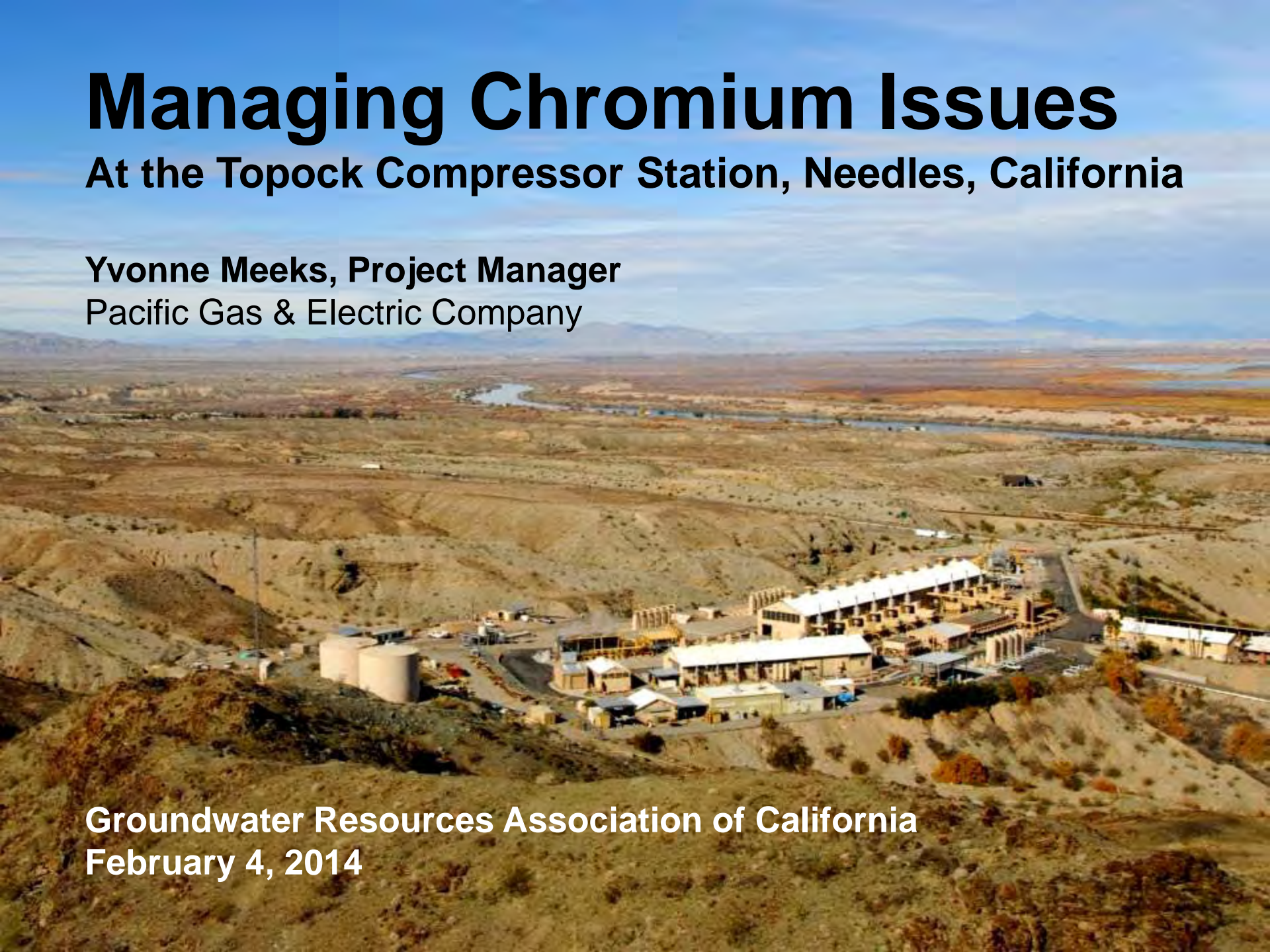


Managing Chromium Issues

At the Topock Compressor Station, Needles, California

Yvonne Meeks, Project Manager
Pacific Gas & Electric Company

Groundwater Resources Association of California
February 4, 2014





- 112 miles south of Las Vegas, NV
- 15 miles southeast of Needles, CA
- Adjacent to I-40 and Colorado River
- Owned / operated by PG&E since 1951

Environmental Program Goals

- Protect human health
- Prevent impacts to the Colorado River
- Remediate soil and groundwater
- Protect cultural and biological resources

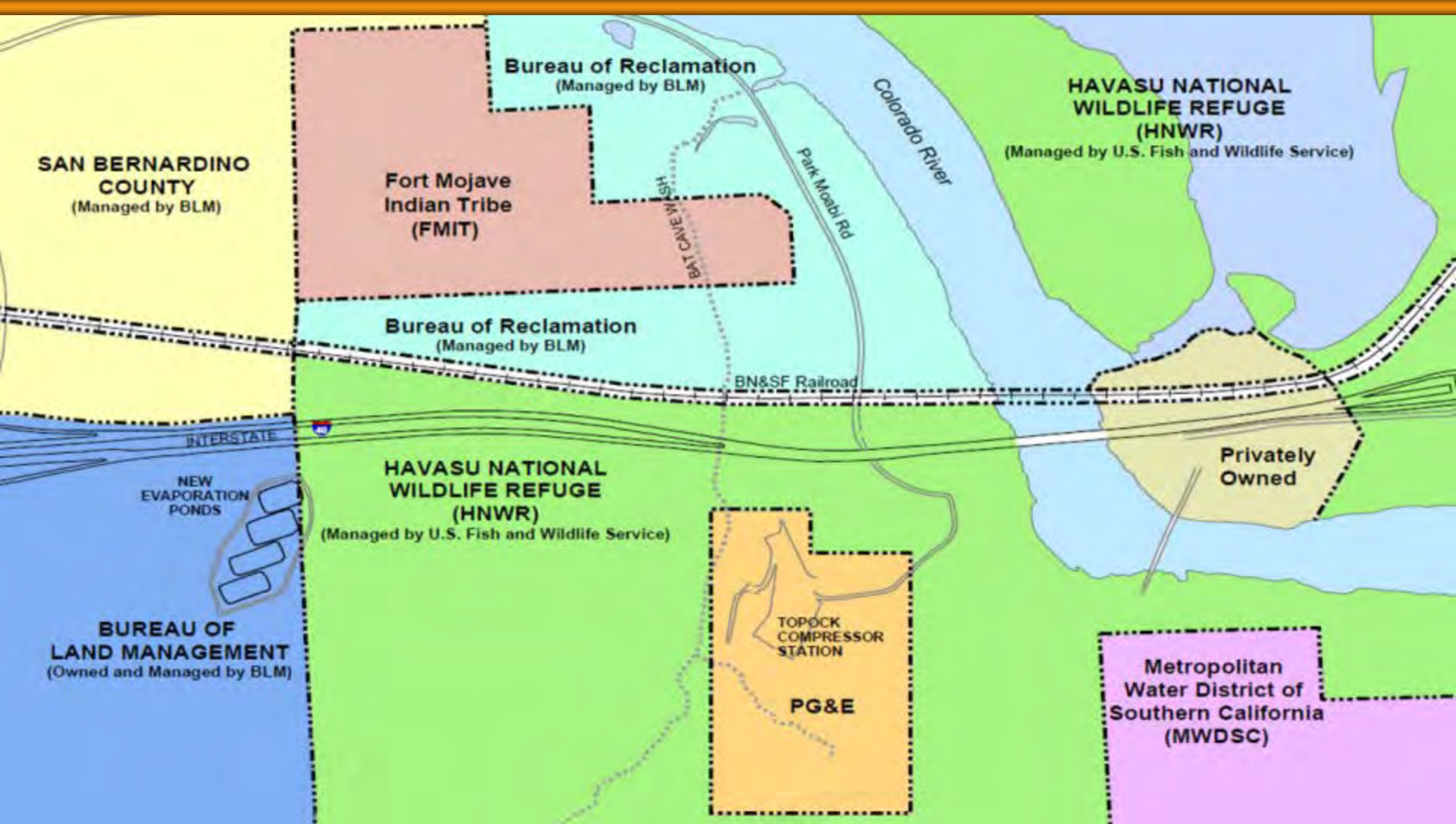


Complex Regulatory Setting

Multiple jurisdictions (RCRA, CERCLA, CEQA, others)
Multiple Tribal Governments and stakeholders



Complex Location and Setting



Complex Environmental Setting



Historical Use of Chromium



- Additive containing chromium was used to prevent corrosion
- Historically, cooling water was discharged to unlined ponds
- Standard practice of the day
- Resulted in contamination of groundwater with hexavalent chromium

No Chromium Detected in Surface Water, Pore Water or Sediment



Groundwater Plume

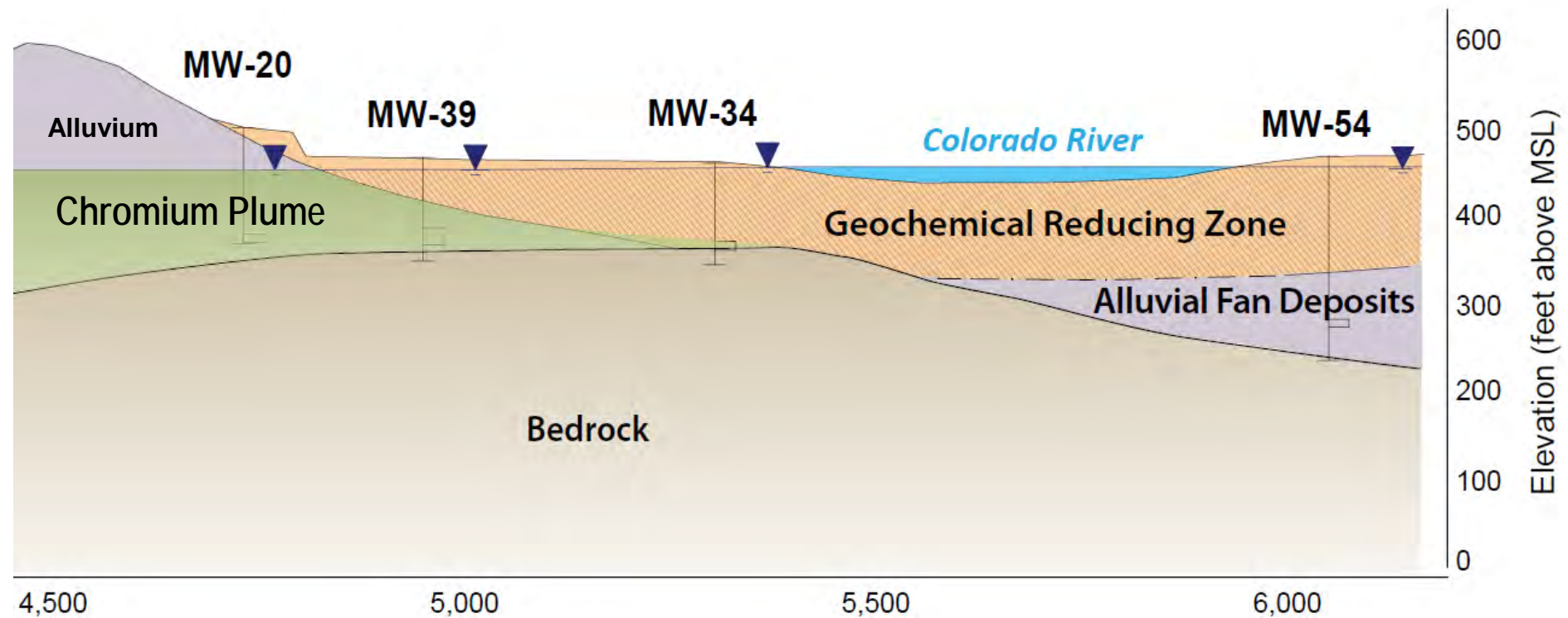
- Primarily hexavalent chromium at concentrations up to 22,000 $\mu\text{g/L}$
- 32 $\mu\text{g/L}$ is background and cleanup goal
- Found at depths ranging from ~28 to 135 ft below ground and extending over an area of ~150 acres
- Groundwater very slow moving downgradient from source area



Site View from Southeast



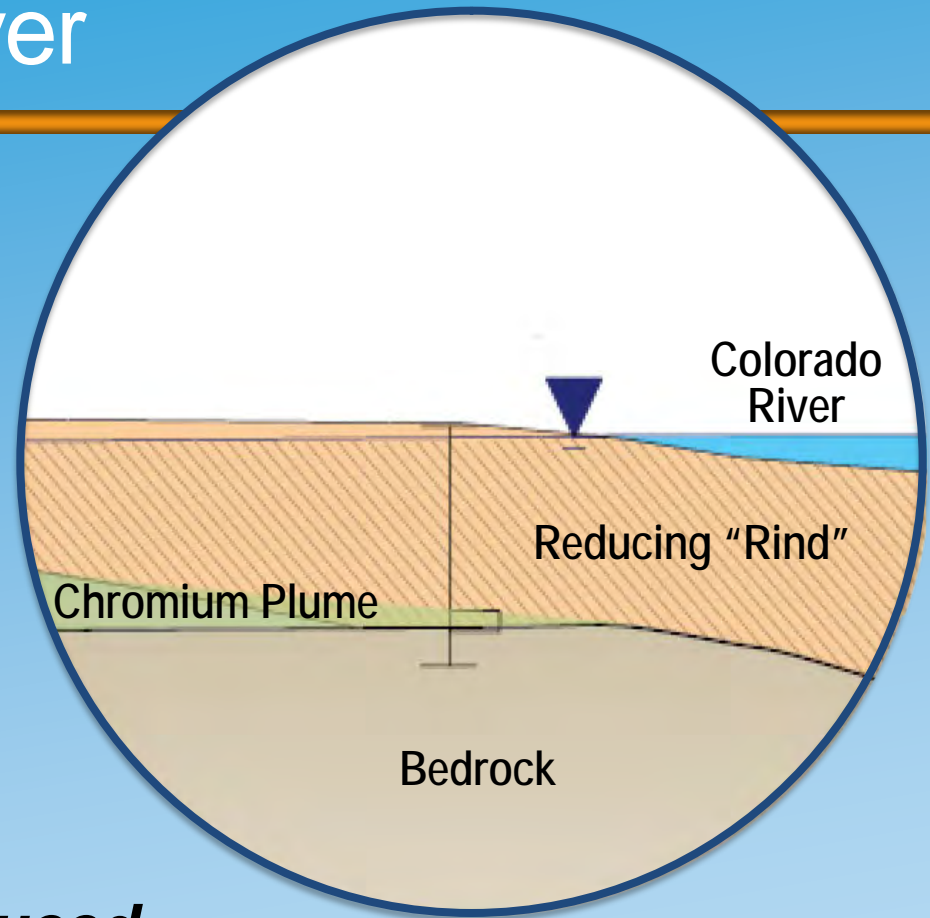
Reducing Zone “Rind” Beneath the Colorado River



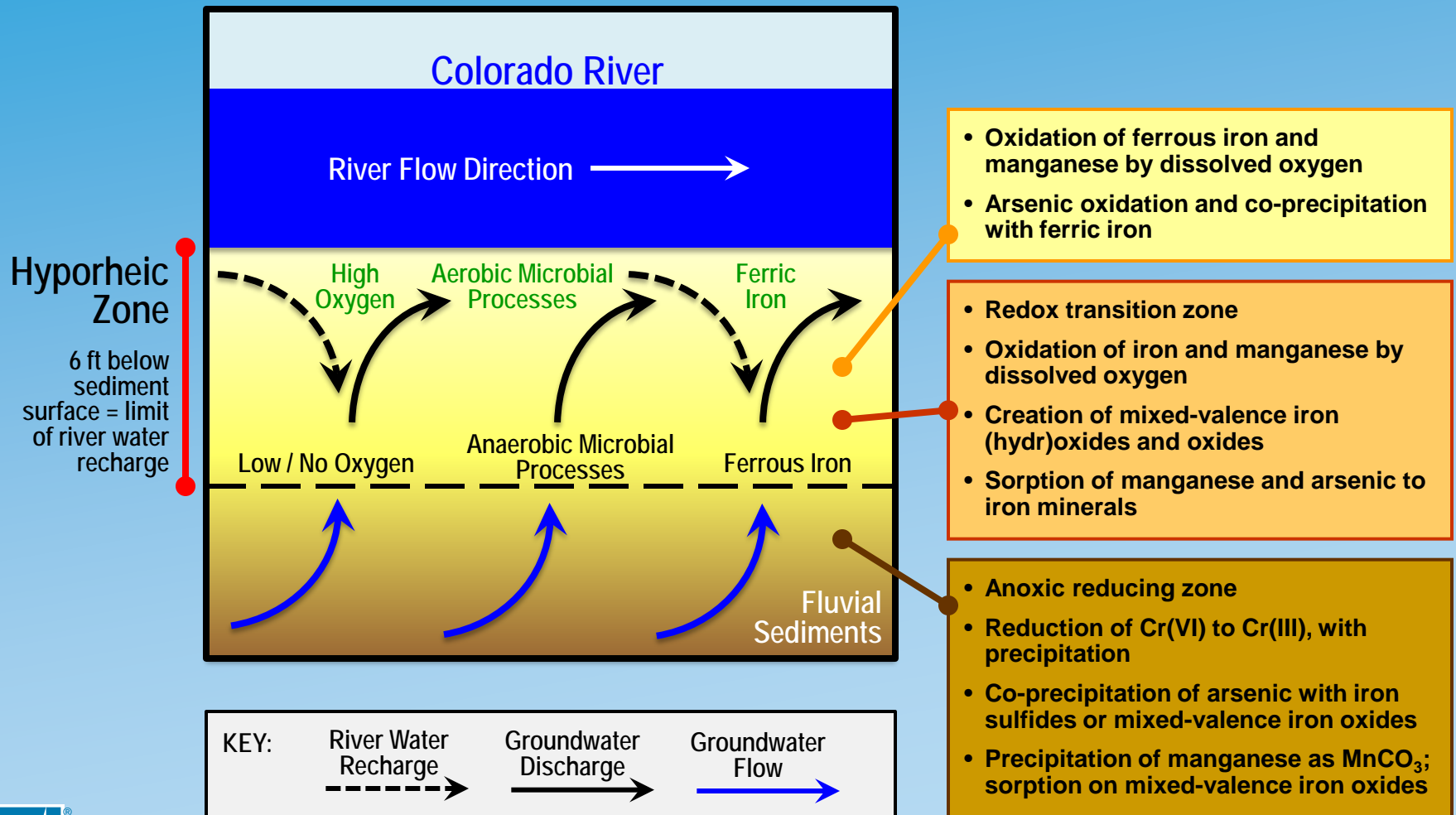
Evidence of Natural Geochemical Barrier Under the River

- Chromium not detected in Colorado River surface water, sediment, or pore water
- Strongly negative ORP in pore water (−162 mV avg.)
- High DOC in fluvial sediments provides nutrients for microbial communities

Cr(VI) in pore water is reduced to Cr(III) and removed from solution by mineral precipitation and adsorption reactions

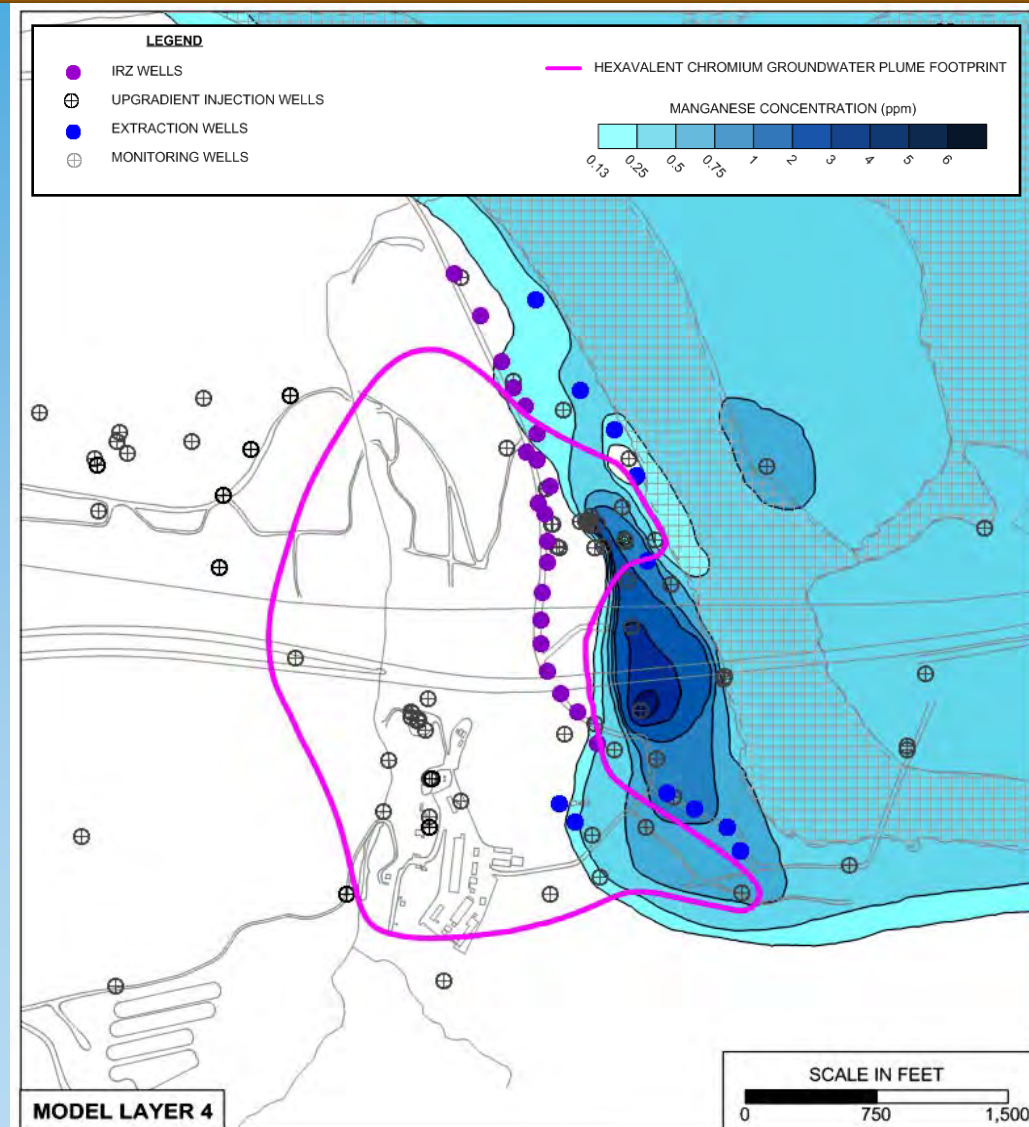


Biogeochemical Dynamics at the Surface Water / Groundwater Interface



Evidence of Natural Geochemical Barrier Under the River

- Manganese used as proxy to further identify extent of reducing “rind”
- Areas shaded blue at right approximate the “rind”
- Integrity of “rind” important to stakeholders and management of plume



Groundwater Remedy



Site Features Influential in Developing Remedial Alternatives



- Depth to bedrock
- Slow groundwater movement
- Wildlife habitat

- Cultural history & significance
- Archeological features
- Transportation corridors

- Uses of Colorado River water
- No use of groundwater as potable

- Hexavalent chromium plume
- Existing reducing zone in floodplain

Selected Groundwater Remedy: In-situ Treatment with Fresh Water Flushing



- In-situ reducing zone (IRZ) to cut-off and treat Cr(VI)
- Fresh water injection to accelerate plume movement (speed up the remedy)
- Carbon-amended water injected where needed
- Extraction wells at river bank and East Ravine
- Existing Interim Measure (IM-3) system dismantled

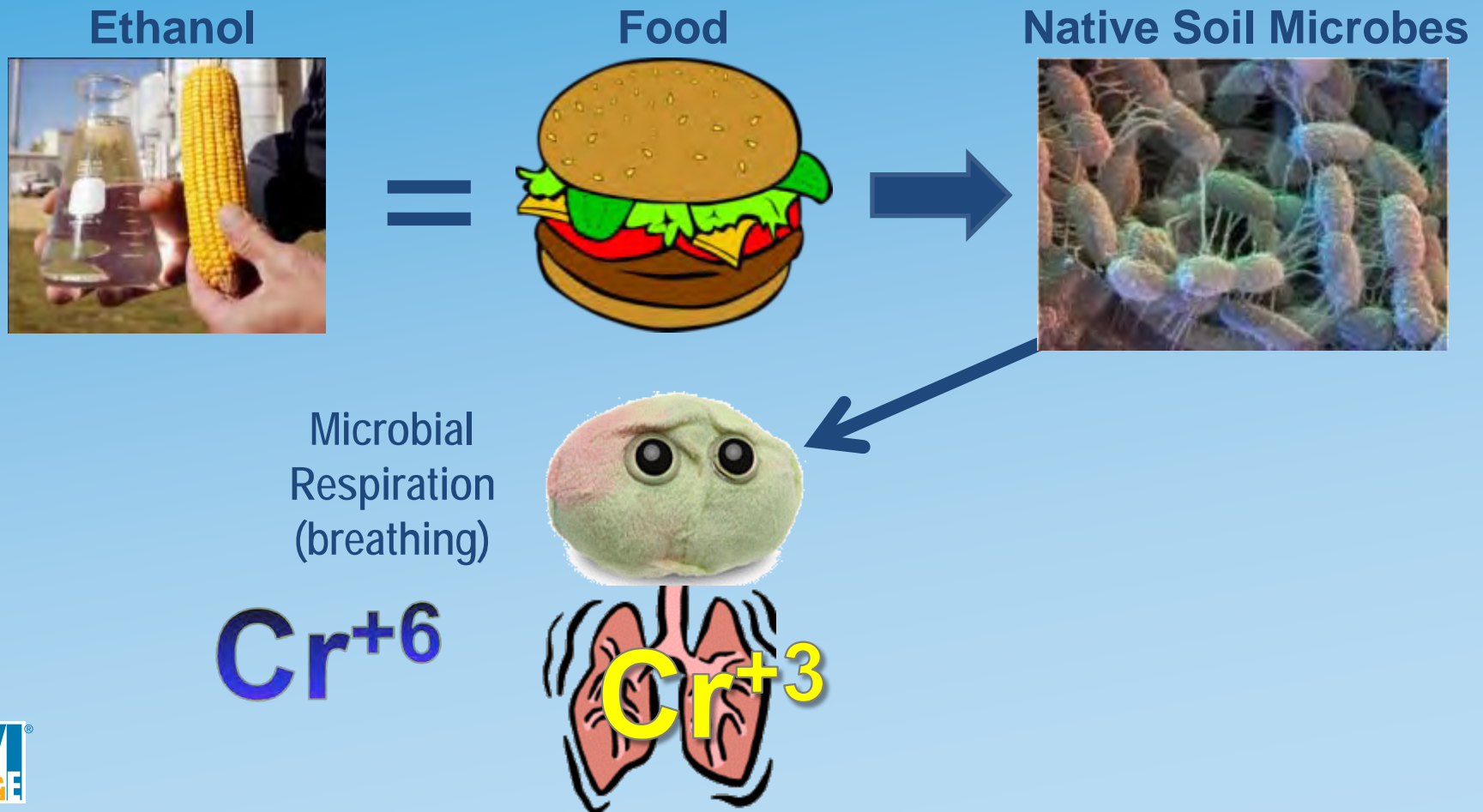
Groundwater Remedy Components



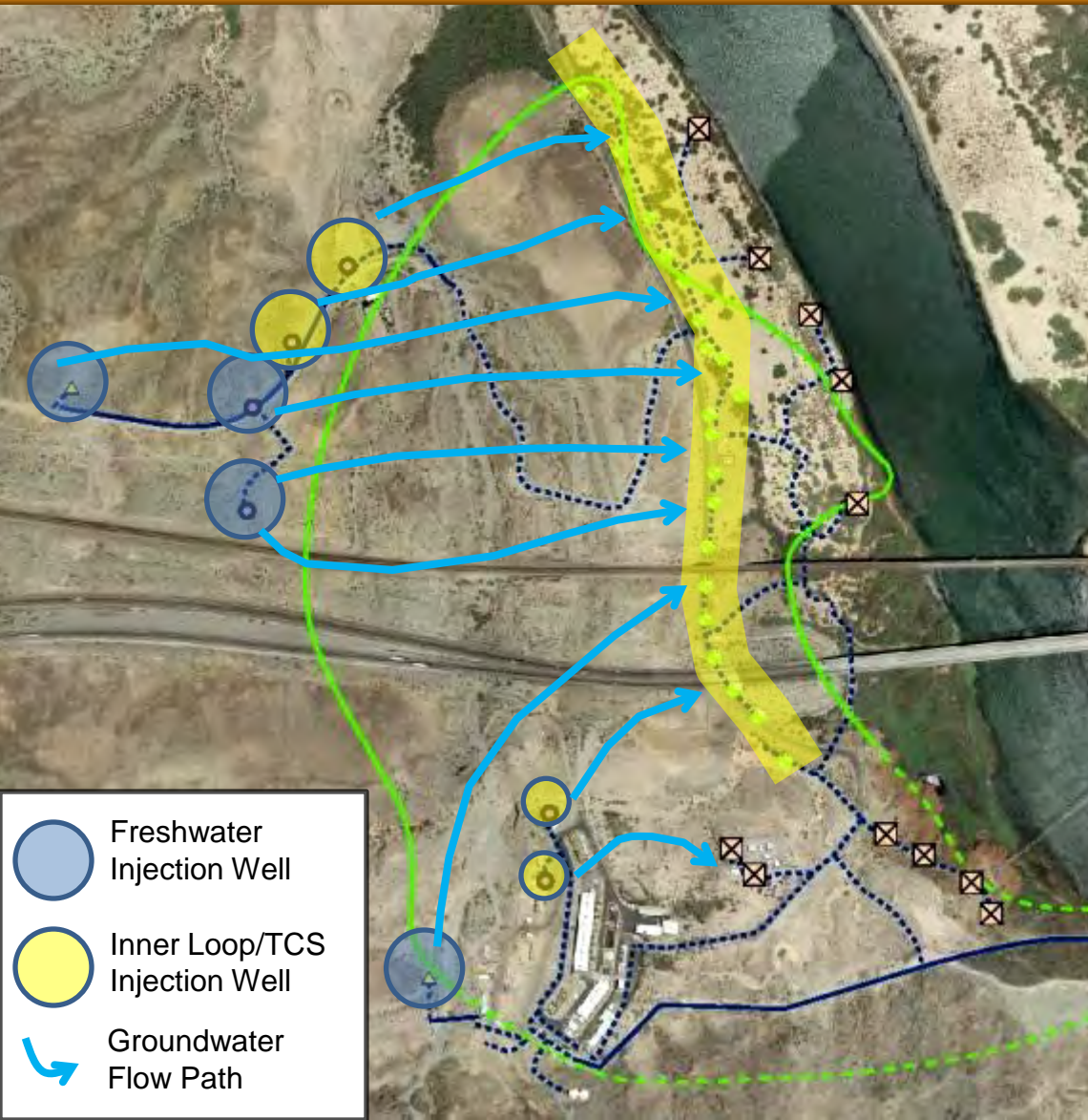
In-situ reducing zone (IRZ) constructed along National Trails Highway treats Cr(VI) as groundwater migrates toward the river

In-situ Remediation Process

Subsurface treatment zones stimulate natural processes to convert and remove hexavalent chromium from groundwater

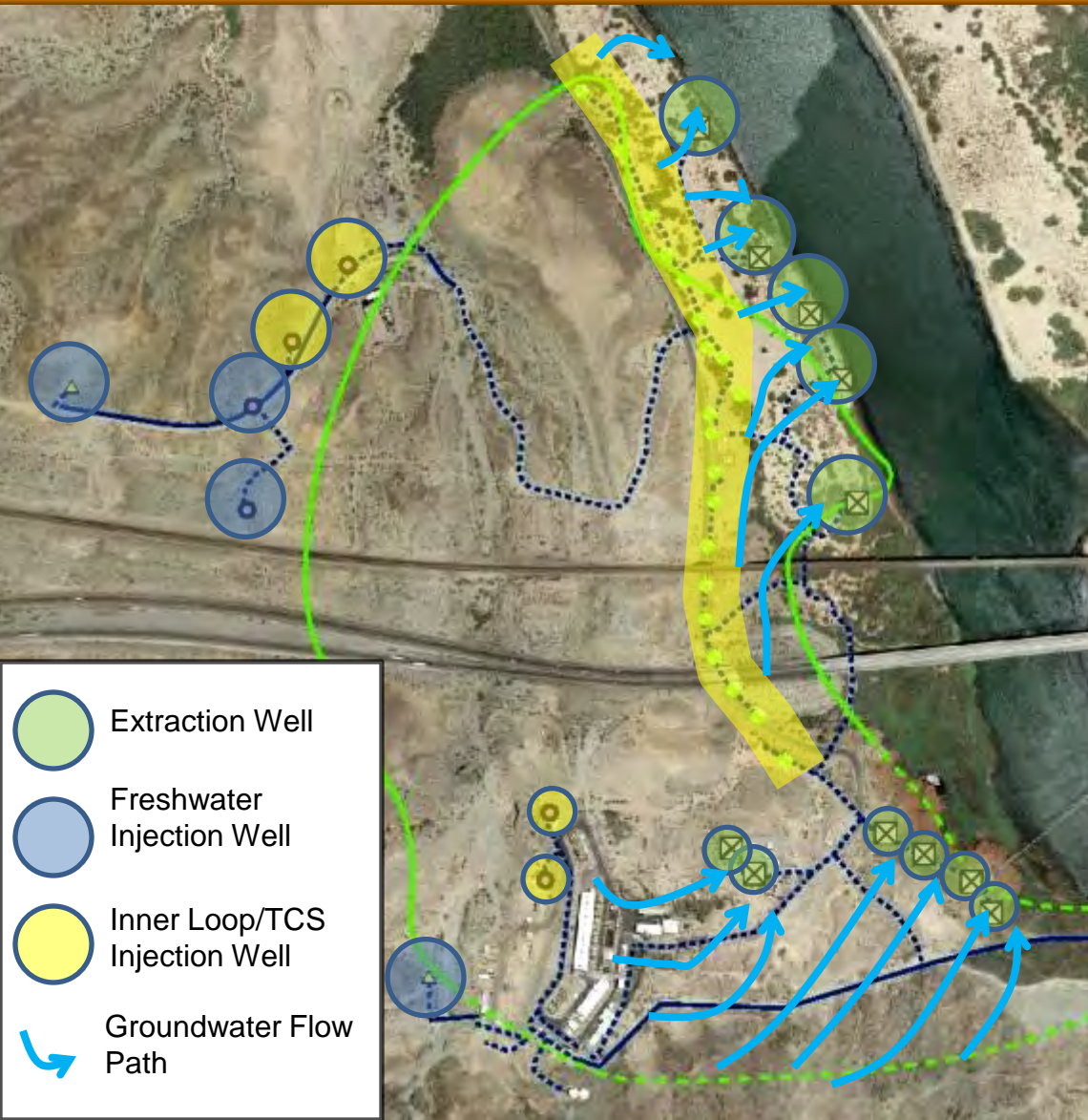


Groundwater Remedy Components: Injection Wells



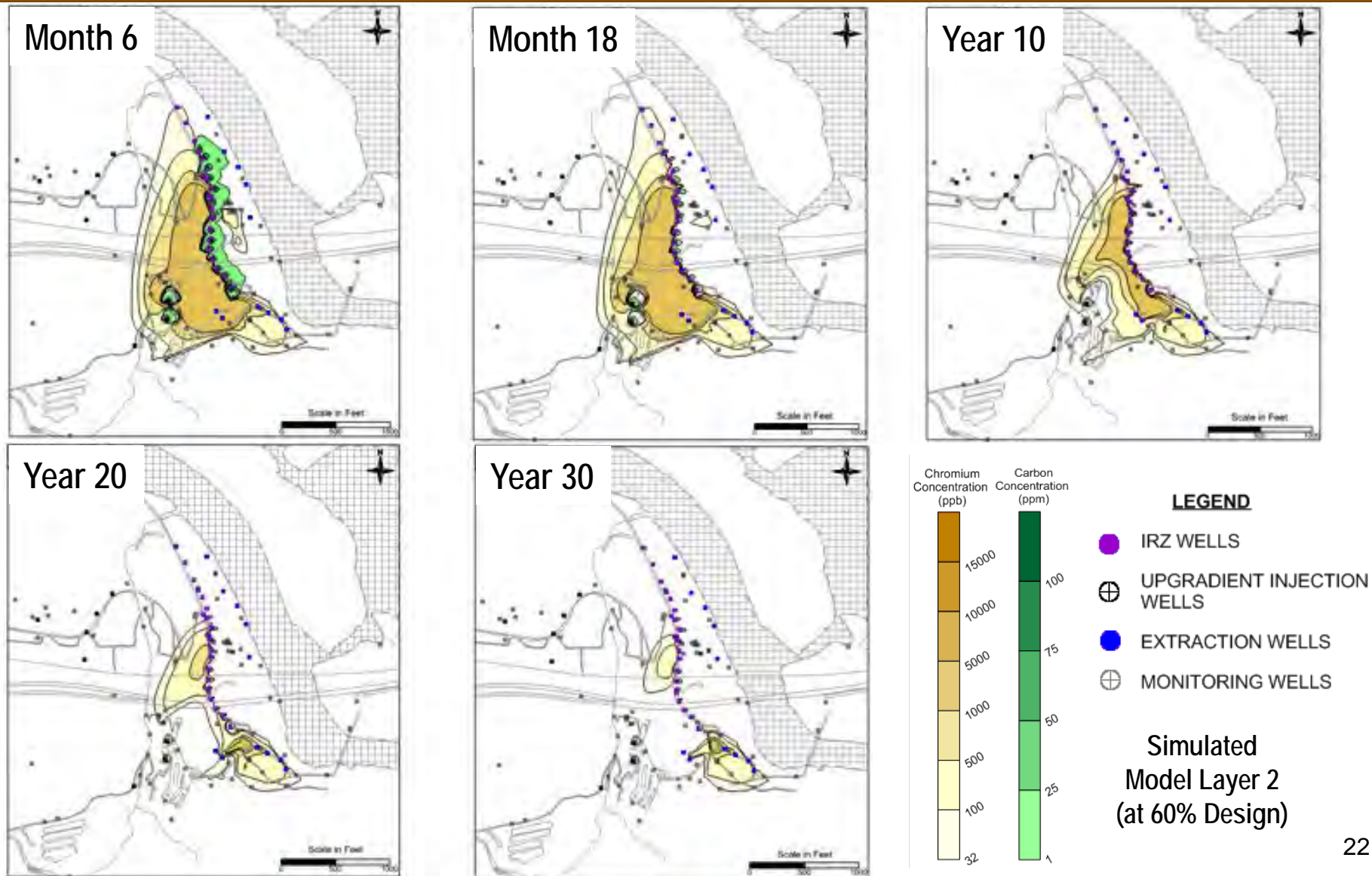
**Injection wells
help to push
plume across
in-situ reducing
zone (IRZ)**

Groundwater Remedy Components: Extraction Wells

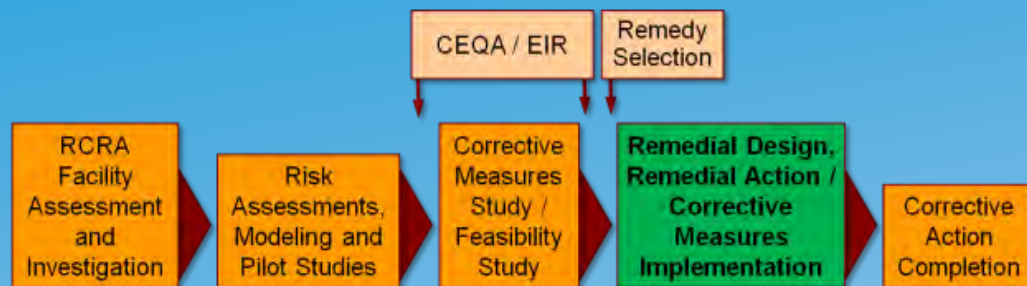


- **Extraction wells provide additional control of byproducts at the river bank and remove chromium from East Ravine**
- **Extracted water goes to amended water injection wells**
- **TCS injection wells treat Cr(VI) in-situ**

Fresh Water Flushing Speeds the Plume Downgradient for Treatment Along IRZ



Implementation is Underway



DESIGN

- Complete remedial design
- Remedial Action Work Plan
- Obtain approvals and agreements to implement the groundwater remedy

2011 – 2014

CEQA EVALUATION

- Sept. 2013 Addendum to January 2011 Final EIR
- Review / Addendum to EIR as needed after Pre-Final (90%) Groundwater Design

Late 2013 – 2014

CONSTRUCTION and START-UP

- Start construction of the groundwater remedy
- Initial start-up and testing of the groundwater remedy

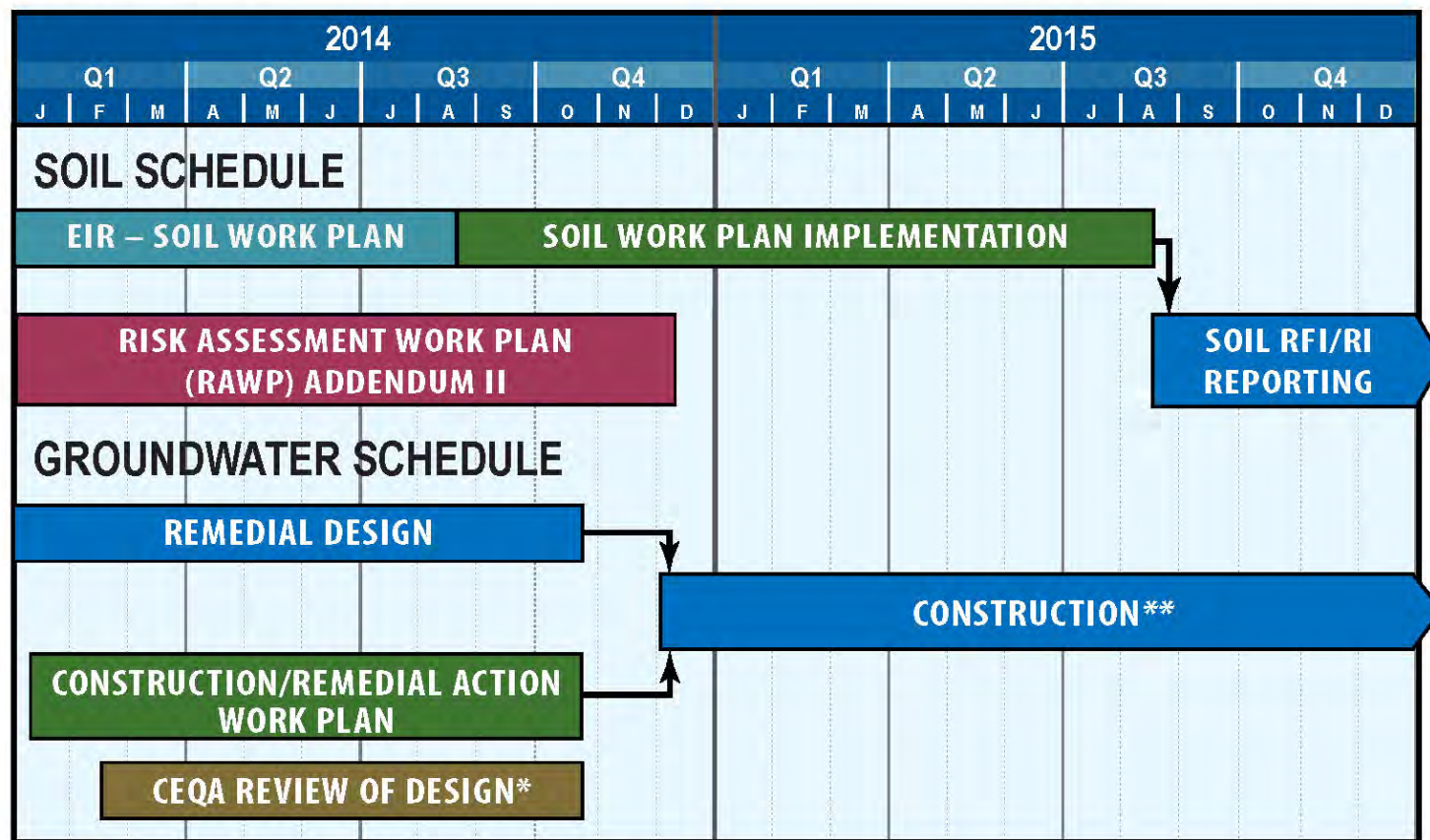
2014 – 2017

Compliance with Mitigation Measures and ARARs

Project Schedule

Soil and Groundwater Schedule (2014-2015)

PG&E Topock Compressor Station
Needles, California
January 29, 2014



CMS/FS Corrective Measure Study/Feasibility Study

RFI/RI RCRA Facility Investigation/Remedial Investigation

* Duration dependent on type of CEQA document

** Start of construction is dependent on CEQA review duration

Thank You

