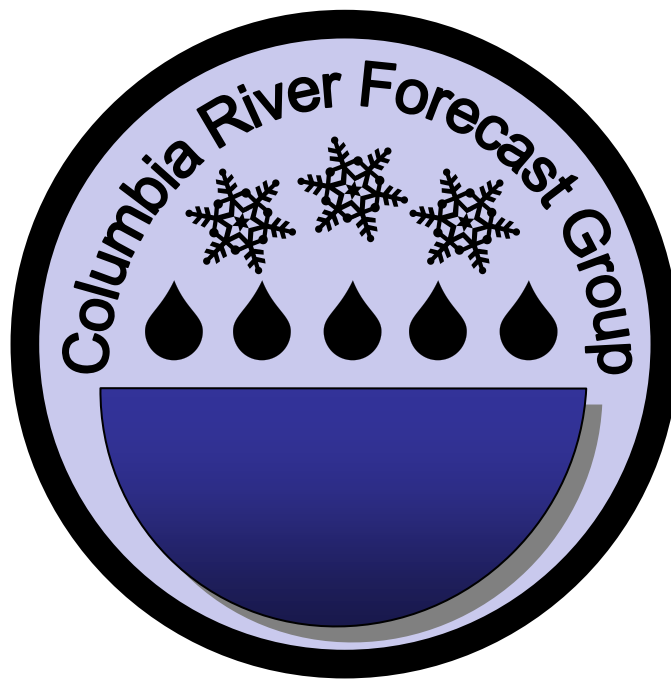


# COLUMBIA RIVER FORECAST GROUP

2009

ANNUAL

REPORT



SEPTEMBER 2010

# COLUMBIA RIVER FORECAST GROUP

2009 ANNUAL REPORT

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# COLUMBIA RIVER FORECAST GROUP

## 2009 ANNUAL REPORT

### 2009 ANNUAL SUMMARY

In November, 2008, there was general agreement that the now defunct Columbia River Water Management Group (WaterMan) provided a means for sharing information and for supporting such projects as the Modified Flows. Attendees of the newly formed Columbia River Forecast Group are interested in strengthening the regional knowledge base. It was suggested that the group organize presentations on various topics such as climate change, water supply forecasting, and data availability. In addition, by coming together as a group, the group can have more clout such as in negotiating for additional Canadian snow gages. A charter for the group was adopted on July 21, 2009.

The Columbia River Forecast Group will work to promote and support the advancement of forecasting skill, products, and techniques in the Columbia River Basin for the purpose of improving reservoir operations for the benefit of the region and as prescribed and documented in the Columbia Basin Fish Accords and 2008 FCRPS Biological Opinion, Reasonable and Prudent Alternative (#7). It will also provide an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques, supporting procedures, and information into the planning and operation of the Columbia River Basin system. The term forecasting will refer to both water supply forecasting and streamflow forecasting.

- a) One of the tasks the group is responsible for accomplishing is to have an “annual meeting in the early fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented next year..”.
- b) Also proposed was a matrix of who does what forecast for what purpose.
- c) It was suggested that improved forecasts would not only help fish but also general operations.
- d) Participants invited to the group included the NRCS, Environment Canada, BCHydro, State of Oregon, Idaho Department of Water Resources, USGS, NWS River Forecast Center, Corps Seattle District, Corps Walla Walla District, Corps Division, BC Hydro and CIG. In addition, other outside of the federal and state governments were invited. This include CRITFC (Columbia River Inter Tribal Fish Commission), the Fish Passage Center, the NW Power and Conservation Council and Dr. Hamid Moradkhani from Portland State University.

- e) Details of how the group would work with the Columbia River Treaty Hydromet Committee are still ongoing. Some of the issues that may arise in this group may involve Canadian stations, information, etc., knowing what the CRTHC does and is working on would be helpful. It was proposed that one or the other of the CRTHC co-chairs from the U.S. would most likely be active in the group and could be the liaison between the two groups. While not necessarily for this purpose, Frank Weber, from BC Hydro, is currently attending the CRFG meetings (2010) and is a member of the Hydromet Committee.
- f) The group will have a rotating chair leading the meetings. The first year will be chaired by Nancy Stephan (BPA). The chair will be rotated annually, BPA, USACE, CRITFIC, BOR, NOAA?.
- g) The “group” needs to come up with a name. Columbia River Water Management Group was the name of the group’s predecessor; however, the use of Water Management has broadened to other areas now. The group settled for the Columbia River Forecasting Group as the current identifier.
- h) Five key work items for the 2010 workplan were established in Sept 2009. These included
  1. Evaluate the benefits/problems with increased frequency of water supply updates. A preliminary study at Hungry Horse (BOR, John Roache / Ted Day) and Dworshak (COE, Steve Hall) are to be conducted in 2010.
  2. Review the climate indices evaluated and selected when the Libby forecast procedure was last updated. Assess and the need and/or merit of updating the procedure with other climate indices such as the Trans-Niño Index. A reassessment of the forecast is to be conducted by Randy Wortman (COE) in 2010.
  3. Verify and track accuracy and limitations of various forecast equations and models (VoDCA, ESP, etc.)
  4. Risk analysis associated with forecasts.
  5. Evaluate the benefits of additional snow pillow sites, particularly in the Canadian portion of the Columbia drainage, assigned to David Bright (BPA)
- i) Appendix C tabulates WSF at several sites in order for the CRFG to begin tracking the forecast accuracy and which forecasts might need to highest priority. Libby has already been targeted to be revised in water year 2010 in the work plan.

# APPENDIX A

## Columbia River Forecast Group

The following pages document the Columbia River Forecast Group Charter approved on July 21, 2009.

### COLUMBIA RIVER FORECAST GROUP CHARTER

#### I. Purpose

The Columbia River Forecast Group will work to promote and support the advancement of forecasting skill, products, and techniques in the Columbia River Basin for the purpose of improving reservoir operations for the benefit of the region and as prescribed and documented in the Columbia Basin Fish Accords and 2008 FCRPS Biological Opinion, Reasonable and Prudent Alternative (#7). It will also provide an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques, supporting procedures, and information into the planning and operation of the Columbia River Basin system. The term forecasting will refer to both water supply forecasting and streamflow forecasting.

#### II. Composition

The CRFG will be composed of technical representatives from the Action Agencies, namely the Bonneville Power Administration, the U.S. Army Corps of Engineers, and the Bureau of Reclamation as well as the parties to the Fish Accords. The CRFG will also be open for participation from any representative of a governmental organization, academic institution or invited guests of the CRFG, who are willing to contribute to the effectiveness and success of the group.

The Chair of the CRFG will be a representative from the three Action Agencies or Fish Accord Tribes. The Chair position will rotate annually among these four representative organizations or groups following the Fall Workshop.

### III. Meetings and Workshops

A general business meeting will occur no less than quarterly but more frequently if workload and projects require it. Meetings and workshops will be called at the discretion of the Chair.

In addition to business meetings, there will be an Annual CRFG Meeting in the fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented in the next year, and to plan committee work for the coming year.

### IV. Functions

1. Facilitate the sharing of information and research pertinent to the improvement of forecasting for the Columbia River Basin, namely in the areas of water supply forecasting, operational streamflows forecasting, data quality and availability, weather forecasting (as it pertains to improving water supply and streamflow forecasting), and climate change.
2. Track and review the performance of current forecasting procedures and techniques, as well as sharing, discussing, and investigating the potential of new forecasting techniques and modeling.
3. When promising research or techniques are discovered and introduced for consideration, the CRFG will develop a strategy for either investigating the potential improvement with available technical staff within the CRFG or provide recommendations or proposals to the Action Agencies for possible funding and support for further research and development.
4. The group will participate in the evaluation of proposed new forecast procedures, models, and techniques and provide recommendations on the incorporation of new procedures into the planning and operation of the Columbia River system.
5. Facilitate the sharing of data, where possible, and the monitoring of the data network and systems which enhance and support the forecasting capabilities of the region. When necessary, the group will provide recommendations on improvements and enhancements to the network.
6. When necessary, the group will plan and facilitate workshops with presenters speaking on current research and forecast projects. The group will also have a role in educating users on forecasting products and on specific focus areas, providing the technical expertise and platform for conducting seminars and workshops on various topics pertinent to the group's purpose.

V. Reporting

The CRFG will produce minutes of each official meeting for distribution to the group and for the purpose of summarizing the group's activities and achievements at the end of the year.

The CRFG will produce an annual summary of the group's activities, achievements, and recommendations no later than four months after the end of the water year. This report will be the basis for annual reporting required for the Biological Opinion and Fish Accord records.

The organization chairing the CRFG will be responsible for meeting notes and annual reporting at the end of the water year.

## **APPENDIX B. MEETING NOTES AND MINUTES**

### **Columbia River Forecast Group**

Meeting notes:

The following meetings took place for the CRFG. Meeting notes are attached where available:

November 19, 2008

January 16, 2009

March 12, 2009 CRFG Workshop (Agenda attached)

July 21, 2009 (No meeting notes)

September 25, 2009

December 15, 2009



# Meeting Minutes for “Columbia River Water Management Group”

November 19<sup>th</sup>, 2008

Location: CRITFC, 1-3 p.m.

## Attendees:

Name	Organization
Nancy Stephan	BPA
Cara McCarthy	BPA
Bob Heinith	CRITFC
Kyle Dittmer	CRITFC
Mary Mellema	BOR
Ted Day (via phone)	BOR
Steve Smith	For CCT
Carl Merkle	CTUIR
Jim Heffernan	CRITFC

## Discussions/Conclusions from meeting:

- e) There was general agreement that the now defunct Columbia River Water Management Group (WaterMan) provided a means for sharing information and for supporting such projects as the Modified Flows. Attendees of the newly formed group are interested in strengthening the regional knowledge base. It was suggested that the group organize presentations on various topics such as climate change, water supply forecasting, and data availability. In addition, by coming together as a group, the group can have more clout such as in negotiating for additional Canadian snow gages.
- f) One of the tasks the group is responsible for accomplishing is: an “annual meeting in the early fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented next year.”. Since this was the first meeting of the group (in November), it was obvious that a fall meeting to accomplish this was not possible this year. However, the group mutually decided to put on a workshop in February or March (depending on progress in December and January) which will be a shortened version of the expected fall workshop in terms of reviewing forecast procedures and performance due to workload of the forecasting agencies during that time of year. The group will be working on formulating the agenda and topics over the next 2 months.
- g) For the upcoming workshop, it was recommended not to repeat the 2006 workshop, but rather provide a semi-review of the techniques presented at that workshop. Nancy also proposed that we draw up a matrix of who does what forecast for what purpose. Finally, in addressing forecasting techniques, it was suggested that improved forecasts would not only help fish but also general operations.
- h) Prior to the Feb/Mar workshop, a letter will be sent to a list of possible participants for the group. Possible participants suggested include the NRCS, Environment Canada, BCHydro, State of Oregon, Idaho Department of Water Resources, USGS, NWS River Forecast Center, Corps Seattle District, Corps Walla Walla District, Corps Division, and CIG. The letter will introduce the group and its purpose and invite their participation in the group as well as inviting them to the workshop.
- i) Steve Smith also suggested that the group provide a briefing to the RIOG at their spring meeting. Details as to the content will need to be worked out.
- j) There was also discussion around the connection between this group and the Columbia River Treaty Hydromet Committee. Some of the issues that may arise in this group may involve Canadian stations, information, etc., knowing what the CRTHC does and is working on would be helpful. Nancy added

that one or the other of the CRTHC co-chairs from the U.S. would most likely be active in the group and could be the liaison between the two groups. In addition, B.C. Hydro should be included as an invitee to participate in the group when we send out letters.

- j) Kyle Dittmer suggested having Dr. Hamid Moradkhani from Portland State University come and talk at the first workshop. Kyle has had conversations with Dr. Moradkhani and believes he may be a valuable resource in the future as the group gets up and running and begins looking into various forecast issues.
- k) It was agreed that the group should have a rotating chair leading the meetings. To start things off, the first year will be chaired by Nancy Stephan (BPA). The chair will be rotated annually.
- l) The “group” needs to come up with a name. Columbia River Water Management Group was the name of the group’s predecessor; however, the use of Water Management has broadened to other areas now. Attendees will be thinking about possible names.

Action Items:

1. Compile a list of possible future participants in the group. Send list out to today’s attendees. **(Nancy Stephan)**
2. Review list of possible participant organizations/names - edit, add, etc. Add contacts if known. **(All)**
3. Prior to the Feb/Mar workshop, a letter will be sent to the list of possible participants, introducing the group and its purpose and inviting their participation in the group as well as inviting them to the workshop. A draft introduction letter will be written. **(Nancy Stephan)**
4. Draft a joint letterhead for the group. **(Bob Heinith)**
5. A general agenda/planning framework will be designed with categories that the group will cover routinely in meetings and in workload planning. A first draft of categories will be sent out to the larger group to edit and refine. **(Nancy Stephan)**
6. Review category list – add, edit, etc. Begin adding specific issues, in addition to those already listed in the MOA), under each category that you think the group should address either immediately or sometime in the future. **(All)**
7. Develop a spreadsheet for tracking group action items, work planning, and goals. **(Nancy Stephan)**
8. Set up conference call for the month of December and a meeting for the month of January. **(Nancy Stephan)**
9. Be thinking about a name for the group. **(All)**

# Columbia River Forecast Group Meeting Minutes

January 16, 2009

Location: CRITFC, 10:00- 11:30 a.m.

Attendees:

Name	Organization
Nancy Stephan	BPA
Cara McCarthy	BPA
Bob Heinith	CRITFC
Kyle Dittmer	CRITFC
Randy Wortman	CORPS (Portland District)
Steve Hall (via phone)	CORPS (Walla Walla District)
Joel Fenolio (via phone)	CORPS (Seattle District)
Steve Smith (via phone)	For CCT
Ted Day (via phone)	BOR

## 1. Review of Action Items

(See Action Items attachment)

## 2. Name and Charter

- a) The attendees decided on the name “Columbia River Forecast Group”, offered by Kyle Dittmer.
- b) Bob Heinith reviewed the description of the CRFG in the MOA (Fish Accords). After some discussion it was agreed that copies of the charter for the old Columbia River Water Management Group and the description of the CRFG in the MOA would be distributed electronically for the group to review. It was agreed that for the new CRFG charter we would start with the MOA description and revise, add, or re-format it into a charter, taking any beneficial parts from old CRWMG charter as appropriate.

## 3. Meeting and Group Topic List

- a) A rough draft of the list of topics and focus areas for the new CRFG was distributed prior to the meeting. Nancy asked for additions, both for the general topics and for potential work under each topic. The purpose of this list is for two things: 1) a format of topics to discuss or cover at each meeting, and 2) a starting list for building and prioritizing our workplan. The group felt the general topics covered everything at this point with a few modifications to some of the topics. Several more work items were added under each topic. It was also brought up that if decide to review forecast performance, we should give forecasting agencies **notice** that we will ask for an assessment of their forecasts. (See attached revised list)

## 4. Participation List

- a) A list of potential participants in the CRFG was also distributed prior to the meeting. The intent of this list is to brainstorm as to who may wish to participant in the CRFG and contribute to its efforts in the future. The list is also expected to be a starting point for groups or individuals we wish to send a letter to inviting them to the March workshop and introducing the CRFG. The group added to the list and filled in contacts for each organization, however, several attendees were tasked with finding contacts for some of the groups. (See attached revised list)

## **5. Letter to Regional Participants**

- a) Nancy reported that this was an action from the last meeting; however, she hadn't had a chance to write the draft. She will provide a draft at the February 10<sup>th</sup> meeting.
- b) A draft of the letterhead or logo will need to be done at the same time. This may be a carryover task for Bob Heinith from the last meeting.

## **6. Workshop Planning**

- a) The group discussed the focus of the workshop. This workshop has several purposes:
  - i) Introduction of the CRFG and its purpose
  - ii) Continuation of discussions from the PRWG initiated workshop in June of 2006.
  - iii) Short presentations by regional forecasters on their forecast methodology.
  - iv) Better understanding of how forecasts are used
  - v) Better understanding of critical operations and decision periods that are impacted by forecasts.
  - vi) General presentations related to forecasting and current research.
  - vii) General discussion with the entire group of ideas and projects the CRFG could put on in its workplan for 2010 and beyond.
  - viii) Discuss the intent of the Fall Workshop: Purpose and Expectations
- b) The date for the workshop was tentatively set for March 12<sup>th</sup>. The group was to get back to Nancy if this date had a major conflict with any other event.
- c) Kyle Dittmer "volunteered" to begin putting together an agenda and speaker list. The group provided a list of possible participants for item iii) above and also suggestions for item vi).

## **7. Next meeting**

- a) Nancy suggested picking a re-occurring date to have the CRFG meetings so they would stay on calendars and keep the group moving along in terms of meeting on a regular basis and accomplishing work. The group decided that it was something to consider, but after the workshop when we might have a better idea of the possible participants. It was also suggested that the standing meeting issue might be a discussion topic at the workshop. Kyle said that CRITFC was busy every third Thursday and Friday of the month, so those days wouldn't be good for a standing meeting.
- b) The next meeting was scheduled for February 10<sup>th</sup> from 2:00-3:30, location at CRITFC. Topics to discuss:
  - 1. Charter
  - 2. Letter to workshop participants
  - 3. Workshop planning and progress

## **8. Action Items**

(See Action Item attachment)

**Columbia River Forecast Group Workshop  
March 12, 2009**

Columbia River Inter-Tribal Fish Commission—Celilo (basement) Conference Room  
729 NE Oregon Street, Portland, Oregon

**WORKSHOP AGENDA**

- 8:00 AM Registration, Workshop Materials, and Sack Lunch
- 8:15 AM Welcome— Nancy Stephan, BPA, and Bob Heinith, CRITFC
- 8:20 AM Review of 2006 Workshop – Bob Heinith, CRITFC Hydro Program
- 8:30 AM Forecast Procedure Review and 2008 performance (15 min. each)
1. NRCS – Dave Garen
  2. NWRFC – Tom Fero
  3. COE – Randy Wortman and Ken Soderlind
  4. USBR – Ted Day
  5. BC-Hydro – Frank Weber
  6. CRITFC – Kyle Dittmer
- 10:00 AM Break...Re-convene at 10:20 AM
- 10:20 AM ESP Forecasting (20 min. each)
1. NWRFC ESP/STP/FEWS Forecasts – Tom Fero
  2. BPA Experience with ESP – Cara McCarthy
  3. COE ESP Toolbox – Randy Wortman
- 11:20 AM Matrix – Which Forecasts are Used for What? When is a Forecast Critical to a User?
- 12:00 PM Sack-Lunch time and discussions
- 1:00 PM Forecast Techniques, Products, and Data (20 min. each)
1. NRCS New Forecast Software and Products – Dave Garen
  2. NWRFC Statistical Water Supply Forecast Update Model – Tom Fero
  3. Report-out on efforts to add snow pillows in B.C. – Brian Kuepper
- 2:00 PM Climate Change Projects (20 min. each)
1. River Management Joint Operating Committee Climate Data Set – Levi Brekke
  2. Glacier Modeling Efforts – Frank Weber
  3. Water Supply Predictability and Climate Change Project – Levi Brekke
- 3:00 PM Break...Re-convene at 3:15 PM
- 3:15 PM Discussion – CRFG Work plan, items for the autumn 2009 Workshop.
- 4:00 PM Closing Remarks

Columbia River Forecast Group  
Meeting Minutes  
September 25, 2009

**Attendees:**

In person:

Nancy Stephan (BPA)  
Cara McCarthy (BPA)  
David Bright (BPA)  
Stephen Smith (CCT)  
Kyle Dittmer (CRITFC) (for last half hour of meeting)

By phone:

Randy Wortman (USACE NWP)  
Steve Hall (USACE NWW)  
Mary Mellema (BOR)

**Topics:**

Fall CRFG Workshop:

- Both the Bi-Op and Fish Accords require and designate that the Action Agencies and Fish Accord signees (Add wording from documents).
- The group recognized that this was competing with quite a few other conferences/workshops going on in October; however the CRFG forecast workshop needed to be before Thanksgiving.
- Discussions at the meeting lead to a possible date of November 17<sup>th</sup> for the workshop.
- Kyle held this date for the CRITFC basement on their room scheduling calendar as a location for the workshop.
- *Action: Participants in the CRFG need to check calendars for the availability of this date.*

2010 Work plan:

- At the previous CRFG meeting, the group selected 5 items from the total list of possible issues and topics that had been documented from previous CRFG meetings and from participants at the March CRFG workshop as potential tasks or projects for the group to work on or investigate.
- The five items selected from the larger list were (Not necessarily in order of preference):
  1. Evaluate the benefits/problems with increased frequency of water supply updates.
  2. Review the climate indices evaluated and selected when the Libby forecast procedure was last updated. Assess and the need and/or merit of updating the procedure with other climate indices such as the Trans-Niño Index.
  3. Verify and track accuracy and limitations of various forecast equations and models (VoDCA, ESP, etc.)
  4. Risk analysis associated with forecasts...
  5. Evaluate the benefits of additional snow pillow sites, particularly in the Canadian portion of the Columbia drainage.
- The intent of this meeting was to begin planning a 2010 CRFG work plan around these items.
- Most of the discussion revolved around item #1, frequency of water supply forecasts. Issues and points brought up during the discussion:
  - Perhaps not all years need to see frequent updates, just the years where the water supply is deteriorating and updates would allow the system to compensate more quickly in order to reach the April 10<sup>th</sup> flood control target. In moderate to good water years, missing the April 10<sup>th</sup> target is not usually an issue.

- If updates were not routinely done, but on an as needed basis, when would you know to start them? What would be the trigger?
  - If updates were to become the norm, would this cause more harm than good? Would the reservoir system be bounced around more frequently as the water supply forecast changes?
  - Not all agencies have a methodology for updating their forecast mid-month. If it was decided to update forecasts mid-month, new forecast procedures would need to be developed for most of the current official forecasts.
  - The only water supply forecast methodologies currently available to do a mid-month update are the NRCS procedures, the BOR procedures, and the RFC's NWSRFS ESP model. The NWSRFS ESP model is the only one currently capable of modeling the entire Columbia Basin.
  - Updating water supply forecasts would require updating flood control target elevations. Procedures and methodologies for updating flood control targets would need to be developed if forecasts were done more frequently.
- Nancy suggested that perhaps one way to assess the potential advantages to updating the water supply forecast more frequently would be to try a test. Doing so would perhaps answer some of the questions posed during the meeting.
  - *Action: Nancy was tasked with outlining a proposal to be brought back to the group for a feasibility discussion.*
  - Item #5 from the potential project list was included in the list for 2010 since the Columbia River Treaty Hydromet Committee was looking into the feasibility of this already.
  - The remaining items were not discussed at the meeting do to a lack of time.
  - *Action: Nancy will send out another Doodle invite to set up more meetings in October and early November.*

# **Columbia River Forecast Group** **Annual Meeting Agenda**

**Chair: Nancy Stephan**

**December 15, 2009**  
**Celilo Room, CRITFC Building**

## **Session 1: Operations and Forecasting**

830 am: CRITFC Model Performance, Kyle Dittmer, CRITFC  
850 am: NRCS Forecast Verification, Dave Garen, NRCS  
910 am: 2009 CRT Forecasts, Frank Weber, BC Hydro  
930 am: RFC Water Supply 2009 Review, Joanne Salerno, NWS/RFC  
950 am: **Break**  
1010 am: Columbia River Forecast Review, Francisco Munoz-Arriola, UW/CIG  
1030 am: Libby and Dworshak Forecast Review, Joel Fenolio/Stephen Hall, COE  
1050 am: Hungry Horse Forecast Review, Ted Day, BOR

## **Session 2: Planning, Development, and Research**

1115 am: Extended Weather Forecasting at BPA, Chris Karafotias, BPA  
1135 am: Teleconnections Analysis, Frank Weber, BC Hydro  
  
1200 pm: **Lunch**  
  
115 pm: GIS Analysis Tools and Hydrologic Modeling Topics, Dave Garen, NRCS  
140 pm: 2014 Planning, Pete Dickerson, COE  
205 pm: Benefit Analysis of Mid-Month Forecasting for Dworshak and Hungry Horse, Ted Day/Stephen Hall, BOR, COE  
230 pm: **Break**

## **Session 3: Strategy Discussion**

245 pm Topics:

- Selection of 2010 CRFG Chairperson
- 2010 Workplan and direction of CRFG
- Scheduling of the fall 2010 meeting and objectives
- Miscellaneous/Round Robin of Action Agencies

315 pm Adjourn

(No notes were available from this meeting)



# APPENDIX C HISTORICAL FORECAST RESULTS

## Columbia River Forecast Group

Historic forecast results:

Period Forecasts for different months = from

<http://www.nwd.usace.army.mil/report/colriverflood.htm>

Observed KAF = from runoff processor

Duncan: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	2003	<u>109%</u>	2013	<u>110%</u>	1972	<u>108%</u>	1968	<u>107%</u>	1876	<u>102%</u>	1834
2006	1839	<u>87%</u>	1906	<u>90%</u>	1946	<u>92%</u>	1922	<u>91%</u>	1932	<u>91%</u>	2120
2007	2087	<u>88%</u>	2122	<u>90%</u>	2096	<u>88%</u>	2221	<u>94%</u>	2257	<u>95%</u>	2370
2008	2202	<u>113%</u>	2091	<u>107%</u>	2091	<u>107%</u>	2059	<u>105%</u>	1985	<u>101%</u>	1957
2009	2003	<u>123%</u>	1945	<u>120%</u>	1866	<u>115%</u>	1859	<u>114%</u>	1787	<u>110%</u>	1627

Libby: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	5786	<u>104%</u>	5630	<u>101%</u>	5371	<u>97%</u>	5401	<u>97%</u>	5096	<u>92%</u>	5564
2006	5487	<u>83%</u>	6186	<u>93%</u>	6350	<u>96%</u>	6076	<u>92%</u>	6179	<u>93%</u>	6629
2007	6955	<u>102%</u>	6582	<u>96%</u>	6516	<u>96%</u>	6847	<u>100%</u>	6990	<u>102%</u>	6822
2008	6282	<u>113%</u>	6498	<u>117%</u>	6435	<u>116%</u>	6387	<u>115%</u>	6166	<u>111%</u>	5539
2009	5526	<u>125%</u>	5436	<u>123%</u>	5296	<u>120%</u>	5672	<u>128%</u>	5209	<u>118%</u>	4425

Hungry Horse: (May – Sep)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	1647	<u>132%</u>	1418	<u>114%</u>	1144	<u>92%</u>	1217	<u>98%</u>	1173	<u>94%</u>	1245
2006	1826	<u>101%</u>	2024	<u>112%</u>	1958	<u>108%</u>	1912	<u>106%</u>	1824	<u>101%</u>	1811
2007	1823	<u>136%</u>	1803	<u>135%</u>	1786	<u>134%</u>	1495	<u>112%</u>	1425	<u>107%</u>	1337
2008	1840	<u>76%</u>	1859	<u>77%</u>	1876	<u>78%</u>	1913	<u>79%</u>	2131	<u>88%</u>	2410
2009	1809	<u>112%</u>	1864	<u>115%</u>	1697	<u>105%</u>	1817	<u>112%</u>	1816	<u>112%</u>	1618

Grand Coulee: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	54863	<u>112%</u>	53657	<u>110%</u>	45820	<u>94%</u>	47628	<u>98%</u>	47628	<u>98%</u>	48807
2006	55466	<u>91%</u>	58480	<u>96%</u>	57877	<u>95%</u>	57275	<u>94%</u>	58500	<u>96%</u>	61189
2007	60000	<u>105%</u>	61600	<u>107%</u>	61200	<u>107%</u>	61600	<u>107%</u>	61000	<u>106%</u>	57350
2008	59300	<u>99%</u>	59200	<u>99%</u>	61300	<u>103%</u>	61600	<u>103%</u>	60000	<u>100%</u>	59739
2009	55800	<u>116%</u>	54600	<u>113%</u>	53100	<u>110%</u>	55400	<u>115%</u>	54000	<u>112%</u>	48186

Brownlee: (Apr – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	3170	<u>88%</u>	2590	<u>72%</u>	1740	<u>48%</u>	2180	<u>60%</u>	2440	<u>68%</u>	3612
2006	6690	<u>75%</u>	8016	<u>89%</u>	6940	<u>77%</u>	8380	<u>93%</u>	9020	<u>101%</u>	8975
2007	5200	<u>185%</u>	3630	<u>129%</u>	3760	<u>134%</u>	3300	<u>118%</u>	3040	<u>108%</u>	2807
2008	4390	<u>101%</u>	5260	<u>120%</u>	5500	<u>126%</u>	5400	<u>124%</u>	4860	<u>111%</u>	4368
2009	4260	<u>76%</u>	4020	<u>72%</u>	3350	<u>60%</u>	4970	<u>89%</u>	5000	<u>90%</u>	5575

Dworshak: (Apr – Jul)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	1914	<u>116%</u>	1642	<u>100%</u>	1423	<u>87%</u>	1321	<u>80%</u>	1344	<u>82%</u>	1643
2006	2601	<u>97%</u>	2707	<u>101%</u>	2612	<u>98%</u>	2593	<u>97%</u>	2626	<u>98%</u>	2677
2007	2905	<u>161%</u>	2126	<u>118%</u>	2192	<u>122%</u>	1982	<u>110%</u>	1868	<u>104%</u>	1799
2008	2717	<u>79%</u>	2738	<u>80%</u>	2810	<u>82%</u>	3010	<u>88%</u>	3003	<u>87%</u>	3434
2009	3075	<u>121%</u>	2681	<u>106%</u>	2461	<u>97%</u>	2662	<u>105%</u>	2631	<u>104%</u>	2539

The Dalles: (Apr – Aug)

Year	Jan		Feb		Mar		Apr		May		Observed
	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	KAF	% of OBS	
2005	74300	<u>109%</u>	69200	<u>101%</u>	57200	<u>84%</u>	60800	<u>89%</u>	61900	<u>90%</u>	68452
2006	87500	<u>90%</u>	94300	<u>97%</u>	91200	<u>93%</u>	92700	<u>95%</u>	95600	<u>98%</u>	97541
2007	91300	<u>116%</u>	88200	<u>112%</u>	88300	<u>112%</u>	85200	<u>108%</u>	84200	<u>107%</u>	78939
2008	88200	<u>95%</u>	91800	<u>98%</u>	94300	<u>101%</u>	94700	<u>102%</u>	90900	<u>98%</u>	93198
2009	82100	<u>102%</u>	79700	<u>99%</u>	74800	<u>93%</u>	82400	<u>102%</u>	81400	<u>101%</u>	80771

In FY10, forecast for Lower Granite and The Dalles (Jan – July) will be included.