very Strong Correlation between Flow and U Concentration

Difference between catchments: higher background U in Halfway drainage






Dissolved Uranium (ug/L)
700
600
500
400
300
200
100
0
MW15-03AZ
MW15-02AZ
MW15-05AZ
MW15-03WB
MW15-04WB
MW15-01WB
MW15-06WB
MW15-05WB
MW14-05A
MW14-05B
MW14-02A
MW15-02WB
Heap Leach Facility
Latte Creek
U in Groundwater
U not attenuated along flow path

Project Water Quality Objectives

- Two approaches were used to develop project water quality objectives and followed CCME protocols:

1. **Direct application of “generic” water quality guidelines**
    - For those parameters with concentrations below generic water quality guidelines in the background
        - *Examples include As, Cd, Hg, Se, Zn*

2. **Background Concentration Procedure**
    - A number of parameters are present naturally at concentrations in excess of respective generic guideline
    - CCME protocol for derivation of SSWQO – used 95th percentile value
        - Examples include U, Al, Cu, Fe

Proposed Water Quality Objectives

Parameter List		Units	Latte Creek CC-1.5	Coffee Creek CC-4.5	Halfway Creek HC-2.5	Regulatory Source
Dissolved Parameters	SO_4	mg/L	309	218	218	BC WQO
	Nitrate-N	mg/L	3	3	3	BC WQO
	Nitrite-N	mg/L	0.02	0.02	0.02	BC WQO
	NH_3-N	mg/L	1.13	1.13	1.13	BC WQO
	CN_{WAD}	µg/L	5	5	5	BC WQO
	Al (diss)	µg/L	351	263	403	SSWQO
Total Metals	Sb	µg/L	20	20	20	BC WQO
	As	µg/L	5	5	5	CCME
	Cd	µg/L	0.13	0.12	0.11	CCME
	Cu	µg/L	5	5	5	SSWQO
	Co	µg/L	4	4	4	BC WQO
	Fe	µg/L	790	1610	905	SSWQO
	Pb	µg/L	2.47	2.06	1.84	CCME
	Hg	µg/L	0.026	0.026	0.026	CCME
	Mo	µg/L	73	73	73	CCME
	Ni	µg/L	82	73	69	CCME
	Se	µg/L	2	2	2	BC WQO
	Ag	µg/L	0.25	0.25	0.25	CCME
	U	µg/L	31	15	86	SSWQO/CCME
	Zn	µg/L	18	18	13	CCME (draft)

Uranium Site Specific Water Quality Objectives

- **Support for the proposed U objective for each catchment**
  - Values reflect what the system currently experiences under a flow-controlled environment
  - Conducted chronic bioassay testing on *Ceriodaphnia dubia* using **site water** collected in **February 2016** and under high U conditions
    - ***HC-2.5*** total U = 78 ppb
    - ***CC-1.5*** total U = 31 ppb

- **Chronic (7 day) test on 100% undiluted site waters versus control (deionized water) for survival and reproduction**

Uranium Site Specific Water Quality Objectives

Results of the toxicity tests for samples CC1.5 and HC2.5 are provided in Tables 2 and 3. There were no adverse effects on survival or reproduction in either of the samples tested.

Table 2. Results: *Ceriodaphnia dubia* survival and reproduction test with sample CC1.5.

Sample ID	Survival (%)	Reproduction (Mean ± SD)	
Control	100	20.5 ± 2.2	<1 ppb U
CC1.5	100	23.8 ± 2.3	31 ppb U

SD = Standard Deviation.

Table 3. Results: *Ceriodaphnia dubia* survival and reproduction test with sample HC2.5.

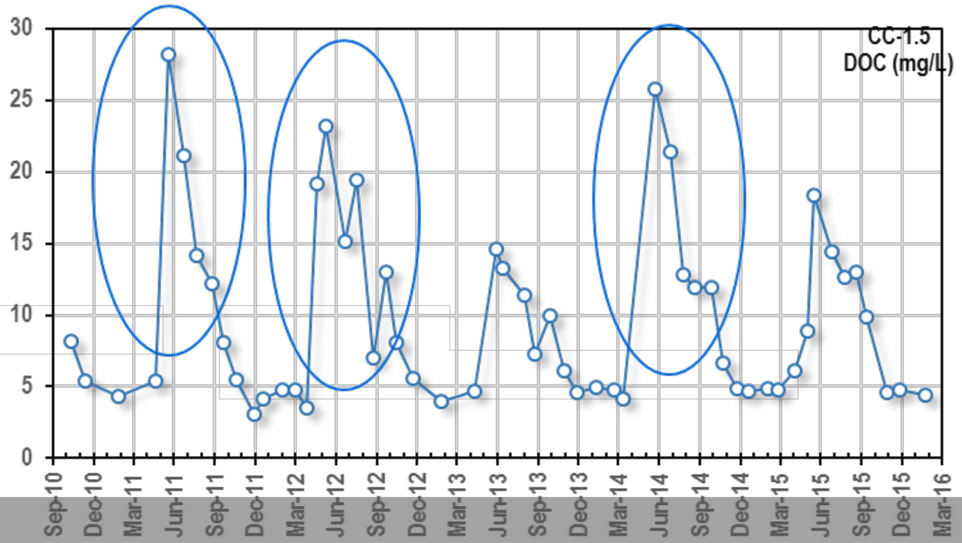
Sample ID	Survival (%)	Reproduction (Mean ± SD)	
Control	100	21.1 ± 2.2	<1 ppb U
HC2.5	100	23.6 ± 1.4	78 ppb U

SD = Standard Deviation.

What about open water period?

Uranium Site Specific Water Quality Objectives

- Major ameliorating factor in the open-water period of May to September on metal availability to organisms
  - includes Cu, Fe, Zn and U
- Natural dissolved organic carbon in all drainages present in high concentrations (hence the name *Coffee Creek*)



Chronic Testing with U Amended Site Water – HC2.5

Table 4. Results: *Ceriodaphnia dubia* survival and reproduction test on HC2.5 (amended with U).

DOC of sample = 9.8 mg/L

Concentrations (µg/L U)		Survival (%)	Reproduction (mean ± SD)
U (nominal)	U (measured)		
lab control	0.7	100	19.5 ± 5.3
0 (site control)	23.9	100	21.3 ± 4.9
10	34.3	90	16.1 ± 7.6
20	44.4	100	18.9 ± 6.9
40	64.2	100	17.1 ± 5.1
80	105.0	100	19.6 ± 5.9
160	188.0	90	15.0 ± 9.7
320	351.0	100	18.4 ± 5.9
Endpoints as µg/L U (based on measured)	LC50	>351*	--
	IC25	--	>351*
	IC50	--	>351*

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration.
* = statistical analyses were conducted against the site control.

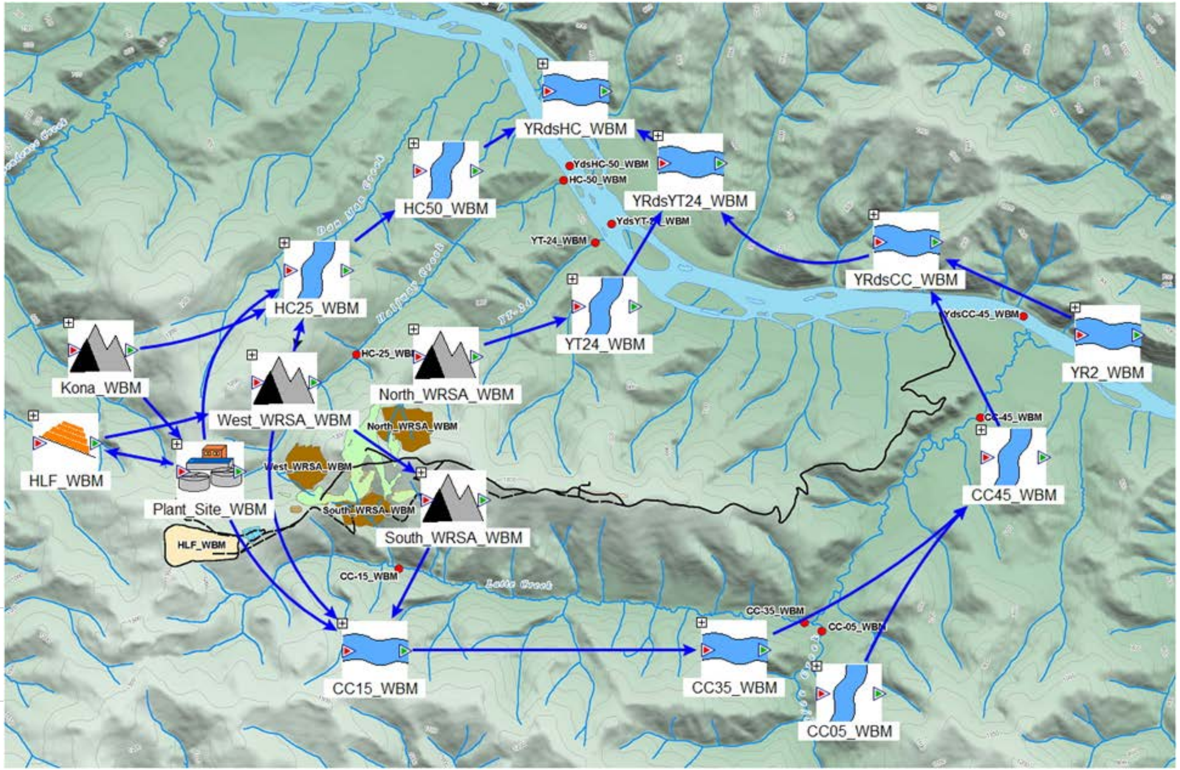
Summary of Site Specific Objective for U

- **Proposed water quality objective of 86 ppb is supported by:**
  - Naturally occurring conditions when stream flows are low
  - Chronic toxicity testing on *C. dubia* is indicating no adverse effects at concentrations >350 ppb
- **Further testing to be conducted using fish, algae and *C. dubia* at higher U concentrations**

Water Quality Modeling for Waste Rock Alternatives

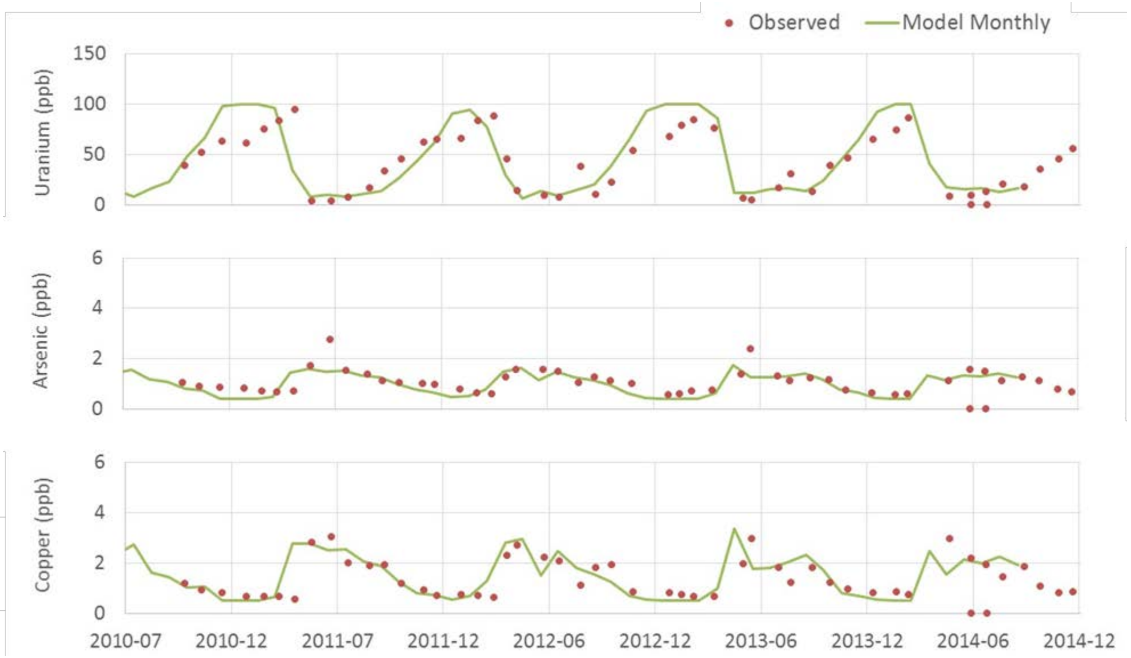
- **The Coffee WBM/WQM is built on the GoldSim platform**
- **Water Balance Model**
  - Precipitation driven (30-year record)
  - Daily time-step
  - Watershed sub-models (all mine facilities and natural catchments)
- **Water Quality Model**
  - Inputs include geochemical source concentrations (WRSA, backfill, pit wall, plant site, WTP)
  - Pit lakes modeled as fully mixed flow cells
  - Node mixing is via conservation of mass (no secondary reactions)

Water Balance/Water Quality Model Setup



Model Validation – Halfway Creek at HC2.5

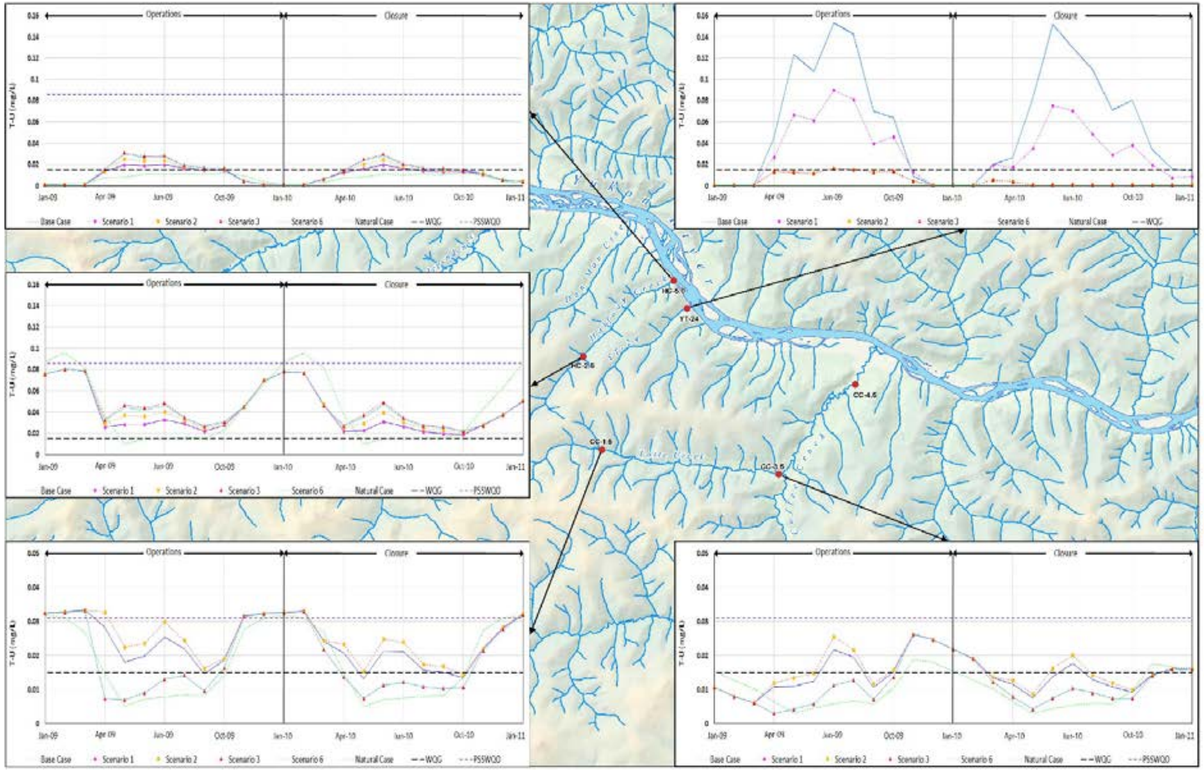
Model only as good as its ability to reproduce existing observations



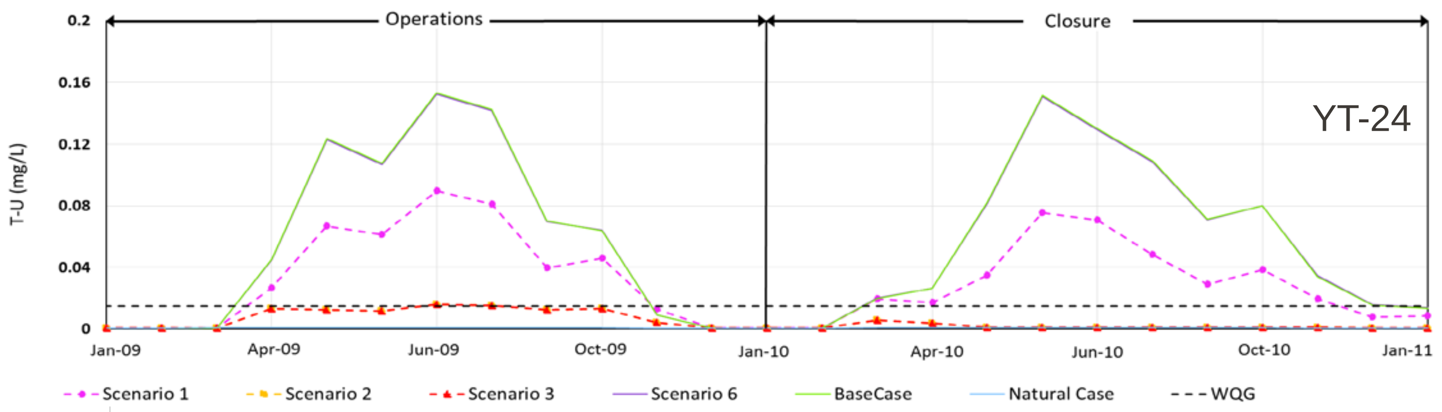
High Level Modeling Assessment of Alternatives

- **Modeled 5 Scenarios (Base; 1, 2, 3, 6)**
  - Did not model Scenario 4 (Backfill) – more complicated source term prediction for flooded backfill
  - Did not model Scenario 5 (essentially the same as Base Case with more backfill)
- **Modeled end of mine condition and initial closure and compared results to baseline condition**

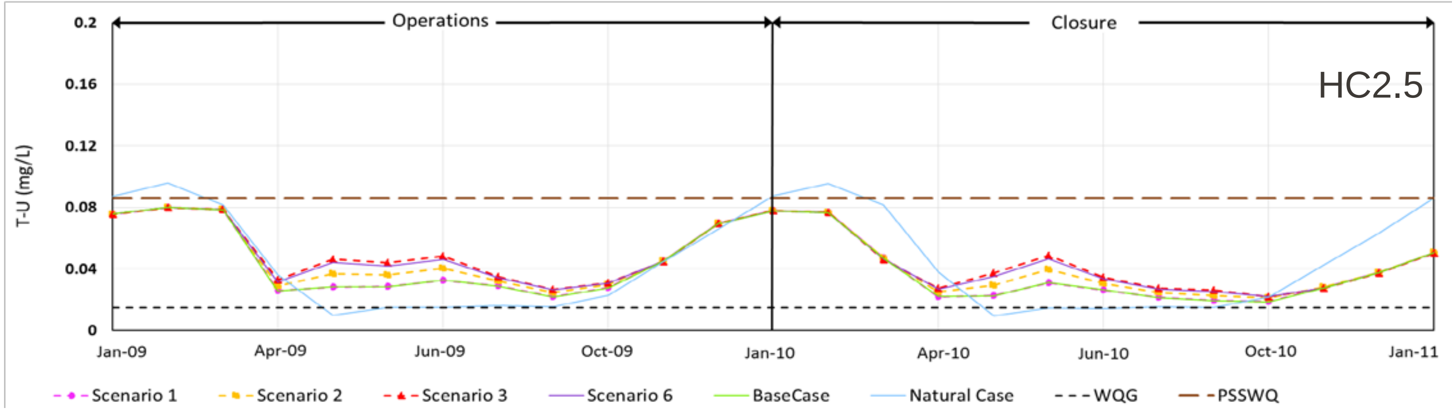
Model Predicted U at Key Nodes

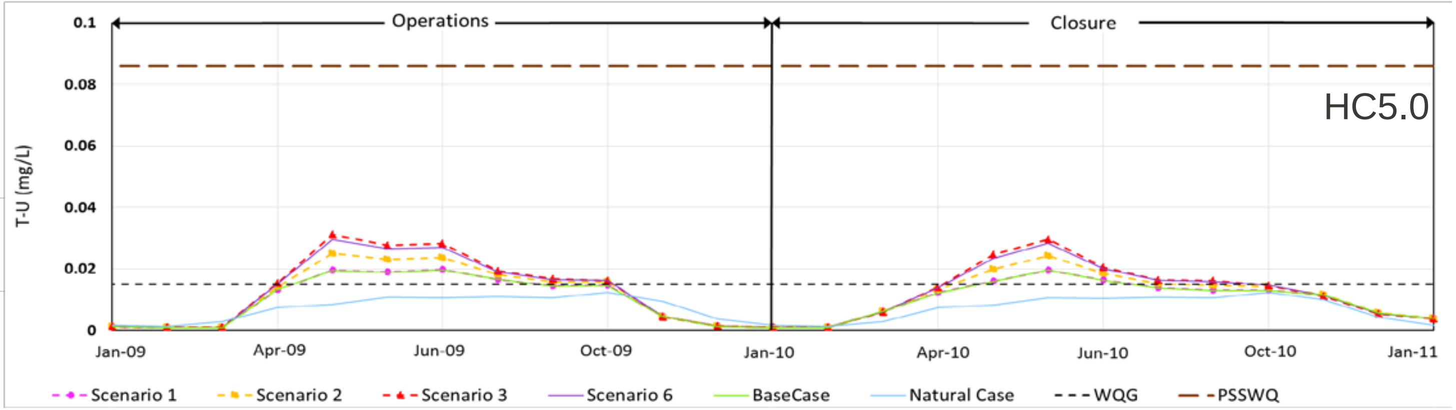


YT-24 Creek Predictions - Uranium

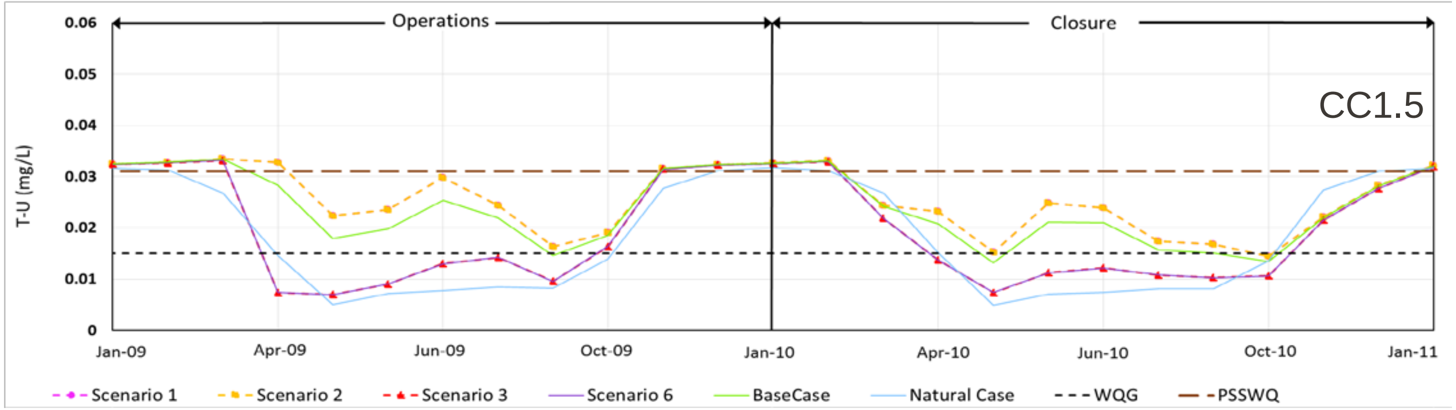


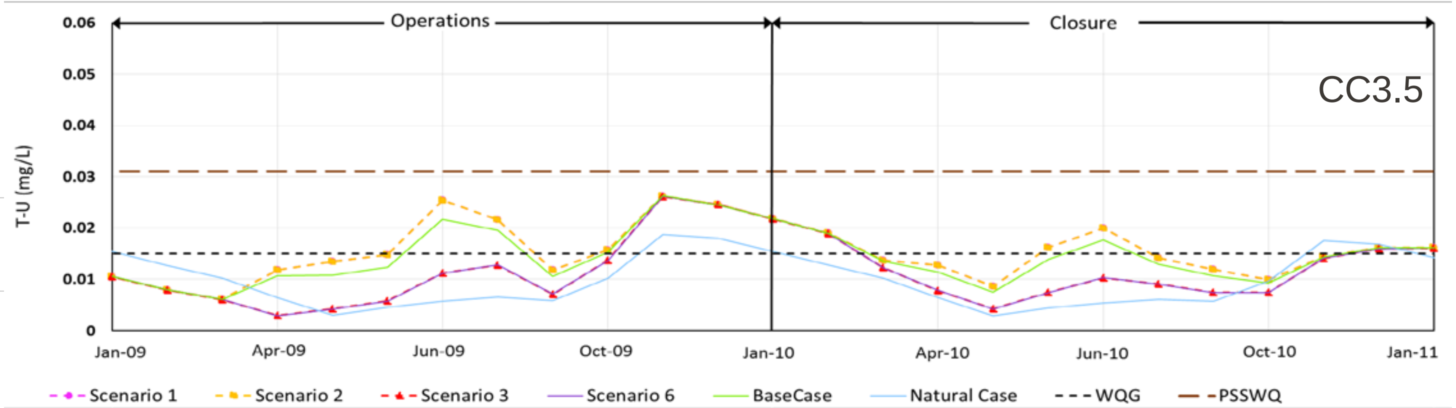
Halfway Creek Predictions - Uranium





Latte Creek Predictions - Uranium





Base Case vs. Single WRSF

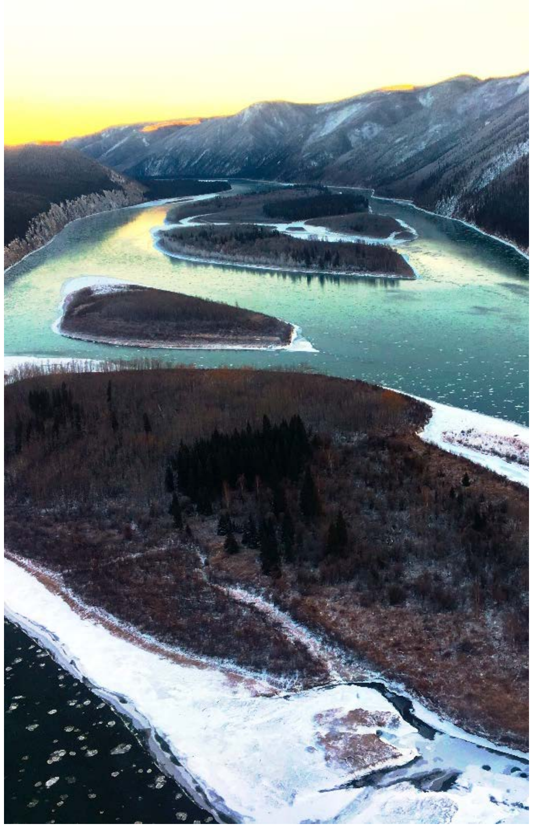
Base case

- Haul cost (LOM, incremental): $0
- Potential Water Management: $43M
- Reference cost: $43M

Single WRSF

- Haul cost (LOM, incremental): $60M
- Water Management: ~$16M
- Reference cost: $76M

Differential for Single WRSF w/conventional haul: +$33M from base case



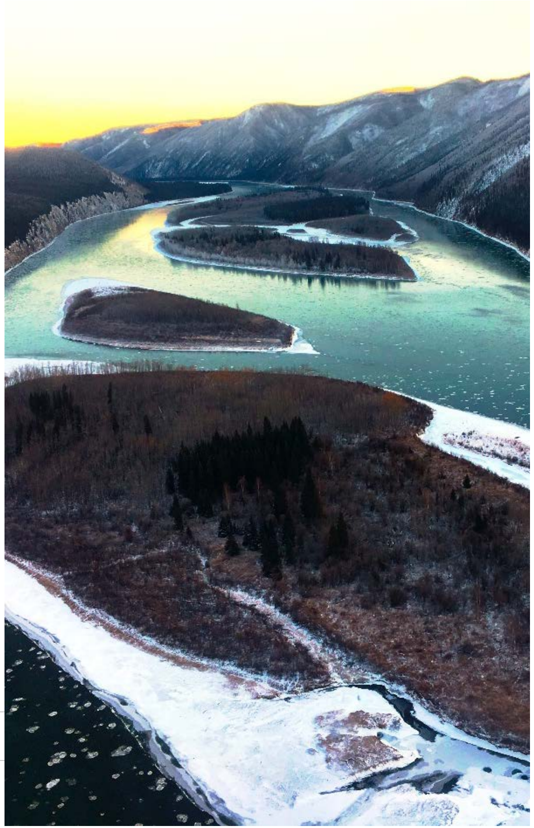
Base Case vs. Single WRSF

Cost reduction opportunities not included

- Mine plan optimization around the single WRSF configuration
- Reduced closure costs
- Reduced monitoring and compliance costs

Potential opportunities with single WRSF

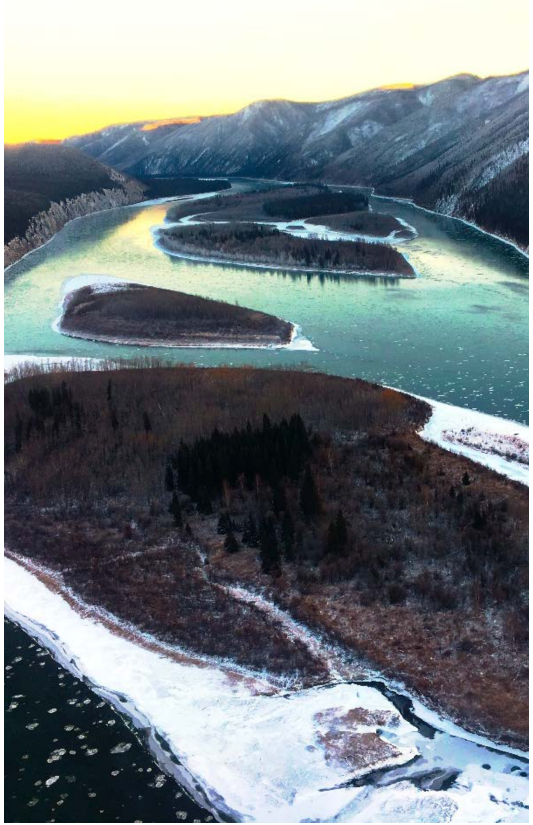
- Alternative haulage technologies



Summary and Ask

Goldcorp's View:

- ***Base Case is optimal from a mining and cost perspective***
- ***Scenario 3 results in reduced environmental impacts and risks, at higher costs.***
- ***Goldcorp will seek to reduce costs through engineering and innovation, but alternative approaches introduce capital and operational risk that Goldcorp must accept.***
- ***Goldcorp is seriously considering Scenario 3 and we regard First Nations preference as a key input***



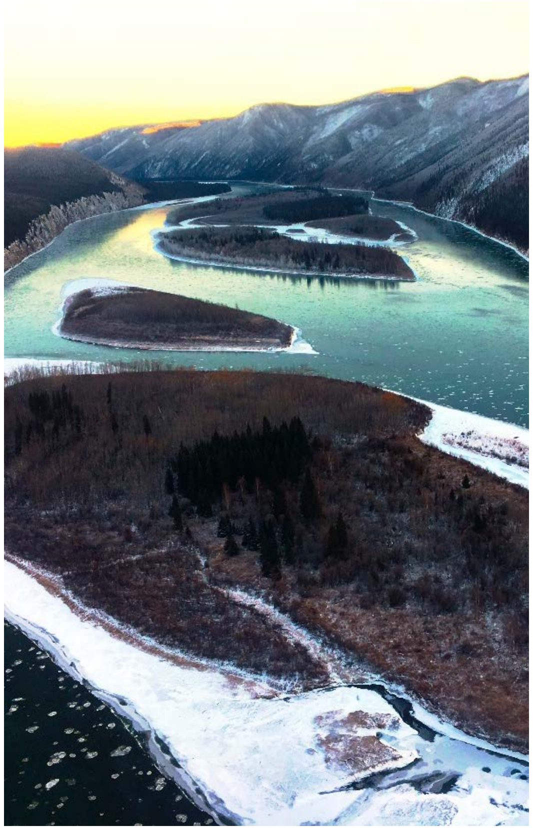
Feedback

What do you think?:

- ***Base Case three WRSF configuration***
- ***Scenario 3 single WRSF configuration***

First Nations can further impact this decision by:

- ***Endorse this mine plan and the Coffee Project during assessment and permitting***
- ***Accept the use of natural gas (LNG) as a primary fuel source for the mine to help Goldcorp manage energy costs and reduce greenhouse gas emissions***
- ***Use your best effort to meet the timing outlined in the Project Proposal Document Sharing Plan***



Discussion – which mine plan do you prefer?

Thank You

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Superintendent, Corporate Social Responsibility
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Email Address REDACTED

Together creating sustainable value

GOLDCORP

Additional information:

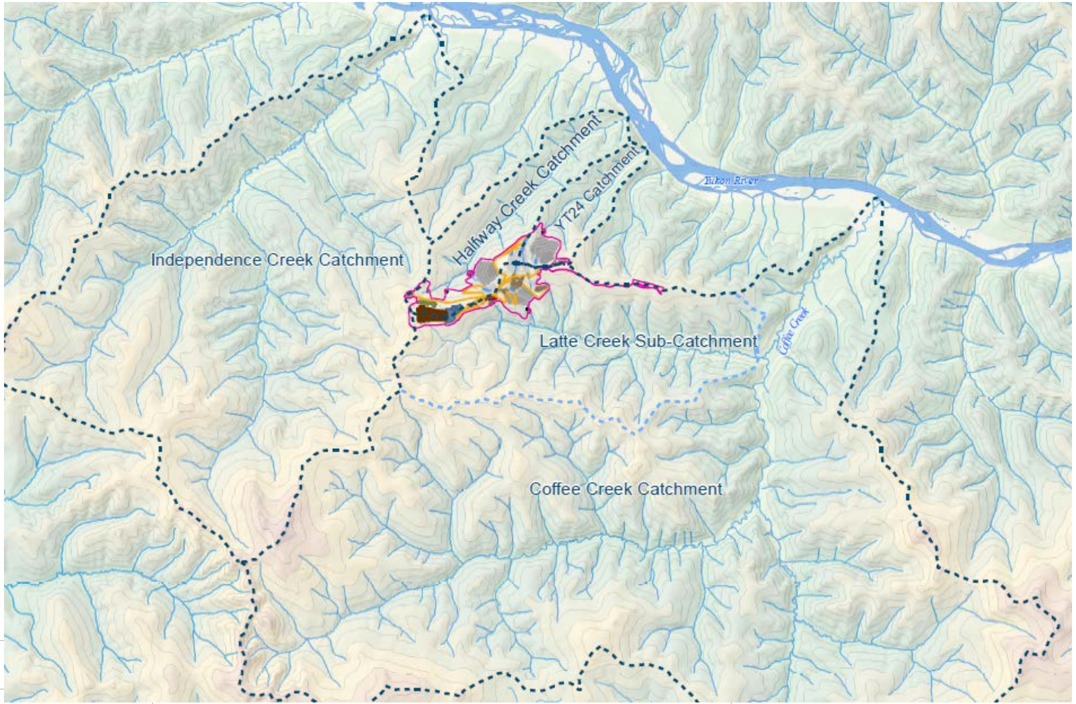
Catchment Map

Water management infrastructure

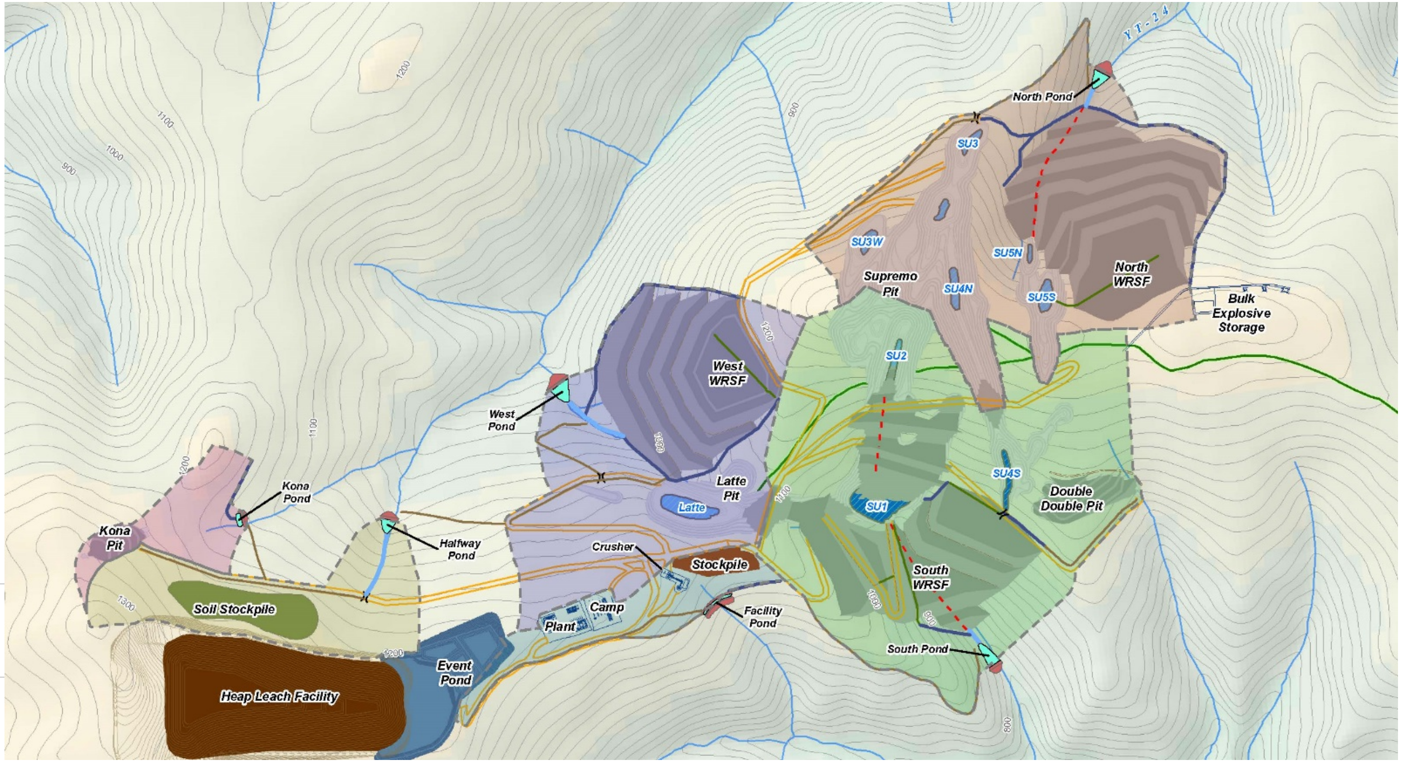
Discharge Limits & Aquatic Habitat

Water Quality Results Overview

Catchments


Halfway Creek Catchment
YT24 Catchment
Yukon River
Independence Creek Catchment
Latte Creek Sub-Catchment
Coffee Creek
Coffee Creek Catchment

Water Management Infrastructure



Discharge Limits & Aquatic Habitat

Latte Creek:

- Arctic grayling in middle and lower reaches in summer only

Coffee Creek: (not directly influenced by project but receives Latte flow)

- Slimy sculpin, Arctic grayling and Chinook Salmon (juvenile) in lower Coffee Creek year-round

Halfway Creek:

- Low density of Arctic grayling in lower 200 m in summer only

Small number of juvenile Chinook captured in lower 200 m in summer

YT-24:

- Slimy sculpin at mouth only when back-watered by Yukon River

APPENDIX 2-B-2

Coffee Gold Project

Trade-off Study on Waste Rock Storage

(November 2016)

PARTNERS IN ACHIEVING MAXIMUM RESOURCE DEVELOPMENT VALUE

JDS Energy & Mining Inc.

Coffee Gold Project
Trade-off Study on Waste Rock Storage

November 2016

GOLDCORP

Basis of Design

In order to better guide the permitting process, pit optimizations were conducted on the various Coffee deposits using a $2,000/oz gold price and 2016 FS cost estimates to determine overall pit shapes

Pit shells selected that limit total Heap leach feed to 60 Mt (versus the 46 Mt in the 2016 FS), while maximizing returns and minimizing lower grade, higher strip ratio material

Pit Shell Summary

Description	Unit	Supremo (#22)	Latte (#20)	Double Double (#28)	Kona (#26)	**Total**
Oxide	(kt)	37,360	9,473	594	1,244	**48,671**
	Au (g/t)	1.27	1.14	2.48	0.91	**1.25**
	Au (koz)	1,530	348	47	36	**1,963**
Upper Transition	(kt)	3,362	3,337	559	315	**7,573**
	Au (g/t)	1.42	1.15	3.06	0.77	**1.40**
	Au (koz)	154	124	55	8	**340**
Middle Transition	(kt)	829	1,699	265	56	**2,849**
	Au (g/t)	1.54	1.37	2.42	0.67	**1.50**
	Au (koz)	41	75	21	1	**138**
Lower Transition	(kt)	449	516	80	10	**1,055**
	Au (g/t)	1.52	1.64	1.84	1.32	**1.60**
	Au (koz)	22	27	5	0	**54**
Total Heap Leach Feed	**(kt)**	**41,999**	**15,025**	**1,498**	**1,626**	**60,148**
	Au (g/t)	**1.29**	**1.19**	**2.65**	**0.88**	**1.29**
	Au (koz)	**1,747**	**574**	**128**	**46**	**2,495**
Waste	(kt)	241,299	36,121	16,624	5,204	**299,249**
Total Material	(kt)	283,298	51,146	18,123	6,830	**359,397**
Strip Ratio	(t:t)	5.7	2.4	11.1	3.2	**5.0**

Trade-off Study Scenarios

Trade-off Scenario	Description
Base Case	Waste Rock Storage Areas optimized for minimal cost for haulage (given 2016 FS backfill strategy)
Scenario #1	South WRSA maximized to store as much as possible North WRSA minimized West WRSA kept roughly the same as 2016 FS Backfill strategy as per 2016 FS
Scenario #2	South WRSA maximized North WRSA eliminated West WRSA increased to accommodate remainder of waste material Backfill strategy as per 2016 FS
Scenario #3	All waste material reporting to West WRSA Minimize backfilling
Scenario #4	Maximize backfill to the greatest extent possible Minimize WRSA's to single location (South WRSA)
Scenario #5	Fully optimize backfill, based on handling/hauling costs
Scenario #6	South WRSA eliminated Optimize North WRSA and West WRSA

Life-of-Mine Production Schedule

Similar to the 2016 FS, a series of pit shells were selected as interim phasing for the production schedule: Latte – 2 phases; Dbl Dbl and Kona – 1 phase; Supremo – 5 phases

Sequencing of pits/phases similar to 2016 FS, as overall pit shapes and contained value were comparable (i.e. based on maximizing value with highest value pits/phases mined first)

HL throughput as per 2016 FS – 5.0 mtpa (no stacking in winter months)

Maximum mining rates similar to 2016 FS (all year mining)

Net result is longer mine life (just over 11 years + pre-strip period)

Analysis

In order to compare scenarios, mine cost models were developed for each waste storage alternative using the LOM production schedule as the basis of the estimate

WRSA development sequences were taken into account (i.e. annual advances, dump development) with 3:1 final slope configurations. Final WRSA dump shapes approximate only (exclude appropriate berm widths, lift heights, etc.)

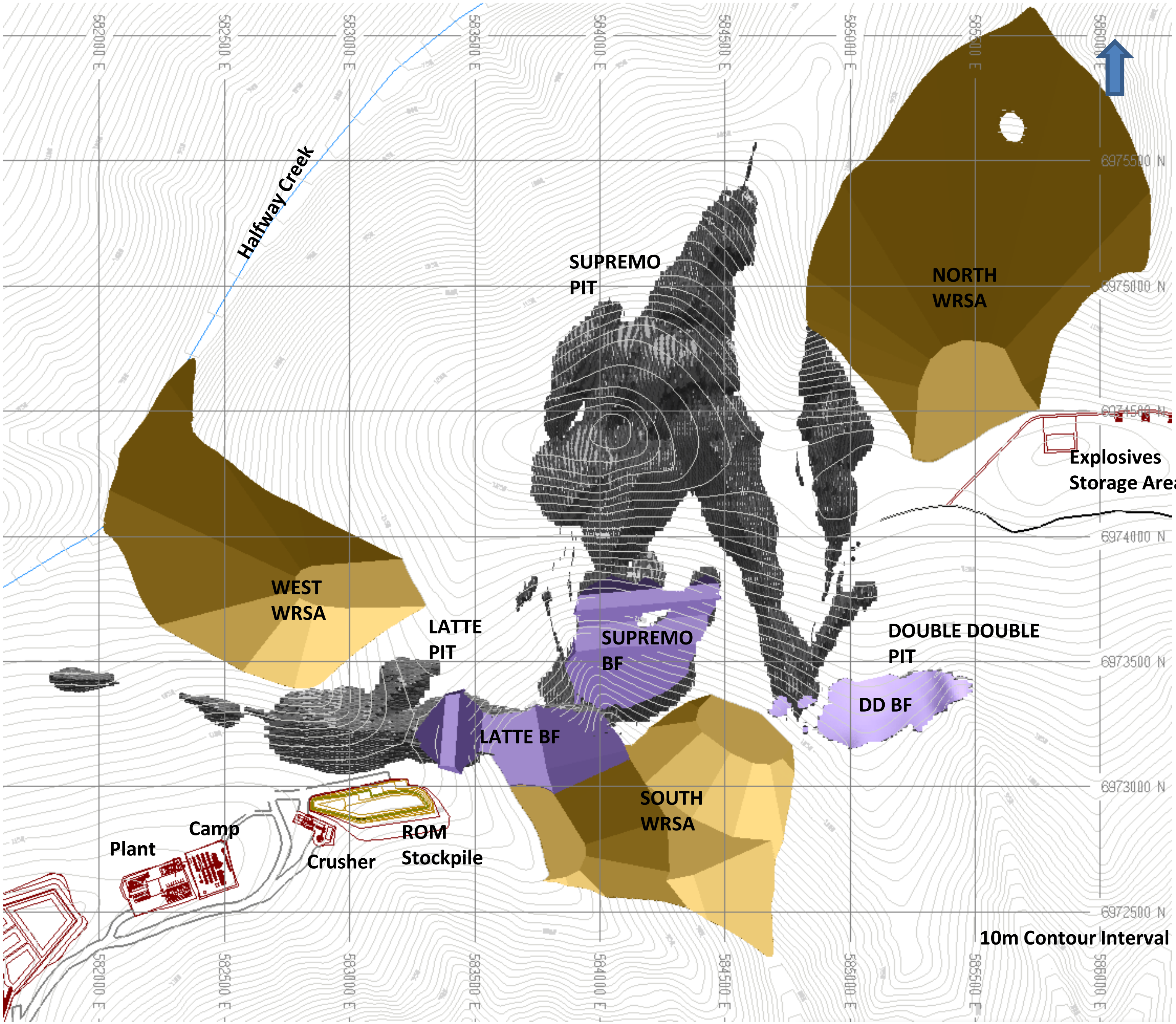
Haul profiles and equipment productivities, along with truck fleet requirements, were developed for each option

Note that no consideration has been given to specific costs, nor limits placed on designs, that may be associated with:

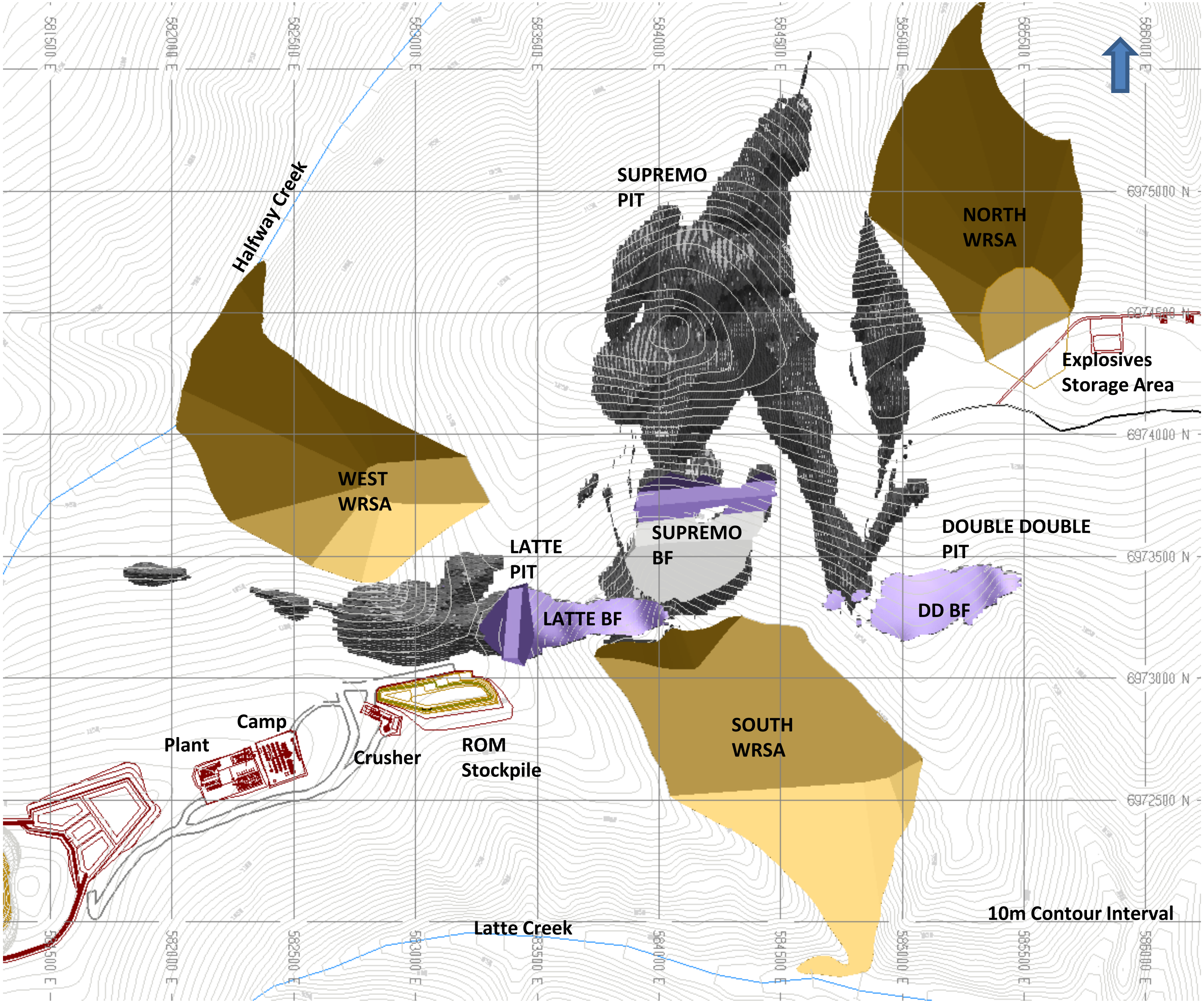
- specific drainage systems and requirements (rock drains; settling ponds/dams, water diversions, etc.)
- mitigating potential impacts on the receiving environment
- Geotechnical/hydrogeological factors

A detailed full economic analysis has not been undertaken for this study

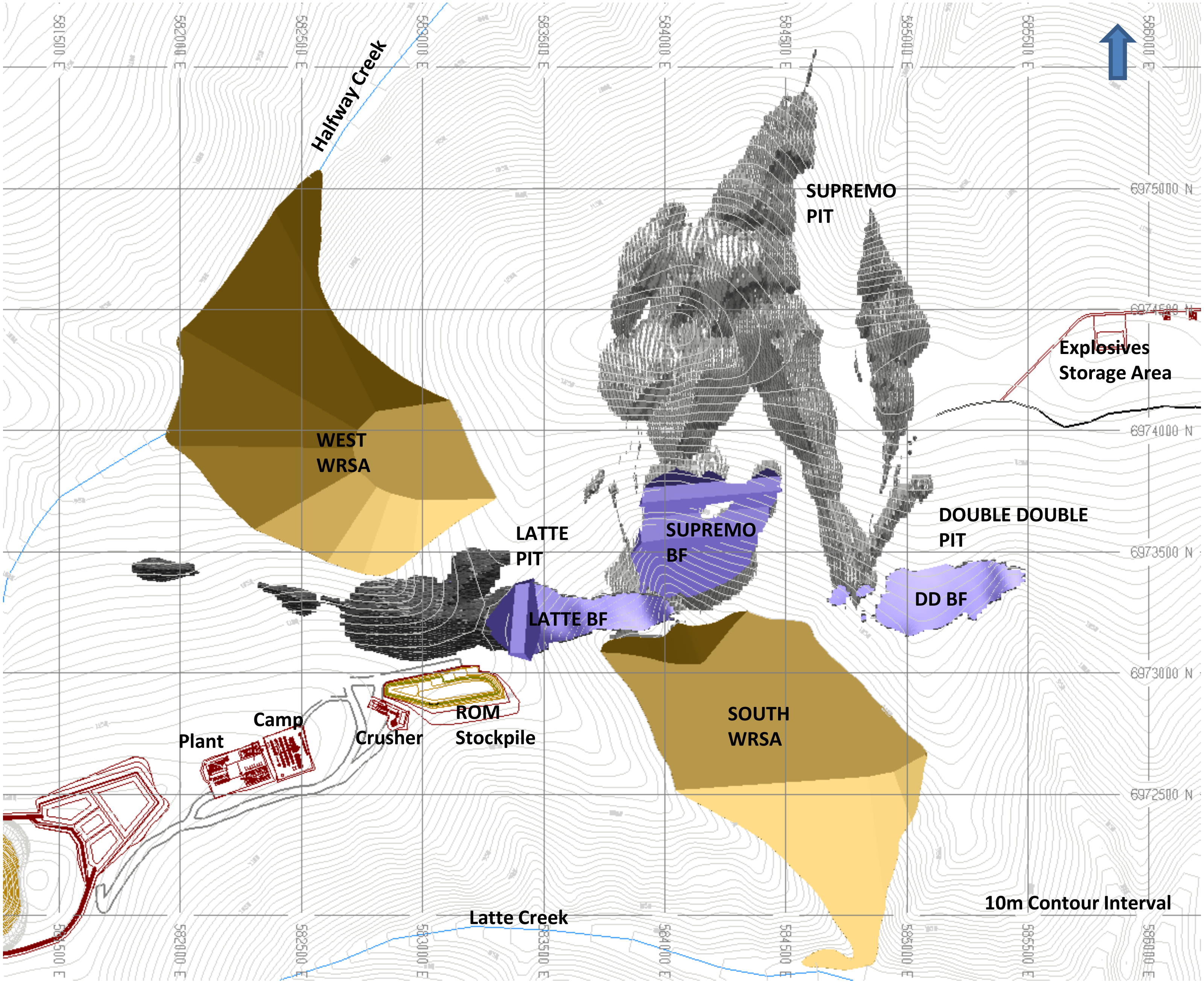
Base Case Site Plan - Optimized for minimal cost for haulage (given 2016 FS backfill strategy)



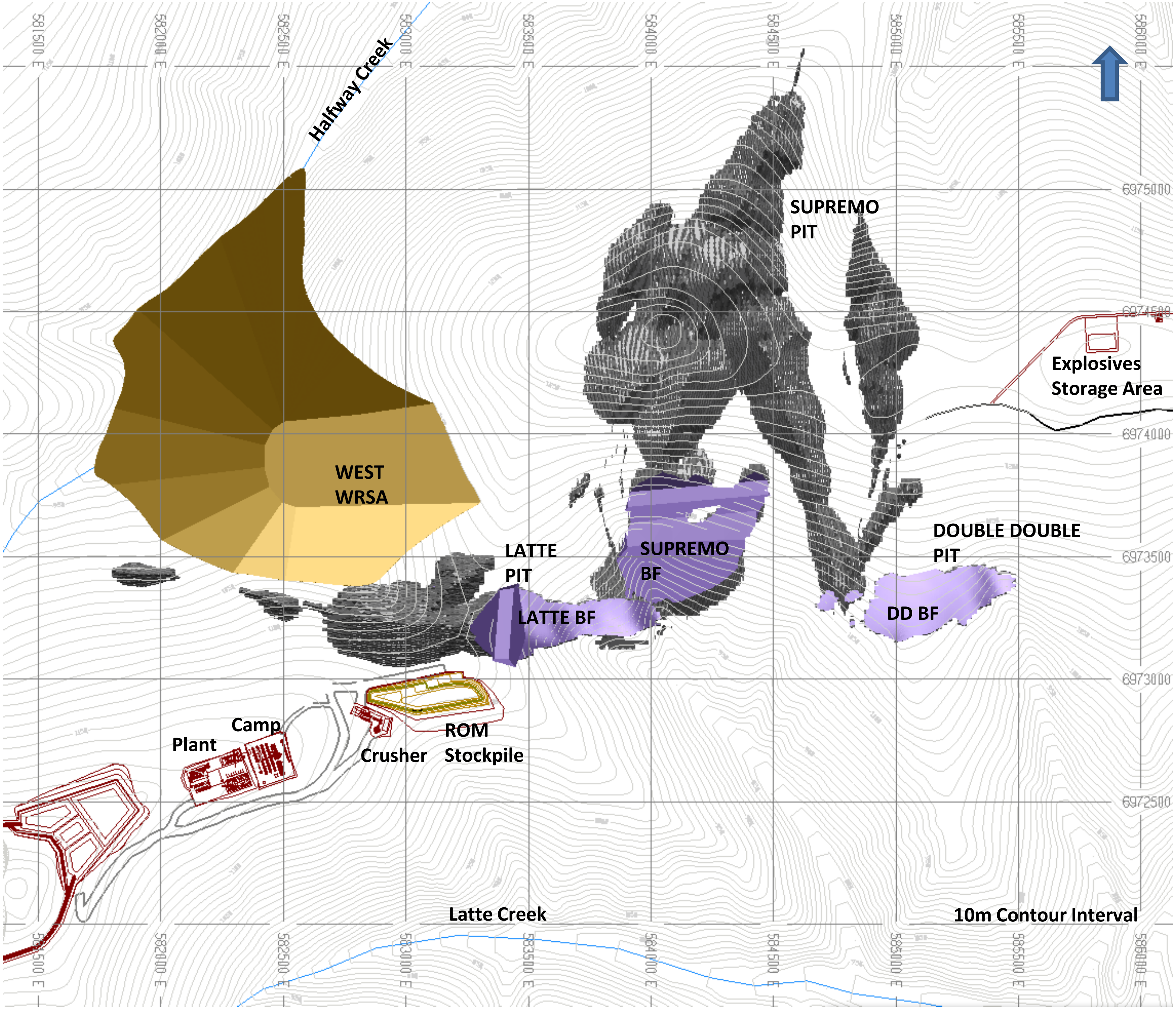
Scenario #1 Site Plan - South WRSA maximized/North WRSA minimized/West WRSA roughly as 2016 FS



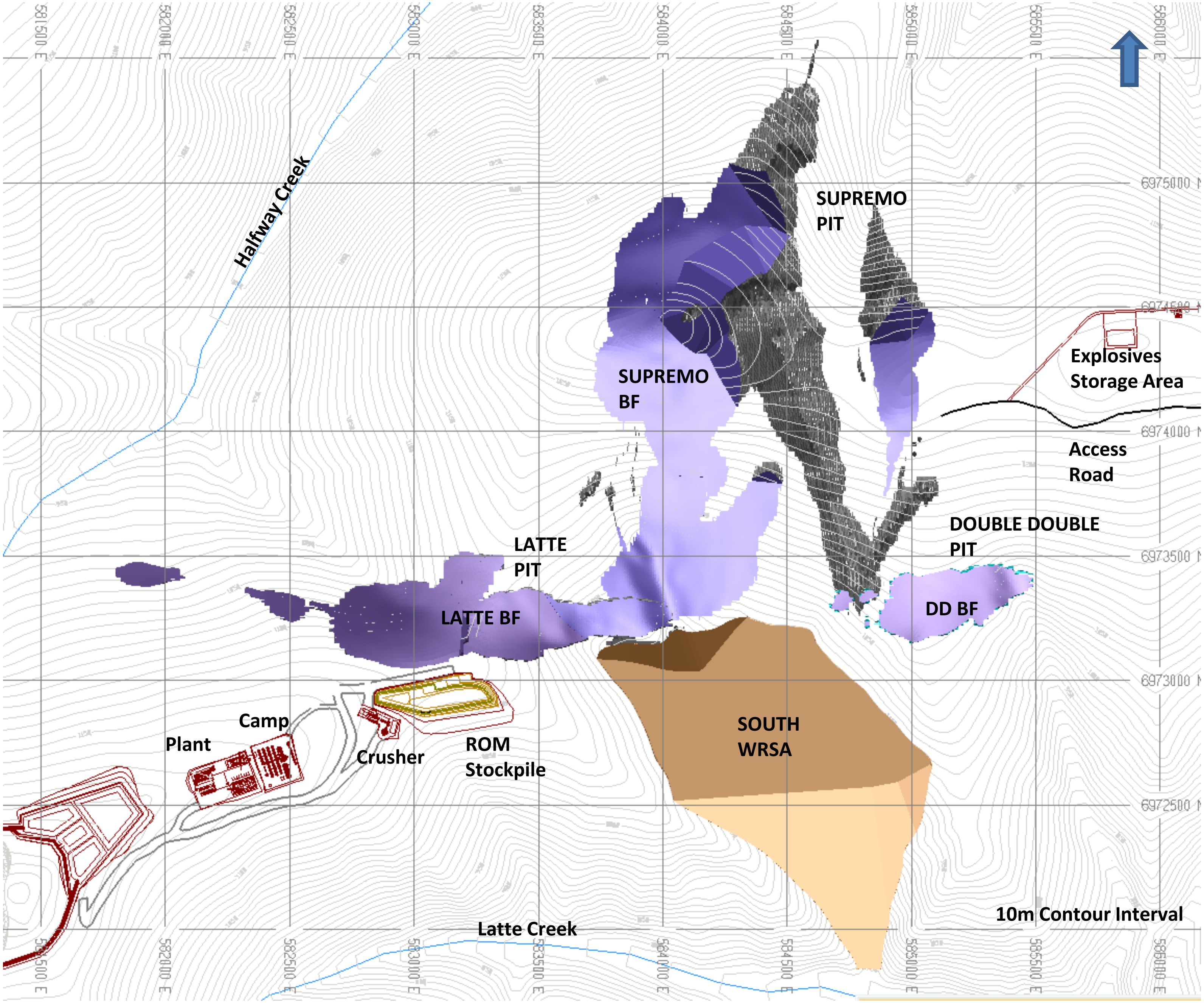
Scenario #2 Site Plan - South WRSA maximized/North WRSA eliminated/West WRSA increased for balance



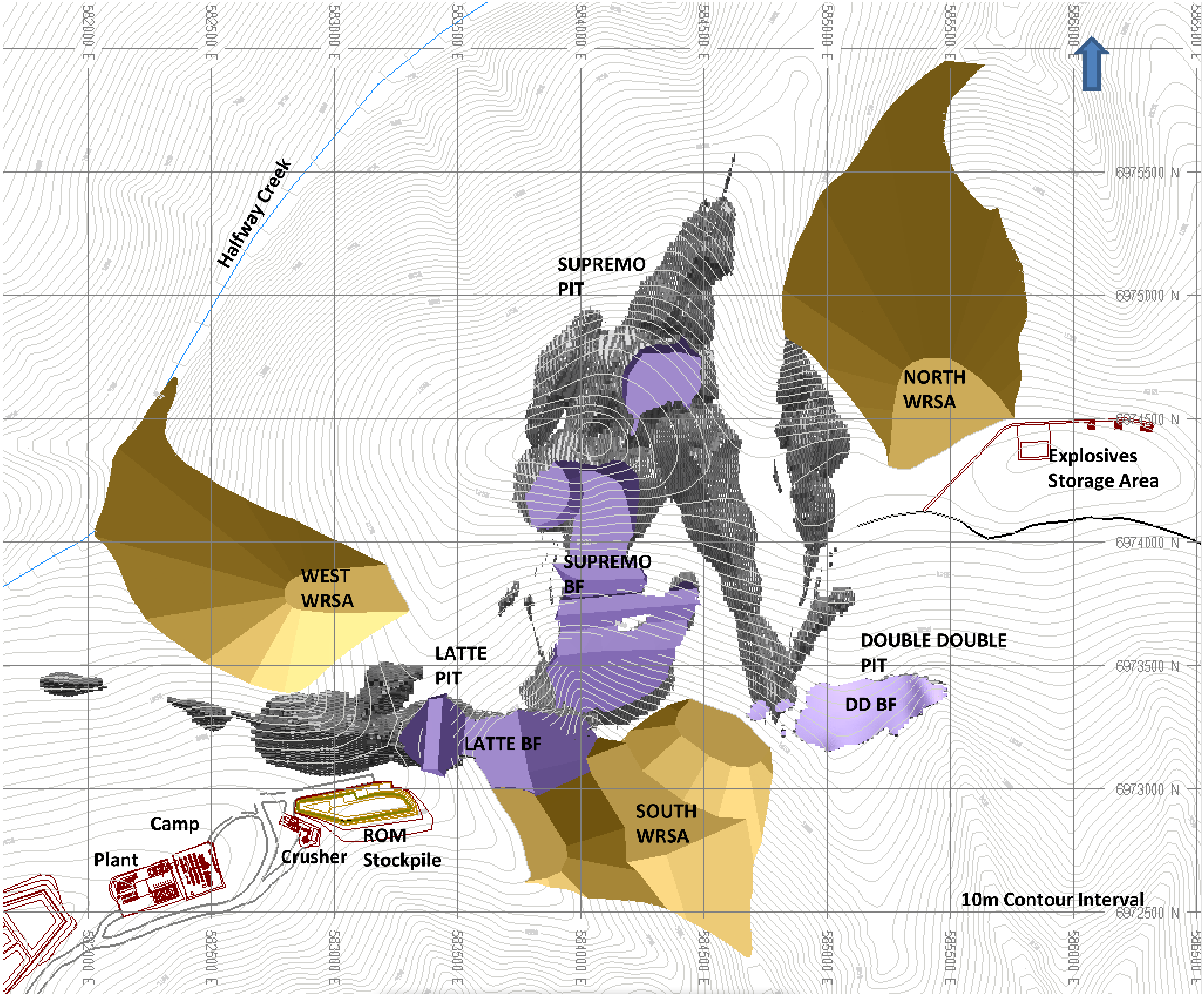
Scenario #3 Site Plan - All waste material reporting to West WRSA



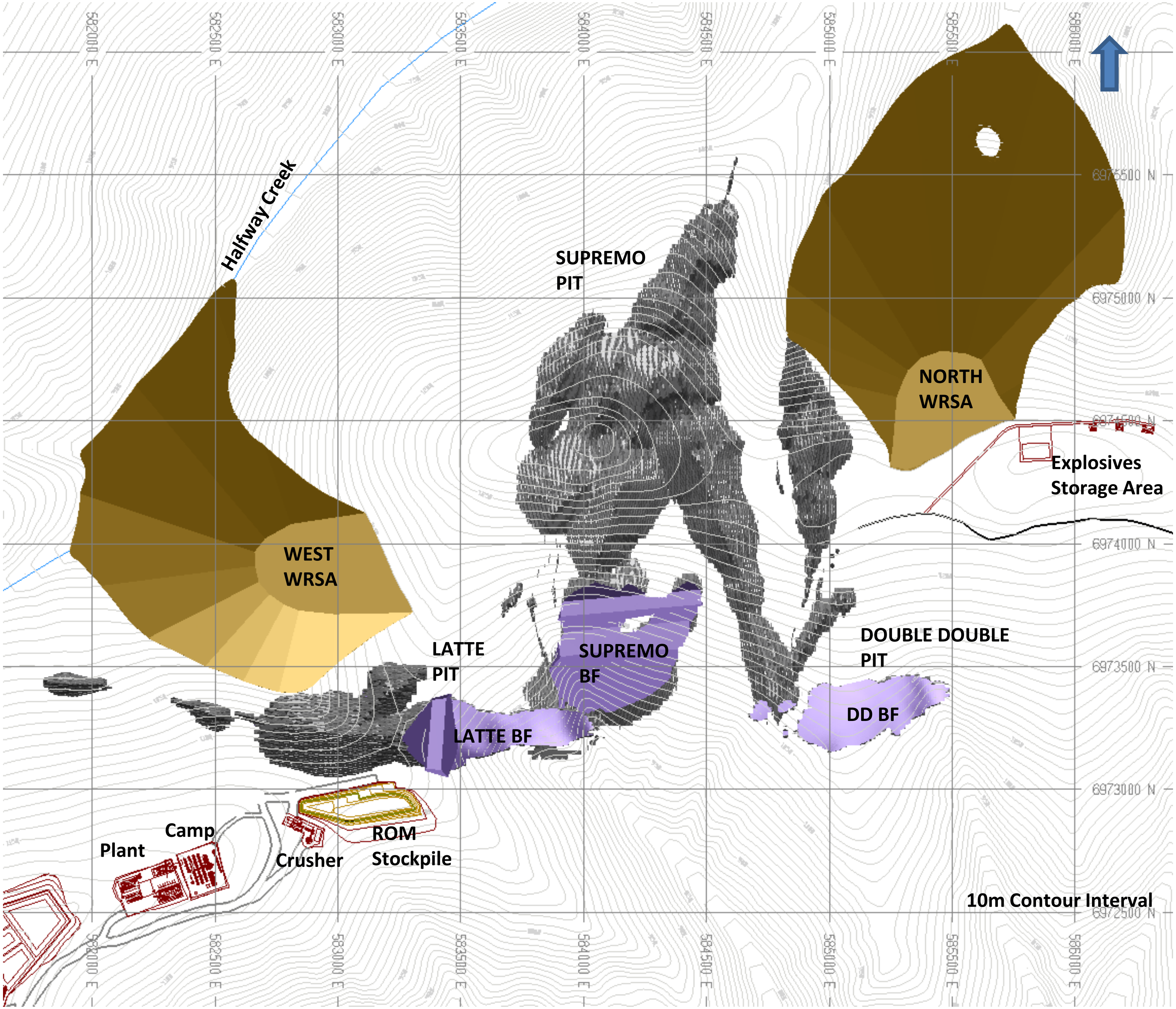
Scenario #4 Site Plan - Maximize backfill to the greatest extent possible/Minimize WRSA's to single location



Scenario #5 Site Plan - Optimize backfill, based on handling/hauling costs



Scenario #6 Site Plan - South WRSA eliminated/Optimize North WRSA and West WRSA



Waste Rock Storage Quantities, Footprints and Surface Areas

WRSA	Description	Unit	Base Case	Scenario #1	Scenario #2	Scenario #3	Scenario #4	Scenario #5	Scenario #6
West WRSA	Tonnage	Mt	70	70	120	246	-	63	134
	Footprint	ha	80	80	115	150	-	75	120
	Surface Area	ha	85	85	120	155	-	79	125
South WRSA	Tonnage	Mt	69	126	126	-	124	71	-
	Footprint	ha	74	100	100	-	100	74	-
	Surface Area	ha	77	102	102	-	102	77	-
North WRSA	Tonnage	Mt	108	50	-	-	-	87	112
	Footprint	ha	155	75	-	-	-	100	155
	Surface Area	ha	160	78	-	-	-	105	160
In-pit Backfill WRSA	Tonnage	Mt	54	54	54	54	176	79	54
	Footprint	ha	-	-	-	-	-	-	-
	Surface Area	ha	-	-	-	-	-	-	--
Total	**Tonnage**	**Mt**	**300**	**300**	**300**	**300**	**300**	**300**	**300**
	Footprint	**ha**	**310**	**255**	**215**	**150**	**100**	**249**	**275**
	Surface Area	**ha**	**322**	**265**	**222**	**155**	**102**	**261**	**285**

Trade-off Study Results

Scenario	Mine Operating Cost *	Mine Capital Cost*	Average One-way Haulage Distance*	Comments
Base Case	-	-	-	WRSA maximum heights - West 290 m; South 210 m; North 400 m; 3 drainages affected; north, south and west facing slopes impacted; multiple WRSA's allow for flexibility in mine plan
Scenario #1	+$21M (3%)	+$4.6M (3%) *(2 trucks)*	+0.19 km (11%)	WRSA maximum heights - West 290 m; South 225 m; North 300 m; 3 drainages affected; north, south and west facing slopes impacted; multiple WRSA's allow for flexibility in mine plan
Scenario #2	+$17M (2%)	+$6.9M (5%) *(3 trucks)*	+0.13 km (7%)	WRSA maximum heights - West 290 m; South 225 m; 2 drainages affected; south and west facing slopes impacted; only 2 WRSA's limit flexibility in mine plan
Scenario #3	+$48M (6%)	+$11.5M (8%) *(5 trucks)*	+0.48 km (27%)	WRSA maximum height - West 290 m; 1 drainage affected; west facing slope impacted; only 1 WRSA severely limits flexibility in mine plan; single WRSA adds risk should significant instability arise
Scenario #4	+$49M (6%)	+$11.5M (8%) *(5 trucks)*	+0.52 km (29%)	WRSA maximum height - South 225 m; 1 drainage affected; south facing slope impacted; only 1 external WRSA limits flexibility in mine plan; single WRSA adds risk should significant instability arise; maximizing backfill is less than optimal from mine cost perspective
Scenario #5	-$5M (-1%)	-	-0.09 km (-5%)	WRSA maximum heights - West 290 m; South 210 m; North 400 m; 3 drainages affected; north, south and west facing slopes impacted; multiple WRSA's and optimal backfilling allow for flexibility in mine plan and reduced mine costs
Scenario #6	+$29M (4%)	+$9.2M (6%) *(4 trucks)*	+0.33 km (19%)	WRSA maximum heights - West 290 m; North 400 m; 2 drainages affected; north and west facing slopes impacted; only 2 WRSA's limits flexibility in mine plan

* Mine operating and capital costs are only meant to reflect relative differences between scenarios

Mine Capital Cost reflects difference in haulage fleet requirements only (same loading and ancillary fleet for all scenarios)

Short term increases in haulage requirements assumed to be dealt with through rental units and reflected in mine operating costs