Lower American River Bank Protection Working Group
Tuesday, June 20th
1:00 – 3:30 p.m.
ICF, 630 K Street, 2nd floor, Sacramento, CA

Meeting Summary

Upcoming Meetings

- LAR BPWG 12th Meeting: Tuesday, August 15th, 2017 (replaced by Field Tour)
- LAR BPWG 13th Meeting: Tuesday, October 31st, 2017

Meeting Summary

I. Welcome, Introductions and Agenda Review (Gregg Ellis, ICF)

Gregg Ellis brought the Lower American River (LAR) Bank Protection Working Group (BPWG) meeting to order. He initiated a round of introductions (see Attachment A for a list of meeting attendees). Ron Stork noted that the SAFCA Director of Planning – Tim Washburn – was not at the meeting. Peter Buck explained that he retired June 15th, but he will be returning in a part time capacity in early July. The BPWG is one of Tim’s priority projects, so he will be back in attendance at the next meeting and will have continued involvement.

Gregg provided an overview of the agenda, noting that there will be two presentations by Brian Wardman from NHC.

II. Initial feedback on April 18th meeting summary

Jim Morgan commented that on the 8th page a question was misstated. The question should have been as follows: does the model assume that the water velocities are the same at all depths? The answer is yes. Joe also noted page numbers should be added to the summary.

Joe appreciated the detailed notes. He found that when looking at the handout Greg Kukas provided from the last meeting, he was able to find answers to his questions in the meeting summary.

Rick Bettis could not attend the meeting, but emailed his feedback to Gregg Ellis. He remains concerned about the durations of flood flows since duration affects the ability of vegetation to withstand erosive forces. He also wanted to know how the BPWG is going to handle climate change and wants this to be a continues topic of discussion. In particular, he’d like DWRs climate change scenarios to be factored in to BPWG assessments where appropriate.

Lilly Allen asked when we will get to habitat values at sites (e.g., spawning and rearing habitat, riparian vegetation, etc.) Gregg responded that we will soon transition to this topic once we have a better sense of specific sites where bank protection may be necessary.
III. Update on Revetment Database within Focus Reach (Brian Wardman, NHC)

Brian began the presentation by explaining what a revetment database is. It is basically a database detailing where various forms of bank protection have been placed in the past that will help us better understand what kind of revetments already exist within the study reach and, to a certain extent, how they have performed.

**Question:** Revetment means angular riprap?

**Answer:** Brian answered that both riprap and cobble are used for protection and both are included in the database.

**Question:** Ron Stork asked if Brian distinguished between the two.

**Answer:** Brian confirmed they did.

While the revetment database is useful as is, a more detailed database is desired. The objective of the update is to learn more about the existing revetments, and to ensure that the revetment designs currently in the reach are still relevant and able to be relied on for protection today. There are three existing databases that Brian pulled data from: the US Army Corps of Engineers (USACE) database (2004), the Department of Water Resources (DWR) Urban Levee Evaluations (ULE) project, and Ayres 2010 Stability Analysis.

**Question:** Peter Buck asked how far back the records go, and what materials the more dated revetments used.

**Answer:** Brian responded that some of the records predate the 1950s, but the existing levees in the study reach were not built until the 1950s, so the records for this reach don’t go back farther than that. Revetments were usually filled in with cobble and other scavenged materials around the site, then they were “paved” with a 1ft thick layer of cobble protection.

**Question:** Someone asked if “craprap” was used often for revetments.

**Answer:** Brian explained that “craprap” is slang for scavenged, non-engineered materials such as broken pieces of old sidewalks and he sees that more often at sites with temporary fixes, i.e. the golf course and around pumps and outfalls.

**Question:** Peter Buck noted that when he was out on the river, he saw cobble that looked relatively uniform. Was that placed there or is it natural?

**Answer:** Brian thinks that it may have been bank paving that was put in near Watt Ave. in the 50s.

**Question:** Ron Stork asked if Brian knew of records that dated back to the 20s or 30s.

**Answer:** Brian responded that in the Study Reach (Paradise Bend – Howe Avenue), there is not much data predating the 1950s.

**Question:** Ron asked if we know that there are not records of the older levees.

**Answer:** Brian responded that Tim Kerr at ARFCD dug pretty deep and gathered everything that was available to the best of their abilities. They have a plan or design for most of the revetments,
and through those efforts there wasn't much if anything from the 20s or 30s. With that said, documents from that era could exist but they haven't been identified/located.

Brian moved on with his presentation. He made note that the USACE database is a GIS database. The entire length of the river is mapped out and depicts features like bank type, bank revetments, percent vegetation cover, etc. Brian noted that while this is good information to have, there is not relevant information about rock placement or design. For the Ayres 2010 Stability Analysis, they went through and visited all the sites.

Brian took all the data they collected from the three databases, compiled the layers, gathered additional information his team found in their various project notes, and put it all into GIS to create their own revetment database. After merging all this data together, they only found one phantom site, and a few undocumented sites. They built an attribute table that includes the plan name, approximate length, visible/buried, plan filename, RM start, RM end, plan year, designer, rock location, left/right bank, and rock type.

Brian went on to explain the changes in revetment designs through the years. “Bank paving” with a 12”-18” layer of cobble was common in the 1950s. A buried rock toe was a common feature in the 1990s. There was a period in the early 2000s where obtaining a 401 water quality permit for installation of a rock toe was an issue, so they were designing around the permit issues by not including a rock toe.

There are also situations where multiple projects have been installed at a single site over a period of many years, so sorting through the data and confirming site conditions are important steps. Brian is working to avoid phantom lines in the data where no one can go back into the record to figure out what was going on.

**Question:** Steve Chainey asked Brian if they have recorded if/where bank protection has moved or slipped downslope?

**Answer:** Brian answered that they conducted this update during the winter when it was not a good time to go out there to record those types of detail.

**Question:** Ron noted that there are a couple of sites that are biotechnical in nature that do not rely on rocks and wondered if those were included in the update.

**Answer:** Brian said they are not in the update but would be good to include. Who would he talk to about that?

**Answer:** Ron answered that Peter Buck would be the one to talk to.

**Comment:** Peter commented that there are only a few of those sites (ex. 10.2R – woody thicket), and several have failed.

**Question:** Gary Estes asked about cobble vs. riprap, which is better for revetment designs.

**Answer:** Brian explained that riprap is blasted angular rock, while cobble is smooth, rounded rock shaped by the river. Cobble is good for sections of the bank that are shallow slope. Riprap is better for interlocking on steep slopes. Fish like cobble better, while engineers like riprap. Some sites call for riprap, some call for cobble, some call for both – it depends on the design and site specific conditions. They are trying to get all the designs on the plan to characterize the whole reach.
**Question:** Steve Chainey commented that there are many different designs that have been used over the years. Are those design details captured in the database?

**Answer:** The main goal is to point the reviewer to the plan set, rather than incorporate all of the design details into the database.

Brian showed a comparison of bathymetric surveys over the last century, which shows substantial incision. This type of data, in combination with the revetment database, could be useful in showing where erosion and incision have occurred in relation to where revetment has been installed.

**Question:** Ron noted that the database and database program both rely on plans. How do you get the actual plans which are the basis for the database?

**Answer:** Brian replied that right now they are on a digital drive, but once the program gets going the plans will be shared.

**Question:** Steve asked if NHC is going to have a record of how many thousands of lineal feet and what percent of the LAR has been revetted?

**Answer:** Brian acknowledged that that was a good idea.

**Question:** Someone asked if Brian had mostly plans (what was intended to be built) or “as-built’s” (what was actually built).

**Answer:** Brian responded that they have predominantly as-builts, including those from the USACE.

**Question:** Chuck Watson asked if they are using the river miles (RMs) that match up with the graphs.

**Answer:** Brian said that they are using the USACE RMs and trying to be consistent. He also acknowledged that keeping track of USACE vs. USGS RMs can be confusing and has thrown them off on occasion until it is caught and corrected.

**Question:** Gary Estes commented that it would be wise going forward to have USACE and USGS work together to reconcile the differences in their RMs. Why is there a difference? Is it because of pre- and post-channelization? It would be good to understand why there is a difference and would be helpful going forward to explain. USGS RMs may be more accessible then USACE, but you can check the Center for Sacramento History for available data.

**Answer:** Brian concurred.

**Comment:** Dan noted that it’s important to use real coordinates, as river miles are based on a snapshot in time and no longer accurate once a river meanders.

**Question:** Chuck Watson noted that the 2016 geomorphic assessment had RMs to the tenth. He wondered if those were Brian’s own measurements. He also noted that Brian should coordinate with USACE.

**Answer:** Brian said yes those were his own measurements, interpreting tenths of a mile in between USACE RMs.
Comment: Chuck explained that the rules dealing with curvature are different between the two agencies. He is not sure if there is a way to reconcile the two because their rules are fundamentally different.

Comment: Ron Stork added that the USACE RM s come from the 1998 topographic, while the USGS RM s date back to the 1920s. Mile 0 on the American River is the same between the two agencies, but once you get up to river mile 10 there is a 0.75 mile difference. On the Sacramento and Feather Rivers the two agencies have completely different RM s. Brian noted that the actual revetment sites are digitized into a GIS system based on as built plans placed into the software exactly where they are (using coordinates). How we refer to the site varies, not the actual mapped location.

III. Update on Site Characterization (Brian Wardman, NHC)

Brian began the presentation with the scope of tasks being carried out by NHC, beginning with site characterization. The goal is to characterize where erosion may occur and why it occurs. Brian and his team looked at flows of interest, what revetments are already out there, what the shear stresses are, hydraulic forces, etc. The next step is to zoom in from the big picture and background information and boil it down in order to characterize each individual site. Then sites where revetments and protection are needed can be identified.

This analysis is made up of 16 sites within the study reach. Brian continued the presentation with what they are planning on doing and how they are going to analyze the sites. He first explains how they differentiated the sites. This was done mainly by soil consistency. If there was one subreach that had two different types of soil, it would be divided into two sites. The sites are defined to have relatively uniform hydraulic, morphologic, and hydraulic resistance characteristics. The objective for the focus reach is to evaluate the potential for erosion at each site up to a design flow of 160,000 cfs.

Brian gave a review on nomenclature. The bench resides between the levee and the river bank. Erosion could potentially occur on the levee embankment, the bench, or the river bank (this includes the toe). The causes of bank erosion are as follows: general scour, general channel migration, local scour (around trees or other objects in the flow), or bank failure from entrainment, block or slip failure, cusp, or tree fall. The fluvial process of the river happens at the toe of the bank and geotechnical failure occurs as a result of that process.

Question: Peter Buck asked what the difference between scour and erosion is.

Answer: Brian explained that erosion is a dislodging of bank material, scouring is the lowering of the river bed, and entrainment is the movement of a particle from one place to another. General scour is characterized by pockets in the channel that just occur.

Levee erosion is mainly caused by general scour or local scour.

Question: Peter Buck commented that he experienced waves perpendicular to the levee at RM2 or 3. Are those potentially boat wakes coming from the Sacramento River? It’s surprising to see them that far up the river.

Answer: Chuck Watson responded that that does happen.
The erosion assessment is depicted in table form. The field on the left focuses on the big picture background analysis including a geomorphic analysis, hydrology, and revetment inventory. The field in the middle are the site characteristics, which is more of a qualitative approach. This part of the analysis picks out susceptible sites and what the causes of erosion are, as well as existing protections against erosion. Site characteristics include mobilization potential, susceptibility, and resistance. The field on the right depicts the potential processes that control erosion. They analyze the erosion potential at each site, and the potential magnitude of erosion. This analysis would differentiate erosion occurring from a single event versus long term erosion.

The general approach of the erosion assessment is through quantitative assessments, to the extent feasible, interpreted in context of site conditions and observed erosion on the LAR. However, not everything can be quantitative and Brian and his team will use both quantitative and qualitative assessments. The question is how to replicate real conditions. In order to achieve this, they have to understand the process very well. Useful information can be gathered from the model, but the model does not capture all the unique nuances of natural processes.

Brian chose RM6.6-6.9R as the sample site. The channel in this segment has historically been incising. There has not been any revetment on the bank, sandy soils are present, high water velocities occur, there is some vegetation, and the potential for mobilization exists. Brian and his team evaluate the velocity, shear stress, impingement, and turbulence at the site.

Question: Peter buck asked what impingement is.

Answer: It is when water is deflected into a bank at an angle; for example, piers on a bridge can direct water into a bank causing impingement. Turbulence is also a key factor; when flow is discontinuous, or turbulent, that often heightens the entrainment of soil. Examples of this are at Paradise Bend and Sac State where a bit of scour can be seen around vegetation.

Considering 2D model results, there can be differences between an 80,000 cfs event and a 160,000 cfs event throughout the cross section. Velocities in the center of the channel will often differ, as they will along the bank and along the levee. This is why we are looking at conditions on the bank and levee separately.

An example of where mobilization may occur at 80,000cfs is across from the Fairbairn Intake. At this site there is mobilization potential along the bank, but the levee protection would hold up during an 80,000cfs event.

Question: Chuck asked, within the "mobilization potential" table, what is meant by scour potential in feet?

Answer: Brian responded that he was trying to tie the initial processes back together, including the ESP process. But in general, he is referring to general scour. He has not settled on the best way to interpret and present the information, so continuing to look for ways to improve upon it.

Question: Chuck Watson asked if it was a qualitative number.

Answer: Yes, it is a qualitative number, as such, need to better explain it.

Comment: Chris Bowles suggested that in the future Brian use a range of numbers rather than a single value.
**Question:** Peter Buck commented that Brian’s explanation makes sense visually. He asked if Brian was talking about bank retreat at the toe.

**Answer:** Brian said yes, going back to the beginning of the presentation, they are trying to differentiate the levee face from the toe.

**Comment:** Steve Chainey suggests that maybe mobilization is a good thing. Maybe that is the river adjusting to a more uniform floodway flow.

**Question:** Peter Buck asks if that were the case, wouldn’t the river move to the left rather than the right?

**Answer:** Brian said yes, but there was a big rock protection constructed that is preventing the river from migrating left. They are trying to determine if the river will erode features they do not want to lose.

**Answer:** Ed Wallace went on to explain that right now Brian is only talking about channel mobilization. They are trying to determine the amount of river power that will move particles. The erosion evaluation part of the process is still a couple of steps away. This presentation is meant to show the way these different variables are going to be combined.

**Comment:** Chuck Watson commented that mobilization potential ignores everything but velocity.

**Question:** Ron Stork asked if they were only looking at the entrainment failure assessment, in other words, one mode of failure.

**Answer:** Brian responded yes, but they all tie together. There are two parts to the assessment. We are currently only looking at one element, so only one third of the answer. This is just a piece of the puzzle.

**Question:** Gregg Ellis asked if the part we are looking at right now is the velocity part.

**Answer:** Ed Wallace responded yes, but it’s a little more than that.

Brian moved on to explain the susceptibility variable. When determining susceptibility, Brian is looking at sites that are more likely to have large bank failures. Brian showed a photo of RM11.85L as an example of a site susceptible to block failure. At the segment being evaluated (RM6.6-6.9R), the bank visually looks over-steepened. You can see the sediment layers, and cracking on the bank. These symptoms could lead to block failure. Another factor is loose deposited materials in the bank in this area. Block failure at this site would not be related to fluvial processes, but to geomorphic processes.

**Question:** Someone asked if stress indicators are separate from susceptibility.

**Answer:** Brian answered that they are part of it.

Brian moved on to explain the resistance variable. Resistance is what is trying to hold bank material in place. It could be revetment on the toe, vegetation on the toe. Patchy vegetation or open areas do not provide much resistance and therefore those areas are more likely to erode. Revetment at the rock toe seems resistant, but Brian wants to figure out how resistant. He notes that vegetation at
the toe is good, but wants to understand it better. Established vegetation would be better than patchy vegetation, but it should be studied further.

The sample site would potentially have some problems at 160,000cfs but it should hold up under 80,000cfs.

Brian then asked the question what is the erosion extent in a single season versus long term – 100-150 years? To answer this question they modeled the erosion rate estimate based on soils and hydraulics, similar to the ESP. They then created synthetic hydrographs for an 115,000cfs event and 160,000cfs event and observed erosion rates.

**Question:** Someone asked what ESP stands for.

**Answer:** Brian answered Erosion Screening Process.

Brian concluded the presentation with a map of the 16 current segments they will be conducting this assessment on – 8 on the right bank, 8 on the left bank. The segments vary in length from 0.3-0.6 miles. They worked through site by site measuring the variables that were just discussed – site characterization, mobilization, susceptibility, and resistance. Segments were determined by grouping similar site characteristics such as substrate, geometry, velocities, etc. This presentation was the initial cut of what they are looking at.

**Question:** Chuck Watson noted that the site delegations follow levees. He asked if the sites include all ground up to the levee.

**Answer:** Brian responded that each site includes the bank, bench, and levee.

**Comment:** Chris Bowles gave kudos the Brian for the presentation. He went on to comment that the hydrology we saw this winter was conducive to bank erosion, especially on the Feather River. Fluctuation in water levels increases erosion, and has a geotechnical effect on the bank, and the rate of drawdown can affect bank conditions and sometimes lead to failure if the banks are saturated. This type of geotechnical analysis is difficult to incorporate into your analysis. There is a similar erosion process in the LAR. Chris asked if the erosion was as bad on the LAR as on the Feather River. He noted that more rapid fluctuations in water levels than typical were definitely present on the LAR. These fluctuations may exacerbate erosion on the LAR. Chris asked if Brian has thought about weighting any of the three categories (mobilization, susceptibility, and resistance). Chris suggests they create a relative ranking of all the sites from least vulnerable to most vulnerable because it would be good for agencies to be able to prioritize the sites.

**Answer:** Brian answered that he is wary of weighting because he does not want to change numbers to get what he wants.

**Comment:** Chris responded that they could have a technical committee to agree and weigh in to improve defensibility.

**Comment:** Gary Estes agreed that it would be valuable to include professional judgement and experience. He suggested that they could take a range so there is room for disagreement.

**Comment:** Chris Bowles responded that this is not an exact science, so there would not be a definitive answer. He suggested that maybe a flow chart would be a good idea to solicit important facts.
Gregg concluded the meeting and also reminded the group that he is always collecting people’s thoughts on what should be on future agendas. For example, Joe O’Connor’s prior request to discuss which designs are plausible for the LAR and Lilly Allen’s comment about discussing habitat conditions as they related to bank erosion.

**Question:** Lilly Allen asked why a representative from USACE isn’t here and wondered if they are planning on coming back to the meetings.

**Answer:** Gregg confirmed that they continue to be involved, but something came up that conflicted with this meeting so they could not make it. Gregg is continuing to coordinate with USACE and requesting their participation. Right now they are spread thin because of what is happening in Oroville and several erosion sites within the flood control system, but we do want them to keep coming.

**Comment:** Peter Buck commented on revetment design challenges. He was shocked to see the conditions of protection sites from the 1990s. He saw beaver damage, downed trees, cottonwoods that had been topped, etc. This underscores the challenge of incorporating the habitat features into the designs and revetments. He thinks there is value in doing another site visit to assess these conditions.

**Answer:** Gregg responded that he will work on getting out in the field again and what we want to look at.

Gregg reminded the group that the NEPA environmental assessment of the update to the Water Control Manual is available for public review on the USACE website. The next meeting is Tuesday, August 15th. There is not a task force meeting between this meeting and the August one, the next task force meeting is in September. KC Sorgen will add the meeting presentations to the website after Brian makes his edits.
### Lower American River Bank Protection Working Group

**June 20, 2017**

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