



TECHNICAL MEMORANDUM

TO: Michael LeBrun, General Manager NCSD
FROM: Brad Newton, Ph.D., P.G.
RE: Technical Memorandum #29 - Spring 2014 Ground Water Index
DATE: June 17, 2014

INTRODUCTION

Groundwater surface elevations (GSE) underlying the Nipomo Mesa are regularly measured at many places (wells) across the mesa. The Spring 2014 Ground Water Index (GWI) has been computed from GSE and presented herein along with historical GWI from 1975 to present based on these groundwater surface elevation measurements collected during spring and fall across the Nipomo Mesa. Limited measurements of GSE were available for the years 1982, 1983, 1984, 1994 and 1997, thus precluding a reliable calculation of GWI for those years.

The Nipomo Mesa Management Area (NMMA) Technical Group (TG) has not reviewed this technical memorandum, its findings, or any presentation of this evaluation.

RESULTS

The Spring 2014 GWI is -0.0163, and is now the lowest Spring value on record (Table 1, Figure 1). The Spring 2013 Key Well Index (KWI) has also declined to its lowest value on record and generally follows the same historical trends as the GWI (Figure 1). The 2013 Water Year (WY) rainfall (8.07 inches) was approximately 50 percent of the long-term average (16.55 inches), and the 2014 WY rainfall (5.75 inches) to-date is approximately 35 percent of the long-term average. With the current drought conditions and ongoing groundwater pumping, there is great cause for concern given that the fall and spring groundwater elevations have declined significantly across the Nipomo Mesa.

METHODOLOGY

The calculation of spring and fall GWI are based on GSE measurements regularly made by San Luis Obispo County Department of Public Works (SLO DPW), NCSD, USGS, and Woodlands. The integration of GSE data is accomplished by using computer software to interpolate between measurements and calculate GWI within the principal production aquifer assuming an unconfined aquifer and a specific yield of 11.7 percent. Limited measurements of GSE were available for the years 1982, 1983, 1984, 1994 and 1997, precluding a reliable calculation of GWI for those years.

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Groundwater Surface Elevation Measurements

Groundwater surface elevation data were obtained from SLO DPW, NCSD, USGS, and Woodlands. SLO DPW measures GSE in monitoring wells during the spring (April) and the fall (October) of each year. Woodlands and NCSD measures GSE in their monitoring wells monthly. For the years 1975 to 1999, available representative GSE data were used to compute GWI. For the years 2000 to 2011, only GSE data from the same 45 wells were used to compute GWI.

The GSE data was reviewed in combination with well completion reports and historical hydrographic records in order to exclude measurements that likely do not accurately represent static water levels within the principal production aquifer. Wells that do not access the principal production aquifer or were otherwise determined to not accurately represent static water levels within the aquifer were not included in analysis.

Groundwater Surface Interpolation

The individual GSE measurements from each year were used to produce a GSE field by interpolation using the inverse distance weighting (IDW) method.

Ground Water Index

The GWI is defined as the annually normalized value of the saturated volume above sea level and bedrock multiplied by the specific yield of 11.7 percent. The GWI is comprised from approximately 45 ground water elevation measurements made by the County of San Luis Obispo each April and October. The value of the Ground Water Index was computed for an area approximately similar to the NMMA Boundary. The base of the saturated volume is mean sea level surface (elevation equals zero) or the bedrock above sea level, whichever is higher. The bedrock surface elevation is based on Figure 11: Base of Potential Water-Bearing Sediments, presented in the report, Water Resources of the Arroyo Grande - Nipomo Mesa Area (DWR 2002). The bedrock surface elevation was preliminarily verified by reviewing driller reports obtained from DWR. The specific yield is based on the average weighted specific yield measurement made at wells within the Nipomo Mesa Hydrologic Sub-Area (DWR 2002, pg. 86). The GWI is similar to the Key Well Index presented in the Nipomo Mesa Management Area Technical Group annual report to the Court, but is not directly comparable.

Key Well Index

The Key Well Index (KWI) was developed by the NMMA Technical Group from eight inland wells representing the whole of the groundwater basin within the NMMA. The Key Well Index was defined for each year from 1975 to present as the average of the normalized spring groundwater data from each well. The lowest value of the Key Well Index could be considered the "historical low" within the NMMA.

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2 **REFERENCES**

3 Department of Water Resources (DWR). 2002. Water Resources of the Arroyo Grande – Nipomo
4 Mesa Area, Southern District Report. 2002.

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**Spring and Fall
Groundwater Index
(GWI, Unitless)**

Year	Rainfall (inches)	Spring GWI	Number of Wells	Fall GWI	Number of Wells	Spring to Fall Difference
1975	17.29	0.3252	54	0.2602	54	0.0650
1976	13.45	0.1870	45	0.1382	65	0.0488
1977	10.23	0.0407	59	(0.0407)	63	0.0813
1978	30.66	0.2033	62		35	--
1979	15.80	0.1057	57	0.1463	63	(0.0407)
1980	16.57	0.2358	55	0.2439	46	(0.0081)
1981	13.39	0.3089	46	0.1301	47	0.1789
1982	18.58	0.5203	42		31	--
1983	33.21		35	0.2927	42	--
1984	11.22		14	0.1382	37	--
1985	12.20	0.3821	37	0.1870	41	0.1951
1986	16.85	0.3171	51	0.0650	51	0.2520
1987	11.29	0.1951	48	0.0976	52	0.0976
1988	12.66	0.1707	51	0.0569	49	0.1138
1989	12.22	0.0000	47	(0.0976)	57	0.0976
1990	7.12	0.0244	55	(0.0813)	53	0.1057
1991	13.18	0.0244	52	(0.0325)	54	0.0569
1992	15.66	0.0163	52	(0.1951)	48	0.2114
1993	20.17	0.1057	54	(0.0569)	61	0.1626
1994	12.15	0.0081	54		36	--
1995	25.87	0.2276	35	0.1220	52	0.1057
1996	16.54	0.1382	45	0.0244	57	0.1138
1997	20.50		20	0.2602	48	--
1998	33.67	0.3740	41	0.2764	44	0.0976
1999	12.98	0.3821	56	0.2358	49	0.1463
2000	21.62*	0.3984	44	0.2033	41	0.1951
2001	10.25*	0.4797	43	0.2114	35	0.2683
2002	14.47	0.3008	29	0.1626	41	0.1382
2003	11.39	0.2846	37	0.0569	42	0.2276
2004	12.57	0.2439	42	0.1789	35	0.0650
2005	22.23	0.3171	38	0.1626	39	0.1545
2006	20.83	0.3902	44	0.1545	41	0.2358
2007	7.11	0.2764	44	0.0569	42	0.2195
2008	15.18	0.1951	43	0.0488	42	0.1463
2009	10.31	0.1382	44	0.0488	43	0.0894
2010	20.07	0.1707	45	0.0650	42	0.1057
2011	34.05	0.2276	43	0.1789	43	0.0488
2012	15.35	0.2439	45	0.0488	44	0.1951
2013	8.07*	0.0650	45	(0.1382)	42	0.2033
2014	5.75	(0.0163)	45			

--: Insufficient for evaluation

*: Preliminary value

Table 1: Unitless GWI computed from Spring 1975 to Fall 2013.

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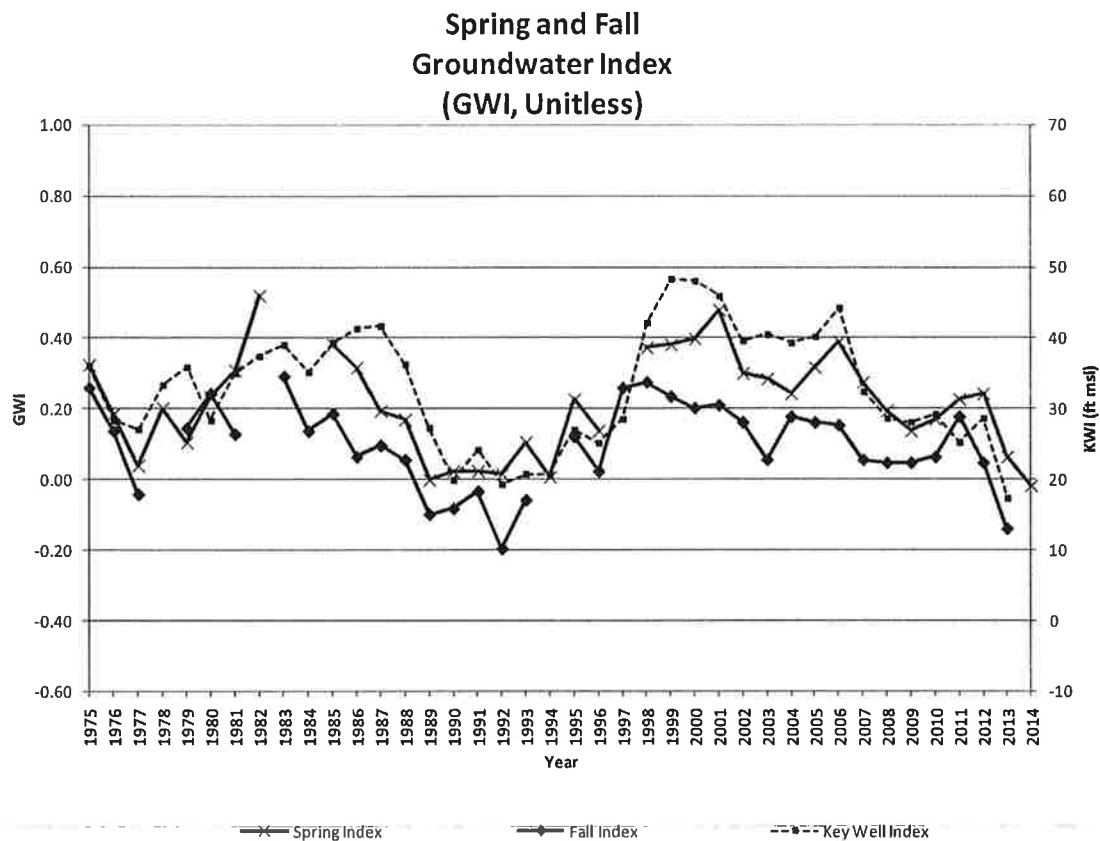
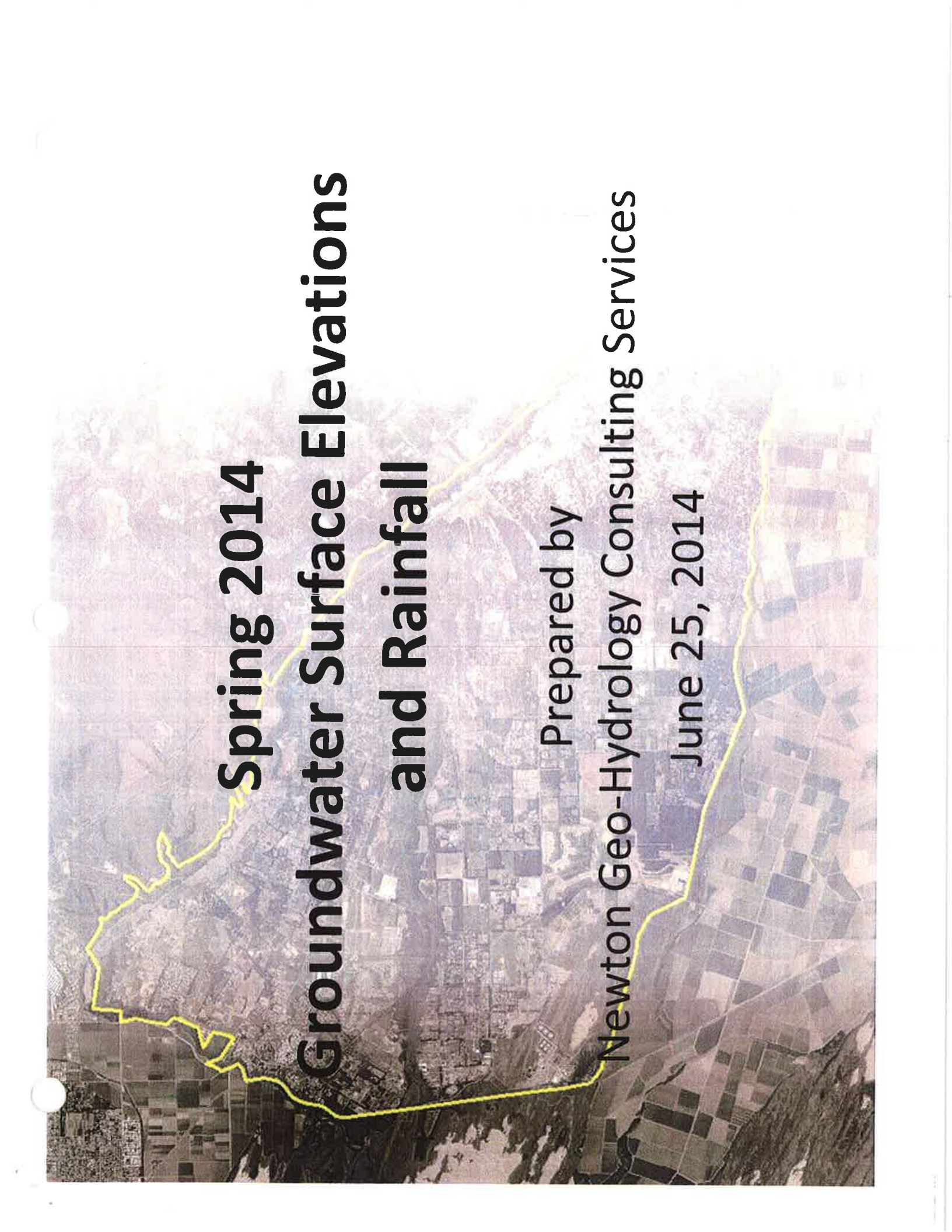


Figure 1: GWI and KWI from 1975 to present.

An aerial photograph of a rural landscape, likely in a semi-arid region, showing a patchwork of fields and some buildings. A yellow line is drawn across the image, possibly indicating a boundary or a specific area of interest. The text is overlaid on the image.

Spring 2014 Groundwater Surface Elevations and Rainfall

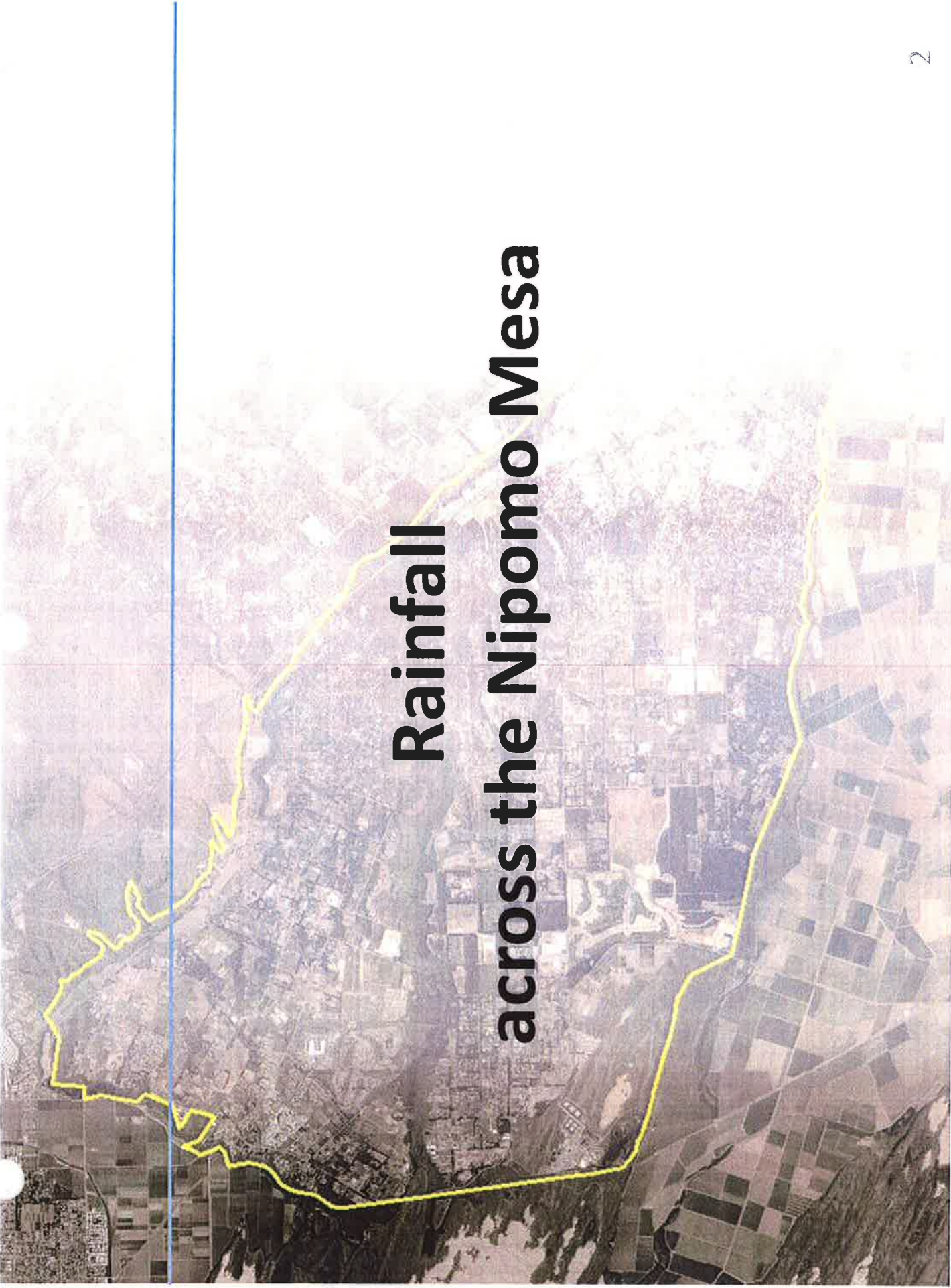
Prepared by
Newton Geo-Hydrology Consulting Services

June 25, 2014

Overview

- Rainfall

- Spring 2014
Ground Water Index

An aerial photograph of a landscape, likely Nipomo Mesa, showing a patchwork of agricultural fields in various shades of brown, tan, and green. A yellow line traces a boundary across the terrain, starting from the bottom left, curving around the right side, and extending towards the top. A thin blue vertical line runs parallel to the left edge of the image. The text "Rainfall across the Nipomo Mesa" is overlaid in the center.

Rainfall across the Nipomo Mesa

Annual Data

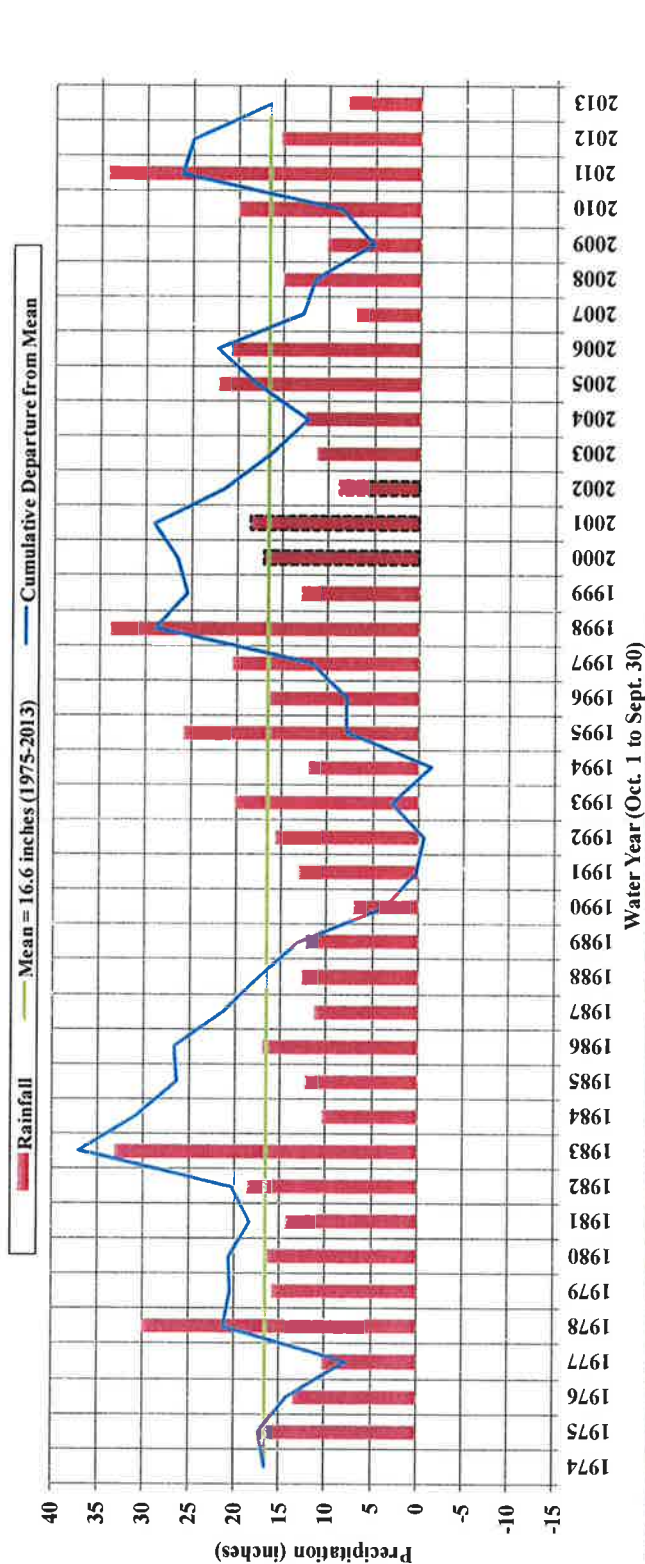
2013-2014

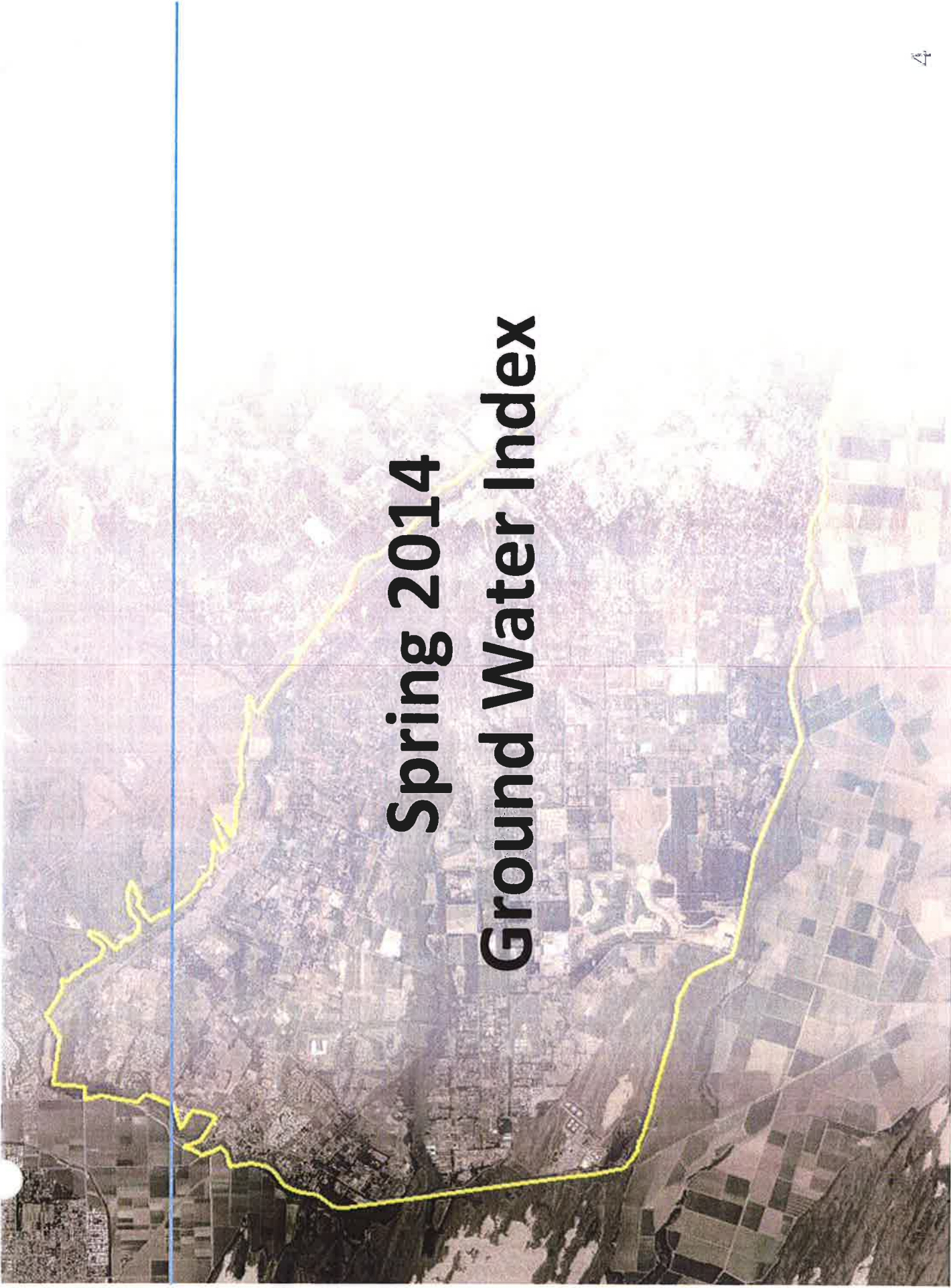
Nipomo East (728)
Currently – 5.75 in.

Nipomo South (730)
Currently – 4.65 in.

Oceano (795)
Currently – 2.92 in.

Cumulative Departure from the Mean Rainfall
Nipomo CDF (151.1)



An aerial photograph of a rural landscape, likely a farm or ranch, with a yellow boundary line tracing a path through the fields. A blue vertical line is drawn on the left side of the image. The text "Spring 2014" and "Ground Water Index" is overlaid on the image.

Spring 2014 Ground Water Index

Spring and Fall
Groundwater Index
(GWI, Unitless)

Year	Rainfall (inches)	Spring GWI	Number of Wells	Fall GWI	Number of Wells	Spring to Fall Difference
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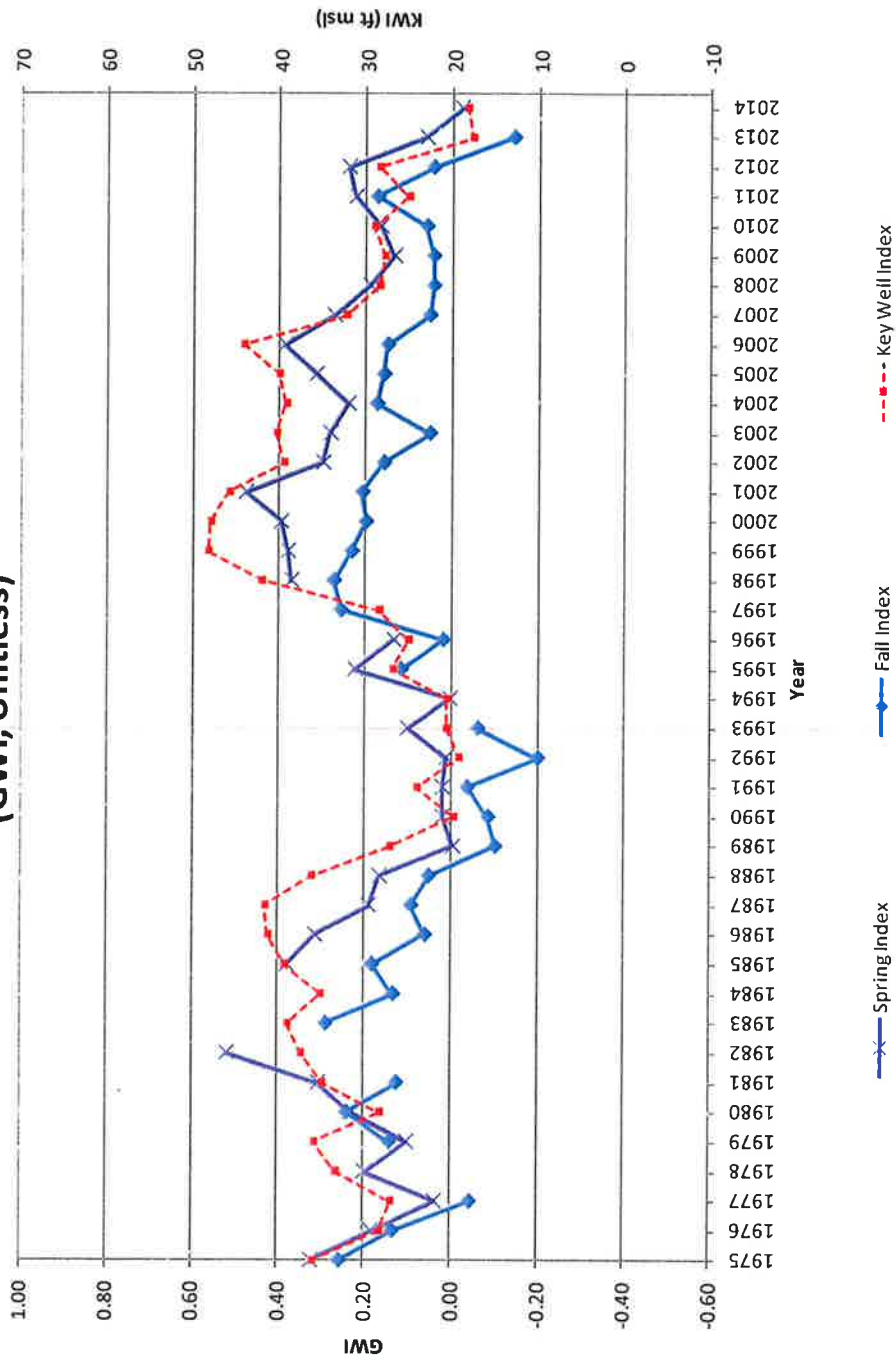
— Insufficient for evaluation

*: Preliminary value

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GWI

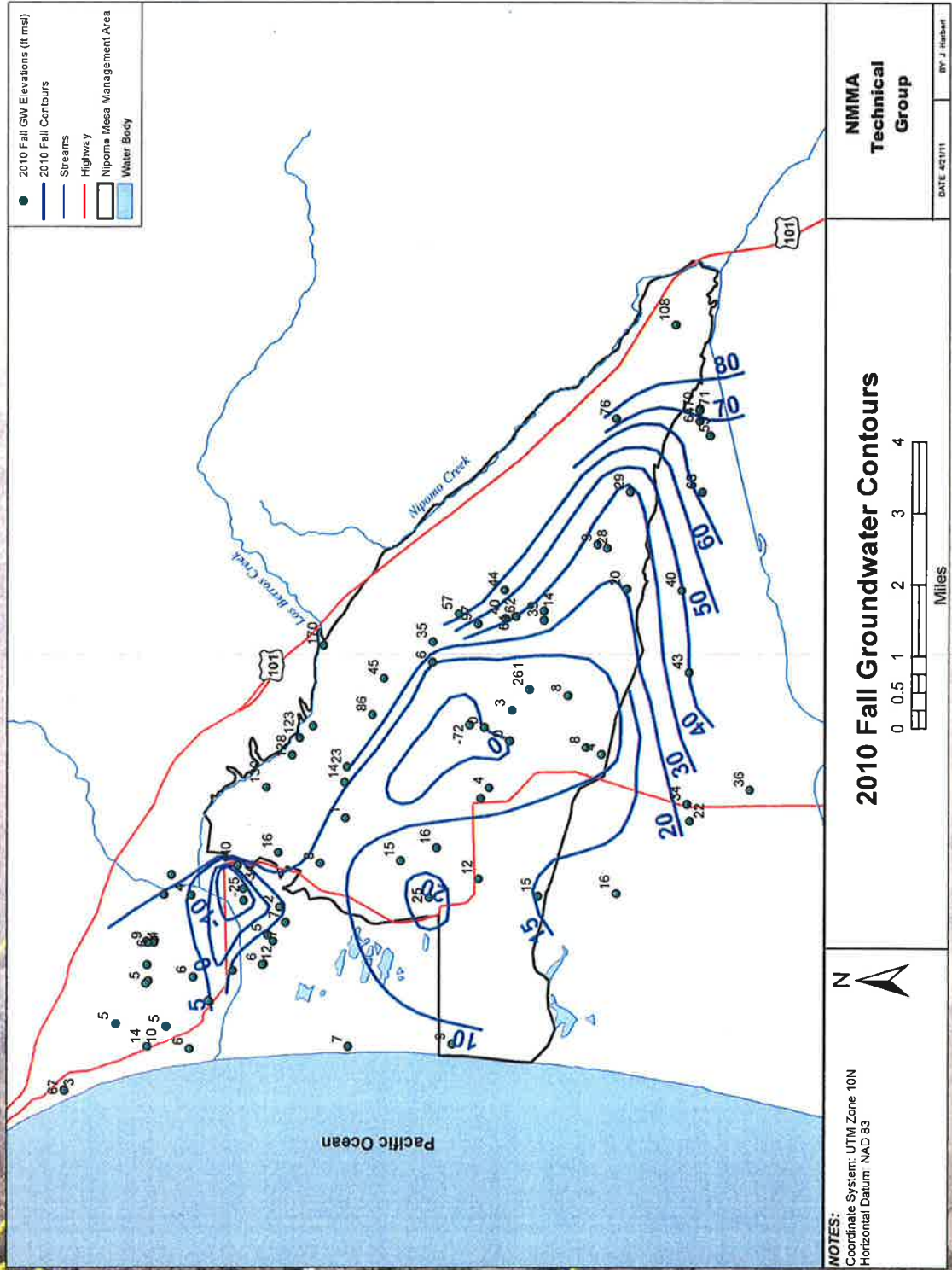
Spring and Fall
Groundwater Index
(GWI, Unitless)



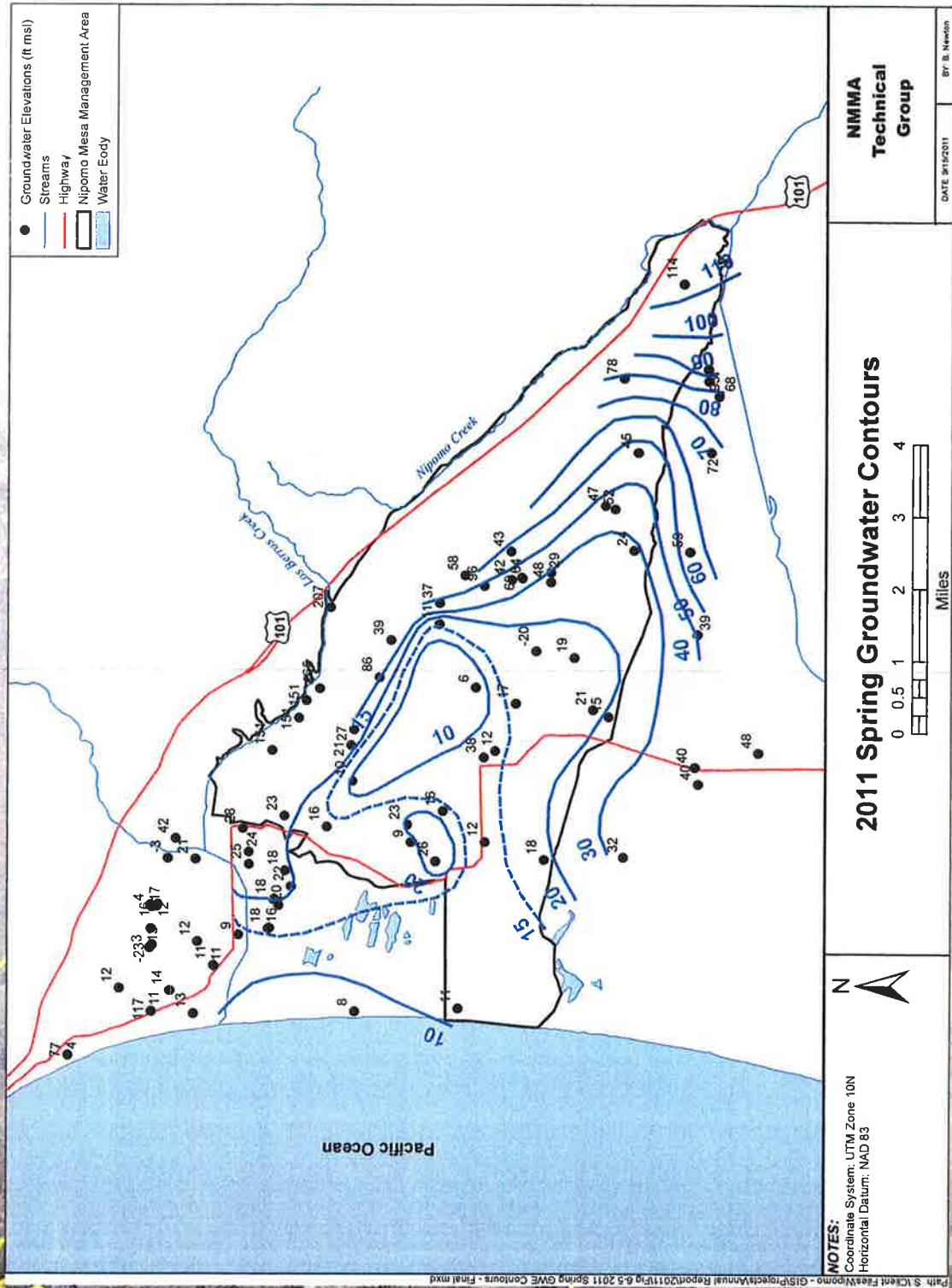
Spatial Distribution

- Groundwater surface elevations are not uniform
- Lowest water levels are in the central and western portion of the Nipomo Mesa
- GWE have declined significantly in a large area in the western portion of the Nipomo Mesa

Groundwater Elevation Map

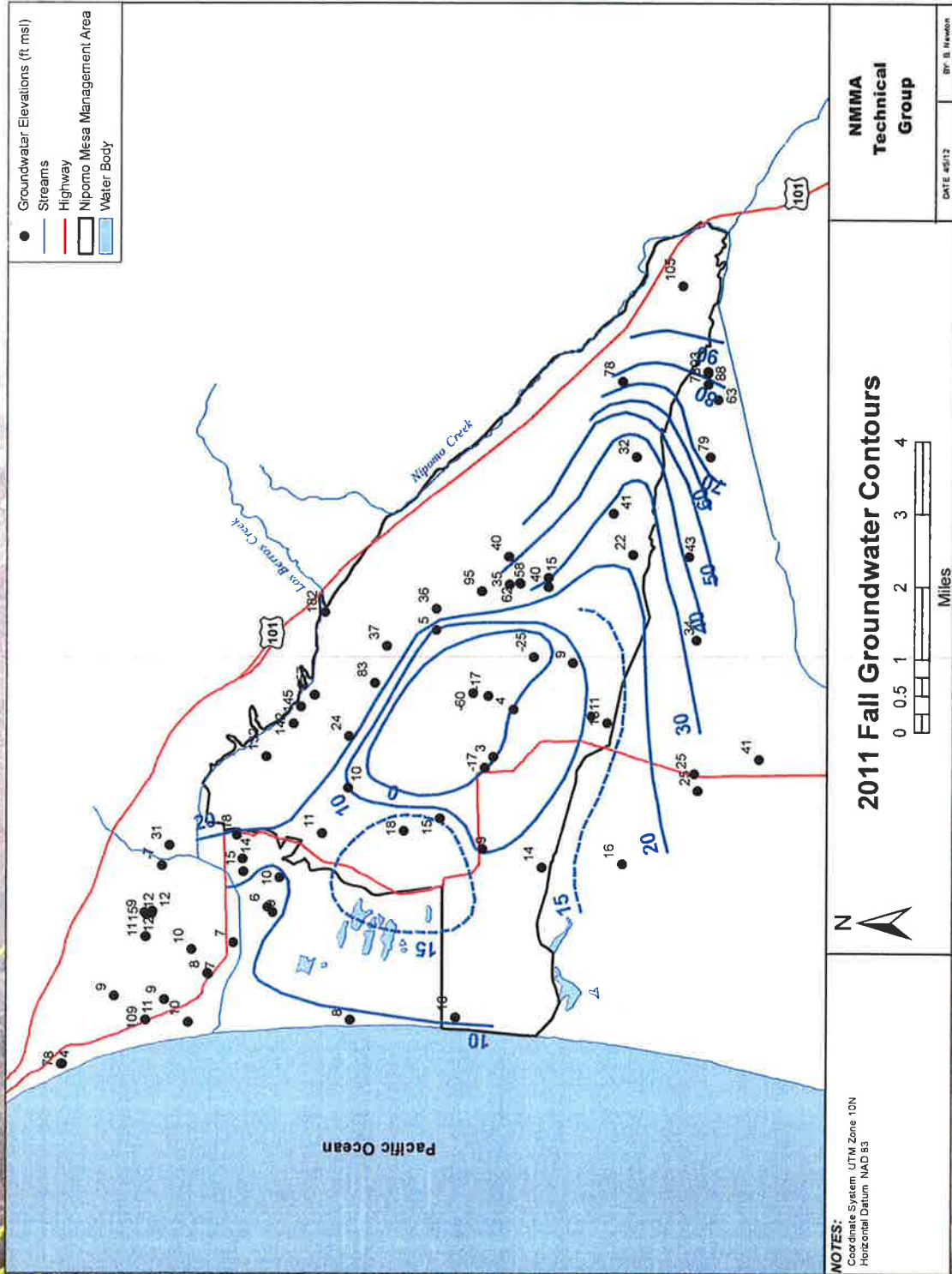


Groundwater Elevation Map

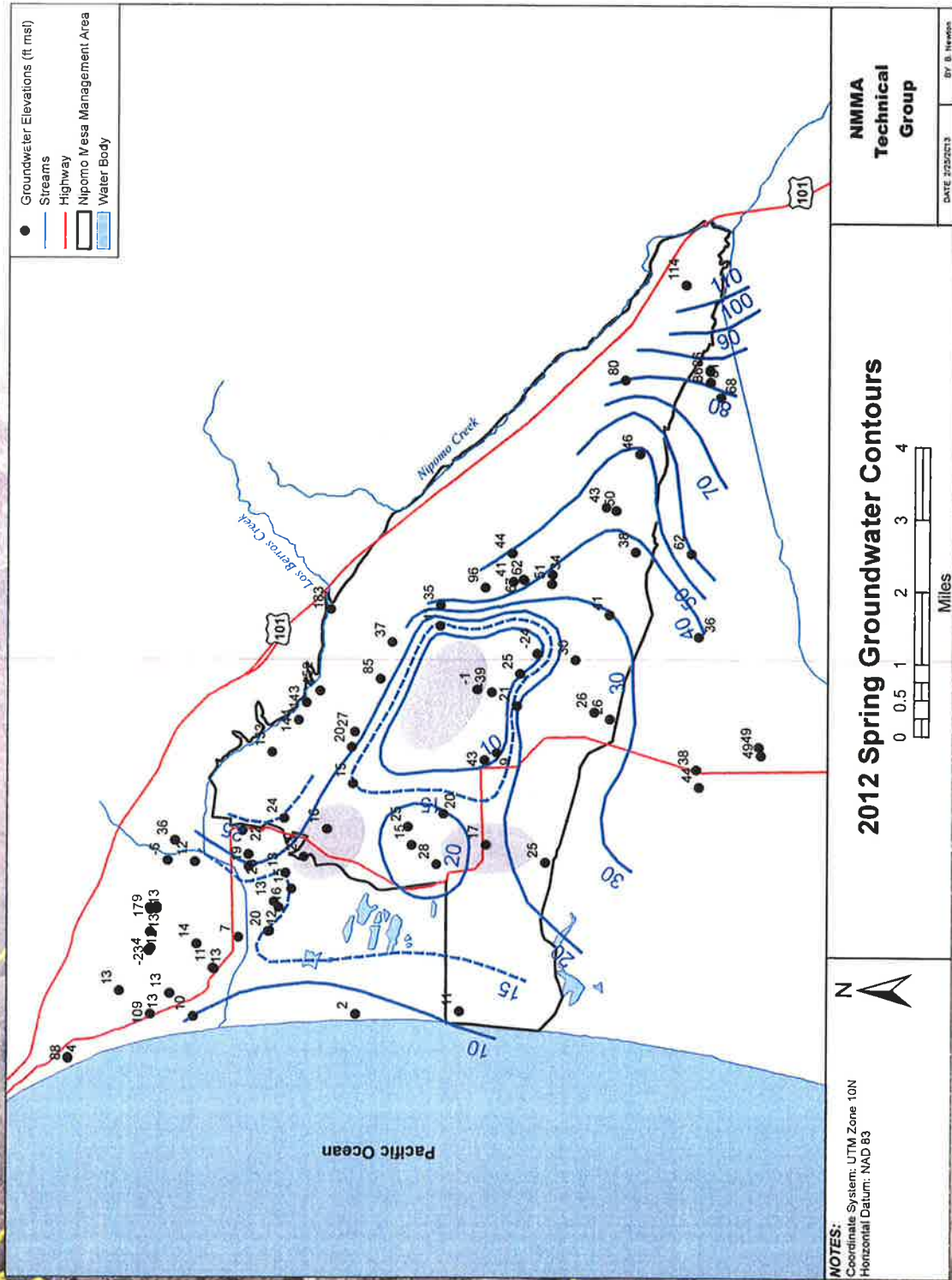


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Groundwater Elevation Map

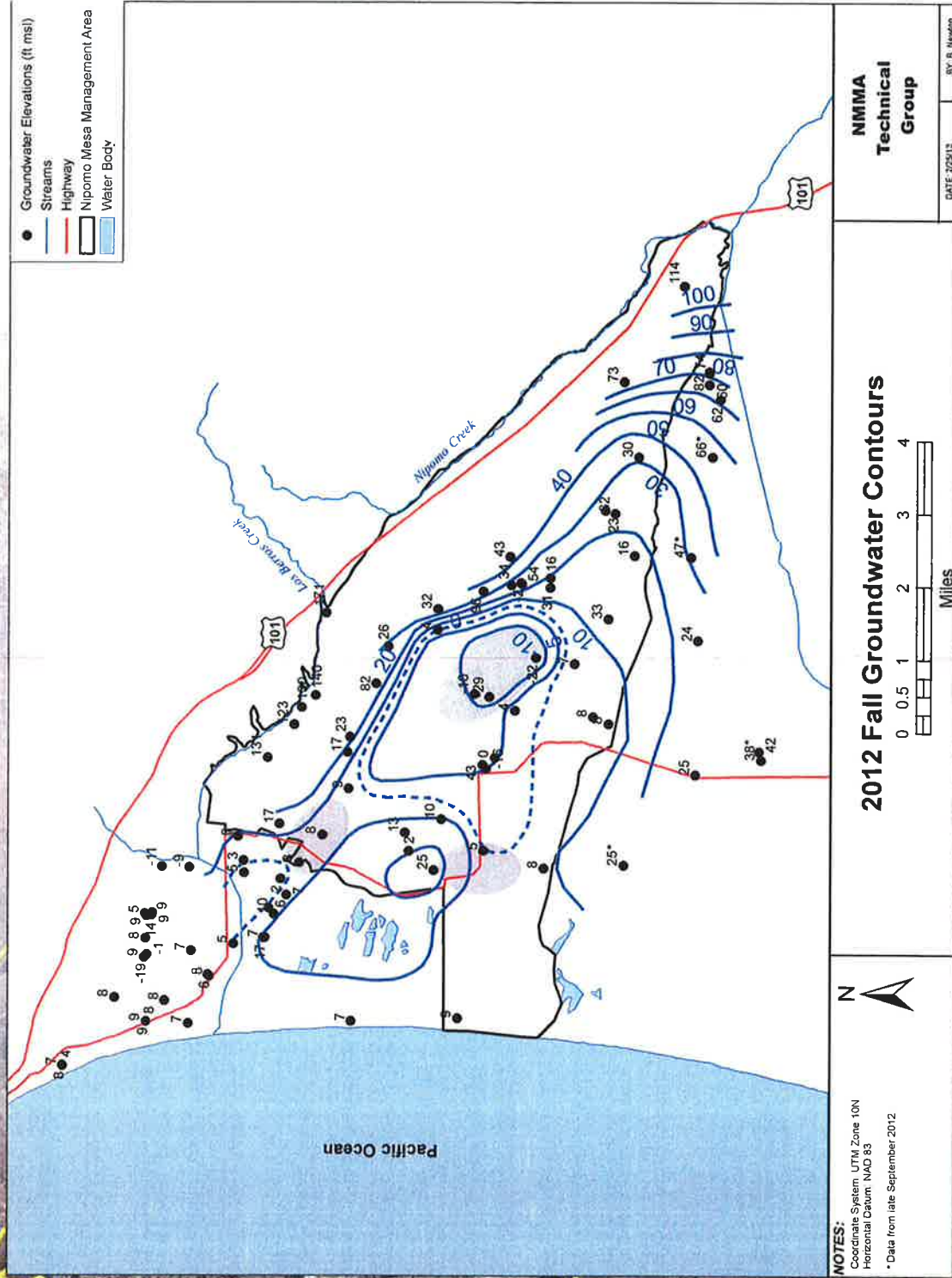


Groundwater Elevation Map

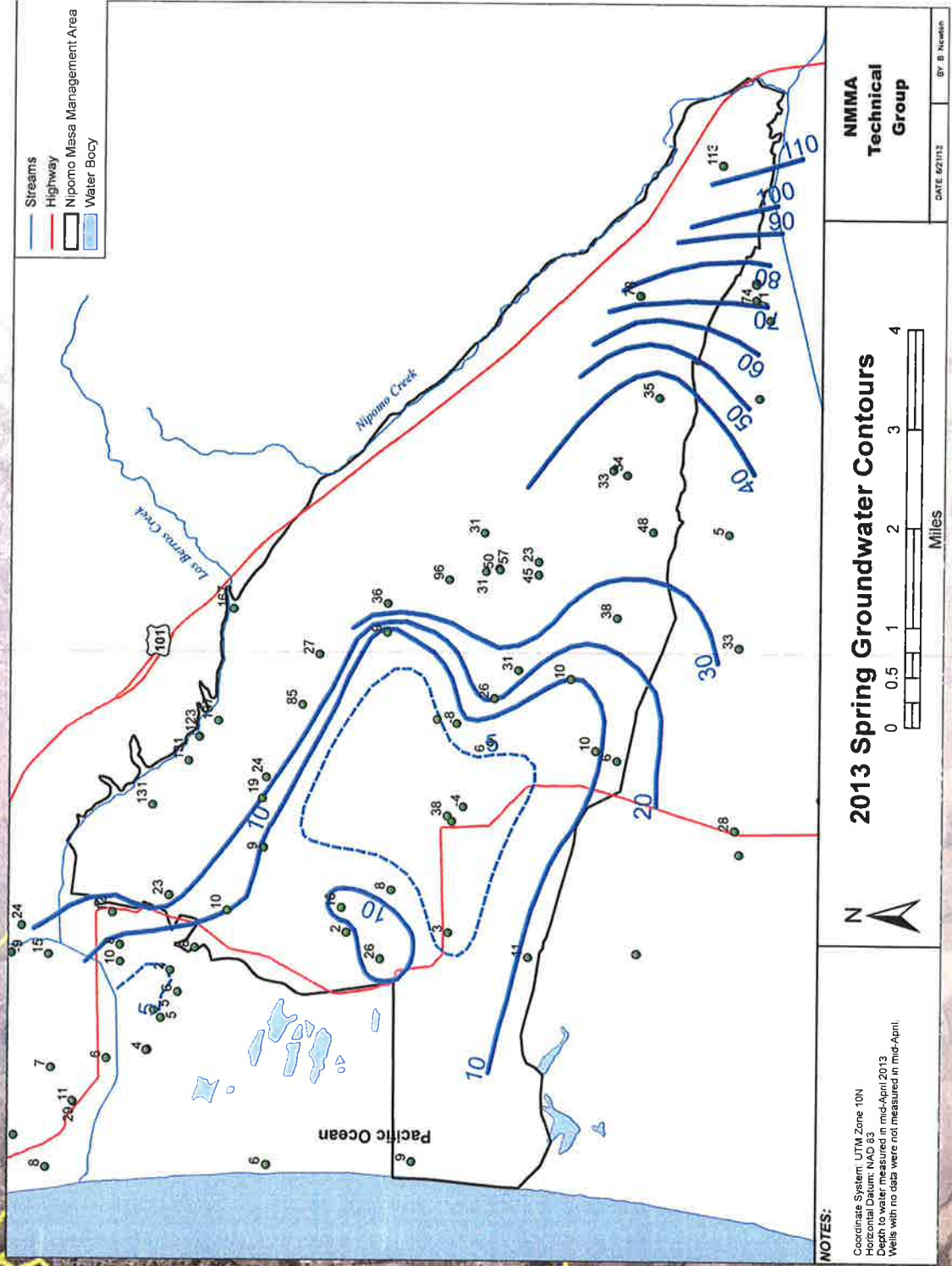


Spring 2014 GWI

Groundwater Elevation Map

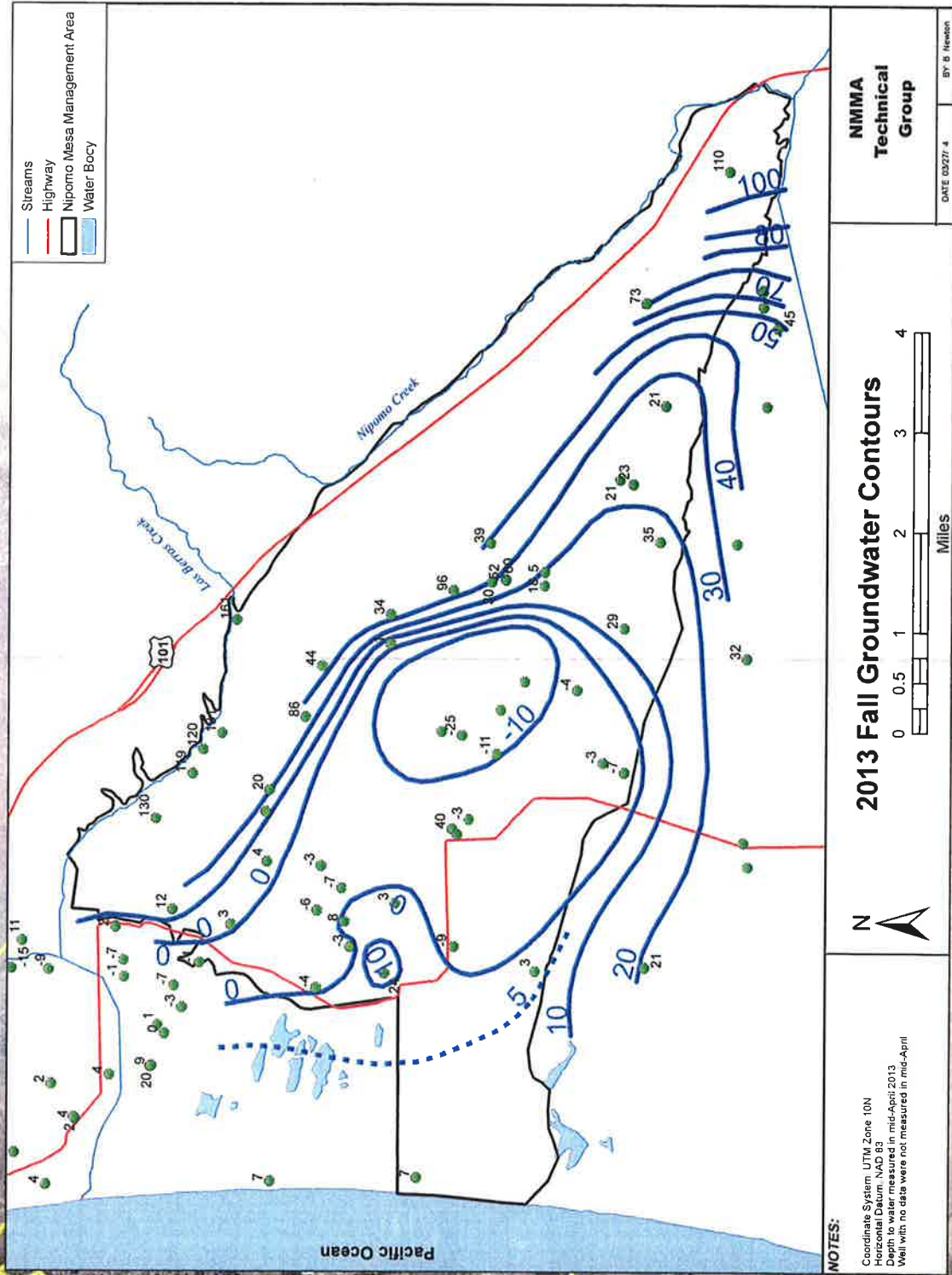


Groundwater Elevation Map

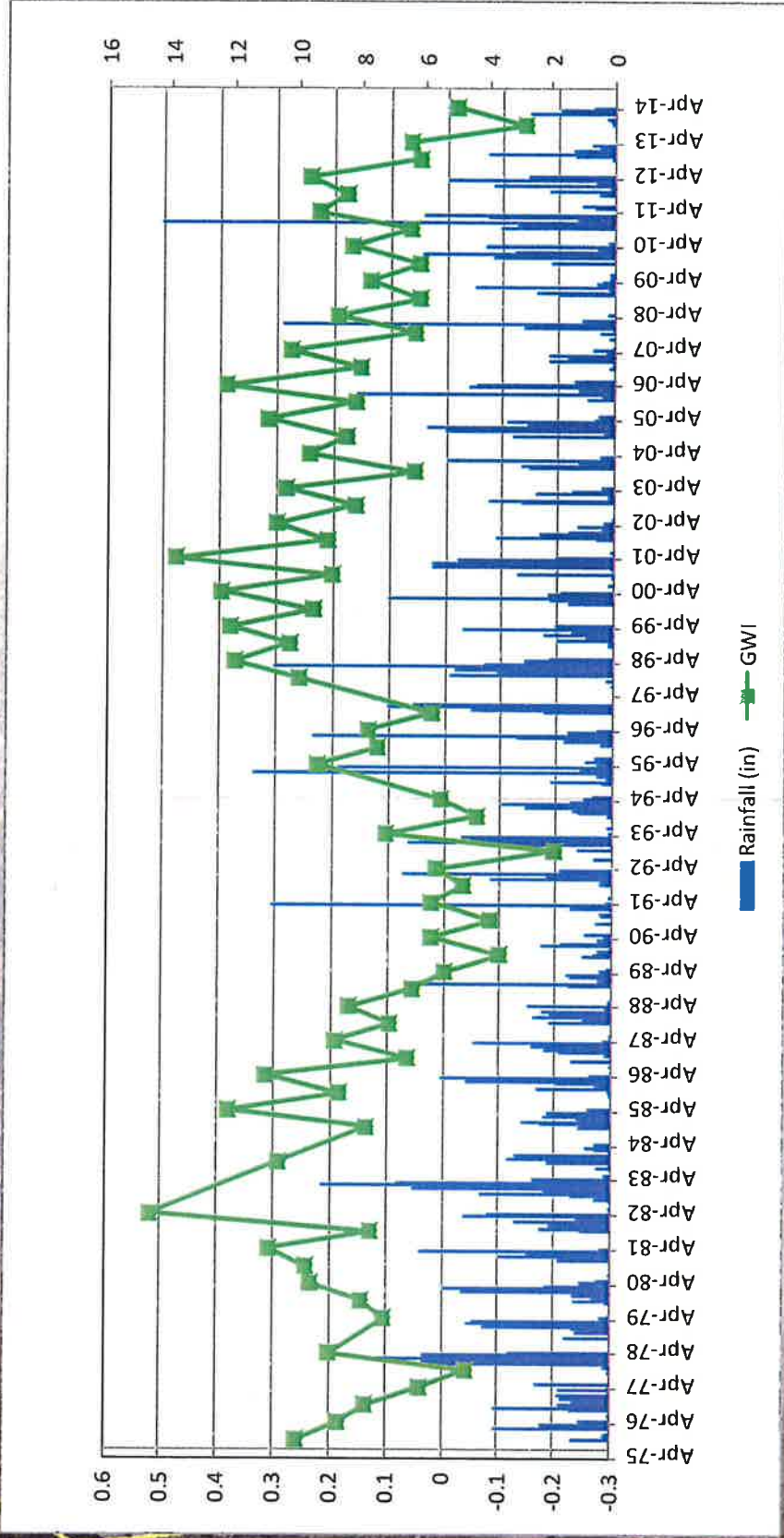


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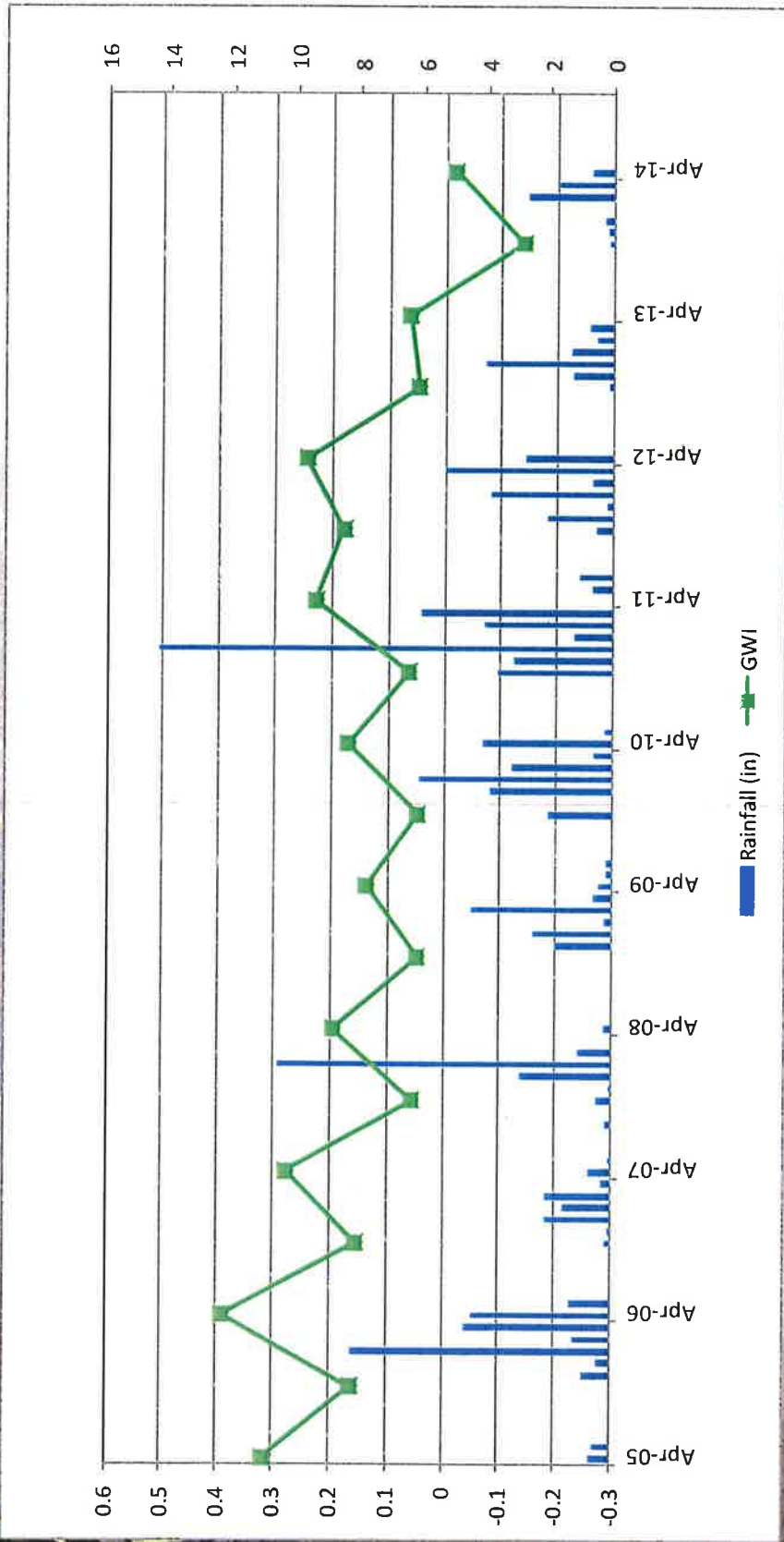


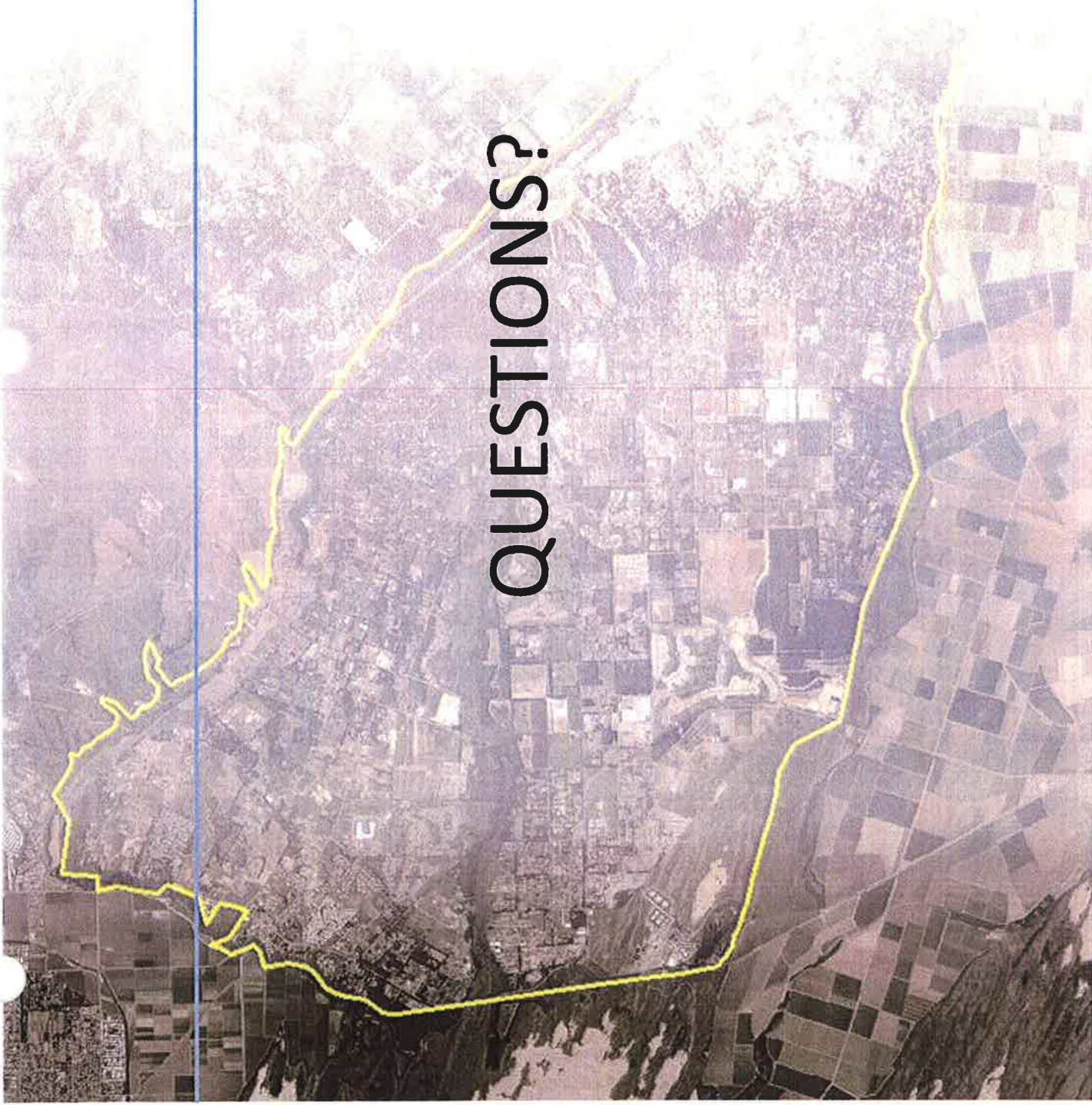
When it rains matters!



Spring 2014 GWI

When it rains matters!



An aerial photograph of a landscape, likely a rural or semi-rural area. The terrain is divided into numerous small, irregular plots of land, some of which are green, suggesting vegetation or crops. A prominent yellow line outlines a large, irregular area that covers most of the central and right portions of the image. A thin blue vertical line runs from the top to the bottom of the image, positioned towards the left side. The overall color palette is dominated by earthy tones like brown, tan, and green.

QUESTIONS?

