



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Developing a water accounting and assessment protocol for water management of mining and minerals processing

Case study preliminary results

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Integrated mineral technologies for more sustainable raw material supply.



minerals to metals



Water



Mining

Mining



Processing



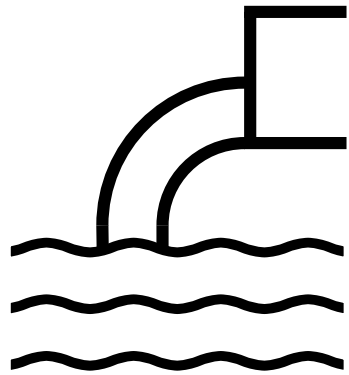
Waste management



Problems



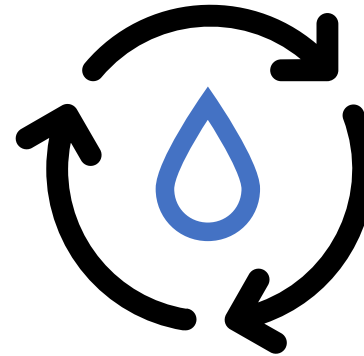
Pollution



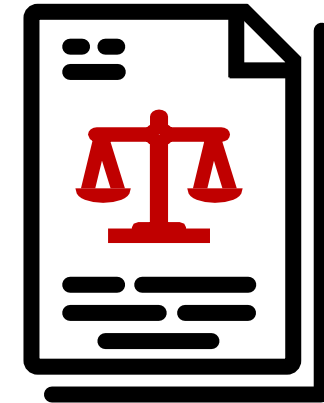
Conflict



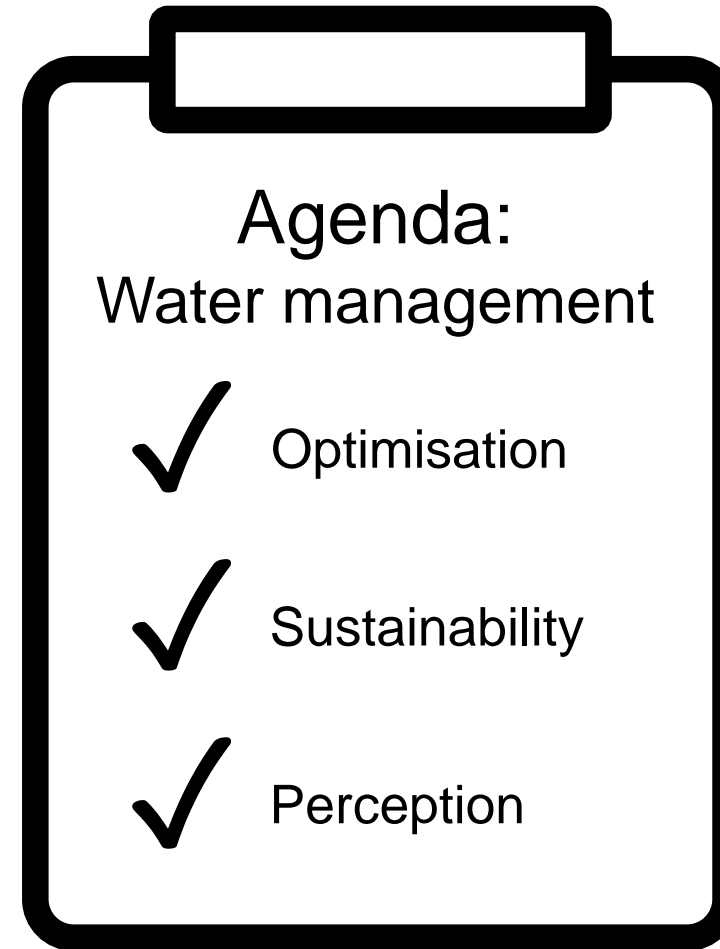
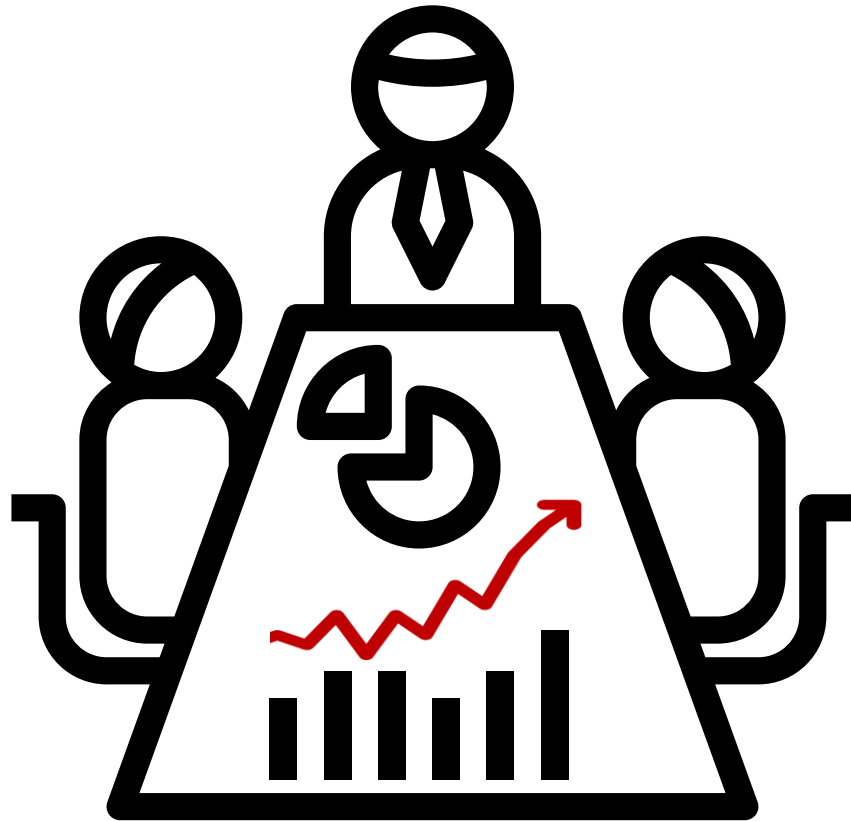
Recycling



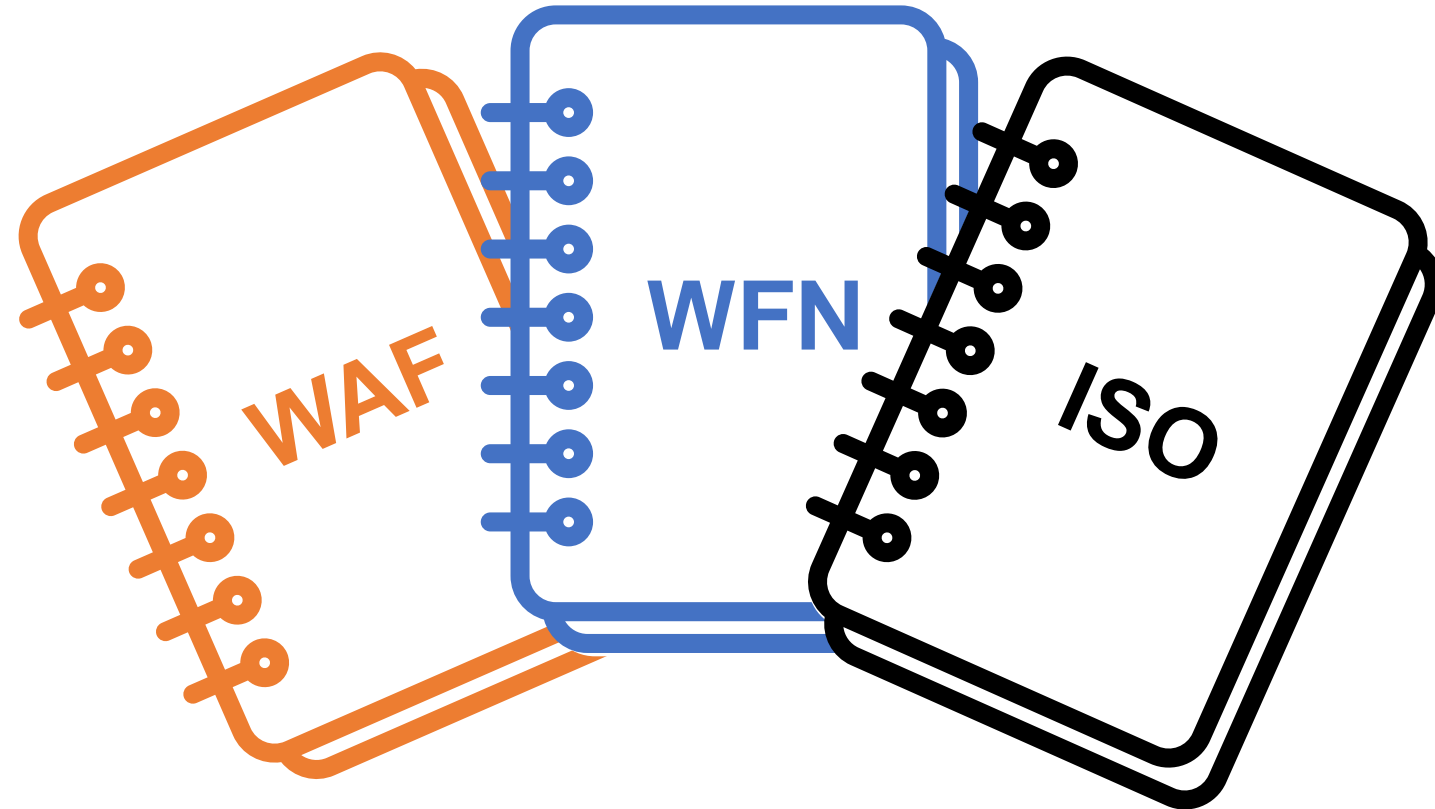
Compliance



Impetus for improvement



Tools and frameworks

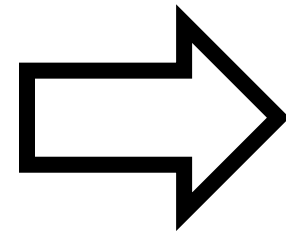
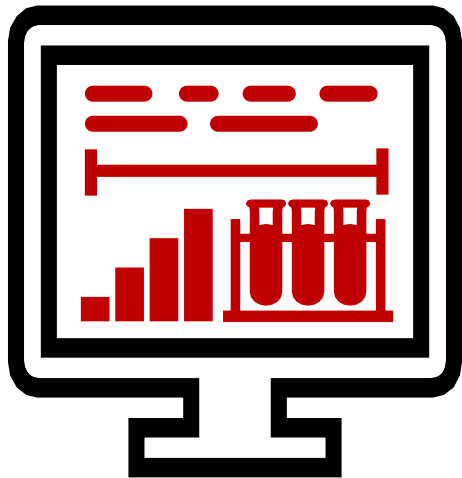


Water
accounting
assessment

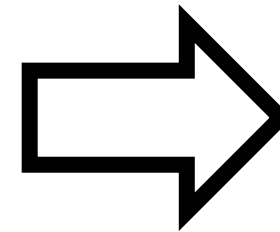
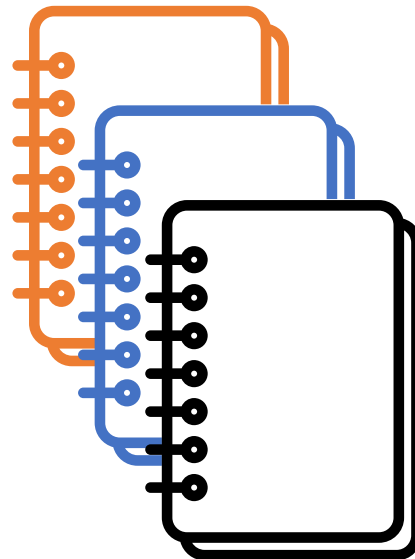
Water management process



Modelling & measurement



Tools & frameworks



End-use context

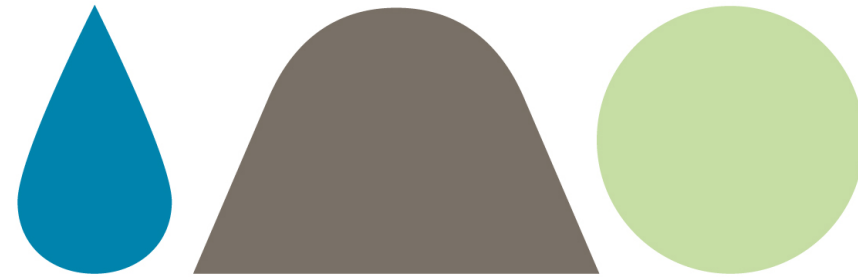


1. Evaluate impact of different measurement and modelling approaches on information outputs
2. Determine impact of different accounting and assessment tools and frameworks on water impact indicators
3. Understand linkages between water indicator end-use context and the modelling or measurement context (i.e. system lens) which provides information relevant to the end-use

ITERAMS project



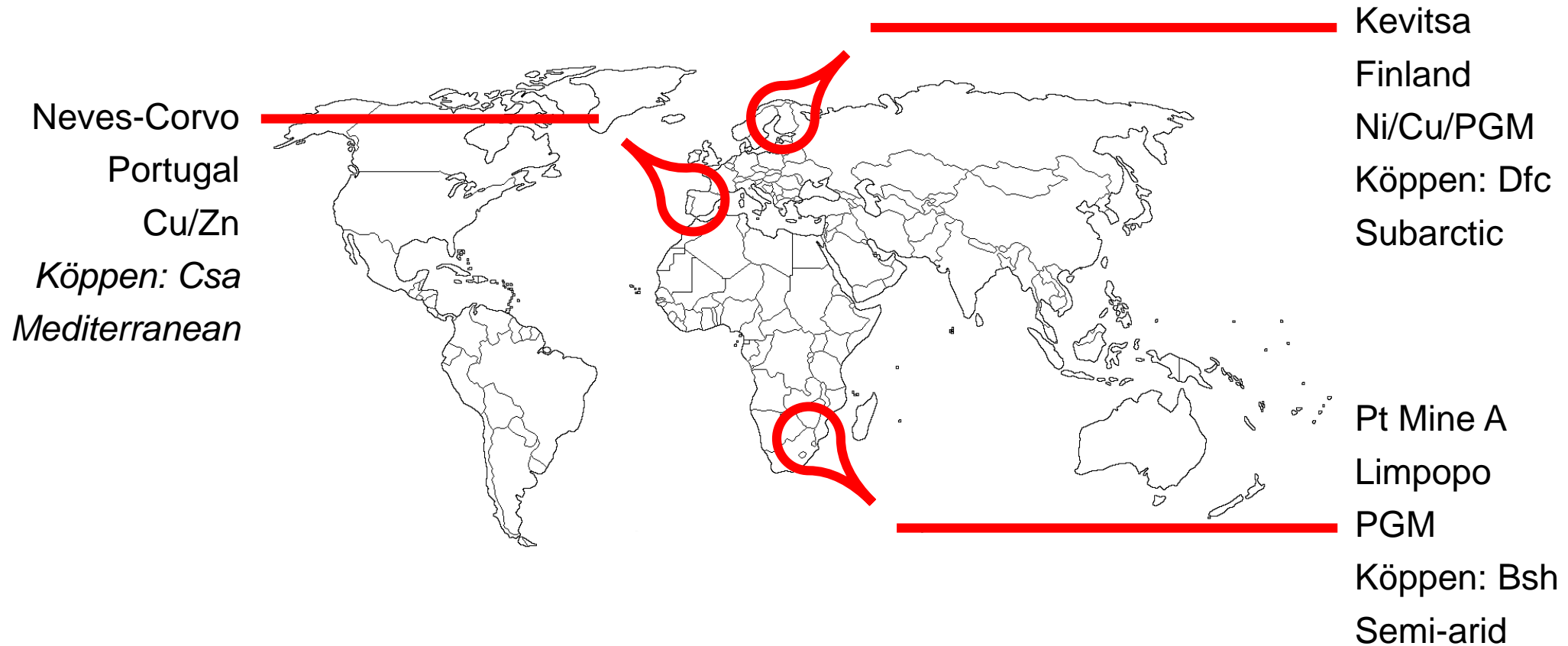
- EU Horizon2020 project
- 16 partners
- 3 mine case study sites
- Goals include increased water use efficiency and minimising environmental footprint



ITERAMS

Integrated mineral technologies for more sustainable raw material supply.

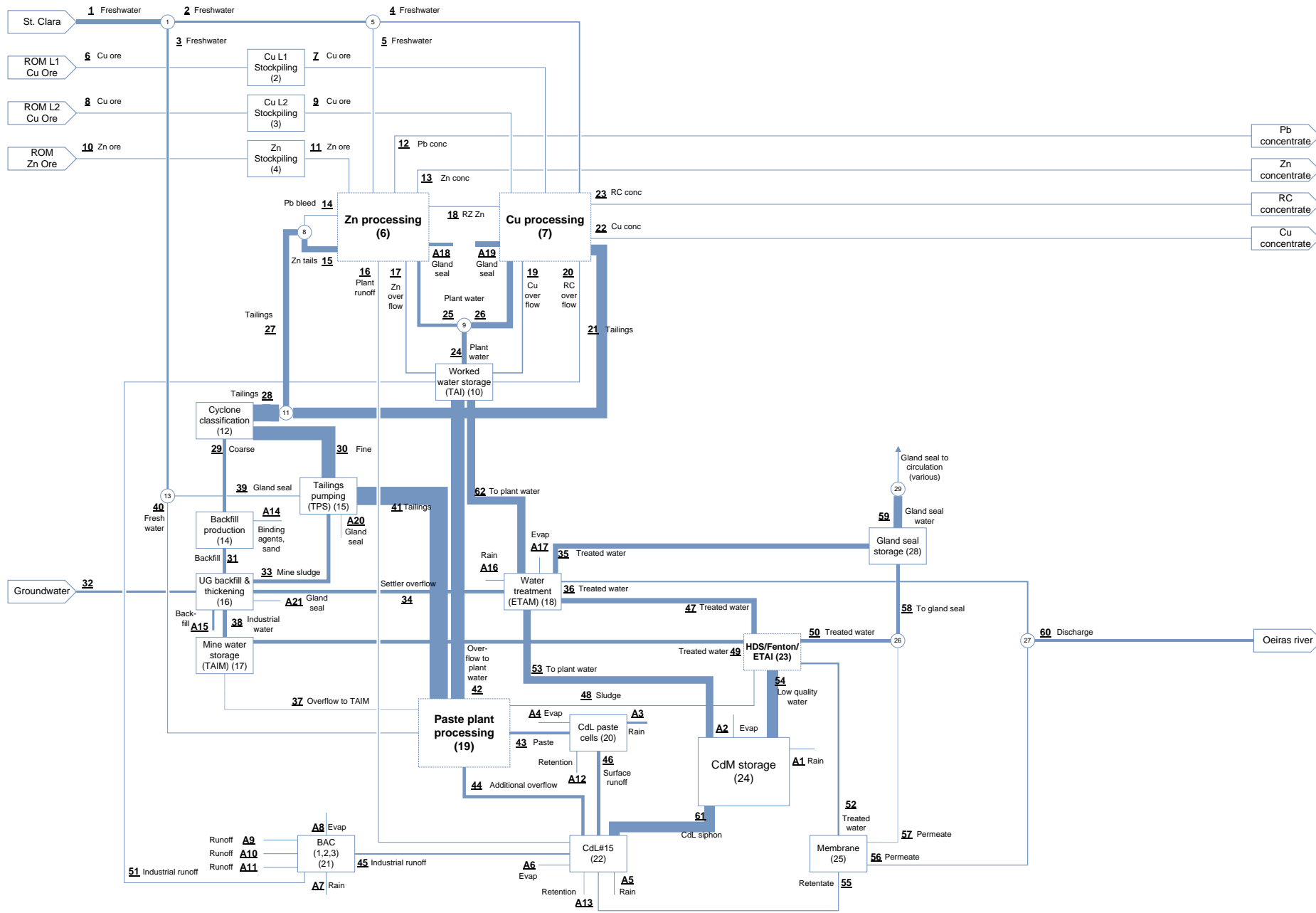
Case studies

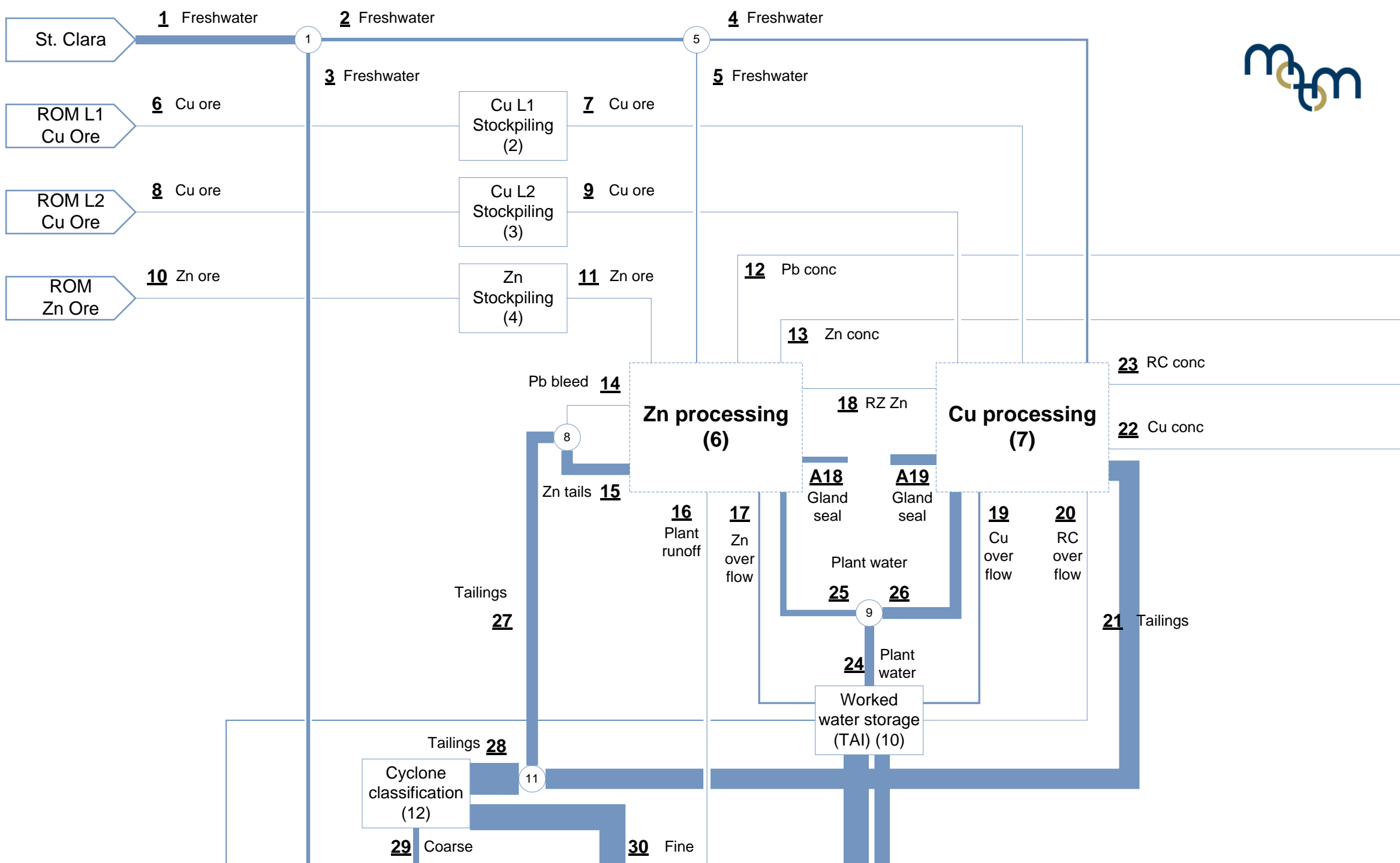


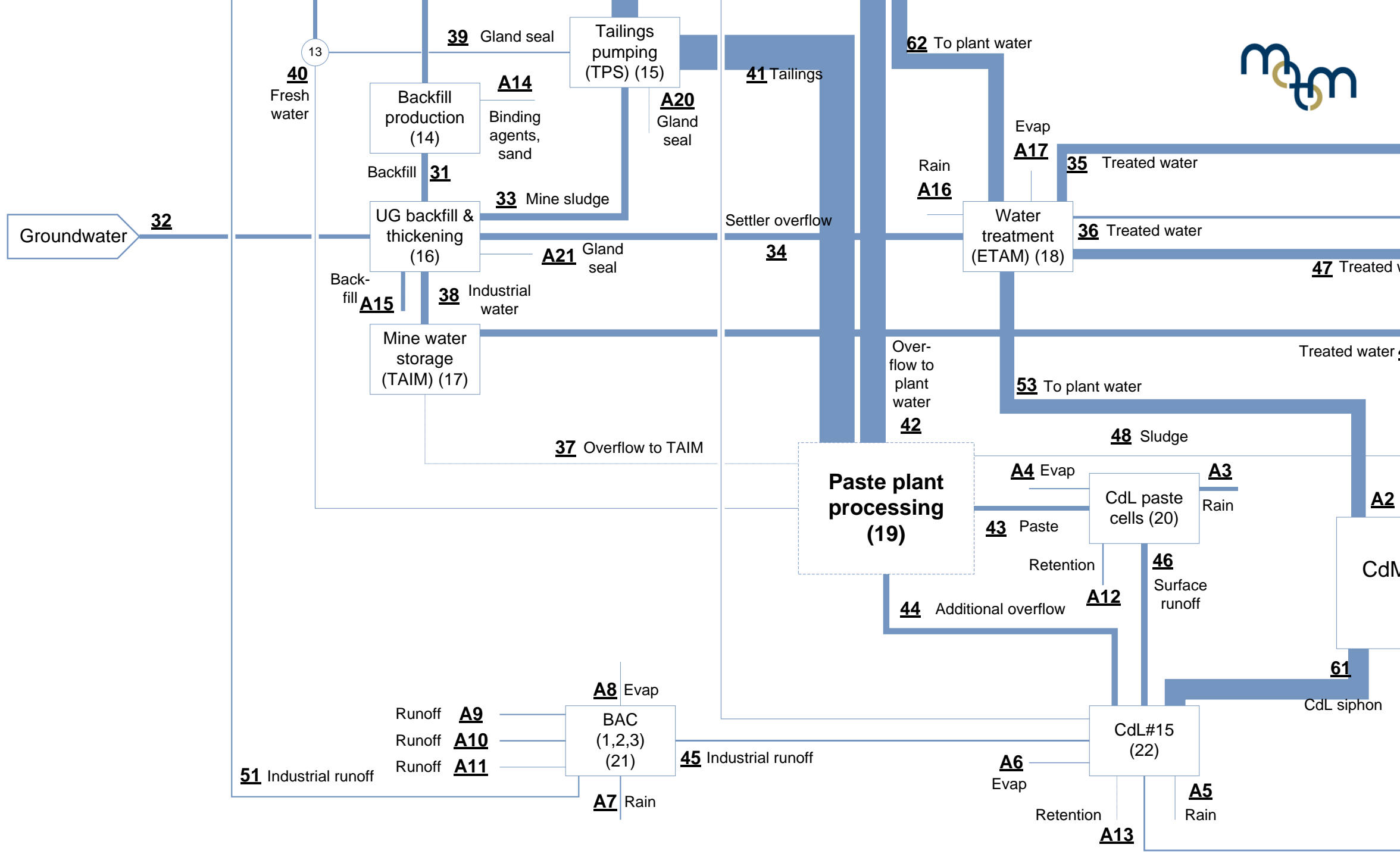
Preliminary results – water balance

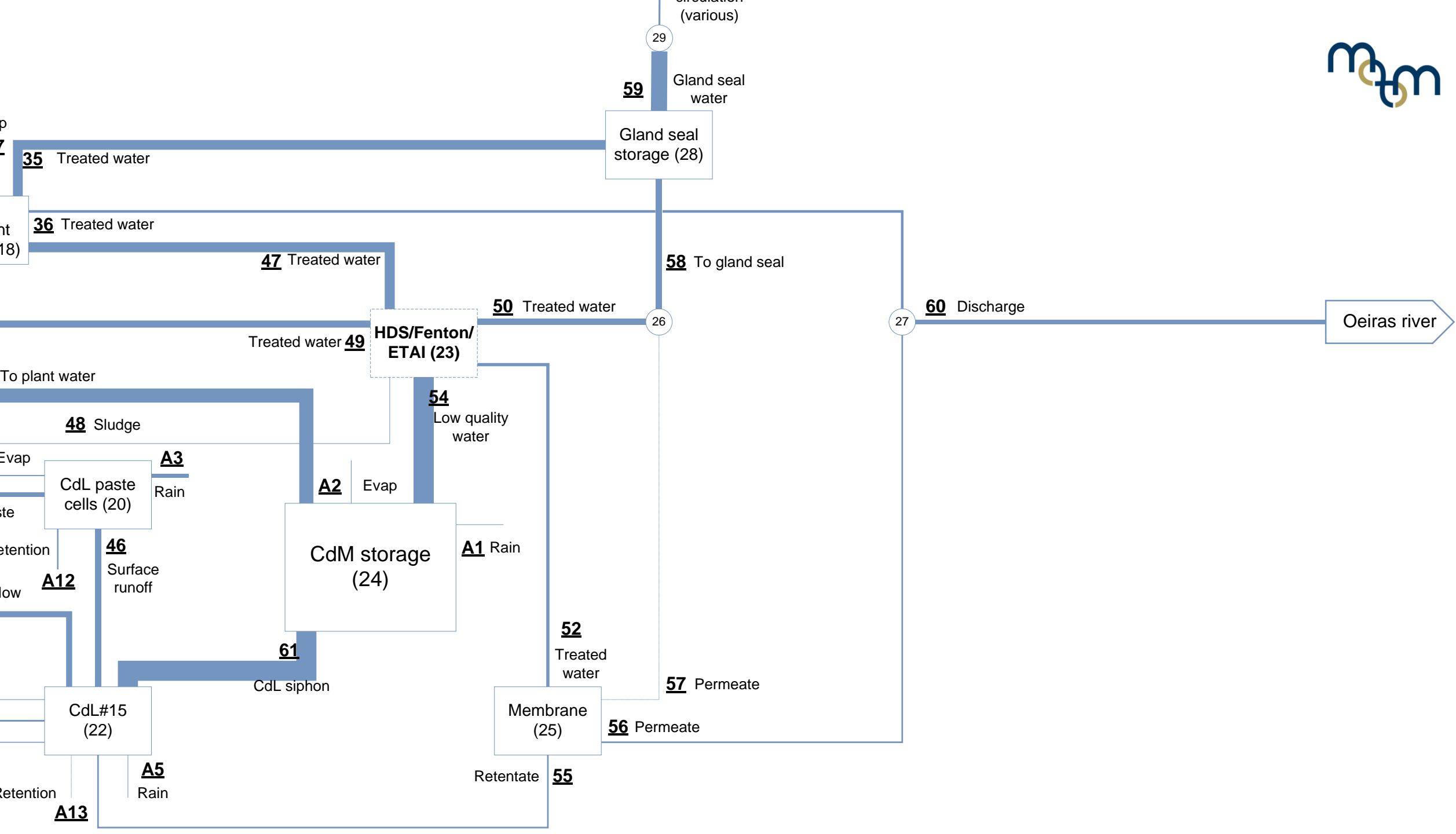


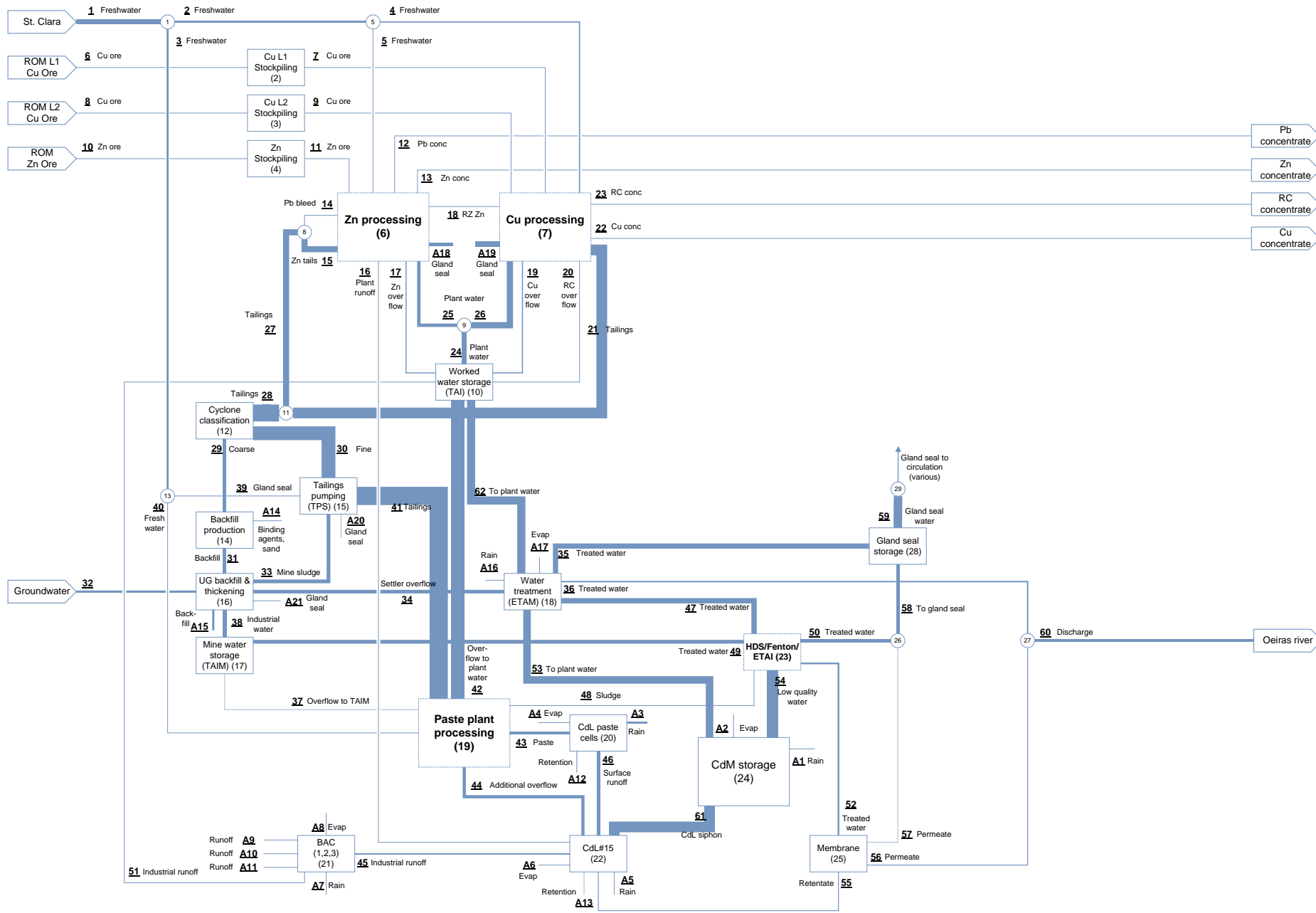
- Build model of process for mass balance (annual averages)
- Collate data from multiple sources (database)
 - Linking to model
- Using available data
 - Fill in data gaps where possible
 - Reconcile data not in agreement
 - Analyse data for trends and interpretation
 - Make assumptions
 - Iterate...
- Focus was on solids, water and pulp density











Lessons learnt so far



- Measurements can be misleading
 - Context is often required to adjudicate and ascertain value
- Normative choices affect the outcome
 - Assumptions, simplifications, estimations, abstractions
- Data management is key
 - Simply having raw data does not make them valuable or usable
- Quality of data matters
 - But there is room for interpretation
- Difficult to interpret data outside the context of a system model
 - Models are necessarily abstractions

- Design more robust modelling framework
 - Flowsheeting
 - Database/data handling
 - Mass balance framework
 - Data reconciliation
 - Predictive modelling (scenarios)
 - Dynamic modelling

References



- Azapagic, A. 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production*, 12(6):639-662.
- Côte, C.M., Kunz, N.C., Smith, K. and Moran, C.J. 2007. *Water issues and sustainable resource processing*. Brisbane, Australia: Centre for Water in the Minerals Industry.
- Côte, C.M., Moran, C.J., Hedemann, C.J. and Koch, C. 2010. Systems modelling for effective mine water management. *Environmental Modelling & Software*, 25(12):1664-1671.
- Danoucaras, A.N., Woodley, A.P. and Moran, C.J. 2014. The robustness of mine water accounting over a range of operating contexts and commodities. *Journal of Cleaner Production*, 84:727-735.
- Haggard, E.L., Sheridan, C.M. and Harding, K.G. 2015. Quantification of water usage at a South African platinum processing plant. *Water SA*, 41(2):279.
- Kunz, N.C. and Moran, C.J. 2016. The utility of a systems approach for managing strategic water risks at a mine site level. *Water Resources and Industry*, 13:1-6.
- Leong, S., Hazelton, J., Taplin, R., Timms, W. and Laurence, D. 2014. Mine site-level water reporting in the Macquarie and Lachlan catchments: a study of voluntary and mandatory disclosures and their value for community decision-making. *Journal of Cleaner Production*, 84:94-106.
- Liu, W., Moran, C.J. and Vink, S. 2011. Quantitative risk-based approach for improving water quality management in mining. *Environmental Science & Technology*, 45(17):7459-7464.
- Northey, S.A., Mudd, G.M., Saarivuori, E., Wessman-Jääskeläinen, H. and Haque, N. 2016. Water footprinting and mining: Where are the limitations and opportunities? *Journal of Cleaner Production*, 135:1098-1116.
- Reid, C., Bécaert, V., Aubertin, M., Rosenbaum, R.K. and Deschênes, L. 2009. Life cycle assessment of mine tailings management in Canada. *Journal of Cleaner Production*, 17(4):471-479.

Acknowledgements



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