

A Working Model for Oil and Gas Produced Water Treatment

Presented at the Opportunities and Obstacles to Improving the Environmental Footprint of Energy Extraction in the Uintah Basin Workshop, October 14th 2010, Utah State University, Vernal, Utah.
Lee Shafer, Integrity Production Services, Inc., Presenter for Anticline Disposal LLC



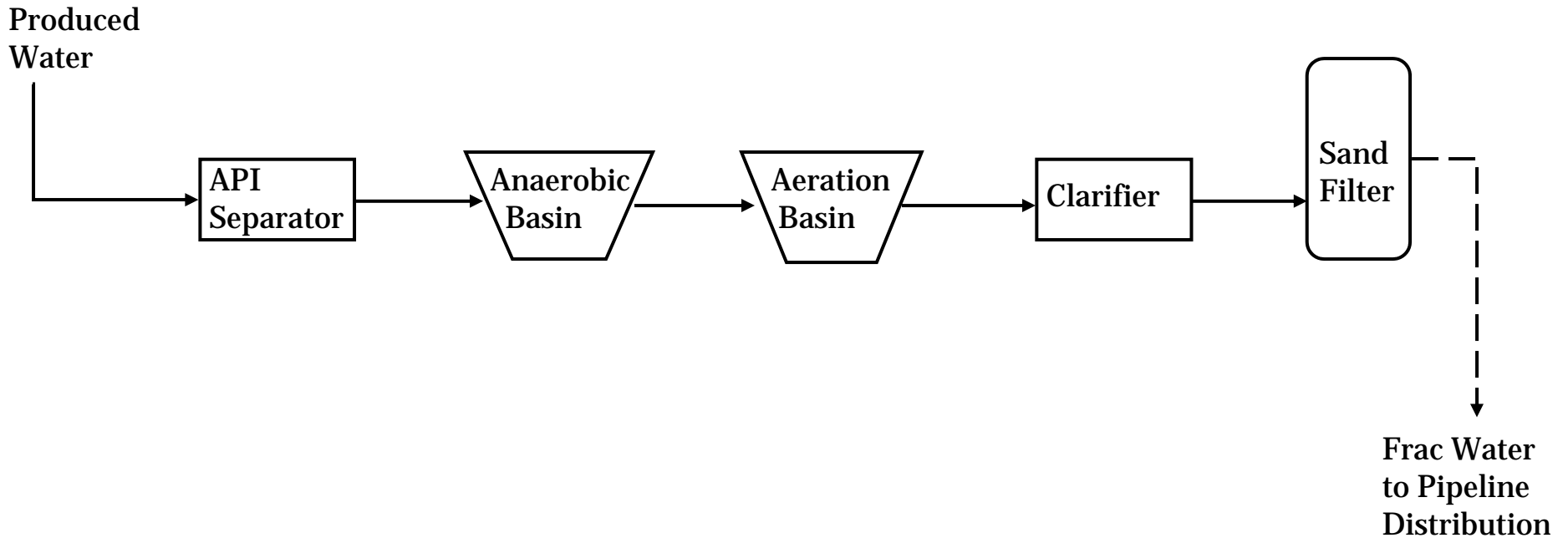
Anticline Disposal numbers

- Since 2006, treated and recycled more than 22 million barrels of water.
- Anticline's pipeline delivery system has eliminated 186,500 truck haul trips.
- Can treat more than 60,000 barrels a day, 365 days a year.
- Discharge quality water is less than 100 mg/l TDS
- and exceeds drinking water standards for boron.

- Typical lab results, “non-detect”:
 - ✓ VOCs
 - ✓ Methanol
 - ✓ Diesel and Gasoline range organics
 - ✓ Sulfate



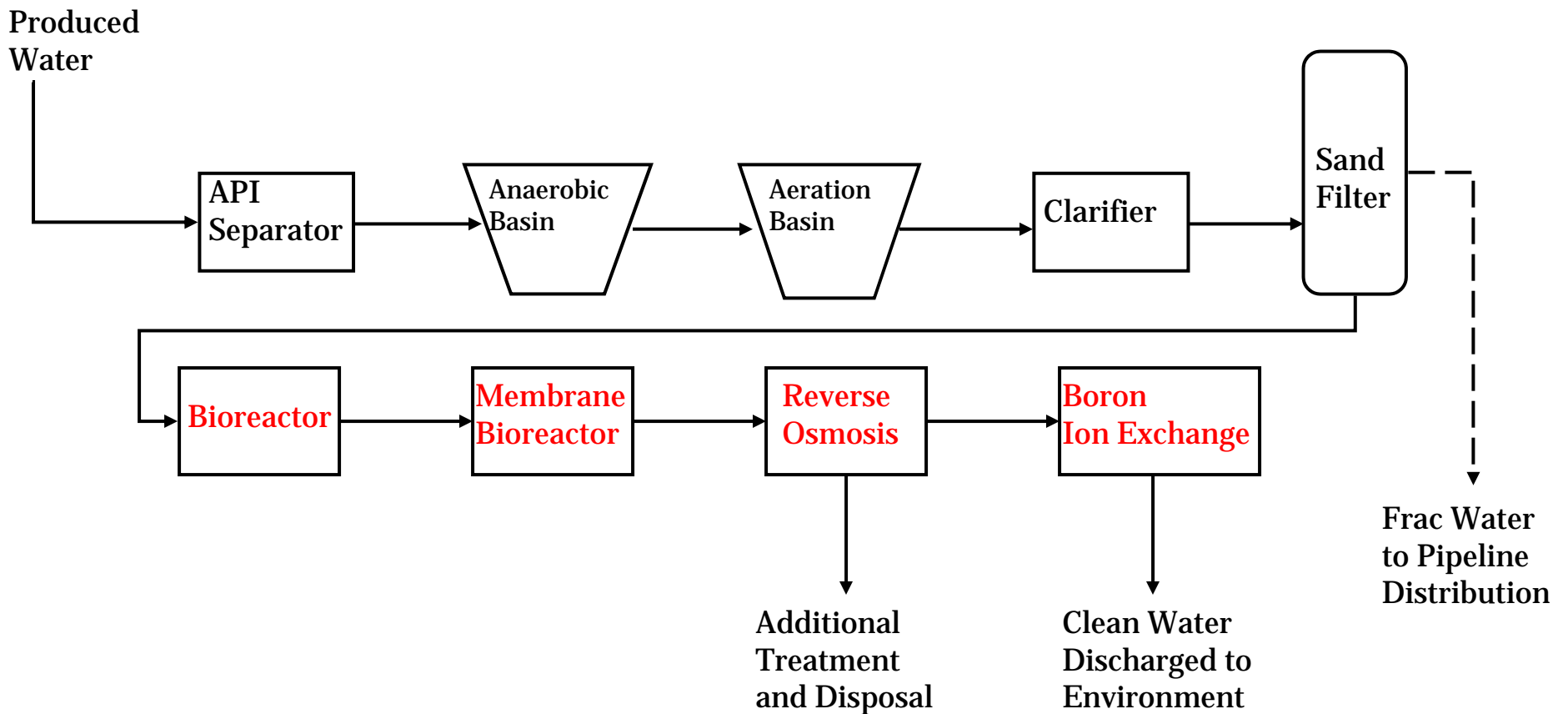
Anticline Disposal "Frac" Process



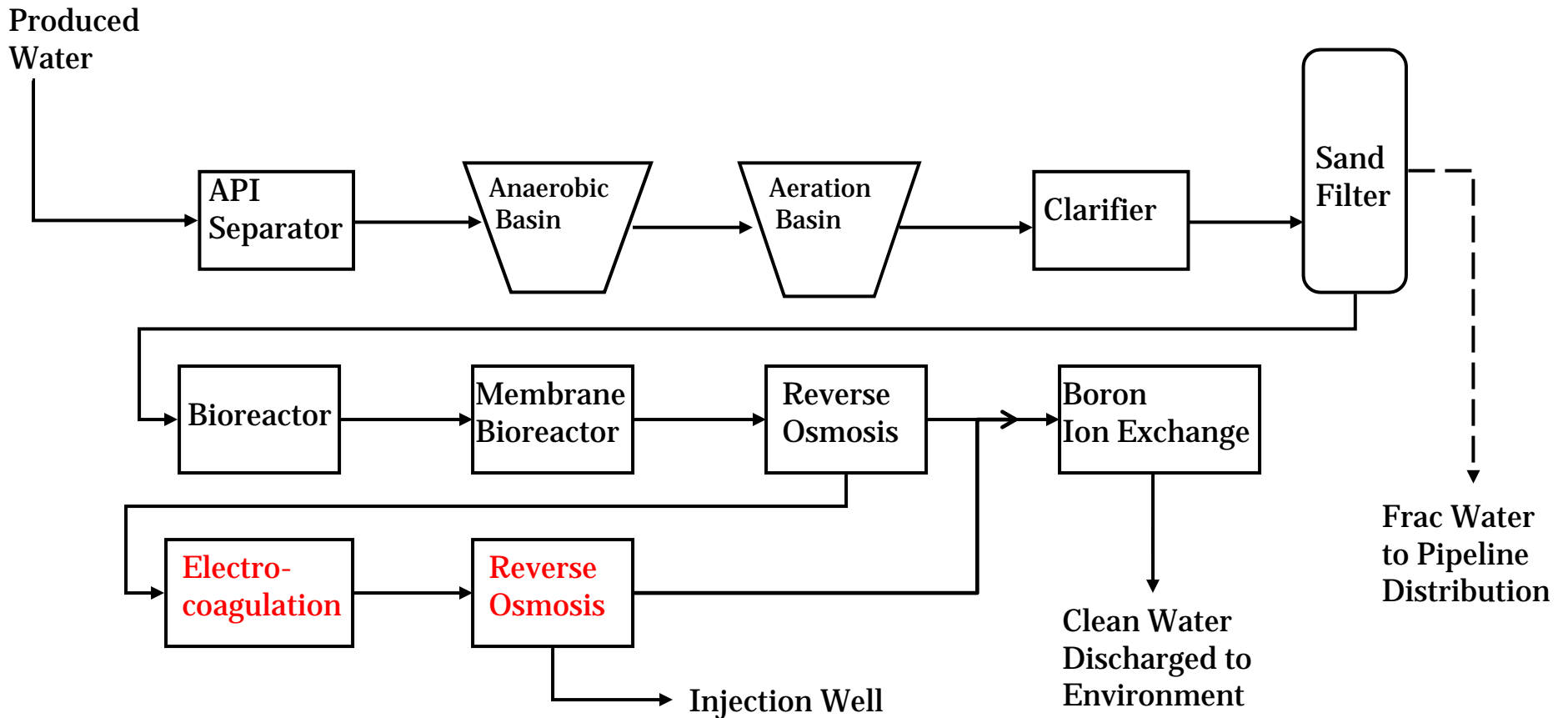




Anticline Disposal "Discharge" Process



Anticline Disposal "Discharge" Process





Anticline Disposal Feed Parameters vs. Discharge Limits and Results

<u>Parameter</u>	<u>typical Feed Range</u>	<u>WYPDES Discharge Limits WY0054224</u>	<u>Results March 2010</u>
O&G, mg/l	50 to 2,400	10	Non-Detect
TDS, mg/l	8,000 to 15,000	500	41
Chloride, mg/l	3,600 to 6,750	230	18
Sulfate, mg/l	10 to 100	3,000	Non-Detect
Conductivity, μ S/cm	8,000 to 20,000	7,500	78
pH	6.5 to 8.5	6.5 to 9	7.34

<u>Whole Effluent Toxicity Testing</u>	<u>Raw water</u>	<u>Salts added</u>
Ceriodaphnia dubia, 80% survival, 48 hr	100 % survival	100%
Pimephales promelas, 80% survival, 96 hr	98.3% survival	100%



Feed Parameters vs. Anticline Disposal Internal Discharge Limits and Results

<u>Parameter</u>	<u>Typical Feed Range</u>	<u>Anticline Disposal Additional Discharge Standards</u>	<u>Results March 2010</u>
BTEX, µg/l	28,000 to 80,000	Non-Detect	Non-Detect
Gasoline Range Organics, µg/l	88,000 to 420,000	Non-Detect	Non-Detect
Diesel Range Organics, mg/l	77 to 1100	Non-Detect	Non-Detect
Methanol, mg/l	40 to 1500	Non-Detect	Non-Detect
Boron, mg/l	15 to 30	0.75	Non-Detect





Anticline Disposal, LLC

Jesse Eubank, Plant Manager/VP

jeubank@anticlinedisposal.com

Nancy MacKenzie, HS&E Director

nmackenzie@anticlinedisposal.com

307-360-3390

High Sierra Water Services, LLC

Jim Winter, President

JWinter@highsierraenergy.com

Integrity Production Services

Lee Shafer, P.E.

shaferips@centurytel.net