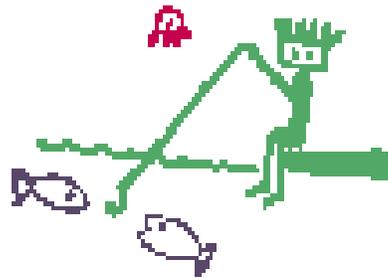


June 3, 2003

**San Juan River Basin
Recovery Implementation Program
Hydrology Committee
April 1, 2003 Meeting Summary**



Members/Alternates Present:

Ray Alvarado
Ron Bliesner
Rick Cox
Dave Frick
Mike Hamman
Steve Harris
John Leeper
Bill Miller
John Simons
Brian Westfall
John Whipple

Others present:

Dave King
Charles Lawler
Eric Knight
Chuck Wanner
Shawn Williams
Marilyn Greenberg, Program Assistant
Shirley Mondy, Program Coordinator

Representing: _____

State of Colorado
U.S. Bureau of Indian Affairs
Water Development Interests
Jicarilla Apache Nation
Jicarilla Apache Nation
Water Development Interests
Navajo Nation
Southern Ute Indian Tribe
U.S. Bureau of Reclamation
U.S. Bureau of Indian Affairs
State of New Mexico

Representing:

U.S. Bureau of Reclamation
Southern Ute Indian Tribe
U.S. Bureau of Reclamation
San Juan Citizens Alliance
City of Farmington
U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service

Introductions and Review and Approval of Agenda Items

John Simons welcomed everyone (in Pat Page's absence) who then introduced themselves. The agenda was approved as amended. The following items were added to the agenda: pond update, discussion of the revised operating criteria that Ron Bliesner sent out 3/31/03; and Ron Bliesner's Biology Committee powerpoint presentation (at the end, if time permits).

Review and Approval of February 11, 2003 Draft Conference Call Summary

The February 11, 2003 draft conference call summary was approved as amended.

Review of Action Item Log

#78 Shiprock gage USGS access discussion with John Leeper. The Committee discussed whether a letter from BIA would give USGS easier access to create a cableway. It was stated that locks get changed and whoever controls the site needs a copy of the letter also. ***John Leeper agreed to get a letter to USGS, and to whomever controls the locations, to ease access for USGS.***

Budget, Schedule, and Status Report

John Simons explained that the 2003 budget is same. The percent completion totals will lag when Ron Bliesner's charges come in. The budget is in good shape for the year, depending upon how much more model verification needs to be done.

The model schedule is pushed out further due to other commitments for Dave King and Ron Bliesner in May. There is not a lot of time for the Committee to get comments back and incorporated by the end of the fiscal year.

Ron Bliesner stated that the calibration, testing, and rules are not completed yet. There is still a lot of work to be done by July 31st, leaving a month to review and a month to correct. It is likely that the review of documentation will slip into next fiscal year.

Dave King has 30 staff days avail (after July 31st), as does Ron Bliesner. The model documentation will be ready for review by August 31st or September 15th, and is expected to be complete by October 31st. Keller Bliesner Engineering does not need more money. Dave King stated that Reclamation is trying to get Eric Knight trained to take on some of the model maintenance role. It may be possible to shift some funds from long term maintenance of the model in order to complete some of these other tasks (calibration, testing, and rules).

Shirley Mondy explained that in order to receive money for FY04, a scope of work will need to be done by the June 3rd conference call. This will be discussed at the end of this meeting. Extra time may be needed for model documentation (versus having Keller Bliesner Engineering do it).

The Committee is concerned about the possibility of Reclamation needing additional funds to complete modeling work. Pat Page needs to be made aware of this.

The scope of work for model operation and maintenance needs to be circulated by the June 3rd conference call - Pat Page.

Navajo Reservoir Operations - Shortage Sharing Update

John Whipple reported that the water users got together to make recommendations to the Secretary of Interior on how to work together on water shortages. Everyone but Navajo Nation has signed on. The original time frame was March 10. The power plants signed on with the caveat that they would be able to get additional water from NIIP if they need it. John Leeper said that it is going before the Inter Government Relations Committee, which meets on Monday. The Navajo Nation President and Vice-President have been ok with the proposal. The forbearance issue is the stickler here. The Navajos don't like the idea of someone giving up water so the mine can operate. Even if it is for money, it isn't well received.

Next week is really the last day that this could go into effect. It is based on minimum probable inflow and hopefully we won't be there. It is not known what the April forecast is yet. March minimum probable inflow improved from February, but mid-March dropped. It is expected that April will look like the March forecast.

Water will be a major issue if the recommendations are not endorsed, and if flows drop below what the direct flow users expect by July or August. John Whipple will meet with the State Engineer on Friday and brief him on what is going on. John Simons stated that the release schedule is based on what we can get from the Animas River and needs for the endangered fish. Currently planned releases from the dam are 350cfs through April, 500cfs through August, and 350cfs from October on.

Rick Cox asked if there are any lessons to date that can be incorporated into the model? Ron Bliesner responded to watch the reservoir content and do not over release. There is a need to watch our current data. We do not have discreet release volumes, we have varied release volumes. He also suggested that Reclamation look for other options for maintaining the gates before lowering the reservoir.

Trigger for Declaring "Extreme Conditions"

Per a request from the Coordination Committee, the Hydrology Committee needs to determine a trigger in extreme conditions. A mechanism is needed to determine if there is a different way to meet flow needs and make sure that the fish get what they need. There are 2 conditions - extremely dry and extremely wet. The Biology Committee would determine what the fish need. The Hydrology Committee needs to define a trigger where Reclamation would need to go to the Biology Committee for a recommendation.

Ron Bliesner stated that the flow recommendations already explain where to put the water and what to do in an extremely wet year. The U.S. Army Corps of Engineers' flood regulations determine what would happen if there were a need for a spill.

The Hydrology Committee is charged with defining extremely low conditions and what is the criteria that says the groups need to get together to discuss current conditions - prior to when Reclamation may decide that there is a situation that requires a change in the operating criteria.

John Simons stated that the minimum probable forecast run last year would not have shown a shortage. All the forecasts were higher than what we actually got. Reclamation receives a minimum probable forecast once a month from the weather service which it extends out about three months. There is no way of predicting summer precipitation, although they have a database of historic forecasts.

This year, the minimum probable inflow predicts a shortage. The Hydrology Committee would tell Reclamation that this is an extreme condition, and the committees would get together to determine what deviations from the flow recommendations, if any, would be appropriate.

In the past, Reclamation or the Service has gone directly to the Biology Committee. The Hydrology Committee could start talking about the forecast in January and build that discussion into the trigger. Then the Hydrology Committee would have input into what is going on. The Hydrology Committee could recommend beginning discussions of flows in the fall, and start

looking at inflows and reservoir level more seriously starting in January. This could be added to each Hydrology Committee meeting agenda. The Committee would have to determine what would be used as the trigger to define an extreme condition.

The Hydrology Committee agreed to add a discussion of hydrologic conditions to the agenda of each meeting or conference call to determine whether extreme conditions exist.

At present, the Hydrology Committee has determined that hydrologic conditions indicate that extreme dry conditions exist and that the Program should consider appropriate water conservation measures. Shirley Mondy will transmit this information to the Coordination Committee.

Model Overview and Validation

Dave King's handout "Calibration Validation Model Comparison - State Mod Releases" dated March 27 2003 shows a gage by gage comparison, in monthly acre feet, of State Mod and RiverWare.in trying to get the model operating consistently with State Mod. It indicates where we are now versus where we thought we were going. There are more hydrology and depletion nodes in the current model than in the previous model. The migration model does some of the same work; it has a similar configuration.

The current model:

1. Operates the San Juan/Chama Project with all the operating criteria and with daily bypasses, monthly thresholds, annual diversion limit, and 10-year diversion limit. It is adjusted more closely to how the San Juan/Chama Project actually operates.
2. Pulls all the monthly forecast data for the daily decision model, computes the values, does the forecast of inflow to Navajo Reservoir, and takes the values over to the daily decision model.
3. It is disaggregating all the depletions that are contiguous to the disaggregation model. The disaggregation model only needs to be rerun when we get new hydrology conditions. The model uses StateMod flows data at the tributaries.

The disaggregation model uses the same configuration as the decision model. It does a mass balance at each gage to get the daily hydrograph.

The Bridge Model will operate RiverWare with current data to give a baseline to compare things with the previous and the next generation models. DMI and daily rules are still needed to run the daily decision model.

The U.S. Army Corp of Engineers Hydrologic Engineering Center Data Storage System is an efficient, binary file, data storage system. It has been updated to make it more user friendly. It can be used to review large amounts of daily data. It can create a table or a chart or plot of the data. It is freeware. This could be a way to share some of the outputs from these models. **If anyone else has ideas for a format that would be appropriate for sharing large amounts of model data, other than through Excel, please let Dave King know.** Ray Alvarado wants it to be compatible with TS2. He recommended that Dave King and Keller-Bliesner Engineering

present the data not just as a bunch of numbers. ***Dave King will add draft documentation on this issue and will add it to the model website.***

Natural Flow Review

Ron Bliesner presented his **San Juan Hydrology Model - Generation 3 Calibration Monthly Model with Historic Demands Powerpoint presentation**. He explained the difference between the StateMod and the RiverWare calibration/correlations.

There is a good fit between the Farmington monthly gage data and the model. There is not a very big error from the cumulative gage readings minus the model calibrations; it is about 40,000 acre feet different over 70 years. The model is currently forecasting more water than the gage shows.

The Shiprock monthly gage versus the model has a continuing overprediction. There is a gage problem in one area - for a specific year of the graph. After 1976 the model is accurate.

There is a good fit between the Four Corners monthly gage and the Model. There is about 40,000 acre feet lost (cumulatively) over 22 years.

There is also a good fit between the Bluff monthly gage and the model. The model under forecasts the gage in this instance. There is a 750,000 acre foot difference over 80 years.

When all the data is averaged by month for the entire period of record, typically the model over forecasted the gage until irrigation began. Bluff matches the least. There is a 10,000 acre feet per year difference between Bluff and Shiprock.

Riverware and Statemod match very well. Statemod calibration mode has an accumulation issue. Keller Bliesner Engineering will continue to work on this to find out and remove the bias.

Update on Long Range Plan and Subcontracting Subcommittees

Tom Pitts is working on getting the Long Range Plan revised and would like the annual work plan and LRP to look similar. He has not given us a date on when the new draft will be sent to the subcommittee.

The subcontracting subcommittee is still having discussions on how this would work and is looking at individual Requests For Proposal (RFP's) as an option. The subcontracts would be reviewed by the peer review panel. They will rank them technically. If no Biology Committee members submitted proposals, then the Biology Committee would do a secondary review of the proposals. The Biology Committee's knowledge needs to be utilized to ensure consistency in the monitoring and research. If this proposal goes forward, then Hydrology Committee proposals would also have to be peer reviewed. The next subcontracting conference call will be on April 17th.

There is still some work to be done before the new starts will be out to the Committee to distribute for bids. There may be a 45 day window of waiting for proposals, so it would be good to get this done as soon as possible.

Pond Update

Ron Bliesner stated that several people have expressed interest in having grow out ponds on their land. The Program may put that out for RFP also. There is a Coordination Committee conference call scheduled for May 15th to discuss pond proposals. This discussion may not be needed if it is done thru RFP.

Outstanding Data Needs to Complete Modeling Work

Dave King discussed the "SJRIIP Hydrology Monthly Log" handout. He stated that he needs to start working on the Bridge Model. There is nothing that is keeping the modelers from moving ahead on the model at this time. They want to create a draft of the users model first so that others will know how to move the data through these models.

CRSS natural flows are being revised using revised 1971 through 2000 Consumptive Uses and Losses (CU&L) depletions. Erik Knight will be assigned the task of incorporating the Arizona and Utah data into our data. The CU&L data were provided by Jim Prairie, a Reclamation Upper Colorado Region employee. We anticipate obtaining additional Jicarilla data that are still being developed. This should include historic irrigated acreages and an estimate of historic non-irrigated acreages. New Mexico data are as noted in the provisional data description. NMISC has been unable to provide additional non-irrigation data.

The "Documentation Handout" dated March 29, 2003 shows items that are currently on the FTP website. Computer security is making it difficult to get some of the model work done; normally the Department of Interior does not have FTP sites. ***John Simons has to send a letter requesting permission for Reclamation to maintain an FTP site so they can continue to do the modeling work.*** Reclamation only allows them to maintain an FTP site with data that is not confidential. ***The Hydrology Committee agreed that it is ok with the data that is out there on the FTP site. If anyone is aware of anything that should not be out there, please let Dave King know.***

John Whipple suggested that a disclaimer be added that these are working documents, or stamp them as draft documents, so that people understand that they are not final documents. ***Dave King will add "draft" documentation to the website.***

Dave King will have the documentation outline available in time to be discussed at the June conference call. Add documentation outline to the agenda for the June 3^d conference call.

Model Maintenance

The modelers are currently relying on Colorado for a lot of data from StateMod. The Committee was asked whether it agrees with this continued dependence on the Colorado data. If not, the modeler would have to get up to speed on the input side. ***Most Committee members are comfortable with the continued link between StateMod and RiverWare.*** Colorado will update information from AZ, UT, and NM if it is made available.

Operating Criteria

The Committee reviewed the February 12, 2003 version of the Draft Operating Criteria and Ron Bliesner incorporated the edits that the Committee agreed on. ***Ron Blesner will email the revised Operating Criteria to the Committee.***

Hydrology Committee Peer Review Panel Discussion

Bill Miller suggested that since the Hydrology Committee operates under the same Program and procedures as the Biology Committee, then we should consider a peer review committee for the Hydrology Committee.

Ron Bliesner observed that nearly everyone on the Biology Committee is a contractor, and there are only two people on the Hydrology Committee who are contractors, and asked if there really is a need to spend money on peer review for an non-interested third party?

Dave Frick stated that the Biology Committee is developing science, whereas the Hydrology Committee is applying science. Rick Cox added that Reclamation is an impartial entity that is developing the model.

Shirley Mondy stated that timing needs to be considered in terms of further funding of model review and development.

Ray Alvarado stated that the model documentation needs to be reviewed to ensure that things are included that validate the effort, the calibration, etc. Rick Cox responded that everyone around this table is going to do that.

Some Committee members thought that if it is a peer review of the model to see if it is ok, then the Program would benefit from that, but that a review of the documentation would be a waste of time and money. It may cost \$100,000 to review the model, walk the reviewers through it, and then revise the model and documentation as needed.

Some Committee members questioned whether this model would have to be defended in court actions. Isn't the intent that it be used in evaluations of section 7 consultations on flow recommendations? If it is likely that the model will be challenged in court, it would be up to them to prove in court that there is a problem with the model. Some Committee members thought that a level of peer review would be a level of amour in court. The perception of validity of model is what would be enhanced by peer review.

Steve Harris proposed, John Whipple seconded, and the Committee agreed that: The Hydrology Committee believes that there is no need for a third party peer review to assure the quality of the model. However, if others in the Program believe that the perception of the quality of the model will be improved by peer review, then the Hydrology Committee would develop a proposal for peer review. This proposal passed, with one committee member opposing.

John Whipple and/or Shirley Mondy will take this recommendation to the next Coordination Committee meeting for further discussion.

Money

There are no new funds to be approved at this time - see page 2 of the Budget, Schedule, and Status Report.

Powerpoint of Geomorphology and Habitat Data

Ron Bliesner presented his Geomorphology and Habitat Data presentation.

Review New Action Items

New action items were reviewed.

Next Conference Calls

The next conference call will be on June 3rd, from 9am - 12noon.

Next Meetings

The next Hydrology Committee meeting will be held on August 5, 2003, in Farmington, beginning at 8:30am.

Calibration Validation Model Comparison - StateMod Releases		3/27/2003	
RiverWare Minus StateMod At Streamflow Gages	Average Annual	Maximum	Minimum
DoloresBelowRico	NaN	0.00	0.00
DoloresNearBedrock	NaN	0.00	0.00
EastMancosNearMancos	0.00	0.00	0.00
EFSanJuanAbvSandCreekNearPagosaSprings	0.00	0.00	0.00
FallCreekNearFallCreek	NaN	0.00	0.00
FloridaAtBondad	-0.32	2.04	-1.57
HartmanDrawNearCortez	0.27	0.53	-0.69
HermosaCreekNearHermosa	0.00	0.00	0.00
LaPlataAtFarmington	9.36	3.65	-2.13
LaPlataAtHesperus	0.21	0.84	-0.77
LaPlataAtStateline	10.83	3.33	-1.96
LeopardCreekAtNoel	NaN	0.00	0.00
LittleNavajoBelowOsoDiversion	-0.03	0.00	-1.00
LosPinosAtIgnacio	3.04	2.34	-1.72
LosPinosLaBoca	3.51	3.18	-1.84
LosPinosNearBayfield	0.00	0.00	0.00
LostCanyonCreekNearDolores	NaN	0.00	0.00
MancosNearTowaoc	19.66	8.81	-1.53
McElmoCreekAboveAlkali	-0.13	5.12	-34.49
McElmoCreekNearCortez	0.01	5.08	-34.46
McElmoCreekStateline	42.83	14.62	-24.33
MiddleMancosNearMancos	0.00	0.00	0.00
MineralCreekNearSilverton	0.00	0.00	0.00
NavajoAtBandedPeak	-0.06	0.55	-0.80
NavajoAtEdith	-0.64	1.49	-2.06
NavajoBelowOsoDiversion	-0.24	0.76	-0.91
PiedraAtRangerStationBridge	0.15	0.77	-0.68
PiedraNearArboles	3.32	2.18	-1.73
PiedraNearPiedra	0.21	1.12	-1.00
RioBlancoBelowSJCDiversion	-0.15	1.02	-1.04
SanJuanAtArchuleta	0.24	1.13	-1.00
SanJuanAtBluff	67.32	24.48	-16.53
SanJuanAtFarmington	0.92	5.93	-9.04
SanJuanAtFourCorners	24.32	12.75	-8.45
SanJuanAtPagosaSprings	-0.62	1.51	-1.18
SanJuanAtShiprock	8.34	8.60	-9.24
SanJuanNearCarracas	7.20	3.97	-2.31
SanMiguelAtNaturita	NaN	0.00	0.00
SanMiguelAtUravan	NaN	0.00	0.00
SanMiguelNearPlacerville	NaN	0.00	0.00
SanMiguelNearTelluride	NaN	0.00	0.00
Special	NaN	0.00	0.00
SpringCreekAtLaBoca	-0.01	1.00	-0.95
TurkeyCreekNearPagosaSprings	0.00	0.00	0.00
VallecitoNearBayfield	0.00	0.00	0.00
WestMancosNearMancos	0.10	1.28	-1.19
WFSanJuanNearPagosaSprings	-0.33	0.61	-0.84
AnimasAboveTacoma	7.00	2.32	-1.04
AnimasAtDurango	9.01	3.56	-1.71
AnimasAtFarmington	7.27	4.90	-8.63
AnimasAtHowardsville	0.00	0.00	0.00
AnimasNearCedarHill	9.62	5.21	-8.04
BeaverCreekNearNorwood	NaN	0.00	0.00
DisappointmentCreekNearDoveCreek	NaN	0.00	0.00
DoloresAtBedrock	NaN	0.00	0.00
DoloresAtDolores	0.00	0.00	0.00

DoloresAtGateway	NaN	0.00	0.00
------------------	-----	------	------

Table 2. San Juan Hydrology Model - Data and Model Development Costs
October 2002 Budget

Task	FY2001 Proposal Schedule	Professional time - staff days			FY2001 Funds	FY2002 Funds	FY2003 Funds	Estimated Cost	Target Schedule
		USBR	Consultants	Total					
A. Analyze and correct gage errors.	Nov-00	0.0	20.0	20.0	\$16,000	\$0	\$0	\$16,000	Sep-01
B. CDSS interface	Nov-00	76.5	7.0	83.5	\$28,321	\$23,451	-\$804	\$50,968	Nov-02
C. Data systems development	Jan-01	76.5	7.0	83.5	\$28,321	\$23,451	-\$804	\$50,968	Nov-02
D. Correct 1970 -1993 database	Mar-01	33.0	0.0	33.0	\$4,088	\$16,377	\$1,099	\$21,564	Nov-02
E. Extend data sets to 1929	Apr-01	16.0	0.0	16.0	\$0	\$9,471	\$1,781	\$11,252	Nov-02
F. Extend data sets from 1993 to 1999	May-01	16.0	0.0	16.0	\$0	\$9,471	\$1,781	\$11,252	Nov-02
G. Configure and Calibrate to CDSS	Jun-01	89.0	11.0	100.0	\$20,873	\$33,484	\$13,203	\$67,560	Nov-02
H. Implement functionality in Riverware	Jun-01	26.0	0.0	26.0	\$16,788	\$0	\$0	\$16,788	Sep-01
I. Daily disaggregation	Aug-01	25.0	35.0	60.0	\$0	\$36,855	\$8,320	\$45,175	Oct-02
J. San Juan Model upgrade / calibration	Sep-01	70.5	80.0	150.5	\$0	\$73,307	\$38,666	\$111,973	Feb-03
K. Coordination with stakeholders	Throughout	84.3	13.0	97.3	\$18,939	\$44,300	\$2,822	\$66,061	Jun-03
L. Develop complete documentation	Nov-01	77.0	25.0	102.0	\$13,601	\$28,329	\$27,156	\$69,086	Feb-03
Expenses					\$23,173	\$41,004	\$3,500	\$67,677	
Total		590	198	788	\$170,103	\$339,500	\$96,720	\$606,323	Feb-03

Expenses include travel, contracting costs, software, work station procurement and training, work station support, and RiverWare modifications. FY2002 funds include \$108,465 of consultant work to be performed in 2003. Negative FY2003 costs also reflect contractor carryovers.

Table 2. San Juan Hydrology Model - Data and Model Development Costs
March 2003 Budget

Task	FY2001 Proposal Schedule	Professional time - staff days			FY2001 Funds	FY2002 Funds	FY2003 Funds	Estimated Cost	Target Schedule
		USBR	Consultant	Total					
A. Analyze and correct gage errors.	Nov-00	0.0	20.0	20.0	\$15,335	\$0	\$0	\$15,335	Sep-01
B. CDSS interface	Nov-00	74.0	4.5	78.5	\$28,321	\$21,558	\$678	\$50,557	May-03
C. Data systems development	Jan-01	74.0	4.5	78.5	\$28,321	\$21,558	\$678	\$50,557	May-03
D. Correct 1970 -1993 database	Mar-01	33.0	0.0	33.0	\$4,088	\$16,377	\$1,356	\$21,822	Oct-02
E. Extend data sets to 1929	Apr-01	16.0	0.0	16.0	\$0	\$9,471	\$1,356	\$10,827	Oct-02
F. Extend data sets from 1993 to 1999	May-01	20.0	0.0	20.0	\$0	\$9,471	\$3,676	\$13,147	May-03
G. Configure and Calibrate to CDSS	Jun-01	87.0	11.0	98.0	\$20,873	\$33,484	\$10,856	\$65,213	Apr-03
H. Implement functionality in Riverware	Jun-01	26.0	0.0	26.0	\$16,788	\$0	\$0	\$16,788	Sep-01
I. Daily disaggregation	Aug-01	27.0	35.0	62.0	\$0	\$36,855	\$9,312	\$46,167	Apr-03
J. San Juan Model upgrade / calibration	Sep-01	73.5	83.0	156.5	\$0	\$75,578	\$41,700	\$117,278	Aug-03
K. Coordination with stakeholders	Throughout	84.3	13.0	97.3	\$18,939	\$44,300	\$0	\$63,239	Sep-03
L. Develop complete documentation	Nov-01	69.9	30.0	99.9	\$13,601	\$32,114	\$23,608	\$69,323	Sep-03
Expenses					\$23,173	\$41,004	\$3,500	\$67,677	
Total		585	201	786	\$169,438	\$341,771	\$96,720	\$607,929	Sep-03

Expenses include travel, contracting costs, software, work station procurement and training, work station support, and RiverWare modifications. FY2002 funds include \$108,465 of consultant work to be performed in 2003. Negative FY2003 costs also reflect contractor carryovers.

San Juan Recovery Implementation Program - Hydrology Model Development
 Tasks By Tasks Status
 03/28/03

Task	Actual Schedule	Target Schedule	Amount Expended	Percent Expended	Percent Completion	Status
A	Sep-01	Sep-01	\$15,335	100%	100%	Initial analysis is complete. Task may be revisited after new model is available.
B		May-03	\$53,323	105%	100%	Interfacing of daily and monthly time-series data is complete. Node and support data interfacing are partially completed.
C		May-03	\$53,323	105%	100%	Database interfacing is completed.
D		Oct-02	\$23,954	110%	100%	Provisional data set exists.
E	Jan-03	Oct-02	\$11,407	105%	100%	Provisional data set exists.
F		May-03	\$11,987	91%	94%	Provisional data set exists.
G		Apr-03	\$67,353	103%	99%	Reconfiguration is essentially complete. Verification continues.
H	Sep-01	Sep-01	\$16,788	100%	100%	StateMod return flow methods are implemented. New RiverWare requests types are implemented. It was demonstrated that StateMod water rights processing can be duplicated in RiverWare if required.
I		Apr-03	\$45,618	99%	98%	Data, models, and methods to support disaggregation are completed. Incorporation of output remains.
J		Aug-03	\$34,701	30%	27%	Some sensitivity testing has been conducted and analyzed. Initial scoping of operation alternatives is complete. Scoping, testing, and implementation is ongoing.
K		Sep-03	\$61,751	98%	95%	Ongoing. Work plan, schedule, and budget are updated at least monthly.
L		Sep-03	\$35,551	51%	44%	Web page has been implemented that includes links to models, rulesets, and documentation. Links are available to 2nd generation documentation and drafts of several third generation documents. Ongoing.
Expenses			\$48,922			
Total			\$480,013	79%	81%	Monthly Log
<p>completed due to work funded by other sources of funds and other reporting factors. Percent completions are based upon all work to complete project whereas percent expended are based on expenditures through -----> 3/22/2003</p>						<p>The primary activities were a closer examination of the StateMod natural flows and model runs, documentation, budgeting and scheduling. In addition, scripts were developed to facilitate long-term operation and maintenance models.</p>

FY2002 funds include \$108,465 of consultant work to be performed in 2003. Negative FY2003 costs also reflect contractor carryovers.

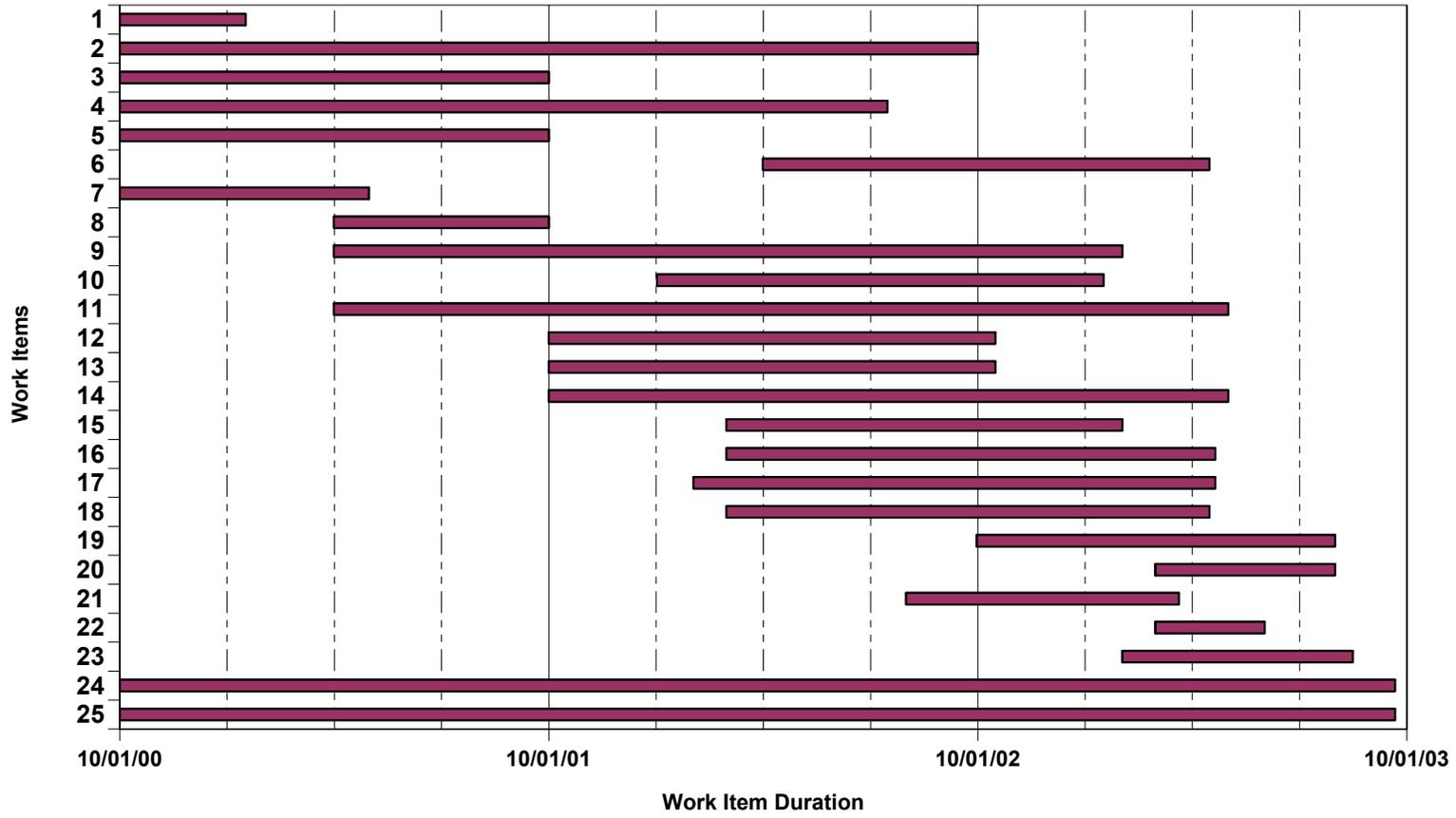
Table 4. Estimated Staff Days and Corresponding Costs
03/28/03

Task	Staff Days			Costs			Expenditures			
	BOR	Consultants	Total	BOR	Consultants	Program Budget	BOR	Consultants	Program Total	Percent Expended
A	0	20	20	\$0	\$15,335	\$15,335	\$0	\$15,335	\$15,335	100%
B	74	5	79	\$47,150	\$3,407	\$50,557	\$48,024	\$5,299	\$53,323	105%
C	74	5	79	\$47,150	\$3,407	\$50,557	\$48,024	\$5,299	\$53,323	105%
D	33	0	33	\$21,822	\$0	\$21,822	\$23,954	\$0	\$23,954	110%
E	16	0	16	\$10,827	\$0	\$10,827	\$11,407	\$0	\$11,407	105%
F	20	0	20	\$13,147	\$0	\$13,147	\$11,987	\$0	\$11,987	91%
G	87	11	98	\$56,886	\$8,327	\$65,213	\$59,026	\$8,327	\$67,353	103%
H	26	0	26	\$16,788	\$0	\$16,788	\$16,788	\$0	\$16,788	100%
I	27	35	62	\$19,672	\$26,495	\$46,167	\$19,672	\$25,946	\$45,618	99%
J	74	83	157	\$54,447	\$62,831	\$117,278	\$22,835	\$11,866	\$34,701	30%
K	84	13	97	\$53,398	\$9,841	\$63,239	\$53,398	\$8,353	\$61,751	98%
L	70	30	100	\$46,613	\$22,710	\$69,323	\$29,465	\$6,086	\$35,551	51%
Expenses				\$45,379	\$22,298	\$67,677	\$42,338	\$6,584	\$48,922	
D&MD	585	201	786	\$433,279	\$0	\$607,929	\$386,918	\$93,095	\$480,013	79%
Other									\$32,844	
Total									\$512,857	
FY2001				\$154,103	\$15,335	\$169,438	\$154,103	\$15,335	\$169,438	
FY2002				\$182,456	\$159,315	\$341,771	\$198,016	\$77,760	\$275,776	
FY2003				\$96,720	\$0	\$96,720	\$50,359	\$0	\$50,359	

Expenditures are through -----> 03/22/03

\$60,000 have been obligated by cooperative agreement for work on tasks B, C, I, G, K, and L.
\$99,315 have been obligated by contract for work on tasks I, J, K, and L.

SJRIP Hydrology Model Development - Detailed Tasks and Schedule Timeline



SJRIP Hydrology Model Development - Detailed Tasks and Schedule Timeline
03/28/03

Work Item Durations

Item	Start Date	End Date	Total Duration	FY2001 Duration	FY2002 Duration	FY2003 Duration	Description
1	10/01/00	01/15/01	107	107	0	0	Migrate flushing release computations to RiverWare rules language.
2	10/01/00	09/30/02	730	365	365	0	Complete doumentation of previous SJRIP Hydrology Model.
3	10/01/00	09/30/01	365	365	0	0	Analyze gage errors and correct gage record as required for reasonable water balance.
4	10/01/00	07/15/02	653	365	288	0	Evolve GIS coverages and databases to support new models including return flow apportionments where necessary.
5	10/01/00	09/30/01	365	365	0	0	Review CDSS San Juan StateMod model and databases, engineering methods, water rights algorithm, and documentation. Identify RiverWare modifications to reproduce CDSS return flow methods and decision process.
6	04/01/02	04/15/03	380	0	183	197	improve specification of 3rd generation model behavior.
7	10/01/00	04/30/01	212	212	0	0	Develop and test implementation of StateMod return flow procedures in RiverWare.
8	04/01/01	09/30/01	183	183	0	0	Develop and test StateMod water rights procedures in revised RiverWare.
9	04/01/01	01/31/03	671	183	365	123	Develop cross model data sets equivalent. This will consist of transforming CDSS input and output data into equivalent spreadsheet and RiverWare terms. Transformation of New Mexico, Utah, and Arizona data will also be required.
10	01/01/02	01/15/03	380	0	273	107	Identify and quantify incidental losses, efficiencies, and headgate capacities
11	04/01/01	05/01/03	761	183	365	213	Develop data storage, analysis and retrieval system, including Data Management Interfaces (DMI's) between respective applications and databases.
12	10/01/01	10/15/02	380	0	365	15	Update 1929-1973 data
13	10/01/01	10/15/02	380	0	365	15	Extend data sets backward to WY1929.
14	10/01/01	05/01/03	578	0	365	213	Extend data sets forward through WY2000.
15	03/01/02	01/31/03	337	0	214	123	Compute New Mexico La Plata shortages and identify offstream depletions.
16	03/01/02	04/20/03	416	0	214	202	Develop and implement disaggregation procedures.
17	02/01/02	04/20/03	444	0	242	202	Reconfigure StateMod and RiverWare models.
18	03/01/02	04/15/03	411	0	214	197	Build and validate reconfigured RiverWare models
19	09/30/02	07/31/03	305	0	1	304	Formulate and prototype decision model operating criteria including sensitivity testing of identified alternatives for improved performance.
20	03/01/03	07/31/03	153	0	0	153	Build and test revised decision model.
21	08/01/02	03/20/03	232	0	61	171	Recompute naturalized flows for reconfiguration with extended data sets.
22	03/01/03	06/01/03	93	0	0	93	Test models with revised naturalized flows and verify gage convergence.
23	02/01/03	08/15/03	196	0	0	196	Analyze runs of revised decision model.
24	10/01/00	09/20/03	1085	365	365	355	Develop documentation and incorporate comments.
25	10/01/00	09/20/03	1085	365	365	355	Program Support And Coordination.

Fiscal Year Start Date	10/01/00	10/01/01	10/01/02
Fiscal Year End Date	09/30/01	09/30/02	09/30/03

HYDROLOGY COMMITTEE COMPLETED ACTION ITEMS FY02 - FY03

	<i>Action Item</i>	<i>Meeting/ Origination Date</i>	<i>Responsible Party</i>	<i>Due Date</i>	<i>Revised Date</i>	<i>Date Completed</i>
1	Complete 2nd generation model documentation. Reclamation portion was mostly the data. Still being reviewed. Responses to commentators have been written. Done. Needs to be added to the website.	7/25/01	Reclamation Keller-Bliesner	11/27/01	John Simons needs to review 7/15/02 9/30/02	10/29/02
2	Write letter to the water districts.	7/25/01	Reclamation	10/31/01		11/27/01
3	Draft Progress Report using Dave King's information. (See #9) A letter documenting the status of the model will be sent to Hydrology Committee by the end of April.	7/25/01	Pat Page	4/30/02		5/7/02
6	Give Dave King and Ron Bliesner the water allocations information (in particular, non-irrigation return flow locations and depletions) from the meeting with New Mexico.	7/25/01	John Simons			9/26/01
7	Let Brent Uilenberg know what funds will not be used in FY 01.	7/25/01	Errol Jensen			9/26/01
8	Send completed FY 2002 budget to Program Coordinator.	7/25/01	Errol Jensen			9/26/01
9	Provide Progress Report information to Errol Jensen.	7/25/01	Colorado (Keller-Bliesner has no progress to report)	10/3/01		10/3/01
10	The Hydrology Committee would like to see the proposal on handling water rights before it is implemented.	7/25/01	Dave King	11/27/01		Decided not to do water rights.
11	Forward the GIS methodology and information to Colorado, and notify John Whipple and Pat Turney when that will happen.	7/25/01	John Simons			Done
13	Add a notation to the Work Plan that Items 1 - 16 will be completed (funds obligated/used) in 2001.	7/25/01	Errol Jensen	7/27/01		9/26/01
14	Prepare Tables 1 and 2 for presentation to the Coordination Committee. (Use Table 3 for the Hydrology Committee only.)	7/25/01	Errol Jensen	7/27/01		9/26/01

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
15	Table 2 needs to be revised to update the schedule.	7/25/01	Errol Jensen	7/27/01		9/26/01
16	Verify how the \$237,000 will be spent in 2001, if much of the remaining work will be completed by Reclamation staff.	7/25/01	Errol Jensen			9/26/01
17	Work through the details and update revised target dates for 2001 funding information and get to Program Coordinator ASAP.	7/25/01	Errol Jensen Dave King	7/27/01		9/26/01
18	Once the scopes of work are complete, notify the Hydrology Committee so that people can express interest in performing the work.	7/25/01	Reclamation	Ongoing		5/7/02
19	Incorporate Product Deliverables and Delivery Dates into the Work Plan. Current tables could be updated with 2003 outcomes and a delivery date for each task.	7/25/01	Pat Page	7/02		6/25/02
20	Anyone interested in attending the San Juan Congressional briefing and tour should let the Program Coordinator know.	7/25/01	Everyone	8/3/01		Cancelled
21	The Hydrology Committee will finalize meeting dates and set conference calls.	9/26/01	Everyone	11/27/01		11/27/01
22	When the report on the Navajo Reservoir Operations Low Flow Test is complete, a copy will be sent to Shirley to be sent out or linked to the San Juan website.	9/26/01	John Simons	March or April 2002	5/14/02 7/1/02	7/1/02
23	The July 25, 2001 Conference Call Summary will be updated on the website.	9/26/01	Marilyn Greenberg	12/1/ 01		11/20/01
24	Reclamation will extend Arizona and Utah historic irrigated acreage data back to 1929, in a spreadsheet format, as needed for the model. Provisional data is complete. Summary of provisional data set has been sent out by Dave King. Final data is pending CRSS process (as of 10/29/02).	9/26/01	Reclamation (11/27/01)	mid May 2002	7/15/02 9/15/02 Extended indefinitely	5/5/03

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
25	The Hydrology Committee will vote to determine if it is appropriate to move forward with the model as proposed, and to bring up concerns for the technical subcommittee to work on.	9/26/01	Everyone	11/27/01		11/27/01
26	Ray Alvarado will put the study on how Colorado did their disaggregation for both hydrologic inflows and diversions on the listserve.	9/26/01	Ray Alvarado			2/1/02
27	Dave King will prepare a concise summary report from the technical subcommittee for the Hydrology Committee to take back and review prior to voting at our next meeting. If anyone has questions, contact a subcommittee member and be ready to vote at the next meeting.	9/26/01	Dave King / Hydrology Committee	11/27/01	3/26/02	3/26/02
28	Dave King will talk with folks, one on one, and find out what they think is a reasonable approach for diversion disaggregation, then consolidate comments (pros and cons), and send it out to the listserve (if approved) for comments. This will be discussed at the Nov. 27 th meeting.	9/26/01	Dave King	11/27/01	3/26/02	3/26/02
29	Keller-Bliesner Engineering will put together information on incidental losses for our next meeting, with a review of products for the committee's review.	9/26/01	Keller-Bliesner	11/27/01	Add'l comments to Bliesner and BOR by 4/29/02	3/26/02
30	The San Juan website will have a link to the model website soon: http://wcao.uc.usbr.gov/envprog/sjrip/	9/26/01	Marilyn Greenberg	12/1/01		11/20/01
31	Pat Page and Bill Miller agreed to schedule a Biology/Hydrology Summit to sort out the data, impacts, and extent of our flexibility.	3/26/02 9/26/01	Pat Page Bill Miller	June or August 2002		6/25/02
32	Reclamation is tasked with tracking and managing the Committee's time and money. A percent complete and percent expended table will be provided by Reclamation and Keller-Bliesner and available for a budget and schedule review at the March 26 th meeting. Pat Page and Dave King will work together to send out a monthly expenditures report.	11/27/01	Dave King Reclamation Keller-Bliesner	Monthly March 26 Ongoing		2/11/03 - process is standardized. Move to completed log.

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
35	John Whipple suggested that the June 14, 2001 version of the Hydrology Committee Model Disclaimer, as approved at the June 19, 2001 Coordination Committee Meeting, be used on Model documentation. Shirley will mail it out on the listserve.	11/27/01	Shirley Mondy			5/1/02
36	Please get comments regarding the September 26, 2001 draft meeting summary to Marilyn Greenberg by 12/7/01. FWS will send out a revised copy.	11/27/01	Everyone Marilyn Greenberg	12/7/01	Revisions still needed. Dave King will assist	1/29/02
37	The Hydrology Committee would like to quantify the benefits of continuing to fund USGS for additional gage readings on the San Juan beyond 2002. The Committee decided to allocate the funds for the additional gage readings and the allocation can be removed later if it needed after the re-evaluation in #34.	1/15/02	Hydrology Committee	after Oct. 29, 2002 Hydrology meeting		10/29/02
38	A Long Term Hydrology Committee Budget Proposal was requested by the Coordination Committee. Please provide your comments to Pat Page. Pat will put the long term budget into a format that is compatible with the work plan and send it back to the Hydrology Committee for comment.	3/26/02 11/27/01	Pat Page Hydrology Committee	3/26/02		5/7/02
39	The final summary of the November 27, 2001 Hydrology Committee conference call will be mailed out to Committee members when revised.	1/15/02	Marilyn Greenberg			1/29/02
40	Dave King will review the budget and progress report targets and address the impacts of missed targets. Dave King and Pat Page will include more details, such as impacts, in the progress reports.	1/15/02	Dave King Pat Page	Ongoing		3/26/02 Format has been established. Ongoing Reports
41	Dave King and Reclamation will develop and add a statement about not using water rights in RiverWare in the model documentation. Statements regarding water rights have been removed from the model documentation.	1/15/02	Dave King			3/26/02

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
42	The Committee is requested to provide additional comments on Keller-Bliesner's 1/11/02 "Draft Plan of Approach" to Ron Bliesner or John Simons by 1/29/02.	1/15/01	Hydrology Committee	1/29/02		3/2/02
43	The January 15, 2002 Conference Call Summary was approved as amended. Marilyn Greenberg will send out the final version to Committee members and post it on the website when revisions have been completed.	3/26/02	Marilyn Greenberg			5/1/02
44	The Committee agreed to talk with USGS, or invite them to come to the Committee and give us a report at the end of the calendar year - around October 22 Hydrology Meeting? (See # 37) USGS has been contacted and they have indicated that they will attend the HC Oct. meeting.	3/26/02		10/22/02		6/25/02
45	The Hydrology Committee voted to recommend moving forward with the "Key Model Input Draft Plan of Approach" dated 3/22/02. New Mexico was the only vote not in favor.	3/26/02	Dave King			3/26/02
46	John Whipple will try to get some written technical comments regarding the Draft Plan of Approach (3/22/02), that was approved, out to Keller-Bliesner and the Hydrology Committee within the next month.	3/26/02	John Whipple	4/26/02 Ongoing	6/7/02	5/22/02
47	The SJRIP 3 rd Generation Hydrologic Data and Model Development plan of approach (3/23/02) will be revised and sent out to the Committee in a couple of days. It should be reviewed by Committee members and comments forwarded to Dave King prior to April 15.	3/26/02	Dave King Hydrology Committee	4/15/02		5/7/02
48	Pat Page and Steve Harris agreed to create a budget and status report with a conversion column to ensure that tasks A-L remain associated with the \$535,500 that was allocated.	3/26/02	Pat Page Steve Harris			5/7/02

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
49	Pat Page will create a reasonable schedule, with a bar chart, to show where we are in terms of completion of tasks and budget that has been utilized/allocated. The chart will also show which tasks can be done concurrently and which work must be completed in order for other work to begin. Work that John Simons was going to do, but cannot do, will be included; as well as the work that needs to wait for John Simons to complete.	3/26/02	Pat Page	4/30/02		5/7/02
50	Steve Harris and Pat Page will send out a long term budget revision. The Committee should review and be ready to discuss at the May 7 Conference Call.	3/26/02	Steve Harris Pat Page	4/30/02		5/7/02
51	The Committee is seeking direction from FWS on whether running the model for 500 acre feet is worth it. Steve Cullinan will check into this and find out what has been approved under the two different 3000 af blocks. Shirley Mondy reported that a few hundred af has been used out of the 2 nd 3000 block of minor depletions so far. 100 af or less is covered by the 2 nd 3000 af of minor depletions, so 500 af is not covered.	3/26/02	Steve Cullinan	4/30/02	6/25/02	6/25/02 Baseline Discussion
52	The Committee will add Hydrology Committee tasks into the LRP. Pat Page and Steve Harris will send a version out for the Committee to review prior to April 30.	3/26/02	Pat Page Steve Harris	4/30/02	5/14/02 Biology Comm. meets 5/21/02	5/7/02
53	Pat Page was asked by the Committee to inquire as to why the Hydrology Committee was not asked, in addition to the Biology Committee, about the flexibility of operations recommendations.	3/26/02	Pat Page	4/30/02		5/7/02
54	The Committee will decide on the FY03 budget request, and whether there is any FY02 give up on 5/ 7/02 conf. call.	3/26/02	Hydrology Committee	5/7/02		5/7/02

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
55	The March 26, 2002 Draft Meeting Summary will be updated with the edits from 5/7 and forwarded to John Whipple for his input. The revised summary will then be sent out to the Committee. The May 7 draft meeting summary and the updated action item log will be sent to the Committee for review. The March 26 th and the May 7 th draft meeting summaries will be reviewed for approval on June 25, 2002.	5/7/02	Marilyn Greenberg John Whipple Hydrology Committee	June 25 for final review/ approval by Committee		6/25/02
56	The Committee agreed to change the meeting summary format to include "Discussion", "Decision", and "Action" sections.	5/7/02	Marilyn Greenberg	Effective Immediately		6/25/02
57	The Committee requested that the Status Report be titled "Status Report" and that the percent expended column be placed next to the percent completions column.	5/7/02	Pat Page			6/25/02
59	There was a motion for the Committee to evaluate the consistency of baseline depletions for the San Juan Basin throughout the model. Further discussion was tabled until the next meeting.	5/7/02	Hydrology Committee	6/25/02		6/25/02
60	Pat Page will revise and send the long term budget out to the listserve for review and approval within the week. Page's time for the rest of the year will be paid for with non-Program funds. Once comments have been received and the Committee approves, the long term budget will be submitted to the Coordination Committee.	5/7/02	Pat Page Hydrology Committee	5/14/02		5/14/02
61	The Committee members will come up with suggestions regarding the target base flow as it relates to the flow recommendations prior to the next meeting. These suggestions will be offered to Reclamation. Page and Simons will attend the May 21 Biology Committee meeting to discuss this item. Reclamation is utilizing a more strict interpretation of flow recommendations because of current drought conditions, and the Farmington gage is being used.	5/7/02	Hydrology Committee Pat Page/John Simons	6/25/02		6/25/02

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
62	Pat Page and Dave King will add a total percent expended and completed line at the bottom of the monthly status report.	6/25/02	Pat Page Dave King	Immediate Ongoing		8/2/02
64	Reclamation will compare their Hammond Project irrigated acreage data with New Mexico's data. Dave King will send an email out to the Hydrology Committee indicating if any discrepancies are found. No discrepancies were found (8/20/02 meeting).	6/25/02	Dave King			7/1/02
65	The discussion on zero flows, on handout #2 from Keller-Bliesner, needs to be strengthened to describe the need for spreading flows out over a month instead of showing several days of zero flow. More description of the magnitude of the missing data would make it easier to understand the methodology. Alvarado & Westfall will discuss (per 8/20/02).	6/25/02	Keller-Bliesner			10/29/02
66	Shirley Mondy will see if Joy Nicholopoulos is available to be on the next Hydrology Committee conference call to answer consultation and baseline questions.	6/25/02	Shirley Mondy		10/29/02	10/29/02
67	Baseline depletions will be discussed further at the 10/29/02 Hydrology Committee meeting.	6/25/02		August 20 conf. call	10/29/02	10/29/02
68	New Mexico water users will meet to discuss strategy for dealing with depletions in the baseline.	6/25/02		Ongoing		Cancelled
69	Jim Brooks would like comments on his revision of the LRP by August 1 st . Steve Harris and Pat Page will review the LRP and put together Hydrology Committee comments and send them out to the Hydrology Committee prior to 8/1/02.	6/25/02	Steve Harris Pat Page Hydrology Committee	August 1		7/10/02
70	The Hydrology Committee will request to be included in the peer review process for the temperature analysis model. Shirley Mondy will send Amy Cutler's status report out to the Hydrology Committee.	6/25/02	Shirley Mondy			6/27/02
71	Shirley Mondy will talk with Brent Uilenberg about the proposed grow out ponds to see what the capital expenditure implications would be.	6/25/02	Shirley Mondy		9/25/02 Coordination Meeting	10/29/02

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
72	Ron Bliesner will send NIIP demands for next year to John Simons, so that information can be included in the Hydrology Committee's flow recommendation memo to the Biology Committee/FWS/Reclamation.	6/25/02	Ron Bliesner John Simons			10/29/02
73	John Simons, Dave King, and Keller-Bliesner agreed to formulate some new operating criteria for the model by August 6, to be discussed at the HC conference call on August 20, 2002.	6/25/02	John Simons Dave King Keller-Bliesner	August 6		8/19/02
74	John Simons will meet with John Whipple on July 11 to discuss the New Mexico data still needed for the model.	6/25/02	John Simons John Whipple	July 11		7/11/02
75	Pat Page will incorporate John Whipple's comments on the "Status Report to the Coordination Committee" in redline and send it back out to the Hydrology Committee for review.	6/25/02	Pat Page Hydrology Committee			7/18/02
76	Hydrology Committee members should email their comments on the Third Generation Navajo Draft Operating Criteria, dated 8/19/02, to Dave King, Ron Bliesner, and/or Brian Westfall by September 13, 2002.	8/20/02	Hydrology Committee	9/13/02	Ongoing	2/11/03
77	Discuss the need for peer review for Hydrology Committee work. Committee members should bring ideas and suggestions to the next meeting. [See #86]	8/20/02	Hydrology Committee	10/29/02	April 1, 2003	4/1/03
79	Ron Bliesner will get the Program temperature data to Amy Cutler, but it may only be data from one location.	10/29/02	Ron Bliesner			11/1/02
80	Marilyn Greenberg will send a copy of this meeting summary to Amy Cutler, per her request.	10/29/02	Marilyn Greenberg			11/1/02
82	John Simons will prepare a risk analysis on the effects of the current drought year to the water supply. This information will be given to Bill Miller to give to the Biology Committee.	10/29/02	John Simons			November 2002
83	Ron Bliesner will extract language out of the flow report to add a section on base flow into the 8/19/2002 operating criteria.	10/29/02	Ron Bliesner	2/15/03		3/31/03

	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
84	Ron Bliesner will notify the Hydrology Committee when the presentation on habitat hydrology will be given in the Biology subcommittee meeting. August 5, 2003 Hydrology Committee meeting (added 2/11/03). Bliesner will present it today if there is time.	10/29/02	Ron Bliesner	May 2003 subcommittee meeting in Logan, UT		4/1/03
85	Defining triggers for extreme conditions - add to agenda for conference call in February.	10/29/02	Pat Page Shirley Mondy			2/11/03
86	The Committee agreed to discuss the need for a peer review panel to oversee all Hydrology Committee work at the April 1, 2003 meeting.	2/11/03	Committee	April 1, 2003		4/1/03
87	Reclamation will revise the budget schedule and report at the next meeting to indicate that work will be complete this fiscal year and within budget. Dave King and Pat Page will set up a conference call with Ron Bliesner and Brian Westfall to determine the plan for the rest of 2003.	2/11/03	Dave King Pat Page Ron Bliesner Brian Westfall			4/1/03
88	Ron Bliesner will revise the entire base flow discussion and get it out to the Committee by Feb. 14, 2003.	2/11/03	Ron Bliesner	Feb. 14, 2003		3/31/03
89	Pat Page will reserve the 4 th floor conference room for the April 1, 2003 Hydrology Committee meeting	2/11/02	Pat Page			2/30/03
90	John Simons will take a look at the USGS data before Ron Bliesner presents at the Biology Committee meeting	2/11/03	John Simons	Feb. 23, 2003		2/23/03
92	The scope of work for model operation needs to be circulated by the June 3 rd conference call.	4/1/03	Pat Page	June 3, 2003		5/28/03
94	The Hydrology Committee determined that hydrologic conditions indicate that extreme dry conditions exist at present, and that the Program should consider appropriate water conservation measures. Shirley Mondy will transmit this information to the Coordination Committee.	4/1/03	Shirley Mondy			04/10/03

95	Dave King will add draft documentation on model data sharing and will add it to the model website.	4/1/03	Dave King			04/02/03
	Action Item	Meeting/ Origination Date	Responsible Party	Due Date	Revised Date	Date Completed
96	John Simons will sent a letter requesting permission for Reclamation to maintain and FTP site so they can continue to do the modeling work.	4/1/03	John Simons			5/29/03
97	Dave King will add "draft" documentation to the documents on the website so that it will be clear to everyone that these are working documents, not final documents.	4/1/03	Dave King			4/2/03
99	Ron Bliesner will email the revised Operating Criteria to the Committee	4/1/03	Ron Bliesner			4/2/03
100	John Whipple and/or Shirley Mondy will take the Hydrology Committee's recommendation of no need for third party peer review to the next Coordination Committee.	4/1/03	John Whipple Shirley Mondy	May 23, 2003		4/10/03

June 26, 2003

HYDROLOGY COMMITTEE ACTION ITEM LOG FY03

	<i>Action Item</i>	<i>Meeting/ Origination Date</i>	<i>Responsible Party</i>	<i>Due Date</i>	<i>Revised Date</i>	<i>Date Completed</i>
4	Add model runs and other information to the permanent hydrology website: http://wcao.uc.usbr.gov/envprog/sjrip/ .	7/25/01	Dave King	Ongoing		Continues to Update
5	Model modification briefings.	7/25/01	Reclamation and Keller-Bliesner	Ongoing		
12	Any new data or methods incorporated into RiverWare or State Mod will be shared with the Hydrology Committee.	7/25/01	Keller-Bliesner and Reclamation	Ongoing		
24	Reclamation will extend Arizona and Utah historic irrigated acreage data back to 1929, in a spreadsheet format, as needed for the model. Provisional data is complete. Summary of provisional data set has been sent out by Dave King. Final data is pending CRSS process (as of 10/29/02).	9/26/01	Reclamation (11/27/01)	mid May 2002	7/15/02 9/15/02 Extended indefinitely	
33	New Mexico will work on developing data on non-irrigation depletions starting in March. [10/29/02] New Mexico has provided provisional data on the prior depletions. Staff will not be available for the next few months to work on this. <i>Dave King has extrapolated pre-1970 non-irrigation depletions data back to a baseline and will send the spreadsheet to Rick Cox.(completed as of 2/11/03)</i> Dave will provide written explanation of how extrapolation was done to Hydrology Committee. The model is operating with provisional generation II data until New Mexico submits further data.	11/27/01	New Mexico	March 2002	Extended	
34	Gage error analysis discussion: the Hydrology Committee still needs to determine whether big losses are due to daily disaggregation. The Committee has the option to re-evaluate losses once the 3 rd Generation model is complete.	11/27/01	Hydrology Committee		When the Model is complete	

	<i>Action Item</i>	<i>Meeting/ Origination Date</i>	<i>Responsible Party</i>	<i>Due Date</i>	<i>Revised Date</i>	<i>Date Completed</i>
58	John Whipple will provide a written statement of New Mexico's concerns re: State Mod. Based on that, Ray Alvarado will provide a written description of StateMod. New Mexico's comments have not yet been received. [10/29/02] Still on New Mexico's back burner.	5/7/02	John Whipple Ray Alvarado	6/17/02	Extended	
63	In the development of the model, if another data set is found that disagrees with the data provided by the state (or anyone else), then that information needs to be discussed at a Hydrology Committee meeting.	6/25/02	Modelers Hydrology Committee	Immediately Ongoing		
78	The Committee agreed to fund add'l trips by USGS, and suggested that USGS fund the necessary improvements (new cableway) at Shiprock. Pat Page will talk to BOR contract people to get a contract going for USGS for 2003 (done Dec. 2, 2002). Ron Bliesner will talk with John Leeper to see if there is anything that can be done from Navajo Nation to assist USGS in obtaining access. Jerry Thomas at BIA in Shiprock manages those access contracts - he may also be able to help.	10/29/02	Hydrology Committee Pat Page Ron Bliesner		April 1, 2003	
81	Add peer review discussion to next summer's meeting agenda when Amy Cutler comes back to present progress and findings.	10/29/02	Pat Page Shirley Mondy	April 1, 2003		
91	John Leeper agreed to get a letter to USGS and to whomever controls the locations to ease access for USGS.	4/1/03	John Leeper			
92	The scope of work for model operation needs to be circulated by the June 3 rd conference call.	4/1/03	Pat Page	June 3, 2003		
93	The Hydrology Committee agreed to add a discussion of hydrologic conditions to the agenda of each meeting or conference call to determine whether extreme conditions exist.	4/1/03	Hydrology Committee Pat Page			

	<i>Action Item</i>	<i>Meeting/ Origination Date</i>	<i>Responsible Party</i>	<i>Due Date</i>	<i>Revised Date</i>	<i>Date Completed</i>
94	The Hydrology Committee determined that hydrologic conditions indicate that extreme dry conditions exist at present, and that the Program should consider appropriate water conservation measures. Shirley Mondy will transmit this information to the Coordination Committee.	4/1/03	Shirley Mondy			
95	Dave King will add draft documentation on model data sharing and will add it to the model website.	4/1/03	Dave King			
96	John Simons will send a letter requesting permission for Reclamation to maintain and FTP site so they can continue to do the modeling work.	4/1/03	John Simons			
97	Dave King will add "draft" documentation to the documents on the website so that it will be clear to everyone that these are working documents, not final documents.	4/1/03	Dave King			
98	Dave King will have a documentation outline available in time to be discussed at the June conference call. Documentation outline will be added to the June 3 rd conference call.	4/1/03	Dave King Pat Page	June 3, 2003		
99	Ron Bliesner will email the revised Operating Criteria to the Committee	4/1/03	Ron Bliesner			
100	John Whipple and/or Shirley Mondy will take the Hydrology Committee's recommendation of no need for third party peer review to the next Coordination Committee.					
101						
102						

May 19, 2003

SJRIP Hydrology Monthly Log

The following is a monthly log of work on third generation San Juan Basin Hydrology Model (SJBHM), associated data development, and operation and maintenance of SJBHM. The SJBHM is used to support the San Juan Recovery Implementation Program (SJRIP). Additional information is available from the SJRIP Hydrology Committee web page at <http://wcao.uc.usbr.gov/envprog/sjrip>.

April, 2003

The primary activities during this month were coordination, creation of additional DMI scripts to facilitate maintenance, adjustment of StateMod model, and development of a draft User's Manual.

March, 2003

The primary activities were a closer examination of the StateMod natural flows and model runs, documentation, budgeting and scheduling. In addition, scripts were developed to facilitate long-term operation and maintenance models.

February, 2003

The primary activities were continuation of the validation process and completion of the migration model configuration and rules. Debugging of the disaggregation model unearthed a StateMod bug that was corrected. Additional technical transfer was provided to field personnel. RiverWare DMI's were modified to support platform independence using latest RiverWare and perl scripts. Work has commenced on the bridge model.

January, 2003

The primary activity was continuation of the validation process. The validation required additional configuration adjustments in StateMod and RiverWare, additional DMI's, and creation of a ruleset to compute aggregated values and to compensate for differences between StateMod and RiverWare. Additional knowledge of StateMod was also acquired to complete the validation. The other activities were technical transfer from Denver to Durango, moving the publicly available data, models, rulesets, and documentation to <ftp.usbr.gov>, updating the daily disaggregation configuration, and creating an initial configuration of the daily decision model.

December, 2002

Several iterations of provisional StateMod output were obtained from CWCB that were used to validate the daily disaggregation model and the monthly migration model. The daily disaggregation model has been completed except data

updates and testing the migration to the daily decision model. The monthly validation model was used to complete development of static data DMI's (elevation area tables, elevation volume tables, stage discharge tables, lagging coefficients), initial conditions DMI's (lagging and reservoirs), and time-series DMI's. The primary validation activity has been to do configuration adjustments and node mapping adjustments related to StateMod carried water cases. A regression that used to forecast San Juan Chama diversions was updated. Data are being collected to update the forecast error regression.

November, 2002

The provisional data set was documented for the Hydrology Committee. Static and dynamic (time-series) data DMI's were added to the validation and migration models. Static data were evolved into RiverWare format that included stage-discharge tables, area-capacity tables, and evaporation tables. Revised StateMod gains distribution coefficients were incorporated into the daily historic gains model. Some testing of new RiverWare data types and RPL functions was done to investigate their potential use in the new model. An initial StateMod data set was obtained for the historic scenario. This model was tested and reviewed and use of the data in RiverWare data stores and models was initiated. Alternatives were investigated to replace the web site's ftp services. Animas forecasting options were investigated.

October, 2002

A daily natural flow model to support the daily decision model was built and partially populated. DMI control, mapping, and scripts were completed for this model. A ruleset to disaggregate extended monthly gage flows and historic depletions was developed. Daily flow fractions were developed for mainstem gages and tributaries. Model will compute daily gains for the mainstem gages that will be used by daily decision model. Static data DMI's were updated. Provisional New Mexico, Arizona, and Utah historic and baseline data sets were provided to CWCB in StateMod format.

September, 2002

Second generation documentation was completed except for some loose ends. Completed updating of historic gaged flows through water year 2000. Conducted technical transfer to new person with focus on support of long-term data maintenance. Improved DMI's, control files, map files, and run scripts to facilitate long-term data maintenance. Created initial documentation of data stores, scripts, control files, map files, and DMI's to facilitate long-term data maintenance. Adjusted schedule and budget to reflect actual FY2002 work, expenditures, and schedule. Worked on daily natural flows model, DMI's, and rulesets. Spreadsheet aggregation utilities were developed.

August, 2002

Preliminary power depletions and system efficiencies were obtained from NMISC. NIIP historic and baseline depletions were developed. Reclamation updated their historic streamflow data and Reclamation reservoir operations data. Reclamation operations data were provided to CWCB. Jicarilla hydrology node information (precipitation and area) was obtained. SJC data set was extended through 2000 and daily flow fractions for the tributaries were developed. An improved SJC configuration and ruleset was tested with the second generation and implemented in the migration model. Rules were tested to support migration of forecasts data from the migration model to the decision model. First draft of revised operating criteria for Navajo was formulated.

July, 2002

Discussions were held with NMISC regarding the mainstem configuration. The irrigation nodes are established but acreage adjustments remain. The non-irrigation configuration is nearing completion. NMISC needs to provide efficiencies, capacities, and non-irrigation depletions. The Jicarilla nodes were located and a hydrology node provided for their water. Daily depletion disaggregation fractions were obtained from the contractor and their usage was tested in RiverWare. A forthcoming version of RiverWare will compute diversion requests of user provided depletion requests. The ability to use user provided frost dates was added to Reclamation's Blaney-Criddle model. A data management interface (DMI) was developed for StateMod daily data to facilitate future data updating. DSS DMI's were also developed to facilitate data archiving.

June, 2002

The RiverWare model and SJRIPDB were modified for known configuration changes. New Mexico non-irrigation configuration remains. Return flow apportions were computed for the known configuration. The ET spreadsheets were adjusted and a New Mexico irrigation spreadsheet was prototyped. Additional climate data were obtained or developed including daily data for all of New Mexico. Disaggregation data and procedures were evolved. Options to implement the disaggregation data and procedures in the RiverWare models were scoped. Additional data management utilities were developed and long-term options to maintain and update data were investigated. Available historic USGS and reservoir operations data were obtained.

May, 2002

Daily climate data were obtained to support daily evapotranspiration estimates that will be used to facilitate disaggregation of irrigation depletions. Monthly climate data for the entire basin were updated through 2000 except for 3 stations

that not yet available. Climate station weights were developed for the anticipated New Mexico irrigation depletion nodes. NMISC cropping patterns and acres were extended from 1929 through 2000 by depletion node in Blaney-Criddle format. The cropping patterns are being used for the daily evapotranspiration computations as well. The ability to optionally compute irrigation depletions using original Blaney-Criddle was added to the code and a comparison run was made. Work was done on other disaggregation data development as well. Hammond historic data were obtained and integrated with historic estimates. Considerable work was done on the StateMod and RiverWare models for the mainstem reconfiguration.

April, 2002

Additional adjustments were made to the modeling approach and associated documentation to address Hydrology Committee questions and to reflect evolution of the model development. The RiverWare monthly model was modified to use diversion objects in lieu of water user objects for supplemental water cases. This allows easier recognition of them in the model, reduces the size of the model, and separates their management. The code that creates the model was migrated to RiverWare 4.0.4. Reclamation's Blaney-Criddle calculator was modified to compute original Blaney-Criddle and to use some of the data formats developed for SJRIP. Original Blaney-Criddle crop coefficients for New Mexico (which are seasonal) were obtained from the New Mexico State Engineer's Office.

March, 2002

An initial cut was made to map New Mexico's irrigation depletions to StateMod and RiverWare nodes. After adding expected non-irrigation nodes, an initial cut was made on return flow distribution. The configuration is being negotiated with NMISC. A discussion was held with CWCB regarding supplemental hydrology nodes (gains between gage nodes) on the main stem of the San Juan. The latest version of CWCB's San Juan StateMod model was obtained to use as a starting point for the main stem reconfiguration. The RiverWare model will be built consistent with the StateMod although some configuration issues remain in both Colorado and New Mexico.

February, 2002

The database and software that are being used to create the monthly model from the StateMod natural flow model was extended to support multiple versions of models. In addition, the ability to distinguish and create water objects by RiverWare depletion request types was provided. This will enable optional use of acres and rates verses user provided depletion requests. The latest San Juan StateMod model was obtained to begin reconfiguration of the main stem San Juan nodes. Provisional acres and cropping patterns were obtained from New Mexico for computation of historic depletions. Initial work was begun on historic Arizona and Utah depletions including obtaining revised data from Utah. The

flow recommendations performance spreadsheet was evolved in anticipation of daily model output. RPL (RiverWare Policy Language) functions were specified to compute the flow recommendation statistics within a model run so that they can be used to optimize releases. This implementation will be funded by research funds because it has application in other basins.

January, 2002

Technical work was limited due to other obligations but a few data management support items were completed that include development of DMI's to import into RiverWare and export data from RiverWare in a format that is consistent with the spreadsheets produced by a RiverWare data file (RDF). These DMI's will enable us to make model updates using output of previous runs. In addition, the ability to optionally include html targets to objects and slots was added to selected DMI's. These formats will be used to provide data access via the internet to stakeholders. A spreadsheet and documentation were developed to facilitate computation of equivalent RiverWare depletion slots from equivalent StateMod data. Another spreadsheet was developed to convert and store the previous model's climate data in the new model's monthly format.

December, 2001

Technical work was limited due to vacation, other obligations, development of the budget, and preparation of contract specifications. However, a few small items were completed. An application was created to create and update a table of model runs that provides links to data and plots. These tables will be added to the web site when an appropriate data format is available. Technology were obtained from another project that has developed a way to create and post a set of plots to an Acrobat (pdf) file from a standard RiverWare output file (RiverWare Data File (RDF)). An inconsistency on use of the minimum pumping to ALP was corrected and posted to the web site rulesets. The process to create a RiverWare model from StateMod was evolved to be more usable as the respective models are reconfigured.

A cooperative agreement was prepared with Kelller-Bliesner to assist with work plan items 10, 16, 20, 23, and 24. Work under this cooperative agreement has not commenced

November, 2001

Technical work was limited due to vacation, other obligations, and development of the budget. However, a few small items were completed. A utility to convert StateMod area-capacity data to RiverWare format was developed and a DMI was created to import the area-capacity data into RiverWare. Documentation of static data DMI's was drafted and added to the web page. Some adjustments were made to the web pages for consistency and to prototype inclusion of data and

plots from models. An outline of documentation needs was provided to CWCB. Configuration and data issues were discussed with NMISC. A disaggregation needs document was drafted and provided to Keller-Blisner for review and extension.

October, 2001

Minimal technical work was done due to vacation, other obligations, work station procurement, and development of the budget and contract specifications.

September, 2001

1. Task H – Completed testing of StateMod water right procedures. This required fixing of RiverWare bug that was discovered in late August.
2. Task L – Slightly revised web page and scoped means to link to model visualization pages. Improved SRJIP database software to facilitate posting of data to web site.
3. Task K – Prepared background material and met with Hydrology Committee subteam and full team.
4. Task A - Gage errors were analyzed and correction options were evaluated.

August, 2001

1. Task L – Official web page was posted and slightly revised.
2. Tasks H and J – Additional testing StateMod water right procedures was conducted.
3. Task C - New Mexico Interstate Streamflow Commission was asked for clarification on irrigated lands identified by their GIS coverage.
4. Task H - CADSWES completed incorporation of lagged return flows into decision functions. Reclamation verified that they worked properly.
5. Task K - Revised Plan Of Study to reflect actual progress made in FY2001 and expected rollover into FY2002.

July, 2001

1. Tasks G and J - We fine tuned the programmatic means of creating RiverWare model from a StateMod model. Although this process worked for the Gains model, initially RiverWare would not save the validation model. This problem has been corrected. The validation model with existing main stem configuration was programmatically created using spatial coordinates that were estimated from known latitudes and longitudes. This resulted in some portions of the model being extremely congested. The locations of objects is being adjusted to improve model navigation. The model will be recreated programmatically after the improved visualization and mainstem reconfiguration are completed.

2. Task L – Reclamation Salt Lake web master was contacted to obtain an official site for the hydrology model web page. A numeric site has been assigned but the official name awaits registration. Committee will be posted as soon as site is posted.
3. Tasks H and J – We scoped and tested implementation of StateMod water rights procedures in RiverWare. Testing to date has not included reservoirs because a few additional StateMod procedural questions remain to be resolved. A report of the implementation has been drafted and will be provided to the committee after testing is completed.
4. Tasks H and J – We had a meeting with CADSWES to discuss possibility of using RiverWare's accounting functionality to support water right rules and areas for improved performance. This will consist of creating compiled versions of some of the RPL (RiverWare Policy Language) functions that were written to support water rights rules.
5. Tasks C and L – An automated means of creating a web page visualization of a RiverWare model has been developed (by another project and borrowed for our use). We will provide a link to the gains model when the official web site is posted. We will use this mechanism to provide access of model data to those committee members that do not have access to RiverWare.

June, 2001

1. Developed programmatic means of creating RiverWare model from StateMod model. This will facilitate updating of RiverWare model as reconfiguration changes are made to StateMod model. Using software to create the RiverWare model also reduces the chances of making linking errors. We used this program to create first version of validation model.
2. Met with CWCB to clarify additional StateMod data and methods.
3. Created Piedra Validation model. We intend to use this model and a calibration model of same subbasin to verify DMI's, compare basic items to StateMod, and to prototype water rights emulation in RiverWare. After our meeting with CWCB, this model is matching nicely with StateMod to the extent that it has been checked.
4. Developed a means of visualizing a RiverWare model on a web page. The technology was developed by another project and borrowed for our use in SJRIP. This will provide non RiverWare user's access to RiverWare data with visualization on a web page that appears similar to an actual RiverWare model.

5. A number of utilities were developed to support RiverWare model creation, and visualization.
6. Researched options to implement water rights emulation in RiverWare.
7. Updated plan of study data and responded to comments to plan of study.

May, 2001

1. Developed log of first and second generation models and rulesets and created web access of same. Included in this structure are a model and ruleset naming convention, links to models and rulesets, links to scenario model runs, and links to documentation.
2. Created a Hydrologic Database (HDB) in Denver to support data access of model input and output data.
3. Met with CADSWES to discuss modifications to HDB to support depletion datatypes. The modifications are minor and non program funded.
4. Met with Ray Bennet of CWCB to clarify how CDSS StateMod water right's algorithm works and to discuss StateMod implementation of the variable efficiency method.
5. Made initial San Juan main stem reconfiguration after discussions with NMISC. Additional discussions with NMISC to clarify some items.
6. Completed software to support mapping of RiverWare nodes to CDSS and DMI's.
7. Built validation model of Piedra basin. Still need to populate and test.
8. Obtained and tested a newer version of RiverWare that corrected a problem with initial conditions for multiple lagged return flows. This version of RiverWare also has a new rules function that should help in SJRIP. It does not yet have the ability to see lagged return flows when estimating reservoir releases. That modification should be available by June 22.

October, 2000 through April, 2001 Activities

1. Previous generation of RiverWare model rules were migrated to run entirely in "new" rules environment. Previous generation of rules was a bridge between "new" and "tcl" (old) rules system. Although actual rules in new model may vary considerably from the previous generation, individual functions may still be used in the new model. Completion of this task enables us to eliminate most

compatibility issues between model generations. This task was completed before SJRIP funds became available using other sources of funding.

2. All comments from previous generation of model were incorporated to the extent possible. It was important to complete this documentation before the modelers became too involved in the new model development. This task was mostly completed without SJRIP funds.
3. Two sensitivity runs were made with the previous generation of model to better understand how the system responds. These runs have not been analyzed (post processed) but could provide some information to improve the next generation model.
4. A contract has been arranged for analyzing and correcting gage errors.
5. Reclamation GIS sets have been updated with Colorado, New Mexico, and USGS coverages. In addition, research funds were used to develop a methodology to estimate the portion of return flows that return to subbasins generated using GIS technology. Return flow proportions are important when estimating water supply of individual water users in StateMod. Some programs funds were used to apply this technology to the San Juan basin. The technology has been provided to Colorado Water Conservation Board to use as they see fit to improve the SJRIP StateMod model.
6. Reclamation have acquired all necessary CDSS (Colorado Decision Support System) software, existing San Juan StateMod model, support data, and documentation. Reclamation staff have worked with CWCB to clarify StateMod methods, data, and operating criteria.
7. DMI's (Data Management Interfaces) have been developed to move data between StateMod and RiverWare, between StateMod and two common Reclamation data formats, and between StateMod and HDB (Hydrologic Data Base). A prototype HDB has been installed in Denver.
8. StateMod return flow methods have been created in RiverWare using research funds. The methods have been tested but additional modifications needs to be completed before the return flow methods can be seen by rules when lagging is invoked.
9. Mapping of CDSS nodes to RiverWare nodes is nearly complete. A validation model will be built initially to verify that water moves through the RiverWare model as it does in StateMod. This model should be completed and tested by mid May.

**San Juan Basin Hydrology Model
Draft Operating Criteria - 2/12/2003**

Deleted: 8/19/2002

Background

This document specifies the operating criteria for the third generation San Juan Basin Hydrology Model (SJBHM). This model is used to support long-term operation and planning decisions in the San Juan River Basin. Primary uses of the model are to evaluate operating scenarios related to meeting San Juan River Basin Recovery Implementation Program (SJRIP) flow recommendations and to evaluate the impact of proposed projects. This document provides a brief overview of the flow recommendations, a brief overview of existing operating criteria, and an outline of potential operating criteria for the third generation model.

The SJRIP flow recommendations consist of two basic components: 1. baseflow, (mean weekly non-spring runoff flow) to provide sufficient aquatic habitat for species recovery and 2. flushing flows to create and maintain habitat over time.

Deleted: s

The SJRIP flow recommendations state: "maintaining low, stable baseflows enhances nursery habitat conditions. Flows between 500 and 1,000 cfs optimize backwater habitat. Selecting flows at the low end of the range increases the availability of water for development and spring releases. It also provides capacity for storm flows to increase flows and still maintain optimum backwater area. This level of flow balances provision of near-maximum low-velocity habitat and near-optimum flows in secondary channels, while allowing water availability to maintain the required frequency, magnitude, and duration of peak flows important for Colorado Pikeminnow reproductive success." The target baseflow level is "500 cfs from Farmington to Lake Powell, with 250 cfs minimum from Navajo Dam."

Formatted: Font: Italic

Formatted: Font: Italic

Deleted: baseflow is a minimum flow that should be maintained in the San Juan River at reference stream gages within the critical habitat.

The flushing flows are provided by making releases during spring runoff with specified hydrographs whose characteristics are dependent upon available flow. The flows at the reference gage (Four corners, NM) are statistically evaluated to determine if flow recommendations are being met. The flow recommendations for spring peak flows are determined to be met when the maximum return periods and recurrence frequencies for specified flows and durations over the period of hydrologic record are met. Tables 1 and 2 summarize the SJRIP flushing flow recommendations.

Table 1. Maximum Return Period Between Events

Flow Criteria & Min Duration	Max. Return Period - yrs
9700 cfs for 5-days	10
7760 cfs for 10-days	6
4850 cfs for 21-days	4
2450 cfs for 10-days	2

Formatted Table

... [1]

Formatted: Tabs: 6.5", Right + Not at 6"

Table 2. Flow Duration Statistics

Duration	Threshold Discharge			
	>10,000	>8,000	>5,000	>2,500
Average Frequency				
1 days	30.0%	40.0%	65.0%	90.0%
5 days	20.0%	35.0%	60.0%	82.0%
10 days	10.0%	33.0%	58.0%	80.0%
15 days	5.0%	30.0%	55.0%	70.0%
20 days		20.0%		65.0%
21 days			50.0%	
30 days		10.0%	40.0%	60.0%
40 days			30.0%	50.0%
50 days			20.0%	45.0%
60 days			15.0%	40.0%
80 days			5.0%	25.0%

The basic approach to meeting the recommended flows is to specify basic operating criteria for the hydrologic model and evaluate the output of the model to determine if the statistics are met.

First and Second Generation Operating Criteria

The first and second generation models used the following basic operating criteria:

1. Operate San Juan Chama by project operating criteria.
2. Operate Animas La Plata by project operating criteria.
3. Operate all other projects to emulate historical operations but for adjusted project sizes depending on the condition being analyzed.
4. Operate Navajo Reservoir to meet historical operating criteria as well as meet flow recommendations.

Navajo Reservoir is the primary facility that is managed to meet flow recommendations. The second generation model enabled ALP to stop pumping in June when a flushing release has not occurred for the past two years and a larger release is not occurring this year. Some additional mitigation options were explored for ALP but were found unusable. The complete set of operating constraints for Navajo Reservoir as presently modeled are:

Deleted: both

1. Maximum release of 5000 cfs.
2. Minimum release of 250 cfs.
3. Minimum elevation of 5985 during the non-irrigation season.
4. Minimum elevation of 5990 during the irrigation season.
5. Provide NIIP demands.
6. Provide downstream demands.
7. Meet COE flood control restrictions.
8. Release surplus water not needed for other uses during runoff season.
9. Release surplus water to meet end of December target space after runoff season.

Formatted: Tabs: 6.5", Right + Not at 6"

Third Generation Operating Criteria

February 12, 2003

10. Meet flow recommendations baseflow specification. (Since this is a monthly model, minimum monthly average flow was set at 525 cfs to be met or exceeded at all gages Farmington to Bluff to approximate a 7-day running average of 500 cfs specified in the SJRIP flow recommendations.)

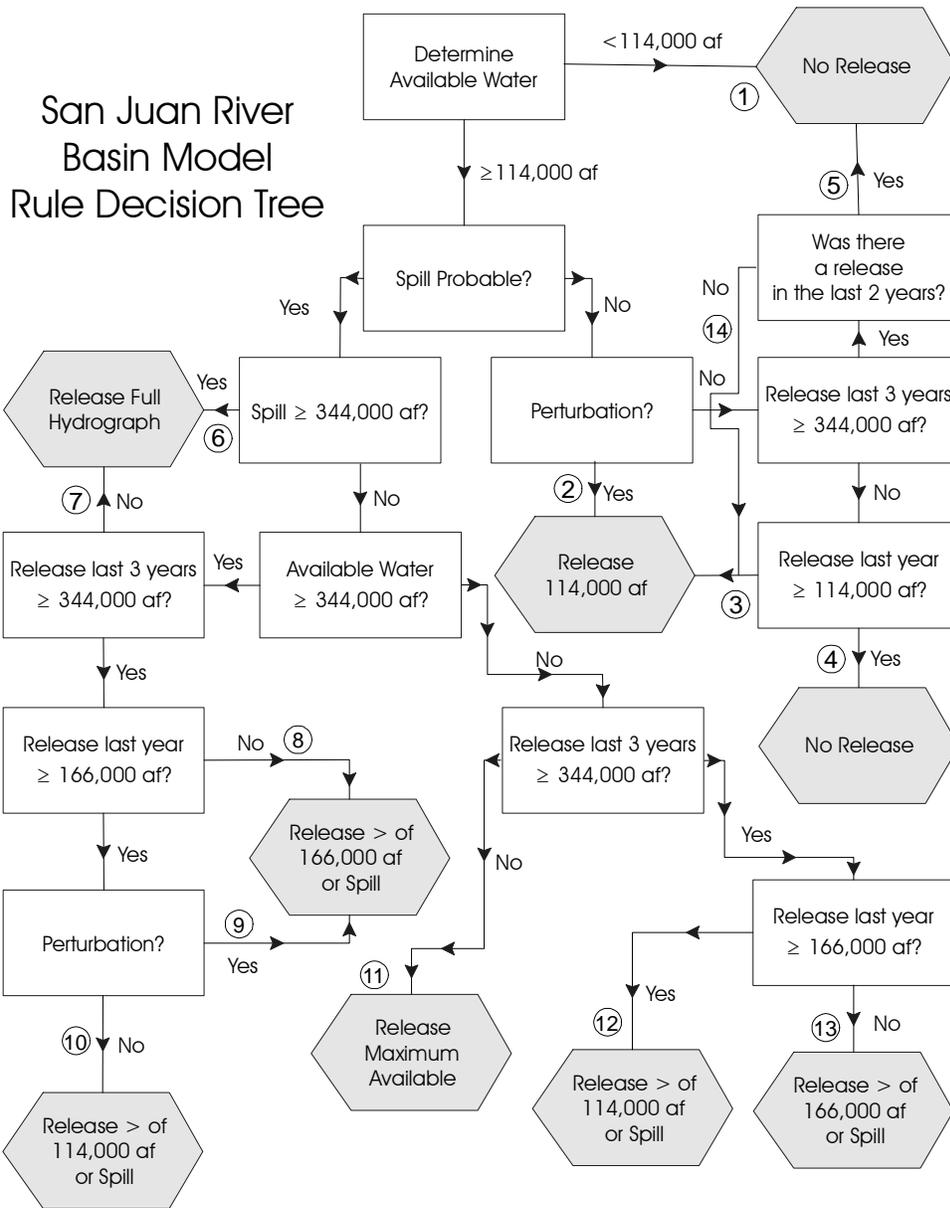
A set of criteria were developed to make flushing releases based upon water supply and previous releases. This is referred to as the decision tree and is shown on Figure 1. The following definitions and conditions are used in the decision tree diagram:

1. available water – water that is not committed to other uses
2. spill – water in excess of storage capacity that must be released to prevent water flowing over the spillway
3. flow recommendation release hydrograph volumes – specified to provide the desired hydrographs for various levels of water supply
4. previous releases – influence the need to make a release in the current year.

The circled numbers shown at decision points correspond to path numbers that are used to track decisions. The flow recommendation release volumes consist of four basic hydrographs as specified in Table 1. During wet years, more water must be released from Navajo than the flushing release volume to prevent Navajo from spilling. The excess water (spill minus available water) is applied to the nose of the hydrograph while attempting to maintain the basic shape of the hydrograph.

In actual operation, the base release was adjusted to 500 cfs and the release volumes adjusted to show the difference between 500 and 600 cfs base release. This adjustment allows the desired release hydrographs to be met while computing the volumes based on a modified base release and is in keeping with the flow recommendation. For consistency with the flow recommendation, the criteria in this document have not been modified.

Figure 1. First and Second Generation SJRIP Decision Tree



Formatted: Tabs: 6.5", Right + Not at 6"

Table 1. Navajo Fish Release Hydrographs

344,000 ac-ft Hydrograph			236,000 ac-ft Hydrograph			166,000 ac-ft Hydrograph		
CFS	Days	Ac-ft	CFS	Days	Ac-ft	CFS	Days	Ac-ft
1,000	7	13,884	1,000	1	1,983	1,000	1	1,983
2,000	7	27,769	1,500	1	2,975	1,500	1	2,975
3,000	7	41,653	2,000	1	3,967	2,000	1	3,967
4,000	7	55,537	2,500	1	4,959	2,500	1	4,959
5,000	21	208,264	3,000	1	5,950	3,000	1	5,950
4,500	1	8,926	3,500	1	6,942	3,500	1	6,942
4,000	2	15,868	4,000	1	7,934	4,000	1	7,934
3,500	1	6,942	5,000	21	208,264	5,000	13	128,926
3,000	2	11,901	4,000	1	7,934	4,000	1	7,934
2,500	2	9,917	3,500	1	6,942	3,500	1	6,942
2,000	2	7,934	3,000	1	5,950	3,000	1	5,950
1,500	2	5,950	2,500	1	4,959	2,500	1	4,959
1,000	2	3,967	2,000	1	3,967	2,000	1	3,967
			1,500	1	2,975	1,500	1	2,975
			1,000	1	1,983	1,000	1	1,983
Total Release	63	418,512		35	277,686		27	198,347
Base Release*	600	74,975		600	41,653		600	32,132
Net Release		343,537			236,033			166,215
*600 cfs for 63 days			*600 cfs for 35 days			*600 cfs for 27 days		

Formatted: Tabs: 6.5", Right + Not at 6"

Limitations of First and Second Generation Model

SJBHM is a RiverWare model that uses RiverWare engineering objects to simulate basin hydrography and facilities, RiverWare data objects to store decision data, and RiverWare Policy Language (RPL) to implement operating criteria using rules. The first and second generation versions of SJBHM were monthly time step models that simulated various daily processes. SJC, ALP, and the flushing release computations are all daily computations within the monthly model. Although daily computations can be done with RPL, engineering objects only fire at the model's time step. Therefore, disaggregation and aggregation issues existed. The most problematic was the flushing release criteria.

The specified flushing release was from Navajo Reservoir. The flow recommendation criteria are evaluated at the Four Corner's gage. Since the model was a monthly model and the flow recommendations are based on daily flow statistics, the daily downstream flow at Four Corner's had to be estimated. This was accomplished by disaggregating the monthly model output into pseudo-daily values after the model had run to evaluate the results against the flow recommendations. Since the model does not know when certain flow conditions have been met, this information cannot be used for future decisions during the model run. The only historic decision information that was available to the model during the run was the type of previous year's release.

Deleted: ,

These models also had a computational inefficiency related to application of the excess water to the flushing release. Specifically, the set of possible hydrographs was recomputed every March and every April. These could be specified in a data object as a prescribed hydrograph for a given water supply. These would essentially be sub-paths of the existing paths.

Options Made Possible By Third Generation Daily Decision Model

The third generation SJBHM will be a daily model. This will give the modelers considerably more flexibility in applying the operating criteria in RPL. Furthermore, it will shift disaggregation issues from the model output to the model input, requiring that the disaggregation process be utilized only when there is a change in input data.. In addition, the ability to compute the flow recommendation performance statistics during a model run provides the ability to use these statistics to affect releases during a model run. How this might be accomplished remains to be decided and is the purpose of this document.

A daily model introduces input data issues as noted above. A daily model also affects operations other than the flow recommendation releases. For instance, the COE flood control criteria are based upon a forecast of daily flows. This requires that daily inflows to Navajo Reservoir be known. Forecasts are based upon monthly hydrology and demands and historical forecast error. Historical forecast error is based upon historical forecast unregulated inflow compared to actual historical unregulated inflow. With the daily model, two questions arise: Will monthly forecast be sufficient for a daily model? Should the option of using mid-month forecasts be explored?

Deleted: suggests

Deleted: For instance, only the San Juan Four Corners gage is presently used to compute performance statistics. Would it make sense to use a sampling of gages as is done in the actual operations?¶
Can more creative use of the fall surplus water release be made? Can the final flushing release decision be delayed until mid-May?

The third generation model implementation also provides opportunity for a revisit of the criteria evaluation. Since the flow recommendations and actual operation use the statistics at the Four Corners gauge, no change is possible here. However, it may make sense to evaluate adjustment of release decisions until mid-May to better match the release volume to actual inflow and to have the capability to analyze alternative releases for late-summer surplus flows that must be released to meet December target space in the reservoir.

Formatted: Tabs: 6.5", Right + Not at 6"

Given the above background and historical information, the following operating criteria are proposed for the third generation model.

Third Generation Operating Criteria

The fundamental operating criteria for the third generation SJBHM will remain the same. However, the StateMod baseline model and the RiverWare monthly migration model will be doing some of the work. Emulation of historical operations should be considerably more sophisticated using this system. SJC will be operated in the migration model. The daily decision model will consist only of those nodes necessary to operate ALP and Navajo Reservoir. The monthly model will only have to be operated when hydrology is revised or when baseline depletions are revised. Disaggregated daily and some monthly data (forecasts) will be transported between the migration model and the daily decision model. (See ThirdGenModelAndDataDevSummary for additional information on the modeling system.)

ALP will be operated in the daily decision model. Its operation will remain the same but have to be reimplemented in RPL for the daily time step. Initially, the overall operating criteria for Navajo Reservoir will remain the same. The flushing release computations will be adjusted to take advantage of the daily time step and enhanced RiverWare features. It is also highly recommended that the daily COE flood control criteria be implemented. RPL code already exists to do this but daily inflows to Navajo would have to be developed.

Due to limited resources to implement the new model, it is highly recommended that the basic process of using a decision tree not be abandoned. This would also facilitate incremental implementation, debugging, and decision tracking. As the model is debugged, calibrated and verified, adjustments to the operating criteria can be made. Initially, the following adjustment to the release decisions are recommended:

1. In the first and second generation models, one of four discrete hydrographs are used if a flushing release is required and water is available in Navajo. These were shown in Table 1 and total 114000, 166000, 236000 and 344000 ac-ft above a 600 cfs base release. If a release of 114,001 ac-ft is called for, the model would release the second hydrograph of 166,000 ac-ft. This results in an over release of 52,000 ac-ft. In the third generation model, this problem will be eliminated, by releasing the actual volume that is required. In the example given, 114,001 ac-ft or a close approximation (see item 2 below) would be released instead of 166,000.

Deleted: flow

2. All release hydrograph possibilities will be prescribed by storage in data objects to reduce computations. The decision tree will determine the basic flushing release volume but a table will determine the actual shape of the hydrograph based upon excess water. This would be called a sub-path to the main decision path.

3. A better algorithm for timing releases will be investigated that includes an analysis of weather data to provide a simulation of forecasting the timing of the Animas runoff to better match the peak release with the peak runoff from the Animas. Presently, the release is centered on the same date each year.

4. The decision tree will be adjusted to incorporate evaluation of return period statistics during the model run. For instance, if the 9700 cfs for 5 days event has occurred within the required 10 years, the decision tree would not necessarily force a release. Conversely, if a condition that was required every 10 years had not occurred for 7 or 8 years, an attempt to conserve a release

Formatted: Tabs: 6.5", Right + Not at 6"

in a given year may be made to allow making a larger release in a subsequent year. The exact nature of these rules must be developed based on trial and error operation, but the concept is to better target the desired results when determining the releases. Again, these would probably be sub-paths of the main decision path. This option is a deviation from the recommended operation in the Flow Recommendations and will be provided as added information to be evaluated for future inclusion in the Flow Recommendations.

5. Presently, once a release begins, it cannot be adjusted. In years where the forecast runoff is not met, the model over-released. With the daily timestep, reservoir inflow will be checked against forecast, with the potential of shortening the duration of the peak when the inflow falls short.

6. Base releases will utilize a mix of down-stream gages and implement the present flow recommendations as written: *“Target base flow (average weekly) following spring peak is 500 cfs at Farmington, Shiprock, Four Corners, and Bluff gages, measured as the average of any two of these gages. Minimum release is 250 cfs. The target flow should be maintained between 500 and 600 cfs, attempting to maintain target flow closer to 500 cfs.”* Prior to mid-June 2002, Reclamation operated utilizing the 7-day average of the minimum two gages. Since then, the operation has changed to use the maximum two gages. Some feel that this is a strict interpretation of the flow recommendation. The SJRIP Biology Committee recognized the confusion of the original language, as it did not specify whether “any two” meant any two gages chosen must meet the criteria (the two minimum gages) or as long as the average of any two of the gages were above 500 cfs, the criteria was met (the two maximum gages). The committee submitted a different method of determining when the base flow recommendation was met to clear-up the ambiguity: *“Use the lesser of the average of Bluff, Four Corners and Shiprock and the average of Farmington, Shiprock and Four Corners. If one or more of the gages is missing or is obviously providing incorrect data, use the remaining gages in the set. Extreme conditions (low or high flows) identified by the Bureau of Reclamation will be handled on a case-by-case basis with recommendations from the Biology Committee.”* Some felt that this was a change to the flow recommendation and could not be implemented without full approval of SJRIP although the flow recommendation document states that *“Other operating rules may be employed to achieve the desired river conditions specified in this chapter, if the natural variability provided by the rules presented above is maintained.”* The Hydrology Committee voted to have the rule implemented according to the Bureau of Reclamation interpretation after mid-June 2002 until some agreement is reached as to the correct interpretation or the flow recommendations are officially modified. To remain flexible, it is proposed that the model have the capability of implementing either interpretation of the two-gage rule or the three-gage rule proposed by the Biology Committee. The bridge model will operate to match the generation two rules of meeting 525 cfs monthly average at all of the four gages. Once fully tested, the post-June 2002 interpretation of the two-gage rule will be used until instructed otherwise.

Formatted: Font: Italic

Deleted: , utilizing a running mean

Formatted: Font: (Default) Arial, 11 pt, Italic

Formatted: Font: (Default) Arial, 11 pt

Formatted: Font: Italic

7. With an integrated daily timestep model, it may be possible to include operation of Ridges Basin Reservoir in meeting flow recommendations. The possibility of joint operation of Navajo and Ridges Basin Reservoir will be explored.

Deleted: d

8. The performance statistics will be evaluated using the same criteria as actual operations are using.

9. None of the above implementations that do not specifically agree with the flow recommendation will be implemented in the official model until approved by the SJRIP. The results and recommendations will be provided to the program for evaluation.

Deleted: ¶

Formatted: Tabs: 6.5", Right + Not at 6"

San Juan Basin Hydrology Model Draft Operating Criteria - 4/2/2003

Background

This document specifies the operating criteria for the third generation San Juan Basin Hydrology Model (SJBHM). This model is used to support long-term operation and planning decisions in the San Juan River Basin. Primary uses of the model are to evaluate operating scenarios related to meeting San Juan River Basin Recovery Implementation Program (SJRIP) flow recommendations and to evaluate the impact of proposed projects. This document provides a brief overview of the flow recommendations, a brief overview of existing operating criteria, and an outline of potential operating criteria for the third generation model.

The SJRIP flow recommendations consist of two basic components: 1. baseflow (mean weekly non-spring runoff flow) to provide sufficient aquatic habitat for species recovery and 2. flushing flows to create and maintain habitat over time.

The SJRIP flow recommendations state: *“maintaining low, stable baseflows enhances nursery habitat conditions. Flows between 500 and 1,000 cfs optimize backwater habitat. Selecting flows at the low end of the range increases the availability of water for development and spring releases. It also provides capacity for storm flows to increase flows and still maintain optimum backwater area. This level of flow balances provision of near-maximum low-velocity habitat and near-optimum flows in secondary channels, while allowing water availability to maintain the required frequency, magnitude, and duration of peak flows important for Colorado Pikeminnow reproductive success.”* The target baseflow level is *“500 cfs from Farmington to Lake Powell, with 250 cfs minimum from Navajo Dam.”*

The flushing flows are provided by making releases during spring runoff with specified hydrographs whose characteristics are dependent upon available flow. The flows at the reference gage (Four corners, NM) are statistically evaluated to determine if flow recommendations are being met. The flow recommendations for spring peak flows are determined to be met when the maximum return periods and recurrence frequencies for specified flows and durations over the period of hydrologic record are met. Tables 1 and 2 summarize the SJRIP flushing flow recommendations.

Table 1. Maximum Return Period Between Events

Flow Criteria & Min Duration	Max. Return Period - yrs
9700 cfs for 5-days	10
7760 cfs for 10-days	6
4850 cfs for 21-days	4
2450 cfs for 10-days	2

Table 2. Flow Duration Statistics

Duration	Threshold Discharge			
	>10,000	>8,000	>5,000	>2,500
	Average Frequency			
1 days	30.0%	40.0%	65.0%	90.0%
5 days	20.0%	35.0%	60.0%	82.0%
10 days	10.0%	33.0%	58.0%	80.0%
15 days	5.0%	30.0%	55.0%	70.0%
20 days		20.0%		65.0%
21 days			50.0%	
30 days		10.0%	40.0%	60.0%
40 days			30.0%	50.0%
50 days			20.0%	45.0%
60 days			15.0%	40.0%
80 days			5.0%	25.0%

The basic approach to meeting the recommended flows is to specify basic operating criteria for the hydrologic model and evaluate the output of the model to determine if the statistics are met.

First and Second Generation Operating Criteria

The first and second generation models used the following basic operating criteria:

1. Operate San Juan Chama (SJC) by project operating criteria.
2. Operate Animas La Plata (ALP) by project operating criteria.
3. Operate all other projects to emulate historical operations but for adjusted project sizes depending on the condition being analyzed.
4. Operate Navajo Reservoir to meet historical operating criteria as well as meet flow recommendations.

Navajo Reservoir is the primary facility that is managed to meet flow recommendations. The second generation model enabled ALP to stop pumping in June when a flushing release has not occurred for the past two years and a larger release is not occurring this year. Some additional mitigation options were explored for ALP but were found unusable. The complete set of operating constraints for Navajo Reservoir as presently modeled are:

1. Maximum release of 5000 cfs.
2. Minimum release of 250 cfs.
3. Minimum elevation of 5985 during the non-irrigation season.
4. Minimum elevation of 5990 during the irrigation season.
5. Provide NIIP demands.
6. Provide downstream demands.
7. Meet COE flood control restrictions.
8. Release surplus water not needed for other uses during runoff season.
9. Release surplus water to meet end of December target space after runoff season.

10. Meet flow recommendations baseflow specification. (Since this is a monthly model, minimum monthly average flow was set at 525 cfs to be met or exceeded at all gages Farmington to Bluff to approximate a 7-day running average of 500 cfs specified in the SJRIP flow recommendations.)

A set of criteria were developed to make flushing releases based upon water supply and previous releases. This is referred to as the decision tree and is shown on Figure 1. The following definitions and conditions are used in the decision tree diagram:

1. available water – water that is not committed to other uses
2. spill – water in excess of storage capacity that must be released to prevent water flowing over the spillway
3. flow recommendation release hydrograph volumes – specified to provide the desired hydrographs for various levels of water supply
4. previous releases – influence the need to make a release in the current year.

The circled numbers shown at decision points correspond to path numbers that are used to track decisions. The flow recommendation release volumes consist of four basic hydrographs as specified in Table 1. During wet years, more water must be released from Navajo than the flushing release volume to prevent Navajo from spilling. The excess water (spill minus available water) is applied to the nose of the hydrograph while attempting to maintain the basic shape of the hydrograph.

In actual operation of the reservoir, the base release was adjusted to 500 cfs and the release volumes adjusted to show the difference between 500 and 600 cfs base release. This adjustment allows the desired release hydrographs to be met while computing the volumes based on a modified base release and is in keeping with the flow recommendation. For consistency with the flow recommendation, the criteria in this document have not been modified.

Figure 1. First and Second Generation SJRIP Decision Tree

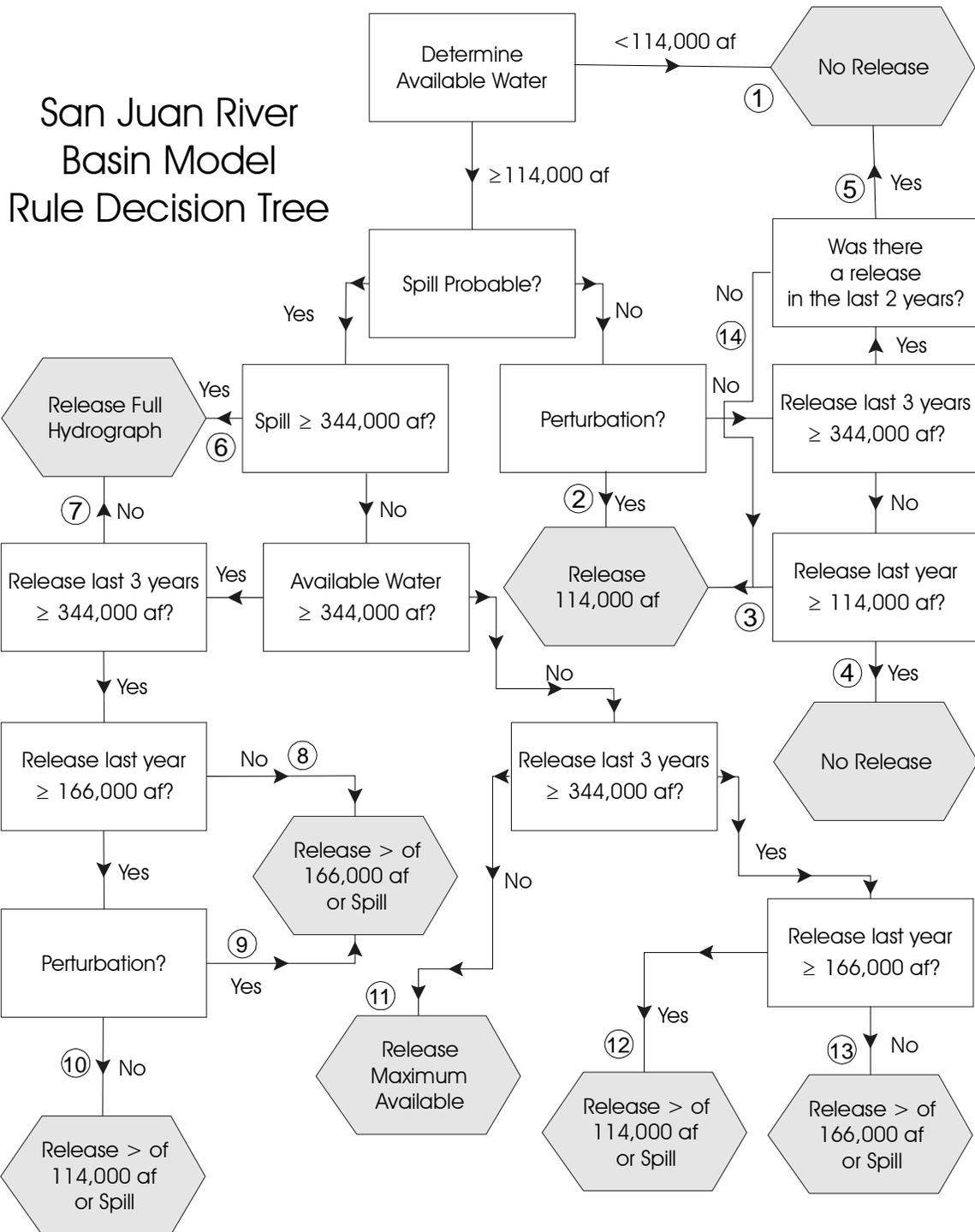


Table 1. Navajo Fish Release Hydrographs

344,000 ac-ft Hydrograph			236,000 ac-ft Hydrograph			166,000 ac-ft Hydrograph			114,000 ac-ft Hydrograph		
CFS	Days	Ac-ft									
1,000	7	13,884	1,000	1	1,983	1,000	1	1,983	1,000	1	1,983
2,000	7	27,769	1,500	1	2,975	1,500	1	2,975	1,500	1	2,975
3,000	7	41,653	2,000	1	3,967	2,000	1	3,967	2,000	1	3,967
4,000	7	55,537	2,500	1	4,959	2,500	1	4,959	2,500	1	4,959
5,000	21	208,264	3,000	1	5,950	3,000	1	5,950	3,000	1	5,950
4,500	1	8,926	3,500	1	6,942	3,500	1	6,942	3,500	1	6,942
4,000	2	15,868	4,000	1	7,934	4,000	1	7,934	4,000	1	7,934
3,500	1	6,942	5,000	21	208,264	5,000	13	128,926	5,000	7	69,421
3,000	2	11,901	4,000	1	7,934	4,000	1	7,934	4,000	1	7,934
2,500	2	9,917	3,500	1	6,942	3,500	1	6,942	3,500	1	6,942
2,000	2	7,934	3,000	1	5,950	3,000	1	5,950	3,000	1	5,950
1,500	2	5,950	2,500	1	4,959	2,500	1	4,959	2,500	1	4,959
1,000	2	3,967	2,000	1	3,967	2,000	1	3,967	2,000	1	3,967
			1,500	1	2,975	1,500	1	2,975	1,500	1	2,975
			1,000	1	1,983	1,000	1	1,983	1,000	1	1,983
Total Release	63	418,512		35	277,686		27	198,347		21	138,843
Base Release*	600	74,975		600	41,653		600	32,132		600	24,992
Net Release		343,537			236,033			166,215			113,851
*600 cfs for 63 days			*600 cfs for 35 days			*600 cfs for 27 days			*600 cfs for 21 days		

Limitations of First and Second Generation Model

SJBHM is a RiverWare model that uses RiverWare engineering objects to simulate basin hydrography and facilities, RiverWare data objects to store decision data, and RiverWare Policy Language (RPL) to implement operating criteria using rules. The first and second generation versions of SJBHM were monthly time step models that simulated various daily processes. SJC, ALP, and the flushing release computations are all daily computations within the monthly model. Although daily computations can be done with RPL, engineering objects only fire at the model's time step. Therefore, disaggregation and aggregation issues existed. The most problematic was the flushing release criteria.

The specified flushing release was from Navajo Reservoir. The flow recommendation criteria are evaluated at the Four Corner's gage. Since the model was a monthly model and the flow recommendations are based on daily flow statistics, the daily downstream flow at Four Corner's had to be estimated. This was accomplished by disaggregating the monthly model output into pseudo-daily values after the model had run to evaluate the results against the flow recommendations. Since the model does not know when certain flow conditions have been met, this information cannot be used for future decisions during the model run. The only historic decision information that was available to the model during the run was the type of previous year's release.

These models also had a computational inefficiency related to application of the excess water to the flushing release. Specifically, the set of possible hydrographs was recomputed every March and every April. These could be specified in a data object as a prescribed hydrograph for a given water supply. These would essentially be sub-paths of the existing paths.

Options Made Possible By Third Generation Daily Decision Model

The third generation SJBHM will be a daily model. This will give the modelers considerably more flexibility in applying the operating criteria in RPL. Furthermore, it will shift disaggregation issues from the model output to the model input, requiring that the disaggregation process be utilized only when there is a change in input data.. In addition, the ability to compute the flow recommendation performance statistics during a model run provides the ability to use these statistics to affect releases during a model run. How this might be accomplished remains to be decided and is the purpose of this document.

A daily model introduces input data issues as noted above. A daily model also affects operations other than the flow recommendation releases. For instance, the COE flood control criteria are based upon a forecast of daily flows. This requires that daily inflows to Navajo Reservoir be known. Forecasts are based upon monthly hydrology and demands and historical forecast error. Historical forecast error is based upon historical forecast unregulated inflow compared to actual historical unregulated inflow. With the daily model, the capability of doing mid-month forecast simulations and release adjustments exists. This capability will be included in the model.

The third generation model implementation also provides opportunity for a revisit of the criteria evaluation. We will evaluate adjustment of release decisions until mid-May to better match the release volume to actual inflow.

Given the above background and historical information, the following operating criteria are proposed for the third generation model.

Third Generation Operating Criteria

The fundamental operating criteria for the third generation SJBHM will remain the same. However, the StateMod baseline model and the RiverWare monthly migration model will be doing some of the work. Emulation of historical operations should be considerably more sophisticated using this system. SJC will be operated in the migration model. The daily decision model will consist only of those nodes necessary to operate ALP and Navajo Reservoir. The monthly model will only have to be operated when hydrology is revised or when baseline depletions are revised. Disaggregated daily and some monthly data (forecasts) will be transported between the migration model and the daily decision model. (See ThirdGenModelAndDataDevSummary for additional information on the modeling system.)

ALP will be operated in the daily decision model. Its operation will remain the same but have to be reimplemented in RPL for the daily time step. Initially, the overall operating criteria for Navajo Reservoir will remain the same. The flushing release computations will be adjusted to take advantage of the daily time step and enhanced RiverWare features. It is also highly recommended that the daily COE flood control criteria be implemented. RPL code already exists to do this but daily inflows to Navajo would have to be developed.

Due to limited resources to implement the new model, the basic process of using a decision tree will be maintained. This would also facilitate incremental implementation, debugging, and decision tracking. As the model is debugged, calibrated and verified, adjustments to the operating criteria can be made. Initially, the following adjustment to the release decisions will be made:

1. In the first and second generation models, one of four discrete hydrographs are used if a flushing release is required and water is available in Navajo. These were shown in Table 1 and total 114000, 166000, 236000 and 344000 ac-ft above a 600 cfs base release. If a release of 114,001 ac-ft is called for, the model would release the second hydrograph of 166,000 ac-ft. This results in an over release of 52,000 ac-ft. In the third generation model, this problem will be eliminated, by releasing the actual volume that is required. In the example given, 114,001 ac-ft or a close approximation (see item 2 below) would be released instead of 166,000. The model will have the capability of utilizing 12 individual monthly base release values and the release volumes computed to meet the hydrograph required based on the monthly base release values.
2. All release hydrograph possibilities will be prescribed by storage in data objects to reduce computations. The decision tree will determine the basic flushing release volume but a table will determine the actual shape of the hydrograph based upon excess water. This would be called a sub-path to the main decision path.
3. A better algorithm for timing releases will be investigated that includes an analysis of weather data to provide a simulation of forecasting the timing of the Animas runoff to better match the peak release with the peak runoff from the Animas. Presently, the release is centered on the same date each year.
4. The decision tree will be adjusted to incorporate evaluation of return period statistics during the model run. For instance, if the 9700 cfs for 5 days event has occurred within the required 10 years, the decision tree would not necessarily force a release. Conversely, if a condition that was required every 10 years had not occurred for 7 or 8 years, an attempt to conserve a release

in a given year may be made to allow making a larger release in a subsequent year. The exact nature of these rules must be developed based on trial and error operation, but the concept is to better target the desired results when determining the releases. Again, these would probably be sub-paths of the main decision path.

5. In the 2nd generation model, once a release begins, it cannot be adjusted. In years where the forecast runoff is not met, the model over-released. With the daily timestep, reservoir inflow will be checked against forecast, with the potential of shortening the duration of the peak when the inflow falls short.

6. Base releases will utilize a mix of down-stream gages and implement the present flow recommendations as written: *“Target base flow (average weekly) following spring peak is 500 cfs at Farmington, Shiprock, Four Corners, and Bluff gages, measured as the average of any two of these gages. Minimum release is 250 cfs. The target flow should be maintained between 500 and 600 cfs, attempting to maintain target flow closer to 500 cfs.”* Since June 2002, the operation has used the maximum two gages. Some feel that this is a strict interpretation of the flow recommendation. The SJRIP Biology Committee recognized that the original language did not specify whether “any two” meant any two gages chosen must meet the criteria (minimum two-gage rule) or as long as the average of any two of the gages were above 500 cfs, the criteria were met (maximum two-gage rule). The committee submitted a different method of determining when the base flow recommendation was met as follows: *“Use the lesser of the average of Bluff, Four Corners and Shiprock and the average of Farmington, Shiprock and Four Corners (Three-gage rule). If one or more of the gages is missing or is obviously providing incorrect data, use the remaining gages in the set. Extreme conditions (low or high flows) identified by the Bureau of Reclamation will be handled on a case-by-case basis with recommendations from the Biology Committee.”* Some feel that this was a change to the flow recommendation and could not be implemented without full approval of SJRIP. The Hydrology Committee voted to have the rule implemented according to the Bureau of Reclamation interpretation after mid-June 2002 until some agreement is reached as to the correct interpretation or the flow recommendations are officially modified. To remain flexible, it is proposed that the model have the capability of implementing the minimum two-gage, maximum two-gage or three-gage rule. The bridge model will operate to match the generation two rules of meeting 525 cfs monthly average at all of the four gages. Once fully tested, the maximum two-gage rule will be used until instructed otherwise by the Program.

7. With an integrated daily timestep model, it may be possible to include operation of Ridges Basin Reservoir in meeting flow recommendations. The possibility of joint operation of Navajo and Ridges Basin Reservoir will be explored.

8. The performance statistics will be evaluated using the same criteria as actual operations are using.

9. None of the above implementations that are inconsistent with the flow recommendation will be implemented in the official model until approved by the SJRIP. The results and recommendations will be provided to the program for evaluation.