REPORT | DECEMBER 2024

RECHARGE FEASIBILITY STUDY
USBR POND SOUTH OF CORNING CANAL

PREPARED FOR

TEHAMA COUNTY FCWCD

AND CORNING SUB-BASIN GSA

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1. BACKGROUND

This feasibility study was conducted as part of the Tehama County GSP Implementation Prop 68 Grant and was part of the grant application. The site is located in the Corning Subbasin and is approximately 10 acres. Historically, this pond has been used by the United States Bureau of Reclamation (USBR) in the winter for flood control when the Corning Canal overtops or during maintenance of the Corning Canal. Due to the size of the pond and its proximity to the Corning Canal, it is considered a potential site for recharge.

2. PERCOLATION TESTING

2.1. Site Description

The USBR pond is located north of Liberal Avenue, near the Corning Canal, in the Corning Subbasin. The pond is approximately 10 acres. The outlet from the pond was sealed to ensure accurate measurement of evaporation and seepage. Water was added to the pond from the Corning Canal through an inlet. A total of 45 acre-feet was added to the pond to allow for a depth of water between four and five feet. A small dock extended out into the pond and was utilized to suspend monitoring equipment.

Figure 2-1 USBR Pond Aerial View

2.2. Methodology

2.2.1. Water Balance

A water balance method was employed to determine the percolation rate at the USBR pond adjacent to the Corning Canal. This method involves accounting for all inflows and outflows and calculating the resulting change in storage in the pond, expressed as the sum of all inflows minus the sum of all outflows.

Inflows include discharges into the pond, direct precipitation, and runoff from the pond's embankments. Outflows consist of water removals, evaporation, and percolation into the subsurface. Ideally, testing is conducted during periods of no precipitation, as even minor precipitation events (e.g., a few tenths of an inch) can introduce significant uncertainty into the results.

When inflows and outflows are recorded as positive values, a negative value indicates a decline in pond storage. The change in storage is measured by observing the decrease in the pond's water level over a specified period. If measurements are taken while all discharges and removals are halted and no precipitation occurs, the change in storage can be attributed solely to evaporation and percolation.

2.2.2. Depth Measurements

Transducers were deployed in the pond to measure changes in water height. Two transducers were used to ensure redundancy and maintain data quality control. The depth measurements do not represent the actual water depth of the pond but are relative to the position of the deployed transducers (e.g., 12 inches below the water surface at the beginning of the test). These measurements provide relative changes in water depth for the duration of the seepage test.

The transducers were hung from posts extended horizontally over the surface on the southeast side of the pond. A catwalk that extended out into the pond over an outlet to a neighboring creek was used to attach the posts that suspended the transducers. Two transducers were utilized to provide redundancy in data collection.

2.2.3. Evaporation Model

Evaporation is calculated using the bulk aerodynamic transfer model. The meteorological station (MET station) deployed at the pond collected data on wind speed and direction, air temperature and humidity, rainfall, and surface water temperature.

The MET station was also deployed on the southeast side of the pond in the vicinity of the transducers as depicted in Figure 2-2. It was set up on the road which runs around the perimeter levee which forms the pond, adjacent to the catwalk from which the transducers were suspended.

Figure 2-2 Monitoring Equipment Setup

2.3. Data Analysis

2.3.1. Water Levels

Data collected from both transducers was analyzed to document relative changes in water levels within the pond. Depth data was collected at one-minute intervals and then aggregated to 15-minute intervals to correspond with the meteorological data used for the evaporation model.

Figure 2-3 shows the data collected from both transducers (T1 and T2) and the calculated mean from both datasets. Both datasets were aggregated on 15-minute intervals starting from May 4th 2024 through May 10th 2024. A mean cumulative relative change of 39.8 mm was observed over the period from May 4th 2024 to May 10th 2024, as shown in Figure 2-3.

As seen in Figure 2-3, T1 experienced interference with water level readings as evidenced by several sharp changes recorded in water levels. This interference can be caused by the transducer being caught in vegetation within the pond. Due to this measured interference, water levels from T2 were utilized for percolation rate calculations. The cumulative change in water level in T2 was 43.6 mm.

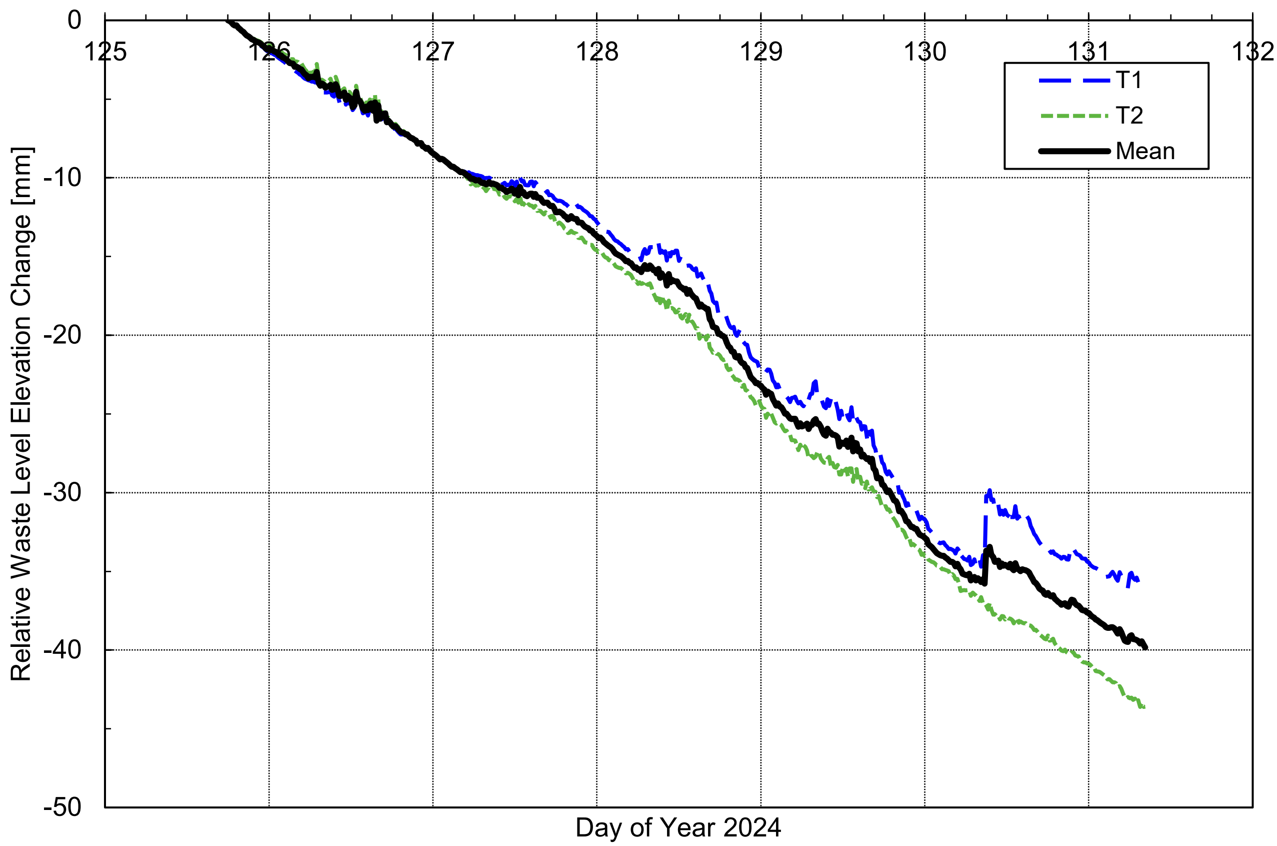

Figure 2-3 Relative Change in Water Level Elevation

2.3.2. Evaporation

Data collected from the MET station was used to calculate the evaporation rate and cumulative evaporation from the surface of the pond. Two infrared radiometer sensors were used to collect water temperature information from the surface of the pond. This information, in conjunction with wind speed and direction, air temperature and humidity and rainfall were used as input for the model to calculate evaporation at 15-minute intervals.

Evaporation was calculated using each of the two infrared radiometer sensors and the mean of those two calculations was also calculated. Figure 2-4 shows cumulative evaporation as calculated from both infrared radiometers (S1 and S2) and mean cumulative evaporation. A mean cumulative evaporation of 31.2 mm was calculated from May 4th 2024 to May 10th 2024.

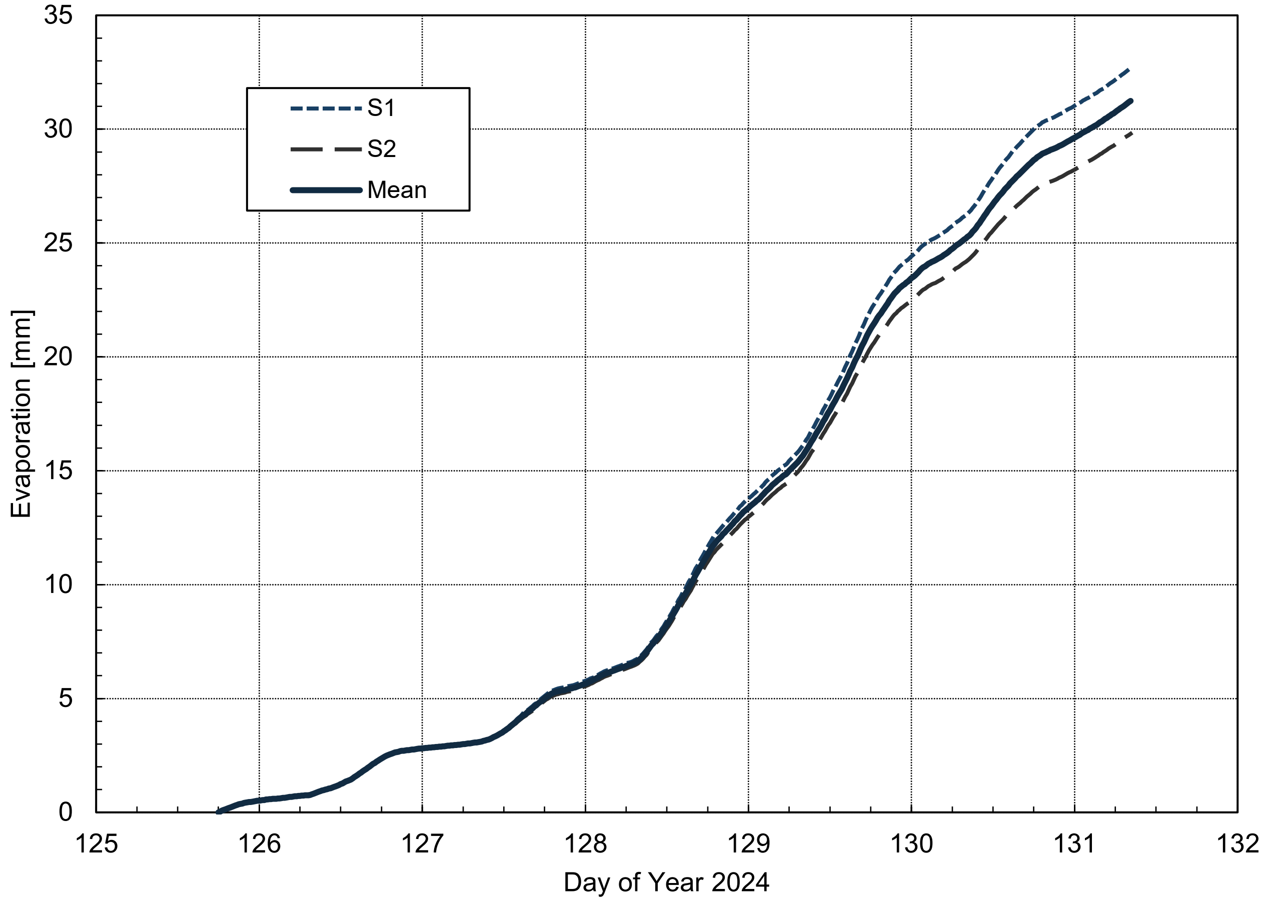

Figure 2-4 Cumulative Evaporation

3. RESULTS

To calculate the percolation rates observed in the pond, a water balance method was utilized. The cumulative evaporation was subtracted from the cumulative change in water levels to determine the percolation rate. Based on the changes in water levels and cumulative evaporation, a percolation rate of 2.2 mm/d was calculated. These results are depicted in Figure 3-1.

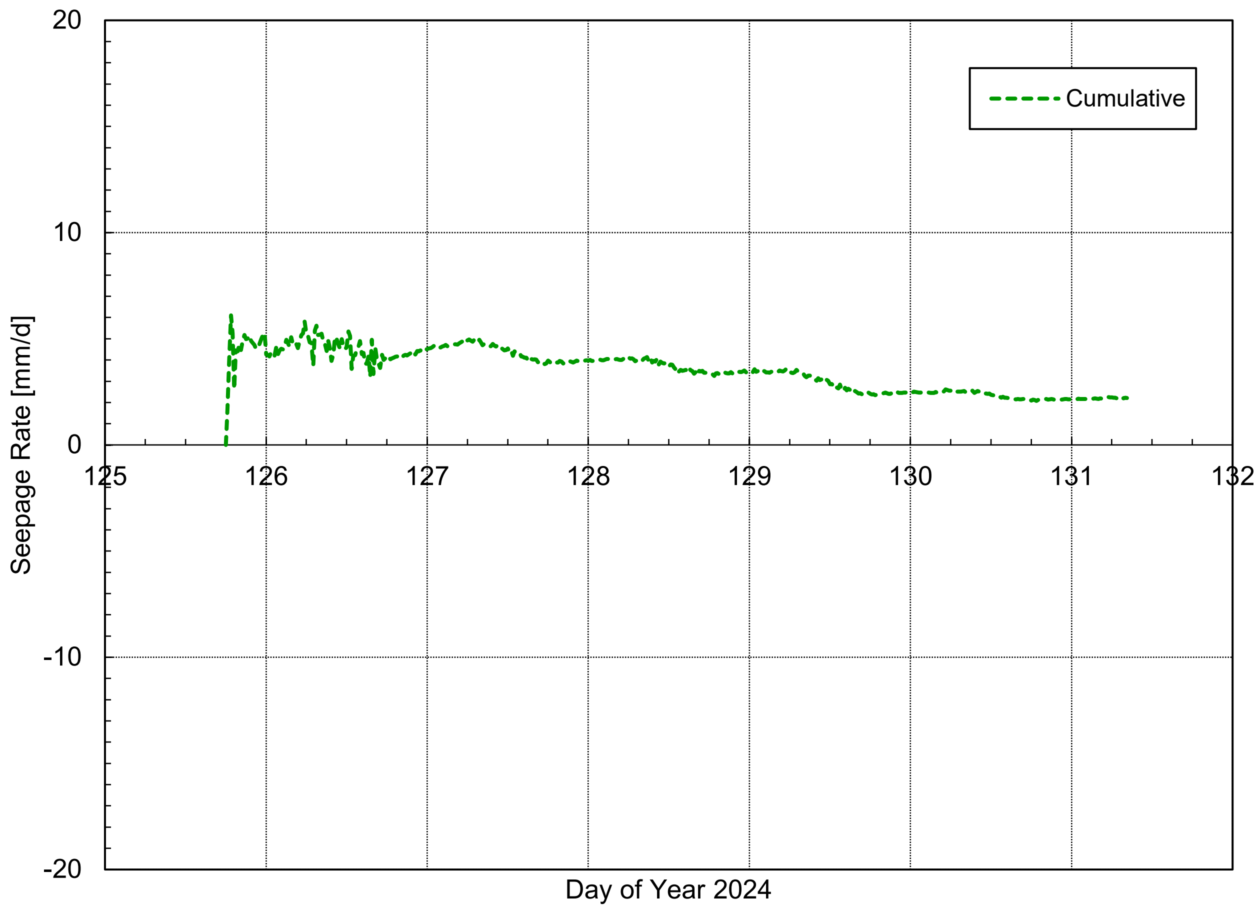

Figure 3-1 Cumulative Percolation Rate

4. RECOMMENDATIONS

The percolation study was conducted over a span of six days. During this time, the percolation rate in the pond converged to 2.2 mm/d. When evaluated in the context of a recharge pond, this rate is very low. This low rate suggests that this pond is better suited as a water storage facility rather than a pond to be used for recharge.

Although as built construction records for the ponds were not available prior to the study, the pond was most likely constructed to minimize water losses similar to the adjacent canal. Without further modification of the pond to improve percolation rates, this site is not suitable for recharge.

Potential modification of the pond was discussed with USBR and TCCA staff. However, USBR and TCCA did not view the idea favorably and highlighted the lengthy process required to seek approval for modifications. Thus, pond modification is not a feasible avenue forward at this site.

Given the limitations of the low percolation rate and inability to modify the pond to improve these percolation rates, this feasibility study concludes that the funds allocated to this site should be diverted to another recharge task under this grant.