



California's Recent Drought – A Word About Lead Time

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Where We've Been in Past Water Years

- 2007 – dry
- 2008 – dry
- 2009 – dry
- 2010 – normal
- 2011 – wet
- 2012 – dry
- 2013 – dry
- 2014 – dry
- 2015 – dry
- 2016 – dry



2012-16 State Drought Response Actions

- May 2013 Executive Order on water transfers
- Dec 2013 formation of Governor's Drought Task Force
- Jan 2014 Governor's emergency proclamation
- March 2014 drought relief legislation
- April 2014 proclamation of continued state of emergency
- Sep 2014 Executive Order for emergency drinking water assistance
- Dec 2014 Executive Order continuing CEQA waiver for specified actions
- March 2015 drought relief legislation
- April 2015 Executive Order
- October 2015 emergency proclamation on tree mortality
- November 2015 Executive Order, continuing conservation/small water systems
- May 2016 Executive Order, conservation requirements
- April 2017 Executive Order, ending statewide drought emergency & calling for continued response to lingering impacts



California's 20th & 21st Century Statewide Droughts

- 1918-20
- 1922-24
- 1929-34
- 1947-50

- 1959-61
- 1976-77
- 1987-92
- 2007-09
- 2012-2016

1976-77

- Delta salinity barriers
- Marin County emergency pipeline
- Statewide reservoir storage at 37% at end of WY 1977
- Bricks in toilet tanks
- Estimated 125,000 acres fallowed



Excerpts from: *The 1976-1977 California Drought, A Review.* DWR, May 1978

There has been one serious problem in these forecasting techniques, and that is the lack of a proven system of long-range weather forecasting. The precipitation levels are never known until relatively late in each season, after the fact.

The procedure used by the NWS in these predictions is beyond the scope of this report, but is based upon predictions of airflow patterns in the atmosphere. The 30-day outlooks have been issued since 1947 but experience shows that success has been modest, with temperature forecasts enjoying more success than precipitation forecasts. Figure 28 is a com-

Although it would be desirable to develop additional skill in forecasting the weather a month hence, what is needed for operation and management of a complex water supply project is a long-term projection, at least a year in advance, with a high degree of reliability.

1987-92

- Santa Barbara emergency pipeline & desalter
- Widespread small water system problems
- About 500,000 acres fallowed
- First state drought water bank
- Water rights legislation regarding conservation & water transfers



Excerpt from: *Lessons Learned From the California Drought (1987-1992)*, USACE 1993

Early drought response actions and proper timing of tactical measures are essential in short-term management of droughts.

The 1987-92 drought has confirmed an earlier belief that droughts in California are truly unpredictable. In hindsight, taking earlier actions would have been warranted during both California droughts. The lesson of the 1976-77 drought was not lost on urban water providers. They made no bets on the drought to be over soon and maintained aggressive demand reduction programs through the most critical year of 1991. The 1987-1992 drought confirmed the earlier lesson on the importance of early drought response.

2007-09 Drought

- Not as severe as big historical droughts in terms of hydrology
- Surplus water no longer available from Colorado River
- Delta: D-1641, new Biological Opinion in 2008
- CVPIA provisions in effect
- First-ever statewide proclamation of drought emergency
- Agricultural impacts in San Joaquin Valley: combined effects of drought + recession
- Small water system problems



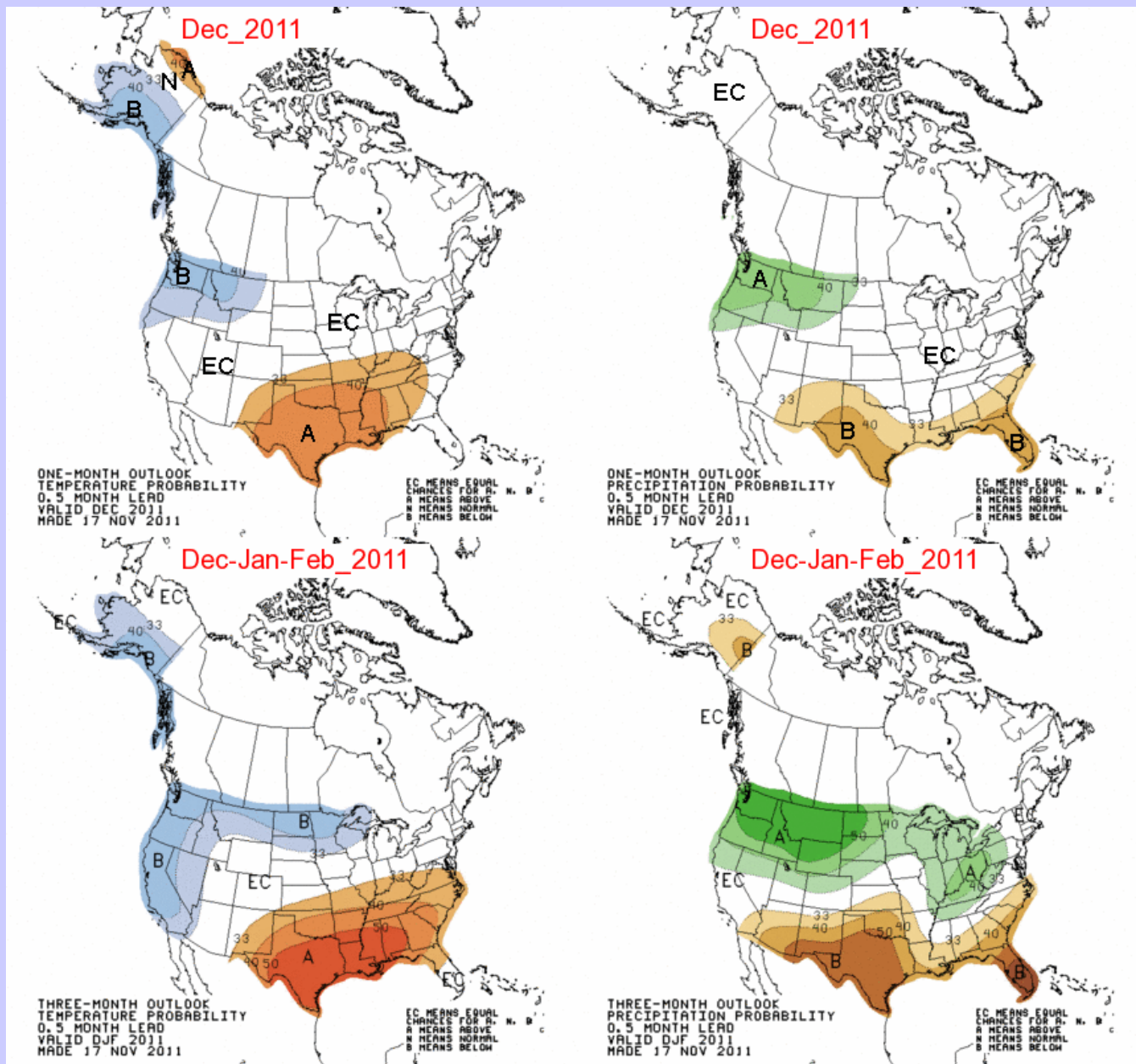
Excerpt From: *California's Drought of 2007-2009*, CDWR, 2010

Monitoring of hydroclimate information also facilitates drought response, especially information that may provide predictive capability for water supply conditions at seasonal to interannual timeframes. Present scientific capabilities provide relatively little useful skill at making forecasts beyond the weather time domain (roughly 10 days out), with limited insight for making such predictions being provided largely only by ENSO conditions. Ongoing research and data collection to understand important events that strongly affect seasonal precipitation — such as atmospheric river events (**FIGURE 39**) — offers promise over the longer-term for assisting in drought response. Additional research and data collection efforts that would be helpful include:

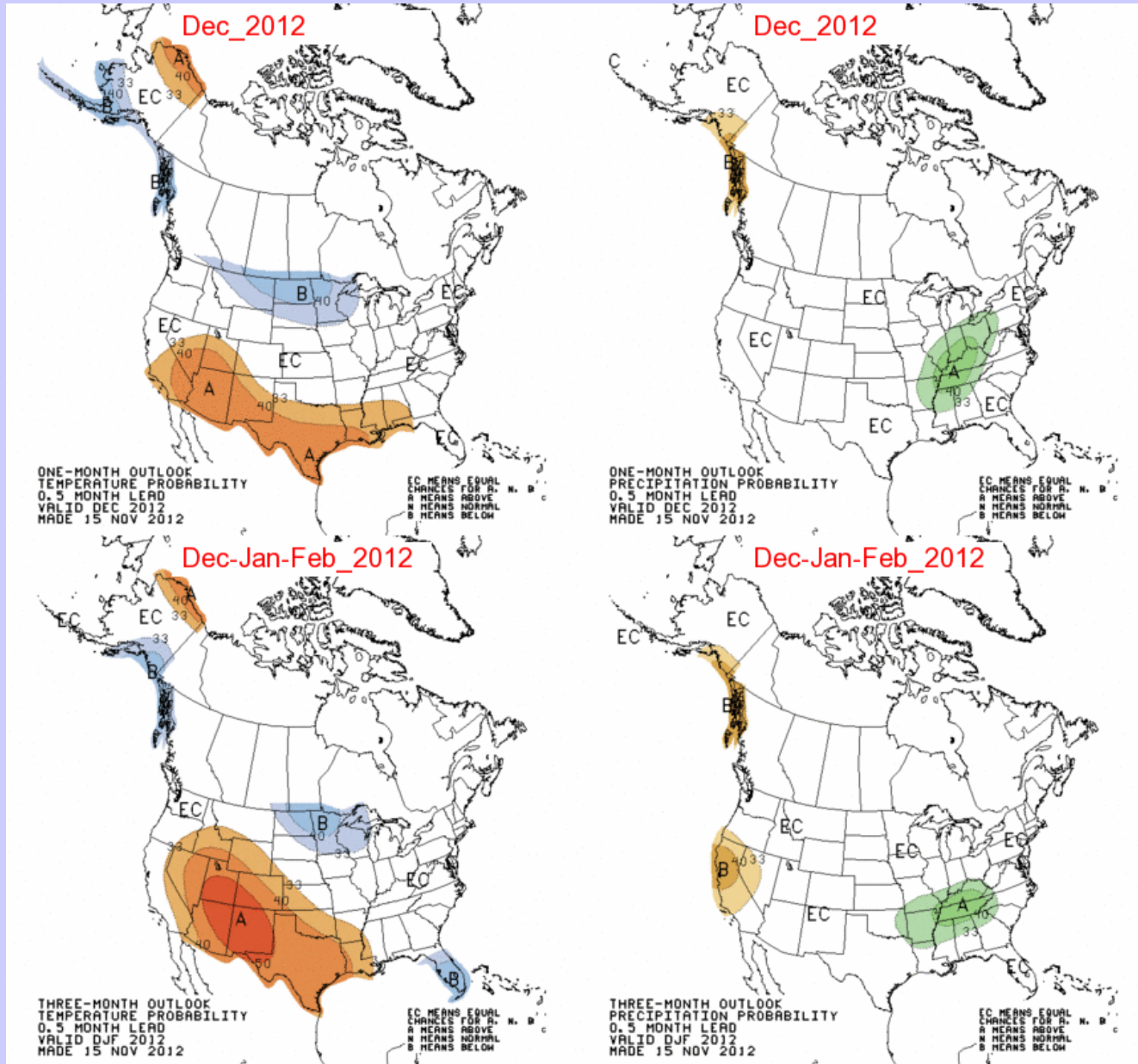
The 2012-16 Drought & Lead Time

Two Examples: Emergency Delta Salinity Barrier & East Porterville Dry Wells

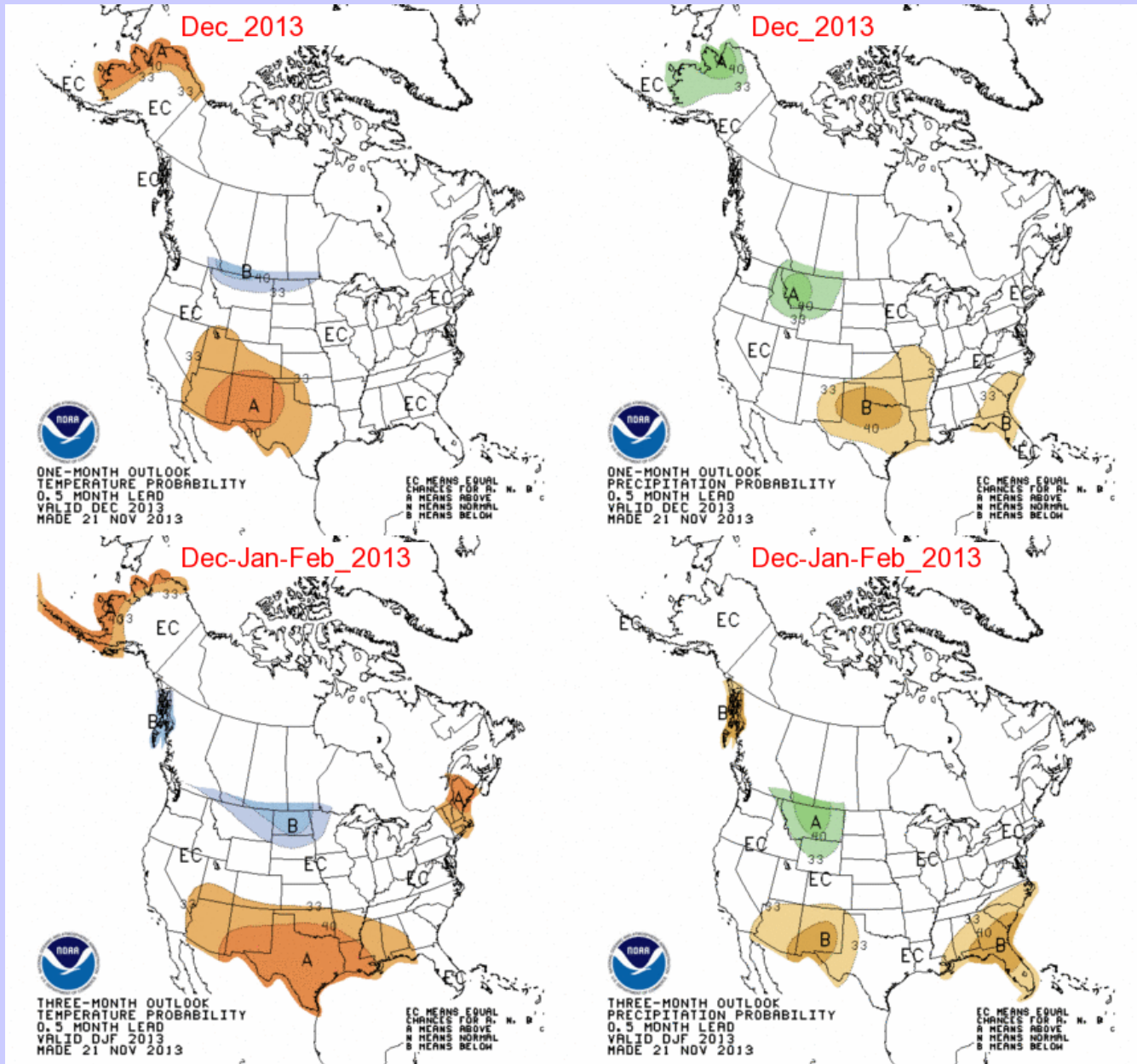
CPC Outlook Issued Nov 2011



CPC Outlook Issued Nov 2012

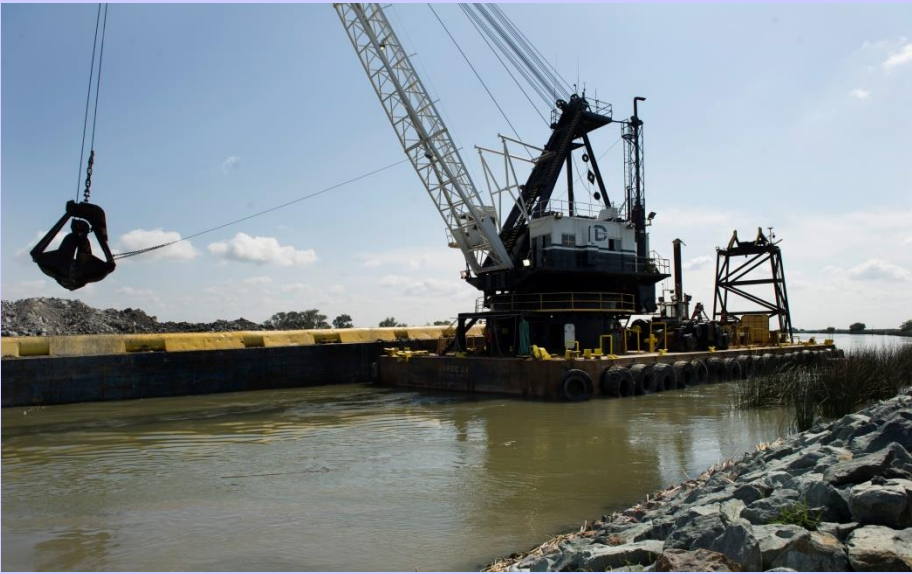


CPC Outlook Issued Nov 2013

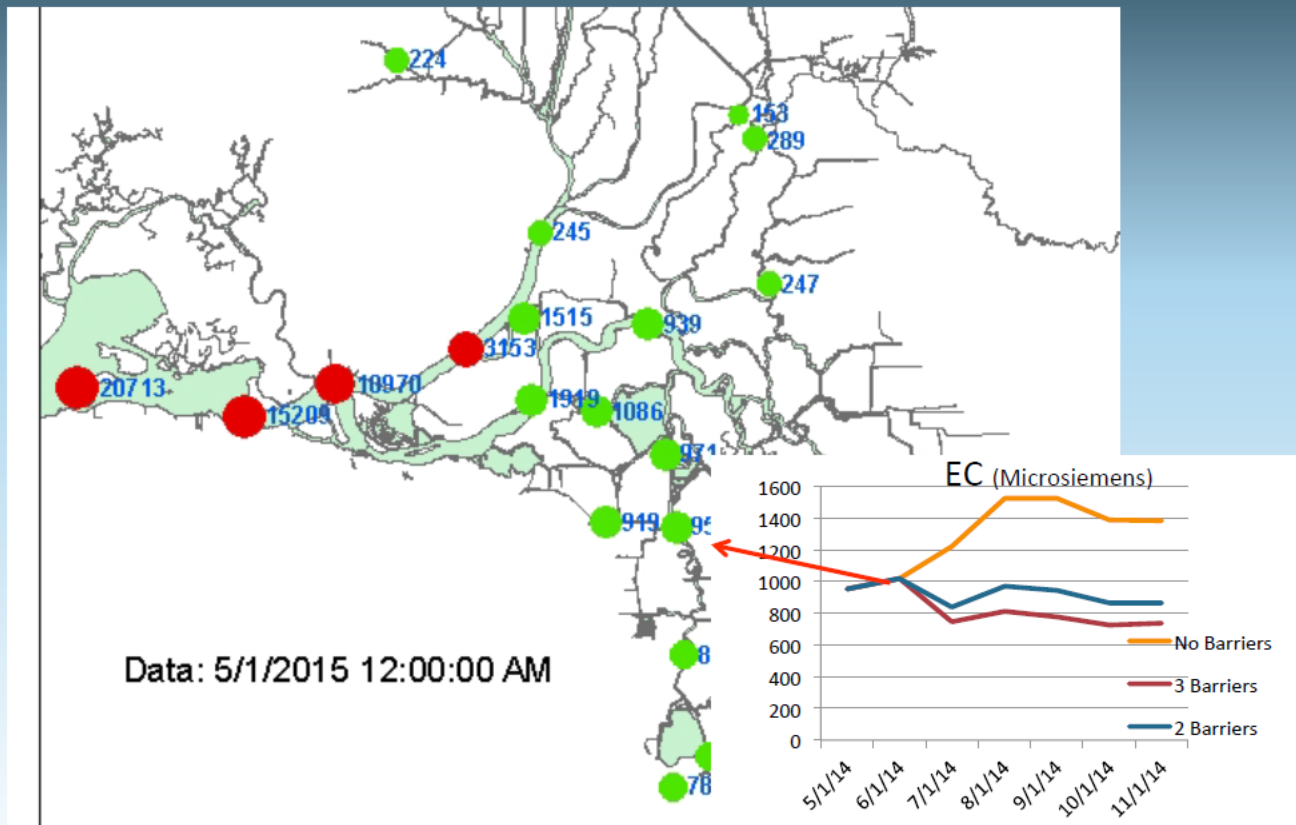


January 2014 – Emergency Delta Barrier

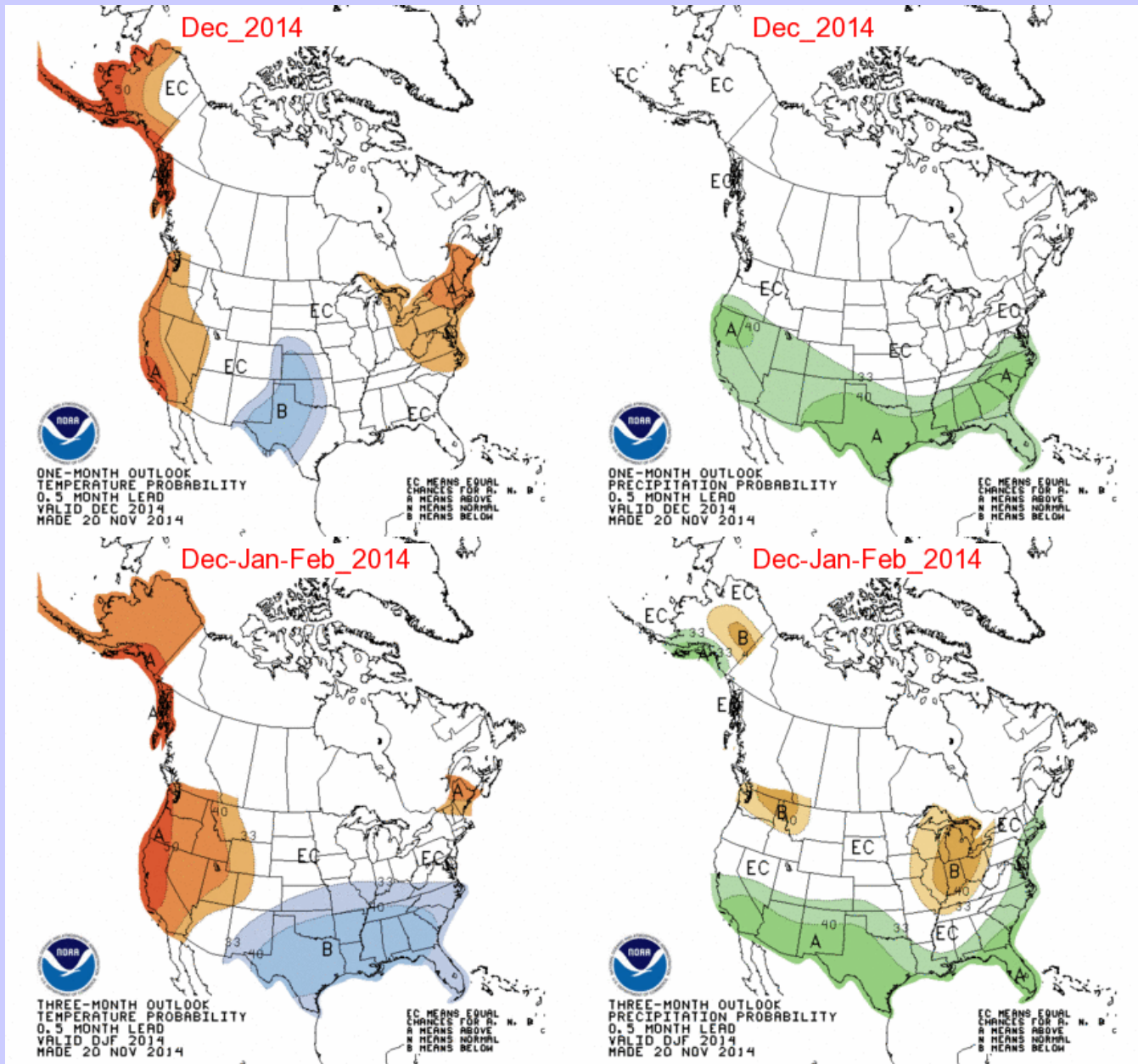
- Record dry early winter, following 2 dry years (subsequently ends up as driest 3-year period on record)
- Governor issues statewide drought emergency proc.
- *16. The Department of Water Resources will take necessary actions to protect water quality and water supply in the Delta, including installation of temporary barriers or temporary water supply connections as needed, and will coordinate with the Department of Fish and Wildlife to minimize impacts to affected aquatic species.*
- How many temporary emergency salinity barriers in the Delta? Where? ESA permits!! Extensive interagency coordination needed. New water quality monitoring stations?
- Go/no go construction date? Depends on Delta inflow.
- (Ultimately no go decision made in May, based on observed inflows. Programmatic plan for long-term temporary barrier installation program environmental compliance is expedited.)



Modeling Results for Extremely Dry Year – Salinity (EC) at Rock Slough



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USGS Computed CA WY Runoff

Dozen Driest years -- (rank out of 115)

| | | | |
|---------|-------------------|----------|-------------------|
| 1. 1977 | 115 th | 7. 1990 | 109 th |
| 2. 1931 | 114 th | 8. 2015 | 108 th |
| 3. 1924 | 113 th | 9. 2001 | 107 th |
| 4. 2014 | 112 th | 10. 1934 | 106 th |
| 5. 1991 | 111 th | 11. 1992 | 105 th |
| 6. 1994 | 110 th | 12. 1976 | 104 th |

January 2015, Emergency Delta Barrier, con't.

- Winter 2015 – barrier go/no go? How many barriers?
- ESA permits??
- Barrier installed May-June on West False River, subsequently removed in Nov.
- 150 tons of rock, 750 feet long, 120 feet wide at base
- 10 new WQ monitoring stations
- Estimated to save 90 TAF in upstream reservoirs

January 2014 East Porterville

- Governor's statewide emergency proc
- *10. The state's Drinking Water Program will work with local agencies to identify communities that may run out of drinking water, and will provide technical and financial assistance to help these communities address drinking water shortages. It will also identify emergency interconnections that exist among the state's public water systems that can help these threatened communities.*

Drought Lead Time Example – East Porterville Unincorporated Area Emergency Water Supply Project

- Jan 2014. Governor's statewide drought emergency proc.
- Feb 2014. Tulare County local emergency proc. Many dry private residential wells. Rough estimate, 1000-2000 dry wells reported at various times.
- Jun 2014. County request to CA OES for emergency alternative water supply for EP (tanks, water haulage). County & Red Cross providing temporary bottled water. (Ultimately State spends about \$650k monthly for bottled and bulk trucked water.)
- May 2015. County meets with CDWR, City of Porterville re proposed new muni well to be integrated into City distribution system.

Comparison of Historical Water Project Allocations in Dry Years

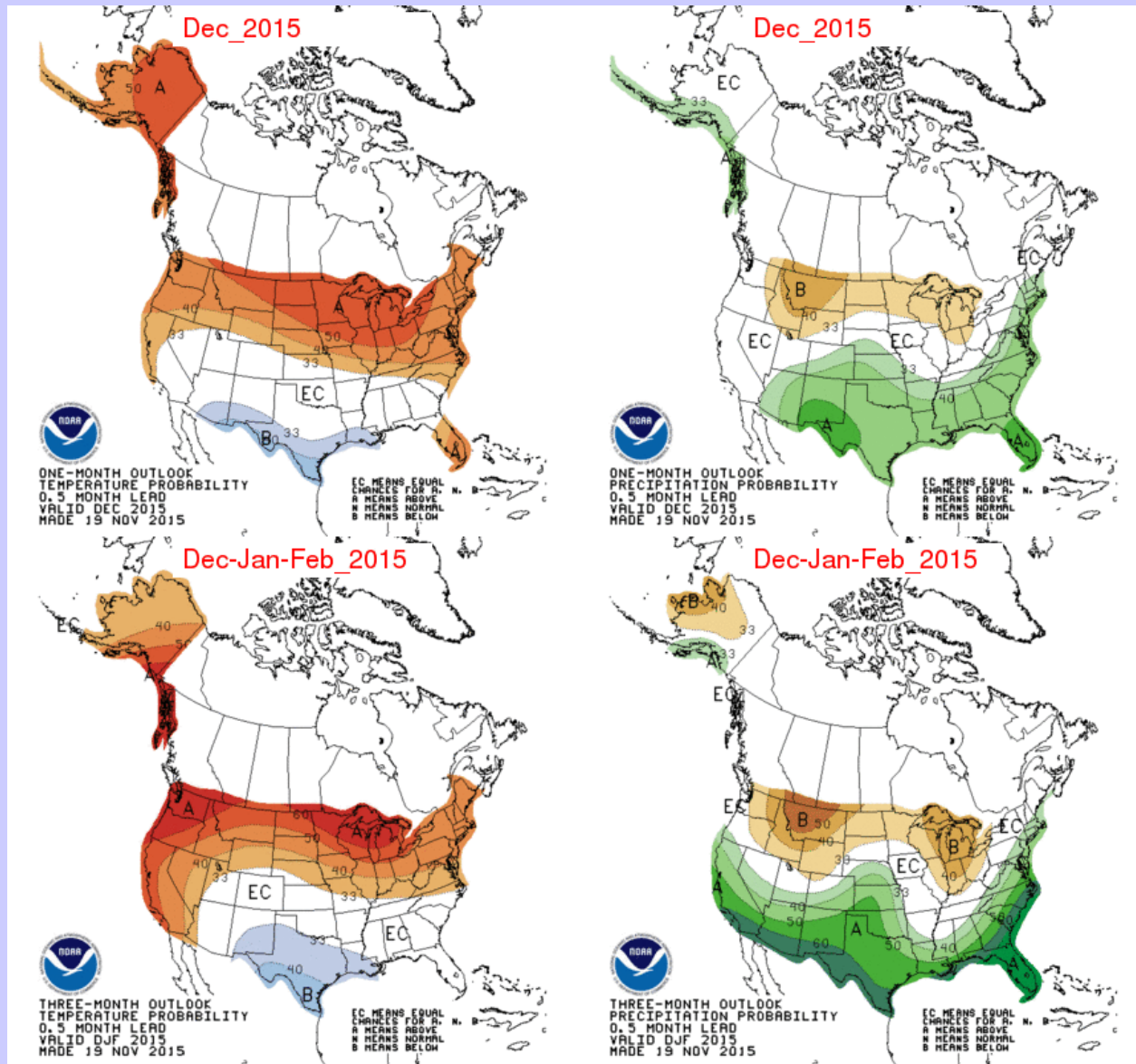
| | 1991 | 2009 | 2014 | 2015 | 2016 |
|----------------------|----------|------|------|------|------|
| SWP | 30% & 0% | 40% | 5% | 20% | 60% |
| CVP N of Delta Ag | 25% | 40% | 0 | 0 | 100% |
| CVP S of Delta Ag | 25% | 10% | 0 | 0 | 5% |
| Friant | 100% | 100% | 0 | 0 | 75% |
| CVP Sac water rights | 75% | 100% | 75% | 75% | 100% |
| CVP SJ water rights | 75% | 100% | 65% | 75% | 100% |



East Porterville, con't

- June 2015. CDWR executes grant agreement with County for \$1.2M for new well for bulk water supply, plan is for City to own well.
- Aug 2015. Well drilling contract awarded by County; County receives SWRCB grant agreement for \$0.5M for EP.
- Jan 2016. New well completed & pump tested
- Feb 2016. DWR executes consultant contract for design of CWS to replace emergency tanks

CPC Outlook Issued Nov 2015



East Porterville, con't

- Feb 2016. Construction of temporary tank filling station begins at well site, became operational in Apr
- May 2016. City enacts ordinance requiring private wells to be abandoned if property connected to City water
- May 2016. MOA among DWR, City, County on roles & responsibilities for project

East Porterville, con't

- Jun-Jul 2016. Decision made to connect EP residents to City water on voluntary basis, 100% DWR funding, free to residents. Connection agreements executed & approved by LAFCo.
- Aug 2016. DWR construction contract executed for Phase 1 hook-ups, first homes connected, 300 homes eligible.
- March 2017, deadline for Phase 2 hook-ups, 765 homes eligible.



CPC Outlook Issued Nov 2016

