

Eureka Resources, LLC - Marcellus Wastewater Treatment - Case Study

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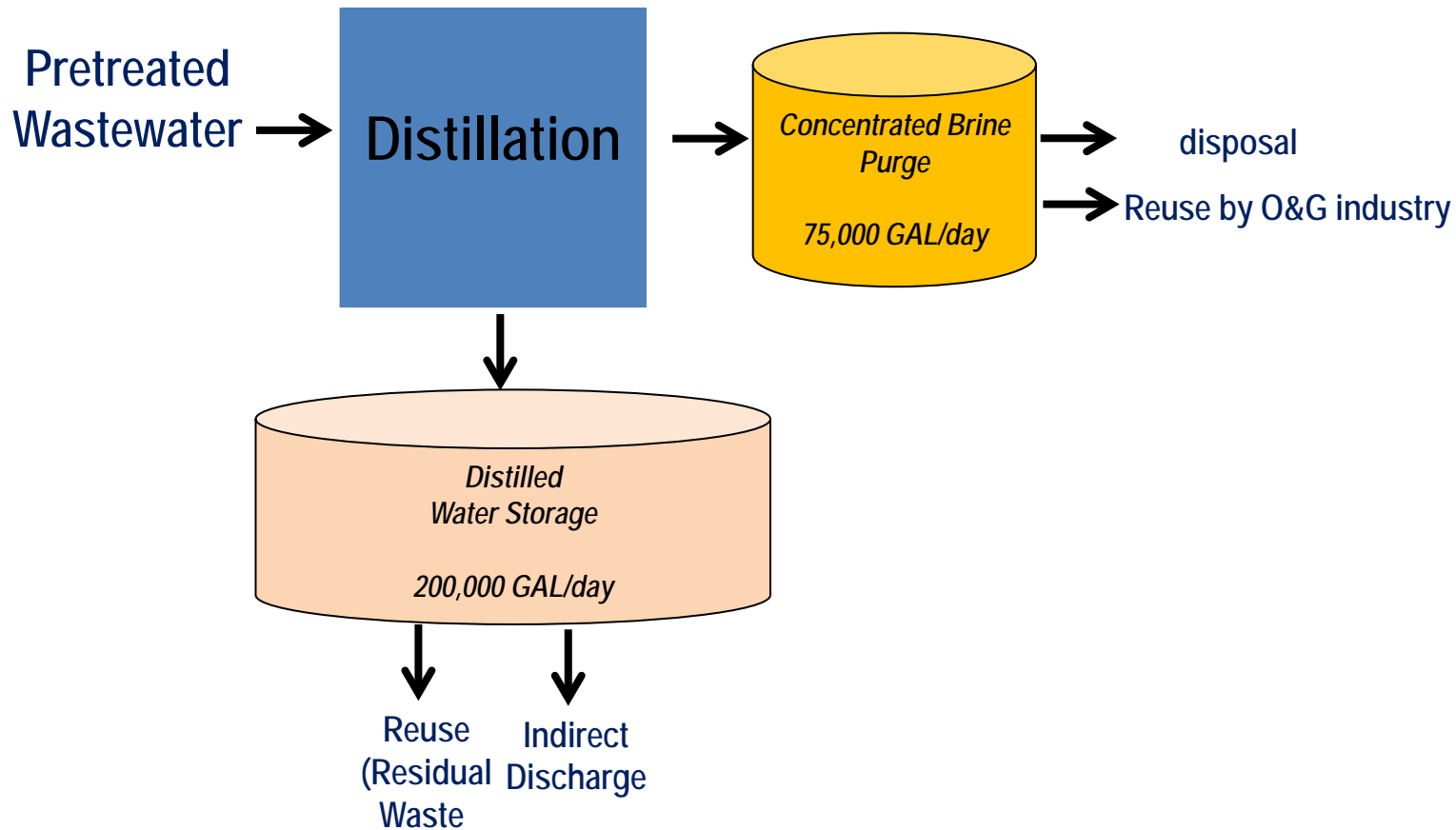
Eureka Resources – Centralized Treatment Approach

- Existing:
 - 420,000 GPD facility in Williamsport
 - Pre-treatment and distillation treatment
- Proposed Projects:
 - 2013 Expansion Projects
 - *Williamsport #2 – Reach Road*
 - *Bradford County (Standing Stone)*
 - Proposed construction of a new centralized plant in *Tioga County (Mansfield), PA*
 - Crystallization and dewatering capability can be applied to all locations.
 - UIC disposal well capability in OH.
 - Centralized treatment in OH.

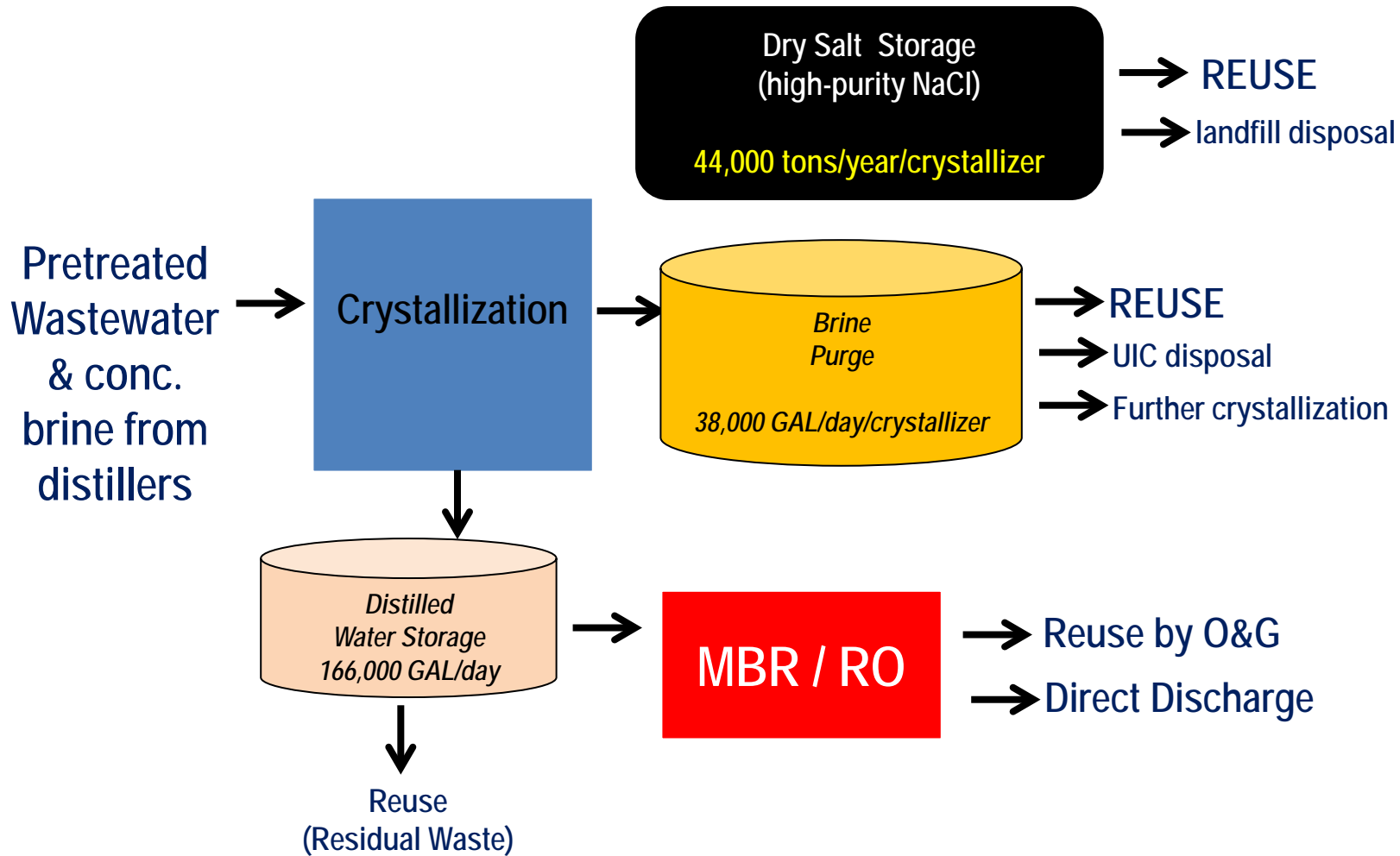
Eureka's Long-Term Business Plan For Maximizing Recycle and Protecting Water Quality

- Pretreatment (phys-chem) → *Blend w/fresh water for reuse.*
 - Secondary Treatment (Distillation and Crystallization)
 - *Blend w/fresh water for reuse*
 - *POTW indirect discharge*
 - *Concentrated brine reused as cold-weather drilling fluid*
 - Tertiary Treatment (Biological/RO)
 - *Unrestricted storage and reuse options*
 - *Direct discharge*
- Advanced brine management (crystallizer)*
- *Additional distilled water.*
 - *Purge brine for reuse*
 - *Salts for reuse.*

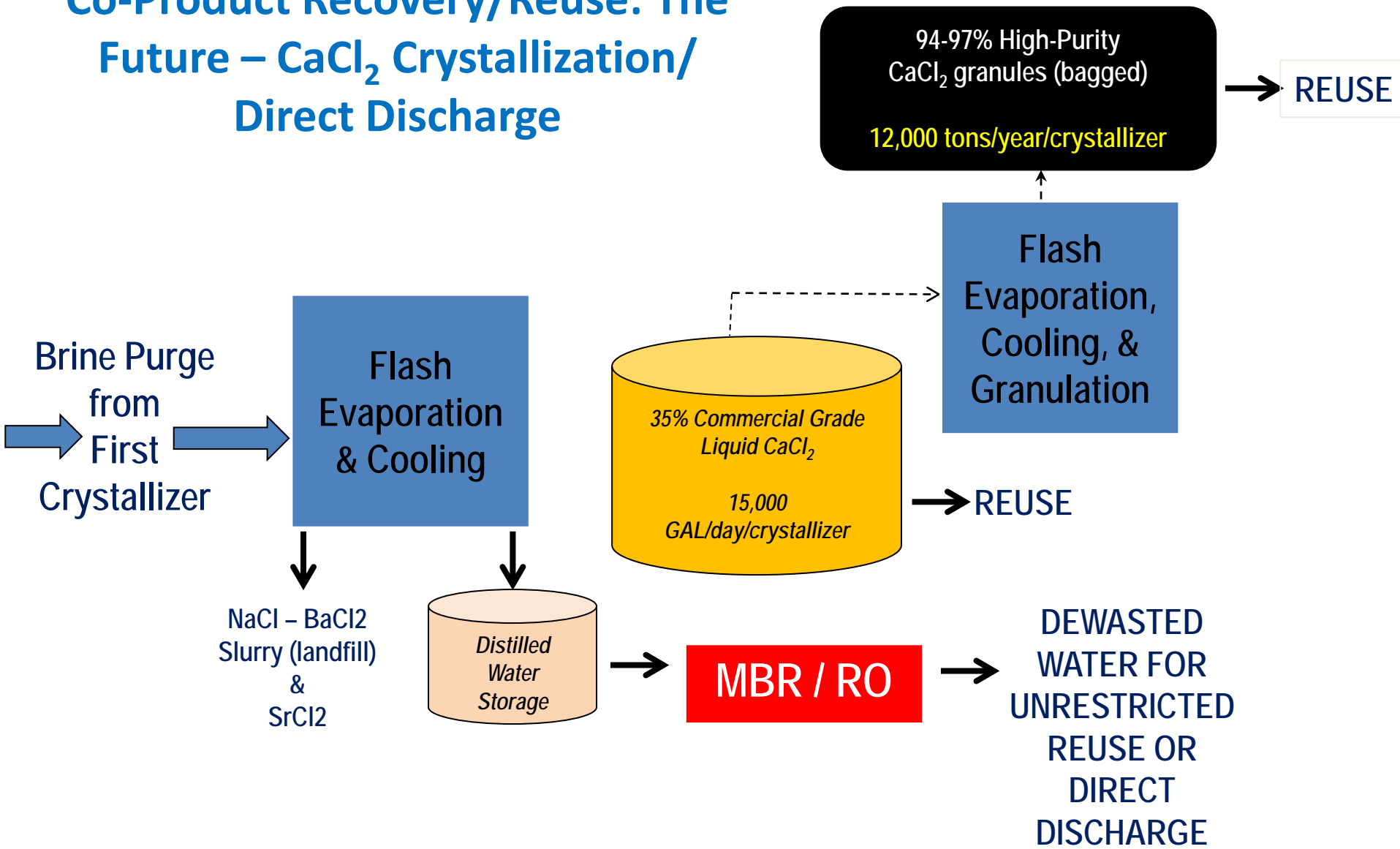
Reuse: The Present – Distillation



Co-Product Recovery/Reuse: The Future – NaCl Crystallization/Direct Discharge



Co-Product Recovery/Reuse: The Future – CaCl_2 Crystallization/ Direct Discharge



Membrane Biological Reactor (MBR)/Reverse Osmosis (RO) Treatment

- Successful 6-month pilot study
- Patent pending
- Target effluent equivalent to WMGR123 standards for declassification (dewasting)
- Allows unrestricted reuse and direct discharge

Co-Product Reuse Studies

- Initial characterization - completed
- Prepare work plan for characterization of commercial road salt, sodium chloride (NaCl) and calcium chloride (CaCl₂) – for review by PaDEP
- Collect and analyze samples – samples collected and at laboratory
- Prepare co-product determination (beneficial reuse under 25 PA Code Parts 287.1 and 287.8) for submission to PaDEP
- Initiate PaDOT pilot study – winter 2013-2014