

San Joaquin River Restoration Program
Restoration Administrator's 2020 Report to Settling Parties

For
US Bureau of Reclamation and
Settling Parties

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1. Introduction

This Restoration Administrator's Report on the status of the San Joaquin River Restoration Program (Program) is prepared in accordance with the Stipulation of Settlement filed September 13, 2006 in the case of *NRDC, et al., v. Kirk Rodgers, et al.* Pursuant to the Stipulation of Settlement (Settlement), the annual report shall include a summary of settlement implementation activities of the previous year, findings of research and data collection, any additional recommended measures to achieve the Restoration Goal, a summary of progress and impediments in meeting targets established pursuant to Settlement Paragraph 11 (Paragraph 11), and a summary of expenditures from the Restoration Administrator (RA) Account.

2. Overview of 2020 Hydrology

Following the 2019 wet water year runoff of 2,735 thousand acre-ft (TAF), the unimpaired San Joaquin River (SJR) runoff in water year 2020 was 902 TAF or just over 50% of the long-term average. The water year began with near-average precipitation through the end of December, and the initial Restoration Allocation issued in mid-January was for a Dry water year type. An extended very dry period between mid-January and mid-March decreased the allocation to Critical-High. Storms in the mid-March to mid-April period boosted the allocation to a Dry year for the remainder of the water year. In order to retain year-round connectivity through all reaches, the RA recommendation in February included the use of Buffer Flows for the first time, plus called on long-term URF exchanges. The increased April Allocation and the corresponding Flow Recommendation eliminated the need for Buffer Flows and **return of** long-term URF exchanges. The final Allocation of 202,197 acre-feet (at Gravelly Ford) resulted in a flow schedule that maintained connectivity through all Restoration reaches and resulted in 63,502 acre-feet of Unreleased Restoration Flows (URFs). The generation of URF's was largely due to the operations under low flow Critical High conditions for a crucial period from the end of February until mid-April. The Fall pulse volume was moved from November 2020 to February 2021, but due to very dry conditions in early 2021, that block was exchanged so that it could be released in March 2021, the beginning of the 2021 Restoration Year.

3. Highlights of Progress and Key Findings, 2020

The Program achieved several important milestones in 2020, a few of the most important of which are highlighted here; additional Program milestones, challenges and accomplishments are described below in Sections 3 and 4:

- As of March 1, 2021, the Program had maintained continuous flows throughout the entirety of the Restoration Area (a length of over 149 river miles between Friant Dam and the confluence of the Merced River) for nearly 1600 days (mid-October 2016 through February 2021). This continuum of river connectivity has not been experienced in the SJR for 75 years.
- In 2020, a total of 57 returning adult spring-run Chinook were trapped in fyke nets in the lower Restoration Area and released into Reach 1. 50 of these fish were confirmed as releases from the Program that had successfully returned to the Restoration Area, the third year (following 2017 and 2019) that it has been documented that spring-run Chinook salmon have completed their life cycle of emigrating out to the Pacific Ocean as juveniles and returning to the SJR as adults.
- Juvenile and adult spring run Chinook salmon from the Interim Salmon Conservation and Research Facility (ISCARF) were released in the Restoration Area in 2020 (see Section 4 and 5 for additional details). Many of the juvenile fish successfully migrated out to and through the San Joaquin Delta, as evidenced by capture of some of the released fish at various monitoring locations in the Delta. Many of the adults successfully spawned in the river, as evidenced by viable redds (salmon egg nests) in the river and juvenile salmon production measured by the rotary screw traps (RSTs).
- The initial 2020 Restoration Allocation was for the Settlement-defined Dry water year type (Dry year); however, a subsequent allocation was for Critical-High and SJR Restoration flows were reduced accordingly. The Allocation eventually returned to a Dry year in late March, but not until mid-April was there sufficient confidence in the forecast remaining in 'Dry' conditions to return to increased flows in the SJR. The final Allocation was a Dry water year type, with an allocation of 202,197 acre-feet (measured at Gravelly Ford). Unreleased Restoration Flows (URF's) of 63,502 (gross, as measured at Millerton Reservoir) acre-feet were sold back or exchanged to the Friant Contractors, reflecting both the substantial flow constraints that constrain river releases and the relatively late Dry year allocation (after the point when water may have otherwise been released to facilitate juvenile salmon outmigration).
- In 2020, the Program continued to make progress on river operations and operational rules. Precise and accurate operations of the San Joaquin River downstream of Millerton Reservoir are complex, due to relatively small watershed storage capacity, the length of the Restoration area, substantial uncontrolled seepage losses, and multi-party operations.
 - The San Joaquin River has a relatively small amount of terminal reservoir storage (520.5 TAF in Millerton Reservoir) in comparison to the annual average runoff of about 1.75 MAF, which means that carryover capacity (the ability to store water across different water

year types) is relatively minimal¹. The 610 TAF of upstream storage capacity in SCE and PGE reservoirs normally helps to control and regulate watershed runoff, but the Creek Fire in September 2020 hampered the release of upstream storage and resulted in unusually low Millerton Reservoir levels in the Fall.

- Restoration flows are measured at Gravelly Ford, 37 miles downstream from their release at Friant Dam. This 37-mile “Reach 1” of the Restoration Area has many surface diversions and nearby groundwater pumps and at times the losses in this reach in 2020 were considerably higher than what was assumed in Exhibit B of the Settlement.
- Reach 2 has fewer surface diversions but very high seepage losses, and the Chowchilla and East Side Bypass floodway systems bifurcate Reach 2 and operate during flood control years.
- Mendota and Sack dams are major irrigation diversions on the San Joaquin River at the upper and lower end of “Reach 3” of the Restoration Area. Delta water is imported (via the Delta-Mendota Canal) and released from Mendota Dam to supply Sack Dam and Arroyo Canal. During the summer months, Delta flows are many times the volume of Restoration Flows, and closer operational coordination is necessary to allocate water appropriately.
- Numerous diverters smaller operate on the river, and high seepage and infiltration losses reduce flows in the river through Reach 4 of the Restoration Area.

In total, these operational challenges make it exceedingly difficult to monitor and operate the river to meet the Restoration Flow targets and ensure consistent river connectivity.

To address these challenges, the Program has continued to work through operational coordination, and operational and accounting rules development. In 2020, hydrologists from the Program and Reclamation’s South-Central California Area Office (SCCAO) continued to refine their hydrologic forecasting and data analysis, resulting in improved coordination between Program water delivery needs and SCCAO water delivery operations. The Program, assisted by contributions from Friant Contractors work group and TAC members, led further refinements in the Restoration Flow Guidelines (RFG’s, Final RFG version 2.1 was issued in 2020), the rules for allocation, release, operations, and accounting for Restoration Flows. As noted above, the Program managed the sale or exchange of 63,502 (gross) acre-feet of URF’s in 2020. In total, these monitoring, operations and release rules improvements will help to ensure stable, consistent Restoration Flow releases pursuant to approved Flow Recommendations.

- Full flow release summaries are included in Appendix B.
- Program activities and progress was severely constrained in 2020 due to the COVID-19 pandemic. Reclamation, the Program, and the Implementing Agencies all implemented numerous measures to ensure employee safety while attempting to maintain progress on various Program objectives. However, numerous activities (for example, fisheries field work) that requires the in-person participation of several staff had to be rescheduled or cancelled for safety reasons. Overall, the

¹ For comparison, Millerton Lake is 520,500 acre-feet in capacity, whereas New Melones (on the Stanislaus) is 2,400,000 acre-feet with less than 2/3 the runoff of the San Joaquin River above Millerton Reservoir, and New Don Pedro (on the Tuolumne) is 2,030,000 acre-feet with similar volume of watershed runoff as the SJR.

Program was able to continue to move several projects forward despite the challenges inherent to remote meetings and working off-site.

4. Challenges and Recommendations-2020

1. COVID-19

The COVID-19 pandemic was a major challenge to the continued progress of the Restoration Program. Although Reclamation, the Program office and the Implementing Agencies adapted as well as possible and were able to maintain forward momentum on key projects, there were numerous constraints to progress. For example:

- Program staff and many Implementing Agency staff worked from home for most of 2020. As of March 2021, it is not clear when office buildings will re-open for normal operations.
- Program and implementing agency staff typically interact with many stakeholders every month, often via in-person meetings. Inability to meet in person definitely slowed design, permitting, land acquisition, and field reconnaissance activities.
- Much of the field work conducted by the Program or Implementing Agencies requires the participation of multiple staff (fish tagging and release, monitoring activities, etc.). While some field activities were able to be continued, many tasks were slowed substantially by safety protocols and other tasks had to be deferred or cancelled.

2. Creek Fire

The Creek Fire started the evening of September 04, 2020 in the Big Creek drainage burning an unprecedented 379,895 acres before being contained on December 24, 2020, making it the largest single source wildfire in California history. The fire burned more than 40% of the upper San Joaquin River watershed and destroyed various flow measurement facilities. The impact on the fire on water quality for the SJR, and for runoff forecasting, will be monitored and assessed by the Program through 2021. More information on the Creek Fire is here:

<https://www.arcgis.com/apps/Cascade/index.html?appid=be2e8afbdddad40e3a77c6bd6d99f3a03>

3. Flow-Related Challenges

a. *Flood Flows – Restoration Flows*

One flow management issue that arose in 2019 is the protection of Restoration Flows during flood control releases to the river. Flood control releases are required to manage reservoir elevation and storage in periods of high precipitation and runoff to avoid uncontrolled spills from the reservoir. Flood control releases with appropriate timing and volume can also meet the needs of Restoration Flow releases, while minimizing impacts to Friant Contractor water supply. As such, the Settlement recognizes in Paragraph 13j (vi) the necessity of “determining the extent to which flood releases meet the Restoration flow hydrographs..... “, and will be addressed in future versions of the Restoration

Flow Guidelines (RFG). For that dual purpose of the flows to occur, however, they must continue down the river through the Restoration Area. These flows, likely a portion of flood control release flows designated as Restoration Flows, should be protected under Section 1707 of the State Water Code as dedicated to preserving or enhancing fisheries resources and therefore cannot be diverted from the SJR or its flood bypass system. Only flows superfluous to the approved Restoration Flow Recommendation would be available for diversion. However, on more than one occasion in previous years of flood control releases (2011, 2017, and 2019), approved Restoration Flows did *not* remain in the river and were instead diverted. In addition, third parties demanded the diversions based on claims of “impacts” from the Restoration Program.

Reclamation began working towards resolution of this issue in 2020, but as of March 15, 2021 a proposed resolution has not been shared with the Settling Parties or other stakeholders in the Restoration Area.

Recommendation: Reclamation should strive to resolve the “flood flows vs Restoration Flows” issue as soon as feasible, but certainly prior to the 2022 water year in case it is a wet year with flood control releases.

b. General Operations Issues

The Restoration area encompasses nearly 150 river miles, from Friant Dam to the confluence with the Merced River. Ensuring smooth and consistent Restoration Flows throughout the Restoration area on a continuous basis involves not just diligent Reclamation operations, but also coordination with numerous stakeholders and operators throughout the Restoration area. Although the accuracy of release and consistency of flow has improved over the past few years of continuous Restoration Flow operations, there is additional work to do. As mentioned above, the Program has maintained continuous river connectivity throughout the Restoration area for over four years; however, at times maintaining those continuous flows has involved fairly significant efforts (measured in hundreds of person-hours) by Program and Reclamation operations staff.

As discussed in the 2019 Annual Report, the Program and SCCAO have worked diligently to better coordinate forecasting, flow and operational issues that impact the Restoration Flows. Many concerns and issues have been identified, diagnosed, and resolved, and particular credit is due to Program and SCCAO staff who have assisted in making Restoration Flows a consistent reality in the San Joaquin River.

In 2020, certain key operational issues were identified and discussed within the Program and SCCAO, and with stakeholders including the Department of Water Resources (DWR), U.S. Geologic Survey (USGS), Central California Irrigation District (CCID) and Henry Miller Reclamation District No. 2131 (HMRD). Current high priority operations issues include:

- Excess losses (much greater than anticipated in Exhibit B) in several reaches of the river, most notably Reach 1 and Reach 4 (Exhibit B assumed the use of the natural river channel in Reach 4B, not the use of the East Side Bypass, thus high loss rates were not anticipated).
- Gauges that do not have, or cannot maintain, the consistent measurement accuracy necessary to support river operations and ensure that flow targets are being met in real time.

- Flow changes by non-Program operations or diverters to meet demands or targets that cause substantial fluctuations in Restoration Flows, notably observed at Gravelly Ford and Sack Dam.
- Substantial unexplained swings in river flows, potentially from changes in seepage rates or from unauthorized or unreported injections, withdrawals, or transfers.

The Program has made and continues to make progress on addressing operational issues such as flow changes, particularly for the GRF and SDP compliance points. However, resolving losses and monitoring issues will likely be more challenging, as most are not directly under the control of Reclamation and will involve working with landowners, diverters, and other river operators to solve.

Recommendation: The RA and TAC will assist the Program Office and SCCAO, to focus on improving monitoring and protection of Restoration Flows down the river and resolution of operational issues during 2020 and 2021 (see RA and TAC Priorities and work with the Water Rules Group later in this Report).

c. Conveyance Capacity status

Conveyance capacity for Restoration Flows remains largely constrained by groundwater levels and the need to avoid impacts to adjacent landowners due to real or perceived seepage associated with Restoration Flows. Although the Program has undertaken extensive efforts to model and monitor groundwater levels to assess seepage impacts, the shallow (within 20 feet of surface) groundwater interactions are complex and influenced by multiple factors. Low quality or inconsistent data from monitoring wells, variation in well response to river flow changes versus other influences, and different irrigation or other operating conditions are all challenges in assessing river-derived versus other factor groundwater impacts.

As of early 2021, channel capacities in Reach 3 are limited to about 800 cfs (subject to flow bench evaluation), inclusive of both Restoration Flows and deliveries to Arroyo Canal. Channel capacities in Reach 4A are limited to about 290 cfs.

Resolution of these immediate constraints is not anticipated prior to the 2023 Restoration year. Resolution of all seepage limitations to allow release of Restoration Flows up to the full settlement amounts is years in the future.

4. Stakeholder Challenges

As described in previous Annual Reports, there are many, many stakeholders (landowners, operators who utilize the river for water conveyance, nearby entities potentially impacted by Restoration Program operations such as adjacent wildlife refuges, or facilities such as County road crossings of the River or flood conveyance system facilities) with an interest in or potentially impacted by the SJRRP. During 2020 as in most previous years, numerous stakeholders expressed reservations, concerns, or protests about SJRRP activities. Typically, these reservations, concerns or protests are presented in a biased fashion (from the perspective of the aggrieved stakeholder, after all). The SJRRP or Reclamation management are

drawn in to resolving the issue at hand, which results in a drain on resources that could otherwise be used to further the SJRRP.

It is anticipated that stakeholders will continue to express reservations, concerns, or protests for the duration of the SJRRP implementation period.

5. Construction Project Challenges

As reported in 2019, the Program continues to face several challenges related to the design and construction of various projects. The Program continues to work through these challenges; however, further delays in design and construction, additional cost, or both appears inevitable. Reclamation has taken several concrete steps in 2020 to reboot these design tasks, or has deployed additional resources to improve progress:

- Reclamation has added additional design staff, and now has design teams working on the Arroyo Canal/Sack Dam complex and the Reach 2B complex separately. In addition, Reclamation is in advanced discussion with the Department of Water Resources (DWR) to have DWR undertake certain levee design elements for the Reach 2B/Compact Bypass project.
- The design of improvements at Sack Dam and the Arroyo Canal intake had been stalled from mid-2018. HMRD, the owner of the Sack Dam and Arroyo Canal facilities was leading the design effort. The design that HRMD's engineers produced did not meet Program operational or cost-share criteria and was rejected. Reclamation has taken over design responsibility for the projects, has produced initial design concepts for the fish bypass channel and is completing initial concepts for the fish screen system, and will be developing an operations overview for the proposed facilities. Under the current schedule, Reclamation will have a 30% design completed for the facilities in late 2021.
- The Program resolved issues around seepage and access for the Mitigations Land Trust (MLT) property and was able to complete necessary geotechnical testing work. A Value Engineering assessment of some of the Reach 2B facilities including the Compact Bypass Control Structure, the Mendota Pool Control Structure, and the Mendota Pool Fish Screen) yielded several design revisions that will simplify construction (and reduce construction time and cost) substantially, and those design changes were incorporated into the Reach 2B facilities' design.
- The Program still needs to complete an overall performance and operational specification for the Reach 2B projects, including the Compact Bypass and associated facilities. These facilities are the primary intersection of river and diversion operations on the river, and robust coordinated operations across all possible operating conditions will be vital to ensure accurate, timely and appropriate water deliveries to meet both the Restoration Goals and water supply obligations. An overall vision and concept for how these key facilities will work in concert should be a vital component of a design effort. It is strongly recommended that Reclamation makes this a priority in the near term.

- Overall, design and construction of the major Paragraph 11 facilities is substantially behind schedule, and in my opinion, there is no hope of completing all of the facilities by the end of 2025.

Recommendation: The Program should continue to press forward with the design of the Paragraph 11 projects and produce a performance and operational specification for both the Arroyo Canal/Sack Dam facilities and the Reach 2B Projects (from the Chowchilla Bypass Control Structure downstream past Sack Dam). The performance specification should identify Program and water delivery operational criteria, overview of responsibilities and obligations for all operating parties, performance metrics for successful operations, and highlight any policy or contractual issues for resolution prior to construction. This specification should be completed by September 2021.

6. Schedule and Budget Concerns & Recommendations

The Record of Decision for the San Joaquin River Restoration Program requires an Annual Workplan be developed outlining expected annual Program activities for the next twelve-month period and is to include projected activities for the subsequent two years and a reporting on the activities accomplished in the prior year. Development of the Annual Work Plan is also a requirement under the State Water Resources Control Board (SWRCB) order approving the change in Reclamation’s water rights for the purposes of preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in, or on, the water. To date, no 2020 or 2021 Annual Work Plan has not been prepared.

In several other annual reports (most recently in 2019), I expressed concerns about the schedule and budget for the implementation of the Program and urged a relentless focus on cost reduction and schedule urgency. At this juncture, I personally believe that the implementation of the Paragraph 11 projects will not be completed until well past 2025 and will ultimately cost considerably more than currently projected. I have shared these concerns with the non-Federal Settling Parties, with senior Program staff, and with Reclamation regional management.

I have also recommended that the Program develop an implementation plan that could help guide overall budget and schedule and highlight areas where additional Reclamation resources would be needed to improve implementation prospects. I continue to believe that an Implementation Plan would be helpful to the Program. For example:

- The Program continues to utilize the same organizational chart as it has for several years, despite the changing focus from planning to design, construction and commissioning.
- The Program has been operating without an in-house Program Engineer for nearly three years
- The Program has been operating without a Water Management Manager for five months (although I understand that a recruitment is underway)
- Reclamation has designated additional resources from Reclamation’s Technical Services Center (TSC) to work on Program facilities; however, it is not clear if this improved level of staffing will be sufficient to meet Program schedule objectives.
- COVID-19 has impacted Program implementation, certainly at no fault of Reclamation or Implementing Agencies. However, it is unclear what Reclamation may be able to do to regain time lost resulting from COVID restrictions.

These and other issues could be addressed or considered in an implementation plan.

Recommendation: Recommendation: The Program should produce a comprehensive Implementation Plan for construction of the Paragraph 11(a) projects that are included in Stage 1 of the Funding Constrained Framework by no later than the end of 2021. This Implementation Plan should include a detailed schedule for design and construction, and a list of current and required resources necessary to implement the schedule.

Recommendation: It is recommended that the Program produce an updated budget, based on the Implementation Plan and schedule and current available design information for the completion of the Paragraph 11(a) projects that are included in Stage 1 of the Funding Constrained Framework, by the end of 2021.

5. Program Milestones and Accomplishments during 2020

This Section provides an overview of specific milestones and accomplishments, and progress towards meeting Paragraph 11, 13 and 14 requirements, and overall program challenges.

Specific Milestones and Accomplishments during 2020

Some of the key Program milestones and accomplishments for 2020 include:

- The National Marine Fisheries Service (NMFS) completed and released the 2021 Technical Memorandum that outlined the spring-run Chinook salmon release and monitoring plans for 2021, plus methods for identification of spring-run Chinook salmon outside of the San Joaquin River. See <https://media.fisheries.noaa.gov/2021-01/sr-tech-temo-2021-1-15.pdf>. Appendix A of the NMFS Technical Memo provides an overview of fish releases in the SJR in 2020.
- Because of the channel conveyance constraints to releasing full Restoration Flows and other operational constraints or decisions, the Program undertook the sale and exchange of just over 63,500 TAF of URF's in 2020, which included approximately 13.5 TAF of Exchange URF. The successful disposition of the URF's to the benefit of the Program required considerable effort in terms of compliance, coordination and contracting by the Program. Sales of URF's in 2020 provided revenue of approximately \$10.2 M; funds from URF sales are added to the Restoration Fund and can be used for costs associated with the Restoration Goal.
- A 2020 Channel Capacity Report (CCR) was published by the Channel Capacity Advisory Group (CCAG) to determine and update estimates of then-existing channel capacities in the Restoration Area, to ensure Restoration Flows would be kept below levels that would increase flood risk². The 2020 CCR determined the then-existing channel capacity will be generally the same as the 2019 CCR, however with some increases in capacity in Reach 4B2, the Mariposa Bypass, and in the Middle Eastside Bypass (MESB) based on additional studies completed and analyzed in 2019 and 2020.
- Work on the Salmon Conservation and Research Facility (SCARF) was not resumed in 2020; however, the State has secured sufficient funding to complete the construction and is now working on required re-design, re-contracting and re-starting the project. Construction is currently scheduled to resume in September 2021. Until the SFARF is commissioned, the interim hatchery facility (iSCARF) continues to produce the required numbers of fish to support Program objectives and research.
- In 2020, 75 redds were identified in the SJR from translocated and released fish. It should be noted that survey work was partially limited due to covid restrictions, so actual redd construction may have been greater than what was observed.
- The Program and Water Rules group reviewed and commented on all 14 of the GSPs in all five restoration reaches with a particular focus on groundwater/surface water connectivity

² https://www.restoresjr.net/wp-content/uploads/2020/02/Channel-Capacity-Report_2020_508.pdf

(interconnected surface waters (ISWs)), actual and planned groundwater dependent ecosystems (GDEs), sustainable management criteria, monitoring, and water budgets.

Progress toward Achieving Paragraph 11, 13, and 14 Requirements during 2020

Pending completion of the Paragraph 11 modifications, the Program is undertaking interim measures to continue the process of reintroduction, build fish stocks, and to continue to glean valuable monitoring data to further inform future adaptive management actions. Specifically, in 2020:

- The Program continued to develop spring-run Chinook salmon brood stock at the iSCARF, utilizing the selected foundation stock from the Feather River Fish Hatchery.
- The Program completed several Young-of-Year and Yearling Juvenile Spring-run Chinook releases, as well as the release of mature fish. The details of those releases are best documented in the NMFS *“2021 Technical Memorandum Regarding the Accounting of San Joaquin River Spring-run Chinook Salmon at the Central Valley Project and State Water Project Sacramento-San Joaquin Delta Fish Collection Facilities”*, at <https://media.fisheries.noaa.gov/2021-01/sr-tech-temo-2021-1-15.pdf>.
- **Adult Releases**

A total of 285 adult spring-run Chinook salmon broodstock cultivated at the iSCARF were released by the California Department of Fish and Wildlife (CDFW) into Reach 1A of the San Joaquin River. Three separate releases occurred, in June, August and September, totaling 136 females and 149 males. All fish received external color-coded Floy tags with individual identification numbers, and all females and a subset of male fish were fitted with acoustic tags to track fine-scale movement. Genetic tissue samples of all broodstock adults were taken at the iSCARF for use in later parentage analysis.
- **Juvenile Releases**

From January – May, several groups of yearling and juvenile fish were released to the SJR. Groups were released in Reach 1 or 2 (generally to test the efficacy of rotary screw traps), or into Reach 5 (for movement out to the ocean). A total of 10,541 yearlings and 233,761 juveniles were released.
- **Adult Chinook Salmon Returns**
 - A total of 57 adult spring-run Chinook salmon were captured in the lower reaches of the Restoration Area and transported to Reach 1. 50 of those fish were genetically identified as having originated from the iSCARF.
 - Fall run trap and haul did not occur in 2020. Incidence of fall run in the SJRRP area were not well documented; unlike previous years, incidental observation of fall run in the SJRRP area was limited due to reduced field work levels as a result of Covid restrictions.

6. Specific RA and TAC Activities Completed During 2020

The RA and TAC completed a variety of tasks during 2020 to support and contribute to Program implementation efforts as required by the Settlement. In addition to specific tasks assigned by the Settlement, the RA and TAC have broad latitude pursuant to the Settlement to consult with State and Federal representatives “on matters including, but not limited to, pre-permitting and pre-ESA consultation activities, sharing of information, and technical assistance during initial project development, planning, design, and implementation phases, and monitoring.”³

Section 6 describes focused TAC priorities for 2020, (particularly those that were not specifically assigned or foreseen in Settlement) and progress on those priorities, and Section 7 describes TAC priorities for 2021.

- The RA provided Restoration Flow Recommendations throughout 2020, to respond to changing conditions and updated Restoration Flow Allocations.
- The RA and the TAC were involved in numerous meetings and discussions regarding various Program initiatives, including:
 - Arroyo Canal/Sack Dam improvements process, including review and comment on various iterations of the Arroyo Canal Fish Screen and Sack Dam improvement facilities;
 - Monitoring seepage well status with regards to permissible Restoration Flows;
 - Input on fisheries monitoring activities in response to flow release operations;
 - RFG meetings and RFG section drafting;
 - Water supply, hydrology and flood control planning including flow coordination calls with Friant Dam operators, SCCAO, and managers from Friant Division Contractors;
 - Weekly flow management conference calls;
 - Improvements in runoff and water supply forecasting including the Airborne Snow Observatory (ASO) Program;
 - Development of improved flow and temperature tracking web applications (see <https://flowwest.shinyapps.io/flowtool/> and <https://flowwest.shinyapps.io/SJRRPMonitoring/>);
 - 2020 Science Meeting (held online).

It should be noted that numerous meetings were cancelled or deferred due to the COVID-19 pandemic.

Bi-Monthly TAC Convened by the RA

Bi-Monthly coordination calls involving TAC members were convened to address restoration issues, updates on meetings recently attended by TAC members, and general program updates. These meetings (conference calls) were useful in improving coordination among TAC members, and usually occurred twice per month throughout 2020.

³ Stipulation of Settlement, Exhibit D Paragraph C.9

RA Weekly Telephone Conferences with the Program Manager and key staff

The RA met via telephone on Monday mornings for an hour or more with the interim and permanent Program Manager throughout 2020 to discuss upcoming events, program schedule, emerging issues, coordination of efforts and other matters.

RA and TAC Member Participation in Regular Water Quality, Monitoring and Flow Scheduling Conference Calls

The RA and Program hold weekly conference calls involving the Implementing Agencies, Settling Parties and RA/TAC to address water quality, flow monitoring and flow scheduling issues. These meetings contributed to improving communication between the various Program participants on a range of flow scheduling and monitoring needs and activities.

RA Participation in Settling Party – Reclamation Meetings

The RA attended Settling Party – Reclamation Meetings convened in 2020. These meetings included the Reclamation Regional Office executive staff, SJRRP Program Manager and representatives of the Settling Parties. These meetings focused on significant policy issues that needed the attention of Program participants.

Participation in other Program Technical and Stakeholder Meetings

In 2020 the RA and/or members of the TAC participated in numerous technical work group and technical feedback meetings:

- The RA participated as available in Fisheries Management Workgroup monthly meetings
- The RA and TAC participated in Restoration Flow Guidelines revision meetings and workshops.
- The RA and TAC participated regularly in the Long-Term Management Plan meetings
- The RA and TAC participated in Spawning and Incubation Group (SIG) bi-monthly meetings
- The RA and TAC worked with the sturgeon passage workgroup to compile and synthesize information and develop a web-based analytic tool for assessing sturgeon migration and passage.
- The RA and TAC participated Water Temperature Management Group meetings

7. Priority RA/TAC Tasks for 2020 – Progress and Results

The RA and TAC annually develop a list of priority tasks to undertake in furtherance of the Settlement and the Restoration Goal. The 2020 TAC priority tasks (beyond routine or administrative tasks as required by the Settlement) fell into two broad categories: (1) Science and Projects Analysis, and (2) Water Accounting & Water Rules. These 2020 priorities were prepared in January 2020, and progress is outlined below. TAC members assigned a lead role (*are identified*).

Science and Projects Analysis

1. Data management. Enhance and expand Program data management capabilities using TAC and other Reclamation or grant funds. Primary 2020 effort focused on managing groundwater level data. (Tompkins)

Results: TAC member Mark Tompkins and the FlowWest team worked with Program staff (Regina Story) to develop an accessible, interactive way to present the extensive groundwater monitoring data collection developed by the Program. This tool (<https://flowwest.shinyapps.io/sjrrpGroundwaterMonitoring/>) should allow faster and more intuitive review and interpretation of groundwater data that defines seepage limits in the Restoration Area, with the goal to refine seepage management plan and increase Restoration Flow conveyance capacity.

2. Fisheries Framework projects/analysis:

- a. Sturgeon Passage habitat and transit work plan (Henery, Tompkins, McBain)

Results: Led by the TAC, with participation by fisheries biologists from the Implementing Agencies, the TAC developed a work plan for sturgeon passage and habitat (flow depths and velocities as well as temperatures) analysis, developed a web-based tool to assess sturgeon habitat and passage under different flow conditions (<https://flowwest.shinyapps.io/sjrrpSturgeon-dev/>), and led several discussions regarding key flow or barrier constraints to sturgeon passage. Final discussions, and a summary technical memo, are slated for 2021.

- b. Reach 1 Productivity, (egg incubation, hatching, and emergence), data synthesis and analysis (Hanson)

Results: Led by the TAC, with participation by fisheries biologists from the Implementing Agencies, the TAC developed a preliminary list of key questions for analysis of productivity in Reach 1. The effort was put on hold pending the completion of the sturgeon analysis (see above) and should resume in 2021.

- c. Considerations around fall-run Chinook salmon trap and haul operations for 2020 and beyond (Henery)

Results: The effort was put on hold pending the completion of the sturgeon analysis (see above) and should resume in 2021 or 2022.

3. Additional synoptic flow measurements for Reach 4 (McBain)

Results: The effort was put on hold due to COVID-19 limitations.

4. Long Term Monitoring Plan (LTMP) participation and comment (McBain)

Results: The TAC (McBain) participated in most of the LTMP meetings, and the RA participated in some of the meetings. The TAC provided written text and technical edits to the LTMP.

5. Millerton Forecast Advisory Committee participation (Vorster)

Results: The TAC (Vorster) participated in all of the Millerton Forecast Advisory Committee, and the RA participated in some of the meetings.

6. Water Temperature Analyses (McBain)

Results: The TAC (McBain Team) led the development of a river temperature estimation tool using historic reservoir outlet temperatures coupled with modeled river temperature data, and a reservoir cold-water pool estimation tool that utilizes historic reservoir temperature profiles and estimated outflow rates. This effort is complete, and the effort is expected to transition towards an updated CE-QUAL-W2 reservoir water temperature model in 2021. This temperature data was also used to inform sturgeon habitat evaluations described in #2 above.

7. Specific Projects review: (Johnson)

- a. 2B Elements – Compact Bypass, Mendota Control and Screen
- b. Arroyo/Sack Dam refurbishment
- c. DWR passage projects
- d. DWR seepage projects
- e. BOR Seepage projects

Results: The RA and TAC participated in specific design milestone reviews for all of these project components in 2020.

Water Accounting & Water Rules

As described in the 2019 Annual Report, the RA and TAC will focus on “water rules” for the SJRRP area to support accurate and precise Restoration Flow release and accounting, to support appropriate protection for Restoration Flows down the length of the SJRRP area, and because of the current highly experienced TAC, Program and Friant representatives. Specific tasks and focus areas for the RA and TAC (Vorster, McBain, Luce), Program staff (Moore, Story, Kegel, and Wolfe) and Friant reps (Ottemoeller) in “Water Accounting & Water Rules” included:

1. The RA and TAC must undertake thoughtful analysis of flow alternatives and provide timely Flow Recommendations.

Results: Accomplished.

2. Continue refinement of Restoration Flow Guidelines to protect Restoration Flows and ensure future RA flow management flexibility.

Results: This undertaking was severely constrained by COVID-19. Perhaps 15% of the original agenda that the Program and RFG work group discussed for 2020 was accomplished.

3. Water Measurement and Operational Consistency – work towards the goal of steady and accurate flows down the river.

- a. Identify and promote needed improvements in gauging and flow measurement.

Results: gaging “white paper,” including a detailed description of all current and existing SJR gaging stations from the Headwaters to below the Merced River in draft form, more work to do by Program and TAC

- b. Work on techniques for improvement of data analysis and/or timeliness, to spot flow issues more quickly such as flow variances or gauge error.

Results: The Program worked diligently to improve coordination and consistency with Reach 3 diverters to good result. Unfortunately, Reach 3 gauges are sub-par, so monitoring and verification of operations in meeting RA Restoration Flow targets is difficult.

4. Undertake better estimates or enumeration of flow losses (or reduction of accretions) in Reaches 1, 2, 3, 4, and 5.

- a. Utilize historical streamflow gauge and groundwater level data (to extent possible).
- b. Undertake real time measurements, synoptic measurements, and/or tracking as possible.
- c. Research and track water rights filings for diverters and/or transfers.

Results: The Program, TAC and Water Rules working group made some progress on this (mostly data identification, compilation, and review), with much more to do. A flow accretion/depletion tool was developed to better estimate future flow accretions/losses based on measured streamflow gauges for 2016-present.

5. Support Department of the Interior and the SWRCB obligations to protect Restoration Flows up and down the river.

- a. Promote implementation of effective and timely monitoring, and identification of flow issues and/or transgressions.
- b. Promote development and implementation of a compliance and/or enforcement plan by Reclamation, Settling Parties, and/or RA as appropriate.

Results: The Program, TAC and Water Rules group are making slow progress towards operational consistency on the river. Although slowed considerably by COVID, there were

several meetings with SWRCB staff to discuss river accounting, and preparation of a draft overview/guidelines for transfers and diversions within the Restoration Area.

6. Assess how groundwater management in and around the Restoration Area could impact the Settlement goals. All the groundwater basins in the Restoration Area are critically overdrafted and excessive groundwater pumping may reduce Restoration Flows, as well as potentially impact the restoration of riparian and wetland habitat along the river and other beneficial uses reliant on SJR flows. The 2013 Sustainable Groundwater Management Act (SGMA) required that by 2020 critically overdrafted groundwater basins prepare Groundwater Sustainability Plans (GSPs). The Settlement also required the parties “to work together in identifying any increased downstream surface or underground diversions and the causes of any seepage losses above those assumed in Exhibit B and in identifying steps that may be taken to prevent or redress such increased downstream surface or underground diversions or seepage losses”.

Results: The Program and Water Rules group reviewed and commented on the GSPs in all five restoration reaches with a particular focus on groundwater/surface water connectivity (interconnected surface waters (ISWs)), actual and planned groundwater dependent ecosystems (GDEs), sustainable management criteria, monitoring and water budgets.. Follow up on next steps in the GSP process will continue.

7. State of water quality assessment: Develop a summary and status regarding the state of water quality in the SJR, with a focus on the Restoration Program area, but including consideration of water quality downstream to Vernalis, that addresses three questions:

- What is the current state of water quality monitoring and reporting, and is it adequate for tracking trends, detecting problems, and informing decisions?
- What rules govern discharges to the river, and are they adequate for protecting water quality in support of the Restoration Goal?
- What is the current status of water quality and do any of the Restoration reaches constitute a water quality “barrier” to migrating fish?

Results: This analysis is underway – a draft report should be completed for review by June 2021.

8. Priority RA/TAC Tasks for 2021

The following list includes proposed 2021 TAC priority tasks (including both tasks as required by the Settlement and focus areas that the RA and TAC feel are important for contribution):

Science and Analysis

1. Expand Data management tools. FlowWest, with suggestions and input from the TAC, completed both groundwater data analysis and sturgeon habitat/flow analysis tools. FlowWest is working on additional funding sources within Reclamation and will consult with the TAC and Program with regards to the next priority data sets. Data sets that would benefit from improved management and analysis tools would include spawning, redd, emigration or rotary screw trap data sets, Millerton Lake water temperatures, and/or SJR temperature data from CDFW loggers (Tompkins).
2. Fisheries Framework analysis:
 - a) Sturgeon Passage habitat and transit: complete the analysis started in 2020, summarize work and document results and recommendations in a technical memorandum. (*Henery, Tompkins*)
 - b) Reach 1 Productivity, data synthesis and analysis (*Hanson*): re-engage on this discussion in 2021, after the completion of the sturgeon habitat and passage analysis.
 - c) Considerations around fall-run Chinook salmon trap and haul operations for 2021 and beyond: re-engage on this discussion in 2021, after the completion of the sturgeon habitat and passage analysis (*Henery*).
 - d) Fisheries issues support: Convene the Fish Forum and identifying other fish-related issues that are pressing for the program; supporting the Program and NMFS in preparing for the 2024 report to Congress on Program status and supporting the program with fish study design review (e.g., juvenile emergence and survival, etc.).
 - e) Coordination with the San Joaquin River Conservancy on floodplain restoration opportunities and design.
3. Water Temperature Analyses (McBain): Transition the old CE-QUAL temperature model for Millerton Lake into the current version of CE-QUAL and develop the model into an operational tool for better managing Restoration Flow releases to preserve cold-water pool to improve fall spawning/incubation water temperatures. Use updated CE-QUAL model for planning of Restoration Flow releases in 2021.
4. Sediment Management Plan (McBain): Participate in the Spawning and Incubation Group to contribute towards developing a Sediment Management Plan for Reach 1A of the SJR. The Sediment Management Plan will address both fine sediment (sand) and coarse sediment (spawning gravels).

Paragraph 11 Projects

1. Encourage Program to develop operational principles for operations of the 2B and Arroyo/Sack Dam complexes. This will at a minimum be a high-level document outlining how the facilities will operate, who makes key decisions, and approaches to ensure adherence to operational requirements.
2. Develop a pathway to improve or assure passage for fish in the flood bypass system (Chowchilla Bypass), including potentially discussions with DWR, Central Valley Flood Protection Board (CVFPB), the Program or other stakeholders. The Chowchilla Bypass is and will continue to be a critical bi-directional pathway for adult and juvenile movement in all years with flood control releases in the Bypass; thus, improvement of this pathway will greatly benefit the success of the Restoration Goal. The Settlement does not specifically require any work in the flood bypass system; however, any progress on this task outside of the work of the SJRRP would be highly beneficial for the success of the SJRRP Restoration Goal.
3. Revisit Program schedule for the 2B Projects, to evaluate current planned project sequencing.
4. Participate in design review for 2B and Arroyo/Sack Dam Complex facilities

Water Accounting & Water Rules

1. Water Measurement and Operational Consistency – work towards the goal of steady and accurate flows down the river.
 - a. Complete and circulate Tech Memo regarding needed improvements in gauging and flow measurement, work towards funding and implementation.
 - b. Work on implementation of improved gauging, and techniques for improvement of data analysis and/or timeliness, to spot flow issues more quickly.
2. Undertake better estimates or enumeration of losses (or reduction of accretions) in Reaches 1, 2, 3, 4, and 5.
 - a. Utilize historical streamflow gauge and groundwater level data (to extent possible) for periods prior to 2016.
 - b. Undertake real time measurements, synoptic measurements, and/or tracking as possible.
3. Better understand water transfers in the Restoration Area, including:
 - a. What constitutes a reportable transfer;
 - b. The rules around permitting and reporting transfers; and
 - c. Track what transfers occur (reported or unreported).
4. Support Department of the Interior and the SWRCB obligations to protect Restoration Flows to the Delta:
 - a. Promote implementation of effective and timely monitoring, and identification of flow issues and/or transgressions;

- b. Continued outreach to SWRCB, so all may understand what role the SWRCB could/should play in monitoring and compliance activities; and
 - c. Promote or lead development and implementation of a voluntary “rules of the river”, or a compliance and/or enforcement plan by Reclamation, Settling Parties, and/or RA as appropriate
5. Follow up on SGMA Groundwater Sustainability Plans (GSPs).
 - a. In coordination with Program staff, follow up with DWR to determine their timeline for providing feedback on the GSPs as well as their process for engaging with the Groundwater Sustainability Agencies (GSA’s) whose GSPs were deemed inadequate or partially adequate. Separately follow-up with GSA’s (e.g., Madera County) that expressed interest in engaging with the Settlement Parties.
 6. Develop (through the RFG Process) a way to smooth Restoration Year transitions (especially wet-to-dry year types). This could include a modest carryover allowance.

Ongoing, or To Be Completed in 2021

1. Continue doing a good and thoughtful job on Flow Recommendations.
2. Continue development of Restoration Flow Guidelines to protect Restoration Flows and future RA flexibility. Continue to work through RFG 2.2 issues and task list (2021).
3. Additional synoptic flow measurements for Reach 4A and MESB (*McBain*): schedule and undertake measurements when COVID-related travel restrictions are relaxed. Should we think about other reaches beyond just Reach 4A and MESB?
4. Long Term Monitoring Plan (LTMP) participation and comment: Continue to participate through the completion of the process, which should be in the first half of 2021 (*McBain*).
5. Millerton Forecast Advisory Committee participation: continue to participate in 2021 (*Vorster*).
6. Continue participating in Spawning and Incubation Group (SIG) (*McBain, Hanson*): Develop proposed work plan for a San Joaquin River Sediment Management Plan that will inform next phases of the Spawning Habitat Adaptive Management Plan (SHAMP (, now called the Spawning Habitat Improvement Plan, or SHIP). Continue working with SIG to address priority information needs for the group that may eventually inform an updated Fisheries Management Plan. Contribute towards writing and reviewing the Sediment Management Plan.
7. Continue refining flow accretions/losses tool to a longer time series (pre-2016) to improve estimates of flow accretions/losses in coordination with the Water Rules group.
8. Expand the Riparian Recruitment analysis in the MESB to Reach 2A to inform future Riparian Recruitment Flows and Flood Control Releases.

9. 2020 RA and TAC Expenditures

The following summary of expenditures was provided by National Fish and Wildlife Foundation (NFWF), the administrator of the grant that funds operations of the RA and TAC.

RA and TAC Expenditures, 2020

Restoration Administrator & Technical Advisory Committee Expenditures - 2020	
Organization	2020 Expenditure Totals
Tom Johnson	\$129,110.05
Bill Luce Consulting	\$24,403.40
Hanson Environmental Inc.	\$14,476.00
McBain Associates	\$53,670.10
The Bay Institute	\$101,362.30
Trout Unlimited, Inc.	\$10,313.30
FlowWest, LLC	\$44,822.50
	\$378,157.65
Hours	
Organization	2020 Hour Totals
Tom Johnson	650.00
Bill Luce Consulting	137.30
Hanson Environmental Inc.	77.00
McBain Associates	413.00
The Bay Institute	642.25
Trout Unlimited, Inc.	69.00
FlowWest, Inc.	278.50
	2267.05

APPENDICIES

Appendix A: URF Revenues

Appendix B: 2019 Flow Accounting (2020 Flow Accounting is still in preparation)

Appendix C: History of Millerton Unimpaired Runoff

Appendix D: Final Restoration Allocations

Appendix A: URF Revenues

2020 URF Revenue Total

URF Sales (Tier)	Block/Recipient	Date	Volume (Net)	Volume (Gross)	Price	Revenue	RWA Offset
Tier 2	Block 1/Class 1	4/28/2020	33,434	35,194	\$ 215.91	\$ 7,218,734.94	Yes
Tier 2	Block 2/Class 1	6/4/2020	4,396	4,627	\$ 215.91	\$ 949,140.36	Yes
Tier 2	Block 3/Class 1	8/6/2020	3,495	3,679	\$ 215.91	\$ 754,605.45	Yes
						\$ -	
						\$ -	
						\$ -	
Potential Revenue related to Exchanges							
Priority Sales	AEWSD	4/28/2020	4,690	4,937	\$ 215.91	\$ 1,012,617.90	Yes
Priority Sales	AEWSD	6/4/2020	617	649	\$ 215.91	\$ 133,216.47	Yes
Priority Sales	AEWSD	8/6/2020	490	516	\$ 215.91	\$ 105,795.90	Yes
Recolor and Exchange	Delano-Earlimart ID	2/9/2021	1,892	1,892	\$ -	\$ -	No
Recolor and Exchange	Lindmore ID	2/9/2021	2,200	2,200	\$ -	\$ -	No
Recolor and Exchange	Lindsay-Strathmore ID	2/9/2021	1,692	1,692	\$ -	\$ -	No
Recolor and Exchange	Orange Cove ID	2/9/2021	680	680	\$ -	\$ -	No
Recolor and Exchange	Saucelito ID	2/9/2021	1,676	1,676	\$ -	\$ -	No
Recolor and Exchange	Shafter-Wasco ID	2/9/2021	1,772	1,772	\$ -	\$ -	No
Recolor and Exchange	Southern San Joaquin MUD	2/9/2021	1,684	1,684	\$ -	\$ -	No
Recolor and Exchange	Terra Bella ID	2/9/2021	2,304	2,304	\$ -	\$ -	No
Total URF (net):			61,022	63,502	Total: \$	10,174,111.02	

See individual year spreadsheets "20XX URF Table Exhibit A" for detailed distributions

New price structure instituted for 2020-2024

Appendix B: Previous Year (2019) Flow Accounting

Table B — Restoration Flow Accounting and Unreleased Restoration Flows, and Holding Contracts, for the period February 2019 through February 2020. Flood management releases to San Joaquin River occurred during March, April, May, June, and July. This accounting includes 1.905 TAF that was generated in the 2019 Restoration Year and advanced into the final days of February 2019 (to the 2018 Restoration Year) and a flood spill of 22.509 TAF of URFs in July.

Feb 1 – Feb 28	–	1.905	–	–	–	–	–	–	–
Mar 1 – Mar 31	15.886	20.291	–	–	–	–	0	–	138.949
Apr 1 – Apr 30	0.276	21.683	–	–	–	–	0	–	80.000
May 1 – May 31	44.031	5.708	9.838	–	–	17.799	0	0	80.006
Jun 1 – Jun 30	10.102	–	8.926	–	–		0		23.999
Jul 1 – Jul 31	7.462	–	7.379	–	–		0		26.509
Aug 1 – Aug 31	10.873	–	11.633	–	–		0		14.244
Sep 1 – Sep 30	11.413	–	11.623	–	–	–	0	–	–
Oct 1 – Oct 31	11.117	–	–	12.732	–	–	0	0	–
Nov 1 – Nov 30	10.364	–	–	13.896	–	–	0		–
Dec 1 – Dec 31	9.429	–	–	14.392	–	–	0		–
Jan 1 – Jan 31	9.749	–	–	–	15.602	–	0	–	–
Feb 1 – Feb 28	11.060	0	–	–	17.258	–	0	–	2.053
		48.587	49.399	41.020	32.860	17.799			365.760
		190.666					0.000		
	151.761	190.666							
		556.426 <i>(2019 Allocation: 556.542 + 0 Returned Exchange = error of 0.116 TAF)</i>							
		708.187							

Note: error correction in 2019 data was made in September of 2020 and March 2021. Proper data is reflected here.

Appendix C: History of Millerton Unimpaired Runoff

Table C — Water Year Totals in Thousand Acre-Feet

Water Year ¹	Unimpaired Runoff ² (Natural River)	SJRRP Water Year Type ³	Water Year ¹	Unimpaired Runoff ² (Natural River)	SJRRP Water Year Type ³	Water Year ¹	Unimpaired Runoff ² (Natural River)	SJRRP Water Year Type ³
1931	480.2	Critical-High	1963	1,945.266	Normal-Wet	1995	3,876.370	Wet
1932	2,047.4	Normal-Wet	1964	922.351	Dry	1996	2,200.707	Normal-Wet
1933	1,111.4	Normal-Dry	1965	2,271.191	Normal-Wet	1997	2,817.670	Wet
1934	691.5	Dry	1966	1,298.792	Normal-Dry	1998	3,160.759	Wet
1935	1,923.2	Normal-Wet	1967	3,233.097	Wet	1999	1,527.040	Normal-Wet
1936	1,853.3	Normal-Wet	1968	861.894	Dry	2000	1,735.653	Normal-Wet
1937	2,208.0	Normal-Wet	1969	4,040.864	Wet	2001	1,065.318	Normal-Dry
1938	3,688.4	Wet	1970	1,445.837	Normal-Dry	2002	1,171.457	Normal-Dry
1939	920.8	Dry	1971	1,416.812	Normal-Dry	2003	1,449.954	Normal-Dry
1940	1,880.6	Normal-Wet	1972	1,039.249	Normal-Dry	2004	1,130.823	Normal-Dry
1941	2,652.5	Wet	1973	2,047.585	Normal-Wet	2005	2,826.872	Wet
1942	2,254.0	Normal-Wet	1974	2,190.308	Normal-Wet	2006	3,180.816	Wet
1943	2,053.7	Normal-Wet	1975	1,795.922	Normal-Wet	2007	684.333	Dry
1944	1,265.4	Normal-Dry	1976	629.234	Critical-High	2008	1,116.790	Normal-Dry
1945	2,134.633	Normal-Wet	1977	361.253	Critical-Low	2009	1,455.379	Normal-Wet
1946	1,727.115	Normal-Wet	1978	3,402.805	Wet	2010	2,028.706	Normal-Wet
1947	1,121.564	Normal-Dry	1979	1,829.988	Normal-Wet	2011	3,304.824	Wet
1948	1,201.390	Normal-Dry	1980	2,973.169	Wet	2012	831.582	Dry
1949	1,167.008	Normal-Dry	1981	1,067.757	Normal-Dry	2013	856.626	Dry
1950	1,317.457	Normal-Dry	1982	3,317.171	Wet	2014	509.579	Critical-High
1951	1,827.254	Normal-Wet	1983	4,643.090	Wet	2015	327.410	Critical-Low
1952	2,840.854	Wet	1984	2,042.750	Normal-Wet	2016	1,300.986	Normal-Dry
1953	1,226.830	Normal-Dry	1985	1,135.975	Normal-Dry	2017	4,395.400	Wet
1954	1,313.993	Normal-Dry	1986	3,031.600	Wet	2018	1,348.979	Normal-Dry
1955	1,161.161	Normal-Dry	1987	756.853	Dry	2019	2,734.772	Wet
1956	2,959.812	Wet	1988	862.124	Dry	2020	886.025	Dry
1957	1,326.573	Normal-Dry	1989	939.168	Normal-Dry			
1958	2,631.392	Wet	1990	742.824	Dry			
1959	949.456	Normal-Dry	1991	1,027.209	Normal-Dry			
1960	826.021	Dry	1992	807.759	Dry			
1961	647.428	Critical-High	1993	2,672.322	Wet			
1962	1,924.066	Normal-Wet	1994	824.097	Dry			

¹ Water year is from Oct 1 through Sept 30, for example the 2010 water year began Oct 1, 2009. Unimpaired Runoff is based on Reclamation calculations, and hypothetical water year types are shown here; actual Restoration water year types are based on the final allocation, which may sometimes differ slightly from the calculated water year total.

² Also known as “Natural River” or “Unimpaired Inflow into Millerton” – This is the total runoff that would flow into Millerton Lake if there were no dams or diversions upstream. There was a lower level of precision prior to 1945.

³ The six SJRRP Water Year Types are based on unimpaired inflow and are not updated as climatology changes. Critical-Low=<400 TAF, Critical-High=400-669.999 TAF, Dry= 670-929.999 TAF, Normal-Dry 930-1449.999, Normal-Wet 1450-2500, Wet>2500

Appendix D: Final Restoration Allocations and Error

Table D — History of Restoration Allocations

Year	Type	Date of Final Allocation Issuance ²	Unimpaired Runoff Forecast in Final Allocation (TAF)	Restoration Allocation in Final Issuance (TAF)	Observed Unimpaired Runoff on Sep. 30 (TAF)	Error (Unimpaired Runoff / Allocation)
2009	Interim Flows			261.5	1,455.379	—
2010	Interim Flows			98.2	2,028.706	—
2011	Interim Flows			152.4	3,304.824	—
2012	Interim Flows			183	831.582	—
2013	Interim Flows			65.5	856.626	—
2014	Restoration Flows	Mar 3	518	0 ¹	509.579	+8.421 / 0 ¹
2015	Restoration Flows	Sep 28	327	0	327.410	-0.410 / 0
2016	Restoration Flows	Sep 30	1300.986	263.295	1,300.986	0 / 0
2017	Restoration Flows	Jul 10	4,444	556.542	4,395.400	+48.600 / 0
2018	Restoration Flows	May 22	1,427	280.258	1,348.979	+78.021 / +10.503
2019	Restoration Flows	May 20	2,690	556.542	2,734.772	-44.772 / 0
2020	Restoration Flows	June 19	880	202.197	886.025	-6.025 / -1.345

¹ No water was provided under this Critical-High designation due to necessity for Friant Dam to release flows for the Exchange Contract.

² In 2018 with the completion of Version 2.0 of the Restoration Flows Guidelines, the date of final Restoration Allocation issuance was advanced from September 30 to either May or June.