PASADENA

Pasadena Water and Power

Sunset Reservoir Wells Perchlorate Investigation Water Types

Presented by
David Kimbrough, Ph.D., Water Quality Manager

Presented to
United States Environmental Protection Agency
Jet Propulsion Laboratories, Pasadena
April 30, 2013

Water Types

Pasadena Water and Power

1. Type 1: **Calcium-bicarbonate groundwater** − Groundwater with calcium as the dominant cation and bicarbonate as the dominant anion. Type 1 water appears to originate as runoff from the San Gabriel Mountains and enters the study area through the Arroyo Seco and the spreading grounds.
2. Type 2: **Sodium-bicarbonate groundwater** − Groundwater with sodium as the dominant cation and bicarbonate as the dominant anion. Type 2 water is typically found in deeper portions of the aquifer.
3. Type 3: **Calcium-bicarbonate/chloride/sulfate groundwater** − Groundwater with calcium as the dominant cation and bicarbonate the dominant anion, but with relatively elevated chloride and sulfate concentrations. This water type consistently has higher levels of TDS than the other two types.

2

PASADENA

Water Types - 2

Pasadena Water and Power

What does *"consistently has higher levels of TDS"* mean?

There were 41 samples Collected in 2005 for the TM, The Results are Summarized Here

	Ca	Na	TDS
Minimum	5.3	14	160
Median	61	35	324
80th %ile	97	53	535
Maximum	152	81	925

PASADENA

Type 1 & 3 Waters

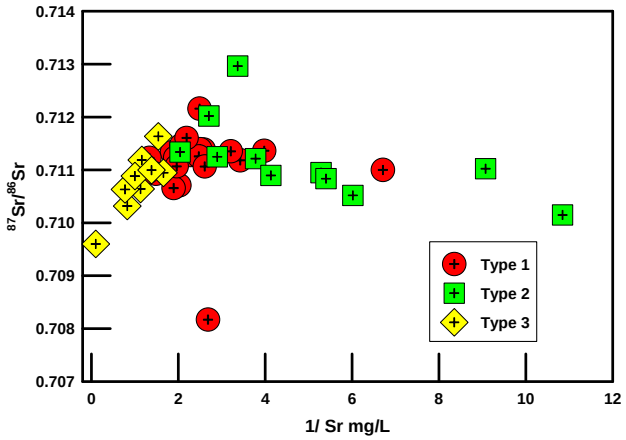
Well	Calcium mg/L	Sodium mg/L	Ca/Na	TDS mg/L	Type
MW 17-2	**106**	**24.5**	**4.33**	**695**	**3**
MW 20-1	82	20	4.10	440	1
MW 20-2	51.2	13.8	3.71	275	1
MW 21-1	**126**	**34.2**	**3.68**	**760**	**3**
MW 21-3	**150**	**44.4**	**3.38**	**900**	**3**
MW 19-2	**115**	**34.4**	**3.34**	**736**	**3**
LAWC No. 3	61.2	19	3.22	324	1
MW 21-4	**96.8**	**30.5**	**3.17**	**545**	**3**
MW 25-1	**98.7**	**32**	**3.08**	**610**	**3**
LFWC No. 2	73.5	24	3.06	460	1
Sunset	108	37	2.92	420	1
MW 17-3	**73.6**	**25.6**	**2.88**	**535**	**3**
MW 24-1	55.6	19.4	2.87	300	1
MW 21-5	**99.6**	**35.3**	**2.82**	**590**	**3**
MW 18-2	56.8	20.3	2.80	276	1
MW 18-3	66.2	23.8	2.78	316	1
MW 18-1	41.9	15.8	2.65	236	1
MW 17-1	35.5	14.4	2.47	190	1
MW 1	68.3	30	2.28	360	1
MW 19-3	64.8	28.9	2.24	426	1
MW 21-2	**152**	**70.5**	**2.16**	**925**	**3**
MW 19-1	42.5	19.8	2.15	240	1
MW 19-4	69.7	33.3	2.09	494	1
MW 19-5	67.8	35.9	1.89	504	1
MW 25-3	68.4	39.5	1.73	414	1
MW 18-4	39	29.3	1.33	224	1
Garfield	41.6	35	1.19	274	1
Bangham	55.5	50	1.11	380	1
MW 25-4	64.5	58.4	1.10	420	1
MW 17-5	65.7	59.8	1.10	185	1

Type 2 Waters

Well	Calcium mg/L	Sodium mg/L	Ca/Na	TDS mg/L	Type
MW-20-3	51	58	0.9	340	2
MW-24-5	34	40	0.9	235	2
MW-24-2	33	44	0.8	270	2
MW-24-3	19	45	0.4	235	2
MW-17-4	18	47	0.4	235	2
MW-25-5	22	68	0.3	264	2
MW-24-4	10	43	0.2	175	2
MW-20-4	13	59	0.2	205	2
MW-25-2	15	81	0.2	324	2
MW-18-5	9	53	0.2	160	2
MW-20-5	5	64	0.1	180	2

Relation Between 1/[Sr] vs. $^{87}Sr/^{86}Sr$ & Water Type

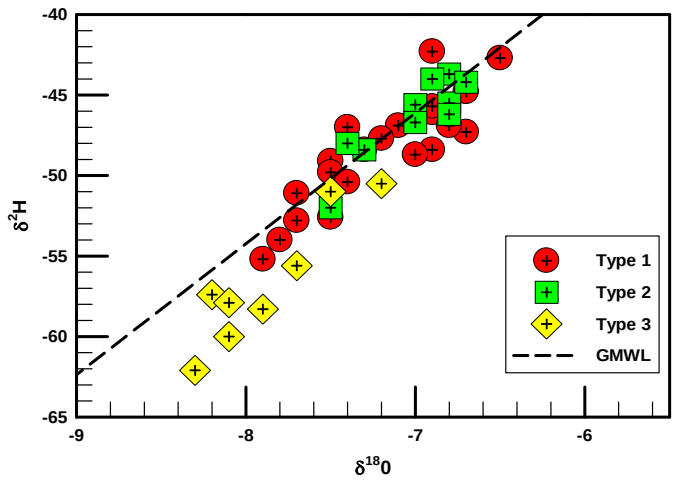
Pasadena Water and Power



PASADENA

SIA Analysis of Water in Raymond Basin Wells with by Water Type

Pasadena Water and Power



PASADENA

Conclusions

Pasadena Water and Power

1. Using these definitions:
   1. Type 1 Ca:Na >1
   2. Type 2 Ca:Na <1**(Low Sr, Low NO_3)**
   3. Type 3 Ca:Na >1 & TDS >80th Percentile (535 mg/L) **(High Sr, High NO_3)**
2. Type 2 and Type 3 waters do not overlap in strontium chemistry but Type 1 overlaps with both Type 2 and Type 3.
3. Sunset Reservoir Wells, all Type 1, appear to have little ClO_4 influence from the LCF or the Colorado River.

PASADENA