United States Department of the Interior

BUREAU OF RECLAMATION
Central Valley Operations Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

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Nat'l Marine Fisheries Svs.
Sacramento, CA

Doc #00581

VIA ELECTRONIC MAIL

Ms. Maria Rea
Assistant Regional Administrator
California Central Valley Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Subject: Reasonable and Prudent Alternative (RPA) Action IV.1.2 of the 2009 Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Biological Opinion (NMFS 2009 BiOp) – Request for Flexibility in Delta Cross Channel (DCC) Gate Operations December 1 through December 14, 2015

Dear Ms. Rea:

As you are aware, drought conditions have continued well into the fall of 2015, with limited inflows into the Sacramento-San Joaquin Delta. Precipitation to date during Water Year 2016 in the Sacramento Valley is below normal, and several tidal and wind-driven events have elevated salinity levels in the western Delta. As a result, water quality in the Delta continues to degrade despite low pumping levels and the DCC gates remaining open most of the fall. Currently the salinity in the western and central Delta is well above levels that signal significant risk of exceeding established drinking water objectives (details are provided below).

RPA Action IV.1.2 prescribes that the DCC gates be closed starting December 1, but the RPA does allow for the DCC gates to open at times during the December 1 through 14 period based on fish monitoring metrics and exceedance of State Water Resources Control Board Decision 1641 (D-1641) water quality objectives. The principle water quality objectives of concern for the Bureau of Reclamation (Reclamation) and the Department of Water Resources (DWR) are the chloride standards at the Contra Costa Pumping Plant at Rock Slough, and ultimately the salinity levels at the project pumping plants in the south Delta. All these locations serve critical municipal and industrial needs where high salinity levels can lead to an interruption of supplies. Because the salinity dynamics that drive these objectives build over time, waiting for actual exceedance of D-1641 water quality objectives to take action only prolongs and intensifies the corrective measures needed to regain compliance (*e.g.*, longer duration or more frequent opening of the DCC gates, and/or increases in upstream reservoir releases).

The table below shows that the current salinity levels (daily averages as of November 22, 2015) are all well above concern levels used in previous DCC gate operation decision tools. The

overall Delta salinity condition has progressed to the point that exceedance of the water quality objective at Contra Costa Pumping Plant at Rock Slough is very likely with extended closure of the DCC gates. A salinity level measured as electrical conductivity (EC) near 1.0 mmhos/cm at Holland Cut has in the past signaled a near future exceedance of 250 mg/l chlorides at the Contra Costa Pumping Plant at Rock Slough. In addition, an EC level consistently above 0.8 at Bacon Island will eventually lead to exceeding the 250 mg/l chloride level at Clifton Court within several weeks even at minimal health and safety pumping rates.

Water Quality Station	Current Salinity Level (mmhos/cm)*	General Concern Level (mmhos/cm)
Jersey Point	2.60	1.8
Bethel Island	1.63	1.0
Holland Cut	1.15	0.8
Bacon Island	0.95	0.7

* 3-day Daily average November 28 through December 1, 2015

The enclosed charts (Enclosure 2) illustrate the modeled progression of salinity at these key locations with the DCC gates opened and closed through December 2015. The modeling assumptions included in this analysis are: (1) the DCC gates are assumed closed on December 1; (2) combined CVP/SWP pumping 1,100 cfs; (3) average outflow for the month of December at approximately 3,100 cfs; and (4) as of November 20, all of the agricultural barriers have been removed.

Closure of the DCC gates from December 1 through 14 will accelerate salinity degradation at these key stations to the point where exceedance of the water quality objectives is imminent and additional DCC gate opening flexibility may be needed later in December to help flush the buildup of salinity at these locations to maintain health and safety needs. In addition, although the weather has been below average and dry across northern California early this week, a windy weather system will quickly move through the region on Thursday, December 3, with some lingering precipitation on Friday, December 4. This system may be a little warmer than previous systems this fall, however this storm will include wind gusts of up to 45 miles per hour from the southwest. Sustained winds from this direction will likely further increase tidal stages and salinity intrusion into the central Delta. Unfortunately, Thursday's weather system is not expected to significantly increase inflows to the Delta given the very dry ground conditions throughout the Central Valley. It is expected that it will take several more strong weather systems to generate significant runoff and Delta inflow. Overall the 14-day forecast identifies some limited periods of precipitation for northern California, but no significant rain events are currently forecast.

For the period of December 3 through 14, given that fish presence in the Delta currently appears low (metrics below one fish per day), and that exceedance of D-1641 water quality objectives is likely within the immediate future with the DCC gates closed, and given the upcoming weather forecasts, Reclamation is requesting to open the DCC gates as necessary to improve water quality in the central Delta and to help balance water quality concerns with fish and wildlife objective flows at Rio Vista. More specifically, during December 3 through 14, Reclamation is proposing to keep the DCC gates open if the following conditions are met: (1) the salinity

readings are all above the concern levels noted in the above table, and (2) the fish monitoring data are below three fish per day for the Knights Landing Catch Index or Sacramento Catch Index (SCI) surveys outlined in RPA IV.1.2. In addition, combined exports would remain at critical health and safety levels (approximately 1,100 cubic feet per second) any time the DCC gates are open. If two of the four salinity stations drop below the concern levels, or if the fish monitoring data are greater than three fish per day, Reclamation would close the gates as soon as it is safe and practical to do so (usually within 24 hours).

Reclamation has requested that the U.S. Fish and Wildlife Service intensify the SCI surveys to a daily effort during this period. In addition, Reclamation will continue to coordinate DCC gate operations with the Delta Operations for Salmonids and Sturgeon technical work group, and discuss them at weekly Real-Time Drought Operations Management Team meetings. It is anticipated that weather patterns will shift at some point to the forecasted seasonal projections provided by the NOAA Climate Prediction Center, bringing some much needed inflow to the Delta. Improved Delta inflows coupled with this preemptive DCC gate action in early December hopefully will eliminate the need for a prolonged DCC gate opening later in December when the risk to migrating winter-run Chinook salmon is much higher.

Reclamation and DWR reviewed the effects of this request for December 1 through 14 on listed species. The resultant Biological Review is enclosed (Enclosure 2). Based on the Biological Review, and because RPA Action IV.1.2 allows for the DCC gates to be open during the December 1 through 14 period based on fish monitoring metrics and exceedance of D-1641 water quality objectives, Reclamation and DWR conclude that the effects of the requested flexibility in DCC gate operations for December 1 through 14 are consistent with what was analyzed in the NMFS 2009 BiOp, and do not jeopardize the continued existence of these listed species or adversely modify or destroy their designated critical habitats. Any incidental take resulting from these changes is consistent with the intent to reduce direct and indirect mortality of emigrating juvenile salmonids and green sturgeon and is within the existing incidental take limits in the NMFS 2009 BiOp. Reclamation seeks NMFS' concurrence in this determination.

We look forward to working with you and your staff as we navigate through another extremely challenging water year and appreciate your willingness to work with us on this time sensitive matter.

Sincerely,

Ronald Milligan
Operations Manager

Enclosures - 2

cc: See next page.

cc: Continued from previous page.

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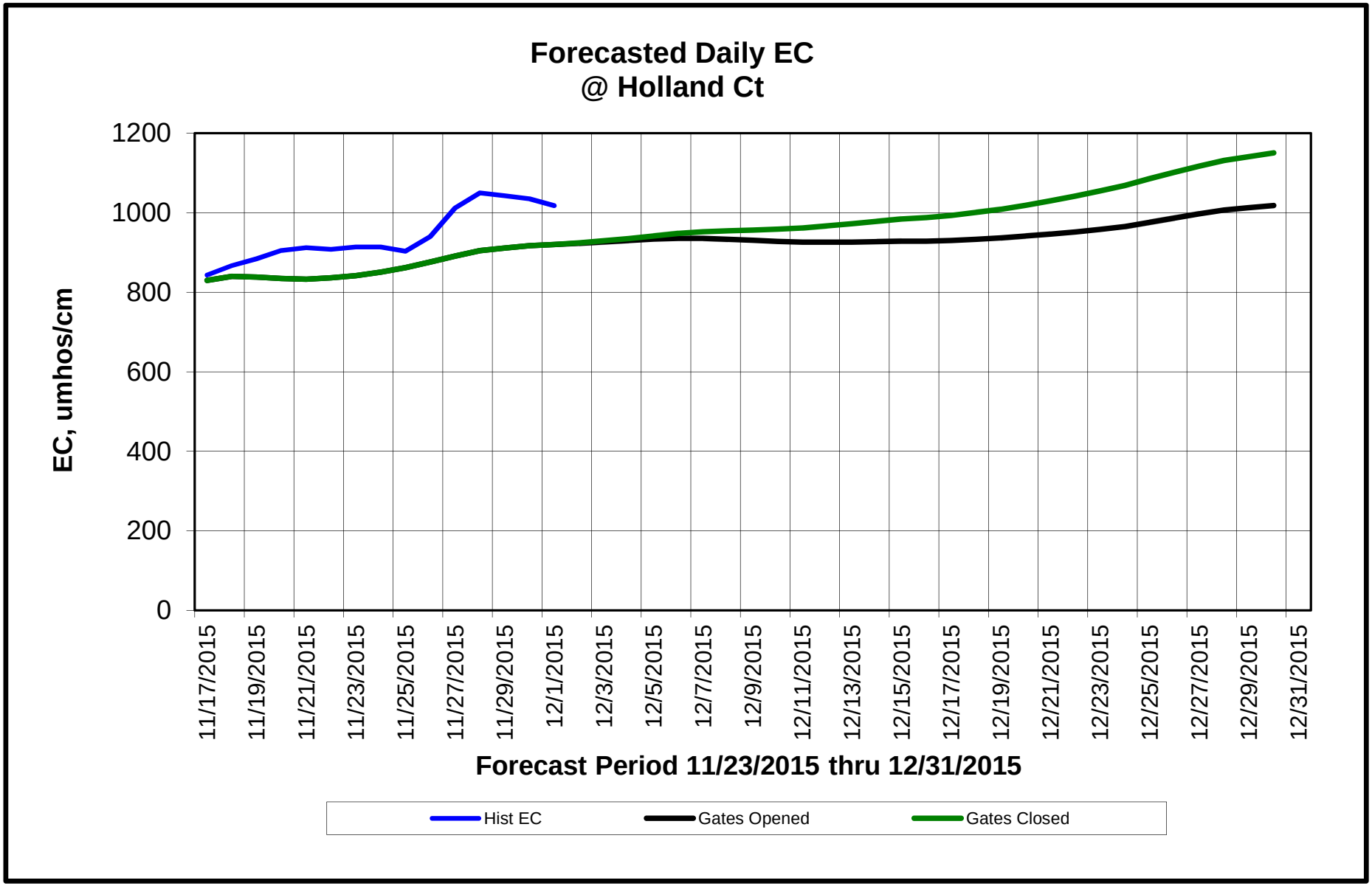
Enclosure 1


Forecasted Daily EC
@ Holland Ct
EC, umhos/cm
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800
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0
11/17/2015
11/19/2015
11/21/2015
11/23/2015
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12/1/2015
12/3/2015
12/5/2015
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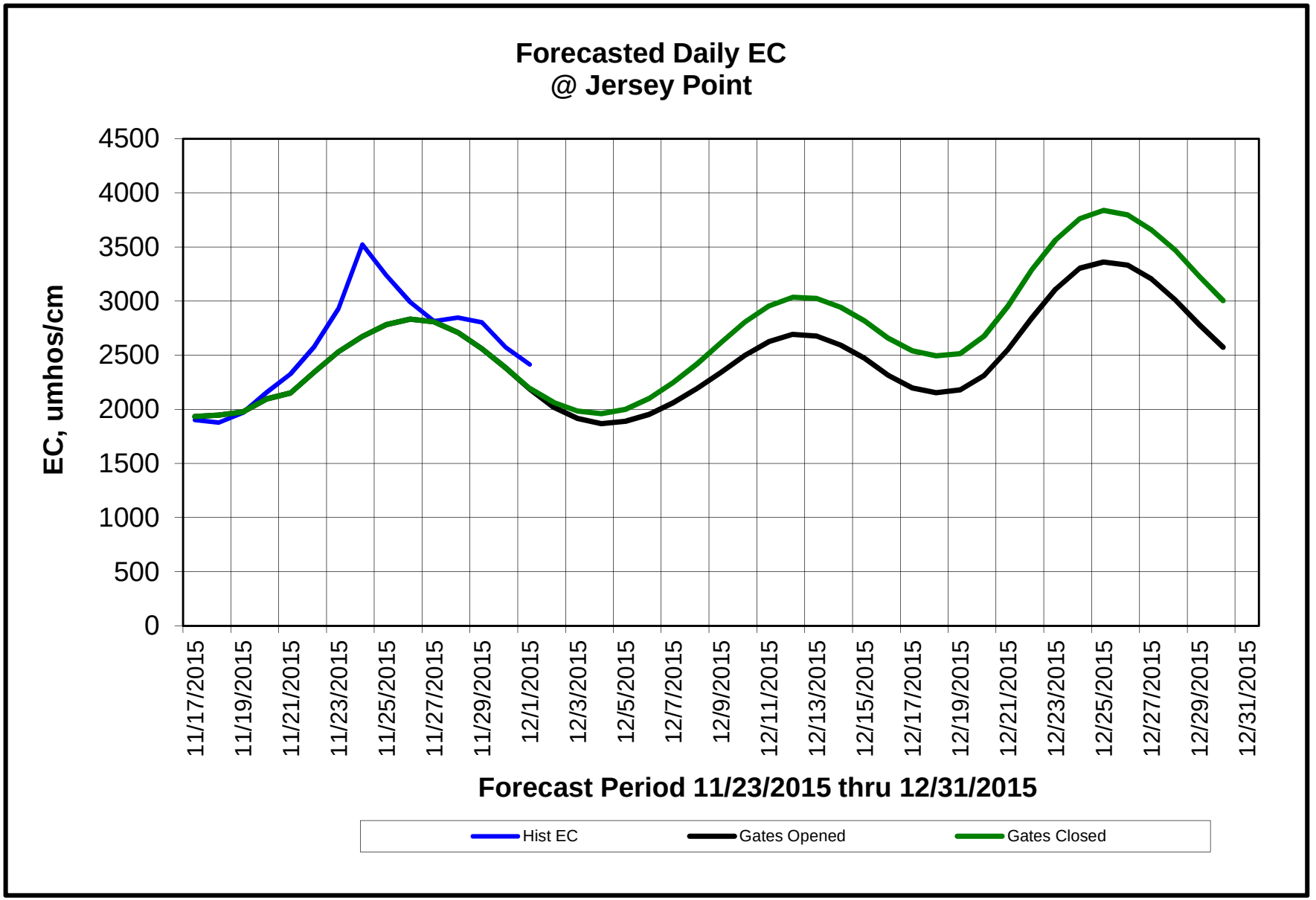
Forecast Period 11/23/2015 thru 12/31/2015
Hist EC
Gates Opened
Gates Closed


Forecasted Daily EC
@ Jersey Point
EC, umhos/cm
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3500
3000
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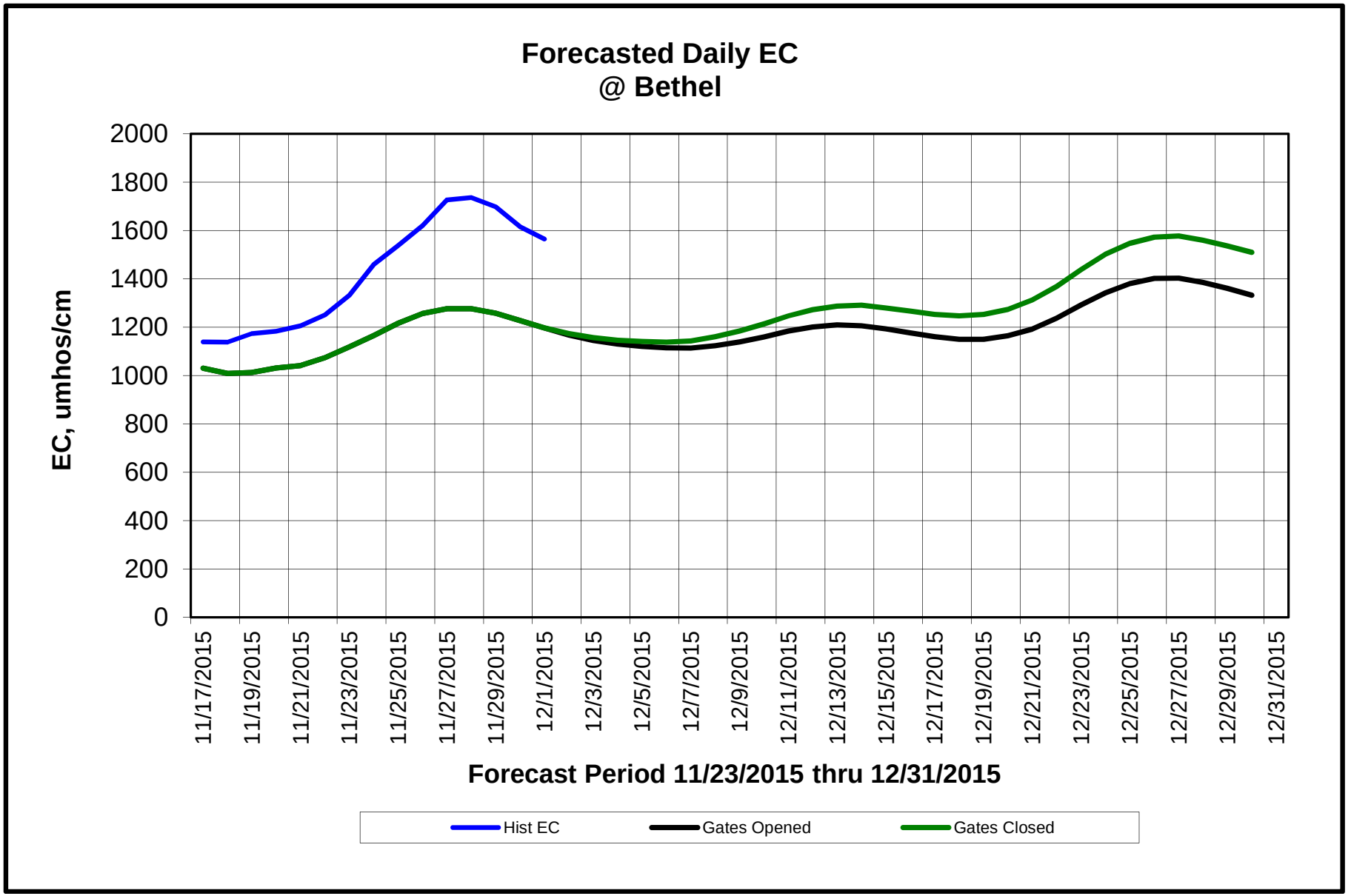
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EC, umhos/cm
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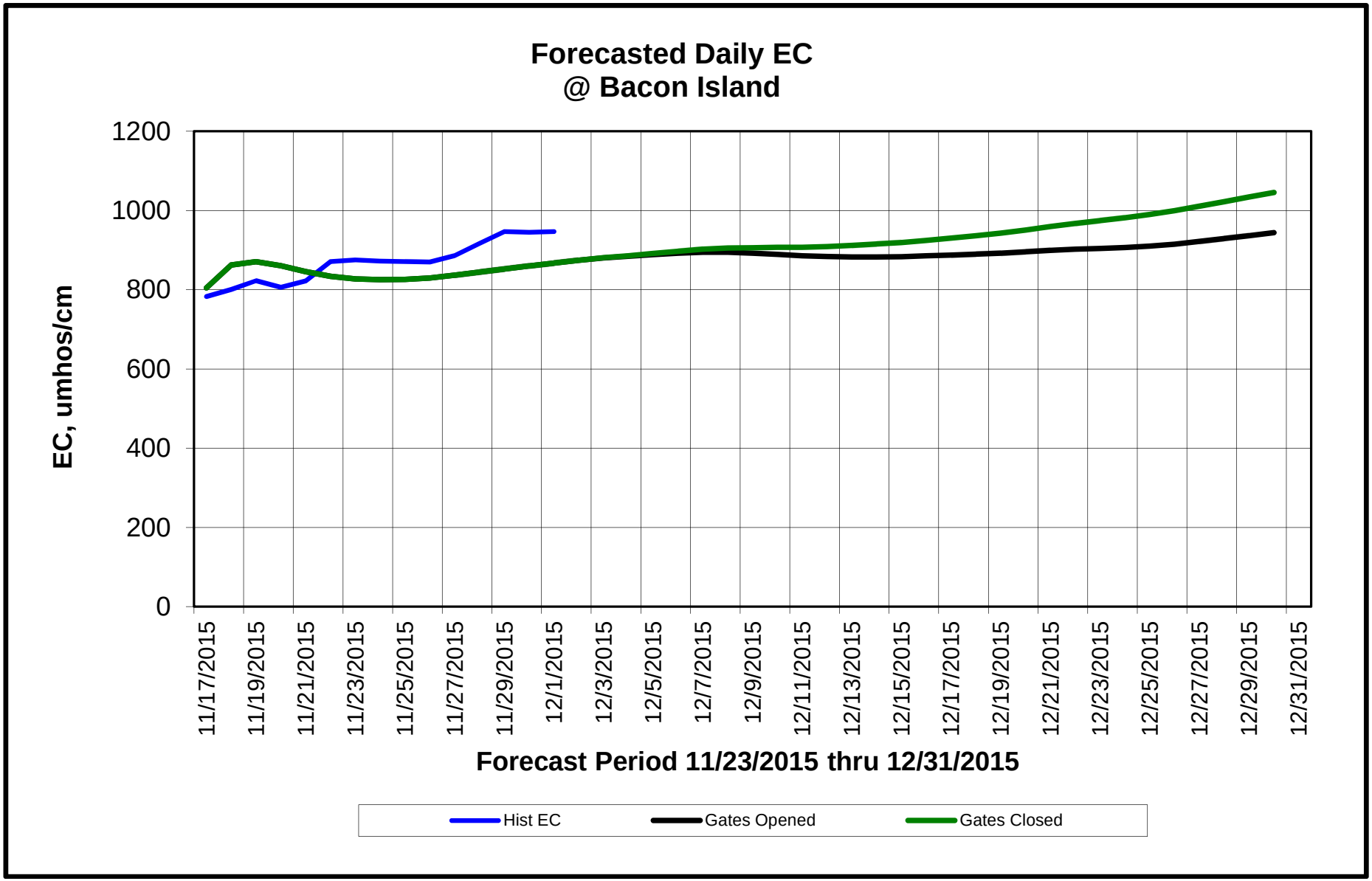
Hist EC
Gates Opened
Gates Closed


Forecasted Daily EC
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EC, umhos/cm
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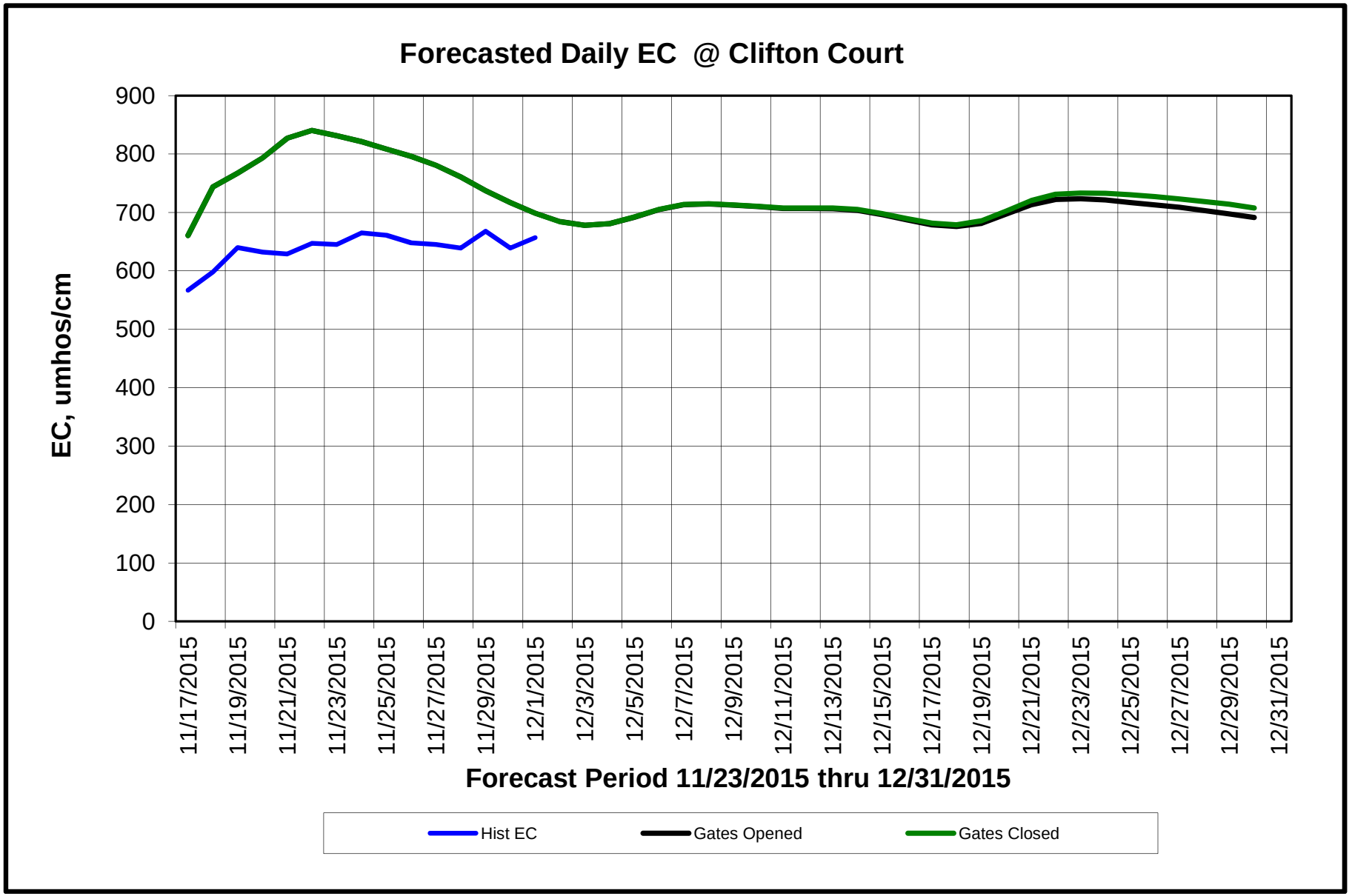
Hist EC
Gates Opened
Gates Closed


Forecasted Daily EC @ Clifton Court
EC, umhos/cm
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11/17/2015
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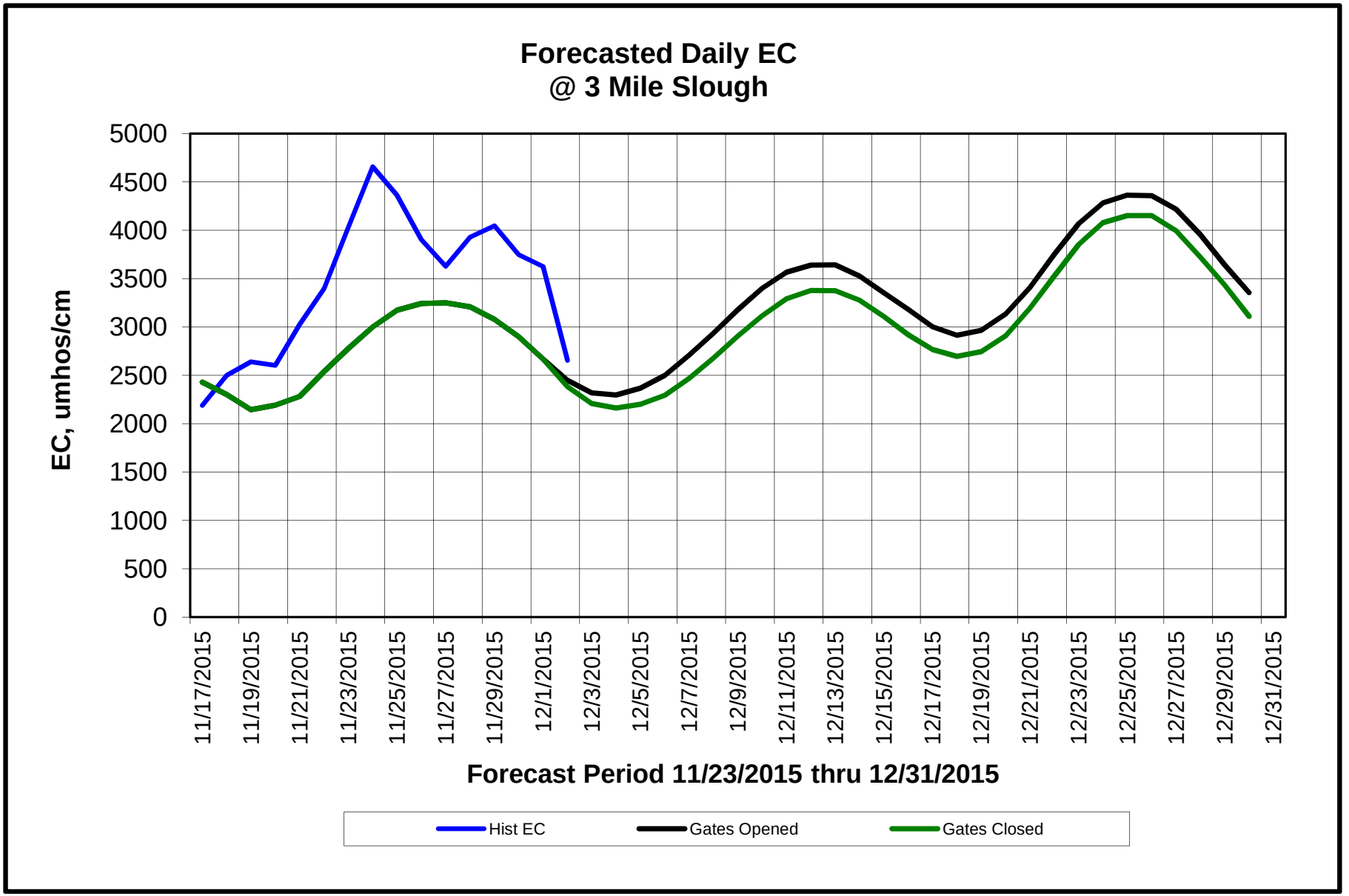
Hist EC
Gates Opened
Gates Closed


Forecasted Daily EC
@ 3 Mile Slough
EC, umhos/cm
5000
4500
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11/19/2015
11/21/2015
11/23/2015
11/25/2015
11/27/2015
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Forecast Period 11/23/2015 thru 12/31/2015
Hist EC
Gates Opened
Gates Closed

Methods and Metrics

A conceptual model of impacts from drought management actions were presented in the Biological Review for the February-March 2015 Project Description (Figure 1, Reclamation 2015). The potential effects of the Proposed Action are considered in the context of the DCC Gate Operation conceptual model. Additionally, the NMFS Biological Opinion (NMFS 2009) was reviewed regarding biological linkage to the Proposed Action. Due to the rapid nature of this review, a limited number of metrics were assessed. These included a qualitative assessment of DCC route entrainment risk and facility entrainment for each species during the Proposed Action. The National Weather Service's Climate Prediction Center's 8-14 day forecasts for temperature and precipitation for various outlook periods were considered.

MANAGEMENT LINKAGE ASSESSMENT	DCC Gate Operation (Interior delta salinity)	Outflow (NDOI) (Change in Location)	Inflow (Storage impacted by DOP, seasonal depletions)	OMR (change in BiOp criteria)	Exports (E/I calculation)
	• Route entrainment	• Tidal influence • Migration rate • Rearing period • Survival rate	• Migration rate • Rearing period • Survival rate	• Route entrainment • Migration rate • Rearing period • Survival rate	• Route entrainment • Migration rate • Facility survival
	• DJFMP periodicity	• Changes in DSM2 velocity characteristics	• Changes in DSM2 velocity characteristics	• SD/CD DJFMP presence/absence	• SD/CD DJFMP presence/absence
	• Changes in DSM2 proportion daily flow	• Changes in DSM2 proportion daily flow	• Changes in DSM2 proportion daily flow	• Facility salvage (Density, total, timing)	• Facility salvage (Density,total, timing)
	• Delta survival information	• Delta survival information	• Delta survival information	• Delta survival information	• Delta survival information

Figure 1. Conceptual model of drought contingency plan elements and their biological linkages to salmonids and assessment information available for evaluation.

Status of the Species and Effects of Proposed Action

Status of Winter Run Chinook Salmon

The current estimate of the winter-run sized juvenile population passing the Red Bluff Diversion Dam is substantially lower than in previous years. The estimated passage of brood year 2015 (BY 2015) winter-run as of November 18, 2015, was 252,675 fish (90% lower and upper confidence intervals are 200,758 and 304,593 fish). The estimated passage of winter-run juveniles for the same date in 2014 and 2013 was 354,876, and 1,249,821, respectively. Monitoring data suggest that the majority of natural-origin juvenile winter-run Chinook Salmon are currently residing in the middle Sacramento River, upstream of Knights Landing[1]. Few winter-run-size Chinook juveniles have been observed in the Delta, Knights Landing, or Tisdale monitoring this season; and none have been observed at these stations in over two weeks (Table 1). Any winter-run Chinook Salmon in the North Delta are likely rearing, not migrating, due to seasonality, temperature, and physiology. As of December 1, 2015, no winter-run-sized Chinook have been observed at the CVP or SWP Delta export facilities. The hatchery production of winter-run Chinook salmon will not be released from the hatchery until after December 2015.

Table 1. Summary of winter-run-sized Chinook salmon (WR) catch in Delta, Knights Landing, and Tisdale monitoring

Monitoring location & gear	Data through:	Seasonal total WR catch	Date of most recent WR catch
Tisdale rotary screw trap	11/28/15	8	10/12/15
Knights Landing rotary screw trap	11/29/15	2	10/17/15
Sacramento Trawl	11/30/15	1	11/6/15
Delta beach seines (all regions)	11/28/15	2	10/29/15
Chipps Island Trawl	11/28/15	0	NA

Effects of Proposed Action on Winter-Run Chinook Salmon

The predicted distribution of winter-run Chinook Salmon during the Proposed Action and a summary of potential risks are presented in Table 2. Given the rearing physiology of the fish, hydrometeorological changes towards increased probability of above average precipitation, and continuation of increased probability of above average temperature patterns (Figure 1 and 2) there is a low-to-moderate risk that more natural-origin juvenile winter-run Chinook salmon will migrate into the Delta, passing the DCC, during the first two weeks of December.

[1] The most recent DOSS estimate (from the 11/24/15 DOSS meeting) is that <5% of winter-run Chinook are in the Delta. Notes posted at:
http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2016.html

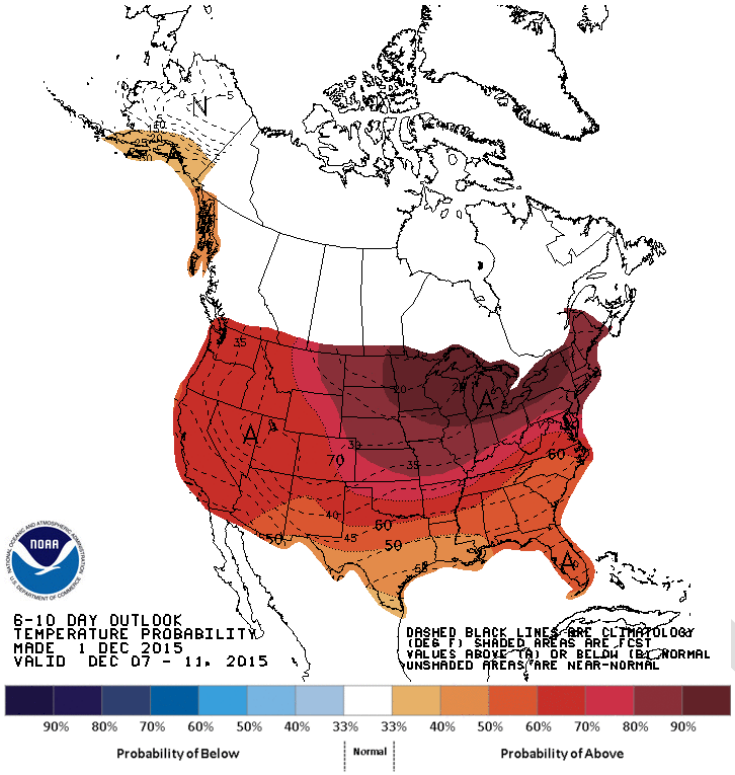

Figure 1. 6-10 day temperature outlook from Climate Prediction Center.

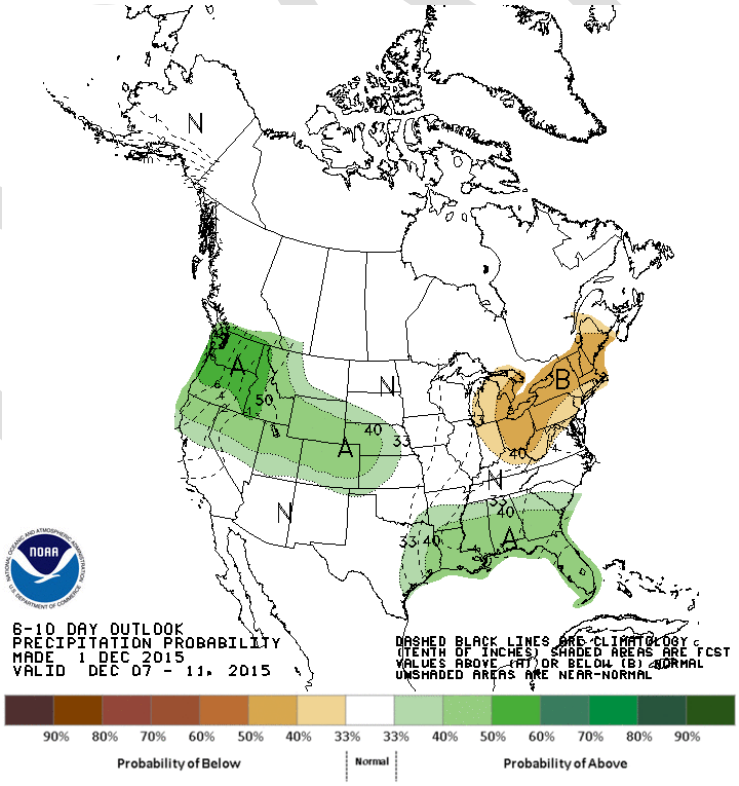

Figure 2. 6-10 day precipitation outlook from Climate Prediction Center.

Delta Cross Channel Gates

Under the Proposed Action, modified DCC gates operations will occur based on water quality and salmonid presence[2]. As of December 1, 2015, it is believed that open DCC gates have a low potential for entraining a substantial proportion of the juvenile winter-run Chinook Salmon population through this junction and into the Central Delta. This is because a majority of the natural (>95%) juvenile winter-run population is believed to be rearing upstream in the middle Sacramento River. The remaining fraction of the natural winter-run juvenile population may be present in the lower Sacramento River, and will be vulnerable to entrainment into an open DCC gate configuration as they reside in this region and move downriver past the DCC gate location. If catch of winter-run juveniles continues to be low, risks of entrainment into the Central and South Delta of DCC opening during the Proposed Action will remain low. If the catch of juvenile winter-run Chinook salmon increases, risks of the proposed action will also increase. Our certainty in the risk of Central Delta entrainment is moderate because juvenile winter-run Chinook have been observed in the North Delta.

Table 2. Current distribution of winter-run Chinook salmon and potential risks of the Proposed Action by life-stage and location.

Winter-run Chinook Salmon Life Stage	Exposed to Proposed Action?	Change in Risk of Central Delta/South Delta Entrainment	Change in Risk of CVP/SWP Facility Entrainment	Certainty
Eggs	This life stage is not present in the Delta.			
Natural-origin Juveniles	Wild juvenile winter-run Chinook salmon are distributed broadly from the Sacramento River into the Northern Delta			
>95% Sacramento River upstream of Knights Landing	No	NA	NA	High
<5% Delta	Yes	Increased	No Change	Moderate/ Low
0% passed Chipps Island	No	NA	NA	High
Hatchery Juveniles	Hatchery winter-run Chinook will not yet have been released from the hatchery during December			
Adults	This life stage is not present in the Delta during early December.			

Delta rearing and outmigration of natural winter-run juveniles past Chipps Island is expected to not be largely complete until mid-April, and the Proposed Action's modification of the DCC gate operations will affect winter-run passing the DCC only for a short duration of their Delta occupancy. Survival of migrating and rearing salmonids in the Interior and Central Delta regions are consistently lower than through the Lower Sacramento River or North Delta. As part of the Proposed Action, when DCC gate conditions are open the combined CVP/SWP exports will be limited to 1,100 cfs, which limits reverse flows in the South Delta. The combination of low

[2] The fish catch triggers in the proposed action, as in Action IV.1.2, are based on "older juveniles". Juvenile Chinook salmon at or above the minimum winter-run size based on the length-at-date model used at a particular sampling location, and below the maximum size considered by the length-at-date model, on a given sampling date, are considered "older juveniles".

outflow, low exports, and open DCC gate creates a hydrodynamic condition dominated by tidal influence, which is expected to result in negligible changes in facility entrainment for particles in the Sacramento and Central/South Delta regions, based on enhanced and neutrally buoyant particle tracking model results (NMFS 2015). Thus, the increase in the likelihood of entrainment into the Central and South Delta is unlikely to result in a change to facility loss of winter-run. Our certainty in the risk of South Delta and CVP/SWP facility entrainment is low because the movement of juvenile Chinook from the Central and into the South Delta and furthermore towards the CVP/SWP facilities is poorly understood.

Summary of Effects on Winter-run Chinook Salmon

Under the currently estimated distribution of winter-run Chinook Salmon, the effects of the Proposed Action are expected to expose the winter-run Chinook Salmon population to negligible additional risks. The Proposed Action includes increased intensity of North Delta monitoring to integrate information indicative of movement of juvenile winter-run Chinook into the North Delta and past the DCC into a decision process for DCC gate operations. If monitoring catch of winter-run Chinook juveniles remains low, route entrainment risks of DCC opening during the first two weeks of December 2015 will remain very low. If monitoring data indicate increased movement of juvenile winter-run Chinook into the Delta and past the DCC, increased risks to the population will be reduced through the Proposed Action's closure of the DCC gates in response to a Knights Landing Catch Index (KLCI) or Sacramento Catch Index (SCI) that exceeds 3 fish per day.

Status of Spring-Run Chinook Salmon

Monitoring data suggest that the majority of natural-origin juvenile (young-of-year and yearling) spring-run Chinook Salmon are currently residing in tributaries upstream of Knights Landing & Tisdale[3]. Direct observations of yearling spring-run sized fish in monitoring efforts are difficult due to the ability of these older fish to avoid sampling gear. Yearling spring-run juveniles often emigrate in the fall and the First Alert of RPA IV.1.1, triggered by increased tributary flows and signifying tributary spring-run Chinook are preparing to emigrate, has been exceeded during November 2015 (Figure 3 and 4). No yearling spring-run-size Chinook juveniles have been observed in Delta, Knights Landing, or Tisdale monitoring this season (Table 3), and it is believed yearling spring-run are in the Sacramento River prepared to emigrate through the Delta. As of December 1, 2015, no spring-run-sized Chinook has been observed at the CVP or SWP Delta export facilities. The hatchery production of spring-run Chinook salmon will not be released from the hatchery until after December 2015.

Effects of Proposed Action on Spring-run Chinook Salmon

The predicted distribution of spring-run Chinook Salmon during the Proposed Action and a summary of potential risks is presented in Table 4. Given the physiology of emigrating yearling juvenile spring-run Chinook salmon and hydrometeorological changes towards increased probability of above average precipitation, and continuation of increased probability of above average temperature patterns (Figure 1 and 2), there is a low-to-moderate risk that natural-origin

[3] The most recent DOSS estimate (from the 11/24/15 DOSS meeting) is that "young-of-year spring-run Chinook are assumed still scarce; some young-of-year spring-run Chinook juveniles have likely not emerged yet from redds." Notes posted at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2016.html

juvenile spring-run Chinook salmon will migrate into the Delta, passing the DCC, during the first two weeks of December.

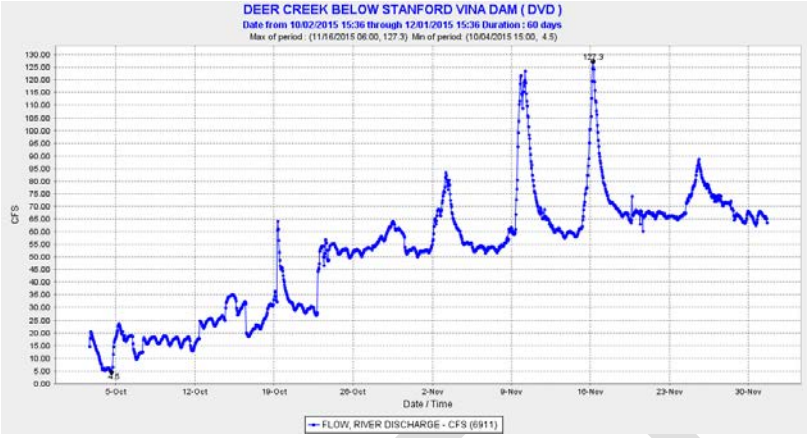

Figure 3. Deer Creek daily flow data for WY 2016. Downloaded from CDEC on December 1, 2015.

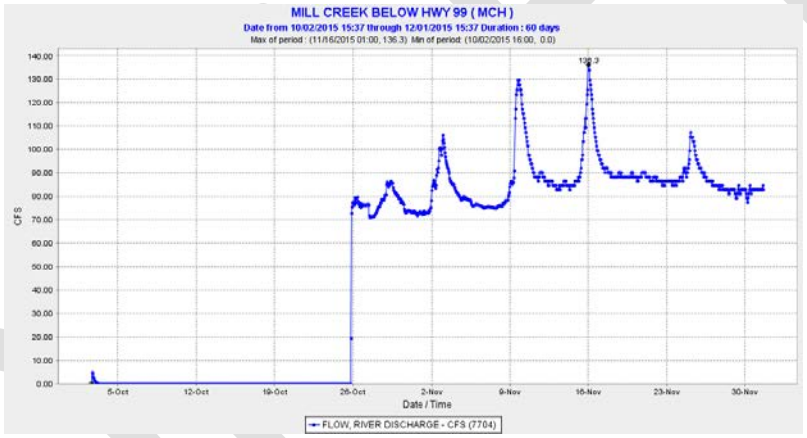

Figure 4. Mill Creek daily flow data for WY 2016. Downloaded from CDEC on December 1, 2015.

Table 3. Summary of spring-run-sized Chinook salmon catch in Delta, Knights Landing, and Tisdale monitoring.

Monitoring location & gear	Data through:	Seasonal total SR catch	Date of most recent SR catch
Tisdale rotary screw trap	11/28/15	0	N/A
Knights Landing rotary screw trap	11/29/15	0	N/A
Sacramento Trawl	11/30/15	0	N/A
Delta beach seines (all regions)	11/24/15	0	N/A
Chipps Island Trawl	11/24/15	0	N/A

Delta Cross Channel Gates

Under the Proposed Action, modified DCC gates operations may occur based on water quality and salmonid presence. Effects to spring-run Chinook Salmon are generally similar to those discussed above for winter-run Chinook; whereby no recent catch of spring-run juveniles in the

Delta, Knights Landing, or Tisdale monitoring suggests a low exposure to the risks of entrainment into the Central or South Delta associated with an open DCC. If catch of spring-run Chinook juveniles continues to be zero or low, risks of DCC opening during the Proposed Action will remain low. If catches of spring-run Chinook juveniles increases, risks of the Proposed Action will also increase. As part of the Proposed Action, when the DCC gates are open the combined CVP/SWP exports will be limited to 1,100 cfs, which limits reverse flows in the South Delta. Due to the low outflow and export conditions, tidal conditions dominate all regions of the Delta, and the increase in the likelihood of entrainment into the Central Delta is unlikely to result in a change to South Delta entrainment or facility loss of spring-run. Although our certainty in the risk of Central Delta entrainment is moderate, our certainty in the risk of South Delta entrainment is low because the movement of juvenile yearling spring-run Chinook from the Central and into the South Delta is poorly understood.

Table 4. Current distribution of spring-run Chinook salmon and potential risks of the Proposed Action by life-stage and location.

Spring-run Chinook Salmon Life Stage	Exposed to Proposed Action?	Change in Risk of Central Delta/South Delta Entrainment	Change in Risk of CVP/SWP Facility Entrainment	Certainty
Eggs	This life stage is not present in the Delta.			
Natural-origin Juveniles	Wild juvenile spring-run Chinook salmon are distributed broadly through the upper and middle Sacramento River and tributaries			
>99% in Sacramento River and tributaries upstream of Knights Landing	No	NA	NA	High
<1% Delta	Yes	Increased	No Change	Moderate/ Low
0% passed Chipps Island	No	NA	NA	High
Hatchery Juveniles	Hatchery spring-run Chinook will not yet have been released from the hatchery during December			
Adults	This life stage is not present in the Delta in early December.			

Summary of Effects on Spring-run Chinook Salmon

Under the current estimated distribution of spring-run Chinook salmon, the effects of the Proposed Action are expected to expose spring-run Chinook salmon to negligible additional risks. The Proposed Action includes increased intensity of North Delta monitoring to integrate information indicative of movement of juvenile spring-run Chinook into the North Delta and past the DCC into a decision process for DCC gate operations. If monitoring catch of spring-run Chinook juveniles remains low, route entrainment risks of DCC opening during the first two weeks of December 2015 will remain very low. If monitoring data indicate movement of yearling spring-run Chinook into the Delta and past the DCC, increased risks to the population will be reduced through the Proposed Action's closure of the DCC gates in response to a Knights Landing Catch Index (KLCI) or Sacramento Catch Index (SCI) that exceeds 3 fish per day.

Status of Central Valley Steelhead

Monitoring data suggest that the majority of natural-origin juvenile steelhead are currently residing in the Sacramento River and tributaries upstream of Knights Landing & Tisdale. No steelhead juveniles have been observed in Delta, Knights Landing, or Tisdale monitoring this season (Table 5). As of December 1, 2015, no steelhead have been observed at the CVP or SWP Delta export facilities. The hatchery production of steelhead will not be released from the hatchery until after December 2015.

Table 5. Summary of steelhead (SH) catch in Delta, Knights Landing, and Tisdale monitoring

Monitoring location & gear	Data through:	Seasonal total SH catch	Date of most recent SH catch
Tisdale rotary screw trap	11/28/15	0	N/A
Knights Landing rotary screw trap	11/29/15	0	N/A
Sacramento Trawl	11/30/15	0	N/A
Delta beach seines (all regions)	11/24/15	0	N/A
Chipps Island Trawl	11/24/15	0	N/A

Effects of Proposed Action on Central Valley Steelhead

The predicted distribution of steelhead during the Proposed Action and a summary of potential risks is presented in Table 6. Given the physiology of the fish and hydrometeorological changes towards increased probability of above average precipitation and continuation of increased probability of above average temperature patterns (Figure 1 and 2) there is a low-to-moderate risk that steelhead will migrate into the Delta, passing the DCC, during the first two weeks of December.

Table 6. Current distribution of steelhead and potential effects of action by life-stage and location.

Steelhead Life Stage	Exposed to Proposed Action?	Change in Risk of Central Delta/South Delta Entrainment	Change in Risk of CVP/SWP Facility Entrainment	Change in Risk of Straying	Certainty
Eggs	This life stage is not present in the Delta.				
Natural-origin Juveniles	Wild juvenile steelhead are distributed broadly through the upper and middle Sacramento River and tributaries				
>99% in Sacramento River and tributaries upstream of Knights Landing and Vernalis	No	NA	NA	NA	High
<1% Delta	Yes	Increased	NA	NA	Moderate/ Low
0% passed	No	NA	NA	NA	High

Chipps Island					
Hatchery Juveniles	Hatchery steelhead will not yet have been released from the hatchery during December				
Adults	Yes	NA	NA	Increased	Moderate

Under the Proposed Action, modified DCC gates operations may occur based on water quality and fish presence as described in the Proposed Action. Effects to steelhead are generally similar to those discussed above for winter-run Chinook, whereby no recent catch of steelhead juveniles in the Delta, Knights Landing, or Tisdale monitoring suggests a low exposure to risks of entrainment into the Central or South Delta associated with an open DCC. If catch of steelhead juveniles continues to be zero or low, risks of DCC opening during the Proposed Action will remain low. If the catch of juvenile steelhead increases, risks of the Proposed Action will also increase. Although our certainty in the risk of Central Delta entrainment is moderate, our certainty in the risk of South Delta entrainment is low because the movement of juvenile yearling spring-run Chinook from the Central and into the South Delta is poorly understood.

When the DCC gates are open, Sacramento River water flows through the DCC and into the Mokelumne River system. This may result in some level of straying of upstream migrating adult Sacramento-River-origin steelhead into the Mokelumne River system, which may delay these adults on their upstream spawning migration. Additionally, Mokelumne River steelhead may stray into the Sacrmento River when the DCC gates are open. Straying adult steelhead move through the open DCC gates and continue their upstream movements may experience a delay in reaching the spawning grounds and an increase in energy expenditure, which is hypothesized to result in lower survival of these adults. Our certainty in the risks associated with straying are moderate because the effect of straying Mokelumne River adult salmonids is a known issue and likely to occur.

Summary of Effects on Steelhead

Under the current estimated distribution of steelhead, the effects of the Proposed Action are expected to be negligible since very few individuals will be exposed to open DCC gates. The Proposed Action includes increased intensity of North Delta monitoring to provide information indicative of movement of steelhead into the North Delta and past the DCC. If monitoring catch of steelhead juveniles remains low, route entrainment risks of DCC opening during the first two weeks of December 2015 will remain very low. If monitoring data indicate movement of juvenile steelhead into the Delta and past the DCC, risks will increase, since steelhead are not included in the "older juvenile" basis for the fish catch index triggers in the Proposed Action.

Status of Green Sturgeon

Information on green sturgeon is extremely limited. Subadult and telemetered adult green sturgeon are present in the Sacramento River and Delta. Juveniles spawned in the upper Sacramento River are likely broadly distributed in the Sacramento River and possibly into the Delta. Between April and July 2015, 491 green sturgeon larvae were captured in Red Bluff Diversion Dam fish monitoring, while approximately 15 additional juveniles (224-353mm) have been captured between August and November (B. Poytress, USFWS, pers. comm.). Physiology of juvenile green sturgeon requires them to remain in fresh water during the first nine months of life, and therefore juveniles may be present in riverine and tidal habitats.

Effects of Proposed Action on Green sturgeon

The predicted distribution of green sturgeon during the Proposed Action and a summary of potential risks are presented in Table 7. Given the physiology of the fish and hydrometeorological changes towards increased probability of above average precipitation, and continuation of increased probability of above average temperature patterns (Figure 1 and 2), there is a low-to-moderate risk that green sturgeon will migrate into the Delta, passing the DCC, during the first two weeks of December.

Delta Cross Channel Gates

Under the Proposed Action, modified DCC gates operations will occur based on water quality and salmonid presence. As of December 1, 2015, it is believed that open DCC gates have a low potential for entraining a substantial proportion of the juvenile green sturgeon through this junction and into the Central Delta. Our certainty in the risk of Central Delta entrainment is low because information about the distribution and migratory and rearing behavior of juvenile green sturgeon is low. Adult green sturgeon have an increased risk of entrainment through open DCC gates and telemetered individuals are known to enter the Central and South Delta during the summer via the DCC.

Table 7. Current distribution of green sturgeon and potential effects of action by life-stage and location.

Green Sturgeon Life Stage	Exposed to Proposed Action?	Change in Risk of Central Delta/South Delta Entrainment	Change in Risk of CVP/SWP Facility Entrainment	Certainty
Eggs	This life stage is not present in the Delta.			
Natural-origin Juveniles (>2 months old and ≤3 years old)	Juvenile green sturgeon are distributed broadly from the Sacramento River possibly into the Delta.			
Sacramento River upstream of Knights Landing	No	NA	NA	High
Delta	Yes	Increased	No Change	Low
Adults	Yes	No change	No Change	High

The Proposed Action will have a similar, but lesser, potential effect on green sturgeon, than it potentially may have on salmonids in the Delta. To review, opening the DCC gates provides an alternate outmigration route through the Interior Delta for juvenile and adult green sturgeon that may pass this location during December. The possible effect is less since green sturgeon utilize Sacramento and interior migratory routes through the Delta often foraging and migrating during the winter in the Western, Central, and South Delta, regardless of the position of the DCC gates (Miller 2015). Thus, while the likelihood of entrainment into the Central Delta during December may increase, these routes are not clearly less suitable or expose green sturgeon to greater risks at the 1,100 cfs export rate described in the Proposed Action. For adults, our certainty in the risk of DCC route entrainment, South Delta entrainment, and CVP/SWP facility entrainment is high. For juveniles, our certainty in the risk of entrainment through the DCC gates, into the South Delta, and at the CVP/SWP facilities is low because the rearing and movement of juvenile green sturgeon in the Central and into the South Delta is poorly understood.

Summary of Effects on Green Sturgeon

Under the current estimated distribution of green sturgeon, the effects of the Proposed Action are expected to be negligible. This is due to the Proposed Action's duration and magnitude being limited compared to the seasonal occupancy of adult and juvenile green sturgeon in the Delta during fall and winter. Also, the Central and Interior regions of the Delta that adult and juvenile green sturgeon may use through open DCC gates currently are used by the species as alternative migration corridors and rearing areas.

References

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