Carriage Water 101

Ian Uecker, PE

Chief, Delta Compliance and Modeling Section

State Water Project Operations Control Office

IV. A.

Overview

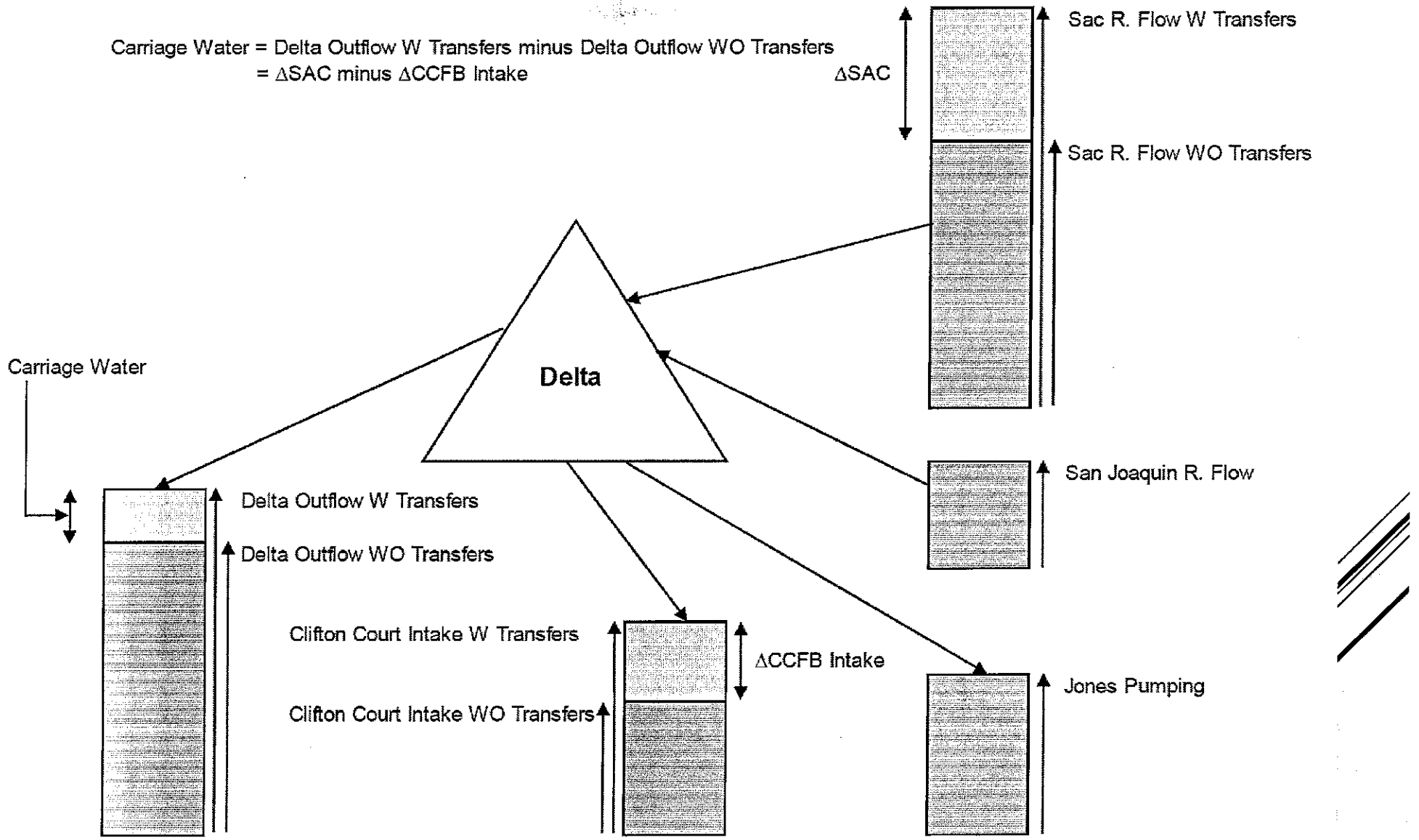
- What is Carriage Water?
- How is Carriage Water assessed by DWR Operations Control Office in coordination with U.S. Bureau of Reclamation
- Examples of Pre-Season and Post-Season Assessments

Carriage Water Calculation

A= Without transfers condition; B = With transfers condtion, historical

EC or Chloride level remaining the same at control locations for both baseline and alternative

Carriage Water = Delta Outflow W Transfers minus Delta Outflow WO Transfers
= ΔSAC minus ΔCCFB Intake



Definition of Carriage Water

- The marginal water cost needed to carry a unit of water across the Delta for export while maintaining a constant salinity level at a given location.
- Mathematically, carriage water may be expressed as,

$$CW = \Delta SAC - \Delta EXP, \text{ with } \Delta EC \approx 0$$

Where,

CW = carriage water,

ΔSAC = increase in SAC River flow

ΔEXP = increase in Delta exports

ΔEC = change in electrical conductivity level at a control point

Controlling Locations

Jersey Point: D-1641 Ag standard and CCWD M/I indicator station

Bethel: CCWD M/I indicator station

Bacon Island: CCWD M/I indicator station

All three locations frequently control operations during the transfer period

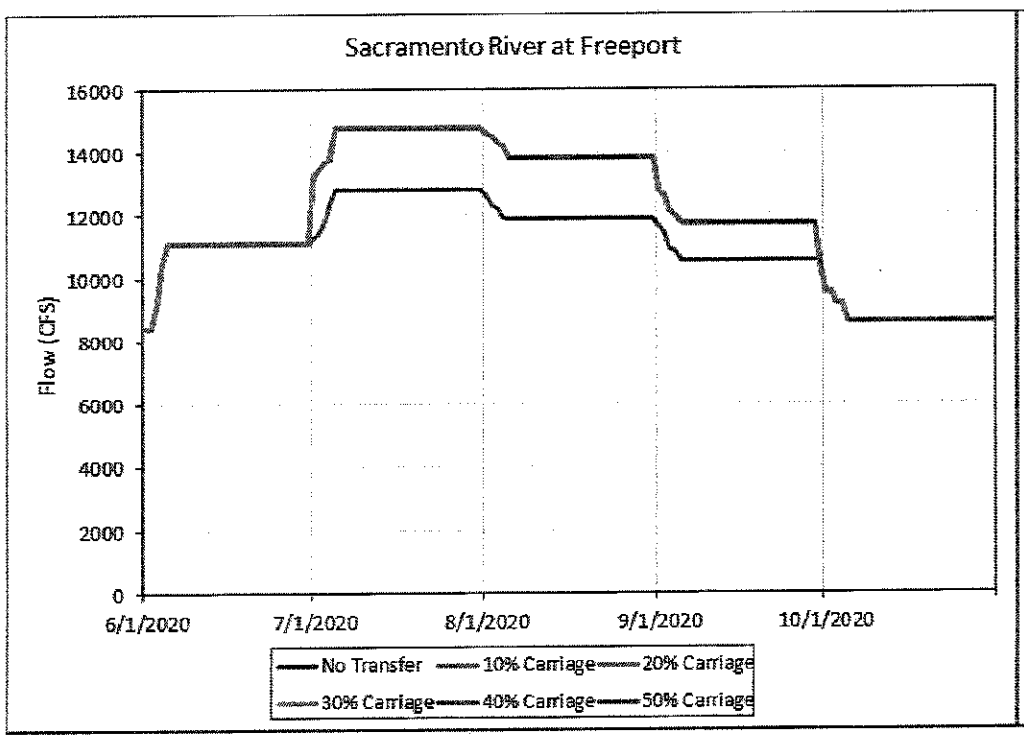
The control location with the highest % CW is used

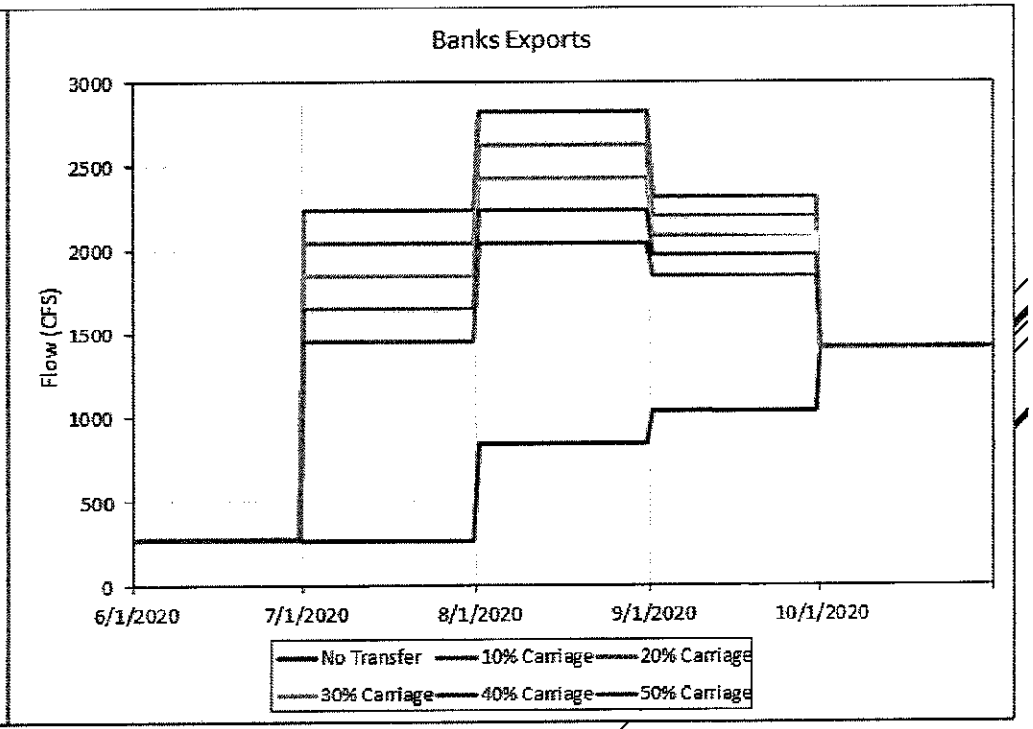
Pre-Season Assessment With DSM2

- DWR SWP Allocation Study is used to develop DSM2 Boundary Conditions
- Transfer Volumes are Layered on top of Freeport and CCFB flows
- Multiple iterations are run with different assumptions of % CW EX: a 10% CW iteration will add the full transfer volume to Freeport and 90% of the transfer volume to Exports

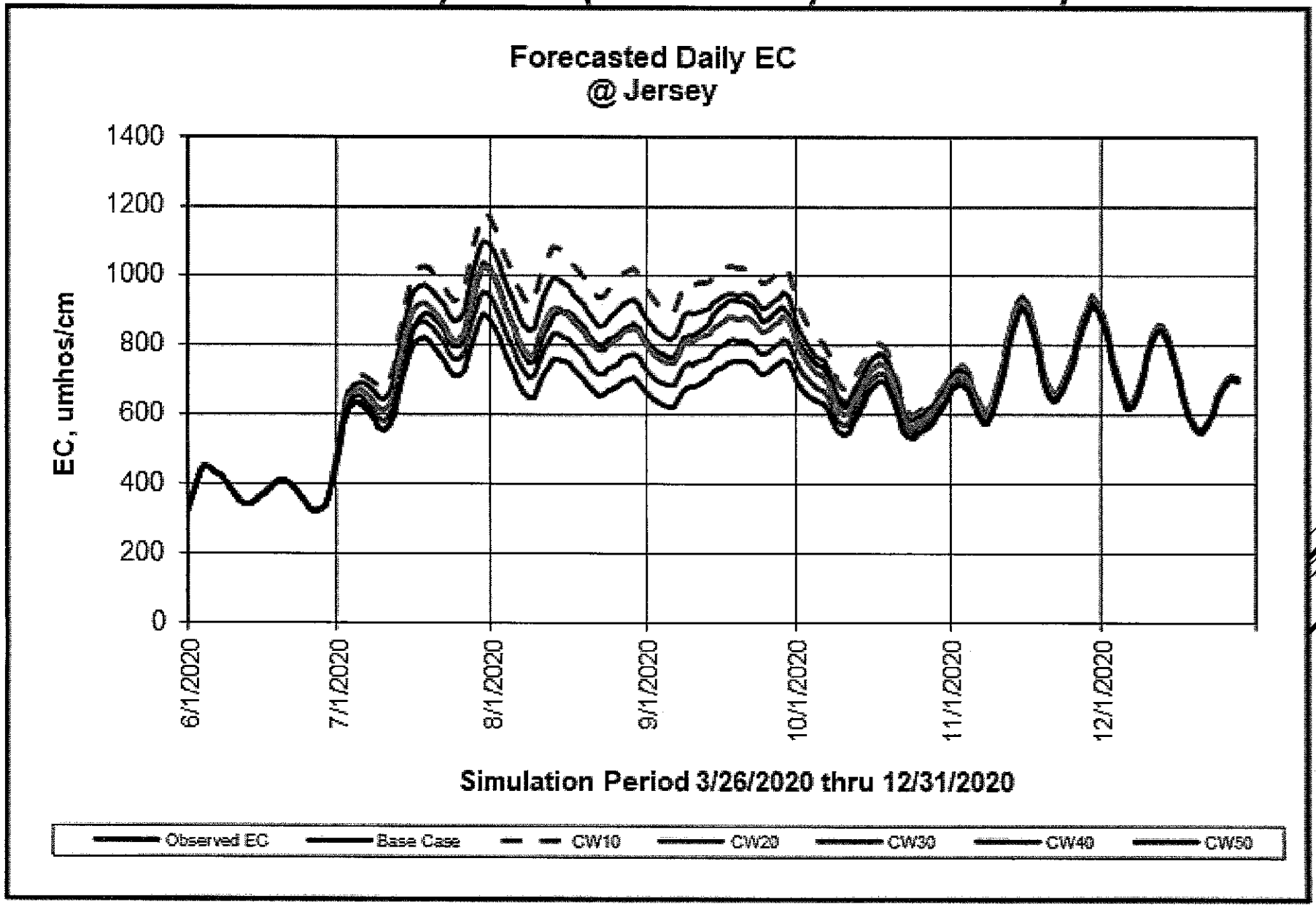
Pre-Season Assessment With DSM2

2020 Pre-Season Boundary Conditions for Freeport and Banks





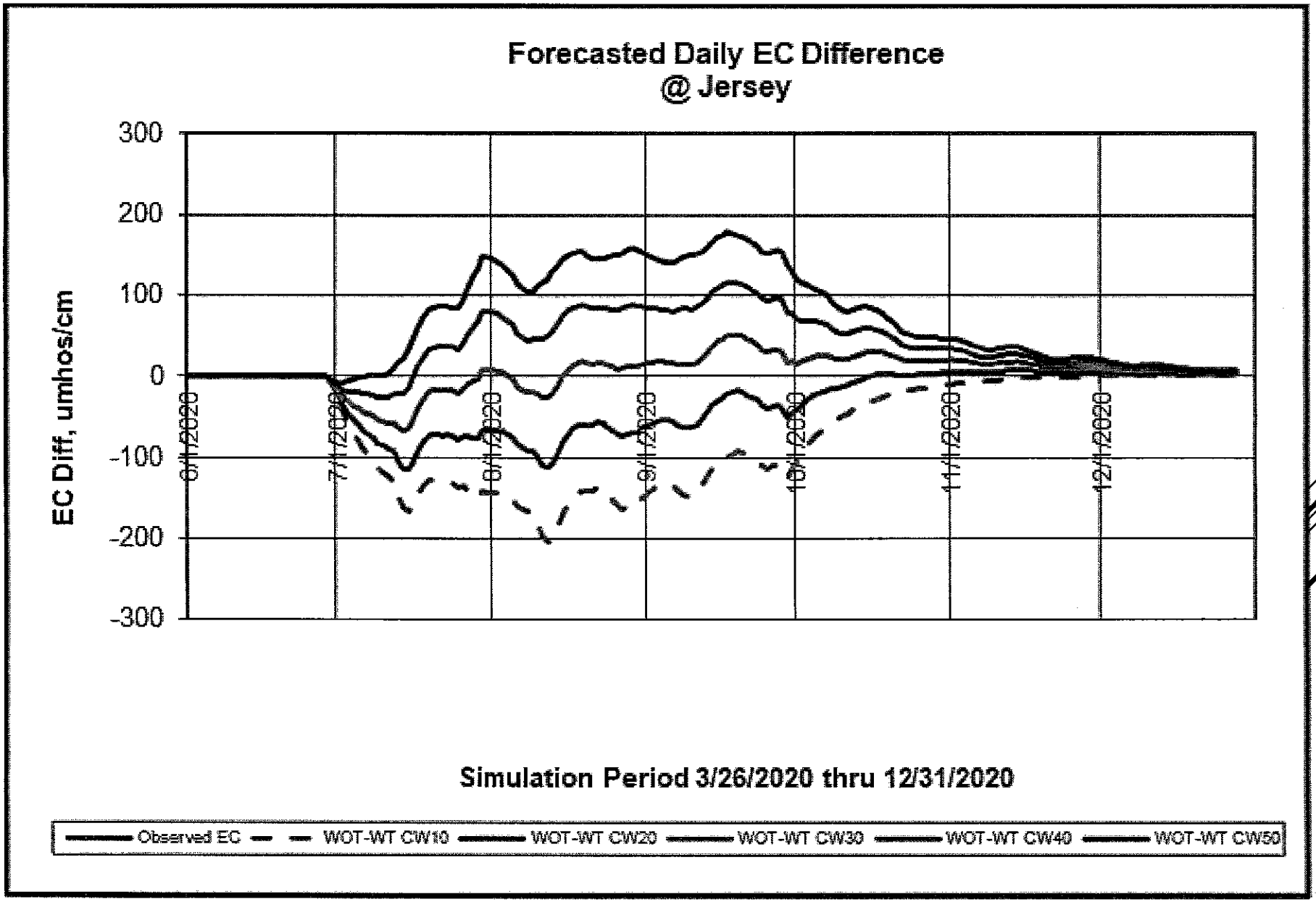
DSM2 Results For Preliminary 2020 Analysis (Jersey Point)



Post Processing Results to get Final %CW

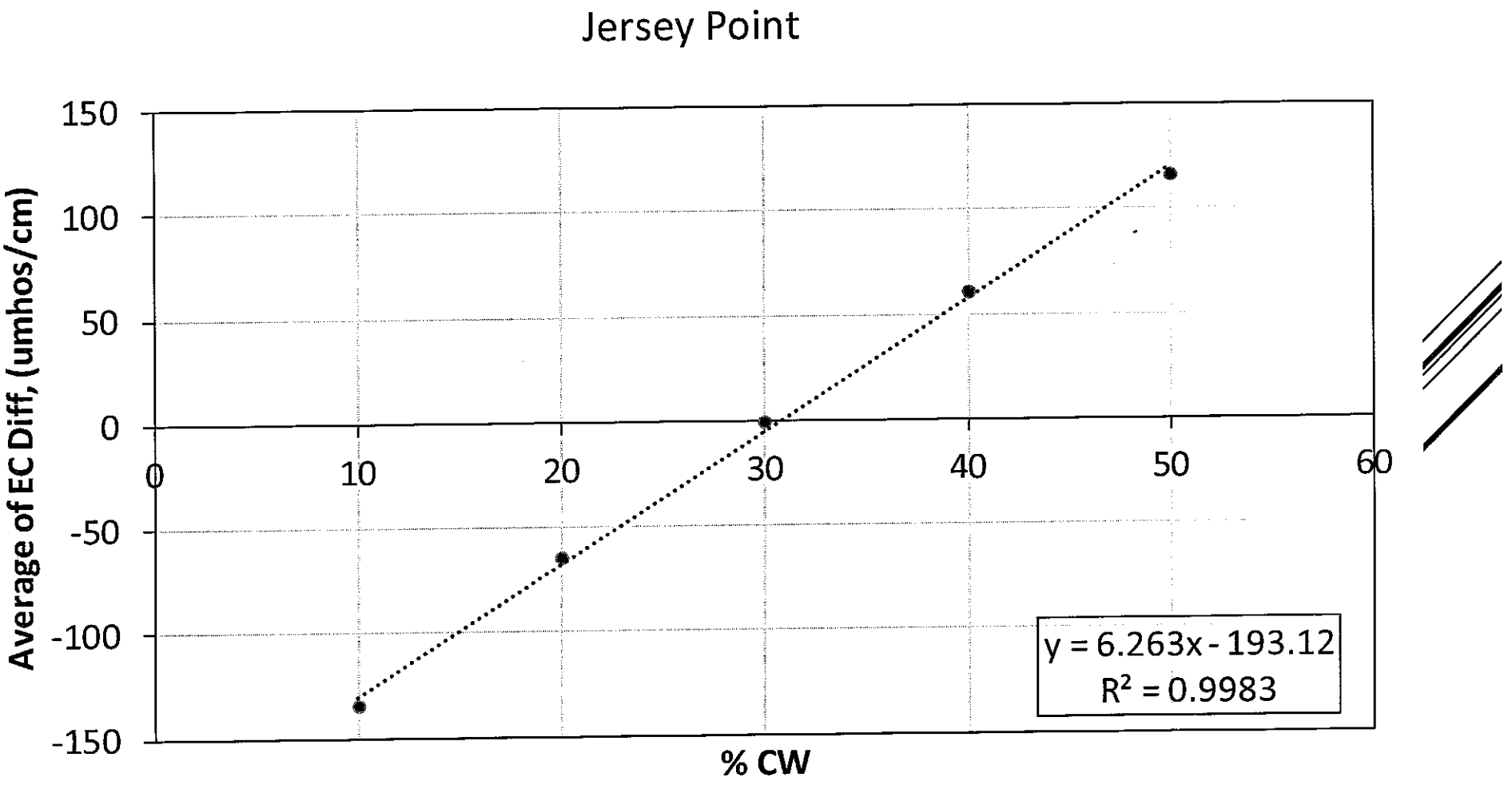
- The average difference in salinity between the Without Transfer Base case and each With Transfer Iteration is calculated for the transfer Period
- Regressions of the %CW assumptions vs the average EC differences are developed
- The objective is to find the %CW that has an average EC difference of zero during the transfer period

DSM2 Results For Preliminary 2020 Analysis (Jersey Point)



Final Solution

- The final step is to solve the regression for zero
- Final result is rounded to the nearest 5%



Pre-Season vs Post-Season

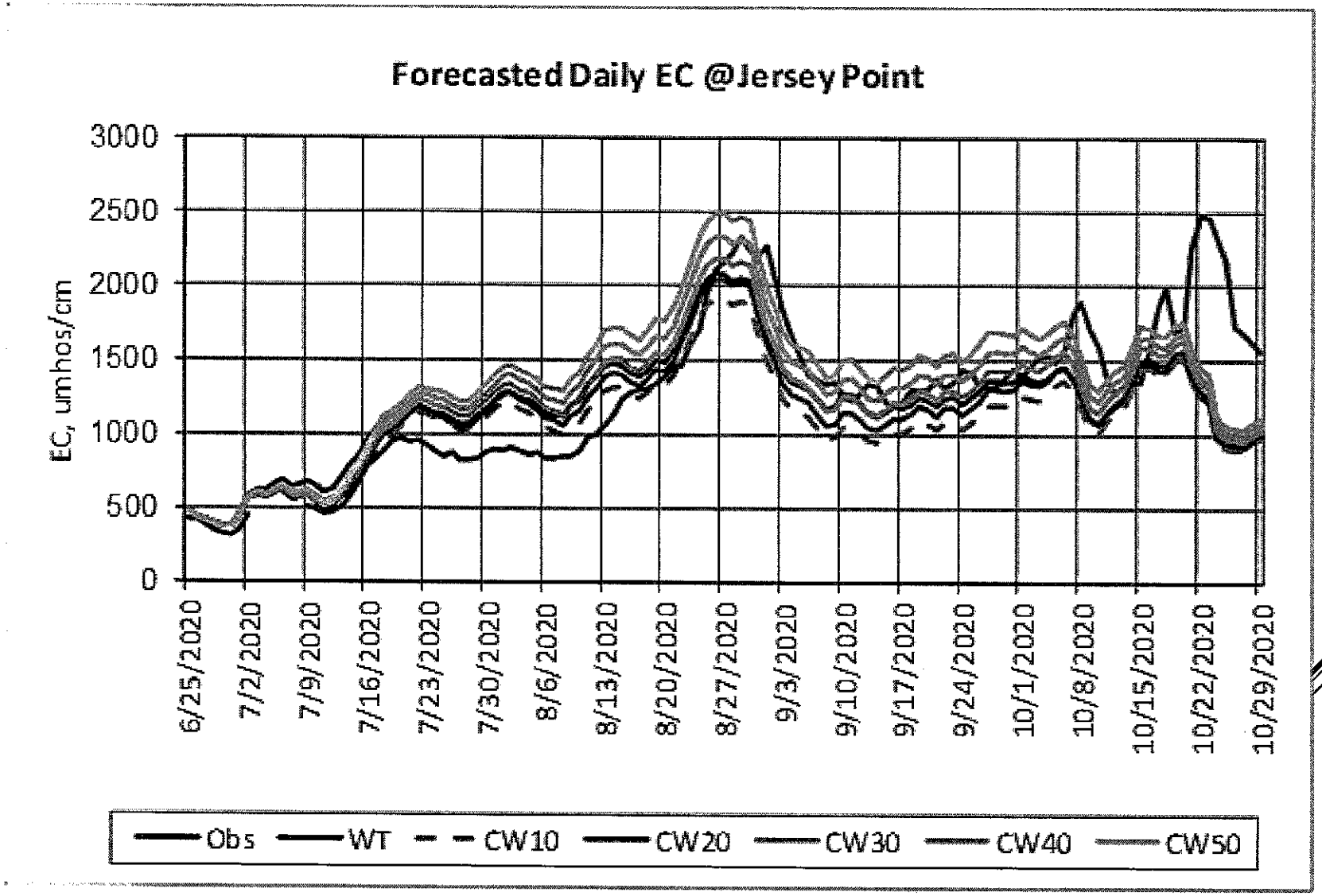
Transfer volumes are present in historical data, but are not represented in allocation studies

- **Pre-Season Assessment**
  - Compares **Multiple With-Transfer Cases** to a **single Without Transfer Case**
- **Post-Season Assessment**
  - Compares **Multiple Without-Transfer Cases** to a **single With Transfer Case**

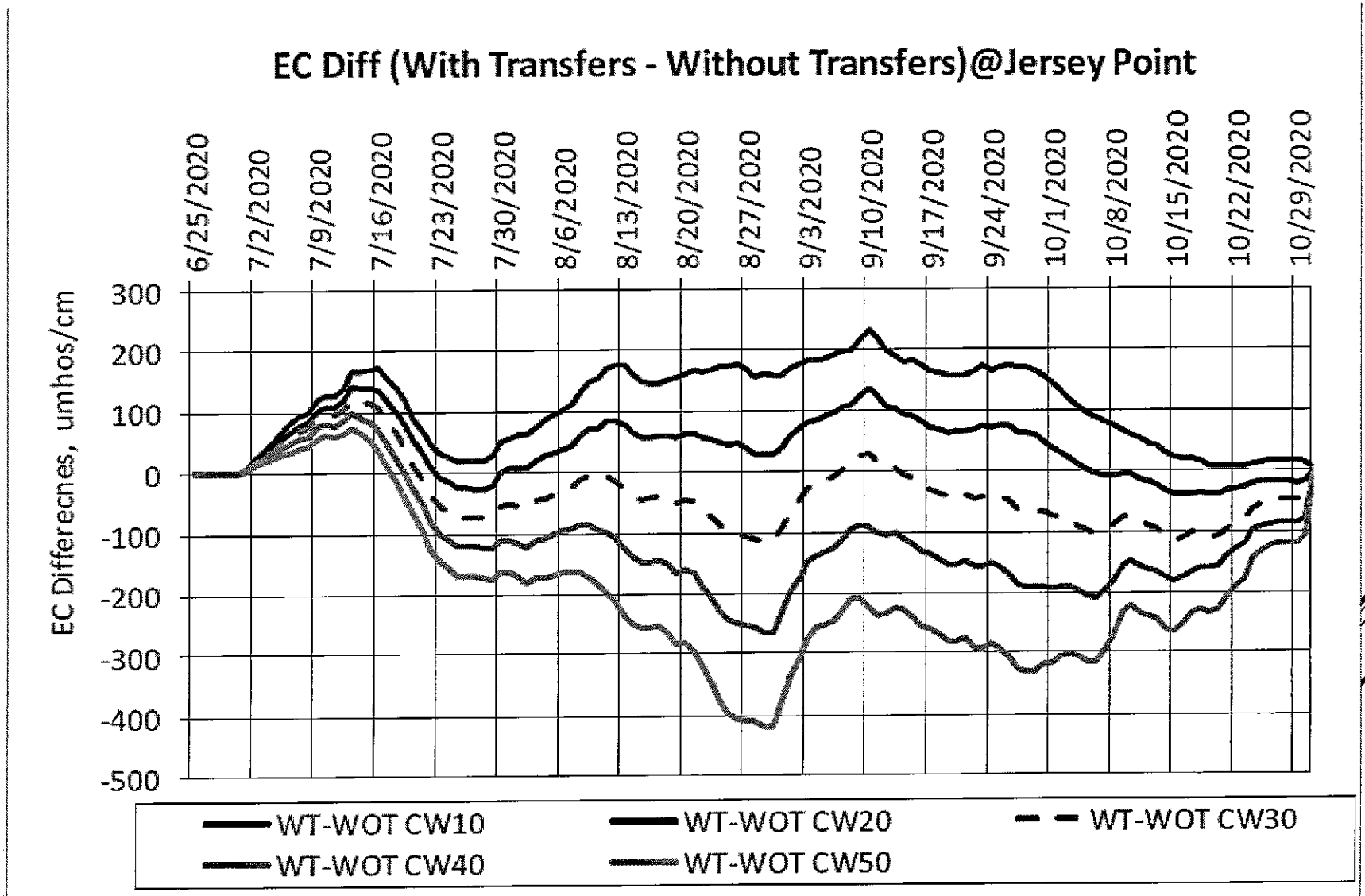
Post-Season Assessment With DSM2

- Historical Data is used to develop DSM2 Boundary Conditions
- Transfer Volumes are subtracted from Freeport and CCFB flows
- Multiple iterations with different assumptions of % CW are run through the model
  - EX: a 10% CW iteration will subtract the full transfer volume from Freeport and 90% of the transfer volume from Exports

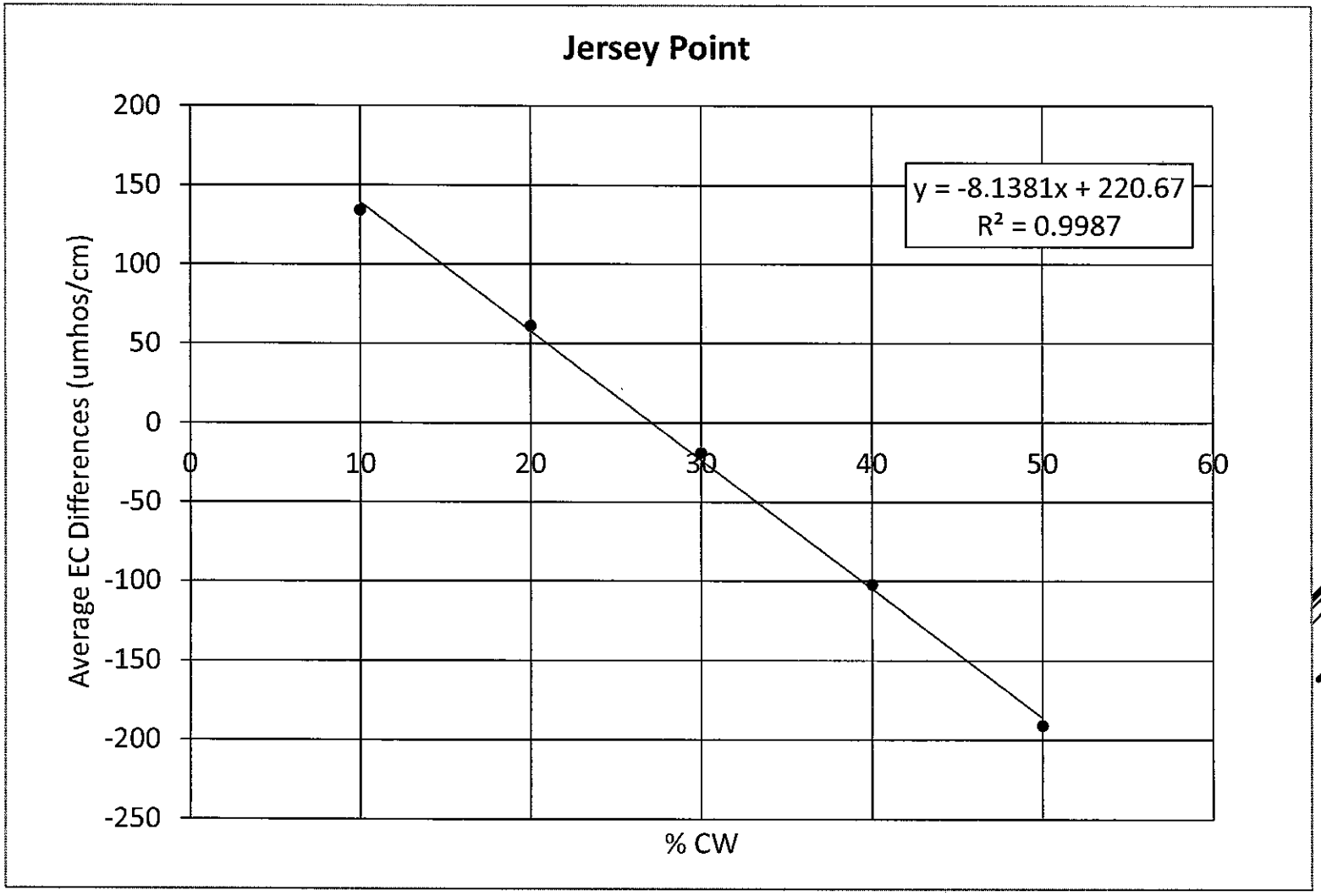
DSM2 Results For Post Season 2020 Analysis (Jersey Point)



DSM2 Results For Post Season 2020 Analysis (Jersey Point)



Final Solution For Post Season 2020 Analysis (Jersey Point)



Uncertainty in Forecasting CW

- Pre-Season CW estimate can vary from Post-Season CW for several reasons
  - Hydrologic variability and uncertainty in allocation Forecasts
  - Coarseness of time-step in inputs
  - Transfer volume and timing changes
  - Deviations in astronomical tidal forecasts
  - Starting salinity conditions

Position Analysis Based CW Analysis

- Early season allocations are informed in part with a Positional Analysis CalSim Run
- These CalSim results can be used as the hydrologic basis for running a range of possible CW estimates with DSM2
- Objective is to get a range of potential CW estimates over a large range of potential hydrologies and operations

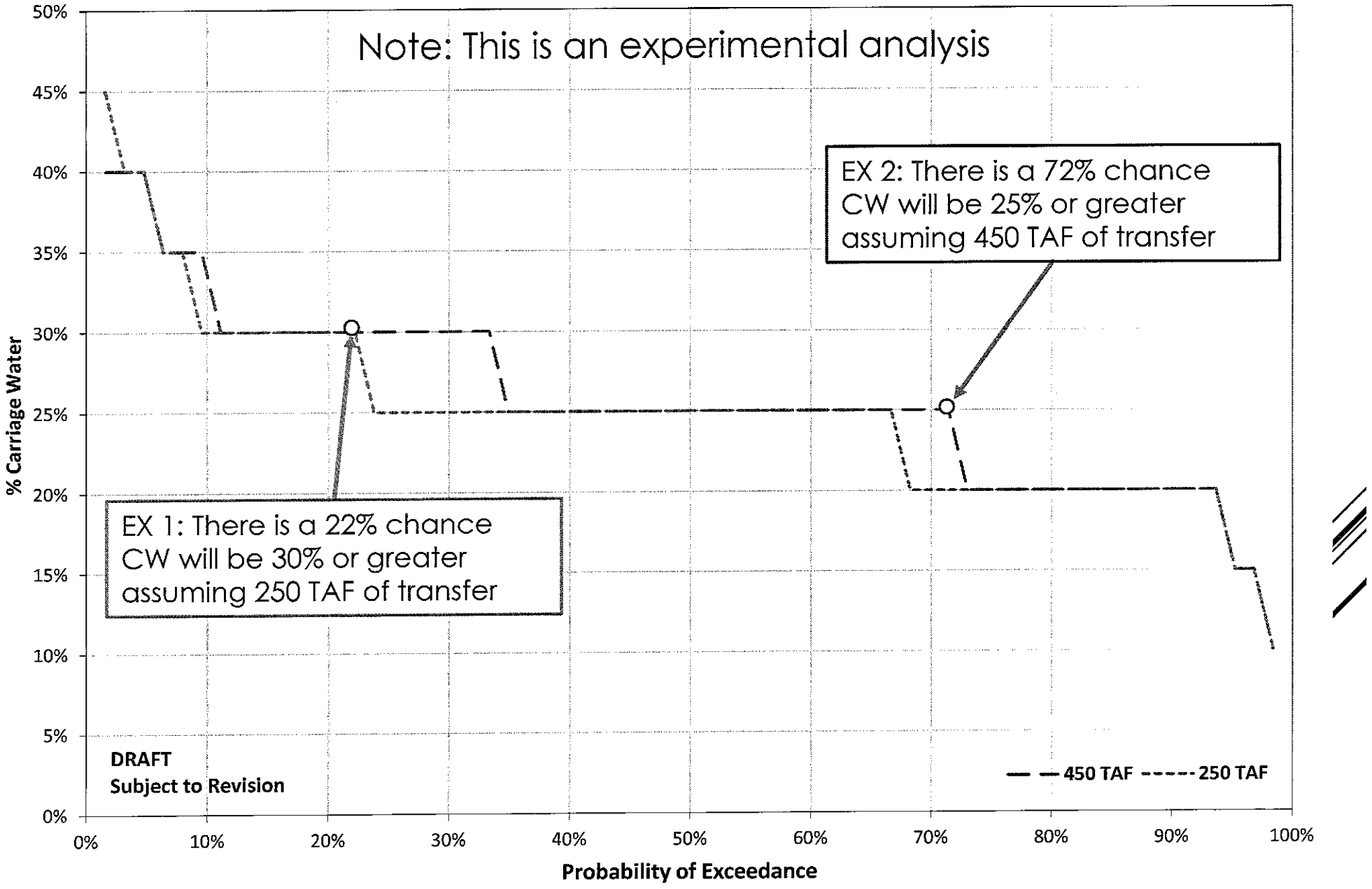
CalSim Position Analysis Background

- Monte Carlo simulation
  - Take a certain known condition and simulate a response from a system over many conditions
- CalSim Position Analysis
  - Start with January 1st storage conditions
  - WY Type updated with actual unimpaired runoff and previous years WY type
  - Simulate project operations over 81 different hydrologies (1922 to 2002)
  - Allocation logic is more consistent with SWP allocation process than the typical CalSim Logic

DSM2 CW Position Analysis Background

- CalSim simulations become the boundary conditions for DSM2
- Pre-Season CW process run for each of these 81 hydrologies
- 62 of these 81 hydrologies are classified as BN, D or C, years where transfers are likely to occur. Analysis was limited to these years(62-year sample)
- 2 Scenarios run with 250 TAF and 450 TAF of transfer assumed in all WYT, split evenly through the transfer period

2021 Carriage Water Exceedance Probability (BN, D and C Years)



Questions?

Ian.Uecker@water.ca.gov

IV. A.

Anthea Hansen

From: Fock, Anna@DWR <Anna.Fock@water.ca.gov>
Sent: Friday, March 12, 2021 10:34 AM
To: Cordova (Cordova@mbkengineers.com); David Guy; Jim Peifer; Eric Chapman; Nickels, Adam M; Leahigh, John@DWR; White, Molly@DWR; Uecker, Ian@DWR; Frances Mizuno; Kiteck, E; White, Kristin N.; Pettit, Tracy@DWR; Stacey Smith; Tu, Ming-Yen@DWR
Cc: Hinojosa, Tracy@DWR; Jose Gutierrez; Russ Freeman; Pablo Arroyave; Tom Boardman; Anthea Hansen; Dana Jacobson; Lon Martin; Janet Roy; Ara Azhderian; Cindy Kao; Andrew Garcia; Chu, Andy@DWR; Katrina Jessop; Demchuk, Vadim@DWR; Chen, Limin@DWR; Shahcheraghi, Reza@DWR; KaHo Kong; Giorgi, Bryant@DWR; Schmitz. Kerry; Brett Ewart; Huot. Mike; Marcus Yasutake; Paul Helliker; Jeff F. Cattaneo; Marta Rivas; Cannon Michael; Melody Hernandez; David Weisenberger; William Bourdeau
Subject: Carriage Water 101

All,

Thank you for your participation of the March 4 Carriage Water 101. Here is a summary table of previous carriage water for: (1) pre-transfer estimate, and (2) post-transfer final value published in DWR Bulletin 132. Please let me know if you have any questions.

Calendar year	Pre-transfer estimate of carriage water	Post-transfer final carriage water published in DWR Bulletin 132
2008	20%	20% (not based on DSM2 modeling)
2009	20%	20% (not based on DSM2 modeling)
2010	20%	20% (not based on DSM2 modeling)
2011	No Transfer	No Transfer
2012	30%	30%
2013	30%	30%
2014	30%	20%
2015	30%	20%
2016	20%	30%
2017	No Transfer	No Transfer
2018	35%	35%
2019	No Transfer	No Transfer
2020	35%	30% (to be published)

Anna Fock, P.E.
State Water Project
Department of Water Resources
1416 9th Street, Room 1121-1
Sacramento, CA 95814
Cell: 916-539-7977

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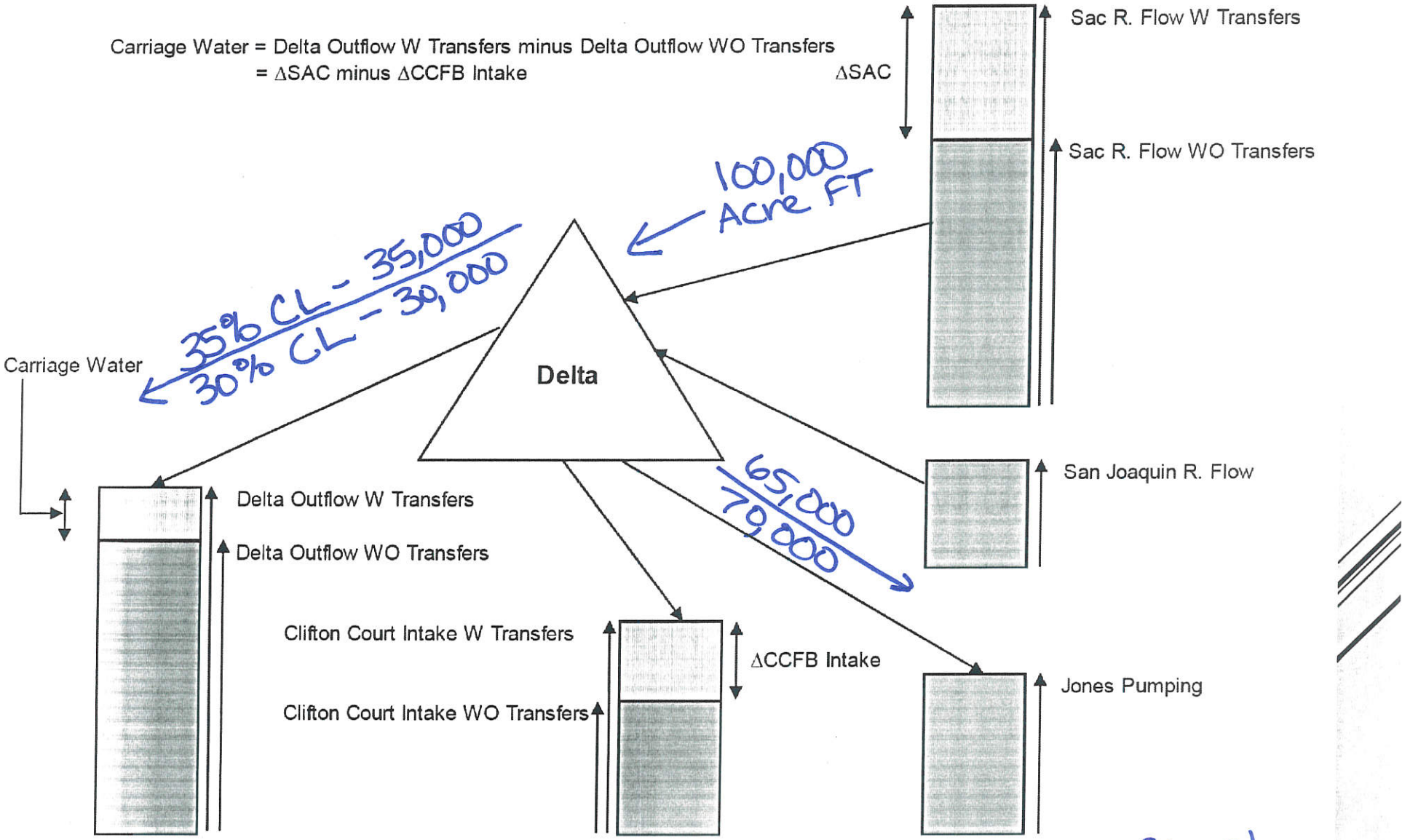
Carriage Water Calculation

A= Without transfers condition; B = With transfers condtion, historical
EC or Chloride level remaining the same at control locations for both baseline and alternative



Problem: Lesser CL at end of year means not enough water was pumped and not enough power scheduled

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Del Puerto Water District
District Reporting to USBR vs. Customer Billing
All Contracts
June 2020 Example

	Long Term Contract 14-06-922 LTR1 2019 Rescheduled Supply	Long Term Contract 14-06-922-LTR1						18-WC-20-5248 DPWD DMC Pump-Ins	15-WC-20-4787 PID RWSP	16-WC-20-4840 GWD	16-WC-20-4844 VOLTA WELLS	16-WC-20-1924 NVRRWP	TOTAL	
	2019 Resched Ag	2020 CVP Ag	Customer 2020 CVP Transfers Out	District 2020 CVP Transfers Out	Customer 2020 CVP Transfers In	District 2020 CVP Transfers In	2020 YCWA Supply	Delivered DPWD 2018-2023 Warren Act Contract for 2020	2020 PID RWSP	2020 GWD Transfers	2020 Volta Well Transfers	2020 NVRRWP Supply Delivered	Metered Deliveries plus Transfers Out	
Jun-20			**2480**	**3737**	**774**	**5529**		**52**		**44**		**2532**	**15148**	**District Reporting**
Jun-20	**1670**	**212**	**2480**	**3737**	**278**	**1209**		**26**				**5536**	**15148**	**Customer Billing**

20-Jun	945	Out	Panoche Water District	Customer
20-Jun	1500	Out	Westlands Water District	Customer
20-Jun	500	Out	Westlands Water District	District
20-Jun	35	Out	Byron-Bethany Irrigation District	Customer
20-Jun	3237	Out	San Luis Water District	District
	6217			

20-Jun	690	In	CCID	Customer
20-Jun	84	In	SLCC	Customer
20-Jun	4000	In	Arvin-Edsion Water Storage District	District
20-Jun	1529	In	SJRECWA	District
	6303			

IV. B.

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IV. C.

Del Puerto WATER District
P.O. Box 1596 Patterson, CA 95363-1596
Phone (209) 892-4470 • Fax (209) 892-4469

Ernest Conant, Regional Director
Bureau of Reclamation, Interior Region 10, California – Great Basin
2800 Cottage Way, MP-100
Sacramento, CA 95825

March 29, 2021

Re: Denial of Del Puerto Water District's Request to Re-Prioritize use of 2020 Rescheduled Project Water

Dear Mr. Conant,

The Del Puerto Water District recently made a request to re-prioritize use of its 2020 Rescheduled Project Water, which is both contemplated and allowable if provided for in writing by Reclamation as per the very first section (entitled General) of the most recent version(s) of the Rescheduling Guidelines for the Federal Share of Storage in the San Luis Reservoir, Central Valley Project, California (RG's). The request was denied by SCCAO as indicated in the attached letter. The District does not believe our request to be a material change to the RG's, rather an option available under them; Further, the District sees no reason why our request would have any impact on Reclamation's ability to "...close out annual water accounting records in a timely manner.", as mentioned in the denial. The District has an excellent history of reconciling its water accounting records with Reclamation, and is receptive to any additional accounting or reporting requirements needed to support our request, including prepaying for the re-prioritized supplies.

We are appreciative of your stated desire to "...look for opportunities for operational flexibility..." as noted in your email to the contractors on March 23, 2021. This request, in my humble opinion, is exactly that type of opportunity, given the current dire situation our growers face. We respectfully ask that your team reconsider the original decision.

Very sincerely yours,

Anthea G. Hansen

Anthea G. Hansen
General Manager

Enclosures: 2

Subject: Denial of Del Puerto Water District's Request to Re-Prioritize use of 2020 Rescheduled Project Water

cc's Continued from Previous Page

cc: Mr. Michael Jackson, P.E., Area Manager, SCC-100, MJackson@usbr.gov
Ms. Heather Casillas, CVPIA Program Manager, CGB-410, hcasillas@usbr.gov
Ms. Sonya Nechanicky, Refuge Water Supply Program Specialist, BDO-100, SNechanicky@usbr.gov
Ms. Kristin N. White, CVO Operations Manager, CVO-102, knwhite@usbr.gov

United States Department of the Interior

BUREAU OF RECLAMATION
South-Central California Area Office
1243 N Street
Fresno, CA 93721-1813

IN REPLY REFER TO:

SCC-100
2.2.4.22

VIA ELECTRONIC MAIL

Ms. Anthea Hansen
General Manager
Del Puerto Water District
P.O. Box 1596
Patterson, California 95363-1596
ahansen@delpuertowd.org

Subject: Request to Re-Prioritize use of 2020 Rescheduled Project Water – Your Letter dated March 11, 2021 – Central Valley Project, California

Dear Ms. Hansen,

Thank you for your subject Letter. We understand the challenges our Central Valley Project water service contractors face in low allocation years like 2021 and it makes sense that you would seek all avenues to get the most out of limited supplies while guarding against a possible consecutive dry year in 2022 to the extent practical.

The Rescheduling Guidelines (RGs) have evolved to their current form over several decades, and through it all Reclamation has sought to provide the right mix of flexibility, rigidity, and certainty.

In addition, to your request, other contractors have requested different changes and/or reversion to earlier flexibilities.

Nonetheless, our objective for several years running has been that the RGs not materially change from year to year, allowing Reclamation to close out annual water accounting records in a timely manner.

Given other contractors' desires for different changes and our objective that the RGs not materially change from year to year we unfortunately are denying your request.

Feel free to contact me at (559) 260-8714 should you desire to discuss this matter further.

Sincerely,

MICHAEL JACKSON Digitally signed by MICHAEL JACKSON Date: 2021.03.17 18:54:09 -07'00'

Michael P. Jackson, P.E.
Area Manager

cc's Continued Next Page.

Subject: Request to Re-Prioritize use of 2020 Rescheduled Project Water – Your Letter dated March 11, 2021 – Central Valley Project, California

cc's Continued From Previous Page.

cc: Mr. Adam M. Nickels, Regional Resources Manager, CGB-400, anickel@usbr.gov
Ms.Heather Casillas, CVPIA Program Manager, CGB-410, hcasillas@usbr.gov
Ms. Sonya Nechanicky, Refuge Water Supply Program Specialist, BDO-100, SNechanicky@usbr.gov
Ms. Kristin N. White, CVO Operations Manager, CVO-102, knwhite@usbr.gov

Del Puerto Water District
Water Delivery Schedule
All Contracts

Page 1

As of 2.28.21

	Long Term Contract 14-06-922 LTR1 2019 Resched Supply = 14021 - 184 Losses		Long Term Contract 14-06-922-LTR1				18-WC-20-5248 DPWD DMC Pump-Ins				15-WC-20-4787 PID RWSP	16-WC-20-4840 GWD	16-WC-20-4844 VOLTA WELLS	WA-16-WC-20-1924 NVRRWP		
			2020 Allocation @ 20% = 28,042													
	2019 Resched Ag	2019 Resched Ag Transfers Out	2020 CVP Ag	2020 CVP Transfers Out	2020 CVP Trans In	2020 YCWA Supply	GROSS DPWD 2018-2023 Warren Act Contract for 2020	5% CONV LOSS DPWD 2018-2023 Warren Act Contract for 2020	Delivered DPWD 2018-2023 Warren Act Contract for 2020	Stored DPWD 2018-2023 Warren Act Contract for 2020	2020 PID RWSP	2020 GWD Transfers	2020 Volta Well Transfers	2020 NVRRWP Supply Gross	2020 NVRRWP Supply Delivered	2020 NVRRWP Supply Stored
Mar-20	2704													1909	0	1909
Apr-20	4123													2077	0	2077
May-20	5519	1491			517		45	2	43			46		2341	1161	1180
Jun-20				6217	6303		54	2	52			44		2320	2532	-212
Jul-20				2551	1599	1069	23	0	23			45		2342	6707	-4365
Aug-20				1600	2475	1519	60	3		57	1683			2231	1290	941
Sep-20				250	2036		67	4	1	62			81	2226	2427	-201
Oct-20			164	730	873		65	4	1	60			71	1305	2634	-1329
Nov-20			1288	136			92	5	1	86		80	46	2056	768	
Dec-20			597				149	8		141		84				
Jan-21			170				178	8		170		64				
Feb-21			218	100			83	4	606			25		239	239	
Unschd			14021			583				49						1288
TOTAL	12346	1491	16458	11584	13803	3171	816	40	727	49	1683	388	198	19046	17758	1288

**6 AF from Apr Delivered in May*

IV.D.1

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Del Puerto Water District
Water Delivery Schedule
All Contracts

Page 2

As of 2.28.21

Scheduled DMC Deliveries	Scheduled CA Aq. Deliveries	Scheduled Transfers Out	DMC Actual Metered Deliveries	Ca Aq Actual Metered Deliveries	Actual CVP Transfers Out	CCID Wheeling of DPWD Contract Supply
			2672	24		8
			4099	3		21
			7193	58	1491	35
			8792	99	6217	40
			9293	109	2551	41
			6882	61	1600	24
			4483	48	250	14
			3688	32	730	23
			2158	14	136	11
			671	1		9
			227	7		
			1085	3	100	
15941						
15941	0	0	51243	459	13075	226

80,944

80,944 check sum

Special Notes Regarding Transfers:

1) 2019 Rescheduled Ag Transfers Out inlcude 1491 AF to SLWD

2) 2020 CVP Transfers Out include 4300 AF to WWD, 35 AF to BBID, 1455 AF to Panoche WD, and 5794 AF to SLWD

3) 2020 CVP Transfers In include 6 AF from BBID, 4000 AF from AEWSD, 1500 AF from LTRID, 250 AF from SLCC, 2109 AF from CCID and 5938 AF from SJRECWA

4) Yuba Transfer gross 4062 AF - 30% losses - 2% losses = Net 2787 AF (2588 AF delivered, 199 AF to storage) and 548 gross - 30% losses = 384 AF

Allocated: 15,504 (difference is 1% loss estimate)

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N. E.

Name	2021 Acreage	2021 Acreage Combined	Additional Supplies	Additional Supplies Requested Combined	Initial Percentage
5G Ag Management Inc.	20	20	15	15	0.09%
Ace Orchards, LLC	**160**	**270**	**25**	**25**	**1.15%**
Escobar Properties LLC et al	110		0		
Adobe Orchards, Inc	**223**	**253**	**120**	**150**	**1.08%**
John W. Hansen Farms	30		30		
Amaravati Farms, LLC	416	416	200	200	1.77%
Bays Ranch, Inc.	**732**	**1,664**	**600**	**600**	**7.09%**
Bays, Daniel & Rebecca	50		0		
Bays Farming	395		0		
Bays, Ken & Michelle	106		0		
Schuler & Bays JV	381		0		
Brooks, Mark	54	54	30	30	0.23%
California Soils, Inc.	38	38	18	18	0.16%
California Transplants	101	101	20	20	0.43%
Calvin Inc.	314	314	250	250	1.34%
CSC Westley, LLC / 5 Star Vineyard, LLC TIC	292	292	300	300	1.24%
Dhillon Farms & Services, LLC	72	72	120	120	0.31%
Fantozzi, Paul	72	72	20	20	0.31%
Garlic City Properties, LLC	43	43	129	129	0.18%
Gemperle Orchards	92	92	14	14	0.39%
Hooper Ranch Property, LLC	275	275	100	100	1.17%
IDC Farms, Inc.	70	70	50	50	0.30%
Ingram Creek Ranch	359	359	50	50	1.53%
JEM Ranches, LLC	**3433**	**3,500**	**2,500**	**2650**	**14.92%**
Maring, Zachary et al	67		150		
KDR Farms	314	314	650	650	1.34%
L & L Investments, LLC	226	226	444	444	0.96%
La Fortaleza LLC	40	40	50	50	0.17%
Longhorn Enterprises	19	19	50	50	0.08%
McWilliams, Les	10	10	17	17	0.04%
Mission NSS II, LLC	154	154	20	20	0.66%
Perez Farms	3766	3,766	600	600	16.05%
Pimentel Farms	290	290	450	450	1.24%
R.C. Capital Investments, LLC	130	130	200	200	0.55%
RDC Farms GP	312	312	180	180	1.33%
Recology Blossom Valley Organics - North	76	76	30	30	0.32%
Rock' N Almonds	166	166	360	360	0.71%
Sabatino, Murphy Jr.	160	160	160	160	0.68%
Shiraz Ranch LLC	1116	1,116	1,000	1000	4.76%
Singh, Baljinder & Ritu	234	234	100	100	1.00%
Singh Farm Inc.	**211**	**383**	**422**	**680**	**1.63%**
Miri Piri, Inc.	172		258		
Singh, Rajinder et ux.	80	80	25	25	0.34%
Stewart & Jasper Farming Co.	2297	2,297	1,000	1000	9.79%
Sunflower Ranch Co.	318	318	200	200	1.36%
Tatla, Jasbir	**203**	**327**	**20**	**120**	**1.39%**
Tatla & Singh	47		20		
JT Farms	77		80		
T & M Farms	1829	1,829	400	400	7.80%
Van Elderen Bros.	**604**	**1,069**	**800**	**1480**	**4.56%**
Dutch Nuts, Inc.	149		130		
Backhill Farms L.P.	316		550		
WMD Farming	**2088**	**2,241**	**1,200**	**1290**	**9.55%**
LAT Farming Trust	153		90		
Totals	23,462	23,462	14,247	14,247	100.00%

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