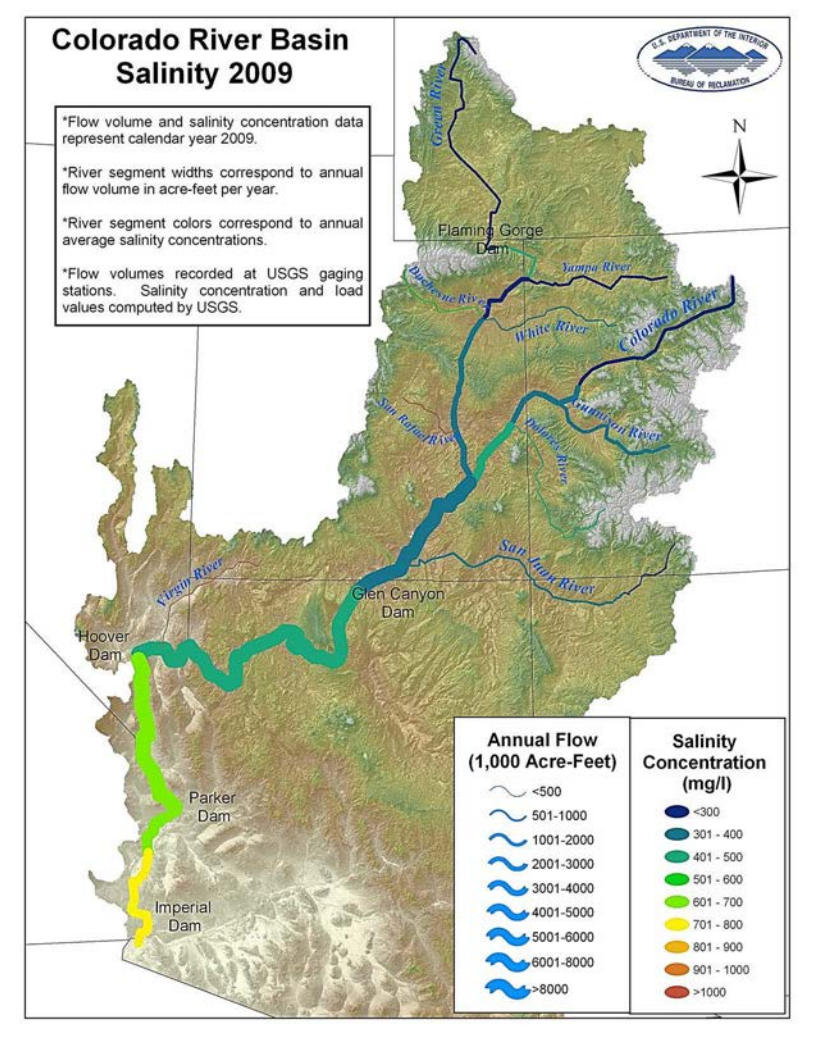
Paradox Valley Unit
Colorado River Basin
Salinity Control Project

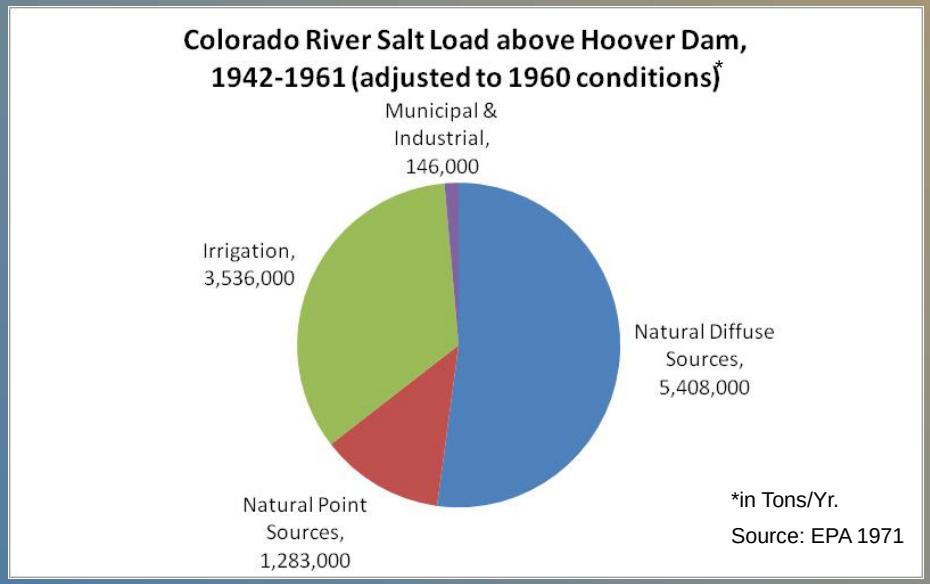
RECLAMATION

- Colorado River Salinity Problem
- Colorado River Basin Salinity Control Forum
- Colorado River Salinity Control Act
- Colorado River Salinity Control Program (USBR)
- Current Paradox Valley Unit Operations
- Paradox Valley Unit Issue
- Paradox Valley Unit Alternative Study/EIS

Colorado River Salinity Sources



- Natural Sources
- Irrigation Sources
- Municipal & Industrial



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Impacts of Increased Salinity

ECONOMIC DAMAGES MODEL

- Household appliances
- Commercial Sector
- Industrial Sector
- Water Utilities
- Agricultural Crop Revenues
- Additional cost of meeting state wide water quality standards
- Costs of recycled water use

2008-2009 avg. salinity levels at Imperial Dam (717 mg/l) modeled show over $376 million/yr in present annual economic damages.

Cost of $173 per ton or $1,733,000 per mg/l of TDS per year.

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Colorado River Basin Salinity Control Forum

Composed of the Seven Basin States:

Arizona
California
Colorado
Nevada
New Mexico
Utah
Wyoming

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Basinwide Salinity Control Standards for the Colorado River

Water Quality Station	Salinity Criteria TDS
Below Hoover Dam	723 mg/l
Below Parker Dam	747 mg/l
Below Imperial Dam	879 mg/l

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Colorado River Salinity Control Act

- **Public Law 93-320 enacted June 24, 1974 and authorized the construction, operation, and maintenance of certain works in the Colorado River Basin to control salinity of water delivered to users in the United States and Mexico. The provisions of the Act are found under 43 U.S.C. 1571-1599.**

- **Amendments in 1984, 1995, 1996, 2000 & 2008**

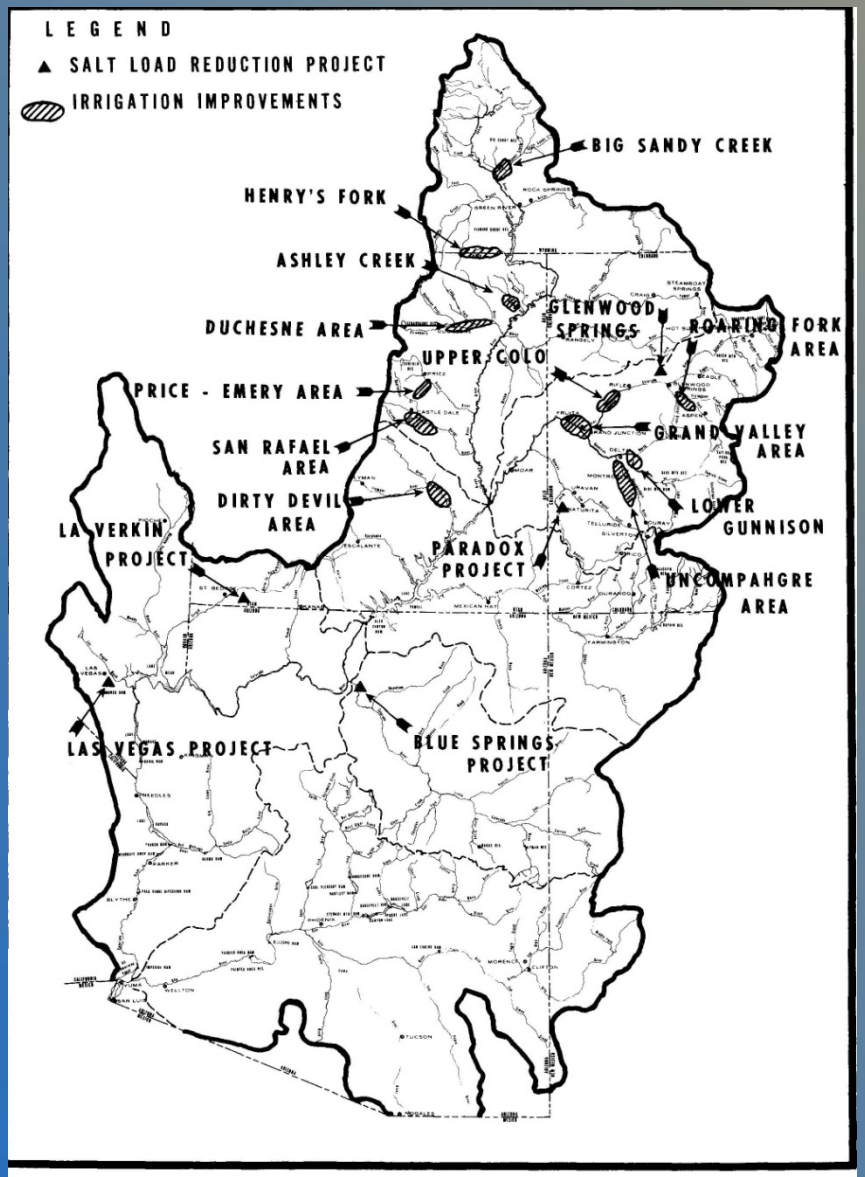


Figure 5. Location of Potential Salt Load Reduction Projects*

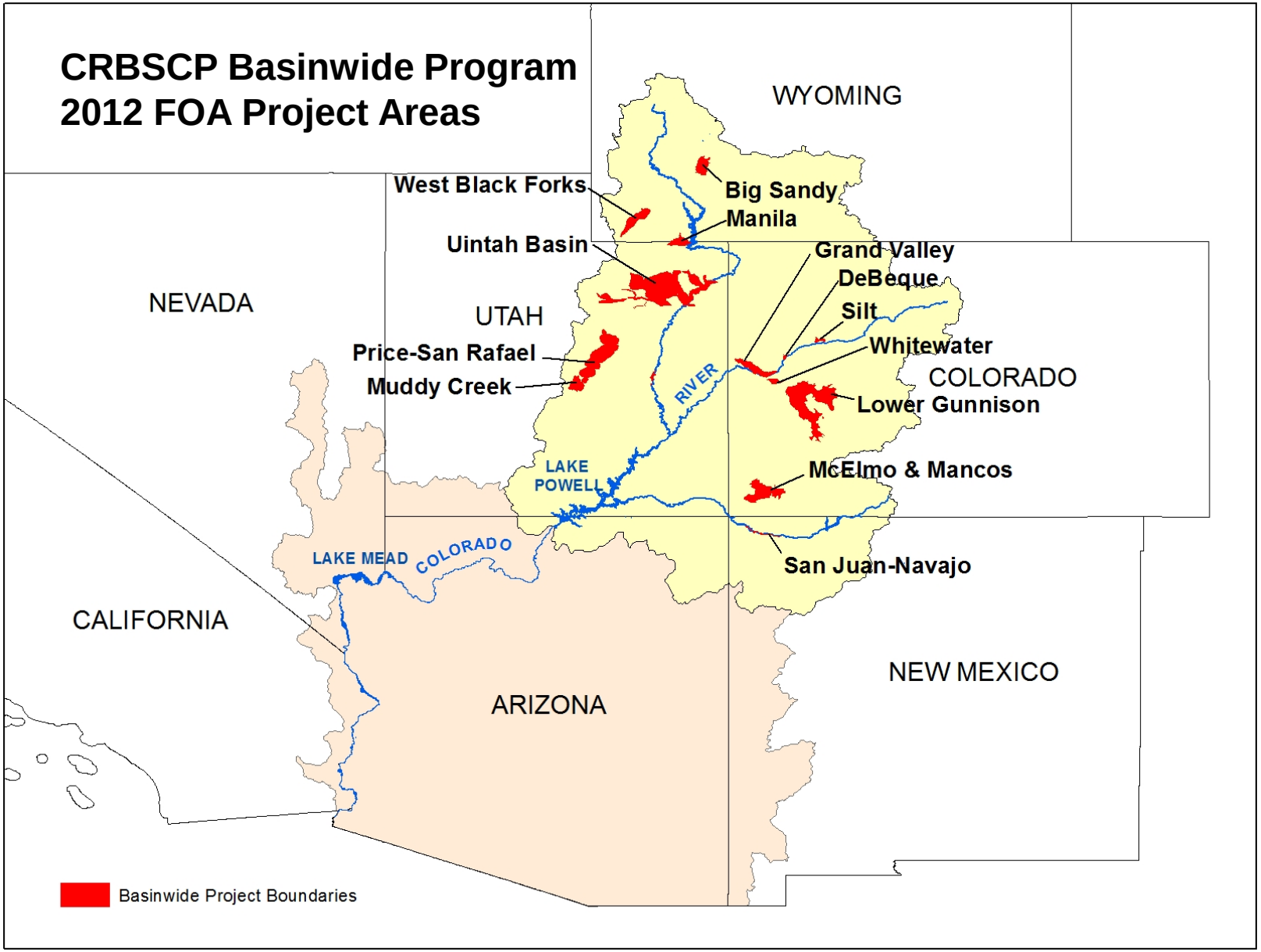
Colorado River Basin Salinity Control Program

Title I Program (below Imperial)
Title II Program (above Imperial)
- **Paradox Valley Unit (USBR)**
- **Basinwide Program (USBR)**
- **USDA NRCS EQIP Program**
- **Basin States Program (CO, UT WY & NM)**

**From 1971 EPA Report entitled The Mineral Quality Problem in the Colorado River Basin, Summary Report*

RECLAMATION

CRBSCP Basinwide Program
2012 FOA Project Areas



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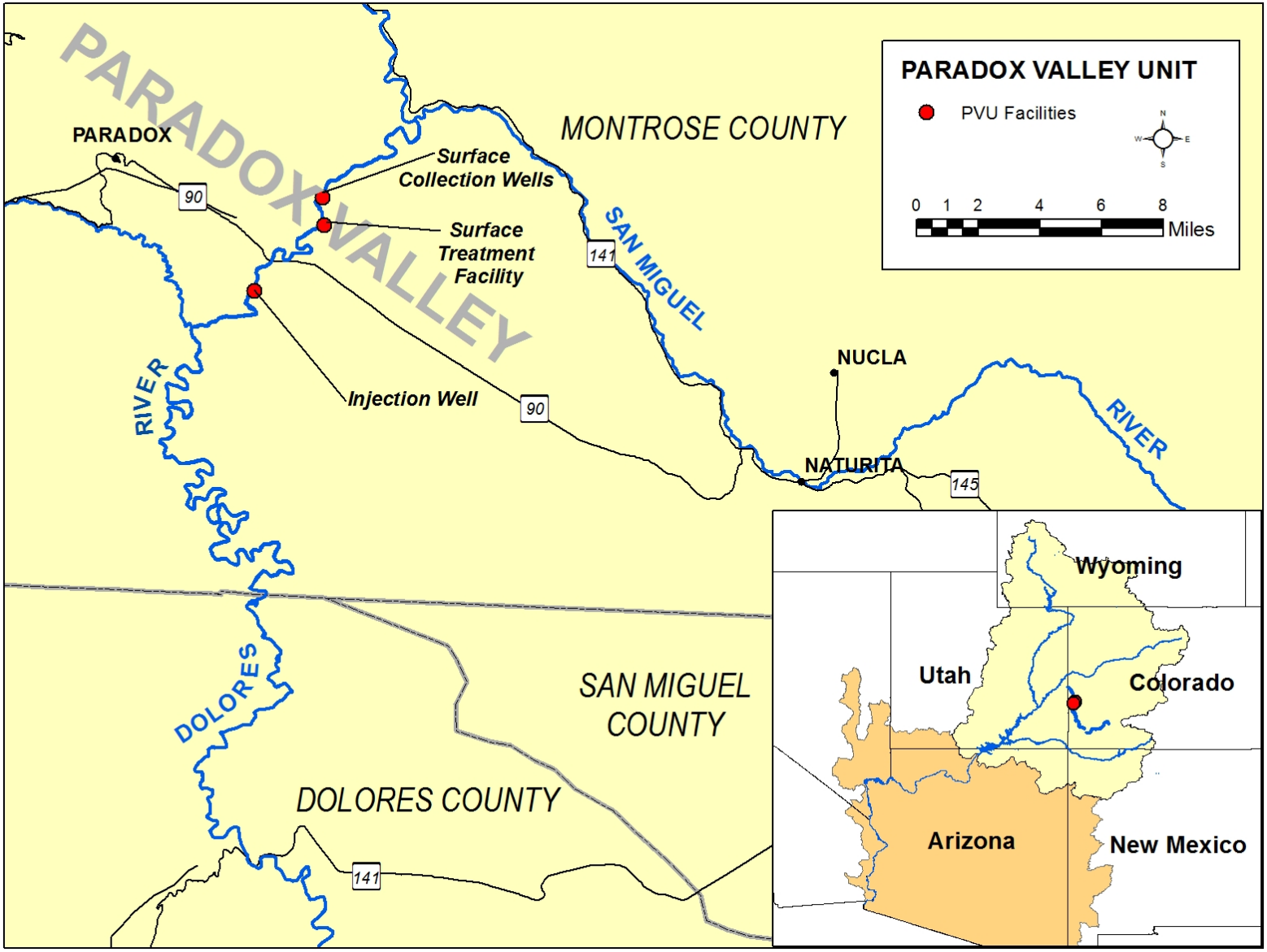
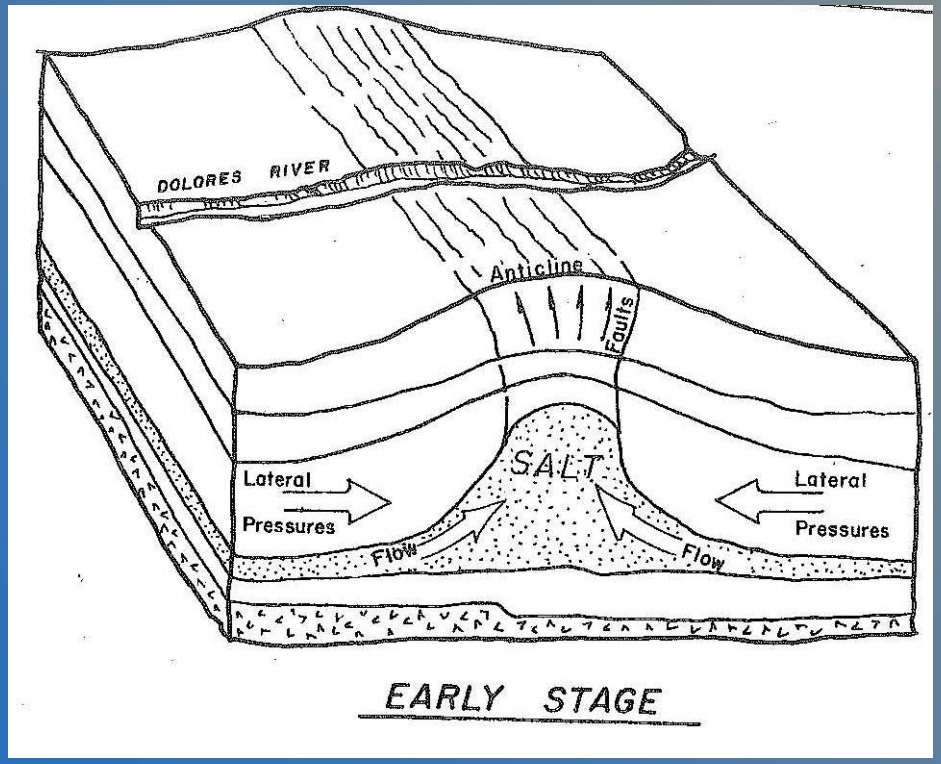
CURRENT PARADOX VALLEY UNIT OPERATIONS

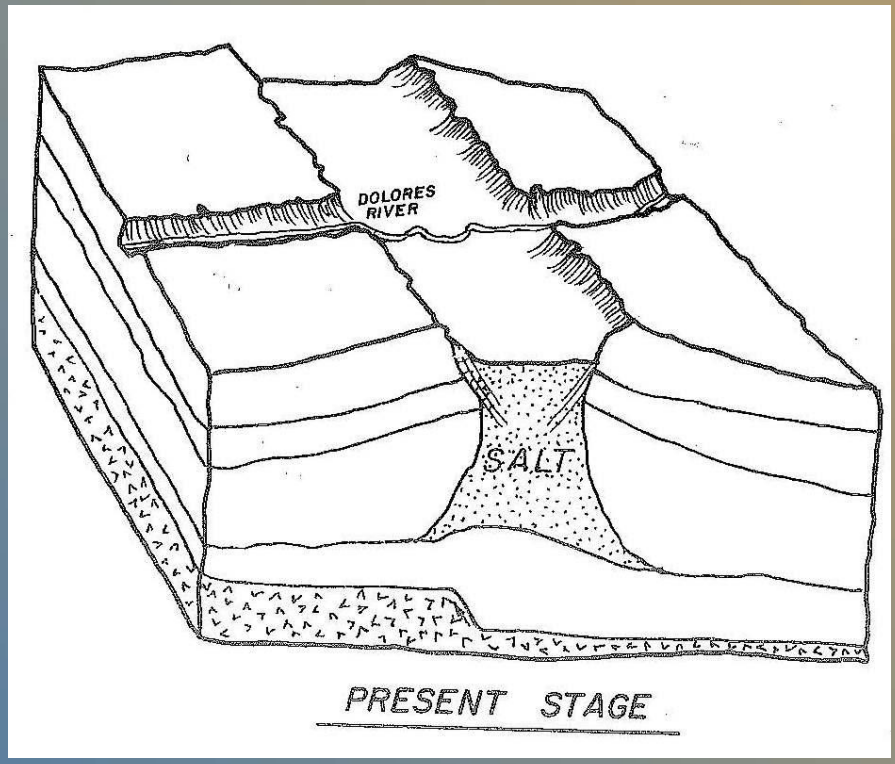
RECLAMATION



RECLAMATION

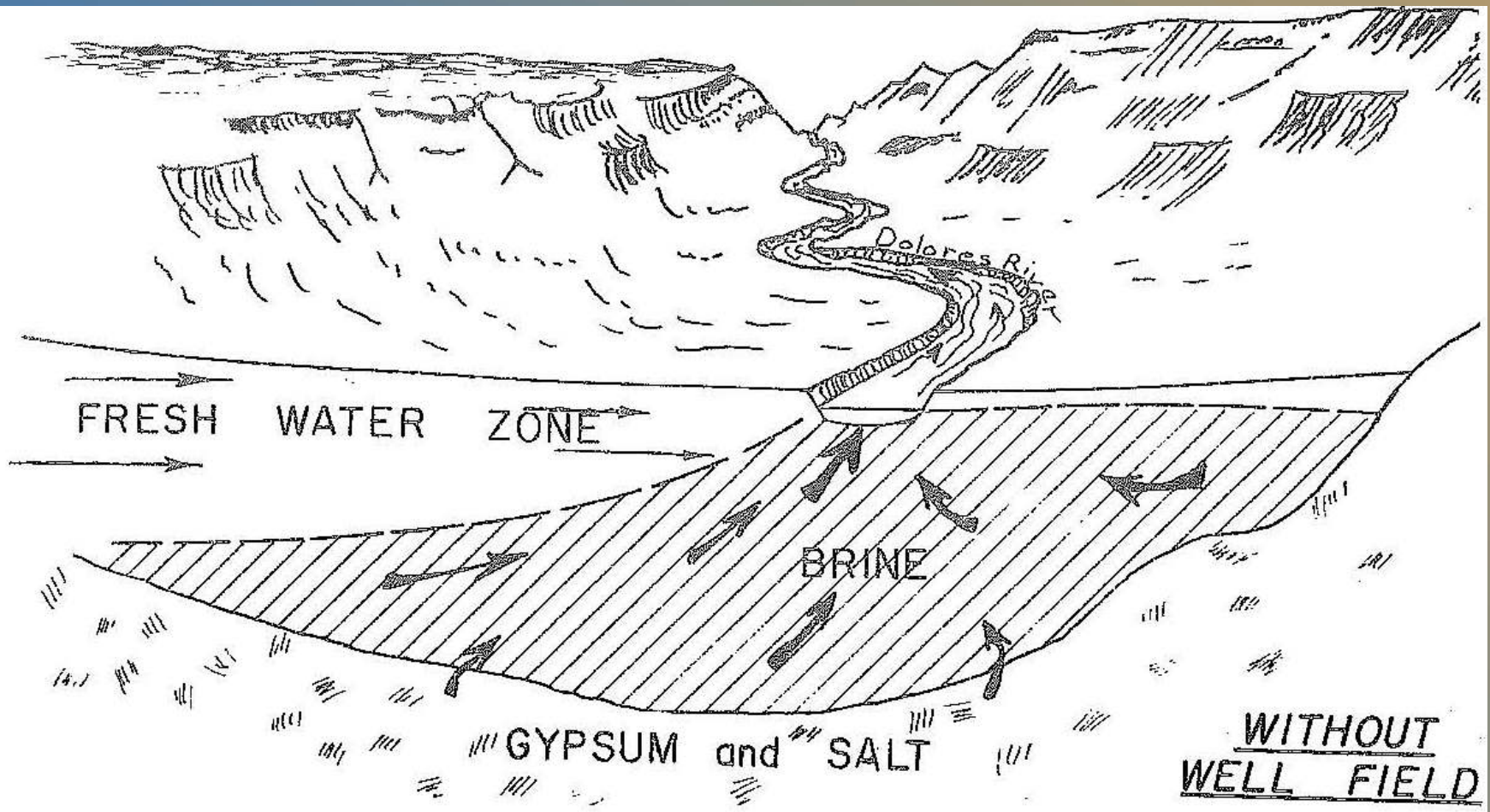
Paradox Valley





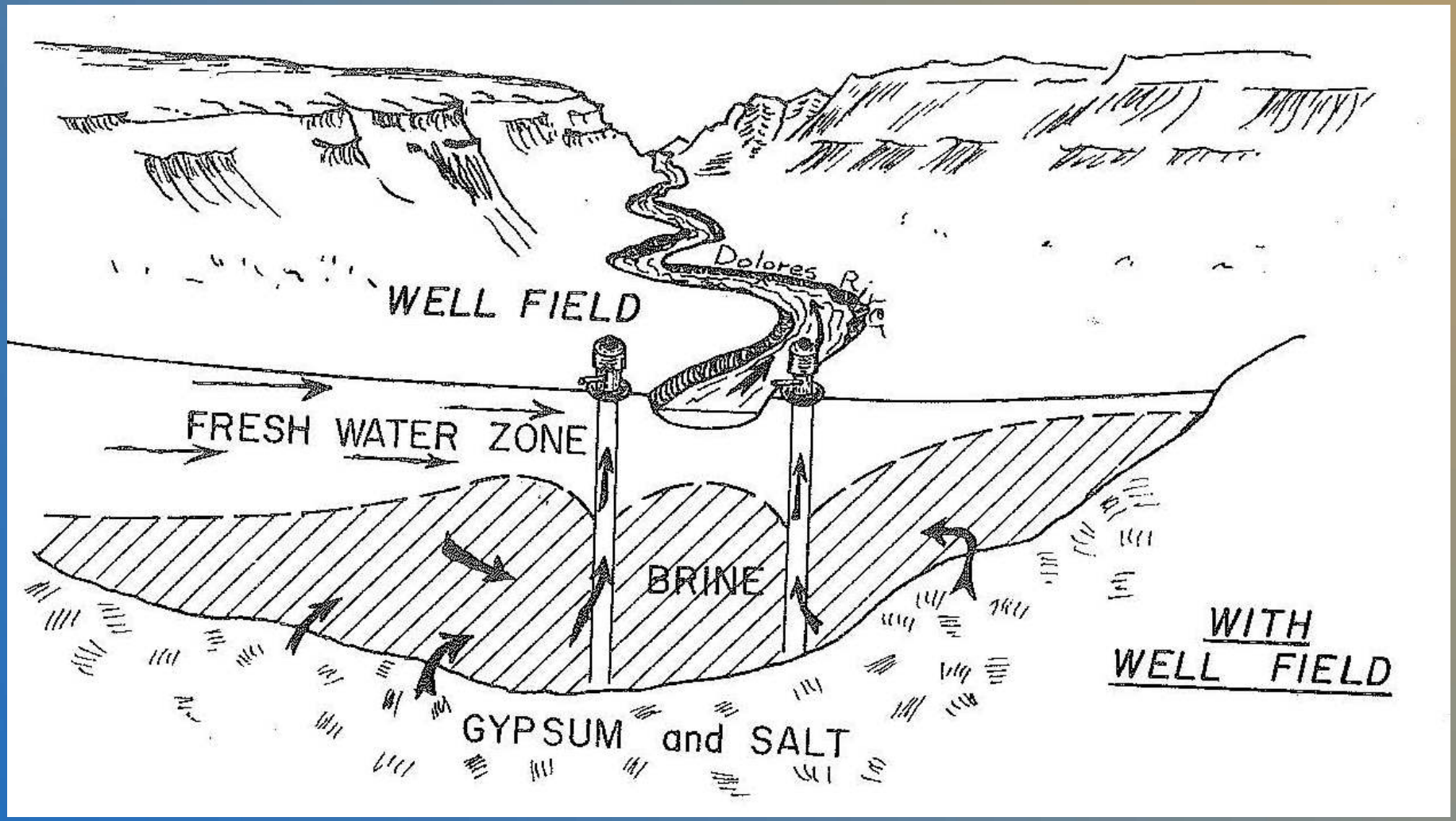
RECLAMATION

How Does the Salt Brine get into the Dolores River?



RECLAMATION

How is the Salt Brine Intercepted?



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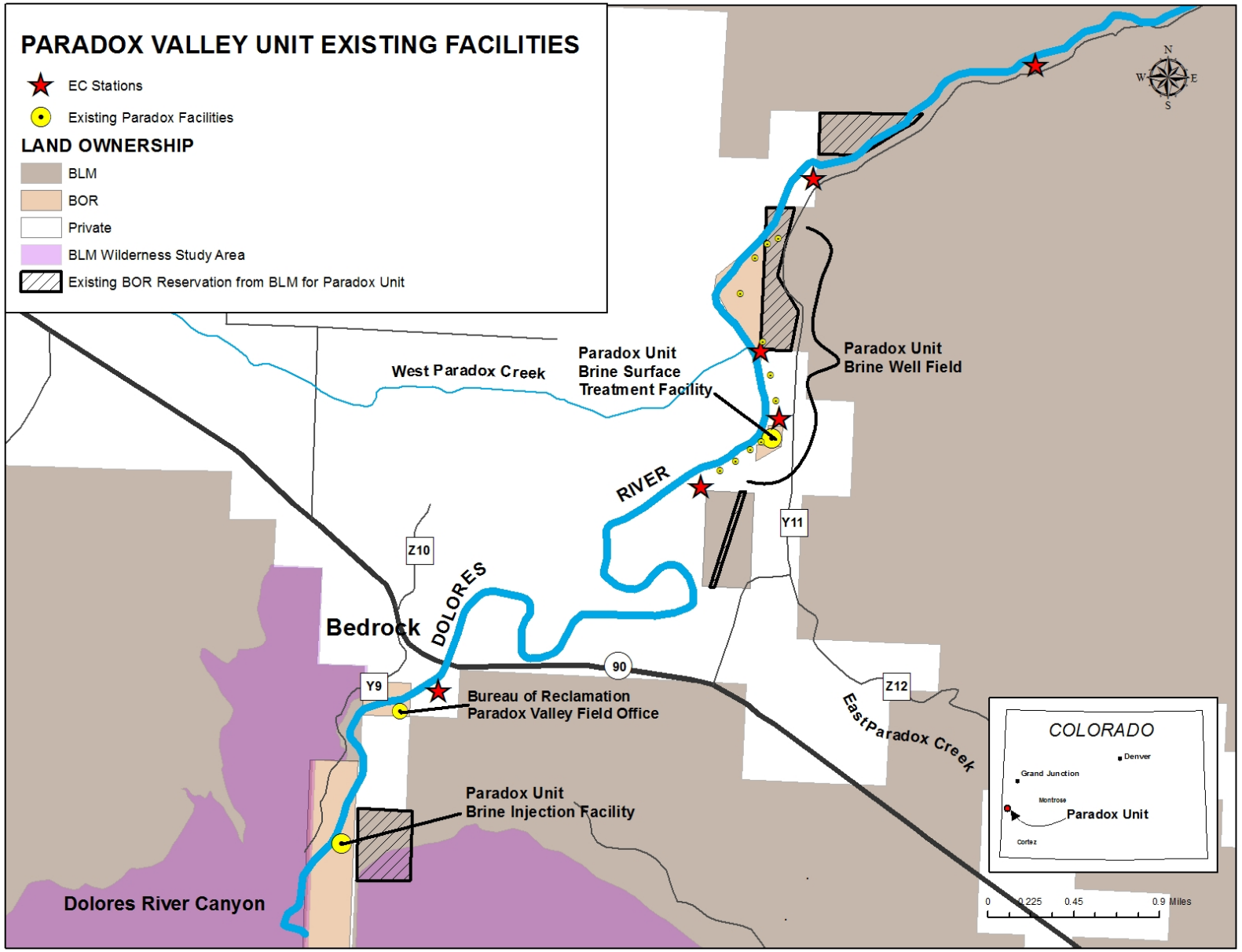
Composite of Brine Wells Adjacent to the Dolores River			
Bicarbonate	96-232 mg/l	Calcium	942-1,742 mg/l
Chloride	87,594-212,528 mg/l	Fluoride	0.1-0.2 mg/l
Magnesium	907-2,177 mg/l	Nitrite	95-108 mg/l
Potassium	1,921-4,565 mg/l	Sodium	6,177-98,991 mg/l
Sulfate	1,158-6,885 mg/l	Strontium[2]	2.3-27.8 mg/l
pH	6.0-7.6	Cadmium[3]	0.47 mg/l
Chromium[3]	0.26 mg/l	Copper[3]	0.22 mg/l
Iron[3]	2.4 mg/l	Lead[3]	2.9 mg/l
Manganese[3]	0.37 mg/l	Nickel[3]	0.23 mg/l
Lithium[3]	0.13 mg/l	Zinc[3]	0.62 mg/l
Conductivity	256,946-278,207 um/cm	Total Dissolved Solids	255,870-264,470 mg/l Seawater is usually between 30,000 & 40,000 1 Gallon of Brine contains about 2.2 lbs of Salt
Hydrogen Sulfide levels sampled at the brine wells range from 10-88 mg/l. Hydrogen sulfide is released when the brine comes in contact with the atmosphere.			

[1]/Compiled from August 2002 sample data for wells 2E, 3E, 4E, 5E, 6E, 8E, 9E, 11E, 12E & 13E.
[2]/From 1978 Definite Plan Report and 2011 sample at Well 9E.
[3]/From 1978 Definite Plan Report.



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Collection Well

- 9 Wells
- 40-70 ft deep
- 30-120 gal/min

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Electrical Conductivity (EC) Station

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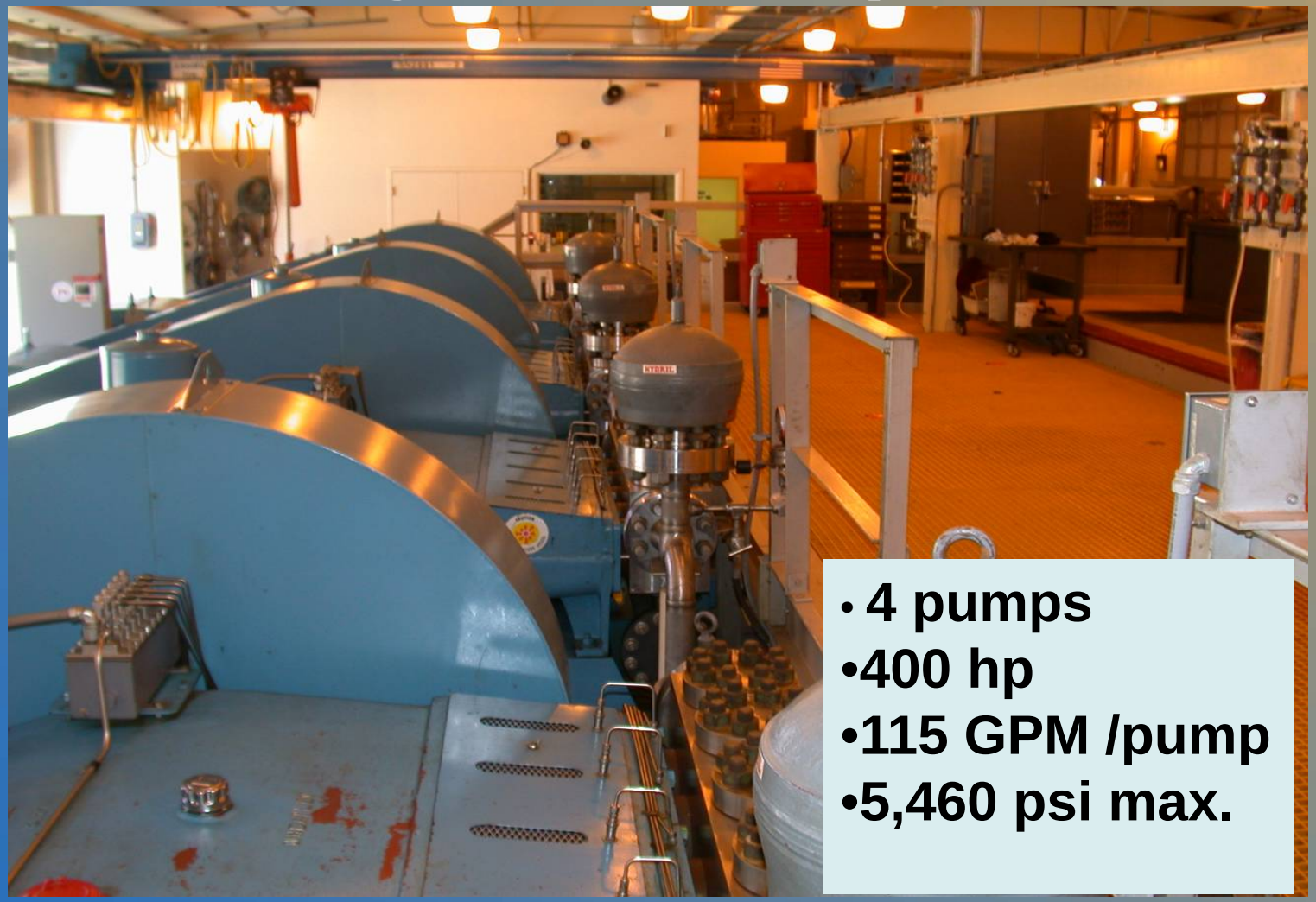
Surface Treatment Facility

RECLAMATION

Brine Injection Facility

RECLAMATION

Injection Pumps



- 4 pumps
- 400 hp
- 115 GPM /pump
- 5,460 psi max.

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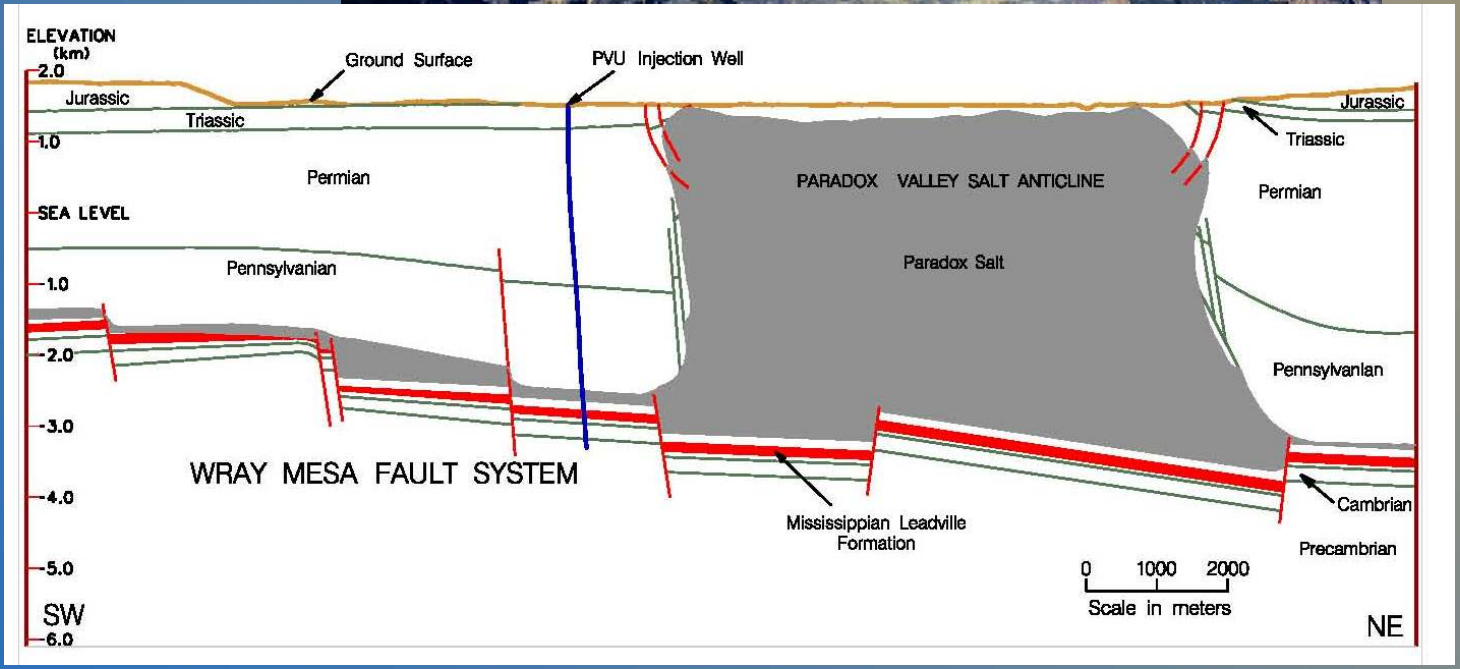
Injection Pumps

RECLAMATION

Injection Well

RECLAMATION

PVU Injection Well



Vertical cross section roughly perpendicular to Paradox Valley, looking to the northwest.
Based on figure from Harr and Bramkamp (1988)

RECLAMATION

Unit Brine Disposal

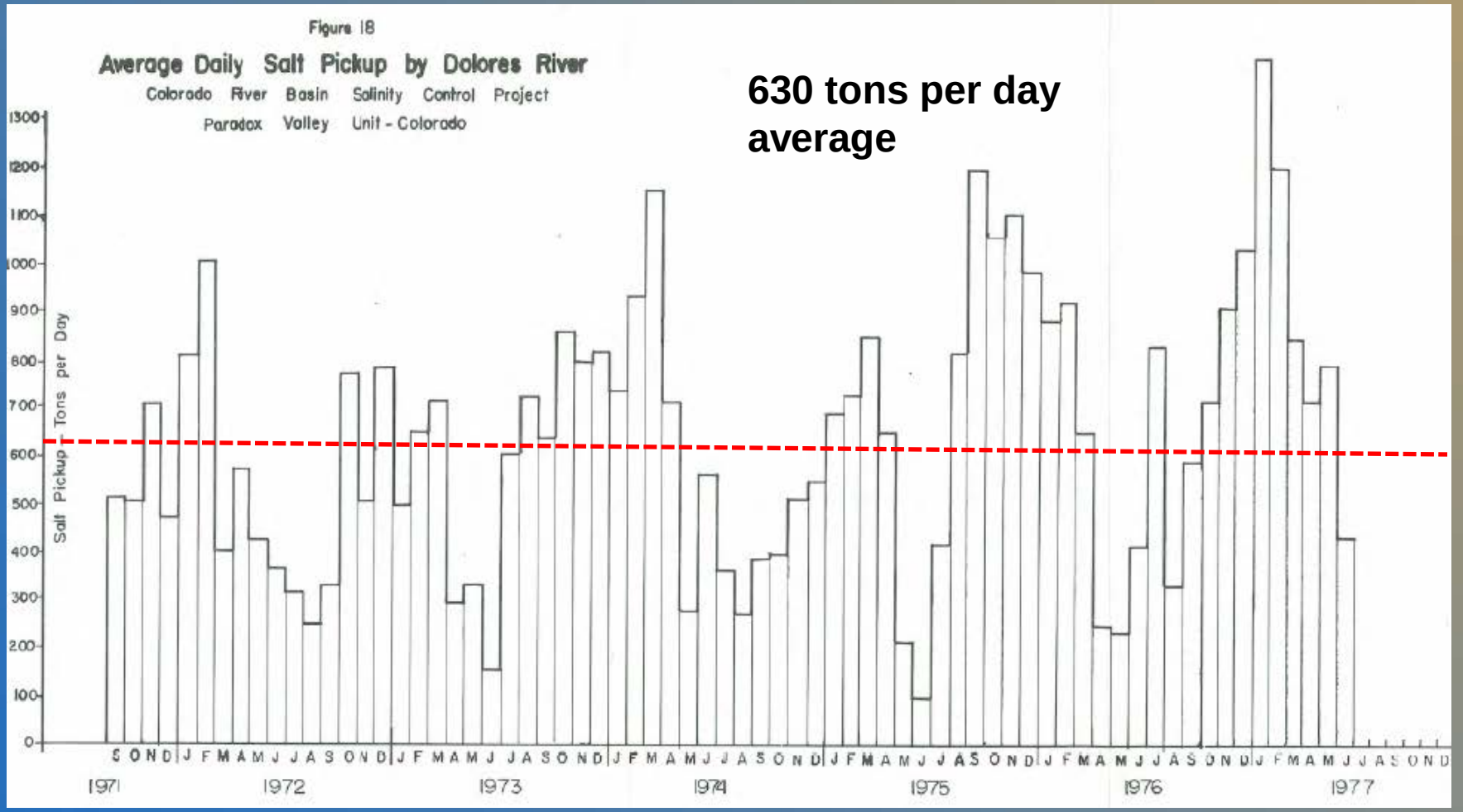
- Brine disposal rate of 230 gallons per minute – 9 to 10 million gallons of Paradox Valley Brine per month.
- At 230 gpm and 2.2 lbs./gal, approximately 1 ton of salt disposed every four minutes
- Annual disposal rate of 110,000 tons salt (dry weight) per year

Unit Accomplishments

- *1996-1999* – 126,000 Tons/Year (Avg)
- *1999-2000* – 96,000 Tons/Year (Avg)
- *2000-2002* – 77,000 Tons/Year (Avg)
- *2002-2012* – 112,000 Tons/Year (Avg)
- *1996-2012* – 1,700,000 Total Tons

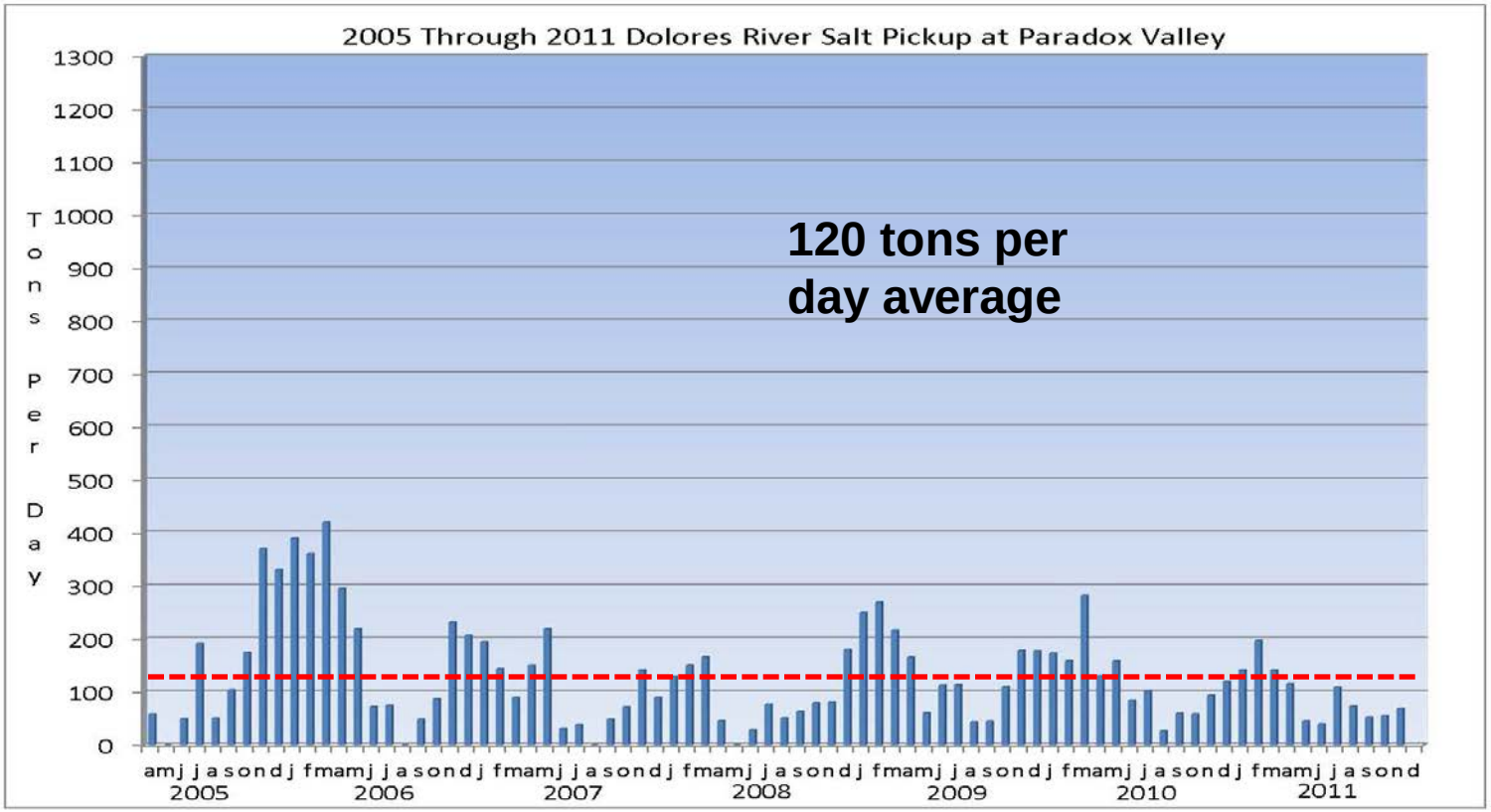
RECLAMATION

1971 To 1977 Dolores River Salt Pickup at Paradox Valley



RECLAMATION

2005 Through 2011 Dolores River Salt Pickup at Paradox Valley



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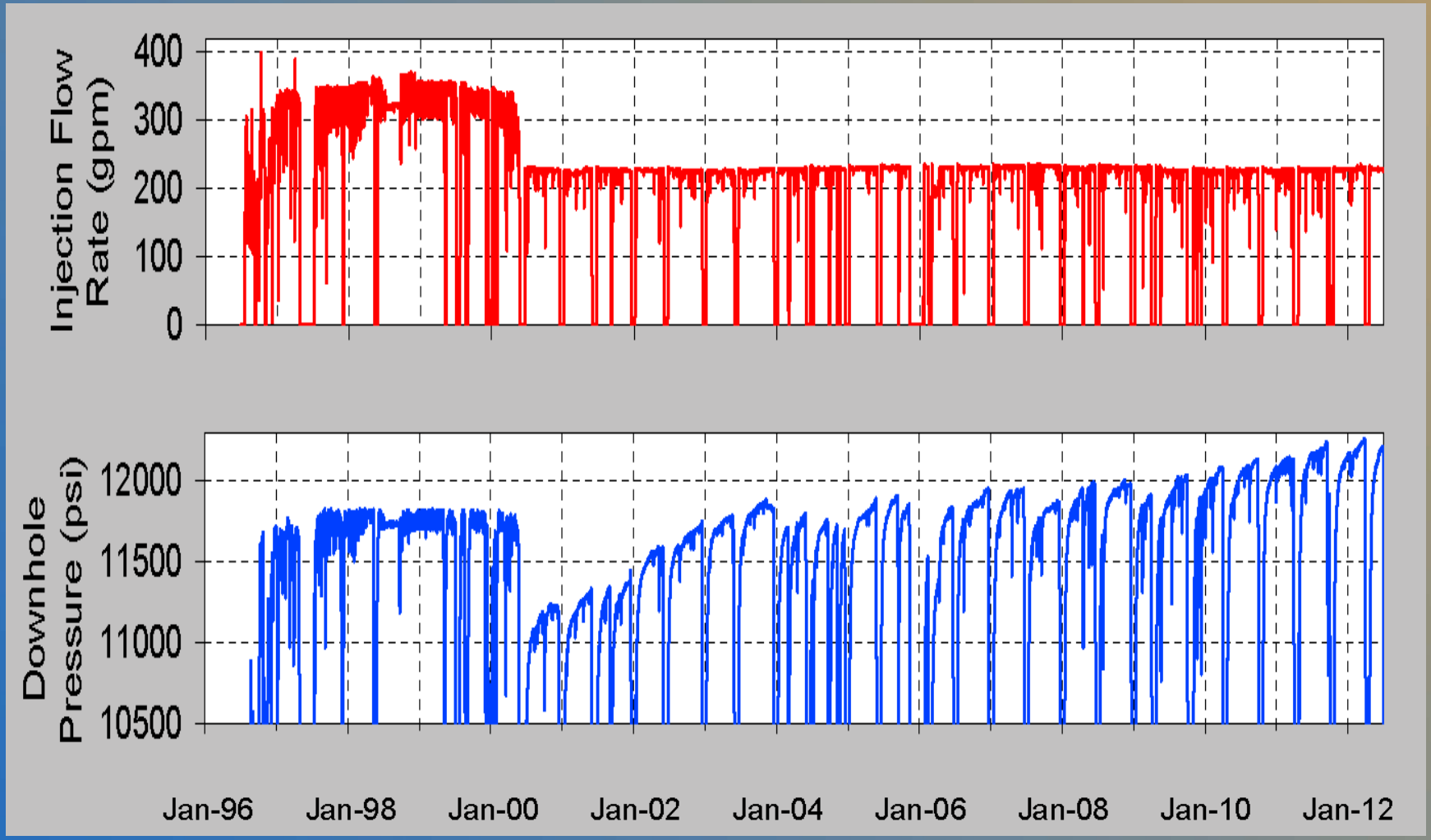
Injection Rate and Pressure



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Current Paradox Valley Unit Issue

- The EPA issued underground injection control (UIC) permit restricts operations to 5,350 psi at the well head, the Maximum Allowable Surface Injection Pressure (MASIP).
- Based on current injection pressure trends, the well may exceed the MASIP in 3 to 5 years.
- Reclamation may request an increase to the MASIP, however its currently unknown what additional increase could be permitted by EPA.
- Alternative methods are being investigated to continue long term salinity control at Paradox.

Paradox Valley Unit
Alternative Study/
Environmental Impact Statement

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Paradox Alternative Study/EIS

Reclamation will conduct an Alternative Study/Environmental Impact Statement to identify and evaluate brine disposal alternatives to replace or supplement the existing Brine Injection Well No. 1 which has a projected remaining useful life of three to five years under current operation.

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National Environmental Policy Act

- **The National Environmental Policy Act (NEPA) of 1970, established a new environmental policy for Federal Agencies.**

- **Reclamation must be environmentally aware in looking at the relationship its planning actions, projects, and programs have with the human environment now and in the future.**

Existing NEPA Compliance for Paradox

- 1979 CRBSCP Paradox Valley Unit Definite Plan Report and Final Environmental Statement

- 1997 CRBSCP Paradox Valley Unit Final Supplemental Definite Plan Report and Environmental Assessment

EPA comments on Radium Dam Evaporation Site Alternative in the 1978 Paradox Valley Unit Final EIS[1]

- Possible contamination of underlying aquifers
- Possible fugitive dust problems regarding salt dispersion to surrounding areas
- Erosion of the proposed salt flats over geologic time
- Conflicts with the existing land uses of ranching, wildlife habitat, and uranium exploration
- Possible hazard to waterfowl

[1]1978 Letter to Regional Director Hall, Bureau of Reclamation from Regional Administrator Merson, Environmental Protection Agency

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Supplemental DPR/EA

Comply with EPA UIC Permit Conditions:

- Install continuous recording devices which monitor the operation of the well.
- USBR operate a 16-station earthquake monitoring network to record both natural and induced earthquakes in the Paradox Valley Area.
- USBR operate a 3-station strong-motion accelerograph network to measure strong ground shaking from induced earthquakes.
- Monthly reporting to EPA on Seismic Network.
- Maximum allowable surface injection pressure is 5,350 psi.

NEPA Process

- **The first step in the NEPA process is to complete a public review of issues and concerns associated with the Alternative Study (Scoping Process). Reclamation will then prepare a scoping report that summarizes comments received.**

- **The next step in the process will be to develop alternatives (including a No Action Alternative) and conduct an assessment of the alternatives. Reclamation will identify and invite cooperating agencies to assist in developing an Environmental Impact Statement.**

Cooperating Agencies

- **Cooperating agencies are governmental entities with jurisdiction by law or special expertise in the proposed action or potential issues.**

- **A cooperating agency provides information, data, and analysis related to its specific area of jurisdiction or expertise. Generally, a cooperating agency will use its own funds for this activity.**

Alternative Study/EIS

- **Reclamation to conduct a Alternative Study/Environmental Impact Statement to evaluate alternatives for continued salinity control at the Paradox Valley Unit.**

- **The study will focus on brine disposal alternatives (use existing collection facilities).**

- **Study to identify alternatives with comparable amount of salinity control (~110,000 tons/yr).**

- **The EIS will include a range of alternatives**

RECLAMATION

Volume of 110,000 Tons of Salt

- **In acre-feet:**
  - **Brine = 307 acre-ft/yr**
  - **Dry Salt =63 acre-ft/yr**

- **The average high school football field (w/ end zones)**
  - **Brine = stacked 233 ft high/yr**
  - **Dry Salt = stacked 48 ft high/yr**

Deep Well Injection Alternative

- **Reclamation has contracted with experts in the fields of geology, exploration geophysics, and drilling to:**

- **Review existing data, and reports**
- **Propose any new data acquisition or analysis**
- **Review criteria to be used in selecting the well site location**
- **Review any new data or analyses performed**
- **Write report(s) on findings**

Deep Well Injection Alternative

- Well Sites and pipeline alignments have not been identified. There is some limited information on an existing wildcat well in west Paradox. This site would require drilling through the Paradox salt zone.
- Alternative will consider advancements in well construction which may increase potential well sites
- UIC Permit is issued by EPA

Deep Well Injection Alternative Issues

- Seismicity
- Cost of construction and operation
- Useful life of well
- Disturbances associated with construction
- Disturbances associated with operation

Evaporation Pond Alternative

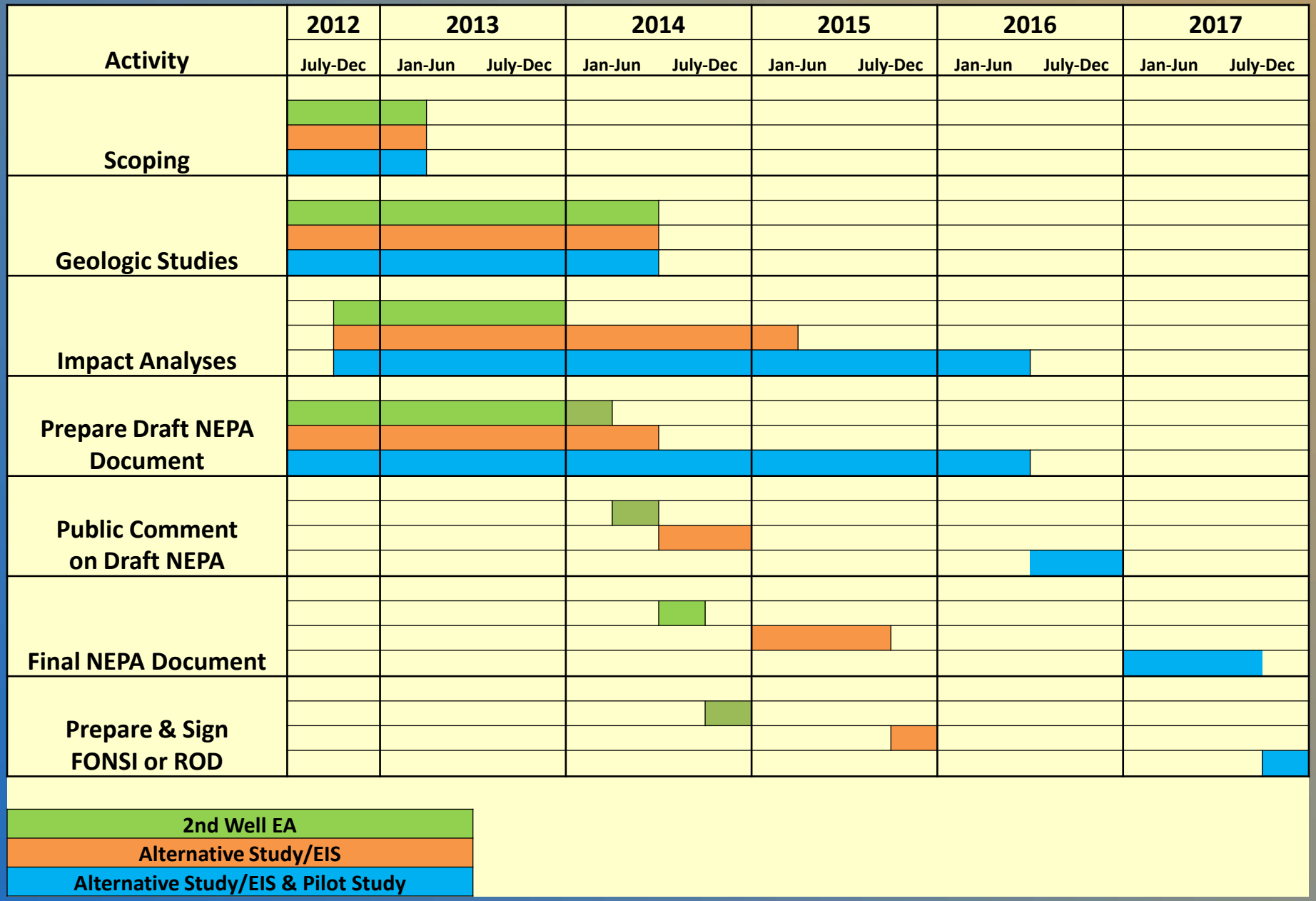
- This alternative would look at one or more evaporation pond facilities to evaporate brine and store the remaining salt.
- Reclamation would initiate an intensive literature review and site assessment of existing evaporation pond usage, impacts, and implemented mitigation measures.
- Reclamation will continue to work with BLM, U.S. Fish and Wildlife Service, State of Colorado, Montrose County and the Paradox Valley Community to identify a suitable site(s) for a pilot and full-scale facility for the Paradox Valley Unit.

Evaporation Pond Alternative Issues

- Landfills are regulated by the State of Colorado and Montrose County. Initial discussions with CDPHE indicate that the brine evaporate is classified as a solid waste. The 1997 UIC permit classified the brine as a non-hazardous waste.
- Reclamation and BLM both have regulations prohibiting landfills on federal lands.
- Moving the evaporate from an evaporation pond to a permitted and approved landfill is expensive.
- Changes in land use. Long-term use of BLM lands would likely require a BLM land withdrawal.
- Migratory Bird Treaty Act compliance.

Other Potential Alternatives

- Combined Well-Evaporation Pond Alternative(s)
- Commercial Operation Alternative(s)
- New Technology Alternative(s)



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Please provide comments on the proposed study/EIS to Reclamation by November 26, 2012.

Written Comments can be mailed to:

Ed Warner, Area Manager
Bureau of Reclamation
2764 Compass Drive, Suite 106
Grand Junction, Colorado 81506

or emailed to:

ParadoxEIS@usbr.gov

RECLAMATION

For More Information, Contact:

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970-248-0608; TStroh@usbr.gov

or

Andy Nicholas, Bureau of Reclamation
Paradox Valley, Colorado
970-859-7214; or ANicholas@usbr.gov

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Links for more information on Colorado River Basin Salinity Control Program

Colorado River Basin Salinity Control Forum Website:
http://www.coloradoriversalinity.org/

Bureau of Reclamation Website:
http://www.usbr.gov/uc/progact/salinity

USDA Natural Resource Conservation Service Website:
http://www.co.nrcs.usda.gov/programs/eqip/eqip.html

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Questions and Comments?

RECLAMATION

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