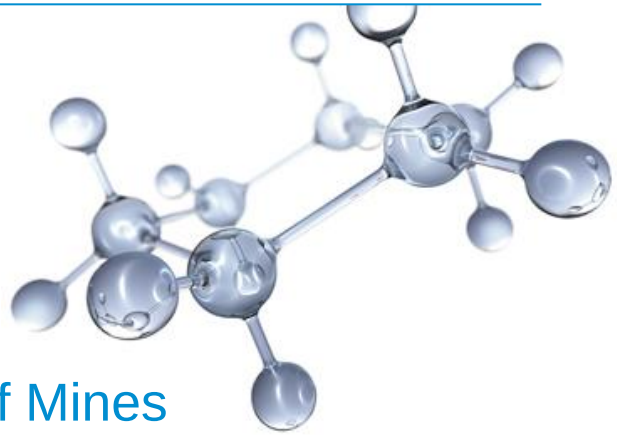
ExxonMobil
Upstream Research

Plan to Test ExxonMobil's *In Situ* Oil Shale Technology on a Proposed RD&D Lease



31st Oil Shale Symposium, Colorado School of Mines

P.L. Tanaka, J.D. Yeakel, W.A. Symington, P.M. Spiecker, M. Del Pico, M.M. Thomas, K.B. Sullivan, M.T. Stone

October 19, 2011

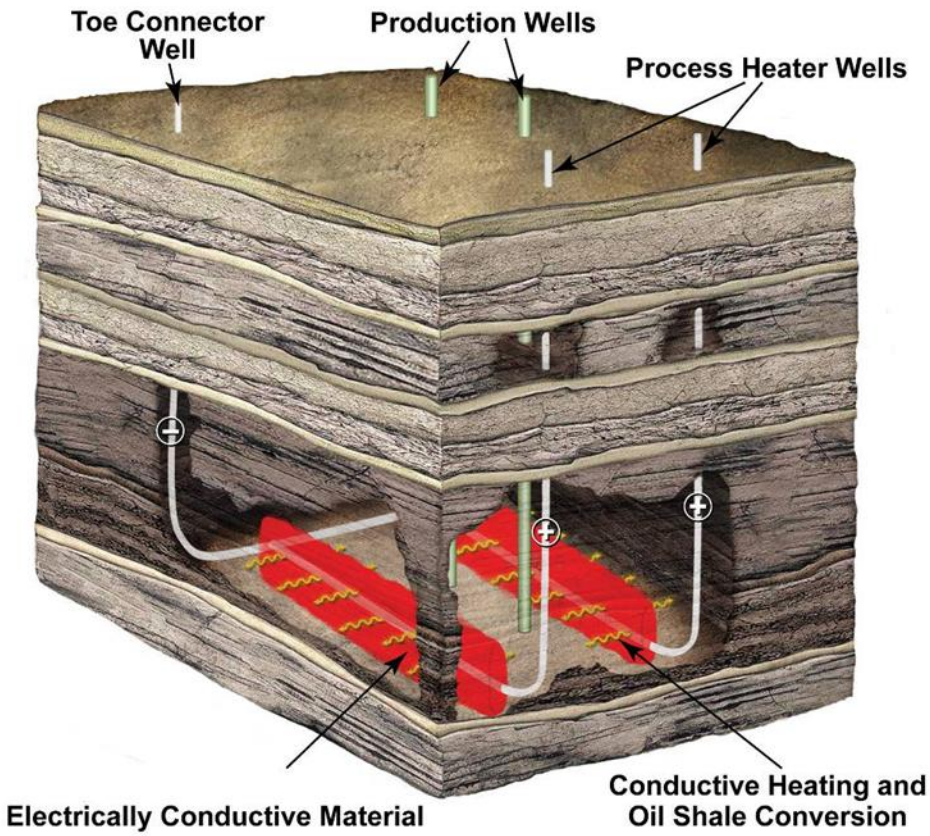
ExxonMobil Technology Development

- Developing *in situ* oil shale technology since 1999
- Colony Mine as a field laboratory since 2007
- 2nd Round Research, Development, and Demonstration (RD&D) Lease Nomination submitted in 2009 is currently under National Environmental Protection Act (NEPA) review
- Developing and progressing plans for RD&D Lease activities

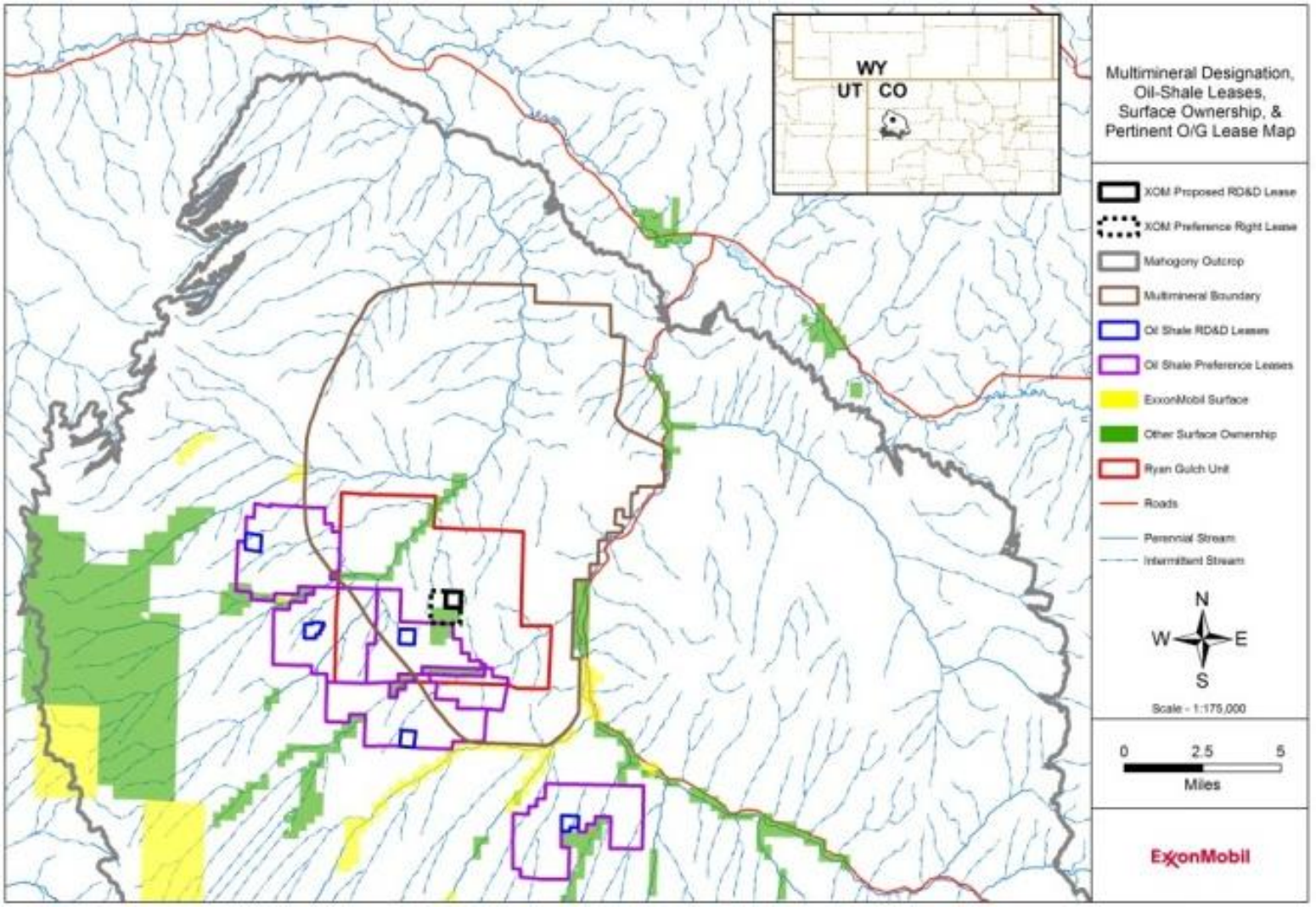
Colony Mine

ExxonMobil's *In Situ* Oil Shale Technology

- Oil shale is heated *in situ* by an electrically conductive material
- Electricity is conducted from one end of the heating element to the other
- Heat conducted into the formation, converting kerogen into oil and gas
- Oil and gas conventionally produced
- Potential for cost-effective recovery with less surface disturbance than
  - Mining and retorting
  - Competitive *in situ* processes
- Several years of continued research required to demonstrate technical, environmental, and economic feasibility



Location of RD&D Lease Nomination



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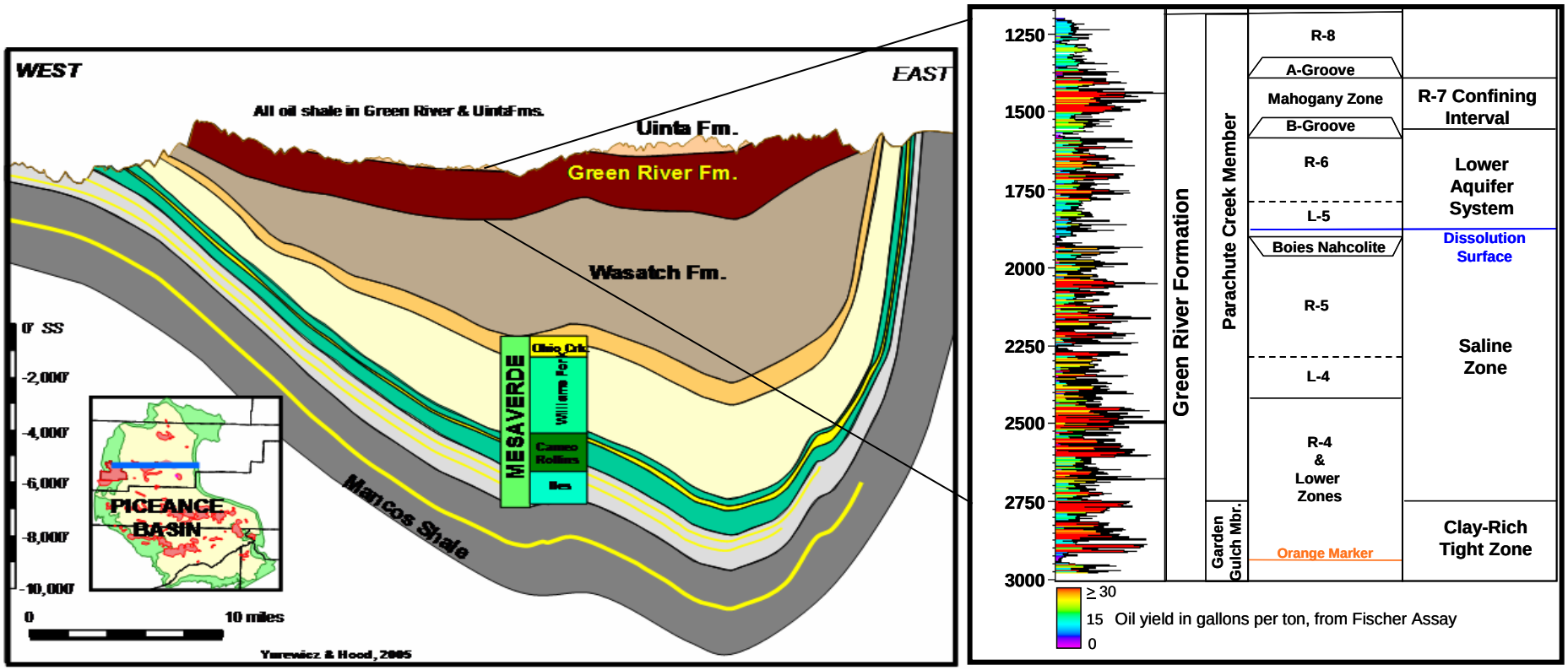
RD&D Lease Geology



- Parachute Creek member ~1500 ft thick
- Primarily organic rich dolostones, sandstone, and in lower parts, evaporites
- Dissolution surface not stratigraphic

- In place RD&D resource estimates
  - ~600 MBOE
  - Nahcolite ~ 87 MT
  - Dawsonite ~30 MT

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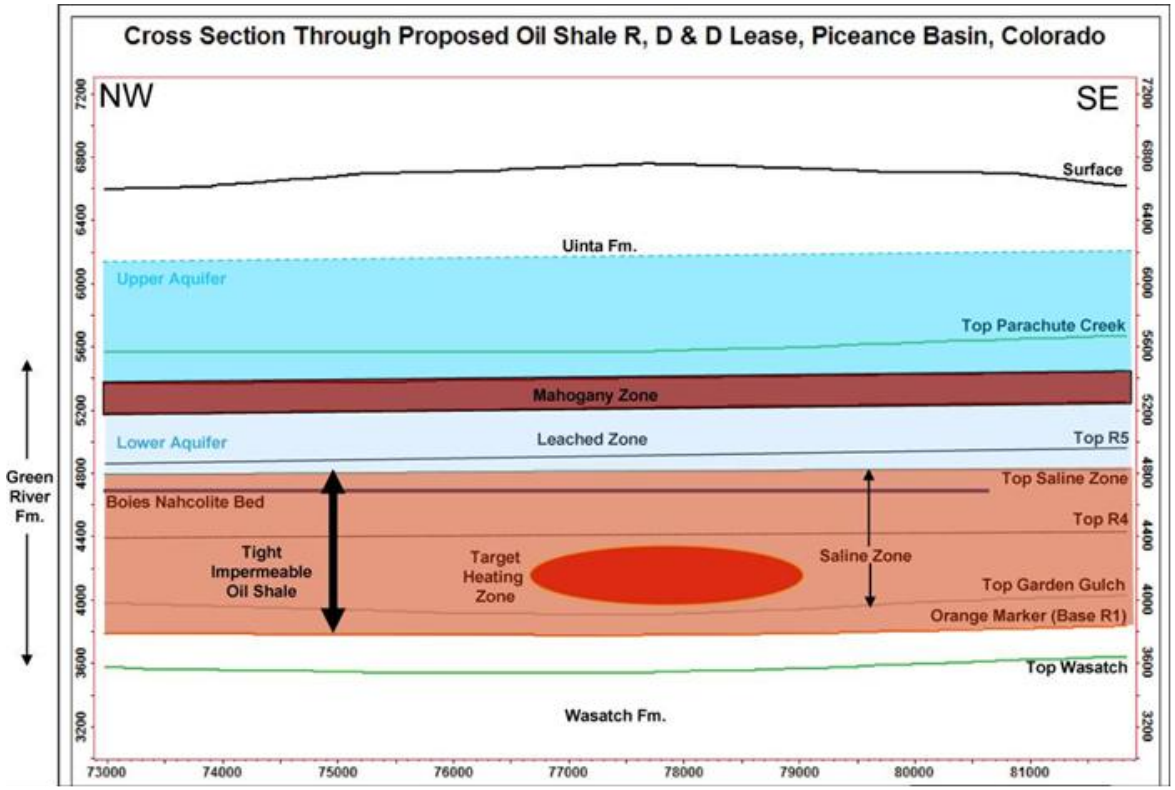
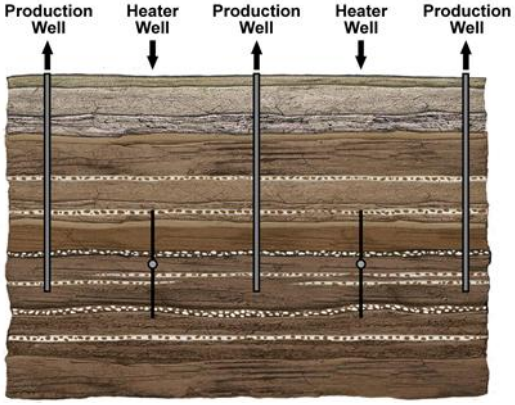
Groundwater Protection

- Groundwater protection through hydraulic isolation of the converted oil shale resource below aquifers
  - Target “tight” saline zone below lower aquifer
  - Maintain unheated, impermeable seal around developed volume

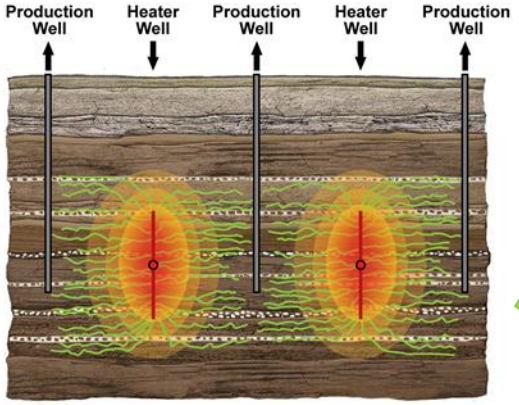


Preservation of Sodium Mineral Value

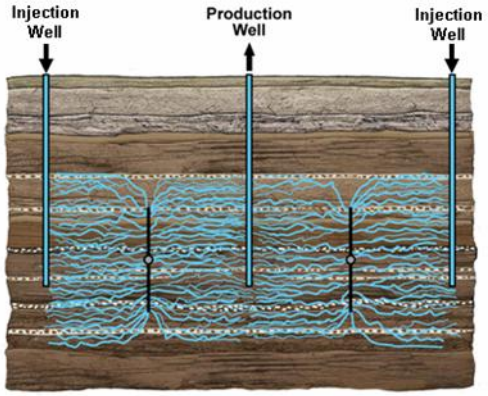
1. Drill Wells, Build Heaters



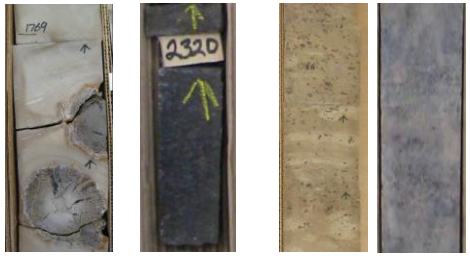
2. Heat: Conversion, Porosity, Oil Production, Nahcolite to Natrite



3. Sodium Mineral Available For Future Recovery



Forms of Nahcolite in RD&D Lease Target Zone



Nodular Bedded Coarse Fine Dispersed

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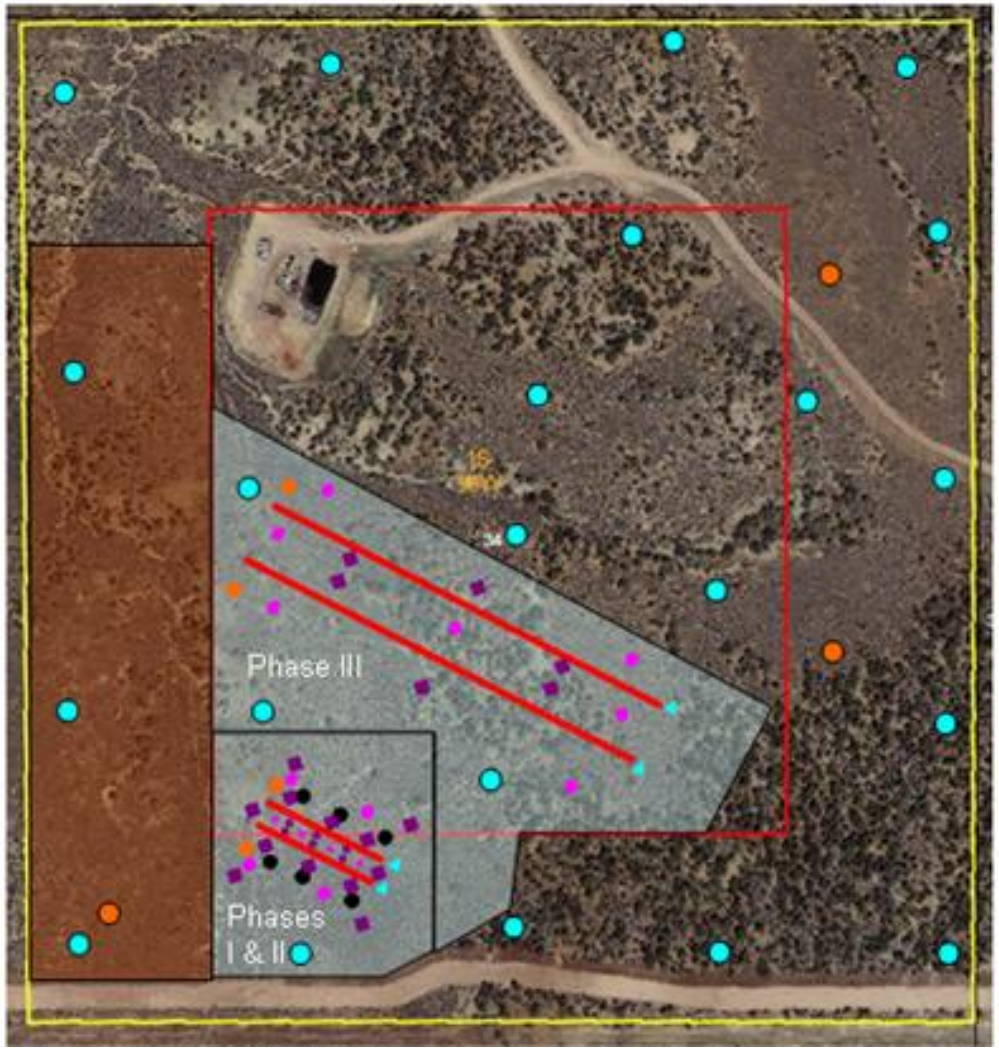
Phased Technology Development



ExxonMobil Oil Shale RD&D Lease
Schematic Layout of Wells and Facilities

Legend

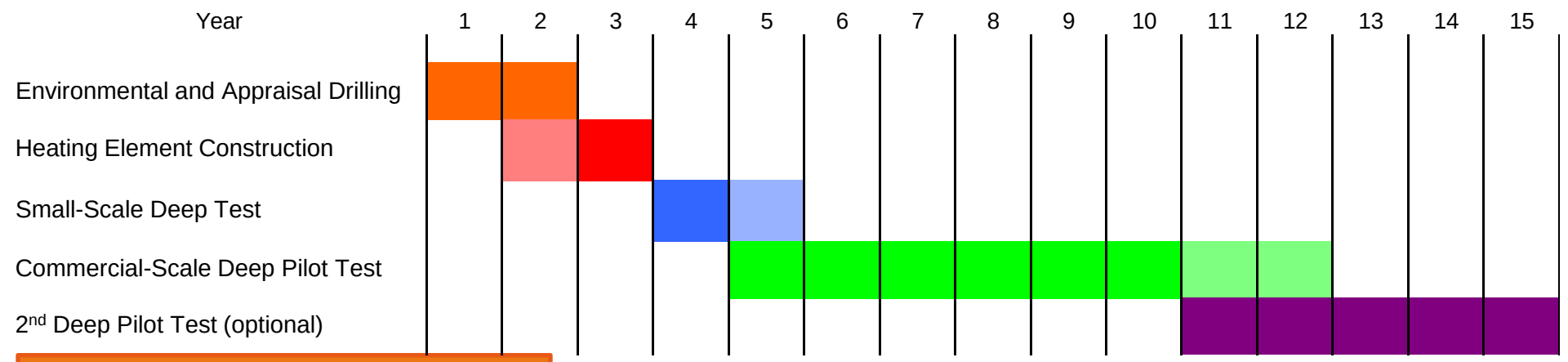
- 500-ft Setback
- Lease Outline
- Appraisal Wells
- Groundwater Monitoring Wells
- Construction Hole
- Observation Hole
- Connector Hole
- Monitoring Hole
- Production Well
- Phase I – III Pads
- Production Facilities
- Heating Element

North

0 500 1,000 ft.

ExxonMobil Upstream Research

Phased Technology Development



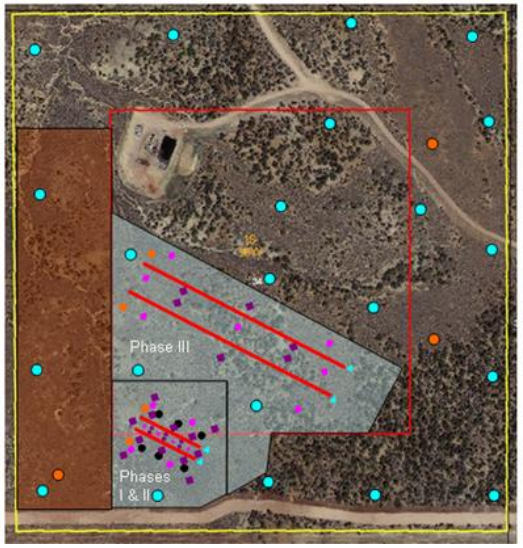
- Appraisal drilling to define experiment locations
- Groundwater monitoring to obtain baseline data

- Build 2 or more small heating elements at depth
- Evaluate characteristics and confinement to target zone
- Make connections and drill production wells

- Heat for six months to demonstrate technology, assess groundwater protection
- Produce oil (up to 175 bpd), water (up to 80 bpd), and gas (up to 350 kscfd)

- Full-scale technology demonstration
- Construct two full-scale heating elements and heat for 2-5 years
- Produce oil (up to 700 bpd), water (up to 300 bpd), and gas (up to 6 Mcfd)
- Test sodium mineral recoverability

- Second full-scale pilot test is an option



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North

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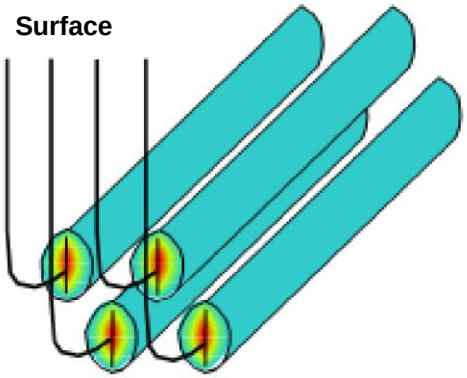
Commercial Outlook: Responsible Development

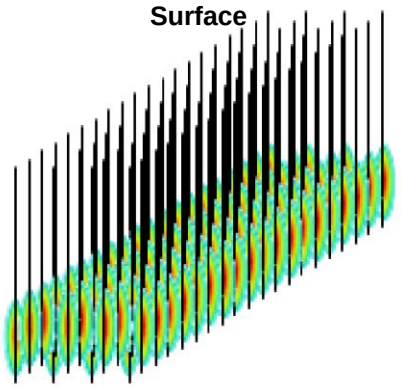
- Measured, protective path to development
- Reduced surface disturbance, water use, and CO_2 emissions
- Environmental elements are a prominent part of R&D program
- Energy Efficiency and CO_2 Emissions
  - Estimated > 3BOE energy produced for each BOE fuel input to power plant
  - Produced gas will fuel energy-efficient combined-cycle gas power plant
  - Opportunities to leverage promising EM CO_2 mitigation, capture, and injection technologies
- Reduced Freshwater Needs

Reduced Surface Disturbance

Planar Heaters



Wellbore Heaters



Reduced Freshwater Needs

(Barrels of water per barrel of oil produced)

Industry Estimates	ExxonMobil's *In Situ* Oil Shale Technology
4-6	1-2

How Much Water?

Description of 1.5 bbl water / bbl oil produced

Scope	Oil Production bbl/day	Water Demand ac-ft/yr*
One Commercial Project	50,000	3,500
Industry (10 projects)	500,000	35,000

* - 1 Acre-foot of water is equivalent to the planned annual use for one household

Closing Comments

- Oil shale comprises an important domestic resource to meet U.S. energy demand and diversify supply
- ExxonMobil's *In Situ* Oil Shale process has significant potential for technical, environmental, and economic success
- Environmentally and socially responsible development
  - Reduced surface disturbance, water use, and CO_2 emissions
  - Groundwater protection
  - Multimineral development
- Going forward:
  - Careful, phased approach that allows for prudent technical, environmental, and social planning and execution
  - Work with all appropriate local, state, and federal agencies to develop viable options