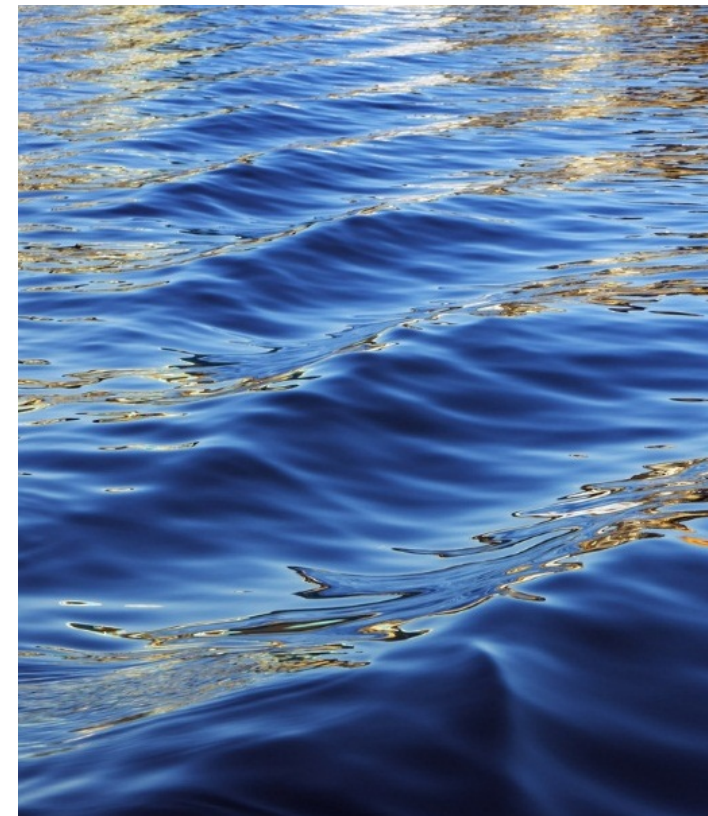




Downstream Oil and Gas Water Reuse

June 24, 2015



About WateReuse

The WateReuse Association educates the public on the importance of reusing water and advocates for policy, laws and funding to increase water reuse in communities across the United States.

For more information, visit:

www.watereuse.org



Industrial Reuse Committee

Helping industry, utility and water reuse professionals create sustainable industrial water supply solutions

- Cooling
- Manufacturing
- Internal Reuse
- Food Processing
- High Purity Applications

Eric Rosenblum, Co-Chair
Enivrospectives

Jon Freedman, Co-Chair
GE Water & Process Technologies

Elise Goldman, Incoming Co-Chair
West Basin Municipal Water District

Andrew Shea, Incoming Co-Chair
HDR

A Few Notes Before We Start...

- Today's webcast will be 75 minutes.
- There is one Professional Development Hour available.
- A PDF of today's presentation can be downloaded when you complete the survey at the conclusion of this webcast.
- Links to view the recording and to download the presentation will also be emailed later.
- If you have questions for the presenters please send a message by typing it into the chat box located on the panel on the left side of your screen.
- If you would like to enlarge your view of the slides, please click the Full Screen button in the upper right corner of the window. To use the chat box, you must exit full screen.

Today's Presenters



Alice Towey

Civil Engineer in the East Bay Municipal Utility
District's Water Resources Planning Division

Lily S. Baldwin

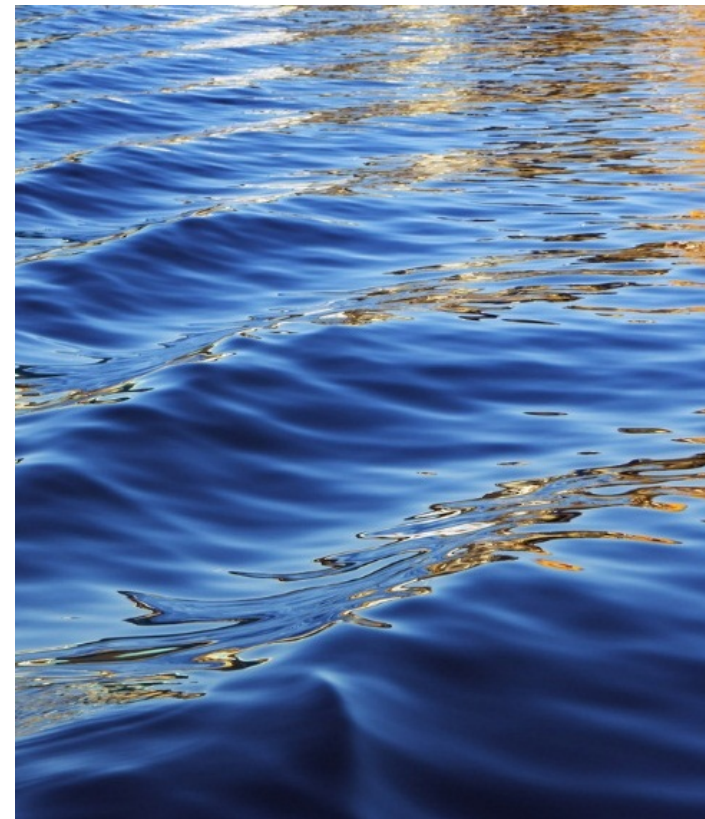
Technical Team Lead in the Environmental Unit
of Chevron Energy Technology Company





Chevron Water Reuse Framework

Lily S. Baldwin, P.E., Chevron Energy Technology Company



Overview

- Chevron's Corporate Integrated Water Management Framework
- Freshwater Position Statement
- Environmental Performance around Water Use
- Business Drivers
- Assessment and Management Practices
- Water Reuse Examples – Global Manufacturing



Operational Excellence and our Environmental Principles

- 
- *Include the environment in decision making*
 - *Reduce our environmental footprint*
 - *Operate responsibly*
 - *Steward our sites*

Corporate Environmental Aspects



1. Accidental Releases Management
2. Air Emissions Management
3. Energy Efficiency and Greenhouse Gas Management
4. *Natural Resources Management*
5. Site Residual Impact Management
6. Waste Management
7. *Wastewater Management*

Freshwater Position Statement

Protecting people and the environment is a core value at Chevron. We are committed to managing our use of freshwater through resource conservation, focusing on the social and environmental impacts of our operations as well as engaging with communities and other stakeholders.



Freshwater Position Statement

With respect to freshwater, Chevron strives to:

- Continually improve environmental performance and reduce impacts from our operations
- Integrate freshwater conservation and efficiency drivers into our business decision-making processes and operational management
- Conserve our use of freshwater in freshwater-constrained areas by reusing and recycling water and reducing the amount used



Freshwater Position Statement



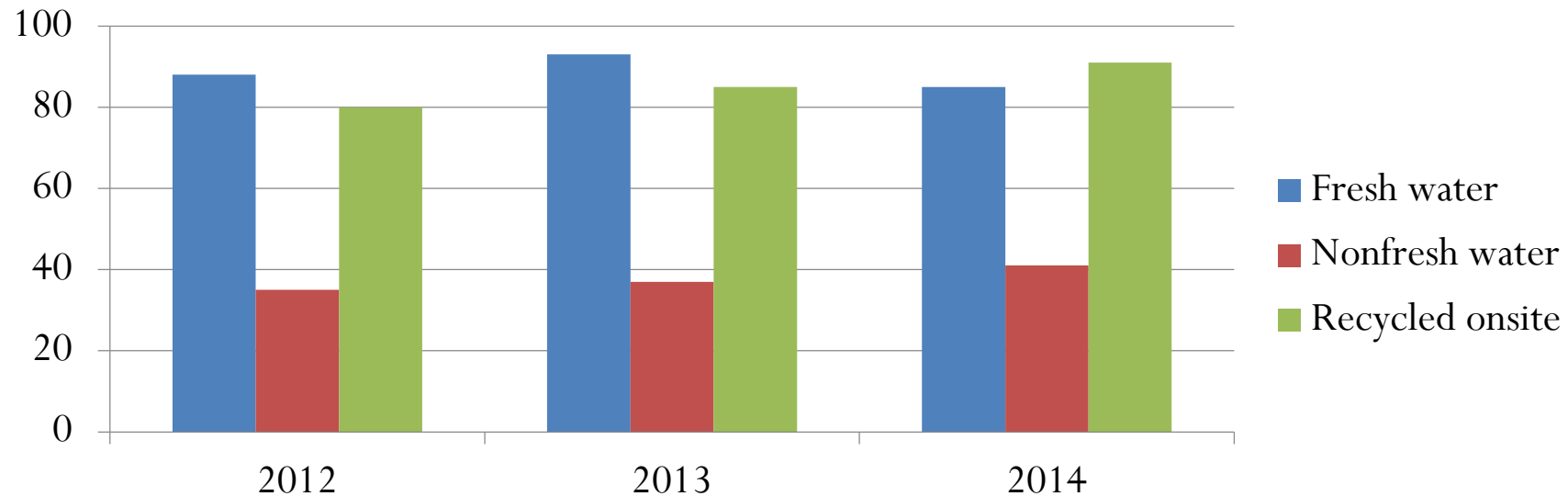
With respect to freshwater, Chevron strives to:

- Account for the use of freshwater in our operations with appropriate metrics.
- Engage with governments, partners, local communities and other stakeholders on significant freshwater resource issues in areas where we operate
- Build partnerships and participate in industry initiatives to share and promote best practices, assist with the development of industry standards, and shape and influence relevant freshwater resource policy



Environmental Performance

	2012	2013	2014
Fresh water withdrawn (million metric tons)	88	93	85
Non-fresh water withdrawn (million metric tons)	35	37	41
Water recycled for use onsite (million metric tons)	80	85	91

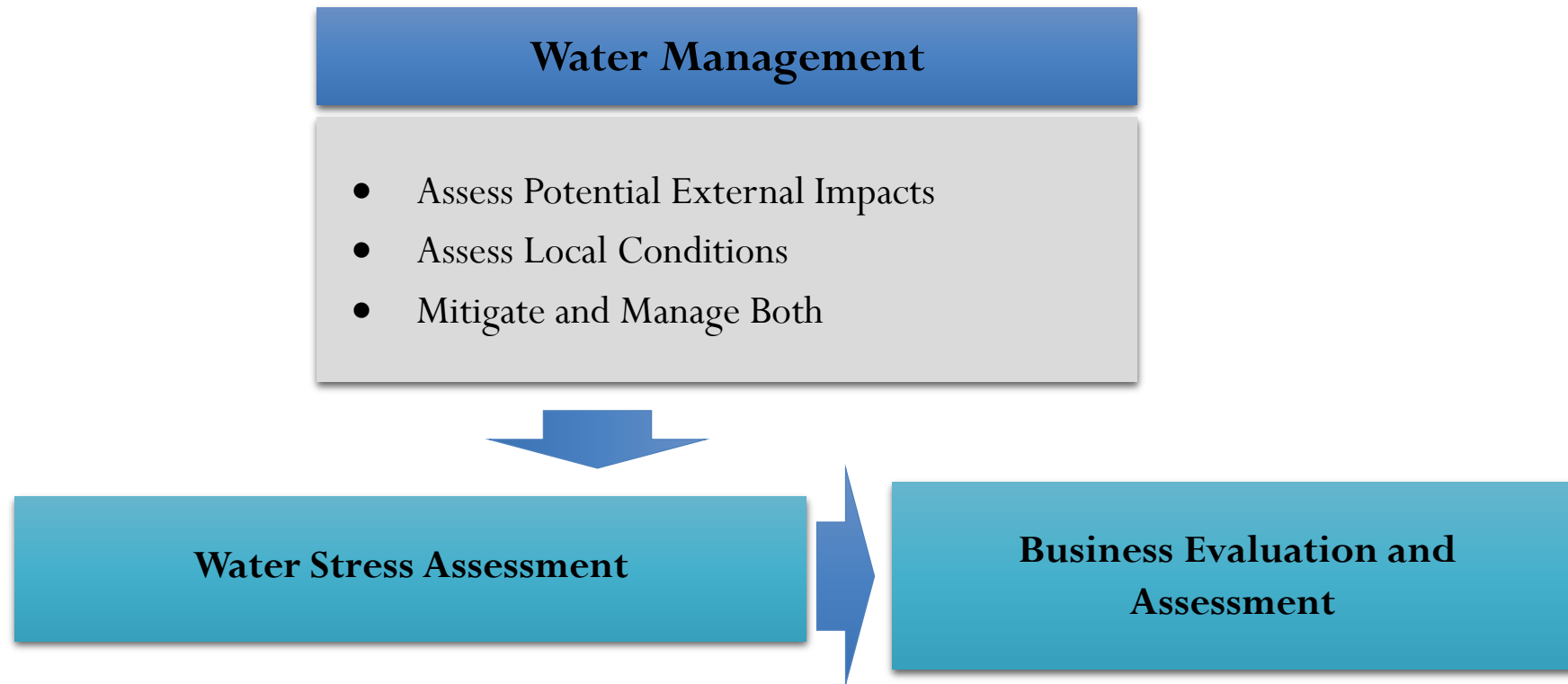


Business Drivers

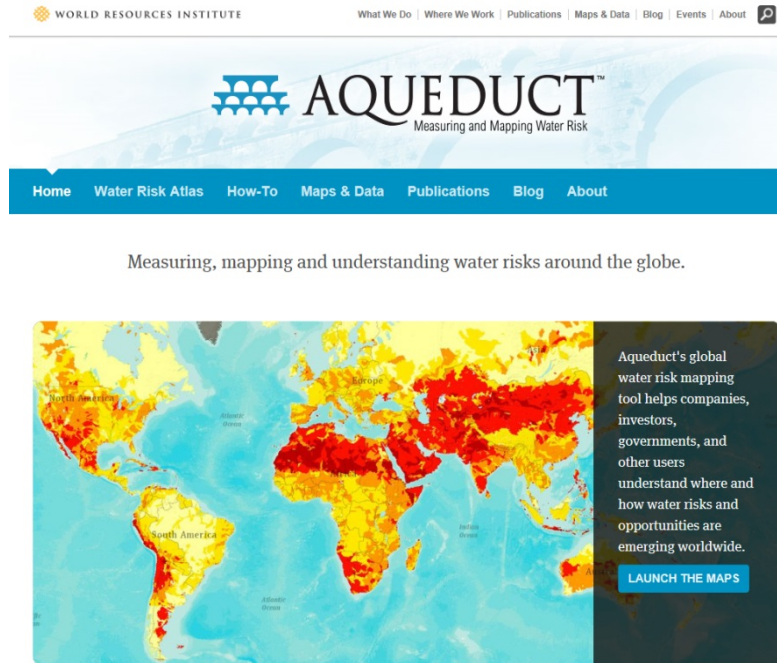
- Maintain our **license to operate** and be **partner of choice** around the world
- **Reduce our potential liability, impacts and cost** over the near and long term
- Improve our ability to **manage for the future** and make more informed decisions



Corporate Integrated Water Management Framework



Assessing Potential External Impacts



<http://www.wri.org/our-work/project/aqueduct>



<http://www.ipieca.org/publication/global-water-tool-oil-and-gas>

Use publicly available mapping tools to evaluate potential external impacts to a Business Unit's ability to obtain water for operations. Includes social, regulatory and environmental conditions.

Assessing Local Conditions



http://www.gemi.org/localwatertool/?_ga=1.31532283.474941746.1432759656

Local Evaluation and Assessment includes consideration of:

- *Federal, State/Regional and Local Regulation*
- *Local business objectives*
- *Local targets/goals*
- *Stakeholder issues*

Global Manufacturing Examples of Water Reuse

*El Segundo Refinery uses
47 % non-fresh water
28 % fresh water*



*Cape Town Refinery uses
44 % non-fresh water
35 % fresh water*



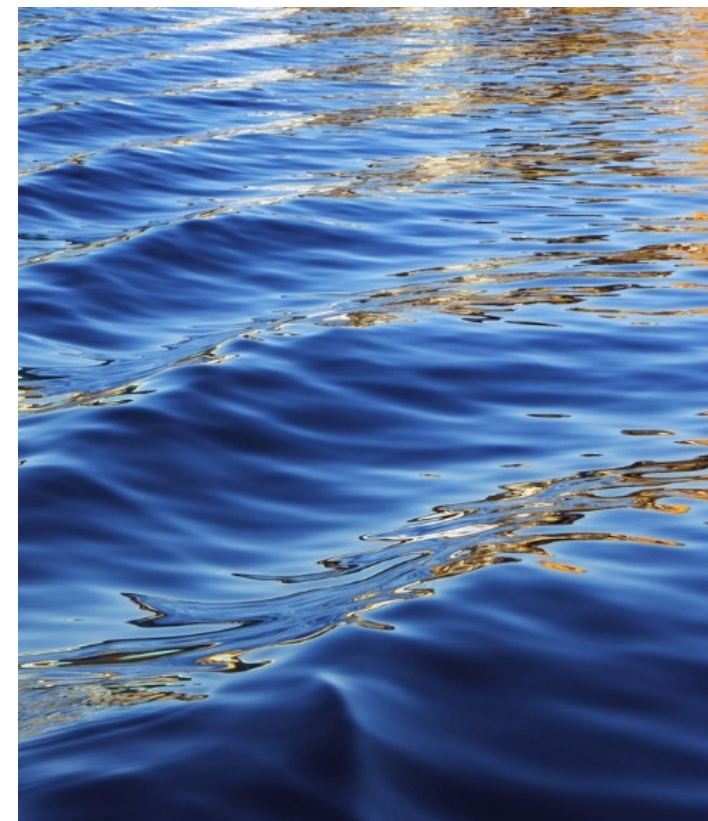
*Richmond Refinery uses
56 % non-fresh water
42% fresh water*





EBMUD and Chevron: A Public-Private Partnership to Conserve Water

Alice Towey, East Bay Municipal Utility District



EBMUD-Chevron Water Recycling

- Background on EBMUD
- EBMUD-Chevron Recycled Water Projects
- Partnership with Chevron
- Future Phases

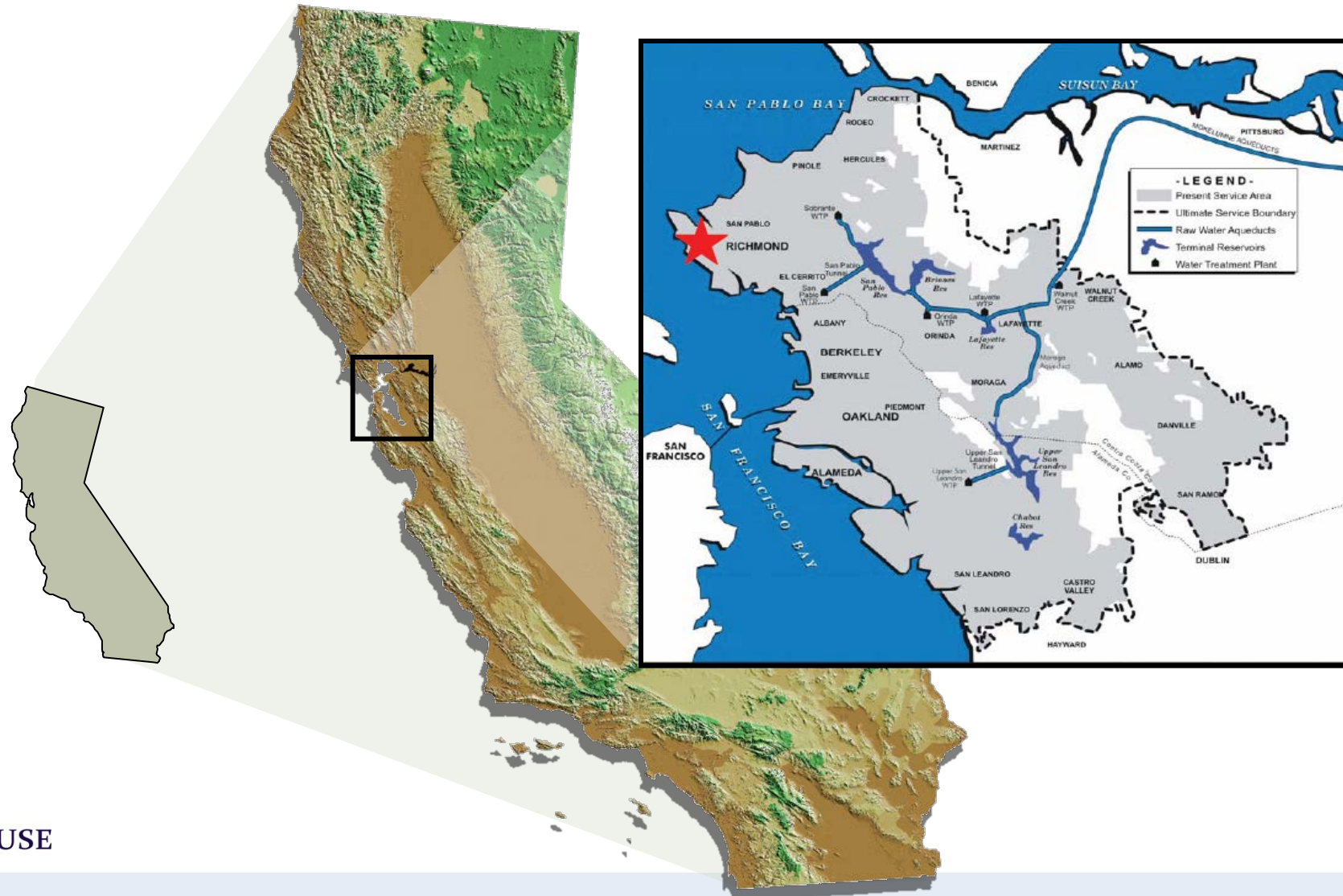


EBMUD-Chevron Water Recycling

- **Background on EBMUD**
- EBMUD-Chevron Recycled Water Projects
- Partnership with Chevron
- Future Phases

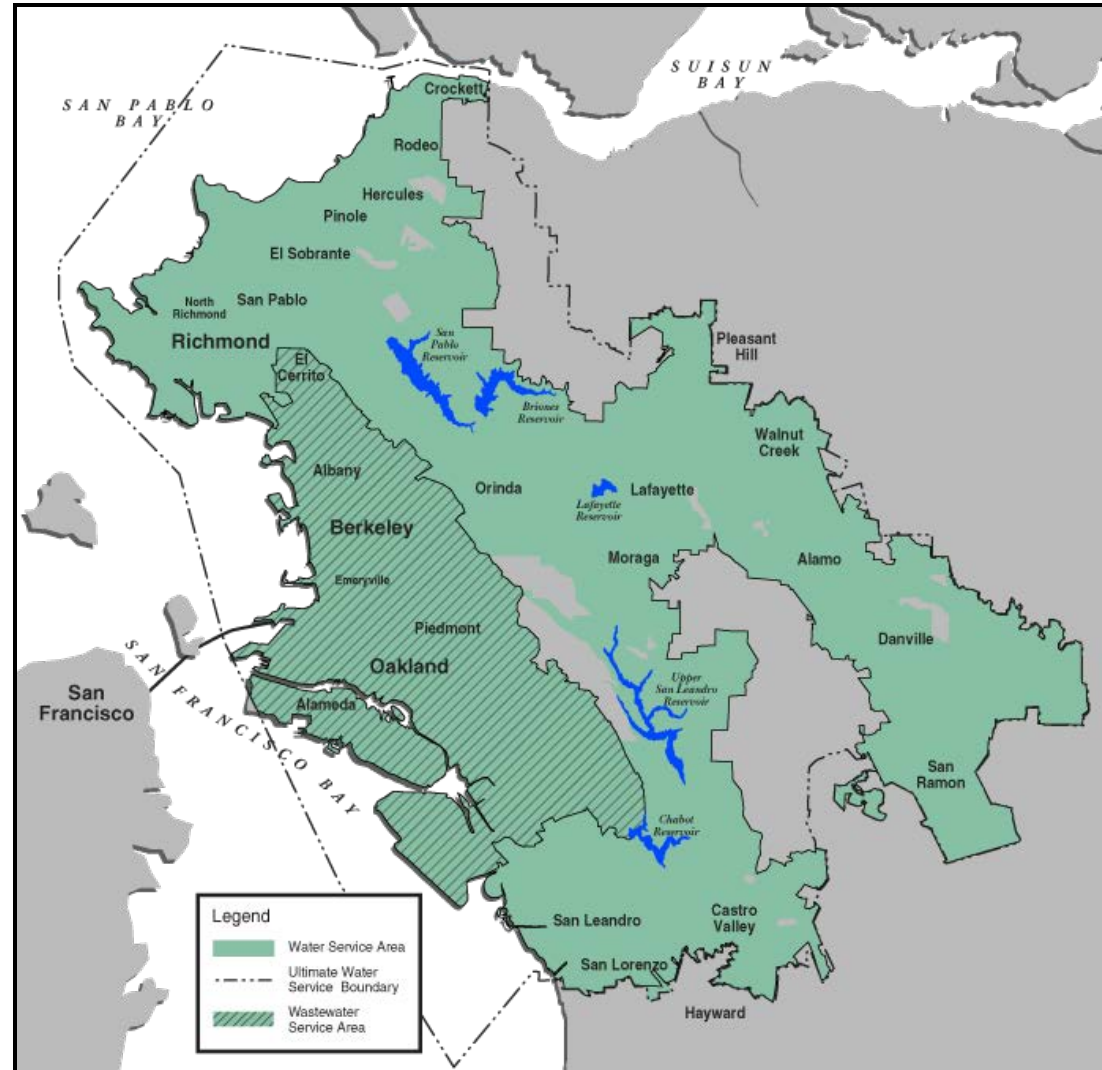


The East Bay Municipal Utility District



EBMUD Service Area

- About 1.3 million potable water customers
- About 640,000 wastewater treatment customers
- Potable water service area is much larger than wastewater treatment service area



EBMUD Recycled Water Program

- EBMUD initiated its recycled water program in the 1970s
- In 1984, EBMUD began supplying recycled water to its first commercial customer, the Richmond Country Club
- EBMUD's current goal is to deliver 20 MGD of recycled water by the year 2040
- EBMUD partners with other wastewater treatment agencies to make recycled water more available throughout its service area



EBMUD-Chevron Water Recycling

- Background on EBMUD
- **EBMUD-Chevron Recycled Water Projects**
- Partnership with Chevron
- Future Phases



Chevron Richmond Refinery

- One of EBMUD's largest water customer
- Conveniently located two miles from West County Wastewater District (WCWD)
- Industrial water uses include cooling systems and boiler feed water
- Currently two recycled water projects:
 - North Richmond Water Recycling Plant
 - Richmond Advanced Recycled Expansion (RARE) Water Project
- Both plants are operated and maintained by EBMUD



North Richmond Water Recycling Plant

- EBMUD's first industrial recycled water project; came online in 1996
- Designed to provide recycled water for refinery cooling systems
- Treatment includes flocculation with caustic soda, slow sand filtration, and chlorine disinfection
- Delivers approximately 4 MGD



RARE Water Project

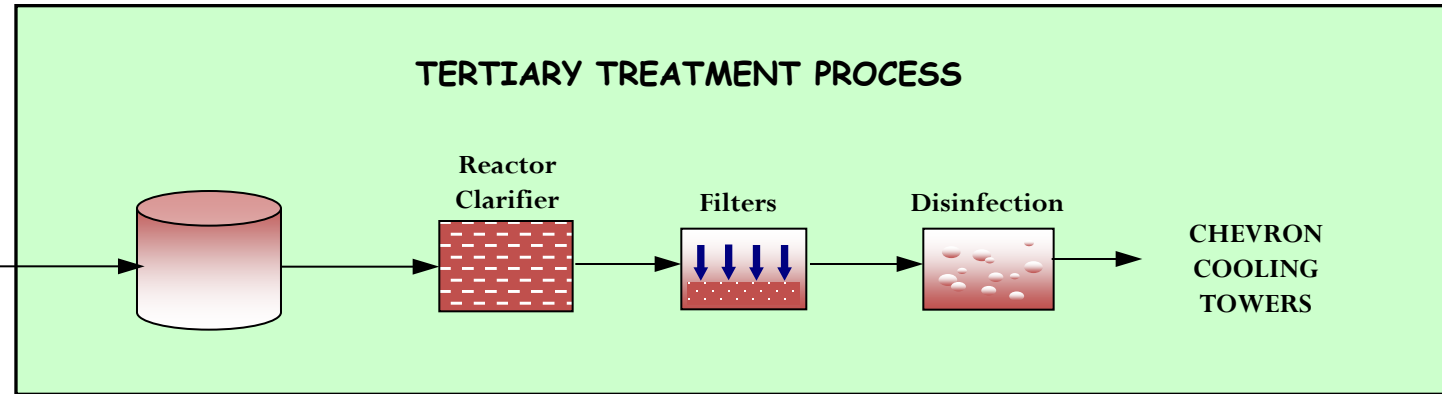
- Came online in 2010
- Provides high purity water for refinery boilers
- Microfiltration and reverse osmosis treatment
- Located within the refinery, but operated and maintained by EBMUD
- Currently sized to provide up to 3.5 MGD



Treatment Process Comparison

WEST COUNTY
WASTEWATER
DISTRICT
SECONDARY
EFFLUENT

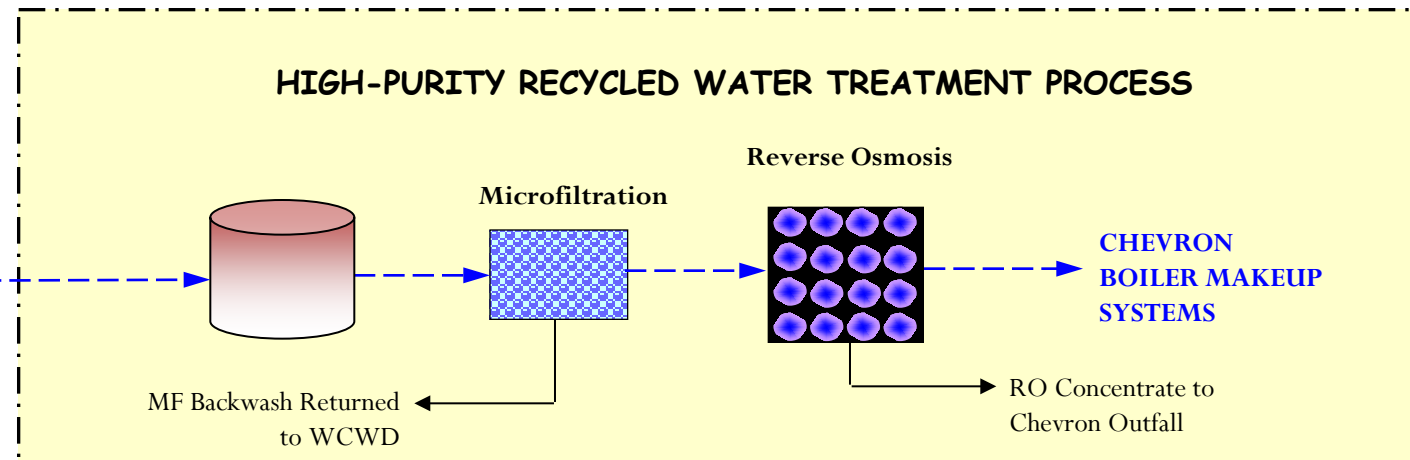
TERTIARY TREATMENT PROCESS



NORTH RICHMOND WATER RECLAMATION PLANT

SAN
FRANCISCO
BAY

HIGH-PURITY RECYCLED WATER TREATMENT PROCESS



RARE WATER PROJECT

EBMUD-Chevron Water Recycling

- Background on EBMUD
- EBMUD-Chevron Recycled Water Projects
- **Partnership with Chevron**
- Future Phases



How to Make Recycled Water Attractive to Industrial Partners

- Drought-resistant water supply that is not subject to water use restrictions
- Water quality can be tailored to meet specific industry needs
- Increased integration of operations
- Can be made cost effective compared to potable water
 - No drought surcharges
 - Different financing options



Partnership Benefits for EBMUD

- Recycled water projects diversify the overall water supply portfolio
- Chevron's use of recycled water frees up potable water to benefit all EBMUD customers
- These projects allow us to provide the right water for the right purpose; conservation of limited fresh water supplies during droughts
- Partnership with industry can make projects cost effective



RARE Project Financing

- Chevron reimburses EBMUD for all capital, operating, and maintenance costs
- Chevron does not pay a volumetric rate for the water
- EBMUD provides 99.5% guaranteed supply availability



Project Coordination

- The key to success: coordination at *all* levels
- Weekly meetings during construction
- Joint development of Operations Coordination Plan
- Regular operations coordination meetings
- Daily communication between Chevron and EBMUD operators



Partnering for Success

- Developing a “win-win” project required understanding of the other party’s goals, concerns, and operational constraints
- Different corporate cultures
- Employee turnover and transition
- Importance of communications and coordination at all levels



EBMUD-Chevron Water Recycling

- Background on EBMUD
- EBMUD-Chevron Recycled Water Projects
- Partnership with Chevron
- **Future Phases**



Richmond Refinery Recycled Water Feasibility Study

- Goals:
 - To explore possibilities for expanding recycled water production at RARE and/or North Richmond projects
 - To evaluate options for improving reliability and recycled water quality at North Richmond
- Evaluate use of Chevron's process wastewater effluent as an additional source for RARE
- Study initiated in 2014



Potential Future Phases

RARE Water Project

- Increase capacity from 3.5 to 4.0 MGD by installing additional MF modules
- Increase capacity to 5.0 MGD (buildout)
- Use of Chevron wastewater effluent may require additional/separate treatment train

North Richmond

- Increase capacity to 5.0 MGD to supply additional Chevron cooling tower
- Upgrades to improve reliability and water quality
- May depend on ability to use Chevron effluent at RARE, thereby freeing up additional WCWD effluent for North Richmond





Alice Towey

East Bay Municipal Utility District
atowey@ebmud.com



Lily S. Baldwin

Chevron Energy Technology Company
LilySBaldwin@chevron.com

Type Your Questions in the Chat Box

A survey will appear in this window at the conclusion of this webcast

