Commission Staff Report - *DRAFT*

DATE: April 26, 2017

COMMISSION MEETING DATE: May 25, 2017

SUBJECT: 2017 Geothermal Facility Operating Protocol – Steam Field Operations Forecast Report April 2017; Applicable to the following projects: Geothermal

AGENDA CATEGORY: Consent

FROM:	Ken Speer	**METHOD OF SELECTION:**
	Assistant General Manager	*N/A*
Division:	Generation Services	
Department:	Geothermal	

IMPACTED MEMBERS:

All Members	☐	**City of Lodi**	☒	**City of Ukiah**	☒
Alameda Municipal Power	☒	**City of Lompoc**	☒	**Plumas-Sierra REC**	☒
Bay Area Rapid Transit	☐	**City of Palo Alto**	☐	**Port of Oakland**	☐
City of Biggs	☒	**City of Redding**	☐	**Truckee Donner PUD**	☐
City of Gridley	☒	**City of Roseville**	☒	**Other**	☐
City of Healdsburg	☒	**City of Santa Clara**	☒	*If other, please specify.*	

_____

_____

SR: xxx:17

RECOMMENDATION:

Adopt Resolution 17-XX approving the 2017 Steam Field Operations Forecast Report dated April 2017 as the Geothermal Operating Protocol effective July 1, 2017. This Operating Protocol is to remain in effect until replaced by the Commission.

BACKGROUND:

The Steam Field Operations Forecast Report is an in depth study of The Geysers reservoir relative to the operation of NCPA's Geothermal facility and provides a generation forecast of the facility. This report will act as the Operating Protocol with the goal of maximizing the generation output.

The Operating Protocol currently uses a two-zone strategy with wells on the west side of the NCPA lease producing to both Plant #1, Units #1and #2. Wells on the east side of the NCPA lease produce to Plant #2, Unit #4. This Protocol will maximize generation while allowing for scheduling flexibility and reduction of load under the proper economic conditions. The Protocol establishes a 2017 annual generation target of 99.3 gross MW.

FISCAL IMPACT:

The 2017-18 approved Geothermal budget covers the proposed action.

SELECTION PROCESS:

Not Applicable.

ENVIRONMENTAL ANALYSIS:

This activity would not result in a direct or reasonably foreseeable indirect change in the physical environment and is therefore not a "project" for purposes of Section 21065 the California Environmental Quality Act. No environmental review is necessary.

COMMITTEE REVIEW:

Committee Review Pending.

Respectfully submitted,

RANDY S. HOWARD
General Manager

Attachments: (2)

- Resolution
- Steam Field Operations Forecast Report – April 2017

SR: xxx:17

RESOLUTION 17-XX

RESOLUTION OF THE NORTHERN CALIFORNIA POWER AGENCY APPROVING THE 2017 STEAM FIELD OPERATIONS FORECAST REPORT AS THE 2017 GEOTHERMAL OPERATING PROTOCOL

(Reference Staff Report #xxx:17)

WHEREAS, the Northern California Power Agency (NCPA) operates and maintains on behalf of the project owners a Geothermal Facility near Middletown, CA, consisting of two power plants with containment areas, and 80 steam production and injection wells connected by roads; and

WHEREAS, the 2017 Steam Field Operations Forecast Report is an in depth study of The Geysers reservoir relative to the operation of NCPA's Geothermal facility and provides a generation forecast of the facility. This report will act as the Operating Protocol with the goal of maximizing the generation output. The Operating Protocol currently uses a two-zone strategy with wells on the west side of the NCPA lease producing to Plant 1, Units #1 and #2. Wells on the east side of the NCPA lease produce to Plant #2, Unit #4. This Protocol will maximize generation while allowing for scheduling flexibility and reduction of load under the proper economic conditions. The Protocol establishes a 2017 annual generation target of 99.3 MW gross; and

WHEREAS, 2017-18 approved budget covers the proposed action; and

WHEREAS, this activity would not result in a direct or reasonably foreseeable indirect change in the physical environment and is therefore not a "project" for purposes of Section 21065 the California Environmental Quality Act. No environmental review is necessary; and

NOW, THEREFORE BE IT RESOLVED that the Commission of the Northern California Power Agency adopts the Steam Field Operations and Forecast Report dated April 2017 as the Geothermal Operating Protocol effective July 1, 2017, to remain in effect until replaced by the Commission.

PASSED, ADOPTED and APPROVED this ____ day of _____, 2017 by the following vote on roll call:

	Vote	Abstained	Absent
Alameda			
BART			
Biggs			
Gridley			
Healdsburg			
Lodi			
Lompoc			
Palo Alto			
Port of Oakland			
Redding			
Roseville			
Santa Clara			
Truckee Donner			
Ukiah			
Plumas-Sierra			

_____

BOB LINGL
CHAIR

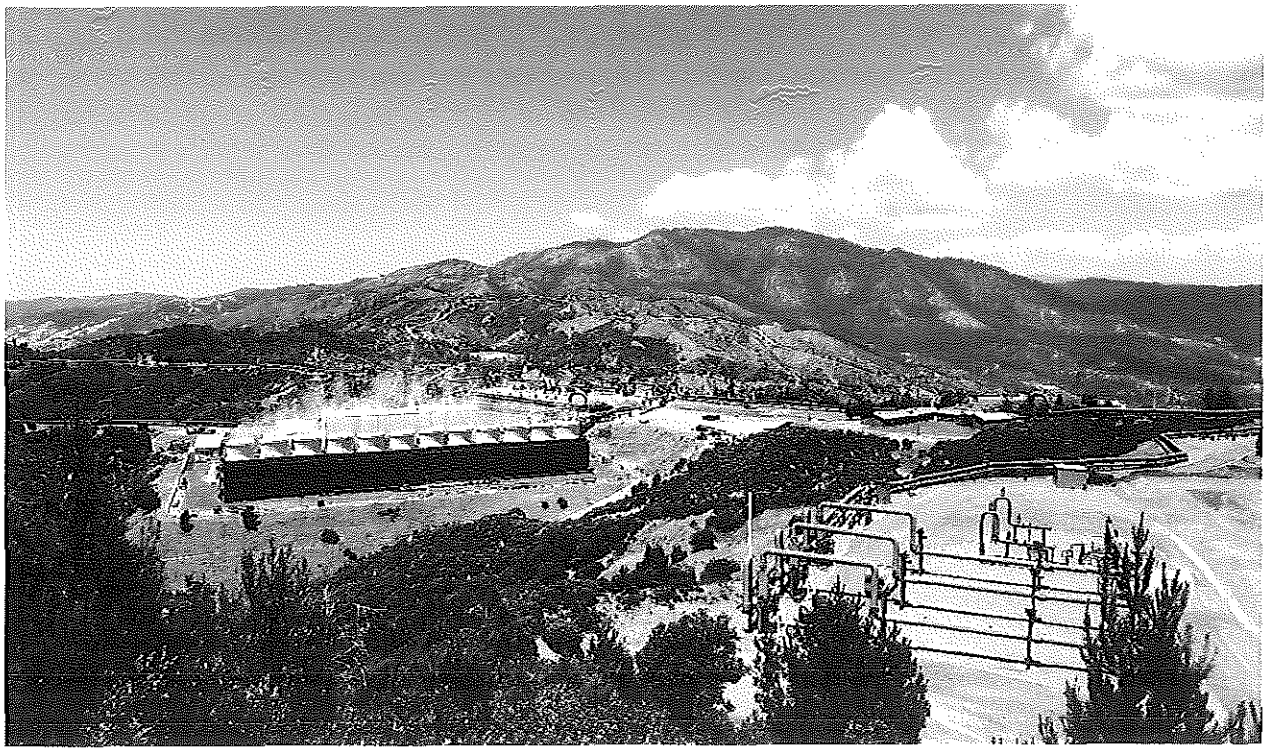
ATTEST: CARY A. PADGETT
ASSISTANT SECRETARY

GEOTHERMAL FACILITIES

NCPA
NORTHERN CALIFORNIA POWER AGENCY

Steam Field Operations

Forecast Report – April 2017



NCPA
Generation Services – Geothermal Facilities

Steam Field Operations and Forecast Report

April 2017

Table of Contents

NCPA
Generation Services Business Unit
Steam Field Operations and Forecast Report

April 2017

Introduction

This report provides an update on the status of the NCPA Geothermal Project. There are three main sections:

I. A review of steam field operations including annual production and injection volumes, the Geothermal Operating Plan, water injection program, and projects.

II. A review of 2016 reservoir performance and generation.

III. A 2017 generation forecast.

Analysis of geothermal reservoir during 2016 indicates a continued 1.9% harmonic decline consistent with prior projections. The average generating capacity for 2016 was 101 MW gross or 93.3 MW net. Gross generation for the year was 887.3 GWhrs with net generation of 820.1 GWhrs.

Water injection continues to be a major contributor to maintaining reservoir pressure and mitigating steam production decline rates. The Southeast Geysers Effluent Pipeline project brings an average of 5,600 gpm of wastewater to The Geysers. NCPA and a nearby power producer share the water, but in late 2015, the Valley Fire damaged several of their power plants and their injection capability. As a result, NCPA received a larger share of the wastewater and water injection rates for the 2016 were up 42% from the previous year averaging 4,836 gpm.

The 2017 generation forecast projects the average generating levels to be 99.3 MW gross or 91.7 MW net for the year. NCPA geothermal facilities are expected to generate 862.2 GWhrs gross or 796.5 GWhrs net in 2017. The 25 year projected gross reserves are estimated to be 18,085 GWhrs or 16,163 GWhrs net.

In terms of the fiscal year, the gross generation is estimated to be 873.2 GWhrs with net generation of 810.9 GWhrs in FY 2017. The respective gross and net generation projected for FY 2018 is 867.8 GWhrs and 800.9 GWhrs.

I. STEAM FIELD OPERATIONS

In This Section

- Overview of Annual Production and Injection
- Geothermal Operating Plan
- Water Injection Program
- Steam field Projects

A. Overview of 2016 Production and Injection

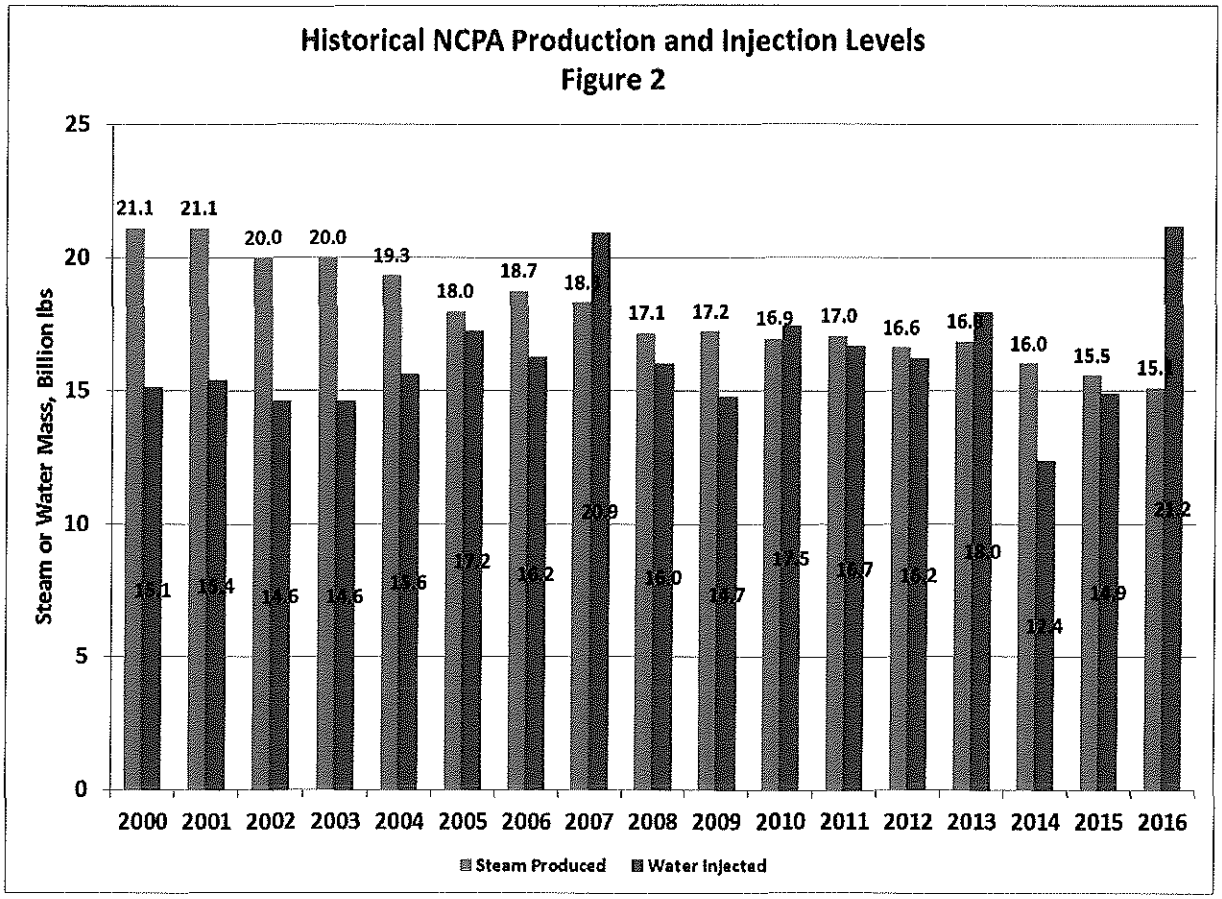
NCPA continued to operate the Geothermal Project as a base load facility in 2016. Steam production for the year was 15.1 Glbs with water injection of 21.2 Glbs for an annual mass replacement ratio of 140%. Water injection on the NCPA lease is a combination of steam condensate recovered from the cooling towers and wastewater from the Southeast Geysers Effluent Pipeline (SEGEP). The water from the SEGEP pipeline is shared between NCPA and a nearby power producer. In late 2015, the Valley Fire damaged several of the nearby producer's power plants resulting in NCPA receiving a larger than normal share of the SEGEP wastewater. As a result, the average injection rate for NCPA increased 42% from the previous year to 4,836 gpm.

The cumulative mass replacement ratio from plant startup in 1983 through 2016 was 65.2% *(Figure 1)*. The net mass withdrawal of steam from the reservoir (Mass Produced less Mass Injected) through 2016 is 223.2 billion lbs.

The average annual generation for 2016 was 101.3 MW gross or 93.5 MW net. The average generation is down from 2015 because of continued steam field decline and plant outages. In 2017, generation levels are projected to be 99.3 MW gross or 91.7 MW net.

Production Highlights during 2016 include:

- Annual average gross generation in 2016 was 101 MW or 93.3 MW net.
- Average annual mass replacement (i.e., the percentage of steam production replaced by water injection) was 140% in 2016 compared to 96.1% for 2015. The 2016 average injection rate was 4,836 gpm and was a 42% increase over the previous year. The increase was due to receiving higher than normal amounts of SEGEP wastewater.
- In 2017, the average generation is projected to be 99.3 MW gross or 91.7 MW net.



B. Geothermal Operating Plan

The Geothermal Project Operating Agreement requires the NCPA Commission to establish an Operating Plan and an annual operating level for the Geothermal Units. The purpose of the plan is to maximize the efficient use of the geothermal resource, protect the power plants and equipment, and meet all regulatory and permitting requirements.

A Geothermal Operating Plan, effective July 1, 2016, was approved and recommended by the Coordinated Operating Group (COG), the Generation Services Business Unit, and the NCPA Commission during the May 26, 2016 meeting. The Plan establishes an Operating Protocol that maintains a Two Zone operation within the NCPA lease. The Two Zone Operation was implemented to improve operational response time during a unit trip at Plant #1 and maximize generation on the NCPA lease while minimizing reservoir communication with nearby competitor operations.

Under the current Protocol, steam production from the west side of the lease, Zone 1, is directed to Units #1 and #2 at Plant #1. Steam production from the east side of the lease, Zone 2, is directed to Plant #2, Unit #4 *(Figure 5)*. Combining zones is periodically tested to determine if the overall generation from both plants can be increased, but has generally resulted in a net loss of generation. The current Protocol effectively utilizes steam production, improves performance at the plants, and complies with existing permits and regulations.

While the Protocol maximizes generation, it does allow for scheduling flexibility and reduction of load under the proper economic conditions. Sustained curtailments of Plants #1 and #2 are possible, but not recommended because recovery of the curtailed generation would take an extended number of years.

C. Water Injection Program

NCPA continues to operate the steam field in the manner intended to maximize the recovery of injected water. In order to maximize recovery, it is important to have sufficient water and distribute it over the widest possible area of the field. It is also necessary to inject water at the lowest possible rate to maximize the heat transfer between the reservoir rock and water. Other factors that weigh into water injection strategy are targeting hotter zones of the field and higher gas concentrations within the reservoir. The water injection program discusses NCPA's supplemental water source, the Southeast Geysers Effluent Pipeline (SEGEP), current injection operations, micro-earthquake activity and non-condensible gas trends as a result of the injection.

1. Southeast Geysers Effluent Pipeline (SEGEP)

The Southeast Geysers Effluent Pipeline (SEGEP) project is a pipeline bringing water to The Geysers for the purpose of supplementing water injection in the field. During normal years, NCPA receives an average 2,700 gpm out of 5,600 gpm water that is delivered. Injection of this water into The Geysers reservoir helps mitigate reservoir pressure declines and increases steam reserves. *Figure 6* shows the historical SEGEP deliveries for NCPA and the total for the project.

SEGEP deliveries were at normal levels until the Valley Fire occurred in September 2015. The fire damaged several geothermal power plants that are operated by a nearby independent power producer and they were not able to take their allotted share of wastewater for several months. NCPA had a 30% higher than normal water injection from the SEGEP pipeline as a result. NCPA average flow rate from SEGEP was 3,709 gpm in 2016 versus 2,859 gpm in 2015.

2. Injection Operations

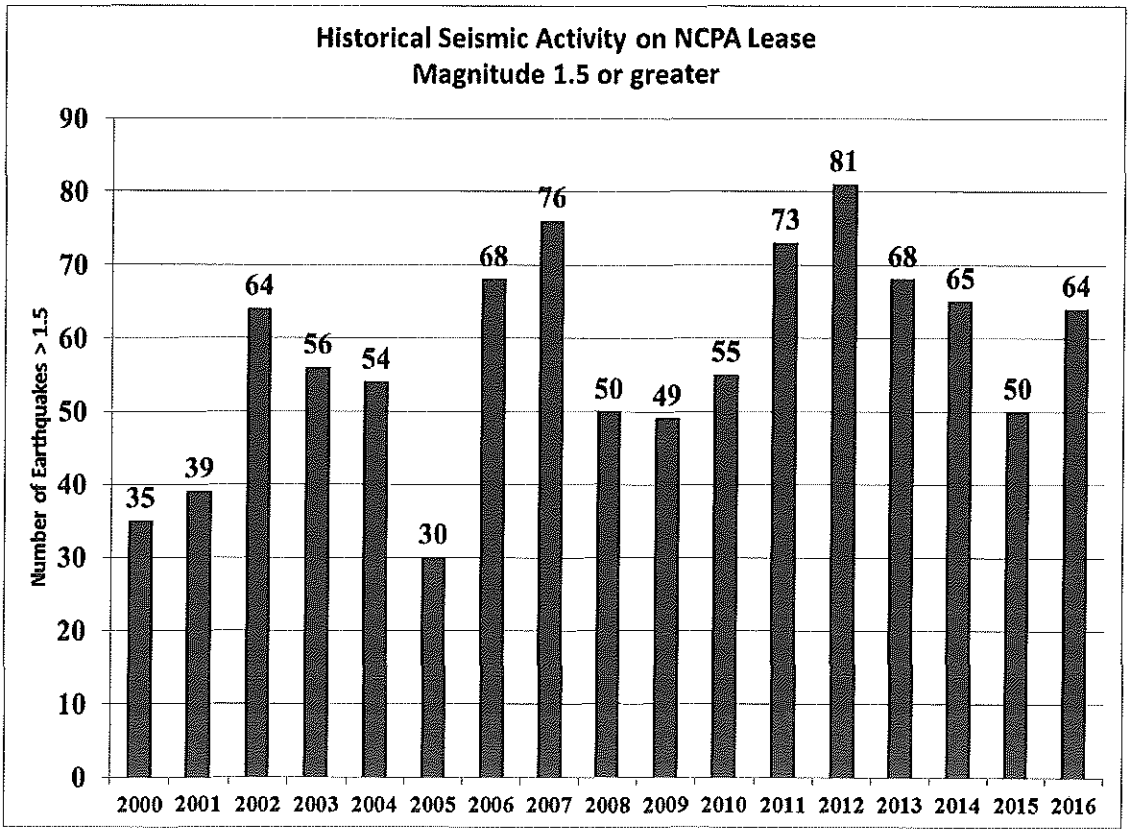
There were 11 different wells used for injection in 2016. The injection strategy continues to be an effort to spread water over large geographic area and limit injection rates down individual wells as much as possible.

Figure 7 shows the relative location of the 11 injection wells on the NCPA lease. Six of these wells, B-6, E-8, H-4, Q-1, Q-4, and Q-10 were only connected to the SEGEP pipeline and therefore received only effluent or wastewater. One well, J-6, is a dedicated condensate injection well receiving water from Plant #2. The remaining four wells received a combination of condensate and wastewater. *Figure 8* and *Table 1* show the relative amounts and type of water each well received in 2016.

3. Micro-earthquake Activity

Studies by the United States Geological Survey (USGS) and others have demonstrated that the steam production and water injection at The Geysers can cause frequent micro seismic events to occur. As a result, NCPA and the other operators are required to continuously monitor and report on the earthquakes that occur within The Geysers geothermal field. *Figure 9* is a map showing the locations of the 804 seismic events of magnitude 1.5 and larger that occurred within The Geysers field during 2016. Fourteen of these events had an earthquake magnitude of 3.0 or greater. The largest seismic event was a magnitude 5.01 on a competitor lease.

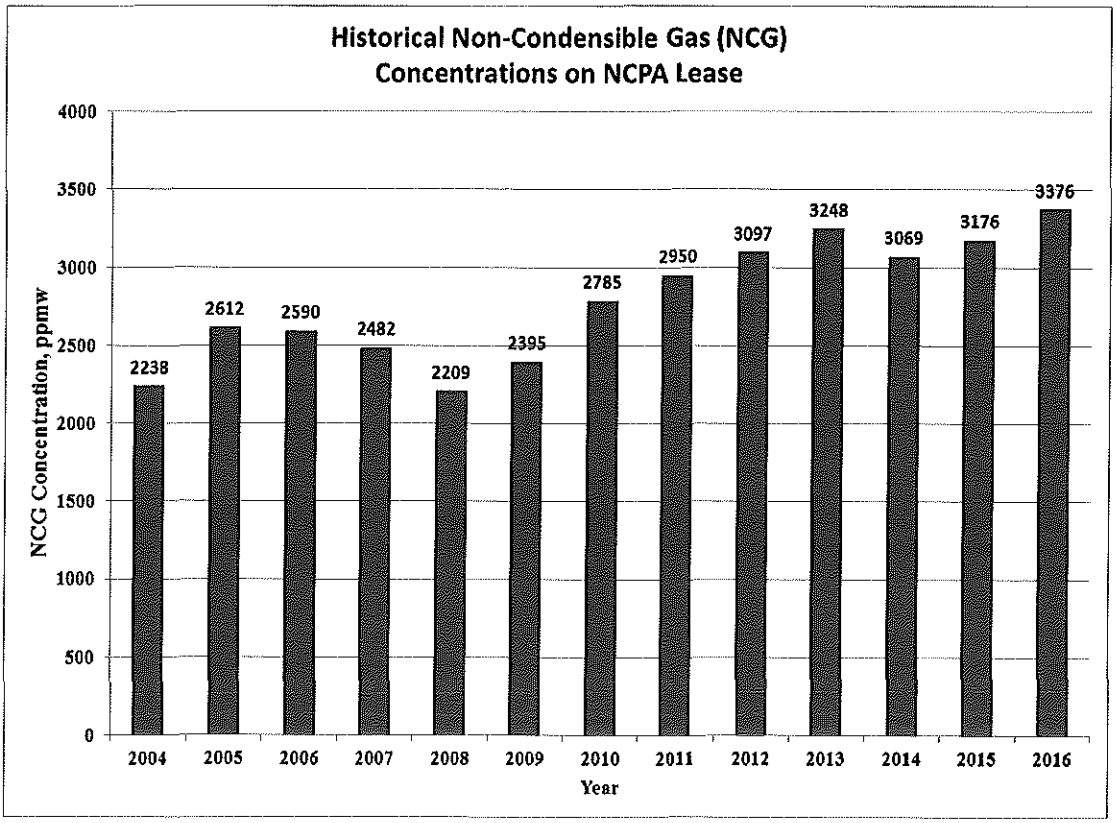
On the NCPA lease, there were 64 events of M=1.5 or greater. The largest event was a magnitude of 3.37 and occurred near NCPA's southern lease line. The figure below shows the historical seismic activity for the NCPA lease from 2000 through 2016. The seismic activity for 2016 was higher than the activity in 2015.



4. *Non-condensible Gas (NCG) Trends*

Non-Condensible Gas (NCG) is a natural product of the reservoir and may be present in varying concentrations within the steam that is produced at The Geysers. NCG production reduces plant efficiency and increases chemical treatment costs. The values vary significantly based on operating guidelines for the field, plant outages, or injection strategy. Water injection in areas of high gas concentration generally reduces NCG production and improves plant efficiency.

Table 4 shows an annual sampling of all the producing wells in the field and the analysis for NCG's. These values can vary somewhat based on daily operational changes and the adjustment of injection strategies within the field, but are considered to be typical concentrations of NCG's for these wells. In spite of increased injection for the year, NCG concentrations were slightly up from the previous year. Figure 10 shows a comparison of the relative changes throughout the field.



D. Geothermal Facility Projects

Major projects completed in 2016 were:

- Sedimentation Basin Repair – The concrete on the Sedimentation Basin needed to be repaired and re-coated to prevent possible structural damage. The project was completed on July 25, 2016 at a cost of $160,122.
- Knockout Pot Repair – Heat loss in the steam production pipelines causes some steam condensate or water to form in the lines. The water is collected by knockout pots for reinjection back into the reservoir. A significant number of knockout pots were not functioning due to debris and needed to be repaired. Repairs or modifications were made to 33 knockout pots. The project was completed on April 29, 2016 and cost $132,252.

In 2017, major projects that have been completed or will be initiated are:

- Plant #1 Yard Repair – A large 40 ft x 100 ft concrete pad was constructed in the Plant #1 yard to prevent asphalt damage from continued storage of phase separators and sulfur bins. In addition, a gas cylinder storage shed was constructed and repairs to existing asphalt in the plant yard were done. The project was completed on March 10, 2017 at a cost of $206,865.
- Unit #4 Main Steam Pipeline – A new Unit #4 main steam pipeline was constructed for the purposes of reducing pressure losses and improving in generation. The pipeline was put into service on March 30, 2017 and the unit saw the expected 1 MW gain in generation. The project cost was the budgeted amount of $950,000. With this project cost and generation benefit, the economics show a three-year payback on investment with an IRR of 38.5% achieved over a fifteen year life.
- Plant #2 Fire Line Replacement – The Plant #2 fire line has been contracted out with an expected project cost of $571,000. Replacement of the Plant #2 fire line should start in May 2017.

II. 2016 RESERVOIR PERFORMANCE REVIEW

In This Section

- Reservoir Pressure Distribution
- Reservoir Pressure and Flowrate Decline
- 2016 Generation Review
- 2017 Generation Forecast

Reservoir performance can be affected by a number of factors such as changes in the location or amount of water injected, the operating pressure of the field, gain or loss of production wells, or changes in the operation of nearby competitor leases. The effects of these changes on the reservoir are normally monitored by conducting pressure build-up tests on production wells, tracer tests on injection wells, and a continuous review of pressure, temperature, and flowrate data from the field. This section will discuss recent changes in reservoir pressure distribution, reservoir pressure decline, and steam field flowrate decline.

A. Reservoir Pressure Distribution

One of the most important parameters in predicting and explaining reservoir performance is static reservoir pressure. *Figure 11* shows areal pressure distributions of static reservoir pressures for April 2016 and April 2017. In general, wells on the west side of the field have the lowest reservoir pressures (< 80 psig) and the east side of the field continues to be the higher pressure area.

B. Reservoir Pressure and Flowrate Decline

Changes in reservoir pressure over time are a function of the mass-replacement ratio. By injecting steam condensate and supplementing it with run-off fresh water and secondary treated wastewater from the Southeast Geysers Project, the decline in reservoir pressures has moderated or slowed with time.

In 2016, 52 wells were shut-in at various times to conduct pressure build-up tests. The tests revealed that the average wellhead shut-in pressure was 72 psig or an average decrease in wellhead pressure of 12.3 psig. This may be attributed to increased injection from 2015. The average well on the NCPA lease flows 27,000 lb/hr at 39.5 psig.

The projected flowrate decline is shown in *Figure 13*. In 2016, the overall steam field flow rate averaged 1,773 klbs/hr. This flow rate is projected to be 1,741 klbs/hr in 2017. The projected overall steam field decline is a harmonic 1.9%. Continued and strategic injection of water over a wide area of the reservoir is expected to enhance recovery and provide better reservoir pressure support in future years.

C. 2016 Generation Review

Gross generation for the NCPA Geo Facilities in 2016 was 887.3 GWhr with net generation of 820.1 GWhr. For FY 2017, gross generation is estimated to be 873.2 GWhrs with net generation of 810.9 GWhrs. The 2016 gross generation capacity was an average of 101 MW while net generation capacity averaged 93.3 MW.

D. 2017 Generation Forecast

The updated forecast of future reservoir performance, and the resulting energy generation forecast for the NCPA geothermal plants, was developed using decline curve analysis in conjunction with a review of the 2015 computerized reservoir model projection. Included in the forecast are:

1. Operation of the steam field in a two-zone operation.
2. Installation of new turbines in Units #1 and #2 in the spring and fall of 2013.
3. The continued benefits being derived from the Southeast Geysers Effluent Pipeline Project.

The most recently developed forecast of steam field operations is illustrated in *Figure 12*. This graph shows NCPA's 34 year historical data for both steam production and water injection, and forecasts of production and injection out to year 2041. With the startup of the Effluent Pipeline in September 1997, and with its continuous operation projected thereafter, the average annual mass replacement is close to 100%. Water injection should continually exceed production in the future and a gradual decline in the level of steam production will approach a near-sustainable level of 80% of the mass of water injected.

The total amount of steam capable of being produced by NCPA through year 2041 is currently estimated at 305.9 billion pounds. Remaining gross generation reserves are estimated to be 18,085 GWhr with net reserves of 16,163 GWhr. *Figures 14* and *15* respectively show the projected net generation capacity and total net generation amount for 2017 through 2041. *Table 4* details the annual gross and net generation. A more detailed monthly five year forecast can be found in *Table 5*.

In 2017, it is estimated that the Geo Facilities will generate 862.2 GWhrs gross or 796.5 GWhrs net. Respective gross and net generation capacity levels for the year are projected to be 99.3 MW gross and 91.7 MW net. For, FY 2017, the respective gross and net generation amounts are projected to be 873.2 GWhrs and 810.9 GWhrs.

SUMMARY

Steam Field Operations

- The NCPA lease produced 15.1 Glbs steam while injecting 21.2 Glbs of water resulting in an average mass replacement of 140% for the year.
- The average gross generation capacity for 2016 was 101 MW gross while the net generation capacity was 93.3 MW net.
- The average water injection increased from 3,398 in 2015 to 4,836 gpm in 2016. The Valley Fire in late 2015 damaged several power plants of a nearby power producer and as a result, NCPA received a larger share of the available wastewater.
- Water recovery as Injection-Derived-Steam needs to be maintained to continue to benefit from the SEGEP Pipeline. The injection strategy going forward is to inject available water supplies over a greater area with the intent of maximizing its recovery over a shorter time period.

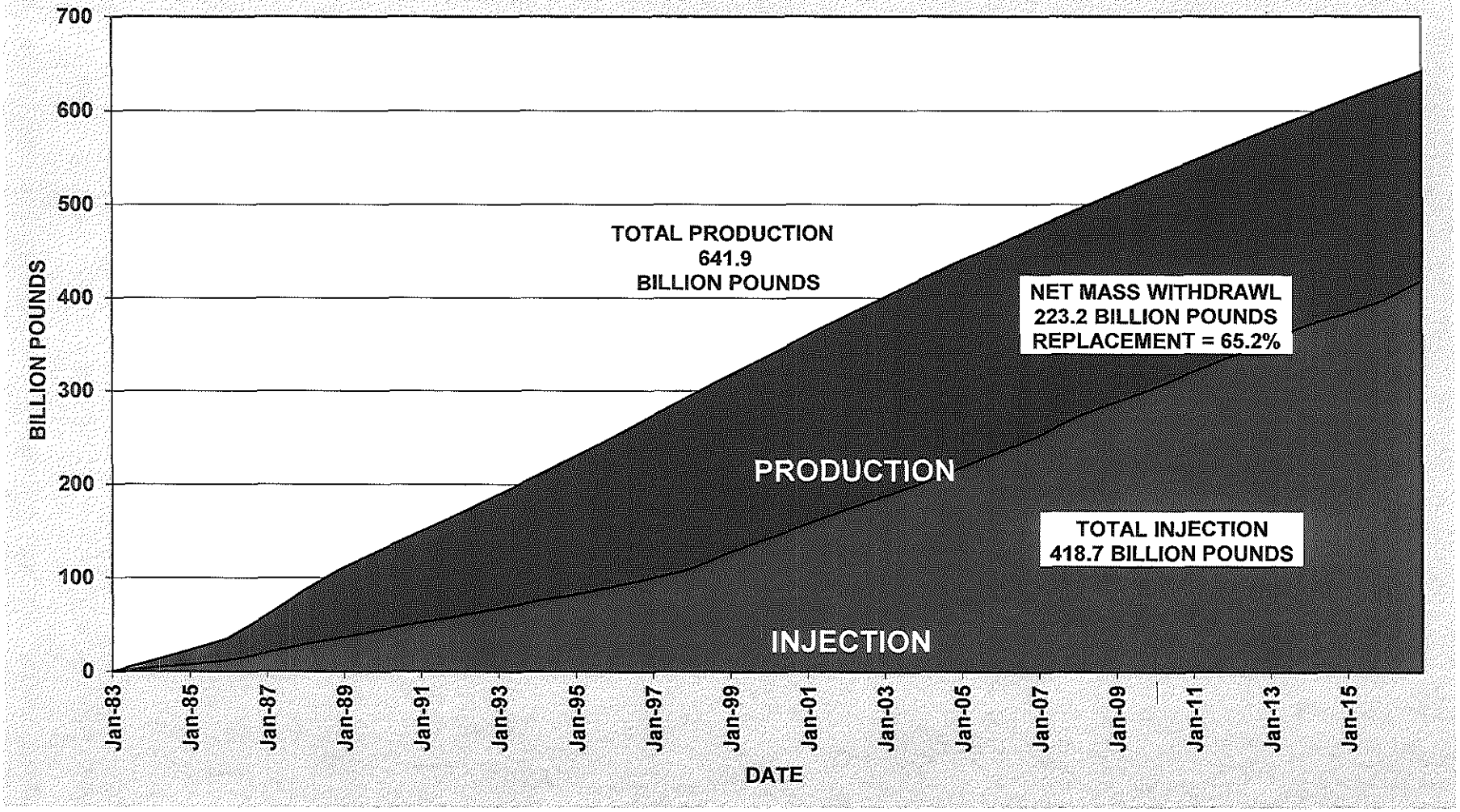
2016 Reservoir Performance Review

- There was a decrease in reservoir pressures mainly at the Q-site well pad due to increased injection. Injection in this area has been reduced to allow the wells to thermally recover.
- Average shut-in wellhead pressure for the NCPA lease was 72.1 psig. The average well produces 27 kph at 39.5 psig.
- The steam field deliverability was 1,773 klbs/hr in 2016. The projected 2017 deliverability is 1,741 klbs/hr. The projected harmonic decline rate going forward is 1.9%.

2016 Generation Review and 2017 Generation Forecast

- Gross generation for 2016 was 887.3 GWhrs with net generation of 820.1 GWhrs. For FY 2017, gross generation is estimated to be 873.2 GWhrs with net generation of 810.9 GWhrs.
- The generation forecast covers the period from 2017-2041. Recoverable steam reserves are estimated at 305.9 billion pounds with the total amount of remaining gross generation estimated at 18,085 GWhr or net generation of 16,163 GWhr.
- The gross generation capacity for 2017 is projected to be 99.3 MW or 91.7 MW net. Gross generation for the year is projected to be 862.2 GWhrs or 796.5 GWhr net. For FY 2017, the respective gross and net generation amounts are projected to be 873.2 GWhrs and 810.9 GWhrs.

FIGURE 1
NCPA STEAMFIELD
CUMULATIVE PRODUCTION AND INJECTION



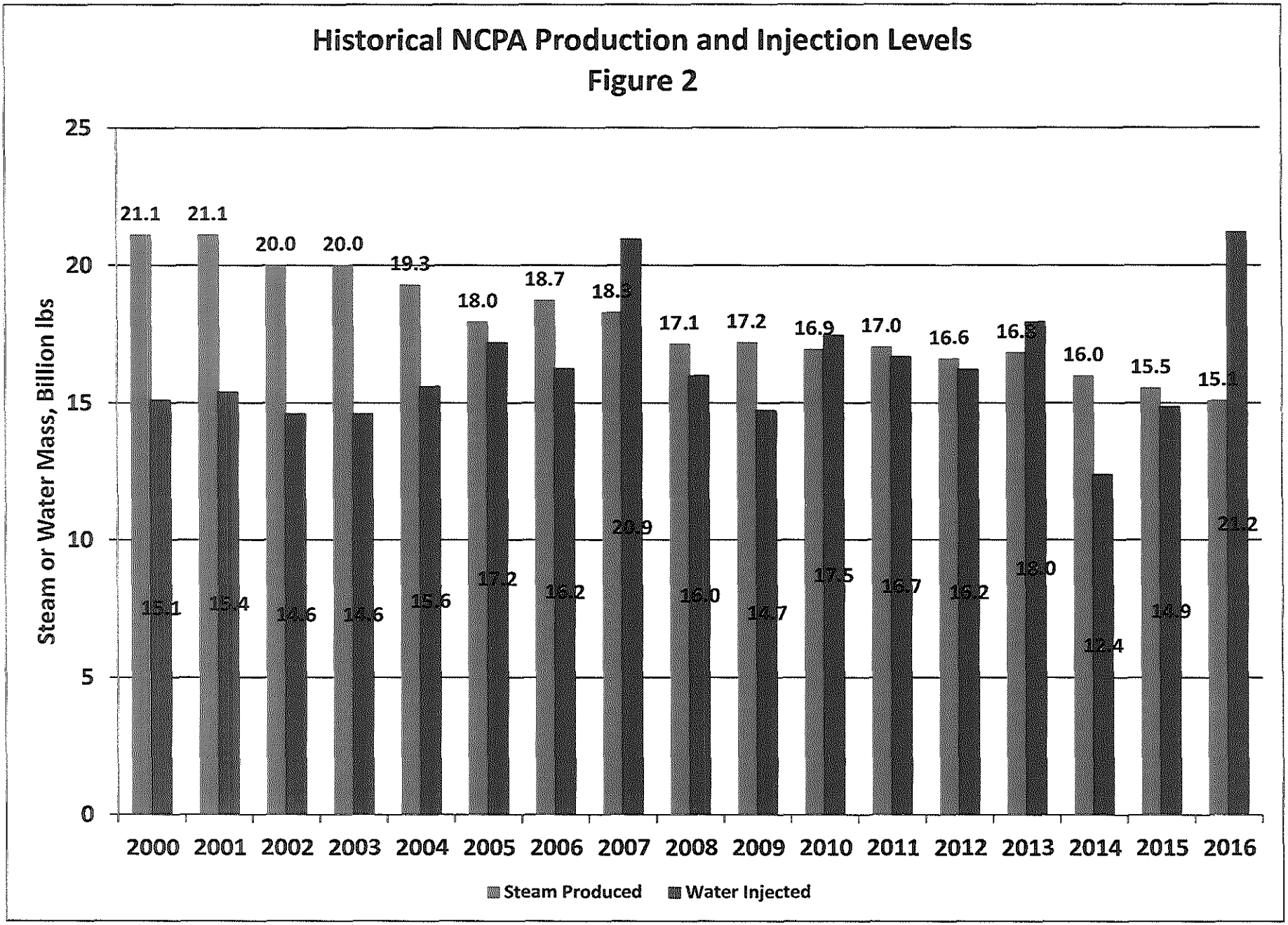
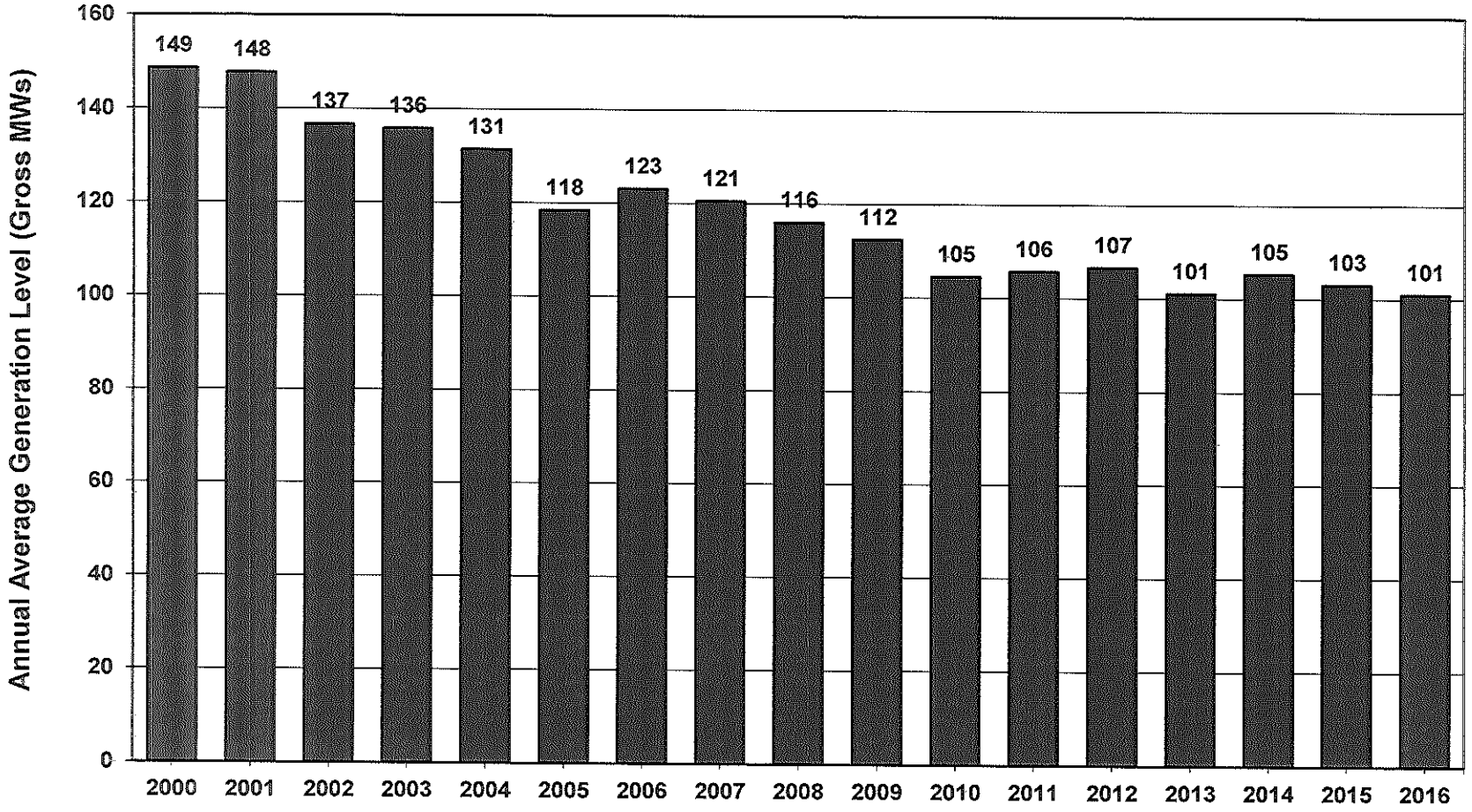

Historical NCPA Production and Injection Levels
Figure 2
Steam or Water Mass, Billion lbs
25
20
15
10
5
0
21.1
21.1
20.0
20.0
19.3
18.0
18.7
18.3
17.1
17.2
16.9
17.0
16.6
16.8
16.0
15.5
15.1
15.1
15.4
14.6
14.6
15.6
17.2
16.2
20.9
16.0
14.7
17.5
16.7
16.2
18.0
12.4
14.9
21.2
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Steam Produced
Water Injected

Figure 3. Historical Power Generation Levels
NCPA Geo Facilities



*Generation levels include downtime for unit outages and overhauls

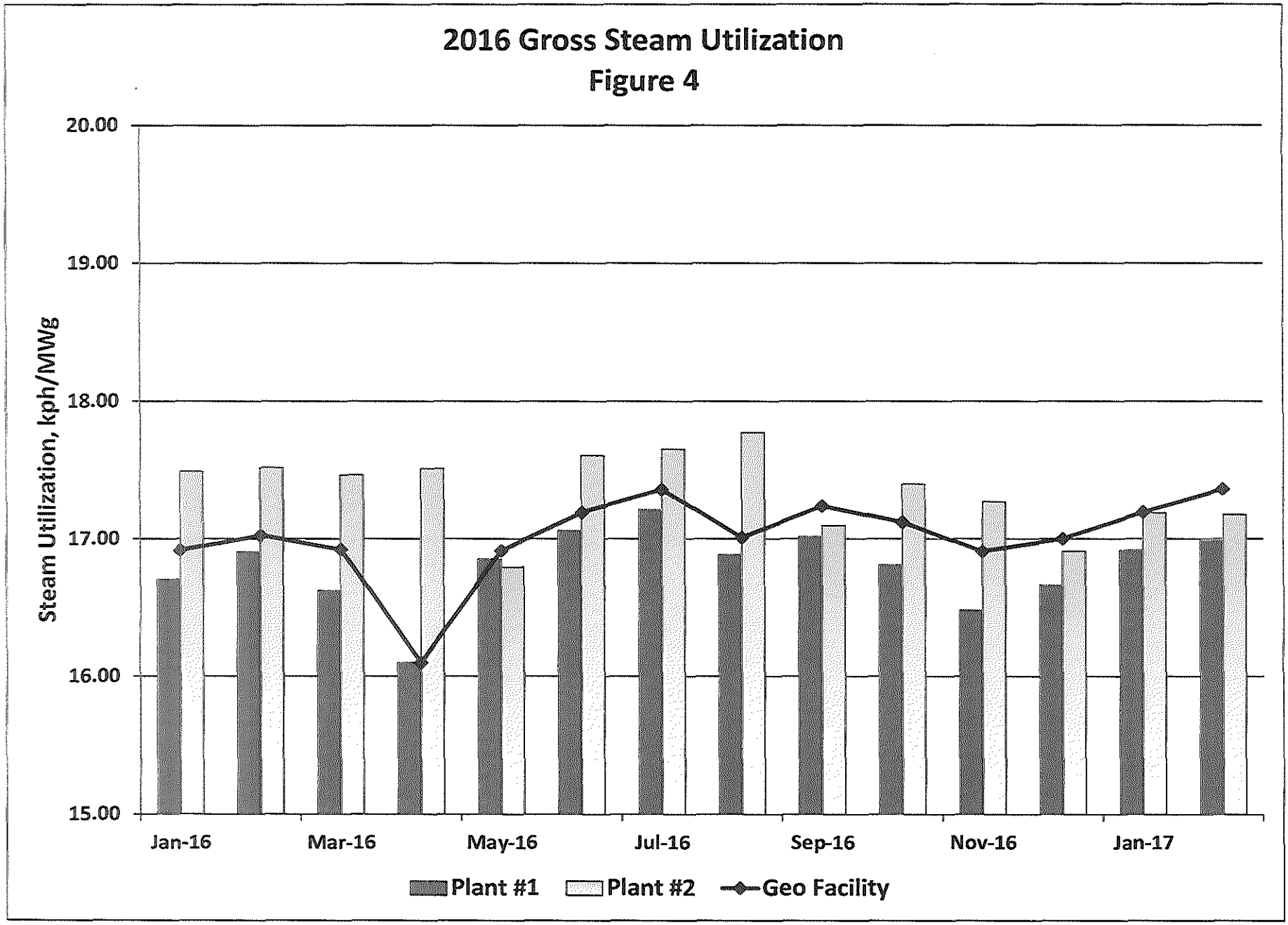
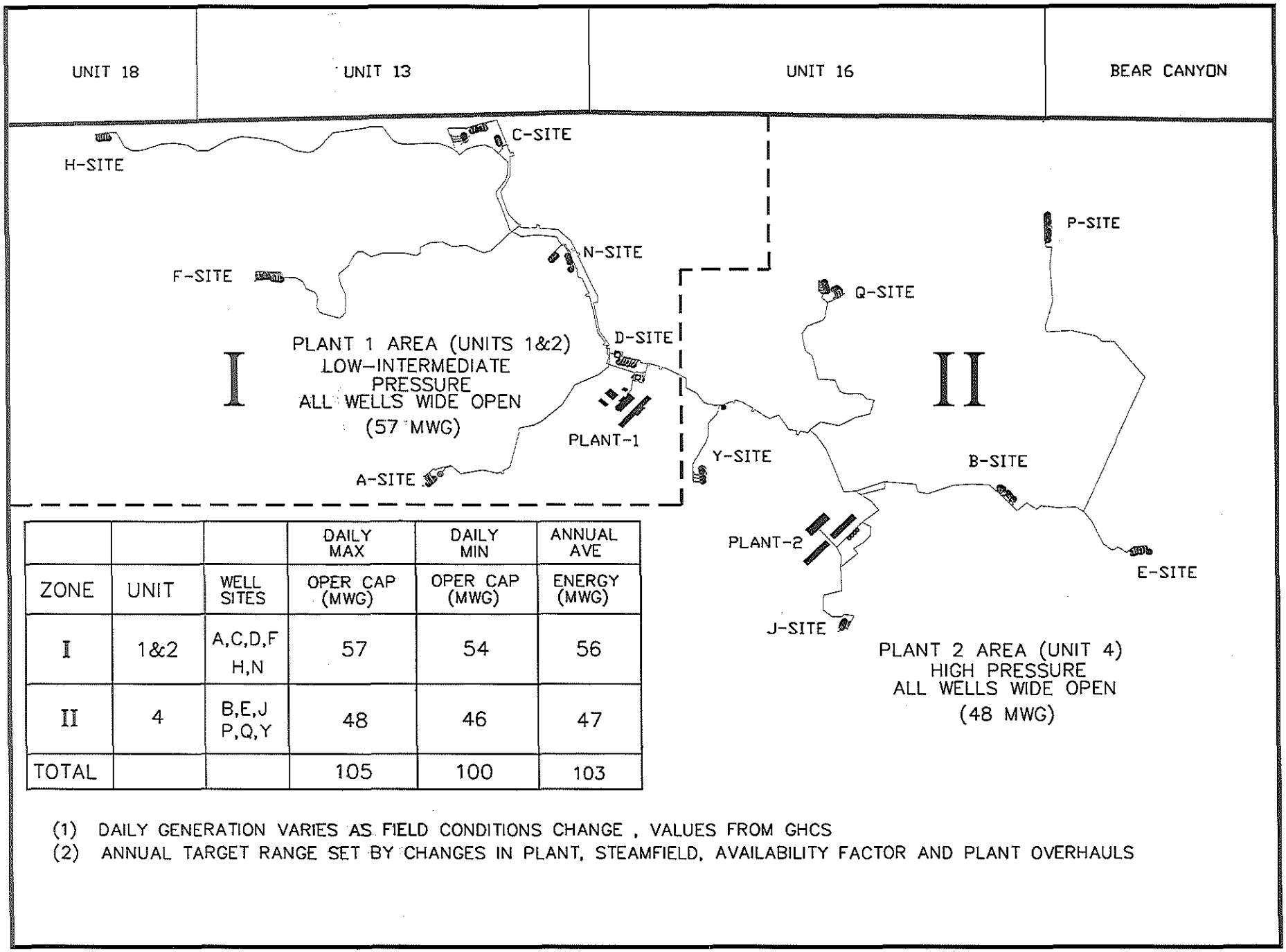

2016 Gross Steam Utilization
Figure 4
20.00
19.00
18.00
17.00
16.00
15.00
Steam Utilization, kph/MWg
Jan-16
Mar-16
May-16
Jul-16
Sep-16
Nov-16
Jan-17
Plant #1
Plant #2
Geo Facility

Figure 5. GEOTHERMAL OPERATIONAL PLAN 2017



			DAILY MAX	DAILY MIN	ANNUAL AVE
ZONE	UNIT	WELL SITES	OPER CAP (MWG)	OPER CAP (MWG)	ENERGY (MWG)
I	1&2	A,C,D,F H,N	57	54	56
II	4	B,E,J P,Q,Y	48	46	47
TOTAL			105	100	103

(1) DAILY GENERATION VARIES AS FIELD CONDITIONS CHANGE , VALUES FROM GHCS
(2) ANNUAL TARGET RANGE SET BY CHANGES IN PLANT, STEAMFIELD, AVAILABILITY FACTOR AND PLANT OVERHAULS

Figure 6. History of SEGEP Deliveries Total and NCPA (Annual Average GPM)

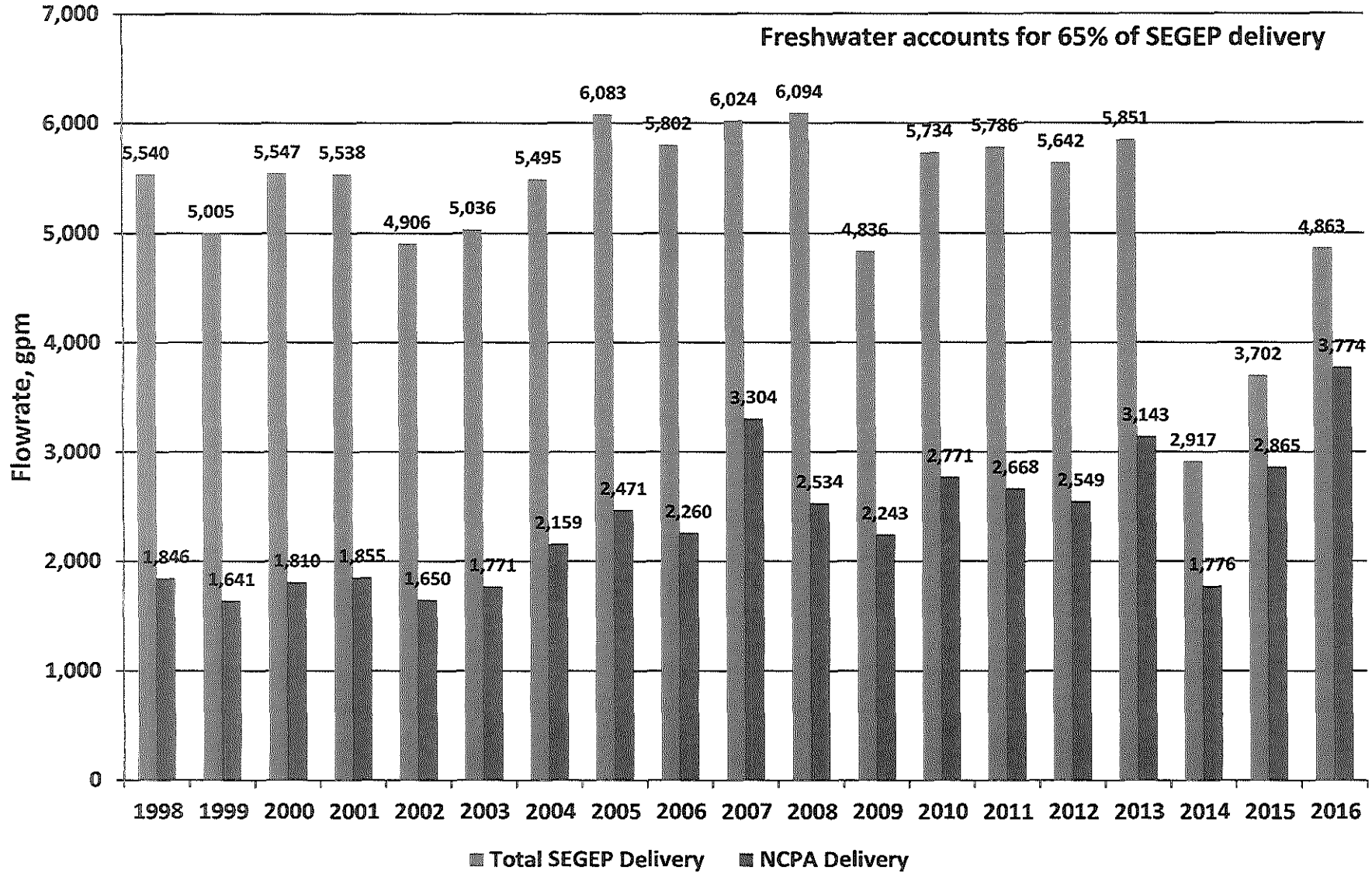


Figure 6 - Historical SEGEP Delivery.xlsx

FIGURE 7 MODIFIED PLAN OF INJECTION

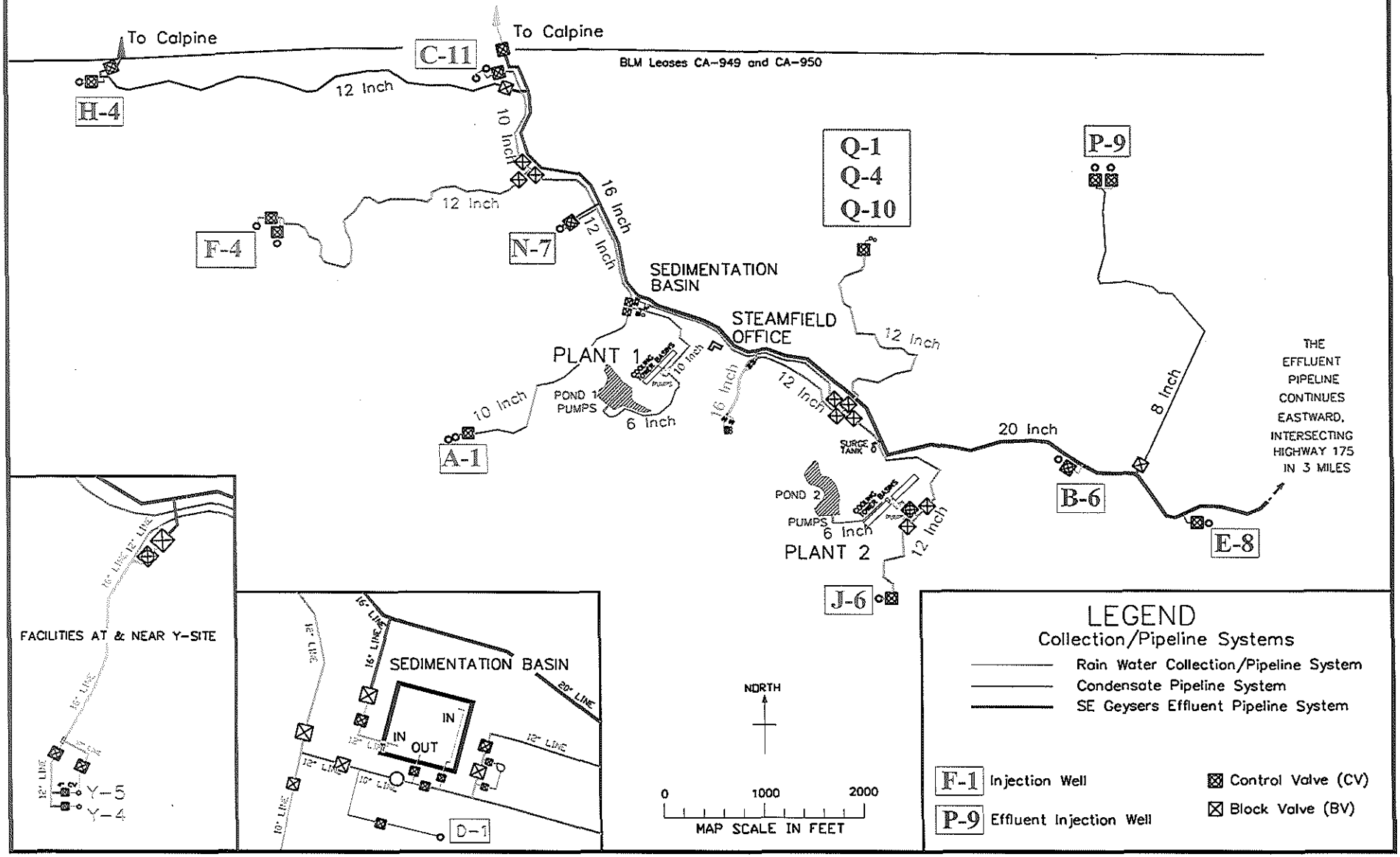
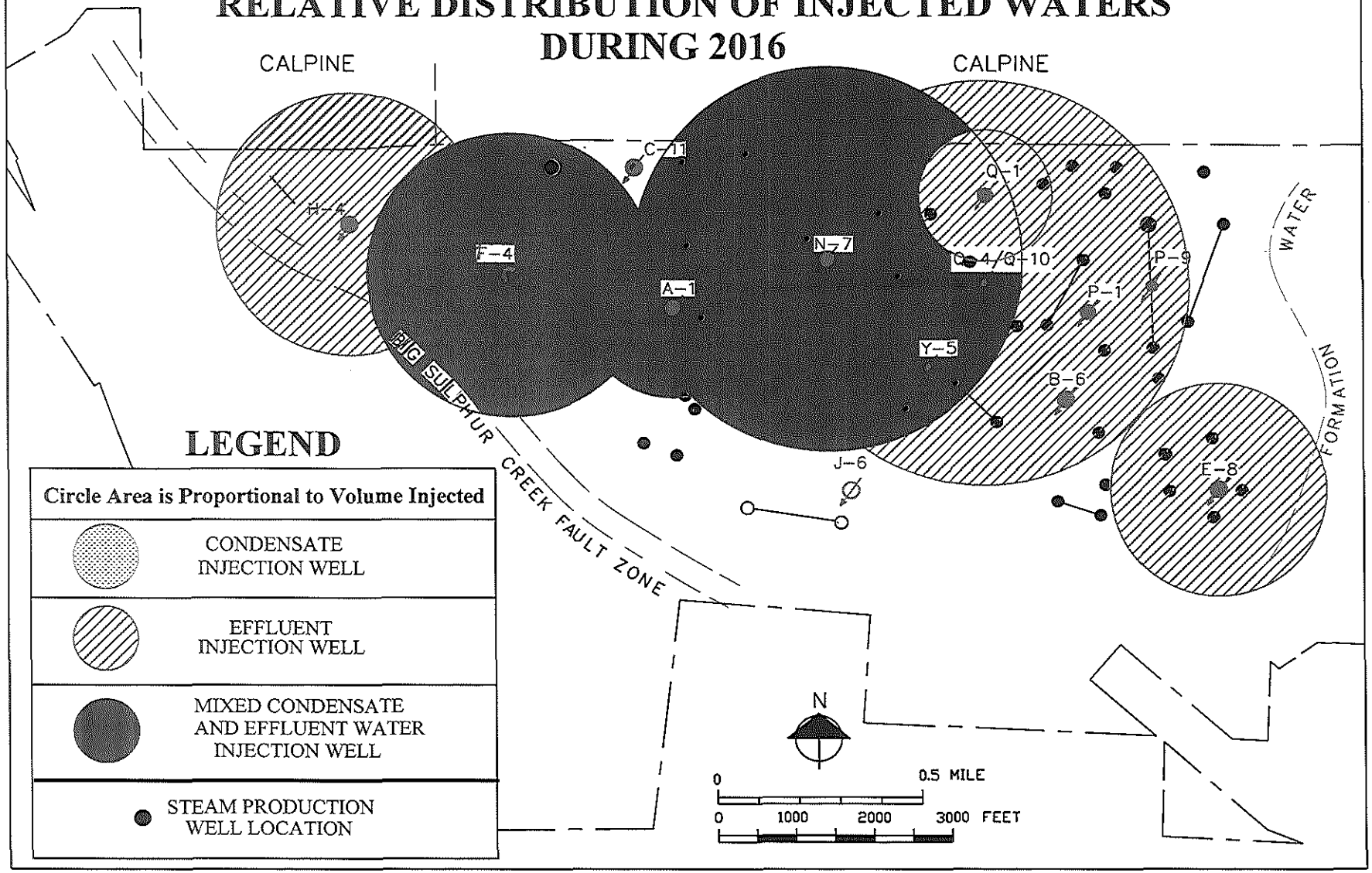


FIGURE 8
NCPA STEAM FIELD
RELATIVE DISTRIBUTION OF INJECTED WATERS
DURING 2016



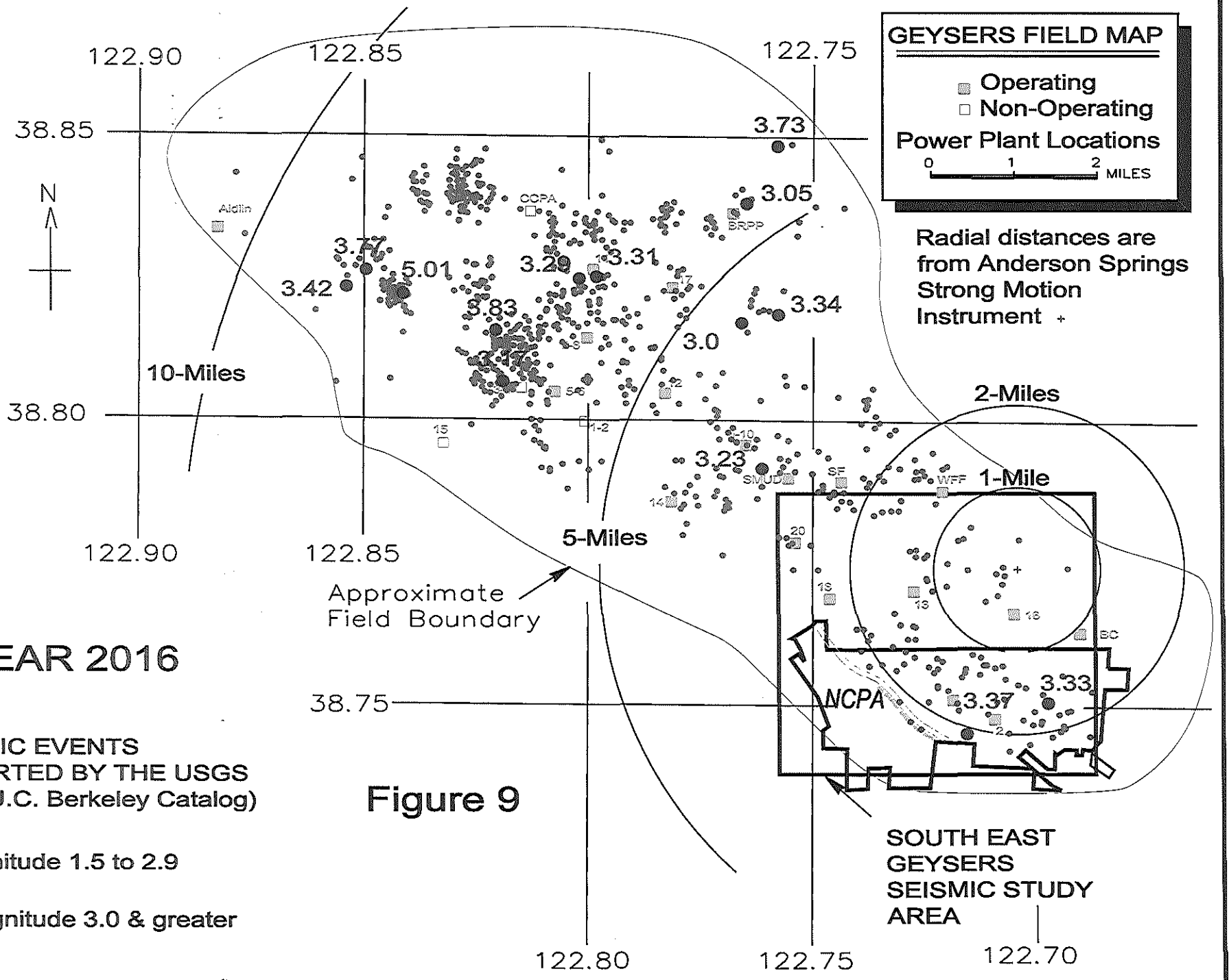

GEYSERS FIELD MAP
Operating
Non-Operating
Power Plant Locations
0 1 2 MILES
Radial distances are from Anderson Springs Strong Motion Instrument +
122.90
122.85
122.75
38.85
38.80
38.75
122.80
N
10-Miles
5-Miles
2-Miles
1-Mile
Approximate Field Boundary
3.73
3.05
3.77
5.01
3.29
3.31
3.42
3.83
3.34
3.0
3.23
3.33
3.37
Aidlin
COPA
BRPP
SMUD
SF
WFF
BC
NCPA
YEAR 2016
SEISMIC EVENTS REPORTED BY THE USGS (from U.C. Berkeley Catalog)
• Magnitude 1.5 to 2.9
● Magnitude 3.0 & greater
SOUTH EAST GEYSERS SEISMIC STUDY AREA

Figure 9

FIGURE 10
NONCONDENSABLE GAS CONCENTRATIONS IN NCPA STEAM (ppm)

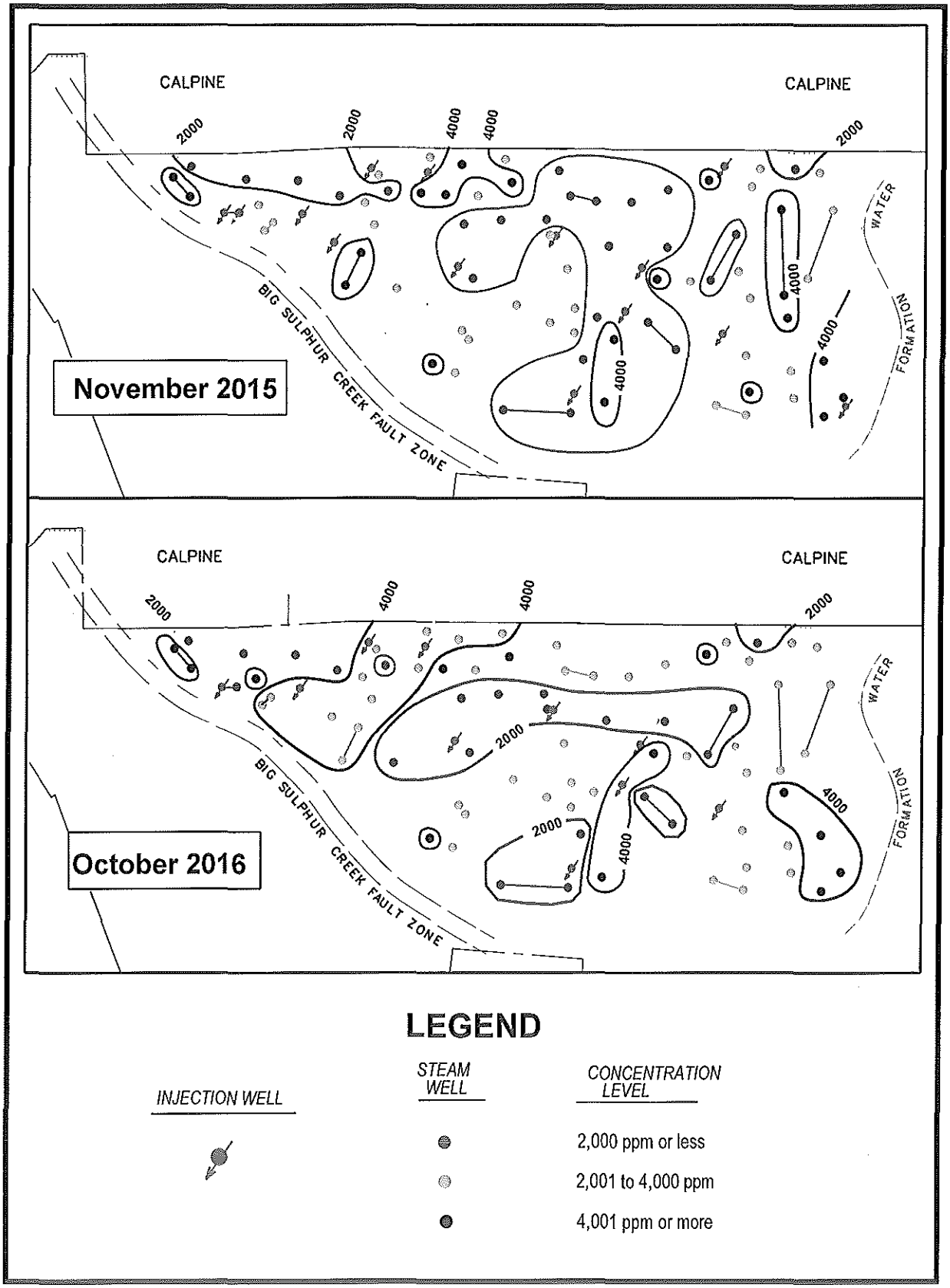
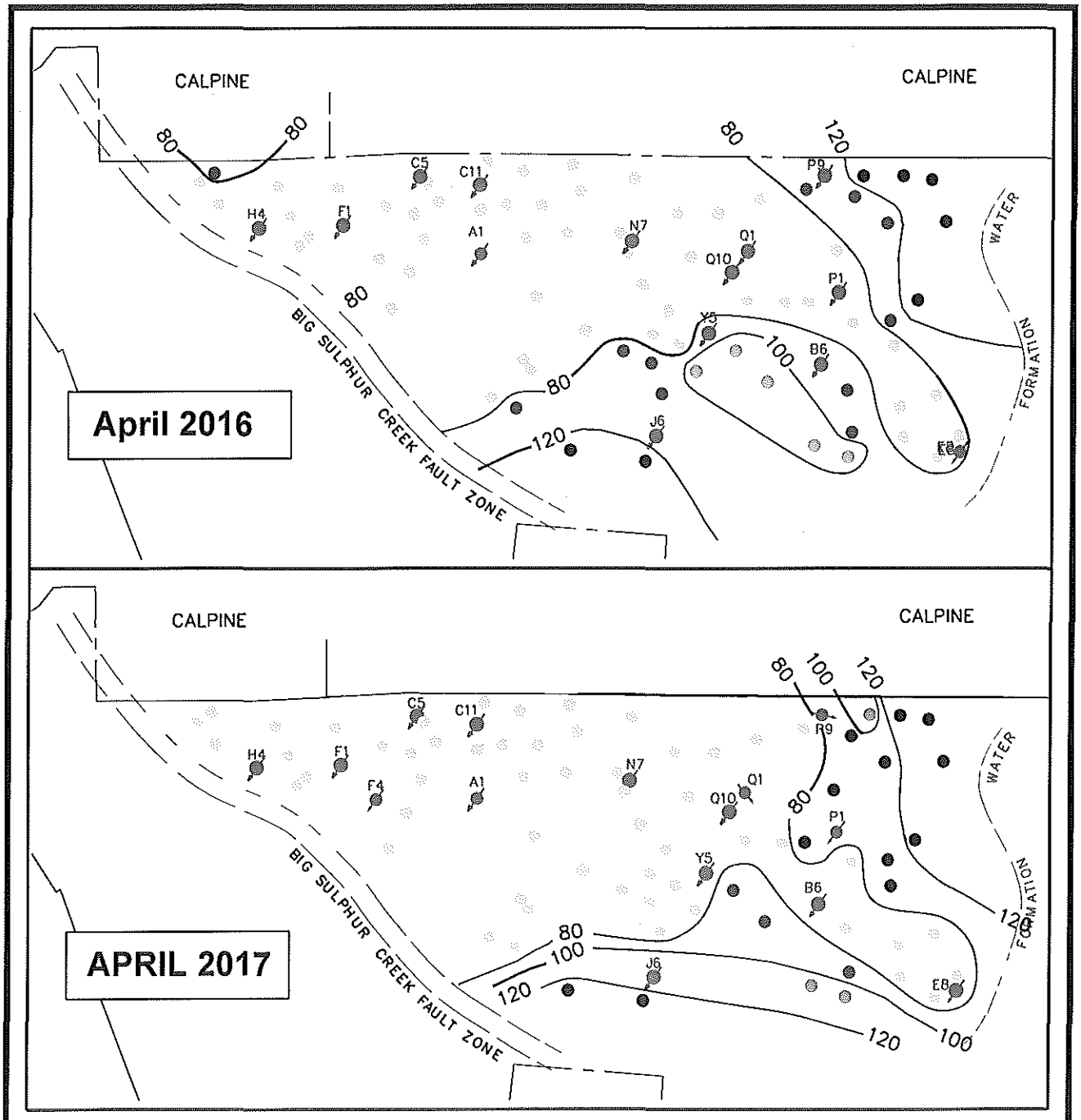


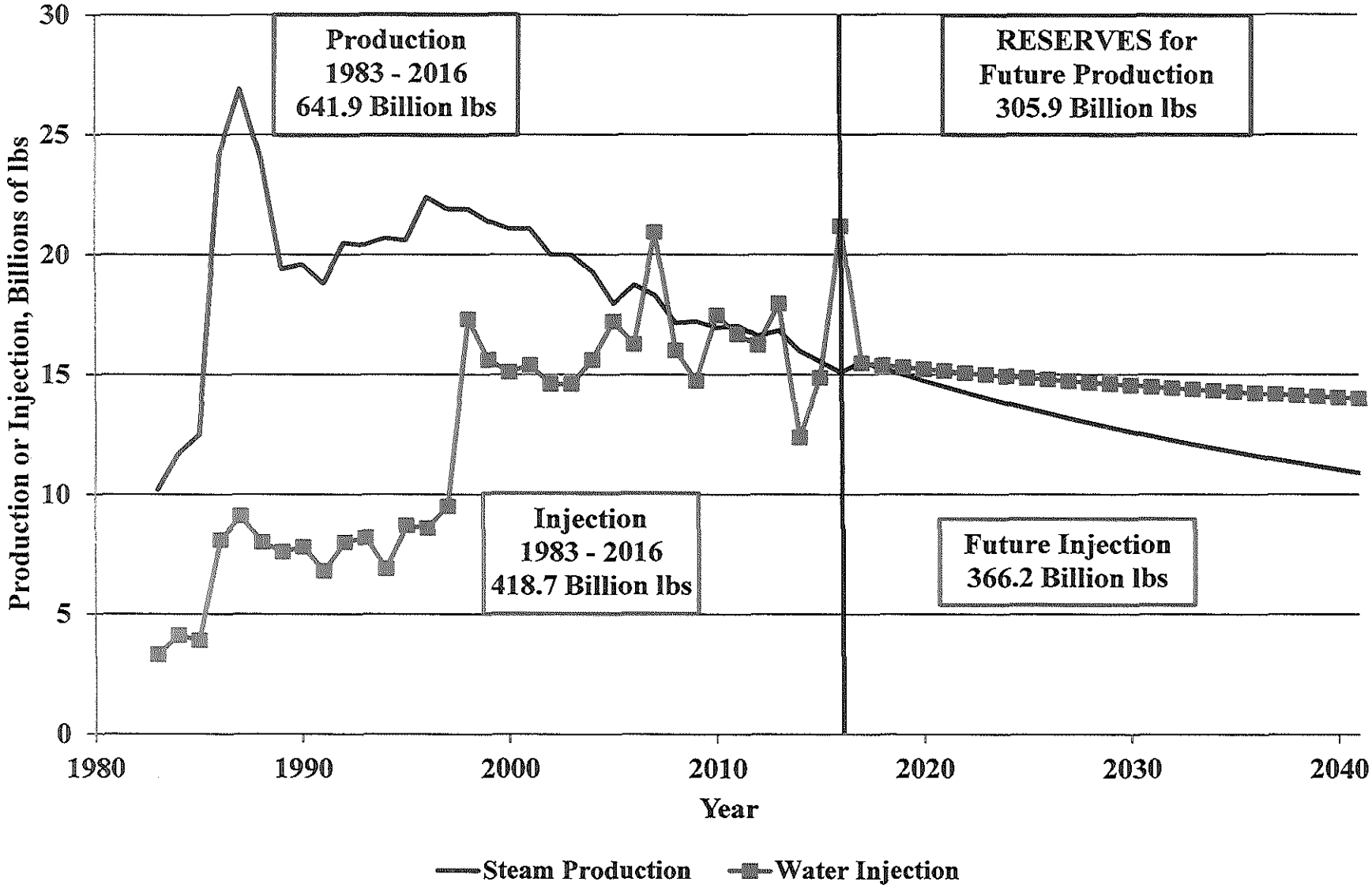
FIGURE 11
NCPA STEAM FIELD RESERVOIR PRESSURE



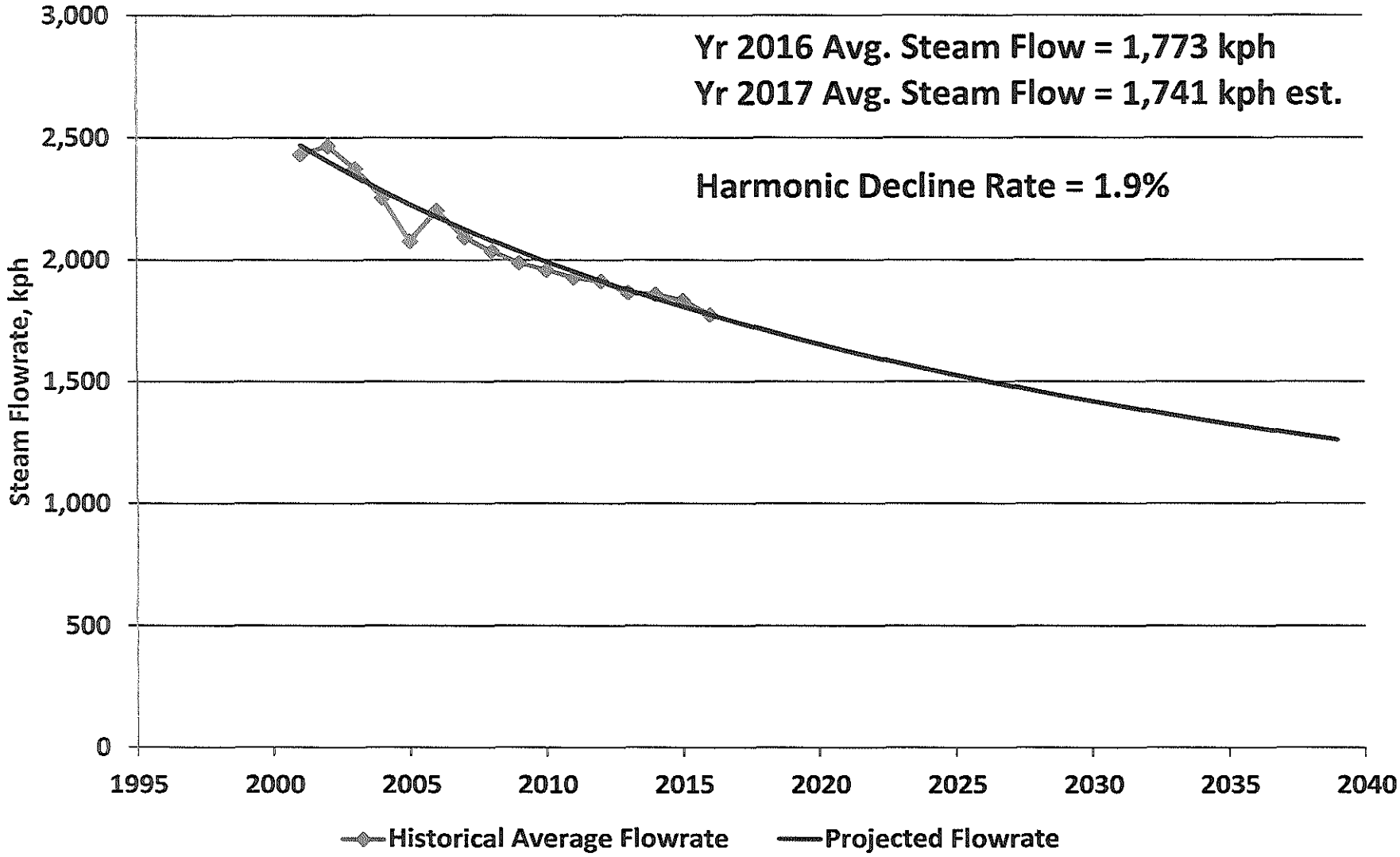
LEGEND

ISOBARIC CONTOUR	*AREA*	*STEAM WELL LOCATION*	*RESERVOIR PRESSURE (PSIG)*
120 — 120	LOW	●	< 80
	MEDIUM LOW	●	80 - 100
	MEDIUM HIGH	●	101 - 120
	HIGH	●	> 120

Historical and Forecast Steam Production & Water Injection
Figure 12

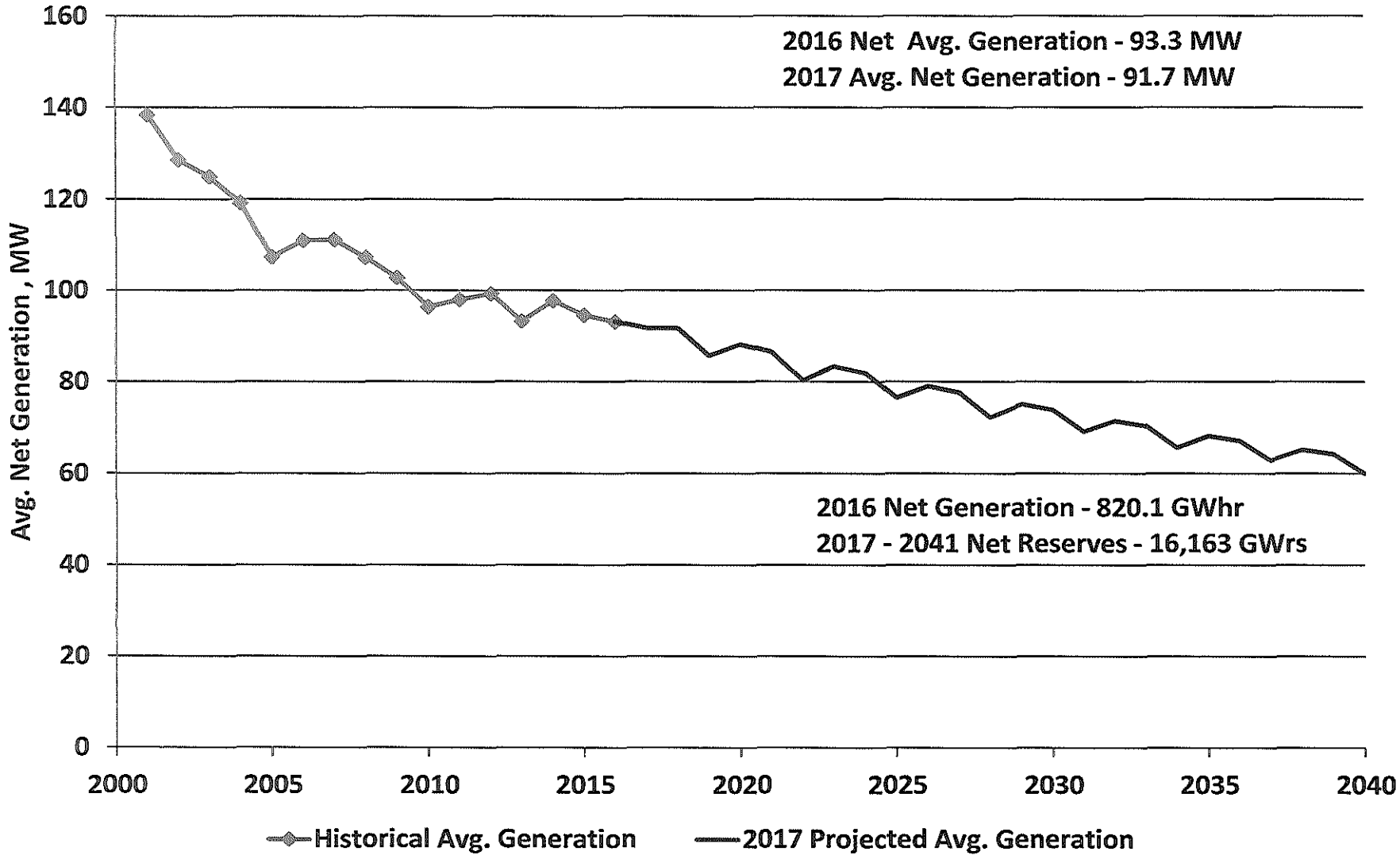


Historical and Projected Steam Flowrates Combined
NCPA Plant #1 & #2
Figure 13

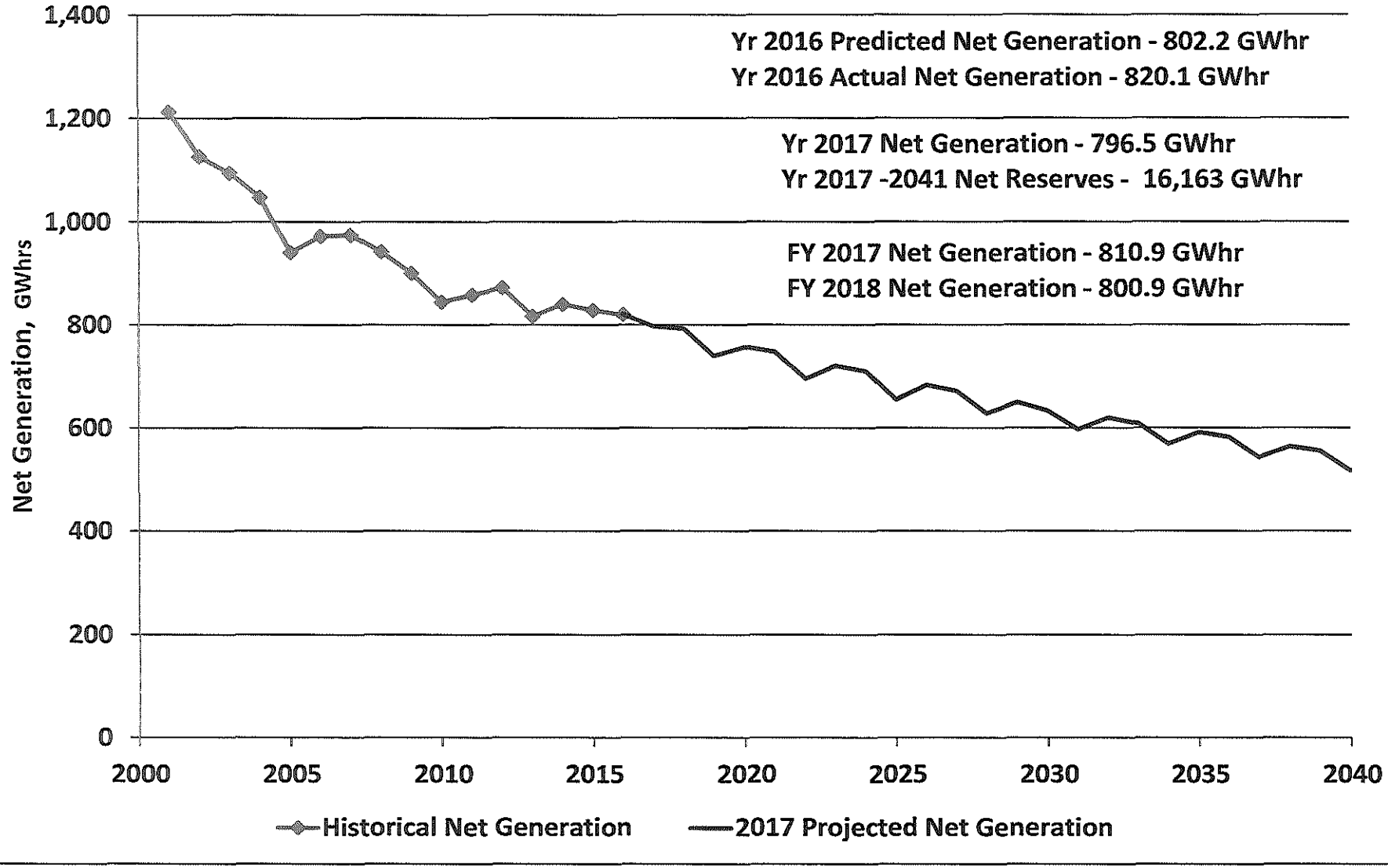


Historical and Projected Average Net Generation Level
Combined NCPA Plants #1 & #2

Figure 14



Historical and Projected Net Generation
Combined NCPA Plants #1 & #2
Figure 15



2016 Injection

Table 1. ANNUAL REPORT OF NCPA INJECTION AT THE GEYSERS STEAM FIELD for Year 2016 (in 1000 Gallons)

Well		Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Condensate[1]	Effluent[2]	Well Total
A-1	Condensate	30,822	13,776	27,118	12,358	15,611	13,118	9,822	-	2,610	19,975	20,675	24,516	190,401		236,072
	Effluent	1,229	6,520	2,337	6,291	4,748	7,569	2,096	-	2,980	6,917	3,120	1,864		45,671	
B-6	Effluent	-	-	-	-	-	-	-	-	-	-	-	18		18	18
C-5	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
C-11	Condensate	-	-	-	-	-	-	-	-	-	-	-	-	-		-
	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	
E-8	Effluent	29,390	12,902	29,859	19,812	17,858	23,644	21,731	20,161	25,705	24,405	27,785	24,527		277,779	277,779
F-1	Condensate	-	-	-	-	-	-	-	-	-	-	-	-	-		-
	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	
F-4	Condensate	35,464	21,644	33,448	19,529	25,482	15,714	5,345	20,809	24,110	24,824	30,654	32,287	289,310		371,285
	Effluent	1,823	8,128	2,855	10,243	7,578	8,889	5,763	9,975	11,003	8,236	4,660	2,822		81,975	
H-1	Effluent	-	-	1,259	16,598	33,345	34,705	28,957	-	-	-	-	-		114,864	114864
H-4	Effluent	31,533	28,350	28,106	23,631	24,881	30,280	32,314	25,248	30,168	29,804	30,035	28,882		343,232	343,232
J-6	Condensate	60	-	19	-	193	-	-	937	-	79	-	61	1,349		1,349
N-4	Condensate	-	-	-	-	-	-	-	-	-	-	-	-	-		-
	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	
N-7	Condensate	21,500	7,930	14,487	235	3,184	624	10,998	4,340	6,591	13,379	11,985	17,647	112,901		502,612
	Effluent	38,198	34,413	38,564	25,653	23,283	30,902	29,489	30,342	36,393	38,136	30,492	33,847		389,711	
P-1	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
P-9	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Q-1	Effluent	2,773	7,374	14,933	16,055	16,608	16,241	16,599	12,326	17,271	17,530	18,583	16,076		172,369	172,369
Q-3	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Q-4	Effluent	19,466	5,966	19,359	18,312	18,943	19,482	21,225	14,101	19,450	18,542	20,791	17,934		213,571	213,571
Q-7	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Q-10	Condensate	-	-	-	-	-	-	-	-	-	-	-	-	0		315,837
	Effluent	34,044	27,836	26,638	19,575	19,164	27,165	27,584	20,698	24,912	31,707	22,834	33,680		315,837	
Y-5	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	-
														Condensate(1)	Effluent(2)	Total
Totals		246,302	174,839	238,982	188,292	210,878	228,333	211,923	158,937	201,193	233,534	221,614	234,161	593,962	1,955,026	2,548,988

During each month the % of Effluent Pipeline water that was fresh water withdrawn from Clear Lake: 52%

Notes:
1. "Effluent" (pipeline) volumes are water from Clear Lake together with LACOSAN and Clearlake Oaks treated wastewater.
2. The 9 Bold well names in *italics* are located in Lake County (Central Valley Region), the 10 others are in Sonoma County (North Coast Region).

TABLE 2. GEOTHERMAL FACILITIES
Summary Table

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Generation (gross)										
(MWh)	1,055,813	1,018,904	981,100	916,437	926,368	936,868	886,004	922,995	903,299	887,299
(MW)	120.5	116.0	112.0	104.6	105.7	106.7	101.1	105.4	103.1	101.0
Generation (net)										
(MWh)	974,387	942,153	900,599	844,642	858,747	872,422	816,824	862,842	837,379	819,149
(MW)	111.2	107.3	102.8	96.4	98.0	99.3	93.2	98.5	95.6	93.3
Protocol										
(MW)	122	116	113	108	108	108	108	107	107	107
Steam Conversion										
(Lbs / Kw)	16.66	16.83	17.53	18.33	18.39	17.72	18.99	17.33	17.20	17.00
Steam Delivered										
(Billion Lbs)	17.59	17.145	17.2	16.8	17.04	16.60	16.83	16.00	15.54	15.08
Load Flexibility (gross)										
Monthly High (MW)	126	121	117	109	109	110	109	110	110	109.78
Monthly Low (MW)	106	101	108	63	106	105	82	104	104	103.00
Injection										
Total (Billion Lbs)	20.94	16.00	14.74	17.45	16.66	16.22	17.96	12.39	14.86	21.21
Condensate (Billion Lbs)	6.23	4.87	2.87	4.96	4.79	5.00	4.21	4.62	4.20	4.94
Effluent (Billion Lbs)	14.47	10.83	9.82	12.13	11.82	11.18	13.75	7.77	12.50	16.27
Mass Replacement										
Annual (%)	119.0%	93.3%	85.7%	103.9%	97.8%	97.7%	106.7%	77.5%	95.6%	140.6%
Cumulative (%)	55.2%	56.2%	57.2%	58.6%	59.8%	60.9%	62.2%	62.6%	63.4%	65.2%
Wells Used For Injection										
	7	8	8	11	15	15	13	12	13	11
NCPA Micro-seismic Activity M> = 1.5	76	50	49	55	73	81	68	58	50	64
NCPA Micro-seismic Activity Maximum Magnitude Event	2.91	2.97	2.64	2.99	3.3	2.91	3.76	4.38	2.99	3.37
NCG Concentration (ppmw)	2,482	2,209	2,395	2,785	2,950	3,097	3,248	3,069	3,176	3,376

Table 3
RESERVOIR PRESSURE
BY WELL 2017

WELL	PRESS
A-3	69.3
A-4	69.3
A-5	67.9
A-6	66.4
A-SITE	68.2
B-2	79.9
B-3	78.6
B-4	75.5
B-5	72.8
B-6	
B-SITE	76.7
C-1	56.3
C-2	53.5
C-4	57.4
C-5	53.0
C-6	53.4
C-7	51.3
C-8	56.2
C-9	55.7
C-10	40.6
C-SITE	53.0

WELL	PRESS
D-1	56.9
D-2	76.5
D-6	72.2
D-7	64.6
D-8	
D-SITE	67.5
E-1	74.5
E-2	77.8
E-3	88.4
E-4	74.5
E-5	77.7
E-6	
E-8	
E-SITE	78.6
F-1	55.6
F-2	61.8
F-3	68.0
F-4	
F-5	68.4
F-6	65.5
F-7	63.3
F-SITE	63.8

WELL	PRESS
H-1	63.8
H-2	78.7
H-3	63.7
H-4	
H-5	58.9
H-SITE	66.3
J-2	79.7
J-3	93.5
J-4	102.3
J-5	133.6
J-SITE	102.3
N-1	58.7
N-2	
N-3	64.0
N-4	56.8
N-5	
N-6	
N-SITE	59.8

WELL	PRESS
P-1	
P-2	119.0
P-4	152.7
P-5	
P-6	
P-7	91.1
P-8	152.9
P-9	
P-SITE	128.9
Q-1	
Q-3	42.2
Q-4	
Q-5	
Q-6	
Q-7	44.3
Q-8	
Q-9	
Q-SITE	43.2
Y-1	64.8
Y-2	61.5
Y-3	65.1
Y-4	
Y-5	
Y-SITE	63.8

VALUES ARE FROM PRESSURE BUILD- UP TESTS
SHADED NUMBERS ARE FOR DATA OBTAINED FROM OTHER STATIC PRESSURE OBSERVATIONS

52 WELLS TESTED AVE. WELL PRESS EQUALS 72.1 psig

AVE SITE PRESS EQUALS 72.7 psig

AVE. FLOWRATE = 27 kph at 39.5 psig

TABLE 4 NCG CONCENTRATIONS (PPMW) 2016
BY WELL, AND SITE AND PROJECT

WELL	NCG	WELL	NCG	WELL	NCG	WELL	NCG
A-3	9843	D-1	3030	H-1	1599	P-1	
A-4	2301	D-2	2706	H-2	1487	P-2	2720
A-5	1085	D-6	3043	H-3	4248	P-4	1486
A-6	3593	D-7	2679	H-4		P-5	1202
A-SITE	**4206**	D-8	972	H-5	3077	P-6	2285
		D-SITE	**1805**	**H-SITE**	**2603**	P-7	3174
B-2	2768					P-8	3095
B-3	4441	E-1	10164	J-2	3443	P-9	
B-4	2971	E-2	3586	J-3	1042	**P-SITE**	**2327**
B-5	2273	E-3	3329	J-4	2610		
B-6		E-4	4745	J-5	930	Q-1	
B-SITE	**3113**	E-5	5503	**J-SITE**	**2006**	Q-3	5323
		E-6	3117			Q-4	
C-1	2948	**E-SITE**	**5074**	N-1	2139	Q-5	2571
C-2	3844			N-2	1490	Q-6	2374
C-4	3814	F-1	1054	N-3	773	Q-7	9559
C-5	12325	F-2	4306	N-4	843	Q-8	3192
C-6	5771	F-3	2084	N-5	3935	Q-9	2398
C-7	3393	F-4		N-6	3977	Q-A	
C-8	6036	F-5	415	**N-SITE**	**2193**	**Q-SITE**	**4236**
C-9	7098	F-6	654				
C-A	2306	F-7	1999			Y-1	2237
C-SITE	**5282**	**F-SITE**	**1752**			Y-2	3827
						Y-3	3328
						Y-4	4394
						Y-5	4483
						Y-SITE	**3447**

VALUES ARE FROM NCPA CHEM LAB ANALYSIS

Number of wells samples wells sampled=	**65**
AVG. WELL NCG =	**3376**
AVG. SITE NCG =	**3170**
NCG Flow Weighted Avg. =	**3091**

2017 Generation - 25 Year Forecast
Table 5

	Total Geo Facilities		Plant #1		Plant #2	
	Gross Generation	Net Generation	Gross Generation	Net Generation	Gross Generation	Net Generation
Year	GWHr	GWHr	GWHr	GWHr	GWHr	GWHr
2017	862.2	796.5	492.4	448.5	369.8	348.1
2018	859.7	792.8	487.9	443.4	371.8	349.4
2019	852.4	739.8	489.3	399.1	363.0	340.6
2020	827.8	757.1	480.0	431.3	347.8	325.8
2021	818.9	748.0	472.2	423.7	346.7	324.3
2022	764.6	695.3	466.0	417.4	298.6	277.9
2023	795.5	720.7	463.8	411.3	331.8	309.4
2024	784.7	709.7	459.0	406.5	325.7	303.2
2025	759.2	654.3	448.1	365.2	311.0	289.1
2026	754.1	683.1	442.5	393.9	311.7	289.3
2027	742.4	671.4	436.9	388.3	305.5	283.1
2028	700.9	627.9	436.3	384.0	264.6	243.9
2029	723.6	649.1	429.8	377.6	293.8	271.4
2030	703.0	632.5	421.0	372.4	282.0	260.1
2031	699.0	596.4	416.0	335.8	283.0	260.6
2032	690.9	619.7	412.1	363.4	278.7	256.2
2033	682.6	608.2	409.6	357.6	273.0	250.6
2034	641.1	568.5	404.8	352.9	236.3	215.6
2035	662.7	591.5	396.8	348.2	265.9	243.3
2036	653.3	582.1	393.3	344.6	260.0	237.5
2037	642.8	542.6	387.8	310.0	255.0	232.6
2038	637.5	563.3	386.7	334.9	250.8	228.4
2039	629.2	555.0	382.4	330.6	246.8	224.4
2040	585.2	516.7	375.0	326.4	210.2	190.3
2041	611.8	540.6	371.9	323.2	239.8	217.3

Notes:

1. Assumes 3 unit operation.
2. Steam Reserves: 305.9 Billion lb.
3. Gross Reserves: 18,085 GWhr
4. Net Reserves: 16,163 GWhr
5. Plant #1 Auxiliary Load is fixed at 5.68 MW.
   Plant #2 Auxiliary Load is fixed at 2.58 MW.
6. Plant availaibility is 99.5% or a forced outage rate of 43.8 hrs per year.
7. See Table 5B for scheduled outages.

2017 Generation Level - 25 Year Forecast
Table 5A

	Plant #1		Plant #2		Total	
Year	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW
2017	56.9	51.8	42.4	39.9	99.3	91.7
2018	56.9	51.3	43.0	40.4	99.9	91.7
2019	56.1	46.3	42.0	39.4	98.1	85.7
2020	55.4	49.8	41.0	38.4	96.4	88.2
2021	54.6	49.0	40.1	37.5	94.7	86.5
2022	53.9	48.3	34.3	31.9	88.2	80.2
2023	53.2	47.6	38.4	35.8	91.6	83.4
2024	52.5	46.9	37.6	35.0	90.1	81.9
2025	51.8	42.4	36.8	34.2	88.6	76.6
2026	51.2	45.6	36.1	33.5	87.2	79.0
2027	50.5	44.9	35.3	32.8	85.9	77.7
2028	49.9	44.3	30.3	27.9	80.2	72.2
2029	49.3	43.7	34.0	31.4	83.3	75.1
2030	48.7	43.1	33.4	30.8	82.1	73.9
2031	48.1	38.9	32.7	30.2	80.9	69.1
2032	47.5	41.9	32.2	29.6	79.7	71.5
2033	47.0	41.4	31.6	29.0	78.6	70.4
2034	46.4	40.8	27.1	24.8	73.6	65.6
2035	45.9	40.3	30.5	27.9	76.4	68.2
2036	45.4	39.8	30.0	27.4	75.4	67.2
2037	44.9	36.0	29.5	26.9	74.4	62.9
2038	44.4	38.7	29.0	26.4	73.4	65.2
2039	43.9	38.2	28.6	26.0	72.4	64.2
2040	43.4	37.8	24.6	22.2	68.0	60.0
2041	42.9	37.3	27.7	25.1	70.6	62.4

* Average generation levels plants including down time for outages and overhauls.

2017 Scheduled Outages - 25 Year Forecast
Table 5B

Year	Plant #1 Unit 1 Scheduled Outages hrs	Plant #1 Unit 2 Scheduled Outages hrs	Plant #2 Unit 4 Scheduled Outages hrs
2017	72	72	300
2018	72	72	72
2019	672	672	72
2020	72	72	72
2021	72	72	72
2022	72	72	1008
2023	72	72	72
2024	72	72	72
2025	672	672	72
2026	72	72	72
2027	72	72	72
2028	72	72	1008
2029	72	72	72
2030	72	72	72
2031	672	672	72
2032	72	72	72
2033	72	72	72
2034	72	72	1008
2035	72	72	72
2036	72	72	72
2037	672	672	72
2038	72	72	72
2039	72	72	72
2040	72	72	1008
2041	72	72	72

2017 Generation - 5 Year Forecast
Table 6

	Total Geo Facilities		Plant #1		Plant #2	
	Gross Generation	Net Generation	Gross Generation	Net Generation	Gross Generation	Net Generation
Date	GWHr	GWHr	GWHr	GWHr	GWHr	GWHr
Jan-17	75.2	70.6	42.3	39.6	32.9	31.0
Feb-17	64.4	60.5	35.1	32.9	29.3	27.7
Mar-17	59.8	56.2	40.8	38.3	19.0	17.9
Apr-17	69.0	63.6	37.3	33.7	31.7	29.9
May-17	75.5	69.5	42.8	38.6	32.7	30.8
Jun-17	73.0	67.1	41.4	37.3	31.6	29.8
Jul-17	75.3	69.2	42.7	38.5	32.6	30.7
Aug-17	75.2	69.1	42.7	38.5	32.5	30.6
Sep-17	72.6	66.8	41.2	37.2	31.4	29.6
Oct-17	74.9	68.9	42.6	38.4	32.4	30.5
Nov-17	72.4	66.5	41.1	37.1	31.3	29.4
Dec-17	74.7	68.6	42.5	38.3	32.3	30.3
Jan-18	74.6	68.5	42.4	38.2	32.2	30.3
Feb-18	67.3	61.8	38.3	34.5	29.0	27.3
Mar-18	71.3	65.4	42.3	38.1	29.0	27.2
Apr-18	63.7	62.3	32.7	33.2	31.0	29.1
May-18	74.1	68.1	42.2	38.1	31.9	30.0
Jun-18	71.6	65.8	40.8	36.8	30.8	29.0
Jul-18	73.9	67.8	42.1	38.0	31.8	29.9
Aug-18	73.8	67.7	42.1	37.9	31.7	29.8
Sep-18	71.3	65.4	40.7	36.6	30.7	28.8
Oct-18	73.6	67.5	42.0	37.8	31.6	29.7
Nov-18	71.1	65.2	40.6	36.5	30.5	28.7
Dec-18	73.4	67.3	41.9	37.7	31.5	29.6
Jan-19	73.2	67.2	41.8	37.7	31.4	29.5
Feb-19	66.1	60.6	37.7	34.0	28.3	26.6
Mar-19	70.0	26.5	41.7	0.0	28.3	26.5
Apr-19	70.6	61.1	40.3	32.7	30.2	28.4
May-19	72.8	66.8	41.6	37.5	31.2	29.3
Jun-19	70.4	64.5	40.2	36.2	30.1	28.3
Jul-19	72.6	66.5	41.5	37.4	31.1	29.1
Aug-19	72.5	66.4	41.5	37.3	31.0	29.1
Sep-19	70.0	64.2	40.1	36.1	29.9	28.1
Oct-19	72.3	66.2	41.4	37.2	30.9	29.0
Nov-19	69.8	64.0	40.0	36.0	29.8	28.0
Dec-19	72.1	66.0	41.3	37.1	30.8	28.8
Jan-20	71.9	65.9	41.2	37.1	30.7	28.8
Feb-20	67.2	61.5	38.5	34.7	28.7	26.9
Mar-20	71.7	65.7	41.2	37.0	30.6	28.7
Apr-20	54.5	49.7	35.8	32.2	18.7	17.5
May-20	71.5	65.4	41.1	36.9	30.5	28.5
Jun-20	69.1	63.2	39.7	35.7	29.4	27.6
Jul-20	71.3	65.2	41.0	36.8	30.3	28.4
Aug-20	71.2	65.1	40.9	36.8	30.3	28.4
Sep-20	68.8	62.9	39.6	35.5	29.3	27.4
Oct-20	71.0	64.9	40.8	36.7	30.2	28.3
Nov-20	68.6	62.7	39.5	35.4	29.1	27.3
Dec-20	70.8	64.7	40.7	36.6	30.1	28.1
Jan-21	70.7	64.6	40.7	36.5	30.0	28.1
Feb-21	63.8	58.3	36.7	33.0	27.0	25.3
Mar-21	67.6	61.7	40.6	36.4	27.0	25.3
Apr-21	64.2	58.7	35.3	31.7	28.9	27.0
May-21	70.3	64.2	40.5	36.4	29.8	27.9
Jun-21	67.9	62.0	39.2	35.1	28.8	26.9
Jul-21	70.1	64.0	40.4	36.3	29.7	27.7
Aug-21	70.0	63.9	40.4	36.2	29.6	27.7
Sep-21	67.6	61.7	39.0	35.0	28.6	26.7
Oct-21	69.8	63.7	40.3	36.1	29.5	27.6
Nov-21	67.4	61.6	38.9	34.9	28.5	26.6

2017 Generation Level - 5 Year Forecast*
Table 6A

	Plant #1		Plant #2		Total	
Year	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW
Jan-17	56.9	53.2	44.3	41.7	101.1	94.9
Feb-17	52.2	48.9	43.7	41.2	95.9	90.1
Mar-17	54.8	51.4	25.5	24.0	80.4	75.5
Apr-17	57.9	52.3	44.3	41.7	102.2	94.0
May-17	57.8	52.2	44.2	41.6	102.0	93.8
Jun-17	57.8	52.1	44.1	41.5	101.9	93.7
Jul-17	57.7	52.1	44.0	41.4	101.7	93.5
Aug-17	57.6	52.0	43.9	41.3	101.6	93.3
Sep-17	57.5	51.9	43.8	41.3	101.4	93.2
Oct-17	57.5	51.9	43.8	41.2	101.2	93.0
Nov-17	57.4	51.8	43.7	41.1	101.1	92.9
Dec-17	57.3	51.7	43.6	41.0	100.9	92.7
Jan-18	57.3	51.7	43.5	40.9	100.8	92.6
Feb-18	57.2	51.6	43.4	40.8	100.6	92.4
Mar-18	57.2	51.5	43.3	40.7	100.5	92.3
Apr-18	57.1	51.5	43.2	40.6	100.3	92.1
May-18	57.0	51.4	43.1	40.6	100.2	92.0
Jun-18	57.0	51.3	43.1	40.5	100.0	91.8
Jul-18	56.9	51.3	43.0	40.4	99.9	91.6
Aug-18	56.8	51.2	42.9	40.3	99.7	91.5
Sep-18	56.8	51.1	42.8	40.2	99.5	91.3
Oct-18	56.7	51.1	42.7	40.1	99.4	91.2
Nov-18	56.6	51.0	42.6	40.0	99.2	91.0
Dec-18	56.6	50.9	42.5	40.0	99.1	90.9
Jan-19	56.5	50.9	42.5	39.9	98.9	90.7
Feb-19	56.4	50.8	42.4	39.8	98.8	90.6
Mar-19	56.4	0.0	42.3	39.7	98.7	39.7
Apr-19	56.3	50.7	42.2	39.6	98.5	90.3
May-19	56.2	50.6	42.1	39.5	98.4	90.1
Jun-19	56.2	50.5	42.0	39.5	98.2	90.0
Jul-19	56.1	50.5	42.0	39.4	98.1	89.9
Aug-19	56.0	50.4	41.9	39.3	97.9	89.7
Sep-19	56.0	50.4	41.8	39.2	97.8	89.6
Oct-19	55.9	50.3	41.7	39.1	97.6	89.4
Nov-19	55.8	50.2	41.6	39.0	97.5	89.3
Dec-19	55.8	50.2	41.6	39.0	97.3	89.1
Jan-20	55.7	50.1	41.5	38.9	97.2	89.0
Feb-20	55.7	50.0	41.4	38.8	97.0	88.8
Mar-20	55.6	50.0	41.3	38.7	96.9	88.7
Apr-20	55.5	49.9	41.2	38.6	96.8	88.6
May-20	55.5	49.8	41.2	38.6	96.6	88.4
Jun-20	55.4	49.8	41.1	38.5	96.5	88.3
Jul-20	55.3	49.7	41.0	38.4	96.3	88.1
Aug-20	55.3	49.7	40.9	38.3	96.2	88.0
Sep-20	55.2	49.6	40.8	38.2	96.1	87.8
Oct-20	55.2	49.5	40.8	38.2	95.9	87.7
Nov-20	55.1	49.5	40.7	38.1	95.8	87.6
Dec-20	55.0	49.4	40.6	38.0	95.6	87.4
Jan-21	55.0	49.3	40.5	37.9	95.5	87.3
Feb-21	54.9	49.3	40.4	37.9	95.4	87.1
Mar-21	54.9	49.2	40.4	37.8	95.2	87.0
Apr-21	54.8	49.2	40.3	37.7	95.1	86.9
May-21	54.7	49.1	40.2	37.6	95.0	86.7
Jun-21	54.7	49.0	40.1	37.6	94.8	86.6
Jul-21	54.6	49.0	40.1	37.5	94.7	86.5
Aug-21	54.5	48.9	40.0	37.4	94.5	86.3
Sep-21	54.5	48.9	39.9	37.3	94.4	86.2
Oct-21	54.4	48.8	39.8	37.3	94.3	86.1
Nov-21	54.4	48.7	39.8	37.2	94.1	85.9
Dec-21	54.3	48.7	39.7	37.1	94.0	85.8

* Average generation levels plants are capable of achieving.

TABLE 7
2017 FORECAST OF GEOTHERMAL PRODUCTION AND INJECTION

TIME STEP	DATE	STEAM PROD. BLBS	COND INJ BLBS	WATER INJ BLBS
1	2017	14.6	4.7	15.1
2	2018	14.4	4.6	15.0
3	2019	14.1	4.5	15.0
4	2020	13.9	4.4	14.9
5	2021	13.7	4.4	14.8
6	2022	13.5	4.3	14.7
7	2023	13.2	4.2	14.7
8	2024	13.0	4.2	14.6
9	2025	12.8	4.1	14.6
10	2026	12.6	4.0	14.5
11	2027	12.5	4.0	14.4
12	2028	12.3	3.9	14.4
13	2029	12.1	3.9	14.3
14	2030	11.9	3.8	14.3
15	2031	11.8	3.8	14.2
16	2032	11.6	3.7	14.2
17	2033	11.4	3.7	14.1
18	2034	11.3	3.6	14.1
19	2035	11.1	3.6	14.0
20	2036	11.0	3.5	14.0
21	2037	10.9	3.5	13.9
22	2038	10.7	3.4	13.9
23	2039	10.6	3.4	13.9
24	2040	10.5	3.3	13.8
25	2041	10.3	3.3	10.5

NOTES :

1. CUM. PRODUCTION AND INJECTION 1983-2016 — 641.9 Billion Lbs Steam; 418.7 Billion Lbs Water
2. TOTAL WATER IS CONDENSATE + EFFLUENT + LAKE + POND
3. FUTURE STEAM PRODUCTION 2017-2041 = 305.9 Billion Lbs
4. FUTURE WATER INJECTION 2017-2041 = 355.9 Billion Lbs