



May 11, 2023

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 October 1, 2022 to March 31, 2023

A. Pipeline Operations

The Southeast Geysers Effluent Pipeline (“SEGEP”) has been in operation since 1997 and has delivered a total 64.3 billion gallons of wastewater at an average rate of 4,793 gpm to the South East Geysers steam field for injection. **Figure 1** illustrates the daily delivery rates since the beginning of the project.

During the six-month period from October 1, 2022 through March 31, 2023, the SEGEP Pipeline was in operation 72.0% of the time (**Figure 2**). Pipeline delivery rates averaged 2.8 million gallons per day (MGD) or 1,946 gpm which is roughly 25% of the historical average noted above.

A major reason for the reduced flow is that California is experiencing drought conditions. The wastewater supplied by LACOSAN is composed of secondary treated wastewater and freshwater from Clearlake. Freshwater can make up between half to two thirds of the system volume but during drought years, freshwater extraction from Clearlake is not allowed. The loss of freshwater has resulted in the SEGEP pipeline operating at a reduced capacity and will remain in effect until May 1, 2023. Any lifting of the freshwater ban will be dependent on the lake level at that time.

B. Observed Seismicity

Seismic Activity in the Southeast Geysers

The USGS recorded 86 seismic events of magnitude 1.5 and greater within the SE Geysers area from October 1, 2022 through March 31, 2023. This is larger than the 50 seismic events over the previous six-month period. Historical trends and locations of the recent events are shown



SMAC Report – Spring 2023

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NCPA Reservoir Engineer
May 11, 2023

Lake County Wastewater Recycling System

A partnership of
Northern California Power Agency
Lake County Sanitation District
Calpine Corporation

- First phase operational 1997; second phase 2001
- Communities supplying effluent: 10
- Total countywide effluent recycled: 85%
- Effluent pipeline length: 50 miles
- Average flow rate: 5800 gpm
- Solar powered treatment & pumping: 3.4 MW
- Effluent-based geothermal power: 100 MW
- Avoided global warming CO₂ emissions: 8 billion lbs. (Jan. 08)



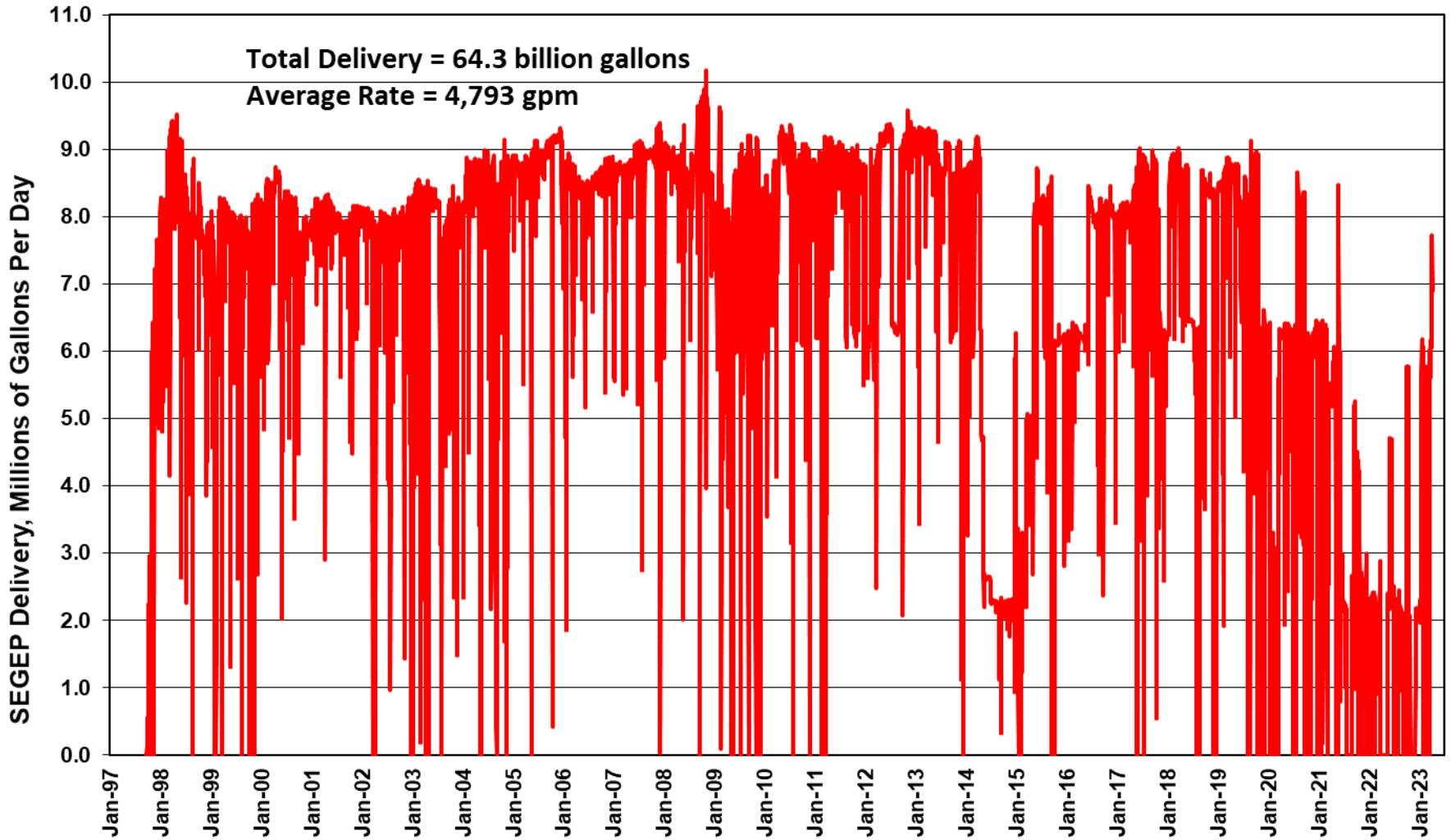
Bear Canyon #1 Pump Station



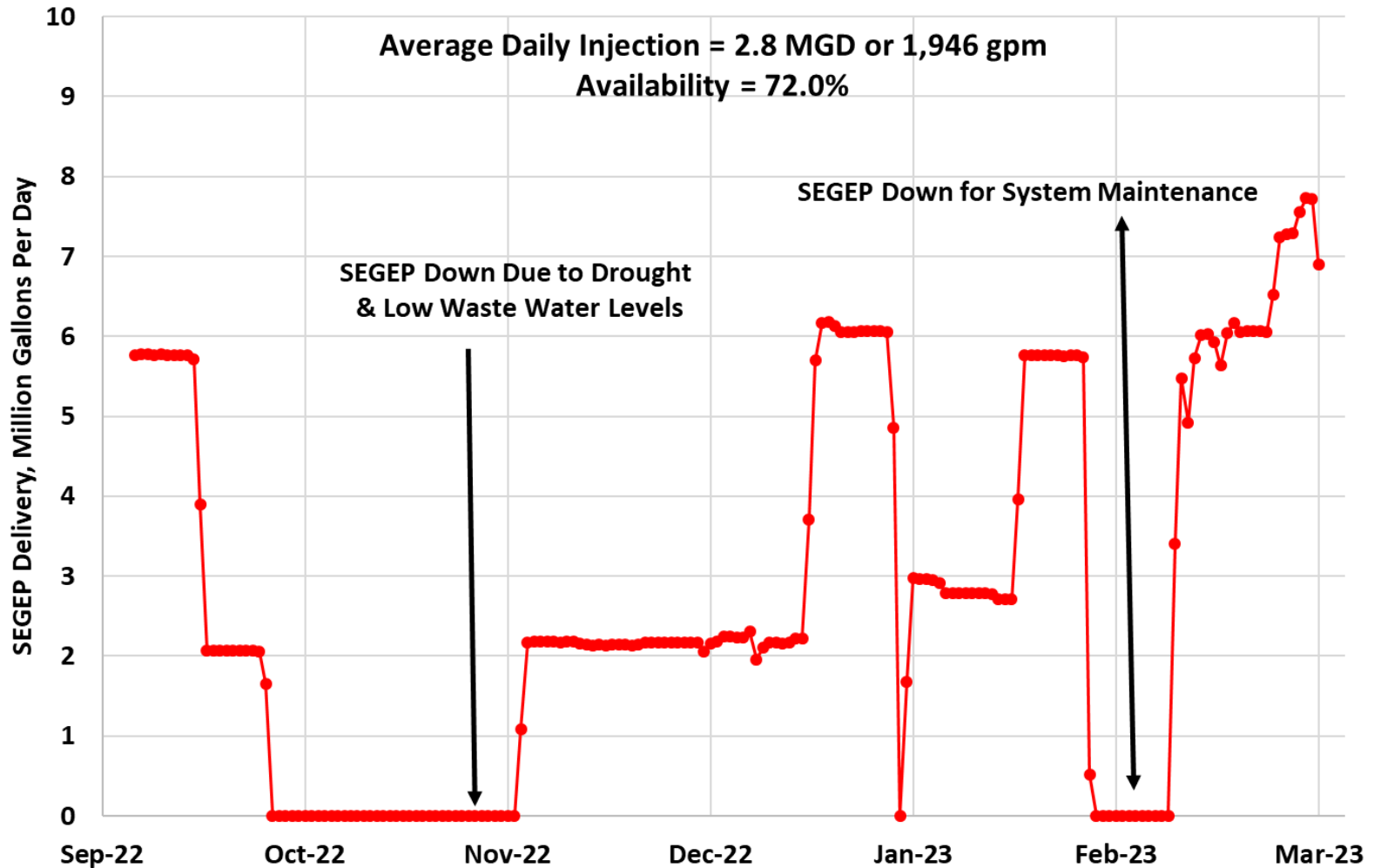
Bear Canyon Pumps



Historical SE Geysers Effluent Pipeline Deliveries to The Geysers
Figure 1



**Southeast Geysers Effluent Pipeline Delivery
October 2022 - March 2023
Figure 2**



Southeast Geysers - Historical Seismic Activity
Magnitude > 1.5
Figure 3

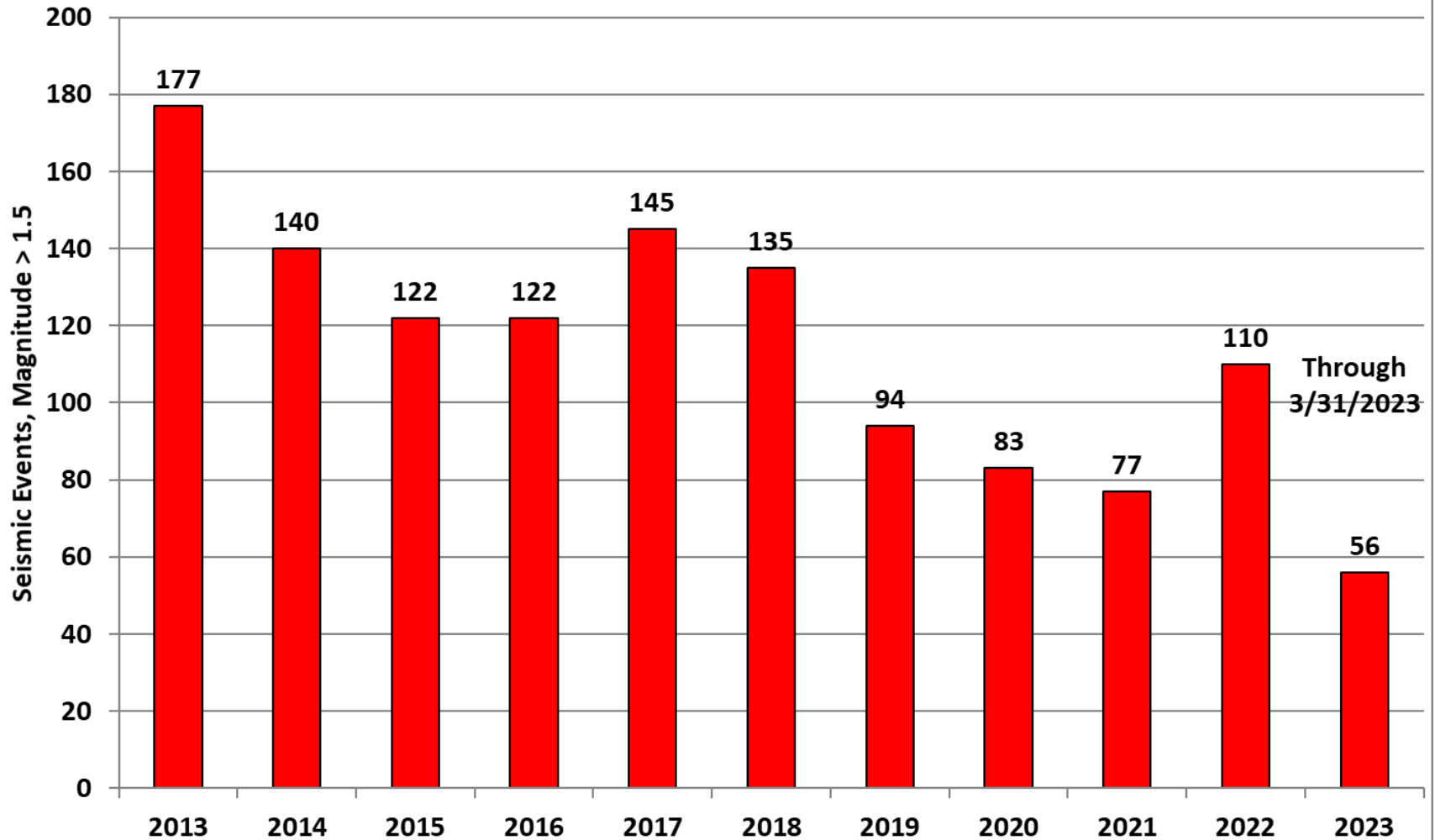
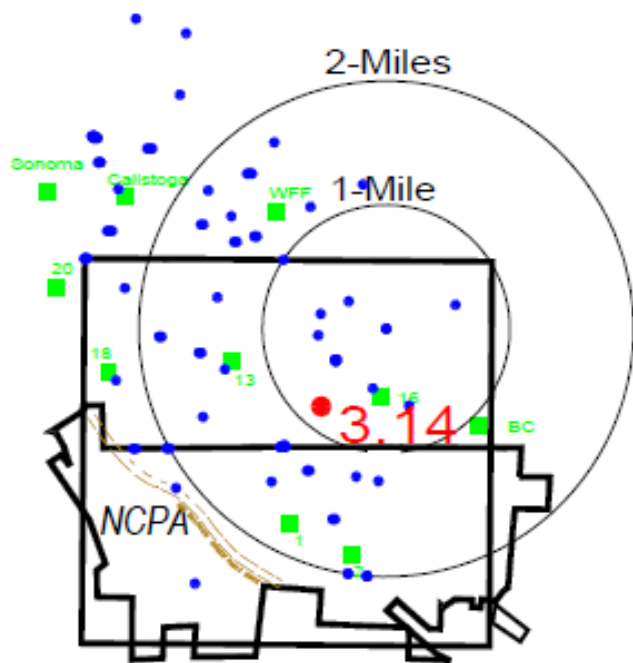


Figure 4



Radial distances are from Anderson Springs Strong Motion Instrument

Oct. 1, 2022 - March 31, 2023

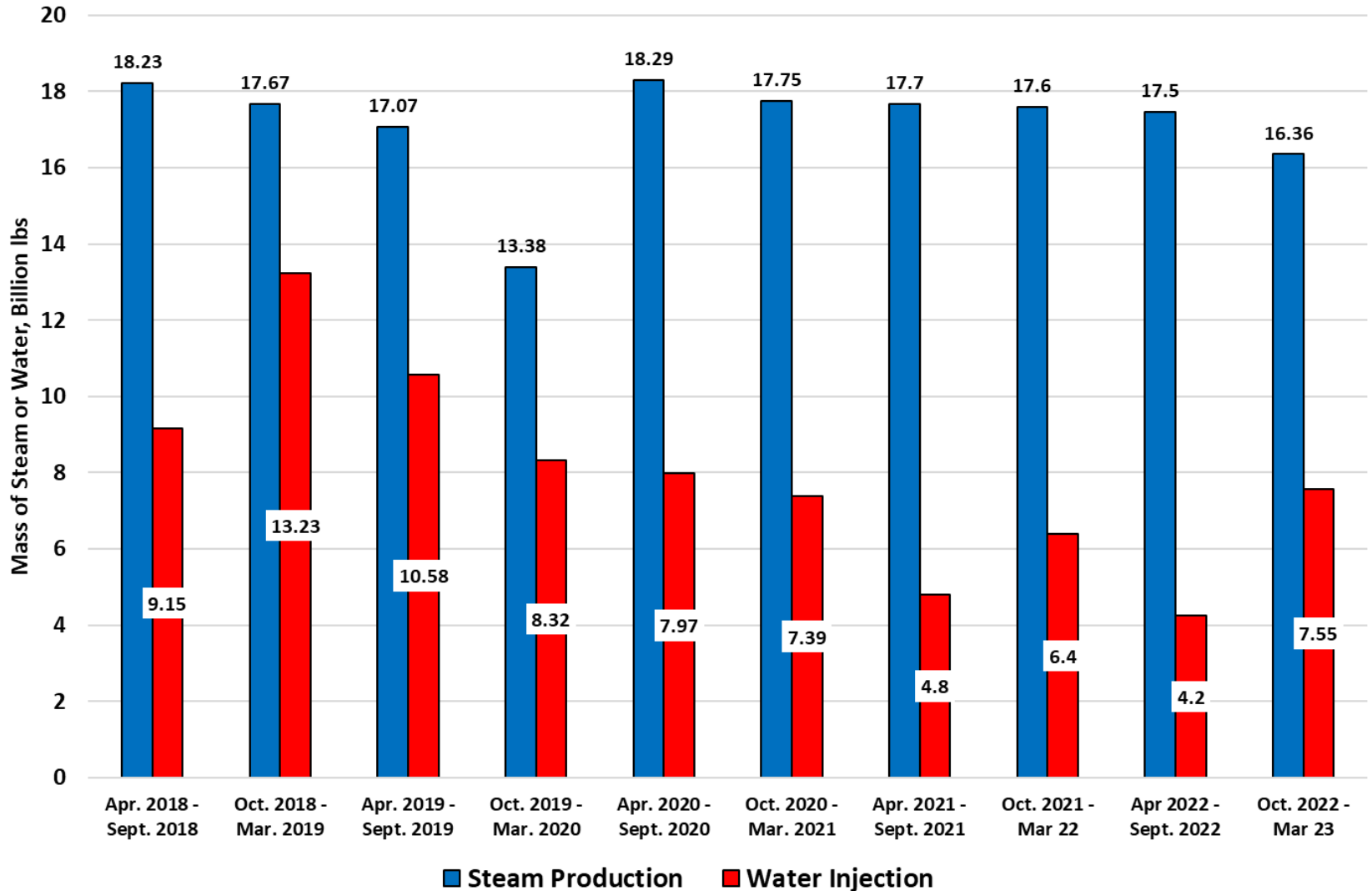
Magnitude > 1.5 - 86 Events

Magnitude > 3.0 - 1 Event

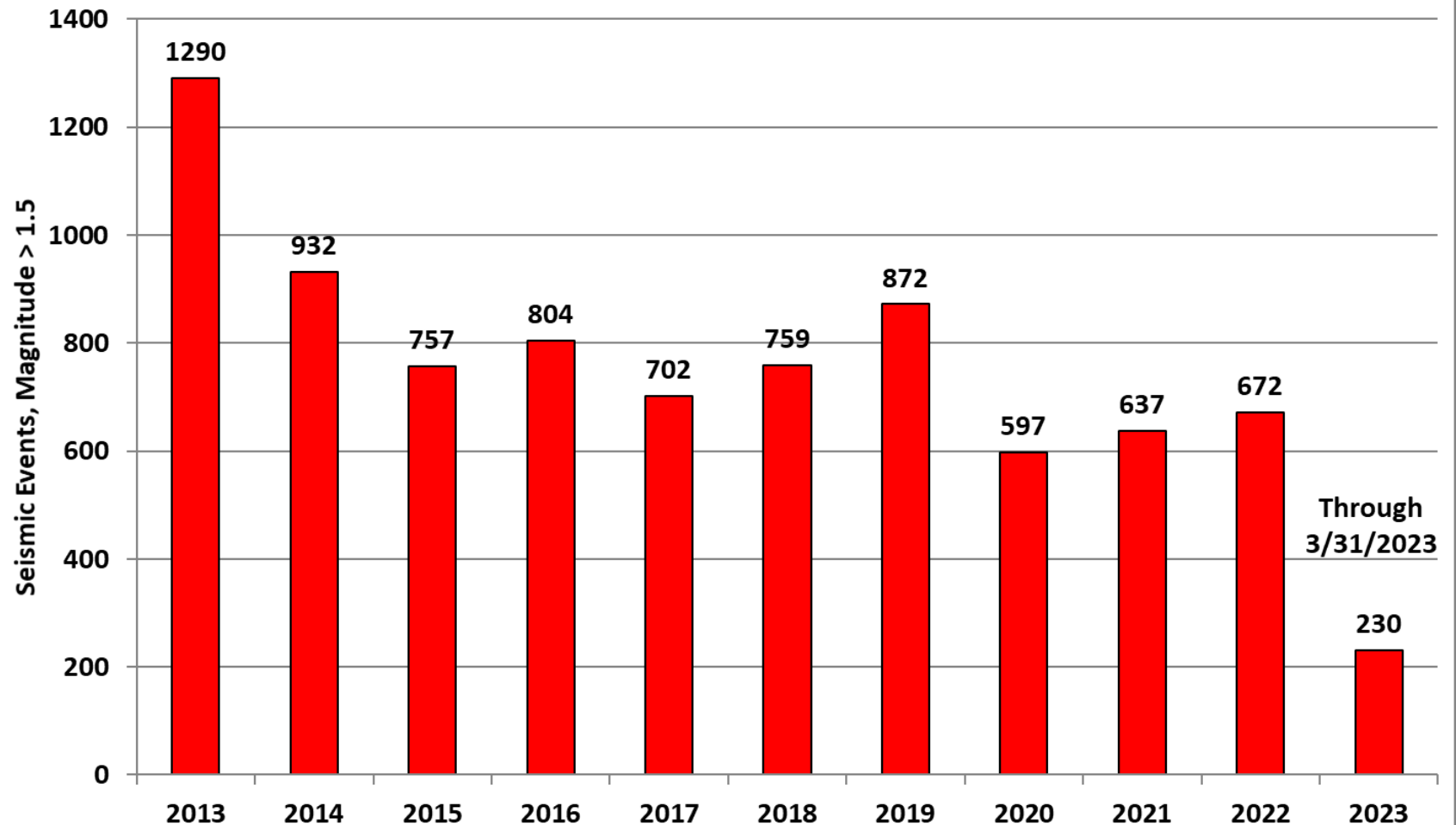
SOUTH EAST GEYSERS SEISMIC STUDY AREA

SEISMIC EVENTS REPORTED BY THE USGS (from U.C. Berkeley Catalog)

SE Geysers Production and Injection
Figure 5



The Geysers (KGRA) - Historical Seismic Activity Magnitude > 1.5 Figure 6



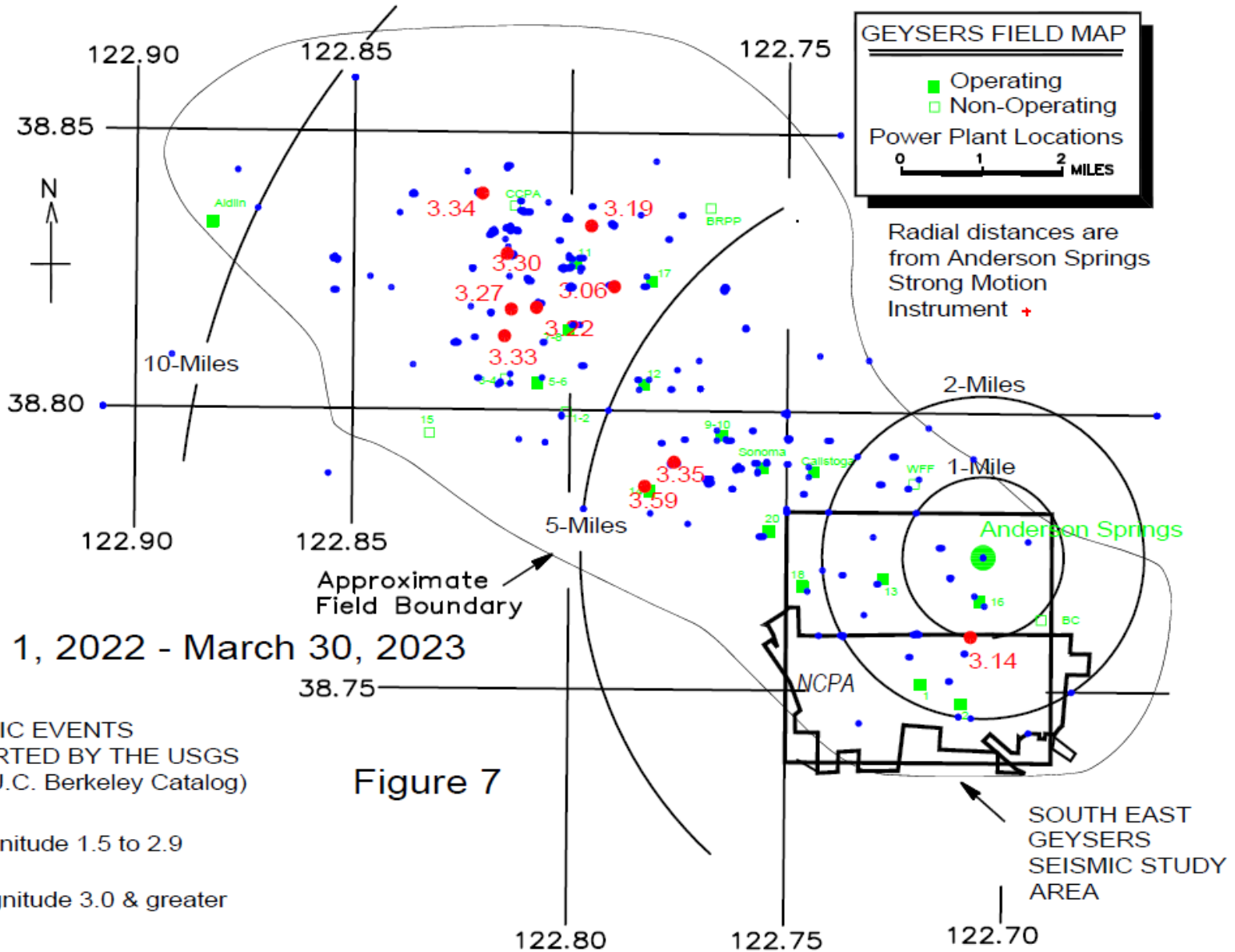


Figure 7

Summary

- **SEGEP Operation**
 - Injection Rate – 1,946 gpm
 - Pipeline availability – 72.0%
 - Injection increasing with Winter rain
- **Southeast Production & Injection**
 - Production – 16.4 Glbs
 - Injection – 7.6 Glbs
- **Seismic Activity – SE Geysers**
 - 86 Events > Magnitude 1.5
 - 1 Events > Magnitude 3.0
- **Seismic Activity – Geysers**
 - 395 Events > Magnitude 1.5
 - 10 Events > Magnitude 3.0
 - Highest Event – Magnitude 3.59

Bear Canyon Pump Station #3



respectively in **Figures 3 and 4**. There was one magnitude 3.0 or greater seismic events in the Southeast Geysers during this reporting period.

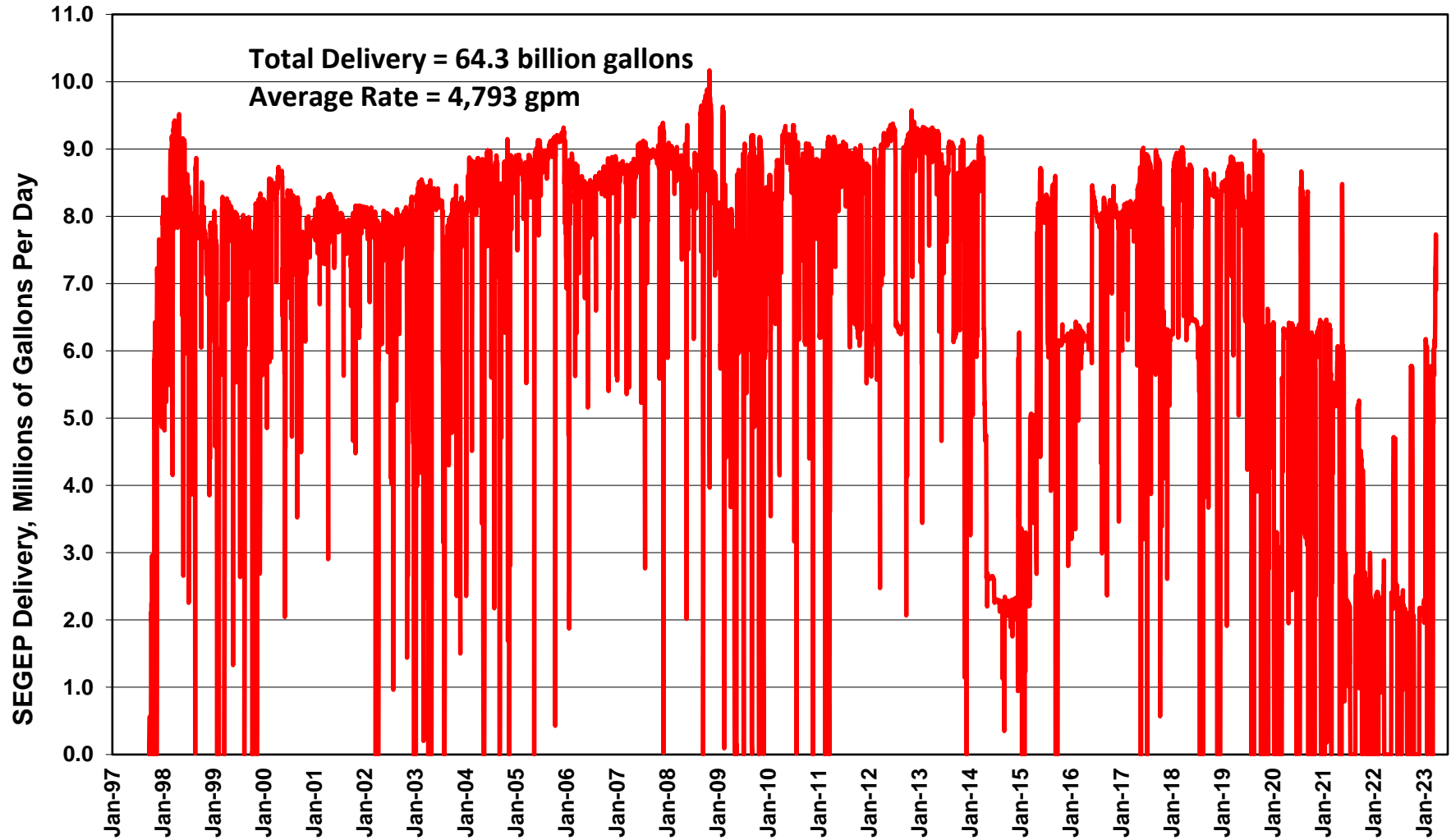
In combination with the seismic activity, steam production for the Southeast Geysers area was 16.36 billion pounds mass for the past six months while water injection was 7.55 billion pounds mass. The mass replacement was approximately 46% for the area. **Figure 5** shows the historical changes in steam production and water injection within the Southeast Geysers area.

Seismic Activity in The Geysers

Within the Geysers geothermal field, there have been 395 events of magnitude 1.5 and greater recorded from October 1, 2022 through March 31, 2023. There were ten events of magnitude 3.0 or greater. The largest event was a magnitude 3.59 and occurred on March 2, 2023. **Figure 6** shows the trends of seismic events for the Geysers since 2013 while **Figure 7** shows the location of the events for the last six months.

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NCPA Geothermal Facility

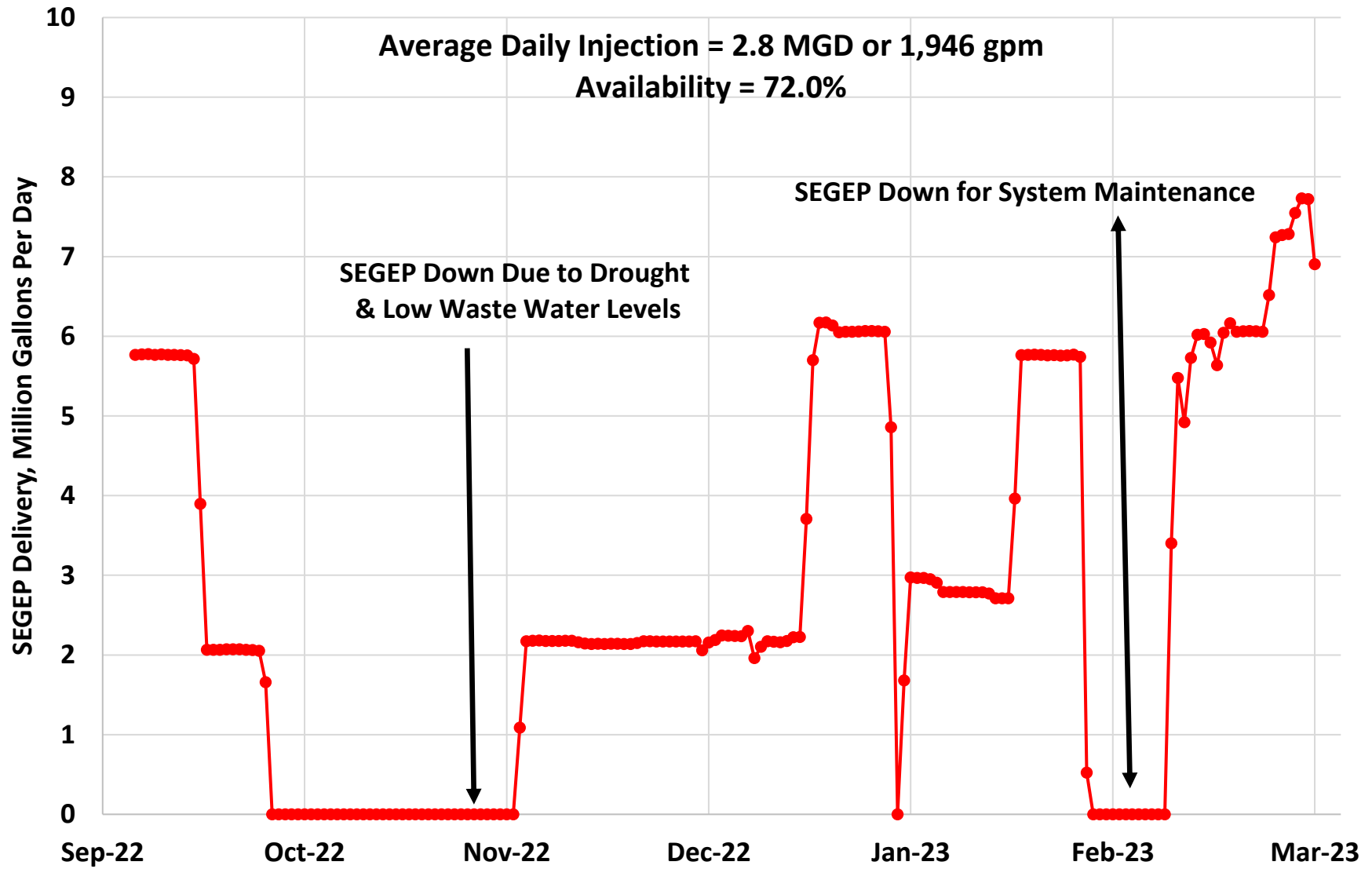
**Historical SE Geysers Effluent Pipeline Deliveries to The Geysers
Figure 1**



Southeast Geysers Effluent Pipeline Delivery

October 2022 - March 2023

Figure 2



Southeast Geysers - Historical Seismic Activity

Magnitude > 1.5

Figure 3

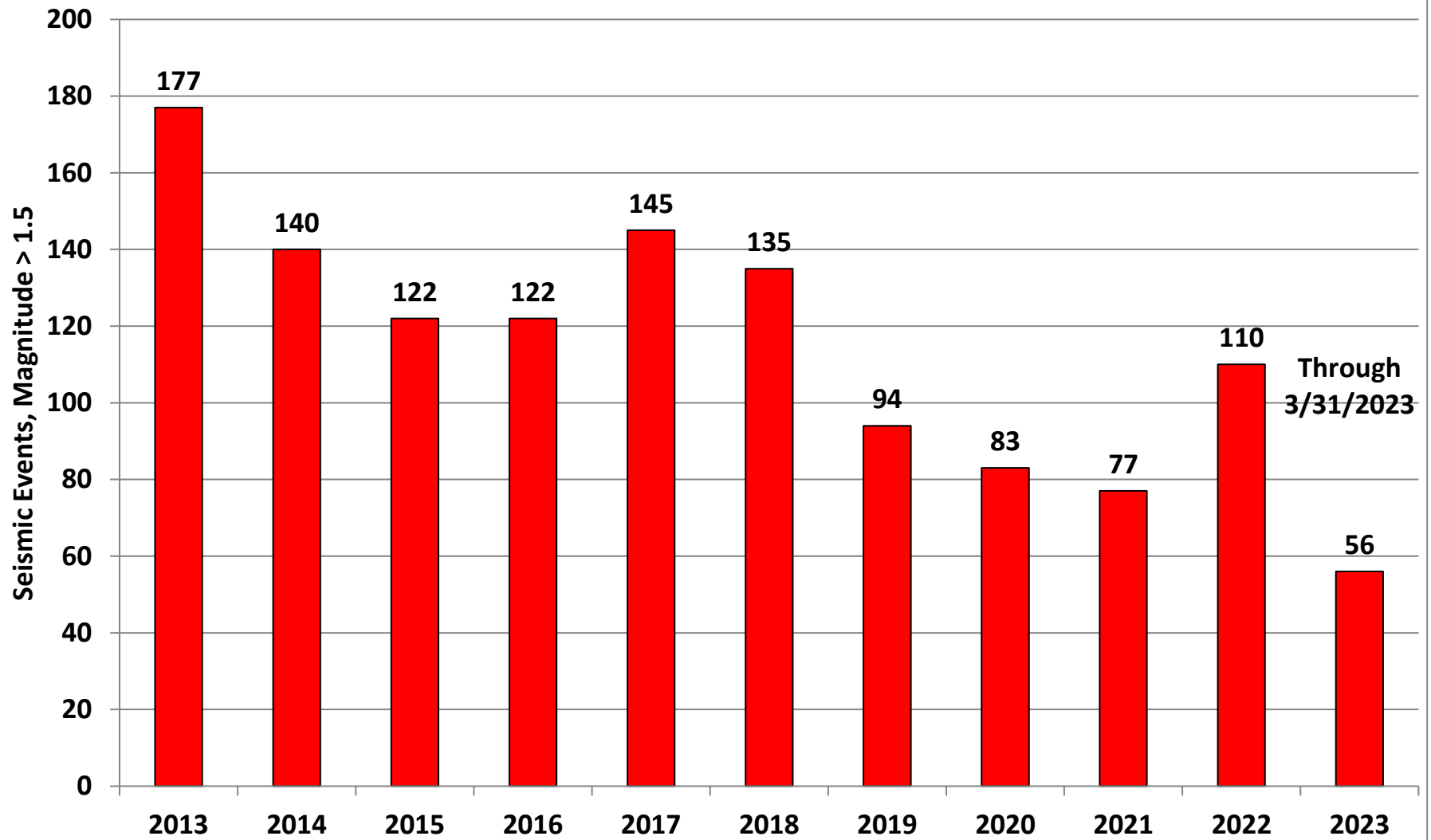
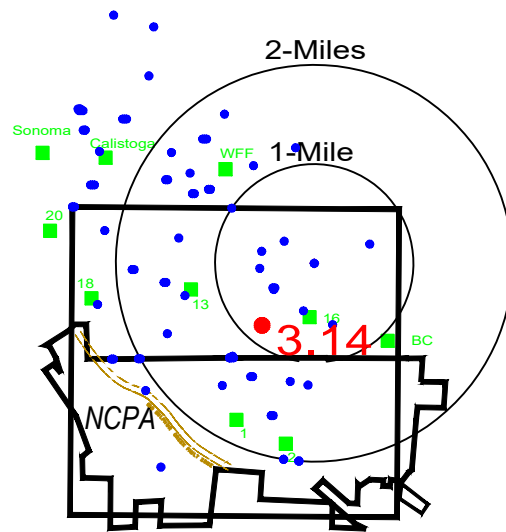


Figure 4



Radial distances are
from Anderson Springs
Strong Motion
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Oct. 1, 2022 - March 31, 2023

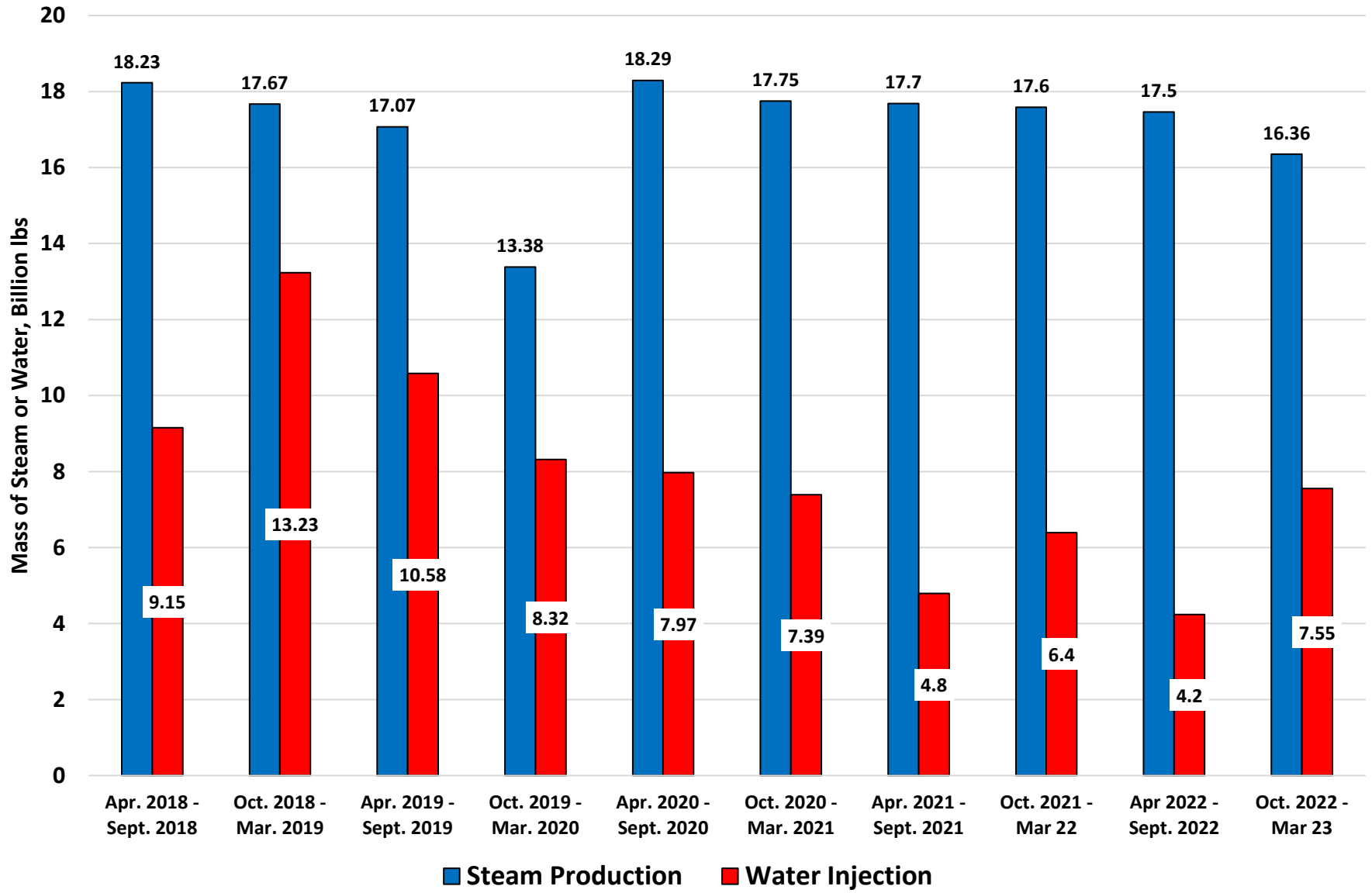
Magnitude > 1.5 - 86 Events

Magnitude > 3.0 - 1 Event

SOUTH EAST
GEYSERS
SEISMIC STUDY
AREA

SEISMIC EVENTS
REPORTED BY THE USGS
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SE Geysers Production and Injection
Figure 5



The Geysers (KGRA) - Historical Seismic Activity

Magnitude > 1.5

Figure 6

