



November 13, 2014

To: Members of the Seismic Monitoring Advisory Committee,
Southeast Geysers Effluent Pipeline Project (SEGEP)

Fm: Northern California Power Agency

Re: SEGEP Operation and Seismicity Report for April 1 through September 30, 2014

A. Pipeline Operations

The Southeast Geysers Effluent Pipeline ("SEGEP") has been in operation for 17 years and has delivered approximately 48.2 billion gallons of water at an average rate of 5,384 gpm to The Geysers steam field for injection. **Figure 1** illustrates the daily delivery rates since the beginning of the project.

During the more recent six month period of April 1, 2014 through September 30, 2014, the SEGEP Pipeline has been in operation almost every day (**Figure 2**). Due to drought conditions, pipeline delivery rates were reduced on May 1, 2014 from an average of 8.11 million gallons per day (MGD) to an average of 3.02 MGD. This reduction in flow remains in effect until further notice. It is dependent on water levels in Clear Lake. The Rumsey gauge at Clear Lake needs to 3.5 ft or higher by May 1, 2015 before additional water can be taken from the lake to supplement wastewater being pumped to The Geysers (**Figure 3**).

B. Observed Seismicity

Seismic Activity in the Southeast Geysers

The USGS recorded a total of 79 seismic events of magnitude 1.5 and greater within the SE Geysers area from April 1, 2014 through September 30, 2014. Their locations are shown in **Figure 4**. There was one seismic event that measured a magnitude 4.38 that occurred on August 24, 2014. The event was located on the NCPA / Calpine lease line and occurred 27 seconds after the Napa earthquake which measured a magnitude 6.0. It is considered to be an overlapping event. In terms of peak ground acceleration (% of gravitational acceleration), the event was 14.7% or a magnitude VI on the Modified Mercalli Intensity scale.

Regarding seismic activity between magnitude 1.5 and 3.0, the Southeast Geysers averaged 13 events per month. This level of activity is down from an average of 16 events per month for the

period of October 1, 2013 through March 31, 2014. There are projected to be 156 seismic events greater than magnitude 1.5 in year 2014. This compares with 192 events in year 2013 (**Figure 5**).

In combination with the seismic activity, steam production for the Southeast Geysers area was 19.78 billion pounds mass for the past six months. This value is up slightly from the previous six month period where 19.05 billion pounds was produced. Due to the drought, water injection levels are down 51.5% with 6.7 billion pounds of water injected. This compares with the 13.8 billion pounds of water injected from October 31, 2013 through March 31, 2014. **Figure 6** shows the historical changes in steam production, water injection and recorded seismicity within the Southeast Geysers area. **Figure 7** shows the cumulative steam production and water injection over six month periods within in the Southeast Geysers area. Steam production is slightly up while water injection and seismic activity are significantly lower when compared to values from the previous six month period.

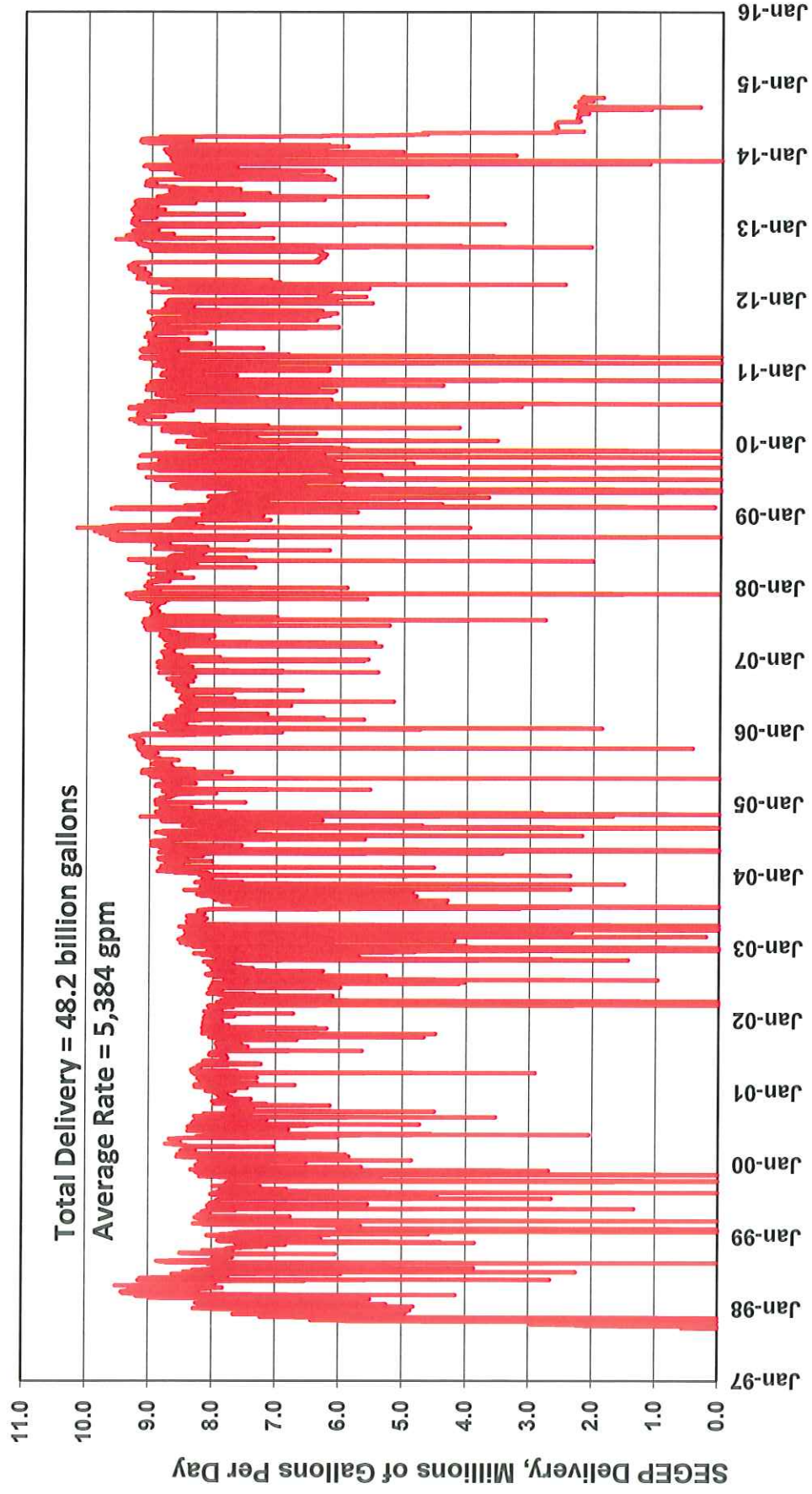
Seismic Activity in The Geysers (KGRA)

Within the Known Geothermal Resource Area (KGRA) of The Geysers geothermal field, there have been 489 events of magnitude 1.5 and greater recorded by the USGS for the past six months. There were 2 earthquake events of magnitude 3.0 and greater. As noted earlier, the largest event was a magnitude 4.38 occurring on August 24, 2014. It was located on the NCPA / Calpine lease line approximately 1.5 miles from the Anderson Springs instrument. The second event was a magnitude 3.29 located in the central Geysers about 6.2 miles from the Anderson Springs instrument and occurred on March 8, 2014 (**Figure 3**). For year 2014, the cumulative total of earthquake events greater than 1.5 is projected to be 1,038 (**Figure 8**). This is down from 1,344 events recorded in 2013.

Ed Voge
Reservoir Engineer
NCPA Geothermal Facility

Figure 1

Historical SE Geysers Effluent Pipeline Deliveries to The Geysers



Southeast Geysers Effluent Pipeline Delivery April 1, 2014 through October 31, 2014

Figure 2



Clear Lake Water Level - USGS Rumsey Gauge 2009 - Present

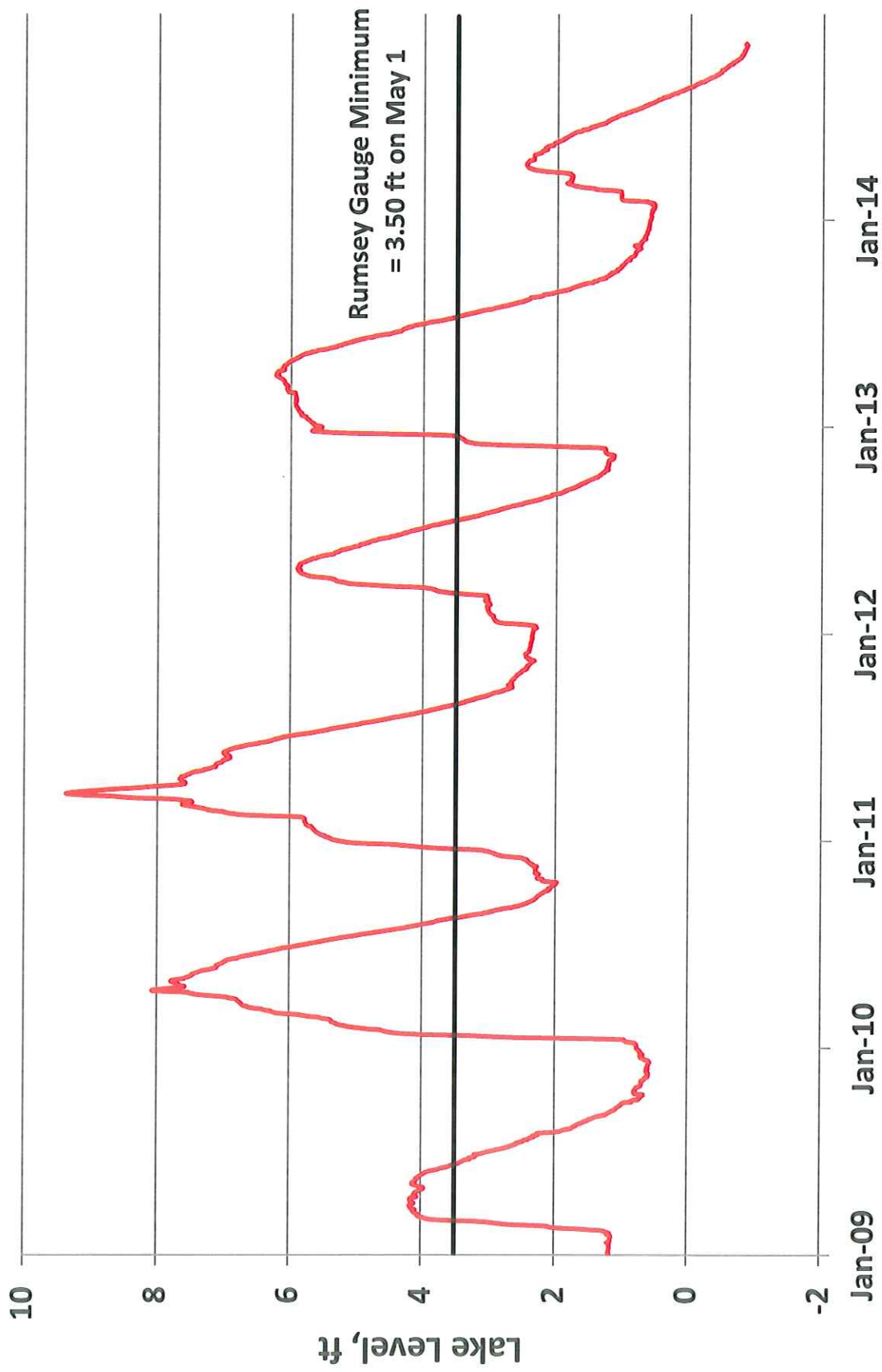
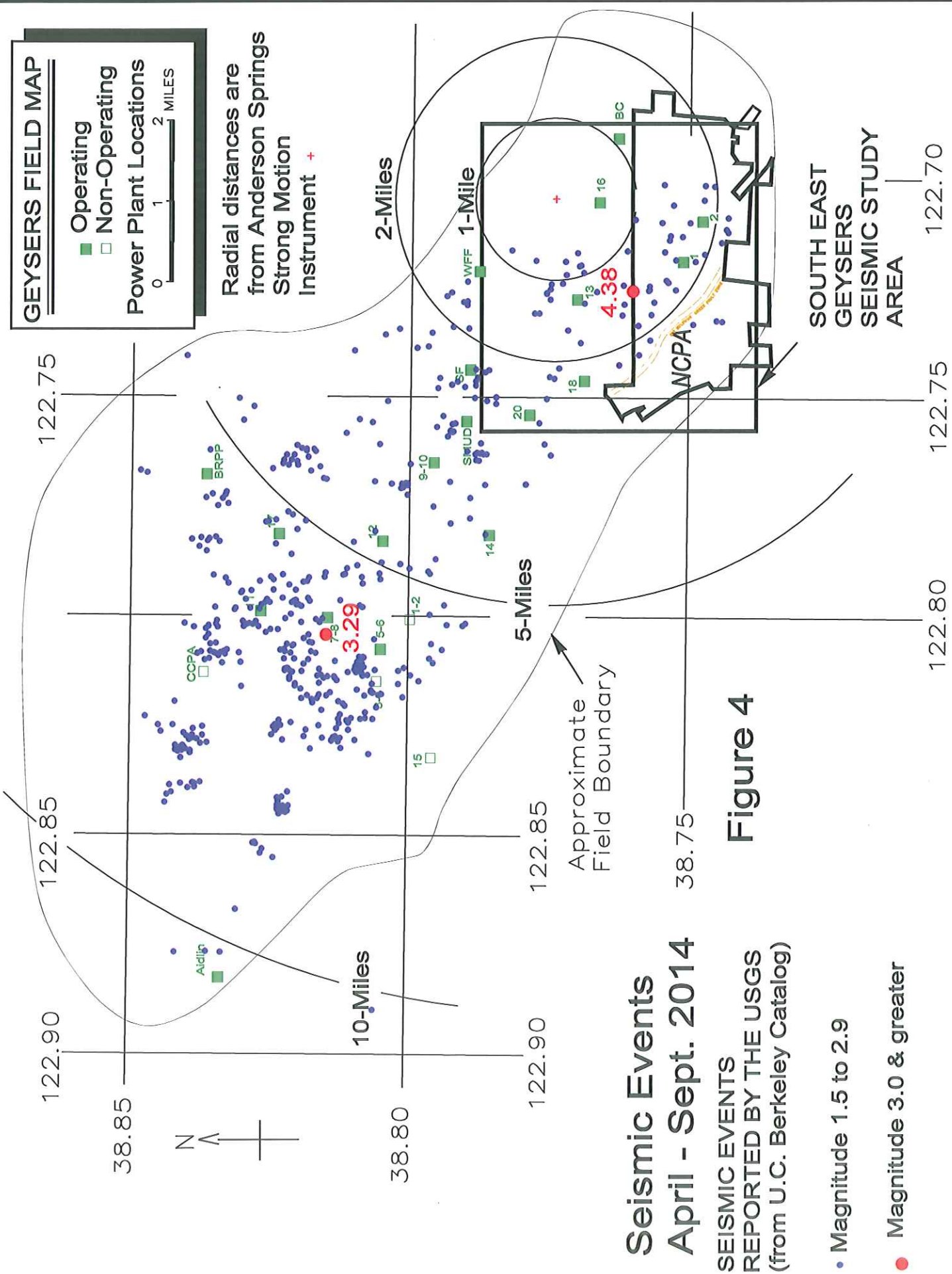


Figure 3



Seismic Events
April - Sept. 2014
 SEISMIC EVENTS
 REPORTED BY THE USGS
 (from U.C. Berkeley Catalog)

Figure 4

- Magnitude 1.5 to 2.9
- Magnitude 3.0 & greater

Southeast Geysers - Historical Seismic Activity **Magnitude > 1.5** **Years 2002 - 2014**

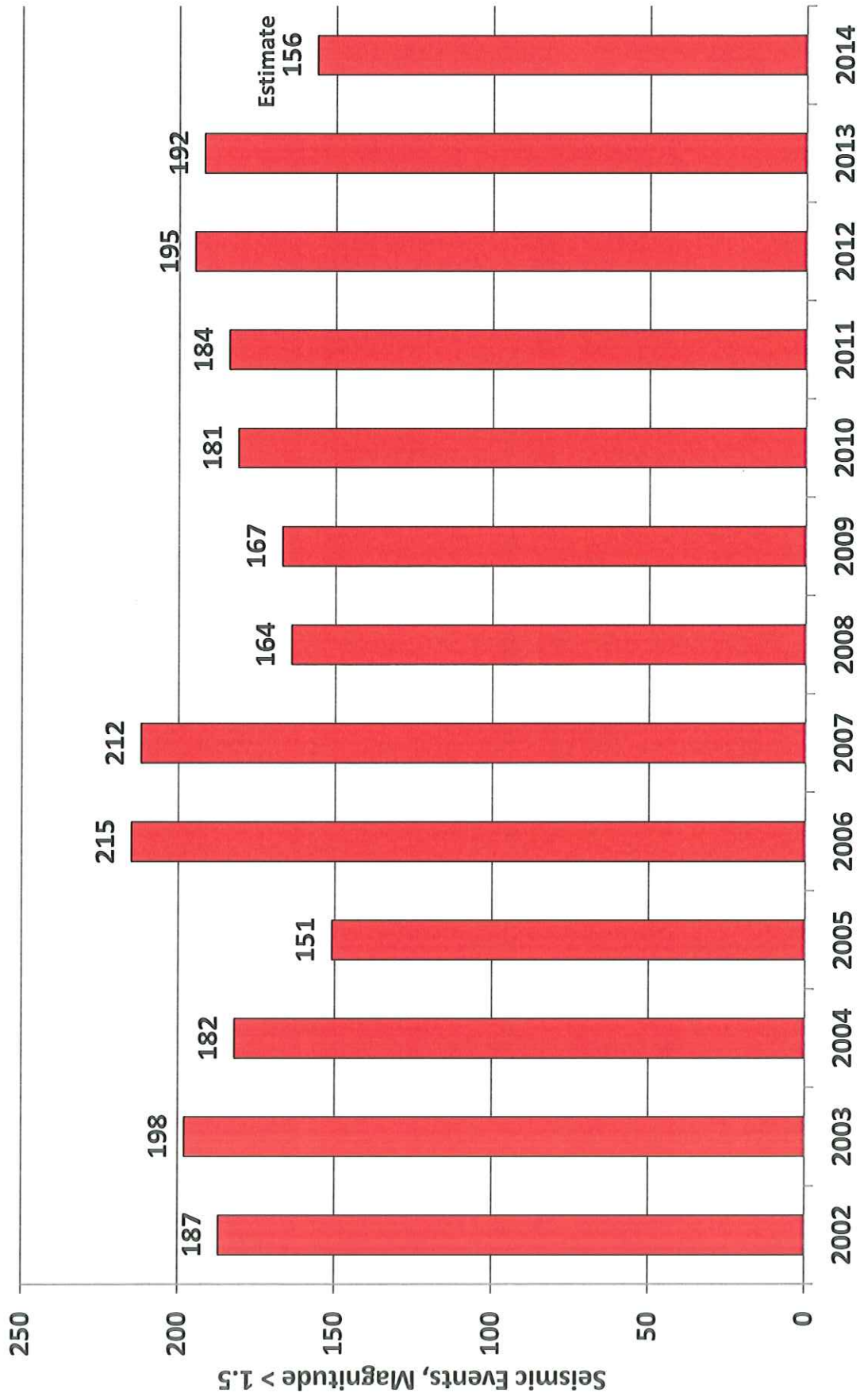
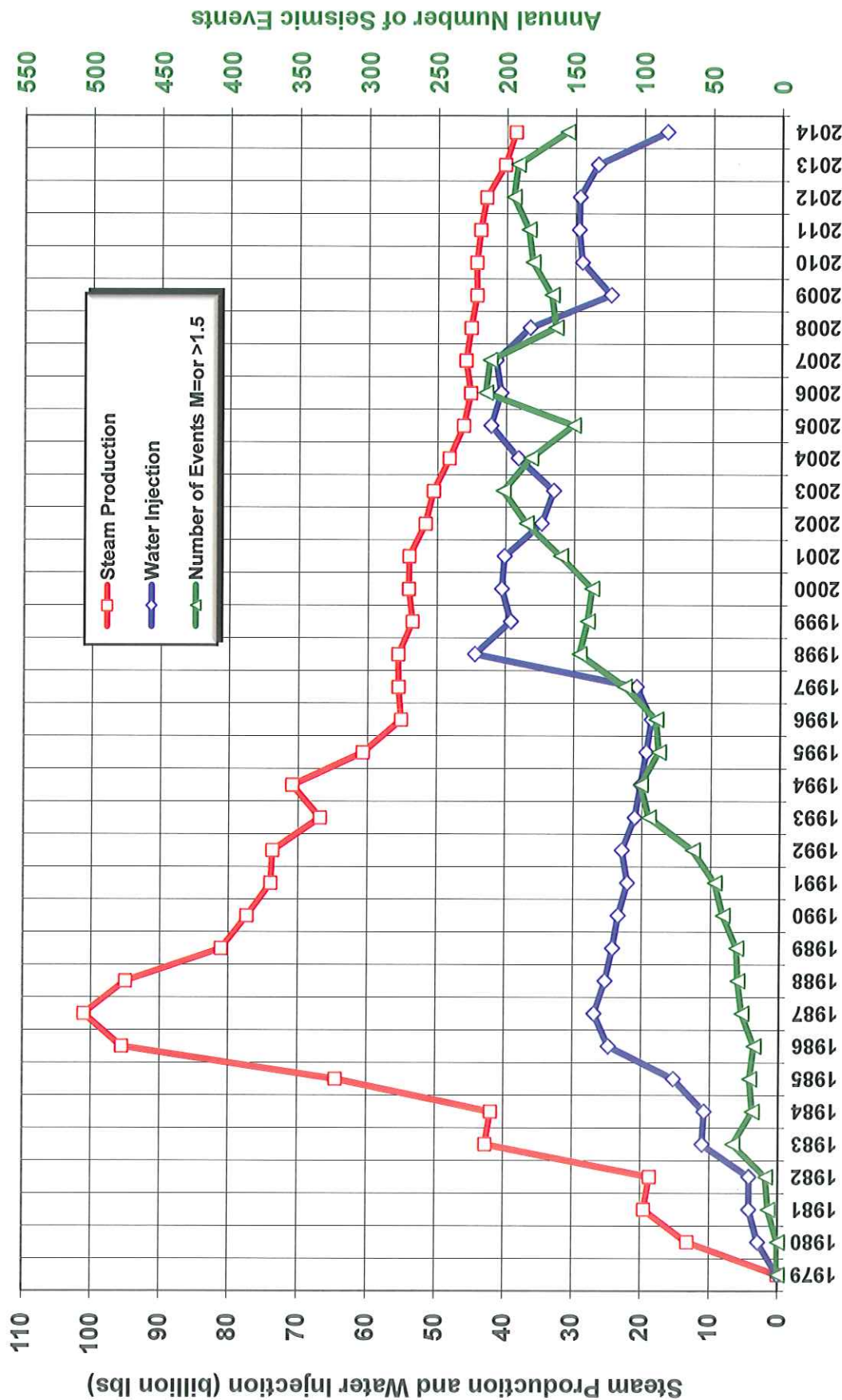


Figure 5

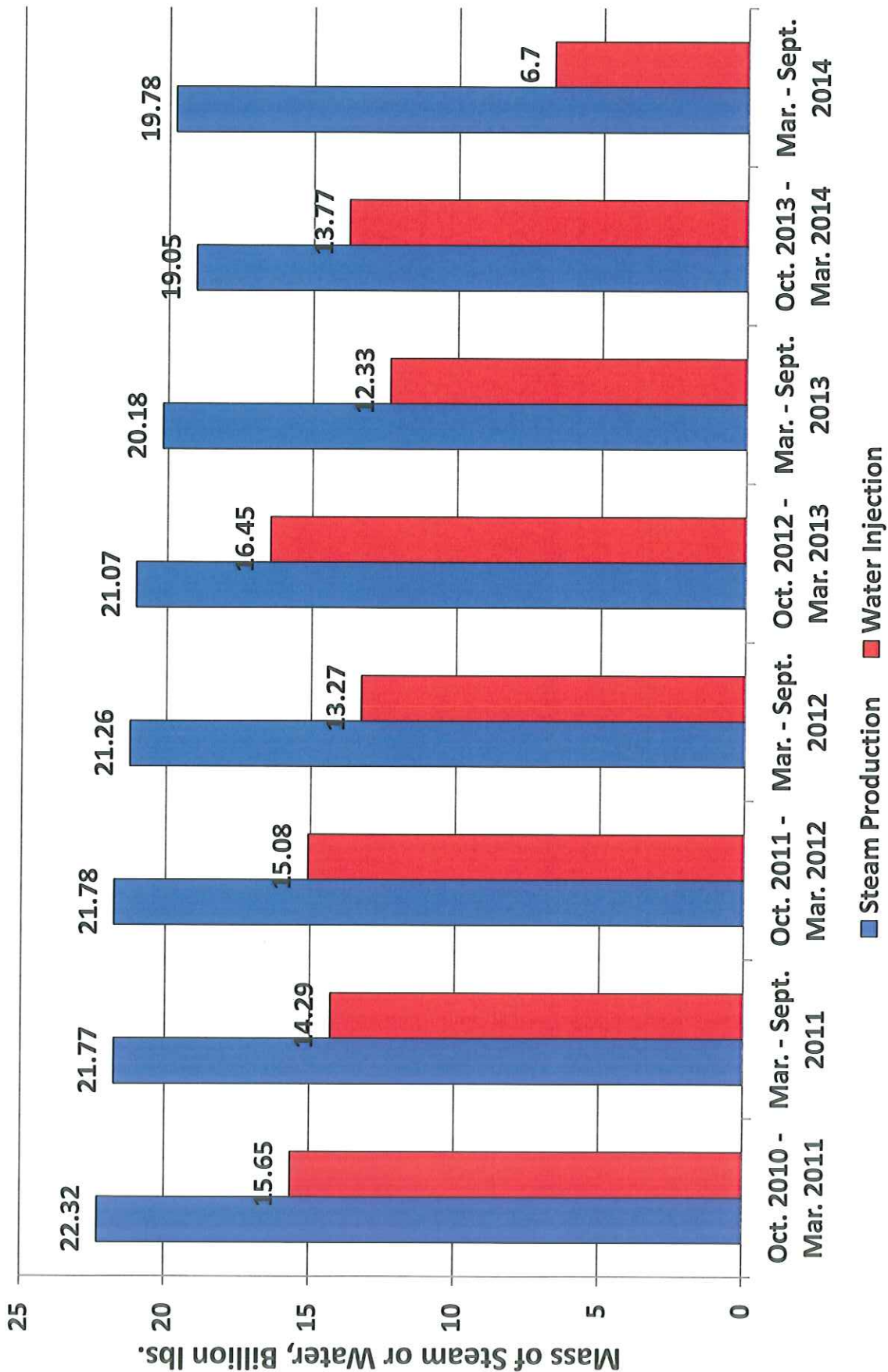
Figure 6

Comparison of Annual Steam Production, Water Injection and Recorded Seismicity in the SE Geysers Area



SE Geysers Production and Injection

Figure 7



The Geysers (KGRA) - Historical Seismic Activity Magnitude > 1.5 Years 2002 - 2014

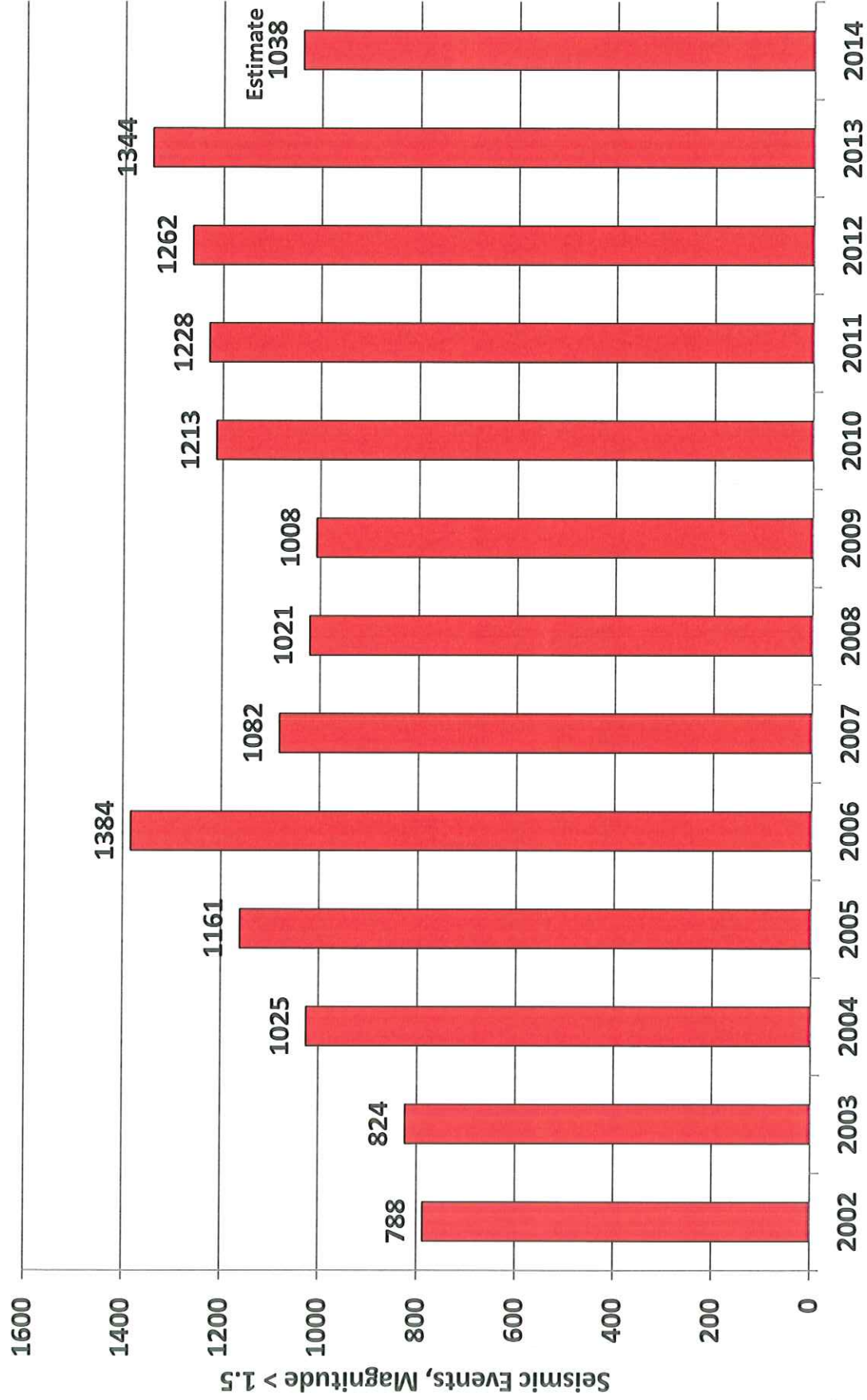


Figure 8