



CBM Infiltration Ponds Powder River Basin

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Infiltration Ponds:

Water budget

Ground Water Quality impacts

Site Assessment Methods

Saturated Paste Extract

Remote sensing

Leonardite removal of sodium

Look for the 2009 CBM Regional Groundwater Monitoring Report

in

February 2010



Infiltration Ponds:

Coal Creek

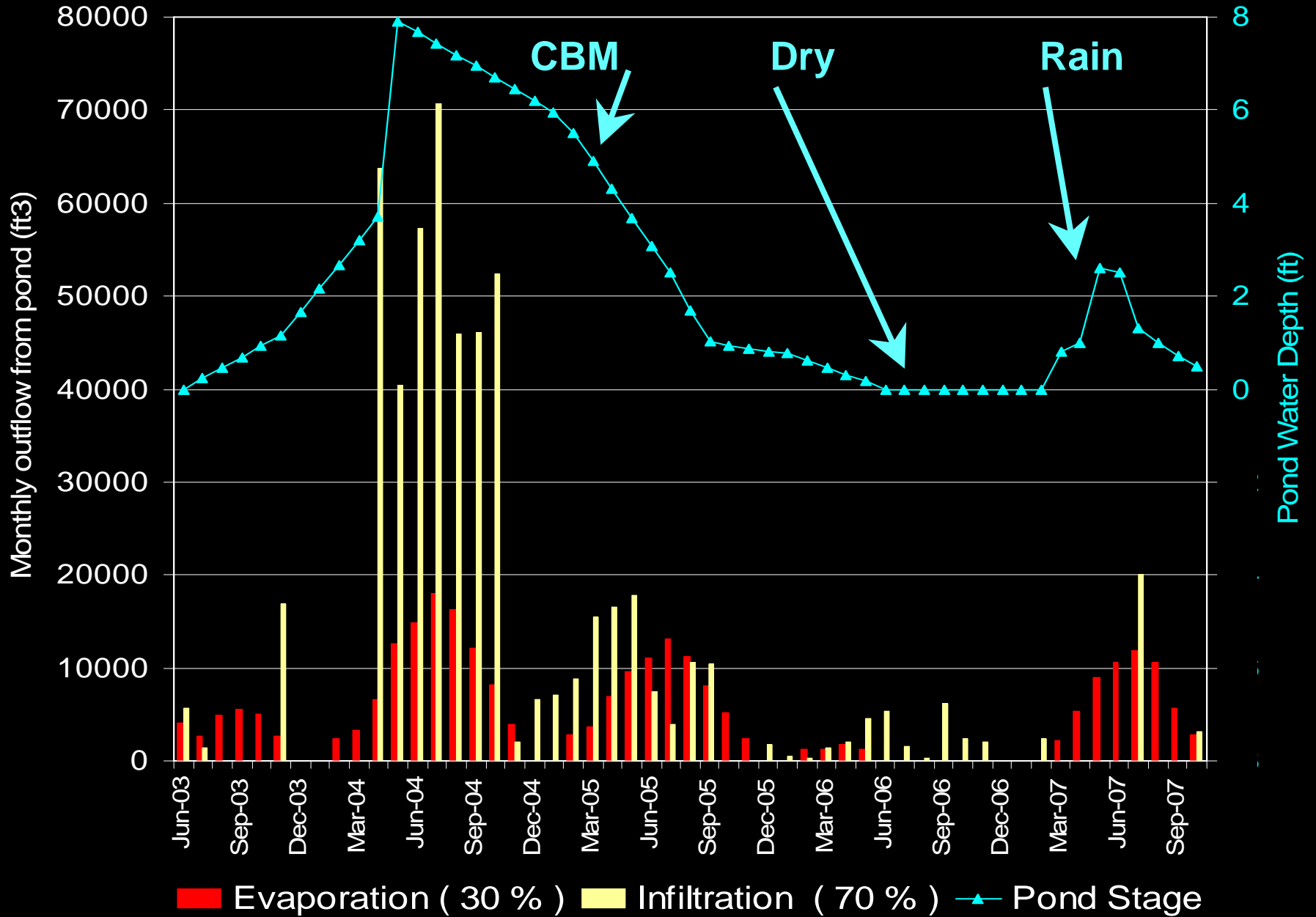
- Off Channel
- Used for approx. 1 year
- Not currently used



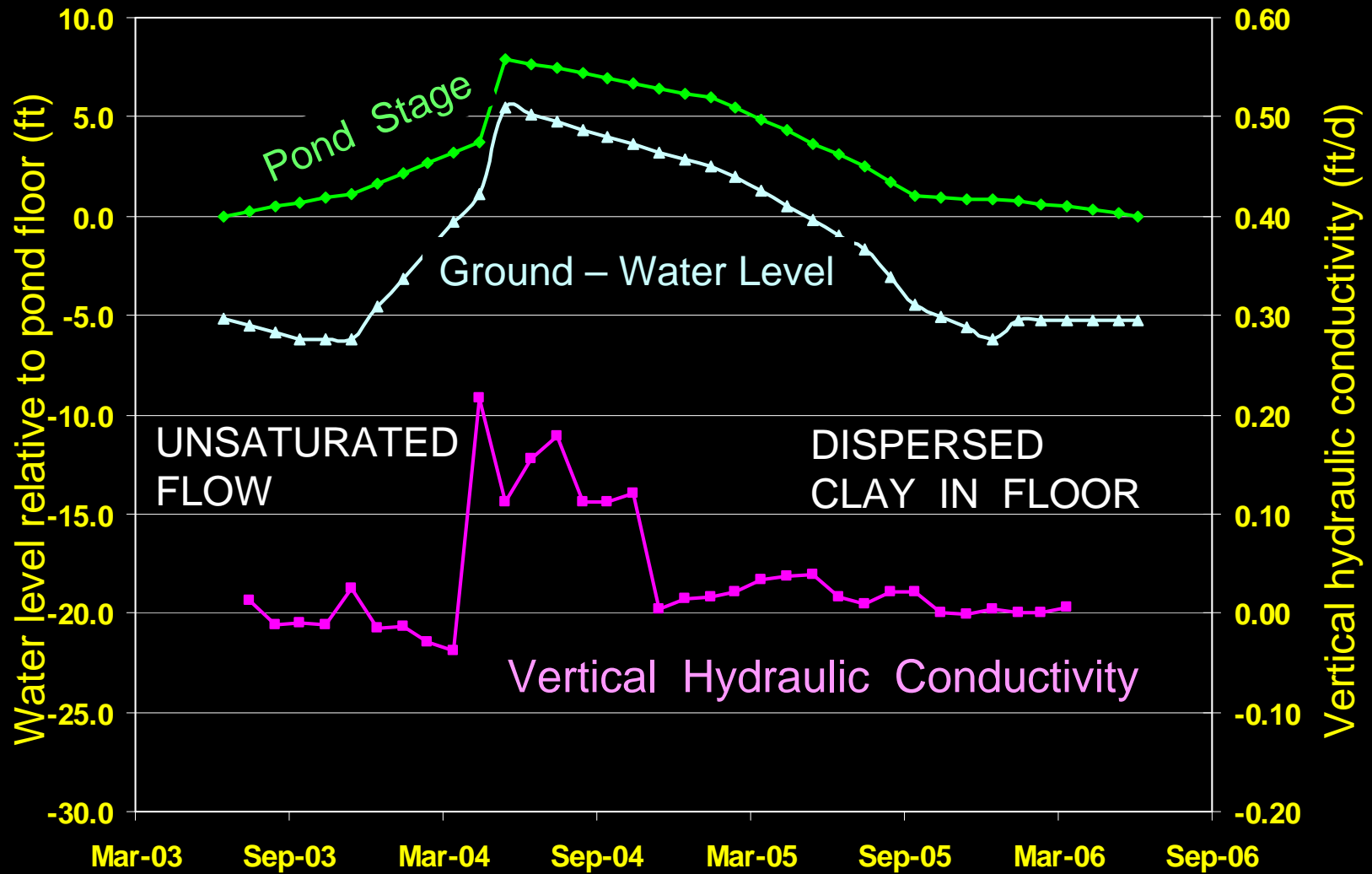
Some of the monitoring wells



Estimated Outflow from the Coal Creek Infiltration Pond



Vertical hydraulic conductivity estimated from the water budget



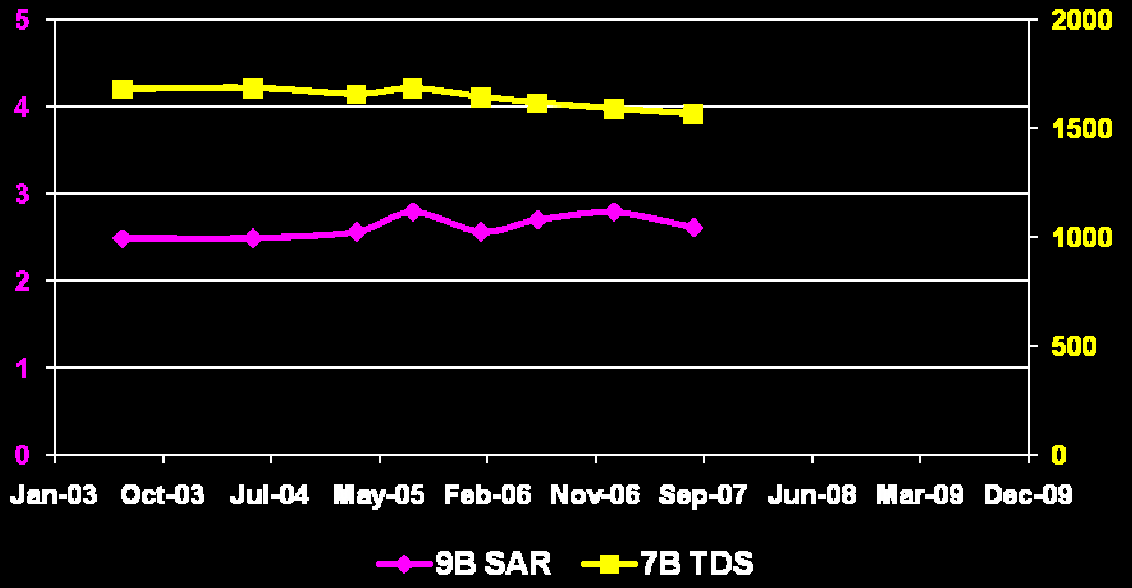


Before

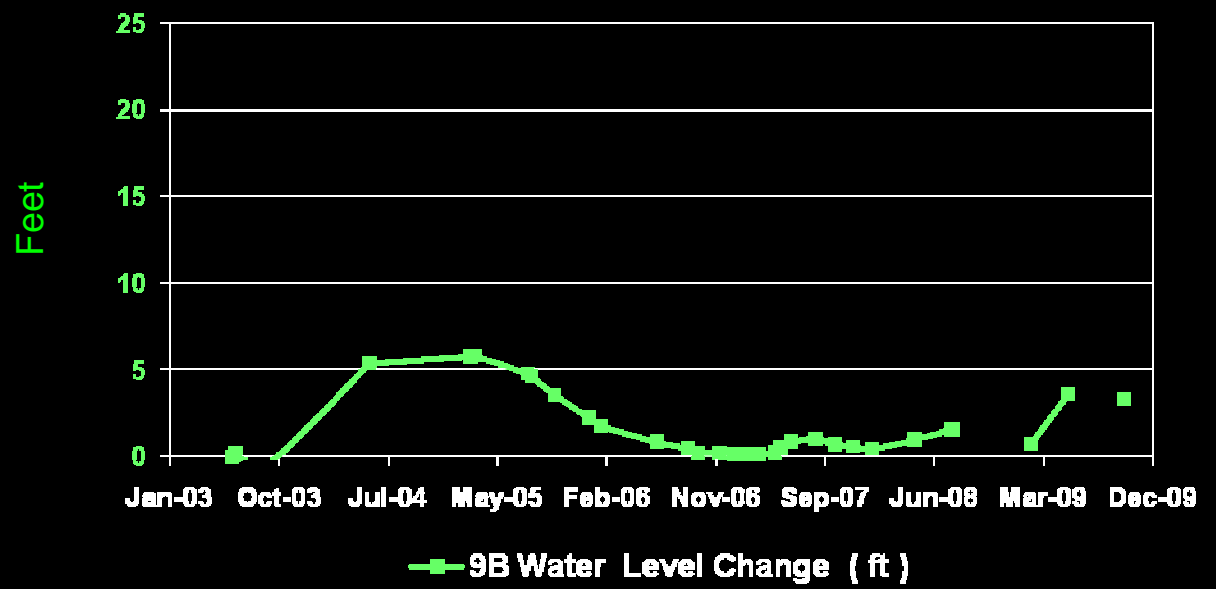


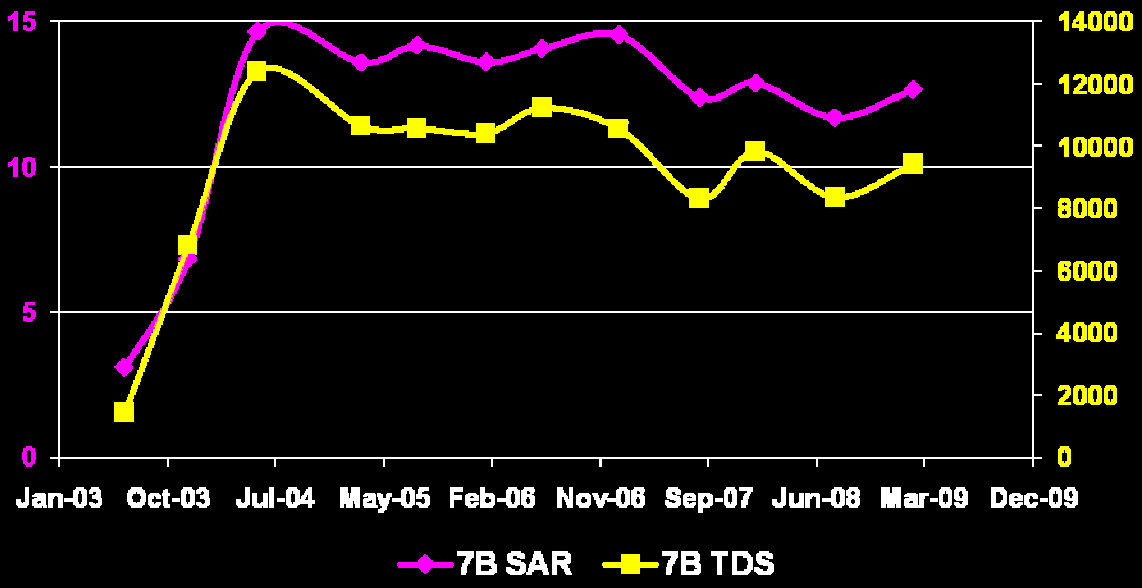
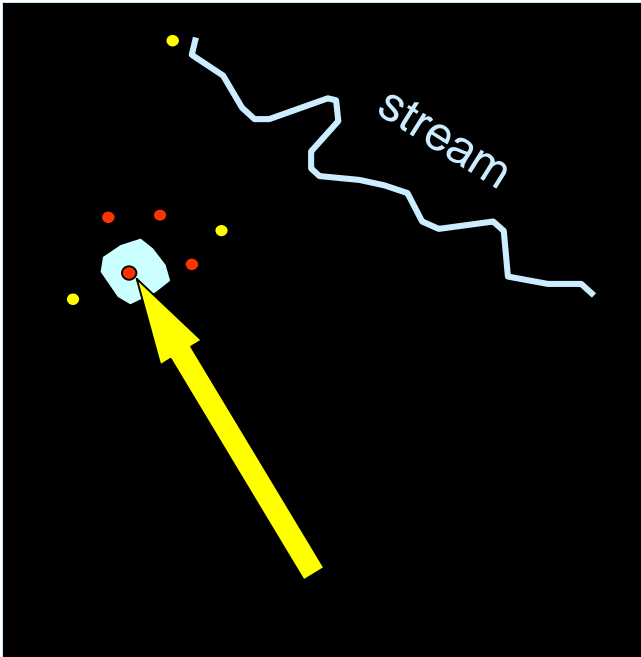
After



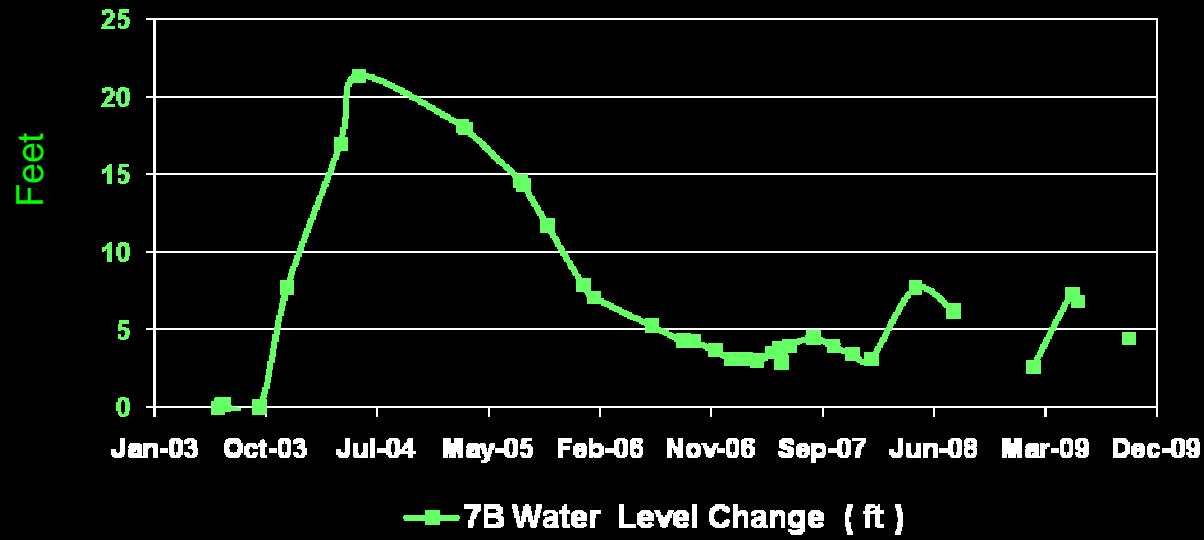


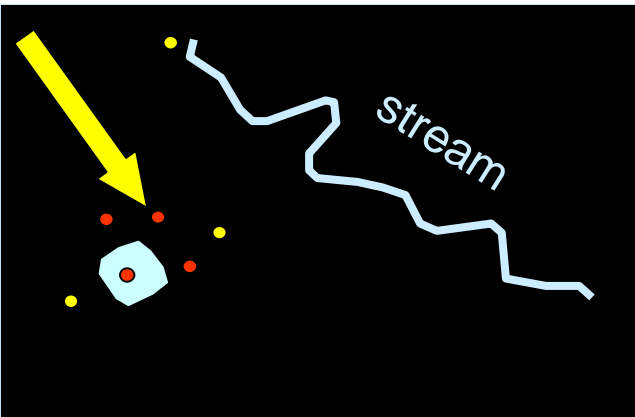
Shallow wells
 Upgradient of pond
 58 ft deep
 9B



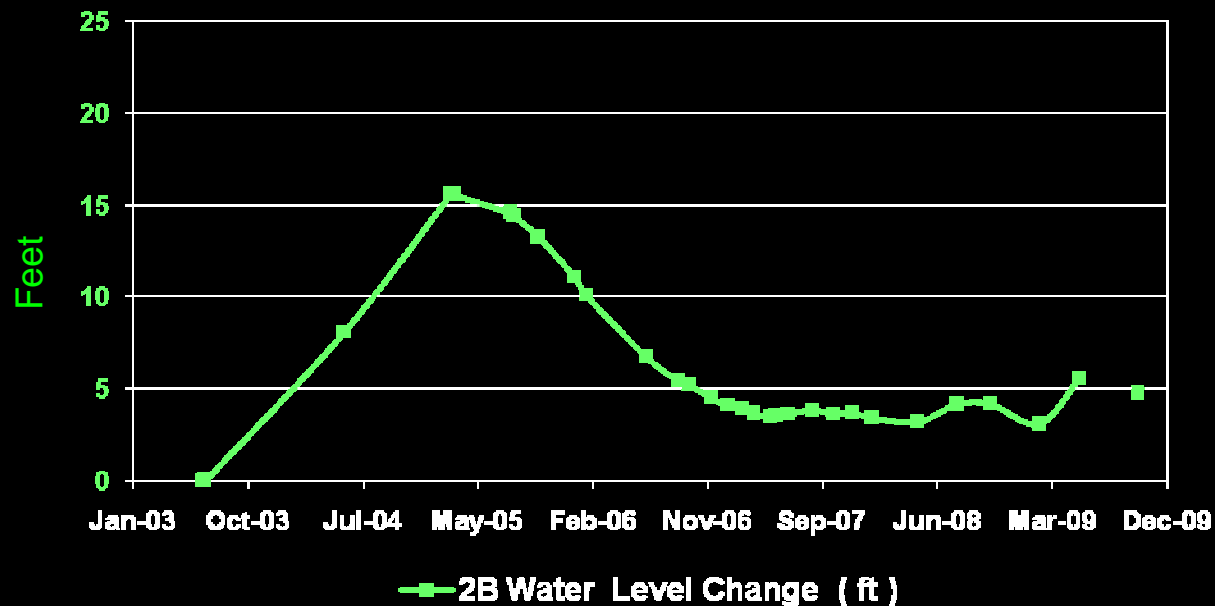
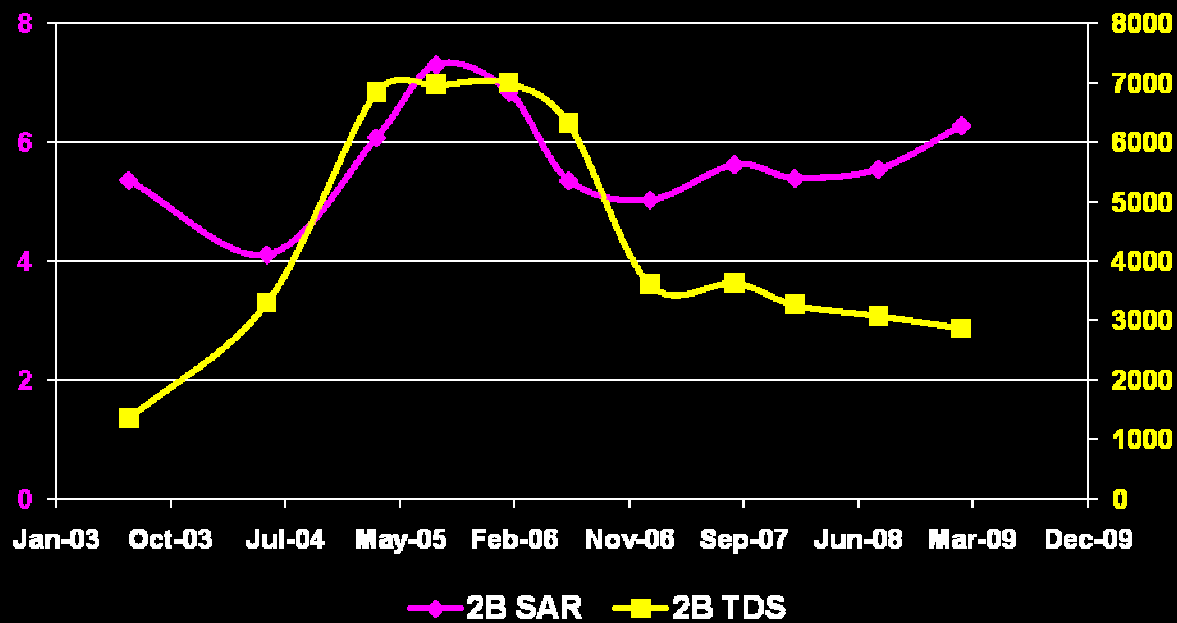


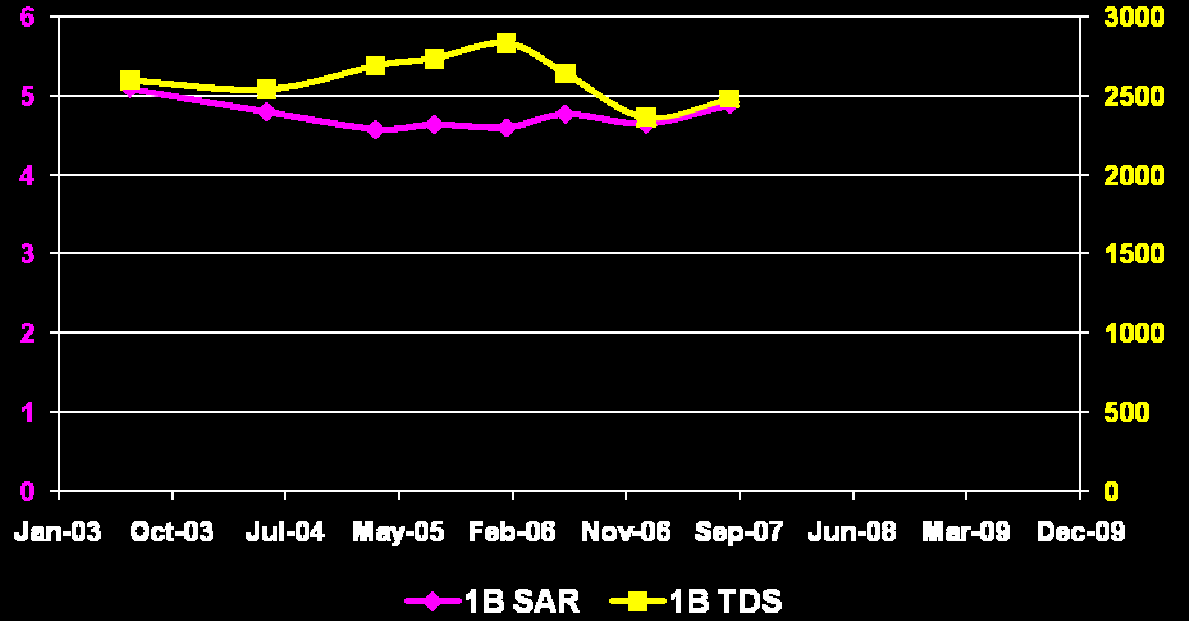
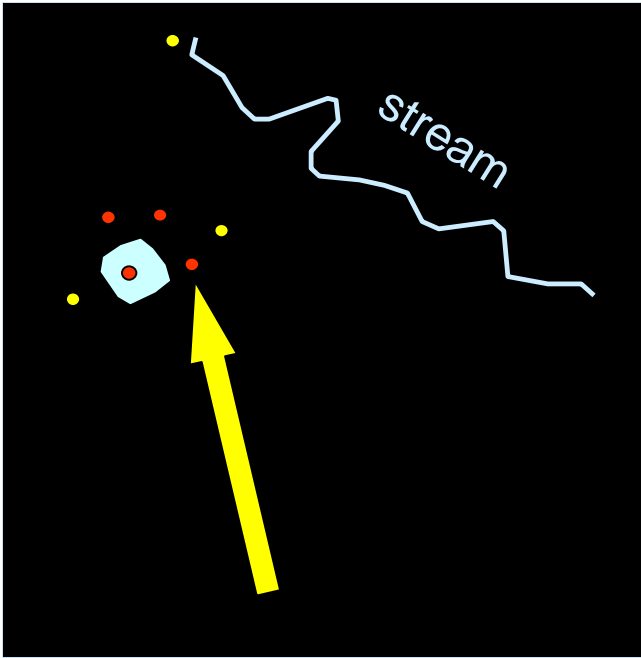
Shallow wells
in pond
7B
23 ft deep



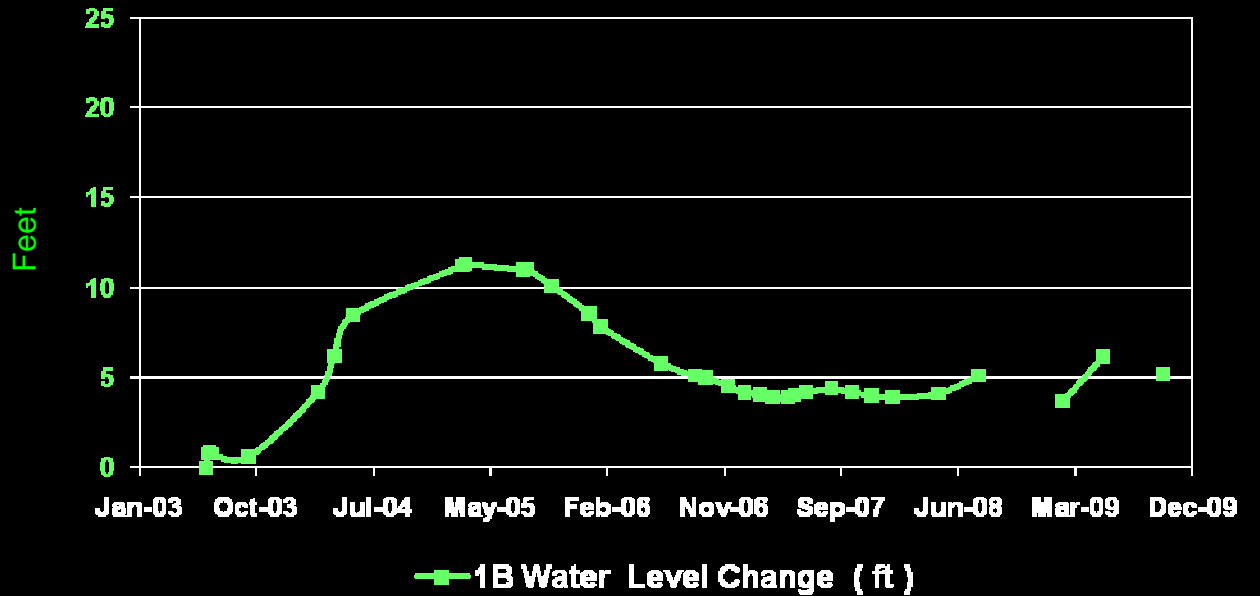


Shallow wells
near pond downgradient
2B
35 ft





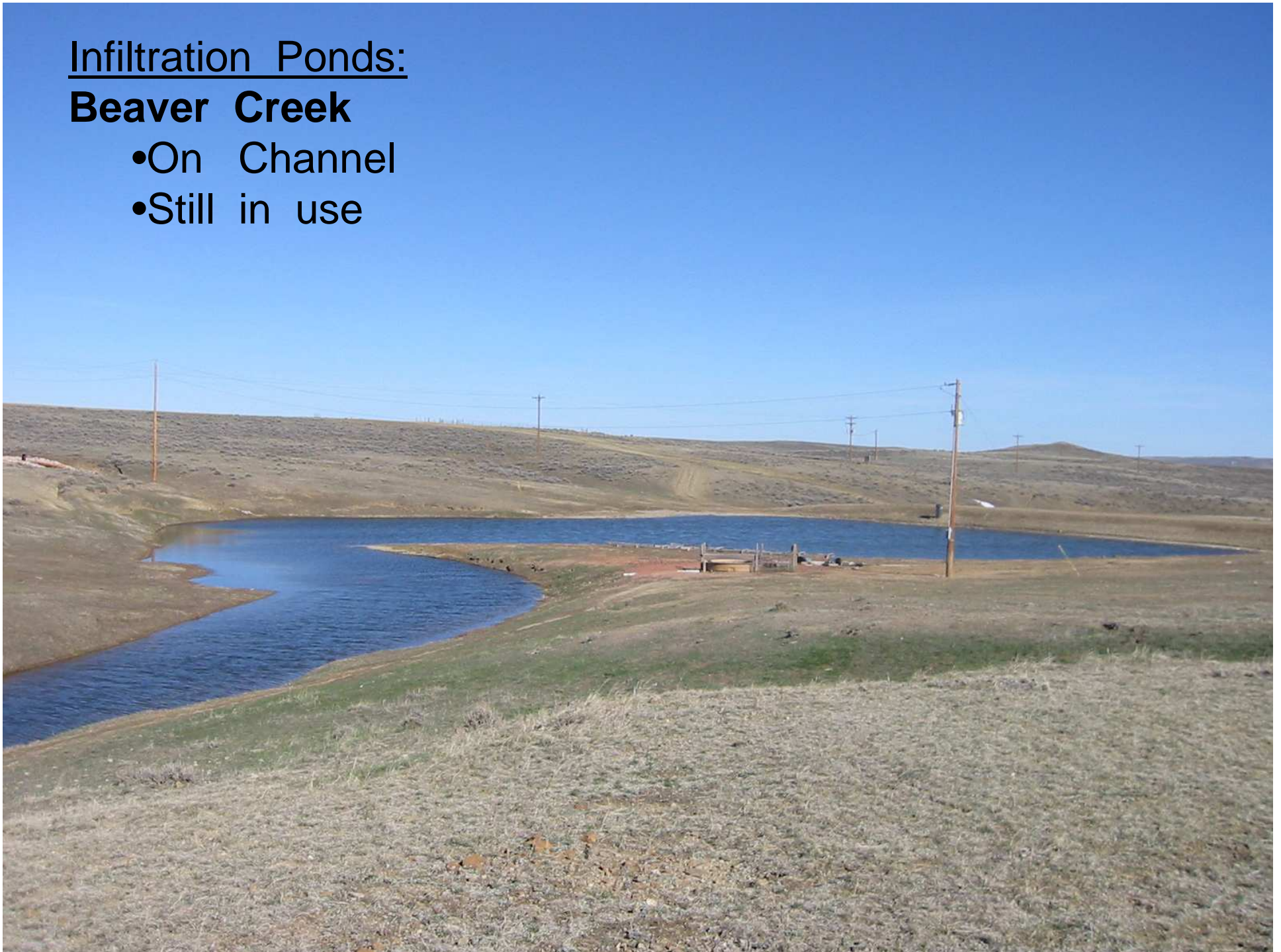
Shallow wells
near pond downgradient
1B
42 ft Deep



Infiltration Ponds:

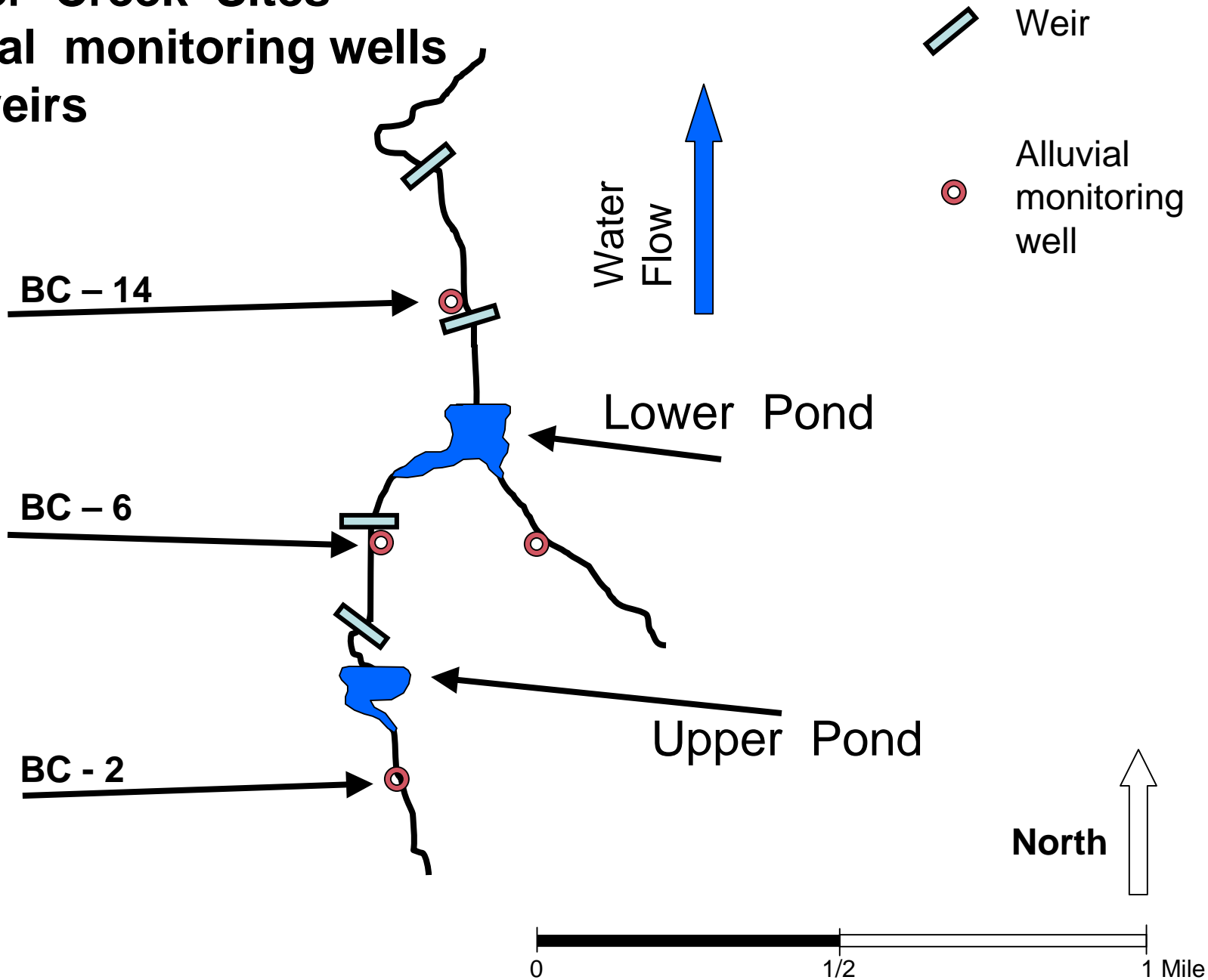
Beaver Creek

- On Channel
- Still in use

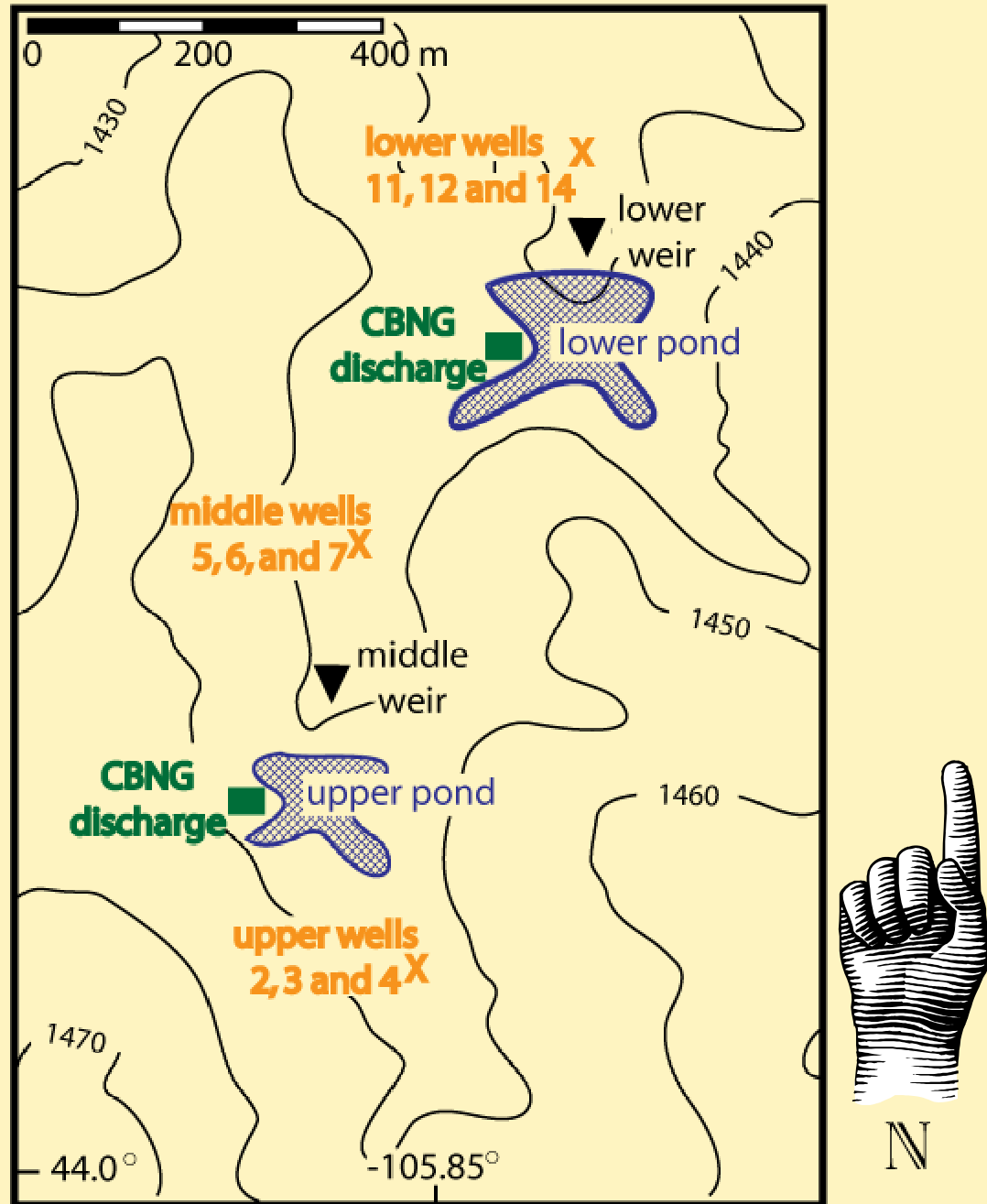


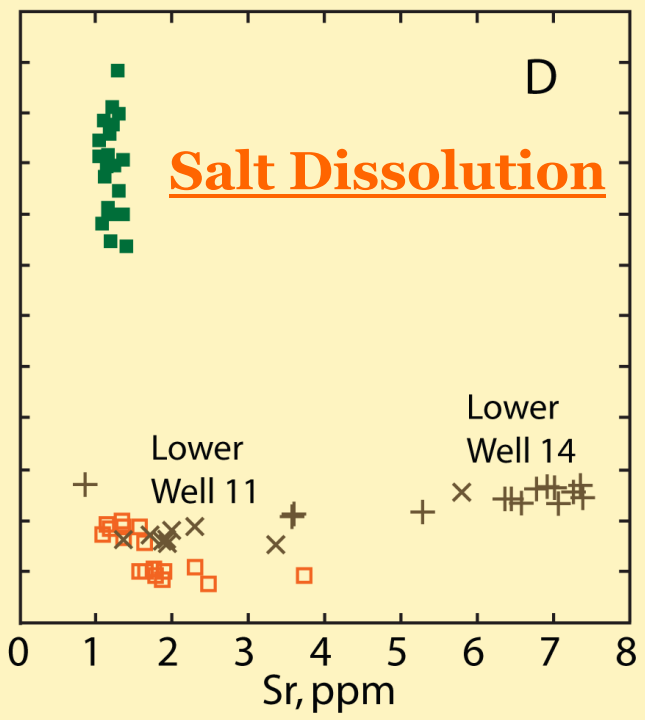
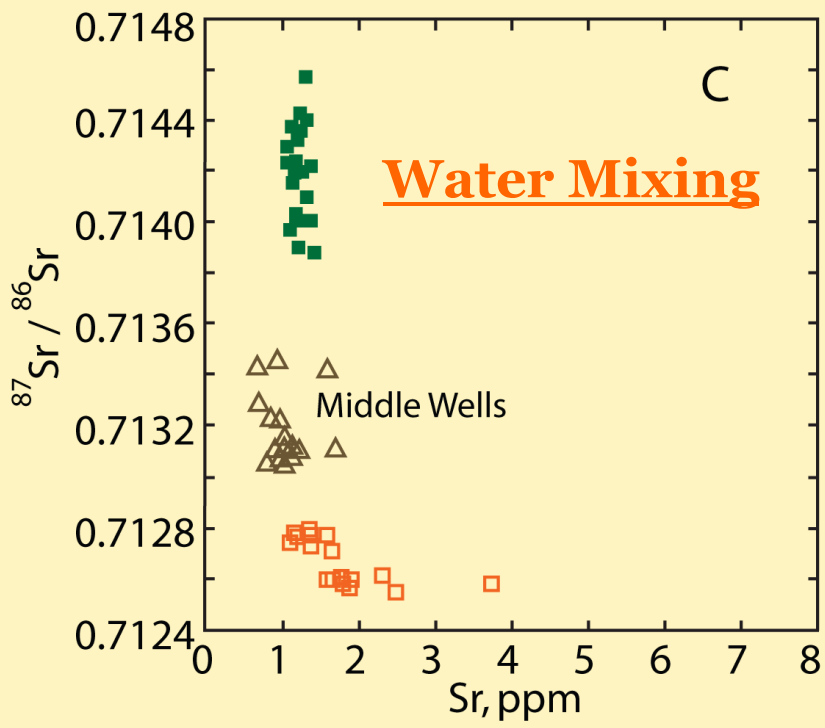
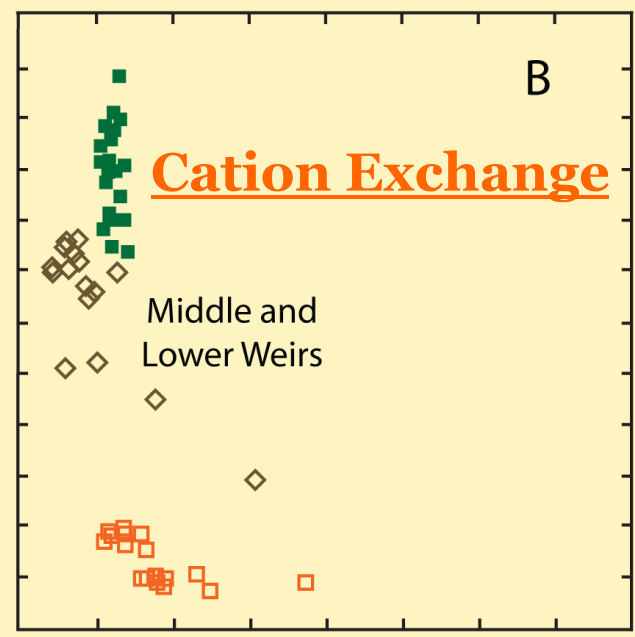
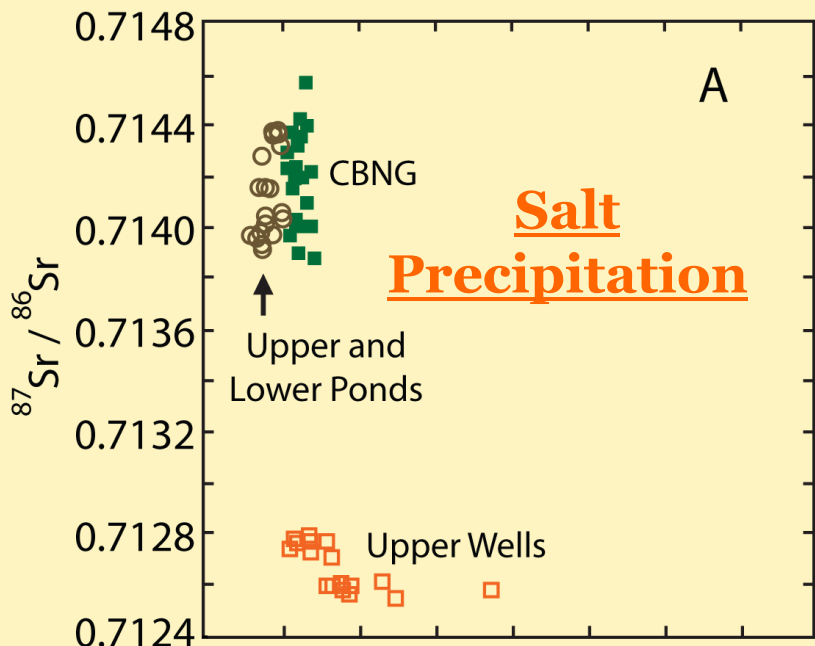
Beaver Creek Sites

Alluvial monitoring wells and weirs



Topographic map of
Beaver Creek
Study Site





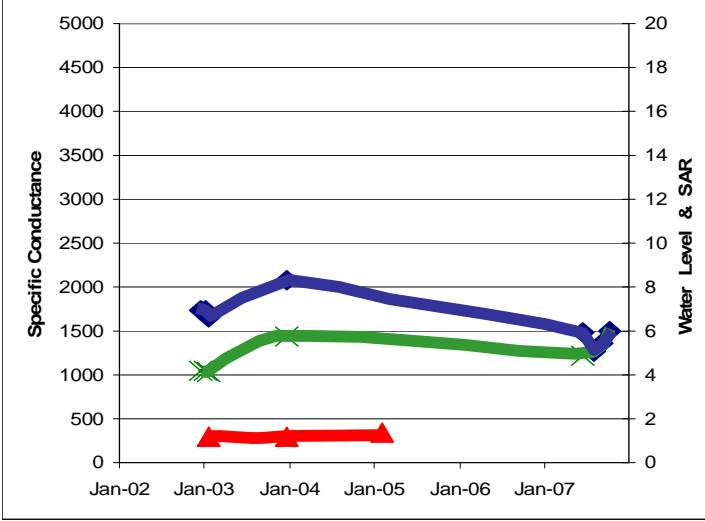
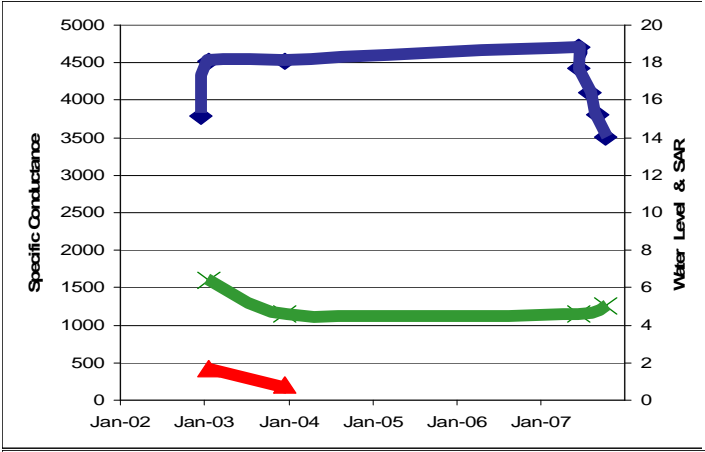
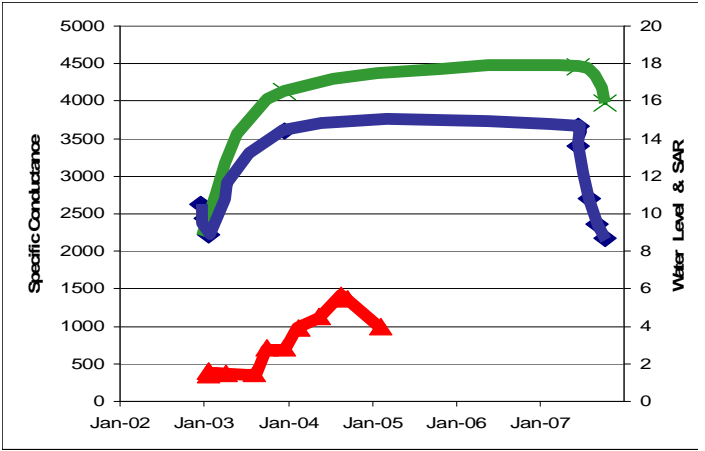
Beaver Creek

Groundwater data

SC

Water Level

SAR



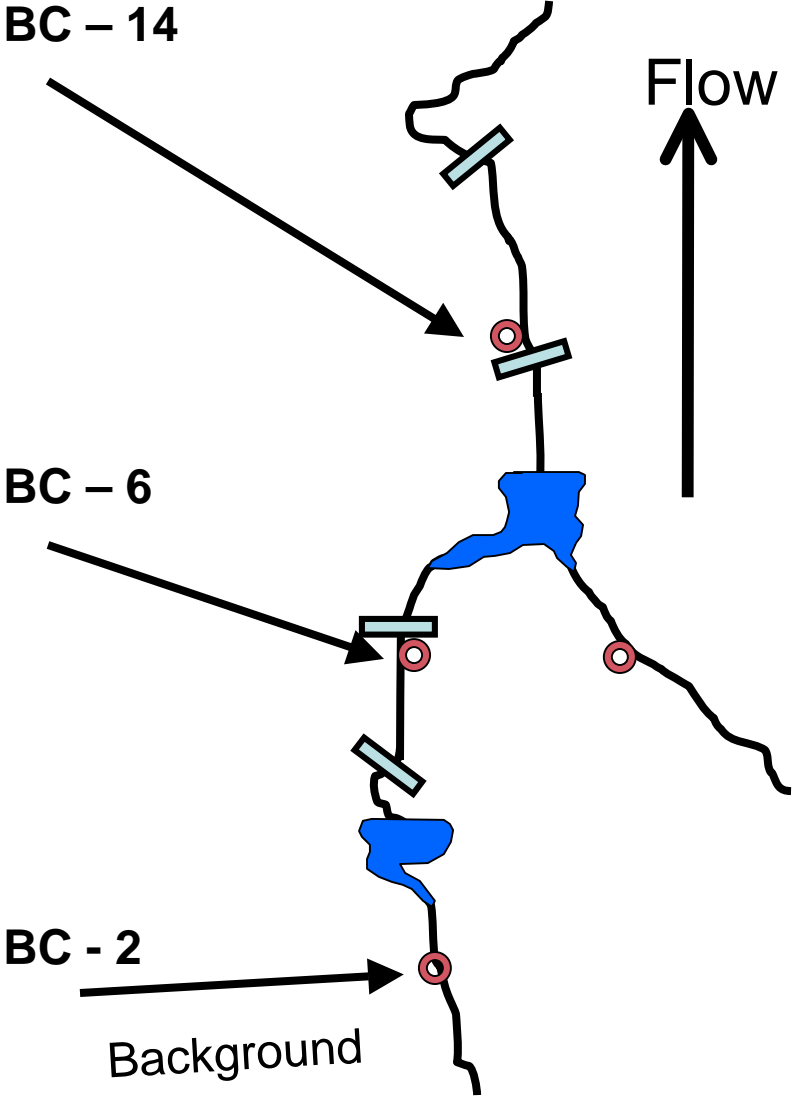
BC - 14

BC - 6

BC - 2

Background

Flow



Site Assessment :
Saturated Paste Extract

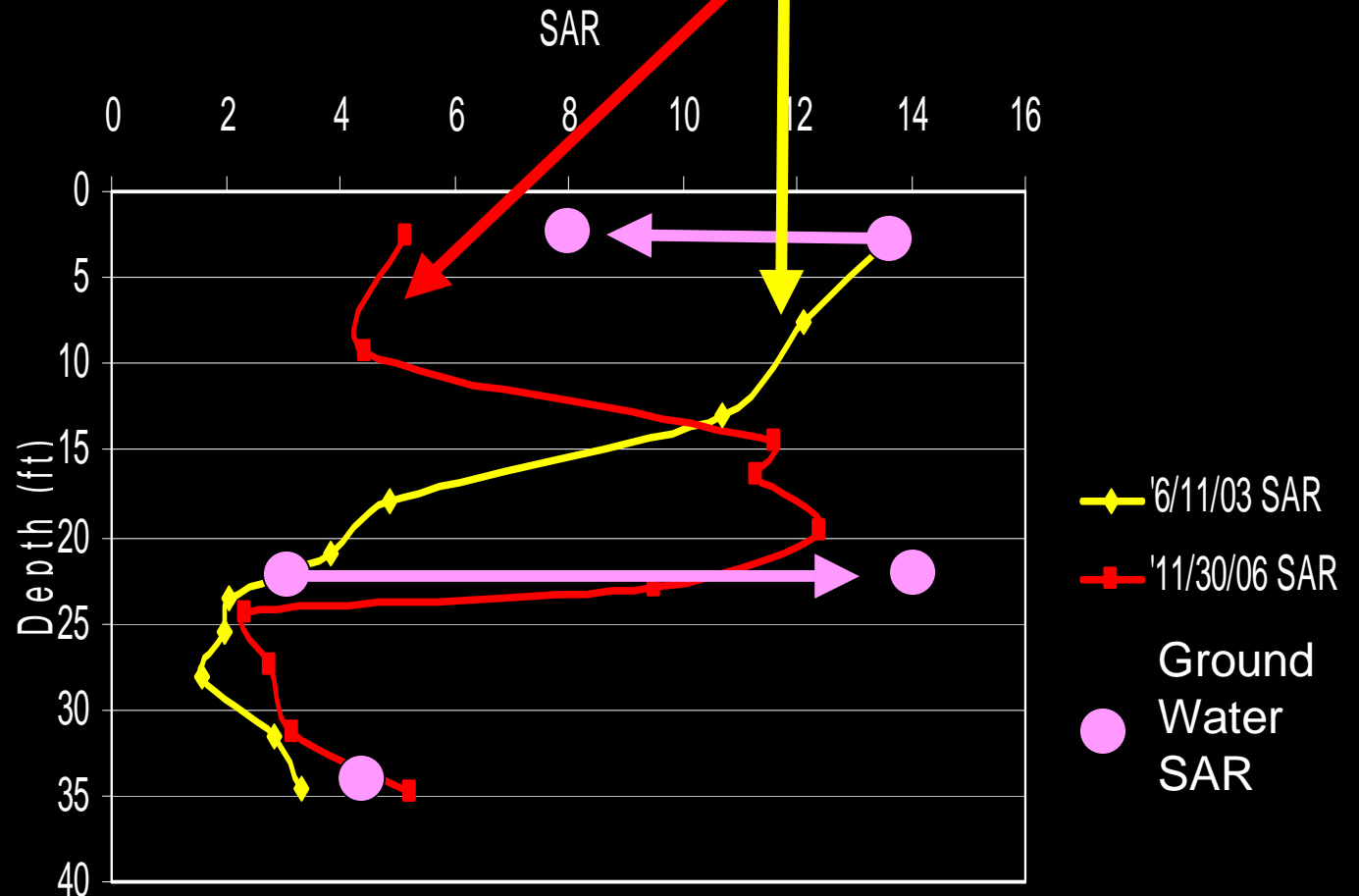
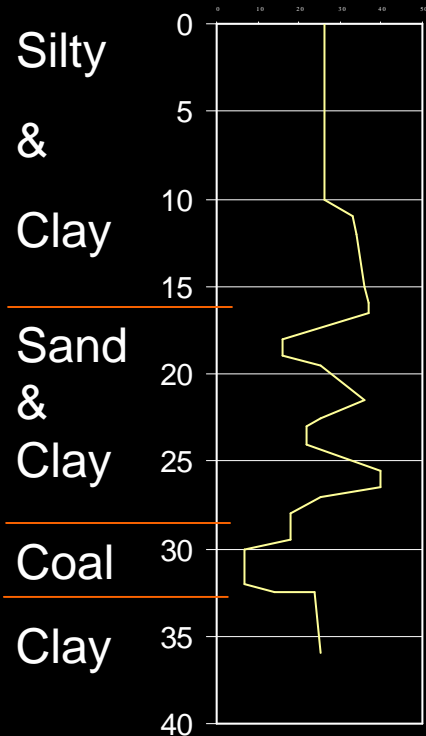
12ba6b
29 -

12ba6b
26 - 29



Coal Creek Infiltration Pond Saturated Paste Extract Data **before** and **after** infiltration

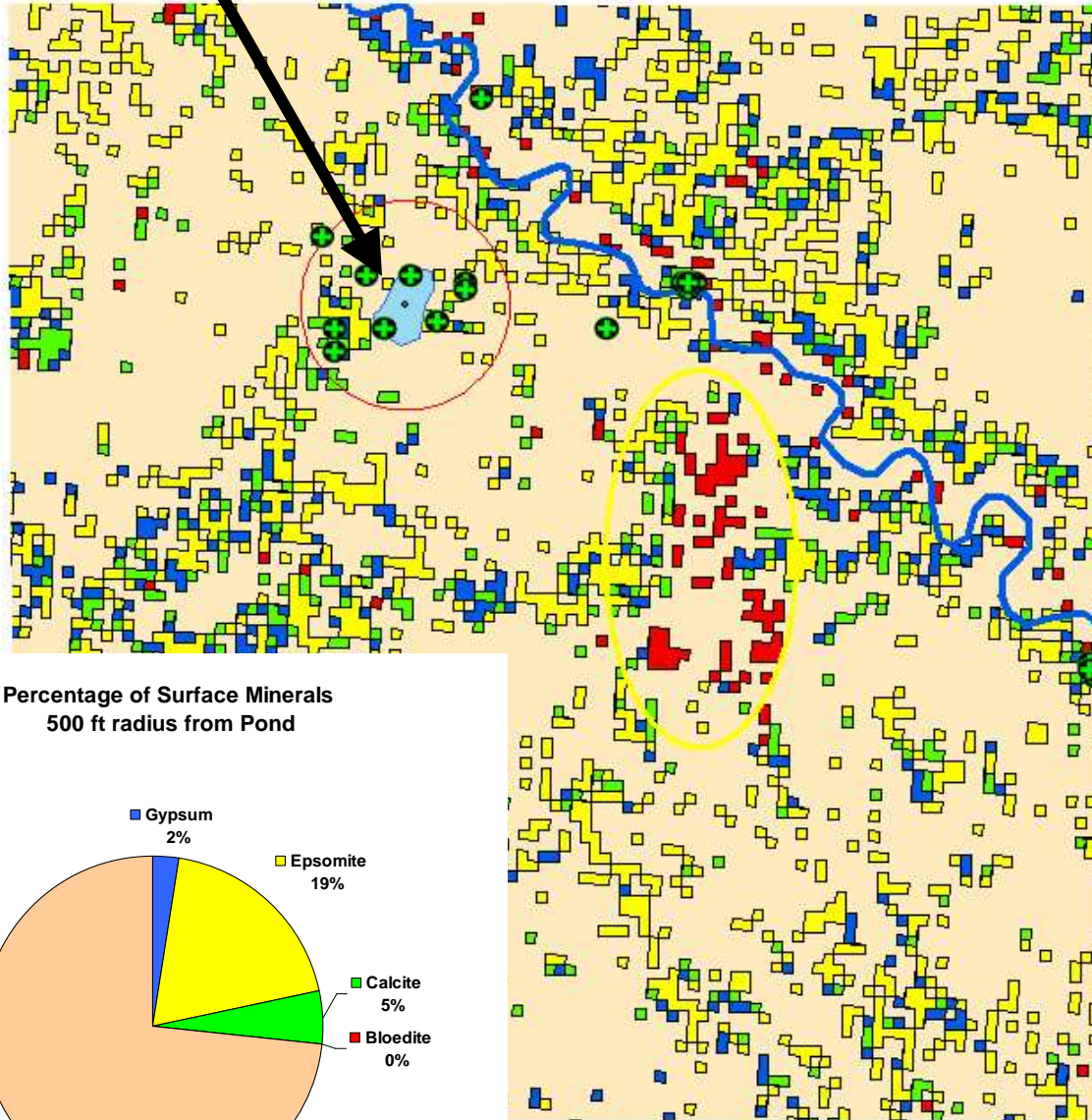
Sodium Adsorption Ratio, CBM = 23



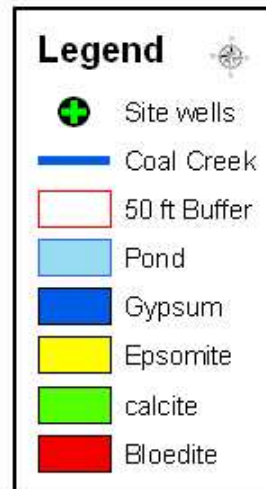
Site Assessment : **Remote Sensing**

- Can satellite data provide information to avoid problem pond sites ?
- Analyzed ASTER* images from August, 2001.
- *Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)
- Just a preliminary evaluation of technique

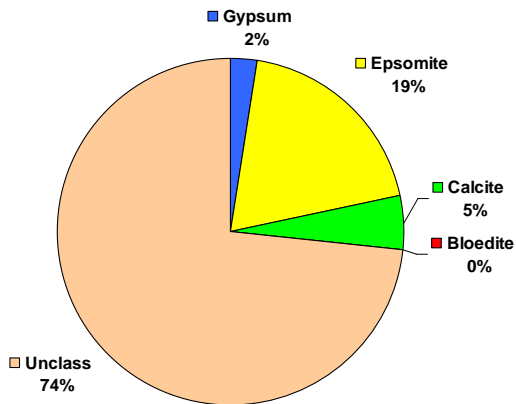
Pond



Analysis of the Coal Creek Site
Using Supervised
Spectral Angle Mapper
(.01 radians)



Percentage of Surface Minerals
500 ft radius from Pond

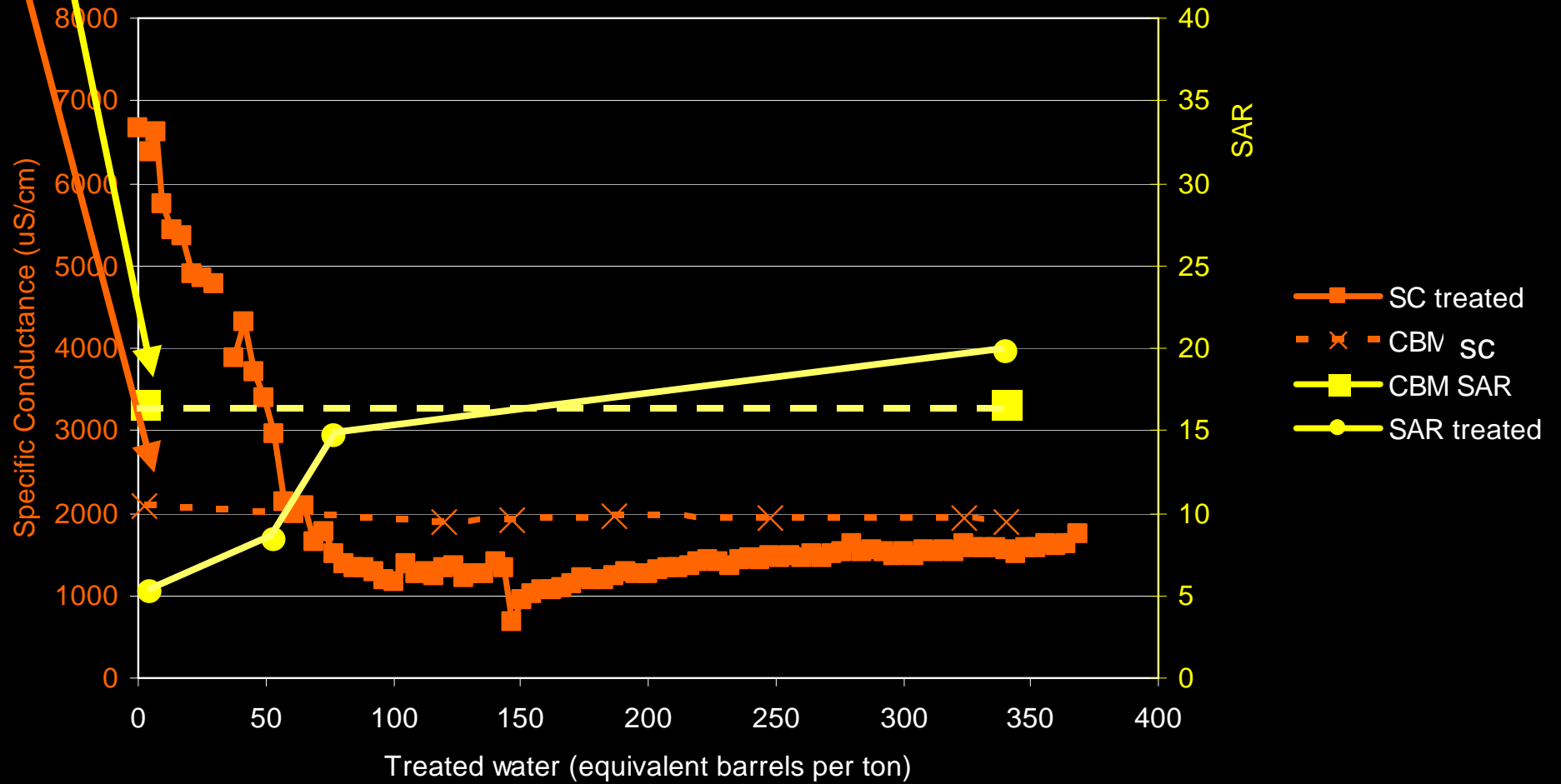


Laboratory test : Leonardite as a treatment medium for water or pond floors



CBM Water treated with Leonardite Column trial 2

Input CBM Water



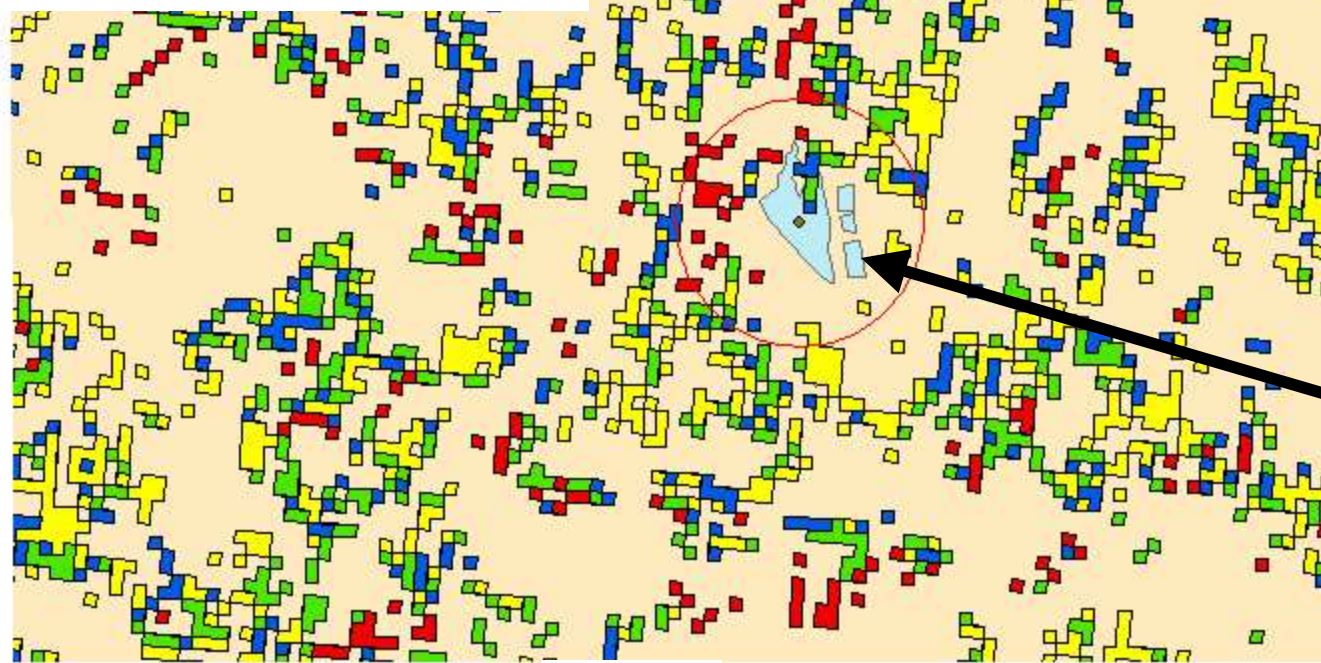
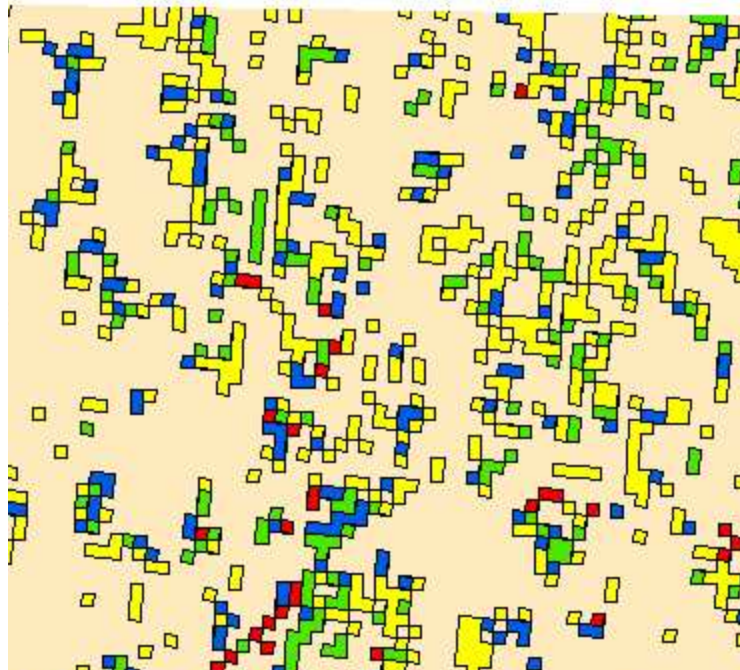
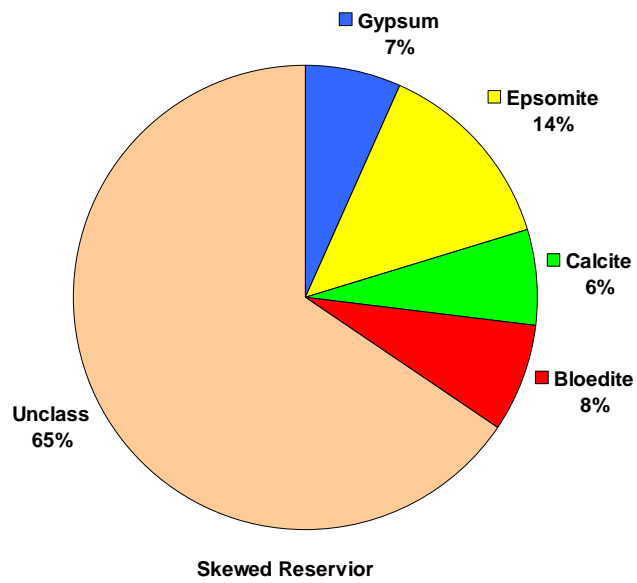
Key Points

- Infiltration Pond can conserve water resources without adversely impacting ground water
- Paste extract and remote sensing can help indicate problem sites in advance
- Leonardite reduces SAR in CBM water but only temporarily

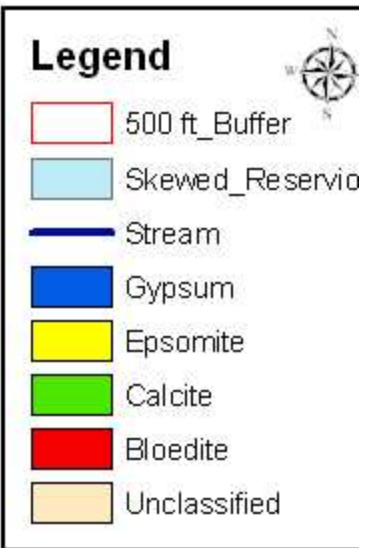
We continue to monitor the Coal Creek site as well as numerous sites in Montana.



Percentage of Surface Minerals
500 ft radius from Pond



Skewed Reservo Site



Pond

1 Mile