

# Floating plants in wet mining projects

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# The Presentation Structure

- ▶ Introduction of the Topic
- ▶ Brief overview of IHC experience in floating plant design and implementation
- ▶ Main types of projects for floating plants application
- ▶ Main types of commodities for floating plants application
- ▶ Main types of floating plant design
- ▶ Approaches to follow choosing floating plant vs land based ones
- ▶ Approaches to follow choosing floating plant vs board-based ones
- ▶ Main factors to take into consideration for the plant size/type/flowsheet selection
- ▶ Mining, transportation and tailing disposal solutions for floating plant use
- ▶ CAPEX & OPEX indications for the floating plants
- ▶ Conclusions and recommendations .

NOTE: The presentation is basing on a broad practical experience of Royal IHC, partner company to IGT

# Introduction of the Topic

- ▶ Latest decades in World and Russian mining industry dry mining method becomes to be the preferred mining method not only for hard rock mineral deposits, but also for alluvial and tailings (man-made) deposits
- ▶ However, Russia still is the largest World alluvial gold producer (about 25-30% of overall gold mining output of the country)
- ▶ Russia also has at least one of the largest (or even the largest) dredging fleet in mining
- ▶ Traditional wet mining options are very well known and are in an extensive use in Russian mining
- ▶ However modern options and techniques are not that well known
- ▶ That relates not only to mining itself, but to the processing as part of an overall mining projects
- ▶ Many alluvial and tailing (man-made) deposits require fast movements of the mining face and have very limited ability of land use
- ▶ Floating plant solutions may help solving the problems and make dead projects alive

# IHC experience in floating plants



- ▶ IHC is the largest and the oldest producer of bucketladder dredges with on-board processing in the World;
- ▶ IHC has accumulated long-time experience designing, implementing and maintaining floating vehicles with on-board processing facilities for different commodities – from aggregates to diamonds, from continental deposits to deep sea;
- ▶ All that gives a unique knowledge base for further floating plants design;
- ▶ Initially these were aggregates sorting floating plants and Ti-Zr gravity separating plants on pontoons, then other kinds came;
- ▶ First success using suction dredge at mining with a separate floating plant for mineral sands – some 50 years ago (1974), multiple successful implementations of the similar approach since that.

# Main types of projects using floating plants



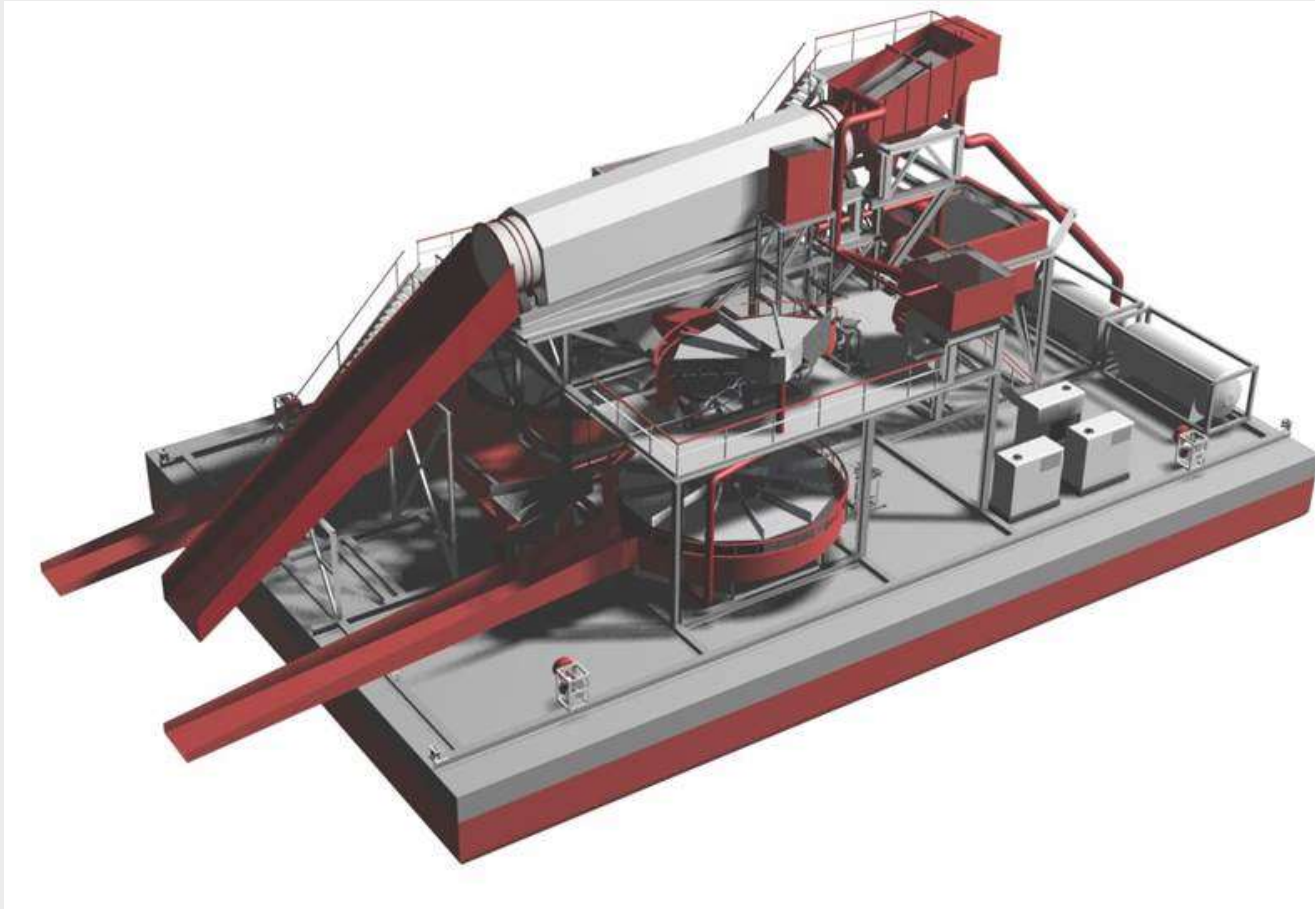
1. Main **types** of projects
  - ▶ Primary/Virgin;
  - ▶ Secondary/Man-made
2. Main **kinds of projects**
  - ▶ Alluvial, both at virgin and tailings (man-made) deposits
  - ▶ Hard rock tails

# Main commodities using floating plants



- ▶ Aggregates (sands & gravel)
- ▶ Oil sands (to get heavy minerals out of oil sands tailings)
- ▶ Gold
- ▶ PGM
- ▶ Diamonds
- ▶ Tin
- ▶ Tungsten
- ▶ Ti-Zr
- ▶ Some other

# Main types of floating plants



- ▶ Screening and sorting aggregates/sands
- ▶ Disintegration/screening + jigging/Au, Sn, PGM, diamonds
- ▶ Screening + surge bin + spiral concentration/ Sn, W, Ti+Zr
- ▶ other

# Floating plant vs land based ones

## Main arguments:

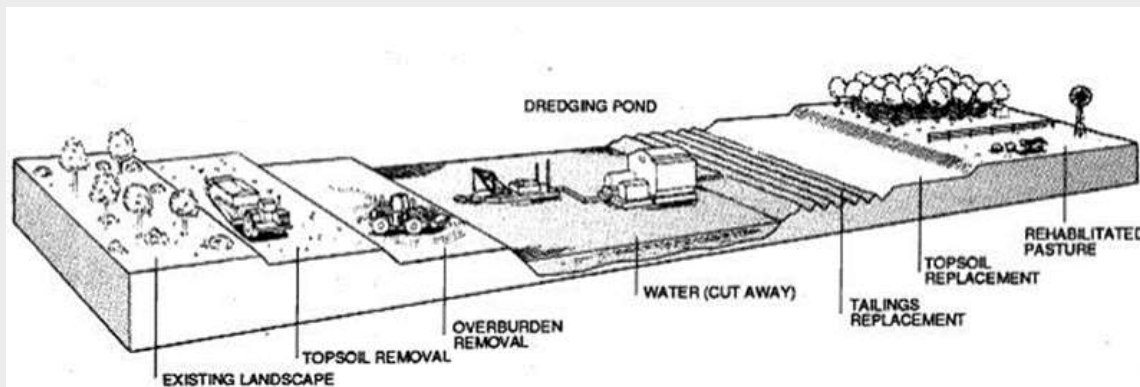
- ▶ Large square of the wet mining area and/or long distance of mined material handling
- ▶ Hi-capacity mining and/or fast move of mining face
- ▶ Lack of space to allocate shore-based process facility
- ▶ Lack of space to dispose tailings
- ▶ Limit transportation distances
- ▶ Sometimes you have to operate on water because of water level in ground (or river, lake, sea)

## Main advantages:

- ▶ Compact design
- ▶ Simple relocation
- ▶ Cheap operating and maintenance
- ▶ Very small staff
- ▶ Easy/cheap tailings disposal
- ▶ Simple arrangements for covering/winterization
- ▶ Optimizing on unit as processing plant; dredge is separate

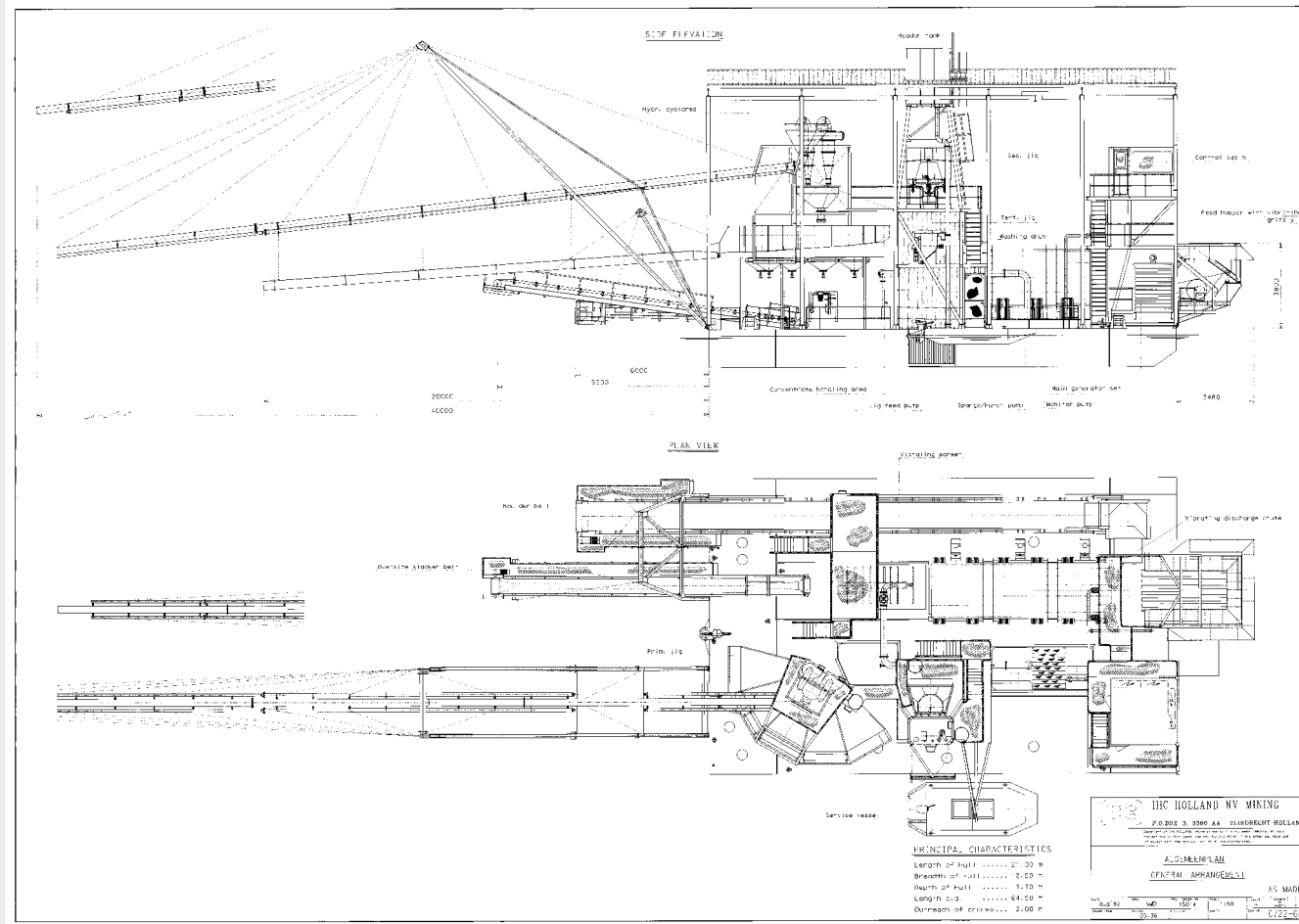
## Main disadvantages:

- ▶ Floating vehicle
- ▶ Balance needs to be taken into account
- ▶ CAPEX might be an issue





# Floating/separate plant vs board-based ones



## Additional advantages:

- ▶ Compact/cheaper design due to lack of mining from the same pontoon
- ▶ Lack of vibration and pitching = much less troubles for processing
- ▶ As pumping required = disintegration made while pumping, with more efficient disintegration and less need to install a scrubber/trommel
- ▶ Better water use arrangements = less slams in water near the plant

## Additional disadvantages:

- ▶ Separate pontoon = pumping required

# Main factors to take into consideration for the plant size/type/flowsheet selection

- ▶ **Throughput** required: how large shall be the plant and how big (or how many?) pontoon(-s) it will need
- ▶ Mining method/equipment: **solid-liquid ratio** in the plant feed and its stability while mining, requirements to include a surge bin into the floating plant' flowsheet
- ▶ **Clay/slams in the feed** material: requirements for disintegration/desliming
- ▶ **Grain size distribution** for the plant **feed**: what to screen out and how to remove/re-transport that
- ▶ **Grain size** distribution of **the commodity**(-ies) in the feed: which process(-es?) to use catching it(them)
- ▶ Concentration requirements: how many **concentration steps** to allocate **at the pontoon** and what to do with the (rough?) concentrate further at shore-based cleaning facility
- ▶ **Tailing disposal arrangements and further rehabilitation requirements**: how far to pump tailings and what to install at the floating plant for that
- ▶ **Energy supply**: what to allocate at the pontoon for that
- ▶ **Climatic conditions**: design arrangements for heating or conditioning of the plant
- ▶ **Other** possible **specificity** to take into consideration

# Relation between the different aspects for floating plant use

## 1. Backhoe + FP

- ▶ Fast move of mining face and the pond
- ▶ Shallow mining
- ▶ Higher cutting forces for hard soil
- ▶ Cyclic feed of FP
- ▶ Slurryfication on board required
- ▶ Disintegration on board required
- ▶ Good for long and narrow streams, might not be that good for large squares

## 2. Suction dredge + FP

- ▶ Hi-capacity mining
- ▶ Deeper mining
- ▶ More stable feed of the plant
- ▶ Slurrification inside a mining tool, but solid-liquid ratio might need to be stabilized
- ▶ Disintegration doesn't ultimately required, dewatering of the feed material might be needed
- ▶ Good for large squares and depths
- ▶ Very good for tailing (man-made) deposits = much better dust control while mining

## 3. Dry mining + slurrification unit + FP

- ▶ Applicable for broad scale of capacities and depths
- ▶ Disintegration inside pipeline, good solid-liquid management, stable plant feed
- ▶ Good for alluvial and tailing (man-made) mining projects
- ▶ Good for (several?) segregated mining areas feeding same FP
- ▶ Good for long transporting distances

# CAPEX and OPEX for floating plants

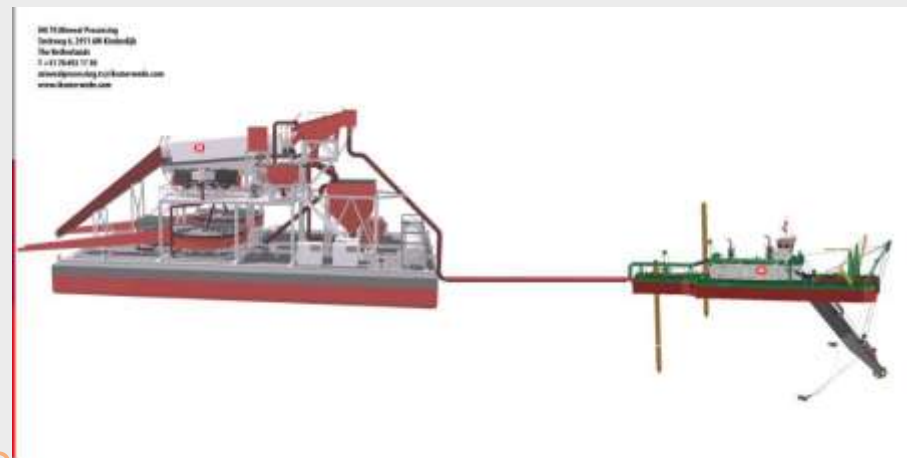
## 1. CAPEX

- ▶ More than for similar shore-based plants (although you do not require any foundation and infrastructural facilities)
- ▶ Less than similar board-based plants
- ▶ Depends on climatic conditions, capacity, commodity type, concentration requirements and some other possible limitations.
- ▶ This also applies for land based plants



## 2. OPEX

- ▶ Usually lower than for both shore- and board-based plants
- ▶ Unit costs (per cub.m of feed or per 1g or 1% of the recovering commodity) also usually better than the mentioned alternatives



# Conclusions and recommendations

- ▶ Floating plant option is promising for various mineral projects – alluvial mines, diluvium cores mining, hard rock tailings (man-made) re-processing and many other options to efficiently recover heavy minerals from there;
- ▶ Depending on exact geological conditions and mining, transporting and tailing disposal options the floating plant might be properly designed for different approaches, throughputs, flowsheets and costs;
- ▶ Most important drivers to start thinking about a floating plant option shifting from board-based or land-based options are water cut of the mining volumes, long and variable distances to transport mined material to the plant and tailings from the plant to the disposal area as well as limitations in water use and availability of mining claim;
- ▶ To implement the floating plant idea a stepwise process is required, from hi-level sketches through pre-engineering to detailed design and implementation;
- ▶ Royal IHC has strong experience and track record of designed plants and implemented projects, having TetraTech as feasibility/engineering partner and IGT as local partner in Russia assisting to an own IHC local personnel, is one of best chances for mining companies and mining entrepreneurs to support in the finding and implementing the floating plant approach.

# Appreciate your attention!

Happy to answer possible questions.

Wit best regards, Mikhail LESKOV, IGT

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