



JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-12653-00

Chevron 20-1D

WMFK (93050)

BERRY PETROLEUM

ROB SIMEONE

C-20 CHEVRON 20-1D

SEPARATOR

Report Date: 11-18-2013

Sample #: 2580

Sampled: 10-29-2013

at 0000

Sample ID: 56541

#### CATIONS

Calcium (as Ca)	344.60
Magnesium (as Mg)	64.04
Barium (as Ba)	29.37
Strontium (as Sr)	21.88
Sodium (as Na)	3823
Potassium (as K)	131.80
Lithium (as Li)	7.47
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.626
Iron (as Fe)	338.20
Manganese (as Mn)	6.43
Zinc (as Zn)	0.863
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	7000
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	375.00
Bicarbonate (as HCO <sub>3</sub> )	610.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	16.97

#### PARAMETERS

Calculated T.D.S.	12520
Molar Conductivity	17020
Resistivity	58.75
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.107
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

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205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Report Date:	11-18-2013	Sampled:	10-29-2013
Sample #:	2580		at 0000
Sample ID:	56541		

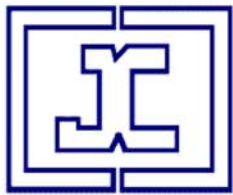
Calcite (CaCO <sub>3</sub> )	2.79	Calcite (CaCO <sub>3</sub> )	0.182
Aragonite (CaCO <sub>3</sub> )	2.27	Aragonite (CaCO <sub>3</sub> )	0.159
Witherite (BaCO <sub>3</sub> )	0.0541	Witherite (BaCO <sub>3</sub> )	-6.59
Strontianite (SrCO <sub>3</sub> )	0.426	Strontianite (SrCO <sub>3</sub> )	-0.526
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00	Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.132
Magnesite (MgCO <sub>3</sub> )	1.02	Magnesite (MgCO <sub>3</sub> )	0.00396
Anhydrite (CaSO <sub>4</sub> )	0.00	Anhydrite (CaSO <sub>4</sub> )	-364.41
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-506.85
Barite (BaSO <sub>4</sub> )	0.00	Barite (BaSO <sub>4</sub> )	-2.66
Celestite (SrSO <sub>4</sub> )	0.00	Celestite (SrSO <sub>4</sub> )	-86.04
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-15.60
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-456.53
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-151.76
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	0.0295
Magnesium silicate	0.00	Magnesium silicate	-161.28
Iron hydroxide (Fe(OH) <sub>3</sub> )	7981	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	9064	Siderite (FeCO <sub>3</sub> )	0.328
Halite (NaCl)	< 0.001	Halite (NaCl)	-203415
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	0.00	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-53264
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.00394

Langelier	0.520	Calcium	344.60	327.13
Ryznar	5.46	Barium	29.37	29.37
Puckorius	3.47	Carbonate	8.98	0.488
Larson-Skold Index	19.70	Phosphate	0.00	0.00
Stiff Davis Index	1.29	Sulfate	0.00	0.00
Oddo-Tomson	0.655			

Temperature (°F)	190.00
Time(secs)	0.00

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205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
C-20 CHEVRON 20-1D  
ROB SIMEONE  
SEPARATOR

Sample ID#: 2580  
ID: 56541  
Report Date: 11-18-2013  
Sample Date: 10-29-2013  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	344.60
Magnesium(as Mg)	64.04
Barium(as Ba)	29.37
Strontium(as Sr)	21.88
Sodium(as Na)	3823
Potassium(as K)	131.80
Lithium(as Li)	7.47
Iron(as Fe)	338.20
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.626
Manganese(as Mn)	6.43
Zinc(as Zn)	0.863
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	7000
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	375.00
Bicarbonate(as HCO <sub>3</sub> )	610.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	16.97

### PARAMETERS

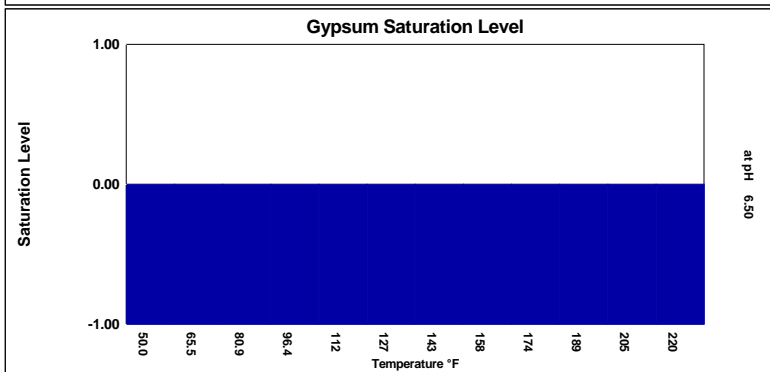
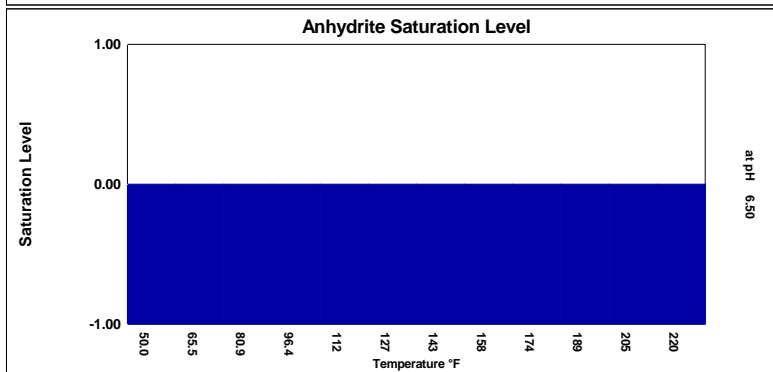
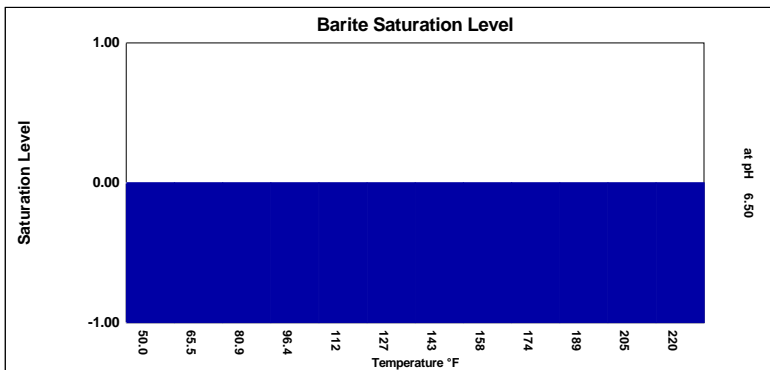
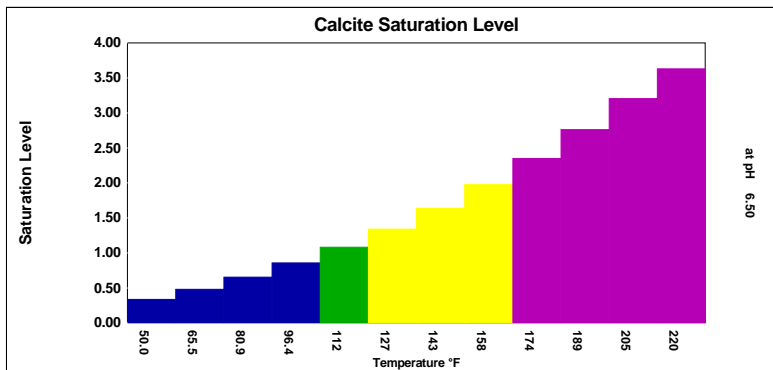
Temperature(°F)	190.00
T.D.S.	12520
Resistivity:	58.75

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.335	-0.159	0.00	-878.94	0.00	-702.36	0.00	-0.250	0.00	-97.30	474.34	0.0927	0.00	-0.00265	0.0909	0.107
65.45	0.00	0.479	-0.109	0.00	-888.71	0.00	-725.63	0.00	-0.376	0.00	-100.01	763.94	0.116	0.00	-0.00273	0.170	0.107
80.91	0.00	0.653	-0.0643	0.00	-869.31	0.00	-740.21	0.00	-0.532	0.00	-99.55	1165	0.140	0.00	-0.00282	0.153	0.107
96.36	0.00	0.855	-0.0240	0.00	-825.62	0.00	-746.78	0.00	-0.711	0.00	-97.42	1691	0.164	0.00	-0.00293	0.201	0.107
111.82	0.00	1.08	0.0118	0.00	-763.53	0.00	-713.76	0.00	-0.909	0.00	-94.65	2353	0.187	0.00	-0.00304	0.211	0.107
127.27	0.00	1.34	0.0461	0.00	-689.19	0.00	-659.15	0.00	-1.15	0.00	-92.22	3198	0.211	0.00	-0.00317	0.177	0.107
142.73	0.00	1.64	0.0796	0.00	-608.20	0.00	-612.43	0.00	-1.43	0.00	-90.18	4258	0.237	0.00	-0.00332	0.143	0.107
158.18	0.00	1.97	0.113	0.00	-525.41	0.00	-572.38	0.00	-1.77	0.00	-88.50	5563	0.265	0.00	-0.00349	0.149	0.107
173.64	0.00	2.35	0.146	0.00	-444.65	0.00	-538.03	0.00	-2.16	0.00	-87.15	7123	0.295	0.00	-0.00369	0.154	0.107
189.09	0.00	2.76	0.180	0.00	-368.80	0.00	-508.60	0.00	-2.63	0.00	-86.11	8946	0.327	0.00	-0.00393	0.0778	0.107
204.55	0.00	3.20	0.214	0.00	-299.79	0.00	-483.45	0.00	-3.16	0.00	-85.37	11015	0.360	0.00	-0.00421	0.0652	0.107
220.00	0.171	3.63	0.250	0.00	-242.76	0.00	-469.10	0.00	-3.86	0.00	-85.97	13179	0.399	0.00	-0.00464	0.0888	0.125
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

05-045-12698-00

Chevron 19-15D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE

I-19 CHEVRON 19-15D  
SEPARATOR

Report Date: 11-18-2013      Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56544

#### CATIONS

Calcium (as Ca)	280.70
Magnesium (as Mg)	56.44
Barium (as Ba)	18.50
Strontium (as Sr)	15.02
Sodium (as Na)	193.14
Potassium (as K)	130.60
Lithium (as Li)	7.37
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.202
Iron (as Fe)	144.30
Manganese (as Mn)	0.770
Zinc (as Zn)	0.277
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	1000
Sulfate (as SO <sub>4</sub> )	50.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	425.00
Bicarbonate (as HCO <sub>3</sub> )	488.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	14.20

#### PARAMETERS

Calculated T.D.S.	2513
Molar Conductivity	3122
Resistivity	320.28
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0660
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.70

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**BERRY PETROLEUM  
ROB SIMEONEI-19 CHEVRON 19-15D  
SEPARATOR

Report Date: 11-18-2013    Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56544

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	5.27
Aragonite (CaCO <sub>3</sub> )	4.29
Witherite (BaCO <sub>3</sub> )	0.0878
Strontianite (SrCO <sub>3</sub> )	0.742
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	1.95
Anhydrite (CaSO <sub>4</sub> )	0.0429
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0318
Barite (BaSO <sub>4</sub> )	14.59
Celestite (SrSO <sub>4</sub> )	0.0687
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	14480
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	8885
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.205
Aragonite (CaCO <sub>3</sub> )	0.194
Witherite (BaCO <sub>3</sub> )	-3.59
Strontianite (SrCO <sub>3</sub> )	-0.123
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.0624
Magnesite (MgCO <sub>3</sub> )	0.104
Anhydrite (CaSO <sub>4</sub> )	-184.32
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-260.81
Barite (BaSO <sub>4</sub> )	9.67
Celestite (SrSO <sub>4</sub> )	-39.66
Fluorite (CaF <sub>2</sub> )	-11.73
Calcium phosphate	>-0.001
Hydroxyapatite	-308.67
Silica (SiO <sub>2</sub> )	-154.13
Brucite (Mg(OH) <sub>2</sub> )	0.0397
Magnesium silicate	-132.73
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.293
Halite (NaCl)	-178946
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-39582
Iron sulfide (FeS)	-0.00198

**SIMPLE INDICES**

Langelier	0.801
Ryznar	5.10
Puckorius	3.44
Larson-Skold Index	3.63
Stiff Davis Index	1.46
Oddo-Tomson	1.13

**BOUND IONS**

Calcium	280.70
Barium	18.50
Carbonate	5.30
Phosphate	0.00
Sulfate	50.00

**TOTAL****FREE**

256.42
18.50
0.435
0.00
27.61

**OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
I-19 CHEVRON 19-15D  
ROB SIMEONE  
SEPARATOR

Sample ID#: 2580  
ID: 56544  
Report Date: 11-18-2013  
Sample Date: 10-29-2013  
at 0000

## WATER CHEMISTRY

### CATIONS

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Lithium(as Li)	7.37
Iron(as Fe)	144.30
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.202
Manganese(as Mn)	0.770
Zinc(as Zn)	0.277
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	1000
Sulfate(as SO <sub>4</sub> )	50.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	425.00
Bicarbonate(as HCO <sub>3</sub> )	488.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	14.20

### PARAMETERS

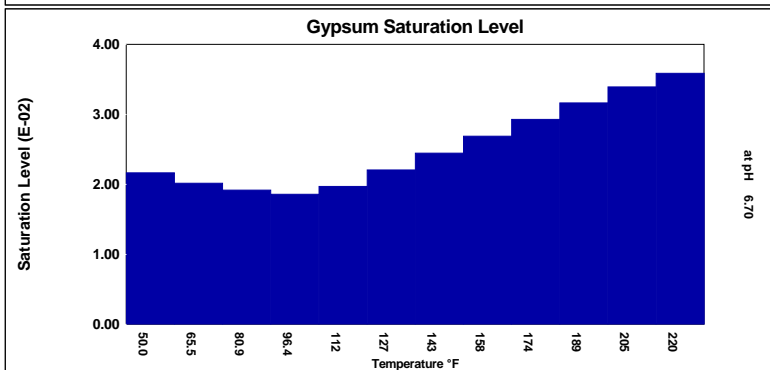
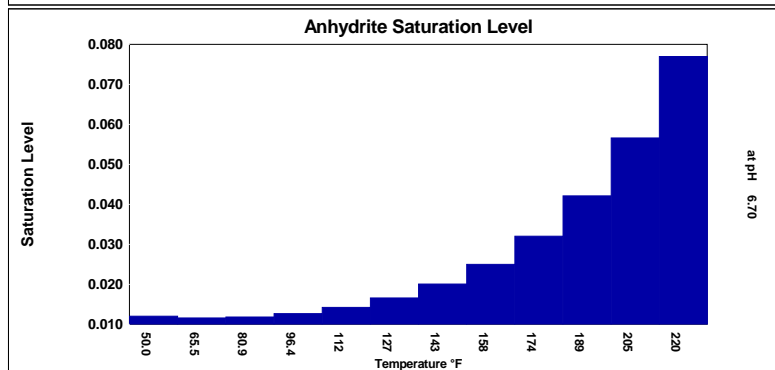
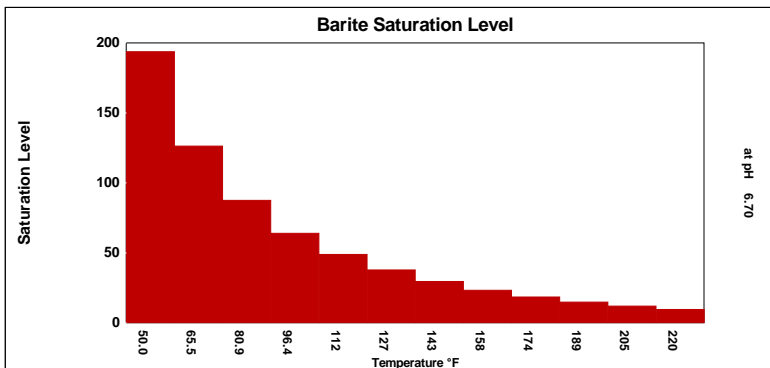
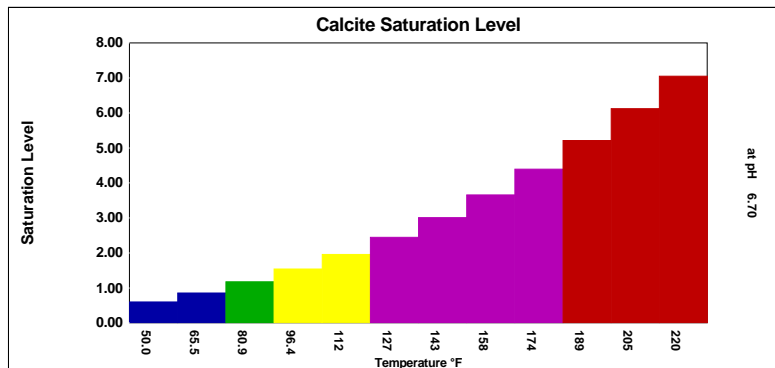
Temperature(°F)	190.00
T.D.S.	2513
Resistivity:	320.28

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.596	-0.0513	0.0120	-523.13	0.0216	-404.56	193.64	10.87	0.0604	-48.19	448.13	0.0873	0.00	-0.00149	0.0758	0.0660
65.45	0.00	0.855	-0.0160	0.0116	-526.19	0.0201	-416.64	126.23	10.82	0.0566	-49.75	724.77	0.109	0.00	-0.00151	0.142	0.0660
80.91	0.00	1.17	0.0165	0.0118	-510.66	0.0192	-422.91	87.44	10.75	0.0563	-49.33	1111	0.131	0.00	-0.00155	0.113	0.0660
96.36	0.00	1.54	0.0460	0.0127	-479.95	0.0186	-423.88	63.96	10.67	0.0579	-47.88	1621	0.152	0.00	-0.00158	0.148	0.0660
111.82	0.00	1.96	0.0725	0.0142	-438.06	0.0197	-400.44	48.84	10.58	0.0603	-46.03	2267	0.172	0.00	-0.00162	0.155	0.0660
127.27	0.00	2.44	0.0984	0.0166	-389.10	0.0221	-364.09	37.80	10.47	0.0626	-44.38	3098	0.193	0.00	-0.00167	0.130	0.0660
142.73	0.00	3.01	0.124	0.0200	-336.76	0.0245	-332.83	29.52	10.33	0.0645	-42.95	4147	0.215	0.00	-0.00172	0.105	0.0660
158.18	0.00	3.65	0.150	0.0250	-284.15	0.0269	-305.87	23.25	10.15	0.0661	-41.72	5437	0.239	0.00	-0.00179	0.110	0.0660
173.64	0.00	4.39	0.176	0.0320	-233.70	0.0293	-282.53	18.46	9.94	0.0675	-40.66	6979	0.264	0.00	-0.00187	0.114	0.0660
189.09	0.00	5.21	0.203	0.0421	-187.17	0.0316	-262.28	14.76	9.69	0.0685	-39.76	8764	0.291	0.00	-0.00198	0.0573	0.0660
204.55	0.00	6.12	0.231	0.0566	-145.72	0.0339	-244.67	11.89	9.39	0.0694	-38.99	10748	0.319	0.00	-0.00211	0.0480	0.0660
220.00	0.171	7.05	0.260	0.0770	-111.31	0.0358	-231.81	9.56	9.04	0.0693	-38.70	12798	0.351	0.00	-0.00231	0.0654	0.0773
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-12696-00  
Chevron 19-1D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE

I-19 CHEVRON 19-1D  
SEPARATOR

Report Date: 11-18-2013      Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56531

#### CATIONS

Calcium (as Ca)	269.50
Magnesium (as Mg)	52.54
Barium (as Ba)	23.72
Strontium (as Sr)	11.27
Sodium (as Na)	40.28
Potassium (as K)	95.74
Lithium (as Li)	6.40
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.716
Iron (as Fe)	370.40
Manganese (as Mn)	2.57
Zinc (as Zn)	0.911
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	1000
Sulfate (as SO <sub>4</sub> )	25.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	450.00
Bicarbonate (as HCO <sub>3</sub> )	488.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	21.02

#### PARAMETERS

Calculated T.D.S.	2546
Molar Conductivity	2924
Resistivity	342.04
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0463
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.90

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**BERRY PETROLEUM  
ROB SIMEONEI-19 CHEVRON 19-1D  
SEPARATOR

Report Date: 11-18-2013    Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56531

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	7.89
Aragonite (CaCO <sub>3</sub> )	6.42
Witherite (BaCO <sub>3</sub> )	0.175
Strontianite (SrCO <sub>3</sub> )	0.864
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	2.88
Anhydrite (CaSO <sub>4</sub> )	0.0195
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0144
Barite (BaSO <sub>4</sub> )	8.80
Celestite (SrSO <sub>4</sub> )	0.0242
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	89262
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	34408
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.353
Aragonite (CaCO <sub>3</sub> )	0.341
Witherite (BaCO <sub>3</sub> )	-2.88
Strontianite (SrCO <sub>3</sub> )	-0.0850
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.0667
Magnesite (MgCO <sub>3</sub> )	0.222
Anhydrite (CaSO <sub>4</sub> )	-196.87
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-276.06
Barite (BaSO <sub>4</sub> )	8.23
Celestite (SrSO <sub>4</sub> )	-46.50
Fluorite (CaF <sub>2</sub> )	-12.05
Calcium phosphate	>-0.001
Hydroxyapatite	-312.25
Silica (SiO <sub>2</sub> )	-153.99
Brucite (Mg(OH) <sub>2</sub> )	0.0632
Magnesium silicate	-133.42
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.468
Halite (NaCl)	-179659
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-39916
Iron sulfide (FeS)	>-0.001

**SIMPLE INDICES**

Langelier	0.974
Ryznar	4.95
Puckorius	3.49
Larson-Skold Index	3.56
Stiff Davis Index	1.64
Oddo-Tomson	1.30

**BOUND IONS**

Calcium	269.50	247.25
Barium	23.72	23.72
Carbonate	7.50	0.696
Phosphate	0.00	0.00
Sulfate	25.00	13.40

**TOTAL****FREE****OPERATING CONDITIONS**

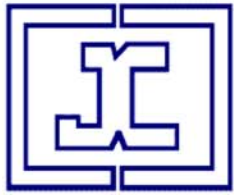
Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
I-19 CHEVRON 19-1D  
ROB SIMEONE  
SEPARATOR

Sample ID#: 2580  
ID: 56531  
Report Date: 11-18-2013  
Sample Date: 10-29-2013  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	269.50
Magnesium(as Mg)	52.54
Barium(as Ba)	23.72
Strontium(as Sr)	11.27
Sodium(as Na)	40.28
Potassium(as K)	95.74
Lithium(as Li)	6.40
Iron(as Fe)	370.40
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.716
Manganese(as Mn)	2.57
Zinc(as Zn)	0.911
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	1000
Sulfate(as SO <sub>4</sub> )	25.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	450.00
Bicarbonate(as HCO <sub>3</sub> )	488.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	21.02

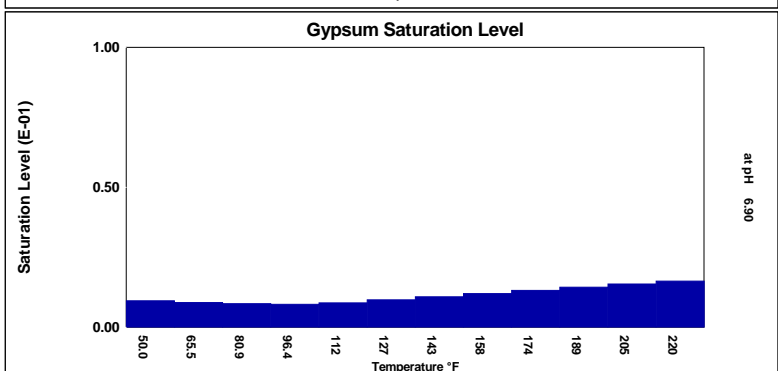
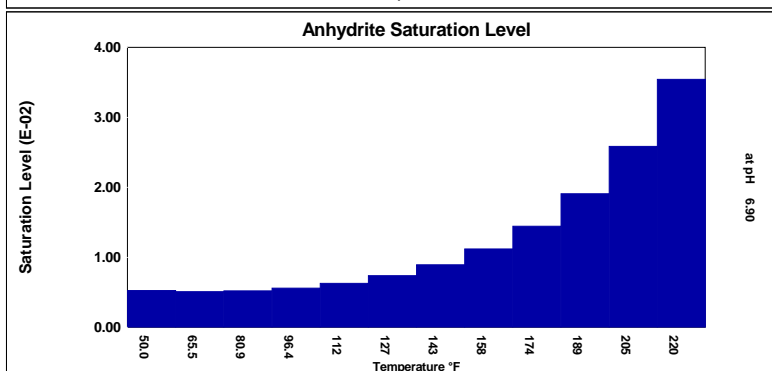
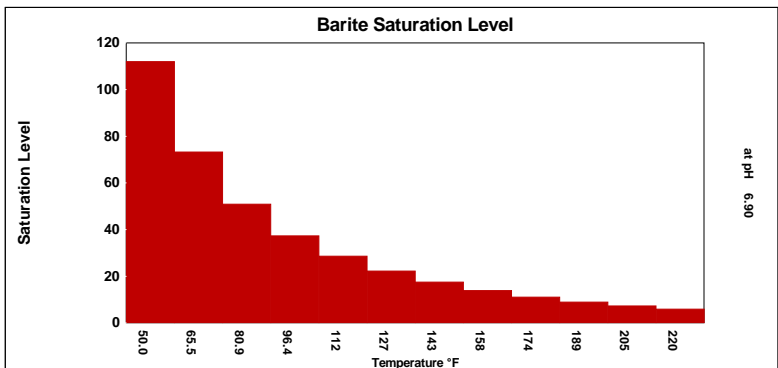
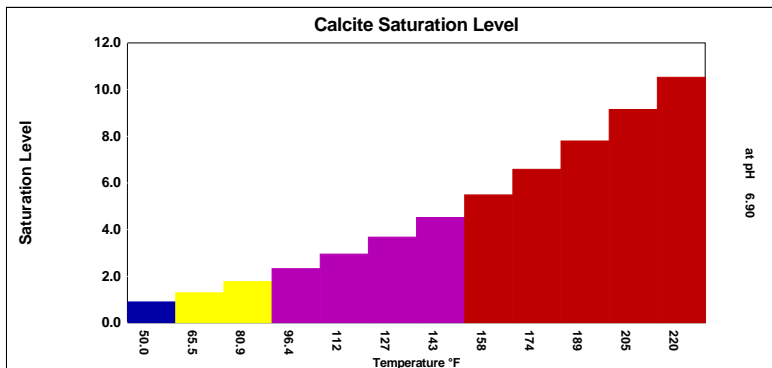
### PARAMETERS

Temperature(°F)	190.00
T.D.S.	2546
Resistivity:	342.04
Sample pH	6.90
Conductivity:	2924

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.898	-0.0138	0.00526	-543.33	0.00945	-424.15	111.97	12.59	0.0204	-56.56	1801	0.141	0.00	>-0.001	0.0662	0.0463
65.45	0.00	1.29	0.0338	0.00508	-546.44	0.00883	-436.37	73.17	12.13	0.0192	-58.03	2911	0.175	0.00	>-0.001	0.124	0.0463
80.91	0.00	1.77	0.0788	0.00519	-530.66	0.00842	-442.72	50.82	11.66	0.0192	-57.48	4461	0.210	0.00	>-0.001	0.0899	0.0463
96.36	0.00	2.32	0.120	0.00558	-499.41	0.00819	-443.68	37.28	11.20	0.0198	-55.86	6502	0.244	0.00	>-0.001	0.118	0.0463
111.82	0.00	2.95	0.158	0.00629	-456.75	0.00871	-419.75	28.57	10.74	0.0207	-53.84	9074	0.276	0.00	>-0.001	0.123	0.0463
127.27	0.00	3.67	0.195	0.00736	-406.84	0.00979	-382.64	22.20	10.28	0.0215	-52.01	12362	0.310	0.00	>-0.001	0.104	0.0463
142.73	0.00	4.52	0.233	0.00894	-353.40	0.0109	-350.67	17.42	9.79	0.0223	-50.41	16476	0.346	0.00	>-0.001	0.0839	0.0463
158.18	0.00	5.48	0.271	0.0112	-299.60	0.0120	-323.00	13.80	9.30	0.0230	-49.00	21473	0.384	0.00	>-0.001	0.0874	0.0463
173.64	0.00	6.58	0.311	0.0144	-247.89	0.0132	-298.96	11.02	8.79	0.0236	-47.76	27336	0.424	0.00	>-0.001	0.0905	0.0463
189.09	0.00	7.80	0.351	0.0191	-200.09	0.0143	-277.95	8.88	8.27	0.0242	-46.67	33933	0.467	0.00	>-0.001	0.0456	0.0463
204.55	0.00	9.14	0.393	0.0258	-157.35	0.0155	-259.49	7.22	7.73	0.0247	-45.69	40987	0.510	0.00	>-0.001	0.0382	0.0463
220.00	0.171	10.52	0.437	0.0354	-121.79	0.0165	-245.81	5.86	7.19	0.0249	-45.20	47871	0.559	0.00	>-0.001	0.0520	0.0542
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-12698-00  
Chevron 19-342D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 19-342D I-19 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-15-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99527

#### CATIONS

Calcium (as Ca)	213.10
Magnesium (as Mg)	16.41
Barium (as Ba)	3.63
Strontium (as Sr)	14.98
Sodium (as Na)	5386
Potassium (as K)	66.35
Lithium (as Li)	2.60
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.175
Iron (as Fe)	16.65
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	8000
Sulfate (as SO <sub>4</sub> )	75.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate (as HCO <sub>3</sub> )	1464
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	10.39

#### PARAMETERS

Calculated T.D.S.	15454
Molar Conductivity	20545
Resistivity	48.67
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.256
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Report Date:	08-24-2015	Sampled:	04-15-2015
Sample #:	3076		at 0000
Sample ID:	99527		

Calcite (CaCO <sub>3</sub> )	3.70	Calcite (CaCO <sub>3</sub> )	0.521
Aragonite (CaCO <sub>3</sub> )	3.01	Aragonite (CaCO <sub>3</sub> )	0.477
Witherite (BaCO <sub>3</sub> )	0.0153	Witherite (BaCO <sub>3</sub> )	-11.33
Strontianite (SrCO <sub>3</sub> )	0.669	Strontianite (SrCO <sub>3</sub> )	-0.447
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00	Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.251
Magnesite (MgCO <sub>3</sub> )	0.558	Magnesite (MgCO <sub>3</sub> )	-0.449
Anhydrite (CaSO <sub>4</sub> )	0.0211	Anhydrite (CaSO <sub>4</sub> )	-430.88
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0154	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-591.92
Barite (BaSO <sub>4</sub> )	1.78	Barite (BaSO <sub>4</sub> )	0.916
Celestite (SrSO <sub>4</sub> )	0.0433	Celestite (SrSO <sub>4</sub> )	-74.82
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-20.48
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-471.82
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-150.97
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	0.0299
Magnesium silicate	0.00	Magnesium silicate	-163.92
Iron hydroxide (Fe(OH) <sub>3</sub> )	366.63	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	1024	Siderite (FeCO <sub>3</sub> )	0.827
Halite (NaCl)	< 0.001	Halite (NaCl)	-204810
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-54553
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.0858

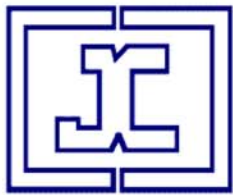
Langelier	0.672
Ryznar	5.16
Puckorius	2.61
Larson-Skold Index	9.40
Stiff Davis Index	1.44
Oddo-Tomson	0.777

Calcium	213.10	187.49
Barium	3.63	3.63
Carbonate	26.15	1.23
Phosphate	0.00	0.00
Sulfate	75.00	57.61

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 19-342D I-19 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99527  
Report Date: 08-24-2015  
Sample Date: 04-15-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	213.10
Magnesium(as Mg)	16.41
Barium(as Ba)	3.63
Strontium(as Sr)	14.98
Sodium(as Na)	5386
Potassium(as K)	66.35
Lithium(as Li)	2.60
Iron(as Fe)	16.65
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.175
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	8000
Sulfate(as SO <sub>4</sub> )	75.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate(as HCO <sub>3</sub> )	1464
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	10.39

### PARAMETERS

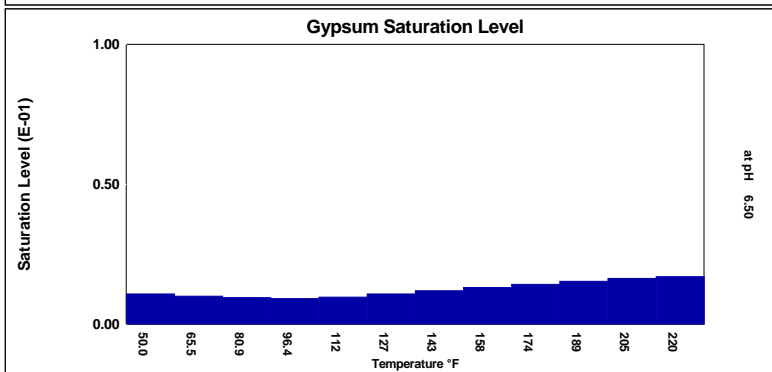
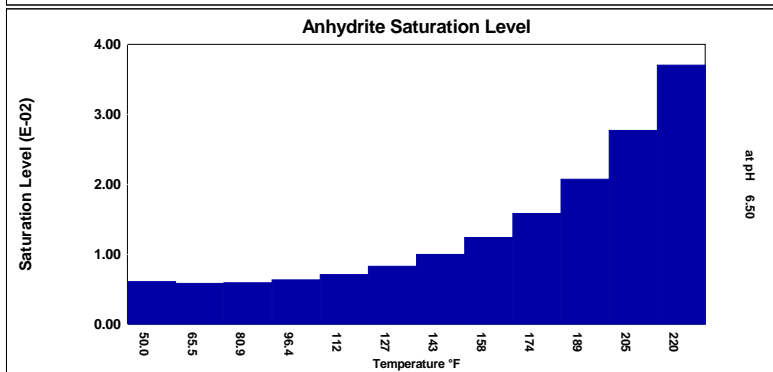
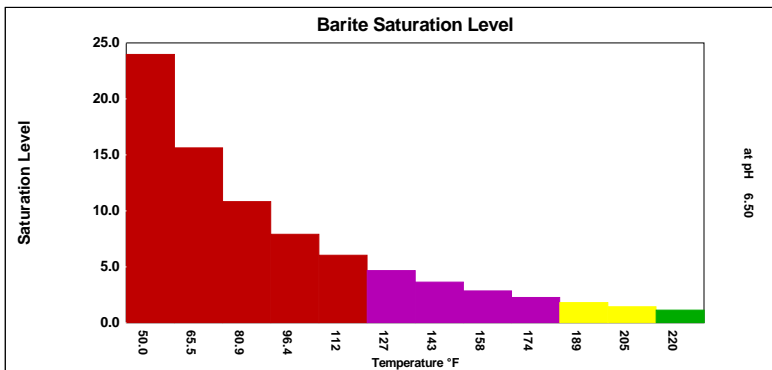
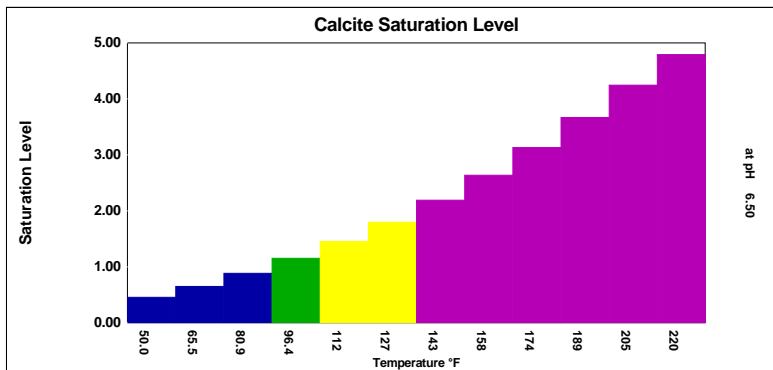
Temperature(°F)	190.00
T.D.S.	15454
Resistivity:	48.67

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.457	-0.236	0.00610	-973.16	0.0108	-793.61	23.97	2.06	0.0386	-84.20	53.12	0.226	0.00	-0.0582	0.127	0.256
65.45	0.00	0.650	-0.134	0.00585	-984.54	0.0100	-819.49	15.62	2.01	0.0362	-87.28	85.73	0.286	0.00	-0.0599	0.237	0.256
80.91	0.00	0.883	-0.0398	0.00594	-965.11	0.00949	-836.05	10.82	1.94	0.0360	-87.08	130.97	0.347	0.00	-0.0619	0.269	0.256
96.36	0.00	1.15	0.0467	0.00635	-919.96	0.00917	-844.04	7.91	1.87	0.0370	-85.14	190.35	0.407	0.00	-0.0641	0.352	0.256
111.82	0.00	1.45	0.125	0.00711	-855.21	0.00970	-809.79	6.03	1.78	0.0385	-82.53	265.09	0.465	0.00	-0.0667	0.369	0.256
127.27	0.00	1.80	0.202	0.00827	-777.23	0.0108	-752.36	4.66	1.67	0.0399	-80.26	360.65	0.527	0.00	-0.0695	0.309	0.256
142.73	0.00	2.19	0.279	0.00997	-691.83	0.0120	-703.15	3.64	1.54	0.0411	-78.40	480.64	0.594	0.00	-0.0727	0.251	0.256
158.18	0.00	2.64	0.357	0.0124	-603.97	0.0131	-660.95	2.86	1.37	0.0420	-76.90	628.30	0.665	0.00	-0.0763	0.261	0.256
173.64	0.00	3.13	0.436	0.0158	-517.57	0.0142	-624.74	2.26	1.17	0.0427	-75.73	805.27	0.742	0.00	-0.0806	0.270	0.256
189.09	0.00	3.67	0.517	0.0207	-435.59	0.0153	-593.70	1.80	0.931	0.0432	-74.87	1011	0.822	0.00	-0.0856	0.136	0.256
204.55	0.00	4.24	0.599	0.0277	-359.97	0.0163	-567.21	1.44	0.638	0.0435	-74.32	1245	0.908	0.00	-0.0914	0.114	0.256
220.00	0.171	4.79	0.687	0.0370	-296.41	0.0170	-552.55	1.14	0.248	0.0427	-75.14	1487	1.01	0.00	-0.100	0.156	0.300
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-14299-00  
Chevron 19-3D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE

I-19 CHEVRON 19-3D  
SEPARATOR

Report Date: 11-18-2013      Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56539

#### CATIONS

Calcium (as Ca)	230.60
Magnesium (as Mg)	51.90
Barium (as Ba)	7.65
Strontium (as Sr)	8.76
Sodium (as Na)	823.38
Potassium (as K)	124.20
Lithium (as Li)	6.39
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.177
Iron (as Fe)	209.10
Manganese (as Mn)	1.24
Zinc (as Zn)	0.222
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	1900
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	390.00
Bicarbonate (as HCO <sub>3</sub> )	610.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	13.07

#### PARAMETERS

Calculated T.D.S.	4096
Molar Conductivity	5499
Resistivity	181.85
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0688
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**BERRY PETROLEUM  
ROB SIMEONEI-19 CHEVRON 19-3D  
SEPARATOR

Report Date: 11-18-2013    Sampled: 10-29-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 56539

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	5.84
Aragonite (CaCO <sub>3</sub> )	4.75
Witherite (BaCO <sub>3</sub> )	0.0481
Strontianite (SrCO <sub>3</sub> )	0.576
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	2.50
Anhydrite (CaSO <sub>4</sub> )	0.00
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Barite (BaSO <sub>4</sub> )	0.00
Celestite (SrSO <sub>4</sub> )	0.00
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	28926
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	17344
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	0.00
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.367
Aragonite (CaCO <sub>3</sub> )	0.349
Witherite (BaCO <sub>3</sub> )	-6.11
Strontianite (SrCO <sub>3</sub> )	-0.399
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.0987
Magnesite (MgCO <sub>3</sub> )	0.223
Anhydrite (CaSO <sub>4</sub> )	-252.81
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-348.67
Barite (BaSO <sub>4</sub> )	-3.08
Celestite (SrSO <sub>4</sub> )	-59.36
Fluorite (CaF <sub>2</sub> )	-14.17
Calcium phosphate	>-0.001
Hydroxyapatite	-342.78
Silica (SiO <sub>2</sub> )	-153.91
Brucite (Mg(OH) <sub>2</sub> )	0.0521
Magnesium silicate	-139.94
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.512
Halite (NaCl)	-185547
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-42708
Iron sulfide (FeS)	-0.00146

**SIMPLE INDICES**

Langelier	0.839
Ryznar	5.12
Puckorius	3.42
Larson-Skold Index	5.33
Stiff Davis Index	1.55
Oddo-Tomson	1.14

**BOUND IONS**

Calcium	230.60	212.11
Barium	7.65	7.65
Carbonate	8.45	0.762
Phosphate	0.00	0.00
Sulfate	0.00	0.00

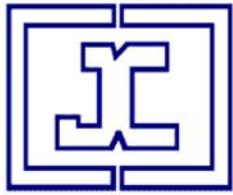
**TOTAL****FREE****OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
I-19 CHEVRON 19-3D  
ROB SIMEONE  
SEPARATOR

Sample ID#: 2580  
ID: 56539  
Report Date: 11-18-2013  
Sample Date: 10-29-2013  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	230.60
Magnesium(as Mg)	51.90
Barium(as Ba)	7.65
Strontium(as Sr)	8.76
Sodium(as Na)	823.38
Potassium(as K)	124.20
Lithium(as Li)	6.39
Iron(as Fe)	209.10
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.177
Manganese(as Mn)	1.24
Zinc(as Zn)	0.222
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	1900
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	390.00
Bicarbonate(as HCO <sub>3</sub> )	610.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	13.07

### PARAMETERS

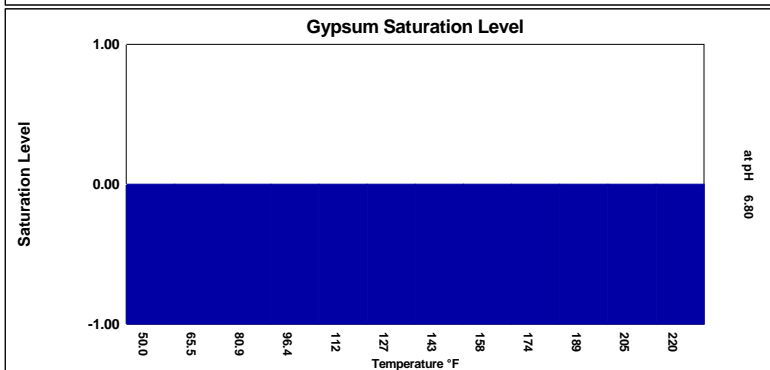
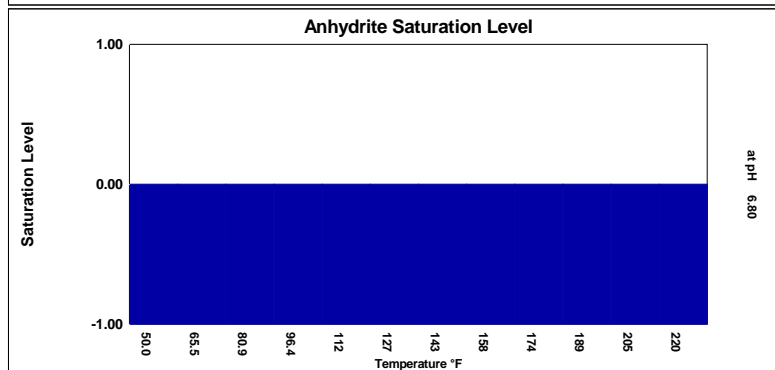
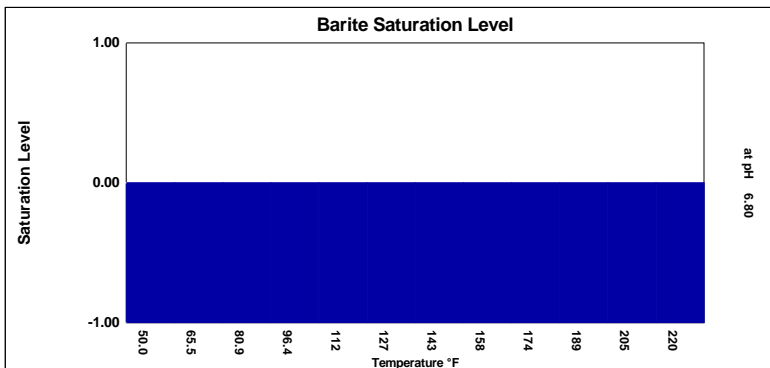
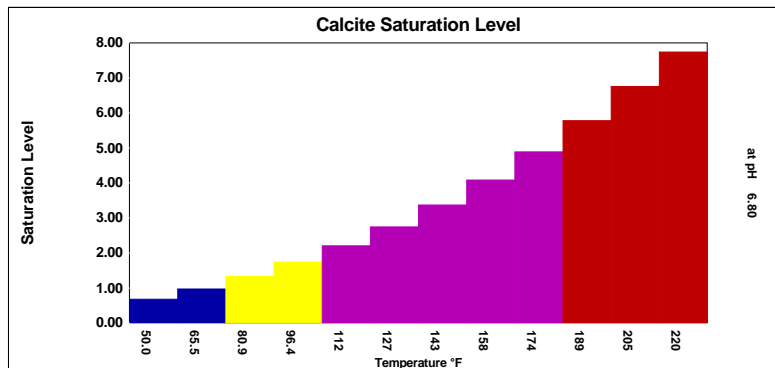
Temperature(°F)	190.00
T.D.S.	4096
Resistivity:	181.85
Sample pH	6.80
Conductivity:	5499

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.673	-0.0629	0.00	-638.67	0.00	-509.61	0.00	-0.432	0.00	-70.36	897.45	0.150	0.00	-0.00104	0.0769	0.0688
65.45	0.00	0.965	-0.00583	0.00	-642.94	0.00	-523.99	0.00	-0.625	0.00	-71.97	1451	0.187	0.00	-0.00106	0.144	0.0688
80.91	0.00	1.32	0.0474	0.00	-626.13	0.00	-531.84	0.00	-0.846	0.00	-71.34	2223	0.225	0.00	-0.00109	0.116	0.0688
96.36	0.00	1.74	0.0961	0.00	-591.97	0.00	-533.72	0.00	-1.08	0.00	-69.52	3239	0.262	0.00	-0.00112	0.152	0.0688
111.82	0.00	2.20	0.140	0.00	-544.88	0.00	-507.50	0.00	-1.33	0.00	-67.26	4519	0.298	0.00	-0.00115	0.159	0.0688
127.27	0.00	2.74	0.184	0.00	-489.44	0.00	-466.24	0.00	-1.61	0.00	-65.23	6160	0.335	0.00	-0.00119	0.133	0.0688
142.73	0.00	3.37	0.227	0.00	-429.74	0.00	-430.71	0.00	-1.91	0.00	-63.47	8219	0.375	0.00	-0.00124	0.108	0.0688
158.18	0.00	4.08	0.272	0.00	-369.26	0.00	-400.00	0.00	-2.26	0.00	-61.93	10732	0.417	0.00	-0.00130	0.113	0.0688
173.64	0.00	4.88	0.317	0.00	-310.73	0.00	-373.39	0.00	-2.64	0.00	-60.61	13713	0.462	0.00	-0.00137	0.117	0.0688
189.09	0.00	5.78	0.364	0.00	-256.13	0.00	-350.28	0.00	-3.05	0.00	-59.47	17118	0.510	0.00	-0.00146	0.0588	0.0688
204.55	0.00	6.75	0.412	0.00	-206.79	0.00	-330.17	0.00	-3.51	0.00	-58.51	20842	0.560	0.00	-0.00157	0.0492	0.0688
220.00	0.171	7.74	0.464	0.00	-165.45	0.00	-316.16	0.00	-4.05	0.00	-58.23	24620	0.617	0.00	-0.00174	0.0671	0.0805
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-14045-00  
Chevron 20-31D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 20-31D J-20 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-15-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99525

### CATIONS

Calcium (as Ca)	174.90
Magnesium (as Mg)	18.90
Barium (as Ba)	53.63
Strontium (as Sr)	23.20
Sodium (as Na)	5995
Potassium (as K)	80.74
Lithium (as Li)	4.03
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.645
Iron (as Fe)	18.36
Manganese (as Mn)	0.0120
Zinc (as Zn)	1.67
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	9300
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	270.00
Bicarbonate (as HCO <sub>3</sub> )	976.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	2.47

### PARAMETERS

Calculated T.D.S.	16667
Molar Conductivity	22837
Resistivity	43.79
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0866
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.90

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



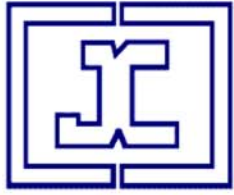


## DEPOSITION POTENTIAL INDICATORS

Sample ID: 99525

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 20-31D J-20 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99525  
Report Date: 08-24-2015  
Sample Date: 04-15-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	174.90
Magnesium(as Mg)	18.90
Barium(as Ba)	53.63
Strontium(as Sr)	23.20
Sodium(as Na)	5995
Potassium(as K)	80.74
Lithium(as Li)	4.03
Iron(as Fe)	18.36
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.645
Manganese(as Mn)	0.0120
Zinc(as Zn)	1.67
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	9300
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	270.00
Bicarbonate(as HCO <sub>3</sub> )	976.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	2.47

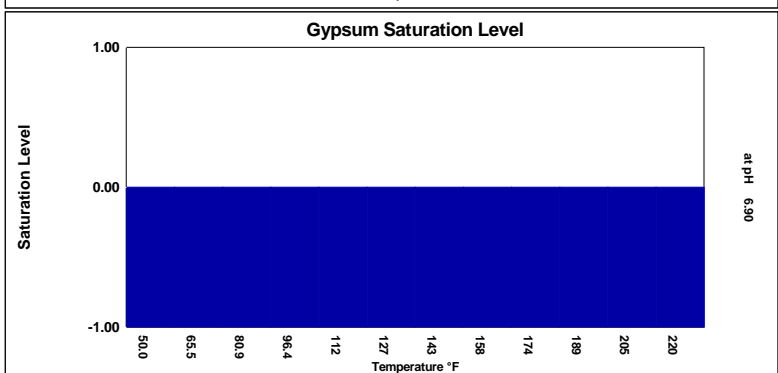
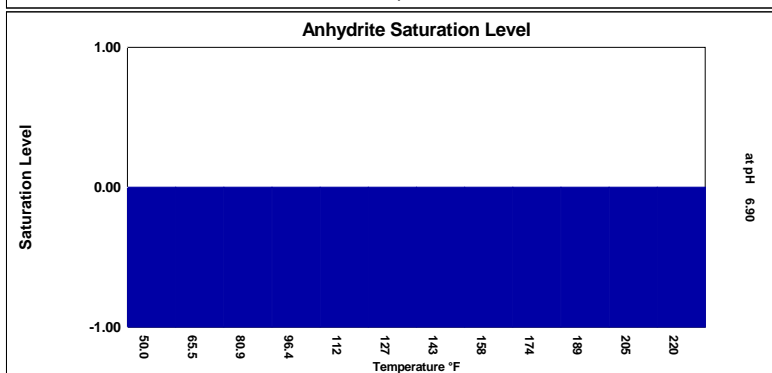
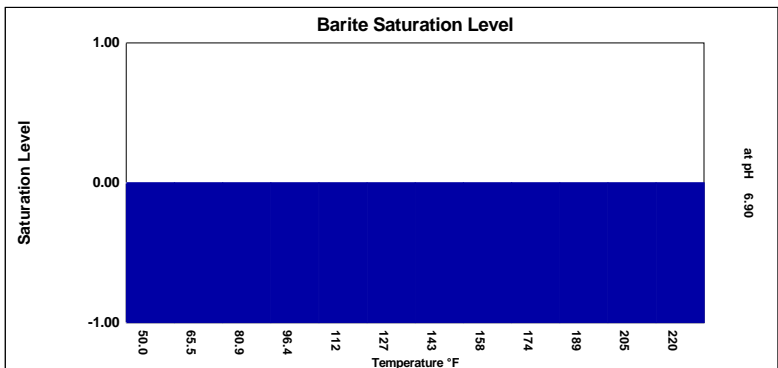
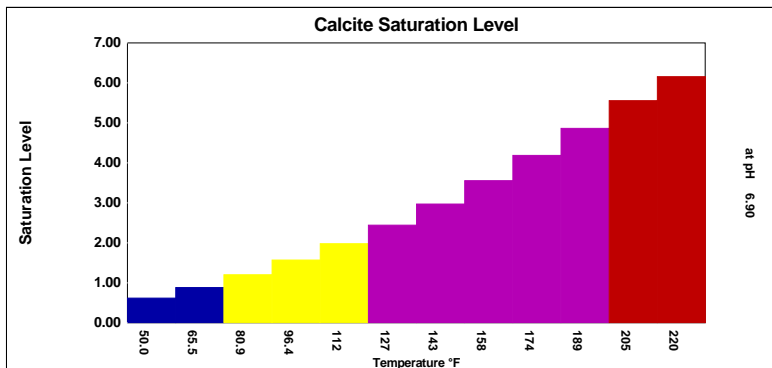
### PARAMETERS

Temperature(°F)	190.00
T.D.S.	16667
Resistivity:	43.79
Sample pH	6.90
Conductivity:	22837

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.618	-0.208	0.00	-1042	0.00	-861.97	0.00	-0.163	0.00	-105.62	93.93	0.386	0.00	-0.0227	0.0840	0.0866
65.45	0.00	0.883	-0.0558	0.00	-1053	0.00	-888.23	0.00	-0.247	0.00	-108.66	151.46	0.487	0.00	-0.0234	0.157	0.0866
80.91	0.00	1.20	0.0864	0.00	-1033	0.00	-905.05	0.00	-0.351	0.00	-108.27	231.07	0.591	0.00	-0.0242	0.134	0.0866
96.36	0.00	1.57	0.218	0.00	-986.12	0.00	-913.19	0.00	-0.473	0.00	-106.06	335.10	0.692	0.00	-0.0252	0.176	0.0866
111.82	0.00	1.98	0.337	0.00	-919.23	0.00	-877.72	0.00	-0.610	0.00	-103.16	464.63	0.789	0.00	-0.0263	0.184	0.0866
127.27	0.00	2.44	0.454	0.00	-838.66	0.00	-818.28	0.00	-0.777	0.00	-100.64	628.64	0.891	0.00	-0.0275	0.155	0.0866
142.73	0.00	2.97	0.573	0.00	-750.36	0.00	-767.36	0.00	-0.981	0.00	-98.54	831.34	1.00	0.00	-0.0289	0.125	0.0866
158.18	0.00	3.55	0.692	0.00	-659.45	0.00	-723.68	0.00	-1.23	0.00	-96.83	1074	1.12	0.00	-0.0306	0.131	0.0866
173.64	0.00	4.19	0.811	0.00	-570.01	0.00	-686.22	0.00	-1.52	0.00	-95.49	1353	1.23	0.00	-0.0327	0.135	0.0866
189.09	0.00	4.86	0.931	0.00	-485.06	0.00	-654.15	0.00	-1.88	0.00	-94.50	1662	1.36	0.00	-0.0353	0.0681	0.0866
204.55	0.00	5.55	1.05	0.00	-406.57	0.00	-626.75	0.00	-2.30	0.00	-93.82	1983	1.48	0.00	-0.0385	0.0571	0.0866
220.00	0.171	6.15	1.17	0.00	-340.76	0.00	-611.96	0.00	-2.86	0.00	-94.69	2272	1.61	0.00	-0.0434	0.0777	0.101
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11969-00  
Chevron 36-1D  
WMFK (93050)

BERRY PETROLEUM  
TIM HEATON

O-36B CHEVRON 36-1D  
POST

Report Date: 12-29-2010      Sampled: 12-21-2010  
Sample #: 64                              at 0000

#### CATIONS

Calcium (as Ca)	226.00
Magnesium (as Mg)	16.32
Barium (as Ba)	19.62
Strontium (as Sr)	14.41
Sodium (as Na)	6731
Potassium (as K)	48.83
Lithium (as Mg)	1.91
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	2.29
Iron (as Fe)	166.80
Boron (as B)	0.291
Manganese (as Mn)	1.43
Zinc (as Zn)	2.56
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	10561
Sulfate (as SO <sub>4</sub> )	5.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	500.00
Bicarbonate (as HCO <sub>3</sub> )	876.00
Carbonate (as CO <sub>3</sub> )	0.00
Silica (as Si)	7.02
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Phosphate (as PO <sub>4</sub> )	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Fluoride (as F)	0.00

#### PARAMETERS

pH	6.70
Temperature (°F)	120.00
Density(g/mL)	1.01
Pressure(atm)	14.70
Calculated T.D.S.	19183
Molar Conductivity	26489

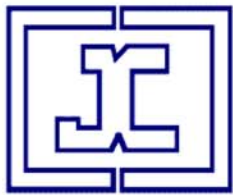
#### CORROSION RATE PREDICTION

CO <sub>2</sub> - H <sub>2</sub> S Rate(mpy)	0.00
--	------

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
O-36B CHEVRON 36-1D  
TIM HEATON  
POST

Sample ID#: 64  
ID: 2580  
Report Date: 12-29-2010  
Sample Date: 12-21-2010  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	226.00
Magnesium(as Mg)	16.32
Barium(as Ba)	19.62
Strontium(as Sr)	14.41
Sodium(as Na)	6731
Potassium(as K)	48.83
Lithium(as Li)	1.91
Iron(as Fe)	166.80
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	2.29
Boron(as B)	0.291
Manganese(as Mn)	1.43
Zinc(as Zn)	2.56
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	10561
Sulfate(as SO <sub>4</sub> )	5.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	500.00
Bicarbonate(as HCO <sub>3</sub> )	876.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as Si)	7.02
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00

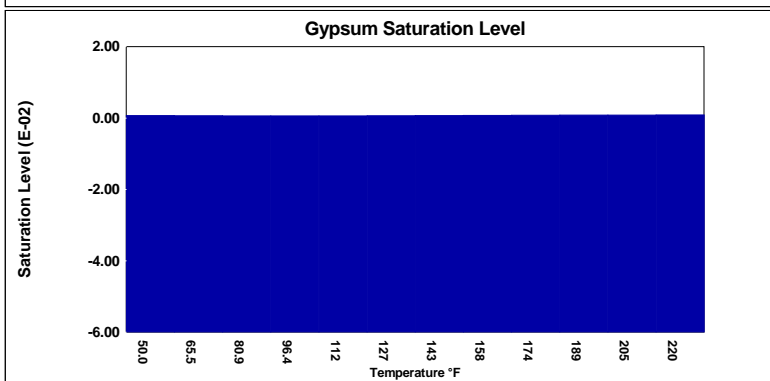
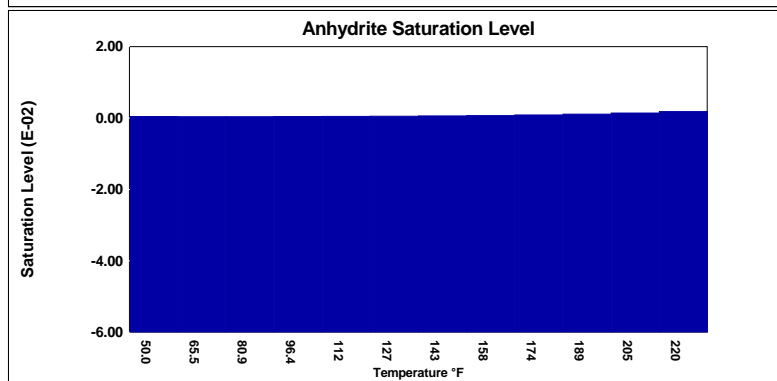
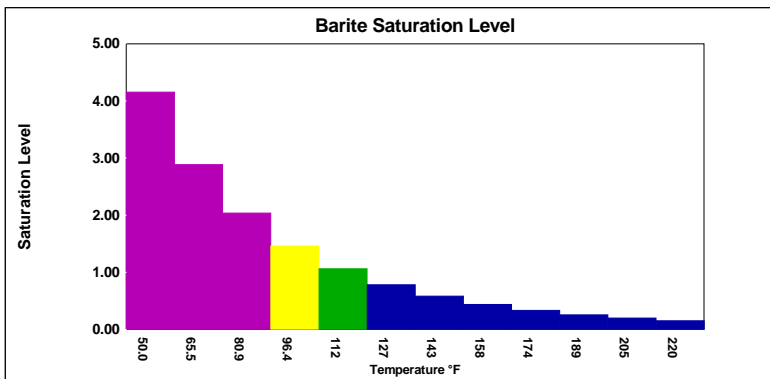
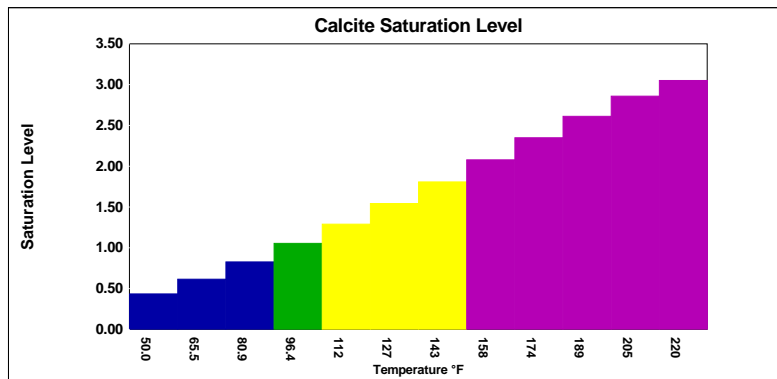
### PARAMETERS

Temperature(°F)	120.00
Sample pH	6.70

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.435	-0.254	< 0.001	-1057	< 0.001	-869.39	4.15	2.43	< 0.001	-168.13	458.54	0.226	0.00	-0.00429	0.0395	0.00900
65.45	0.00	0.615	-0.153	< 0.001	-1070	< 0.001	-897.86	2.88	2.00	< 0.001	-166.03	736.87	0.284	0.00	-0.00444	0.0739	0.00900
80.91	0.00	0.826	-0.0622	< 0.001	-1051	< 0.001	-917.10	2.04	1.49	< 0.001	-164.44	1119	0.342	0.00	-0.00459	0.0350	0.00900
96.36	0.00	1.05	0.0178	< 0.001	-1004	< 0.001	-927.88	1.46	0.871	< 0.001	-163.32	1612	0.398	0.00	-0.00478	0.840	0.00900
111.82	0.00	1.29	0.0871	< 0.001	-937.67	< 0.001	-893.85	1.06	0.148	< 0.001	-162.65	2218	0.449	0.00	-0.00498	0.166	0.00900
127.27	0.00	1.54	0.152	< 0.001	-856.89	< 0.001	-835.22	0.780	-0.692	< 0.001	-162.41	2977	0.503	0.00	-0.00521	0.0745	0.00900
142.73	0.00	1.81	0.215	< 0.001	-768.26	< 0.001	-785.65	0.581	-1.66	< 0.001	-162.57	3906	0.559	0.00	-0.00548	0.0405	0.00900
158.18	0.00	2.08	0.276	< 0.001	-676.99	< 0.001	-743.76	0.437	-2.76	< 0.001	-163.13	5012	0.617	0.00	-0.00579	0.0316	0.00900
173.64	0.00	2.35	0.335	< 0.001	-587.24	< 0.001	-708.41	0.332	-4.00	< 0.001	-164.10	6288	0.676	0.00	-0.00616	0.0261	0.00900
189.09	0.00	2.61	0.392	0.00107	-502.04	< 0.001	-678.69	0.254	-5.40	< 0.001	-165.48	7710	0.737	0.00	-0.00660	0.0118	0.00900
204.55	0.00	2.86	0.447	0.00139	-423.41	< 0.001	-653.85	0.197	-6.97	< 0.001	-167.28	9242	0.797	0.00	-0.00713	0.00992	0.00900
220.00	0.171	3.05	0.503	0.00180	-357.66	< 0.001	-642.09	0.150	-8.91	< 0.001	-171.74	10698	0.867	0.00	-0.00798	0.0135	0.0105
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11973-00  
Chevron 36-3D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-3D O-36B PAD  
SEPARATOR

Report Date: 11-26-2014    Sampled: 11-15-2014  
Sample #: 3076    at 0000  
  
Sample ID: 84983

#### CATIONS

Calcium (as Ca)	21.13
Magnesium (as Mg)	12.61
Barium (as Ba)	0.204
Strontium (as Sr)	1.71
Sodium (as Na)	3325
Potassium (as K)	22.37
Lithium (as Li)	0.274
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	0.0510
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	4900
Sulfate (as SO <sub>4</sub> )	250.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	250.00
Bicarbonate (as HCO <sub>3</sub> )	305.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	8844
Molar Conductivity	12990
Resistivity	76.98
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0281
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.90

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**LINN OPERATING  
ROB SIMEONE  
GARFIELD COCHEVRON 36-3D O-36B PAD  
SEPARATORReport Date: 11-26-2014 Sampled: 11-15-2014  
Sample #: 3076 at 0000  
Sample ID: 84983**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	0.251
Aragonite (CaCO <sub>3</sub> )	0.204
Witherite (BaCO <sub>3</sub> )	< 0.001
Strontianite (SrCO <sub>3</sub> )	0.0523
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	0.268
Anhydrite (CaSO <sub>4</sub> )	0.0115
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00846
Barite (BaSO <sub>4</sub> )	0.553
Celestite (SrSO <sub>4</sub> )	0.0272
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	8.26
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	1.94
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	-0.931
Aragonite (CaCO <sub>3</sub> )	-1.20
Witherite (BaCO <sub>3</sub> )	-10.31
Strontianite (SrCO <sub>3</sub> )	-2.35
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-1.62
Magnesite (MgCO <sub>3</sub> )	-0.717
Anhydrite (CaSO <sub>4</sub> )	-393.90
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-531.36
Barite (BaSO <sub>4</sub> )	-0.0974
Celestite (SrSO <sub>4</sub> )	-35.51
Fluorite (CaF <sub>2</sub> )	-32.16
Calcium phosphate	-0.00227
Hydroxyapatite	-412.11
Silica (SiO <sub>2</sub> )	-152.86
Brucite (Mg(OH) <sub>2</sub> )	0.0708
Magnesium silicate	-153.52
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	> -0.001
Siderite (FeCO <sub>3</sub> )	0.0152
Halite (NaCl)	-196830
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-49219
Iron sulfide (FeS)	-0.252

**SIMPLE INDICES**

Langelier	-0.534
Ryznar	7.97
Puckorius	6.81
Larson-Skold Index	28.22
Stiff Davis Index	0.240
Oddo-Tomson	-0.317

**BOUND IONS**

Calcium	21.13
Barium	0.204
Carbonate	7.89
Phosphate	0.00
Sulfate	250.00

**TOTAL****FREE**

19.23
0.204
0.578
0.00
212.53

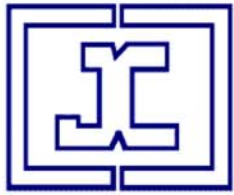
**OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 36-3D O-36B PAD  
ROB SIMEONE  
SEPARATOR  
GARFIELD CO

Sample ID#: 3076  
ID: 84983  
Report Date: 11-26-2014  
Sample Date: 11-15-2014  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	21.13
Magnesium(as Mg)	12.61
Barium(as Ba)	0.204
Strontium(as Sr)	1.71
Sodium(as Na)	3325
Potassium(as K)	22.37
Lithium(as Li)	0.274
Iron(as Fe)	0.0510
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	4900
Sulfate(as SO <sub>4</sub> )	250.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	250.00
Bicarbonate(as HCO <sub>3</sub> )	305.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

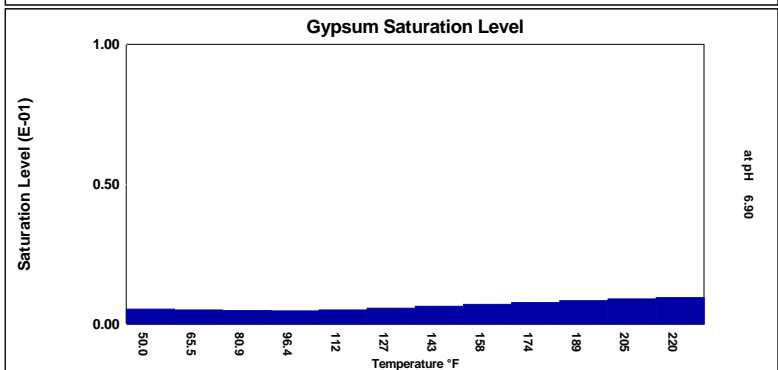
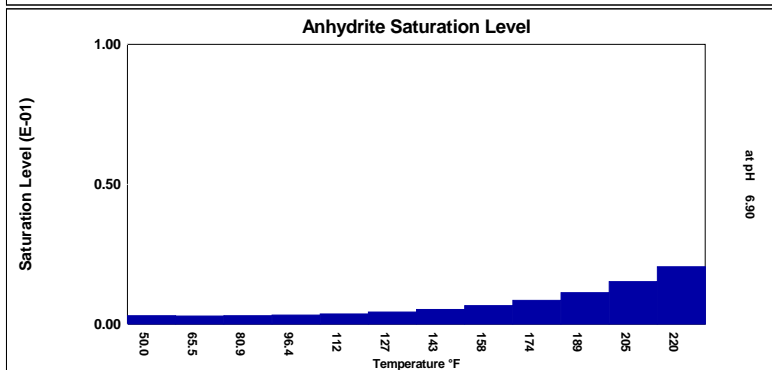
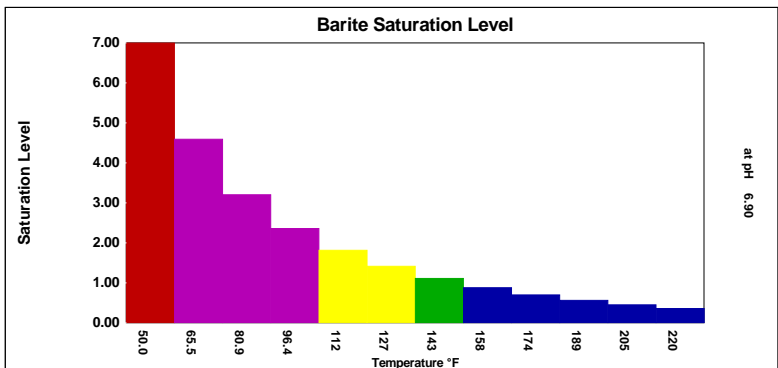
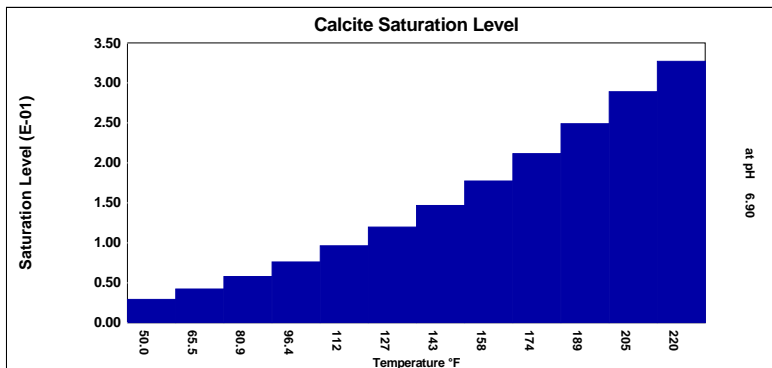
### PARAMETERS

Temperature(°F)	190.00
T.D.S.	8844
Conductivity:	12990
Resistivity:	76.98

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.0293	-2.70	0.00304	-870.75	0.00542	-719.37	6.99	0.104	0.0227	-41.95	0.102	-0.125	0.00	-0.228	0.0913	0.0281
65.45	0.00	0.0422	-2.36	0.00295	-878.03	0.00509	-739.21	4.59	0.0945	0.0215	-43.94	0.166	-0.0922	0.00	-0.230	0.171	0.0281
80.91	0.00	0.0579	-2.08	0.00303	-859.14	0.00488	-751.15	3.20	0.0831	0.0215	-43.78	0.254	-0.0647	0.00	-0.232	0.109	0.0281
96.36	0.00	0.0761	-1.84	0.00328	-818.51	0.00477	-755.87	2.36	0.0696	0.0223	-42.46	0.370	-0.0428	0.00	-0.234	0.143	0.0281
111.82	0.00	0.0962	-1.63	0.00371	-761.44	0.00509	-724.83	1.81	0.0542	0.0234	-40.72	0.516	-0.0259	0.00	-0.237	0.150	0.0281
127.27	0.00	0.120	-1.45	0.00436	-693.33	0.00575	-674.28	1.41	0.0352	0.0244	-39.21	0.702	-0.0125	0.00	-0.239	0.125	0.0281
142.73	0.00	0.147	-1.30	0.00530	-619.14	0.00641	-630.79	1.11	0.0118	0.0253	-37.97	0.934	-0.00216	0.00	-0.242	0.102	0.0281
158.18	0.00	0.177	-1.16	0.00664	-543.10	0.00709	-593.27	0.878	-0.0169	0.0261	-36.95	1.22	0.00559	0.00	-0.245	0.0922	0.0281
173.64	0.00	0.212	-1.04	0.00856	-468.54	0.00776	-560.87	0.699	-0.0520	0.0267	-36.15	1.55	0.0112	0.00	-0.249	0.0737	0.0281
189.09	0.00	0.249	-0.937	0.0113	-397.90	0.00842	-532.89	0.561	-0.0947	0.0272	-35.54	1.92	0.0151	0.00	-0.252	0.0249	0.0281
204.55	0.00	0.289	-0.841	0.0152	-332.78	0.00906	-508.76	0.452	-0.146	0.0275	-35.11	2.31	0.0175	0.00	-0.256	0.00985	0.0281
220.00	0.171	0.327	-0.774	0.0206	-277.51	0.00950	-493.80	0.359	-0.215	0.0272	-35.42	2.69	0.0187	0.00	-0.262	0.0378	0.0329
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11035-00  
Chevron 18-344D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-344D D-20 PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580    at 0000  
  
Sample ID: 67303

#### CATIONS

Calcium (as Ca)	148.20
Magnesium (as Mg)	47.92
Barium (as Ba)	16.16
Strontium (as Sr)	15.63
Sodium (as Na)	4125
Potassium (as K)	113.80
Lithium (as Li)	8.77
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	57.31
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.584
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	6700
Sulfate (as SO <sub>4</sub> )	100.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	175.00
Bicarbonate (as HCO <sub>3</sub> )	488.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	11849
Molar Conductivity	16817
Resistivity	59.47
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0739
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.60

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-344D D-20 PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580                      at 0000  
  
Sample ID: 67303

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	1.26
Aragonite (CaCO <sub>3</sub> )	1.03
Witherite (BaCO <sub>3</sub> )	0.0318
Strontianite (SrCO <sub>3</sub> )	0.325
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	0.780
Anhydrite (CaSO <sub>4</sub> )	0.0234
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0171
Barite (BaSO <sub>4</sub> )	12.05
Celestite (SrSO <sub>4</sub> )	0.0685
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	2185
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	1607
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.0591
Aragonite (CaCO <sub>3</sub> )	0.00752
Witherite (BaCO <sub>3</sub> )	-8.21
Strontianite (SrCO <sub>3</sub> )	-0.773
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.294
Magnesite (MgCO <sub>3</sub> )	-0.0677
Anhydrite (CaSO <sub>4</sub> )	-411.44
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-561.80
Barite (BaSO <sub>4</sub> )	8.65
Celestite (SrSO <sub>4</sub> )	-62.27
Fluorite (CaF <sub>2</sub> )	-21.80
Calcium phosphate	>-0.001
Hydroxyapatite	-446.77
Silica (SiO <sub>2</sub> )	-152.05
Brucite (Mg(OH) <sub>2</sub> )	0.0368
Magnesium silicate	-159.72
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.330
Halite (NaCl)	-201893
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-52383
Iron sulfide (FeS)	-0.0176

**SIMPLE INDICES**

Langelier	0.170
Ryznar	6.26
Puckorius	4.51
Larson-Skold Index	23.73
Stiff Davis Index	0.944
Oddo-Tomson	0.323

**BOUND IONS**

Calcium	148.20
Barium	16.16
Carbonate	8.55
Phosphate	0.00
Sulfate	100.00

**TOTAL****FREE**

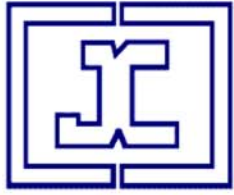
139.35
16.16
0.491
0.00
74.10

**OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES****205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096**

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
CHEVRON 18-344D D-20 PAD  
ROB SIMEONE  
SEPARATOR  
GARFIELD CO

Sample ID#: 2580  
ID: 67303  
Report Date: 04-21-2014  
Sample Date: 03-18-2014  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	148.20
Magnesium(as Mg)	47.92
Barium(as Ba)	16.16
Strontium(as Sr)	15.63
Sodium(as Na)	4125
Potassium(as K)	113.80
Lithium(as Li)	8.77
Iron(as Fe)	57.31
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.584
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	6700
Sulfate(as SO <sub>4</sub> )	100.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	175.00
Bicarbonate(as HCO <sub>3</sub> )	488.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

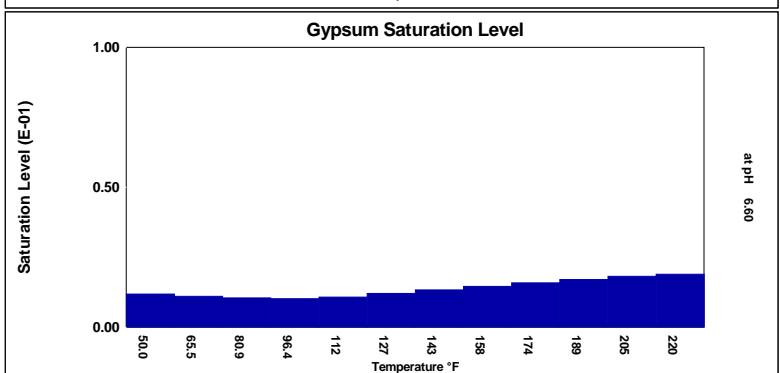
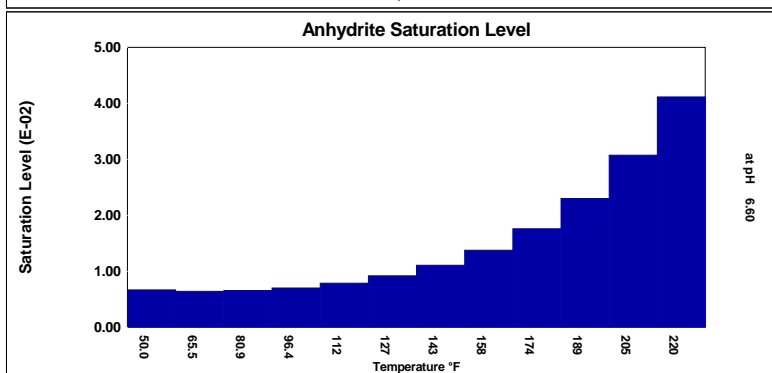
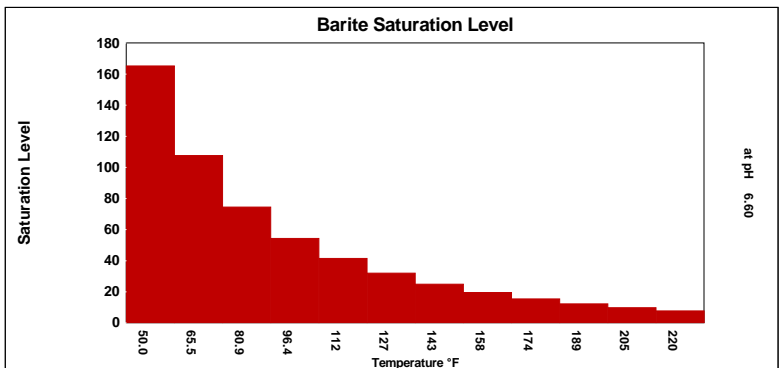
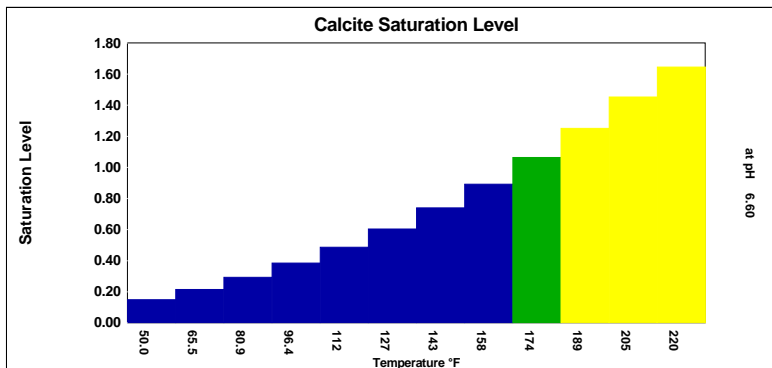
### PARAMETERS

Temperature(°F)	190.00
T.D.S.	11849
Resistivity:	59.47
Sample pH	6.60
Conductivity:	16817

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.149	-0.455	0.00666	-928.49	0.0118	-759.90	165.14	9.50	0.0621	-70.46	83.25	0.0916	0.00	-0.0119	0.0791	0.0739
65.45	0.00	0.214	-0.368	0.00642	-937.74	0.0110	-782.84	107.55	9.47	0.0582	-73.34	134.53	0.115	0.00	-0.0122	0.148	0.0739
80.91	0.00	0.293	-0.292	0.00655	-918.21	0.0105	-797.13	74.39	9.42	0.0578	-73.21	205.79	0.140	0.00	-0.0126	0.121	0.0739
96.36	0.00	0.384	-0.227	0.00702	-874.69	0.0102	-803.48	54.31	9.37	0.0593	-71.47	299.28	0.164	0.00	-0.0131	0.159	0.0739
111.82	0.00	0.486	-0.171	0.00787	-812.95	0.0108	-770.36	41.38	9.30	0.0617	-69.12	416.77	0.187	0.00	-0.0136	0.167	0.0739
127.27	0.00	0.603	-0.120	0.00918	-738.91	0.0121	-715.62	31.93	9.22	0.0638	-67.10	567.23	0.212	0.00	-0.0141	0.140	0.0739
142.73	0.00	0.739	-0.0727	0.0111	-658.02	0.0133	-668.62	24.84	9.12	0.0655	-65.43	756.35	0.238	0.00	-0.0148	0.113	0.0739
158.18	0.00	0.892	-0.0279	0.0138	-574.91	0.0146	-628.18	19.48	9.00	0.0669	-64.10	987.94	0.266	0.00	-0.0156	0.118	0.0739
173.64	0.00	1.06	0.0151	0.0176	-493.28	0.0159	-593.37	15.37	8.85	0.0679	-63.06	1265	0.296	0.00	-0.0164	0.122	0.0739
189.09	0.00	1.25	0.0567	0.0230	-415.82	0.0171	-563.43	12.21	8.66	0.0685	-62.31	1587	0.328	0.00	-0.0175	0.0615	0.0739
204.55	0.00	1.45	0.0972	0.0307	-344.36	0.0182	-537.75	9.76	8.43	0.0688	-61.81	1947	0.362	0.00	-0.0188	0.0515	0.0739
220.00	0.171	1.64	0.135	0.0411	-284.02	0.0189	-522.76	7.69	8.14	0.0674	-62.48	2319	0.400	0.00	-0.0208	0.0702	0.0865
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-11036-00  
Chevron 18-441D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-441D D-20 PAD  
WELLHEAD

Report Date: 08-24-2015 Sampled: 04-02-2015  
Sample #: 3076 at 0000  
Sample ID: 99505

### CATIONS

Calcium (as Ca)	120.70
Magnesium (as Mg)	18.01
Barium (as Ba)	21.67
Strontium (as Sr)	11.70
Sodium (as Na)	4749
Potassium (as K)	50.95
Lithium (as Li)	2.09
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.922
Iron (as Fe)	72.56
Manganese (as Mn)	0.653
Zinc (as Zn)	1.61
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	6900
Sulfate (as SO <sub>4</sub> )	275.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	625.00
Bicarbonate (as HCO <sub>3</sub> )	1220
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	13562
Molar Conductivity	18142
Resistivity	55.12
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.214
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-441D D-20 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99505  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	120.70
Magnesium(as Mg)	18.01
Barium(as Ba)	21.67
Strontium(as Sr)	11.70
Sodium(as Na)	4749
Potassium(as K)	50.95
Lithium(as Li)	2.09
Iron(as Fe)	72.56
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.922
Manganese(as Mn)	0.653
Zinc(as Zn)	1.61
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	6900
Sulfate(as SO <sub>4</sub> )	275.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	625.00
Bicarbonate(as HCO <sub>3</sub> )	1220
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

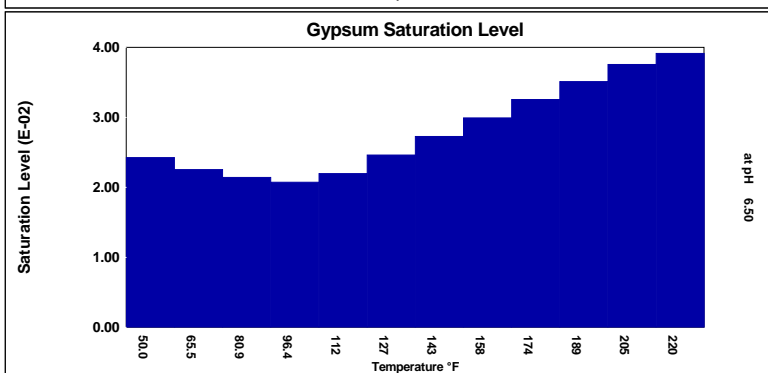
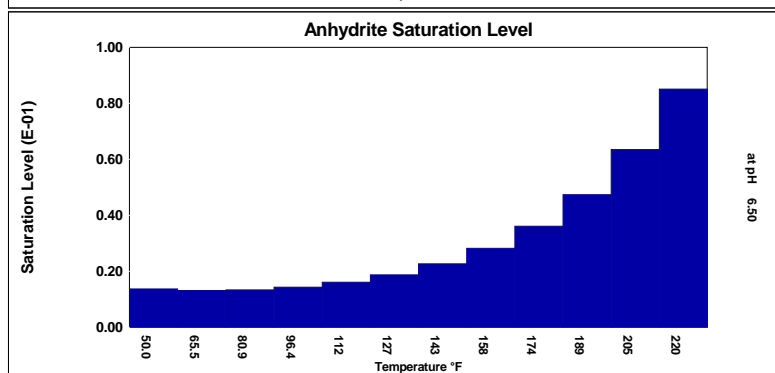
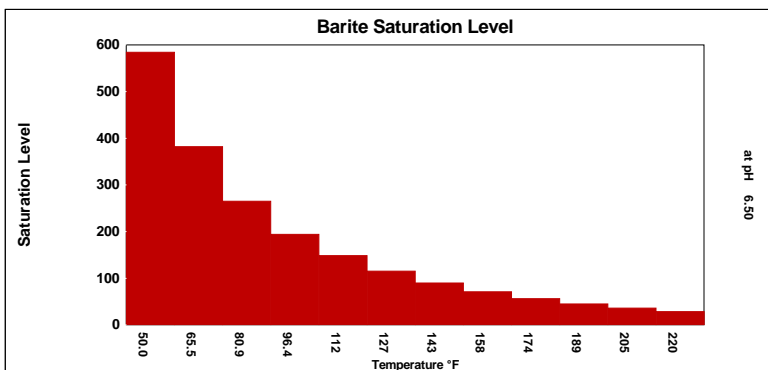
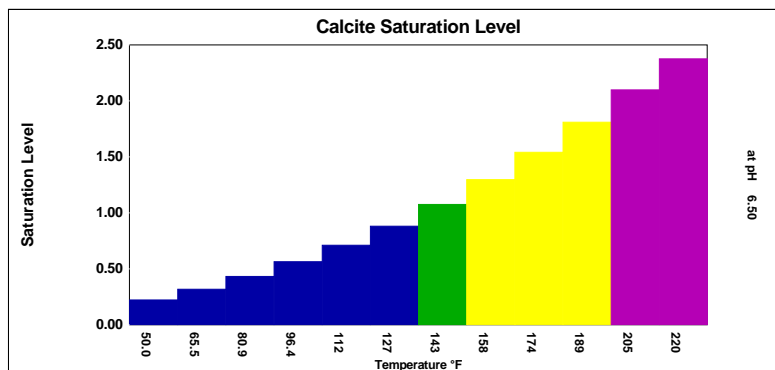
Temperature(°F)	190.00
T.D.S.	13562
Resistivity:	55.12

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.222	-0.565	0.0137	-936.44	0.0242	-760.88	584.14	12.81	0.123	-45.55	198.99	0.187	0.00	-0.0128	0.119	0.214
65.45	0.00	0.317	-0.437	0.0131	-946.92	0.0225	-785.53	381.62	12.80	0.115	-48.15	321.65	0.236	0.00	-0.0132	0.222	0.214
80.91	0.00	0.432	-0.324	0.0134	-927.71	0.0214	-801.20	264.85	12.78	0.115	-48.15	492.17	0.286	0.00	-0.0136	0.240	0.214
96.36	0.00	0.564	-0.223	0.0143	-883.74	0.0207	-808.65	194.02	12.76	0.118	-46.76	716.71	0.335	0.00	-0.0141	0.314	0.214
111.82	0.00	0.711	-0.134	0.0161	-820.89	0.0220	-775.28	148.39	12.74	0.124	-44.83	999.03	0.382	0.00	-0.0147	0.330	0.214
127.27	0.00	0.881	-0.0504	0.0187	-745.27	0.0246	-719.51	114.95	12.71	0.128	-43.18	1361	0.433	0.00	-0.0153	0.276	0.214
142.73	0.00	1.08	0.0294	0.0226	-662.45	0.0273	-671.66	89.81	12.68	0.132	-41.83	1817	0.487	0.00	-0.0160	0.224	0.214
158.18	0.00	1.30	0.107	0.0282	-577.19	0.0299	-630.54	70.70	12.64	0.136	-40.77	2379	0.545	0.00	-0.0168	0.233	0.214
173.64	0.00	1.54	0.184	0.0361	-493.27	0.0325	-595.17	56.05	12.59	0.138	-39.95	3055	0.608	0.00	-0.0177	0.242	0.214
189.09	0.00	1.81	0.259	0.0473	-413.42	0.0351	-564.76	44.73	12.52	0.140	-39.36	3844	0.673	0.00	-0.0188	0.122	0.214
204.55	0.00	2.10	0.335	0.0634	-339.54	0.0375	-538.72	35.89	12.45	0.141	-38.99	4742	0.743	0.00	-0.0201	0.102	0.214
220.00	0.171	2.38	0.410	0.0851	-276.89	0.0391	-523.75	28.37	12.35	0.139	-39.61	5682	0.823	0.00	-0.0222	0.139	0.251
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11037-00  
Chevron 18-434D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-434D D-20 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-09-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99518

#### CATIONS

Calcium (as Ca)	149.80
Magnesium (as Mg)	21.36
Barium (as Ba)	17.01
Strontium (as Sr)	14.11
Sodium (as Na)	4460
Potassium (as K)	56.64
Lithium (as Li)	2.08
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	10.90
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	6500
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate (as HCO <sub>3</sub> )	1464
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	12794
Molar Conductivity	17258
Resistivity	57.94
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.189
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.70

#### COMMENTS

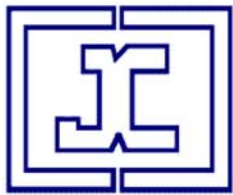
GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-434D D-20 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99518  
Report Date: 08-24-2015  
Sample Date: 04-09-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	149.80
Magnesium(as Mg)	21.36
Barium(as Ba)	17.01
Strontium(as Sr)	14.11
Sodium(as Na)	4460
Potassium(as K)	56.64
Lithium(as Li)	2.08
Iron(as Fe)	10.90
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	6500
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate(as HCO <sub>3</sub> )	1464
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

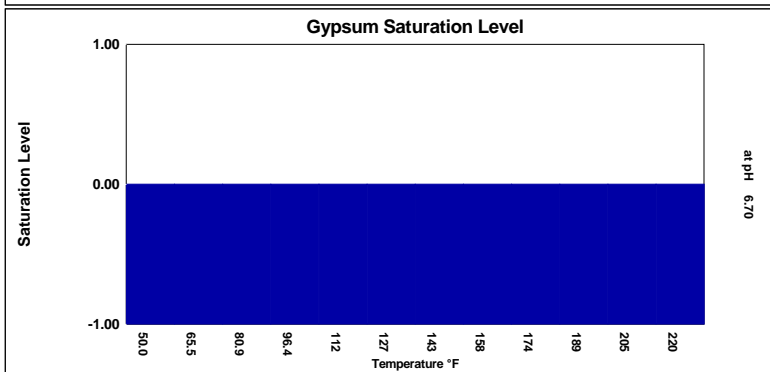
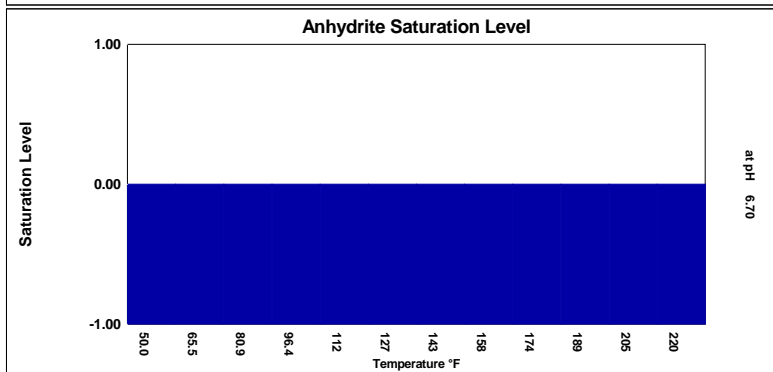
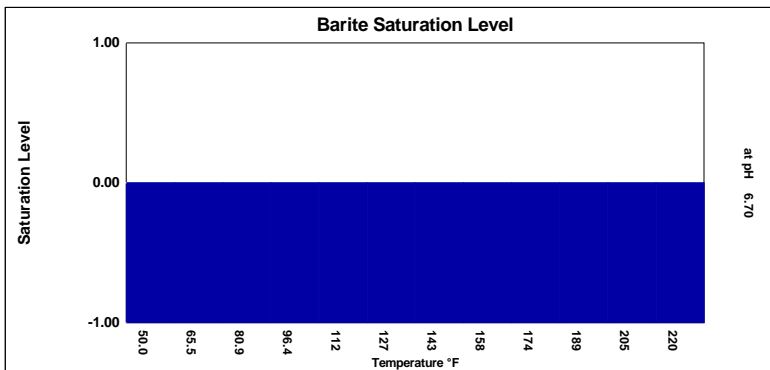
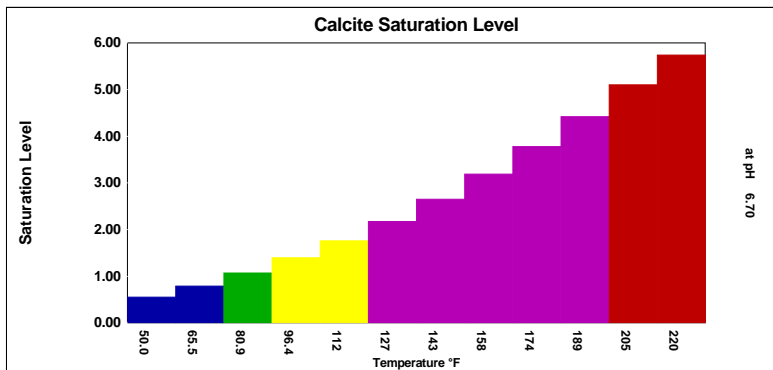
Temperature(°F)	190.00
T.D.S.	12794
Resistivity:	57.94
Sample pH	6.70
Conductivity:	17258

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.552	-0.246	0.00	-958.01	0.00	-792.61	0.00	-0.403	0.00	-97.62	60.34	0.346	0.00	-0.0485	0.113	0.189
65.45	0.00	0.786	-0.104	0.00	-967.64	0.00	-815.94	0.00	-0.599	0.00	-100.25	97.47	0.438	0.00	-0.0499	0.211	0.189
80.91	0.00	1.07	0.0297	0.00	-948.24	0.00	-830.48	0.00	-0.834	0.00	-99.78	149.04	0.532	0.00	-0.0515	0.221	0.189
96.36	0.00	1.39	0.153	0.00	-904.63	0.00	-836.93	0.00	-1.10	0.00	-97.66	216.63	0.623	0.00	-0.0532	0.290	0.189
111.82	0.00	1.76	0.265	0.00	-842.66	0.00	-803.68	0.00	-1.38	0.00	-94.93	301.57	0.711	0.00	-0.0553	0.304	0.189
127.27	0.00	2.17	0.375	0.00	-768.31	0.00	-748.68	0.00	-1.72	0.00	-92.52	409.75	0.804	0.00	-0.0576	0.255	0.189
142.73	0.00	2.65	0.486	0.00	-687.09	0.00	-701.49	0.00	-2.11	0.00	-90.50	545.41	0.905	0.00	-0.0602	0.207	0.189
158.18	0.00	3.19	0.599	0.00	-603.66	0.00	-660.90	0.00	-2.55	0.00	-88.82	710.91	1.01	0.00	-0.0632	0.215	0.189
173.64	0.00	3.78	0.714	0.00	-521.71	0.00	-625.95	0.00	-3.06	0.00	-87.47	906.61	1.13	0.00	-0.0668	0.223	0.189
189.09	0.00	4.42	0.831	0.00	-444.01	0.00	-595.90	0.00	-3.64	0.00	-86.41	1131	1.24	0.00	-0.0712	0.112	0.189
204.55	0.00	5.10	0.950	0.00	-372.36	0.00	-570.14	0.00	-4.30	0.00	-85.64	1379	1.37	0.00	-0.0764	0.0940	0.189
220.00	0.171	5.74	1.08	0.00	-311.98	0.00	-555.19	0.00	-5.11	0.00	-86.18	1626	1.51	0.00	-0.0843	0.128	0.221
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.







JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11038-00  
Chevron 18-444D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-444D D-20 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-09-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99519

#### CATIONS

Calcium (as Ca)	109.80
Magnesium (as Mg)	16.77
Barium (as Ba)	16.00
Strontium (as Sr)	10.86
Sodium (as Na)	3176
Potassium (as K)	41.16
Lithium (as Li)	1.71
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	16.08
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.197
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	4500
Sulfate (as SO <sub>4</sub> )	200.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	215.00
Bicarbonate (as HCO <sub>3</sub> )	1037
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	9222
Molar Conductivity	12614
Resistivity	79.28
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.160
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.60

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Sample ID: 99519

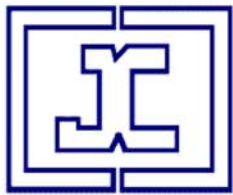
Calcite ( $\text{CaCO}_3$ )	0.032
Aragonite ( $\text{CaCO}_3$ )	0.241
Witherite ( $\text{BaCO}_3$ )	-6.66
Strontianite ( $\text{SrCO}_3$ )	-0.532
Calcium oxalate ( $\text{CaC}_2\text{O}_4$ )	-0.352
Magnesite ( $\text{MgCO}_3$ )	-0.314
Anhydrite ( $\text{CaSO}_4$ )	-360.53
Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )	-493.86
Barite ( $\text{BaSO}_4$ )	9.17
Celestite ( $\text{SrSO}_4$ )	-37.14
Fluorite ( $\text{CaF}_2$ )	-23.10
Calcium phosphate	>-0.001
Hydroxyapatite	-412.07
Silica ( $\text{SiO}_2$ )	-152.52
Brucite ( $\text{Mg}(\text{OH})_2$ )	0.0355
Magnesium silicate	-153.33
Iron hydroxide ( $\text{Fe}(\text{OH})_3$ )	< 0.001
Strengite ( $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$ )	>-0.001
Siderite ( $\text{FeCO}_3$ )	0.665
Halite ( $\text{NaCl}$ )	-196722
Thenardite ( $\text{Na}_2\text{SO}_4$ )	-49002
Iron sulfide ( $\text{FeS}$ )	-0.0497

Calcium	109.80	94.78
Barium	16.00	16.00
Carbonate	14.21	0.990
Phosphate	0.00	0.00
Sulfate	200.00	161.37

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-444D D-20 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99519  
Report Date: 08-24-2015  
Sample Date: 04-09-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	109.80
Magnesium(as Mg)	16.77
Barium(as Ba)	16.00
Strontium(as Sr)	10.86
Sodium(as Na)	3176
Potassium(as K)	41.16
Lithium(as Li)	1.71
Iron(as Fe)	16.08
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.197
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	4500
Sulfate(as SO <sub>4</sub> )	200.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	215.00
Bicarbonate(as HCO <sub>3</sub> )	1037
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

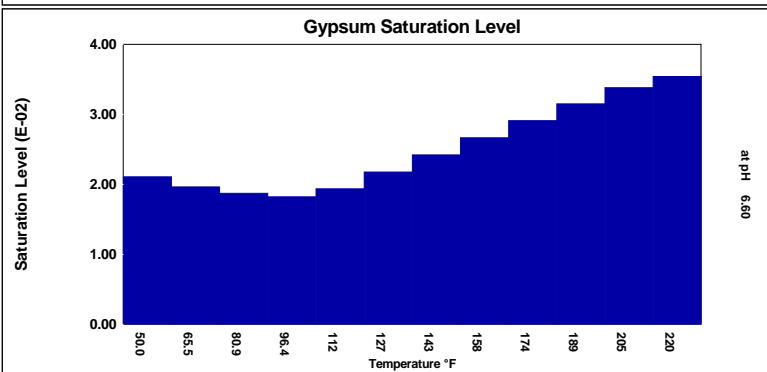
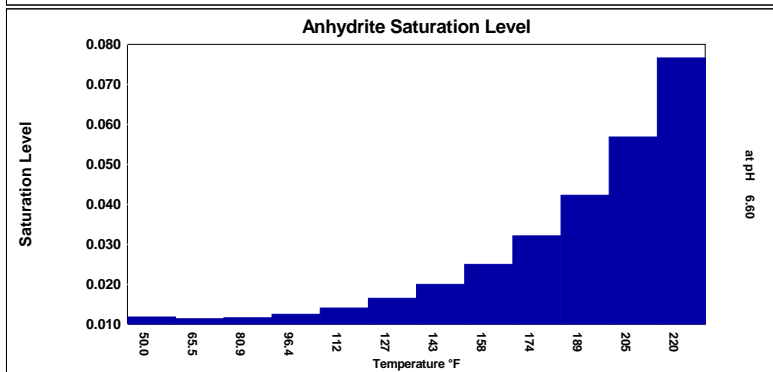
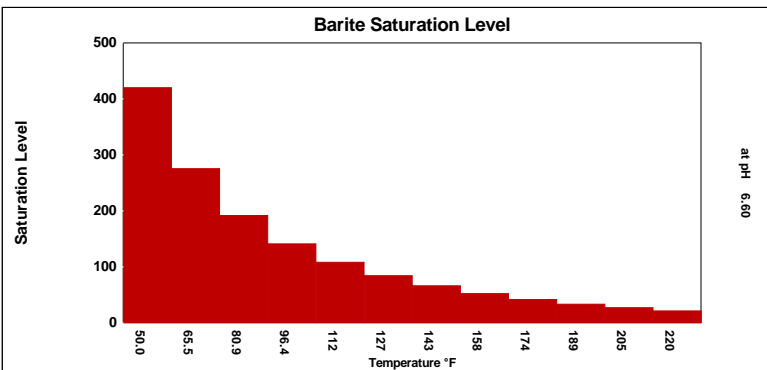
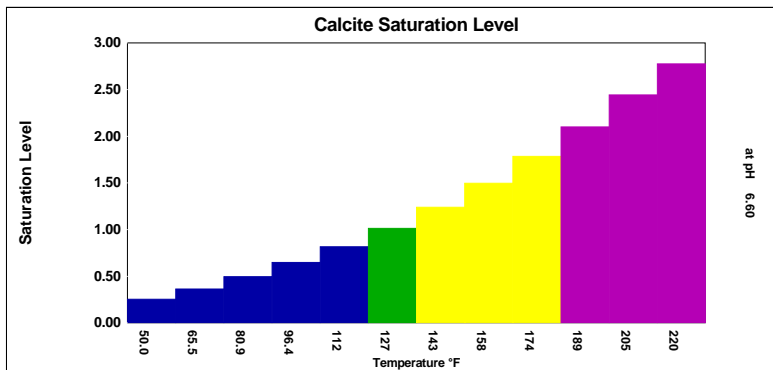
Temperature(°F)	190.00
T.D.S.	9222
Resistivity:	79.28

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.254	-0.473	0.0118	-835.96	0.0211	-679.47	419.86	9.45	0.110	-44.28	55.59	0.184	0.00	-0.0347	0.106	0.160
65.45	0.00	0.362	-0.355	0.0114	-843.81	0.0196	-699.99	275.23	9.44	0.104	-46.52	89.94	0.232	0.00	-0.0357	0.198	0.160
80.91	0.00	0.494	-0.250	0.0116	-825.33	0.0187	-712.46	191.70	9.42	0.104	-46.36	137.84	0.282	0.00	-0.0367	0.199	0.160
96.36	0.00	0.646	-0.156	0.0125	-784.97	0.0182	-717.55	140.97	9.40	0.108	-44.92	200.86	0.331	0.00	-0.0379	0.260	0.160
111.82	0.00	0.816	-0.0735	0.0141	-728.04	0.0194	-686.73	108.24	9.38	0.113	-42.99	280.30	0.377	0.00	-0.0392	0.273	0.160
127.27	0.00	1.01	0.00456	0.0165	-660.03	0.0217	-636.32	84.18	9.35	0.118	-41.31	382.37	0.426	0.00	-0.0407	0.229	0.160
142.73	0.00	1.24	0.0798	0.0200	-585.89	0.0242	-592.96	66.04	9.32	0.122	-39.92	511.12	0.480	0.00	-0.0424	0.186	0.160
158.18	0.00	1.50	0.153	0.0250	-509.87	0.0266	-555.57	52.21	9.28	0.125	-38.79	669.70	0.536	0.00	-0.0444	0.193	0.160
173.64	0.00	1.78	0.226	0.0321	-435.26	0.0291	-523.27	41.58	9.23	0.128	-37.88	859.62	0.597	0.00	-0.0467	0.200	0.160
189.09	0.00	2.10	0.298	0.0423	-364.53	0.0315	-495.38	33.32	9.17	0.131	-37.18	1081	0.661	0.00	-0.0495	0.101	0.160
204.55	0.00	2.44	0.371	0.0568	-299.28	0.0338	-471.34	26.86	9.10	0.132	-36.68	1331	0.729	0.00	-0.0529	0.0845	0.160
220.00	0.171	2.77	0.444	0.0766	-243.75	0.0354	-456.37	21.37	9.00	0.131	-37.00	1592	0.806	0.00	-0.0579	0.115	0.187
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-10897-00  
Chevron 6-43D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 6-43D H-7A PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-09-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99522

### CATIONS

Calcium (as Ca)	126.60
Magnesium (as Mg)	17.02
Barium (as Ba)	17.35
Strontium (as Sr)	12.96
Sodium (as Na)	4004
Potassium (as K)	62.39
Lithium (as Li)	2.08
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	12.12
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	5800
Sulfate (as SO <sub>4</sub> )	300.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate (as HCO <sub>3</sub> )	976.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	11357
Molar Conductivity	15541
Resistivity	64.35
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0733
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	7.00

### COMMENTS

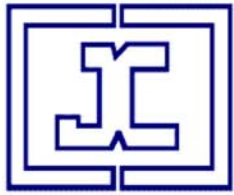
GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 6-43D H-7A PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99522  
Report Date: 08-24-2015  
Sample Date: 04-09-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	126.60
Magnesium(as Mg)	17.02
Barium(as Ba)	17.35
Strontium(as Sr)	12.96
Sodium(as Na)	4004
Potassium(as K)	62.39
Lithium(as Li)	2.08
Iron(as Fe)	12.12
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	5800
Sulfate(as SO <sub>4</sub> )	300.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate(as HCO <sub>3</sub> )	976.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

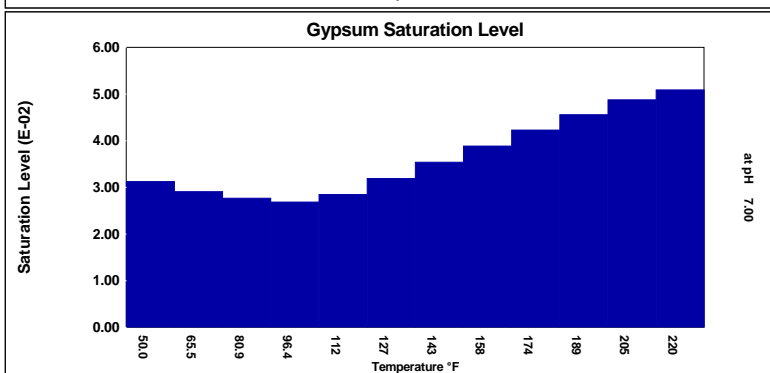
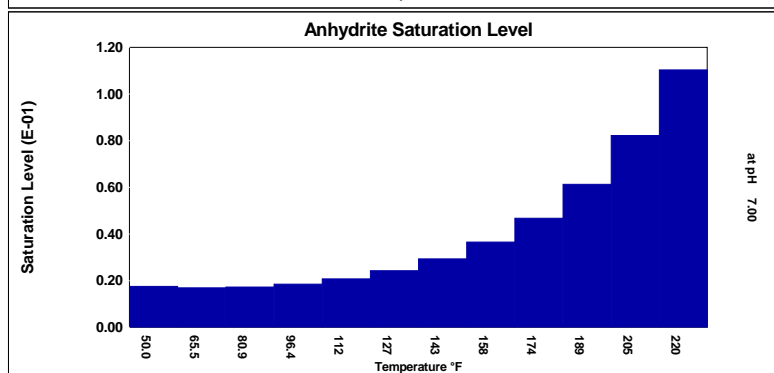
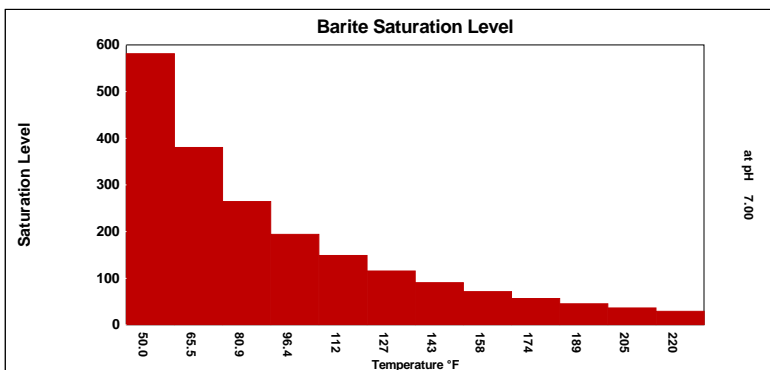
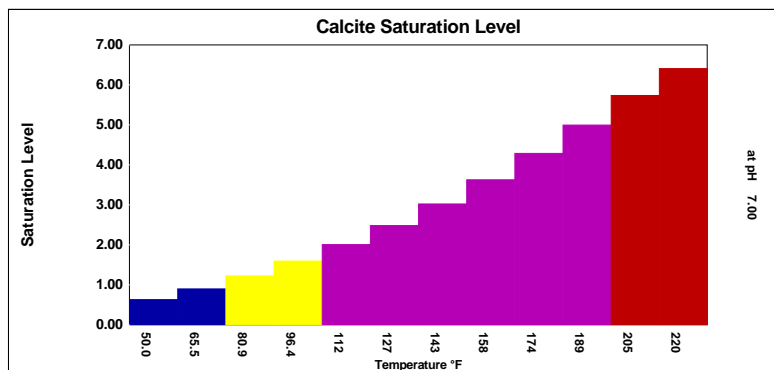
Temperature(°F)	190.00
T.D.S.	11357
Resistivity:	64.35
Sample pH	7.00
Conductivity:	15541

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.628	-0.234	0.0175	-873.77	0.0312	-703.87	580.88	10.26	0.169	-36.93	88.93	0.456	0.00	-0.0217	0.0788	0.0733
65.45	0.00	0.896	-0.0575	0.0169	-883.21	0.0291	-726.87	380.02	10.25	0.159	-39.22	143.70	0.574	0.00	-0.0223	0.148	0.0733
80.91	0.00	1.22	0.109	0.0172	-864.43	0.0276	-741.29	264.19	10.23	0.158	-39.19	219.76	0.696	0.00	-0.0230	0.121	0.0733
96.36	0.00	1.59	0.262	0.0185	-822.18	0.0268	-747.88	193.84	10.22	0.163	-37.91	319.46	0.816	0.00	-0.0238	0.158	0.0733
111.82	0.00	2.01	0.402	0.0208	-762.08	0.0285	-715.82	148.49	10.20	0.171	-36.16	444.25	0.929	0.00	-0.0247	0.166	0.0733
127.27	0.00	2.48	0.540	0.0242	-689.95	0.0319	-662.59	115.22	10.18	0.178	-34.65	602.44	1.05	0.00	-0.0258	0.139	0.0733
142.73	0.00	3.02	0.679	0.0293	-611.11	0.0354	-616.90	90.18	10.15	0.184	-33.41	798.34	1.18	0.00	-0.0271	0.113	0.0733
158.18	0.00	3.63	0.819	0.0365	-530.07	0.0388	-577.59	71.13	10.12	0.189	-32.42	1033	1.31	0.00	-0.0286	0.117	0.0733
173.64	0.00	4.29	0.960	0.0467	-450.40	0.0422	-543.74	56.51	10.08	0.193	-31.65	1303	1.45	0.00	-0.0305	0.121	0.0733
189.09	0.00	5.00	1.10	0.0613	-374.75	0.0455	-514.61	45.16	10.03	0.196	-31.08	1598	1.60	0.00	-0.0329	0.0612	0.0733
204.55	0.00	5.73	1.24	0.0822	-304.82	0.0487	-489.57	36.32	9.98	0.198	-30.69	1902	1.74	0.00	-0.0359	0.0513	0.0733
220.00	0.171	6.41	1.39	0.110	-245.38	0.0508	-474.61	28.80	9.90	0.195	-31.14	2176	1.90	0.00	-0.0406	0.0699	0.0858
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-12348-00  
Chevron 18-3D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-3D K-17 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99512

### CATIONS

Calcium (as Ca)	105.30
Magnesium (as Mg)	15.91
Barium (as Ba)	15.86
Strontium (as Sr)	11.17
Sodium (as Na)	2865
Potassium (as K)	55.38
Lithium (as Li)	2.02
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	396.00
Manganese (as Mn)	3.12
Zinc (as Zn)	0.0890
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	4600
Sulfate (as SO <sub>4</sub> )	25.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	425.00
Bicarbonate (as HCO <sub>3</sub> )	1098
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	9251
Molar Conductivity	12407
Resistivity	80.60
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.100
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.90

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Sample ID: 99512

Calcite ( $\text{CaCO}_3$ )	0.929
Aragonite ( $\text{CaCO}_3$ )	0.864
Witherite ( $\text{BaCO}_3$ )	-6.01
Strontianite ( $\text{SrCO}_3$ )	0.244
Calcium oxalate ( $\text{CaC}_2\text{O}_4$ )	-0.367
Magnesite ( $\text{MgCO}_3$ )	0.205
Anhydrite ( $\text{CaSO}_4$ )	-404.91
Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )	-544.74
Barite ( $\text{BaSO}_4$ )	5.52
Celestite ( $\text{SrSO}_4$ )	-71.49
Fluorite ( $\text{CaF}_2$ )	-23.45
Calcium phosphate	>-0.001
Hydroxyapatite	-416.05
Silica ( $\text{SiO}_2$ )	-152.69
Brucite ( $\text{Mg}(\text{OH})_2$ )	0.0711
Magnesium silicate	-154.11
Iron hydroxide ( $\text{Fe}(\text{OH})_3$ )	< 0.001
Strengite ( $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$ )	>-0.001
Siderite ( $\text{FeCO}_3$ )	1.41
Halite ( $\text{NaCl}$ )	-197667
Thenardite ( $\text{Na}_2\text{SO}_4$ )	-49360
Iron sulfide ( $\text{FeS}$ )	-0.00107

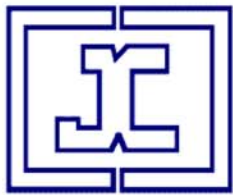
Calcium	105.30	93.02
Barium	15.86	15.86
Carbonate	27.00	2.09
Phosphate	0.00	0.00
Sulfate	25.00	18.86

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-3D K-17 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99512  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	105.30
Magnesium(as Mg)	15.91
Barium(as Ba)	15.86
Strontium(as Sr)	11.17
Sodium(as Na)	2865
Potassium(as K)	55.38
Lithium(as Li)	2.02
Iron(as Fe)	396.00
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	3.12
Zinc(as Zn)	0.0890
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	4600
Sulfate(as SO <sub>4</sub> )	25.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	425.00
Bicarbonate(as HCO <sub>3</sub> )	1098
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

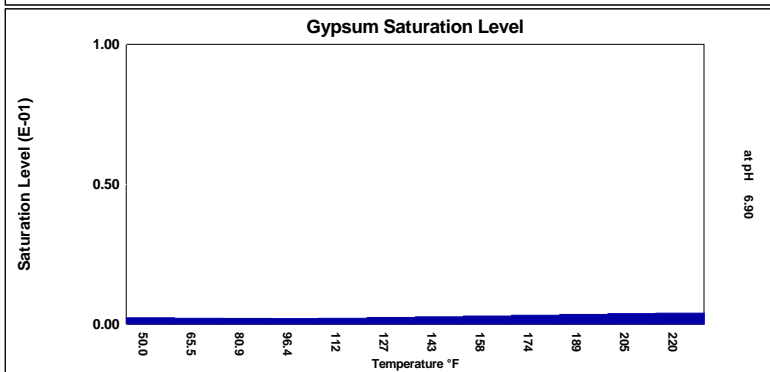
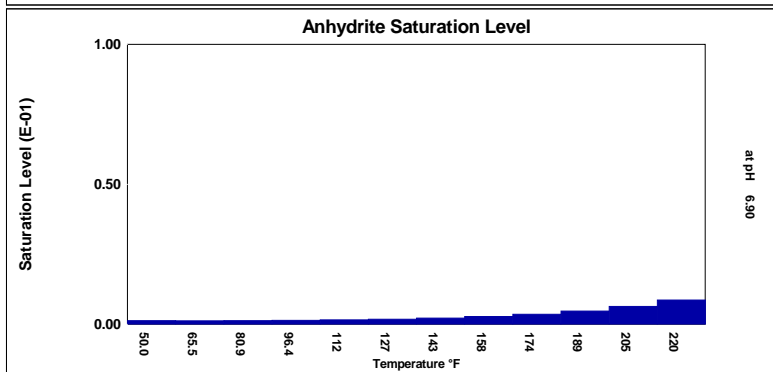
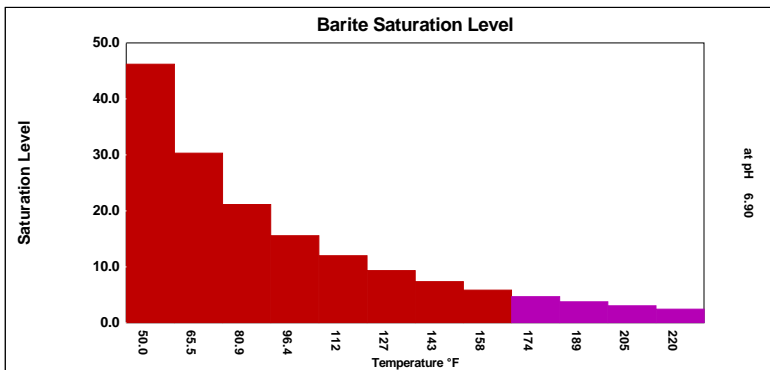
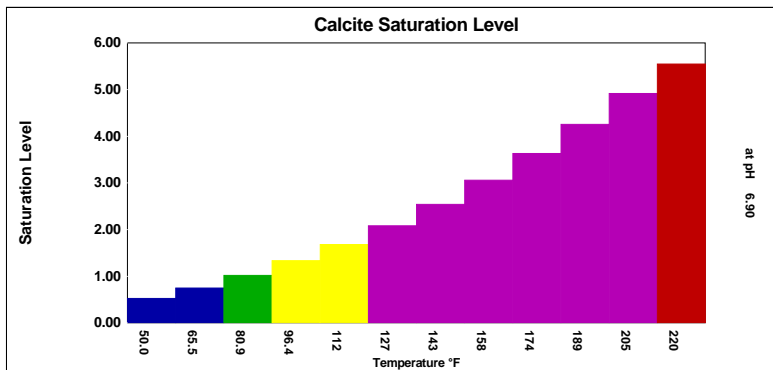
Temperature(°F)	190.00
T.D.S.	9251
Resistivity:	80.60
Sample pH	6.90
Conductivity:	12407

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.522	-0.314	0.00129	-888.07	0.00231	-735.70	46.18	8.96	0.0126	-82.44	2933	0.400	0.00	>-0.001	0.0888	0.100
65.45	0.00	0.746	-0.147	0.00125	-895.71	0.00216	-756.03	30.30	8.75	0.0119	-84.80	4743	0.502	0.00	>-0.001	0.166	0.100
80.91	0.00	1.02	0.00887	0.00128	-876.75	0.00206	-768.25	21.13	8.49	0.0119	-84.33	7258	0.606	0.00	>-0.001	0.148	0.100
96.36	0.00	1.33	0.151	0.00138	-835.68	0.00201	-773.06	15.57	8.20	0.0123	-82.36	10560	0.709	0.00	>-0.001	0.193	0.100
111.82	0.00	1.68	0.281	0.00156	-777.85	0.00214	-741.59	11.97	7.89	0.0130	-79.82	14703	0.807	0.00	>-0.001	0.202	0.100
127.27	0.00	2.08	0.407	0.00182	-708.80	0.00241	-690.31	9.34	7.53	0.0135	-77.56	19977	0.912	0.00	>-0.001	0.170	0.100
142.73	0.00	2.54	0.534	0.00222	-633.56	0.00268	-646.15	7.35	7.11	0.0141	-75.64	26552	1.02	0.00	>-0.001	0.138	0.100
158.18	0.00	3.06	0.661	0.00278	-556.40	0.00296	-607.99	5.83	6.65	0.0145	-74.02	34509	1.14	0.00	>-0.001	0.143	0.100
173.64	0.00	3.63	0.791	0.00358	-480.72	0.00324	-574.96	4.66	6.13	0.0149	-72.66	43810	1.27	0.00	>-0.001	0.148	0.100
189.09	0.00	4.25	0.921	0.00473	-408.97	0.00352	-546.31	3.76	5.56	0.0153	-71.55	54237	1.40	0.00	-0.00107	0.0748	0.100
204.55	0.00	4.92	1.05	0.00638	-342.83	0.00379	-521.46	3.05	4.93	0.0156	-70.66	65358	1.53	0.00	-0.00116	0.0627	0.100
220.00	0.171	5.54	1.19	0.00864	-286.74	0.00400	-505.85	2.45	4.18	0.0156	-70.82	76014	1.69	0.00	-0.00131	0.0854	0.117
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-12347-00  
Chevron 18-4D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-4D K-17 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-09-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99523

#### CATIONS

Calcium (as Ca)	133.70
Magnesium (as Mg)	19.60
Barium (as Ba)	17.18
Strontium (as Sr)	14.81
Sodium (as Na)	3940
Potassium (as K)	66.92
Lithium (as Li)	2.19
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	30.41
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.242
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	5900
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate (as HCO <sub>3</sub> )	1098
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	11266
Molar Conductivity	15609
Resistivity	64.07
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0999
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.90

#### COMMENTS

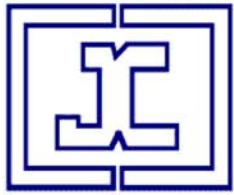
GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-4D K-17 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99523  
Report Date: 08-24-2015  
Sample Date: 04-09-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	133.70
Magnesium(as Mg)	19.60
Barium(as Ba)	17.18
Strontium(as Sr)	14.81
Sodium(as Na)	3940
Potassium(as K)	66.92
Lithium(as Li)	2.19
Iron(as Fe)	30.41
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.242
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	5900
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate(as HCO <sub>3</sub> )	1098
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

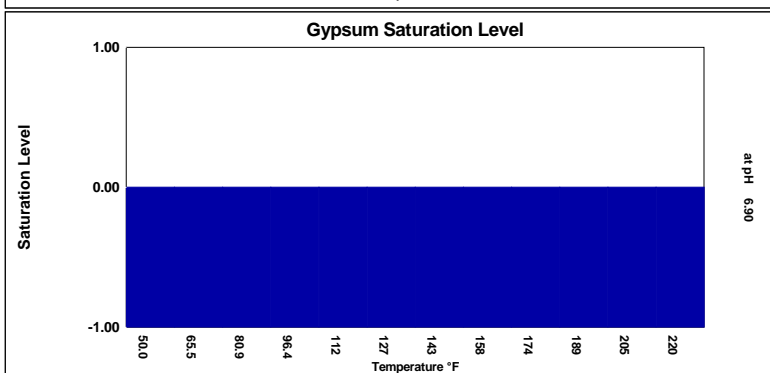
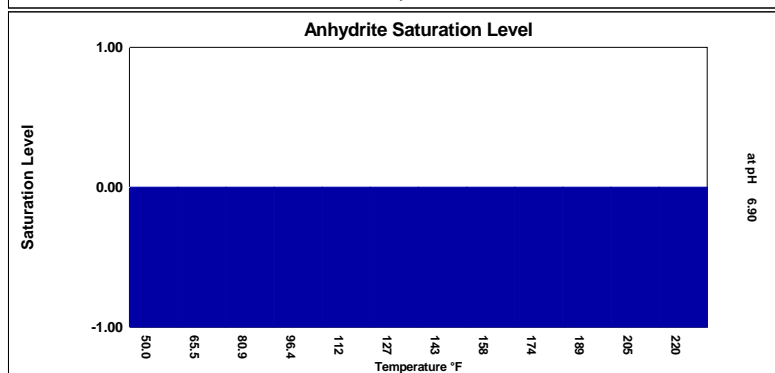
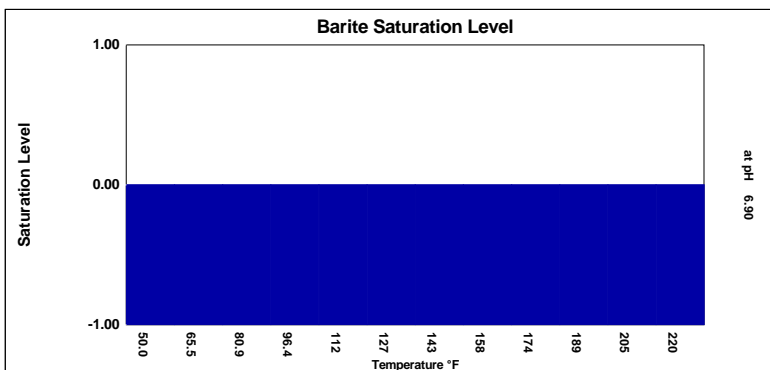
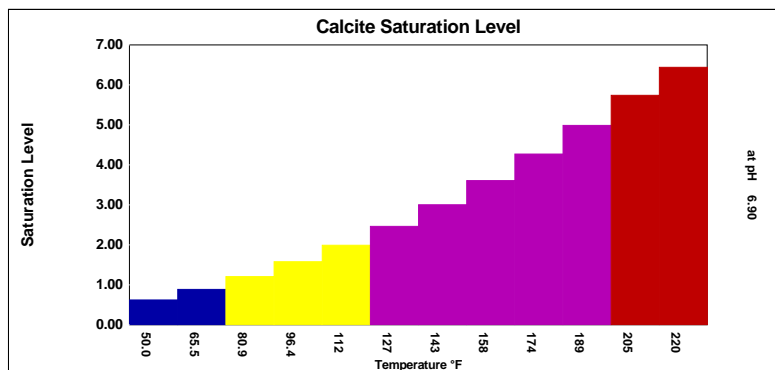
Temperature(°F)	190.00
T.D.S.	11266
Resistivity:	64.07
Sample pH	6.90
Conductivity:	15609

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.620	-0.216	0.00	-929.87	0.00	-769.88	0.00	-0.370	0.00	-93.50	209.35	0.409	0.00	-0.0104	0.0887	0.0999
65.45	0.00	0.886	-0.0571	0.00	-938.56	0.00	-791.85	0.00	-0.550	0.00	-96.00	338.19	0.513	0.00	-0.0107	0.166	0.0999
80.91	0.00	1.21	0.0921	0.00	-919.25	0.00	-805.34	0.00	-0.768	0.00	-95.51	517.01	0.621	0.00	-0.0110	0.147	0.0999
96.36	0.00	1.58	0.229	0.00	-876.62	0.00	-811.05	0.00	-1.01	0.00	-93.43	751.01	0.727	0.00	-0.0114	0.193	0.0999
111.82	0.00	1.99	0.355	0.00	-816.31	0.00	-778.50	0.00	-1.28	0.00	-90.76	1044	0.828	0.00	-0.0119	0.202	0.0999
127.27	0.00	2.46	0.479	0.00	-744.12	0.00	-725.02	0.00	-1.59	0.00	-88.40	1417	0.935	0.00	-0.0124	0.170	0.0999
142.73	0.00	3.00	0.603	0.00	-665.35	0.00	-679.06	0.00	-1.95	0.00	-86.40	1879	1.05	0.00	-0.0130	0.137	0.0999
158.18	0.00	3.61	0.729	0.00	-584.52	0.00	-639.50	0.00	-2.36	0.00	-84.74	2437	1.17	0.00	-0.0138	0.143	0.0999
173.64	0.00	4.27	0.858	0.00	-505.20	0.00	-605.40	0.00	-2.84	0.00	-83.38	3087	1.30	0.00	-0.0147	0.148	0.0999
189.09	0.00	4.98	0.986	0.00	-430.02	0.00	-576.02	0.00	-3.38	0.00	-82.31	3808	1.43	0.00	-0.0158	0.0747	0.0999
204.55	0.00	5.74	1.12	0.00	-360.75	0.00	-550.77	0.00	-3.99	0.00	-81.51	4571	1.57	0.00	-0.0172	0.0625	0.0999
220.00	0.171	6.44	1.25	0.00	-302.34	0.00	-535.84	0.00	-4.75	0.00	-81.93	5296	1.72	0.00	-0.0194	0.0852	0.117
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-12346-00  
Chevron 18-5D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 18-5D K-17 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99511

### CATIONS

Calcium (as Ca)	10.51
Magnesium (as Mg)	5.51
Barium (as Ba)	0.204
Strontium (as Sr)	0.754
Sodium (as Na)	579.10
Potassium (as K)	12.97
Lithium (as Li)	0.618
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	147.20
Manganese (as Mn)	0.217
Zinc (as Zn)	1.79
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	900.00
Sulfate (as SO <sub>4</sub> )	25.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	375.00
Bicarbonate (as HCO <sub>3</sub> )	366.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	2086
Molar Conductivity	3024
Resistivity	330.72
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0432
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

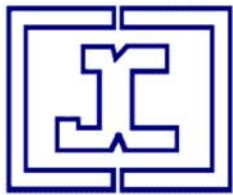


## DEPOSITION POTENTIAL INDICATORS

Sample ID: 99511

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-5D K-17 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99511  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	10.51
Magnesium(as Mg)	5.51
Barium(as Ba)	0.204
Strontium(as Sr)	0.754
Sodium(as Na)	579.10
Potassium(as K)	12.97
Lithium(as Li)	0.618
Iron(as Fe)	147.20
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.217
Zinc(as Zn)	1.79
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	900.00
Sulfate(as SO <sub>4</sub> )	25.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	375.00
Bicarbonate(as HCO <sub>3</sub> )	366.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

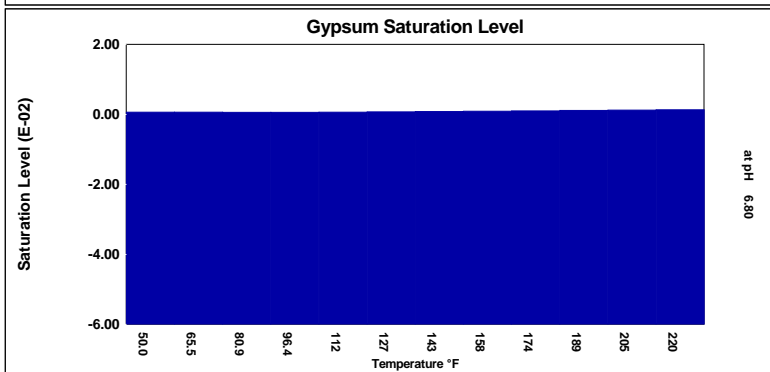
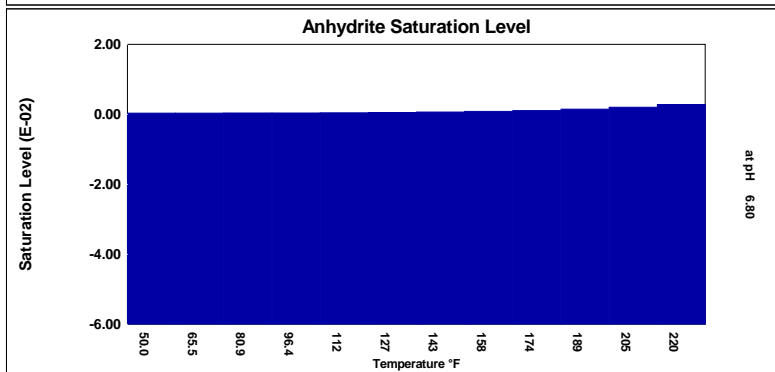
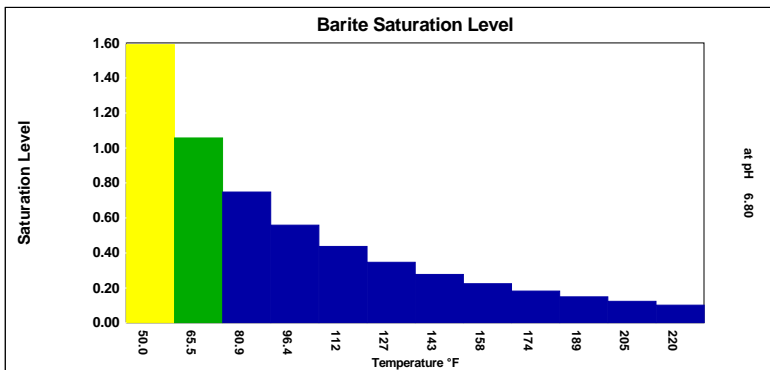
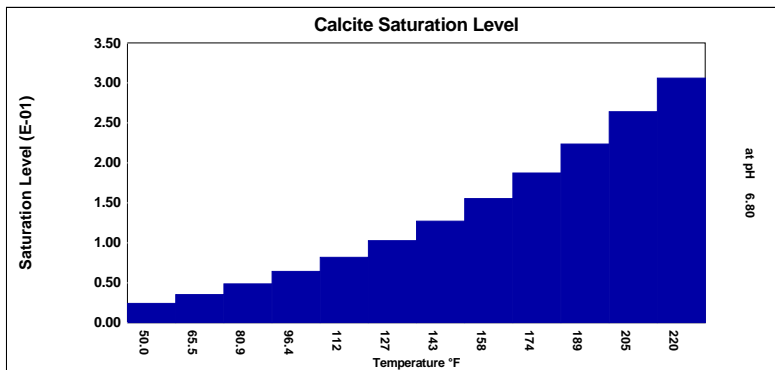
Temperature(°F)	190.00
T.D.S.	2086
Resistivity:	330.72

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.0244	-2.21	< 0.001	-607.56	< 0.001	-509.78	1.59	0.0446	0.00225	-52.49	495.34	0.0803	0.00	>-0.001	0.0644	0.0432
65.45	0.00	0.0353	-1.93	< 0.001	-609.20	< 0.001	-520.04	1.06	0.00643	0.00215	-53.71	806.26	0.101	0.00	>-0.001	0.121	0.0432
80.91	0.00	0.0486	-1.70	< 0.001	-593.41	< 0.001	-524.80	0.747	-0.0405	0.00219	-53.10	1242	0.121	0.00	-0.00100	0.0860	0.0432
96.36	0.00	0.0643	-1.50	< 0.001	-563.37	< 0.001	-524.58	0.559	-0.0943	0.00230	-51.53	1820	0.142	0.00	-0.00102	0.113	0.0432
111.82	0.00	0.0820	-1.33	< 0.001	-522.77	< 0.001	-501.07	0.436	-0.154	0.00245	-49.60	2554	0.161	0.00	-0.00105	0.118	0.0432
127.27	0.00	0.103	-1.18	< 0.001	-475.30	< 0.001	-465.09	0.346	-0.224	0.00260	-47.84	3499	0.181	0.00	-0.00108	0.0990	0.0432
142.73	0.00	0.127	-1.05	< 0.001	-424.31	< 0.001	-433.82	0.276	-0.309	0.00275	-46.29	4696	0.203	0.00	-0.00111	0.0803	0.0432
158.18	0.00	0.155	-0.937	< 0.001	-372.61	< 0.001	-406.51	0.223	-0.409	0.00288	-44.92	6168	0.226	0.00	-0.00116	0.0836	0.0432
173.64	0.00	0.187	-0.834	0.00107	-322.35	< 0.001	-382.54	0.182	-0.525	0.00302	-43.70	7923	0.250	0.00	-0.00121	0.0865	0.0432
189.09	0.00	0.224	-0.742	0.00145	-275.11	0.00109	-361.41	0.149	-0.661	0.00314	-42.63	9938	0.276	0.00	-0.00128	0.0436	0.0432
204.55	0.00	0.264	-0.659	0.00199	-231.85	0.00119	-342.72	0.123	-0.816	0.00327	-41.67	12149	0.304	0.00	-0.00138	0.0365	0.0432
220.00	0.171	0.306	-0.592	0.00277	-194.50	0.00129	-328.43	0.101	-1.01	0.00334	-41.13	14374	0.334	0.00	-0.00152	0.0498	0.0505
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





## WATER CHEMISTRY

Report Date:	08-24-2015	Sampled:	04-02-2015
Sample #:	3076		at 0000
Sample ID:	99510		

Chloride (as Cl)	800.00
Sulfate (as SO <sub>4</sub> )	50.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	550.00
Bicarbonate (as HCO <sub>3</sub> )	1244
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

Calculated T.D.S.	3246
Molar Conductivity	3734
Resistivity	267.83
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.145
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

## GARFIELD CO

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096





## DEPOSITION POTENTIAL INDICATORS

Report Date:	08-24-2015	Sampled:	04-02-2015
Sample #:	3076		at 0000
Sample ID:	99510		

Calcite (CaCO <sub>3</sub> )	0.325	Calcite (CaCO <sub>3</sub> )	-1.19
Aragonite (CaCO <sub>3</sub> )	0.265	Aragonite (CaCO <sub>3</sub> )	-1.51
Witherite (BaCO <sub>3</sub> )	0.00334	Witherite (BaCO <sub>3</sub> )	-6.38
Strontianite (SrCO <sub>3</sub> )	0.136	Strontianite (SrCO <sub>3</sub> )	-1.26
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00	Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-2.37
Magnesite (MgCO <sub>3</sub> )	0.789	Magnesite (MgCO <sub>3</sub> )	-0.174
Anhydrite (CaSO <sub>4</sub> )	0.00116	Anhydrite (CaSO <sub>4</sub> )	-297.28
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	< 0.001	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-393.42
Barite (BaSO <sub>4</sub> )	0.243	Barite (BaSO <sub>4</sub> )	-0.372
Celestite (SrSO <sub>4</sub> )	0.00552	Celestite (SrSO <sub>4</sub> )	-41.67
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-28.41
Calcium phosphate	0.00	Calcium phosphate	-0.00459
Hydroxyapatite	0.00	Hydroxyapatite	-308.13
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-153.90
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	0.0499
Magnesium silicate	0.00	Magnesium silicate	-132.61
Iron hydroxide (Fe(OH) <sub>3</sub> )	30409	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	> -0.001
Siderite (FeCO <sub>3</sub> )	40544	Siderite (FeCO <sub>3</sub> )	1.00
Halite (NaCl)	< 0.001	Halite (NaCl)	-178538
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-39373
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.00118

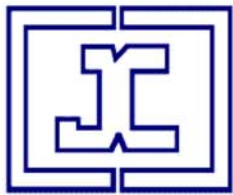
Langelier	-0.386
Ryznar	7.57
Puckorius	5.42
Larson-Skold Index	1.15
Stiff Davis Index	0.274
Oddo-Tomson	-0.0525

Calcium	5.71	4.59
Barium	0.204	0.204
Carbonate	7.88	1.49
Phosphate	0.00	0.00
Sulfate	50.00	41.47

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 18-2D K-17 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99510  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	5.71
Magnesium(as Mg)	7.37
Barium(as Ba)	0.204
Strontium(as Sr)	0.800
Sodium(as Na)	818.76
Potassium(as K)	13.53
Lithium(as Li)	0.658
Iron(as Fe)	195.00
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.339
Manganese(as Mn)	1.42
Zinc(as Zn)	0.904
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	800.00
Sulfate(as SO <sub>4</sub> )	50.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	550.00
Bicarbonate(as HCO <sub>3</sub> )	1244
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

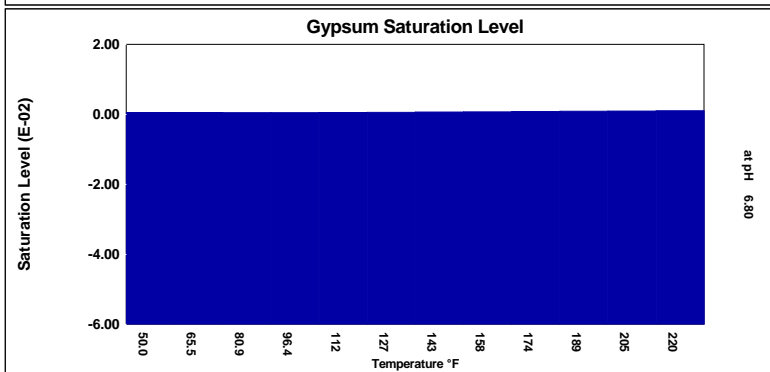
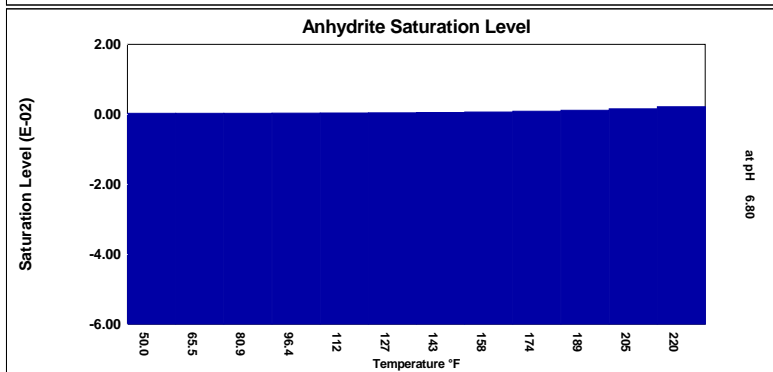
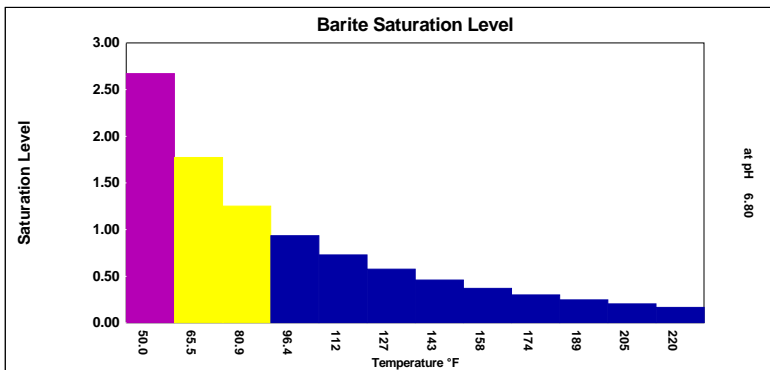
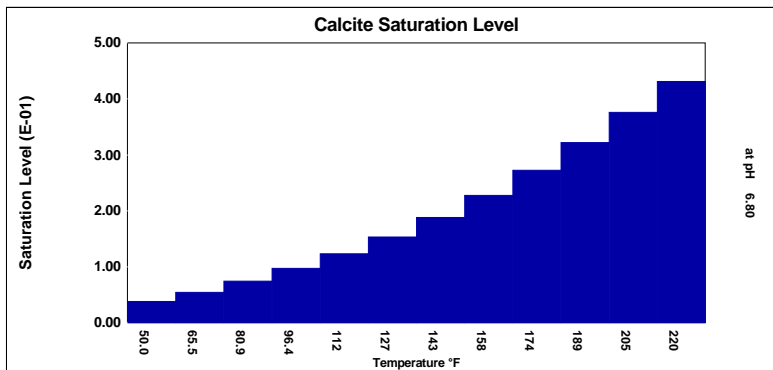
Temperature(°F)	190.00
T.D.S.	3246
Resistivity:	267.83

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.0382	-3.44	< 0.001	-656.32	< 0.001	-550.58	2.67	0.0755	0.00402	-51.50	2010	0.289	0.00	>-0.001	0.102	0.145
65.45	0.00	0.0545	-3.07	< 0.001	-658.72	< 0.001	-562.23	1.77	0.0525	0.00384	-52.87	3268	0.361	0.00	>-0.001	0.191	0.145
80.91	0.00	0.0743	-2.73	< 0.001	-642.34	< 0.001	-568.03	1.25	0.0242	0.00389	-52.31	5033	0.437	0.00	>-0.001	0.187	0.145
96.36	0.00	0.0973	-2.44	< 0.001	-610.46	< 0.001	-568.44	0.933	-0.00864	0.00408	-50.72	7367	0.510	0.00	>-0.001	0.244	0.145
111.82	0.00	0.123	-2.18	< 0.001	-567.08	< 0.001	-543.59	0.727	-0.0451	0.00434	-48.74	10327	0.579	0.00	>-0.001	0.256	0.145
127.27	0.00	0.153	-1.95	< 0.001	-516.14	< 0.001	-505.11	0.575	-0.0888	0.00460	-46.95	14133	0.652	0.00	>-0.001	0.215	0.145
142.73	0.00	0.188	-1.73	< 0.001	-461.31	< 0.001	-471.74	0.459	-0.142	0.00484	-45.39	18947	0.731	0.00	-0.00102	0.174	0.145
158.18	0.00	0.228	-1.54	< 0.001	-405.58	< 0.001	-442.62	0.369	-0.204	0.00507	-44.01	24868	0.815	0.00	-0.00106	0.181	0.145
173.64	0.00	0.272	-1.36	< 0.001	-351.30	< 0.001	-417.11	0.300	-0.279	0.00529	-42.80	31926	0.904	0.00	-0.00111	0.188	0.145
189.09	0.00	0.322	-1.20	0.00114	-300.17	< 0.001	-394.67	0.245	-0.366	0.00550	-41.73	40037	0.999	0.00	-0.00118	0.0947	0.145
204.55	0.00	0.376	-1.05	0.00155	-253.27	< 0.001	-374.82	0.202	-0.468	0.00570	-40.78	48936	1.10	0.00	-0.00126	0.0793	0.145
220.00	0.171	0.431	-0.917	0.00213	-212.89	< 0.001	-360.06	0.166	-0.595	0.00581	-40.32	57947	1.21	0.00	-0.00140	0.108	0.169
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**BERRY PETROLEUM  
ROB SIMEONEK-17 CHEVRON 18-1D  
SEPARATOR

Report Date: 05-15-2013    Sampled: 04-15-2013  
Sample #: 2580                      at 0000  
  
Sample ID: 37516

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	0.0906
Aragonite (CaCO <sub>3</sub> )	0.0737
Witherite (BaCO <sub>3</sub> )	< 0.001
Strontianite (SrCO <sub>3</sub> )	0.192
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	0.682
Anhydrite (CaSO <sub>4</sub> )	0.00
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Barite (BaSO <sub>4</sub> )	0.00
Celestite (SrSO <sub>4</sub> )	0.00
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	4464
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	3573
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	0.00
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	-0.984
Aragonite (CaCO <sub>3</sub> )	-1.20
Witherite (BaCO <sub>3</sub> )	-6.12
Strontianite (SrCO <sub>3</sub> )	-0.594
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-1.41
Magnesite (MgCO <sub>3</sub> )	-0.0449
Anhydrite (CaSO <sub>4</sub> )	-374.96
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-491.99
Barite (BaSO <sub>4</sub> )	-3.56
Celestite (SrSO <sub>4</sub> )	-44.56
Fluorite (CaF <sub>2</sub> )	-25.77
Calcium phosphate	-0.00134
Hydroxyapatite	-276.83
Silica (SiO <sub>2</sub> )	-154.31
Brucite (Mg(OH) <sub>2</sub> )	0.0240
Magnesium silicate	-125.77
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	> -0.001
Siderite (FeCO <sub>3</sub> )	0.133
Halite (NaCl)	-172050
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-36682
Iron sulfide (FeS)	-0.00342

**SIMPLE INDICES**

Langelier	-1.01
Ryznar	8.52
Puckorius	6.86
Larson-Skold Index	3.31
Stiff Davis Index	-0.407
Oddo-Tomson	-0.651

**BOUND IONS**

Calcium	7.82
Barium	0.204
Carbonate	0.834
Phosphate	0.00
Sulfate	0.00

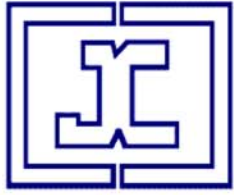
**TOTAL****FREE****OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
K-17 CHEVRON 18-1D  
ROB SIMEONE  
SEPARATOR

Sample ID#: 2580  
ID: 37516  
Report Date: 05-15-2013  
Sample Date: 04-15-2013  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	7.82
Magnesium(as Mg)	31.63
Barium(as Ba)	0.204
Strontium(as Sr)	6.42
Sodium(as Na)	388.29
Potassium(as K)	63.26
Lithium(as Li)	4.70
Iron(as Fe)	94.31
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.573
Manganese(as Mn)	0.901
Zinc(as Zn)	0.892
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	700.00
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	150.00
Bicarbonate(as HCO <sub>3</sub> )	366.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as Si)	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	12.77

### PARAMETERS

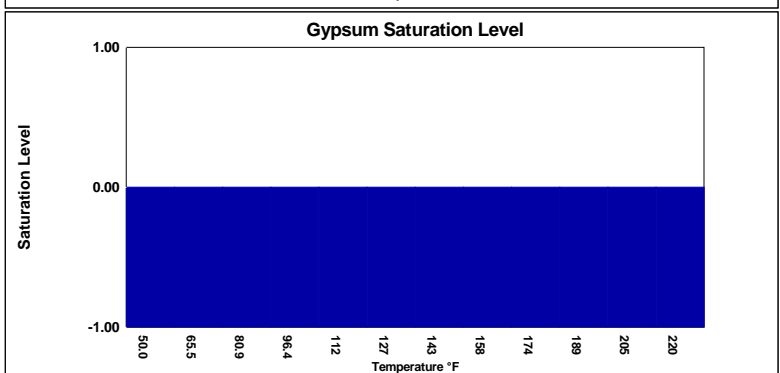
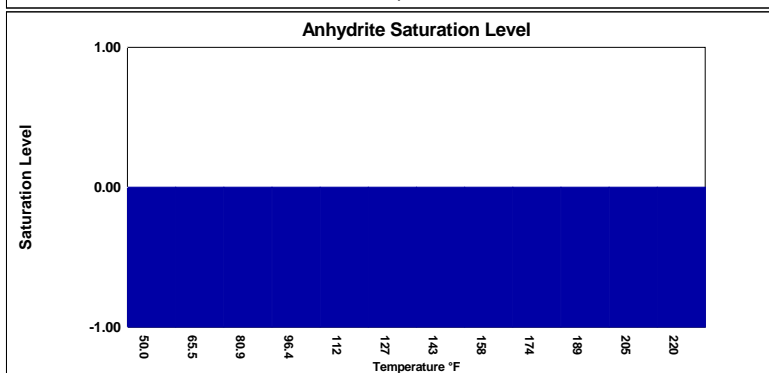
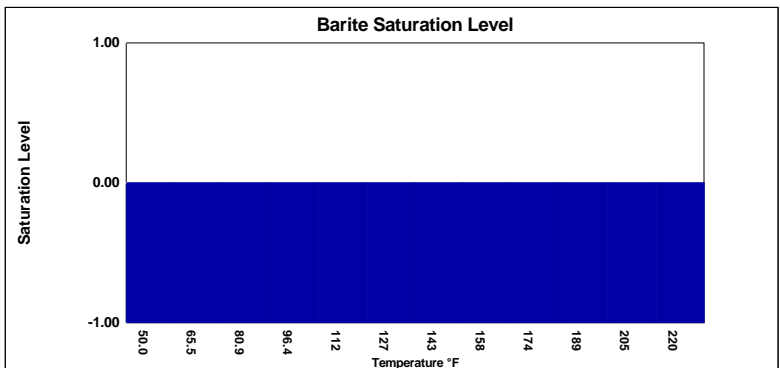
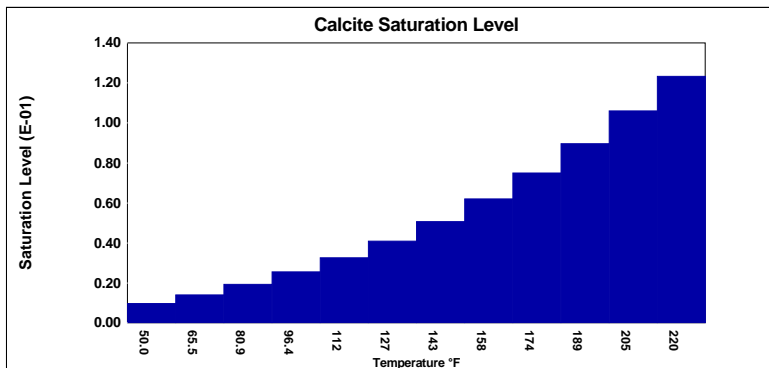
Temperature(°F)	190.00
T.D.S.	1788
Resistivity:	406.14
Sample pH	6.50
Conductivity:	2462

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.00964	-2.48	0.00	-586.51	0.00	-493.91	0.00	-1.07	0.00	-54.60	168.48	0.0384	0.00	-0.00268	0.0771	0.0692
65.45	0.00	0.0139	-2.20	0.00	-587.71	0.00	-503.38	0.00	-1.32	0.00	-55.70	274.46	0.0482	0.00	-0.00273	0.144	0.0692
80.91	0.00	0.0193	-1.96	0.00	-572.27	0.00	-507.58	0.00	-1.58	0.00	-55.05	423.32	0.0582	0.00	-0.00278	0.116	0.0692
96.36	0.00	0.0255	-1.76	0.00	-543.25	0.00	-507.01	0.00	-1.83	0.00	-53.48	621.15	0.0679	0.00	-0.00283	0.152	0.0692
111.82	0.00	0.0325	-1.58	0.00	-506.27	0.00	-502.98	0.00	-2.07	0.00	-51.56	873.44	0.0770	0.00	-0.00290	0.160	0.0692
127.27	0.00	0.0409	-1.43	0.00	-472.96	0.00	-499.33	0.00	-2.33	0.00	-49.82	1200	0.0866	0.00	-0.00297	0.134	0.0692
142.73	0.00	0.0506	-1.29	0.00	-443.90	0.00	-496.49	0.00	-2.60	0.00	-48.28	1617	0.0970	0.00	-0.00305	0.109	0.0692
158.18	0.00	0.0620	-1.18	0.00	-418.45	0.00	-494.42	0.00	-2.89	0.00	-46.92	2138	0.108	0.00	-0.00315	0.113	0.0692
173.64	0.00	0.0749	-1.08	0.00	-396.08	0.00	-493.07	0.00	-3.20	0.00	-45.71	2771	0.120	0.00	-0.00327	0.117	0.0692
189.09	0.00	0.0896	-0.990	0.00	-376.38	0.00	-492.45	0.00	-3.54	0.00	-44.66	3522	0.132	0.00	-0.00342	0.0590	0.0692
204.55	0.00	0.106	-0.912	0.00	-358.99	0.00	-492.52	0.00	-3.89	0.00	-43.73	4384	0.146	0.00	-0.00360	0.0494	0.0692
220.00	0.171	0.123	-0.852	0.00	-345.84	0.00	-496.45	0.00	-4.30	0.00	-43.22	5314	0.160	0.00	-0.00388	0.0674	0.0811
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-12349-00  
Chevron 5-3D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 5-3D L-4 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99509

#### CATIONS

Calcium (as Ca)	204.10
Magnesium (as Mg)	23.86
Barium (as Ba)	24.09
Strontium (as Sr)	18.43
Sodium (as Na)	5256
Potassium (as K)	66.11
Lithium (as Li)	2.62
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	90.42
Manganese (as Mn)	0.301
Zinc (as Zn)	0.303
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	8200
Sulfate (as SO <sub>4</sub> )	175.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	325.00
Bicarbonate (as HCO <sub>3</sub> )	854.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	14979
Molar Conductivity	20421
Resistivity	48.97
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.149
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Report Date:	08-24-2015	Sampled:	04-02-2015
Sample #:	3076		at 0000
Sample ID:	99509		

Calcite ( $\text{CaCO}_3$ )	2.13	Calcite ( $\text{CaCO}_3$ )	0.220
Aragonite ( $\text{CaCO}_3$ )	1.73	Aragonite ( $\text{CaCO}_3$ )	0.176
Witherite ( $\text{BaCO}_3$ )	0.0589	Witherite ( $\text{BaCO}_3$ )	-7.69
Strontianite ( $\text{SrCO}_3$ )	0.477	Strontianite ( $\text{SrCO}_3$ )	-0.605
Calcium oxalate ( $\text{CaC}_2\text{O}_4$ )	0.00	Calcium oxalate ( $\text{CaC}_2\text{O}_4$ )	-0.255
Magnesite ( $\text{MgCO}_3$ )	0.475	Magnesite ( $\text{MgCO}_3$ )	-0.377
Anhydrite ( $\text{CaSO}_4$ )	0.0477	Anhydrite ( $\text{CaSO}_4$ )	-411.49
Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )	0.0348	Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )	-570.53
Barite ( $\text{BaSO}_4$ )	26.97	Barite ( $\text{BaSO}_4$ )	13.66
Celestite ( $\text{SrSO}_4$ )	0.122	Celestite ( $\text{SrSO}_4$ )	-54.76
Fluorite ( $\text{CaF}_2$ )	0.00	Fluorite ( $\text{CaF}_2$ )	-20.61
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-472.63
Silica ( $\text{SiO}_2$ )	0.00	Silica ( $\text{SiO}_2$ )	-151.22
Brucite ( $\text{Mg}(\text{OH})_2$ )	< 0.001	Brucite ( $\text{Mg}(\text{OH})_2$ )	0.0299
Magnesium silicate	0.00	Magnesium silicate	-164.15
Iron hydroxide ( $\text{Fe}(\text{OH})_3$ )	1971	Iron hydroxide ( $\text{Fe}(\text{OH})_3$ )	< 0.001
Strengite ( $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$ )	0.00	Strengite ( $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$ )	>-0.001
Siderite ( $\text{FeCO}_3$ )	3201	Siderite ( $\text{FeCO}_3$ )	0.482
Halite ( $\text{NaCl}$ )	< 0.001	Halite ( $\text{NaCl}$ )	-205113
Thenardite ( $\text{Na}_2\text{SO}_4$ )	< 0.001	Thenardite ( $\text{Na}_2\text{SO}_4$ )	-54788
Iron sulfide ( $\text{FeS}$ )	0.00	Iron sulfide ( $\text{FeS}$ )	-0.0166

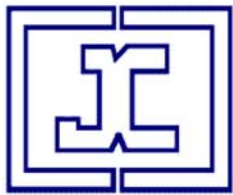
Langelier	0.417
Ryznar	5.67
Puckorius	3.46
Larson-Skold Index	16.68
Stiff Davis Index	1.18
Oddo-Tomson	0.522

Calcium	204.10	185.62
Barium	24.09	24.09
Carbonate	14.90	0.717
Phosphate	0.00	0.00
Sulfate	175.00	132.18

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 5-3D L-4 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99509  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	204.10
Magnesium(as Mg)	23.86
Barium(as Ba)	24.09
Strontium(as Sr)	18.43
Sodium(as Na)	5256
Potassium(as K)	66.11
Lithium(as Li)	2.62
Iron(as Fe)	90.42
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.301
Zinc(as Zn)	0.303
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	8200
Sulfate(as SO <sub>4</sub> )	175.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	325.00
Bicarbonate(as HCO <sub>3</sub> )	854.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

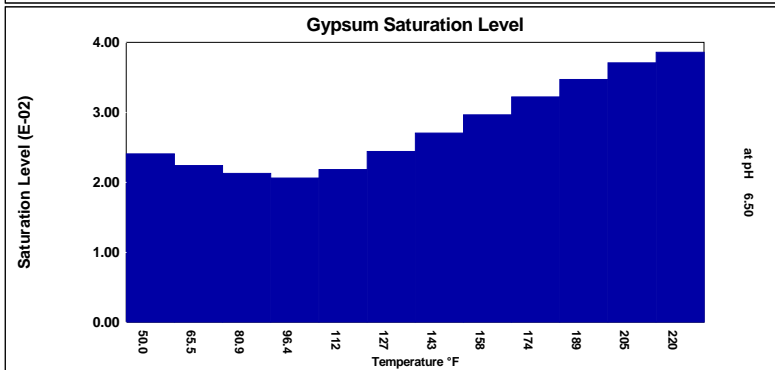
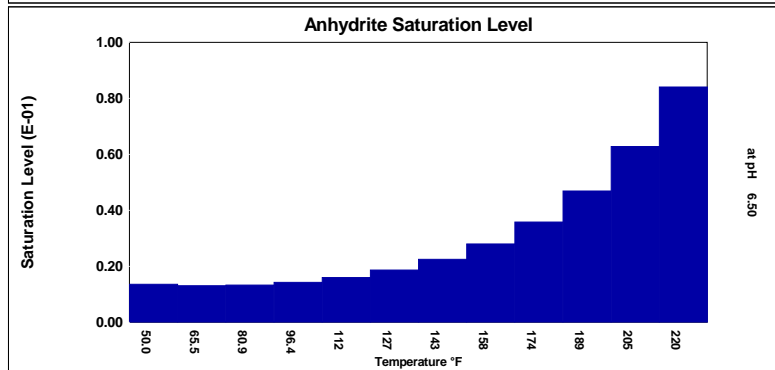
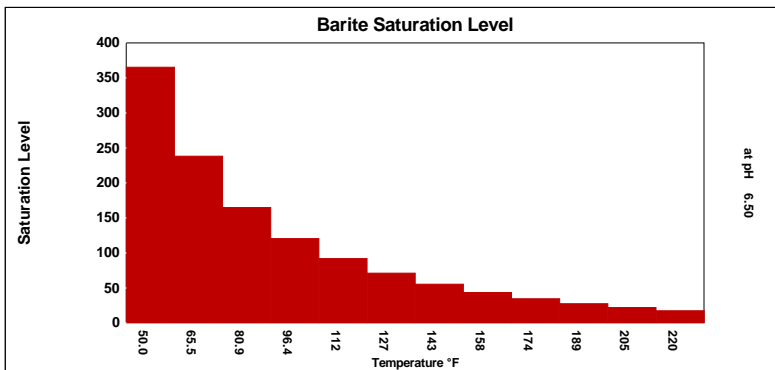
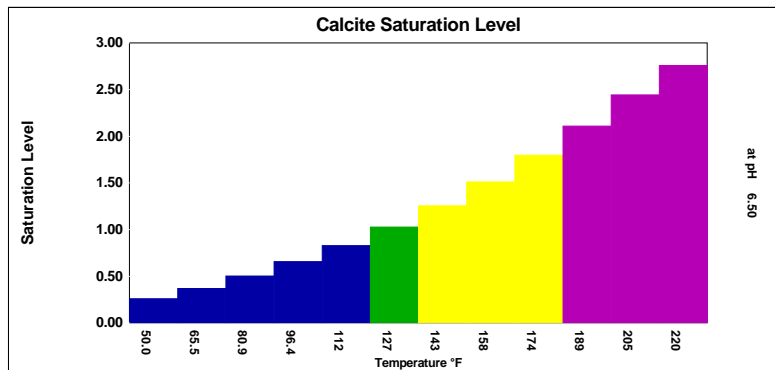
Temperature(°F)	190.00
T.D.S.	14979
Resistivity:	48.97
Sample pH	6.50
Conductivity:	20421

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.258	-0.334	0.0136	-956.22	0.0241	-772.90	365.23	14.22	0.109	-62.14	165.91	0.134	0.00	-0.0111	0.103	0.149
65.45	0.00	0.368	-0.250	0.0131	-967.47	0.0224	-798.76	237.95	14.20	0.102	-65.26	267.76	0.168	0.00	-0.0114	0.193	0.149
80.91	0.00	0.502	-0.175	0.0133	-947.91	0.0213	-815.35	164.69	14.17	0.102	-65.26	409.10	0.204	0.00	-0.0118	0.190	0.149
96.36	0.00	0.656	-0.108	0.0143	-902.60	0.0206	-823.42	120.34	14.13	0.104	-63.60	594.61	0.239	0.00	-0.0123	0.249	0.149
111.82	0.00	0.828	-0.0489	0.0160	-837.68	0.0218	-789.12	91.79	14.09	0.109	-61.30	828.13	0.272	0.00	-0.0127	0.261	0.149
127.27	0.00	1.03	0.00680	0.0186	-759.46	0.0244	-731.52	70.92	14.04	0.112	-59.33	1127	0.308	0.00	-0.0133	0.219	0.149
142.73	0.00	1.25	0.0605	0.0225	-673.75	0.0270	-682.15	55.27	13.97	0.116	-57.72	1502	0.347	0.00	-0.0139	0.177	0.149
158.18	0.00	1.51	0.113	0.0280	-585.51	0.0296	-639.79	43.40	13.89	0.118	-56.45	1963	0.388	0.00	-0.0147	0.185	0.149
173.64	0.00	1.80	0.165	0.0358	-498.68	0.0322	-603.42	34.33	13.79	0.120	-55.48	2517	0.432	0.00	-0.0155	0.191	0.149
189.09	0.00	2.11	0.217	0.0469	-416.16	0.0347	-572.22	27.33	13.67	0.122	-54.79	3160	0.479	0.00	-0.0165	0.0964	0.149
204.55	0.00	2.44	0.269	0.0628	-339.95	0.0371	-545.58	21.88	13.52	0.122	-54.38	3891	0.529	0.00	-0.0177	0.0808	0.149
220.00	0.171	2.76	0.322	0.0840	-275.69	0.0386	-530.72	17.26	13.33	0.120	-55.19	4650	0.585	0.00	-0.0195	0.110	0.174
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.







JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-12343-00  
Chevron 5-2D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 5-2D L-4 PAD  
WELLHEAD

Report Date: 08-24-2015 Sampled: 04-02-2015  
Sample #: 3076 at 0000  
Sample ID: 99507

### CATIONS

Calcium (as Ca)	276.70
Magnesium (as Mg)	33.00
Barium (as Ba)	34.08
Strontium (as Sr)	22.77
Sodium (as Na)	5151
Potassium (as K)	61.45
Lithium (as Li)	2.49
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	1.87
Iron (as Fe)	93.42
Manganese (as Mn)	0.828
Zinc (as Zn)	0.920
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	8000
Sulfate (as SO <sub>4</sub> )	275.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	400.00
Bicarbonate (as HCO <sub>3</sub> )	1098
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.644

### PARAMETERS

Calculated T.D.S.	15144
Molar Conductivity	20099
Resistivity	49.75
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.191
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Report Date:	08-24-2015	Sampled:	04-02-2015
Sample #:	3076		at 0000
Sample ID:	99507		

Calcite (CaCO <sub>3</sub> )	3.53	Calcite (CaCO <sub>3</sub> )	0.379
Aragonite (CaCO <sub>3</sub> )	2.87	Aragonite (CaCO <sub>3</sub> )	0.344
Witherite (BaCO <sub>3</sub> )	0.105	Witherite (BaCO <sub>3</sub> )	-6.23
Strontianite (SrCO <sub>3</sub> )	0.743	Strontianite (SrCO <sub>3</sub> )	-0.250
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00	Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.195
Magnesite (MgCO <sub>3</sub> )	0.793	Magnesite (MgCO <sub>3</sub> )	-0.114
Anhydrite (CaSO <sub>4</sub> )	0.0952	Anhydrite (CaSO <sub>4</sub> )	-364.26
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0696	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-516.97
Barite (BaSO <sub>4</sub> )	57.88	Barite (BaSO <sub>4</sub> )	19.79
Celestite (SrSO <sub>4</sub> )	0.228	Celestite (SrSO <sub>4</sub> )	-39.70
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-18.46
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-474.21
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-151.53
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	0.0300
Magnesium silicate	0.00	Magnesium silicate	-164.56
Iron hydroxide (Fe(OH) <sub>3</sub> )	2012	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	4136	Siderite (FeCO <sub>3</sub> )	0.612
Halite (NaCl)	< 0.001	Halite (NaCl)	-205728
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-54904
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.0163

Langelier	0.653
Ryznar	5.19
Puckorius	2.83
Larson-Skold Index	12.85
Stiff Davis Index	1.42
Oddo-Tomson	0.757

Calcium	276.70	244.28
Barium	34.08	34.08
Carbonate	19.14	0.910
Phosphate	0.00	0.00
Sulfate	275.00	202.13

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 5-2D L-4 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99507  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	276.70
Magnesium(as Mg)	33.00
Barium(as Ba)	34.08
Strontium(as Sr)	22.77
Sodium(as Na)	5151
Potassium(as K)	61.45
Lithium(as Li)	2.49
Iron(as Fe)	93.42
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	1.87
Manganese(as Mn)	0.828
Zinc(as Zn)	0.920
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	8000
Sulfate(as SO <sub>4</sub> )	275.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	400.00
Bicarbonate(as HCO <sub>3</sub> )	1098
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.644

### PARAMETERS

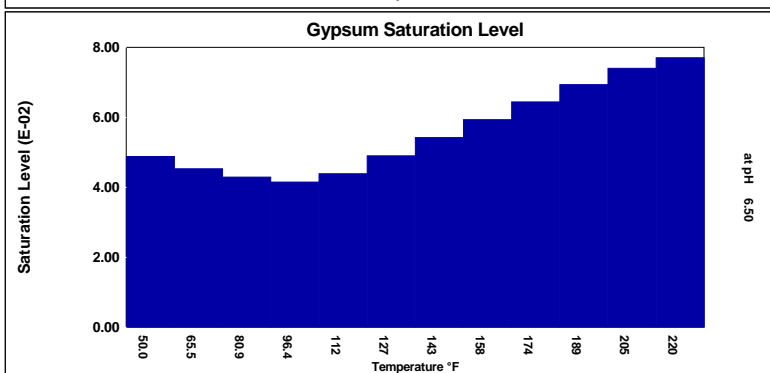
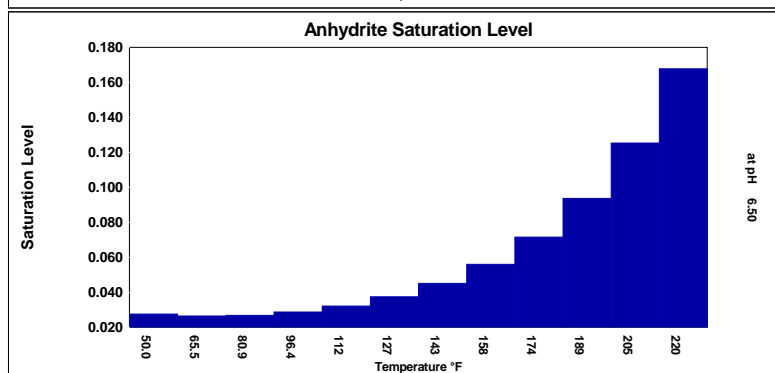
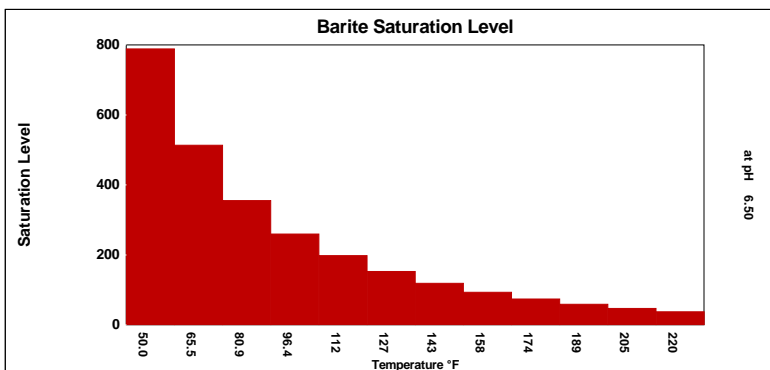
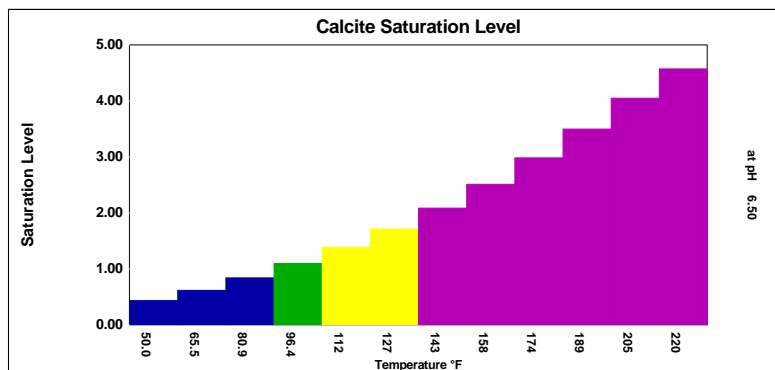
Temperature(°F)	190.00
T.D.S.	15144
Resistivity:	49.75
Sample pH	6.50
Conductivity:	20099

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.433	-0.194	0.0275	-905.24	0.0488	-714.34	788.46	20.15	0.205	-45.56	214.64	0.171	0.00	-0.0109	0.113	0.191
65.45	0.00	0.617	-0.115	0.0264	-917.31	0.0453	-741.15	513.35	20.14	0.192	-48.55	346.20	0.214	0.00	-0.0113	0.212	0.191
80.91	0.00	0.839	-0.0429	0.0268	-898.39	0.0429	-758.57	355.03	20.12	0.191	-48.68	528.74	0.259	0.00	-0.0117	0.223	0.191
96.36	0.00	1.10	0.0229	0.0287	-853.54	0.0415	-767.32	259.20	20.09	0.196	-47.27	768.34	0.304	0.00	-0.0121	0.292	0.191
111.82	0.00	1.38	0.0824	0.0321	-788.96	0.0439	-733.52	197.55	20.07	0.204	-45.26	1070	0.346	0.00	-0.0126	0.306	0.191
127.27	0.00	1.71	0.140	0.0374	-711.02	0.0490	-676.36	152.52	20.03	0.211	-43.55	1456	0.392	0.00	-0.0131	0.256	0.191
142.73	0.00	2.08	0.198	0.0451	-625.57	0.0542	-627.42	118.78	19.99	0.217	-42.17	1940	0.441	0.00	-0.0137	0.208	0.191
158.18	0.00	2.51	0.256	0.0560	-537.60	0.0593	-585.47	93.23	19.94	0.222	-41.09	2537	0.493	0.00	-0.0144	0.216	0.191
173.64	0.00	2.98	0.315	0.0715	-451.06	0.0644	-549.47	73.72	19.87	0.226	-40.28	3250	0.549	0.00	-0.0153	0.224	0.191
189.09	0.00	3.50	0.375	0.0936	-368.91	0.0693	-518.64	58.65	19.79	0.228	-39.72	4083	0.609	0.00	-0.0162	0.113	0.191
204.55	0.00	4.05	0.436	0.125	-293.11	0.0740	-492.32	46.93	19.69	0.229	-39.41	5028	0.671	0.00	-0.0174	0.0946	0.191
220.00	0.171	4.57	0.501	0.168	-229.15	0.0770	-477.55	37.03	19.56	0.225	-40.18	6010	0.743	0.00	-0.0192	0.129	0.223
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-12352-00  
Chevron 5-4D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 5-4D L-4 PAD  
WELLHEAD

Report Date: 08-24-2015 Sampled: 04-02-2015  
Sample #: 3076 at 0000  
Sample ID: 99508

### CATIONS

Calcium (as Ca)	585.60
Magnesium (as Mg)	53.72
Barium (as Ba)	13.01
Strontium (as Sr)	33.27
Sodium (as Na)	5183
Potassium (as K)	85.43
Lithium (as Li)	2.98
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	134.60
Manganese (as Mn)	1.89
Zinc (as Zn)	0.781
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	8800
Sulfate (as SO <sub>4</sub> )	75.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	550.00
Bicarbonate (as HCO <sub>3</sub> )	1220
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	1.91

### PARAMETERS

Calculated T.D.S.	16243
Molar Conductivity	21350
Resistivity	46.84
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.129
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

Report Date:	08-24-2015	Sampled:	04-02-2015
Sample #:	3076		at 0000
Sample ID:	99508		

Calcite (CaCO <sub>3</sub> )	15.49	Calcite (CaCO <sub>3</sub> )	1.07
Aragonite (CaCO <sub>3</sub> )	12.61	Aragonite (CaCO <sub>3</sub> )	1.06
Witherite (BaCO <sub>3</sub> )	0.0807	Witherite (BaCO <sub>3</sub> )	-9.28
Strontianite (SrCO <sub>3</sub> )	2.19	Strontianite (SrCO <sub>3</sub> )	0.882
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00	Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.0963
Magnesite (MgCO <sub>3</sub> )	2.81	Magnesite (MgCO <sub>3</sub> )	0.619
Anhydrite (CaSO <sub>4</sub> )	0.0469	Anhydrite (CaSO <sub>4</sub> )	-319.56
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0343	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-460.70
Barite (BaSO <sub>4</sub> )	4.99	Barite (BaSO <sub>4</sub> )	5.91
Celestite (SrSO <sub>4</sub> )	0.0755	Celestite (SrSO <sub>4</sub> )	-74.47
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-13.34
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-486.01
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-151.03
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	0.0605
Magnesium silicate	0.00	Magnesium silicate	-166.38
Iron hydroxide (Fe(OH) <sub>3</sub> )	10897	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	11985	Siderite (FeCO <sub>3</sub> )	1.33
Halite (NaCl)	< 0.001	Halite (NaCl)	-207148
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-56025
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.00617

Langelier	1.31
Ryznar	4.18
Puckorius	2.03
Larson-Skold Index	12.18
Stiff Davis Index	2.07
Oddo-Tomson	1.39

Calcium	585.60	527.17
Barium	13.01	13.01
Carbonate	46.89	1.97
Phosphate	0.00	0.00
Sulfate	75.00	49.43

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 5-4D L-4 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99508  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	585.60
Magnesium(as Mg)	53.72
Barium(as Ba)	13.01
Strontium(as Sr)	33.27
Sodium(as Na)	5183
Potassium(as K)	85.43
Lithium(as Li)	2.98
Iron(as Fe)	134.60
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	1.89
Zinc(as Zn)	0.781
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	8800
Sulfate(as SO <sub>4</sub> )	75.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	550.00
Bicarbonate(as HCO <sub>3</sub> )	1220
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	1.91

### PARAMETERS

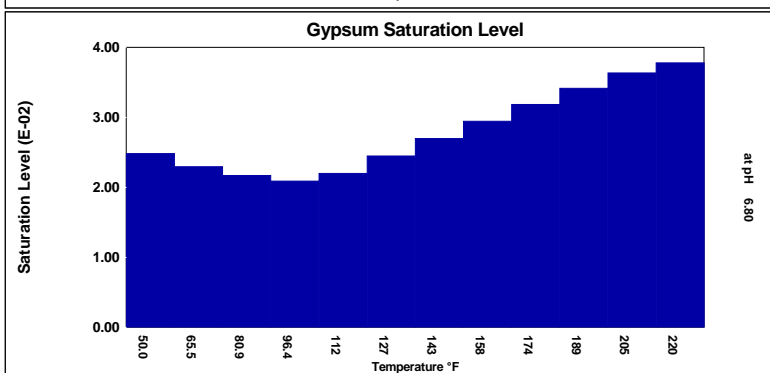
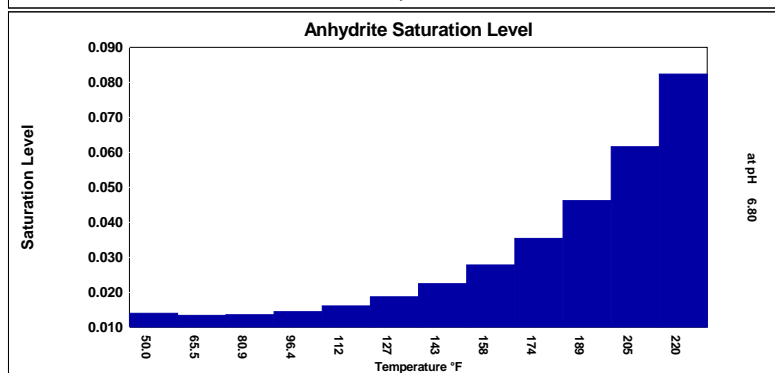
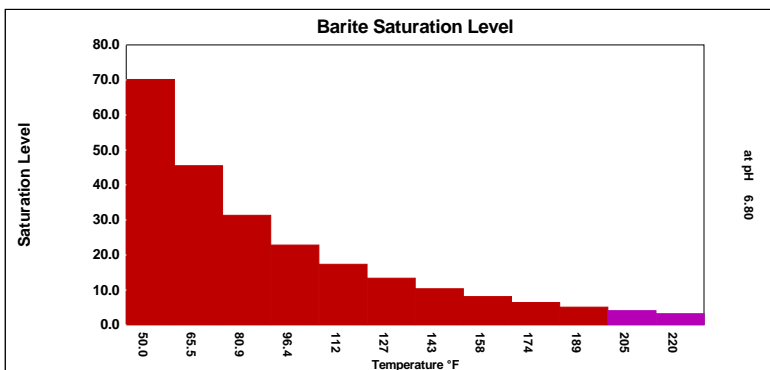
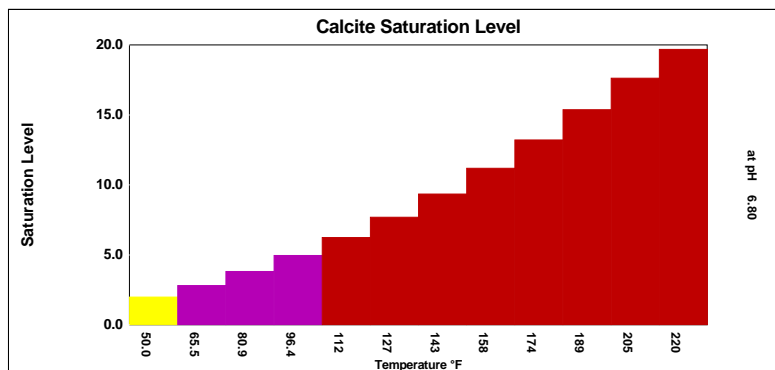
Temperature(°F)	190.00
T.D.S.	16243
Resistivity:	46.84
Sample pH	6.80
Conductivity:	21350

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	1.98	0.164	0.0140	-843.08	0.0248	-648.36	70.08	7.57	0.0700	-83.62	664.29	0.382	0.00	-0.00399	0.0977	0.129
65.45	0.00	2.81	0.266	0.0134	-855.90	0.0229	-675.16	45.44	7.50	0.0653	-86.95	1067	0.478	0.00	-0.00412	0.183	0.129
80.91	0.00	3.81	0.367	0.0136	-837.60	0.0217	-692.69	31.31	7.41	0.0646	-86.83	1623	0.576	0.00	-0.00426	0.173	0.129
96.36	0.00	4.96	0.464	0.0145	-793.32	0.0209	-701.65	22.77	7.30	0.0661	-84.88	2349	0.673	0.00	-0.00443	0.227	0.129
111.82	0.00	6.23	0.555	0.0161	-729.41	0.0220	-668.74	17.29	7.17	0.0685	-82.23	3257	0.766	0.00	-0.00461	0.238	0.129
127.27	0.00	7.69	0.649	0.0187	-652.60	0.0245	-613.14	13.31	7.02	0.0706	-79.93	4408	0.864	0.00	-0.00483	0.199	0.129
142.73	0.00	9.34	0.747	0.0224	-568.95	0.0270	-565.88	10.33	6.82	0.0724	-78.04	5836	0.969	0.00	-0.00508	0.162	0.129
158.18	0.00	11.18	0.850	0.0278	-483.68	0.0294	-525.66	8.09	6.58	0.0738	-76.53	7561	1.08	0.00	-0.00537	0.168	0.129
173.64	0.00	13.20	0.956	0.0354	-400.95	0.0318	-491.41	6.38	6.28	0.0748	-75.36	9577	1.20	0.00	-0.00572	0.174	0.129
189.09	0.00	15.36	1.07	0.0462	-323.89	0.0341	-462.30	5.06	5.93	0.0754	-74.52	11845	1.32	0.00	-0.00614	0.0879	0.129
204.55	0.00	17.62	1.18	0.0616	-254.58	0.0363	-437.62	4.04	5.51	0.0757	-73.98	14292	1.44	0.00	-0.00667	0.0736	0.129
220.00	0.171	19.67	1.30	0.0824	-198.18	0.0378	-424.29	3.19	4.96	0.0743	-74.87	16636	1.59	0.00	-0.00750	0.100	0.151
		xSAT		xSAT		xSAT		xSAT		xSAT		xSAT		xSAT			
		Lbs per 1000 Barrels		Lbs per 1000 Barrels		Lbs per 1000 Barrels		Lbs per 1000 Barrels		Lbs per 1000 Barrels		Lbs per 1000 Barrels		Lbs per 1000 Barrels			

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-11255-00  
Chevron 5-432D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 5-432D M-4 PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-09-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99521

### CATIONS

Calcium (as Ca)	310.80
Magnesium (as Mg)	28.14
Barium (as Ba)	33.73
Strontium (as Sr)	27.10
Sodium (as Na)	5196
Potassium (as K)	64.72
Lithium (as Li)	2.36
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	45.68
Manganese (as Mn)	0.0900
Zinc (as Zn)	0.175
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	8100
Sulfate (as SO <sub>4</sub> )	200.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	325.00
Bicarbonate (as HCO <sub>3</sub> )	1098
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	15145
Molar Conductivity	20306
Resistivity	49.25
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.117
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

### COMMENTS

GARFIELD CO

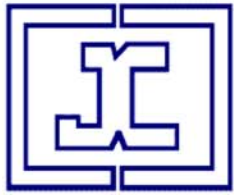
JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096





# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 5-432D M-4 PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99521  
Report Date: 08-24-2015  
Sample Date: 04-09-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	310.80
Magnesium(as Mg)	28.14
Barium(as Ba)	33.73
Strontium(as Sr)	27.10
Sodium(as Na)	5196
Potassium(as K)	64.72
Lithium(as Li)	2.36
Iron(as Fe)	45.68
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0900
Zinc(as Zn)	0.175
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	8100
Sulfate(as SO <sub>4</sub> )	200.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	325.00
Bicarbonate(as HCO <sub>3</sub> )	1098
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

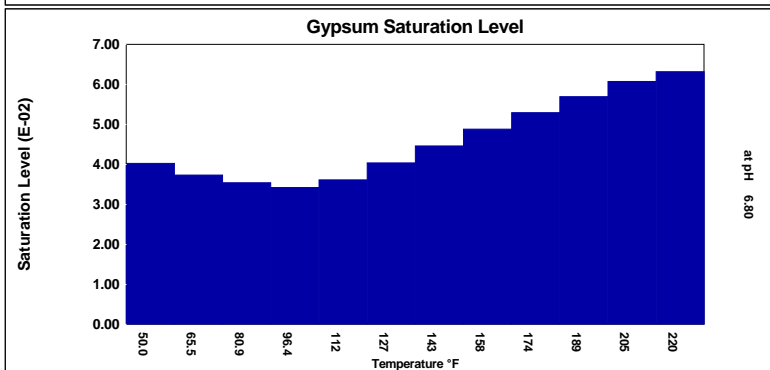
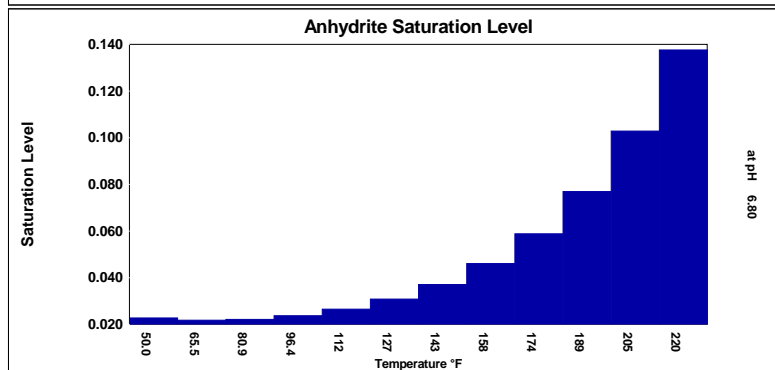
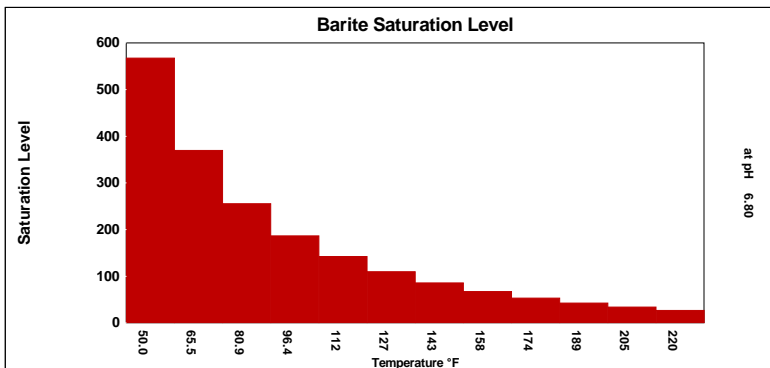
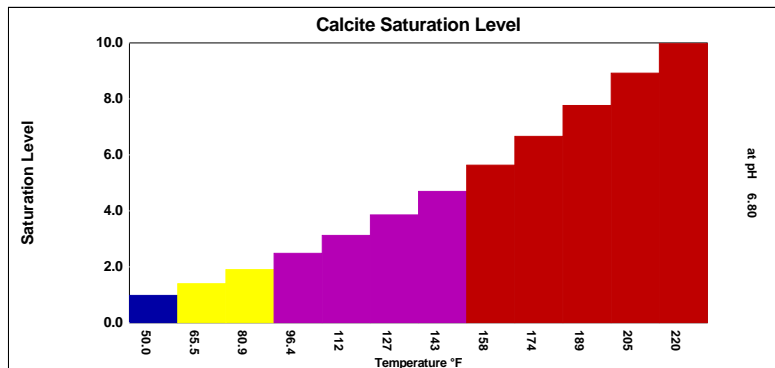
Temperature(°F)	190.00
T.D.S.	15145
Resistivity:	49.25
Sample pH	6.80
Conductivity:	20306

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.982	-0.00546	0.0227	-903.59	0.0402	-713.94	567.37	19.93	0.178	-54.56	211.55	0.341	0.00	-0.0111	0.0942	0.117
65.45	0.00	1.40	0.106	0.0218	-915.59	0.0373	-740.54	369.30	19.91	0.166	-57.74	340.93	0.429	0.00	-0.0115	0.176	0.117
80.91	0.00	1.90	0.213	0.0221	-896.67	0.0354	-757.77	255.40	19.88	0.165	-57.81	520.17	0.518	0.00	-0.0119	0.163	0.117
96.36	0.00	2.48	0.313	0.0236	-851.92	0.0342	-766.40	186.44	19.85	0.170	-56.22	754.92	0.607	0.00	-0.0123	0.213	0.117
111.82	0.00	3.12	0.406	0.0265	-787.51	0.0361	-732.69	142.08	19.81	0.176	-53.99	1049	0.691	0.00	-0.0128	0.224	0.117
127.27	0.00	3.86	0.500	0.0308	-709.85	0.0403	-675.77	109.70	19.76	0.183	-52.08	1422	0.781	0.00	-0.0134	0.188	0.117
142.73	0.00	4.69	0.596	0.0371	-624.80	0.0446	-627.10	85.43	19.70	0.188	-50.52	1887	0.877	0.00	-0.0141	0.152	0.117
158.18	0.00	5.63	0.695	0.0460	-537.35	0.0488	-585.40	67.06	19.62	0.192	-49.29	2449	0.978	0.00	-0.0148	0.158	0.117
173.64	0.00	6.66	0.797	0.0588	-451.47	0.0529	-549.66	53.03	19.53	0.195	-48.36	3108	1.09	0.00	-0.0158	0.164	0.117
189.09	0.00	7.76	0.900	0.0769	-370.12	0.0569	-519.07	42.20	19.41	0.197	-47.70	3850	1.20	0.00	-0.0169	0.0827	0.117
204.55	0.00	8.92	1.00	0.103	-295.28	0.0607	-492.96	33.79	19.27	0.198	-47.30	4651	1.31	0.00	-0.0184	0.0693	0.117
220.00	0.171	9.97	1.12	0.138	-232.46	0.0631	-478.39	26.67	19.09	0.195	-48.10	5420	1.44	0.00	-0.0206	0.0944	0.137
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





## WATER CHEMISTRY

M-4 CHEVRON 5-433D  
SEPARATOR

Report Date: 07-13-2011 Sampled: 06-27-2011  
Sample #: 7138 at 0000

Calcium (as Ca)	233.00
Magnesium (as Mg)	15.31
Barium (as Ba)	18.56
Strontium (as Sr)	15.23
Sodium (as Na)	4379
Potassium (as K)	38.29
Lithium (as Li)	1.24
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.289
Iron (as Fe)	35.99
Manganese (as Mn)	0.858
Zinc (as Zn)	0.644
Lead (as Pb)	0.00

Chloride (as Cl)	6700
Sulfate (as SO <sub>4</sub> )	45.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	854.00
Bicarbonate (as HCO <sub>3</sub> )	275.00
Carbonate (as CO <sub>3</sub> )	0.00
Silica (as Si)	0.00
Phosphate (as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

pH	6.40
Temperature (°F)	120.00
Density(g/mL)	1.01
Pressure(atm)	1.00
Calculated T.D.S.	13435
Molar Conductivity	18567
Field Fe	0.00

CO <sub>2</sub> - H <sub>2</sub> S Rate(mpy)	0.00
--	------

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096



## DEPOSITION POTENTIAL INDICATORS

M-4 CHEVRON 5-433D  
SEPARATOR

Report Date: 07-13-2011      Sampled: 06-27-2011  
Sample #: 7138                      at 0000

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	1.04	Calcite (CaCO <sub>3</sub> )	0.00860
Aragonite (CaCO <sub>3</sub> )	0.867	Aragonite (CaCO <sub>3</sub> )	-0.0372
Witherite (BaCO <sub>3</sub> )	0.0301	Witherite (BaCO <sub>3</sub> )	-8.06
Strontianite (SrCO <sub>3</sub> )	0.130	Strontianite (SrCO <sub>3</sub> )	-1.91
Magnesite (MgCO <sub>3</sub> )	0.0812	Magnesite (MgCO <sub>3</sub> )	-2.03
Anhydrite (CaSO <sub>4</sub> )	0.00525	Anhydrite (CaSO <sub>4</sub> )	-767.44
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00707	Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-731.52
Barite (BaSO <sub>4</sub> )	10.68	Barite (BaSO <sub>4</sub> )	9.50
Celestite (SrSO <sub>4</sub> )	0.0127	Celestite (SrSO <sub>4</sub> )	-127.73
Fluorite (CaF <sub>2</sub> )	0.00	Fluorite (CaF <sub>2</sub> )	-15.96
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-328.15
Silica (SiO <sub>2</sub> )	0.00	Silica (SiO <sub>2</sub> )	-71.88
Brucite (Mg(OH) <sub>2</sub> )	< 0.001	Brucite (Mg(OH) <sub>2</sub> )	-2.63
Magnesium silicate	0.00	Magnesium silicate	-116.69
Iron hydroxide (Fe(OH) <sub>3</sub> )	166.70	Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00	Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	426.82	Siderite (FeCO <sub>3</sub> )	0.281
Halite (NaCl)	< 0.001	Halite (NaCl)	-182163
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001	Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-51580
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.0350

## BOUND IONS

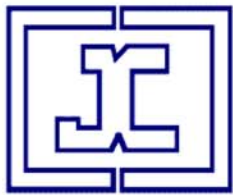
Langelier	0.146	Calcium	233.00	193.85
Ryznar	6.11	Barium	18.56	18.56
Puckorius	3.64	Carbonate	2.20	0.418
Larson-Skold Index	10.47	Phosphate	0.00	0.00
Stiff Davis Index	0.175	Sulfate	45.00	36.25
Oddo-Tomson	-0.0465			

## OPERATING CONDITIONS

Temperature (°F)	120.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY  
M-4 CHEVRON 5-433D  
TIM HEATON  
SEPARATOR

Sample ID#: 7138  
ID: \*2580  
Report Date: 07-13-2011  
Sample Date: 06-27-2011  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	233.00
Magnesium(as Mg)	15.31
Barium(as Ba)	18.56
Strontium(as Sr)	15.23
Sodium(as Na)	4379
Potassium(as K)	38.29
Lithium(as Li)	1.24
Iron(as Fe)	35.99
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.289
Manganese(as Mn)	0.858
Zinc(as Zn)	0.644
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	6700
Sulfate(as SO <sub>4</sub> )	45.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	854.00
Bicarbonate(as HCO <sub>3</sub> )	275.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as Si)	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

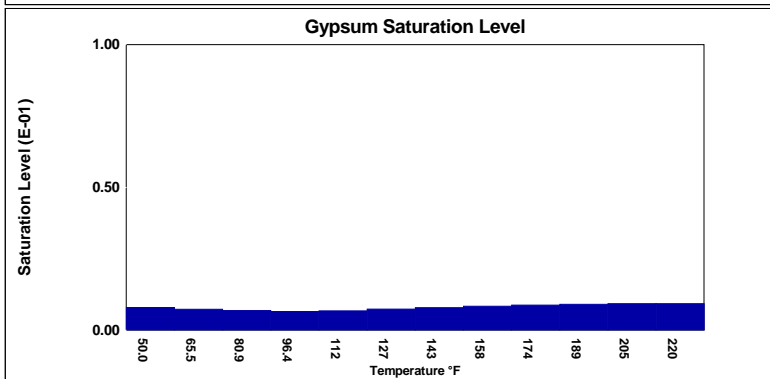
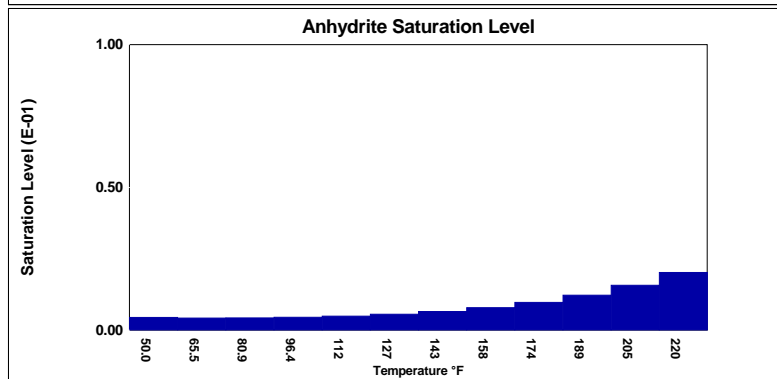
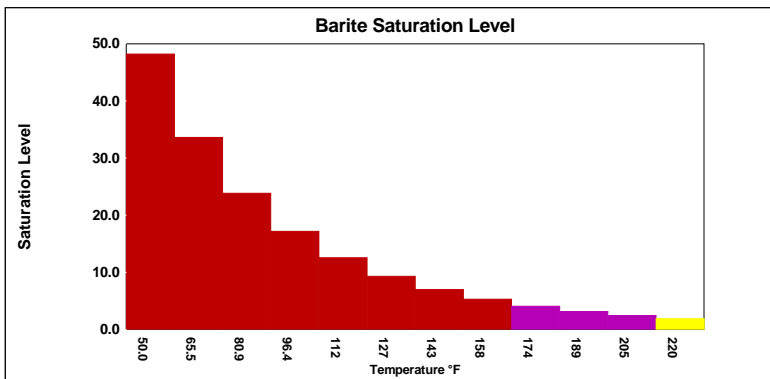
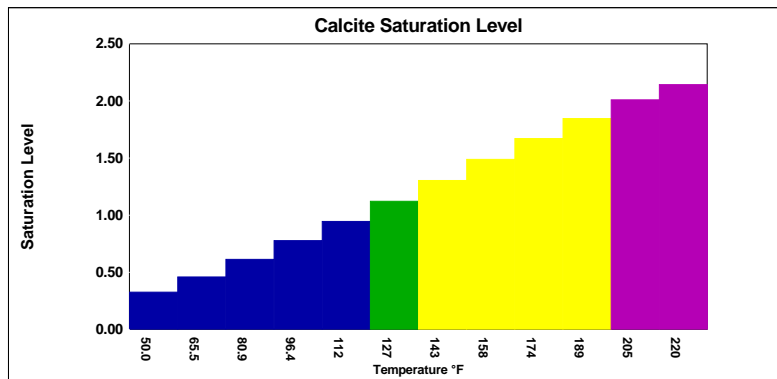
### PARAMETERS

Temperature(°F)	120.00
Sample pH	6.40

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.325	-0.241	0.00446	-911.97	0.00793	-740.00	48.19	10.65	0.0123	-133.41	74.41	0.133	0.00	-0.0301	0.199	0.713
65.45	0.00	0.459	-0.171	0.00426	-922.83	0.00731	-764.72	33.60	10.50	0.0125	-131.48	119.94	0.167	0.00	-0.0310	0.423	0.713
80.91	0.00	0.613	-0.110	0.00428	-905.08	0.00686	-781.21	23.83	10.30	0.0126	-129.96	182.34	0.201	0.00	-0.0319	0.629	0.713
96.36	0.00	0.777	-0.0581	0.00450	-863.61	0.00652	-790.22	17.17	10.05	0.0127	-128.82	263.19	0.234	0.00	-0.0330	0.824	0.713
111.82	0.00	0.944	-0.0135	0.00493	-804.20	0.00674	-759.99	12.55	9.71	0.0127	-128.02	363.43	0.264	0.00	-0.0343	0.864	0.713
127.27	0.00	1.12	0.0275	0.00559	-732.73	0.00734	-708.35	9.29	9.29	0.0127	-127.56	489.74	0.296	0.00	-0.0357	0.728	0.713
142.73	0.00	1.30	0.0660	0.00654	-654.63	0.00788	-664.77	6.96	8.77	0.0127	-127.41	645.88	0.329	0.00	-0.0372	0.589	0.713
158.18	0.00	1.49	0.103	0.00787	-574.54	0.00836	-627.99	5.28	8.14	0.0126	-127.57	835.16	0.363	0.00	-0.0390	0.592	0.713
173.64	0.00	1.67	0.138	0.00970	-496.07	0.00875	-596.99	4.04	7.38	0.0125	-128.03	1059	0.398	0.00	-0.0410	0.594	0.713
189.09	0.00	1.84	0.172	0.0122	-421.85	0.00906	-570.91	3.12	6.49	0.0123	-128.81	1317	0.435	0.00	-0.0435	0.293	0.713
204.55	0.00	2.01	0.205	0.0157	-353.61	0.00929	-549.07	2.43	5.46	0.0121	-129.92	1606	0.474	0.00	-0.0463	0.242	0.713
220.00	0.171	2.14	0.238	0.0202	-296.28	0.00929	-537.76	1.87	4.15	0.0116	-133.04	1909	0.518	0.00	-0.0507	0.328	0.835
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-14283-00  
Chevron 36-7D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-7D O-36A PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99514

#### CATIONS

Calcium (as Ca)	182.00
Magnesium (as Mg)	22.55
Barium (as Ba)	19.19
Strontium (as Sr)	16.41
Sodium (as Na)	3770
Potassium (as K)	61.80
Lithium (as Li)	2.48
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	29.13
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.161
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	5800
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	400.00
Bicarbonate (as HCO <sub>3</sub> )	976.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	3.10

#### PARAMETERS

Calculated T.D.S.	10961
Molar Conductivity	15218
Resistivity	65.71
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.127
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.70

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 36-7D O-36A PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99514  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	182.00
Magnesium(as Mg)	22.55
Barium(as Ba)	19.19
Strontium(as Sr)	16.41
Sodium(as Na)	3770
Potassium(as K)	61.80
Lithium(as Li)	2.48
Iron(as Fe)	29.13
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.161
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	5800
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	400.00
Bicarbonate(as HCO <sub>3</sub> )	976.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	3.10

### PARAMETERS

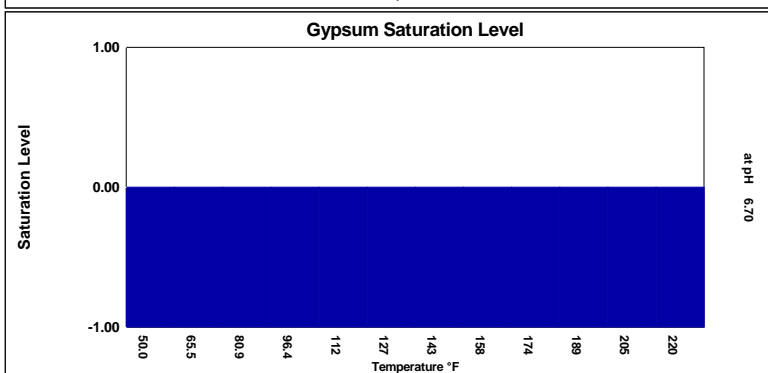
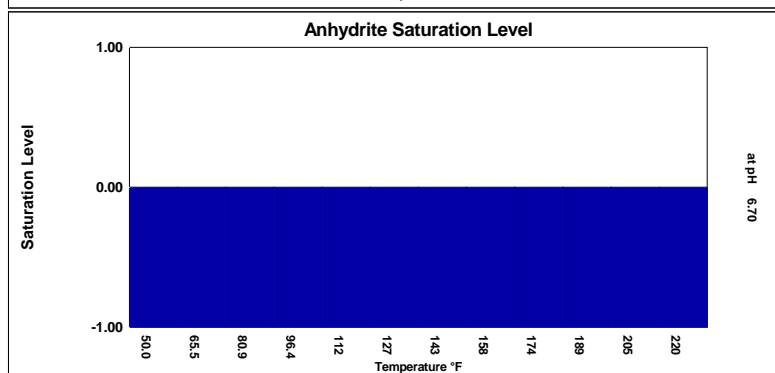
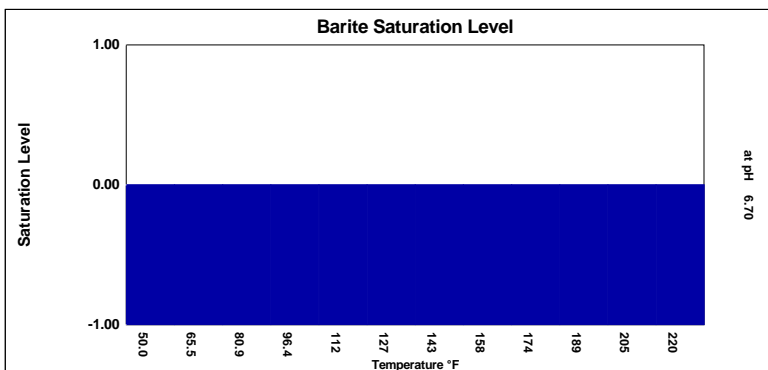
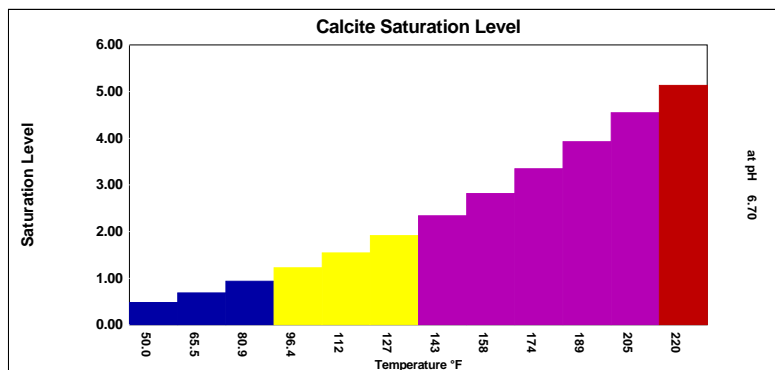
Temperature(°F)	190.00
T.D.S.	10961
Resistivity:	65.71
Sample pH	6.70
Conductivity:	15218

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.479	-0.215	0.00	-899.12	0.00	-737.41	0.00	-0.330	0.00	-92.36	113.29	0.227	0.00	-0.0169	0.0970	0.127
65.45	0.00	0.684	-0.114	0.00	-907.79	0.00	-759.22	0.00	-0.492	0.00	-94.83	182.98	0.286	0.00	-0.0174	0.182	0.127
80.91	0.00	0.934	-0.0212	0.00	-888.64	0.00	-772.60	0.00	-0.688	0.00	-94.33	279.78	0.346	0.00	-0.0180	0.171	0.127
96.36	0.00	1.22	0.0634	0.00	-846.35	0.00	-778.24	0.00	-0.911	0.00	-92.26	406.71	0.405	0.00	-0.0186	0.224	0.127
111.82	0.00	1.54	0.140	0.00	-786.52	0.00	-745.98	0.00	-1.15	0.00	-89.60	566.34	0.461	0.00	-0.0193	0.235	0.127
127.27	0.00	1.91	0.215	0.00	-714.94	0.00	-693.00	0.00	-1.44	0.00	-87.25	769.76	0.521	0.00	-0.0201	0.197	0.127
142.73	0.00	2.34	0.289	0.00	-636.91	0.00	-647.52	0.00	-1.77	0.00	-85.26	1025	0.586	0.00	-0.0211	0.160	0.127
158.18	0.00	2.81	0.364	0.00	-556.92	0.00	-608.39	0.00	-2.16	0.00	-83.61	1337	0.655	0.00	-0.0222	0.166	0.127
173.64	0.00	3.34	0.440	0.00	-478.54	0.00	-574.66	0.00	-2.61	0.00	-82.25	1706	0.728	0.00	-0.0235	0.172	0.127
189.09	0.00	3.92	0.518	0.00	-404.40	0.00	-545.64	0.00	-3.12	0.00	-81.19	2130	0.805	0.00	-0.0251	0.0869	0.127
204.55	0.00	4.54	0.596	0.00	-336.27	0.00	-520.72	0.00	-3.70	0.00	-80.39	2599	0.885	0.00	-0.0270	0.0728	0.127
220.00	0.171	5.13	0.679	0.00	-278.96	0.00	-505.89	0.00	-4.43	0.00	-80.80	3071	0.977	0.00	-0.0300	0.0991	0.148
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-10625-00  
Chevron 36-42D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-42D O-36A PAD  
WELLHEAD

Report Date: 08-24-2015 Sampled: 04-02-2015  
Sample #: 3076 at 0000  
Sample ID: 99516

### CATIONS

Calcium (as Ca)	174.10
Magnesium (as Mg)	25.58
Barium (as Ba)	40.81
Strontium (as Sr)	19.38
Sodium (as Na)	4817
Potassium (as K)	95.48
Lithium (as Li)	3.09
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.484
Iron (as Fe)	109.50
Manganese (as Mn)	0.967
Zinc (as Zn)	0.586
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	7300
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	600.00
Bicarbonate (as HCO <sub>3</sub> )	1464
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.669

### PARAMETERS

Calculated T.D.S.	14040
Molar Conductivity	18698
Resistivity	53.48
Sp.Gr.(g/mL)	1.01
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0382
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	7.50

### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096





## DEPOSITION POTENTIAL INDICATORS

Sample ID: 99516

Calcite ( $\text{CaCO}_3$ )	5.84
Aragonite ( $\text{CaCO}_3$ )	5.79
Witherite ( $\text{BaCO}_3$ )	3.00
Strontianite ( $\text{SrCO}_3$ )	6.38
Calcium oxalate ( $\text{CaC}_2\text{O}_4$ )	-0.305
Magnesite ( $\text{MgCO}_3$ )	4.36
Anhydrite ( $\text{CaSO}_4$ )	-451.50
Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )	-611.69
Barite ( $\text{BaSO}_4$ )	-2.09
Celestite ( $\text{SrSO}_4$ )	-88.35
Fluorite ( $\text{CaF}_2$ )	-22.11
Calcium phosphate	>-0.001
Hydroxyapatite	-461.36
Silica ( $\text{SiO}_2$ )	-151.57
Brucite ( $\text{Mg}(\text{OH})_2$ )	0.296
Magnesium silicate	-162.24
Iron hydroxide ( $\text{Fe}(\text{OH})_3$ )	< 0.001
Strengite ( $\text{FePO}_4 \cdot 2\text{H}_2\text{O}$ )	>-0.001
Siderite ( $\text{FeCO}_3$ )	7.05
Halite ( $\text{NaCl}$ )	-203811
Thenardite ( $\text{Na}_2\text{SO}_4$ )	-53589
Iron sulfide ( $\text{FeS}$ )	-0.00160

Calcium	174.10	145.85
Barium	40.81	40.81
Carbonate	198.51	10.48
Phosphate	0.00	0.00
Sulfate	0.00	0.00

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES**  
205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 36-42D O-36A PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99516  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	174.10
Magnesium(as Mg)	25.58
Barium(as Ba)	40.81
Strontium(as Sr)	19.38
Sodium(as Na)	4817
Potassium(as K)	95.48
Lithium(as Li)	3.09
Iron(as Fe)	109.50
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.484
Manganese(as Mn)	0.967
Zinc(as Zn)	0.586
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	7300
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	600.00
Bicarbonate(as HCO <sub>3</sub> )	1464
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.669

### PARAMETERS

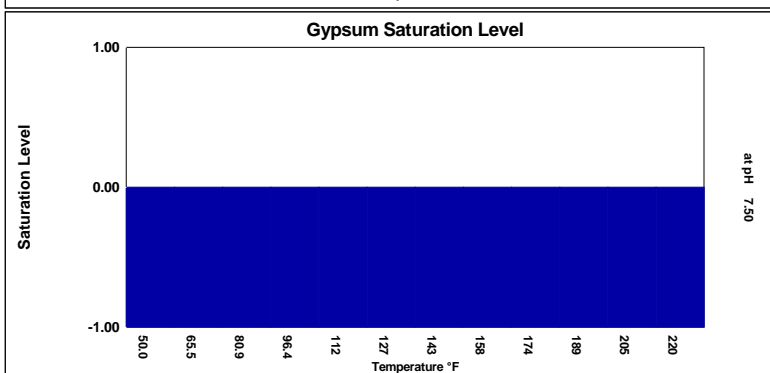
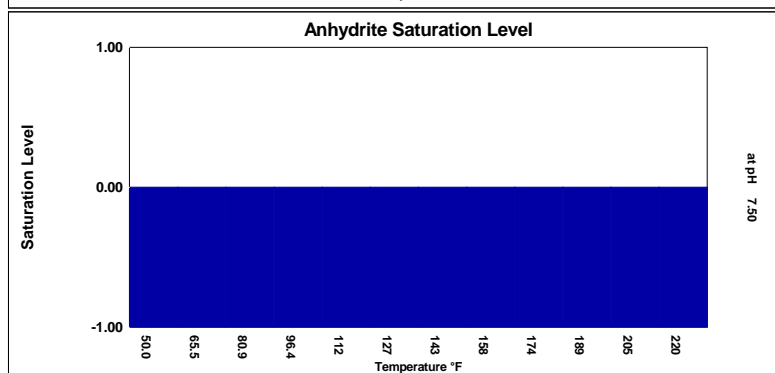
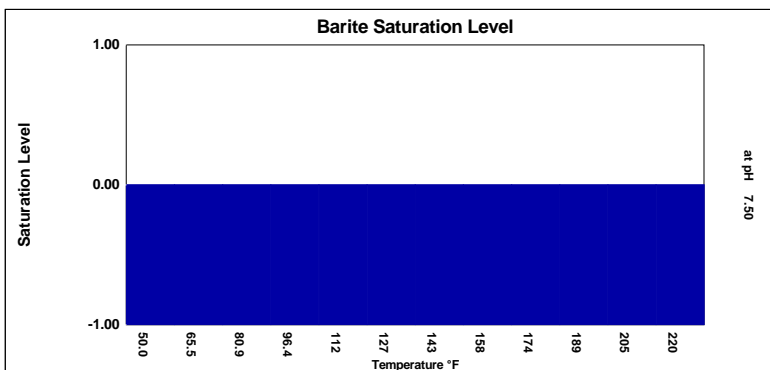
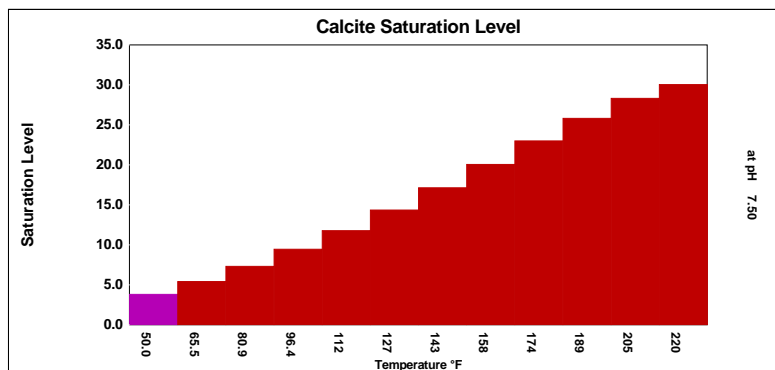
Temperature(°F)	190.00
T.D.S.	14040
Resistivity:	53.48

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	3.81	1.42	0.00	-983.31	0.00	-811.52	0.00	-0.188	0.00	-99.94	3449	2.24	0.00	>-0.001	0.0615	0.0382
65.45	0.00	5.40	1.97	0.00	-993.85	0.00	-836.25	0.00	-0.283	0.00	-102.71	5558	2.81	0.00	>-0.001	0.115	0.0382
80.91	0.00	7.31	2.52	0.00	-974.40	0.00	-851.95	0.00	-0.402	0.00	-102.26	8460	3.39	0.00	>-0.001	0.0796	0.0382
96.36	0.00	9.46	3.04	0.00	-929.90	0.00	-859.34	0.00	-0.540	0.00	-100.10	12194	3.95	0.00	>-0.001	0.104	0.0382
111.82	0.00	11.77	3.52	0.00	-866.35	0.00	-825.59	0.00	-0.694	0.00	-97.28	16732	4.47	0.00	-0.00103	0.109	0.0382
127.27	0.00	14.34	4.01	0.00	-789.99	0.00	-769.33	0.00	-0.879	0.00	-94.80	22250	5.00	0.00	-0.00108	0.0916	0.0382
142.73	0.00	17.13	4.50	0.00	-706.46	0.00	-721.13	0.00	-1.10	0.00	-92.71	28642	5.54	0.00	-0.00116	0.0743	0.0382
158.18	0.00	20.05	4.98	0.00	-620.56	0.00	-679.70	0.00	-1.37	0.00	-90.96	35521	6.07	0.00	-0.00126	0.0773	0.0382
173.64	0.00	22.99	5.43	0.00	-536.16	0.00	-644.08	0.00	-1.69	0.00	-89.54	42259	6.58	0.00	-0.00139	0.0801	0.0382
189.09	0.00	25.80	5.82	0.00	-456.06	0.00	-613.39	0.00	-2.07	0.00	-88.41	47932	7.03	0.00	-0.00158	0.0404	0.0382
204.55	0.00	28.31	6.14	0.00	-382.14	0.00	-586.96	0.00	-2.51	0.00	-87.56	51572	7.39	0.00	-0.00185	0.0338	0.0382
220.00	0.171	30.03	6.43	0.00	-319.88	0.00	-571.70	0.00	-3.09	0.00	-88.08	52218	7.71	0.00	-0.00227	0.0461	0.0448
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-11087-00  
Chevron 36-423D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-423D O-36A  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99515

### CATIONS

Calcium (as Ca)	164.50
Magnesium (as Mg)	10.66
Barium (as Ba)	4.28
Strontium (as Sr)	4.33
Sodium (as Na)	339.74
Potassium (as K)	21.40
Lithium (as Li)	3.16
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	6.01
Iron (as Fe)	280.50
Manganese (as Mn)	3.57
Zinc (as Zn)	0.555
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	800.00
Sulfate (as SO <sub>4</sub> )	25.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate (as HCO <sub>3</sub> )	732.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	2496
Molar Conductivity	2898
Resistivity	345.12
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.136
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.50

### COMMENTS

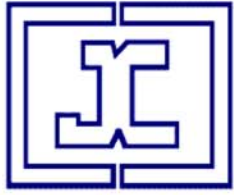
GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096



# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 36-423D O-36A  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99515  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	164.50
Magnesium(as Mg)	10.66
Barium(as Ba)	4.28
Strontium(as Sr)	4.33
Sodium(as Na)	339.74
Potassium(as K)	21.40
Lithium(as Li)	3.16
Iron(as Fe)	280.50
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	6.01
Manganese(as Mn)	3.57
Zinc(as Zn)	0.555
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	800.00
Sulfate(as SO <sub>4</sub> )	25.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	300.00
Bicarbonate(as HCO <sub>3</sub> )	732.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

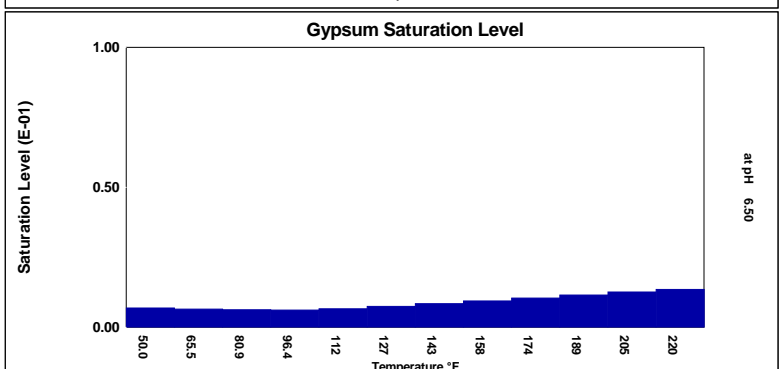
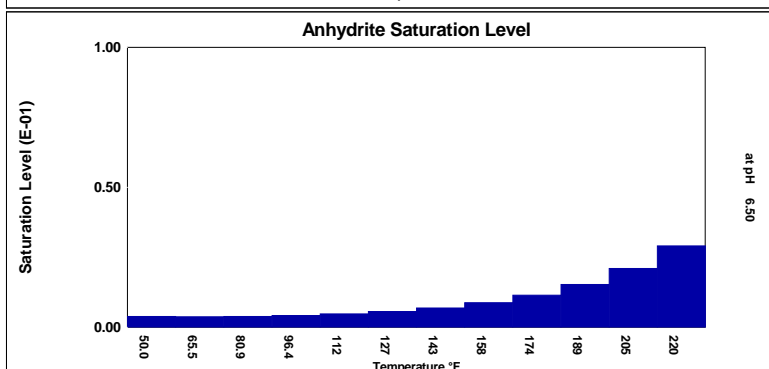
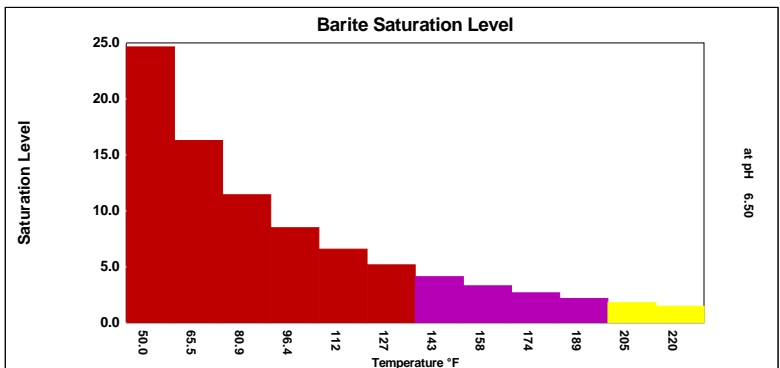
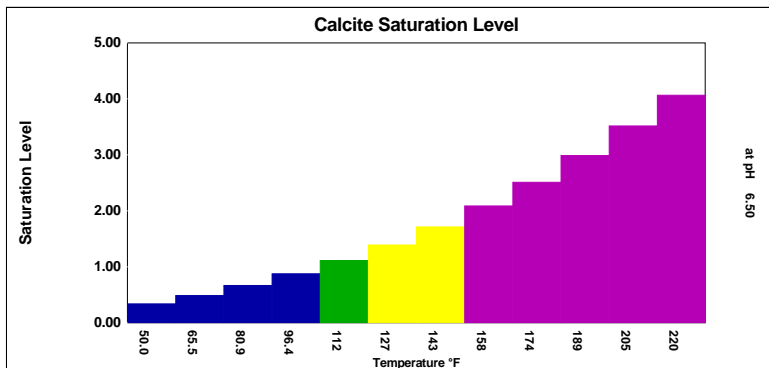
Temperature(°F)	190.00
T.D.S.	2496
Resistivity:	345.12

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.339	-0.137	0.00383	-565.72	0.00689	-453.91	24.64	2.41	0.00958	-55.80	860.35	0.0815	0.00	-0.00114	0.0996	0.136
65.45	0.00	0.486	-0.0929	0.00373	-568.36	0.00648	-465.60	16.28	2.35	0.00910	-57.13	1396	0.102	0.00	-0.00116	0.186	0.136
80.91	0.00	0.666	-0.0530	0.00384	-552.66	0.00623	-471.51	11.44	2.27	0.00918	-56.53	2145	0.122	0.00	-0.00118	0.179	0.136
96.36	0.00	0.876	-0.0174	0.00417	-521.93	0.00612	-472.12	8.49	2.18	0.00958	-54.91	3139	0.143	0.00	-0.00121	0.234	0.136
111.82	0.00	1.11	0.0142	0.00475	-480.04	0.00658	-448.33	6.59	2.08	0.0101	-52.91	4403	0.162	0.00	-0.00124	0.246	0.136
127.27	0.00	1.39	0.0441	0.00563	-430.97	0.00748	-411.50	5.18	1.97	0.0107	-51.09	6034	0.182	0.00	-0.00127	0.206	0.136
142.73	0.00	1.71	0.0732	0.00691	-378.30	0.00843	-379.65	4.12	1.83	0.0112	-49.49	8114	0.203	0.00	-0.00131	0.167	0.136
158.18	0.00	2.09	0.102	0.00876	-325.02	0.00942	-351.98	3.30	1.66	0.0117	-48.09	10702	0.227	0.00	-0.00136	0.174	0.136
173.64	0.00	2.51	0.130	0.0114	-273.44	0.0104	-327.83	2.68	1.48	0.0122	-46.84	13844	0.251	0.00	-0.00141	0.180	0.136
189.09	0.00	2.99	0.159	0.0153	-225.28	0.0115	-306.69	2.18	1.26	0.0126	-45.75	17569	0.277	0.00	-0.00148	0.0908	0.136
204.55	0.00	3.52	0.188	0.0210	-181.63	0.0126	-288.12	1.80	1.01	0.0130	-44.79	21851	0.304	0.00	-0.00156	0.0761	0.136
220.00	0.171	4.06	0.218	0.0291	-144.54	0.0135	-274.26	1.47	0.720	0.0133	-44.30	26476	0.335	0.00	-0.00168	0.104	0.159
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11088-00  
Chevron 36-322D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-322D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580    at 0000  
  
Sample ID: 67311

#### CATIONS

Calcium (as Ca)	193.90
Magnesium (as Mg)	58.20
Barium (as Ba)	12.20
Strontium (as Sr)	13.27
Sodium (as Na)	95.21
Potassium (as K)	109.00
Lithium (as Li)	8.51
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	302.30
Manganese (as Mn)	2.73
Zinc (as Zn)	0.349
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	900.00
Sulfate (as SO <sub>4</sub> )	25.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	395.00
Bicarbonate (as HCO <sub>3</sub> )	488.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	2254
Molar Conductivity	2794
Resistivity	357.90
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0558
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-322D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580                      at 0000  
  
Sample ID: 67311

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	4.79
Aragonite (CaCO <sub>3</sub> )	3.90
Witherite (BaCO <sub>3</sub> )	0.0761
Strontianite (SrCO <sub>3</sub> )	0.862
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	2.68
Anhydrite (CaSO <sub>4</sub> )	0.0154
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0114
Barite (BaSO <sub>4</sub> )	4.99
Celestite (SrSO <sub>4</sub> )	0.0314
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	48334
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	24143
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.254
Aragonite (CaCO <sub>3</sub> )	0.239
Witherite (BaCO <sub>3</sub> )	-4.26
Strontianite (SrCO <sub>3</sub> )	-0.0709
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.0871
Magnesite (MgCO <sub>3</sub> )	0.169
Anhydrite (CaSO <sub>4</sub> )	-213.34
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-294.82
Barite (BaSO <sub>4</sub> )	4.77
Celestite (SrSO <sub>4</sub> )	-43.82
Fluorite (CaF <sub>2</sub> )	-13.60
Calcium phosphate	>-0.001
Hydroxyapatite	-304.54
Silica (SiO <sub>2</sub> )	-154.04
Brucite (Mg(OH) <sub>2</sub> )	0.0497
Magnesium silicate	-131.78
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.371
Halite (NaCl)	-178042
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-39200
Iron sulfide (FeS)	>-0.001

**SIMPLE INDICES**

Langelier	0.751
Ryznar	5.30
Puckorius	3.74
Larson-Skold Index	3.21
Stiff Davis Index	1.40
Oddo-Tomson	1.08

**BOUND IONS**

Calcium	193.90
Barium	12.20
Carbonate	5.05
Phosphate	0.00
Sulfate	25.00

**TOTAL****FREE**

177.56
12.20
0.552
0.00
13.80

**OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES****205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096**

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
CHEVRON 36-322D O-36A PAD  
ROB SIMEONE  
SEPARATOR  
GARFIELD CO

Sample ID#: 2580  
ID: 67311  
Report Date: 04-21-2014  
Sample Date: 03-18-2014  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	193.90
Magnesium(as Mg)	58.20
Barium(as Ba)	12.20
Strontium(as Sr)	13.27
Sodium(as Na)	95.21
Potassium(as K)	109.00
Lithium(as Li)	8.51
Iron(as Fe)	302.30
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	2.73
Zinc(as Zn)	0.349
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	900.00
Sulfate(as SO <sub>4</sub> )	25.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	395.00
Bicarbonate(as HCO <sub>3</sub> )	488.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

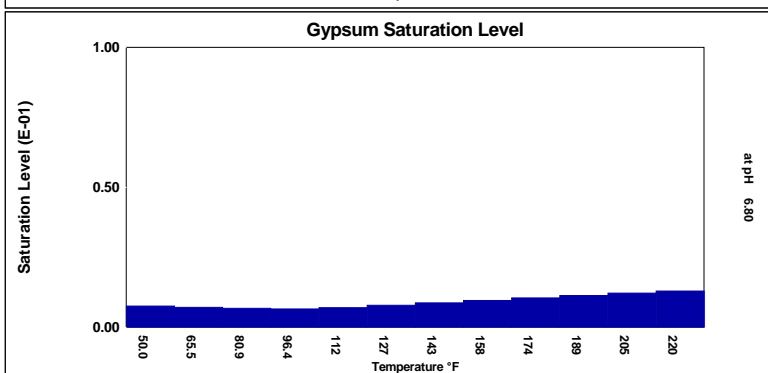
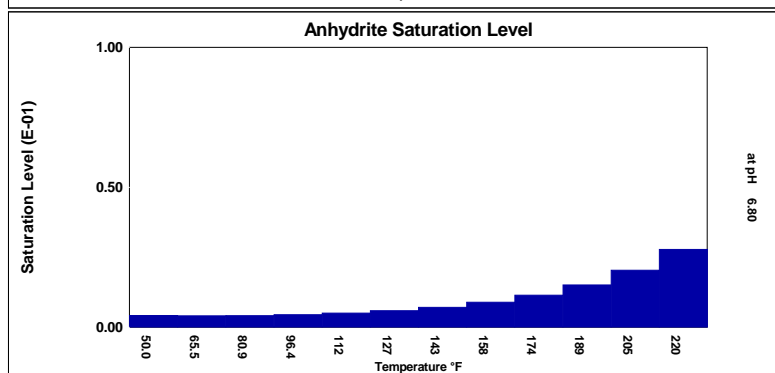
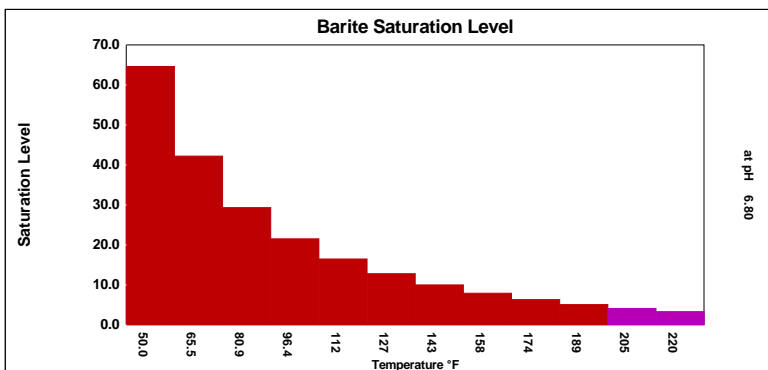
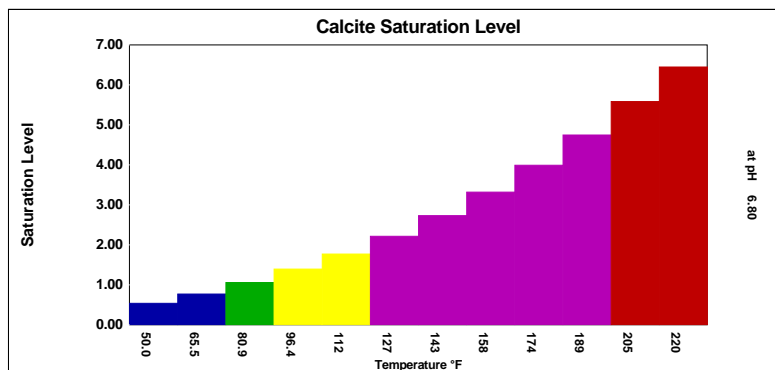
Temperature(°F)	190.00
T.D.S.	2254
Resistivity:	357.90
Sample pH	6.80
Conductivity:	2794

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.537	-0.0821	0.00422	-557.98	0.00760	-443.83	64.57	7.01	0.0270	-53.50	1224	0.110	0.00	>-0.001	0.0711	0.0558
65.45	0.00	0.772	-0.0351	0.00408	-560.70	0.00709	-455.60	42.19	6.89	0.0253	-54.92	1982	0.138	0.00	>-0.001	0.133	0.0558
80.91	0.00	1.06	0.00800	0.00417	-544.89	0.00676	-461.54	29.30	6.74	0.0253	-54.38	3043	0.165	0.00	>-0.001	0.101	0.0558
96.36	0.00	1.39	0.0470	0.00448	-513.92	0.00657	-462.17	21.48	6.57	0.0261	-52.80	4443	0.192	0.00	>-0.001	0.133	0.0558
111.82	0.00	1.77	0.0819	0.00504	-471.74	0.00698	-438.26	16.45	6.38	0.0272	-50.84	6215	0.218	0.00	>-0.001	0.139	0.0558
127.27	0.00	2.21	0.116	0.00589	-422.35	0.00783	-401.27	12.76	6.14	0.0283	-49.07	8490	0.245	0.00	>-0.001	0.117	0.0558
142.73	0.00	2.73	0.149	0.00713	-369.37	0.00871	-369.30	9.99	5.87	0.0292	-47.51	11357	0.273	0.00	>-0.001	0.0946	0.0558
158.18	0.00	3.32	0.183	0.00892	-315.85	0.00959	-341.51	7.89	5.55	0.0301	-46.14	14872	0.304	0.00	>-0.001	0.0985	0.0558
173.64	0.00	3.99	0.217	0.0115	-264.16	0.0105	-317.26	6.29	5.20	0.0308	-44.94	19052	0.336	0.00	>-0.001	0.102	0.0558
189.09	0.00	4.74	0.252	0.0151	-216.04	0.0113	-295.99	5.05	4.80	0.0314	-43.88	23844	0.369	0.00	>-0.001	0.0514	0.0558
204.55	0.00	5.58	0.287	0.0204	-172.63	0.0122	-277.26	4.09	4.36	0.0319	-42.93	29102	0.405	0.00	>-0.001	0.0431	0.0558
220.00	0.171	6.45	0.324	0.0278	-136.01	0.0130	-263.23	3.30	3.88	0.0321	-42.45	34414	0.444	0.00	>-0.001	0.0587	0.0653
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}/{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.







JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11089-00  
Chevron 36-422D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-422D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580    at 0000  
  
Sample ID: 67307

#### CATIONS

Calcium (as Ca)	121.30
Magnesium (as Mg)	45.46
Barium (as Ba)	0.453
Strontium (as Sr)	7.47
Sodium (as Na)	309.29
Potassium (as K)	83.22
Lithium (as Li)	8.67
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	156.20
Manganese (as Mn)	0.782
Zinc (as Zn)	1.49
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	900.00
Sulfate (as SO <sub>4</sub> )	50.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate (as HCO <sub>3</sub> )	366.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	2085
Molar Conductivity	2882
Resistivity	347.02
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0424
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.80

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-422D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580                      at 0000  
  
Sample ID: 67307

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	2.41
Aragonite (CaCO <sub>3</sub> )	1.96
Witherite (BaCO <sub>3</sub> )	0.00227
Strontianite (SrCO <sub>3</sub> )	0.389
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	1.65
Anhydrite (CaSO <sub>4</sub> )	0.0237
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0176
Barite (BaSO <sub>4</sub> )	0.456
Celestite (SrSO <sub>4</sub> )	0.0436
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	25740
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	9873
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	< 0.001
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.139
Aragonite (CaCO <sub>3</sub> )	0.116
Witherite (BaCO <sub>3</sub> )	-6.50
Strontianite (SrCO <sub>3</sub> )	-0.464
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.128
Magnesite (MgCO <sub>3</sub> )	0.0784
Anhydrite (CaSO <sub>4</sub> )	-225.30
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-307.77
Barite (BaSO <sub>4</sub> )	-0.313
Celestite (SrSO <sub>4</sub> )	-38.54
Fluorite (CaF <sub>2</sub> )	-15.96
Calcium phosphate	>-0.001
Hydroxyapatite	-295.45
Silica (SiO <sub>2</sub> )	-154.21
Brucite (Mg(OH) <sub>2</sub> )	0.0491
Magnesium silicate	-129.89
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.275
Halite (NaCl)	-176113
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-38410
Iron sulfide (FeS)	-0.00131

**SIMPLE INDICES**

Langelier	0.442
Ryznar	5.92
Puckorius	4.54
Larson-Skold Index	4.38
Stiff Davis Index	1.08
Oddo-Tomson	0.783

**BOUND IONS**

Calcium	121.30
Barium	0.453
Carbonate	3.24
Phosphate	0.00
Sulfate	50.00

**TOTAL****FREE**

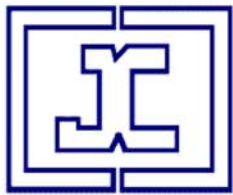
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0.409
0.00
31.30

**OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES****205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096**

# DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
CHEVRON 36-422D O-36A PAD  
ROB SIMEONE  
SEPARATOR  
GARFIELD CO

Sample ID#: 2580  
ID: 67307  
Report Date: 04-21-2014  
Sample Date: 03-18-2014  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	121.30
Magnesium(as Mg)	45.46
Barium(as Ba)	0.453
Strontium(as Sr)	7.47
Sodium(as Na)	309.29
Potassium(as K)	83.22
Lithium(as Li)	8.67
Iron(as Fe)	156.20
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.782
Zinc(as Zn)	1.49
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	900.00
Sulfate(as SO <sub>4</sub> )	50.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	350.00
Bicarbonate(as HCO <sub>3</sub> )	366.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

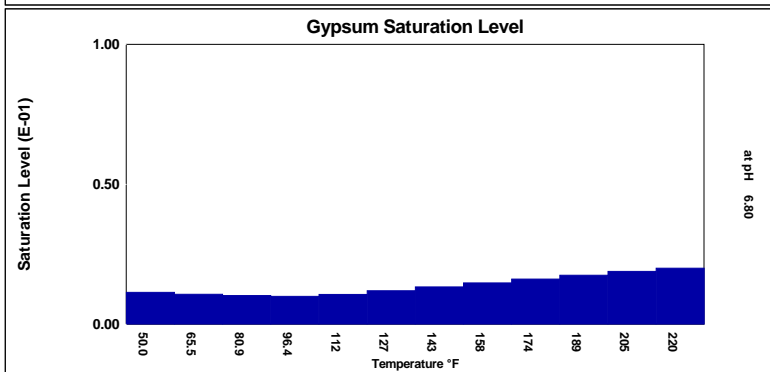
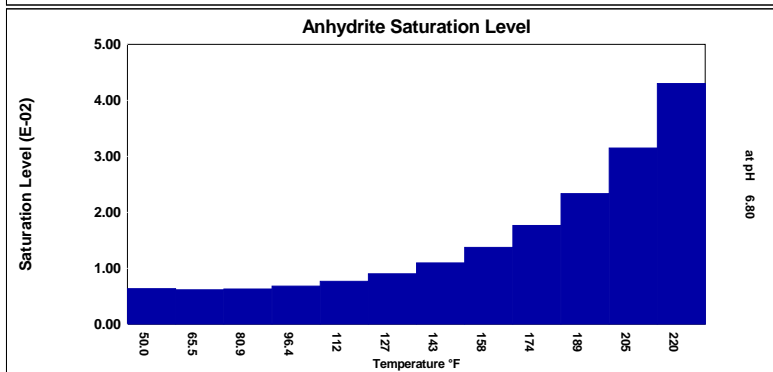
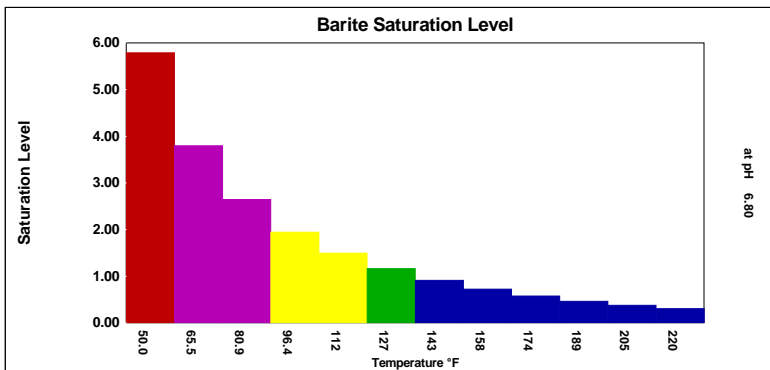
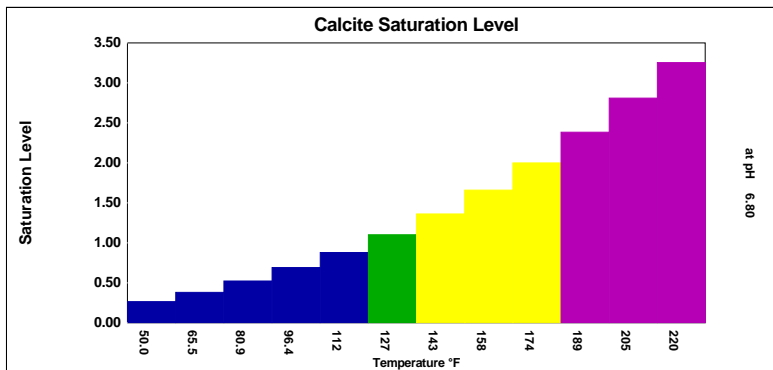
Temperature(°F)	190.00
T.D.S.	2085
Resistivity:	347.02

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.264	-0.194	0.00634	-564.50	0.0114	-456.00	5.78	0.222	0.0366	-47.01	493.17	0.0808	0.00	>-0.001	0.0640	0.0424
65.45	0.00	0.381	-0.142	0.00615	-566.72	0.0107	-467.13	3.79	0.197	0.0345	-48.42	800.32	0.101	0.00	>-0.001	0.120	0.0424
80.91	0.00	0.524	-0.0953	0.00631	-550.98	0.0102	-472.59	2.64	0.166	0.0345	-47.98	1231	0.121	0.00	-0.00102	0.0850	0.0424
96.36	0.00	0.691	-0.0546	0.00681	-520.56	0.00999	-472.89	1.94	0.130	0.0357	-46.55	1800	0.141	0.00	-0.00104	0.111	0.0424
111.82	0.00	0.880	-0.0189	0.00768	-479.26	0.0106	-449.27	1.49	0.0879	0.0374	-44.76	2522	0.160	0.00	-0.00107	0.117	0.0424
127.27	0.00	1.10	0.0143	0.00901	-430.91	0.0120	-412.87	1.16	0.0368	0.0390	-43.15	3450	0.180	0.00	-0.00110	0.0979	0.0424
142.73	0.00	1.36	0.0460	0.0109	-379.03	0.0134	-381.35	0.911	-0.0260	0.0404	-41.76	4623	0.201	0.00	-0.00113	0.0793	0.0424
158.18	0.00	1.66	0.0768	0.0137	-326.51	0.0147	-353.92	0.721	-0.103	0.0416	-40.55	6064	0.224	0.00	-0.00118	0.0826	0.0424
173.64	0.00	2.00	0.107	0.0177	-275.62	0.0161	-329.96	0.575	-0.195	0.0426	-39.50	7782	0.248	0.00	-0.00123	0.0855	0.0424
189.09	0.00	2.38	0.137	0.0233	-227.99	0.0175	-308.93	0.462	-0.306	0.0435	-38.59	9750	0.273	0.00	-0.00131	0.0431	0.0424
204.55	0.00	2.81	0.167	0.0315	-184.67	0.0189	-290.43	0.374	-0.437	0.0442	-37.80	11910	0.300	0.00	-0.00140	0.0361	0.0424
220.00	0.171	3.25	0.197	0.0430	-147.63	0.0200	-276.48	0.302	-0.600	0.0444	-37.42	14087	0.330	0.00	-0.00154	0.0492	0.0496
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





JACAM LABORATORIES

## DownHole R<sub>x</sub>

### WATER CHEMISTRY

045-11090-00  
Chevron 36-412D  
WMFK (93050)

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-412D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580    at 0000  
  
Sample ID: 67308

#### CATIONS

Calcium (as Ca)	123.40
Magnesium (as Mg)	61.15
Barium (as Ba)	0.204
Strontium (as Sr)	8.09
Sodium (as Na)	311.49
Potassium (as K)	101.20
Lithium (as Li)	7.81
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	53.61
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

#### ANIONS

Chloride (as Cl)	800.00
Sulfate (as SO <sub>4</sub> )	0.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	395.00
Bicarbonate (as HCO <sub>3</sub> )	488.00
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

#### PARAMETERS

Calculated T.D.S.	2014
Molar Conductivity	2757
Resistivity	362.70
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0788
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	6.60

#### COMMENTS

GARFIELD CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

**JACAM LABORATORIES****DownHole R<sub>x</sub>****DEPOSITION POTENTIAL INDICATORS**

BERRY PETROLEUM  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-412D O-36A PAD  
SEPARATOR

Report Date: 04-21-2014    Sampled: 03-18-2014  
Sample #: 2580                      at 0000  
  
Sample ID: 67308

**SATURATION LEVEL**

Calcite (CaCO <sub>3</sub> )	2.12
Aragonite (CaCO <sub>3</sub> )	1.72
Witherite (BaCO <sub>3</sub> )	< 0.001
Strontianite (SrCO <sub>3</sub> )	0.363
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Magnesite (MgCO <sub>3</sub> )	1.97
Anhydrite (CaSO <sub>4</sub> )	0.00
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Barite (BaSO <sub>4</sub> )	0.00
Celestite (SrSO <sub>4</sub> )	0.00
Fluorite (CaF <sub>2</sub> )	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO <sub>2</sub> )	0.00
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) <sub>3</sub> )	3744
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Siderite (FeCO <sub>3</sub> )	3040
Halite (NaCl)	< 0.001
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	0.00
Iron sulfide (FeS)	0.00

**MOMENTARY EXCESS (Lbs/1000 Barrels)**

Calcite (CaCO <sub>3</sub> )	0.103
Aragonite (CaCO <sub>3</sub> )	0.0823
Witherite (BaCO <sub>3</sub> )	-6.45
Strontianite (SrCO <sub>3</sub> )	-0.440
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.120
Magnesite (MgCO <sub>3</sub> )	0.0812
Anhydrite (CaSO <sub>4</sub> )	-227.33
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-308.58
Barite (BaSO <sub>4</sub> )	-3.80
Celestite (SrSO <sub>4</sub> )	-47.12
Fluorite (CaF <sub>2</sub> )	-15.57
Calcium phosphate	>-0.001
Hydroxyapatite	-290.52
Silica (SiO <sub>2</sub> )	-154.08
Brucite (Mg(OH) <sub>2</sub> )	0.0308
Magnesium silicate	-128.75
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Siderite (FeCO <sub>3</sub> )	0.227
Halite (NaCl)	-174960
Thenardite (Na <sub>2</sub> SO <sub>4</sub> )	-37899
Iron sulfide (FeS)	-0.00554

**SIMPLE INDICES**

Langelier	0.387
Ryznar	5.83
Puckorius	4.07
Larson-Skold Index	2.81
Stiff Davis Index	1.01
Oddo-Tomson	0.731

**BOUND IONS**

Calcium	123.40	113.84
Barium	0.204	0.204
Carbonate	2.92	0.337
Phosphate	0.00	0.00
Sulfate	0.00	0.00

**TOTAL****FREE****OPERATING CONDITIONS**

Temperature (°F)	190.00
Time(secs)	0.00

**JACAM LABORATORIES****205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096**

# DownHole SAT™ Water Analysis Report

## SYSTEM IDENTIFICATION

BERRY PETROLEUM  
CHEVRON 36-412D O-36A PAD  
ROB SIMEONE  
SEPARATOR  
GARFIELD CO

Sample ID#: 2580  
ID: 67308  
Report Date: 04-21-2014  
Sample Date: 03-18-2014  
at 0000

## WATER CHEMISTRY

### CATIONS

Calcium(as Ca)	123.40
Magnesium(as Mg)	61.15
Barium(as Ba)	0.204
Strontium(as Sr)	8.09
Sodium(as Na)	311.49
Potassium(as K)	101.20
Lithium(as Li)	7.81
Iron(as Fe)	53.61
Field Iron(as Fe)	0.00
Ammonia(as NH <sub>3</sub> )	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

### ANIONS

Chloride(as Cl)	800.00
Sulfate(as SO <sub>4</sub> )	0.00
Bromine(as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	395.00
Bicarbonate(as HCO <sub>3</sub> )	488.00
Carbonate(as CO <sub>3</sub> )	0.00
Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

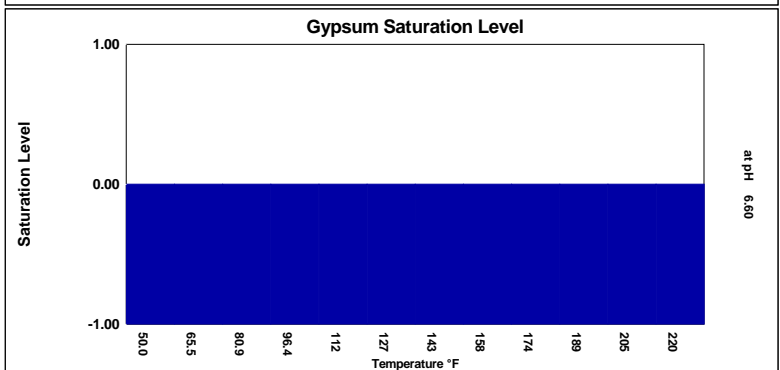
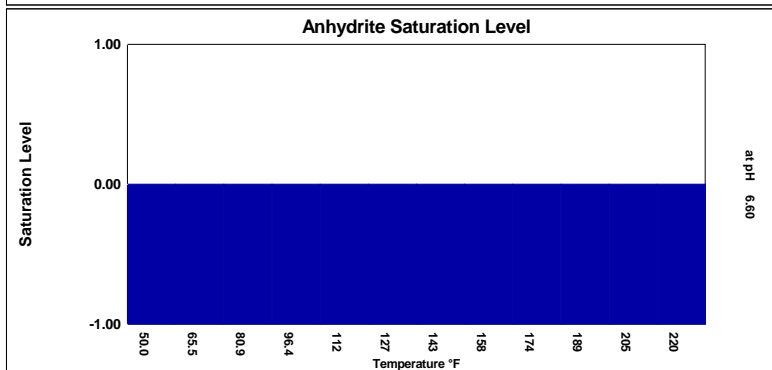
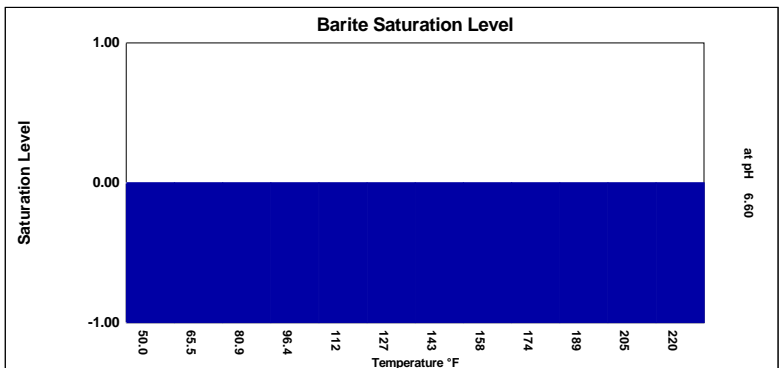
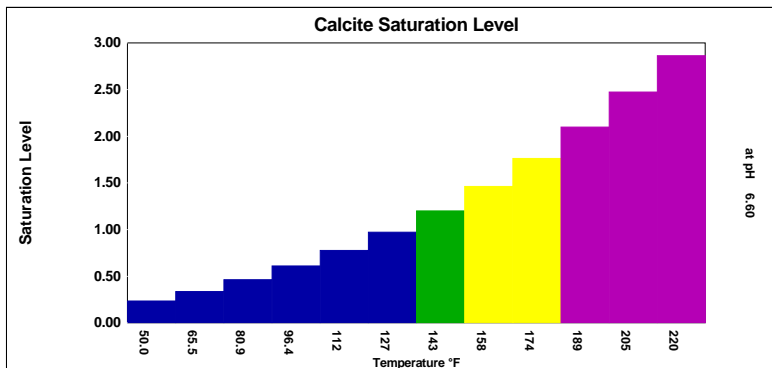
Temperature(°F)	190.00
T.D.S.	2014
Resistivity:	362.70
Sample pH	6.60
Conductivity:	2757

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## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.233	-0.189	0.00	-559.55	0.00	-454.85	0.00	-1.14	0.00	-57.44	148.27	0.0664	0.00	-0.00424	0.0810	0.0788
65.45	0.00	0.336	-0.142	0.00	-561.52	0.00	-465.48	0.00	-1.41	0.00	-58.63	240.70	0.0831	0.00	-0.00432	0.152	0.0788
80.91	0.00	0.462	-0.101	0.00	-545.93	0.00	-470.55	0.00	-1.68	0.00	-57.97	370.25	0.100	0.00	-0.00440	0.126	0.0788
96.36	0.00	0.609	-0.0646	0.00	-515.98	0.00	-470.57	0.00	-1.95	0.00	-56.34	541.70	0.117	0.00	-0.00450	0.166	0.0788
111.82	0.00	0.776	-0.0330	0.00	-475.43	0.00	-447.27	0.00	-2.20	0.00	-54.34	759.61	0.132	0.00	-0.00461	0.174	0.0788
127.27	0.00	0.971	-0.00383	0.00	-428.07	0.00	-411.56	0.00	-2.48	0.00	-52.53	1041	0.149	0.00	-0.00473	0.146	0.0788
142.73	0.00	1.20	0.0238	0.00	-377.29	0.00	-380.62	0.00	-2.77	0.00	-50.93	1398	0.166	0.00	-0.00488	0.118	0.0788
158.18	0.00	1.46	0.0504	0.00	-325.97	0.00	-353.72	0.00	-3.08	0.00	-49.52	1840	0.185	0.00	-0.00505	0.123	0.0788
173.64	0.00	1.76	0.0764	0.00	-276.33	0.00	-330.26	0.00	-3.42	0.00	-48.27	2375	0.205	0.00	-0.00526	0.127	0.0788
189.09	0.00	2.10	0.102	0.00	-229.94	0.00	-309.71	0.00	-3.78	0.00	-47.18	3000	0.226	0.00	-0.00552	0.0641	0.0788
204.55	0.00	2.47	0.127	0.00	-187.87	0.00	-291.71	0.00	-4.16	0.00	-46.24	3709	0.248	0.00	-0.00585	0.0537	0.0788
220.00	0.171	2.86	0.153	0.00	-152.01	0.00	-278.22	0.00	-4.60	0.00	-45.75	4458	0.273	0.00	-0.00635	0.0732	0.0923
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO<sub>3</sub>}/K<sub>sp</sub>. pCO<sub>2</sub> (atm) is the partial pressure of CO<sub>2</sub> in the gas phase.  
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.





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# DownHole R<sub>x</sub>

## WATER CHEMISTRY

045-11091-00  
Chevron 36-323D  
WMFK (93050)

LINN OPERATING  
ROB SIMEONE  
GARFIELD CO

CHEVRON 36-323D O-36A PAD  
WELLHEAD

Report Date: 08-24-2015    Sampled: 04-02-2015  
Sample #: 3076    at 0000  
  
Sample ID: 99513

### CATIONS

Calcium (as Ca)	12.82
Magnesium (as Mg)	7.84
Barium (as Ba)	0.811
Strontium (as Sr)	1.15
Sodium (as Na)	976.58
Potassium (as K)	16.22
Lithium (as Li)	0.828
Ammonia (as NH <sub>3</sub> )	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	267.50
Manganese (as Mn)	0.566
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

### ANIONS

Chloride (as Cl)	1000
Sulfate (as SO <sub>4</sub> )	75.00
Bromine (as Br)	0.00
Dissolved CO <sub>2</sub> (as CO <sub>2</sub> )	500.00
Bicarbonate (as HCO <sub>3</sub> )	1464
Carbonate (as CO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Boron (as B)	0.291

### PARAMETERS

Calculated T.D.S.	3892
Molar Conductivity	4438
Resistivity	225.31
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO <sub>2</sub> (atm)	0.0786
pH <sub>2</sub> S(atm)	0.00
Temperature (°F)	190.00
pH	7.20

### COMMENTS

GARFIELD CO

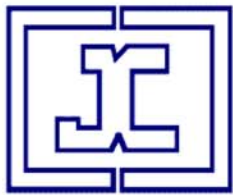
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205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096





# DownHole SAT™ Water Analysis Report



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## SYSTEM IDENTIFICATION

LINN OPERATING  
CHEVRON 36-323D O-36A PAD  
ROB SIMEONE  
WELLHEAD  
GARFIELD CO

Sample ID#: 3076  
ID: 99513  
Report Date: 08-24-2015  
Sample Date: 04-02-2015  
at 0000

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Field Iron(as Fe)	0.00
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Zinc(as Zn)	0.0820
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Chloride(as Cl)	1000
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Silica(as SiO <sub>2</sub> )	0.00
Phosphate(as PO <sub>4</sub> )	0.00
H <sub>2</sub> S (as H <sub>2</sub> S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO <sub>3</sub> )	0.00
Boron(as B)	0.291

### PARAMETERS

Temperature(°F)	190.00
T.D.S.	3892
Resistivity:	225.31

## SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO <sub>3</sub>		Anhydrite CaSO <sub>4</sub>		Gypsum CaSO <sub>4</sub> *2H <sub>2</sub> O		Barite BaSO <sub>4</sub>		Celestite SrSO <sub>4</sub>		Siderite FeCO <sub>3</sub>		Mackawenite FeS		CO <sub>2</sub> (mpy)	pCO <sub>2</sub> (atm)
50.00	0.00	0.233	-1.98	< 0.001	-686.24	0.00150	-573.55	13.80	0.445	0.00756	-50.08	7491	0.888	0.00	>-0.001	0.0809	0.0786
65.45	0.00	0.330	-1.55	< 0.001	-689.35	0.00140	-586.41	9.15	0.427	0.00720	-51.57	12165	1.11	0.00	>-0.001	0.152	0.0786
80.91	0.00	0.449	-1.15	< 0.001	-672.57	0.00133	-593.07	6.45	0.405	0.00730	-51.05	18696	1.34	0.00	>-0.001	0.126	0.0786
96.36	0.00	0.585	-0.781	< 0.001	-639.37	0.00130	-594.03	4.80	0.380	0.00764	-49.45	27283	1.57	0.00	>-0.001	0.165	0.0786
111.82	0.00	0.737	-0.452	0.00101	-593.90	0.00139	-568.18	3.74	0.351	0.00812	-47.45	38060	1.78	0.00	>-0.001	0.173	0.0786
127.27	0.00	0.910	-0.141	0.00119	-540.34	0.00158	-527.83	2.96	0.317	0.00859	-45.63	51714	2.01	0.00	>-0.001	0.145	0.0786
142.73	0.00	1.11	0.158	0.00145	-482.49	0.00176	-492.75	2.36	0.276	0.00906	-44.02	68537	2.25	0.00	>-0.001	0.118	0.0786
158.18	0.00	1.33	0.448	0.00182	-423.55	0.00196	-462.09	1.90	0.227	0.00951	-42.59	88435	2.50	0.00	>-0.001	0.123	0.0786
173.64	0.00	1.57	0.729	0.00236	-366.03	0.00215	-435.12	1.55	0.169	0.00995	-41.31	110795	2.77	0.00	>-0.001	0.127	0.0786
189.09	0.00	1.83	1.00	0.00313	-311.73	0.00234	-411.26	1.27	0.102	0.0104	-40.14	134315	3.05	0.00	>-0.001	0.0640	0.0786
204.55	0.00	2.11	1.27	0.00424	-261.86	0.00254	-390.07	1.06	0.0250	0.0108	-39.08	157001	3.34	0.00	>-0.001	0.0536	0.0786
220.00	0.171	2.38	1.52	0.00579	-218.99	0.00269	-374.35	0.870	-0.0711	0.0111	-38.52	176007	3.65	0.00	>-0.001	0.0731	0.0920
		xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels		

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