



AQUA PURE
CLEAR SOLUTIONS

SHALE GAS WATER MANAGEMENT



Fountain Quail
WATER MANAGEMENT

SHALE GAS WATER MANAGEMENT - OUTLINE

- **AQUA-PURE INTRODUCTION**
- **NATURE OF FLOWBACK**
- **TREATMENT DECISION FACTORS**
- **TECHNOLOGY OPTIONS**
- **TREATMENT STRATEGIES**
- **CASE STUDIES**
 - **BARNETT SHALE**
 - **MARCELLUS SHALE**
 - **MOBILE PRIMARY TREATMENT**
 - **LARGE CUSTOM FACILITIES**
- **WATER QUALITY AND FRAC PERFORMANCE**





AQUA-PURE VENTURES INC

FOUNTAIN QUAIL WATER MANAGEMENT

**PUBLIC COMPANY
TSX VENTURE EXCHANGE (AQE)**

**WHOLLY OWNED SUBSIDIARY OF
AQUA-PURE**

CALGARY, ALBERTA

FORT WORTH, TEXAS

**ENGINEERING , DESIGN, AND
CONSTRUCTION MANAGMENT**

OPERATION AND SERVICE

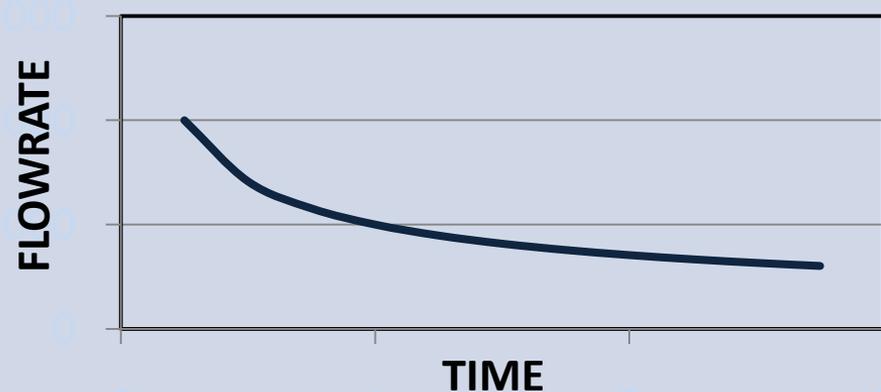
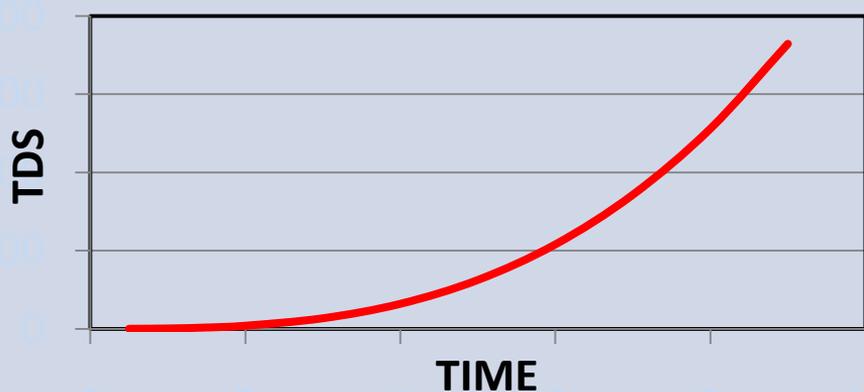
**OILFIELD BACKGROUND
(UNDERSTANDS ENERGY INDUSTRY)**

**AVIATION BACKGROUND
(QUALITY AND RELIABILITY)**

15,000,000 BBL OF COMMERCIAL SHALE GAS EXPERIENCE

FACTORS IMPACTING FLOWBACK

- **SOURCE (FRESH) WATER QUALITY**
- **FRAC FLUID CHEMICAL PROGRAM**
- **FORMATION GEOLOGY**
- **CONTACT WITH FORMATION WATERS**
- **TIME (UNDERGROUND AND ON SURFACE)**



FLOWBACK COMPOSITION

- Dissolved Salts
- Dissolved Minerals
- Frac Chemicals
- Polymers
- Bacteria (SBR)
- Suspended Solids
- NORM
- Volatile Organics
- Semi Volatile Organics
- Hydrocarbons
- Ammonia
- Carbonate Scales
- Sulphate Scales

**CHANGES FROM
WELL TO WELL AND
DAY TO DAY ON THE
SAME WELL**

		Fayetteville	Marcellus	Barnett
Na	(mg/L)	5362.6	24445.0	12453.0
Mg	(mg/L)	77.3	263.1	253.0
Ca	(mg/L)	256.3	2921.0	2242.0
Sr	(mg/L)	21.0	347.0	357.0
Ba	(mg/L)	0.8	679.0	42.0
Mn	(mg/L)	0.5	3.9	44.0
Fe	(mg/L)	27.6	25.5	33.0
SO4	(mg/L)	149.4	9.1	60.0
HCO3	(mg/L)	1281.4	261.4	289.0
Cl	(mg/L)	8042.3	43578.4	23797.5
TDS	(mg/L)	15,219	72,533	39,570
S.G.		1.010	1.050	1.030

THE BALANCING ACT

PUBLIC SAFETY (DRINKING WATER, TRUCK TRAFFIC)

COMMUNITY RELATIONSHIPS (TRUCK TRAFFIC, LAND ACCESS)

REGULATORY CLIMATE (PERMITS, DISCHARGE, ACCESS)

ENVIRONMENTAL RISK / LIABILITY (SPILLS)

SHARED LONG TERM ACCESS TO SOURCE WATER AND DISPOSAL

FRAC FLUID QUALITY (WELL PERFORMANCE)

WATER MANAGEMENT COSTS

THE VARIABLES

FLOWBACK CHEMISTRY (TDS, TSS, COC, SCALING TENDENCY, NORM, H₂S)

DISPOSAL OPTIONS (GEOLOGY, DISTANCE, COST)

SOURCE WATER OPTIONS (QUANTITY, DISTANCE, COST)

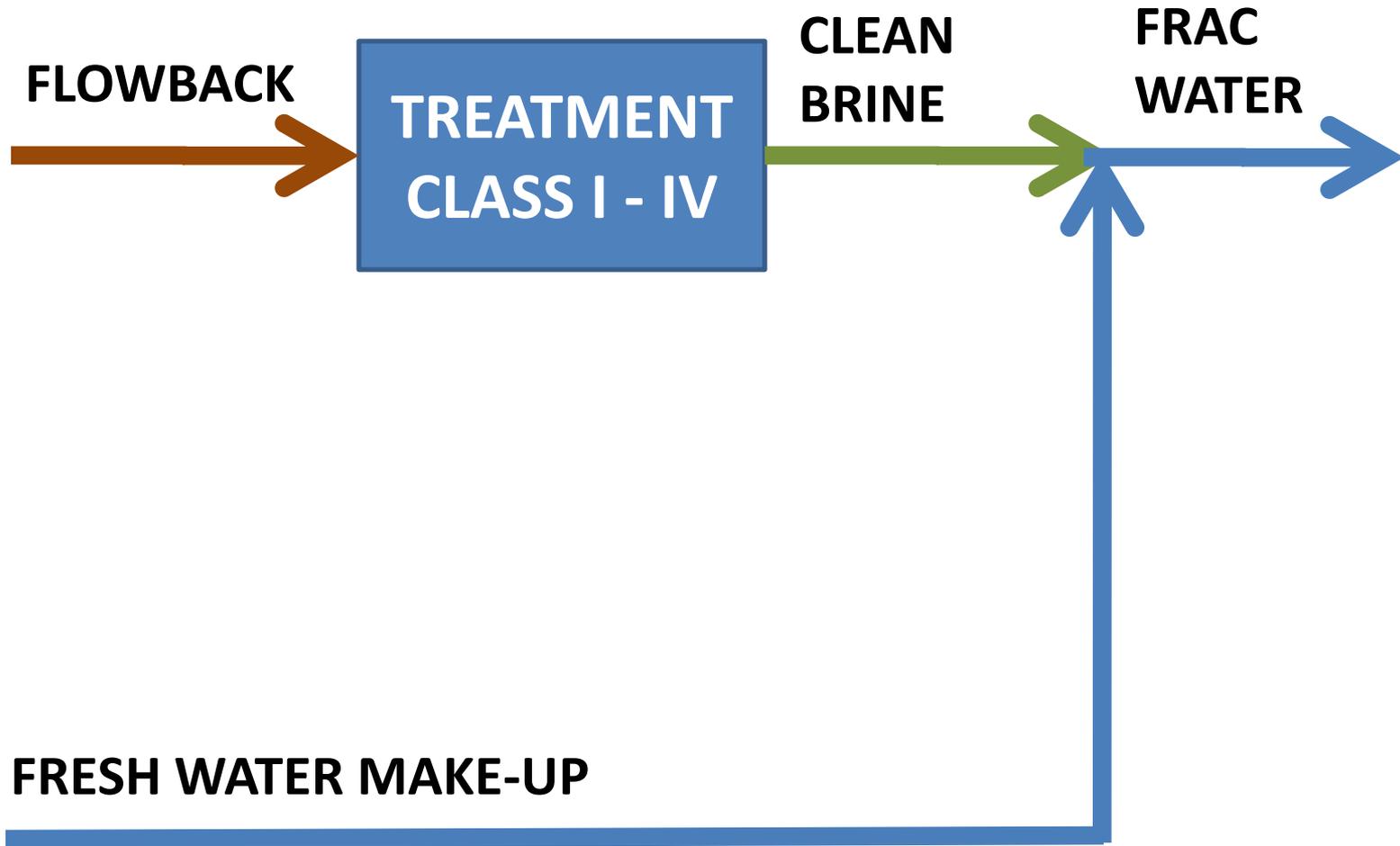
STORAGE OPTIONS (PITS, TANKS)

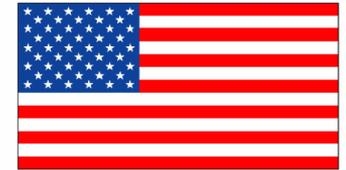
TRANSPORTATION OPTIONS (TRUCK, PIPE – PERMANENT, FAST, POLY)

TREATMENT OPTIONS

	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V	CLASS VI
	PRIMARY	LOW POLISH	HIGH POLISH	SELECTIVE ION REMOVAL	EVAPORATION	ZERO LIQUID DISCHARGE
	Clarification	Clarification Polishing Filter	Clarification UF Membrane	Clarification UF Membrane Ion Exchange	Clarification MVR Evaporation	Clarification Evaporation Crystallization
TSS (mg/L)	50	10	5	5	< 5	< 50
Max Particle Size (um)	75	10	1	1	1	1
Divalent Ion Removal [Ca, Mg, Sr, Ba, SO ₄] (mg/L)	<20%	<20%	<20%	+90%	+99%	+99%
Salt Removal [NaCl] (mg/L)	0%	0%	0%	0%	+99%	+99%
Approx Relative Cost	1.0	1.2	1.4	1.5 – 3.0	2.5	3.5

RE-USE TREATMENT





ROVER - MOBILE PRIMARY TREATMENT FOR RE-USE

POINT-OF-SOURCE TREATMENT:

REDUCES DISPOSAL / TRANSPORT

APPLICABLE TO ALL SHALE PLAYS:

LARGE MARKET

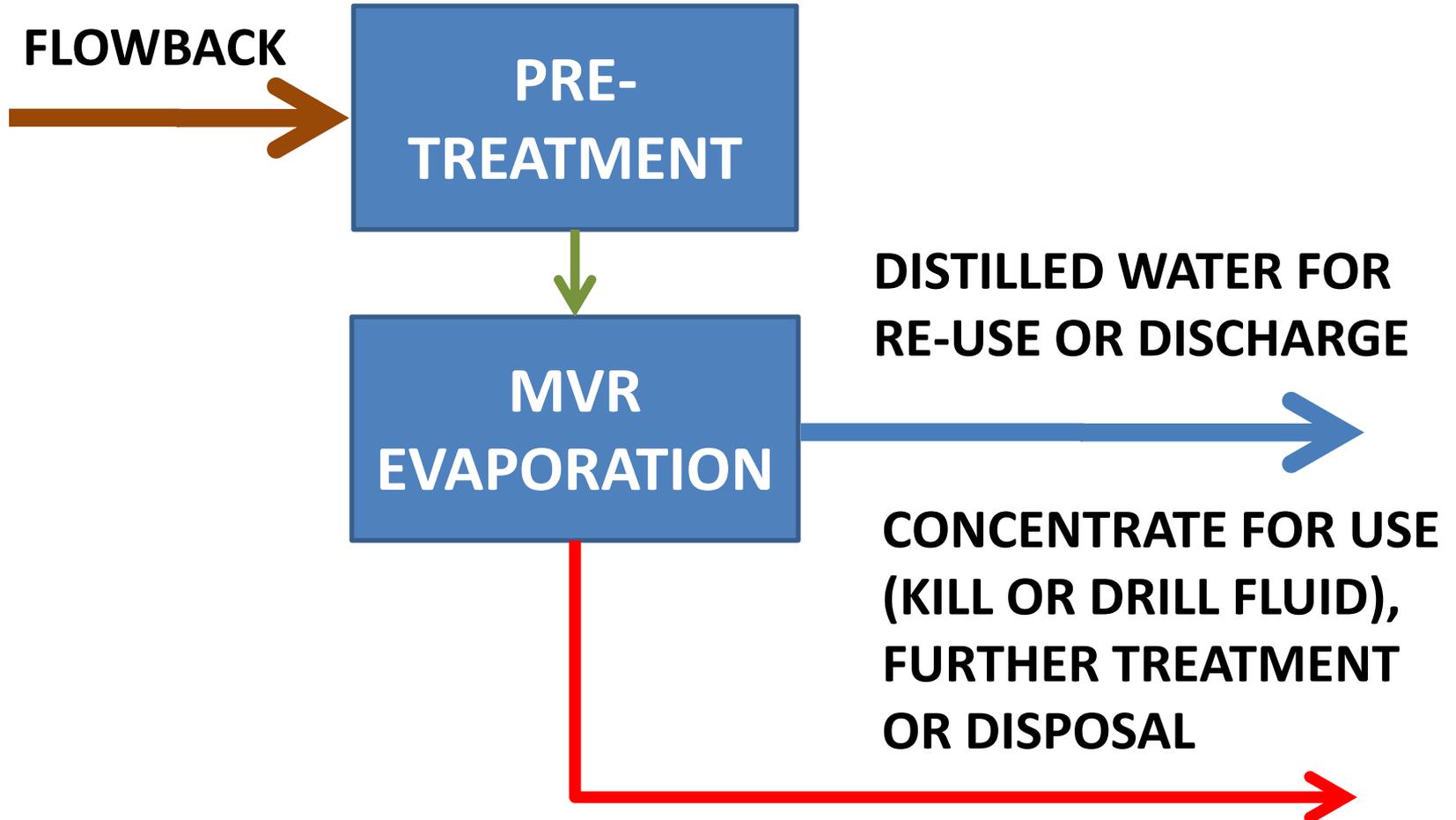
OUR EXPERIENCE GIVES US AN EDGE:

14 TECHNOLOGY TRIALS



- **PRIMARY TREATMENT (TSS REMOVAL) PROVIDES LOW COST OPTION FOR MANY PRODUCERS**
- **AQUA-PURE EXPERT IN TSS REMOVAL (LEARNINGS FROM NOMAD PRE-TREATMENT)**
- **10,000 BBL/DAY CAPACITY**
- **OPERATIONAL WITHIN 2 HOURS OF ARRIVING ON-SITE**
- **DOT APPROVED**
- **COMPLETELY SELF-RELIANT (GENERATES OWN POWER AND UTILITIES)**

RE-CYCLE TREATMENT



FOUNTAIN QUAIL AND EUREKA RESOURCES

MARCELLUS SHALE, PA

SINCE:

JUNE 2010

CAPACITY:

3 x NOMAD 2000

WATER PROCESSED TO DATE:

250,000 BBL

- **POTW DISCHARGE TO CEASE 2011 + EXTREMELY HIGH DISPOSAL COSTS (WATER MANAGEMENT A NECESSITY)**
- **OPTIMIZATION WORK RESULTED IN 110% OF NAME PLATE PRODUCTION (SETTING NEW PERFORMANCE STANDARDS)**
- **DEMONSTRATES PROFFICIENCY IN ADAPTING TO NEW AREAS (NEW WATERS, FREEZING WINTER)**
- **HIGH POTENTIAL FOR SHORT TERM EXPANSION**



FOUNTAIN QUAIL AND DEVON ENERGY

BARNETT SHALE, TX

SINCE:

MARCH 2005

CAPACITY:

4 x NOMAD 2000

WATER PROCESSED TO DATE:

14,750,000 BBL

- **FIRST COMMERCIAL SHALE GAS WATER RECYCLING OPERATION (PROVEN INNOVATION GAINING EXPERIENCE)**
- **TREATMENT OF FLOWBACK AND PRODUCED WATER (FAMILIAR WITH CHEMISTRY RANGE)**
- **TIGHT MARGINS DROVE EFFICIENCY (ABUNDANT DISPOSAL OPTIONS)**
- **NOW CHALLENGING PREVIOUS RELIABILITY LIMITS (NEW FACILITIES, NEW PHILOSOPHY)**

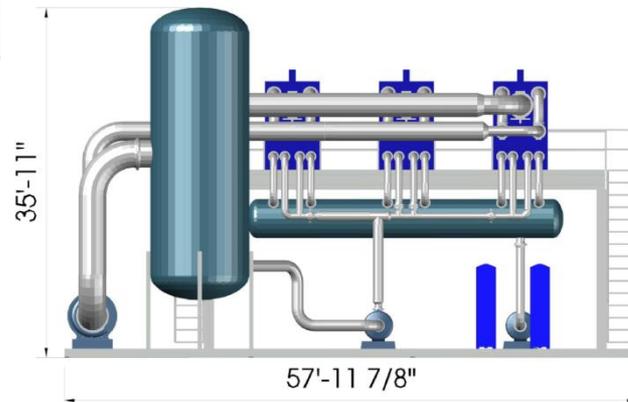
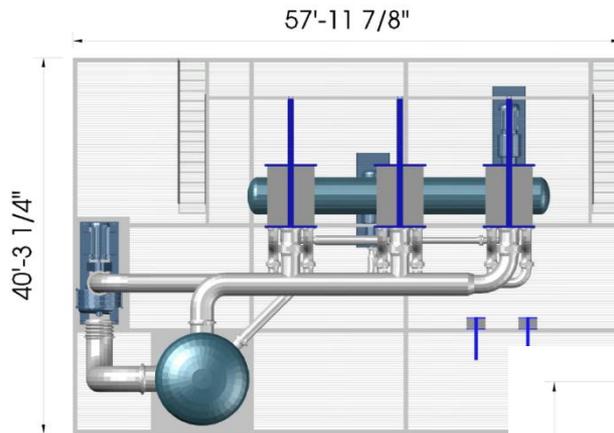


LARGE FACILITY DESIGN

10,000 BBL / DAY

CAPACITY:

10,000 to 60,000 BBL/DAY



- LOWER OPERATING AND MAINTENANCE COST
- HIGHER ENERGY EFFICIENCY
- HIGHER WATER RECOVERY
- REDUCTION IN OVERALL \$ PER BARREL TREATMENT COSTS

WATER QUALITY VS FRAC PERFORMANCE

CONCERN	ACTOR	IMPACT
Friction Reducer Effectiveness	Multivalent Ions (Fe, Ca, Mg, Ba, Sr) Salinity (High TDS, Chlorides)	Can impair effectiveness and drive up horsepower costs.
Scaling	CaCO ₃ , CaSO ₄ , BaSO ₄ , SrSO ₄ , FeSO ₄ , FeCO ₃	Equipment and line fouling, loss of formation permeability
Bacteria	Sulphate Reducing Bacteria	Sour formation (H ₂ S) Safety
Metals	Iron (Fe)	Formation Plugging (Iron Oxides)
Suspended Solids	Sands, Silts, Clays, Scale Particles	Formation Damage, loss of permeability

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