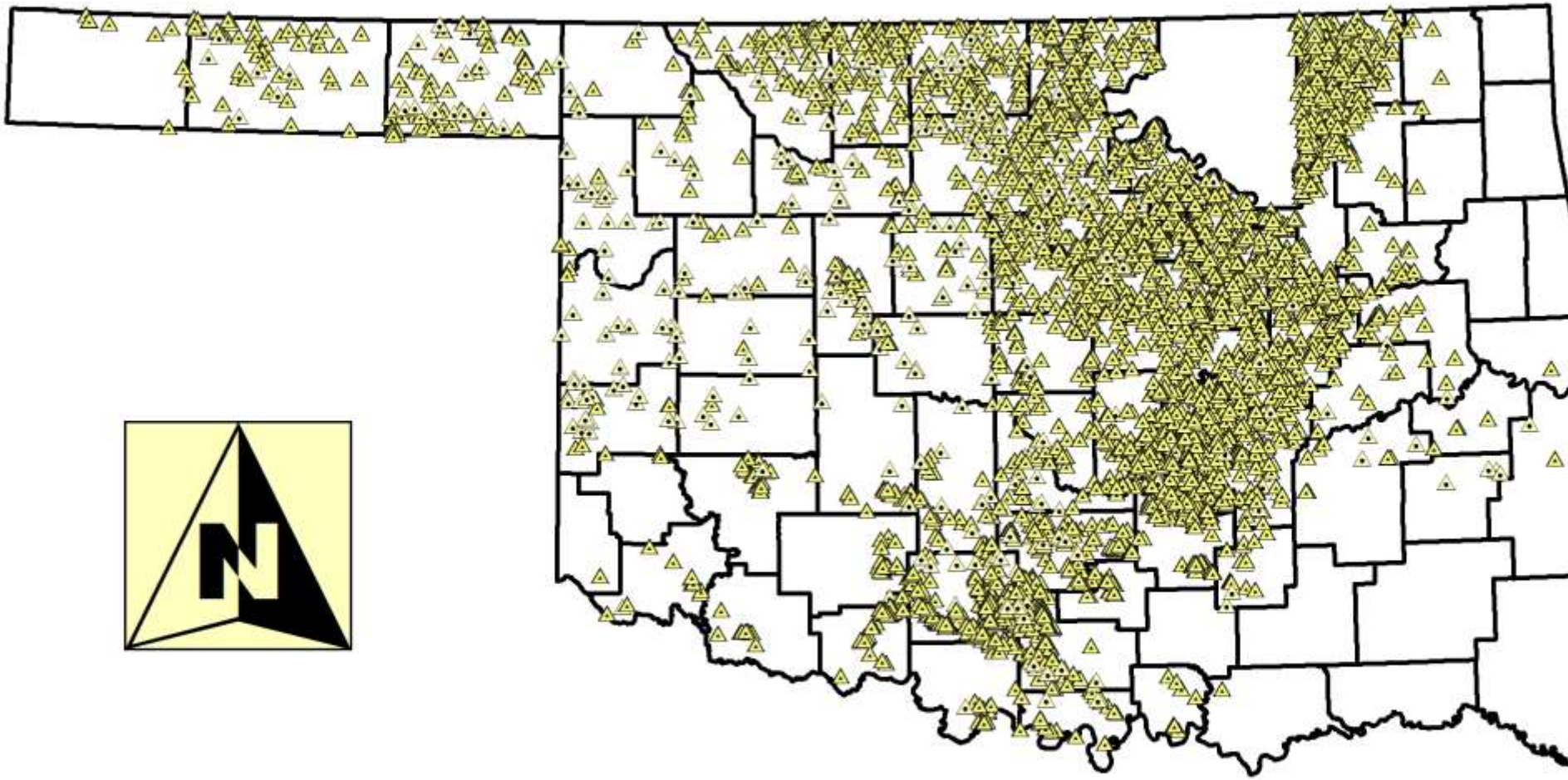
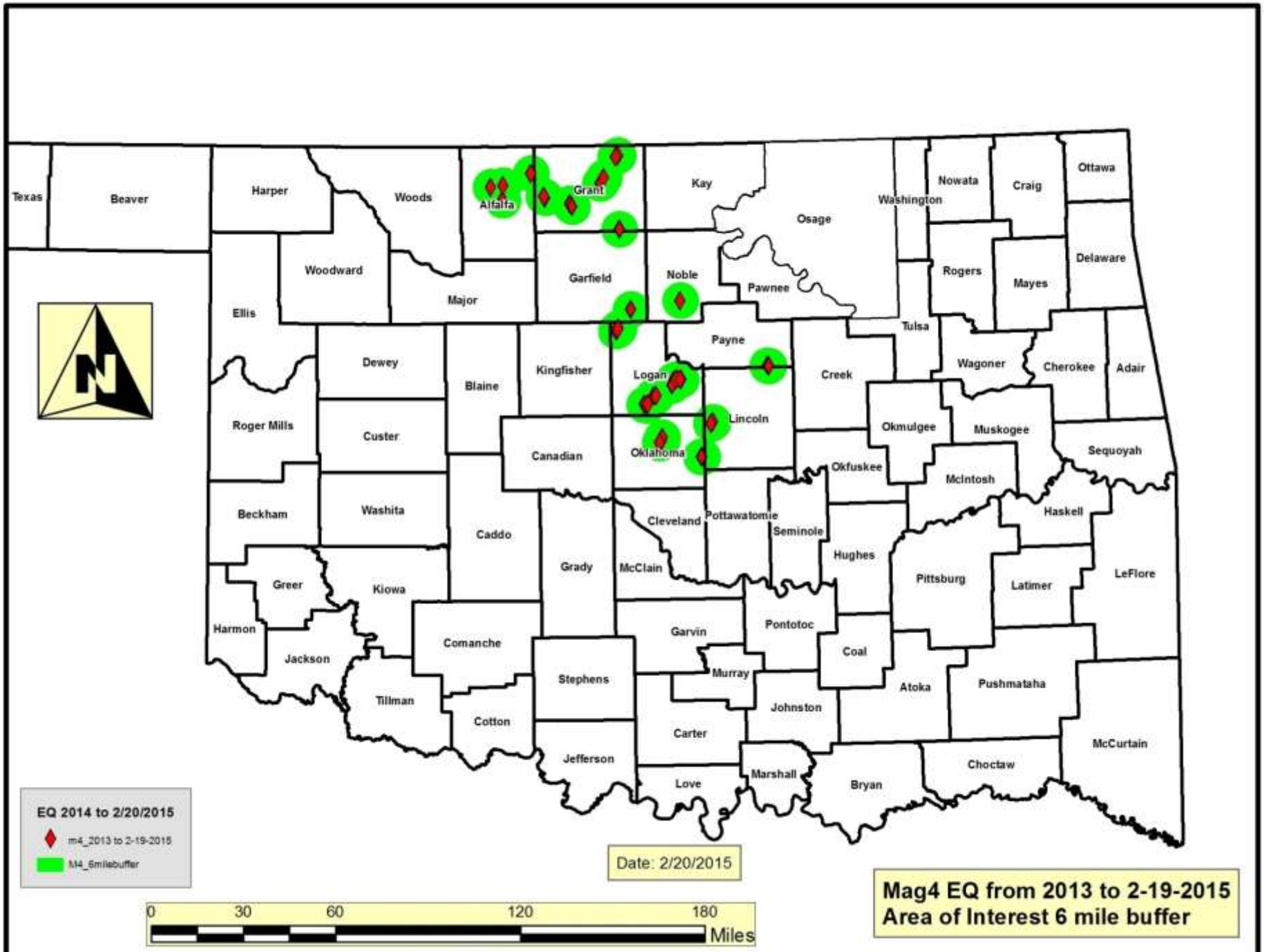
Oklahoma Corporation Commission

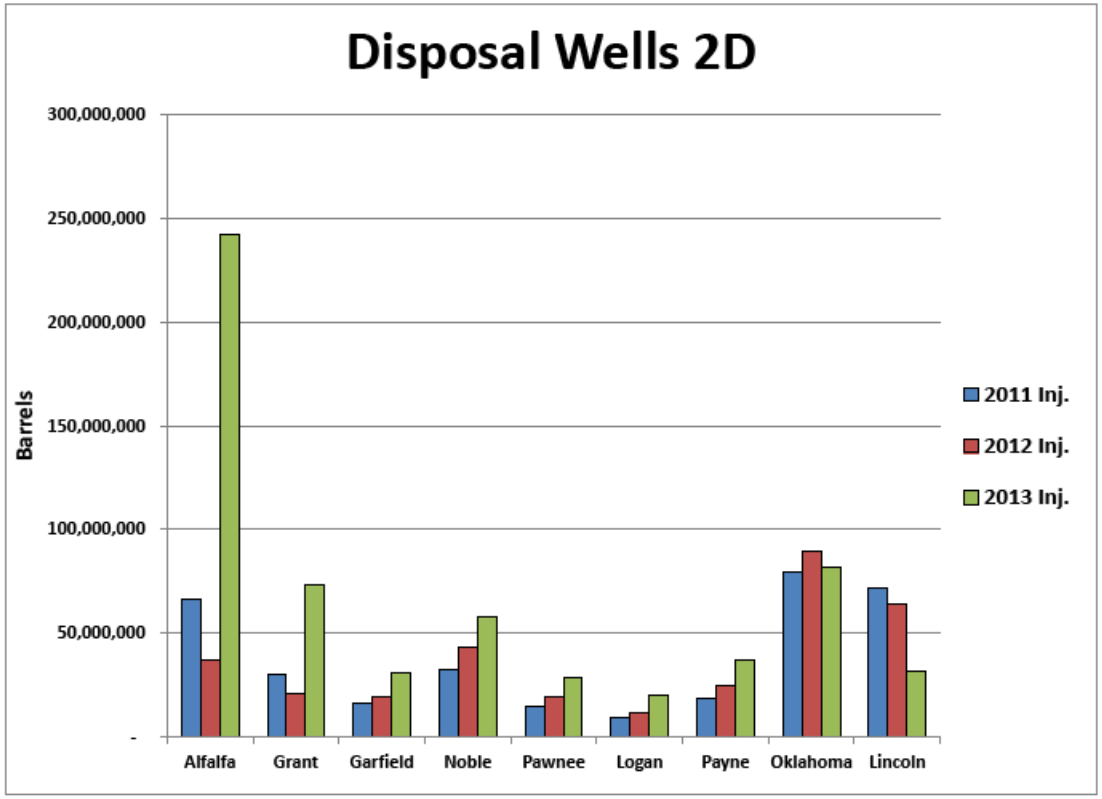
Oil and Gas Conservation Division

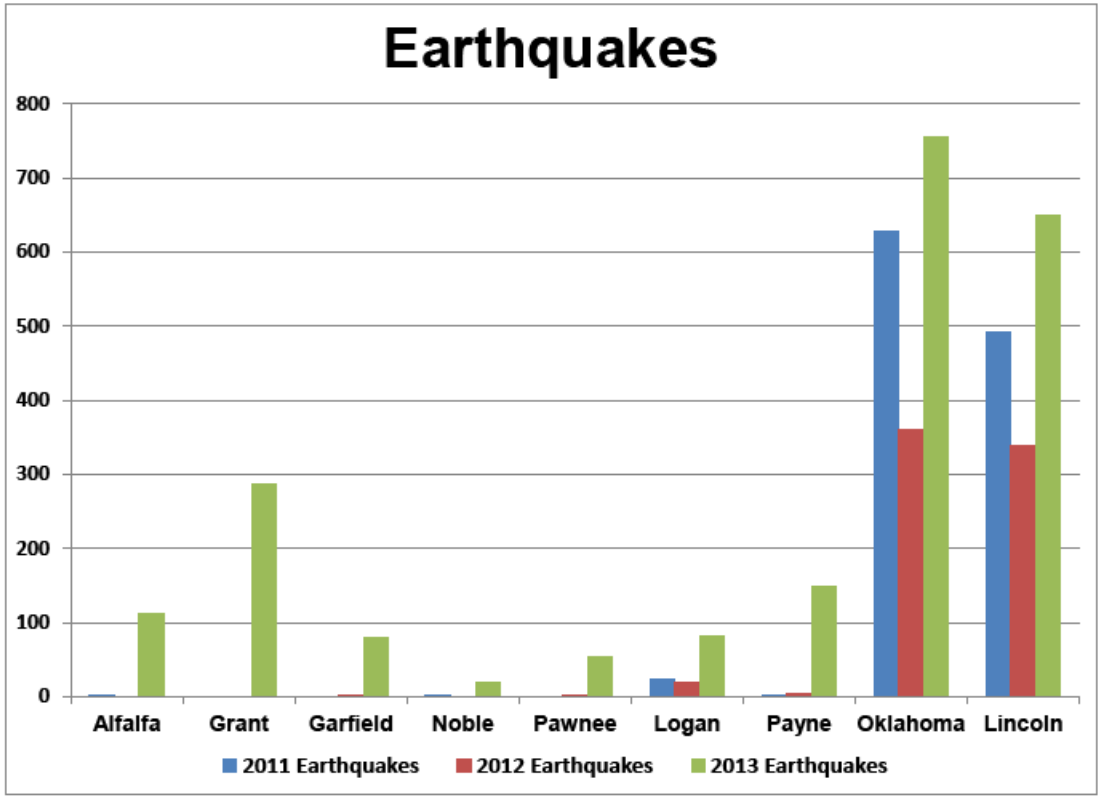
Tim Baker, Director

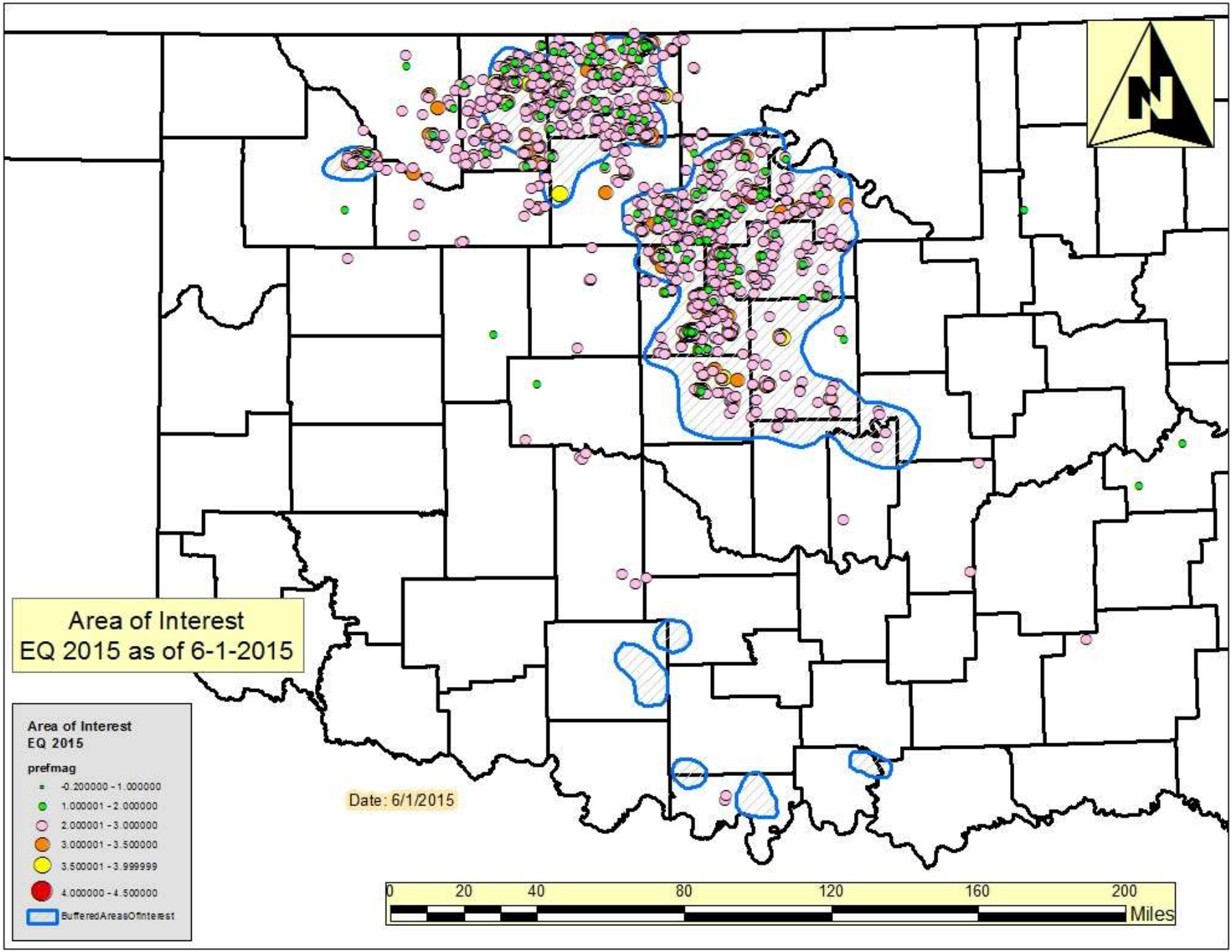
Disposal Wells

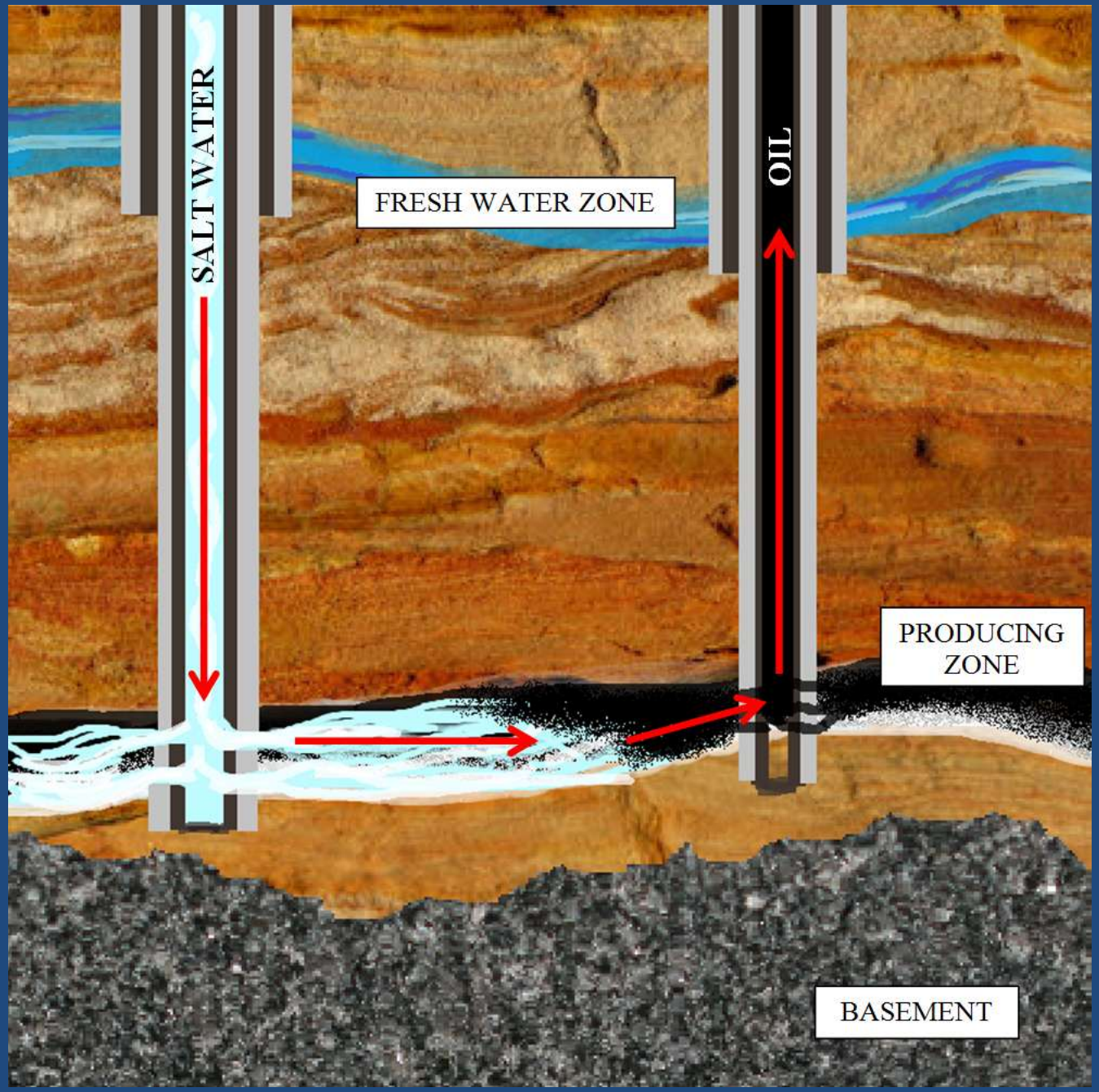


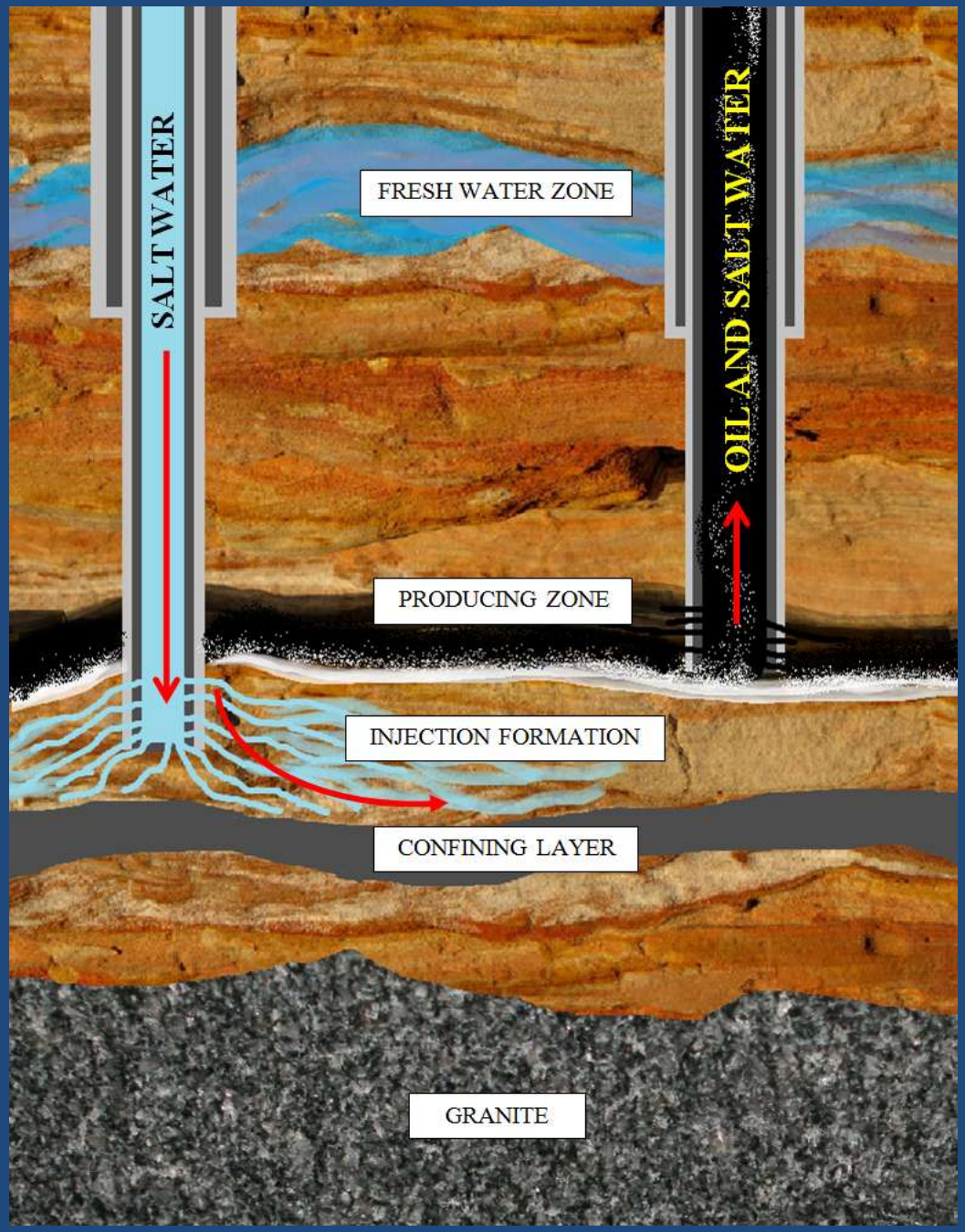

Texas
Beaver
Harper
Woods
Alfalfa
Grant
Kay
Osage
Washington
Nowata
Craig
Ottawa
Woodward
Garfield
Noble
Pawnee
Rogers
Mayes
Delaware
Ellis
Major
Tulsa
Dewey
Blaine
Kingfisher
Logan
Payne
Creek
Wagoner
Cherokee
Adair
Roger Mills
Custer
Canadian
Oklahoma
Lincoln
Okmulgee
Muskogee
Sequoyah
Okfuskee
McIntosh
Beckham
Washita
Caddo
Grady
Cleveland
Pottawatomie
Seminole
Hughes
Haskell
Greer
Kiowa
McClain
Pittsburg
Latimer
LeFlore
Harmon
Jackson
Comanche
Garvin
Pontotoc
Coal
Tillman
Stephens
Murray
Atoka
Pushmataha
Cotton
Johnston
Carter
Jefferson
Marshall
Bryan
Choctaw
McCurtain
Love
N
EQ 2014 to 2/20/2015
m4_2013 to 2-19-2015
M4_6milebuffer
Date: 2/20/2015
0
30
60
120
180
Miles
Mag4 EQ from 2013 to 2-19-2015
Area of Interest 6 mile buffer

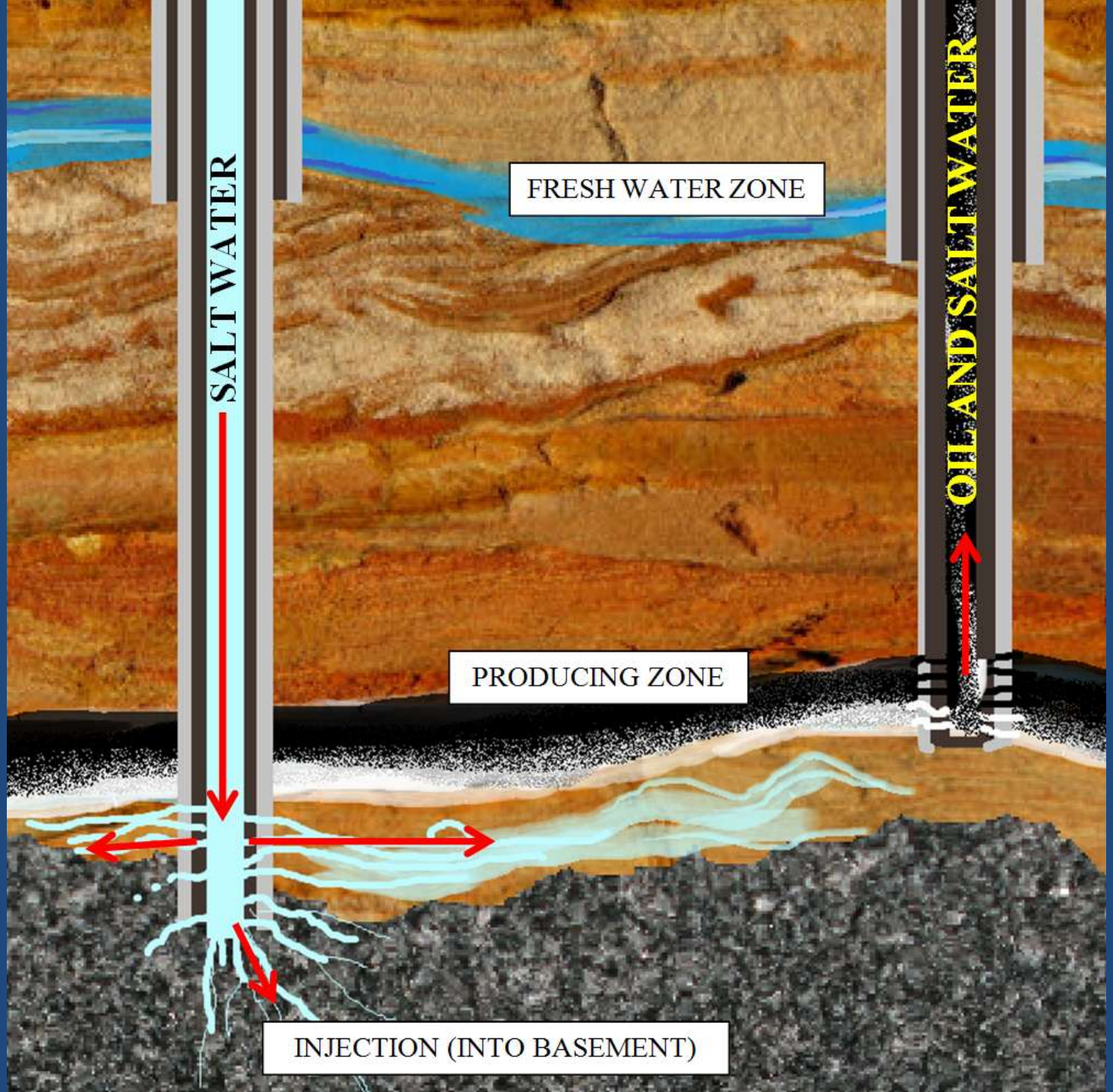

Disposal Wells 2D
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
-
Barrels
Alfalfa
Grant
Garfield
Noble
Pawnee
Logan
Payne
Oklahoma
Lincoln
2011 Inj.
2012 Inj.
2013 Inj.


Earthquakes
800
700
600
500
400
300
200
100
0
Alfalfa
Grant
Garfield
Noble
Pawnee
Logan
Payne
Oklahoma
Lincoln
2011 Earthquakes
2012 Earthquakes
2013 Earthquakes


Area of Interest
EQ 2015 as of 6-1-2015
Area of Interest
EQ 2015
prefmag
-0.200000 - 1.000000
1.000001 - 2.000000
2.000001 - 3.000000
3.000001 - 3.500000
3.500001 - 3.999999
4.000000 - 4.500000
BufferedAreasOfInterest
Date: 6/1/2015
0
20
40
80
120
160
200
Miles
N

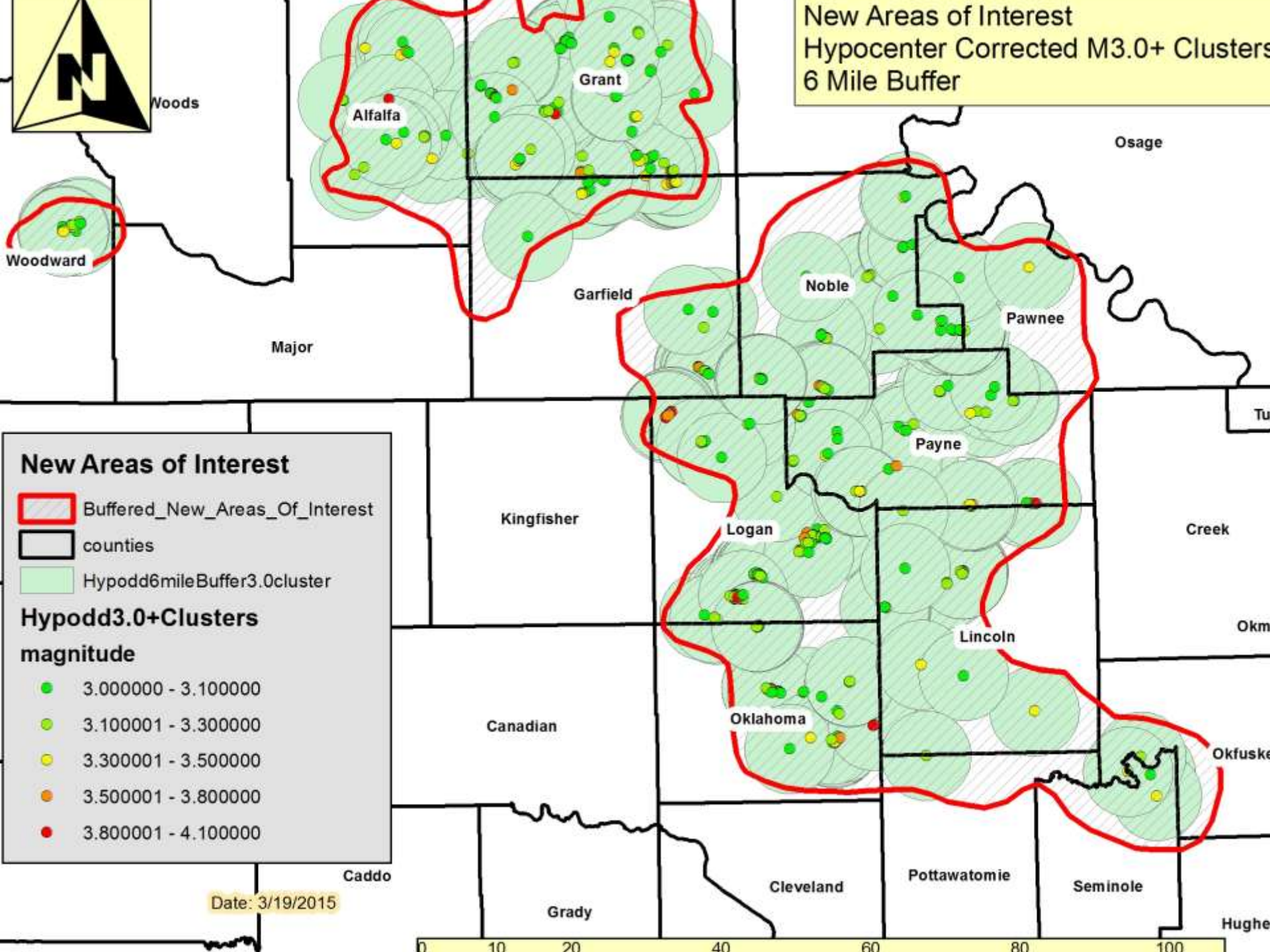

SALT WATER
FRESH WATER ZONE
OIL
PRODUCING ZONE
BASEMENT

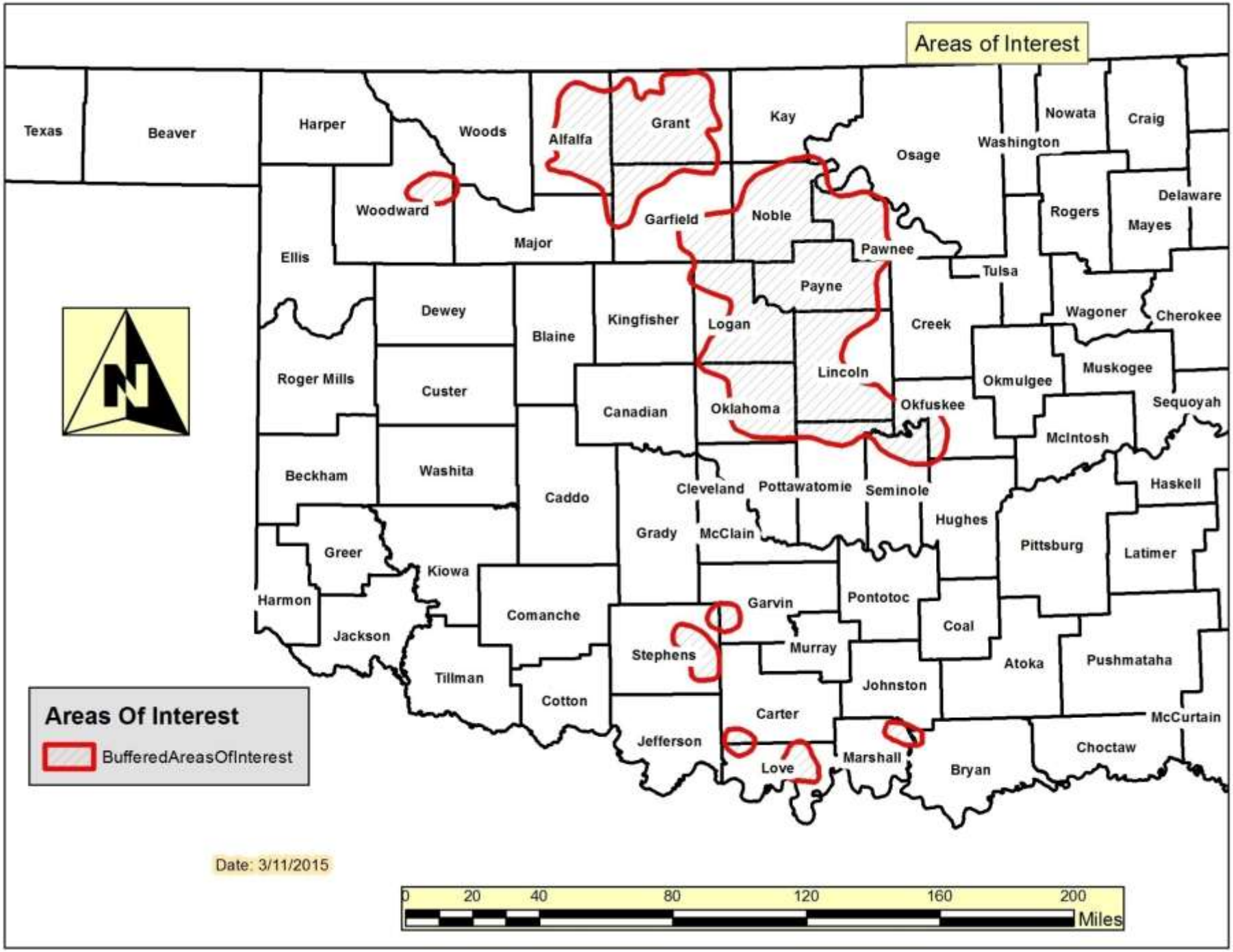

SALT WATER
OIL AND SALT WATER
FRESH WATER ZONE
PRODUCING ZONE
INJECTION FORMATION
CONFINING LAYER
GRANITE


SALT WATER
FRESH WATER ZONE
OIL AND SALTWATER
PRODUCING ZONE
INJECTION (INTO BASEMENT)

OGCD Area of Interest

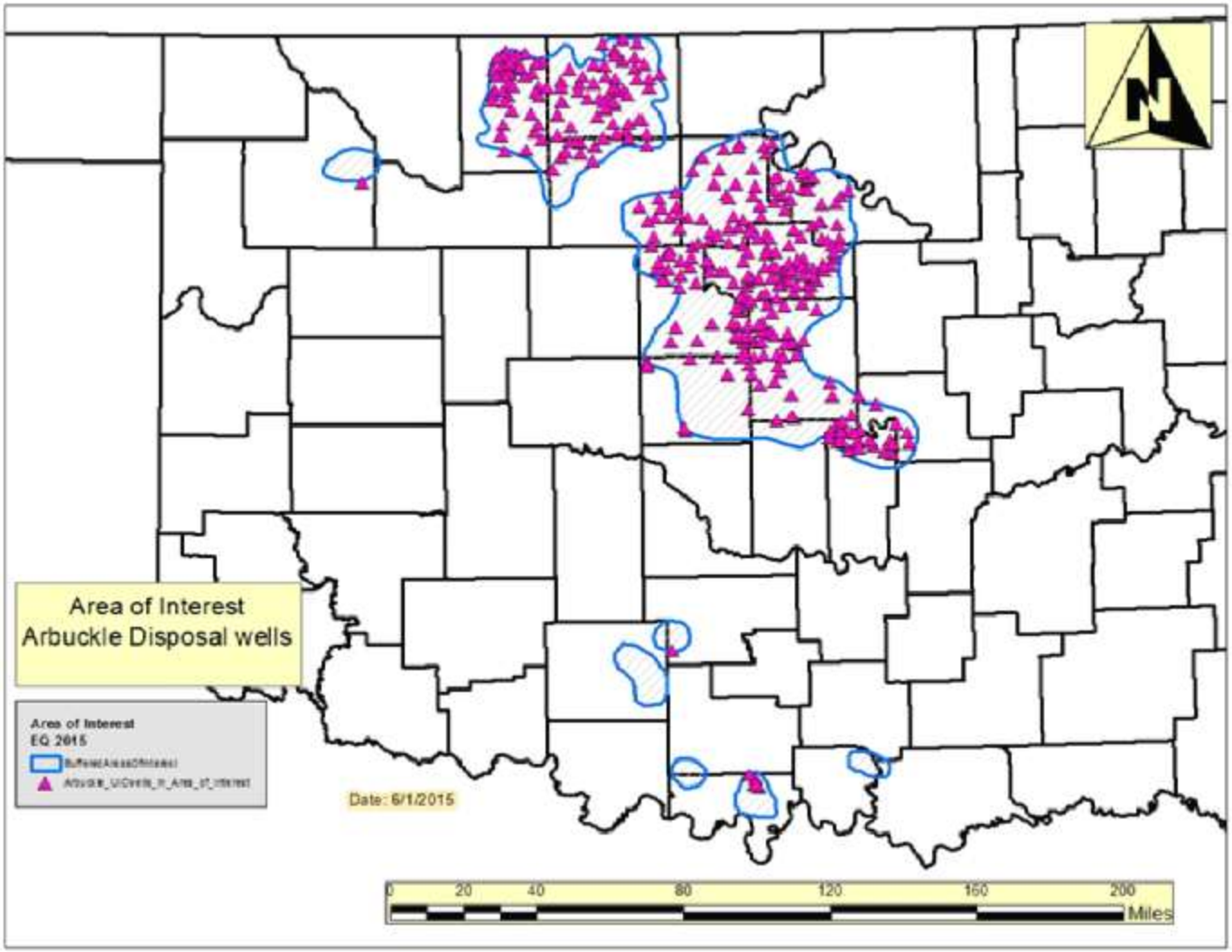
- Area Of Interest (AOI) includes seismic swarms.
  1. Swarm is defined as an area consisting of at least (2) two events with epicenters within .25 mi. of each other, with at least one event with a magnitude 3.0 or greater
  2. AOI is a ten (10) km area (6 mi) with central mass of the swarm as center

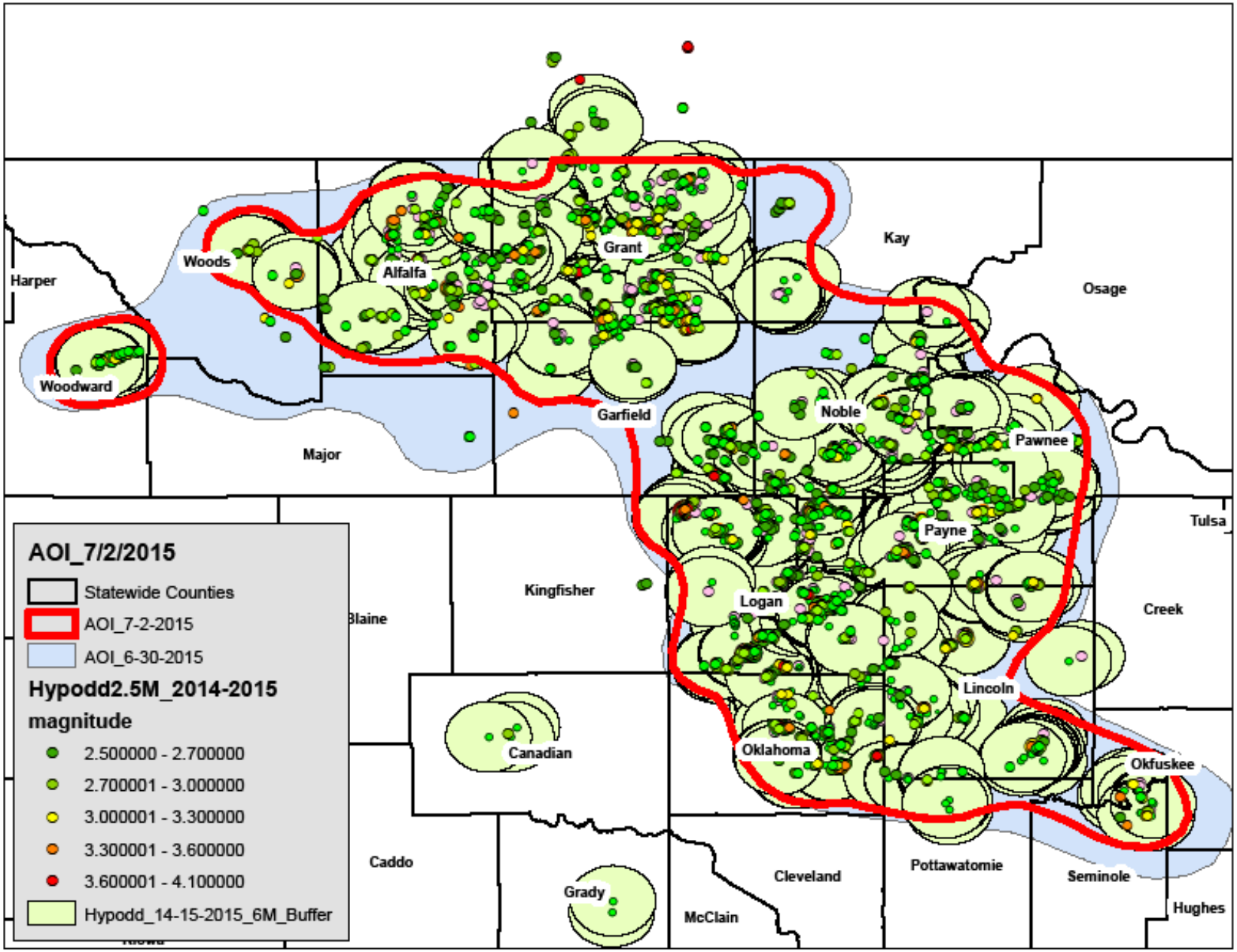

New Areas of Interest
Hypocenter Corrected M3.0+ Clusters
6 Mile Buffer
Woods
Alfalfa
Grant
Osage
Woodward
Garfield
Noble
Pawnee
Major
Payne
Kingfisher
Logan
Creek
Lincoln
Canadian
Oklahoma
Okfuske
Caddo
Cleveland
Pottawatomie
Seminole
Grady
Hughe
New Areas of Interest
Buffered_New_Areas_Of_Interest
counties
Hypodd6mileBuffer3.0cluster
Hypodd3.0+Clusters
magnitude
3.000000 - 3.100000
3.100001 - 3.300000
3.300001 - 3.500000
3.500001 - 3.800000
3.800001 - 4.100000
Date: 3/19/2015
0
10
20
40
60
80
100

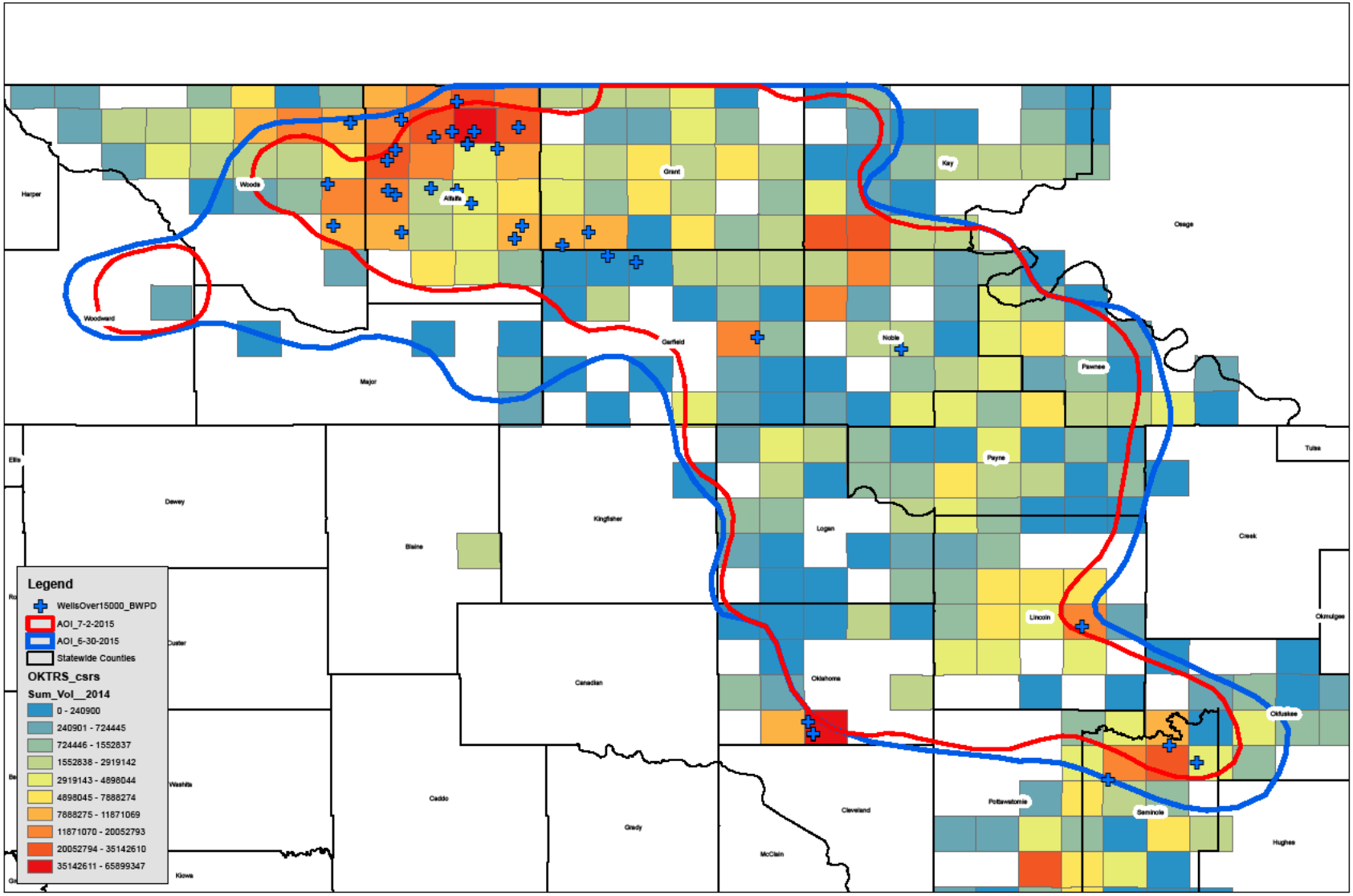

Areas of Interest
Texas
Beaver
Harper
Woods
Alfalfa
Grant
Kay
Osage
Washington
Nowata
Craig
Woodward
Garfield
Noble
Pawnee
Rogers
Mayes
Delaware
Ellis
Major
Tulsa
Payne
Dewey
Blaine
Kingfisher
Logan
Creek
Wagoner
Cherokee
Roger Mills
Custer
Lincoln
Okmulgee
Muskogee
Canadian
Oklahoma
Okfuskee
Sequoyah
McIntosh
Beckham
Washita
Caddo
Cleveland
Pottawatomie
Seminole
Haskell
Grady
McClain
Hughes
Pittsburg
Latimer
Greer
Kiowa
Harmon
Comanche
Garvin
Pontotoc
Coal
Jackson
Stephens
Murray
Atoka
Pushmataha
Tillman
Cotton
Johnston
Carter
McCurtain
Jefferson
Love
Marshall
Bryan
Choctaw
Areas Of Interest
BufferedAreasOfInterest
Date: 3/11/2015
0
20
40
80
120
160
200
Miles

OGCD Areas Of Interest

- Directive sent out March 18th
- Operators had 7 days to begin reporting.
- Operators had until April 18th to provide their information to the OGCD.
- Operators who do not provide this information or do not have an approved plugging schedule will be required to reduce their disposal volumes by 50% until they satisfy the directive.


Area of Interest
Arbuckle Disposal wells
Area of Interest
EQ 2015
Date: 6/1/2015
0
20
40
80
120
160
200
Miles


AOI_7/2/2015
Statewide Counties
AOI_7-2-2015
AOI_6-30-2015
Hypodd2.5M_2014-2015
magnitude
2.500000 - 2.700000
2.700001 - 3.000000
3.000001 - 3.300000
3.300001 - 3.600000
3.600001 - 4.100000
Hypodd_14-15-2015_6M_Buffer
Harper
Woods
Alfalfa
Grant
Kay
Osage
Woodward
Garfield
Noble
Pawnee
Major
Payne
Tulsa
Kingfisher
Logan
Creek
Blaine
Lincoln
Canadian
Oklahoma
Okfuskee
Caddo
Grady
Cleveland
Pottawatomie
Seminole
McClain
Hughes


Harper
Woods
Alfalfa
Grant
Kay
Osage
Woodward
Garfield
Noble
Pawnee
Major
Ellis
Dewey
Blaine
Kingfisher
Payne
Logan
Tulsa
Creek
Lincoln
Okmulgee
Custer
Canadian
Oklahoma
Okfuskee
Washita
Caddo
Grady
Cleveland
Pottawatomie
Seminole
McClain
Hughes
Kiowa
Legend
WellsOver15000_BWPD
AOI_7-2-2015
AOI_6-30-2015
Statewide Counties
OKTRS_csrs
Sum_Vol__2014
0 - 240900
240901 - 724445
724446 - 1552837
1552838 - 2919142
2919143 - 4898044
4898045 - 7888274
7888275 - 11871069
11871070 - 20052793
20052794 - 35142610
35142611 - 65899347

Status of Wells
9/28/15

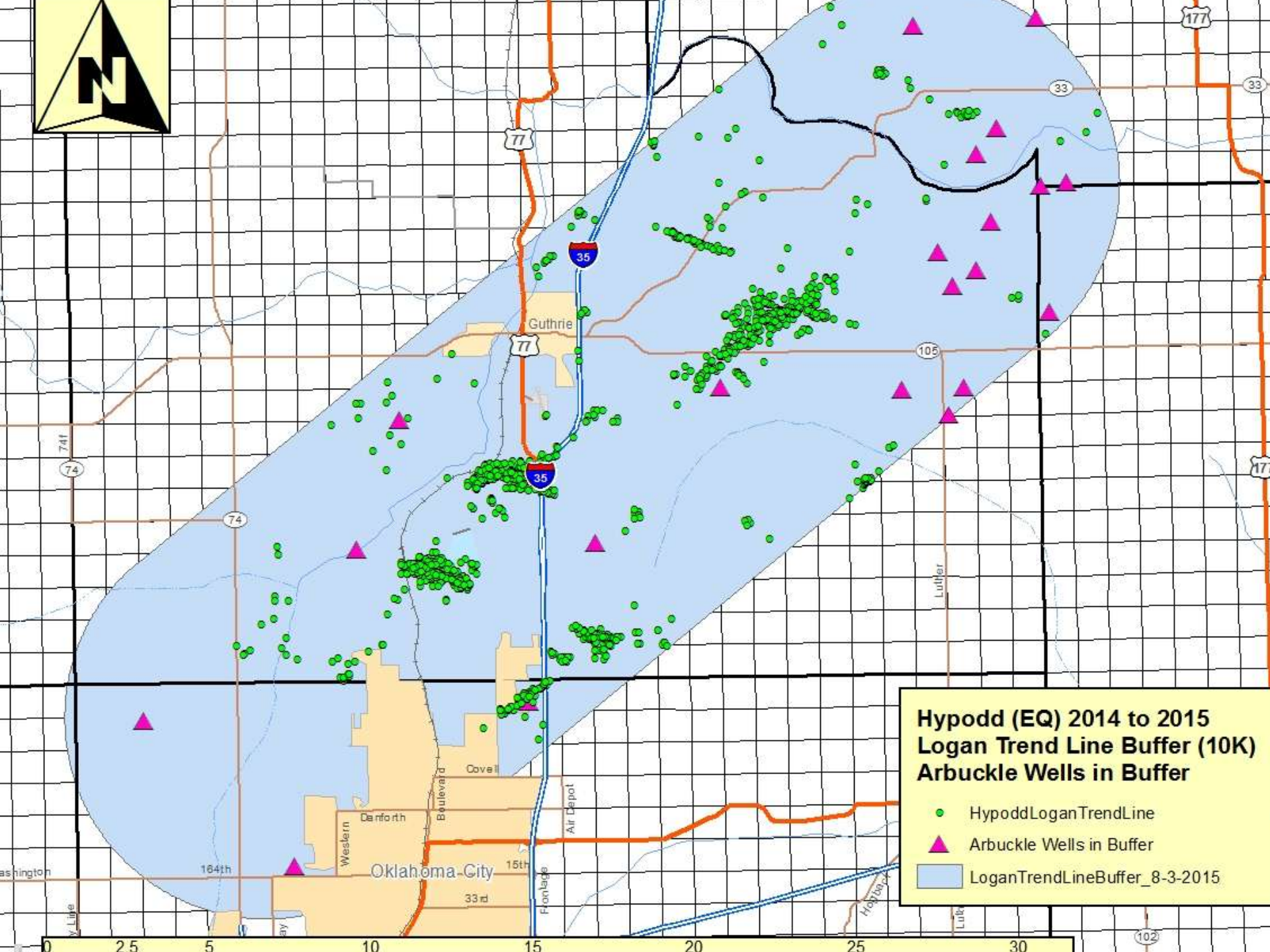
• Wells that plug back	171
• Wells with app. Schedules	24
• Wells decreased vol. 50%	17
• Wells under 1000 bbls/d	46
• Wells not in basement	181
• Wells not in use (SI)	43
• Wells under review	110
• Total	592

OCC Permitting Protocol

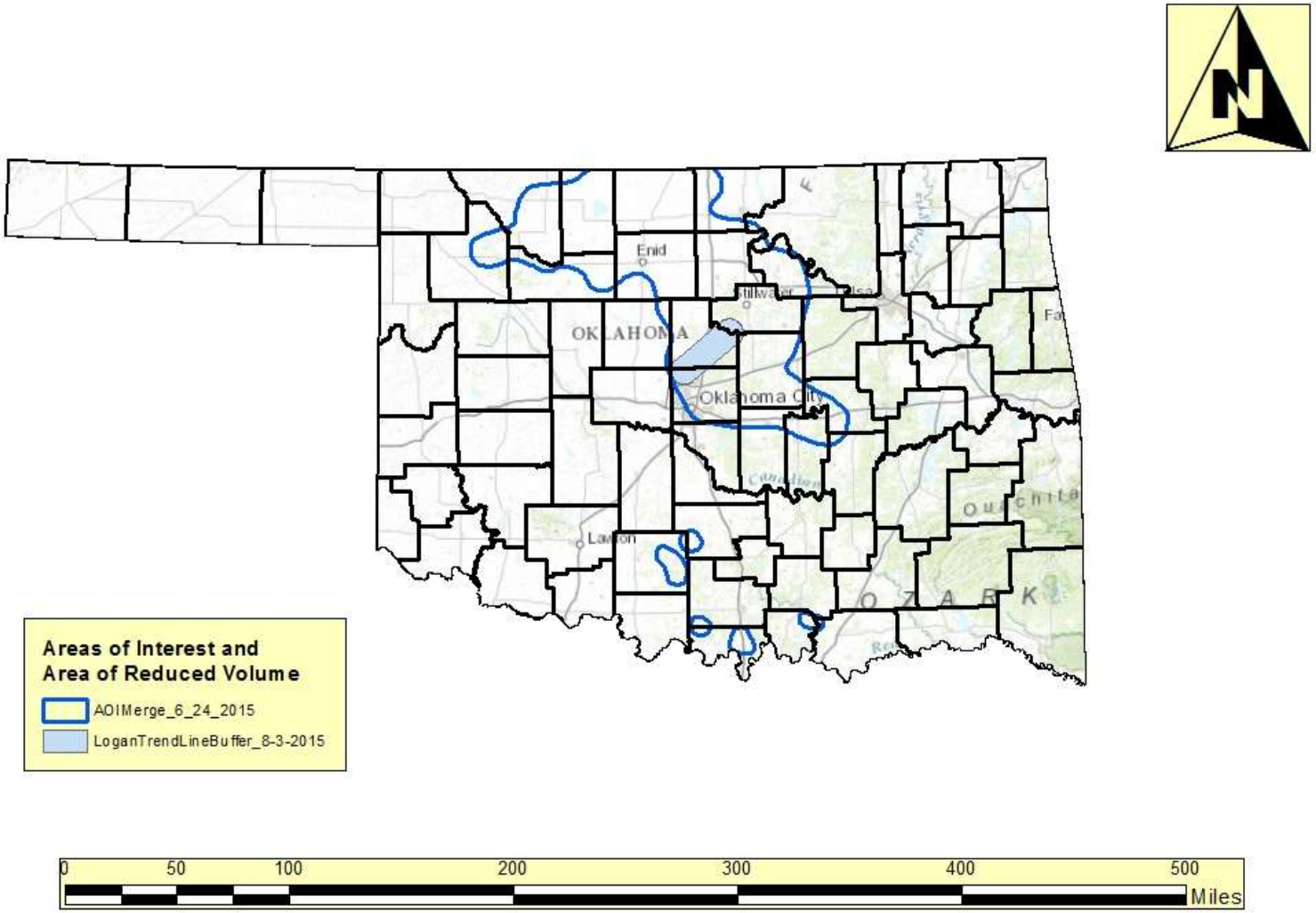
- 1. Check location of proposed well with permitting map.
- 2. If well location is within 3 miles of optimal fault, within 6 miles of a seismic swarm, or within an area of interest ask operator for a technical meeting.
- 3. Ask operator to demonstrate level of risk of induced seismicity.(technical data)
- 4. Require application to go to hearing.
- 5. Staff will take neutral position.

Current Staff

- Senior Hydrologist
- Geologist (UIC)
- Geologist (Special Project Grant)
- Data entry



Hypodd (EQ) 2014 to 2015
Logan Trend Line Buffer (10K)
Arbuckle Wells in Buffer
HypoddLoganTrendLine
Arbuckle Wells in Buffer
LoganTrendLineBuffer_8-3-2015
Guthrie
Oklahoma City
Covell
Danforth
Western
Boulevard
Air Depot
Frontage
Luther
164th
15th
33rd
74
77
35
105
33
177
102
0
2.5
5
10
15
20
25
30

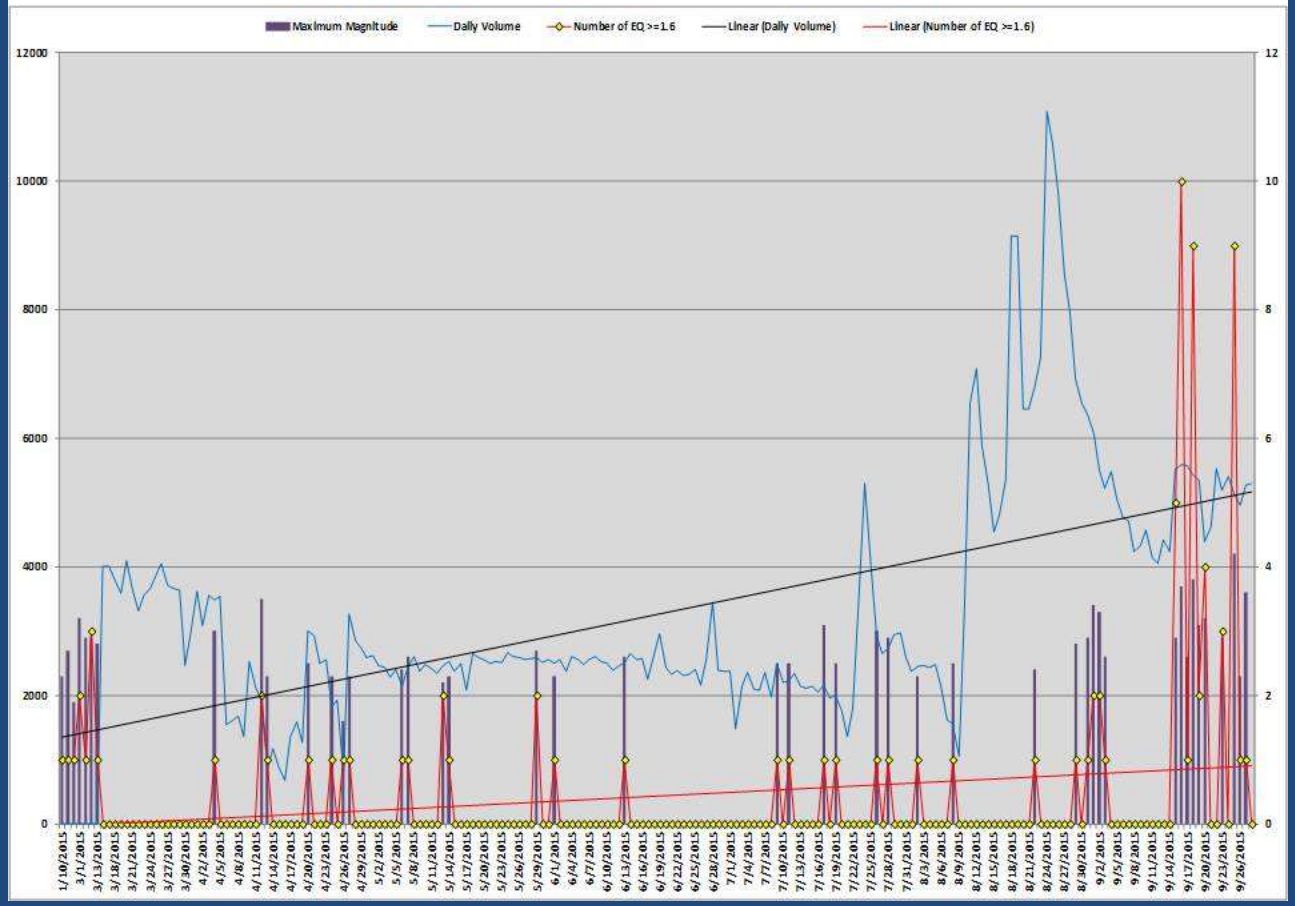

Enid
OKLAHOMA
Oklahoma City
Lawton
Areas of Interest and
Area of Reduced Volume
AOIMerge_6_24_2015
LoganTrendLineBuffer_8-3-2015
0
50
100
200
300
400
500
Miles

Logan Co. Trend

- Earthquake activity.
- 2012 2
- 2013 14
- 2014 359
- 2015 (7/31/15) 253

Logan Co. Trend Directive

- August 3rd latest directive was sent out
- Compared 2014 volumes to 2012 – reduced by a total of 3.4 million bbls/yr
- Operators were given 60 days to reduce volumes


Maximum Magnitude
Daily Volume
Number of EQ >=1.6
Linear (Daily Volume)
Linear (Number of EQ >=1.6)
12000
10000
8000
6000
4000
2000
0
12
10
8
6
4
2
0
1/10/2015
3/1/2015
3/13/2015
3/18/2015
3/21/2015
3/24/2015
3/27/2015
3/30/2015
4/2/2015
4/5/2015
4/8/2015
4/11/2015
4/14/2015
4/17/2015
4/20/2015
4/23/2015
4/26/2015
4/29/2015
5/2/2015
5/5/2015
5/8/2015
5/11/2015
5/14/2015
5/17/2015
5/20/2015
5/23/2015
5/26/2015
5/29/2015
6/1/2015
6/4/2015
6/7/2015
6/10/2015
6/13/2015
6/16/2015
6/19/2015
6/22/2015
6/25/2015
6/28/2015
7/1/2015
7/4/2015
7/7/2015
7/10/2015
7/13/2015
7/16/2015
7/19/2015
7/22/2015
7/25/2015
7/28/2015
7/31/2015
8/3/2015
8/6/2015
8/9/2015
8/12/2015
8/15/2015
8/18/2015
8/21/2015
8/24/2015
8/27/2015
8/30/2015
9/2/2015
9/5/2015
9/8/2015
9/11/2015
9/14/2015
9/17/2015
9/20/2015
9/23/2015
9/26/2015

Oklahoma Corporation Commission

Oil and Gas Conservation Division

Tim Baker, Director