RioTinto

Developing Low Impact Mining Approaches

12/08/2020

3 Phases Challenge

I. Ideation Challenge
   - Winners announced
   - Winners not obliged to participate into next phase

II. Concept Stage Challenge (Current)
   - **Open to everybody**
   - **Pre-registration opened Sep. 18, 2020**
   - **Open for submissions as of Sep. 25, 2020**
   - **Submissions must be received by Jan. 6, 2021**
   - **Up to 4 winners selected to proceed to Feasibility Stage Challenge by Feb. 12, 2021**
   - **Concept-stage winners each receive portion of (up to) $200,000 award pool for feasibility development**

III. Feasibility-Stage Challenge
   - Only Concept Stage Winners can participate
   - Feasibility Stage Challenge launches on Mar. 15, 2021
   - Submissions must be received by Sep. 20, 2021
   - Analysis of submissions and pitch-backs/demos completed by Nov. 30, 2021
   - Up to two (2) winners selected by Jan. 14, 2022
   - Potential contracts up to $300,000 (each) negotiated with up to two (2) winners in Q1 2022

Challenge Overview

- Rio Tinto Iron and Titanium (RTIT) is continuously looking for new deposits of mineral sands to mine, which contain valuable heavy minerals such as ilmenite, zircon and rutile
- The traditional methods for mining mineral sands deposits include significant infrastructure and disruption to the area

PCP- Primary concentration plant

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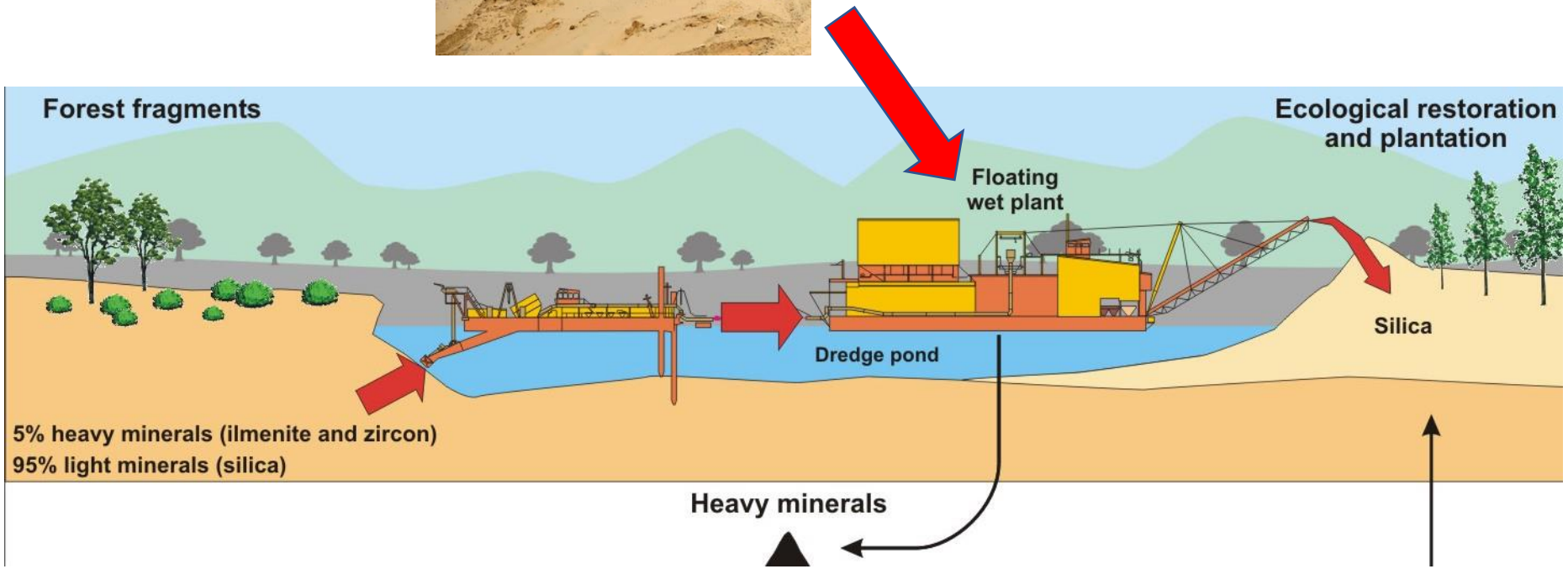
Challenge Overview

- As rich, sizeable and easily accessible deposits become depleted, RTIT is exploring smaller deposits or deposits of considerable size but low in grade and located in difficult to mine areas where traditional methods are not favourable
- The regions where these mining areas are located often face significant water scarcity challenges, which can significantly limit water availability for mining operations
- In this challenge, we seek your ideas for conceptual solutions related to new mining approaches whereby mineral sands are mined and processed using unconventional means that minimize or eliminate the need for water, infrastructure or other disruptions to the area
- The conceptual solutions and novel ideas should address excavation, initial separation/concentration, and backfill of material (any or all three is acceptable)
- The solution should enable on-site concentration of total heavy minerals (THM) to achieve a mass reduction prior to being transported off-site for further processing
- This is a concept stage challenge but submissions shall be deemed feasible and financially viable.

Current mining process



Current THM concentration process

Dredging unit

DMU

ROM

ROM

Wet PCP (gravity separation circuit)

Heavy mineral concentrate

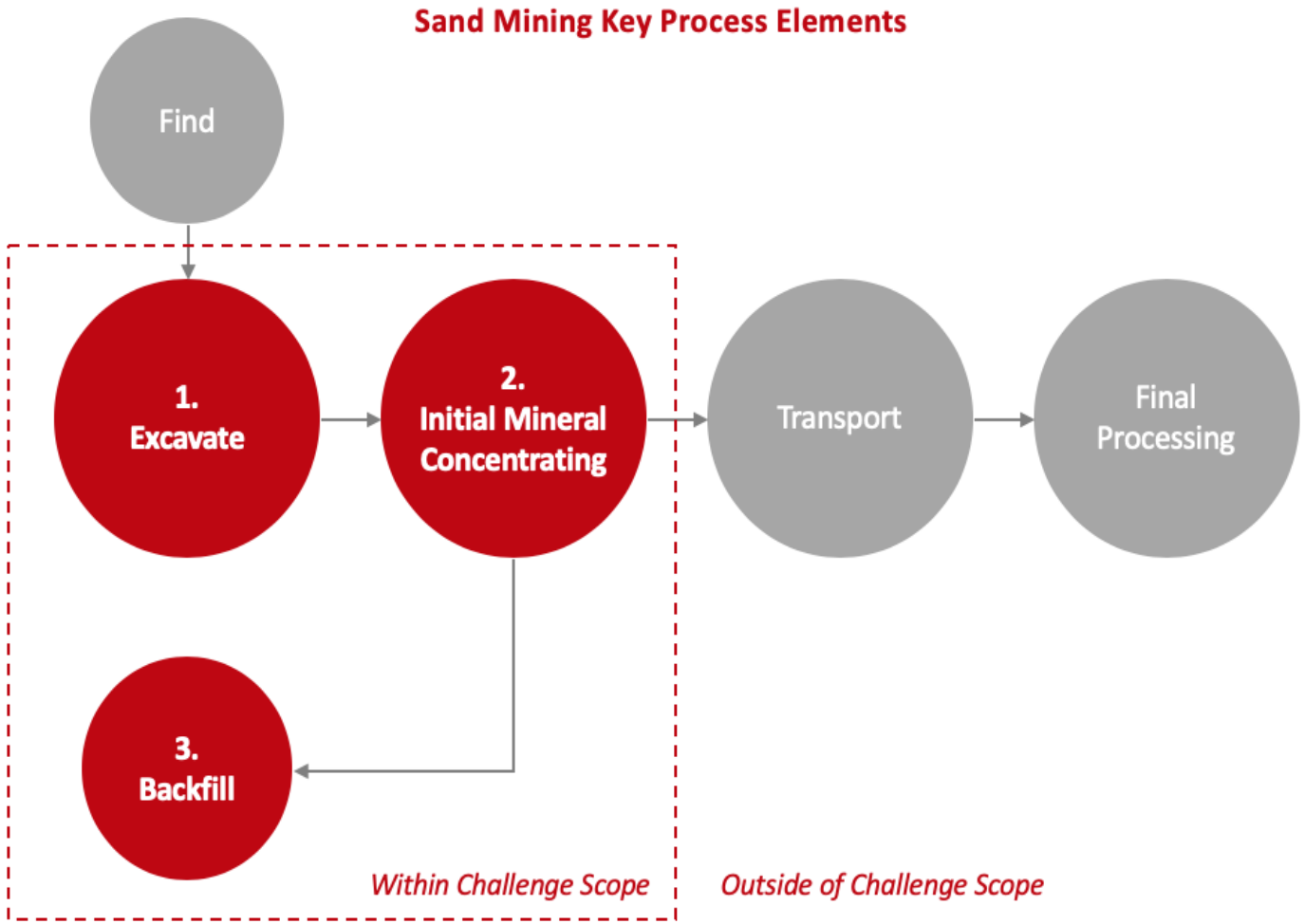
Mineral separation plant

Tails stacking

Rehabilitation

PCP- Primary concentration plant
THM- Total heavy minerals
DMU- Dry mining unit
ROM- Run of mine ore

Challenge Scope



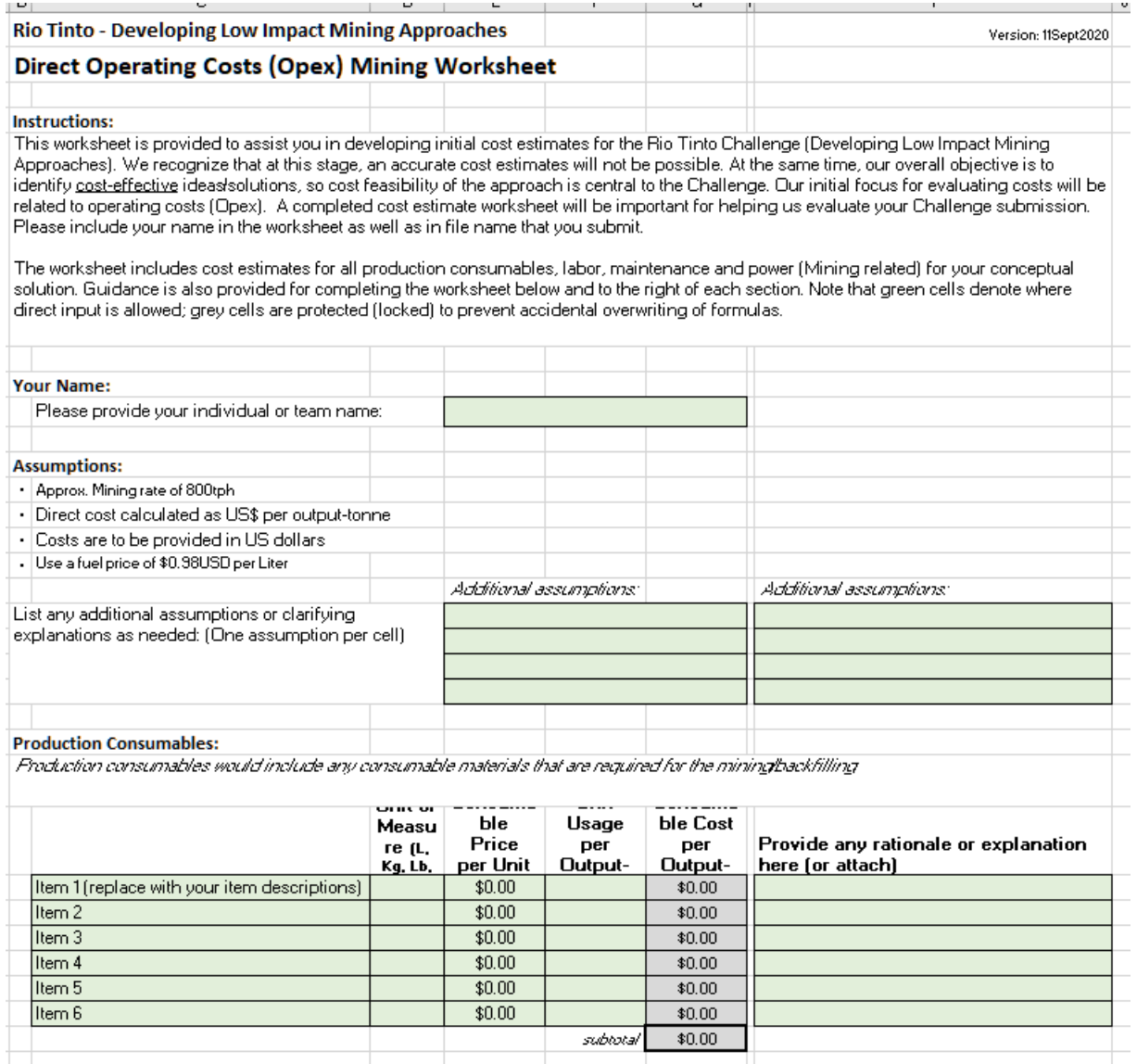
Samples: Potential study area

- The samples for the proof of concept will most likely be collected from Mozambique (Mutamba)
- It should be noted that your solution should be able to treat a variety of deposits
- THM grade is ~3 %
- Valuable heavy minerals include ilmenite (60 %), rutile (1%) and zircon (3%)
- Other heavy minerals include chromite, magnetite, titanomagnetite, kyanite and garnet

Mineral	Chemical Formula	Approx. density (sg)	Properties affecting separation
Ilmenite	$FeTiO_3$	4.5	Heavy, magnetic, conductive
Rutile	TiO_2	4.2	Heavy, non-magnetic, semi-conductive
Zircon	$ZrSiO_4$	4.5	Heavy, non-magnetic, non-conductive
Chromite, Magnetite, Titano-magnetite	Cr-Fe-Ti oxides	>4	Heavy, magnetic, conductive
Other Heavy minerals (kyanite, garnets, etc.)	Various	2.7-5	Various

Concept Stage Evaluation

Criteria	Weight
Innovativeness	20%
Impact	30%
Technical Feasibility	25%
Financial Viability	25%



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Direct Operating Costs (Opex) Mining Worksheet

Instructions:

This worksheet is provided to assist you in developing initial cost estimates for the Rio Tinto Challenge (Developing Low Impact Mining Approaches). We recognize that at this stage, an accurate cost estimates will not be possible. At the same time, our overall objective is to identify cost-effective ideas/solutions, so cost feasibility of the approach is central to the Challenge. Our initial focus for evaluating costs will be related to operating costs (Opex). A completed cost estimate worksheet will be important for helping us evaluate your Challenge submission. Please include your name in the worksheet as well as in file name that you submit.

The worksheet includes cost estimates for all production consumables, labor, maintenance and power (Mining related) for your conceptual solution. Guidance is also provided for completing the worksheet below and to the right of each section. Note that green cells denote where direct input is allowed; grey cells are protected (locked) to prevent accidental overwriting of formulas.

Your Name:

Please provide your individual or team name:

Assumptions:

- Approx. Mining rate of 800tph
- Direct cost calculated as US$ per output-tonne
- Costs are to be provided in US dollars
- Use a fuel price of $0.98USD per Liter

	Additional assumptions:	*Additional assumptions:*
List any additional assumptions or clarifying explanations as needed: (One assumption per cell)		

Production Consumables:

Production consumables would include any consumable materials that are required for the mining/backfilling

	Unit of Measure (L, Kg, Lb,	ble Price per Unit	Usage per Output-	ble Cost per Output-	Provide any rationale or explanation here (or attach)
Item 1 (replace with your item descriptions)		$0.00		$0.00	
Item 2		$0.00		$0.00	
Item 3		$0.00		$0.00	
Item 4		$0.00		$0.00	
Item 5		$0.00		$0.00	
Item 6		$0.00		$0.00	
			subtotal	$0.00	

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