FEASIBILITY STUDY

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From: Davids Engineering, Inc.

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Subject: **Corning Water District Rapid Appraisal**

1 Executive Summary

Corning Water District (CWD or District) was formed in June 1954 and currently has a service area boundary extending from Thomes Creek on the north, the Southern Pacific Railroad on the east, five (5) miles west of Interstate 5, and four (4) miles south of Corning Road and currently includes 11,075 irrigable acres. In 1963, CWD entered into a contract with the Bureau of Reclamation (Reclamation) to construct a water distribution system to deliver up to 25,300 acre-feet annually. In 1998, CWD permanently relinquished its entitlement to 2,300 acre-feet of its CVP water supply to the United States in exchange for payment of accumulated interest and non-interest-bearing Operation and Maintenance (O&M) Deficits through Federal Fiscal Year 1997. In 2017 and 2019, the District further relinquished 3,000 acre-feet and 5,000 acre-feet, respectively, of their water allocation to prepay O&M Deficits and to reduce the cost of CVP surface water supply. The District's existing contract with Reclamation provides for the annual delivery of up to 15,000 acre-feet of Central Valley Project Water.

In recent years, many landowners have converted from flood irrigation to groundwater-supplied pressure drip, micro sprayers, or sprinkler irrigation requiring booster pumps and filter stations as well as transitioned largely to permanent crops. Small parcel sizes, drought conditions, higher Reclamation water prices, and increased farm water use efficiency have reduced CWD's overall water deliveries significantly in recent years to the point where they struggle to use their full allocation of 15,000 acre-feet annually.

The purpose of this Technical Memorandum is to summarize the results of a "Rapid Appraisal" focused on increasing surface water use and reducing groundwater dependency in CWD. Prior to increasing surface water use it is prudent to (1) understand if the distribution infrastructure can accommodate increased flow, (2) determine if CWD has surplus water to supply and (3) quantify potential increased demand. A service area capacity analysis was completed to determine if the CWD distribution infrastructure can handle an increase in demand by comparing as-built design capacities of each lateral to turnout delivery data supplied by CWD for the 2019, 2020, 2021, 2023, and 2024 irrigation seasons. CWD delivers an average of 8,500 acre-feet of their 15,000 acre-feet annual allocation, or 57% of their annual allocation. This equates to just 34% of the delivery capacity the system was designed to distribute (25,300 acre-feet), suggesting the system can accommodate increased deliveries on a macro scale.

Once it was determined that the system is capable of delivering additional surface water, DE conducted a lateral level analysis to determine potential bottlenecks. Three scenarios were analyzed looking at pump stations and associated laterals individually rather than the system as a whole:

1. Current use– The average use over the analysis period.
2. Future use – Increased demand due to potential annexations in addition to an assumed increase of 30% over the average use determined during the analysis period.
3. Allocation capacity – An analysis to determine if the future use scenario (#2) will exceed CWD's 15,000 acre-feet allocation.

The maximum potential instantaneous flowrate for the future use scenario is the summation of (1) existing use, (2) 30% more water use from existing customers, and (3) estimated water use from potential annexations and is summarized in Figure ES1 below.

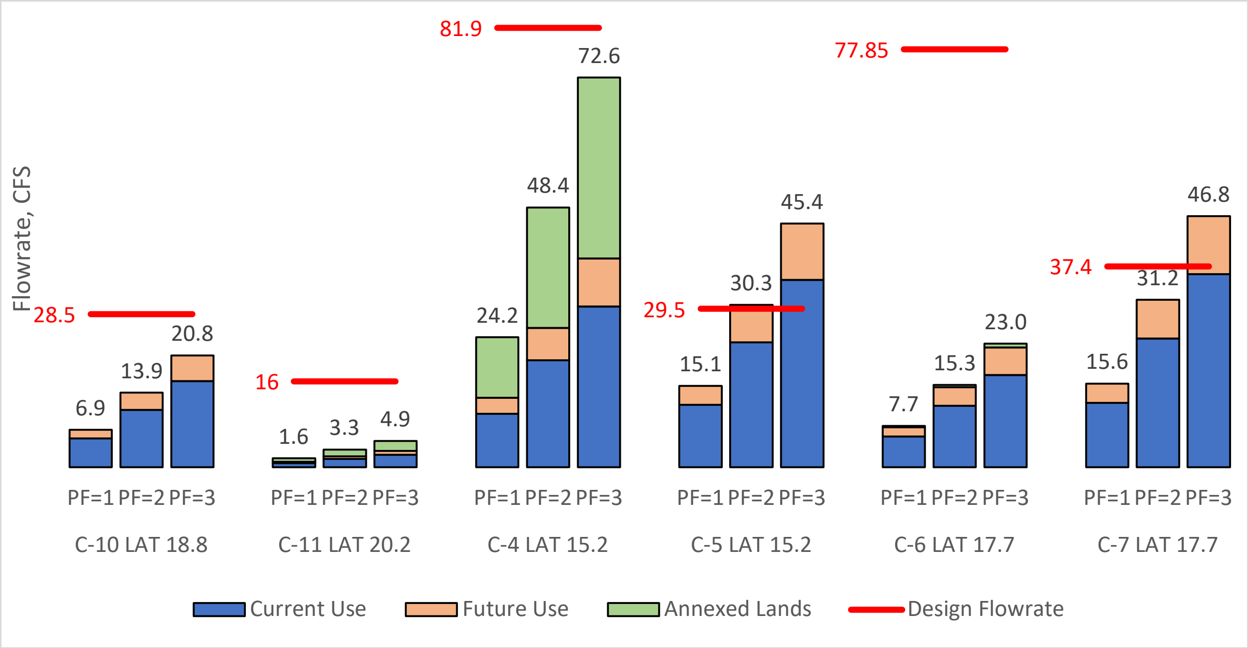

Figure ES1. Estimated maximum instantaneous flowrate in the Corning Water District's distribution system using monthly flowrate data from 2019, 2020, 2021, 2023, and 2024 irrigation seasons with the addition of 30% and estimated increase due to potential annexed lands. CFS = cubic feet per second. PF = peaking factor.

It is recommended that further analysis be completed that includes more granular delivery flow data to more accurately determine an appropriate peaking factor for each pump station. Prior to conducting annexations, CWD should enter into funding agreements with landowners of the proposed annexing lands whereby a more granular and focused analysis of the potential impacts of annexation to the affected lateral can be performed and paid for by the annexing landowners or subsidized by CWD to encourage new customers to use surface water. Additionally, annexed lands should be considered a lower tier of use ensuring that existing lands will receive their full allotment and only if there is extra water available can the annexed lands take water. This protects existing customers and allows CWD to deliver more water up to their maximum allotment.

Table ES1 on the following page provides a summary of findings following the lateral based analysis:

Table ES1. Summary of Conclusions from Lateral Level Analysis. CFS = cubic feet per second.

Summary of Conclusions
1. CWD's current surface water right of 15,000 acre-feet (due to previous relinquishments totaling 10,300 acre-feet) is less than 60% of the annual delivery capacity
2. CWD has delivered an average of approximately 8,500 acre-feet, or 57% of their 15,000 acre-feet entitlement, in 2019, 2020, 2023 and 2024 (recent years with full allocation) which equates to just 34% of the system's design capacity of 25,300 acre-feet.
3. The C-5 pump station, along with Lateral 15.2 downstream of C-5, is the only pump station that cannot handle the estimated future use assuming a peaking factor of 2. There are no proposed annexations on Lateral 15.2, meaning all the estimated future flowrate is attributable to the assumption that existing customers use 30% more water.
4. The C-4 pump station, along with lateral 15.2, is estimated to get close to the design capacity (81.9 CFS) assuming a peaking factor of 3 with an estimated peak flowrate of 72.6 CFS that is largely attributable to deliveries to potential future annexed lands.
5. The C-7 pump station, along with Lateral 17.7, is estimated to exceed capacity (37.4 CFS) by approximately 9.4 CFS assuming a peaking factor of 3.
6. All other pump stations (C-6, C-10, & C-11) and connected laterals can handle flowrate increases of at least 27% and a maximum of 71% assuming a peaking factor of 3.

Assuming additional surface water use is technically feasible, CWD should consider development and implementation of a surface water incentive program that aims to promote the use of surface water through educating customers about the importance of using surface water in-lieu of groundwater and creating incentives, financial or otherwise, to use surface water as opposed to groundwater. The surface water incentive program should focus on:

- Ensuring the cost for surface water is less than that to pump groundwater. CWD currently sells surface water cheaper than it costs growers to pump groundwater. To ensure this practice continues CWD should investigate and implement infrastructure improvements and modernization measures aimed at improving efficiency and reducing pumping costs.
- CWD should continue to provide a high level of service to customers by maintaining a flexible, reliable, and equitable surface water supply system. The on-demand nature of the existing system ensures flexibility is good, and equity is inherent based on the design of the system. However, reliability can be improved through conjunctive use and pump maintenance.
- Implement groundwater demand management consistent with the Corning Subbasin GSP to further encourage surface water use.
- CWD should focus on educating existing and potential customers about the cost savings associated with using CWD surface water as opposed to pumping groundwater, the CWD system and its high level of service, and the local implications of SGMA and the importance of surface water use to promote long-term sustainability.

Additionally, CWD can make several system improvements by improving the quality of the water delivered by mitigating aquatic vegetation growth, connecting customers to the CWD system, and making several infrastructure improvements as follows:

- Connect the C-11 pump station to the existing SCADA system.
- Install a variable frequency drive (VFD) at the C-10 pump station.
- Evaluate the need for VFD's on other pump stations to potentially save electricity costs.
- Repair non-operational pumps to meet increasing demand.

1 Introduction and Background

Corning Water District (CWD or District) was formed in June 1954 and currently has a service area boundary extending from Thomes Creek on the north, the Southern Pacific Railroad on the east, five miles west of Interstate 5, and four miles south of Corning Road. Due to water distribution problems, the portion of the district north of Thomes Creek was separated in the late 1950s into what is now known as Thomes Creek Water District. The resulting boundary change left Corning Water District with approximately 17,000 acres within its service area, of which approximately 14,000 acres were considered irrigable. In 1989, by mutual agreement between the United States Bureau of Reclamation (Reclamation) and CWD, the official District acreage was changed from 14,000 acres to 11,075 acres. The original 14,000 acres represented the total acreage within the district boundaries, some of which was non-obligated/non-eligible lands. The final adjustment documented each obligated/eligible parcel of land within the District boundary.

The 11,075 acres are both irrigable and eligible to receive district water. For the first six years of District operations, only small amounts of water were delivered by temporary pumps and siphons to a few canal-side properties. The original irrigated acres within the District totaled 3,000. When the District was first formed, much of the land was irrigated with groundwater, which had led to a decline in groundwater levels. In 1967, the District began to provide surface water deliveries at reasonable prices to the existing flood irrigated lands and groundwater levels within the District started to recover.

In recent years, many landowners have converted from flood irrigation to groundwater-supplied pressure drip, micro sprayers, or sprinkler irrigation (collectively "pressurized systems") requiring booster pumps and filter stations as well as transitioned largely to permanent crops. Consequently, many landowners have abandoned the use of the CWD distribution system (further described below) which was originally designed for flood irrigation. CWD has adapted their operations to accommodate the low-flow long-duration deliveries that are now required, but struggle to sell and deliver their full allocation of 15,000 acre-feet (AF) per year.

The Tehama County Flood Control and Water Conservation District (TCFCWCD) Groundwater Sustainability Agency (GSA) was awarded grant funding through a Proposition 68 (Round 2) Department of Water Resources (DWR) grant for implementation of the Corning Subbasin Groundwater Sustainability Plan (GSP) which was submitted to the DWR in January 2022 to comply with the Sustainable Groundwater Management Act (SGMA). Davids Engineering (DE) has been tasked with providing support to CWD with the goal of increasing surface water use in the District. The purpose of this Technical Memorandum is to summarize the results of a "Rapid Appraisal" focused on increasing surface water use in CWD.

2 Approach

DE structured this analysis similar to the Rapid Appraisal Process[1] where qualified evaluators can conduct focused field visits and discussions with District staff to quickly identify potential for specific modernization actions, or challenges in project operation, management, resources, and hardware. DE prepared a data request and conducted a half day workshop on November 7, 2024, with District staff

[1] Irrigation Training and Research Center (ITRC) California Polytechnic University. https://digitalcommons.calpoly.edu/bae_fac/32/

including a tour of portions of the CWD system. The results of these cursory investigations provided the insight for this Technical Memorandum.

3 History of Water Supply

In 1963, CWD entered into a contract with Reclamation to construct a water distribution system to deliver up to 25,300 acre-feet annually. The system included four canal-side pumping plants and two lift stations with regulating reservoirs, as well as necessary pipelines and totalizing flow meters for delivery and measurement of water (See Figure 1). In early 1967, construction of the distribution system was completed, and water deliveries began that spring. The final system had 341 delivery turnouts.

The original irrigated acreage included significant lands planted with permanent crops (primarily olives), and landowners have continued to convert lands within the District from forage and annual crops to permanent crops. Recently, in response to one of the largest, local olive buyers, Bell-Carter, cancelling contracts, growers have started to transition to other permanent crops, such as almonds and walnuts. The District has seen an increase in irrigated area to a historical high of approximately 9,209 acres in 2023 (as compared to 5,931 acres in 1994, 7,338 acres in 2008, 7,287 acres in 2016, and 7,500 acres in 2019) as growers have elected to utilize District surface water from the Central Valley Project (CVP) on their newly planted orchards.

In recent years, growers have significantly improved their on-farm water delivery systems. Where practical, water delivery for permanent crops has been converted from flood irrigation to low volume pressurized irrigation. Pressurized irrigation was utilized on 6,876 acres in 2019 equating to over 90% of the total irrigated acreage at that time.

In 1998, CWD permanently relinquished its entitlement to 2,300 acre-feet of its CVP water supply to Reclamation in exchange for payment of accumulated interest and non-interest-bearing Operation and Maintenance (O&M) Deficits through Federal Fiscal Year 1997. In 2017 and 2019, the District further relinquished 3,000 acre-feet and 5,000 acre-feet, respectively, of their water allocation to prepay O&M Deficits and to reduce the cost of CVP surface water supply. The 10,300 acre-feet total supply reduction is used by Reclamation to increase the supply of water available to meet fish and wildlife purposes authorized by the Central Valley Project Improvement Act (CVPIA). The District’s current contract with Reclamation provides for the annual delivery of up to 15,000 acre-feet of Central Valley Project Water.

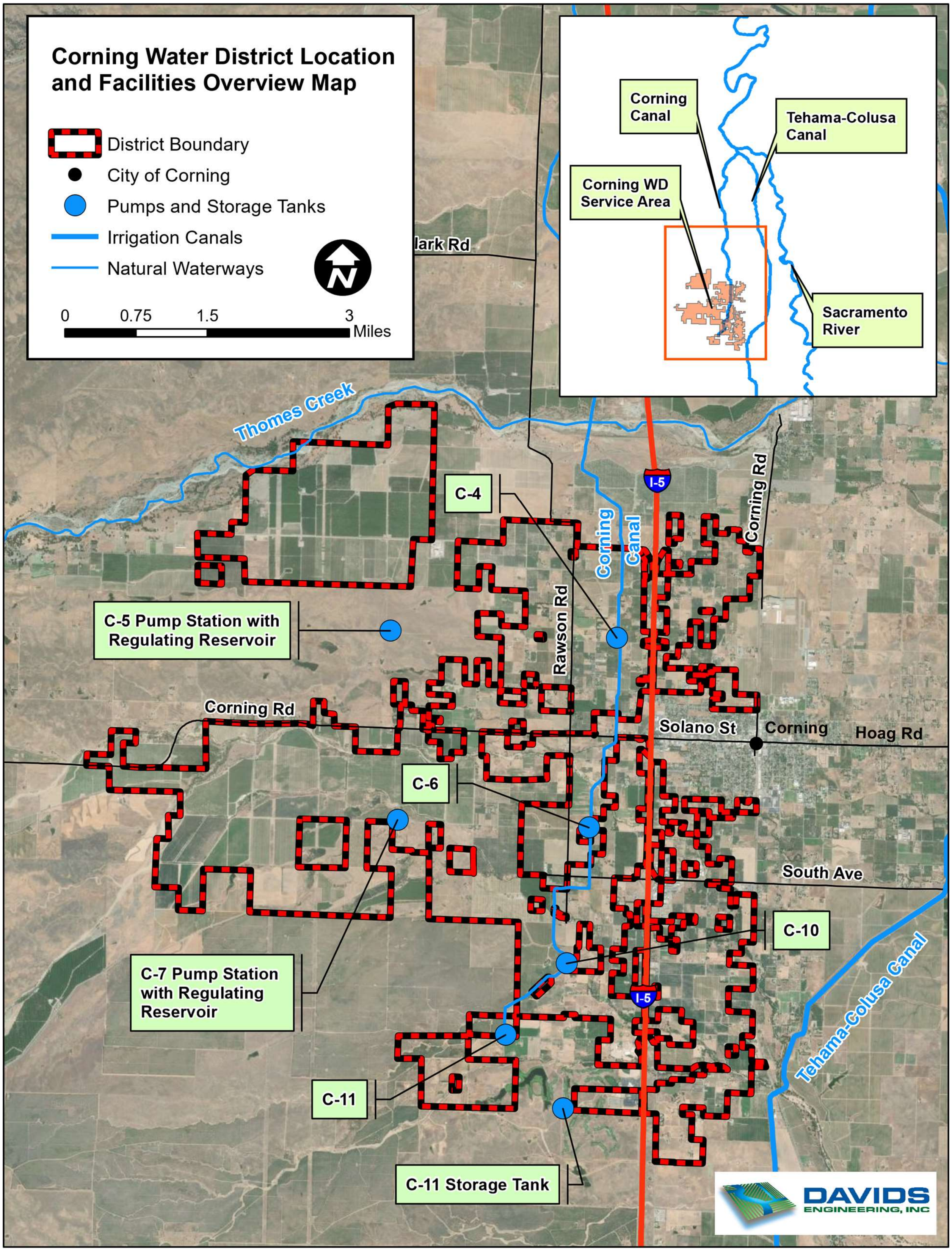

Figure 1. Corning Water District Location and Facilities Overview Map.

4 Increasing Surface Water Use

4.1 System Capacity and Allocation

Prior to increasing surface water use it is prudent to (1) understand if the distribution infrastructure can accommodate increased flow and (2) determine if CWD has surplus water to supply.

A service area capacity analysis was completed to determine if the CWD distribution infrastructure can handle an increase in demand. The desktop analysis used readily available information obtained from as-built drawings produced by Reclamation. The analysis compares the as-built design capacities of each lateral to turnout delivery data supplied by CWD for the 2019, 2020, 2021, 2023, and 2024 irrigation seasons.

The CWD system is designed to deliver up to 25,300 acre-feet annually in accordance with CWD's surface water right when the system was designed. Considering (1) CWD's current surface water right of 15,000 acre-feet (due to previous relinquishments totaling 10,300 acre-feet) is less than 60% of the annual delivery capacity, and (2) CWD has delivered an average of approximately 8,500 acre-feet, or 57% of their 15,000 acre-feet entitlement, in 2019, 2020, 2023 and 2024 (recent years with full allocation) which equates to just 34% of the system's design capacity of 25,300 acre-feet, one can reasonably conclude that there is additional capacity beyond what is currently used, and beyond CWD's current surface water right.

4.1.1 Current Use System Capacity

CWD has totalizing flow meters at each delivery turnout and records the volume of water delivered monthly. This data is then entered into a computer program by CWD staff for billing purposes and reports are generated that sum the delivery volumes by lateral. These monthly delivery volumes comprise the dataset that was made available for this analysis. Consequently, this analysis makes several assumptions related to instantaneous flowrate through a given lateral:

1. The maximum monthly volume for each year was used which is intended to represent peak operating conditions for a given year.
2. In order to conduct a flowrate based capacity analysis on a smaller time step, the monthly lateral volumes were assumed to be the product of a constant flowrate for the entire month; because a perfectly uniform flowrate is unlikely, peaking factors of 1, 2, and 3 were used to capture the likely undulations in flowrate. Peaking factor can be defined as the ratio between the peak demand and the average demand over a certain time period (in this scenario, the time period is 1 month), therefore a peaking factor of 1 equates to the average demand. A range of peaking factors are used to capture the uncertainty in the timing of delivery flowrates. Peaking factors are generally considered conservative, meaning they are designed to overestimate the maximum possible value, thereby providing a safety margin in engineering calculations; a higher peaking factor indicates a more conservative approach, as it takes into account potential extreme scenarios and fluctuations. The actual peaking factor for each lateral can be determined with more granular flowrate data (i.e. weekly or daily as opposed to monthly) and is recommended to be determined more accurately in a future study.
3. The additional capacity available was determined based on the year with the highest monthly volume and therefore the highest average flowrate.

With the above defined assumptions, the results of the analysis are as follows:

- All pump stations and laterals can deliver the maximum monthly average flowrate assuming peaking factors of 1 and 2.
- Assuming a peaking factor of 3 means pump station C-5 and Lateral 15.2 are operating at 34.9 CFS which exceeds the design flowrate of 29.5 CFS.
- Pump station C-7 and Lateral 17.7 are nearly at full capacity (37.4 CFS) with a flowrate of 36 CFS assuming a peaking factor of 3.
- All other pump stations and laterals can handle between 44% and 86% more flow assuming a peaking factor of 3 (see Figure 2).

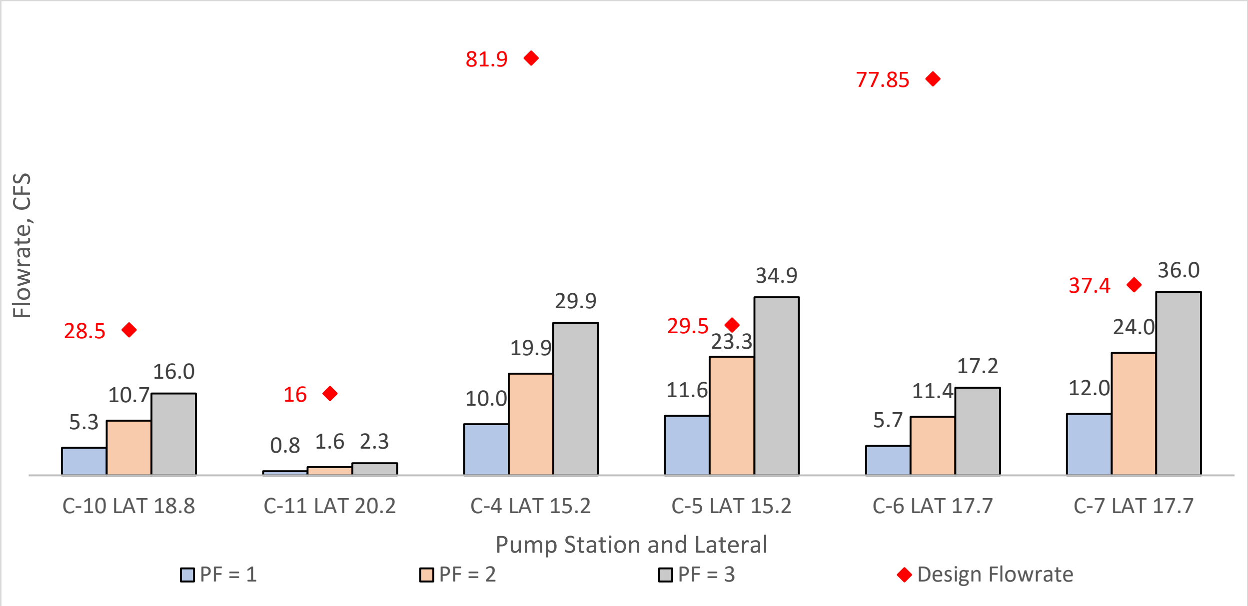

Figure 2. Maximum monthly average flowrate delivered during the 2019, 2020, 2021, 2023, and 2024 irrigation seasons with peaking factors of 1, 2, and 3 as compared to the design flow capacity in Corning Water District's distribution system. CFS = cubic feet per second. PF = peaking factor.

4.1.2 Future Use Capacity Analysis

A projected future use scenario was created to determine if projected increases in water use can be accommodated by the existing CWD distribution system. The future use scenario builds upon the current use scenario in that it (1) uses the maximum monthly average flowrate with peaking factors of 1, 2, and 3, (2) assumes 30% more water use by existing customers, and (3) includes annexation of several lands as CWD has been approached by several landowners interested in annexing into the District. For purposes of estimating water use by these potential annexations, it was assumed 3 feet of water would be used annually across the entirety of each property, which is a conservative estimate for most crops. To determine an average flowrate given an annual application depth (3 feet), the following steps were taken:

1. The average maximum monthly volume for each lateral as a percentage of total annual volume delivered was determined for the years 2019, 2020, 2021, 2023, and 2024. For example, on average 23.7% of the total annual volume delivered by the C-10 pump station was delivered in the month with the highest water use; all other months of the year delivered a smaller percentage.

2. The average maximum monthly volumes as a percentage of total volume delivered (Step 1) for each lateral were then applied to the potential lands to be annexed based on the lateral that would likely supply said lands. For example, to determine the estimated maximum monthly volume at the C-10 pump station, three (3) feet of water is multiplied by 23.7% to get approximately 0.71 feet of water being delivered to all acres of the proposed annexations (3 feet X 23.7% = 0.71 feet). Then the application depth (0.71 feet) is multiplied by the acreages of the proposed annexations which results in an average maximum monthly volume delivered for each property.
3. This average maximum monthly volume was assumed to be the product of a constant flowrate for the entire month with a range of peaking factors (1, 2, and 3) applied to account for the likely variations in delivery flowrate (see Table 1).

Table 1. Average daily flowrate delivered to proposed annexations. Annual volume is based on three (3) feet of water applied across the acreage of each property. The maximum monthly volume is determined by multiplying the annual volumes by the average percentage of volume used for the month with the greatest water use and is unique to each lateral. The maximum flow is then calculated based on the maximum monthly volume across a range of peaking factors (1, 2 and 3). AF = acre-feet. CFS = cubic feet per second.

Property	Acreage	Annual Volume, AF	Lateral	Pump Station	Flowrate (PF=1), CFS	Flowrate (PF=2), CFS	Flowrate (PF=3), CFS
1	19	57	17.7A	C-6	0.22	0.45	0.67
2	47.33	141.99	15.2	C-4	0.55	1.10	1.65
3	35.42	106.26	20.7	C-11	0.63	1.25	1.88
4	557	1671	15.2	C-4	6.48	12.96	19.44
5	361	1083	15.2	C-4	4.20	8.4	12.60

The maximum potential instantaneous flowrate for the future use scenario is the summation of (1) existing use, (2) 30% more water use from existing customers, and (3) estimated water use from potential annexations and is summarized in Figure 3 below. All pump stations and laterals can handle the estimated future delivery flows assuming a peaking factor of 1. Results of the analysis are as follows:

- The C-5 pump station, along with Lateral 15.2 downstream of C-5, is the only pump station that cannot handle the estimated future use assuming a peaking factor of 2. There are no proposed annexations on Lateral 15.2, meaning all the estimated flowrate is attributable to existing customers using 30% more water.
- The C-4 pump station, along with lateral 15.2, is estimated to get close to the design capacity (81.9 CFS) assuming a peaking factor of 3 with an estimated peak flowrate of 72.6 CFS that is largely attributable to deliveries to proposed annexed lands.
- The C-7 pump station, along with Lateral 17.7, is estimated to exceed capacity (37.4 CFS) by approximately 9.4 CFS assuming a peaking factor of 3.
- All other pump stations (C-6, C-10, & C-11) and connected laterals can handle flowrate increases of at least 27% and a maximum of 71% assuming a peaking factor of 3.

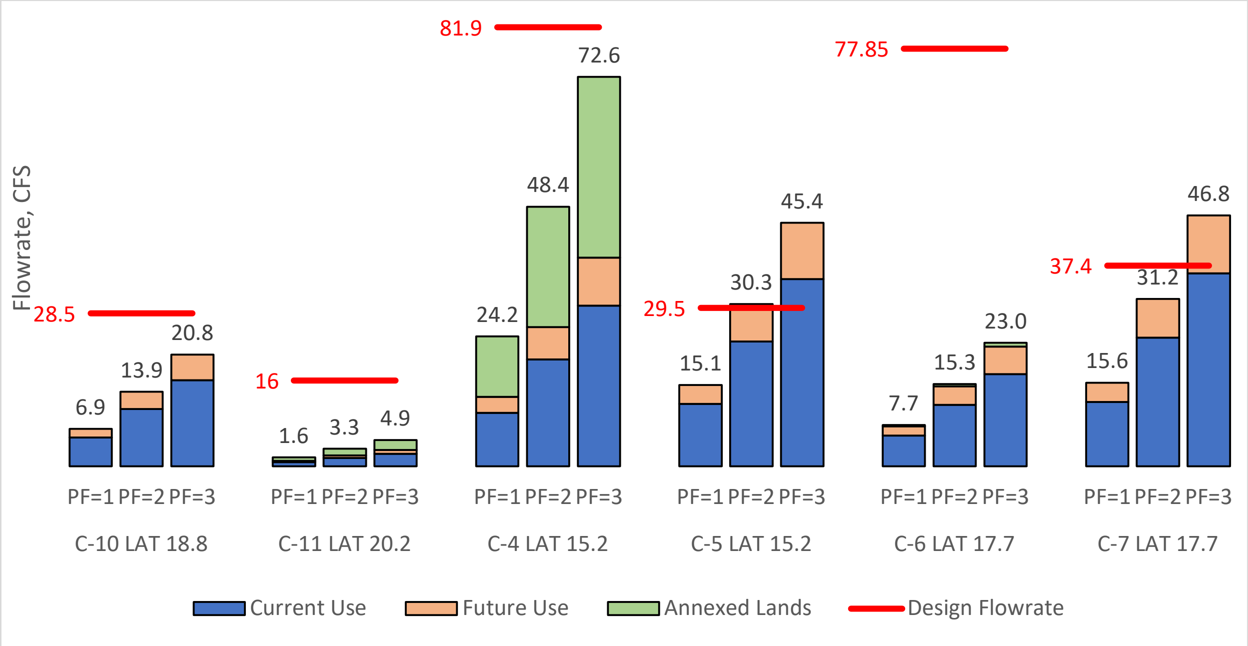

Figure 3. Estimated maximum instantaneous flowrate in the Corning Water District's distribution system using monthly flowrate data from 2019, 2020, 2021, 2023, and 2024 irrigation seasons with the addition of 30% and estimated increase due to potential annexed lands. CFS = cubic feet per second. PF = peaking factor.

4.1.3 Allocation Analysis

An analysis was completed to determine whether CWD would exceed their surface water right of 15,000 acre-feet using the assumption that existing customers will utilize 30% more water and potential annexed lands will be introduced. This analysis was completed for the 2019, 2020, 2021, 2023, and 2024 irrigation seasons and it was determined that if 30% more water was used by existing customers and the proposed annexed lands were introduced, CWD would have been able to meet delivery demand in all years except 2024 as the projected use in that year is 15,883 acre-feet. All other years included in this analysis could handle the additional demand produced by 30% more water use by existing customers and the proposed annexed lands with water to spare (see Table 2).

To summarize, the CWD distribution system can handle significantly more flow with the exception of the C-5 pump station, assuming a peaking factor of 2 or greater, and the C-7 pump station assuming a peaking factor of 3 or higher, however CWD is limited by their surface water right. Although none of the pump stations servicing lands proposed to be annexed are at risk of reaching the design flow capacity assuming a maximum peaking factor of 3, it is recommended further analysis be completed that includes more granular delivery flow data to more accurately determine an appropriate peaking factor for each pump station.

Table 2. Annual volume delivered during the 2019, 2020, 2021, 2023, and 2024 irrigation seasons with the addition of 30% and estimated increase due to potential annexed lands as compared to existing surface water right of 15,000 acre-feet.

Annual Volume Delivered in Acre-Feet					
Lateral	2019	2020	2021	2023	2024
C-10 LAT 18.8	688	804	76	948	1,225
C-11 LAT 20.2	97	83	4	110	103
C-4 LAT 15.2	2,112	1,988	172	2,419	2,445
C-5 LAT 15.2	1,588	1,862	181	1,851	2,794
C-6 LAT 17.7	1,020	1,856	42	476	765
C-7 LAT 17.7	2,249	1,769	127	2,053	2,534
Total:	**7,753**	**8,363**	**602**	**7,855**	**9,865**
Total + 30%:	**10,079**	**10,872**	**782**	**10,212**	**12,824**
Total + 30% + Annexations:	**13,139**	**13,931**	**3,842**	**13,271**	**15,883**

Prior to conducting annexations, CWD should enter into funding agreements with landowners of the proposed annexing lands whereby a more granular and focused analysis of the potential impacts of annexation to the affected lateral can be performed and paid for by the annexing landowners or subsidized by CWD to encourage new customers to use surface water. Additionally, annexed lands should be considered a lower tier of use ensuring that existing lands will receive their full allotment and only if there is extra water available can the annexed lands take water. This protects existing customers and allows CWD to deliver more water up to their maximum allotment.

4.2 Surface Water Incentive Program

CWD should consider the development and implementation of a surface water incentive program that aims to promote the use of surface water through educating customers about the importance of using surface water in-lieu of groundwater and creating incentives, financial or otherwise, to use surface water as opposed to groundwater. The remainder of section 4.2 provides potential components and considerations associated with a surface water incentive program.

4.2.1 Competitive Pricing

Recent droughts have caused CWD to not receive any federal water allocations in 2014, 2015, 2021 and 2022, but instead received limited water via water transfer that was subsequently sold to customers for $600 per AF (in 2014, 2015 and 2021). CWD did not deliver any water in 2022. Consequently, many growers throughout the District drilled wells to obtain groundwater for irrigation. To receive the power necessary to run these wells, PG&E required these growers to sign a three-year contract to pay for power to these sites. Many growers continued to use these wells and decided not to receive surface water for the duration of their contract with PG&E. These groundwater wells, which are not District-owned or operated, cost approximately $109 per acre-foot to operate[2] which is higher than the cost of

[2] Value provided by Corning Water District and is assumed to be an average groundwater pumping cost. This is the cost to pump groundwater at sufficient discharge pressure for a typical pressurized system.

surface water ($80 per acre-foot) in 2024. However, CWD surface water is typically pressurized beyond the CWD delivery pressure for use in on-farm pressurized systems. The cost for this additional pumping is estimated at about $21 per acre-foot[3] meaning the total cost to use CWD surface water in pressurized systems is approximately $101 per acre-foot or $8 per acre-foot cheaper than pumping groundwater.

It is important that CWD keep the volumetric cost of surface water well below the cost to pump groundwater to retain existing customers and encourage more surface water use. To keep the cost of surface water as low as possible, CWD can improve system efficiency. One of CWD's largest operational costs is the cost to operate pumping stations. Therefore, any opportunities to save on pumping costs should be explored with the intention of making efficiency improvements to lower electricity costs. Cost savings can then be passed down to customers via lower rates which can further incentivize surface water use. Section 4.4 below provides a list of potential efficiency improvements.

CWD may be able to incentivize surface water use through modification of their water rate structure where the per acre assessment fee is increased but includes a certain amount of surface water, say one (1) AF per acre as an example. This would encourage growers to use at least the portion of surface water included in the assessment fee since it is already paid for. Restructuring rates may be unlikely to be achieved as it would need to be approved through a majority vote of all landowners within CWD through the Proposition 218 process, most of which do not use CWD surface water, and therefore would not approve of an increased assessment fee for a service they won't use. The District's Operational Rules and Regulations (last modified February 28, 2018) states the Operation and Maintenance Assessment fee (currently $10.41 per acre per year) is annually reviewed by the District Board of Directors and may be changed based on the maintenance expenses required for that budget year. Being this statement potentially conflicts with the Proposition 218 process and the Assessment fee has never been changed, it is recommended that CWD consult with legal counsel to review this alternative.

4.2.2 Level of Water Delivery Service

The level of water delivery service can be defined by flexibility, reliability, and equity, and is further discussed in the following sections.

4.2.2.1 Flexibility

Flexibility refers to the adjustability of frequency, rate, and duration. Flexibility in frequency allows customers to receive water on a schedule that aligns with their demand patterns. Flexible rate delivery means water suppliers (CWD) can adjust the flowrate to match customer usage. Flexibility in duration enables customers to receive supply over a shorter or longer time frame based on their needs. CWD system was designed to provide flood irrigation heads to delivery turnouts and is now largely being used to supply pressurized systems. This puts stress on the system in that the frequency, rate, and duration of pressurized system irrigation differs significantly from that of flood irrigation. The CWD has been able to retain its ability to provide water on-demand despite this change in irrigation technique. This is a high level of service and provides flexibility to growers that is on par with pumping groundwater. CWD must strive to maintain this level of flexibility and conduct outreach to increase surface water use by existing customers, as well as, encourage new customers.

[3] Value provided by Corning Water District and is the cost to boost surface water provided by CWD to be suitable for pressurized system irrigation.

4.2.2.2 Reliability

Reliability refers to the consistency and dependability of water supply to meet the customer's needs. The CWD system is pressurized and thus is made up of infrastructure that requires significant maintenance. In addition, this infrastructure is aging and is inherently subject to failure. CWD does have redundancy built into their system in that each pump station consists of numerous pumps, and rarely have all pumps been required in recent history. However, CWD currently has several pumps across various pump stations that are non-operational and if more surface water is delivered in the future, it may become necessary to operate all, or most, pumps.

Additional reliability concerns are present in that CWD is subject to CVP allocation reductions. Given the increasing frequency of allocation reductions, it is imperative that CWD develop and promote a conjunctive use program whereby surface water use is maximized when it is available, thus preserving groundwater resources for use in times of surface water scarcity. A key component to the success of a conjunctive use program is outreach and education which is discussed in section 4.2.4.

4.2.2.3 Equity

Equity refers to a water supplier's ability to provide consistent delivery volumes and pressure across the entire distribution system such that certain customers are not receiving better services than others. There are inherent inequities in all irrigation distribution systems and CWD is no exception. For example, landowners at the end of a lateral receive delivery at lower pressures than delivery turnouts near the pump stations due to friction losses in the pipeline. There are a handful of customers that report low pressure, but for the most part the CWD distribution system provides adequate pressure to its customers even though a specific level of pressure at the turnout is not required or guaranteed. Being the CWD system is underutilized, customers typically receive their fair share of water on an on-demand basis and delivery volume is not an issue.

4.2.3 Groundwater Demand Management

Limiting groundwater use will mean growers need to use surface water. The Corning Subbasin GSP is currently being reviewed by the DWR and includes groundwater demand management (GDM), but the details have yet to be defined, and it is not yet clear how the Corning Subbasin is planning on implementing GDM. Upon DWR's approval of the GSP, assuming GDM is included in the accepted GSP, CWD should work with the GSA to implement the GSP and educate growers as explained in the following section.

4.2.4 Education and Outreach

CWD should consider an education and outreach program that focuses on educating existing and potential customers. Here is a list of topics:

- CWD should focus on the cost savings associated with purchasing surface water in-lieu of pumping groundwater. CWD should perform a study to accurately understand what groundwater pumping costs are across the district to compare with their surface water prices, then advertise the cost savings.
- CWD should educate customers about the fact the system is on-demand and provides users with good flexibility in frequency, rate, and duration. Potential customers should be educated about the process of obtaining surface water and the simplicity of using surface water from CWD.

- The outreach should underscore the importance of surface water use in-lieu of groundwater to promote long-term sustainability. By encouraging the use of surface water when it is available, customers can reduce reliance on over-extracted groundwater resources, which helps protect local aquifers and ensures a more resilient water supply for the future.
- The Sustainable Groundwater Management Act (SGMA) has implications on the amount of groundwater that can be pumped. The implications of SGMA, specifically defined in the Corning Subbasin GSP, should be explained to growers to encourage surface water use.
- Provide resources for information; making it easy to get information is important. Contact information should be provided for CWD itself, as well as the local Groundwater Sustainability Agency.

To spread the information listed above, CWD can utilize newsletters and billing mailers, dedicate a portion of board meetings to these topics, host dedicated workshops that invite the community to learn about any and all of the topics above, and provide information and encourage attendance at other local water workshops that are not necessarily hosted by CWD (Corning Subbasin Advisory Board Meetings). The Corning Subbasin GSP website is a resource that growers should be encouraged to visit and interact with.

4.3 Improve Water Quality

Poor water quality is a common complaint received from CWD customers. The CWD system is situated at the downstream end of the Corning Canal and CWD is currently the only significant water user on the Corning Canal. Consequently, the Corning Canal is operated as a pool in that water is delivered from the Corning Canal headgates and stored in the downstream end of the Corning Canal where the pump stations pump water as necessary to meet demand. Slow moving water, combined with the warm weather of the summer months, produce ideal conditions for aquatic vegetation to grow. Although the pump stations have filters, some aquatic vegetation still makes its way into the distribution system. Additionally, the filters occasionally fail and are less effective during these down times. The Tehama Colusa Canal Authority (TCCA) operates and maintains the Corning Canal. The TCCA occasionally applies aquatic herbicides into the water delivered to the Corning Canal and sprays the canal when it is dry during the offseason to mitigate aquatic weed growth. CWD also has two (2) reservoirs that supply the C-5 and C-7 pump stations that fill with sediment over the course of the irrigation season providing a media for aquatic vegetation to grow. The C-5 and C-7 pump stations do not have filters and therefore can ingest the aquatic vegetation and deliver it to customers.

Potential solutions for mitigating aquatic vegetation growth in the Corning Canal are:

1. Operate the canal less like a pool and more like a canal. A constant flow of water can help mitigate the growth of aquatic vegetation. This may include coordination with the TCCA to achieve a more consistent flow of water into the Corning Canal and could also include spillage at the downstream end of the system. Care should be taken to ensure that the level of service to customers is not impacted negatively.
2. Ask the TCCA to inject the water with herbicides more frequently, experiment with different herbicides to determine the most effective, ask the TCCA to mechanically remove the aquatic vegetation surrounding the pump stations, and install more robust filtration at the pump station intakes.

To mitigate the issue of aquatic vegetation growth in the C-5 and C-7 reservoirs, the reservoirs should be cleaned out frequently reducing the potential for aquatic vegetation growth. Care should be taken not to damage the concrete lining while cleaning the reservoirs.

4.4 Infrastructure Improvements

Infrastructure improvements should be made with the intention of creating a more efficient system such that cost savings can be passed down to customers and increasing the level of service, further incentivizing surface water use. Below are a few potential opportunities for improvements:

- Connect the C-11 pump station to the existing SCADA system. Currently District staff must drive to the C-11 (about once per day during the irrigation season) to check the water level in the standpipe. Although the pumps are automated to maintain a consistent water level, if there is an issue with the site the District does not realize the issue unless the issue is identified during a site visit. The ability to remotely view the water level means far fewer site visits and a potential increase in level of service as issues can be identified immediately and subsequently solved.
- Modify the existing flowmeters at all pump stations such that instantaneous flowrate and the volumetric totalizer can be read onsite by District staff. Similarly, flowrate and volume should be added to the existing SCADA system and historical records for each should be saved. Many SCADA systems have the ability to save records that can be downloaded if desired.
- Install a variable frequency drive (VFD) at the C-10 pump station. Currently the C-10 pump station regulates water level via an overflow pipe that returns water to the Corning Canal. This is inefficient because (1) it means more water is being pumped than necessary and (2) the District is paying for this water that is being returned and not delivering it to customers for profit. A VFD in combination with programming the water level “set point” to maintain the water level just below the overflow point will (1) ensure water is not spilling (no wasted pumping) and (2) keep the water level, and therefore delivery pressure, consistent.
- Evaluate the need for VFD’s on other pump stations to potentially save electricity costs. Cost savings can then be passed down to customers to further incentivize surface water use.
- It is not currently an issue, but as CWD delivers more surface water, the pumps that are currently non-operational will need to be repaired to meet demand.
- Connect existing on-farm groundwater-supplied pressurized systems to the CWD system with new turnout infrastructure to support conjunctive use. In the near term, grant funds could be made available to interested customers to cover some or all the construction costs.

5 Conclusion and Recommendations

The purpose of this Technical Memorandum is to summarize the results of a “Rapid Appraisal” focused on increasing surface water use in CWD. A service area capacity analysis was completed to determine if the CWD distribution infrastructure can handle an increase in deliveries by comparing as-built design capacities of each lateral to turnout delivery data supplied by CWD for the 2019, 2020, 2021, 2023, and 2024 irrigation seasons. In general, CWD delivers an average of 8,500 acre-feet of their 15,000 acre-feet annual allocation and because the system was designed to deliver 25,300 acre-feet annually, one can reasonably conclude the system as a whole can handle increased usage. When looking at individual pump stations and laterals assuming 30% more water use from existing customers and increased demand due to several proposed annexations, the C-5 pump station (and Lateral 15.2 downstream of C-5) cannot handle the capacity assuming a peaking factor of 2, and the C-4 pump station (Lateral 15.2) and C-7 pump station (Lateral 17.7) cannot handle the capacity assuming a peaking factor of 3. Ultimately, further analysis including more granular delivery flow data is necessary to more accurately determine an appropriate peaking factor for each pump station, and infrastructure improvements should be investigated to determine the feasibility of increasing capacity of the C-5 pump station and Lateral 15.2.

Assuming additional surface water use is technically feasible, CWD should consider development and implementation of a surface water incentive program that aims to promote the use of surface water through educating customers about the importance of using surface water in-lieu of groundwater and creating incentives, financial or otherwise, to use surface water as opposed to groundwater. The surface water incentive program should focus on:

- Ensuring the cost for surface water is less than that to pump groundwater. CWD currently sells surface water cheaper than it costs growers to pump groundwater and it must remain this way.
- CWD should provide a high level of service to customers by maintaining a flexible, reliable, and equitable surface water supply system. The on-demand nature of the existing system ensures flexibility is good, and equity is inherent based on the design of the system. However, reliability can be improved through conjunctive use and pump maintenance and repair.
- Implement groundwater demand management consistent with the Corning Subbasin GSP to further encourage surface water use.
- CWD should focus on educating existing and potential customers about the cost savings associated with using CWD surface water as opposed to pumping groundwater, the CWD system and its high level of service, and the local implications of SGMA and the importance of surface water use to promote long-term sustainability.

Additionally, CWD can make several system improvements by improving the quality of the water delivered by mitigating aquatic vegetation growth, connecting customers to the CWD system, and making several infrastructure improvements as follows:

- Connect the C-11 pump station to the existing SCADA system.
- Install a variable frequency drive (VFD) at the C-10 pump station.
- Evaluate the need for VFD’s on other pump stations to potentially save electricity costs.
- Repair non-operational pumps to meet increasing demand.