

Joe Countryman: Alright, it's a pleasure to be here; and I have an awesome task: to give you a quick history of the Sacramento River Flood Control Project in ten minutes. So, lets go!

To give you a real brief summary of it: the project was designed by people without the proper tools, with a rudimentary understanding of the river mechanics of the system, a lack of knowledge of the strength of the enemy that has been characterized as "battling the inland sea." They had a very insufficient knowledge of the enemy they were battling, and basically, it turned out to be one of the most successful civil works projects ever constructed in the United States.

Why do I say that? The project has led California to the eighth largest economic force in the world. For the first hundred years of California's life, agriculture was the number one economic force, and the Sacramento River Flood Control Project was one of the direct causes for that growth in economic strength.

This is California and, if you notice, the Central Valley has got two major levees on either side: the Close Range and the Sierras. Those are two levee systems that will never fail, and have worked beautifully over time. The Central Valley itself is a vast swampland, including hundreds of thousands of acres of riparian habitat. And this is something what it looked like. This is the Butte Basin, the one major flood basin in the valley that was not recaptured or reclaimed. And, pretty much every year this is what the valley looked like before the Sacramento River Valley Flood Control Project was constructed.

If you forget the project levee in this slide, and you see the natural levee, because of when the river rose each time and came out of banks it would dump sediment. So, there were natural levees formed close to the river, and depressions -- the land was much lower away from the river. So, this

is the setting that it had -- then a cataclysmic event happened; gold was discovered in California.

A huge influx of people came that needed to be fed, housed, and so forth. The other thing, the discovery of gold did is -- this is a photo of hydraulic mines, where the miners actually washed the hills down, and sent the sediment downstream into the river; 'course, in this very cartoony feature. What this did was fill the channels with sediment. It -- Marysville and Yuba City -- the channel bottom was raised 26 feet. At one point, the channel actually became higher than the city, Marysville, adjoining it because of this sediment that had then come down from the hydraulic mines.

So, we had this vast system; there were over a million acres of swamp and overflow lands along the Sacramento River. So, immediately, farmers began to try to recapture the lands for agricultural use, and their individual efforts were paltry and incapable of doing the job, because every time they would raise their levee, taking storage out of the floodplain, of course, the water would rise and the next guy would get flooded and then he would raise his levee and then everybody was flooding and it wasn't working. And this was sort-of the sad state of affairs that existed before the Sacramento River Flood Control Project.

What the project has done is reclaim all but one of these floodplains. It is a plain of about 800 thousand acres of flood land to economic use: agriculture, in particular, some urban, and we're seeing more urban encroachment currently. So, what's left is the Butte Basin, is still a flood basin. The Sutter flood basin has been turned into a bypass; that is, that's, a structure where we divert water from the river to an adjoining basin. And the [Yolo] bypass, which is, if you came from Davis-San Francisco area, you drove across to get here.

What was the project? I was told by [Glory Steinberg] just yesterday -- and I didn't know this -- that this is the first cost-shared, federally cost-shared, project in the United States. It was cost-shared from the very beginning; back in 1970.

The key to the project was navigation. The federal government felt that was its key role, and that was the main reason for their participation, and reclamation was the other main purpose. The definition of reclamation is: cultivate, make better, restore, acquire, rescue from undesired state, make available for human habitation; and, by any measure the Sacramento River Flood Control Project has delivered.

It has over a thousand miles of levees; it has bypasses, weirs and -- here's a photograph of the Freemont Weir that diverts the water to the Yolo Bypass. One of the most important things for you to know and understand is during flood periods only about 20 percent of the flood flow is carried in the river; 80 percent are carried in the bypass. So, when you look at Sacramento, and you look at the Sacramento River, and you think, "Gee, here's a system that has to pass 6-700 thousand (BFS);" and you stand on one levee and you look across to the other, and you say, "How is it possible?" It's only possible because about 20 percent of the flows is being carried in the river; 80 percent of the flows are being carried in the bypass. This is the Sacramento Weir and Bypass, it is the only gated weir in the system, and, if I had it my way we wouldn't have any gated weirs in the system; but that's another story.

Okay, what we're -- I have to cut this down so, we're going to go to the real big issues of what levee failures and what problems the Sacramento River Flood Control Project has. Bank erosion and, that is the major concern. One of the beauties of the plan by the original developers was: by keeping the levee close to the river the velocity would be maintained, and the river would scour and move the hydraulic mining debris out of the system. And they were absolutely right; the problem is: about 1945 all

the hydraulic mining debris was gone, and the river did not stop moving debris. It's still moving it today, and reference the Department of Water Resources massive Bank Protection Project that they did just these last two years, is a direct result of the original design and concept of this system. It was designed to scour; it is scouring, and that has led to erosion.

This photograph is pretty good I think: 1950, this is right here in Sacramento. You can see in this photo: bulldozers are pushing material up on the land side of the levee, while the river is taking away material on the water side of the levee; quite an interesting flood fight there. The banks are under attack. We have spent more money on bank protection for this project than we've spent for the entire project, and it's getting -- it's- it's not even going to be close. We're spending so much money; we have to spend so much money on bank protection just to maintain the survivability of this project.

The other major thing that is out there -- and we're seeing more and more of -- and has been, highlighted- highlighted recently -- is the modern geo-technical analysis. Of course, there was no modern geo-technical analysis when this project was designed and constructed. You need proof? This is the Feather River Levee, right by Yuba City. What you see here is about a five-foot high by 50-foot wide lens of sand within the levee that extended completely through the levee. The Corps uncovered this when they were doing some work up on the project. I wish I could tell you that this is uncommon, that this is the only place this exists, but that's just not the case.

This is a photograph of 1986 flood fight. I was chief of design at the Corps at this time. I was helicoptered out to this site to perform a flood fight, and I don't know if you can see the stress marks in this levee, where it's, sub- subsided; mud is flowing underneath the levee, out the side and, I don't know how, but we actually saved this levee and it did not fail in

1986. Basically, we had to place fill on the water side of the levee to cut down the seepage that was occurring underneath the levee.

This is in [Atomas] in 1997, if you see the seepage in the fields out there; it also nicely shows vegetation, the location of the vegetation, along this reach of the river. So, what have we done to counter this seepage and geo-technical problem? At least in the urban areas the Corps, along with the state and the local sponsors, have constructed slurry walls. Now, these slurry walls originally started about 40-foot deep and at some places now they're 80 to 90, and I'm understanding in West Sacramento, somebody told me yesterday, they may go down to a 110, or something like that.

In some aspects, slurry walls are unproven flood control features, and I say that just because they're new and haven't had much testing. We're all hoping that they are effective for a long, long period of time. But that has been the major thing that's been done in urban areas because you can't build additional berms and you can't set back the levees very well. Also, stabilization berms have been placed on the back -- all trying to counter the effects of [unintelligible].

Okay, last part: in the last fifty years there have been four failures. I've changed this because somebody pointed out another one, I had three and then four, but there have actually been four failures of the Sacramento River Flood Control Project. None of those failures have occurred where vegetation is; that doesn't mean that where you clean the levee that there's more, you know, likely to fail. I'm just trying to point out here, for the purposes of the symposium. The four major failures that have occurred, have occurred in perfectly clean, no tree locations.

And if you think about it, after all I've told you about how it was designed, how it was constructed and what the problems are, and we've got 11 hundred miles of levees; four failures in 50 years is pretty remarkable.

