

# DIAMOND PROCESSING

## WDL plant processing layout

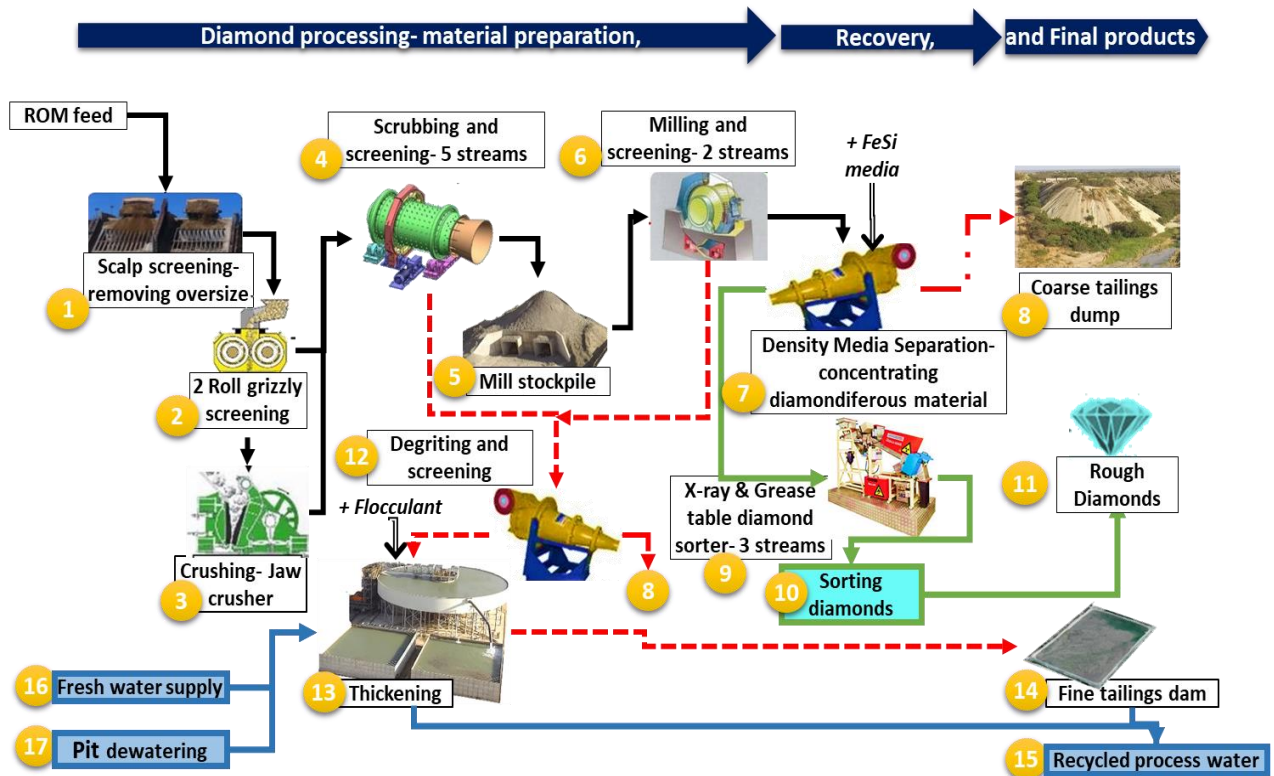


Figure 1 WDL Diamond Processing Flow Diagram (PFD)

### Stage 1. Comminution and Sizing

The comminution and sizing process reduces Run of Mine (ROM) rock material from blasting into smaller, more manageable sizes for further processing. This stage involves the following unit processes:

#### Typical units are:

- i.) **conveyor belts** for transferring process of coarse material totalling 7.0km,
- ii.) **storage bins** for short-term material storage to regulate downstream feed.
- iii.) **pumps** for transferring fluid material that is water and fine tailings.

1. **Scalping:** Dry ROM material is classified using a mechanical inclined static screen to recover treatment material and remove oversize material (greater than 300mm) (2 streams each 110 Ton storage bin, ATEC apron feeder 1.5mWx6.0mL 11kw motor feed 1000tph).
2. **2-Roll Grizzly Screening:** This step classifies material using a mechanical roller screen, recovering treatment material below 150mm and directing oversized material to the primary crusher (Helam 1.3mDia.x3.0mL 44kw feed 800tph).

3. **Primary Crushing:** The primary crusher reduces the size of the treatment material to below 150mm through mechanical impact (Jaw crusher Osborn 36"x48" 160kw feed 300tph).
4. **Scrubbing (5 streams):** Clayish lumps in the plant feed ore are broken down using a mechanical rotating drum with added water, followed by wet screening to classify mill feed material and remove fine tailings as slurry (5 streams each 80 Ton storage bin, 4 streams each Scrubber 2.0mDia.x5.0mL, WEG motor 90kw feed 120tph, Weir Enduron dewatering screen feed 150 tph double decks V/Motors and 1 stream Scrubber 2.3mDia.x7.0mL, WEG motor 220kw feed 220tph, Weir Enduron dewatering screen feed 250 tph double decks V/Motors and FLS-Krebs 6"x4" under flow pump).
5. **Mill Stockpiling:** The stockpile provides a large open reserve material to ensure consistent operation downstream mills process even if upstream processes slows down or temporarily stops (2 streams each Osborn apron feeder 1.5mWx6.0mL 30kw motor feed 600tph).
6. **Milling and Screening (2 streams):** Semi-Autogenous (SAG) mills grind material using rock pebbles as media within a rotating drum, with added water. Wet screening follows to classify Dense Media Separation (DMS) feed material, recycle pebbles, and remove fine tailings that are pumped to de-grit cyclones (2 streams each NCP SAG Mill 5.6mDia.x3.2mL, WEG motor 700kw feed 300tph, Weir Enduron dewatering screen feed 350 tph double decks V/Motors and FLS-Krebs 6"x4" under flow pump).

## Stage 2. Concentration and Diamond Recovery

This stage daily recovery is conducted under the supervision of a Government officer, an Investor's Diamond Protection Officer (DPO), and the WDL security team. The process flow includes:

7. **Dense Medium Separation:** Dense material from the feed ore are separated through three hydro cyclones, after mixing the ore with powdered ferrosilicon (FeSi) slurry and then pumped to the hydrocyclones at the required pressure 180kpa and 2.65 specific gravity. Diamonds and other heavy minerals are recovered as concentrate material in the underflow, while lighter waste material floats in the overflow and are discarded as coarse tailings (60 Tons and 10 Tons storage bins for DMS feed and DMS sink screen discharge. FeSi slurry recirculation circuit includes a FLS-Krebs 8"x6" densifier pump feeding 4 Densifiers, a FLS-Krebs 8"x6" dilute media pump feeding 4 magnetic separators and a FLS-Krebs 8"x6" correct media pump feeding mixing box. The separation circuit includes a FLS-Krebs 10"x8" pump feeding 3 streams each with a Multotec 470mm hydrocyclone feeding 70 tph, a dewatering screen Weir Enduron single deck, V/motor 50 tph used to recover FeSi and transfer underflow concentrate to sink screen bin and 2 dewatering screens Weir Enduron double deck, G-Exciter 300 tph used to recover FeSi and transfer overflow to coarse tailings conveyor).
8. **Final Coarse Tailings:** Waste coarse tailings are transported via surface conveyor belts to the crest of the tailings dump for safe disposal.
9. **Diamond Sorting (3 streams):** X-ray transmission machines detect and recover diamonds from the wet concentrate stream as they fluoresce, with rejects sent to

grease scavenging tables to capture any undetected diamonds (3 streams each Flow Sort x-ray diamond recovery machine model XR2/19DW single pass feed 10tph).

10. **Diamond Sorting:** Sorting is performed under strict supervision and involves:
  - i.) **Hand Sorting:** Rough diamonds are sorted manually into secured sort glove boxes.
  - ii.) **Grading:** Diamonds are graded by particle size.
  - iii.) **Acidizing:** Diamonds are cleaned with hydrochloric (HCl) acid.
11. **Final Rough Diamonds:** The sorted and graded rough diamonds are securely stored. Government officials handle valuation and exporting to sales market processes.

### Stage 3. Water Reticulation

The water reticulation process focuses on optimizing water recovery and reuse within the plant:

12. **De-gritting:** Coarse tailings in slurry are classified by de-grit cyclones. Slimes material is recovered in the overflow, while grit in the underflow is screened and removed and conveyed to the coarse tailings stream (6 streams dewatering cyclones each Weir Cavex 650mm hydrocyclones feed 210tph, 2 streams dewatering screens each Weir Enduron single deck, G-Exciter feed 350 tph and FLS-Krebs 6"×4" under flow pump).
13. **Thickening:** Process water from slimes concentration is clarified by adding flocculants. The overflow is clarified water, which is recycled for plant use, while waste slimes/ fine tailings are removed in the underflow (Thickener Outotec 50m diameter Kimberlite High Compression Rate, Raised Tank with rake lift feed 240tph. Flocculant make up and dosing plant Outotec feed 10 m<sup>3</sup>/hr).
14. **Final Fine Tailings:** Slimes from the thickener tank's underflow are pumped to the fine tailings dam for safe disposal with decant water drained and returned to the plant for reuse (slimes pumping system 3 lines each with 4 pumps in series Warman size 8"×6" and 3.6km HDPE pipeline 315mmOD. Return water raft pumping system 2 lines each with Warman 8"×6" pump and 3.6km HDPE pipeline 315mmOD).
15. **Recycled Process Water:** Reclaimed water from the thickener tank overflow discharges to storage water tanks and recirculated by pumps for processing use (2 elevated pressed steel water tank each 2,500m<sup>3</sup> and 3 Weir SDC400-500 pumps 250kw motor supplying process water through a network of pipes).
16. **Fresh Water Supply:** Fresh water is primarily supplied from external sources (Kahama Shinyanga Water and Sanitary Authority - KASHWASA) and secondarily pumped from internal sources (Nhumbu and Songwa dams pump stations each 1 pump Samco pump size 12"×8") through a transmission line (10.5km steel pipeline 660mmDia).
17. **Pit Dewatering:** Water is pumped from the open pit sump after collecting streams and rain season runoff (raft pumping system 2 lines each with 2 pumps in series Warman pump size 8"×6" and 1.0km HDPE pipeline 280mmOD).

#### **Stage 4. Power Reticulation**

18. **TANESCO Power Supply:** The primary external power supply, distributed to electrical equipment, motors, and lighting throughout the plant (2 transformers total 25.0MVA).
19. **Power Generators:** Standby thermal power generation used during TANESCO power interruptions to ensure continuous operation (5 generators total 7.5MVA).
20. **Transmission lines:** 3 lines each 3.3kv double-circuit transmission line 3.5km with ring switch gears to distribute various loads that is substations, motor control centres and lighting.

#### **Stage 5. Diamond process monitoring and control**

21. **Security:** CCTV surveillance, access control and perimeter fencing to secure the final product.
22. **Automation** PLC hardware and software to run the process equipment automatically and effectively.