BUREAU OF RECLAMATION

After-Action Review Report

Klamath Project Operation in Water Year 2025

Klamath Project, Oregon/California

California-Great Basin Region

Cover Photo: Agency Lake-Barnes Unit Reconnection on January 9, 2025, Klamath Falls, Oregon
Photo Credit: Adam Johnson, United States Fish and Wildlife Service

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Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

After-Action Review Report

Klamath Project Operation in Water Year 2025

Klamath Project, Oregon/California

California-Great Basin Region

prepared by

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United States Department of the Interior, Bureau of Reclamation

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Appendix A: Summary Infographics for the Klamath Project Operations in Water Year 2025

Abbreviations and Acronyms

AAR	After-Action Review
A-B Reconnection	Agency Lake-Barnes Units reconnection
BiOp	Biological Opinion
BiOp refuge water supply	Up to 43 TAF of water to maintain the elevations of TLNWR Sump 1A and LKNRW Unit 2 during the irrigation season for sucker protection as prescribed in 2024 USFWS BiOp
cfs	cubic foot per second
Combined Forecast	Reclamation adopted seasonal water supply forecast for Project Supply allocation using multiple forecasts per 2024 BiOps; for WY25, it is the average of the 50-percent forecast from NRCS and the 50-percent forecast of Seasonal NWI
DPS	Deferred Project Supply
ESA	Endangered Species Act of 1973, As Amended
FFA	Flexible Flow Account
KDD	Klamath Drainage District
KRM	Keno Release Model, a version of the Klamath Basin Planning Model that supported the ESA consultation and resulting 2024 BiOps
LRDC	Lost River Diversion Channel
LKNWR	Lower Klamath National Wildlife Refuge
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration
NWI	Normalized Wetness Index
ODFW	Oregon Department of Fish and Wildlife
Ops Index	Operation Index
OWRD	Oregon Water Resources Department
Project	Klamath Project
Project Supply	Project water supply for the irrigation season
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RTO	Real-time Operations
Seasonal NWI	Seasonal Normalized Wetness Index, a customized index that is functionally comparable with the NRCS and CNRFC forecasts in the context of Project operations

Services	USFWS and NMFS
TAF	thousand acre-feet
TLNWR	Tule Lake National Wildlife Refuge
UKL	Upper Klamath Lake
USBRKB Datum	Bureau of Reclamation Klamath Basin Datum
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WY	Water Year
WYOps	Water Year Operations

Chapter 1 Introduction

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) manages the Klamath Project (Project), which has provided water for irrigation, domestic, and related purposes since its authorization in 1905. Project operations are subject to applicable federal and state law and regulations, as well as relevant contracts and agreements. Figure 1 shows the extent of the Project and major facilities.

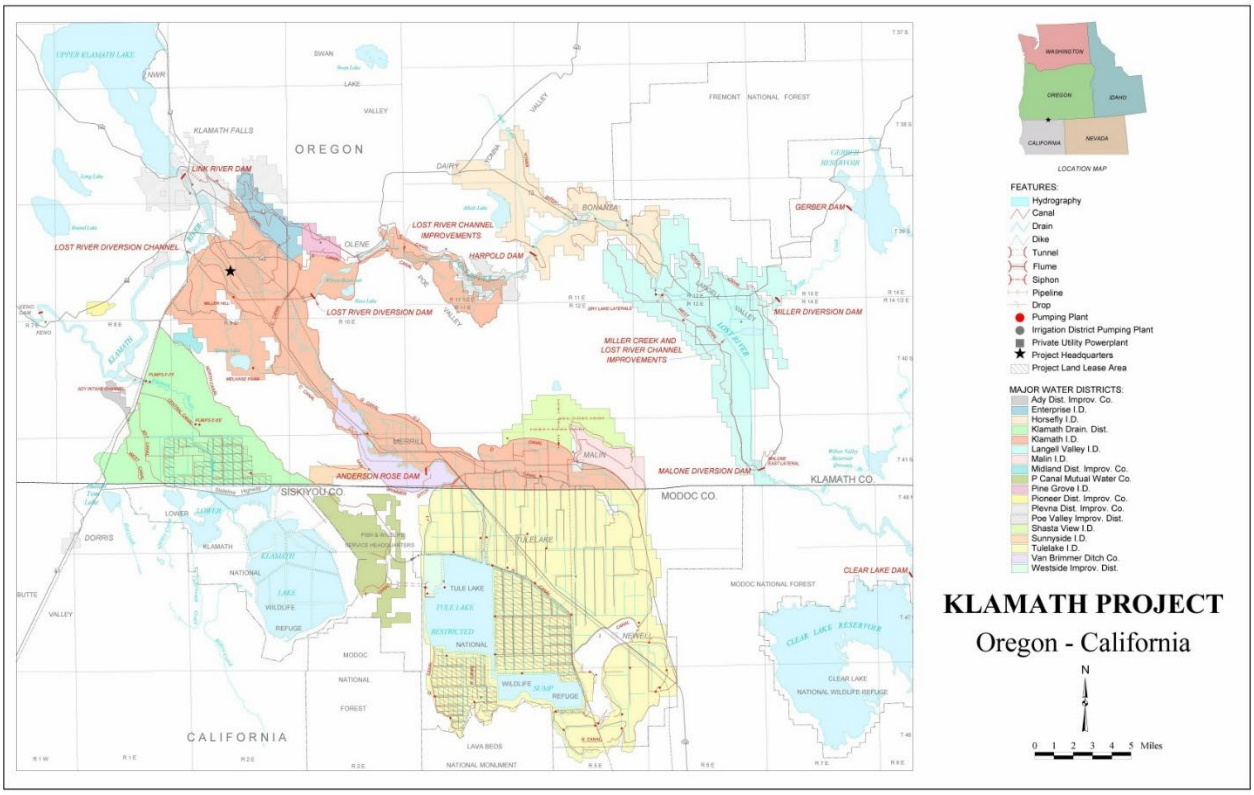

Figure 1. Klamath Project Area and Major Facilities

This figure is a hirotical Klamath Project map developed by Reclamation with unknown date. It shows the major water bodies and streams in the Klamath Proejct area with major Project features and facilities, and major water districts receiving water from the Project. This map is included for reference only; there is no new information added to the historical map.

Background

Reclamation hosted its first after-action review (AAR) for Project operations in Water Year 2024 (WY24) in response to stakeholder recommendations to improve communication and coordination. The purpose of this AAR Workshop was to establish shared understanding of

Project operations in WY24 and examine areas of success with positive outcomes and areas of improvement with actionable recommendations in future operations. This in-person WY24 Project operations AAR workshop was originally scheduled for November 2024 but was postponed until January 2025 due to severe weather conditions. Although the workshop concluded with positive outcomes, participation by water users was limited because of scheduling conflicts. Recognizing the value of the AAR process, Reclamation intended to conduct another review for Water Year 2025 (WY25).

In WY25, Project operations occurred under two major changes in physical environment:

1. Removal of the four PacifiCorp dams downstream of Keno Dam, with the final in-river work completed on October 2, 2024; and

2. Hydrologic reconnection of the Agency Lake–Barnes Units with Upper Klamath Lake (UKL) (referred to as A-B Reconnection in this report), with a limited breach on December 20, 2024, and completion on January 9, 2025.

Reclamation also assumed the ownership of Keno Dam and responsibility of continued operation of Link River Dam and Keno Dam in July 2024. WY25 is the first complete year for Reclamation's operations of these facilities. Additional facility condition assessments and improvement considerations are underway.

To address Project operations under these new conditions, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) issued Biological Opinions (BiOps) in October and November 2024, respectively, to meet Endangered Species Act (ESA) requirements with these anticipated changes.[1,2] Following their issuance, Reclamation transitioned Project operations accordingly. Where feasible, associated accounting procedures were applied retroactively to operations beginning on October 1, 2024, to coincide with the start of the water year.

Beyond updated operational requirements, the 2024 BiOps include an adaptive management framework to support long-term scientific and management needs in the Klamath Basin. They also establish a Real-Time Operations (RTO) Team and a Water Year Operation (WYOps) Team to support inter-seasonal and intra-seasonal coordination and any operational adjustments necessary as Reclamation gains experience under the changed physical environment and regulatory framework.

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[1] NMFS, 2024. *Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Klamath Project Operations from October 1, 2024, through September 30, 2029*. October 28.

[2] USFWS, 2024. *Biological Opinion on the Effects of the Proposed Klamath Project Operations Plan, Effective November 15, 2024, through October 31, 2029, on Federally Listed Threatened and Endangered Species*. November 15.

After extensive coordination and consultation with the Services, Tribes, water users, and other interested parties, Reclamation prepared this AAR Report in lieu of an in-person workshop. This approach reflected challenges in scheduling a workshop in a timely manner, disruptions associated with the federal government shutdown, and concerns about winter-travel safety if further delays were required.

Report Purpose

Reclamation issued the *2025 Annual Operations Plan* in April 2025 to describe the Project operations anticipated between April 1 and September 30, 2025. The plan acknowledges that a limited amount of Project water delivery may continue beyond September 30 for some irrigators to complete their crop production. Throughout the irrigation season, Reclamation convened regular RTO meetings to keep agencies, Tribes, water users, and other interested parties informed of ongoing conditions and operational decisions. On September 10, 2025, Reclamation issued a letter titled *Environmental Compliance Review for Klamath Project Adaptive Management in 2025*, outlining its intent to fully satisfy the estimated project demand and explaining how this continued to meet the regulatory requirements of the 2024 BiOps during WY25.

This AAR Report summarizes the overall outcomes of Project operations, key influencing factors, and the effectiveness of communication and coordination. It also identifies potential refinements for continued Project operations. This review also incorporates input and feedback from RTO discussions, consultations with regulatory agencies (e.g., NMFS and FWS [collectively, the Services], the Oregon Water Resources Department [OWRD]), Tribes, and other Project-related engagement opportunities that occurred throughout the water year.

Project operations rely heavily on real-time data and forecasts produced by Reclamation and partner entities such as the U.S. Geological Survey. Accordingly, the data presented in this report should be considered provisional and subject to further quality assurance and quality control review by corresponding responsible parties.

Report Organization

This AAR Report includes four chapters described below.

- Chapter 1 provides background for this AAR Report and its purpose.
- Chapter 2 summarizes overall Project operations for WY25, including hydrometeorological, storage, and river conditions for the Klamath River and Lost River systems, including the Flexible Flow Account (FFA).

- Chapter 3 details irrigation diversions and refuge water deliveries, including accounting for Project Supply, Deferred Project Supply (DPS), and refuge water supply as defined in the 2024 BiOps.
- Chapter 4 provides the findings and consideration in continued Project operations.

Attachment A includes summary infographics of Project operations in WY 2025 to support the discussions in Chapters 2 and 3. The information and statistics focus on the operations of the Klamath River system. Relevant condition-dependent factors and influences of the Lost River system are included as appropriate for context. Aligned in time, these infographics help illustrate the temporal relationships among concurrent events, operational decisions, and outcomes of Project operations.

Fishery Recovery After Dam Removal in WY25

October 2, 2024, marked the last day of river work for dam removal on the Klamath River. The subsequent recovery of anadromous fishery has been stronger than anticipated:

- Chinook salmon was first observed in Jenny Creek on October 10, 2024. Additional observations later in October confirmed their presence in Spencer Creek, which had previously been blocked by the former J.C. Boyle Dam.,
- Coho salmon was first observed near the Fall Creek Hatchery on November 13, 2024. More were observed in later November and December, reaching as far as the Klamath River reach below the former J.C. Boyle Dam.
- Pacific Lamprey was first observed in Spencer Creek in June 2024.
- The first image of Chinook salmon passing Keno Dam was captured on September 24, 2025.
- In October 2025, Chinook salmon tagged by the Oregon Department of Fish and Wildlife (ODFW) below Keno Dam were detected above Link River Dam (October 9), Williamson River (October 10), and Sprague River (October 14).

Photo credit: ODFW

Chapter 2 Annual Operation Summary and River Conditions

Operations for water management of the Project are inherently complex. They must account for uncertain hydrometeorological conditions, comply with applicable laws and regulations, and respond to real-time operational needs for both Project demand and environmental requirements. The WY25 irrigation season officially concluded on September 30, 2025, though limited irrigation typically continues into November for end-of-season demand.

This chapter provides an overview of Project operations and river conditions in both the Klamath and Lost River systems. These systems interact only under specific conditions and at certain locations. Chapter 3 focuses on irrigation diversions and water deliveries to the Lower Klamath National Wildlife Refuge (LKNWR) and Tule Lake National Wildlife Refuge (TLNWR) along with other pertinent topics.

Regional Climate and Meteorological Conditions

Understanding of regional climate and meteorological conditions is the foundation for reviewing the Project operations in WY25.

Climate Conditions

Figure 2 shows the drought conditions in Oregon reported by U.S. Drought Monitor in the beginning of each month in WY25.[3] The moderate drought conditions in the Project area in 2024 were alleviated by December storms. The continued wet weather patterns in winter months provided a basin condition with minimum drought concerns. Later, the dry weather experienced by the Klamath Basin in March through June 2025 resulted in abnormally dry conditions by July in the Project area.

[3] U.S. Drought Monitor, 2025. Map Archive.

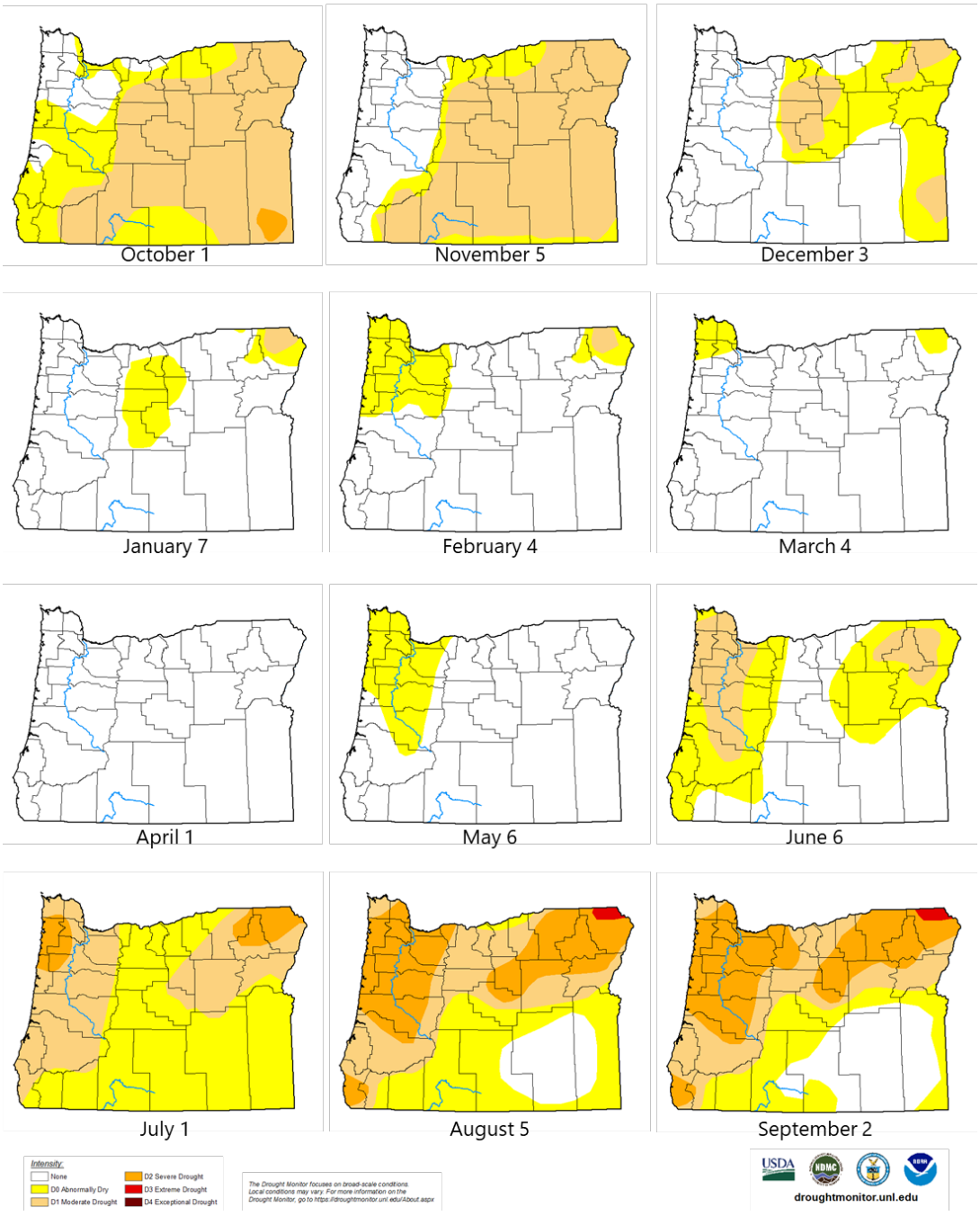

Figure 2. Drought Conditions Reported by U.S. Drought Monitor by Month in WY25

This figure shows the collection of monthly US Drought Monitor information for the State of Oregon in Water Year 2025. The drought concern in Klamath Basin dissipated in December 2024 completely, but reemerged in June, intensified in July but still within abnormal dry level without a declared drought condition. The conditions persisted through the end of WY25.

Meteorological Conditions

Table 1 summarizes the range of daily air temperature and monthly precipitation in Klamath Falls by month in WY25, measured at Reclamation's Cooperative Agricultural Weather Network (AgriMet) site.

In WY25, the weather conditions in WY were relatively mild with noticeable peak precipitation and cold temperatures in February and dry spring months with relatively warmer conditions. This pattern influenced both estimated irrigation demand and overall water supply prospects. Additional precipitation in July provided some relief in Project operations.

Table 1. Range of Daily Air Temperature and Total Precipitation at Klamath Falls AgriMet Station by Month in WY25

Month	Low Daily Mean Air Temperature (degree Fahrenheit)	High Daily Mean Air Temperature (degree Fahrenheit)	Monthly Precipitation (inches)
October	31.73	60.32	0.46
November	22.96	46.89	2.79
December	24.60	41.80	3.57
January	26.22	39.38	1.02
February	-1.03	41.43	4.00
March	31.40	54.99	1.09
April	32.92	54.51	0.78
May	41.08	67.94	0.49
June	44.12	74.48	0.14
July	61.51	79.99	2.01
August	61.24	76.98	0.49
September	47.49	69.06	0.63
Total	n/a	n/a	17.47

Key: n/a = Not applicable.

New Era of Project Operations

WY25 marked the beginning of a new era in Project operations. The 2024 BiOps were developed under the assumption that both PacifiCorp's dam removals and the A-B Reconnection would be completed. While the in-river dam removal work concluded on October 2, 2024, levee breach for the A-B Reconnection was not completed until January 2025. The 2024 BiOps also include a new Project operating framework associated with UKL

management, which has only indirect effects on some operations in the Lost River System management.

In July 2024, Reclamation assumed ownership of Keno Dam, as well as operational responsibility for both Keno Dam and Link River Dam. WY25 therefore represents the first full year of Reclamation-led operations for these facilities. Encouragingly, fishery species responded to the post-dam-removal river conditions better than expected but did not impose additional operational constraints on the Project in WY25. in WY25. Reclamation also initiated investigations into infrastructure limitations requiring future attention, including the fish ladder at Keno Dam and the absence of fish screens at irrigation diversions.

New Approach to Project Operations

The new Project operating framework aims at streamlining operational practices and refining water allocation approaches among different uses.

Onboarding Process and Adaptive Management

WY25 served as an onboarding year for implementing the new Project operating framework in the 2024 BiOps. Under this new framework, Project operations rely on continuous tracking of hydrometeorological conditions through the Normalized Wetness Index (NWI) and water storage conditions in UKL using the UKL Status Index. These two indices are combined into a single Operations Index (Ops Index) that is used to distribute available water among various uses. The use of Ops Index incorporates considerations of existing storage conditions and hydrologic forecast, resulting in more balanced representation of Project water supply conditions. Parameters for supporting the use of these indices were developed based on experience in Project operations and extensive use of models.[4]

The 2024 NMFS BiOp also changed the compliance location for Klamath River flow requirements downstream of the Project, moving upstream over 40 river miles from the USGS gage below the former Iron Gate Dam to Keno Dam. In addition, the 2025 USFWS BiOp added requirements for water supply to maintain water levels in LKNWR and TLNWR during the irrigation season for sucker protection.

Throughout WY25, adaptive management—adjusting operations in response to evolving conditions—proved essential. Equally important was ongoing communication and collaboration among Reclamation, the Services, Tribes, water users, and other interested parties.

[4] See 2024 BiOps for details.

Use of Models

The 2024 BiOps incorporate, by reference, the Klamath Basin Planning Model and specifically the Keno Release Model (KRM) for illustrating the many customized accounting procedures in the proposed action. These models were used during consultation to analyze the resulting potential range of operational outcomes with assumptions to support the ESA consultation. The above tools were used in WY25 to support Project operations; however, final operational decisions are at Reclamation's discretion based on real-time conditions and the outcomes of coordination and consultation with the Services, Tribes, OWRD, water users, and interested parties.

Transition of the Regulatory Framework

Reclamation began transitioning Project operations to conform with the 2024 BiOps following their issuance in late 2024. Prior to that point, operations were governed by the 2019 BiOps. The transition period extended approximately through December 2024. As part of this transition, Reclamation retroactively applied key accounting procedures consistent with the KRM—specifically the FFA and DPS—effective October 1, 2024.

Project Communication

Consistent with the 2024 BiOps, Reclamation enhanced and streamlined its Project communication in WY25. These improvements built on the positive experience of communication and engagement in WY24 and incorporated recommendations from the WY24 AAR Workshop.

Real-Time Operations Team

The primary forum for communication regarding Project operations is the regular RTO meetings that were typically on weekly basis during the irrigation season. The first RTO meeting was held on January 10, 2025. During the transition period, the Flow Accounting Scheduling Technical Advisory Group (FASTA) were held for the same purpose with certain limitations on participants according to the 2019 BiOps. Reclamation broadened the invitation to RTO meetings to alleviate these limitations. FASTA and RTO meetings were held virtually with stakeholder participation, and the information packages were distributed to all participants for transparency and for record keeping. If there were no substantial updates, the annotated information packages were distributed without a live meeting. Table 3 shows the statistics of FASTA and RTO meetings Reclamation convened in WY25.

Table 3. FASTA and RTO Meetings in WY25

Meeting Type	Number of FASTA Meetings in October through December 2024	Number of RTO Meetings in January through September 2025	Subtotal
Live Virtual Meetings	4	26	30
Information Distribution Only	4	5	9
Total	8	31	39

Key: FASTA = Flow Accounting Scheduling Technical Advisory Group; RTO = Real-Time Operations Team

Reclamation continued to invite NRCS and CNRFC forecasters to provide monthly forecast briefings from January through June as part of the RTO meetings, a recommended practice from the 2023 Klamath Basin Forecast Workshop.[5] For WY25 operations, a seasonal NWI forecast was incorporated into the new Project operating framework and its author, Larry Dunsmoor was included in the forecast briefings..

The 2024 BiOps allow Reclamation to convene a longer-term WYOps Team if the RTO Team is insufficient for broader planning needs. However, in WY25, there was no need or request for convening WYOps meetings.

The primary benefit of RTO meetings is to provide broad participation with timely updates on Project operations, fostering shared understanding. Reclamation also responded to requests from individual parties to address specific issues or concerns that were not suitable for the larger group or required more in-depth discussion via ad-hoc meetings. Separately, Reclamation initiated a separate Klamath Basin Science Collaborative process to address the broader, long-term basin management topics that are out of the scope of annual Project operations.

The federal government restructuring in WY25 created disruptions and impacts on resources and support for Project operations. Reclamation communicated the changes and associated effects on Project operations as timely as possible during the regular RTO meetings.

Coordination with the Services and Tribes

Reclamation worked closely with the Services and Tribes to implement the 2024 BiOps and conducted as-needed coordination to address specific concerns and to coordinate actions, such as Klamath River pulse flows. Topic-specific outcomes from these consultations are presented in Chapter 4 with context.

[5] Reclamation, in collaboration with the Services, hosted a workshop in September 2023 with a focus on water supply forecast with participation from subject matter experts and broad participation from local agencies, state and local governments, and interested parties to discuss the status of forecast technology, potential investments for skill improvement, and risk sharing in water supply management.

Coordination with OWRD

Reclamation maintained regular coordination with OWRD to meet the complex water-rights provisions associated with UKL and the Project operations, including Tribal claims and water user's water rights.

Coordination with Water Users

Throughout WY25, Reclamation regularly participated in weekly coordination meetings among water users (i.e., multi-district operations meetings) to enhance the coordination and collaboration for Project operations and understand the needs and concerns of water users.

Klamath River System

The Klamath River system is the primary source of water supply for the Project and the primary focus of the 2024 BiOps. The Project operations on the Klamath River System in WY25 are summarized below. Attachment A provides summary infographics with detailed timelines of different aspects of Project operations in a convenient view so that concurrent activities can be examined for better understanding.

Major UKL Inflows and Net Inflows

Table 4 shows the UKL inflows from two major tributaries: the Williamson River and Wood River and estimated net inflows. Wood River inflows peaked in February 2026. Williamson River inflows peaked in April but tapered off quickly in subsequent months. The UKL also receives inflows from other minor tributaries and is affected by the surface water-groundwater interface around the lake.

Table 4. Major UKL Inflows in WY25 at USGS Gaging Stations and Net Inflows

Month	Williamson River Below Sprague River near Chiloquin, Oregon (AF)	Wood River Near Klamath Agency, Oregon (AF)	Calculated UKL Net Inflow (AF)
October	32,116	21,126	54,225
November	36,371	22,627	106,188
December	48,843	25,208	175,327
January	93,283	27,047	135,888
February	53,681	25,311	148,895
March	171,273	28,324	230,714
April	212,172	22,219	238,397
May	119,663	22,840	131,340
June	43,587	24,587	28,410
July	35,695	22,812	9,005
August	34,580	22,241	24,906
September	33,586	21,864	43,271
Total	914,809	286,205	1,326,566

Key: UKL = Upper Klamath Lake; AF = acre-feet.

UKL net inflows are a primary input for Project operations on the Klamath River system. In WY25, total UKL net inflow was approximately 1.327 million acre-feet, corresponding to the 25% exceedance probability for the 1991–2024 period of record. However, the April–September net inflow—more relevant for Project water supply for irrigation use (referred to as Project Supply in the remaining document)—was 475 thousand acre-feet (TAF), which corresponds to the 34% exceedance probability for the same period.

Net inflows are influenced by lake evaporation, groundwater, and non-project diversions, as well as Project operations. While period totals of net inflow have traditionally been used as a proxy for overall hydrologic and water supply conditions, WY25 requires closer examination due to its atypical sub-seasonal pattern because of the previously mentioned abnormal dry spring conditions. Figure 3 compares the monthly WY25 UKL net inflows with historical records from 1991–2024.

As mentioned earlier, levee breach for the A-B Reconnection was not completed until January 9, 2025. There were multiple extensive discussions in WY24 over concerns on the timing of levee breach and potential consequence on UKL level. Fortunately, these concerns were alleviated by the storms in late December 2024 and January 2025 and resulting in high UKL net inflow in January 2025.

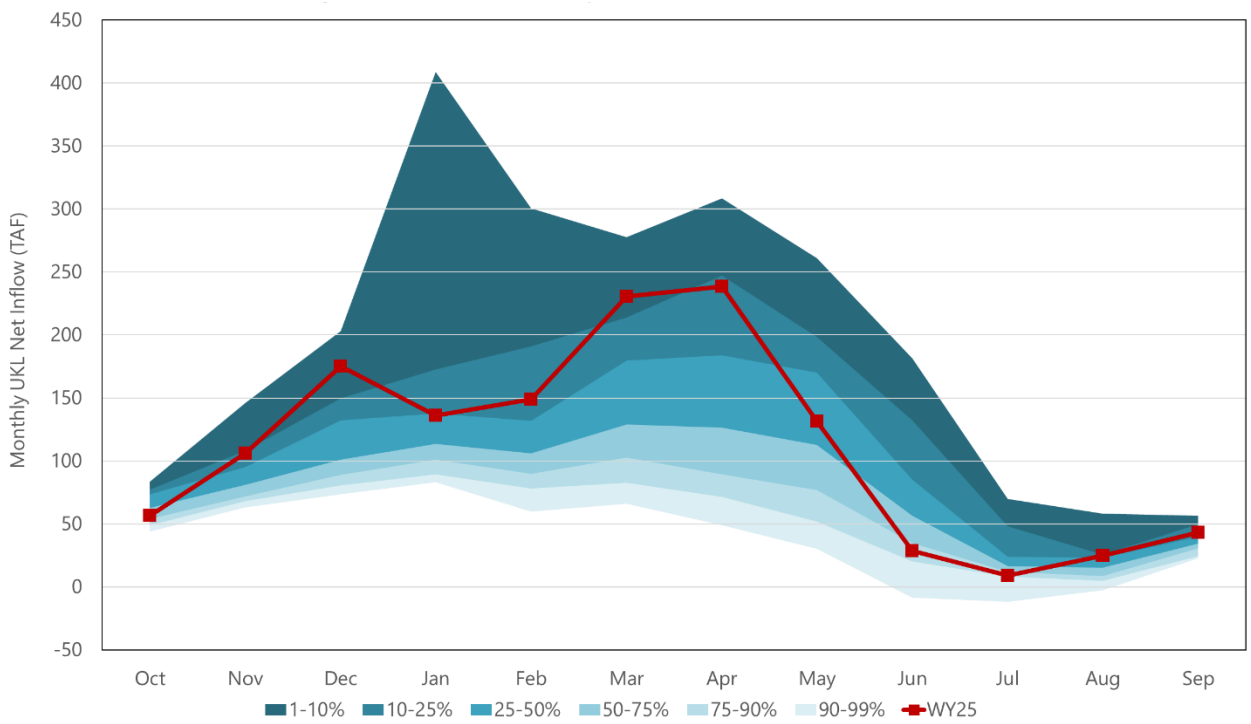

Figure 3. WY25 UKL Net Inflows by Month Compared with Historical Records (1991-2024) in Exceedance Probability

This figure shows the line chart in red for WY25 UKL Net inflows by month from October 2024 through September 2025. The information is compared with the exceedance probability of historical records from 1991 through 2024), showing in bands of 1-10%, 10-25%, 25-50%, 50-75%, 75-90%, and 90-99%. The WY25 records from October 2024 through September 2025 are about 67, 11, 6, 25, 22, 8, 11, 42, 81, 86, 12, and 18% in exceedance probability.

UKL Outflows

Table 5 shows the major outflows from the UKL including releases at Link River Dam and diversions of A Canal, excluding allowable diversions of WY24 irrigation season in October and November.

Table 5. Major UKL Outflows in WY25

Month	Link River Dam Release (AF)	Keno Canal Release (AF)	A Canal Diversion[1](AF)
October	53,869	446	-
November	57,864	0	-
December	44,454	0	-
January	67,940	0	-
February	64,677	0	-
March	165,342	0	2,334
April	207,431	208	10,791
May	141,917	922	31,793
June	97,031	893	37,053
July	78,129	922	42,769
August	66,744	922	35,779
September	51,915	893	23,414
Total	1,097,314	5,207	183,932

[1] A Canal diversion includes diversions of the Project Supply from the UKL and Deferred Project Supply, excluding the allowable diversions of WY24 irrigation season.

Link River Dam Releases

Reclamation assumed the operations of the Link River Dam in July 2024. The Link River Dam is the main control of the UKL storage for power generation and for release to the Link River and Lake Ewauna constructed by PacificCorp in 1921. Among the two canals built for power generation, the Ankeny Canal on the east bank of the river is no longer used. The Keno Canal on the west bank remains functional to convey water for irrigation use or fish attractant flows, contributing to the total Link River Dam release.

A Canal Diversions

A Canal is the largest irrigation diversion of the Project, serving a major portion of the Project areas that also receive water supply from the Lost River. The irrigation water diverted from this facility includes the allocated Project Supply from the UKL and DPS. More details on irrigation diversions are provided in Chapter 3.

UKL Flood Control Spill to the Klamath River

Reclamation's flood control operations balance several factors, including current hydrometeorological conditions, storage conditions in UKL, the available facility capacity to route water to refuges, and flooding risks around UKL and Keno Impoundment. Areas with flood risk concerns include the Highway 97 corridor on the east bank of UKL, South Suburban Road/Altamont corridor, as well as areas near the North Canal, Miller Island, and the Ady Canal. When feasible, Reclamation prioritizes proactive releases to refuges to reduce the need for reactive flood operations. Table 6 summarizes the resulting UKL spills to

the Klamath River in WY25. Chapter 3 contains more details on refuge water delivery and FFA pulse flow implementation in the context of flood operations.

Table 6. UKL Flood Control Spills in WY25

Period	Peak Total Link River Dam Release (cfs)	Total UKL Spill Volume (AF)
3/17-4/6	4,290 on 4/3	20,410
5/1-5/3	3,470 on 5/3	5,682

Key: UKL = Upper Klamath Lake; cfs = cubic feet per second; AF = acre-feet.

Given the wet winter conditions in the Klamath Basin, Reclamation took proactive measures that limited the need for more extensive flood control operations. This successful outcome reflects active coordination and consultation on FFA pulse-flow releases, as well as strategic releases to LKNWR when conditions allowed. UKL flood operations can influence the accounting of FFA and DPS, which have lower priority for the use of available UKL storage space. In WY25, FFA was not affected, but DPS experienced reductions due to flood control spills. Additional details of flood operations are provided in Chapter 3.

UKL Storage Conditions

Consistent with Reclamation's water rights, throughout this report, Project storage refers to the active UKL storage above elevation 4,136 feet (ft) on Bureau of Reclamation Klamath Basin (USBRKB) Datum.

The A-B Reconnection resulted in increase in UKL surface area and storage. For WY25 operations, Reclamation used the updated UKL elevation-area-capacity information based on their 2023 UKL bathymetric survey results[6] and the estimates of additional surface area and volume provided by the A-B Reconnection.[7] This data use is consistent with the analyses supporting 2024 BiOps. Because of the A-B Reconnection, the reported Project storage by elevation is not directly comparable to historical records.

Figure 4 shows the end-of-month UKL elevations. The daily UKL elevation peaked on April 4 and 5 at 4,143.12 feet, with a storage volume of 626.847 TAF. Wet conditions in late winter and early spring produced high Project storage, but the following dry spring introduced operational challenges, including increased irrigation demands and the potential need to draw more heavily on UKL supplies. As discussed later in Chapter 3, enhanced coordination between Reclamation and water users, along with efficient use of alternative water sources

[6] Reclamation, 2023. *2020-2022 Sedimentation Survey, Upper Klamath Lake*. Technical Memorandum No. ENV-2023-036. February.

[7] Dunsmoor, L., 2022. Technical Memorandum: Evaluating the Potential Effects on Water Management of Proposed Wetland Restoration in the Upper Klamath National Wildlife Refuge. *Appendix B, Environmental Assessment of Wetland restoration on Upper Klamath National Wildlife Refuge Barnes Unit, Agency Lake Units and Adjacent Lands*. USFWS. October 2023.

(e.g., DPS), contributed to achieving an end-of-September elevation near the 25% exceedance probability of 1991 through 2024 records.

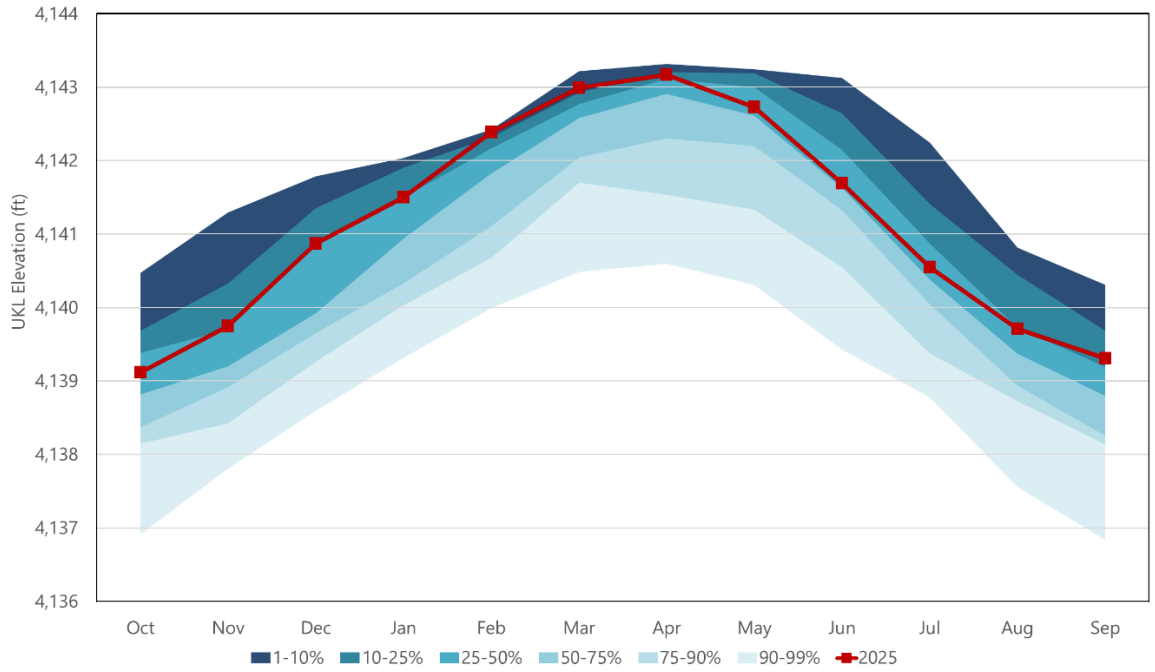

Figure 4. WY25 End-of-Month UKL Elevations Compared with Historical Records (1991-2024) in Exceedance Probability

This figure shows the line chart in red for WY25 UKL elevation by month from October 2024 through September 2025. The information is compared with the exceedance probability of historical records from 1991 through 2024), showing in bands of 1-10%, 10-25%, 25-50%, 50-75%, 75-90%, and 90-99%. The WY25 UKL elevations from October 2024 through September 2025 are about 30, 23, 26, 26, 7, 7, 13, 42, 42, 43, 29 and 23% in exceedance probability.

Reclamation worked closely with the OWRD to satisfy the Klamath Tribe claim on UKL elevations.[8] Table 7 summarizes the periods when UKL levels were at or above the claim in WY25. During the irrigation season, the Klamath Tribe claim is specified in a stairstep cross different periods. However, Project operations maintained a steadier drawdown from UKL without abrupt changes, resulting in UKL elevations that were generally above the claim level in the early part of a period and below it in the later part of the same period. See Table 7 and Appendix A for details.

[8] OWRD Klamath Tribal Instream Claim Dashboard, Claim Number: 622 Upper Klamath Lake Elevation.

Table 7. UKL Levels Compared with the Klamath Tribe UKL Elevation Claim

Period	Klamath Tribe UKL Elevation Claim (ft; USBRKB Datum)	Periods when UKL Levels at or above the Elevation Claim
10/1-10/15	4,139.50	-
10/16-11/30	4,140.50	-
12/1-12/31	4,141.00	-
1/1-3/31	Consistent with flood control purposes, raise the elevation as quickly as possible	-
4/1-6/15	4,143.00	4/1-5/19
6/16-6/30	4,142.00	6/17-6/21
7/1-7/15	4,141.50	7/1-7/5
7/16-8/15	4,140.50	7/17-8/2
8/16-9/30	4,139.50	8/17-9/12

Key: UKL = Upper Klamath Lake; USBRKB = U.S. Bureau of Reclamation, Klamath Basin; AF = acre-feet.

Major Diversions and Inflows of the Keno Impoundment

The major categories of diversion from the Keno Impoundment include the following:

- Fall/winter diversions of Klamath Drainage District (KDD),
- Spring/summer irrigation diversions by irrigation districts for the WY25 season, and
- Refuge water deliveries.

The Keno Impoundment also receives the following flows:

- Flood water from the Lost River system through the Lost River Diversion Channel (LRDC), and
- Return flow from the Lower Klamath National Wildlife Refuge (LKNWR) through the F/FF Pumps of the Klamath Straits Drain.

Table 8 summarizes the major diversions and inflows of the Keno Impoundment in WY25. Irrigation diversions associated with the WY24 irrigation season, which concluded in November 2024, are not included in these statistics. Additional details regarding irrigation diversions, refuge deliveries, and the relationship between DPS accounting, LRDC inflows, and F/FF Pump discharges are provided in Chapter 3.

Table 8. Major Diversions and Inflows of the Keno Impoundment

Month	KDD Winter Diversion[1] (AF)	WY25 Irrigation Diversion[2] (AF)	WY25 Refuge Delivery[3] (AF)	Inflow through F/FF Pumps (AF)	LRDC Inflow (AF)
October	-	-	-	-	-
November	10,061	-	-	-	-
December	5,461	-	4,176	-	11,175
January	6,137	-	5,369	-	16,740
February	1,289	-	5,119	5,474	30,961
March	-	4,403	13,305	11,018	32,620
April	-	10,791	8,784	4,827	11,989
May	-	45,330	3,539	2,377	-
June	-	71,766	1,402	2,986	-
July	-	75,633	1,553	2,148	-
August	-	57,005	1,746	2,245	-
September	-	30,645	2,908	1,867	3,484
Total	22,947	295,603	47,900	32,943	106,969

Key: KDD = Klamath Drainage District; WY25 = Water Year 2025; LRDC = Lost River Diversion Channel.

[1] KDD winter diversion includes diversions at North Canal and Ady Canal. See Chapter 3 for details.

[2] Irrigation diversion includes both the Project Supply and Deferred Project Supply at Station 48, North Canal, and Ady Canal. of North Canal and Ady Canal. See Chapter 3 for details.

[3] Refuge delivery includes deliveries from the Deferred Project Supply (including spill), transfers, and refuge water supply per 2024 USFWS BiOp through Ady Canal, and a small amount of uncategorized water in December 2024 while Project operations were in transition. See Chapter 3 for details.

Klamath River Releases

Keno Dam is the downstream end of the Keno Impoundment and the last control point on the Klamath River near the Project boundary. The following Reclamation Project operations meet Keno Dam release requirements and implement the FFA prescribed in the 2024 BiOps.

Releases from Keno Dam to the Klamath River

Keno Dam releases are the objective of Klamath River flow requirements under the 2024 NMFS BiOp. The calculation of target flows is based on a fixed schedule of base release that is to be modified based on the daily Ops Index, applicable ramping rates, and FFA use. Table 9 shows the resulting monthly Keno Dam releases. After the transition period ending in December, monthly volumes of Keno Dam releases were comparable with the targets except for high flow months and exceeded target releases consistently.

Table 9. Monthly Keno Dam Releases in WY25

Month	Base Flow[1] (AF)	Target Release[1] (AF)	Actual Release[1] (AF)
October	46,116	46,649	42,803
November	44,184	44,982	44,759
December	40,316	45,813	48,103
January	39,967	81,615	74,555
February	36,248	73,227	94,610[2]
March	44,420	168,607	197,395[2]
April	58,078	206,343	218,737
May	54,900	119,190	125,752
June	44,674	59,002	58,340
July	40,316	41,559	41,334
August	40,493	41,270	41,474
September	44,301	45,202	45,108
Total	534,012	973,459	1,032,970

Key: AF =acre-feet.

[1] Keno Dam base flows, target releases and Reclamation's compliance with actual Keno Dam releases are managed on a daily basis with ramping requirements. See Appendix A for daily comparison.

[2] Flexible Flow Account use for pulse flow release was implemented from 2/27 through 3/9.

Flexible Flow Account

The purpose of the FFA is to reserve a portion of the water supply allocated for the Klamath River to enhance river conditions below Keno Dam at a later date. For planning purposes, the following assumptions were used to support the BiOps and for WY25 Project operations for consistency:

- The FFA accumulation period is October 1 through March 1, and
- The FFA use period is March 2 through June 30.

For WY25, the FFA reached its maximum volume of 35,000 AF on February 9. Following consultation with the Services, Tribes, and other interested parties, Reclamation implemented a pulse flow release to the Klamath River in late February through early March in anticipation of elevated inflows to UKL.

The consultation resulted in two attributes of the pulse flow that were different from the originally planned implementation:

- A higher peak release of 8,090 cubic feet per second (cfs), compared to the planned 6,090 cfs, and
- An adjusted schedule, with the peak occurring one day earlier on February 28 to better align with the ongoing hydrologic event.

In terms of priority in using UKL storage, FFA ranks below Project Supply but above DPS. However, the early and successful pulse flow implementation exhausted the entire FFA volume by March 8. As a result, in WY25, no spill of FFA occurred during later flood control operations.

Table 10. Keno Dam Releases and Associated FFA Use in the Pulse Flow Event in WY25

Date	Target Release (cfs)	Actual Release (cfs)	FFA Use (AF)	FFA Balance (AF)
2/23	1,330	1,410	-	35,000
2/24	1,343	2,400	-	35,000
2/25	2,100	3,270	-	35,000
2/26	2,500	3,280	-	35,000
2/27	2,500	6,420	6,428	28,572
2/28	4,420	8,090	11,361	17,210
3/1	6,090	5,720	7,593	9,618
3/2	3,720	3,780	3,934	5,684
3/3	2,780	3,240	2,645	3,038
3/4	2,500	2,660	1,248	1,790
3/5	2,360	2,480	809	981
3/6	2,180	2,340	462	519
3/7	2,160	2,340	357	162
3/8	2,221	2,340	162	-
3/9	2,194	2,330	-	-
3/10	2,188	2,270	-	-

Key: AF =acre-feet; cfs = cubic feet per second; FFA = Flexible Flow Account.

Lost River (Eastside) System

Reclamation transferred the ownership and operating responsibilities of local facilities (e.g., diversion dams, channels, and canals) to local irrigation districts in 1950s, allowing more flexibility and efficiency for best use of their available resources. As a result, Reclamation Project operations in the Lost River system focus on interactions with the Klamath River system and requirements for end-of-September storage elevations and refuge water levels described in the 2024 BiOps. The condition-dependent interactions include redirecting flood flows to the Klamath River via LRDC, and water in the TLNWR, the terminus for the Lost River and many irrigation drainages, to the LKNWR through the D Pumping Plant and Tule Lake Tunnel.

The following summarizes Project operations of the Lost River system in WY25 including hydrometeorological, storage, and river flow conditions. Irrigation diversions in the Lost River system are managed by irrigation districts and thus excluded from the discussion. Similar to the Klamath River system, see Chapter 3 for more details of DPS use and BiOps refuge water deliveries.

Hydrometerological and Storage Conditions

The Lost River system has two storage units. Clear Lake is the largest storage unit in the Lost River System. It is a shallow reservoir with significant potential of evaporation loss; the corresponding depth at its maximum storage capacity (537 TAF) is about 20 ft. Gerber Lake is located on a higher elevation with a much smaller capacity (94.27 TAF). For sucker protection, 2024 USFWS BiOp set requirements for the end-of-September elevations for Clear Lake and Gerber Lake for protecting sucker habitats in the LKNWR and TLNWR; it also established the BiOp refuge water supply to augment the protection, which is discussed in more detail in Chapter 3.

Figures 4 and 5 show the end-of-month elevations of Clear Lake and Gerber Lake, respectively. Relatively speaking and compared with the Klamath River System, the Lost River watershed was more productive in WY25, resulting in a high than average condition at both reservoirs. The storage of both reservoirs peaked around the beginning of May, almost a month later than that of the UKL, suggesting that the dry spring conditions were less prominent in the Lost River watershed. The end-of-September elevation of both reservoirs were significantly above the requirements per the 2024 USFWS BiOp. Table 11 shows the key parameters of these two reservoirs in WY25.

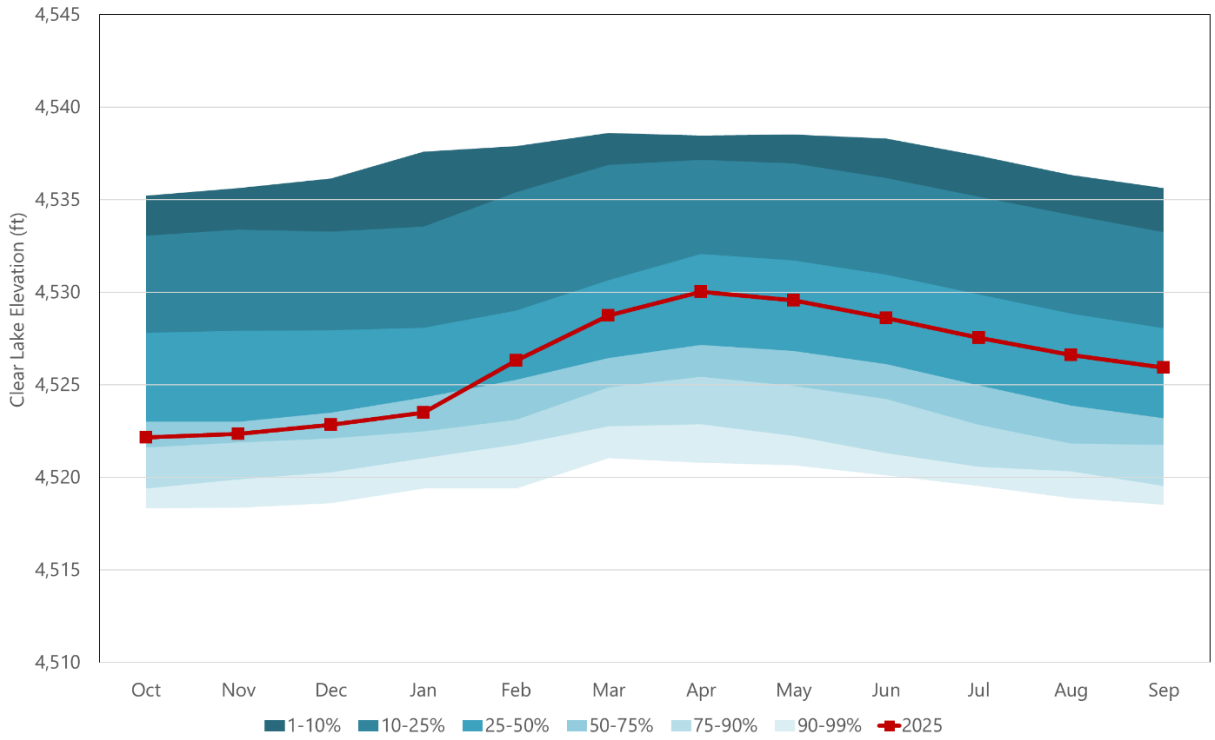

Figure 4. WY25 End-of-Month Clear Lake Elevations Compared with Historical Records (1991-2024) in Exceedance Probability

This figure shows the line chart in red for WY25 Clear Lake elevation by month from October 2024 through September 2025. The information is compared with the exceedance probability of historical records from 1991 through 2024), showing in bands of 1-10%, 10-25%, 25-50%, 50-75%, 75-90%, and 90-99%. The WY25 Clear Lake elevations from October 2024 through September 2025 are about 43, 41, 40, 38, 56, 64, 66, 66, 62, 61, 61, and 64% in exceedance probability.

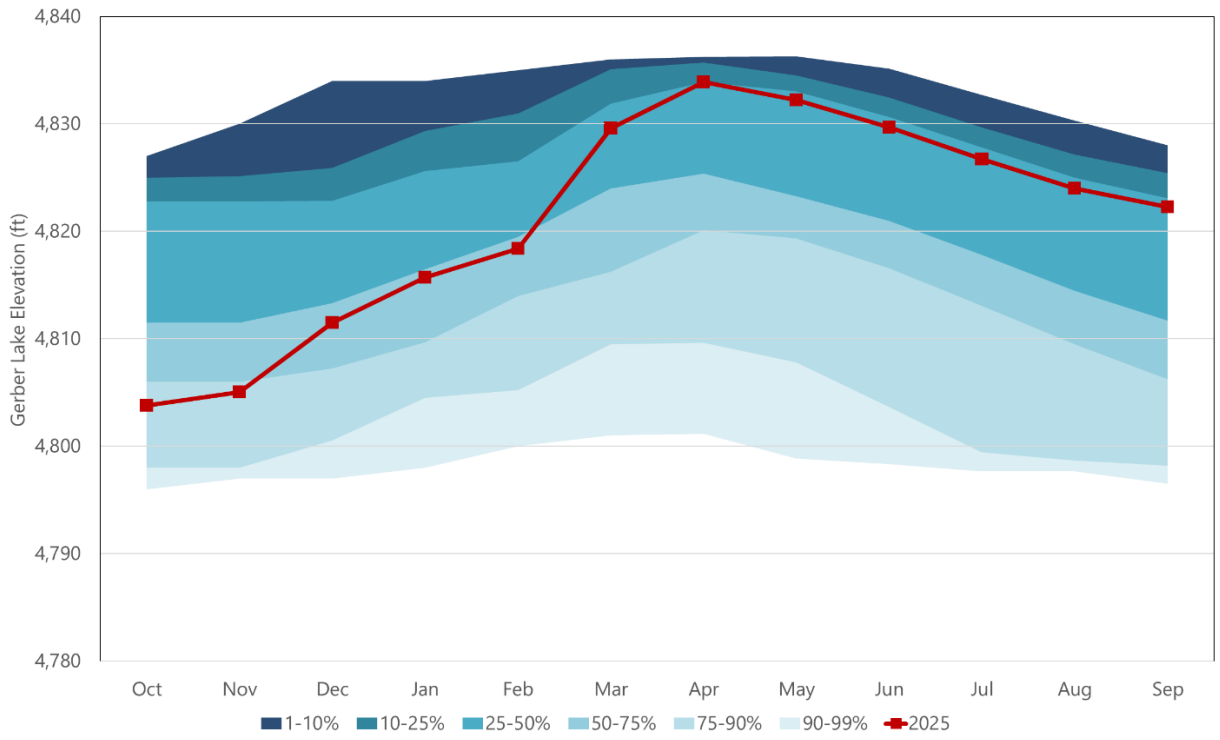

Figure 5. WY25 End-of-Month Gerber Lake Elevations Compared with Historical Records (1991-2024) in Exceedance Probability

This figure shows the line chart in red for WY25 Gerber Lake elevation by month from October 2024 through September 2025. The information is compared with the exceedance probability of historical records from 1991 through 2024), showing in bands of 1-10%, 10-25%, 25-50%, 50-75%, 75-90%, and 90-99%. The WY25 Gerber Lake elevations from October 2024 through September 2025 are about 19, 23, 44, 48, 49, 68, 75, 74, 73, 69, 69 and 72% in exceedance probability.

Table 11. WY25 Key Parameters for the Lost River System Operations

Parameter	Clear Lake	Gerber Lake
Conservation Storage Capacity (TAF)	527 at 4,535.4 ft	94.270 at 4,835.4 ft
Maximum Elevation (ft)	4,833.95 on 5/3 and 5/4	4,530.04 on 4/30 and 5/1
End-of-September Elevation (ft)	Required: 4,520.60 Actual: 4,525.93	Required: 4,798.10 Actual: 4,822.28

Key: TAF = thousand acre-feet; ft = feet.

Flow Conditions

In addition to reservoir elevations, Reclamation's Project operations in the Lost River System focus on its interaction with the Klamath River System, as well as deliveries to TLNWR and LKNWR. Water users have assumed the operational responsibilities for irrigation deliveries in the Lost River system. Table 12 shows the flow conditions at selective locations in the Lost River System.

Table 12. Lost River Flows at Selective Locations

Month	LRDC to the Keno Impoundment[1] (AF)	F/FF Pumps to the Keno Impoundment[2] (AF)	Anderson Rose Diversion Dam to TLNWR (AF)	D Pumping Plant to LKNWR (AF)
October	-	-	91	-
November	-	-	1,182	-
December	11,175	-	4,399	2,380
January	16,740	-	1,146	8,500
February	30,961	5,474	3,947	8,405
March	32,620	11,018	1,400	13,887
April	11,989	4,827	793	4,712
May	-	2,377	670	-
June	-	2,986	2,223	-
July	-	2,148	6,764	-
August	-	2,245	2,497	-
September	3,484	1,867	1,902	3,064
Total	106,969	32,943	27,017	40,948

Key: TLNWR = Tule Lake National Wildlife Refuge; LKNWR = Lower Klamath National Wildlife Refuge; LRDC = Lost River Diversion Channel; AF = acre-feet

[1] Not all LRDC discharges into the Keno Impoundment are qualified for credits in the Deferred Project Supply Account; see Chapter 3 for more details.

[2] F/FF Pumps also receives return flows that did not originate from the Lost River system. Not all F/FF Pumps discharges into the Keno Impoundment are qualified for credits in the Deferred Project Supply Account; see Chapter 3 for more details.

Discharges into the Keno Impoundment

Flows from the Lost River System are directed to the Keno Impoundment through the LRDC primarily to reduce flood risks downstream; however, under certain conditions, the LRDC and the Keno Impoundment could be more efficient in delivering water to LKNWR than typical deliveries through D Plant. The 2024 BiOps establish criteria for crediting LRDC inflows as DPS if contributing to the Keno Dam releases or maintaining refuge water levels in lieu of UKL release. See Chapter 3 for more detail.

Discharges into Refuges

The Anderson Rose Diversion Dam is the last controlling structure on the Lost River before it discharges into the TLNWR. The D Pumping Plant can further divert water from TLNWR to LKNWR. In 2025, a portion of LRDC flows were used as an operational offset to get water to LKNWR via the Ady Canal per 2024 BiOps as part of the DPS calculation.

The irrigation drainages discharged into the TLNWR are hard to measure. 2024 USFWS BiOp requires Reclamation to provide up to 43 TAF of water to maintain the elevations of Sump

1A in TLNWR and Unit 2 in LKNRW during the irrigation season for sucker protection (referred to as BiOp refuge water supply). This reference is more relevant to Project operations, and its implementation in WY25 is provided in Chapter 3.

Other Supporting Programs and Actions

There are ongoing programs that provide support to Reclamation's Project operations.

- The Klamath Project Drought Response Program, which facilitates irrigation land fallowing as a means for demand reduction during drought conditions, was not active in WY 2025 due to the wetter hydrology.

- Voluntary Project water transfers are part of Reclamation's and individual irrigation district's regular operations to provide additional flexibility and efficiency in Project water use, while complying with water rights and other pertinent regulations. In WY 2025, one water transfer with a total of 2.54 TAF in July through September was implemented for delivery to LKNWR.

- Irrigation districts continue to implement voluntary water conservation efforts to improve agricultural water use efficiency, and the results were reflected in the overall Project water use and accounting. Reclamation operates AgriMet stations in the Klamath Basin to provide site-specific weather data as technical assistance to water users.

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Chapter 3 Irrigation Diversions and Refuge Deliveries

This chapter summarizes the irrigation diversions and refuge deliveries in more detail to supplement the river system-wide summary in Chapter 2. Two types of irrigation diversions with different contexts complete the annual irrigation use:

- Fall/winter diversions for field flooding and pre-irrigation of fall plantings based on water rights of irrigation districts, and
- Spring/summer diversions for agricultural production supported by Project Supply and DPS.

Deliveries to LKNWR and TLNWR from various sources were described with relevant operational details for context.

Seasonal Water Supply Forecasts

The new operating framework for Project operations in the 2024 BiOps limited the application of seasonal water supply forecasts to Project Supply allocation only. Other aspects of Project operations, including the management of the FFA reserved for river management, do not depend on seasonal water supply forecasts.

Available Forecasts

Natural Resources Conservation Service (NRCS) has historically been the primary source for seasonal water supply forecasts used for Project operations. NRCS provides forecasts for UKL net inflows and updates from January through June. Starting in mid-2024, NRCS has enhanced their seasonal water supply forecast with machine learning.

California-Nevada River Forecast Center (CNRFC) provides daily stream flow forecasts for UKL net inflows year-round and contributes seasonal water supply forecasts.

The new Project operating framework in the 2024 BiOps involves the use of a seasonal version of NWI (i.e., the Seasonal NWI) for Project Supply allocation. The Seasonal NWI is consistent with NWI in design and parameter use, and comparable functionally with the NRCS and CNRFC forecasts in the context of Project operations.[9]

[9] See Reclamation's 2024 Biological Assessment for detail.

Use of Multiple Forecasts

The 2024 BiOps require Reclamation to evaluate the use of multiple forecasts to reduce uncertainty in seasonal water supply projections. For Project operations, the primary forecasting need is the April–September seasonal water supply reflected in UKL inflows.

Incorporating an ensemble of credible forecast products was a consensus recommendation from experts participating in Reclamation's 2023 Klamath Basin Forecast Workshop. Advances in technology have made multi-model forecasting more accessible; however, a rigorous evaluation of the available forecast products is essential to understand their relative strengths, weaknesses, and forecasting skill for the issues most relevant to the Project.

In late 2024, Reclamation convened a working group that included subject-matter experts from NRCS and CNRFC, along with the NWI developer, Larry Dunsmoor, to assess the performance of the NRCS, CNRFC, and NWI forecasts.[10] Hindcasts by all three available forecasts were performed for a consistent period of analysis to establish a common basis for comparison. As part of the process, CNRFC also improved the model performance by modifying certain parameters for UKL net inflow forecast.

The group examined alternative approaches for combining these products to improve the accuracy of the April–September water supply forecast. Based on the findings, Reclamation adopted a combined forecast methodology for WY25 Project operations, specifically for Project Supply allocations, by averaging the NRCS and NWI forecasts (Combined Forecast). This simple average approach has proven beneficial in NRCS's recent efforts to enhance forecast skill through machine-learning methods and ensemble-based techniques. The outcome was reported in March RTO meetings including a topic-specific presentation on March 27.

Forecast Comparison

Table 13 provides a summary of available forecast products. For WY25, Reclamation adopted the Combined Forecast for Project Supply allocation purposes.

[10] As part of the efforts, CNRFC updated and recalibrated its model, and the period for comparison of forecast has extended to 2024. NRCS completed its model upgrade in 2024 to include results of machine learning and ensemble forecast.

Table 13. Selective Attributes of Available Seasonal Water Supply Forecast Products

Forecast Product	Subject of Forecast	Schedule of Availability	Technical Approach to Forecast
NRCS	Seasonal water supply in UKL net inflow	January through June	Statistical model
CNRFC	Daily flows and seasonal water supply in UKL net inflow	Daily throughout the year	Watershed physical process-driven model
Seasonal NWI	Seasonal water supply in UKL net inflow	March through June	Statistical model
Combined Forecast	Seasonal water supply in UKL net inflow	March through June	Average of NRCS and Seasonal NWI

Key: NRCS = Natural Resources Conservation Service; CNRFC = California-Nevada River Forecast Center; Seasonal NWI = Seasonal Normalized Wetness Index by Dunsmoor; Combined Forecast = Reclamation adopted water supply index for Project operations per the 2024 BiOps; BiOps = Biological Opinions.

Table 14 shows the expected values (i.e., 50-percent forecasts) of water supply in April through September by NRCS, CNRFC, NWI, and the adopted combined forecast. Each forecast shows different levels of sensitivity to the weather pattern in WY25—wet winter and dry spring. Due to its design, NWI has more muted responses to change. Being hydrologic indices, NRCS and CNRFC forecasts showed more sensitivity to the dry conditions which developed during the spring of 2025.

Table 14. Comparison of Seasonal April-through-September Water Supply Forecasts (Actual Amount = 472.3 TAF)

Date of Forecast	NRCS Forecast[1] (TAF)	CNRFC Forecast[1] (TAF)	NWI Forecast[1] (TAF)	Combined Forecast[1] (TAF)
1/1	510	476	-	-
1/16	485	502	-	-
2/1	560	624	-	-
2/16	640	660	-	-
3/1	640	684[2]	538	589
3/16	690	771[2]	540	615
4/1	720	670	613	667
4/16	635	679	561	598
5/1	578	675	520	549
5/16	565	523	560	562
6/1	480	464	520	500

Key: NRCS = Natural Resources Conservation Service; CNRFC = California-Nevada River Forecast Center; NWI = Normalized Wetness Index; Combined Forecast = Average of NRCS and NWI forecasts.

[1] The realized volume to the forecast date was added to the forward-looking forecasts.

[2] The record of the exact date is not available; the record of an adjacent date is used.

Hydrometeorological conditions in WY25 were generally moderate. Although unusual, the pattern of a wet winter that quickly turned into a dry spring did not yield conditions that are beyond the range of historical variability. Project operations did not encounter notable challenges or issues attributable to Reclamation's use of the Combined Forecast for Project supply allocations. Given these conditions—and the fact that only one year of operational data is available—there is no clear basis at this time for revising the current combined forecast methodology.

Fall/Winter Irrigation Diversions

The Klamath Drainage District (KDD) diverts water from the Keno Impoundment under its water rights through the North Canal and Ady Canal during the fall and winter months to flood fields within the KDD service area and on lease lands in LKNWR. This practice provides cascading operational benefits by reducing water demands during the irrigation season and lowering the need for pesticide use. Typically, flooded fields are drained in late winter or early spring, with the return flows conveyed back to the Keno Impoundment through the F/FF Pumps.

Reclamation simplified the accounting for KDD's fall and winter diversions with the support of all parties of the same UKL claim including Reclamation for Project operations. Under this simplified approach, KDD diversions through the North Canal and Ady Canal from October through February are categorized as fall/winter irrigation diversions, while diversions from March through September are counted against Project Supply. Table 15 presents the monthly totals of KDD fall/winter diversions in WY25. Diversions of WY24 Project Supply in early October 2024 were excluded from these statistics.

Table 15. Monthly KDD Fall/Winter Irrigation Diversions in WY25

Month	North Canal[1] (AF)	Ady Canal[1] (AF)	Monthly Total (AF)
October	-	-	-
November	4,176	5,885	10,061
December	989	4,472	5,461
January	3,767	2,370	6,137
February	99	1,190	1,289
March	-	-	-
April	-	-	-
May	-	-	-
June	-	-	-
July	-	-	-
August	-	-	-
September	-	-	-
Total	9,031	13,916	22,947

Key: AF = acre-feet; KDD = Klamath Drainage District; WY24 = Water Year 2024; BiOps = Biological Opinions.

[1] KDD diversions in early October 2024 were from WY24 Project Supply, which was subject to the 2019 BiOps and thus excluded.

Ady District Improvement Company is another entity with water rights that could support this practice near the Klamath River; their limited allowable volume was accounted for as part of the local accretion/depletion of the Keno Impoundment.

Spring/Summer Irrigation Diversions

Spring and summer irrigation diversions include withdrawals of allocated Project Supply from UKL as well as deliveries of DPS at various locations. The 2024 BiOps introduce greater potential interaction between irrigation diversion management and refuge water deliveries, as well as between UKL water management and district-level operations. Consistent with the 2024 BiOps, Reclamation implemented several measures during Project operations to enhance operational efficiency, increase flexibility, and support collaborative water management.

Project Supply

In WY25, Reclamation allocated and managed Project Supply following the procedures set forth in the 2024 BiOps.

Progression of Project Supply Allocations

Table 16 summarizes the progression of Project Supply allocations for WY25 with increasing certainty based on the procedures established in the 2024 BiOps. The information was regularly shared in RTO meetings.

Table 16. Progression of UKL Project Supply Allocations

Date	Project Supply Allocation (TAF)	Project Supply from Storage	Project Supply from Inflow	Variable Project Supply
3/1	245	Projected	Projected	Projected
4/1	277	Firm	Projected	Projected
4/15	256	-	Firm	Projected
5/1	241	-	-	Projected
5/15	249	-	-	Projected
6/1	233	-	-	Firm

Key: TAF = thousand acre-feet.

Demand Changes in Spring and Response Actions

Reclamation estimated spring and summer irrigation demands using historical use patterns and input from water users. These estimates were updated as needed throughout the season. Under the Project operations framework in the 2024 BiOps, estimated irrigation demand does not influence Project Supply allocations. Instead, the demand estimate serves as a reference point for Reclamation to evaluate whether response actions may be warranted. If estimated demand exceeds the projected Project Supply, Reclamation may consider a range of shortage-planning actions, including transfers, additional conservation measures, or other operational arrangements. A drought plan may also be developed if a substantial shortage is anticipated.

The effects of the dry spring are reflected in the progression of Project Supply allocations shown in Table 16. Reclamation disclosed an increase in estimated irrigation demand in June due to unfavorable weather conditions. Because Project Supply allocations—finalized in early June—are independent of demand estimates, the increased demand did not affect the established allocation.

Following the initial disclosure of demand increase in June, Reclamation kept RTO participants informed of ongoing efforts to close the projected water supply gap, including issuing a memo detailing the potential need for additional water. Through close collaboration with water users, Reclamation met the increased demand by utilizing other water sources, including DPS, and by supporting increased district-level coordination to improve water use efficiency. There were neither drought planning actions nor additional use of UKL stored water in WY25 to meet the demand. Active coordination, cooperation, and communication were critical to achieving this favorable outcome.

Irrigation Diversions from Project Supply

Table 17 summarizes the irrigation diversions from Project Supply at various diversion points, excluding the diversions of WY24 Project Supply in October and November. Project Supply presented herein contains only water supply from UKL for water users, which also received water supply from DPS, water supply from the Lost River system, and irrigation water reuse where feasible. See later discussions for details.

As previously discussed, the dry conditions in March through June after a hydrologically productive winter resulted in adjustments reflected in various forecast products including the Combined Forecast adopted by Reclamation per 2024 BiOps. Reclamation also adjusted its estimate of irrigation demand; however, demand estimates are not referenced in the criteria and procedures of 2024 BiOps for Project Supply allocation, but for Reclamation to considered if any drought emergency actions are warranted.

Working with water users and other stakeholders, Reclamation did not declare needs of drought measures and leveraged other sources of water including DPS and irrigation water reuse to successfully remedy the potential water supply gap, which was first identified as 38 TAF in June through the remaining irrigation season. At the end of WY25, a balance of 4,402 AF of Project Supply from the 233-TAF allocation was available for the tail-end of the remaining irrigation season for crops such as potatoes in Tulelake Irrigation District and garlic in Klamath Irrigation District.

Table 17. Monthly Irrigation Diversions from Project Supply in WY25

Month	A Canal[1] (AF)	Station 48[1] (AF)	Miller Hill[1] (AF)	North Canal[1] (AF)	Ady Canal[1] (AF)	Monthly Total[1] (AF)
October	-	-	-	-	-	-
November	-	-	-	-	-	-
December	-	-	-	-	-	-
January	-	-	-	-	-	-
February	-	-	-	-	-	-
March	-	-	-	-	-	-
April	5,810	-	-	-	-	5,810
May	28,729	7,749	829	1,749	1,911	40,966
June	31,992	20,718	1,823	3,287	4,064	61,884
July	34,788	17,508	1,987	2,967	4,314	61,564
August	26,075	7,756	1,552	1,524	4,541	41,447
September	13,058	440	293	422	2,714	16,927
Total	140,453	54,170	6,483	9,948	17,544	228,598

Key: AF = acre-feet.

[1] Diversions from WY24 Project Supply in October and November were excluded.

Deferred Project Supply

The 2024 BiOps specify that DPS is the credits water users accumulate for Project operations using water from the Lost River system in lieu of UKL water during November through September. Attributable credits occur when neither Link River Dam nor Keno Dam is spilling, and inflows from the Lost River system via LRDC or return flows through the F/FF Pumps are used for at least one of the following two purposes in lieu of UKL water: meeting the target release from Keno Dam and maintaining water level at Sump 1A in TLNWR and Unit 2 in LKNWR. In other words, not all flows of LDRC and F/FF Pumps into the Keno Impoundment are eligible for DPS credits. In WY25, DPS accumulation started in late December 2024, and the associated accounting was performed daily.

Combining Accounting of BiOp Refuge Water Supply and DPS

The 2024 USFWS BiOp requires up to 43 TAF of refuge water supply, available at a uniformed daily rate between April 1 and October 30, to maintain water levels at LKNWR Unit 2 and TLNWR Sump 1A. Reclamation has many options for providing this water supply in addition to UKL stored water; these options including Lost River flows, UKL flood control releases, voluntary transfers and exchanges, unused Project supply, and other arrangements in accordance with federal and state authorizations.

In collaboration with water users, Reclamation implemented a streamlined accounting process. For accounting purposes, Reclamation added credits of refuge water supply to the DPS account balance for management in an even rate from April 1 through September 30, consistent with the allowable schedule for DPS accumulation. In exchange, irrigation districts were responsible for maintaining the water levels at Unit 2 and Sump 1A; water deducting from the DPS account balance for water level maintenance purposes was tracked and reported as BiOp refuge water delivery. This streamlined procedure incentivizes more integrated water management on the district level for efficiency and flexibility. This approach also eliminates the need to track the reuse of LRDC and F/FF Pumps flows for maintaining water levels in refuges (i.e., the second scenario for DPS eligibility).

Low Priority for Using UKL Storage

The balance of DPS is stored in UKL with a lesser priority than storing Project Supply, FFA, and water needed for other Reclamation's obligations. During flood operations, DPS spill will occur before UKL spill. In WY25, DPS spill occurred and Reclamation was able to redirect the water to the LKNWR. See later discussion on flood operations for more details.

WY25 DPS Uses

In WY25, DPS was used for irrigation and refuge water supply, which includes BiOp refuge water supply delivery as mentioned above. At the end of WY25, there were 7,798 AF of DPS remaining to be used in the remaining irrigation season for irrigation and refuge uses, and the DPS accumulation stopped. Table 18 shows the monthly DPS uses for irrigation and

refuge delivery and end-of-month balance in WY25; these aggregated statistics for irrigation use and refuge delivery are further expanded in subsequent discussions.

Table 18. Monthly DPS Uses and End-of-Month Balances in WY25

Month	Irrigation[1] (AF)	Refuge Delivery[2] (AF)	Monthly Total (AF)	End-of-Month Balance (AF)
October	-	-	-	-
November	-	-	-	-
December	-	1,994	1,994	7,097
January	-	5,369	5,369	18,468
February	-	5,119	5,119	35,802
March	4,403	13,305	17,708	27,980
April	4,981	8,784	13,765	28,651
May	4,363	3,538	7,901	24,727
June	9,883	1,402	11,285	23,477
July	14,099	1,216	15,315	17,594
August	15,558	904	16,462	10,661
September	13,718	1,546	15,264	7,798
Total	67,005	43,178	110,183	n/a

Key: AF = acre-feet; n/a = not applicable.

[1] See Table 19 for details of irrigation diversions from DPS.

[2] See Table 20 for details of refuge delivery from DPS.

Irrigation Diversions from DPS

As previously mentioned, using DPS is the major response action to alleviate the challenges with increased demand due to dry spring conditions. Table 19 summarizes the irrigation diversions from DPS at various diversion points, showing increased irrigation diversions from DPS after June.

Table 19. Monthly Irrigation Diversions from DPS in WY25

Month	A Canal (AF)	Station 48 (AF)	Miller Hill (AF)	North Canal (AF)	Ady Canal (AF)	Monthly Total (AF)
October	-	-	-	-	-	-
November	-	-	-	-	-	-
December	-	-	-	-	-	-
January	-	-	-	-	-	-
February	-	-	-	-	-	-
March	2,334	-	-	-	2,069	4,403
April	4,981	-	-	-	-	4,981
May	3,064	820	92	181	206	4,363
June	5,061	3,336	292	543	651	9,883
July	7,980	3,999	456	691	973	14,099
August	9,704	3,026	586	569	1,674	15,558
September	10,355	349	176	526	2,313	13,718
Total	43,479	11,529	1,603	2,509	7,885	67,005

Key: AF = acre-feet.

Flood Operations

As noted in Chapter 2, Reclamation considers multiple factors when conducting flood operations, including public safety and opportunities to beneficially use floodwater. Although UKL spill volumes were limited in WY25 (see Table 6), two additional elements of Project operations are particularly relevant in the context of flood management.

First, through consultation with the Services, Tribes, and interested parties, Reclamation implemented the FFAFFA pulse-flow release in late February and early March to take advantage of a natural high-water event. This approach maximized the operational value of the FFA and helped reduce the likelihood of more extensive flood-control actions.

Second, in coordination with water users, Reclamation released DPS water to the LKNWR when DPS spill was likely, subject to conveyance and other physical constraints. When a DPS spill became unavoidable in early spring, Reclamation directed the water to the LKNWR in a similar manner. These deliveries supported water-level maintenance in Unit 2 of the LKNWR and Sump 1A of the TLNWR for sucker protection, while also helping to reduce reliance on BiOp refuge water supplies. Consequently, Reclamation's implementation of the combined accounting approach for DPS and BiOp refuge water deliveries further enhanced the operational value of DPS management within the broader context of flood operations.

Reclamation's active coordination and the cooperation of all participating parties were essential to these efforts. Collectively, these actions illustrate the benefits of a more integrated approach to Project operations.

Refuge Water Delivery

Tables 20 and 21 summarize the water deliveries to the LKNWR and TLNWR in WY25, respectively.

Table 20. Monthly LKNWR Water Delivery in WY25 by Source

Month	UC (AF)	Transfer (AF)	Flood Op (AF)	DPS (AF)	BiOp Water Supply (AF)	Lost River (D Plant) (AF)
October	-	-	-	-	-	-
November	-	-	-	-	-	-
December	2,182	-	-	1,994	-	2,380
January	-	-	-	5,369	-	8,500
February	-	-	-	5,119	-	8,405
March	-	-	6,694	6,611	-	13,887
April	-	-	1,097	2,096	5,591	4,712
May	-	-	226	224	3,088	-
June	-	-	-	-	1,402	-
July	-	337	-	-	1,216	-
August	-	841	-	-	904	-
September	-	1,362	-	-	1,546	3,064
Total	2,182	2,540	8,018	21,412	13,748	40,948

Key: LKNWR = Lower Klamath National Wildlife Refuge; UC = Uncategorized; Flood Op = Flood Operations (i.e., DPS spill); DPS = Deferred Project Supply; BiOp = Biological Opinion; BiOp Water Supply = Refuge water supply prescribed in 2024 USFWS BiOp; D Plant = D Pumping Plant; AF = acre-feet.

Table 21. Monthly TLNWR Water Delivery in WY25 by Source

Month		Flood Op (AF)	DPS (AF)	Lost River (Anderson Rose Diversion Dam) (AF)
October		-	-	91
November		-	-	1,182
December		-	-	4,399
January		-	-	1,146
February		-	-	3,947
March		-	-	1,400
April		-	-	793
May		-	-	670
June		-	-	2,223
July		-	-	6,764
August		-	-	2,497
September		-	-	1,902
Total		-	-	27,017

Key: TLNWR = Tule Lake National Wildlife Refuge; Flood Op = Flood operations (i.e., DPS spill); DPS = Deferred Project Supply; AF = acre-feet.

Early Uncategorized Delivery

During the transition period in December 2024, refuge water delivery with a total of 2.182 TAF was made at Reclamation's discretion in late December 2024 with concerns over elevated inflows to UKL. Because this delivery occurred in the transition period, it was not categorized in any account prescribed by the 2024 BiOps.

Voluntary Transfer

In WY25, one water transfer with a total of 2.54 TAF for delivery to the LKNWR occurred in July through September.

DPS Contributions

Refuge water supply from DPS (21,412 AF) and DPS spill during flood operations (8,018 AF) was delivered to the LKNWR. The significant amount of preemptive release of DPS suggests active management of UKL storage in the new Project operating framework. With the relatively productive Lost River system in WY25, there was no DPS water delivered to the TLNWR. This is a result of the above-mentioned simplified DPS accounting procedures Reclamation implemented in cooperation with water users, which alleviates the challenges in tracking contribution of return flows for maintaining required refuge water level.

BiOp Refuge Water Supply

Reclamation coordinated with USFWS and water users to implement BiOp refuge water supply per 2024 USFWS BiOp. Through continued coordination in early 2025, USFWS recognized that the required water elevation for LKNWR Unit 2 was set incorrectly; the correct elevation should be 4,082.7 ft on the NAVD 88 datum.[11] In addition, USFWS also issued a memorandum on June 11, 2025, to temporarily relax the required elevation for TLNWR Sump 1A through October 1, 2025, from 4,034.0 ft to 4,033.5 ft (USBRKB Datum) to alleviate human health and safety concerns stemming from potential dike failure and resulting flooding conditions.[12] Reclamation is expected to coordinate with the Service and Tulelake Irrigation District to conduct appropriate bathymetric and dike surveys and take steps to remedy operational issues prior to April 1, 2026.

In WY25, a total of 13.748 TAF was used for maintaining water elevations in LKNWR Unit 2 and TLNWR Sump 1A with the above corrections and modifications (see Table 20). Table 22 summarizes the compliance status of required water levels in WY25. Although Sump 1A did fall below the normal required elevation shown in the table, there was a temporary operational agreement in place with USFWS due to subsidence of the berm surrounding the sump.

Table 22 Refuge Water Level Compliance

Compliance Location	Compliance Period (Irrigation Season after April 1)	Required Water Elevation (ft)	Percentage of Days in Compliance in WY25
LKNWR Unit 2	April through October	4,082.7[1]	100%
TLNWR Sump 1A	April through October	4034.0/4,033.5[2]	100%

[1] The elevation reflects the correction of referenced datum correction with USFWS' recognition.

[2] The elevation reflects the temporary relaxation till October 1, 2025, approved by USFWS to avoid human health and safety concerns stemming from potential dike failure and resulting flooding conditions.

[11] Phillips, B., 2025. Personal communication. December 29.

[12] USFWS, 2025. Reclamation request for Temporary relaxation of Tule Lake Sump 1A Elevation. Memorandum. July 11.

Chapter 4 Findings

WY25 marked another significant year of transition for the Klamath River Basin and for Reclamation's Project operations. Working collaboratively with the Services, Tribes, state and federal agencies, water users, and other interested parties (collectively, Klamath Basin stakeholders), Reclamation advanced the onboarding of the new operational framework established in the 2024 BiOps, which were developed for a system with post–dam removal and A–B Reconnection conditions. This review of WY25 Project operations is to establish shared understanding among Klamath Basin stakeholders on the outcome of implementing the new operational framework and identify potential areas for refinement. This chapter summarizes the key findings of this review.

Summary of Findings

Reclamation operated the Project in compliance with applicable laws and regulations, including the 2024 BiOps, which established a new operational framework for the changed physical environment. Hydrometeorological conditions in WY25 were generally mild, with above-average UKL net inflow. Although the rapid shift from a wet winter to a dry spring[13] introduced challenges for water-supply management, these challenges were successfully addressed through collaboration and use of available water sources without increasing UKL water use or triggering consultation to modify the annual operations plan.

Key Performance Indicators

WY25 is an important onboarding year for this new operating framework. Overall, and aided in part by generally favorable hydrometeorological conditions, Project operations delivered satisfactory outcomes as evidenced by the following key indicators.

- Project operations were consistent with the terms and conditions of the 2024 BiOps.
- The Klamath Tribes' water-right claim on UKL elevations was met throughout WY25.[14]

[13] This was a pattern shared across the broader region, including California.

[14] See Table 7 and associated discussions regarding comparison between the stair-step UKL elevation claim and the gradually changed UKL elevations resulting from steady withdrawal from UKL storage during the irrigation season.

- Following the transition period, Keno Dam releases met required target flows, and downstream river temperatures below the former Iron Gate Dam aligned with expectations set forth in the 2024 BiOps.
- The FFA was successfully implemented, reaching its maximum allowable volume and supporting a pulse-flow release that was timed to coincide with a natural high-water event and initiated earlier than planned to alleviate flood concerns and reduce potential loss of DPS due to flood control spills.
- The demands of KDD fall/winter diversions under its water rights for field flooding were met.
- The irrigation demands of water users were met by the allocated Project Supply and DPS, with complementary district-level management, without requiring major shortage planning or drought response measures.
- Water elevations in LKNWR Unit 2 and TLNWR Sump 1A were maintained above required thresholds for sucker protection using BiOp refuge water supply, voluntary transfers, irrigation drainages, and Lost River flows. No major disease outbreaks occurred.
- No flooding around the Keno Impoundment or downstream of Keno Dam was attributed to Project operations.
- UKL storage was efficiently managed, resulting in limited spilling to the Klamath River.
- End-of-September elevations in Clear Lake and Gerber Reservoir exceeded minimum required levels.

Implementation of Practices and Accounting Procedures

Reclamation successfully implemented the flexibility and efficiency measures allowed under the 2024 BiOps and other applicable laws and regulations:

- WY24 irrigation diversions (ending in November 2024) were accounted for separately and excluded from WY25 accounting.
- KDD diversions from November through February, excluding WY24 irrigation diversions, were treated as fall/winter diversions allowable under KDD's water rights. The streamlined accounting procedures are supported by all parties to the same UKL claim, including Reclamation for Project operations.
- Project Supply was allocated in accordance with the 2024 BiOps, including its finalization based on the June 1 forecast. The Combined Forecast approach satisfied

the BiOps requirement to use multiple forecasts to reduce uncertainty. Subject matter experts supported the adopted methodology, and WY25 implementation provided no basis for immediate revision or improvement.

- Crediting and use for FFA and DPS were implemented in accordance with the 2024 BiOps, supported by daily accounting and regular reporting through RTO meetings. Proactive coordination and consultation maximized the benefits of the FFA pulse-flow release and improved the efficiency of DPS management DPS and refuge water deliveries, particularly in the context of flood operations. DPS and BiOp refuge-water management were effectively integrated for improved efficiency and increase in water user's ability and willingness to leverage district-level water management and use irrigation drainage for maintaining refuge water levels to the extent possible to reduce reliance on UKL stored water.

Communication and Coordination

Reclamation streamlined its communication approach in WY25, consistent with recommendations from the WY24 AAR Workshop and recognizing the inherent challenges of coordinating complex Project operations without overwhelming stakeholders. Execution of these improvements was affected by federal restructuring and staff changes, but the following outcomes were achieved:

- The Klamath Basin Science Collaboration was established as a separate forum to address basin-scale resource management issues outside the scope of Project operations.
- Reclamation engaged in consultations with OWRD, the Services, and Tribes as appropriate, without adding additional layers of management structure or meetings.
- Reclamation invested in RTO meetings to be the primary venue for communication with Klamath Basin stakeholders on intra-seasonal and seasonal Project operations. The absence of requests to convene WYOps meetings suggests that RTO meeting coverage was sufficient. Following every RTO meeting, an annotated presentation package was distributed for transparency and future reference.
- Reclamation distributed weekly meeting digests to a broad list of interested parties for situational awareness and transparency.
- Reclamation responded individually to stakeholder questions and concerns not suited for group meetings like RTO meetings, including several Government-to-Government meetings with the Yurok and Klamath Tribes.
- Reclamation participated in regular meetings hosted by water users to facilitate close coordination and cooperation for Project operations, including district-level

water management to improve joint management of Project Supply, DPS, and BiOp refuge water supply.

Areas of Potential Refinement

The first year of 2024 BiOps implementation yielded positive results and revealed no major issues of the new operating framework that requires immediate attention or corrective actions. Continued collaboration and refinement remain essential for realizing the intent of coordinated and cooperative water management and risk sharing. The adaptive management framework remains central to Project operations.

Based on the outcome and review of WY25 Project operations, the following areas warrant continued monitoring and potential refinement:

1. Assessing the new operating framework

   The new operating framework was customized specifically for the Project using the records from 1991 through 2022 with the assumption that future conditions are within the range of historical records with similar attributes. The rapid transition between wet winter and dry spring conditions, as observed in WY25, was unusual in its pattern, but not beyond the range of historical records. Continued monitoring and research for potential refinement if warranted could be helpful to Project operations in changing climate.

   A separate but relevant consideration is to incorporate seasonal and climate signals in irrigation demand estimate to better prepare for potential water shortage planning efforts, if necessary.

2. Evaluating practices and procedures for implementing the 2024 BiOps

   Current procedures—including accounting for KDD fall/winter diversions, FFA, DPS, and BiOp refuge water—worked reasonably effective, and no immediate changes are currently identified. However, it is recognized that many accounting and operational procedures in 2024 BiOps including using NWI and Ops Index for operational decisions can be confusing to those stakeholders who are not involved in Project operations regularly. Reclamation should continue working with water users, the Services, and Tribes to identify potential refinements and opportunities for streamlining the processes and procedures.

   Particularly, in WY25, the identified increase in demand of up to 38 TAF initially due to weather conditions was accommodated by mixed measures of using other sources of water including DPS and irrigation water reuse. While the level of operational

flexibility and corresponding collaboration between Reclamation and water users were celebrated, it may suggest room for adjustments in the current set of procedures and rules to increase certainty of Project operations and performance (e.g., FFA, DPS and BiOp refuge water). It cannot be overstated that Project operations in WY25 were experimental with major changes in physical environment and use of a new approach for allocating water among various beneficial uses. This, however, requires more in-depth analyses in collaboration with water users and other agencies and stakeholders are necessary.

Separately, an annual review process will be beneficial for examining the adequacy of the Combined Forecast. More frequent reassessments and revisions are not recommended, as it would introduce instability into in-season irrigation operations.

3. Enhancing communication effectiveness

   A recurring need is to improve shared understanding and confidence in the accounting, crediting, and operational logic of the various accounts. The complexity of accreditation and accounting of various accounts (e.g., DPS, FFA, and BiOp refuge water delivery) can be overwhelming for stakeholders who do not work with system-operation models regularly or are not involved in Project operations regularly. Many questions raised during RTO meetings stemmed from this knowledge gap, despite multiple dedicated meetings during the BiOps development process. RTO meetings can reinforce previously communicated concepts but cannot support foundational educational needs. Additional communication and training tools could improve transparency and shared understanding, including:

   - A refresher session on accounting procedures such as DPS accounting and operational logic could be held in February, prior to the start of the irrigation season,
   - Flowcharts for navigating the complex rules and procedures as described in 2024 BiOps could be helpful to improve understanding and identify potential areas of improvement and streamlining,
   - Selective topic-specific workshops that are deemed beneficial, especially when certain changes may be warranted (e.g., seasonal water supply forecast, water supply allocation among beneficial uses), and
   - Concise explanatory materials with baseline guidance on key elements of the Project operations.