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# Response to the off-the-wall comments on Delta levees and earthquakes that were part of a presentation by Dr. Jerry Meral, Under Secretary of the California Natural Resources Agency, on the Bay Delta Conservation Plan at a special meeting of the Redding City Council held on November 18, 2013.

Transcription of recorded remarks courtesy of Maven's Minutes, November 25, 2013
http://mavensnotebook.com/

There are thousands of miles of levees protecting the islands, he said. "*Unfortunately, those levees are built on a very poor foundation. They are built on peat soils or soft clay soils, and they were built mostly with clamshell dredges many years ago and built in a casual way by the farmers who originally reclaimed the islands, although we're trying to improve them. Now the problem we have with this is that each of these islands that you see in blue here has failed at one time or another. Some of them have failed seven times. When they fail, you will see your tax dollars at work because the state and federal government come in, repair the failed levees, pump out the islands, mostly at state or federal expense, there's some local share, and they go back into farming again. They are not polluted, particularly, so they can begin to farm again, but this is very expensive. The last time it happened, it was tens of millions of dollars to repair Jones Tract*."

There are in fact less than a thousand miles of Delta levees that are currently maintained, not thousands of miles. Further, since 1982, the State has contributed significant funding under both the subventions and special projects programs to make significant improvements to the Delta levee system with the overall goal of achieving the Delta-specific PL 84-99 standard that had been agreed to in 1982 by the State and federal governments. In spite of the negative propaganda on Delta levees that emanates from the more political elements within DWR, the DWR staff members that are responsible for these Delta levee programs are justifiably proud of the progress that has been made. The recent construction of "fat levees" on Jones Tract as a result of outstanding cooperation between the East Bay Municipal Utility District, DWR, the Department of Fish and Wildlife, and the local reclamation district showed both that it was possible to construct such levees in line with the cost estimates contained in the Economic Sustainability Plan of the Delta Protection Commission, a unit of the same Natural Resources Agency of which Dr Meral is the Under Secretary. In fact, the significant spending on the Delta levee system since 1982 means that most of the Delta levees have been effectively rebuilt in that time. The picture that is painted by the doomsday school of hundred-year old, non-engineered levees is just wrong. It would be more correct to say that the bulk of the levee

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system has been rebuilt in the last 30 years in accordance with modern engineering practices.

The problem for the state and federal water projects is that if an island fails in the summer and there's not a lot of flow in the Delta, water comes in from San Francisco Bay to fill the space that is created when the levee fails, he said. "*Some of you may remember in 1972 when Anderson-Brannan Island failed, it was in the middle of the summer, probably from a gopher hole, who knows, you never find out what causes these things; the ocean came in to fill this space and the Delta became salty, and it was very difficult to pump water to the 20 million people who rely on it from the southern Delta*."

There are not 20 million people who rely on water exported from the South Delta. There are according to various reports 20 to 25 million people who obtain some portion of their water from Delta exports but, with the exception of Zone 7 of Alameda County, essentially all of the urban water districts that take some water from the Delta also have alternate sources of supply. The extent of any future outages will be a function of how many islands are breached in a single event, how much salinity intrusion there is, and how long it takes for the Delta to flush out, but the probability that there would be any significant interruption of exports as a result of a single island flooding is very small, even in summer time.

"The danger we're really facing in the Delta is an earthquake threat, he said. "*The USGS has said that there is a 60% chance of a major earthquake in the East Bay over the next 40 years and if that happens, many people predict that there will be as many as 20 islands fail at once. You've got to keep in mind that these island levees are based on very poor soils and we get liquefaction, just the same way they did in the Sunset District in the Loma Prieta earthquake or other places, such as in Kobe Japan. When you don't have a good foundation, everything just slumps as you shake it, so this is what we fear would happen …* "

This is a new variation on misquoting the USGS! In a recent BDCP blog, Richard Stapler actually got it right saying "the U.S. Geological Survey estimates that there is a 63 percent chance of an earthquake of magnitude 6.7 or greater in the San Francisco Bay region in the next 30 years". Only about a third of that hazard involves earthquakes generated in the East Bay on the Hayward fault. The other two-thirds of the hazard comes from earthquakes on faults on the Peninsula or in the North Bay. Even the Hayward fault is 30 miles from the western edge of the Delta, and much further from most of the Delta. The major example of liquefaction in the Loma Prieta earthquake was

in the Marina, not the Sunset District. The Marina District is very susceptible to liquefaction because the outer portion of the district is built on recent hydraulically filled sands. To understand the susceptibility of soils in the Delta to liquefaction you have to read Appendix E of the Economic Sustainability Report, but basically the likelihood of liquefaction is low and it is confined mostly to project levees that may have been constructed on recent alluvial foundations. The popular belief that peats perform badly in earthquakes is incorrect, as also discussed in Appendix E of the Economic Sustainability Report. This is confirmed by the testing of an embankment on Sherman Island by professors from UCLA, which was intended to replicate a nearby magnitude 7 earthquake, and did not result in a failure of the peat foundation. Even if levees suffer some distress during an earthquake they will not necessarily breach. For instance, the levees in Kobe, Japan that Dr Meral refers to, actually continued to hold water even though they were quite badly damaged. With proper emergency preparedness and response, any levees in the Delta that suffer distortion in an earthquake could be repaired before the next incidence of high water. That is part of the reason the probability of actually seeing multiple flooded islands is so low. Dr Meral should be going around the State preaching about the need for improved emergency preparedness and response, rather than trash-talking the levee system for which his agency is largely responsible.

Question from city council member: In the earthquakes that we have had, in San Francisco Bay Area, since we've been busy out there since the 1840s … how many of those islands have failed in any of the prior earthquakes?

"*The last earthquake we had of large size was the Loma Prieta earthquake, but the shaking in the Delta was very limited because the Loma Prieta earthquake was centered over in the peninsula, so it was much further away than, for example, the Hayward fault*," responded Mr. Meral. "*That was the only major earthquake we've had since we had the problem of the islands going below sea level – there hasn't been a major earthquake to affect the Delta since that happened. The 1907 earthquake occurred of course, but at that time all the islands were still pretty much at sea level so we didn't have this liquefaction problem*."

"*A very interesting thing happened in the Loma Prieta earthquake, though*," he continued. "*There was an old barn. It was a pole barn, and it had been demolished, but the poles were still in the ground, and the soil around that area liquefied enough so that the poles floated up, so when someone came out the next day, they saw these old poles sticking up out of the ground, which shows the liquefaction potential. But we really haven't had a big earthquake since the Winter's Fault back in the 1890s when the Delta was mostly not even reclaimed, so much of this is based on engineering science as opposed to experience. We really haven't had that*."

It is generally agreed that the 1906 San Francisco earthquake occurred in 1906, not in 1907. I have checked the video of the meeting and the transcript is correct. Dr Meral inexplicably said 1907. Any liquefaction problem in the Delta is unrelated to whether or not the islands are subsided. Maybe Dr Meral meant that we did not have the same potential salt water intrusion problem in 1906, but who knows. The Winters-Vacaville earthquake sequence of 1892 occurred "within a zone of active crustal shortening accommodated by postulated blind thrust faults", not on Winter's fault which does not exist. The pole barn story is apocryphal. The original report by Michael Finch was debunked in a 1992 DWR report that points out that Venice Island, where this allegedly occurred, was flooded at the time, which was during the 1983 Coalinga earthquake, not the 1989 Loma Prieta earthquake! I am informed that Dr Meral has previously been told this, but I guess he does not want to let go of a good yarn.

If there is an earthquake and we have multiple island failures, then the sea water will come in and eventually the Delta becomes salty and you can't export water, he said. "*This is a serious consequence for the entire state of California. It would take a long time to repair the islands, pump them out and get fresh water going again. How long we don't really know, we've never had a multi-island failure of this type. But certainly it would be more than 6 months and it could be up to three years. If enough failures occurred, it could be 10 years.*"

No, it would most likely not be more than 6 months. The latest studies for the DWR conducted by RMA and Jack R. Benjamin & Associates indicate that even in a worse than worst case event, an undefined earthquake causing 50 levees breaches and 20 flooded islands, a scenario that has an annual probability of occurrence somewhere between 0.1 and 0.01 percent, the Delta would likely flush out within several months or six months at the most. In the case of levee failures in a major flood, the Delta will already be awash with fresh water and the demand for exports would in any case be low. Dr Meral should talk to Steve Bradley and Geoff Shaw of DWR about these studies.

*Robert Pyke Ph.D., G.E, is an individual consultant on geotechnical, earthquake and water resources engineering. He obtained his Ph.D. at the University of California, Berkeley, working with the late Professor Harry Seed, the father of earthquake geotechnical engineering. His Ph.D. thesis is entitled "Settlement and Liquefaction of Sands Under Multi-Directional Loading". He is a registered civil and geotechnical engineer in the State of California. Dr Jerry Meral also has a Ph.D. from the University of California - in zoology. He is not licensed to practice any branch of engineering in the State of California.*