



March 19, 2014

TO: Flood Authority Members
FROM: Scott Boettcher, Staff
SUBJECT: Chehalis Basin Gages Meeting

At the 1/16/2014 Flood Authority meeting I was tasked with convening a "State of the Gages" meeting involving USGS, NWS, Ecology, WEST Consultants, WSE, and Public Works and Emergency Management staff (see [https://www.ezview.wa.gov/Portals/_1492/images/Inundation%20maps%20\(current%20status%20and%20unfunded%20needs\)%20--%201152014.pdf](https://www.ezview.wa.gov/Portals/_1492/images/Inundation%20maps%20(current%20status%20and%20unfunded%20needs)%20--%201152014.pdf)). Below summarizes the results of that meeting, presents next step opportunities, and makes assignments. We will discuss this at tomorrow's Flood Authority meeting. If you have any questions, feel free to call or email (360/480-6600, scottb@sbgh-partners.com).

NEXT STEP OPPORTUNITIES

Chehalis Basin Gages Meeting

Meeting:

"Chehalis Basin Gages" meeting was held Friday, March 14, 2014 at the WA State Department of Ecology building (Lacey, WA). Meeting was held as a follow-up action item to the January 16, 2014 Flood Authority meeting. Purpose of the meeting was to build a collective sense of next step opportunities to better support and administer the system of gages and stations within the Chehalis Basin. Agenda topics covered in the meeting were:

- Welcome, Introductions, Agenda Review.
- Review/Discussion of Basin Gages Document.
- Discussion of Gaging Needs in the Basin.
- Discussion of Leveraging/Sharing/Collaborative Opportunities.
- Next Steps.

Meeting materials can be accessed here -- <https://www.dropbox.com/sh/sr7t79geceugkpc/cTcJF4Wo3F>

Meeting Participants:

- Brent Bower (NOAA/NWS)
- Marijke van Heeswijk (USGS)
- Ken Frasl (USGS)
- Mark Mastin (USGS)
- Brad Hopkins (Ecology)
- Jessica Hausman (Ecology)



- Paul Pickett (Ecology)
- Casey Kramer (WSDOT)
- Jim Bachmeier (Thurston County)
- Andrew Kinney (Thurston County)
- Tim Elsea (Lewis County)
- Shirley Kook (Lewis County)
- Ross McDowell (Lewis County)
- Dave Curtis (WEST Consultants)
- Ray Walton (WEST Consultants)
- Steve Gustafson (WEST Consultants)
- Larry Karpack (WSE)
- Scott Boettcher (Flood Authority, Staff)

Meeting Discussion and Next Step Opportunities:

The group had an engaging session, covering a lot of ground and a lot of topics. The following presents end-points to many of the topics discussed. The group agreed to meeting again (likely in September 2014) to check-in on the status of next step action items coming from the group's discussion.

1. **Chehalis River Basin Flood Warning System** — Group discussed the important role accurate information (from basin gages and stations) plays in developing and displaying accurate inundation maps. The group also discussed the importance of managing user expectations as to inundation map forecast accuracy and forecast confidence.
Next Step Action Item → Dave Curtis (WEST) will continue to work with USGS, NWS and US Army Corps of Engineers to develop inundation map display approaches that better reflect inundation map forecast accuracy and inundation map forecast confidence and will report back at the group's next meeting.
2. **Update Basin Gages Document** — Group reviewed the "Chehalis Basin Gages & Stations 03142014 -- USGS edits" document (attached). Group found it a valuable first-step tool to easily access and understand basin gages. The group also discussed the need to document quality procedures in communicating the level of certainty in gaging information.
Next Step Action Item → Scott Boettcher (Flood Authority Staff) will work with basin gage owners and basin gage interests to (1) update the document with possible additional gages identified by the group, (2) complete any existing missing information, (3) fix any links, and (4) add in additional information regarding funding partners, stage (y/n), quality procedures, rating curve (y/n), past surveys, etc.
3. **Rating Curves for "Chehalis River at Centralia" and "Skookumchuck River at Centralia"** — Group discussed the fact that the present rating curves for the Chehalis River at Centralia gage (<http://water.weather.gov/ahps2/hydrograph.php?wfo=SEW&gage=CENW1&view=1,0,1,0,0,0,1,0>) and the Skookumchuck River at Centralia gage (<http://water.weather.gov/ahps2/hydrograph.php?wfo=SEW&gage=CTAW1&view=1,0,1,0,0,0,1,0>) have only "synthetic" rating curves (meaning they are theoretically derived). Group agreed there would be value in having actually measured and plotted rating curves based on observed flood elevations. Having such is of substantial interest to Lewis County, Chehalis, Centralia and WSDOT. Group also discussed the "Chehalis River



Near Adna" gage (http://waterdata.usgs.gov/wa/nwis/uv/?site_no=12021800&PARAMeter_cd=00060,00065) as potentially another gage that warrants development of observation-based rating curves.

Next Step Action Item → Casey Kramer (WSDOT) and Scott Boettcher (Flood Authority Staff) will work with agencies and basin gage interests to develop a position statement and proposal regarding the necessity for rating curves, and in particular for the Chehalis River at Centralia and Skookumchuck River at Centralia gages.

4. **Gage datum surveys** — Group discussed the "Newaukum River Near Chehalis" gage (http://waterdata.usgs.gov/wa/nwis/uv/?site_no=12025000) and the likelihood that it may have a gage datum error on the order of about 3 feet because the datum is from a topographic map and has not been surveyed. Group also discussed that there may be other gages in the basin without surveyed datums that should be evaluated.

Next Step Action Item → USGS will survey the datum for the Newaukum River near Chehalis gage. Scott will collect information at #2 above about gage datum accuracy. Scott will also solicit input from the group as to any gages in the basin they think should be prioritized for future gage datum surveys.

5. **More Gages?** — Group heard a presentation from Paul Pickett of a quick, cursory analysis he did of less optimally gaged reaches and drainages in the upper basin. Paul's analysis (attached) was done to support a group discussion around gaps in gaging, gaging needs in the basin (especially for modeling and forecasting), and whether the present gaging configuration in the basin was optimally arranged for flood hazard reduction purposes.

Next Step Action Item → Paul Pickett (Ecology) will update his analysis on less optimally gaged reaches and drainages based on the group's discussion. Additionally, it was acknowledged by the group that there'd be value, potentially, in studying the Basin's overall gaging needs, gaps, redundancies, and optimization opportunities (and do so as part of a next biennium funding package).

6. **Additional Resources/Sources** — Over the course of discussion the following additional resources and sources of information were identified as potentially valuable and relevant:

- Office of Washington State Climatologist -- <http://www.climate.washington.edu/>
- NWS Advanced Hydrologic Prediction Service -- <http://water.weather.gov/ahps/>
- USGS Nooksack Gage Review document -- <http://pubs.er.usgs.gov/publication/sir20095170>
- USGS National Streamflow Information Program (NSIP) -- <http://water.usgs.gov/nsip/>
- USGS Chehalis Basin Gaging Schematic -- <http://wa.water.usgs.gov/data/realtime/adr/interactive/schematics/Chehalis.pdf>

7. **USGS NSIP Funding** — USGS identified NSIP funds as a potential additional source for funding operations and maintenance of basin gages that are eligible for NSIP funding. By using NSIP funds, USGS gage partners could free up existing partner dollars to cover other basin gage needs, e.g., less optimally gaged reaches. Being eligible for NSIP funding does not mean USGS can fund all these gages, as the funds are limited and USGS needs to evaluate monitoring needs throughout the state.

Next Step Action Item → USGS has identified the following active gages in the basin as eligible for NSIP funds:

- Chehalis River near Doty -- http://waterdata.usgs.gov/wa/nwis/uv/?site_no=12020000
- Newaukum River near Chehalis -- http://waterdata.usgs.gov/wa/nwis/uv/?site_no=12025000



- Skookumchuck River near Vail -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12025700
- Skookumchuck River near Bucoda -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12026400
- Chehalis River near Grand Mound -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12027500
- Satsop River near Satsop -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12035000
- Wynoochee River near Gridale -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12035400
- Wynoochee River above Black Creek near Montesano -- http://waterdata.usgs.gov/wa/nwis/uv?site_no=12037400

And the following inactive gage:

- Chehalis River Near Satsop -- <http://wa.water.usgs.gov/cgi/adr.cgi?12035002>

8. **High water marks**-Casey Kramer raised the issue of a consistent methodology for high water marks. Dave Curtis described a simple methodology of a tube with crushed cork that can be used for citizen monitoring of high water marks.
Next Step Action Item → Scott Boettcher will follow-up with basin emergency managers about the idea of a basin-wide citizen monitoring network, possibly through the existing "River Watchers" network, for documenting high water marks using this simple tube-with-cork methodology.
9. **National Hydrologic Warning Council Workshop in WA** — Dave Curtis (WEST) briefed the group on plans by the National Hydrologic Warning Council (http://www.hydrologicwarning.org/content.aspx?page_id=0&club_id=617218) to hold a two-day workshop in WA (for the Pacific Northwest region) in September or October of 2014.
Next Step Action Item → Dave Curtis (WEST) will keep the group aware as the workshop develops (topics, dates, location, etc.)
10. **Next Meeting** — Group found the meeting valuable and expressed a desire to similarly meet again in the Fall.
Next Step Action Item → Scott Boettcher (Flood Authority Staff) will convene a second meeting of the full group in early-September 2014 to hear status reports on next step action items and to continue discussions on strategies to better support and administer the system of gages and stations within the Chehalis Basin.

CHEHALIS BASIN GAGES STATIONS

Station # (Flood site)	Owner (site)	Lat	Long	Station Name	Bar	Btry	Dew	Dis CFS	Gage Ht	Rain Acc	Rain Incr	Rel Hum	Res	Solar Rad	Tem	Tide Elev	Tide Pred	Wtr Tem	Wnd Dir	Wnd Gust	Wnd Spd	Mnt Frq	Seasonal or Contin
Lewis County																							
D15045B2	CRBFA	46.779131	-123.3076917	RIVERSIDE RAIN GAGE (RFA-STA8)		Y				Y	Y				Y							4	C
D15056C4	CRBFA	46.7527560	-122.5459940	SKOOKUMCHUCK RAIN GAGE		Y				Y	Y				Y							4	C
D1507028	CRBFA	46.6702580	-122.6126580	NEWAUKUM-WEYCO RAIN GAGE		Y				Y	Y				Y							4	C
D15080AC	CRBFA	46.4785440	-123.2971670	CHEHALIS BLW THRASH CRK	Y	Y			Y	Y	Y	Y		Y	Y				Y		Y	4	C
12019310	USGS	46.545317	-123.298717	CHEHALIS RIVER ABOVE MAHAFFEY CREEK NR PE ELL, WA (Tin Bridge)				Y	Y														C
12020000	USGS	46.6173000	-123.2780000	CHEHALIS RIVER NEAR DOTY, WA				Y	Y	Y	Y				Y								C
12020525	USGS	46.6347200	-123.2955600	ELK CREEK BELOW DEER CREEK NEAR DOTY, WA				Y	Y														S
12025100	USGS	46.6611100	-122.9827700	CHEHALIS RIVER AT WWTP AT CHEHALIS, WA					Y														S
12020800	USGS	46.4448000	-123.0840000	SOUTH FORK CHEHALIS RIVER NEAR WILDWOOD, WA				Y	Y	Y	Y												S
12021800	USGS	46.625833	-123.100556	CHEHALIS RIVER NEAR ADNA, WA					Y														S
12024000	USGS	46.5757000	-122.6850000	SOUTH FORK NEWAUKUM RIVER NEAR ONALASKA, WA				Y	Y	Y	Y												S
12024400	USGS	46.6673000	-122.7700000	NF NEWAUKUM RIVER ABOVE BEAR CREEK NEAR FOREST, WA				Y	Y	Y	Y												S
12025000	USGS	46.6201000	-122.9450000	NEWAUKUM RIVER NEAR CHEHALIS, WA				Y	Y														C
12025500	NOAA (NWS)	46.7125000	-122.9775000	CHEHALIS RIVER AT CENTRALIA, WA					Y														C
12026600	NOAA (NWS)	46.7311111	-122.952778	SKOOKUMCHUCK RIVER AT CENTRALIA, WA					Y														C
Grays Harbor County																							
D15006B8	CRBFA	47.321308	-123.5955889	HAYWIRE RIDGE RAIN GAGE		Y				Y	Y				Y							4	C
D1502054	CRBFA	47.179722	-123.5594444	WEST FORK SATSOP RIVER AT COUGAR SMITH ROAD NEAR SATSOP 13NNW		Y			Y	Y	Y				Y							4	C
9441102	NOAA (NDBS)	46.9040000	-124.1050000	WESTPORT, WA	Y								Y		Y	Y	Y	Y	Y	Y	Y	Y	C
12031000	USGS	46.9393000	-123.3140000	CHEHALIS RIVER AT PORTER, WA				Y	Y														C
12035000	USGS	47.0007000	-123.4950000	SATSOP RIVER NEAR SATSOP, WA				Y	Y														C
12035100	USGS	46.9625000	-123.603333	CHEHALIS RIVER NEAR MONTESANO, WA					Y														C
12035380	USGS	47.385556	-123.604444	WYNOOCHEE LAKE NEAR GRISDALE, WA					Y														C
12035400	USGS	47.3804000	-123.6100000	WYNOOCHEE RIVER NEAR GRISDALE, WA				Y	Y														C
12036000	USGS	47.2990000	-123.6530000	WYNOOCHEE RIVER ABOVE SAVE CREEK NEAR ABERDEEN, WA				Y	Y														C
12037400	USGS	47.0115000	-123.6550000	WYNOOCHEE RIVER ABOVE BLACK CREEK NR MONTESANO, WA				Y	Y														C

Initial Analysis of Ungaged Reaches and Drainages

Gage or Location	Area (sq mi)	Note	%	% of
CHEHALIS RIVER NEAR DOTY, WA	113	Q	33%	above Adna
ELK CREEK BELOW DEER CREEK NEAR DOTY, WA	58	Q	17%	above Adna
SOUTH FORK CHEHALIS RIVER NEAR WILDWOOD, WA	27	Q	8%	above Adna
South Fork near mouth, basin below Wildwood	97	-	68%	ungaged lower river
Ungaged above Adna	142	-	42%	
Ungaged above Adna w 1 more gage	45	-	13%	
CHEHALIS RIVER NEAR ADNA, WA	340	Z only	58%	above Adna that is gaged
Bunker Creek	33	-	34%	% of ungaged Adna to Newaukum
Stearns Creek	36	-	37%	% of ungaged Adna to Newaukum
Ungaged Adna to Newaukum	97	-	100%	
Ungaged Adna to Newaukum w 2 more gages	28	-	29%	
above Newaukum	437	-		
NEWAUKUM RIVER NEAR CHEHALIS, WA	155	Q		above Chehalis
Dillenbaugh Creek	17	-	65%	% of ungaged Newaukum to Chehalis
Ungaged Newaukum to Chehalis	26	-	100%	
Ungaged Newaukum to Chehalis W 1 more gage	9	-	35%	
CHEHALIS RIVER AT WWTP AT CHEHALIS, WA	618	Z only	57%	gaged above Chehalis
SKOOKUMCHUCK RIVER NEAR BUCODA, WA	198	Q	71%	% of Chehalis to Grand Mound
Salzer Creek	24	-	30%	% of ungaged Chehalis to Grand Mound
Lincoln Creek	43	-	54%	% of ungaged Chehalis to Grand Mound
Ungaged Chehalis to Grand Mound	79		29%	
Ungaged Chehalis to Grand Mound w 2 more gages	12		4%	
CHEHALIS RIVER NEAR GRAND MOUND, WA	895	Q	71%	gaged above Grand Mound
Ungaged above Grand Mound - current	344		38%	
Ungaged above Grand Mound w 6 more gages	94		11%	