ALTERNATIVES EVALUATION STUDY – PUBLIC RELEASE VERSION
CASCADE ORCHARDS IRRIGATION COMPANY

Prepared for

Cascade Orchards Irrigation Company
12786 Shore St
Leavenworth, Washington 98826

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

Washington Water Trust
1530 Westlake Ave N, Suite 400
Seattle, Washington 98109

December 2015

ALTERNATIVES ANALYSIS STUDY – PUBLIC RELEASE VERSION

CASCADE ORCHARDS IRRIGATION COMPANY

Prepared for

Cascade Orchards Irrigation Company
12786 Shore Street
Leavenworth, Washington 98826

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

Washington Water Trust
1530 Westlake Avenue N, Suite 400
Seattle, Washington 98109

Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, Washington 98104

December 2015

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

afa	acre-foot per acre
afy	acre-foot per year
COIC	Cascade Orchards Irrigation Company
cfs	cubic foot per second
DS	downstream
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
FOS	factor of safety
fps	foot per second
ft^2	square foot
IPID	Icicle and Peshastin Irrigation Districts
IWG	Icicle Work Group
LNFH	Leavenworth National Fish Hatchery
NAIP	National Agriculture Imagery Program
NMFS	National Marine Fisheries Service
O&M	operations and maintenance
POD	point of diversion
POU	place of use
psi	pound per square inch
PUD	Public Utility District
Qi	instantaneous water right withdrawal limit
Qa	annual water right withdrawal volume
Reclamation	U.S. Bureau of Reclamation
RM	river mile
TDH	Total Dynamic Head
TWRP	Trust Water Rights Program
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife
WRATS	Water Rights Acquisition Tracking System
WRIS	Water Rights Information System
WWT	Washington Water Trust

1 INTRODUCTION

This report summarizes an appraisal-level analysis of alternatives that would improve the Cascade Orchards Irrigation Company (COIC) delivery system. COIC operates a network of open ditches and pipelines that deliver water for irrigation to properties west of Icicle Creek and south of the Wenatchee River near Leavenworth, Washington. These facilities are supplied through an Icicle Creek diversion, which is shared with Leavenworth National Fish Hatchery (LNFH). LNFH is operated by the U.S. Fish and Wildlife Service (USFWS) for the U.S. Department of Reclamation (Reclamation) as mitigation for hydropower facilities on the Columbia River.

COIC's legal predecessors developed lands for irrigation near Leavenworth in 1901 by diverting water from Icicle Creek and developing infrastructure to irrigate up to 600 acres, and a subsequent water rights adjudication granted them the most senior water rights on Icicle Creek. In 1939 and 1940, COIC entered into three agreements with the U.S. government to allow an easement for the planned construction of LNFH, to share a surface water diversion on Icicle Creek, and to provide excess water to LNFH from the COIC water rights. Since that time, COIC and LNFH have shared a diversion at Icicle Creek river mile (RM) 4.5 and have jointly operated the diversion under the general understanding of these agreements.

The present-day COIC irrigation system delivers their 11.9 cubic feet per second (cfs) water right via about 2 miles of mostly unlined ditch following Icicle Creek Road to the northwest of Icicle Creek, and discharging into the Wenatchee River just upstream from its confluence with Icicle Creek. This alternatives analysis study seeks to evaluate COIC's water rights and water needs, identify alternatives for improved water delivery, and evaluate potential conservation and financial benefits for projects at COIC.

1.1 Background

Icicle Creek is a major tributary to the Wenatchee River and provides habitat for fish species listed under the Endangered Species Act (ESA), including Chinook salmon, bull trout, and steelhead. The primary out-of-stream water uses in the Icicle Creek Subbasin include irrigation, fish rearing at LNFH, and municipal use. Out-of-stream water use has reduced

flows in lower Icicle Creek and impacted passage and habitat conditions for ESA-listed species. Improving instream flows in lower Icicle Creek is one of the primary goals of resource managers and stakeholders in the Icicle Creek Subbasin.

In October 2014, Washington Water Trust (WWT) signed a Memorandum of Agreement to evaluate conservation alternatives and conduct a review of water rights for COIC. The intent was to provide technical information and water rights data to help inform a feasibility study for four improvement alternatives that would enhance flows in lower Icicle Creek. This analysis identifies instream flow benefits and construction costs for alternatives that would improve instream flows in Icicle Creek by replacing the COIC diversion on Icicle Creek with a pumped diversion on the Wenatchee River and/or improving the efficiency of the COIC delivery system.

WWT developed an initial suite of alternatives for this project prior to drafting this alternatives analysis report. At this time, these alternatives include the following:

- **Alternative 1**: A pressurized, on-demand system supplied via a pump station on the Wenatchee River or Icicle Creek that would replace the existing ditch system. The COIC portion of the diversion on Icicle Creek would no longer operate, and saved water would be protected by the Washington State Department of Ecology's (Ecology's) Trust Water Rights Program (TWRP).
- **Alternative 2:** A pressurized, on-demand system supplied via a pump station as in Alternative 1. The infrastructure would be sized to accommodate additional pumping and delivery to meet other COIC needs or deliver water to LNFH to help address some of their water supply concerns. The COIC portion of the Icicle Creek diversion would no longer operate, with saved water protected in the TWRP.
- **Alternative 3**: Use the existing infrastructure, while reducing seepage losses in the system via piping or lining of the open, unlined ditch. This alternative would have lower construction costs, but in turn may have fewer funding opportunities with less water available for protection. The COIC portion of the historical Icicle Creek diversion would continue to operate.
- **Alternative 4**: Evaluate COIC's current water use patterns to identify efficiency improvement opportunities, landscaping changes, or other conservation measures that could create savings and that might make water available for future uses at COIC or

be marketed for municipal and/or mitigated uses. Alternative 4 would be considered in addition to Alternatives 1, 2, and 3.

Improving the COIC delivery system is one of several potential projects currently being evaluated by stakeholders within the Icicle Creek Subbasin. A stakeholder group, the Icicle Work Group (IWG), was convened two years ago by Chelan County Natural Resources Department and Ecology to take a comprehensive look at water resource management in the Icicle Creek Subbasin. The IWG consists of LNFH; federal, state, and local agencies; irrigation districts (including COIC); the City of Leavenworth; non-profit organizations (including WWT); environmental groups; and other stakeholders. The IWG is working to identify and evaluate projects to improve management of water in the Icicle Creek Subbasin and improve instream flow conditions in Lower Icicle Creek. This alternatives analysis was funded under a grant from Ecology's Office of the Columbia River. Projects endorsed by the IWG are collectively intended to meet the following nine Guiding Principles:

1. Streamflow that:
   - Provides passage
   - Provides healthy habitat
   - Serves channel formation function
   - Meets aesthetic and water quality objectives
   - Is resilient to climate change
2. Sustainable hatchery that:
   - Provides healthy fish in adequate numbers
   - Is resource efficient
   - Significantly reduces phosphorus loading
   - Has appropriately screened diversion(s)
   - Does not impede fish passage
3. Tribal Treaty and federally-protected fishing/harvest rights are met at all times.
4. Provide additional water to meet municipal and domestic demand.
5. Improve agricultural reliability that:
   - Is operational
   - Is flexible

- Decreases risk of drought impacts
- Is economically sustainable

6. Improve ecosystem health, including protection and enhancement of aquatic and terrestrial habitat.
7. Comply with state and federal law.
8. Protect Non-Treaty Harvest.
9. Comply with the Wilderness Act of 1964, the Alpine Lakes Wilderness Act of 1976, and the Alpine Lakes Wilderness Management Plan.

Improvement of the COIC delivery system would meet multiple prongs of the IWG Guiding Principles. This project has the potential to do the following:

- Restore up to 11.9 cfs of flow to lower Icicle Creek by relocating the diversion to the Wenatchee River (Guiding Principle No. 1).
- Assist in providing a sustainable hatchery by conveying additional water supplies to the hatchery (Guiding Principle No. 2).
- Conserve water by reducing consumptive use, which could be used to improve municipal and domestic water demand (Guiding Principle No. 4).
- Improve the reliability of water supply for agriculture within the COIC service area (Guiding Principle No. 5)
- Potentially benefit habitat (Guiding Principle No. 6) and Treaty and Non-Treaty Harvest (Guiding Principles No. 3 and No. 8) by improving flows in lower Icicle Creek.

1.2 Scope of Work

The scope of this study is to provide initial technical information for the alternatives described previously, which are intended to reduce surface water diversions from Icicle Creek by improving efficiency and/or replacing the existing surface water diversion with a pumped diversion on the Wenatchee River. WWT contracted with Anchor QEA, LLC, to provide technical support and coordination for this analysis. The following elements were completed as part of the scope of this analysis.

1. **Collection and Review of Background Information**
   - Anchor QEA and WWT worked with COIC and others to collect and review critical project information, including information on the existing COIC system, topography, water rights documentation, flow data, and GIS data.
   - Anchor QEA and WWT identified additional information needed to complete this analysis and met with COIC to discuss the project and data needs.
2. **Summary of Existing Needs and Conditions**
   - Anchor QEA worked with WWT and others to perform field investigations to better understand existing water use, water needs, efficiency, and existing delivery system conditions.
   - Anchor QEA worked with WWT to identify design constraints, COIC's irrigation and water supply needs, and water delivery challenges.
   - Anchor QEA and WWT prepared a written summary of the existing COIC irrigation system, water supply needs, and delivery system conditions, included in Section 2 of this report.
3. **Evaluation of the Alternatives**
   - The primary objectives of this project were to evaluate three potential efficiency improvement alternatives and to review potential savings realized from reduced water use plants on individual properties.
   - Anchor QEA and WWT worked with COIC and other stakeholders to complete the following for each alternative:
     - An analysis of Wenatchee River hydrology to inform feasibility for pumping from the Wenatchee River
     - A hydraulic analysis to evaluate hydraulic profiles, pressures, and sizes of pipes and pumps
     - A list of major materials and estimated quantities for each alternative
     - A preliminary Opinion of Probable Construction Costs and a life cycle cost analysis to evaluate the present value of long-term operating costs, such as power, operations, and maintenance costs
     - A summary table comparing and contrasting the alternatives

4. **Preparation of a Summary Report**
   - This report summarizes the results of the alternatives analysis.

1.3 Purpose

This analysis aims to evaluate opportunities and constraints for the above-listed COIC delivery system improvement alternatives. Goals of the alternatives analysis include the following:

- Evaluate efficiency improvement alternatives for the COIC delivery system.
- Provide a basis for comparing the costs, benefits, opportunities, and constraints of the alternatives.
- Summarize the analysis in enough detail to enable COIC and other stakeholders to weigh the alternatives, plan for future improvements, and pursue funding for an improvement project.

Participating in the study does not obligate COIC in any way to proceed with an improvement project. However, WWT anticipates that the information provided will inspire a careful evaluation of the alternatives and whether they match the long-term interests and goals of COIC water users. Conservation projects that benefit fish, wildlife, and other natural resources can be translated into funding proposals to finance system upgrades and provide additional financial incentives to COIC.

2 EXISTING CONDITIONS

2.1 Description of Existing Facilities

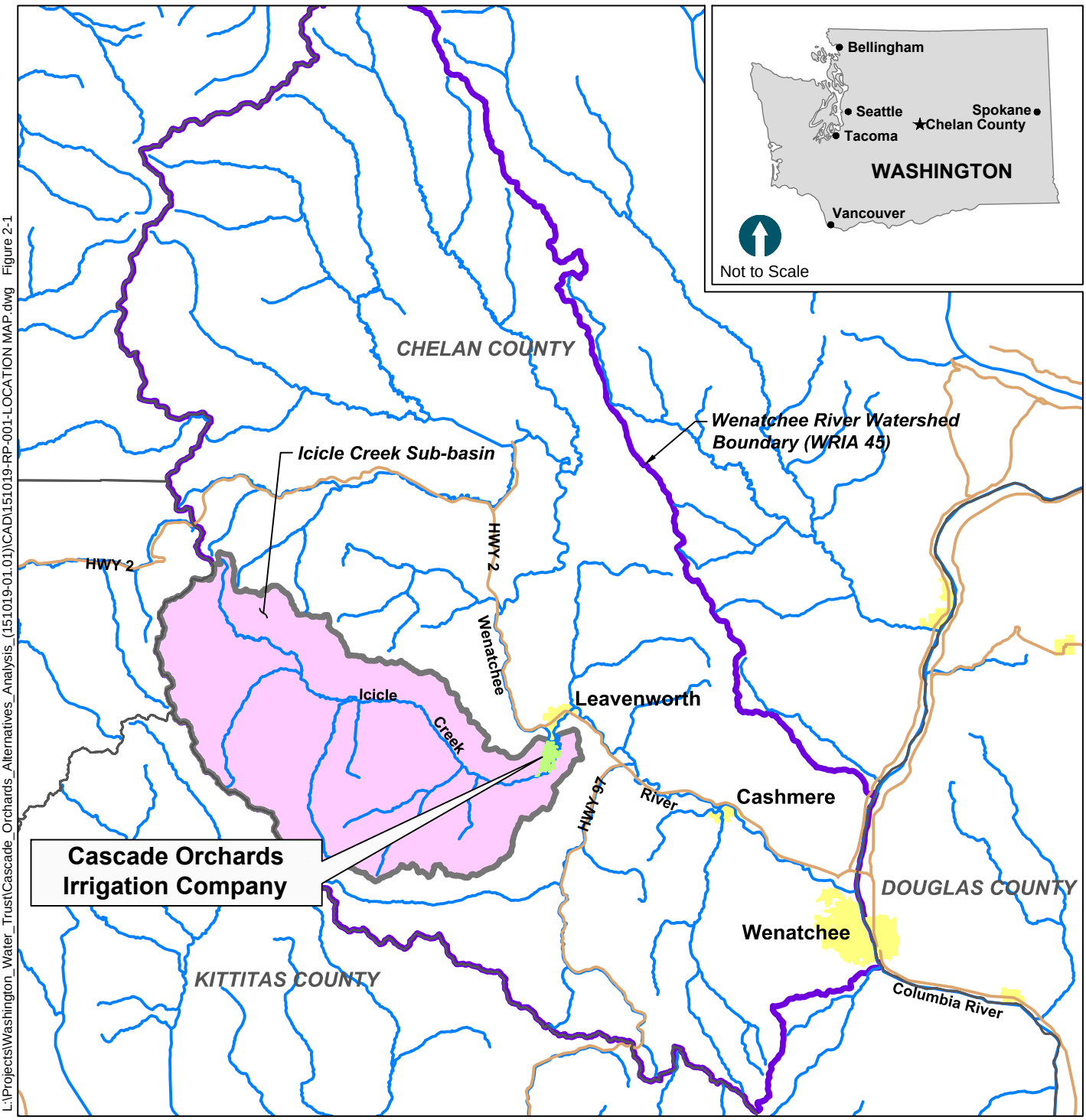
The COIC service area is located in Chelan County, Washington, south of the town of Leavenworth, as shown in Figure 2-1. COIC conveys water to customers for irrigation primarily through a system of open, unlined ditch and closed lateral pipelines. The existing ditch system and service area are shown on Figure 2-2. This section provides a brief description of existing facilities, from the diversion at Icicle Creek to the tailwater at the Wenatchee River, and identifies some operational challenges and deficiencies associated with the existing delivery system.

2.1.1 Shared Diversion with LNFH

COIC diverts surface water through diversion facilities on the left bank (looking downstream) of Icicle Creek, approximately 4.5 miles upstream of the confluence of Icicle Creek and the Wenatchee River. Diversion facilities are shared with LNFH and were constructed in the early 1940s under agreements between COIC and the U.S. government, established with the development of the hatchery. The facilities are designed to divert up to 54 cfs, which is equal to the combined total of the instantaneous surface water rights for COIC and LNFH. The diversion facilities consist of the following:

- A reinforced concrete diversion dam spanning Icicle Creek, and a fish ladder
- A reinforced concrete headgate structure (with a debris rack) that diverts water to a reinforced concrete channel constructed on the left bank of Icicle Creek
- A small control shed where the canal transitions to a buried pipeline
- Approximately 1,200 to 1,300 feet of buried pipeline extending from the control shed to a bifurcation structure near a campground on Icicle Road

Photographs 1, 2, and 3 in Appendix A show the shared diversion facilities on Icicle Creek.



L:\Projects\Washington_Water_Trust\Cascade_Orchards_Alternatives_Analysis_(151019-01.01)\CAD\151019-RP-001-LOCATION MAP.dwg Figure 2-1

Oct 30, 2015 10:33am drice

SOURCE: Basemap prepared from Chelan County GIS Data

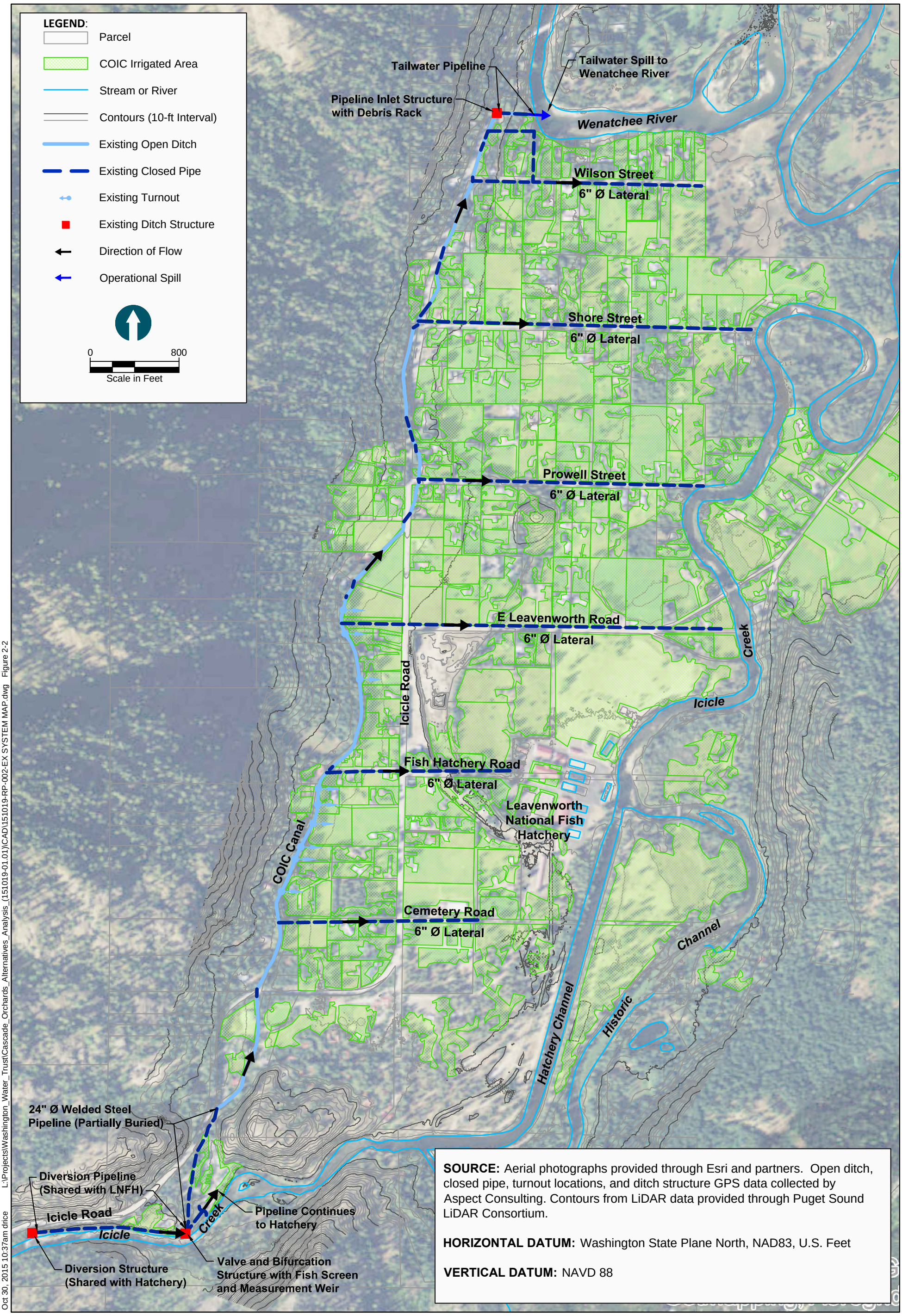
HORIZONTAL DATUM: Washington State Plane North, NAD 83

0 8

Scale in Miles

ANCHOR QEA

Figure 2-1
Location Map
Alternatives Analysis Study
Cascade Orchards Irrigation Company



L:\Projects\Washington_Water_Trust\Cascade_Orchards_Alternatives_Analysis_(151019-01.01)\CAD\151019-RP-002-EX SYSTEM MAP.dwg Figure 2-2
Oct 30, 2015 10:37am drice

ANCHOR QEA

Figure 2-2
Existing COIC Delivery System
Alternatives Analysis Study
Cascade Orchards IrrigationCompany

2.1.2 Bifurcation, Screening, and Measurement Structure

A bifurcation structure on the left bank of Icicle Creek splits the flow of water conveyed to COIC from water conveyed to LNFH near a recreational vehicle campground on Icicle Road. The structure consists of a buried valve with an exposed hand-wheel actuator. The valve is housed in a concrete masonry unit structure with a wood and metal cover that opens to provide access to the hand-wheel. The valve is opened to divert water from the pipeline to an open reinforced concrete structure adjacent to the valve enclosure. Water rises through an opening in the bottom of the structure.

An overflow pipe allows for water and fish to spill from the structure back to Icicle Creek. A rotating drum fish screen in the structure prevents fish from passing into the irrigation system. The screen is powered by a paddle wheel that rotates in the water downstream of the screen. The fish screen and paddle wheel are operational, but are aging, outdated, and in need of upgrading. The reinforced concrete structure is also deteriorating.

Downstream of the paddle wheel, water flows over a small suppressed rectangular weir. A staff gage upstream of the weir is read daily during the irrigation season and the flow rate is determined based on a rating curve for the weir. Downstream of the weir, water flows through a debris rack into a 24-inch-diameter steel pipeline. The valve enclosure, bifurcation structure, screening, and weir facilities are shown in Photographs 4 through 8 in Appendix A.

2.1.3 Pipeline to Sleeping Lady

A 24-inch-diameter welded-steel pipeline conveys water through the campground to an outlet on the parcel occupied by the Sleeping Lady Resort. The pipeline is approximately 1,180 feet long and, for most of its length, is installed slightly above the existing ground level. The pipe is supported by regularly spaced reinforced concrete supports. The pipeline and supports appear to generally be in good condition. The pipeline is shown in Photograph 9 in Appendix A.

2.1.4 Open Ditch

From the Sleeping Lady Resort to the tailwater pipeline at the downstream end of the COIC system, water is conveyed mostly through an open, unlined ditch. The ditch is approximately 1.9 miles long and has an average slope of approximately 0.0011 feet per foot of length. The ditch is typically about 8 to 10 feet wide and 1 to 2 feet deep, with heavily vegetated ditch banks. Most of the ditch runs through natural pine forest. However, seepage from the ditch also appears to support a healthy mix of cottonwood trees and other riparian plants. Photographs 10, 11, and 12 in Appendix A show typical sections of the open ditch.

2.1.5 Culverts

The ditch passes through several culverts. Culverts typically consist of buried concrete, corrugated metal, or plastic pipe installed at locations where roads and driveways cross the ditch. Some typical culverts are shown in Photographs 13 and 14 in Appendix A.

2.1.6 Turnouts

Several turnouts were observed along the open ditch. These turnouts typically deliver water to properties adjacent to the ditch and consist of a screened pump intake or a screened pipe inlet. Photographs 15 and 16 in Appendix A show examples of turnouts located on the open ditch bank.

2.1.7 Laterals

The COIC delivery system also includes a series of laterals that extend east from the open ditch into the valley. The laterals primarily serve properties east of Icicle Road and are generally aligned with existing roadways. The laterals consist of closed, 6-inch-diameter pipelines that operate under pressure resulting from the difference in elevation between water level in the open ditch and the lateral. The laterals range in length from 500 feet to more than 3,400 feet and are typically supplied through some type of small, wooden, screened structure on the ditch bank. Photographs of lateral intake structures on the open ditch are shown in Photographs 17 and 18 in Appendix A.

2.1.8 Tailwater to Wenatchee River

Excess water conveyed through the open ditch is spilled to the Wenatchee River through a pipeline that discharges to the right bank of the Wenatchee River approximately 0.7 miles upstream of its confluence with Icicle Creek. The open ditch conveys water to the pipeline at a small reinforced concrete structure with a debris rack adjacent to Icicle Road. The pipeline is approximately 270 feet long. A staff gage located upstream of the inlet structure in the open ditch provides a way for the ditch rider to monitor and manage the spill. The inlet structure at the tailwater pipeline is shown in Photograph 19 in Appendix A.

2.2 Operational Challenges and Deficiencies

Like other irrigation systems built in the first half of the 20th century, COIC's infrastructure is aging and requires frequent repairs and regular maintenance. Although the system is well maintained, additional upgrades will likely be needed in the near future to repair and replace deteriorating infrastructure, improve efficiency, and improve operations and maintenance (O&M). The following sections identify some key deficiencies that will likely need to be addressed.

2.2.1 Shared Diversion, Bifurcation, Screening, and Measurement

The shared diversion with LNFH is aging, and it is anticipated that the facilities will require improvement in the near future. The USFWS and Reclamation have identified the need to upgrade the diversion and anticipate that they will be required to replace the facilities to meet current fish passage and screening guidelines. Although COIC operates a fish screen and bypass within their portion of the bifurcation structure, the fish screen is outdated and would likely need to be updated or replaced with screening closer to the point of diversion. When USFWS and Reclamation are required to replace the diversion facilities, COIC's share in the cost of those upgrades is likely to represent a major expense, unless another water supply alternative is adopted.

The existing diversion, bifurcation, screening, and measurement facilities are also outdated and deteriorating. None of the equipment is automated. Some of the concrete is spalling and cracking. Repairs and maintenance associated with an aging facility can be expected to increase until the facilities are replaced.

2.2.2 Open Ditches and Culverts

Water is lost through seepage and evaporation from the open, unlined ditch. However, a seepage analysis summarized in Section 3 indicates that seepage and evaporation losses are low in comparison to other ditch systems of similar size and configuration. Open ditches are also subject to leaks and failure, especially where located on the side of a steep hill or in a slide area. The COIC ditch is generally not located on steep hillsides or in slide areas that are at a high risk of failure, and so ditch failures have not historically been an issue.

Significant maintenance is required each fall and spring to clean and prepare open ditches for the irrigation season. To keep the ditch operating at capacity, COIC has to remove fallen trees, trim vegetation, and remove sediment from the ditch. Because most of the ditch is surrounded by trees, cleaning and maintenance can be challenging, especially following a stormy winter, when large volumes of trees, branches, and debris have to be removed from the ditch before it can be filled with water.

2.2.3 Laterals and Turnouts

Lateral pipelines and turnouts typically have to be screened to keep out needles, twigs, leaves, and other floating debris. Cleaning and maintenance of screening facilities is required to maintain capacity and operation. Turnout screens are typically maintained by the water users, while lateral intake facilities and pipelines are maintained by COIC. COIC has indicated that the lateral pipelines range in age, condition, and material. Lateral pipelines were installed and replaced over several years and the type and condition of lateral pipe is not known for all of the laterals. Laterals occasionally leak or break and require repair. Locating the pipe and finding the appropriate fitting and repair equipment can be a challenge and results in interruptions to service.

3 WATER SUPPLY NEEDS

3.1 Existing Water Use

COIC measures water entering and exiting the system using weirs. The upper weir is located just downstream of the COIC-LNFH bifurcation, and the lower weir is located just upstream of the point where COIC tailwater discharges to the Wenatchee River. Diversion statistics for the upper weir (water measured entering the system) for 2011 through 2014 are summarized in Table 3-1.

Table 3-1
COIC Water Use (2011 to 2014)

Year	Irrigation Season (days)	Average Diversion[1] (cfs)	Peak Average Daily Diversion[1] (cfs)	Total Annual Diversion (acre-feet)
2011	171	6.0	8.0	2,046
2012	167	6.5	6.8	2,109
2013	169	5.9	7.7	1,935
2014	168	6.1	6.6	2,001

Notes:
COIC = Cascade Orchard Irrigation District
cfs = cubic feet per second
1 Diversions are from Ecology's records and represent flows measured by COIC at the weir in the bifurcation structure.

In Table 3-1, the Peak Average Daily Diversion represents measurements by COIC at the weir below the LNFH bifurcation. The Average Diversion rate was calculated by dividing the sum of the Peak Average Daily Diversion values by the number of days in the irrigation season. The Total Annual Diversion was calculated as the sum of water diverted in each day of the irrigation season using the conversion formula that 1 cfs diverted for 24 hours is equal to 1.98 acre-feet. Table 3-1 should not be taken as the only source of quantifying potential maximum instantaneous demand of the water right. Peak flow rates could be higher under transient conditions such as during the peak hours of use on hot days or during initial season canal activation. In addition, as mentioned elsewhere in this document, COIC has a contract with Reclamation to deliver excess water to LNFH, which would occur above the bifurcation.

WWT worked independently with COIC to provide an internal assessment of the validity and extent of their water rights. This is included in a great deal of detail in a report provided to COIC. The methods included review of geospatial data to determine actual use of water on COIC to help for their planning purposes, application of Ecology guidance documents to validate and quantify their water rights, and completion of a seepage loss study to help inform the various alternatives. WWT is not an arbiter of water rights, and the final quantification of their water rights can only be validated via application of state law through subsequent change applications with Ecology. While many of the details of this analysis are still under legal review by COIC's legal counsel, WWT nevertheless found strong evidence of beneficial use of water by COIC up to and including their historical rights as documented by adjudicated Certificate No. 1 on Icicle Creek and subsequent change applications. All of these are a matter of public record, and should be taken as the current quantities for water rights at COIC.

WWT worked with Blue Water GIS to complete an evaluation of COIC's on-property water use and estimate current extent of beneficial use on properties served by the water right. The evaluation was completed using ARCGIS data for parcels assessed by COIC from Chelan County Assessor's parcel database and 2009 and 2013 aerial photography from the National Agriculture Imagery Program (NAIP). The following methodology was used:

1. Blue Water GIS grouped contiguous parcels listed under the same owner to facilitate evaluation of the data by landowner.
2. Blue Water GIS delineated irrigated areas based on whether areas appeared to be irrigated in aerial photographs. Approximately 1,100 acres were reviewed and 280 separate polygons were delineated representing discrete lawn, pasture, or crop areas using 2009 and 2013 NAIP aerial photographs. An assumed crop type (mostly grass/lawn) was assigned to each area and one of the following levels of confidence were assigned to each delineated area for each aerial photograph:
   - Low = "Possible" irrigation, not necessarily green, but including any type of field showing evidence of recent cultivation
   - High = "Likely" irrigation, partial or some green denoting irrigation
3. Blue Water GIS intersected the delineated irrigated areas with the layer of parcels grouped by landowner and deleted all polygons with no owners and less than 0.1 acre

of irrigated area. The result was a GIS database with irrigated acreage estimated for each landowner by crop type and confidence level.

4. Blue Water then imported the GIS database file into Microsoft Access to query the data and exported the data tables into Microsoft Excel for further analysis.

The results of this analysis are confidential because they contain sensitive information regarding beneficial use of the water rights. However, WWT found considerable evidence supporting the validity of COIC water rights and subsequent beneficial use in line with the original intent as listed in the water right certificates and subsequent changes. Current active certificates authorize an 11.9 cfs water right for service to up to 600 irrigated acres, with additional considerations outlined in 1940 change applications and documented by 1939 agreements with the U.S. government, which address the shared diversion and delivery system with the LNFH.

3.2 Water Rights Evaluation

As a disclaimer, authors of this report are not arbiters of water rights in the state of Washington. Authority for adjudicating or determining the extent and validity of water rights is reserved only to superior courts, Ecology, or other entities with jurisdiction under Washington State law. None of the material provided in this section, or elsewhere in this report, is either given or intended to be construed as legal advice. All water rights holders are encouraged to consult an attorney with a specialization in water law in Washington State when making decisions about their water rights.

COIC operates an irrigation delivery system serving water rights for up to 600 irrigated acres in the lower reaches of Icicle Creek Subbasin in the Wenatchee River Watershed. Ditch facilities were constructed in soils composed primarily of granitic sand and fluvially reworked volcanic deposits. Icicle Creek drains a large alpine basin, including numerous lakes, some of which are used as irrigation reservoirs. The lower reaches of the Icicle Creek Subbasin offer a beautiful environment, supporting year-round recreational activities, and a home to resorts and the renowned destination town of Leavenworth, Washington.

The 1929 Icicle Creek water right adjudication awarded COIC the only Class I water right, with a 1905 priority date. Land use has changed over the years from mixed agriculture to domestic lawn and garden with some agriculture. The most notable change in the area came about shortly after this adjudication, with the establishment of LNFH on approximately 150 acres of historical floodplain that was originally part of the Cascade Orchards plat. The U.S. Department of the Interior, through the U.S. Bureau of Reclamation (Reclamation), contracted with COIC to purchase land and water rights. The intent of Reclamation's interest in locating a hatchery in the upper Wenatchee River drainage was to mitigate for the impact of the Grand Coulee Dam on the salmon fisheries in the Columbia River system. Surface water rights obtained for LNFH from the Wenatchee River were later transferred to Icicle Creek for LNFH operations, though LNFH subsequently discontinued the use of Wenatchee River water for hatchery operations. COIC's current water rights are summarized in Table 3-2.

Table 3-2
COIC Water Rights

Document Number	Priority Date	Qi (cfs)	Qa (acre-feet)	Area (acres)	Place of Use	Notes
S4-*35001JWRIS	01/01/1905	12	Not listed	600	See Figure 2-1	Class 1 water right on Icicle Creek, Changed by Certificate of Change No S4-CV1P170
S4-CV1P170	07/06/1940					Change to Icicle Creek Certificate No. 1.

Notes:
cfs = cubic feet per second
COIC = Cascade Orchard Irrigation District
Q_a = annual water right withdrawal volume
Q_i = instantaneous water right withdrawal limit

*3.2.1 1905 – Adjudicated Water Right Certificate No. S4-*35001JWRIS*

The 1929 Icicle Creek Water Right Adjudication Decree authorized COIC the diversion of up to 12.0 cfs from Icicle Creek for the irrigation of 600 acres within "Cascade Orchards, according to the official plat thereof on file in the office of the County Auditor of Chelan County." The only Class I water right on Icicle Creek, Icicle Creek Certificate No. 1

("S4-*35001JWRIS")[1] cites a point of diversion (POD) located in the SE ¼, NE ¼, Section 27, T 24 N, R 14 EWM.[2] The water right priority date is 1905. The irrigation season identified in the Report of Referee is somewhat ambiguous. It states that "Some of the lands irrigated from Icicle Creek do not require irrigation before May 1st, while on other lands water is applied about April 15th and some years even earlier. The irrigation season on all lands extend to September 15th."

*3.2.2 Authorized Changes to S4-*35001JWRIS (S4-CV1P170)*

S4-CV1P170 was a change to S4-*35001JWRIS authorized July 6, 1940, and changes the purpose and place of use for a 0.10 cfs portion of the Water Right (and 0.103 cfs of Surface Water Claim No. 006167), as follows:

> 0.1 cfs appurtenant to the following described lands for irrigation S½ Lot 10, Block 6, Cascade Orchards, Section 23, T 24 N, R 17 EWM and Lot 5, Block 1, First Addition to Cascade Orchards, Section 26, T 24 N, R. 17 EWM and 0.103 cfs now appurtenant to certain lands for irrigation, which make up a right-of-way for a canal and fish rearing ponds in Section 23, T 24 N, R. 17 EWM, more particularly described in a contract between the USA and the COIC, dated November 6, 1939.

Certificate of Change No. S4-CV1P170 authorized a change in the place of use (POU) and purpose for 0.203 cfs of water from Icicle Creek from irrigation to "a supply for fish hatchery, rearing ponds and appurtenant facilities, and domestic use." It is possible that 0.1 cfs of the water is authorized under S4-*35001JWRIS and 0.103 cfs is not; the 0.103 may be appurtenant to lands not included in the Cascade Orchards plat. This would explain the existence of Water Right Claim No. 006167, described below. The Purpose of Use for this

[1] S4-*35001JWRIS is a filing nomenclature used by the Washington Department of Ecology to organize water rights into a coded tracking system, beginning in 1972 with the Water Rights Information System (WRIS) and migrated into an updated "Water Rights Application Tracking System" (WRATS) in 1995. Icicle Creek Certificate No. 1 is filed under the WRATS system as S4-*35001JWRIS.

[2] A note on the water right certificate (and confirmation on map) confirms that Range 14 was listed in error and this POD is in fact in Range 17.

portion of the water right is to "supply for fish hatchery, rearing ponds and appurtenant facilities and domestic use on the following described property."

It should be noted that this change leaves 11.9 cfs for COIC. Ecology's Water Rights Acquisition Tracking System (WRATS) database lists COIC's water right as allowing for diversion of up to 11.9 cfs and 2064.5 acre-feet per year (afy) for the irrigation of 600 acres with a year-round period of use. The basis for Ecology's assignment of 2064.5 acre-feet in WRATS is unknown. Ecology has not made a tentative determination of the extent and validity of this water right after it was adjudicated and so the assignment of this quantity is not likely binding in any way.

3.2.3 2004 – Application for Change No. CS4-ADJ35P1

The information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.2.4 Water Right Claim No. 006167 (S4-006167CL)

The information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.2.5 Additional changes to the Water Rights

The information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.2.6 Contracts with LNFH (U.S. Government)

The information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.2.7 Discussion

*3.2.7.1 Adjudicated Water Right Certificate No. S4-*35001JWRIS*

The state quantifies water rights in instantaneous water right withdrawal limit (Qi) and annual water right withdrawal volume (Qa) amounts based on a duty for the region

reflecting the climate, soil, and crop type. While the annual quantity for COIC's adjudicated water right was not elucidated in the decree, the Report of Referee did quantify the instantaneous water duty for the right at 1 cfs per 50 acres of land, which equates to 12 cfs for 600 acres. Diverting 12 cfs over a 180-day irrigation period, April 15 through September 15, would yield 4,276.8 acre-feet (12*180*1.98 = 4276.8), a duty of 7.128 acre-feet per acre (afa).

After being changed to provide water for the hatchery, S4-*35001JWRIS now authorizes the diversion of 11.9 cfs and 2,064.5 afy for the purpose of irrigation on 600 acres according to Ecology's records. As stated previously, the basis for Ecology establishing this annual quantity in WRATS is unknown, and the assignment of 2,064.5 acre-feet for this water right is not likely to be binding absent a tentative determination of the extent and validity of this water right. Note that the adjudicated right reflects a debit of 0.10 cfs, but Certificate No. CS4-CV1P070 authorized the change of 0.203 cfs. The source of the additional 0.103 cfs is unclear.

Additional information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.2.7.2 Water Right Claim No. 006167 (S4-006167CL)

The information provided by WWT in this section is not publicly available, so it is not further described in the public version of this report.

3.3 Existing Conveyance Efficiency

Open ditch systems lose water through seepage and evaporation. The efficiency of an open, unlined ditch system varies based on the type of soil the ditch was constructed in, shading and vegetation, length of ditch, and ditch maintenance. Some open ditch systems in north central Washington operate at efficiencies less than 50%, meaning that more than half of the water diverted from the source is lost through seepage, evaporation, leaks, or spills before making it to water users' turnouts for irrigation. The existing COIC ditch was evaluated to estimate the rate at which water is lost through seepage and to determine the efficiency of the COIC open ditch delivery system. This section summarizes the seepage loss analysis.

3.3.1.1 Purpose and Methods

The purpose of the seepage loss study was to provide information regarding potential ditch losses in COIC's unlined ditch supplied by the surface water right on Icicle Creek. On August 10, 2015, representatives from WWT, the Washington State Department of Fish and Wildlife (WDFW), Aspect Consulting, and Chelan County Natural Resources joined COIC president Dan Wilkinson to measure ditch flow rates and estimate losses on this system. The team used velocity meters and the cross sectional method for stream gaging. In this method, technicians divide the stream channel into numerous cross sections, measuring the width and depth of each subsection. The width and depth of each subsection are multiplied to estimate the area. Hand-held velocity meters are then used to determine the average velocity of the water in each subsection. The flow rate in each subsection is then calculated as the product of the area and the measured velocity, and the flow rates of each subsection are totaled to determine the overall flow rate at that cross section of the stream or ditch.

Ditch losses were estimated by comparing flows measured at different cross sections along the open ditch from the upstream end to the downstream end. Measurements were made during a single day. Prior to completing flow measurements, all water users were notified by letter to turn off their systems so that there would not be any withdrawals from the open ditch system, though it is possible that some use was still occurring, for example, where users had their sprinkler systems on timers and failed to turn them off. During the seepage analysis, a technician from Aspect Consulting collected GPS data for the major components of the COIC system, which were used to develop the map shown in Figure 2-1.

3.3.1.2 Results

Two teams completed measurements at five locations along the open ditch. Though all of those performing measurements had experience doing cross-sectional flow measurements, two different types of flow meters were used, resulting in some inconsistency between the readings. It should be noted, however, that the weir at the top of the COIC system, which is periodically calibrated, was measuring 6.0 cfs during the study, or about the average amount between the two sets of readings. Therefore, it is likely that the flows at each point in the system were within 0.4 cfs of the actual reading, or about a 7% error.

The purpose of the exercise was to determine and compare the ditch loss to the overall flow rate diverted. Ditch losses and the percentage of loss in a reach of the ditch were then estimated by comparing the numbers from the same team down the canal. As can be seen in Table 3-3, the losses measured by the two teams were 0.26 cfs and 0.32 cfs of loss from the top of the system down to the Wilkinson property, just upstream of Shore Street. The ditch was observed to be overflowing at Shore Street. Consequently, the measurements completed at the downstream end of the system do accurately reflect seepage loss. The ditch cross section appears to be tapered at the lower end and is not sized to convey the flow rates that were measured during the seepage analysis. Flow rates are typically lower at the end of the ditch due to irrigation withdrawals upstream.

Table 3-3
COIC Seepage Analysis Summary

	Team 1[1]			Team 2[2]		
Location	Measured Flow (cfs)	Total Gain/ (Loss)[3] (cfs)	Total Gain/ (Loss)[3] (%)	Measured Flow (cfs)	Gain/ (Loss)[3] (cfs)	Gain/ (Loss)[3] (%)
Top Weir	5.61	-	-	6.47	-	-
Bayne Property	-	-	-	6.45	0.02	0.3%
Wilkinson Property	5.35	0.26	4.6%	6.15	0.32	4.9%
Shore Street	5.36	0.25	4.5%	-	-	-
DS End of Open Ditch[4]	4.80	0.81	16.9%	4.57	1.90	29.4%

Notes:
cfs = cubic feet per second
COIC = Cascade Orchard Irrigation District
DS = downstream
1 Staff from Washington Water Trust/Washington Department of Fish and Wildlife
2 Staff from Chelan County Natural Resources Department
3 Represents water loss measured from Top Weir to measurement location.
4 The loss measured below Shore Street was largely due to ditch overtopping, which occurred because the downstream end of the ditch is not sized to accommodate the flow rates that were being conveyed under Shore Street.

The results of the seepage loss study suggest that seepage losses are relatively small. The first team measured a 4.6% loss from the bifurcation to the Wilkinson property. The second team measured a 4.9% for the same segment of the ditch, which includes approximately 1.6 miles of the total 1.9 miles between the bifurcation and the tailwater pipeline. The variations in

measurements are within the margins of error of the measuring devices, and represent only very small losses. Further discussion is provided in Section 5 regarding the potential benefits and costs of improving the existing system by piping or lining (Alternative 3), rather than relocating the point of diversion to the Wenatchee River or some other point downstream (Alternatives 1 and 2). The seepage analysis suggests that simply piping or lining the existing ditch is likely to yield only 0.5 cfs of water savings. The analysis indicates that the open COIC ditch, although unlined, is operating at a high level of efficiency compared with other similar systems.

3.4 Consumptive Use and Water Supply Needs

The improvement alternatives evaluated in this study would include closed pipe systems (Alternatives 1 and 2) or piping or lining of the existing system (Alternative 3) that would improve efficiency of delivery. The improvements will need to be sized to allow COIC to continue to use their water rights to meet crop irrigation requirements, account for inefficiencies in water user irrigation systems, and account for any remaining inefficiencies in the COIC delivery system.

Crop irrigation requirements, assumed inefficiencies, and deliveries required for the existing COIC system were evaluated using methods and guidelines provided in Ecology Guidance Document 1210 (Ecology 2005). This guidance provides a means of using irrigated acreage, crop type, irrigation types, and regional crop use data to calculate estimated water use in an irrigated place of use. Authority for the use of this Guidance Document is granted to Ecology in making tentative determinations of the extent and validity of the beneficial use of water rights, as further codified under the Washington State Water Code under RCW's 90.03.290, 90.03.380, and 90.44. 100, further implemented by Ecology Policy Numbers 1120 and 1210.

Beneficial use calculations provide instantaneous and annual quantity estimates of water rights based on available data and standards for calculations with the date provided in the Guidance and Policy Documents referenced above. As noted in Section 3.1, WWT used ArcGIS digitization services provided by Blue Water GIS to delineate potentially irrigated acreage.

Additional data provided to COIC by WWT in this section is not publicly available, so it is not further described in the public version of this report.

4 DESCRIPTION OF POTENTIAL IMPROVEMENT ALTERNATIVES

Four potential improvement alternatives have been identified for evaluation as part of this appraisal study. The first two alternatives would include replacing the existing gravity ditch and diversion system with a pressurized pump and pipe system. Table 4-1 summarizes the general characteristics and options associated with these three alternatives.

Table 4-1
Description of Potential Improvement Alternatives

Alternative	Description	Water Supply	Water Delivery System
1	Replace existing system with a pressurized, on-demand, system supplied by a river pump station. Discontinue operation of COIC diversion. Put water into trust.	Replace existing gravity diversion facilities with a pump station on the Wenatchee River near the Icicle Road Bridge or on Icicle Creek near Shore Street.	Install pressurized delivery pipeline in alignment of existing ditch and replace existing laterals with new pipelines.
2	Replace existing system with a pressurized, on-demand, system supplied by a river pump station. Discontinue operation of COIC diversion. Put water into trust. Add capacity for other needs, such as fire protection, or supply for LNFH.	Replace existing gravity diversion facilities with a pump station on the Wenatchee River near the Icicle Road Bridge or on Icicle Creek near Shore Street.	Install pressurized delivery pipeline in alignment of existing ditch and replace existing laterals with new pipelines.
3	Improve existing infrastructure by piping or lining to improve efficiency.	Maintain operation of existing diversion.	Replace existing open ditch with gravity pipelines or line existing ditch. Existing laterals to remain.
4	Evaluate consumptive use and identify opportunities to provide additional water savings via water user conservation.	Would be combined with Alternative 1, 2, or 3.	Would be combined with Alternative 1, 2, or 3.

Notes:
COIC = Cascade Orchard Irrigation District
LNFH = Leavenworth National Fish Hatchery

4.1 Alternative 1 – Pressurized System to Serve COIC Only

Alternative 1 would replace the existing COIC delivery system with a pressurized, on-demand system supplied by a pump station located near the confluence of the Wenatchee River and Icicle Creek. The proposed improvements that would be included as part of this alternative are shown conceptually in Figure 4-1.

4.1.1 Water Supply

Alternative 1 would change the POD for the COIC water supply to a surface water pump station located near the confluence of the Wenatchee River and Icicle Creek. The pump station would be designed as follows:

- Location – The pump station would likely be sited at one of the following locations:
  - On the right bank (looking downstream) of the Wenatchee River downstream of the Icicle Road Bridge and upstream of the existing tailwater discharge
  - On the left bank (looking downstream) of Icicle Creek near the end of Shore Street
- Intake Configuration – The intake would likely include an inclined screen intake or an intake screen manifold on the end of a suction pipe designed to meet current NMFS and WDFW guidelines. The intake would be designed to fit into the river bank and divert flows over a range of river flow conditions.
- Wet Well/Intake Structure – The intake would likely divert surface water into a reinforced concrete wet well for pumping. The pumps would be mounted above the wet well.
- Capacity – Three different supply capacities were evaluated to provide a range of design costs for consideration by COIC and other stakeholders. Table 4-2 summarizes the capacities that were evaluated.

Table 4-2
Alternative 1 – Water Supply Capacities Evaluated

Option	Capacity for COIC (cfs)	Capacity for LNFH/Other Uses (cfs)	Total Capacity (cfs)
1	4	0	4
2	6	0	6
3	8	0	8

Notes:
cfs = cubic feet per second
COIC = Cascade Orchard Irrigation District
LNFH = Leavenworth National Fish Hatchery

4.1.2 Water Delivery System

Water would be delivered through a pressurized pipe system, consisting primarily of pressure-rated PVC irrigation pipe, valves, fittings, and other appurtenances. The main distribution pipeline would extend approximately 1.9 miles from the pump station to the property boundary between the Sleeping Lady Resort and the recreation vehicle campground on Icicle Road. The laterals would also be replaced by pressurized pipelines.

4.2 Alternative 2 – Pressurized System to Serve COIC and Additional Demand

Alternative 2 would also replace the existing COIC delivery system with a pressurized, on-demand system supplied by a pump station located near the confluence of the Wenatchee River and Icicle Creek. The primary difference between Alternatives 1 and 2 is that Alternative 2 would include capacity to supply additional needs beyond just the COIC irrigation demand. Those needs might include water for fire protection, or excess capacity to supply LNFH to reduce their reliance on their surface water diversions from Icicle Creek. For the sake of this study, it was assumed that additional capacity would be provided from the pump station to LNFH, although the place of use for the additional flow rates may vary depending on the type of additional use identified. The proposed improvements that would be included as part of this alternative are shown in conceptually in Figure 4-2.

4.2.1 Water Supply

Alternative 2 would change the POD for the COIC water supply to a surface water pump station located near the confluence of the Wenatchee River and Icicle Creek. The pump station would be designed as follows:

- Location – The pump station would likely be sited at one of the following locations:
  - On the right bank (looking downstream) of the Wenatchee River downstream of the Icicle Road Bridge and upstream of the existing tailwater discharge
  - On the left bank (looking downstream) of Icicle Creek near the end of Shore Street
- Intake Configuration – The intake would likely include an inclined screen intake or an intake screen manifold on the end of a suction pipe designed to meet current NMFS and WDFW guidelines. The intake would be designed to fit into the river bank and divert flows over a range of river flow conditions.
- Wet Well/Intake Structure – The intake would likely divert surface water into a reinforced concrete wet well for pumping. The pumps would be mounted above the wet well.
- Capacity – Two different supply capacities were evaluated to provide a range of design costs for consideration by COIC and other stakeholders. Table 4-3 summarizes the capacities that were evaluated.

Table 4-3
Alternative 2 – Water Supply Capacities Evaluated

Option	Capacity for COIC (cfs)	Capacity for LNFH/Other Uses (cfs)	Total Capacity (cfs)
1	4	8	12
2	8	16	24

Notes:
cfs = cubic feet per second
COIC = Cascade Orchard Irrigation District
LNFH = Leavenworth National Fish Hatchery

4.2.2 Water Delivery System

Water would be delivered through a pressurized pipe system, consisting primarily of pressure-rated PVC irrigation pipe, valves, fittings, and other appurtenances. The main distribution pipeline would extend approximately 1.9 miles from the pump station to the property boundary between the Sleeping Lady Resort and the recreation vehicle campground on Icicle Road. The laterals would also be replaced by pressurized pipelines.

4.3 Alternative 3 – Upgrade Existing Gravity System

Alternative 3 would upgrade existing infrastructure to improve efficiency by piping or lining the existing unlined ditch. The COIC portion of the shared diversion facilities would continue to operate as they currently do. Potential upgrades are illustrated in Figure 4-3.

4.3.1 Water Supply

Alternative 3 would maintain the POD for the COIC water supply on Icicle Creek. The water supply would continue to be a shared facility with LNFH and COIC would likely be required to share in the maintenance and likely upgrade or replacement of those facilities with the USFWS and Reclamation to maintain supply to both COIC and LNFH.

4.3.2 Water Delivery System

The existing delivery system would continue to be used in its present configuration, except that unlined portions of the COIC ditch would be replaced with one of the following, or a combination of the two:

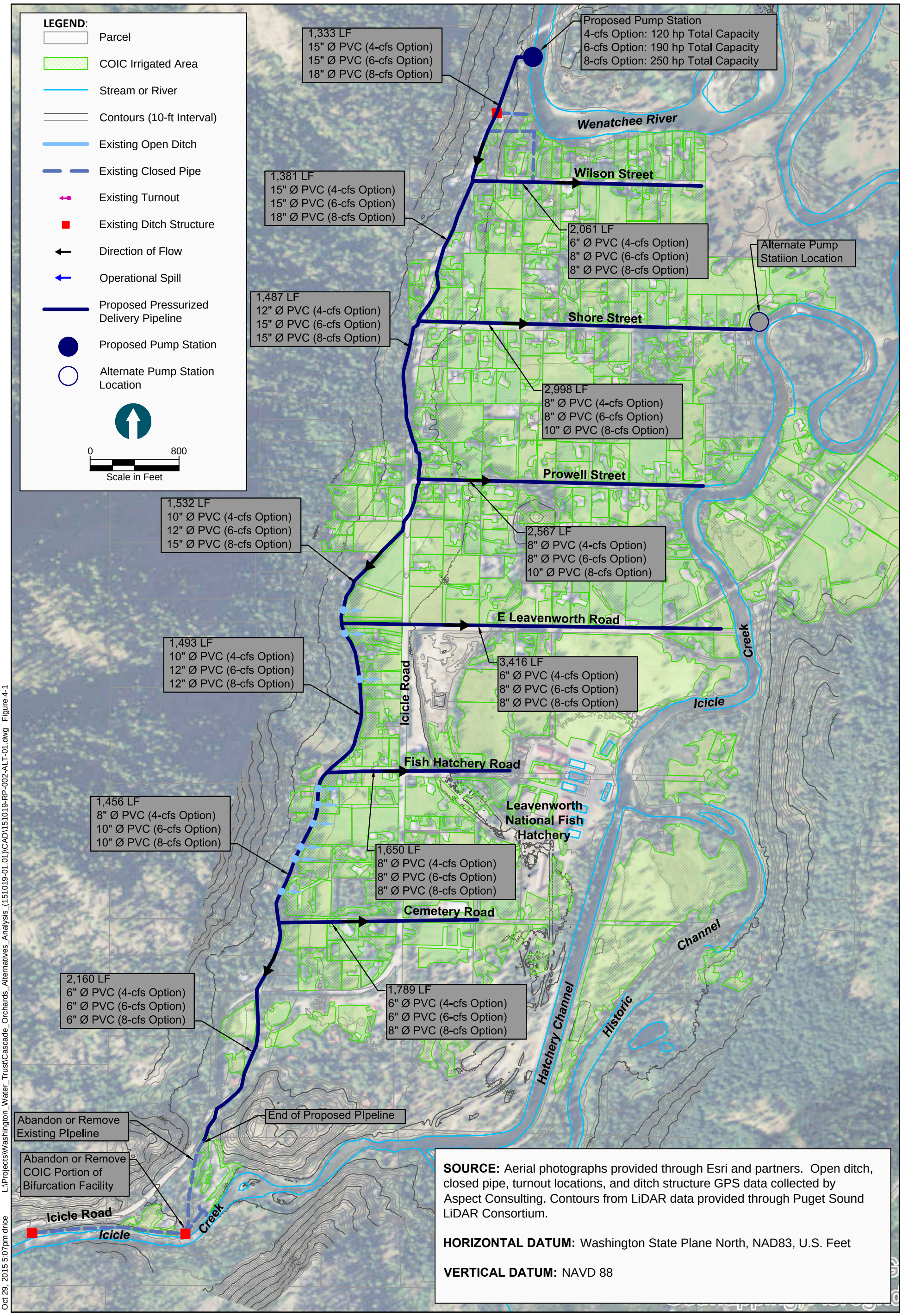
- **Gravity Pipeline** – A gravity pipeline would likely consist of corrugated high-density polyethylene or PVC pipe. The pipeline would be designed to be water tight, but would not be designed to operate under pressure. Existing lateral pipelines would remain and would be fed through connections to the proposed pipeline. The system would still require spilling of excess water at the existing tailwater location.
- **Lining** – Ditch lining would be installed over existing unlined ditch sections that would likely consist of a geomembrane liner with 3 inches of shotcrete topping. The liner would reduce seepage, but the ditch would still be open and would require cleaning and maintenance to remove trees, branches, and debris.

4.4 Alternative 4

Alternative 4 would identify water savings measures that could be implemented by water users to improve water use efficiency. Opportunities may include the following:

- **Water Efficient Landscaping** – Most of the properties that currently use COIC water for irrigation are rural residential lots. Although there is still limited agricultural use, most of the water is used to irrigate lawn, pasture, and small gardens. Replacement of lawn or other high water-use landscaping with native plants and low-water use landscaping would reduce consumptive use.
- **Improved Irrigation Efficiency** – Many of the properties that currently irrigate with COIC water use solid set or drip irrigation systems that are generally very efficient. COIC may wish to evaluate whether there are opportunities to help water users' who do not have efficient irrigation systems upgrade their facilities to improve water use efficiency and further reduce consumptive use.
- **Irrigation Timing** – COIC does not currently restrict or require water users to rotate the timing of irrigation. Because many of the parcels are residential and many of the homes are vacation homes, the peak weekend water demand in the summer is likely very high compared to overall average water demand. Encouraging members to stagger irrigation and to time their irrigation during the early morning hours and late evening hours could result in a reduced peak demand on the system and reduced evapotranspiration. In addition, some municipalities offer rebates and assistance to water users who want to purchase sprinkler timers, soil moisture meters, or other devices that allow water users to reduce overwatering.

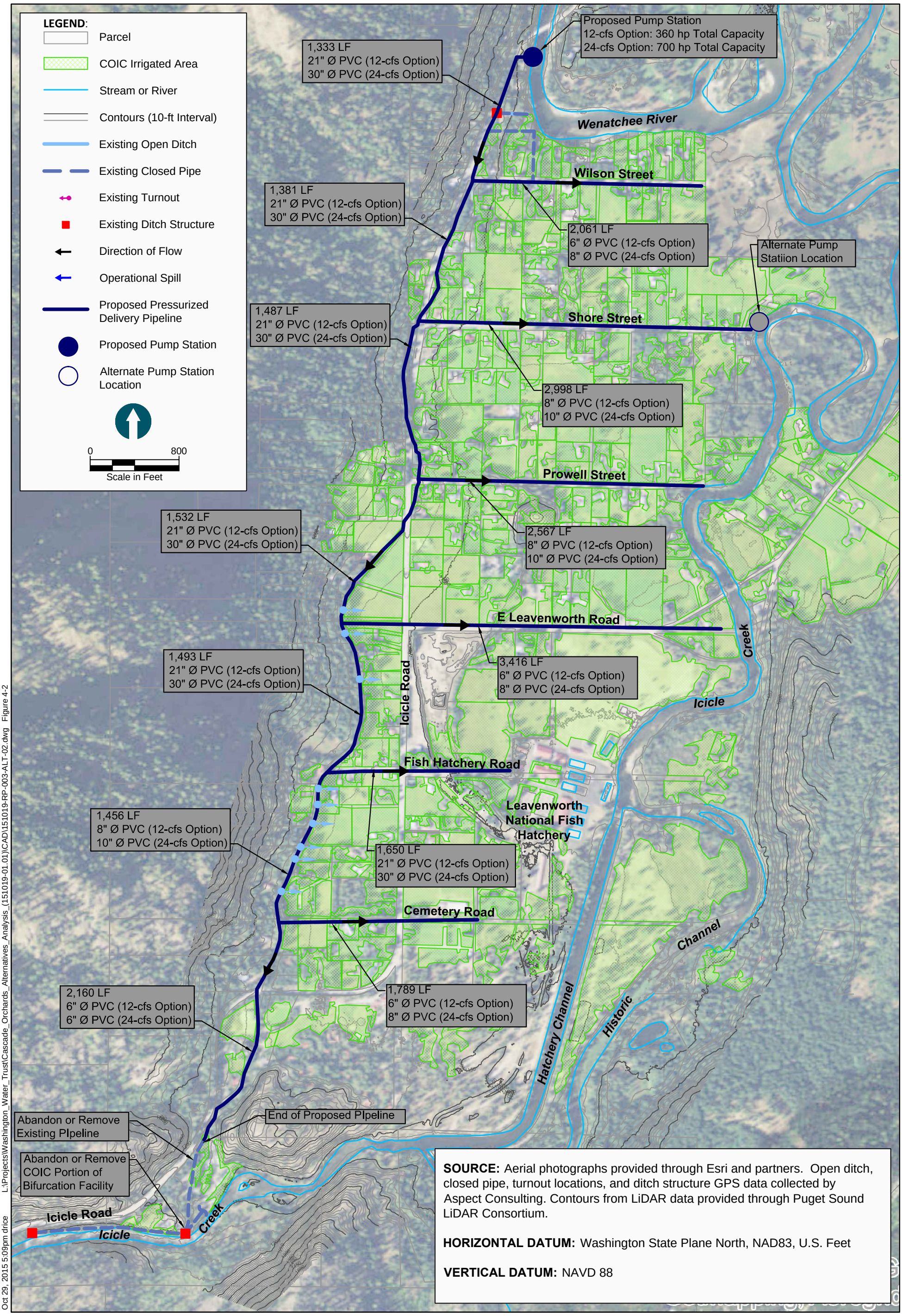
This alternative is not intended to be a stand-alone alternative, but should be considered as an addition to Alternatives 1 through 3. This costs and benefits of this alternative have not been evaluated in detail, but this alternative is included for consideration because reducing consumptive use could result in water savings that could be used for future growth or marketed for other downstream water needs.



L:\Projects\Washington_Water_Trust\Cascade_Orchards_Alternatives_Analysis_(151019-01.01)\CAD\151019-RP-002-ALT-01.dwg Figure 4-1
Oct 29, 2015 5:07pm drice

ANCHOR QEA

Figure 4-1
Alternative 1 - Proposed COIC Delivery System
Alternatives Analysis Study
Cascade Orchards Irrigation Company



Oct 29, 2015 5:09pm drice L:\Projects\Washington_Water_Trust\Cascade_Orchards_Alternatives_Analysis_(151019-01.01)\CAD\151019-RP-003-ALT-02.dwg Figure 4-2

ANCHOR QEA

Figure 4-2
Alternative 2 - Proposed COIC Delivery System
Alternatives Analysis Study
Cascade Orchards Irrigation Company

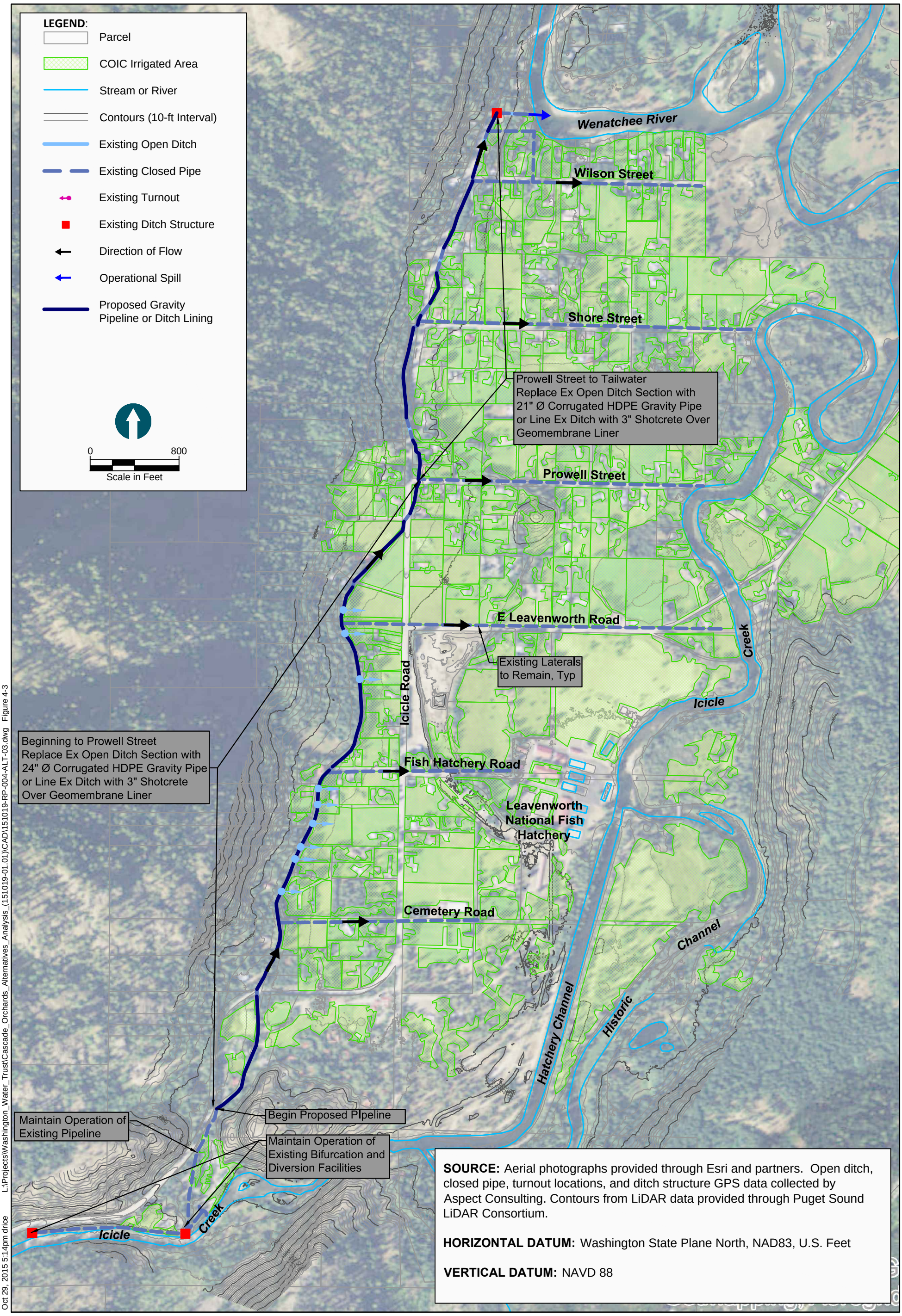


Figure 4-3
Alternative 3 - Proposed COIC Delivery System
Alternatives Analysis Study
Cascade Orchards Irrigation Company

ANCHOR QEA

5 ALTERNATIVES ANALYSIS

5.1 Water Supply Feasibility

Two options are proposed for future water supply for the COIC system. The options include replacing the existing surface water diversion shared with LNFH on Icicle Creek with a pumped diversion near the confluence of the Wenatchee River and Icicle Creek (Alternatives 1 and 2), or maintaining operation of the existing diversion (Alternative 3).

5.1.1 New Surface Water Diversion (Alternatives 1 and 2)

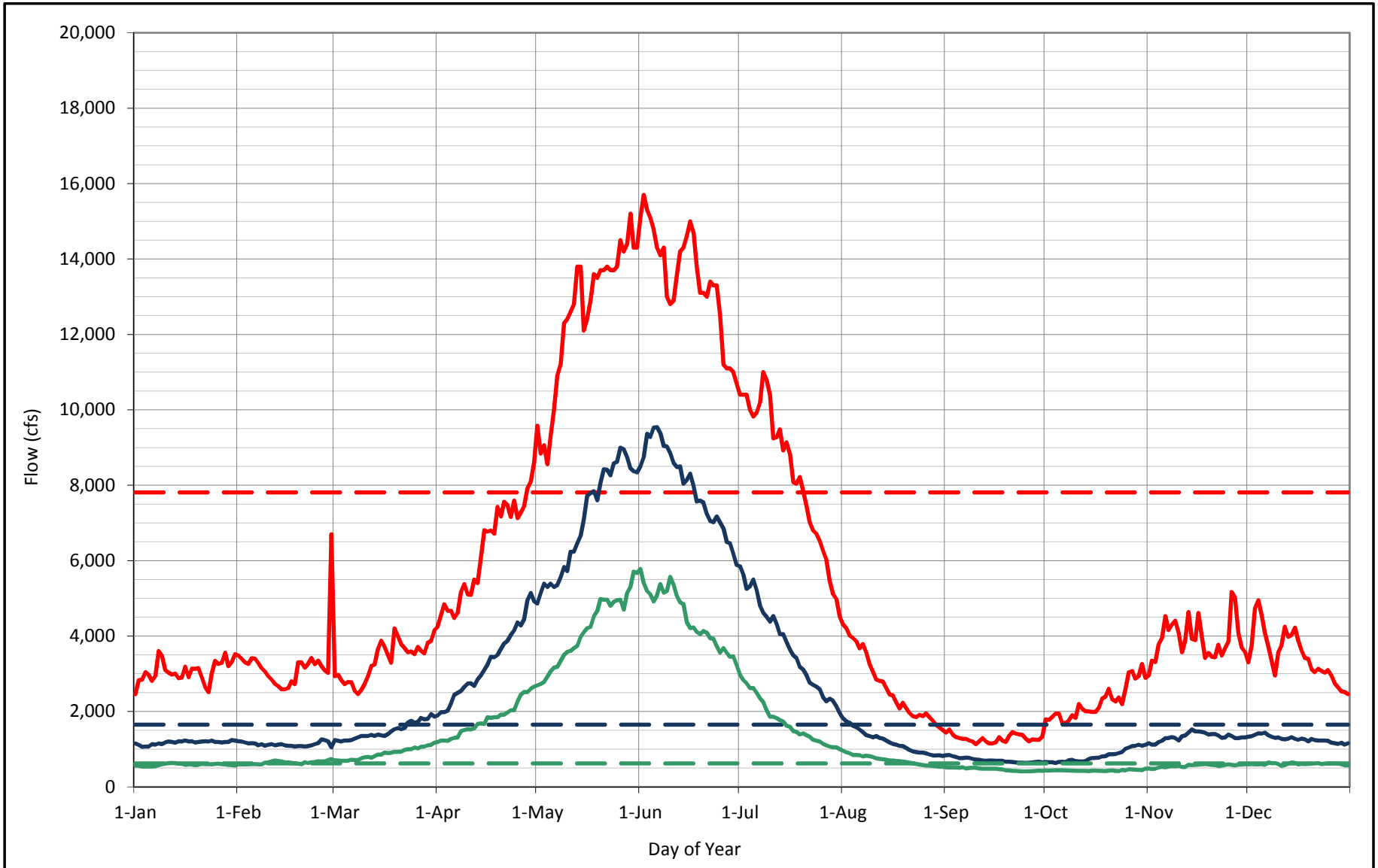
5.1.1.1 Wenatchee River Hydrology

Flows in the Wenatchee River are measured by the U.S. Geological Survey (USGS) at gages downstream of Leavenworth at Peshastin (Gage No. 12459000) and upstream of Leavenworth near Plain (USGS Gage No. 12457000). Flow exceedance hydrographs are included in Figures 5-1 and 5-2.

5.1.1.2 Icicle Creek Hydrology

The USGS also operates a gage (Gage No. 12458000) on Icicle Creek upstream of Snow Creek. The gage does not measure inflows to and diversion from Icicle Creek downstream of the gage, including the surface water diversions to Icicle and Peshastin Irrigation District (IPID) and COIC/LNFH, as well and inflow from Snow Creek and other smaller tributaries. Ecology has maintained a gage on (Gage No. 45B070) on Icicle Creek near the East Leavenworth Bridge. The gage was manually monitored from May 2007 to October 2010 and has been monitored continuously with telemetry since October 2010. Figure 5-3 illustrates the variation in flows on Icicle Creek at the East Leavenworth Bridge. These flows are similar to those that would be expected just upstream of the confluence of the Wenatchee River and Icicle Creek.

The primary areas of concern related to instream flows for Icicle Creek are downstream of the IPID and COIC/LNFH diversions and upstream of East Leavenworth Road. As a result, moving the existing diversion downstream to a point near the confluence of the Wenatchee River and Icicle Creek would allow for restoration of COIC's full diversion flow rate to the critical reach on Icicle Creek



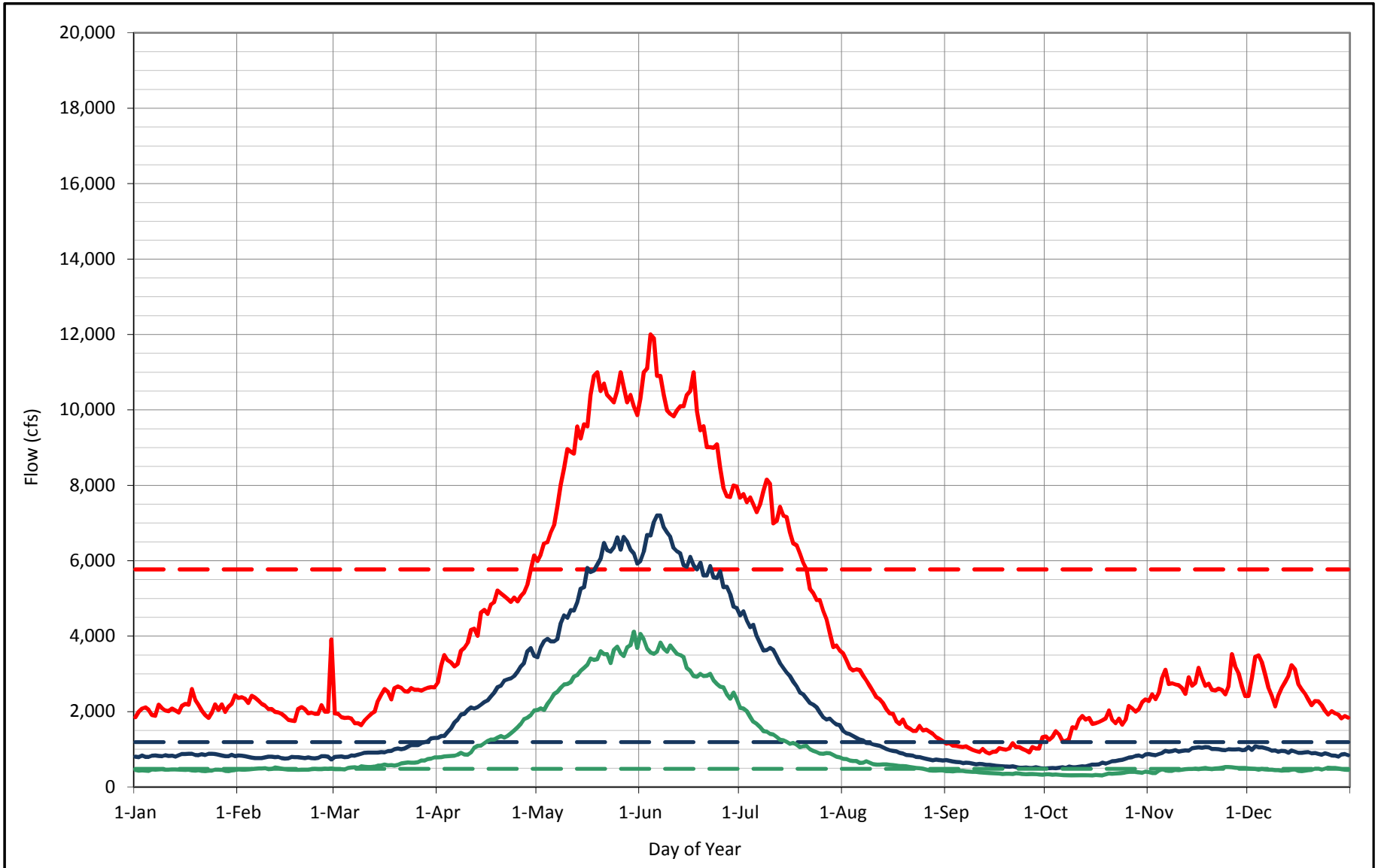
Legend:

USGS Gage No.: 12459000
Period of Record: 1/1930 - Present

- 10% Daily Mean Exceedance
- 50% Daily Mean Exceedance
- 90% Daily Mean Exceedance
- 10% Overall Exceedance
- 50% Overall Exceedance
- 90% Overall Exceedance

Figure 5-1
Daily Mean Flow Exceedance Probability
Wenatchee River at Peshastin
COIC Alternatives Analysis Study

ANCHOR QEA



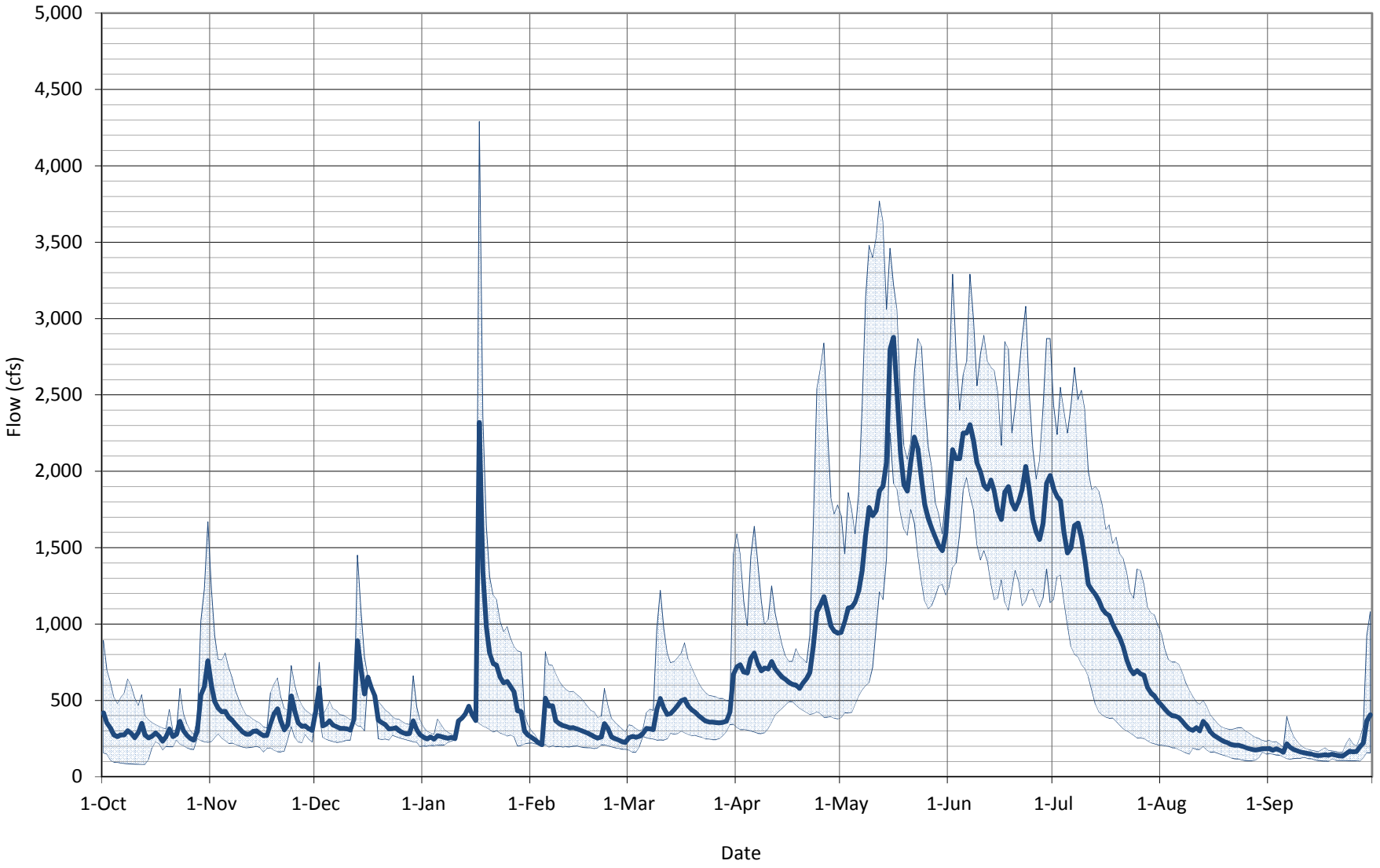
Legend:

USGS Gage No.: 12457000
Period of Record: 11/1910 - Present

- 10% Daily Mean Exceedance
- 50% Daily Mean Exceedance
- 90% Daily Mean Exceedance
- 10% Overall Exceedance
- 50% Overall Exceedance
- 90% Overall Exceedance

Figure 5-2
Daily Mean Flow Exceedance Probability
Wenatchee River at Plain, WA
COIC Alternatives Analysis Study

ANCHOR QEA



Legend:

Range of flows (2011-2014)

ECY No. 45B070
Icicle Creek near Leavenworth

Figure 5-3
Comparison of Annual Flow Variation
Icicle Creek near Leavenworth
COIC Alternatives Analysis Study

ANCHOR QEA

5.1.1.3 Geomorphology

To ensure long-term viability of the water supply from a surface water pump station, it is critical to understand both channel variability and transport of sediment and bedload at a proposed pump station location. In addition, the depth of water at the proposed pump location also has to be adequate for diversion of water over a wide range of flow conditions, including low late summer flow conditions.

Geomorphology of the Wenatchee River and Icicle Creek were reviewed near the confluence and two locations were identified where river conditions would likely be suitable for a surface water pump station:

- **Wenatchee River Near Icicle Road Bridge** – The COIC ditch discharges excess water back to the Wenatchee River just downstream of Icicle Road (Photographs 20 and 21, Appendix A). There river flows around a bed rock outcropping, on the right bank, between the Icicle Road Bridge and the existing tailwater discharge. The water on the right bank of the river is deep, even during low flow conditions, and would be suitable for pumping. Construction and access would be challenging at this location due to bed rock, steep slopes, and private property constraints.
- **Icicle Creek Near End of Shore Street** – Icicle Creek is easily accessible from the end of Shore Street. The creek bends to the east just downstream of Shore Street and there is a relatively deep pool on the outside of the bend near the left bank of the river (Photograph 22). The left bank is stabilized with exposed rock along the outside of the bend and large trees on the bank indicate that the creek channel is relatively stable at this location. The bank is lower and would provide more direct access to a pump station site than at the site on the Wenatchee River. The site is located on private property and would need to be evaluated further to assess the impact of sediment deposition and bedload movement. Sand deposition is occurring just upstream of the proposed site and a gravel bar is present across the creek from the site.

5.1.1.4 Screening

A river pump station facility would require fish screening consistent with NMFS and WDFW guidelines. Different types of screens are available for surface water diversions that meet NMFS and WDFW guidelines. In order to minimize maintenance, ensure performance, and

secure approval by WDFW, the screen would need to be self-cleaning. For the size and type of pumping facilities that would be required for the alternatives identified in this report, likely screen types would include:

- **Inclined Plate Screen** - An inclined plate screen would be equipped with an air-burst system or a mechanical brush for self-cleaning and would be installed on a structure built to match the river bank.
- **Traveling Water Screen** – A traveling water screen would rotate on a conveyor and lift debris out of the water to be removed with internal jets or a brush.
- **End-of-Pipe Screen** – A manifold of cylindrical or conical shaped screens could be installed on a suction line with internal spray, air-burst system, or brushes for self-cleaning. The screen and suction line would be submerged in the river and removed at the end of each irrigation season.

Table 5-1 provides a summary of likely fish screen sizing requirements for the range of flow rates evaluated for Alternatives 1 and 2.

Table 5-1
Preliminary Fish Screening Requirements

Design Flow Rate (cfs)	Maximum Approach Velocity (fps)	Effective Screen Area (ft^2)	Screen Area with FOS (ft^2)
4	0.4	10.00	12.70
6	0.4	15.00	19.05
8	0.4	20.00	25.40
12	0.4	30.00	38.10
24	0.4	60.00	76.20

Notes:
cfs = cubic feet per second
FOS = factor of safety, assumed to be 27%
fps = feet per second
ft^2 = square feet

5.1.2 Maintain Existing Surface Water Diversion (Alternative 3)

5.1.2.1 River Hydrology

Alternative 3 would maintain operation of the current diversion facilities on Icicle Creek. The facilities would be subject to the flow conditions and variations in flow that occur in Icicle Creek at the current diversion location. As noted previously, COIC has the first priority water right on Icicle Creek and COIC has generally had sufficient water supply, even under low flow conditions. However, flow conditions downstream of the diversion to East Leavenworth Road have impacted fish passage and habitat conditions, and there will continue to be pressure on water users to leave more flow in Icicle Creek to improve those conditions.

5.1.2.2 Coordination with LNFH

COIC shares and operates diversion facilities with LNFH under the agreements cited in Section 3 of this report. Continued operation of existing diversion facilities will require continued coordination with LNFH to ensure that water supply needs are met for both COIC and LNFH. LNFH is under increasing pressure to replace diversion facilities with facilities that meet current NMFS and WDFW guidelines for screen and fish passage. LNFH and Reclamation will likely be required to replace these facilities in the near future. COIC may likely be required to share in the cost of replacing these facilities and would be impacted by the work that would need to be done.

5.2 Hydraulic Analysis

Hydraulic analyses were completed to determine preliminary sizing for pumping facilities and delivery pipelines for the purpose of developing preliminary opinions of probable costs. The hydraulic analyses were based on the flow rates outlined in Section 4.

5.2.1 Alternatives 1 and 2

A spreadsheet analysis was used to estimate hydraulic losses and pumping requirements for the range of flow rates evaluated for Alternatives 1 and 2. The analysis used the following assumptions and criteria for pipe sizing:

- The Hazen-Williams formula was used to estimate hydraulic losses in delivery pipelines, with a Hazen-Williams coefficient, C, of 140.
- Delivery pipe was assumed to be pressurized PVC irrigation pipe.
- The analysis assumed an allowance for minor losses in bends, valves, pipe entrances, pipe exits, and other fittings equal to 10% of the friction loss in a reach of delivery pipeline.
- Pumps and pipe were sized to maintain pressures at the highest end of the system, near the recreation vehicle campground on Icicle Road, between 20 and 30 pounds per square inch.

Table 5-2 summarizes the results of the hydraulic analysis for Alternative 1. Facility sizing and configuration for Alternative 1 is shown in Figure 4-1.

Table 5-2
Summary of Hydraulic Analysis – Alternative 1

Item	4-cfs Capacity	6-cfs Capacity	8-cfs Capacity
Pump Station Design Flow	4 cfs	6 cfs	8 cfs
Pumping, TDH	183 feet	188 feet	192 feet
Main Line Sizing	6-inch to 15-inch	6-inch to 15-inch	6-inch to 18-inch
Main Line Pressures	20 psi to 73 psi	20 psi to 76 psi	20 psi to 77 psi
Lateral Sizing	6-inch to 8-inch	6-inch to 8-inch	8-inch to 10-inch
Lateral Pressures	31 psi to 64 psi	30 psi to 65 psi	34 psi to 67 psi

Notes:
cfs = cubic feet per second
psi = pounds per square inch
TDH = Total Dynamic Head

Table 5-3 summarizes the results of the hydraulic analysis for Alternative 2. Facility sizing and configuration for Alternative 2 is shown in Figure 4-2.

Table 5-3
Summary of Hydraulic Analysis – Alternative 3

Item	12-cfs Capacity	24-cfs Capacity
Pump Station Design Flow	12 cfs	24 cfs
Pumping/TDH	180 feet	180 feet
Main Line Sizing	6-inch to 21-inch	6-inch to 30-inch
Main Line Pressures	20 psi to 72 psi	20 psi to 72 psi
Lateral Sizing	6-inch to 21-inch	8-inch to 30-inch
Lateral Pressures	31 psi to 62 psi	34 psi to 62 psi

Notes:
cfs = cubic feet per second
psi = pounds per square inch
TDH = Total Dynamic Head

5.2.2 Alternative 3

A spreadsheet analysis was also used to estimate hydraulic conditions under a gravity flow scenario for Alternative 3. The analysis used the following assumptions and criteria for pipe sizing:

- Manning's formula was used to estimate the depth in each pipeline, with a Manning's coefficient, n, of 0.012.
- Delivery pipe was assumed to be smooth-walled, corrugated, high density polyethylene.
- Pipe was sized so that the depth of flow at the peak flow rate would typically be less than 90% of the pipe diameter.

Table 5-4 summarizes the results of the hydraulic analysis for Alternative 3. Facility sizing and configuration for Alternative 3 is shown in Figure 4-3.

Table 5-4
Summary of Hydraulic Analysis – Alternative 1

Item	Full Piping Option
Design Diversion Flow Rate	8 cfs
Main Line Sizing	21-inch to 24-inch
Lateral Sizing	Same as Existing
Lateral Pressures	Same as Existing

Notes:
cfs = cubic feet per second

5.3 Cost Analysis

5.3.1 Implementation Costs

Opinions of probable construction and implementation costs were developed for each of the alternatives and for each different capacity option evaluated. Table 5-5 provides a summary of the Opinion of Probable Construction Costs for the alternatives and options evaluated as part of this study. A more detailed breakdown of materials and work and their related costs is included in Appendix B.

The opinions of probable construction costs incorporate the following:

- A 10% allowance for mobilization/demobilization
- An 8.2% sales tax rate

The total construction costs and total project costs are reported in ranges. The low end of the range includes a 15% contingency and the high end of the range includes a 30% contingency. Other project implementation costs would include the following:

- **Engineering, Permitting, and Administration** – A 20% allowance for engineering, permitting, and administration.
- **Land Acquisition** – Most of the alternatives would require additional easements or land to construct a new pump station or pipeline. An allowance was provided for each alternative. Actual land acquisitions costs would be subject to negotiation with private property owners.

Table 5-5

Summary of Opinion of Probable Implementation Costs

Item	Alternative 1			Alternative 2		Alternative 3	
	4-cfs	6-cfs	8-cfs	12-cfs	24-cfs	Full Piping	Full Lining
Site and Preparation Work	$109,000	$104,000	$104,000	$104,000	$104,000	$47,500	$47,500
Pressurized Delivery Pipelines	$697,000	$774,000	$878,000	$1,074,000	$1,470,000	$0	$0
Gravity Delivery Pipelines	$0	$0	$0	$0	$0	$783,000	$0
Ditch Lining	$0	$0	$0	$0	$0	$0	$567,000
River Pump Station	$431,000	$569,000	$673,000	$882,000	$1,472,000	$0	$0
Subtotal – Construction Cost	**$1,237,000**	**$1,447,000**	**$1,655,000**	**$2,060,000**	**$3,046,000**	**$830,500**	**$614,500**
Mobilization/Demobilization (10%)	$123,700	$144,700	$165,500	$206,000	$304,600	$83,050	$61,450
Sales Tax (8.2%)	$101,434	$118,654	$135,710	$168,920	$249,772	$68,101	$50,389
Total Construction Cost[2]	**$1,681,000 – $1,901,000**	**$1,967,000 – $2,223,000**	**$2,249,000 – $2,543,000**	**$2,800,000 – $3,166,000**	**$4,140,000 – $4,680,000**	**$1,129,000 – $1,277,000**	**$835,000 – $944,000**
Total Non-construction Costs[2, 3]	**$386,000 – $430,000**	**$443,000 – $495,000**	**$505,000 – $564,000**	**$620,000 – $693,000**	**$898,000 – $1,006,000**	**$226,000 – $255,000**	**$167,000 – $189,000**
Total Project Implementation Cost[2]	**$2,067,000 – $2,331,000**	**$2,410,000 – $2,718,000**	**$2,754,000 – $3,107,000**	**$3,420,000 – $3,859,000**	**$5,038,000 – $5,686,000**	**$1,355,000 – $1,532,000**	**$1,002,000 – $1,133,000**

Notes:

1 Costs are in 2015 dollars. Actual costs will vary based on materials and labor costs at the time of construction.

2 The high end of the range of Total Construction, Total Non-construction Costs, and Total Project Costs includes a 30% construction contingency. The low end of the range includes a 15% construction contingency.

3 Non-construction costs include an allowance for engineering, permitting, and administration (estimated as 20% of the Total Construction Cost) and an allowance for land acquisition (See Appendix B for additional details).

5.3.2 Long-term Operating Costs

Long-term operating costs were also evaluated. Long-term operating costs will include O&M costs, administrative costs, pumping power costs, and the cost of funding replacement of the facilities when they have reached the end of their life cycle.

O&M costs were estimated based on our understanding of the costs associated with operating similar irrigation systems of similar size. Assumed costs include salary and benefits for the manager, administrative costs, transportation costs, utilities, phones, maintenance, small repairs, supplies, and contracted labor costs.

Opinions of annual pumping power costs were developed using Chelan County Public Utility District (PUD) Rate Schedule No. 5 for Irrigation Service. Pumping costs were estimated based on delivery of an annual volume of water proportional to the capacity of the pump station.

Replacement costs were evaluated to determine the annual deposit that would need to be made to an account to fund replacement of the facilities at the end of the assumed life cycle for the project. For this analysis, the following design life cycles were assumed:

- Pipe and infrastructure – 50 years
- Pumps and electrical equipment – 25 years

It is unlikely that all of the facilities would need to be completely replaced at the end of their assumed life cycle. For this reason, the analysis was performed for three levels of replacement: 25, 50, and 100%. The life cycle replacement cost analysis is included in Appendix C. The analysis assumed an annual interest on the replacement fund of 3% and an annual inflation rate of 3%.

Two methods of annual deposit to a replacement fund were evaluated. The first would be a constant annual deposit through the life of the project. The second would be an increasing annual deposit, escalated at the assumed annual inflation rate. The analysis of both methods is included in Appendix C.

Table 5-6 summarizes the opinions of annual long-term operating costs for each alternative (in 2015 dollars). The annual replacement fund costs shown represent the first annual deposit that would be needed to the replacement fund, assuming the following:

- Escalation of the annual replacement fund deposit would be at an annual rate of 3%.
- 25% of pipe and infrastructure would need to be replaced within the 50-year design life cycle for those components.
- 100% of pumps and electrical equipment would need to be replaced within the 25-year design life cycle for those components.

Table 5-7 includes a summary of annual replacement fund costs at years 1, 25, and 50 of the 50-year design life cycle. All costs are reported in 2015 dollars.

For Alternative 1, it was estimated that O&M costs would range from $62,000 for a 4-cfs system to $64,000 for an 8-cfs system during the first year of operation. Pumping costs for Alternative 1 would range from just over $5,000 per year for a 4-cfs system to more than $10,000 for an 8-cfs system. Replacement fund costs during the first year of the project would range from just over $26,000 for a 4-cfs system to more than $39,000 for an 8-cfs system.

The operating costs would increase for Alternative 2 due to the larger size and initial cost of the facilities required. It was estimated that O&M costs would range from $66,000 for a 12-cfs system to more than $70,000 for a 24-cfs system during the first year of operation. Pumping costs would range from just over $15,000 for a 12-cfs system to more than $29,000 for a 24-cfs system. Replacement fund costs during the first year of the project would range from just over $50,000 for a 12-cfs system to more than $81,000 for a 24-cfs system.

O&M costs for the improvements to the existing system would be similar to, or slightly lower than, costs currently incurred by COIC. Potential savings would result from eliminating the need to clean or shape piped portions of the ditch. No pumping costs would be incurred. Replacement fund costs during the first year of the project were estimated to range from just over $6,600 for a fully piped system to more than $4,900 for a fully lined system. It should be noted that there may likely be costs associated with upgrade and/or replacement of existing diversion facilities for Alternative 3 that have not been evaluated and are not included in this opinion of long-term operating costs.

Table 5-6

Summary of Long-term Operating Costs

Item	Alternative 1			Alternative 2		Alternative 3	
	4-cfs	6-cfs	8-cfs	12-cfs	24-cfs	Full Piping	Full Lining
Annual O&M/Administration	$62,000	$63,000	$64,000	$66,000	$70,000	$62,000	$66,000
Annual Pumping Power Cost[2]	$5,114	$8,046	$10,559	$15,167	$29,408	$0	$0
Subtotal – Operating Costs	**$67,114**	**$71,046**	**$74,559**	**$81,167**	**$99,408**	**$62,000**	**$66,000**
Annual Replacement Fund Cost[3]	$26,410	$33,659	$39,236	$50,303	$81,146	$6,638	$4,908
Total with Replacement Fund Costs	**$93,500**	**$104,700**	**$113,800**	**$131,500**	**$180,600**	**$68,600**	**$70,900**

Notes:
O&M = operations and maintenance
1 Costs shown are in 2015 dollars. Long-term cost analysis assumes that costs will increase with inflation.
2 Pumping power costs are based on Chelan County PUD Rate Schedule 5 for Irrigation Service.
3 The annual replacement fund cost represents the deposit required during the first year of funding to fund replacement of 25% of all pipe and infrastructure during a 50-year design life cycle and 100% of all pumps and electrical equipment during a 25-year design life cycle.

Table 5-7

Summary of Annual Replacement Fund Costs

Design Life Cycle Year	Alternative 1			Alternative 2		Alternative 3	
	4-cfs	6-cfs	8-cfs	12-cfs	24-cfs	Full Piping	Full Lining
1	$26,410	$33,659	$39,236	$50,303	$81,146	$6,638	$4,908
25	$53,685	$68,422	$79,759	$102,255	$164,954	$13,494	$9,977
50	$112,405	$143,259	$166,997	$214,099	$345,376	$28,254	$20,889

Notes:
1 Costs represent replacement fund deposit required to fund replacement of 25% of all pipe and infrastructure during a 50-year design life cycle and 100% of all pumps and electrical equipment during a 25-year design life cycle.
2 Costs shown are in 2015 dollars. Long-term cost analysis assumes that costs will increase with inflation.

6 SUMMARY AND RECOMMENDATIONS

6.1 Summary and Comparison of Alternatives

Table 6-1 provides a comparison of Alternatives 1, 2, and 3 evaluated as part of this alternatives analysis. The comparison of alternatives indicates the following:

6.1.1 Alternative 1

Alternative 1 would result in construction of a pressurized delivery system supplied by a pump station near the confluence of the Wenatchee River and Icicle Creek. COIC's portion of the diversion facilities shared with LNFH on Icicle Creek would no longer operate. Saved water would be put into trust. The alternative would benefit the critical reach of Icicle Creek by moving COIC's diversion and associated water right downstream. If withdrawals up to the limit allowed by the water right were moved to the new POD, the benefit to flows in Icicle Creek would be as much as 11.9 cfs. In addition to leaving flow in lower Icicle Creek, the improvements would also increase the efficiency of the COIC system and A range of design capacities, from 4 cfs to 8 cfs, were evaluated for this alternative to cover the range of potential future water needs. It is likely that a pressurized system would need to be sized to deliver a flow rate near the middle of that range.

Alternative 1 would be less expensive than Alternative 2, but more expensive than Alternative 3. The Opinion of Probable Costs indicates that total project costs for a 6-cfs capacity system would be approximately $2.4 to $2.7 million. That represents a cost of $203,000 to $228,000 per cfs of benefit in Icicle Creek, assuming a maximum 11.9-cfs maximum in lower Icicle Creek.

Some of the key challenges associated with implementation of Alternative 1 include the following:

- **Private Property Impacts** – Construction of a pump station on the Wenatchee River or on Icicle Creek near the confluence with the Wenatchee River would require acquisition of and access through private property. In addition, those who own property along the existing open ditch have already or are likely to express concern

about losing access to the open, flowing water and the impact that enclosing the ditch will have on trees and drainage in and around their properties.

- **Permitting** – Construction of the pump station on the bank of the Wenatchee River or Icicle Creek would be subject to environmental permitting requirements. Permitting requirements and/or fatal flaws have not yet been identified.
- **Pump Station Construction** – Pump station construction would also require a system to control the flow of water and excavation into the river bank. Construction of a pump station along the Wenatchee River near the Icicle Road Bridge would also be challenging due to the height of the river bank and the presence of bedrock.
- **Long-term O&M** – There are power and O&M costs associated with pump station operation that COIC does not currently deal with. COIC would likely have to contract certain O&M tasks, such a maintenance of electrical equipment and pumps, which would add cost. However, some of those costs would be offset because the O&M required for the delivery system would be reduced.
- **Impacts to Icicle Road** – Construction of the pressurized delivery system would require installation of pipe across Icicle Road at four locations.
- **Water Right Transfer** – Implementation of this alternative would require successful transfer of the POD on COIC's water right to the Wenatchee River or to a point on Icicle Creek near Shore Street. If a pump station site is selected on the Wenatchee River upstream of the confluence with Icicle Creek, COIC would have to demonstrate that any uses of Wenatchee River water from the pump station to the confluence would not be impaired by the project.

6.1.2 Alternative 2

Alternative 2 would also result in construction of a pressurized delivery system supplied by a pump station near the confluence of the Wenatchee River and Icicle Creek. COIC's portion of the diversion facilities shared with LNFH on Icicle Creek would no longer operate. Saved water would be put into trust. The alternative would benefit the critical reach of Icicle Creek by moving COIC's diversion and associated water right downstream. It could also potentially increase that benefit by supplying LNFH with surface water deliveries to offset the surface water and groundwater withdrawals that support hatchery operations. One of the key constraints on water supply for LNFH is that the water used for the hatchery

process has to be the right temperature and water quality to ensure successful fish rearing. The USFWS has indicated that additional supply from the Wenatchee River would not likely meet temperature and water quality constraints for supply to LNFH. However, if this approach proved to be less expensive than other water supply options being considered, there may be opportunities to condition the water prior to use to meet those constraints.

If withdrawals up to the limit allowed by the water right were moved to the new point of diversion, the benefit to flows in Icicle Creek would be as much as 11.9 cfs. Additional benefit could be realized by conveying 8 to 16 cfs to LNFH or providing excess capacity of fire protection flows. A range of design capacities, from 12 cfs to 24 cfs, were evaluated for this alternative to cover the range of potential future water needs.

Due to the large pump and pipe sizes that would be needed to provide additional capacity, Alternative 2 would be the most expensive alternative. The Opinion of Probable Cost indicates that the total project cost for a 12-cfs capacity system would be approximately $3.4 to $3.9 million. That represents a cost of $172,000 to $194,000 per cfs of benefit in Icicle Creek, assuming a maximum 19.9-cfs benefit to Icicle Creek, which would include the flow associated with the 11.9-cfs COIC water right plus up to 8 cfs delivered through the system to LNFH. The Opinion of Probable Cost indicates that the total project cost for a larger 24-cfs capacity system would be approximately $5.0 to $5.7 million. That represents a cost of $181,000 to $204,000 per cfs of benefit in Icicle Creek, assuming a maximum 27.9-cfs benefit to Icicle Creek, which would include the flow associated with the 11.9-cfs COIC water right plus up to 16 cfs delivered through the system to LNFH.

Similar key challenges would apply to the implementation of Alternative 2 as those that were noted for Alternative 1. Private property, permitting, and construction challenges would be more pronounced due to the larger size of facilities required for Alternative 2.

6.1.3 Alternative 3

The seepage loss study suggests that up to 0.5 cfs of water could be saved by increasing the efficiency of the canal through piping or lining. The Opinion of Probable Cost indicates that piping unlined portions of the ditch would result in a total project cost of $1.4 to

$1.5 million. That represents a cost of $2.7 to $3.1 million per cfs of benefit to Icicle Creek, which is much more expensive than other water efficiency projects that have typically qualified for funding in the Wenatchee River Basin.

An additional savings of more than 1,000 acre-feet on an annual basis could also be realized by retrofitting the diversion on Icicle Creek with an adjustable gate structure that limits diverted water in the amounts needed by season to significantly reduce the volume of water carried through the system and spilled to the Wenatchee River. The current intake is adjusted manually and is typically set to deliver excess water to ensure that adequate water is available at the bottom of the system. The excess water is spilled to the Wenatchee River.

6.1.4 Alternative 4

Alternative 4 was calculated by estimating annual consumptive quantities of existing crops and associated irrigation practices from Ecology Guidance Document 1210 and Policy 1120. Assuming total irrigated area within COIC is close to the 419 acres of potential irrigation shown in the analysis, up to 733 acre-feet of consumptive use is occurring at COIC. Additional research will be required to assess actual consumptive use, including a 0.01-acre resolution assessment of crop, lawn, or landscaping types, type of water application systems used in each parcel, and more refined data on actual transpiration using precise measurements from tensiometers and associated technology.

Implementation of water use efficiency measures, included as Alternative 4, would include replacement of higher-use landscaping with low water use landscaping, improved irrigation efficiency, or voluntary timing of irrigation. A low water use landscaping program at COIC would free up additional consumptive use water by documenting changes in parcel-scale water use through replanting of lower water use plants such as fescue, buffalo grass, or native landscaping. This water could then be used for additional consumptive use within COIC or be sold to higher-demand end users downstream.

Table 6-1

Comparison of Alternatives

Item	Alternative 1			Alternative 2		Alternative 3	
	4-cfs Capacity	**6-cfs Capacity**	**8-cfs Capacity**	**12-cfs Capacity**	**24-cfs Capacity**	**Full Piping Option**	**Full Lining Option**
Description of Alternative	• Replace existing diversion with pump station on Wenatchee River near Icicle Road • Install pressurized delivery system • Install capacity to deliver up to 4 cfs for irrigation	• Replace existing diversion with pump station on Wenatchee River near Icicle Road • Install pressurized delivery system • Install capacity to deliver up to 6 cfs for irrigation	• Replace existing diversion with pump station on Wenatchee River near Icicle Road • Install pressurized delivery system • Install capacity to deliver up to 8 cfs for irrigation	• Replace existing diversion with pump station on Wenatchee River near Icicle Road • Install pressurized delivery system • Install capacity to deliver up to 4 cfs for irrigation and 12 cfs additional flow to LNFH or for other needs, such as fire protection	• Replace existing diversion with pump station on Wenatchee River near Icicle Road • Install pressurized delivery system • Install capacity to deliver up to 8 cfs for irrigation and 16 cfs additional flow to LNFH or for other needs, such as fire protection	• Maintain existing diversion • Upgrade existing delivery system by piping unlined open canal with gravity pipelines	• Maintain existing diversion • Upgrade existing delivery system by lining unlined open canal with shotcrete over geotextile liner
Total Pumping Power Required	120	190	250	360	700	No Pumping	No Pumping
Recommended Pipe	6-inch to 15-inch, 80-psi Rated PVC	6-inch to 15-inch, 80-psi Rated PVC	6-inch to 18-inch, 80-psi Rated PVC	6-inch to 15-inch, 80-psi Rated PVC	6-inch to 21-inch, 80-psi Rated PVC	6-inch to 30-inch, 80-psi Rated PVC	No Pipe
Alternative Costs:							
• Total Opinion of Probable Construction Costs	$1,681,000 to $1,901,000	$1,967,000 to $2,223,000	$2,249,000 to $2,543,000	$2,800,000 to $3,166,000	$4,140,000 to $4,680,000	$1,129,000 to $1,277,000	$835,000 to $944,000
• Total Opinion of Probable Project Costs	$2,067,000 to $2,331,000	$2,410,000 to $2,718,000	$2,754,000 to $3,107,000	$3,420,000 to $3,859,000	$5,038,000 to $5,686,000	$1,355,000 to $1,532,000	$1,002,000 to $1,133,000
• Total Opinion of Annual O&M/Administration Costs	$62,000	$63,000	$64,000	$66,000	$70,000	$62,000	$66,000
• Total Opinion of Annual Pumping Power Cost	$5,114	$8,046	$10,559	$15,167	$29,408	$0	$0
• Total Opinion of Annual Operating Costs • (O&M/Administration + Pumping Power)	$67,114	$71,046	$74,559	$81,167	$99,408	$62,000	$66,000
• Annual Replacement Fund Cost (Year 1)	$26,410	$33,659	$39,236	$50,303	$81,146	$6,638	$4,908
Icicle Creek Flow Benefit (Below Existing Diversion)	11.9	11.9	11.9	19.9	27.9	0.5	0.5

Item	Alternative 1			Alternative 2		Alternative 3	
	4-cfs Capacity	6-cfs Capacity	8-cfs Capacity	12-cfs Capacity	24-cfs Capacity	Full Piping Option	Full Lining Option
Total Project Cost per Icicle Flow Benefit	$174,000 to $196,000	$203,000 to $228,000	$231,000 to $261,000	$172,000 to $194,000	$181,000 to $204,000	$2,710,000 to $3,064,000	$2,004,000 to $2,266,000
Other Key Benefits	• Eliminates need to participate with LNFH in future upgrades to existing diversion • Improved delivery system reliability • Pressurized deliveries to water users	• Eliminates need to participate with LNFH in future upgrades to existing diversion • Improved delivery system reliability • Pressurized deliveries to water users	• Eliminates need to participate with LNFH in future upgrades to existing diversion • Improved delivery system reliability • Pressurized deliveries to water users	• Eliminates need to participate with LNFH in future upgrades to existing diversion • Improved delivery system reliability • Pressurized deliveries to water users • Excess capacity for LNFH or other uses, such as firefighting	• Eliminates need to participate with LNFH in future upgrades to existing diversion • Improved delivery system reliability • Pressurized deliveries to water users • Excess capacity for LNFH or other uses, such as firefighting	• Would represent a smaller change to existing operation • Would have less impact to existing infrastructure • Would be easier to permit and implement	• Would represent a smaller change to existing operation • Would have less impact to existing infrastructure • Would be easier to permit and implement • Ditch would still be open and accessible to adjacent property owners
Key Challenges	• Property acquisition required for pump station • Permitting pump station construction within Wenatchee River Channel • Pump station construction on steep river bank with bedrock • Long-term O&M of pumping facilities • Impacts to Icicle Road and other local streets • Water right transfer	• Property acquisition required for pump station • Permitting pump station construction within Wenatchee River Channel • Pump station construction on steep river bank with bedrock • Long-term O&M of pumping facilities • Impacts to Icicle Road and other local streets • Water right transfer	• Property acquisition required for pump station • Permitting pump station construction within Wenatchee River Channel • Pump station construction on steep river bank with bedrock • Long-term O&M of pumping facilities • Impacts to Icicle Road and other local streets • Water right transfer	• Property acquisition required for pump station • Permitting pump station construction within Wenatchee River Channel • Pump station construction on steep river bank with bedrock • Long-term O&M of pumping facilities • Impacts to Icicle Road and other local streets • Water right transfer • River water may not be the right quality and temperature for supply to LNFH	• Property acquisition required for pump station • Permitting pump station construction within Wenatchee River Channel • Pump station construction on steep river bank with bedrock • Long-term O&M of pumping facilities • Impacts to Icicle Road and other local streets • Water right transfer • River water may not be the right quality and temperature for supply to LNFH	• COIC would still share diversion with LNFH and would likely be required to participate in upgrading the diversion in the near term • Project would not offer enough water savings and benefit to Icicle Creek to justify funding from agencies	• COIC would still share diversion with LNFH and would likely be required to participate in upgrading the diversion in the near term • Project would not offer enough water savings and benefit to Icicle Creek to justify funding from agencies

Notes:
cfs = cubic feet per second
COIC = Cascade Orchard Irrigation District
LNFH = Leavenworth National Fish Hatchery
O&M = operations and maintenance
1 Costs shown are in 2015 dollars. Actual costs will vary based on materials and labor costs at the time of construction.

6.2 Recommendations for Additional Work

The intent of this study has been to evaluate alternatives in enough detail to provide a basis for COIC to determine whether the alternatives presented here match the long-term interests and goals of COIC water users. The study is also intended to be used as a tool in the decision-making process as COIC works with WWT and other stakeholders toward identifying opportunities for funding improvements to the system. It is recommended that the following be considered as the process moves forward toward selection of a preferred improvement alternative and implementation of that alternative:

- Refine the on-property analysis of crop/landscape type, consumptive demand, and watering practices at the 0.01 acre or smaller scale using tensiometers and associated technologies to more precisely define the irrigable acreage with COIC.
- Use the refined analysis to determine a design capacity that will provide flexibility for future water supply needs while making sure the system is properly sized to qualify for funding.
- Review the potential for adding capacity to serve LNFH and/or other needs, such as fire protection, with stakeholders and the IWG. Further evaluate opportunities to expand the pump station and delivery system to re-water wells at LNFH or replace surface water diversions, comparing the costs of expanding the COIC project to include LNFH water to other options currently being considered by LNFH to improve supply to the hatchery.
- Develop opinions of cost for a "no action" alternative that would forecast the costs of continuing to operate and maintain the existing system as is, without implementation of one of these alternatives considered in this study. Include the cost of the likely need to participate in upgrade of the diversion facilities shared with LNFH.
- Meet with COIC, as needed, to select and refine the concept for a preferred alternative.
- Coordinate with landowners to evaluate the feasibility of the layout and configuration of delivery system facilities.
- Perform additional field investigations to determine feasibility, including topographic survey and geotechnical field investigations.
- Refine the design analysis and sizing of pumping and delivery facilities based on the additional field work and identify and quantify major materials and components.

- Refine the cost analysis to reflect changes to the system configuration and sizing.
- Coordinate with Chelan County PUD to complete a more detailed assessment of power requirements and refine opinions of cost for extending power to selected pumping sites.
- Complete an environmental review and permitting fatal-flaw analysis to identify any regulatory issues that could impact implementation of the improvement project.
- Hold shareholder meetings to get input from COIC water users.
- Work with WWT and the IWG to identify potential funding sources for the project.
- Incorporate the additional steps into a more detailed feasibility study of improvements to the COIC system and develop preliminary design drawings.

7 REFERENCES

Ecology (Washington State Department of Ecology), 2005. *Water Resources Program Guide*. GUID-1210. Policy and Planning Section. October 11, 2005.

APPENDIX A
PHOTOGRAPHS

Photograph 1 – Existing COIC/LNFH Shared Diversion Facilities on Icicle Creek

Photograph 2 – Debris Rack at Inlet to Diversion Pipeline under Control House

Photograph 3 – Inside Control House with Control Gate Operator

Photograph 4 – Bifurcation, Valve Enclosure

Photograph 5 – Inside Valve Enclosure

Photograph 6 – Bifurcation with Fish Bypass Pipe and Fish Screen

Photograph 7 – Fish Screen and Paddle Wheel

Photograph 8 – Weir, Pipe Inlet, Debris Rack

Photograph 9 – Pipe through RV Campground on Icicle Road

Photograph 10 – Open Ditch Downstream of Pipe Outlet at Sleeping Lady

Photograph 11 – Open Ditch West of Icicle Road

Photograph 12 – Open Ditch West of Icicle Road

Photograph 13 – Culvert Crossing at Icicle Road

Photograph 14 – Culvert Crossing at Shore Street

Photograph 15 – Typical Turnout Structure West of Icicle Road

Photograph 16 – Typical Pumped Turnout West of Icicle Road

Photograph 17 – Lateral Intake Structure West of Icicle Road

Photograph 18 – Lateral Intake Structure West of Icicle Road

Photograph 19 – Inlet to Tailwater Pipeline at Downstream End of System

Photograph 20 –Tailwater Location and Potential Pump Station Location on Wenatchee River

Photograph 21 –Tailwater Location and Potential Pump Station Location on Wenatchee River

Photograph 22 – Potential Pump Station Location on Icicle Creek Near Shore Street

APPENDIX B
OPINION OF PROBABLE IMPLEMENTATION COSTS

Cascade Orchards - Alternatives Analysis
Opinion of Probable Costs

David Rice, P.E.
29-Oct-15

ITEM	UNIT	UNIT COST	ALTERNATIVE 1 4 CFS QTY	ALTERNATIVE 1 4 CFS COST	ALTERNATIVE 2 6 CFS QTY	ALTERNATIVE 2 6 CFS COST	ALTERNATIVE 1 8 CFS QTY	ALTERNATIVE 1 8 CFS COST	ALTERNATIVE 2 12 CFS QTY	ALTERNATIVE 2 12 CFS COST	ALTERNATIVE 2 24 CFS QTY	ALTERNATIVE 2 24 CFS COST	ALTERNATIVE 3 FULL PIPING QTY	ALTERNATIVE 3 FULL PIPING COST	ALTERNATIVE 3 FULL LINING QTY	ALTERNATIVE 3 FULL LINING COST
Miscellaneous Site Work																
Diversion and Care of Water	LS	VARIES	1	$30,000	1	$30,000	1	$30,000	1	$30,000	1	$30,000	1	$3,000	1	$3,000
Temporary and Permanent Access	LS	VARIES	1	$15,000	1	$15,000	1	$15,000	1	$15,000	1	$15,000	1	$2,500	1	$2,500
Temporary Erosion and Sediment Control	LS	VARIES	1	$25,000	1	$20,000	1	$20,000	1	$20,000	1	$20,000	1	$15,000	1	$15,000
Construction Surveying	LS	VARIES	1	$15,000	1	$15,000	1	$15,000	1	$15,000	1	$15,000	1	$15,000	1	$15,000
Clearing and Grubbing	AC	$4,000	6.0	$24,000	6.0	$24,000	6.0	$24,000	6.0	$24,000	6.0	$24,000	3.0	$12,000	3.0	$12,000
Subtotal - Miscellaneous Site Work				**$109,000**		**$104,000**		**$104,000**		**$104,000**		**$104,000**		**$47,500**		**$47,500**
Pressurized Distribution Pipe System[1]																
30-inch PVC Irrigation Pipe and Appurtenances	LF	$115		$0		$0		$0		$0	8,875	$1,020,577		$0		$0
24-inch PVC Irrigation Pipe and Appurtenances	LF	$95		$0		$0		$0		$0		$0		$0		$0
21-inch PVC Irrigation Pipe and Appurtenances	LF	$80		$0		$0		$0	8,875	$709,967		$0		$0		$0
18-inch PVC Irrigation Pipe and Appurtenances	LF	$65		$0		$0	2,714	$176,401		$0		$0		$0		$0
15-inch PVC Irrigation Pipe and Appurtenances	LF	$50	2,714	$135,700	4,200	$210,018	3,018	$150,920		$0		$0		$0		$0
12-inch PVC Irrigation Pipe and Appurtenances	LF	$40	1,487	$59,480	3,025	$120,981	1,493	$59,705		$0		$0		$0		$0
10-inch PVC Irrigation Pipe and Appurtenances	LF	$32	3,025	$96,800	1,456	$46,577	7,020	$224,630		$0	7,020	$224,630		$0		$0
8-inch PVC Irrigation Pipe and Appurtenances	LF	$25	8,669	$216,725	12,691	$317,282	8,917	$222,914	7,020	$175,492	7,267	$181,672		$0		$0
6-inch PVC Irrigation Pipe and Appurtenances	LF	$20	9,426	$188,520	3,949	$78,982	2,160	$43,192	9,426	$188,530	2,160	$43,192		$0		$0
4-inch PVC Irrigation Pipe and Appurtenances	LF	$15		$0		$0		$0		$0		$0		$0		$0
Subtotal - Pressurized Distribution Pipe				**$697,000**		**$774,000**		**$878,000**		**$1,074,000**		**$1,470,000**		**$0**		**$0**
Gravity Piping or Lining Improvements																
24-inch PVC Irrigation Pipe and Appurtenances	LF	$95		$0		$0		$0		$0		$0	6,042	$573,990		$0
21-inch PVC Irrigation Pipe and Appurtenances	LF	$80		$0		$0		$0		$0		$0	2,614	$209,120		$0
Geomembrane Ditch Liner	LF	$1.50		$0		$0		$0		$0		$0		$0	138,496	$207,744
Shotcrete Topping	CY	$280		$0		$0		$0		$0		$0		$0	1,282	$359,064
Subtotal - Gravity Irrigation Improvements				**$0**		**$0**		**$0**		**$0**		**$0**		**$783,000**		**$567,000**
River Pump Station and Intake Facilities																
Reinforced Concrete Pump Station Structure	EA	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000		$0		$0
Steel Supports for Screen	LS	VARIES	1	$11,000	1	$17,000	1	$23,000	1	$37,000	1	$68,000		$0		$0
Wedge Wire or Profile Bar Screen	SF	$350	14	$4,900	21	$7,350	28	$9,800	42	$14,700	84	$29,400		$0		$0
Air Blast or Other Self-cleaning System	LS	VARIES	1	$40,000	1	$60,000	1	$80,000	1	$120,000	1	$230,000		$0		$0
Vertical Turbine Pump, 175 HP, VFD	EA	$150,000		$0		$0		$0		$0	5	$750,000		$0		$0
Vertical Turbine Pump, 90 HP, VFD	EA	$85,000		$0		$0		$0	5	$425,000		$0		$0		$0
Vertical Turbine Pump, 65 HP, VFD	EA	$65,000		$0	4	$260,000	3	$195,000		$0		$0		$0		$0
Vertical Turbine Pump, 60 HP, VFD	EA	$60,000	3	$180,000		$0	2	$120,000		$0		$0		$0		$0
3-Phase Power Extension Allowance	LS	VARIES	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000		$0		$0
Electrical and Controls	LS	VARIES	1	$65,000	1	$85,000	1	$100,000	1	$130,000	1	$215,000		$0		$0
Pump Station Discharge Pipe, Fittings, Valves, Meter	LS	VARIES	1	$20,000	1	$30,000	1	$35,000	1	$45,000	1	$70,000		$0		$0
Subtotal - River Pump Station and Intake Facilies				**$431,000**		**$569,000**		**$673,000**		**$882,000**		**$1,472,000**		**$0**		**$0**
Construction Subtotal				**$1,237,000**		**$1,447,000**		**$1,655,000**		**$2,060,000**		**$3,046,000**		**$830,500**		**$614,500**
Mobilization / Demobilization	10.0%			$123,700		$144,700		$165,500		$206,000		$304,600		$83,050		$61,450
Sales Tax	8.2%			$101,434		$118,654		$135,710		$168,920		$249,772		$68,101		$50,389
Subtotal - Construction Contract				**$1,462,000**		**$1,710,000**		**$1,956,000**		**$2,435,000**		**$3,600,000**		**$982,000**		**$726,000**
Contingency - High	30.0%			$438,600		$513,000		$586,800		$730,500		$1,080,000		$294,600		$217,800
Contingency - Low	15.0%			$219,300		$256,500		$293,400		$365,250		$540,000		$147,300		$108,900
Total Construction Cost - High				**$1,901,000**		**$2,223,000**		**$2,543,000**		**$3,166,000**		**$4,680,000**		**$1,277,000**		**$944,000**
Total Construction Cost - Low				**$1,681,000**		**$1,967,000**		**$2,249,000**		**$2,800,000**		**$4,140,000**		**$1,129,000**		**$835,000**
Other Project Related Costs																
Engineering, Permitting, and Adminstration - High	20.0%			$380,200		$444,600		$508,600		$633,200		$936,000		$255,400		$188,800
Engineering, Permitting, and Adminstration - Low	20.0%			$336,200		$393,400		$449,800		$560,000		$828,000		$225,800		$167,000
Allowance for Land Acquisition and Easements	LS	VARIES	1	$50,000	1	$50,000	1	$55,000	1	$60,000	1	$70,000				
Total of Project Related Costs - High				**$430,000**		**$495,000**		**$564,000**		**$693,000**		**$1,006,000**		**$255,000**		**$189,000**
Total of Project Related Costs - Low				**$386,000**		**$443,000**		**$505,000**		**$620,000**		**$898,000**		**$226,000**		**$167,000**
Total Project Cost - High				**$2,331,000**		**$2,718,000**		**$3,107,000**		**$3,859,000**		**$5,686,000**		**$1,532,000**		**$1,133,000**
Total Project Cost - Low				**$2,067,000**		**$2,410,000**		**$2,754,000**		**$3,420,000**		**$5,038,000**		**$1,355,000**		**$1,002,000**

Notes:
1) Pipe unit costs include trenching; furnishing and installing pipe, fittings, and appurtenances including turnout connections for water users; backfilling; compaction of backfill; and surface repai
2) Subtotals and totals are rounded to the nearest $1,000.
3) Costs are in 2015 dollars.

Cascade Orchards - Alternatives Analysis
Long-term Operating Costs (Operations and Maintenance, Pumping Power, and Replacement Fund Costs)

David Rice, P.E.
29-Oct-15

ITEM	UNIT	UNIT COST	ALTERNATIVE 1 4 CFS QTY	ALTERNATIVE 1 4 CFS COST	ALTERNATIVE 2 6 CFS		ALTERNATIVE 1 8 CFS QTY	ALTERNATIVE 1 8 CFS COST	ALTERNATIVE 2 12 CFS QTY	ALTERNATIVE 2 12 CFS COST	ALTERNATIVE 2 24 CFS QTY	ALTERNATIVE 2 24 CFS COST	ALTERNATIVE 3 FULL PIPING QTY	ALTERNATIVE 3 FULL PIPING COST	ALTERNATIVE 3 FULL LINING QTY	ALTERNATIVE 3 FULL LINING COST
Annual Operations and Maintenance Cost[1]				**$62,000**		**$63,000**		**$64,000**		**$66,000**		**$70,000**		**$62,000**		**$66,000**
Annual Replacement Fund Cost[1]				**$26,410**		**$33,659**		**$39,236**		**$50,303**		**$81,146**		**$6,638**		**$4,908**
Pumping Power Costs[2]																
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50	0	$0.00	0	$0.00
Seasonal Energy Charge																
APR	/kWh	$0.0165	12,891	$212.70	20,411	$336.77	26,856	$443.12	38,673	$638.10	75,197	$1,240.75	0	$0.00	0	$0.00
MAY	/kWh	$0.0165	19,981	$329.68	31,636	$522.00	41,627	$686.84	59,943	$989.05	116,555	$1,923.16	0	$0.00	0	$0.00
JUN	/kWh	$0.0165	25,782	$425.40	40,821	$673.55	53,712	$886.25	77,345	$1,276.20	150,394	$2,481.49	0	$0.00	0	$0.00
JUL	/kWh	$0.0165	33,301	$549.47	52,727	$870.00	69,378	$1,144.74	99,904	$1,648.42	194,258	$3,205.26	0	$0.00	0	$0.00
AUG	/kWh	$0.0165	33,301	$549.47	52,727	$870.00	69,378	$1,144.74	99,904	$1,648.42	194,258	$3,205.26	0	$0.00	0	$0.00
SEP	/kWh	$0.0165	25,782	$425.40	40,821	$673.55	53,712	$886.25	77,345	$1,276.20	150,394	$2,481.49	0	$0.00	0	$0.00
Monthly Demand Charge	/HP/MO	$3.52	120	$422.40	190	$668.80	250	$880.00	360	$1,267.20	700	$2,464.00	0	$0.00	0	$0.00
Total Annual Pumping Costs				**$5,114**		**$8,046**		**$10,559**		**$15,167**		**$29,408**		**$0**		**$0**
Total Annual Operating Costs[3]				**$93,500**		**$104,700**		**$113,800**		**$131,500**		**$180,600**		**$68,600**		**$70,900**

Notes:
1) See life cycle cost analysis, in 2015 dollars.
2) Pumping power costs are based on 2015 Chelan PUD Electrical Rate Schedule 5 (Irrigation Service)
3) The total operating costs are rounded to nearest $100, and include O&M, Replacement Fund, and Power Costs

APPENDIX C
LIFE CYCLE COST ANALYSIS

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 4 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$1,447,703	$453,297	$1,901,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$1,586,648		$237,276		
To Replace 50% of Proposed Facility		$3,173,297		$474,552		
To Replace 100% of Proposed Facility	$1,447,703	$6,346,594	$453,297	$949,103	$1,901,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$15,344		$2,617		
To Replace 50% of Proposed Facility		$30,687		$5,234		
To Replace 100% of Proposed Facility	$14,000	$61,375	$5,000	$10,469	$19,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$1,601,992**		**$239,893**		
To Replace 50% of Proposed Facility		**$3,203,984**		**$479,786**		
To Replace 100% of Proposed Facility	**$1,461,703**	**$6,407,969**	**$458,297**	**$959,572**	**$1,920,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$14,202	$14,202	$6,580	$13,777
To Replace 50% of Proposed Facility	$28,405	$28,405	$13,160	$27,553
To Replace 100% of Proposed Facility	$56,810	$56,810	$26,319	$55,106
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$7,528		$4,720	
To Replace 50% of Proposed Facility	$15,056		$9,441	
To Replace 100% of Proposed Facility	$30,111		$18,882	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$15,302		$9,596	
To Replace 50% of Proposed Facility	$30,605		$19,191	
To Replace 100% of Proposed Facility	$61,210		$38,383	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$32,040		$20,091	
To Replace 50% of Proposed Facility	$64,080		$40,183	
To Replace 100% of Proposed Facility	$128,159		$80,365	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$40,521
Years 26-50		$69,309
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$26,410
Year 25		$53,685
Year 50		$112,405

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$1,901,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$239,893
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$479,786
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$959,572
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$7,528	$7,754	$7,986	$8,226	$8,473	$8,727	$8,989	$9,258	$9,536	$9,822	$10,117	$10,420	$10,733	$11,055	$11,386	$11,728	$12,080	$12,442	$12,816	$13,200	$13,596	$14,004	$14,424	$14,857	$15,302
Interest		$0	$226	$465	$719	$987	$1,271	$1,571	$1,888	$2,222	$2,575	$2,947	$3,339	$3,751	$4,186	$4,643	$5,124	$5,629	$6,161	$6,719	$7,305	$7,920	$8,565	$9,243	$9,953	$10,697
End of Year Balance		**$7,528**	**$15,507**	**$23,959**	**$32,903**	**$42,363**	**$52,360**	**$62,920**	**$74,066**	**$85,824**	**$98,220**	**$111,284**	**$125,042**	**$139,526**	**$154,767**	**$170,796**	**$187,648**	**$205,358**	**$223,961**	**$243,495**	**$264,000**	**$285,516**	**$308,085**	**$331,752**	**$356,561**	**$382,560**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$15,056	$15,507	$15,972	$16,452	$16,945	$17,453	$17,977	$18,516	$19,072	$19,644	$20,233	$20,840	$21,466	$22,110	$22,773	$23,456	$24,160	$24,885	$25,631	$26,400	$27,192	$28,008	$28,848	$29,713	$30,605
Interest		$0	$452	$930	$1,438	$1,974	$2,542	$3,142	$3,775	$4,444	$5,149	$5,893	$6,677	$7,503	$8,372	$9,286	$10,248	$11,259	$12,321	$13,438	$14,610	$15,840	$17,131	$18,485	$19,905	$21,394
End of Year Balance		**$15,056**	**$31,014**	**$47,917**	**$65,806**	**$84,726**	**$104,721**	**$125,840**	**$148,131**	**$171,647**	**$196,441**	**$222,567**	**$250,085**	**$279,053**	**$309,534**	**$341,593**	**$375,297**	**$410,715**	**$447,921**	**$486,990**	**$528,000**	**$571,032**	**$616,170**	**$663,503**	**$713,122**	**$765,120**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$30,111	$31,014	$31,945	$32,903	$33,890	$34,907	$35,954	$37,033	$38,144	$39,288	$40,467	$41,681	$42,931	$44,219	$45,546	$46,912	$48,319	$49,769	$51,262	$52,800	$54,384	$56,015	$57,696	$59,427	$61,210
Interest		$0	$903	$1,861	$2,875	$3,948	$5,084	$6,283	$7,550	$8,888	$10,299	$11,786	$13,354	$15,005	$16,743	$18,572	$20,496	$22,518	$24,643	$26,875	$29,219	$31,680	$34,262	$36,970	$39,810	$42,787
End of Year Balance		**$30,111**	**$62,029**	**$95,835**	**$131,613**	**$169,451**	**$209,442**	**$251,679**	**$296,263**	**$343,294**	**$392,881**	**$445,135**	**$500,169**	**$558,106**	**$619,068**	**$683,186**	**$750,593**	**$821,431**	**$895,843**	**$973,980**	**$1,055,999**	**$1,142,063**	**$1,232,341**	**$1,327,007**	**$1,426,244**	**$1,530,241**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$4,720	$4,862	$5,008	$5,158	$5,313	$5,472	$5,636	$5,806	$5,980	$6,159	$6,344	$6,534	$6,730	$6,932	$7,140	$7,354	$7,575	$7,802	$8,036	$8,277	$8,526	$8,781	$9,045	$9,316	$9,596
Interest		$0	$142	$292	$451	$619	$797	$985	$1,184	$1,393	$1,615	$1,848	$2,093	$2,352	$2,625	$2,912	$3,213	$3,530	$3,863	$4,213	$4,581	$4,966	$5,371	$5,796	$6,241	$6,708
End of Year Balance		**$4,720**	**$9,724**	**$15,024**	**$20,633**	**$26,565**	**$32,834**	**$39,455**	**$46,445**	**$53,818**	**$61,591**	**$69,783**	**$78,411**	**$87,493**	**$97,050**	**$107,102**	**$117,669**	**$128,774**	**$140,440**	**$152,689**	**$165,547**	**$179,039**	**$193,192**	**$208,032**	**$223,590**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$9,441	$9,724	$10,016	$10,316	$10,626	$10,945	$11,273	$11,611	$11,959	$12,318	$12,688	$13,068	$13,460	$13,864	$14,280	$14,709	$15,150	$15,604	$16,073	$16,555	$17,051	$17,563	$18,090	$18,632	$19,191
Interest		$0	$283	$583	$901	$1,238	$1,594	$1,970	$2,367	$2,787	$3,229	$3,695	$4,187	$4,705	$5,250	$5,823	$6,426	$7,060	$7,726	$8,426	$9,161	$9,933	$10,742	$11,592	$12,482	$13,415
End of Year Balance		**$9,441**	**$19,448**	**$30,048**	**$41,265**	**$53,129**	**$65,668**	**$78,911**	**$92,889**	**$107,635**	**$123,183**	**$139,566**	**$156,821**	**$174,986**	**$194,100**	**$214,204**	**$235,338**	**$257,548**	**$280,879**	**$305,378**	**$331,094**	**$358,078**	**$386,384**	**$416,065**	**$447,179**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$18,882	$19,448	$20,032	$20,633	$21,252	$21,889	$22,546	$23,222	$23,919	$24,637	$25,376	$26,137	$26,921	$27,729	$28,560	$29,417	$30,300	$31,209	$32,145	$33,109	$34,103	$35,126	$36,180	$37,265	$38,383
Interest		$0	$566	$1,167	$1,803	$2,476	$3,188	$3,940	$4,735	$5,573	$6,458	$7,391	$8,374	$9,409	$10,499	$11,646	$12,852	$14,120	$15,453	$16,853	$18,323	$19,866	$21,485	$23,183	$24,964	$26,831
End of Year Balance		**$18,882**	**$38,897**	**$60,095**	**$82,531**	**$106,258**	**$131,335**	**$157,821**	**$185,778**	**$215,271**	**$246,365**	**$279,132**	**$313,643**	**$349,973**	**$388,201**	**$428,407**	**$470,677**	**$515,097**	**$561,758**	**$610,756**	**$662,188**	**$716,157**	**$772,767**	**$832,130**	**$894,359**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916	$1,974	$2,033
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$2,000	$2,060	$2,122	$2,185	$2,251	$2,319	$2,388	$2,460	$2,534	$2,610	$2,688	$2,768	$2,852	$2,937	$3,025	$3,116	$3,209	$3,306	$3,405	$3,507	$3,612	$3,721	$3,832	$3,947	$4,066
Contracted Labor Costs		$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,564	$3,671	$3,781	$3,895	$4,012	$4,132	$4,256	$4,384	$4,515	$4,651	$4,790	$4,934	$5,082
Total O&M Expenses		**$62,000**	**$63,860**	**$65,776**	**$67,749**	**$69,782**	**$71,875**	**$74,031**	**$76,252**	**$78,540**	**$80,896**	**$83,323**	**$85,822**	**$88,397**	**$91,049**	**$93,781**	**$96,594**	**$99,492**	**$102,477**	**$105,551**	**$108,717**	**$111,979**	**$115,338**	**$118,798**	**$122,362**	**$126,033**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 4 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account
Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$1,282,020**
25% Replacement	$365,426	$229,149	
50% Replacement	$730,852	$458,297	
100% Replacement	$1,461,703	$916,594	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$1,282,020**
25% Replacement	$365,426	$229,149	
50% Replacement	$730,852	$458,297	
100% Replacement	$1,461,703	$916,594	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,601,992
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,203,984
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,407,969
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$502,283
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,004,565
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,009,131
$15,761	$16,234	$16,721	$17,223	$17,740	$18,272	$18,820	$19,385	$19,966	$20,565	$21,182	$21,818	$22,472	$23,146	$23,841	$24,556	$25,293	$26,051	$26,833	$27,638	$28,467	$29,321	$30,201	$31,107	$32,040
$11,477	$12,294	$13,150	$14,046	$14,984	$15,966	$16,993	$18,067	$19,191	$20,365	$21,593	$22,877	$24,218	$25,618	$27,081	$28,609	$30,204	$31,869	$33,606	$35,419	$37,311	$39,284	$41,343	$43,489	$45,727
$409,798	**$438,327**	**$468,198**	**$499,467**	**$532,191**	**$566,428**	**$602,241**	**$639,693**	**$678,850**	**$719,780**	**$762,556**	**$807,250**	**$853,940**	**$902,704**	**$953,626**	**$1,006,791**	**$1,062,287**	**$1,120,207**	**$1,180,646**	**$1,243,703**	**$1,309,481**	**$1,378,087**	**$1,449,630**	**$1,524,226**	**$0**
$31,523	$32,469	$33,443	$34,446	$35,479	$36,544	$37,640	$38,769	$39,932	$41,130	$42,364	$43,635	$44,944	$46,293	$47,681	$49,112	$50,585	$52,103	$53,666	$55,276	$56,934	$58,642	$60,401	$62,213	$64,080
$22,954	$24,588	$26,300	$28,092	$29,968	$31,931	$33,986	$36,134	$38,382	$40,731	$43,187	$45,753	$48,435	$51,236	$54,162	$57,218	$60,407	$63,737	$67,212	$70,839	$74,622	$78,569	$82,685	$86,978	$91,454
$819,597	**$876,653**	**$936,396**	**$998,934**	**$1,064,381**	**$1,132,856**	**$1,204,482**	**$1,279,386**	**$1,357,700**	**$1,439,561**	**$1,525,112**	**$1,614,500**	**$1,707,880**	**$1,805,409**	**$1,907,252**	**$2,013,581**	**$2,124,574**	**$2,240,414**	**$2,361,292**	**$2,487,406**	**$2,618,963**	**$2,756,174**	**$2,899,260**	**$3,048,451**	**$0**
$63,046	$64,937	$66,885	$68,892	$70,959	$73,087	$75,280	$77,539	$79,865	$82,261	$84,728	$87,270	$89,888	$92,585	$95,363	$98,223	$101,170	$104,205	$107,331	$110,551	$113,868	$117,284	$120,802	$124,427	$128,159
$45,907	$49,176	$52,599	$56,184	$59,936	$63,863	$67,971	$72,269	$76,763	$81,462	$86,374	$91,507	$96,870	$102,473	$108,325	$114,435	$120,815	$127,474	$134,425	$141,678	$149,244	$157,138	$165,370	$173,956	$182,907
$1,639,194	**$1,753,307**	**$1,872,792**	**$1,997,867**	**$2,128,762**	**$2,265,712**	**$2,408,964**	**$2,558,771**	**$2,715,399**	**$2,879,122**	**$3,050,224**	**$3,229,001**	**$3,415,759**	**$3,610,817**	**$3,814,504**	**$4,027,163**	**$4,249,148**	**$4,480,828**	**$4,722,584**	**$4,974,813**	**$5,237,925**	**$5,512,347**	**$5,798,520**	**$6,096,902**	**$0**
$9,884	$10,180	$10,486	$10,800	$11,124	$11,458	$11,802	$12,156	$12,520	$12,896	$13,283	$13,681	$14,092	$14,514	$14,950	$15,398	$15,860	$16,336	$16,826	$17,331	$17,851	$18,386	$18,938	$19,506	$20,091
$0	$297	$611	$944	$1,296	$1,669	$2,062	$2,478	$2,917	$3,380	$3,869	$4,383	$4,925	$5,496	$6,096	$6,727	$7,391	$8,089	$8,821	$9,591	$10,399	$11,246	$12,135	$13,067	$14,044
$9,884	**$20,360**	**$31,457**	**$43,200**	**$55,620**	**$68,747**	**$82,611**	**$97,245**	**$112,682**	**$128,958**	**$146,110**	**$164,174**	**$183,191**	**$203,201**	**$224,247**	**$246,373**	**$269,625**	**$294,049**	**$319,697**	**$346,619**	**$374,868**	**$404,501**	**$435,574**	**$468,147**	**$0**
$19,767	$20,360	$20,971	$21,600	$22,248	$22,916	$23,603	$24,311	$25,040	$25,792	$26,565	$27,362	$28,183	$29,029	$29,900	$30,797	$31,721	$32,672	$33,652	$34,662	$35,702	$36,773	$37,876	$39,012	$40,183
$0	$593	$1,222	$1,887	$2,592	$3,337	$4,125	$4,957	$5,835	$6,761	$7,738	$8,767	$9,850	$10,991	$12,192	$13,455	$14,782	$16,177	$17,643	$19,182	$20,797	$22,492	$24,270	$26,134	$28,089
$19,767	**$40,720**	**$62,913**	**$86,401**	**$111,241**	**$137,494**	**$165,221**	**$194,489**	**$225,364**	**$257,917**	**$292,220**	**$328,349**	**$366,383**	**$406,403**	**$448,495**	**$492,746**	**$539,249**	**$588,099**	**$639,394**	**$693,238**	**$749,736**	**$809,001**	**$871,147**	**$936,294**	**$0**
$39,534	$40,720	$41,942	$43,200	$44,496	$45,831	$47,206	$48,622	$50,081	$51,583	$53,131	$54,725	$56,367	$58,058	$59,799	$61,593	$63,441	$65,344	$67,305	$69,324	$71,403	$73,546	$75,752	$78,025	$80,365
$0	$1,186	$2,443	$3,775	$5,184	$6,674	$8,250	$9,913	$11,669	$13,522	$15,475	$17,533	$19,701	$21,983	$24,384	$26,910	$29,565	$32,355	$35,286	$38,364	$41,594	$44,984	$48,540	$52,269	$56,178
$39,534	**$81,441**	**$125,826**	**$172,801**	**$222,481**	**$274,987**	**$330,443**	**$388,978**	**$450,729**	**$515,834**	**$584,440**	**$656,698**	**$732,765**	**$812,806**	**$896,989**	**$985,492**	**$1,078,498**	**$1,176,197**	**$1,278,788**	**$1,386,475**	**$1,499,473**	**$1,618,003**	**$1,742,295**	**$1,872,588**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$4,188	$4,313	$4,443	$4,576	$4,713	$4,855	$5,000	$5,150	$5,305	$5,464	$5,628	$5,797	$5,970	$6,150	$6,334	$6,524	$6,720	$6,921	$7,129	$7,343	$7,563	$7,790	$8,024	$8,265	$8,512
$5,234	$5,391	$5,553	$5,720	$5,891	$6,068	$6,250	$6,438	$6,631	$6,830	$7,035	$7,246	$7,463	$7,687	$7,918	$8,155	$8,400	$8,652	$8,911	$9,179	$9,454	$9,738	$10,030	$10,331	$10,641
$129,814	**$133,709**	**$137,720**	**$141,852**	**$146,107**	**$150,490**	**$155,005**	**$159,655**	**$164,445**	**$169,378**	**$174,459**	**$179,693**	**$185,084**	**$190,637**	**$196,356**	**$202,246**	**$208,314**	**$214,563**	**$221,000**	**$227,630**	**$234,459**	**$241,493**	**$248,737**	**$256,200**	**$263,886**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 6 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$1,616,043	$606,957	$2,223,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$1,771,145		$317,708		
To Replace 50% of Proposed Facility		$3,542,290		$635,417		
To Replace 100% of Proposed Facility	$1,616,043	$7,084,581	$606,957	$1,270,833	$2,223,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$17,536		$3,141		
To Replace 50% of Proposed Facility		$35,071		$6,281		
To Replace 100% of Proposed Facility	$16,000	$70,142	$6,000	$12,563	$22,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$1,788,681**		**$320,849**		
To Replace 50% of Proposed Facility		**$3,577,362**		**$641,698**		
To Replace 100% of Proposed Facility	**$1,632,043**	**$7,154,723**	**$612,957**	**$1,283,396**	**$2,245,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$15,858	$15,858	$8,800	$18,426
To Replace 50% of Proposed Facility	$31,715	$31,715	$17,600	$36,851
To Replace 100% of Proposed Facility	$63,430	$63,430	$35,201	$73,703
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$8,405		$6,313	
To Replace 50% of Proposed Facility	$16,810		$12,627	
To Replace 100% of Proposed Facility	$33,620		$25,254	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$17,086		$12,834	
To Replace 50% of Proposed Facility	$34,171		$25,668	
To Replace 100% of Proposed Facility	$68,343		$51,336	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$35,774		$26,871	
To Replace 50% of Proposed Facility	$71,547		$53,743	
To Replace 100% of Proposed Facility	$143,094		$107,486	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$51,058
Years 26-50		$89,560
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$33,659
Year 25		$68,422
Year 50		$143,259

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$2,223,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$320,849
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$641,698
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,283,396
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$8,405	$8,657	$8,917	$9,184	$9,460	$9,744	$10,036	$10,337	$10,647	$10,967	$11,296	$11,635	$11,984	$12,343	$12,713	$13,095	$13,488	$13,892	$14,309	$14,738	$15,180	$15,636	$16,105	$16,588	$17,086
Interest		$0	$252	$519	$803	$1,102	$1,419	$1,754	$2,108	$2,481	$2,875	$3,290	$3,728	$4,188	$4,674	$5,184	$5,721	$6,285	$6,879	$7,502	$8,156	$8,843	$9,564	$10,320	$11,112	$11,943
End of Year Balance		**$8,405**	**$17,314**	**$26,751**	**$36,738**	**$47,300**	**$58,462**	**$70,252**	**$82,697**	**$95,825**	**$109,666**	**$124,252**	**$139,614**	**$155,786**	**$172,803**	**$190,700**	**$209,516**	**$229,289**	**$250,060**	**$271,871**	**$294,765**	**$318,788**	**$343,988**	**$370,412**	**$398,113**	**$427,142**
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$16,810	$17,314	$17,834	$18,369	$18,920	$19,487	$20,072	$20,674	$21,294	$21,933	$22,591	$23,269	$23,967	$24,686	$25,427	$26,189	$26,975	$27,784	$28,618	$29,477	$30,361	$31,272	$32,210	$33,176	$34,171
Interest		$0	$504	$1,039	$1,605	$2,204	$2,838	$3,508	$4,215	$4,962	$5,750	$6,580	$7,455	$8,377	$9,347	$10,368	$11,442	$12,571	$13,757	$15,004	$16,312	$17,686	$19,127	$20,639	$22,225	$23,887
End of Year Balance		**$16,810**	**$34,629**	**$53,501**	**$73,475**	**$94,599**	**$116,925**	**$140,504**	**$165,394**	**$191,650**	**$219,333**	**$248,504**	**$279,228**	**$311,572**	**$345,606**	**$381,400**	**$419,032**	**$458,578**	**$500,120**	**$543,741**	**$589,530**	**$637,577**	**$687,976**	**$740,825**	**$796,226**	**$854,284**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$33,620	$34,629	$35,668	$36,738	$37,840	$38,975	$40,144	$41,348	$42,589	$43,867	$45,183	$46,538	$47,934	$49,372	$50,853	$52,379	$53,950	$55,569	$57,236	$58,953	$60,722	$62,543	$64,420	$66,352	$68,343
Interest		$0	$1,009	$2,078	$3,210	$4,409	$5,676	$7,015	$8,430	$9,924	$11,499	$13,160	$14,910	$16,754	$18,694	$20,736	$22,884	$25,142	$27,515	$30,007	$32,624	$35,372	$38,255	$41,279	$44,449	$47,774
End of Year Balance		**$33,620**	**$69,257**	**$107,003**	**$146,950**	**$189,199**	**$233,849**	**$281,009**	**$330,788**	**$383,300**	**$438,666**	**$497,008**	**$558,457**	**$623,145**	**$691,211**	**$762,801**	**$838,064**	**$917,156**	**$1,000,240**	**$1,087,483**	**$1,179,060**	**$1,275,154**	**$1,375,952**	**$1,481,650**	**$1,592,452**	**$1,708,568**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$6,313	$6,503	$6,698	$6,899	$7,106	$7,319	$7,539	$7,765	$7,998	$8,238	$8,485	$8,739	$9,001	$9,272	$9,550	$9,836	$10,131	$10,435	$10,748	$11,071	$11,403	$11,745	$12,097	$12,460	$12,834
Interest		$0	$189	$390	$603	$828	$1,066	$1,317	$1,583	$1,864	$2,159	$2,471	$2,800	$3,146	$3,511	$3,894	$4,297	$4,721	$5,167	$5,635	$6,126	$6,642	$7,184	$7,752	$8,347	$8,971
End of Year Balance		**$6,313**	**$13,006**	**$20,094**	**$27,596**	**$35,529**	**$43,914**	**$52,770**	**$62,118**	**$71,979**	**$82,376**	**$93,332**	**$104,872**	**$117,019**	**$129,801**	**$143,245**	**$157,379**	**$172,231**	**$187,833**	**$204,217**	**$221,414**	**$239,459**	**$258,388**	**$278,236**	**$299,044**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$12,627	$13,006	$13,396	$13,798	$14,212	$14,638	$15,077	$15,530	$15,995	$16,475	$16,970	$17,479	$18,003	$18,543	$19,099	$19,672	$20,262	$20,870	$21,496	$22,141	$22,806	$23,490	$24,194	$24,920	$25,668
Interest		$0	$379	$780	$1,206	$1,656	$2,132	$2,635	$3,166	$3,727	$4,319	$4,943	$5,600	$6,292	$7,021	$7,788	$8,595	$9,443	$10,334	$11,270	$12,253	$13,285	$14,368	$15,503	$16,694	$17,943
End of Year Balance		**$12,627**	**$26,011**	**$40,188**	**$55,191**	**$71,059**	**$87,828**	**$105,540**	**$124,236**	**$143,959**	**$164,753**	**$186,665**	**$209,743**	**$234,038**	**$259,603**	**$286,490**	**$314,757**	**$344,462**	**$375,667**	**$408,433**	**$442,827**	**$478,918**	**$516,775**	**$556,473**	**$598,087**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$25,254	$26,011	$26,792	$27,596	$28,423	$29,276	$30,154	$31,059	$31,991	$32,951	$33,939	$34,957	$36,006	$37,086	$38,199	$39,345	$40,525	$41,741	$42,993	$44,283	$45,611	$46,980	$48,389	$49,841	$51,336
Interest		$0	$758	$1,561	$2,411	$3,311	$4,264	$5,270	$6,332	$7,454	$8,638	$9,885	$11,200	$12,585	$14,042	$15,576	$17,189	$18,885	$20,668	$22,540	$24,506	$26,570	$28,735	$31,007	$33,388	$35,885
End of Year Balance		**$25,254**	**$52,023**	**$80,375**	**$110,382**	**$142,117**	**$175,657**	**$211,081**	**$248,472**	**$287,917**	**$329,505**	**$373,329**	**$419,486**	**$468,077**	**$519,205**	**$572,980**	**$629,514**	**$688,925**	**$751,333**	**$816,866**	**$885,655**	**$957,836**	**$1,033,550**	**$1,112,946**	**$1,196,175**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916	$1,974	$2,033
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$3,000	$3,090	$3,183	$3,278	$3,377	$3,478	$3,582	$3,690	$3,800	$3,914	$4,032	$4,153	$4,277	$4,406	$4,538	$4,674	$4,814	$4,959	$5,107	$5,261	$5,418	$5,581	$5,748	$5,921	$6,098
Contracted Labor Costs		$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,564	$3,671	$3,781	$3,895	$4,012	$4,132	$4,256	$4,384	$4,515	$4,651	$4,790	$4,934	$5,082
Total O&M Expenses		**$63,000**	**$64,890**	**$66,837**	**$68,842**	**$70,907**	**$73,034**	**$75,225**	**$77,482**	**$79,807**	**$82,201**	**$84,667**	**$87,207**	**$89,823**	**$92,518**	**$95,293**	**$98,152**	**$101,097**	**$104,129**	**$107,253**	**$110,471**	**$113,785**	**$117,199**	**$120,715**	**$124,336**	**$128,066**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 6 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$1,633,925**
25% Replacement	$408,011	$306,479	
50% Replacement	$816,022	$612,957	
100% Replacement	$1,632,043	$1,225,914	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$1,633,925**
25% Replacement	$408,011	$306,479	
50% Replacement	$816,022	$612,957	
100% Replacement	$1,632,043	$1,225,914	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,788,681
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,577,362
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,154,723
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$671,786
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,343,573
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,687,146
$17,598	$18,126	$18,670	$19,230	$19,807	$20,401	$21,013	$21,644	$22,293	$22,962	$23,651	$24,360	$25,091	$25,844	$26,619	$27,417	$28,240	$29,087	$29,960	$30,859	$31,784	$32,738	$33,720	$34,732	$35,774
$12,814	$13,727	$14,682	$15,683	$16,730	$17,826	$18,973	$20,173	$21,427	$22,739	$24,110	$25,543	$27,040	$28,604	$30,237	$31,943	$33,724	$35,582	$37,523	$39,547	$41,659	$43,862	$46,160	$48,557	$51,056
$457,554	**$489,407**	**$522,759**	**$557,672**	**$594,210**	**$632,437**	**$672,423**	**$714,240**	**$757,960**	**$803,660**	**$851,421**	**$901,323**	**$953,454**	**$1,007,901**	**$1,064,757**	**$1,124,117**	**$1,186,081**	**$1,250,751**	**$1,318,233**	**$1,388,639**	**$1,462,082**	**$1,538,683**	**$1,618,563**	**$1,701,852**	**$0**
$35,196	$36,252	$37,340	$38,460	$39,614	$40,802	$42,026	$43,287	$44,586	$45,923	$47,301	$48,720	$50,182	$51,687	$53,238	$54,835	$56,480	$58,174	$59,920	$61,717	$63,569	$65,476	$67,440	$69,463	$71,547
$25,629	$27,453	$29,364	$31,366	$33,460	$35,653	$37,946	$40,345	$42,854	$45,478	$48,220	$51,085	$54,079	$57,207	$60,474	$63,885	$67,447	$71,165	$75,045	$79,094	$83,318	$87,725	$92,321	$97,114	$102,111
$915,109	**$978,815**	**$1,045,519**	**$1,115,345**	**$1,188,419**	**$1,264,874**	**$1,344,847**	**$1,428,479**	**$1,515,920**	**$1,607,321**	**$1,702,841**	**$1,802,647**	**$1,906,908**	**$2,015,802**	**$2,129,514**	**$2,248,235**	**$2,372,162**	**$2,501,501**	**$2,636,466**	**$2,777,277**	**$2,924,164**	**$3,077,365**	**$3,237,126**	**$3,403,703**	**$0**
$70,393	$72,505	$74,680	$76,920	$79,228	$81,605	$84,053	$86,575	$89,172	$91,847	$94,602	$97,440	$100,364	$103,374	$106,476	$109,670	$112,960	$116,349	$119,839	$123,435	$127,138	$130,952	$134,880	$138,927	$143,094
$51,257	$54,907	$58,729	$62,731	$66,921	$71,305	$75,892	$80,691	$85,709	$90,955	$96,439	$102,170	$108,159	$114,414	$120,948	$127,771	$134,894	$142,330	$150,090	$158,188	$166,637	$175,450	$184,642	$194,228	$204,222
$1,830,218	**$1,957,629**	**$2,091,038**	**$2,230,689**	**$2,376,838**	**$2,529,748**	**$2,689,693**	**$2,856,959**	**$3,031,839**	**$3,214,641**	**$3,405,683**	**$3,605,294**	**$3,813,816**	**$4,031,605**	**$4,259,029**	**$4,496,470**	**$4,744,324**	**$5,003,002**	**$5,272,932**	**$5,554,554**	**$5,848,329**	**$6,154,730**	**$6,474,252**	**$6,807,406**	**$0**
$13,219	$13,616	$14,024	$14,445	$14,878	$15,324	$15,784	$16,258	$16,745	$17,248	$17,765	$18,298	$18,847	$19,413	$19,995	$20,595	$21,213	$21,849	$22,504	$23,180	$23,875	$24,591	$25,329	$26,089	$26,871
$0	$397	$817	$1,262	$1,733	$2,232	$2,758	$3,315	$3,902	$4,521	$5,174	$5,863	$6,587	$7,350	$8,153	$8,998	$9,885	$10,818	$11,798	$12,828	$13,908	$15,041	$16,230	$17,477	$18,784
$13,219	**$27,231**	**$42,072**	**$57,779**	**$74,390**	**$91,947**	**$110,489**	**$130,061**	**$150,709**	**$172,478**	**$195,417**	**$219,578**	**$245,012**	**$271,775**	**$299,923**	**$329,516**	**$360,614**	**$393,281**	**$427,584**	**$463,591**	**$501,374**	**$541,006**	**$582,565**	**$626,131**	**$0**
$26,438	$27,231	$28,048	$28,889	$29,756	$30,649	$31,568	$32,515	$33,491	$34,496	$35,530	$36,596	$37,694	$38,825	$39,990	$41,189	$42,425	$43,698	$45,009	$46,359	$47,750	$49,182	$50,658	$52,178	$53,743
$0	$793	$1,634	$2,524	$3,467	$4,463	$5,517	$6,629	$7,804	$9,043	$10,349	$11,725	$13,175	$14,701	$16,307	$17,995	$19,771	$21,637	$23,597	$25,655	$27,815	$30,082	$32,460	$34,954	$37,568
$26,438	**$54,462**	**$84,144**	**$115,558**	**$148,781**	**$183,893**	**$220,978**	**$260,123**	**$301,417**	**$344,955**	**$390,834**	**$439,156**	**$490,025**	**$543,550**	**$599,847**	**$659,032**	**$721,228**	**$786,562**	**$855,168**	**$927,182**	**$1,002,748**	**$1,082,012**	**$1,165,131**	**$1,252,262**	**$0**
$52,876	$54,462	$56,096	$57,779	$59,512	$61,298	$63,137	$65,031	$66,982	$68,991	$71,061	$73,193	$75,388	$77,650	$79,980	$82,379	$84,850	$87,396	$90,018	$92,718	$95,500	$98,365	$101,316	$104,355	$107,486
$0	$1,586	$3,268	$5,049	$6,933	$8,927	$11,034	$13,259	$15,607	$18,085	$20,697	$23,450	$26,349	$29,401	$32,613	$35,991	$39,542	$43,274	$47,194	$51,310	$55,631	$60,165	$64,921	$69,908	$75,136
$52,876	**$108,924**	**$168,288**	**$231,116**	**$297,562**	**$367,786**	**$441,956**	**$520,246**	**$602,835**	**$689,911**	**$781,669**	**$878,311**	**$980,049**	**$1,087,101**	**$1,199,693**	**$1,318,063**	**$1,442,455**	**$1,573,125**	**$1,710,336**	**$1,854,365**	**$2,005,495**	**$2,164,025**	**$2,330,261**	**$2,504,524**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$6,281	$6,470	$6,664	$6,864	$7,070	$7,282	$7,500	$7,725	$7,957	$8,196	$8,442	$8,695	$8,956	$9,224	$9,501	$9,786	$10,080	$10,382	$10,694	$11,014	$11,345	$11,685	$12,036	$12,397	$12,769
$5,234	$5,391	$5,553	$5,720	$5,891	$6,068	$6,250	$6,438	$6,631	$6,830	$7,035	$7,246	$7,463	$7,687	$7,918	$8,155	$8,400	$8,652	$8,911	$9,179	$9,454	$9,738	$10,030	$10,331	$10,641
$131,908	**$135,865**	**$139,941**	**$144,139**	**$148,464**	**$152,918**	**$157,505**	**$162,230**	**$167,097**	**$172,110**	**$177,273**	**$182,592**	**$188,069**	**$193,711**	**$199,523**	**$205,508**	**$211,674**	**$218,024**	**$224,565**	**$231,301**	**$238,241**	**$245,388**	**$252,749**	**$260,332**	**$268,142**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 8 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$1,828,481	$714,519	$2,543,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$2,003,972		$374,011		
To Replace 50% of Proposed Facility		$4,007,944		$748,022		
To Replace 100% of Proposed Facility	$1,828,481	$8,015,889	$714,519	$1,496,044	$2,543,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$19,728		$3,664		
To Replace 50% of Proposed Facility		$39,455		$7,328		
To Replace 100% of Proposed Facility	$18,000	$78,910	$7,000	$14,656	$25,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$2,023,700**		**$377,675**		
To Replace 50% of Proposed Facility		**$4,047,400**		**$755,350**		
To Replace 100% of Proposed Facility	**$1,846,481**	**$8,094,799**	**$721,519**	**$1,510,701**	**$2,568,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$17,941	$17,941	$10,359	$21,689
To Replace 50% of Proposed Facility	$35,882	$35,882	$20,718	$43,378
To Replace 100% of Proposed Facility	$71,764	$71,764	$41,435	$86,756
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$9,509		$7,432	
To Replace 50% of Proposed Facility	$19,019		$14,863	
To Replace 100% of Proposed Facility	$38,038		$29,727	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$19,331		$15,107	
To Replace 50% of Proposed Facility	$38,661		$30,214	
To Replace 100% of Proposed Facility	$77,322		$60,428	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$40,474		$31,631	
To Replace 50% of Proposed Facility	$80,948		$63,261	
To Replace 100% of Proposed Facility	$161,896		$126,523	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$59,376
Years 26-50		$104,697
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$39,236
Year 25		$79,759
Year 50		$166,997

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$2,543,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$377,675
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$755,350
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,510,701
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$9,509	$9,795	$10,088	$10,391	$10,703	$11,024	$11,355	$11,695	$12,046	$12,408	$12,780	$13,163	$13,558	$13,965	$14,384	$14,815	$15,260	$15,718	$16,189	$16,675	$17,175	$17,690	$18,221	$18,768	$19,331
Interest		$0	$285	$588	$908	$1,247	$1,605	$1,984	$2,384	$2,807	$3,252	$3,722	$4,217	$4,739	$5,288	$5,865	$6,473	$7,111	$7,782	$8,487	$9,228	$10,005	$10,820	$11,676	$12,572	$13,513
End of Year Balance		**$9,509**	**$19,589**	**$30,265**	**$41,565**	**$53,514**	**$66,144**	**$79,483**	**$93,563**	**$108,416**	**$124,076**	**$140,578**	**$157,958**	**$176,255**	**$195,508**	**$215,757**	**$237,045**	**$259,416**	**$282,916**	**$307,592**	**$333,495**	**$360,675**	**$389,185**	**$419,082**	**$450,422**	**$483,265**
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$19,019	$19,589	$20,177	$20,782	$21,406	$22,048	$22,709	$23,391	$24,092	$24,815	$25,560	$26,326	$27,116	$27,930	$28,768	$29,631	$30,520	$31,435	$32,378	$33,350	$34,350	$35,380	$36,442	$37,535	$38,661
Interest		$0	$571	$1,175	$1,816	$2,494	$3,211	$3,969	$4,769	$5,614	$6,505	$7,445	$8,435	$9,478	$10,575	$11,730	$12,945	$14,223	$15,565	$16,975	$18,456	$20,010	$21,640	$23,351	$25,145	$27,025
End of Year Balance		**$19,019**	**$39,179**	**$60,531**	**$83,129**	**$107,029**	**$132,288**	**$158,966**	**$187,125**	**$216,832**	**$248,152**	**$281,156**	**$315,917**	**$352,511**	**$391,016**	**$431,514**	**$474,090**	**$518,832**	**$565,832**	**$615,185**	**$666,990**	**$721,350**	**$778,371**	**$838,164**	**$900,844**	**$966,530**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$38,038	$39,179	$40,354	$41,565	$42,812	$44,096	$45,419	$46,781	$48,185	$49,630	$51,119	$52,653	$54,232	$55,859	$57,535	$59,261	$61,039	$62,870	$64,756	$66,699	$68,700	$70,761	$72,884	$75,070	$77,322
Interest		$0	$1,141	$2,351	$3,632	$4,988	$6,422	$7,937	$9,538	$11,228	$13,010	$14,889	$16,869	$18,955	$21,151	$23,461	$25,891	$28,445	$31,130	$33,950	$36,911	$40,019	$43,281	$46,702	$50,290	$54,051
End of Year Balance		**$38,038**	**$78,357**	**$121,062**	**$166,258**	**$214,058**	**$264,575**	**$317,931**	**$374,251**	**$433,663**	**$496,303**	**$562,312**	**$631,834**	**$705,021**	**$782,031**	**$863,027**	**$948,179**	**$1,037,664**	**$1,131,664**	**$1,230,370**	**$1,333,980**	**$1,442,699**	**$1,556,741**	**$1,676,327**	**$1,801,688**	**$1,933,061**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$7,432	$7,655	$7,884	$8,121	$8,364	$8,615	$8,874	$9,140	$9,414	$9,697	$9,988	$10,287	$10,596	$10,914	$11,241	$11,578	$11,926	$12,283	$12,652	$13,031	$13,422	$13,825	$14,240	$14,667	$15,107
Interest		$0	$223	$459	$710	$974	$1,255	$1,551	$1,863	$2,194	$2,542	$2,909	$3,296	$3,703	$4,132	$4,584	$5,058	$5,558	$6,082	$6,633	$7,212	$7,819	$8,456	$9,125	$9,825	$10,560
End of Year Balance		**$7,432**	**$15,309**	**$23,653**	**$32,483**	**$41,822**	**$51,692**	**$62,116**	**$73,120**	**$84,728**	**$96,966**	**$109,863**	**$123,446**	**$137,745**	**$152,791**	**$168,615**	**$185,252**	**$202,735**	**$221,101**	**$240,386**	**$260,629**	**$281,870**	**$304,151**	**$327,515**	**$352,008**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$14,863	$15,309	$15,768	$16,242	$16,729	$17,231	$17,748	$18,280	$18,828	$19,393	$19,975	$20,574	$21,191	$21,827	$22,482	$23,157	$23,851	$24,567	$25,304	$26,063	$26,845	$27,650	$28,480	$29,334	$30,214
Interest		$0	$446	$919	$1,419	$1,949	$2,509	$3,102	$3,727	$4,387	$5,084	$5,818	$6,592	$7,407	$8,265	$9,167	$10,117	$11,115	$12,164	$13,266	$14,423	$15,638	$16,912	$18,249	$19,651	$21,120
End of Year Balance		**$14,863**	**$30,618**	**$47,305**	**$64,966**	**$83,644**	**$103,384**	**$124,233**	**$146,240**	**$169,455**	**$193,932**	**$219,725**	**$246,891**	**$275,489**	**$305,581**	**$337,231**	**$370,504**	**$405,471**	**$442,202**	**$480,771**	**$521,257**	**$563,740**	**$608,302**	**$655,031**	**$704,016**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$29,727	$30,618	$31,537	$32,483	$33,458	$34,461	$35,495	$36,560	$37,657	$38,786	$39,950	$41,149	$42,383	$43,654	$44,964	$46,313	$47,702	$49,134	$50,608	$52,126	$53,690	$55,300	$56,959	$58,668	$60,428
Interest		$0	$892	$1,837	$2,838	$3,898	$5,019	$6,203	$7,454	$8,774	$10,167	$11,636	$13,184	$14,813	$16,529	$18,335	$20,234	$22,230	$24,328	$26,532	$28,846	$31,275	$33,824	$36,498	$39,302	$42,241
End of Year Balance		**$29,727**	**$61,237**	**$94,611**	**$129,932**	**$167,288**	**$206,768**	**$248,466**	**$292,480**	**$338,911**	**$387,864**	**$439,450**	**$493,783**	**$550,979**	**$611,163**	**$674,462**	**$741,009**	**$810,941**	**$884,403**	**$961,543**	**$1,042,515**	**$1,127,480**	**$1,216,604**	**$1,310,062**	**$1,408,032**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,500	$1,545	$1,591	$1,639	$1,688	$1,739	$1,791	$1,845	$1,900	$1,957	$2,016	$2,076	$2,139	$2,203	$2,269	$2,337	$2,407	$2,479	$2,554	$2,630	$2,709	$2,790	$2,874	$2,960	$3,049
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$3,000	$3,090	$3,183	$3,278	$3,377	$3,478	$3,582	$3,690	$3,800	$3,914	$4,032	$4,153	$4,277	$4,406	$4,538	$4,674	$4,814	$4,959	$5,107	$5,261	$5,418	$5,581	$5,748	$5,921	$6,098
Contracted Labor Costs		$3,000	$3,090	$3,183	$3,278	$3,377	$3,478	$3,582	$3,690	$3,800	$3,914	$4,032	$4,153	$4,277	$4,406	$4,538	$4,674	$4,814	$4,959	$5,107	$5,261	$5,418	$5,581	$5,748	$5,921	$6,098
Total O&M Expenses		**$64,000**	**$65,920**	**$67,898**	**$69,935**	**$72,033**	**$74,194**	**$76,419**	**$78,712**	**$81,073**	**$83,505**	**$86,011**	**$88,591**	**$91,249**	**$93,986**	**$96,806**	**$99,710**	**$102,701**	**$105,782**	**$108,956**	**$112,224**	**$115,591**	**$119,059**	**$122,631**	**$126,310**	**$130,099**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 1 - Pressurized System, No Excess Capacity, 8 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$1,904,658**
25% Replacement	$461,620	$360,760	
50% Replacement	$923,241	$721,519	
100% Replacement	$1,846,481	$1,443,038	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$1,904,658**
25% Replacement	$461,620	$360,760	
50% Replacement	$923,241	$721,519	
100% Replacement	$1,846,481	$1,443,038	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,023,700
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,047,400
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,094,799
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$790,768
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,581,536
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,163,071
$19,911	$20,508	$21,123	$21,757	$22,409	$23,082	$23,774	$24,487	$25,222	$25,979	$26,758	$27,561	$28,388	$29,239	$30,116	$31,020	$31,951	$32,909	$33,896	$34,913	$35,961	$37,039	$38,151	$39,295	$40,474
$14,498	$15,530	$16,611	$17,743	$18,928	$20,169	$21,466	$22,823	$24,243	$25,726	$27,278	$28,899	$30,593	$32,362	$34,210	$36,140	$38,155	$40,258	$42,453	$44,743	$47,133	$49,626	$52,226	$54,937	$57,764
$517,674	**$553,712**	**$591,446**	**$630,946**	**$672,284**	**$715,534**	**$760,775**	**$808,085**	**$857,550**	**$909,255**	**$963,291**	**$1,019,750**	**$1,078,731**	**$1,140,332**	**$1,204,658**	**$1,271,818**	**$1,341,923**	**$1,415,090**	**$1,491,439**	**$1,571,095**	**$1,654,189**	**$1,740,854**	**$1,831,230**	**$1,925,462**	**$0**
$39,821	$41,016	$42,246	$43,514	$44,819	$46,164	$47,548	$48,975	$50,444	$51,957	$53,516	$55,122	$56,775	$58,479	$60,233	$62,040	$63,901	$65,818	$67,793	$69,826	$71,921	$74,079	$76,301	$78,590	$80,948
$28,996	$31,060	$33,223	$35,487	$37,857	$40,337	$42,932	$45,646	$48,485	$51,453	$54,555	$57,797	$61,185	$64,724	$68,420	$72,279	$76,309	$80,515	$84,905	$89,486	$94,266	$99,251	$104,451	$109,874	$115,528
$1,035,347	**$1,107,423**	**$1,182,892**	**$1,261,892**	**$1,344,568**	**$1,431,069**	**$1,521,549**	**$1,616,171**	**$1,715,100**	**$1,818,510**	**$1,926,582**	**$2,039,501**	**$2,157,461**	**$2,280,664**	**$2,409,316**	**$2,543,636**	**$2,683,846**	**$2,830,179**	**$2,982,877**	**$3,142,190**	**$3,308,377**	**$3,481,707**	**$3,662,460**	**$3,850,924**	**$0**
$79,642	$82,031	$84,492	$87,027	$89,638	$92,327	$95,097	$97,950	$100,888	$103,915	$107,032	$110,243	$113,551	$116,957	$120,466	$124,080	$127,802	$131,636	$135,585	$139,653	$143,842	$148,158	$152,602	$157,181	$161,896
$57,992	$62,121	$66,445	$70,974	$75,714	$80,674	$85,864	$91,293	$96,970	$102,906	$109,111	$115,595	$122,370	$129,448	$136,840	$144,559	$152,618	$161,031	$169,811	$178,973	$188,531	$198,503	$208,902	$219,748	$231,055
$2,070,694	**$2,214,847**	**$2,365,784**	**$2,523,785**	**$2,689,136**	**$2,862,138**	**$3,043,098**	**$3,232,341**	**$3,430,200**	**$3,637,020**	**$3,853,163**	**$4,079,002**	**$4,314,922**	**$4,561,327**	**$4,818,633**	**$5,087,271**	**$5,367,692**	**$5,660,359**	**$5,965,755**	**$6,284,380**	**$6,616,754**	**$6,963,415**	**$7,324,920**	**$7,701,848**	**$0**
$15,560	$16,027	$16,508	$17,003	$17,513	$18,039	$18,580	$19,137	$19,711	$20,303	$20,912	$21,539	$22,185	$22,851	$23,536	$24,242	$24,970	$25,719	$26,490	$27,285	$28,103	$28,947	$29,815	$30,709	$31,631
$0	$467	$962	$1,486	$2,040	$2,627	$3,247	$3,902	$4,593	$5,322	$6,091	$6,901	$7,754	$8,652	$9,597	$10,591	$11,636	$12,734	$13,888	$15,099	$16,371	$17,705	$19,105	$20,572	$22,111
$15,560	**$32,054**	**$49,523**	**$68,012**	**$87,566**	**$108,231**	**$130,058**	**$153,097**	**$177,401**	**$203,026**	**$230,028**	**$258,468**	**$288,407**	**$319,910**	**$353,043**	**$387,877**	**$424,483**	**$462,936**	**$503,314**	**$545,699**	**$590,173**	**$636,825**	**$685,745**	**$737,026**	**$0**
$31,120	$32,054	$33,016	$34,006	$35,026	$36,077	$37,159	$38,274	$39,422	$40,605	$41,823	$43,078	$44,370	$45,701	$47,072	$48,485	$49,939	$51,437	$52,980	$54,570	$56,207	$57,893	$59,630	$61,419	$63,261
$0	$934	$1,923	$2,971	$4,081	$5,254	$6,494	$7,803	$9,186	$10,644	$12,182	$13,802	$15,508	$17,304	$19,195	$21,183	$23,273	$25,469	$27,776	$30,199	$32,742	$35,410	$38,209	$41,145	$44,222
$31,120	**$64,108**	**$99,047**	**$136,025**	**$175,132**	**$216,463**	**$260,116**	**$306,194**	**$354,802**	**$406,051**	**$460,056**	**$516,935**	**$576,814**	**$639,820**	**$706,087**	**$775,754**	**$848,966**	**$925,872**	**$1,006,629**	**$1,091,397**	**$1,180,346**	**$1,273,650**	**$1,371,489**	**$1,474,053**	**$0**
$62,241	$64,108	$66,031	$68,012	$70,053	$72,154	$74,319	$76,548	$78,845	$81,210	$83,647	$86,156	$88,741	$91,403	$94,145	$96,969	$99,878	$102,875	$105,961	$109,140	$112,414	$115,786	$119,260	$122,838	$126,523
$0	$1,867	$3,846	$5,943	$8,161	$10,508	$12,988	$15,607	$18,372	$21,288	$24,363	$27,603	$31,016	$34,609	$38,389	$42,365	$46,545	$50,938	$55,552	$60,398	$65,484	$70,821	$76,419	$82,289	$88,443
$62,241	**$128,216**	**$198,094**	**$272,049**	**$350,263**	**$432,925**	**$520,232**	**$612,387**	**$709,604**	**$812,102**	**$920,112**	**$1,033,871**	**$1,153,628**	**$1,279,639**	**$1,412,173**	**$1,551,508**	**$1,697,931**	**$1,851,744**	**$2,013,257**	**$2,182,795**	**$2,360,692**	**$2,547,299**	**$2,742,978**	**$2,948,105**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$3,141	$3,235	$3,332	$3,432	$3,535	$3,641	$3,750	$3,863	$3,979	$4,098	$4,221	$4,347	$4,478	$4,612	$4,751	$4,893	$5,040	$5,191	$5,347	$5,507	$5,672	$5,843	$6,018	$6,198	$6,384
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$6,281	$6,470	$6,664	$6,864	$7,070	$7,282	$7,500	$7,725	$7,957	$8,196	$8,442	$8,695	$8,956	$9,224	$9,501	$9,786	$10,080	$10,382	$10,694	$11,014	$11,345	$11,685	$12,036	$12,397	$12,769
$6,281	$6,470	$6,664	$6,864	$7,070	$7,282	$7,500	$7,725	$7,957	$8,196	$8,442	$8,695	$8,956	$9,224	$9,501	$9,786	$10,080	$10,382	$10,694	$11,014	$11,345	$11,685	$12,036	$12,397	$12,769
$134,002	**$138,022**	**$142,162**	**$146,427**	**$150,820**	**$155,345**	**$160,005**	**$164,805**	**$169,749**	**$174,842**	**$180,087**	**$185,490**	**$191,055**	**$196,786**	**$202,690**	**$208,770**	**$215,034**	**$221,485**	**$228,129**	**$234,973**	**$242,022**	**$249,283**	**$256,761**	**$264,464**	**$272,398**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 2 - Pressurized System with Excess Capacity, 12 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$2,236,357	$929,643	$3,166,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$2,450,995		$486,616		
To Replace 50% of Proposed Facility		$4,901,989		$973,233		
To Replace 100% of Proposed Facility	$2,236,357	$9,803,979	$929,643	$1,946,466	$3,166,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$24,111		$4,711		
To Replace 50% of Proposed Facility		$48,223		$9,422		
To Replace 100% of Proposed Facility	$22,000	$96,446	$9,000	$18,844	$31,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$2,475,106**		**$491,327**		
To Replace 50% of Proposed Facility		**$4,950,212**		**$982,655**		
To Replace 100% of Proposed Facility	**$2,258,357**	**$9,900,425**	**$938,643**	**$1,965,310**	**$3,197,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$21,943	$21,943	$13,476	$28,216
To Replace 50% of Proposed Facility	$43,886	$43,886	$26,952	$56,432
To Replace 100% of Proposed Facility	$87,772	$87,772	$53,904	$112,864
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$11,631		$9,668	
To Replace 50% of Proposed Facility	$23,261		$19,336	
To Replace 100% of Proposed Facility	$46,522		$38,672	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$23,642		$19,653	
To Replace 50% of Proposed Facility	$47,285		$39,306	
To Replace 100% of Proposed Facility	$94,570		$78,612	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$49,502		$41,149	
To Replace 50% of Proposed Facility	$99,004		$82,298	
To Replace 100% of Proposed Facility	$198,008		$164,597	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$75,847
Years 26-50		$134,807
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$50,303
Year 25		$102,255
Year 50		$214,099

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$3,166,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$491,327
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$982,655
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,965,310
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$11,631	$11,979	$12,339	$12,709	$13,090	$13,483	$13,887	$14,304	$14,733	$15,175	$15,630	$16,099	$16,582	$17,080	$17,592	$18,120	$18,664	$19,224	$19,800	$20,394	$21,006	$21,636	$22,285	$22,954	$23,642
Interest		$0	$349	$719	$1,110	$1,525	$1,964	$2,427	$2,916	$3,433	$3,978	$4,553	$5,158	$5,796	$6,467	$7,174	$7,917	$8,698	$9,518	$10,381	$11,286	$12,237	$13,234	$14,280	$15,377	$16,527
End of Year Balance		**$11,631**	**$23,959**	**$37,017**	**$50,836**	**$65,451**	**$80,898**	**$97,212**	**$114,433**	**$132,599**	**$151,752**	**$171,935**	**$193,193**	**$215,571**	**$239,118**	**$263,883**	**$289,920**	**$317,281**	**$346,023**	**$376,204**	**$407,884**	**$441,127**	**$475,997**	**$512,562**	**$550,893**	**$591,062**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$23,261	$23,959	$24,678	$25,418	$26,181	$26,966	$27,775	$28,608	$29,466	$30,350	$31,261	$32,199	$33,165	$34,160	$35,184	$36,240	$37,327	$38,447	$39,600	$40,788	$42,012	$43,272	$44,571	$45,908	$47,285
Interest		$0	$698	$1,438	$2,221	$3,050	$3,927	$4,854	$5,833	$6,866	$7,956	$9,105	$10,316	$11,592	$12,934	$14,347	$15,833	$17,395	$19,037	$20,761	$22,572	$24,473	$26,468	$28,560	$30,754	$33,054
End of Year Balance		**$23,261**	**$47,918**	**$74,033**	**$101,672**	**$130,903**	**$161,796**	**$194,425**	**$228,866**	**$265,198**	**$303,504**	**$343,870**	**$386,385**	**$431,142**	**$478,235**	**$527,767**	**$579,840**	**$634,562**	**$692,046**	**$752,408**	**$815,769**	**$882,254**	**$951,994**	**$1,025,124**	**$1,101,786**	**$1,182,125**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$46,522	$47,918	$49,355	$50,836	$52,361	$53,932	$55,550	$57,216	$58,933	$60,701	$62,522	$64,398	$66,329	$68,319	$70,369	$72,480	$74,654	$76,894	$79,201	$81,577	$84,024	$86,545	$89,141	$91,815	$94,570
Interest		$0	$1,396	$2,875	$4,442	$6,100	$7,854	$9,708	$11,665	$13,732	$15,912	$18,210	$20,632	$23,183	$25,868	$28,694	$31,666	$34,790	$38,074	$41,523	$45,144	$48,946	$52,935	$57,120	$61,507	$66,107
End of Year Balance		**$46,522**	**$95,836**	**$148,066**	**$203,344**	**$261,805**	**$323,592**	**$388,849**	**$457,731**	**$530,396**	**$607,009**	**$687,741**	**$772,770**	**$862,283**	**$956,471**	**$1,055,534**	**$1,159,680**	**$1,269,125**	**$1,384,093**	**$1,504,816**	**$1,631,538**	**$1,764,508**	**$1,903,988**	**$2,050,249**	**$2,203,572**	**$2,364,249**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$9,668	$9,958	$10,257	$10,565	$10,881	$11,208	$11,544	$11,890	$12,247	$12,615	$12,993	$13,383	$13,784	$14,198	$14,624	$15,062	$15,514	$15,980	$16,459	$16,953	$17,462	$17,985	$18,525	$19,081	$19,653
Interest		$0	$290	$597	$923	$1,268	$1,632	$2,017	$2,424	$2,854	$3,307	$3,784	$4,288	$4,818	$5,376	$5,963	$6,581	$7,230	$7,912	$8,629	$9,382	$10,172	$11,001	$11,870	$12,782	$13,738
End of Year Balance		**$9,668**	**$19,916**	**$30,770**	**$42,258**	**$54,407**	**$67,247**	**$80,809**	**$95,124**	**$110,224**	**$126,146**	**$142,923**	**$160,594**	**$179,196**	**$198,769**	**$219,356**	**$240,999**	**$263,744**	**$287,636**	**$312,724**	**$339,059**	**$366,692**	**$395,678**	**$426,073**	**$457,936**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$19,336	$19,916	$20,514	$21,129	$21,763	$22,416	$23,088	$23,781	$24,494	$25,229	$25,986	$26,766	$27,569	$28,396	$29,248	$30,125	$31,029	$31,960	$32,918	$33,906	$34,923	$35,971	$37,050	$38,161	$39,306
Interest		$0	$580	$1,195	$1,846	$2,535	$3,264	$4,035	$4,849	$5,707	$6,613	$7,569	$8,575	$9,636	$10,752	$11,926	$13,161	$14,460	$15,825	$17,258	$18,763	$20,344	$22,002	$23,741	$25,564	$27,476
End of Year Balance		**$19,336**	**$39,832**	**$61,541**	**$84,516**	**$108,814**	**$134,495**	**$161,618**	**$190,247**	**$220,449**	**$252,292**	**$285,846**	**$321,187**	**$358,392**	**$397,539**	**$438,713**	**$481,999**	**$527,488**	**$575,272**	**$625,448**	**$678,117**	**$733,384**	**$791,356**	**$852,147**	**$915,873**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$38,672	$39,832	$41,027	$42,258	$43,526	$44,832	$46,176	$47,562	$48,989	$50,458	$51,972	$53,531	$55,137	$56,791	$58,495	$60,250	$62,057	$63,919	$65,837	$67,812	$69,846	$71,941	$74,100	$76,323	$78,612
Interest		$0	$1,160	$2,390	$3,692	$5,071	$6,529	$8,070	$9,697	$11,415	$13,227	$15,137	$17,151	$19,271	$21,503	$23,852	$26,323	$28,920	$31,649	$34,516	$37,527	$40,687	$44,003	$47,481	$51,129	$54,952
End of Year Balance		**$38,672**	**$79,665**	**$123,082**	**$169,032**	**$217,629**	**$268,989**	**$323,235**	**$380,494**	**$440,898**	**$504,583**	**$571,693**	**$642,375**	**$716,783**	**$795,078**	**$877,425**	**$963,998**	**$1,054,975**	**$1,150,543**	**$1,250,896**	**$1,356,235**	**$1,466,768**	**$1,582,713**	**$1,704,294**	**$1,831,745**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,500	$1,545	$1,591	$1,639	$1,688	$1,739	$1,791	$1,845	$1,900	$1,957	$2,016	$2,076	$2,139	$2,203	$2,269	$2,337	$2,407	$2,479	$2,554	$2,630	$2,709	$2,790	$2,874	$2,960	$3,049
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Contracted Labor Costs		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Total O&M Expenses		**$66,000**	**$67,980**	**$70,019**	**$72,120**	**$74,284**	**$76,512**	**$78,807**	**$81,172**	**$83,607**	**$86,115**	**$88,698**	**$91,359**	**$94,100**	**$96,923**	**$99,831**	**$102,826**	**$105,911**	**$109,088**	**$112,361**	**$115,731**	**$119,203**	**$122,779**	**$126,463**	**$130,257**	**$134,164**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 2 - Pressurized System with Excess Capacity, 12 CFS Pump Station

(yellow)	Input Cells - Assumed or Given Values
(blue)	Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	PIPE/ INFRA.	PUMPS	OVERALL PROJECT
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$2,441,875**
25% Replacement	$564,589	$469,322	
50% Replacement	$1,129,179	$938,643	
100% Replacement	$2,258,357	$1,877,286	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$2,441,875**
25% Replacement	$564,589	$469,322	
50% Replacement	$1,129,179	$938,643	
100% Replacement	$2,258,357	$1,877,286	

26	27	28	29	30	31	32	33	34	35	36	37	38
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$24,352	$25,082	$25,835	$26,610	$27,408	$28,230	$29,077	$29,950	$30,848	$31,774	$32,727	$33,709	$34,720
$17,732	$18,994	$20,317	$21,701	$23,151	$24,667	$26,254	$27,914	$29,650	$31,465	$33,362	$35,345	$37,416
$633,146	**$677,223**	**$723,374**	**$771,685**	**$822,244**	**$875,141**	**$930,473**	**$988,337**	**$1,048,835**	**$1,112,074**	**$1,178,162**	**$1,247,216**	**$1,319,352**
$48,704	$50,165	$51,670	$53,220	$54,816	$56,461	$58,155	$59,899	$61,696	$63,547	$65,453	$67,417	$69,440
$35,464	$37,989	$40,633	$43,402	$46,301	$49,335	$52,508	$55,828	$59,300	$62,930	$66,724	$70,690	$74,833
$1,266,292	**$1,354,445**	**$1,446,748**	**$1,543,370**	**$1,644,488**	**$1,750,283**	**$1,860,946**	**$1,976,674**	**$2,097,670**	**$2,224,147**	**$2,356,325**	**$2,494,432**	**$2,638,704**
$97,407	$100,329	$103,339	$106,439	$109,633	$112,921	$116,309	$119,798	$123,392	$127,094	$130,907	$134,834	$138,879
$70,927	$75,978	$81,267	$86,805	$92,602	$98,669	$105,017	$111,657	$118,600	$125,860	$133,449	$141,379	$149,666
$2,532,584	**$2,708,890**	**$2,893,496**	**$3,086,740**	**$3,288,975**	**$3,500,566**	**$3,721,892**	**$3,953,347**	**$4,195,340**	**$4,448,294**	**$4,712,650**	**$4,988,864**	**$5,277,409**
$20,243	$20,850	$21,475	$22,120	$22,783	$23,467	$24,171	$24,896	$25,643	$26,412	$27,204	$28,021	$28,861
$0	$607	$1,251	$1,933	$2,654	$3,417	$4,224	$5,076	$5,975	$6,924	$7,924	$8,977	$10,087
$20,243	**$41,700**	**$64,426**	**$88,479**	**$113,917**	**$140,801**	**$169,196**	**$199,168**	**$230,786**	**$264,121**	**$299,249**	**$336,247**	**$375,196**
$40,485	$41,700	$42,951	$44,239	$45,567	$46,934	$48,342	$49,792	$51,286	$52,824	$54,409	$56,041	$57,722
$0	$1,215	$2,502	$3,866	$5,309	$6,835	$8,448	$10,152	$11,950	$13,847	$15,847	$17,955	$20,175
$40,485	**$83,400**	**$128,853**	**$176,958**	**$227,833**	**$281,602**	**$338,392**	**$398,335**	**$461,571**	**$528,242**	**$598,499**	**$672,495**	**$750,392**
$80,971	$83,400	$85,902	$88,479	$91,133	$93,867	$96,683	$99,584	$102,571	$105,648	$108,818	$112,082	$115,445
$0	$2,429	$5,004	$7,731	$10,617	$13,670	$16,896	$20,304	$23,900	$27,694	$31,695	$35,910	$40,350
$80,971	**$166,800**	**$257,706**	**$353,916**	**$455,667**	**$563,204**	**$676,783**	**$796,671**	**$923,142**	**$1,056,485**	**$1,196,997**	**$1,344,990**	**$1,500,784**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374
$3,141	$3,235	$3,332	$3,432	$3,535	$3,641	$3,750	$3,863	$3,979	$4,098	$4,221	$4,347	$4,478
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941
$138,189	**$142,335**	**$146,605**	**$151,003**	**$155,533**	**$160,199**	**$165,005**	**$169,955**	**$175,054**	**$180,306**	**$185,715**	**$191,286**	**$197,025**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**
26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,475,106
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,950,212
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,900,425
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,028,731
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,057,461
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,114,923
$35,761	$36,834	$37,939	$39,077	$40,250	$41,457	$42,701	$43,982	$45,301	$46,660	$48,060	$49,502
$39,581	$41,841	$44,201	$46,665	$49,238	$51,922	$54,724	$57,646	$60,695	$63,875	$67,191	$70,649
$1,394,694	**$1,473,369**	**$1,555,510**	**$1,641,252**	**$1,730,740**	**$1,824,119**	**$1,921,544**	**$2,023,172**	**$2,129,168**	**$2,239,704**	**$2,354,955**	**$0**
$71,523	$73,668	$75,879	$78,155	$80,500	$82,914	$85,402	$87,964	$90,603	$93,321	$96,121	$99,004
$79,161	$83,682	$88,402	$93,331	$98,475	$103,844	$109,447	$115,293	$121,390	$127,750	$134,382	$141,297
$2,789,388	**$2,946,738**	**$3,111,019**	**$3,282,504**	**$3,461,479**	**$3,648,238**	**$3,843,087**	**$4,046,344**	**$4,258,337**	**$4,479,408**	**$4,709,911**	**$0**
$143,046	$147,337	$151,757	$156,310	$160,999	$165,829	$170,804	$175,928	$181,206	$186,642	$192,241	$198,008
$158,322	$167,363	$176,804	$186,661	$196,950	$207,689	$218,894	$230,585	$242,781	$255,500	$268,764	$282,595
$5,578,776	**$5,893,477**	**$6,222,038**	**$6,565,009**	**$6,922,958**	**$7,296,476**	**$7,686,174**	**$8,092,687**	**$8,516,674**	**$8,958,816**	**$9,419,822**	**$0**
$29,727	$30,619	$31,537	$32,484	$33,458	$34,462	$35,496	$36,561	$37,657	$38,787	$39,951	$41,149
$11,256	$12,485	$13,779	$15,138	$16,567	$18,067	$19,643	$21,297	$23,033	$24,854	$26,763	$28,765
$416,179	**$459,283**	**$504,599**	**$552,221**	**$602,246**	**$654,775**	**$709,914**	**$767,772**	**$828,462**	**$892,103**	**$958,817**	**$0**
$59,454	$61,238	$63,075	$64,967	$66,916	$68,924	$70,991	$73,121	$75,315	$77,574	$79,901	$82,298
$22,512	$24,971	$27,557	$30,276	$33,133	$36,135	$39,286	$42,595	$46,066	$49,708	$53,526	$57,529
$832,358	**$918,567**	**$1,009,199**	**$1,104,442**	**$1,204,491**	**$1,309,550**	**$1,419,827**	**$1,535,543**	**$1,656,924**	**$1,784,206**	**$1,917,634**	**$0**
$118,908	$122,476	$126,150	$129,934	$133,832	$137,847	$141,983	$146,242	$150,629	$155,148	$159,803	$164,597
$45,024	$49,941	$55,114	$60,552	$66,267	$72,269	$78,573	$85,190	$92,133	$99,415	$107,052	$115,058
$1,664,716	**$1,837,133**	**$2,018,397**	**$2,208,883**	**$2,408,982**	**$2,619,099**	**$2,839,655**	**$3,071,087**	**$3,313,849**	**$3,568,413**	**$3,835,268**	**$0**
$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$4,612	$4,751	$4,893	$5,040	$5,191	$5,347	$5,507	$5,672	$5,843	$6,018	$6,198	$6,384
$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$202,936	**$209,024**	**$215,294**	**$221,753**	**$228,406**	**$235,258**	**$242,316**	**$249,585**	**$257,073**	**$264,785**	**$272,729**	**$280,910**
$15,723	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**
39	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 2 - Pressurized System with Excess Capacity, 12 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$3,120,351	$1,559,649	$4,680,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$3,419,831		$816,390		
To Replace 50% of Proposed Facility		$6,839,663		$1,632,779		
To Replace 100% of Proposed Facility	$3,120,351	$13,679,326	$1,559,649	$3,265,559	$4,680,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$33,975		$8,375		
To Replace 50% of Proposed Facility		$67,951		$16,750		
To Replace 100% of Proposed Facility	$31,000	$135,901	$16,000	$33,500	$47,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$3,453,807**		**$824,765**		
To Replace 50% of Proposed Facility		**$6,907,613**		**$1,649,530**		
To Replace 100% of Proposed Facility	**$3,151,351**	**$13,815,227**	**$1,575,649**	**$3,299,059**	**$4,727,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$30,620	$30,620	$22,622	$47,364
To Replace 50% of Proposed Facility	$61,239	$61,239	$45,243	$94,729
To Replace 100% of Proposed Facility	$122,479	$122,479	$90,486	$189,458
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$16,229		$16,229	
To Replace 50% of Proposed Facility	$32,459		$32,458	
To Replace 100% of Proposed Facility	$64,918		$64,917	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$32,991		$32,991	
To Replace 50% of Proposed Facility	$65,982		$65,981	
To Replace 100% of Proposed Facility	$131,965		$131,962	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$69,076		$69,075	
To Replace 50% of Proposed Facility	$138,152		$138,150	
To Replace 100% of Proposed Facility	$276,305		$276,300	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$121,106
Years 26-50		$220,078
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$81,146
Year 25		$164,954
Year 50		$345,376

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$4,680,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$824,765
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,649,530
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,299,059
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$16,229	$16,716	$17,218	$17,734	$18,266	$18,814	$19,379	$19,960	$20,559	$21,176	$21,811	$22,465	$23,139	$23,834	$24,549	$25,285	$26,044	$26,825	$27,630	$28,458	$29,312	$30,192	$31,097	$32,030	$32,991
Interest		$0	$487	$1,003	$1,550	$2,128	$2,740	$3,387	$4,070	$4,790	$5,551	$6,353	$7,198	$8,088	$9,024	$10,010	$11,047	$12,137	$13,282	$14,485	$15,749	$17,075	$18,467	$19,926	$21,457	$23,062
End of Year Balance		**$16,229**	**$33,433**	**$51,653**	**$70,937**	**$91,332**	**$112,886**	**$135,652**	**$159,681**	**$185,031**	**$211,758**	**$239,921**	**$269,584**	**$300,811**	**$333,669**	**$368,228**	**$404,559**	**$442,740**	**$482,847**	**$524,962**	**$569,169**	**$615,556**	**$664,215**	**$715,238**	**$768,726**	**$824,779**
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$32,459	$33,433	$34,436	$35,469	$36,533	$37,629	$38,758	$39,920	$41,118	$42,352	$43,622	$44,931	$46,279	$47,667	$49,097	$50,570	$52,087	$53,650	$55,259	$56,917	$58,624	$60,383	$62,195	$64,060	$65,982
Interest		$0	$974	$2,006	$3,099	$4,256	$5,480	$6,773	$8,139	$9,581	$11,102	$12,705	$14,395	$16,175	$18,049	$20,020	$22,094	$24,274	$26,564	$28,971	$31,498	$34,150	$36,933	$39,853	$42,914	$46,124
End of Year Balance		**$32,459**	**$66,865**	**$103,307**	**$141,875**	**$182,664**	**$225,773**	**$271,303**	**$319,363**	**$370,062**	**$423,515**	**$479,843**	**$539,169**	**$601,622**	**$667,338**	**$736,455**	**$809,119**	**$885,480**	**$965,694**	**$1,049,923**	**$1,138,338**	**$1,231,113**	**$1,328,429**	**$1,430,477**	**$1,537,451**	**$1,649,557**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$64,918	$66,865	$68,871	$70,937	$73,066	$75,258	$77,515	$79,841	$82,236	$84,703	$87,244	$89,861	$92,557	$95,334	$98,194	$101,140	$104,174	$107,299	$110,518	$113,834	$117,249	$120,766	$124,389	$128,121	$131,965
Interest		$0	$1,948	$4,012	$6,198	$8,512	$10,960	$13,546	$16,278	$19,162	$22,204	$25,411	$28,791	$32,350	$36,097	$40,040	$44,187	$48,547	$53,129	$57,942	$62,995	$68,300	$73,867	$79,706	$85,829	$92,247
End of Year Balance		**$64,918**	**$133,731**	**$206,614**	**$283,750**	**$365,328**	**$451,545**	**$542,607**	**$638,726**	**$740,124**	**$847,030**	**$959,685**	**$1,078,338**	**$1,203,245**	**$1,334,676**	**$1,472,911**	**$1,618,238**	**$1,770,959**	**$1,931,387**	**$2,099,847**	**$2,276,676**	**$2,462,225**	**$2,656,858**	**$2,860,953**	**$3,074,903**	**$3,299,115**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$16,229	$16,716	$17,218	$17,734	$18,266	$18,814	$19,378	$19,960	$20,559	$21,175	$21,811	$22,465	$23,139	$23,833	$24,548	$25,285	$26,043	$26,824	$27,629	$28,458	$29,312	$30,191	$31,097	$32,030	$32,991
Interest		$0	$487	$1,003	$1,550	$2,128	$2,740	$3,387	$4,069	$4,790	$5,551	$6,353	$7,198	$8,087	$9,024	$10,010	$11,047	$12,137	$13,282	$14,485	$15,749	$17,075	$18,466	$19,926	$21,457	$23,061
End of Year Balance		**$16,229**	**$33,432**	**$51,653**	**$70,936**	**$91,330**	**$112,884**	**$135,649**	**$159,679**	**$185,028**	**$211,754**	**$239,917**	**$269,580**	**$300,806**	**$333,663**	**$368,221**	**$404,553**	**$442,732**	**$482,839**	**$524,953**	**$569,159**	**$615,546**	**$664,203**	**$715,226**	**$768,713**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$32,458	$33,432	$34,435	$35,468	$36,532	$37,628	$38,757	$39,920	$41,117	$42,351	$43,621	$44,930	$46,278	$47,666	$49,096	$50,569	$52,086	$53,649	$55,258	$56,916	$58,623	$60,382	$62,194	$64,059	$65,981
Interest		$0	$974	$2,006	$3,099	$4,256	$5,480	$6,773	$8,139	$9,581	$11,102	$12,705	$14,395	$16,175	$18,048	$20,020	$22,093	$24,273	$26,564	$28,970	$31,497	$34,150	$36,933	$39,852	$42,914	$46,123
End of Year Balance		**$32,458**	**$66,864**	**$103,305**	**$141,873**	**$182,661**	**$225,769**	**$271,299**	**$319,358**	**$370,056**	**$423,508**	**$479,835**	**$539,160**	**$601,612**	**$667,327**	**$736,443**	**$809,105**	**$885,465**	**$965,677**	**$1,049,906**	**$1,138,319**	**$1,231,092**	**$1,328,407**	**$1,430,453**	**$1,537,426**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$64,917	$66,864	$68,870	$70,936	$73,064	$75,256	$77,514	$79,839	$82,235	$84,702	$87,243	$89,860	$92,556	$95,332	$98,192	$101,138	$104,172	$107,297	$110,516	$113,832	$117,247	$120,764	$124,387	$128,119	$131,962
Interest		$0	$1,948	$4,012	$6,198	$8,512	$10,960	$13,546	$16,278	$19,161	$22,203	$25,410	$28,790	$32,350	$36,097	$40,040	$44,187	$48,546	$53,128	$57,941	$62,994	$68,299	$73,866	$79,704	$85,827	$92,246
End of Year Balance		**$64,917**	**$133,728**	**$206,611**	**$283,745**	**$365,322**	**$451,538**	**$542,598**	**$638,715**	**$740,111**	**$847,016**	**$959,669**	**$1,078,319**	**$1,203,225**	**$1,334,654**	**$1,472,886**	**$1,618,211**	**$1,770,929**	**$1,931,355**	**$2,099,812**	**$2,276,638**	**$2,462,184**	**$2,656,814**	**$2,860,905**	**$3,074,851**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,500	$1,545	$1,591	$1,639	$1,688	$1,739	$1,791	$1,845	$1,900	$1,957	$2,016	$2,076	$2,139	$2,203	$2,269	$2,337	$2,407	$2,479	$2,554	$2,630	$2,709	$2,790	$2,874	$2,960	$3,049
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$6,000	$6,180	$6,365	$6,556	$6,753	$6,956	$7,164	$7,379	$7,601	$7,829	$8,063	$8,305	$8,555	$8,811	$9,076	$9,348	$9,628	$9,917	$10,215	$10,521	$10,837	$11,162	$11,497	$11,842	$12,197
Contracted Labor Costs		$6,000	$6,180	$6,365	$6,556	$6,753	$6,956	$7,164	$7,379	$7,601	$7,829	$8,063	$8,305	$8,555	$8,811	$9,076	$9,348	$9,628	$9,917	$10,215	$10,521	$10,837	$11,162	$11,497	$11,842	$12,197
Total O&M Expenses		**$70,000**	**$72,100**	**$74,263**	**$76,491**	**$78,786**	**$81,149**	**$83,584**	**$86,091**	**$88,674**	**$91,334**	**$94,074**	**$96,896**	**$99,803**	**$102,797**	**$105,881**	**$109,058**	**$112,329**	**$115,699**	**$119,170**	**$122,745**	**$126,428**	**$130,221**	**$134,127**	**$138,151**	**$142,296**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 2 - Pressurized System with Excess Capacity, 12 CFS Pump Station

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$3,939,136**
25% Replacement	$787,838	$787,825	
50% Replacement	$1,575,676	$1,575,649	
100% Replacement	$3,151,351	$3,151,298	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$3,939,136**
25% Replacement	$787,838	$787,825	
50% Replacement	$1,575,676	$1,575,649	
100% Replacement	$3,151,351	$3,151,298	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,453,807
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,907,613
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13,815,227
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,726,874
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,453,749
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,907,497
$33,981	$35,000	$36,050	$37,132	$38,246	$39,393	$40,575	$41,792	$43,046	$44,337	$45,667	$47,037	$48,449	$49,902	$51,399	$52,941	$54,529	$56,165	$57,850	$59,586	$61,373	$63,214	$65,111	$67,064	$69,076
$24,743	$26,505	$28,350	$30,282	$32,305	$34,421	$36,636	$38,952	$41,374	$43,907	$46,554	$49,321	$52,212	$55,231	$58,385	$61,679	$65,118	$68,707	$72,453	$76,362	$80,441	$84,695	$89,132	$93,760	$98,584
$883,503	**$945,008**	**$1,009,409**	**$1,076,823**	**$1,147,373**	**$1,221,188**	**$1,298,398**	**$1,379,142**	**$1,463,563**	**$1,551,807**	**$1,644,029**	**$1,740,387**	**$1,841,047**	**$1,946,181**	**$2,055,965**	**$2,170,585**	**$2,290,232**	**$2,415,104**	**$2,545,408**	**$2,681,356**	**$2,823,169**	**$2,971,079**	**$3,125,322**	**$3,286,146**	**$0**
$67,962	$70,001	$72,101	$74,264	$76,492	$78,786	$81,150	$83,584	$86,092	$88,675	$91,335	$94,075	$96,897	$99,804	$102,798	$105,882	$109,059	$112,330	$115,700	$119,171	$122,746	$126,429	$130,222	$134,128	$138,152
$1,767,006	**$1,890,017**	**$2,018,818**	**$2,153,646**	**$2,294,747**	**$2,442,376**	**$2,596,797**	**$2,758,285**	**$2,927,125**	**$3,103,614**	**$3,288,057**	**$3,480,774**	**$3,682,094**	**$3,892,361**	**$4,111,930**	**$4,341,171**	**$4,580,464**	**$4,830,209**	**$5,090,815**	**$5,362,711**	**$5,646,339**	**$5,942,158**	**$6,250,645**	**$6,572,292**	**$0**
$135,924	$140,001	$144,201	$148,527	$152,983	$157,573	$162,300	$167,169	$172,184	$177,349	$182,670	$188,150	$193,794	$199,608	$205,597	$211,764	$218,117	$224,661	$231,401	$238,343	$245,493	$252,858	$260,444	$268,257	$276,305
$98,973	$106,020	$113,401	$121,129	$129,219	$137,685	$146,543	$155,808	$165,497	$175,628	$186,217	$197,283	$208,846	$220,926	$233,542	$246,716	$260,470	$274,828	$289,813	$305,449	$321,763	$338,780	$356,529	$375,039	$394,338
$3,534,012	**$3,780,033**	**$4,037,635**	**$4,307,292**	**$4,589,494**	**$4,884,751**	**$5,193,593**	**$5,516,570**	**$5,854,251**	**$6,207,228**	**$6,576,114**	**$6,961,548**	**$7,364,189**	**$7,784,723**	**$8,223,861**	**$8,682,341**	**$9,160,929**	**$9,660,417**	**$10,181,631**	**$10,725,422**	**$11,292,678**	**$11,884,316**	**$12,501,289**	**$13,144,585**	**$0**
$33,980	$35,000	$36,050	$37,131	$38,245	$39,392	$40,574	$41,791	$43,045	$44,337	$45,667	$47,037	$48,448	$49,901	$51,398	$52,940	$54,528	$56,164	$57,849	$59,585	$61,372	$63,213	$65,110	$67,063	$69,075
$0	$1,019	$2,100	$3,244	$4,456	$5,737	$7,091	$8,521	$10,030	$11,622	$13,301	$15,070	$16,933	$18,895	$20,959	$23,129	$25,411	$27,809	$30,329	$32,974	$35,751	$38,664	$41,721	$44,926	$48,285
$33,980	**$69,999**	**$108,149**	**$148,525**	**$191,226**	**$236,355**	**$284,020**	**$334,332**	**$387,407**	**$443,366**	**$502,334**	**$564,440**	**$629,821**	**$698,617**	**$770,974**	**$847,043**	**$926,983**	**$1,010,957**	**$1,099,135**	**$1,191,694**	**$1,288,817**	**$1,390,694**	**$1,497,525**	**$1,609,514**	**$0**
$67,961	$69,999	$72,099	$74,262	$76,490	$78,785	$81,149	$83,583	$86,090	$88,673	$91,333	$94,073	$96,896	$99,802	$102,797	$105,880	$109,057	$112,329	$115,698	$119,169	$122,744	$126,427	$130,220	$134,126	$138,150
$0	$2,039	$4,200	$6,489	$8,911	$11,474	$14,181	$17,041	$20,060	$23,244	$26,602	$30,140	$33,866	$37,789	$41,917	$46,258	$50,823	$55,619	$60,657	$65,948	$71,502	$77,329	$83,442	$89,852	$96,571
$67,961	**$139,999**	**$216,298**	**$297,050**	**$382,451**	**$472,710**	**$568,040**	**$668,664**	**$774,814**	**$886,732**	**$1,004,667**	**$1,128,881**	**$1,259,643**	**$1,397,234**	**$1,541,948**	**$1,694,087**	**$1,853,966**	**$2,021,914**	**$2,198,270**	**$2,383,387**	**$2,577,633**	**$2,781,389**	**$2,995,050**	**$3,219,028**	**$0**
$135,921	$139,999	$144,199	$148,525	$152,981	$157,570	$162,297	$167,166	$172,181	$177,346	$182,667	$188,147	$193,791	$199,605	$205,593	$211,761	$218,114	$224,657	$231,397	$238,339	$245,489	$252,854	$260,439	$268,252	$276,300
$0	$4,078	$8,400	$12,978	$17,823	$22,947	$28,363	$34,082	$40,120	$46,489	$53,204	$60,280	$67,733	$75,579	$83,834	$92,517	$101,645	$111,238	$121,315	$131,896	$143,003	$154,658	$166,883	$179,703	$193,142
$135,921	**$279,998**	**$432,597**	**$594,099**	**$764,903**	**$945,420**	**$1,136,079**	**$1,337,328**	**$1,549,629**	**$1,773,464**	**$2,009,335**	**$2,257,761**	**$2,519,285**	**$2,794,469**	**$3,083,896**	**$3,388,174**	**$3,707,933**	**$4,043,828**	**$4,396,539**	**$4,766,774**	**$5,155,266**	**$5,562,778**	**$5,990,100**	**$6,438,056**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$3,141	$3,235	$3,332	$3,432	$3,535	$3,641	$3,750	$3,863	$3,979	$4,098	$4,221	$4,347	$4,478	$4,612	$4,751	$4,893	$5,040	$5,191	$5,347	$5,507	$5,672	$5,843	$6,018	$6,198	$6,384
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$12,563	$12,940	$13,328	$13,728	$14,139	$14,564	$15,000	$15,450	$15,914	$16,391	$16,883	$17,390	$17,911	$18,449	$19,002	$19,572	$20,159	$20,764	$21,387	$22,029	$22,690	$23,370	$24,071	$24,794	$25,537
$12,563	$12,940	$13,328	$13,728	$14,139	$14,564	$15,000	$15,450	$15,914	$16,391	$16,883	$17,390	$17,911	$18,449	$19,002	$19,572	$20,159	$20,764	$21,387	$22,029	$22,690	$23,370	$24,071	$24,794	$25,537
$146,564	**$150,961**	**$155,490**	**$160,155**	**$164,960**	**$169,908**	**$175,006**	**$180,256**	**$185,663**	**$191,233**	**$196,970**	**$202,879**	**$208,966**	**$215,235**	**$221,692**	**$228,343**	**$235,193**	**$242,249**	**$249,516**	**$257,002**	**$264,712**	**$272,653**	**$280,833**	**$289,258**	**$297,935**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 3 - Full Piping of Open Ditch, Gravity System

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$1,277,000	$0	$1,277,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$1,399,562		$0		
To Replace 50% of Proposed Facility		$2,799,124		$0		
To Replace 100% of Proposed Facility	$1,277,000	$5,598,248	$0	$0	$1,277,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$13,152		$0		
To Replace 50% of Proposed Facility		$26,303		$0		
To Replace 100% of Proposed Facility	$12,000	$52,607	$0	$0	$12,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$1,412,714**		**$0**		
To Replace 50% of Proposed Facility		**$2,825,427**		**$0**		
To Replace 100% of Proposed Facility	**$1,289,000**	**$5,650,855**	**$0**	**$0**	**$1,289,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$12,524	$12,524	$0	$0
To Replace 50% of Proposed Facility	$25,049	$25,049	$0	$0
To Replace 100% of Proposed Facility	$50,098	$50,098	$0	$0
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$6,638		$0	
To Replace 50% of Proposed Facility	$13,277		$0	
To Replace 100% of Proposed Facility	$26,553		$0	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$13,494		$0	
To Replace 50% of Proposed Facility	$26,989		$0	
To Replace 100% of Proposed Facility	$53,978		$0	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$28,254		$0	
To Replace 50% of Proposed Facility	$56,509		$0	
To Replace 100% of Proposed Facility	$113,017		$0	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$12,524
Years 26-50		$12,524
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$6,638
Year 25		$13,494
Year 50		$28,254

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$1,277,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$6,638	$6,838	$7,043	$7,254	$7,472	$7,696	$7,927	$8,164	$8,409	$8,662	$8,921	$9,189	$9,465	$9,749	$10,041	$10,342	$10,653	$10,972	$11,301	$11,640	$11,990	$12,349	$12,720	$13,101	$13,494
Interest		$0	$199	$410	$634	$870	$1,121	$1,385	$1,665	$1,959	$2,271	$2,598	$2,944	$3,308	$3,691	$4,094	$4,518	$4,964	$5,433	$5,925	$6,442	$6,984	$7,553	$8,151	$8,777	$9,433
End of Year Balance		**$6,638**	**$13,675**	**$21,128**	**$29,016**	**$37,358**	**$46,174**	**$55,486**	**$65,315**	**$75,683**	**$86,615**	**$98,135**	**$110,268**	**$123,041**	**$136,481**	**$150,616**	**$165,477**	**$181,094**	**$197,499**	**$214,726**	**$232,808**	**$251,782**	**$271,684**	**$292,555**	**$314,433**	**$337,360**
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$13,277	$13,675	$14,085	$14,508	$14,943	$15,391	$15,853	$16,329	$16,819	$17,323	$17,843	$18,378	$18,929	$19,497	$20,082	$20,685	$21,305	$21,944	$22,603	$23,281	$23,979	$24,699	$25,440	$26,203	$26,989
Interest		$0	$398	$821	$1,268	$1,741	$2,241	$2,770	$3,329	$3,919	$4,541	$5,197	$5,888	$6,616	$7,382	$8,189	$9,037	$9,929	$10,866	$11,850	$12,884	$13,968	$15,107	$16,301	$17,553	$18,866
End of Year Balance		**$13,277**	**$27,350**	**$42,256**	**$58,031**	**$74,715**	**$92,348**	**$110,972**	**$130,629**	**$151,367**	**$173,231**	**$196,271**	**$220,537**	**$246,082**	**$272,962**	**$301,233**	**$330,955**	**$362,189**	**$394,999**	**$429,451**	**$465,615**	**$503,563**	**$543,369**	**$585,109**	**$628,865**	**$674,720**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$26,553	$27,350	$28,171	$29,016	$29,886	$30,783	$31,706	$32,657	$33,637	$34,646	$35,686	$36,756	$37,859	$38,995	$40,164	$41,369	$42,610	$43,889	$45,205	$46,562	$47,958	$49,397	$50,879	$52,405	$53,978
Interest		$0	$797	$1,641	$2,535	$3,482	$4,483	$5,541	$6,658	$7,838	$9,082	$10,394	$11,776	$13,232	$14,765	$16,378	$18,074	$19,857	$21,731	$23,700	$25,767	$27,937	$30,214	$32,602	$35,107	$37,732
End of Year Balance		**$26,553**	**$54,700**	**$84,512**	**$116,062**	**$149,430**	**$184,696**	**$221,943**	**$261,259**	**$302,733**	**$346,462**	**$392,541**	**$441,073**	**$492,164**	**$545,924**	**$602,466**	**$661,909**	**$724,377**	**$789,997**	**$858,902**	**$931,231**	**$1,007,126**	**$1,086,737**	**$1,170,218**	**$1,257,730**	**$1,349,440**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916	$1,974	$2,033
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$3,000	$3,090	$3,183	$3,278	$3,377	$3,478	$3,582	$3,690	$3,800	$3,914	$4,032	$4,153	$4,277	$4,406	$4,538	$4,674	$4,814	$4,959	$5,107	$5,261	$5,418	$5,581	$5,748	$5,921	$6,098
Contracted Labor Costs		$1,500	$1,545	$1,591	$1,639	$1,688	$1,739	$1,791	$1,845	$1,900	$1,957	$2,016	$2,076	$2,139	$2,203	$2,269	$2,337	$2,407	$2,479	$2,554	$2,630	$2,709	$2,790	$2,874	$2,960	$3,049
Total O&M Expenses		**$62,000**	**$63,860**	**$65,776**	**$67,749**	**$69,782**	**$71,875**	**$74,031**	**$76,252**	**$78,540**	**$80,896**	**$83,323**	**$85,822**	**$88,397**	**$91,049**	**$93,781**	**$96,594**	**$99,492**	**$102,477**	**$105,551**	**$108,717**	**$111,979**	**$115,338**	**$118,798**	**$122,362**	**$126,033**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 3 - Full Piping of Open Ditch, Gravity System

	Input Cells - Assumed or Given Values
	Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$322,250**
25% Replacement	$322,250	$0	
50% Replacement	$644,500	$0	
100% Replacement	$1,289,000	$0	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$322,250**
25% Replacement	$322,250	$0	
50% Replacement	$644,500	$0	
100% Replacement	$1,289,000	$0	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,412,714
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,825,427
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,650,855
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$13,899	$14,316	$14,746	$15,188	$15,644	$16,113	$16,596	$17,094	$17,607	$18,135	$18,679	$19,240	$19,817	$20,411	$21,024	$21,655	$22,304	$22,973	$23,663	$24,372	$25,104	$25,857	$26,632	$27,431	$28,254
$10,121	$10,841	$11,596	$12,386	$13,214	$14,079	$14,985	$15,933	$16,923	$17,959	$19,042	$20,174	$21,356	$22,591	$23,881	$25,229	$26,635	$28,103	$29,636	$31,235	$32,903	$34,643	$36,458	$38,351	$40,324
$361,380	**$386,538**	**$412,879**	**$440,454**	**$469,311**	**$499,504**	**$531,085**	**$564,112**	**$598,642**	**$634,737**	**$672,459**	**$711,872**	**$753,045**	**$796,048**	**$840,953**	**$887,836**	**$936,776**	**$987,852**	**$1,041,150**	**$1,096,757**	**$1,154,764**	**$1,215,263**	**$1,278,353**	**$1,344,135**	**$0**
$27,798	$28,632	$29,491	$30,376	$31,287	$32,226	$33,193	$34,189	$35,214	$36,271	$37,359	$38,480	$39,634	$40,823	$42,048	$43,309	$44,608	$45,947	$47,325	$48,745	$50,207	$51,713	$53,265	$54,863	$56,509
$20,242	$21,683	$23,192	$24,773	$26,427	$28,159	$29,970	$31,865	$33,847	$35,919	$38,084	$40,348	$42,712	$45,183	$47,763	$50,457	$53,270	$56,207	$59,271	$62,469	$65,805	$69,286	$72,916	$76,701	$80,648
$722,760	**$773,075**	**$825,759**	**$880,908**	**$938,622**	**$999,007**	**$1,062,170**	**$1,128,224**	**$1,197,285**	**$1,269,474**	**$1,344,917**	**$1,423,744**	**$1,506,090**	**$1,592,096**	**$1,681,907**	**$1,775,673**	**$1,873,552**	**$1,975,705**	**$2,082,301**	**$2,193,515**	**$2,309,527**	**$2,430,526**	**$2,556,707**	**$2,688,271**	**$0**
$55,597	$57,265	$58,983	$60,752	$62,575	$64,452	$66,386	$68,377	$70,429	$72,541	$74,718	$76,959	$79,268	$81,646	$84,095	$86,618	$89,217	$91,893	$94,650	$97,490	$100,414	$103,427	$106,529	$109,725	$113,017
$40,483	$43,366	$46,385	$49,546	$52,854	$56,317	$59,940	$63,730	$67,693	$71,837	$76,168	$80,695	$85,425	$90,365	$95,526	$100,914	$106,540	$112,413	$118,542	$124,938	$131,611	$138,572	$145,832	$153,402	$161,296
$1,445,520	**$1,546,150**	**$1,651,518**	**$1,761,816**	**$1,877,245**	**$1,998,014**	**$2,124,340**	**$2,256,448**	**$2,394,570**	**$2,538,948**	**$2,689,834**	**$2,847,488**	**$3,012,181**	**$3,184,192**	**$3,363,813**	**$3,551,346**	**$3,747,103**	**$3,951,409**	**$4,164,602**	**$4,387,029**	**$4,619,054**	**$4,861,053**	**$5,113,414**	**$5,376,542**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$6,281	$6,470	$6,664	$6,864	$7,070	$7,282	$7,500	$7,725	$7,957	$8,196	$8,442	$8,695	$8,956	$9,224	$9,501	$9,786	$10,080	$10,382	$10,694	$11,014	$11,345	$11,685	$12,036	$12,397	$12,769
$3,141	$3,235	$3,332	$3,432	$3,535	$3,641	$3,750	$3,863	$3,979	$4,098	$4,221	$4,347	$4,478	$4,612	$4,751	$4,893	$5,040	$5,191	$5,347	$5,507	$5,672	$5,843	$6,018	$6,198	$6,384
$129,814	**$133,709**	**$137,720**	**$141,852**	**$146,107**	**$150,490**	**$155,005**	**$159,655**	**$164,445**	**$169,378**	**$174,459**	**$179,693**	**$185,084**	**$190,637**	**$196,356**	**$202,246**	**$208,314**	**$214,563**	**$221,000**	**$227,630**	**$234,459**	**$241,493**	**$248,737**	**$256,200**	**$263,886**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**
26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 3 - Full Lining of Open Ditch, Gravity System

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

ASSUMPTIONS:	PIPE/INFRASTRUCTURE	PUMPS/ELEC	OVERALL PROJECT
Estimated Capital Cost (Total Construction Cost[1]):	$944,000	$0	$944,000
Interest on Replacement Fund:			3.00%
Rate of Inflation:			3.00%
Life Cycle:	50 Years	25 Years	50 Years

SUMMARY OF REPLACEMENT COSTS:	PIPE/INFRASTRUCTURE		PUMPS/ELEC		OVERALL PROJECT	
	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]	CURRENT[2]	FUTURE[3]
Estimated Project Replacement Cost:						
To Replace 25% of Proposed Facility		$1,034,602		$0		
To Replace 50% of Proposed Facility		$2,069,204		$0		
To Replace 100% of Proposed Facility	$944,000	$4,138,407	$0	$0	$944,000	
Disposal and Removal Cost:						
To Replace 25% of Proposed Facility		$9,864		$0		
To Replace 50% of Proposed Facility		$19,728		$0		
To Replace 100% of Proposed Facility	$9,000	$39,455	$0	$0	$9,000	
Total Replacement Cost:						
To Replace 25% of Proposed Facility		**$1,044,466**		**$0**		
To Replace 50% of Proposed Facility		**$2,088,931**		**$0**		
To Replace 100% of Proposed Facility	**$953,000**	**$4,177,862**	**$0**	**$0**	**$953,000**	

REPLACEMENT FUND SUMMARY:	PIPE/INFRASTRUCTURE		PUMPS/ELEC	
	YEARS 1 - 25	YEARS 26 - 50	YEARS 1 - 25	YEARS 26 - 50
Annual Deposit Required (Assume Equal Deposit Made Each Year Through Life Cycle of Facility)				
To Replace 25% of Proposed Facility	$9,260	$9,260	$0	$0
To Replace 50% of Proposed Facility	$18,519	$18,519	$0	$0
To Replace 100% of Proposed Facility	$37,039	$37,039	$0	$0
Deposit Required at **Year 1** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$4,908		$0	
To Replace 50% of Proposed Facility	$9,816		$0	
To Replace 100% of Proposed Facility	$19,632		$0	
Deposit Required at **Year 25** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$9,977		$0	
To Replace 50% of Proposed Facility	$19,954		$0	
To Replace 100% of Proposed Facility	$39,907		$0	
Deposit Required at **Year 50** (Assume Deposits Increase at the Rate of Inflation):				
To Replace 25% of Proposed Facility	$20,889		$0	
To Replace 50% of Proposed Facility	$41,779		$0	
To Replace 100% of Proposed Facility	$83,557		$0	

OVERALL REPLACEMENT FUND SUMMARY:		
Component	Probable % Replaced	Life Cycle Years
Pipelines	25%	50
Well Supply/Pumping	100%	25
Annual Deposit Required (Equal Deposit Each Year)		
Years 1-25		$9,260
Years 26-50		$9,260
Annual Deposit Required (Deposits Increase at Rate of Inflation)		
Year 1		$4,908
Year 25		$9,977
Year 50		$20,889

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Capital Expenses:	**$944,000**																									
Replacement Expenses:																										
For 25% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pipeline and Infrastructure Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 25% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 50% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
For 100% Pump/Electrical Replacement		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$4,908	$5,055	$5,207	$5,363	$5,524	$5,690	$5,860	$6,036	$6,217	$6,404	$6,596	$6,794	$6,998	$7,207	$7,424	$7,646	$7,876	$8,112	$8,355	$8,606	$8,864	$9,130	$9,404	$9,686	$9,977
Interest		$0	$147	$303	$469	$644	$829	$1,024	$1,231	$1,449	$1,679	$1,921	$2,177	$2,446	$2,729	$3,027	$3,341	$3,670	$4,017	$4,381	$4,763	$5,164	$5,585	$6,026	$6,489	$6,974
End of Year Balance		**$4,908**	**$10,110**	**$15,621**	**$21,452**	**$27,620**	**$34,138**	**$41,022**	**$48,289**	**$55,955**	**$64,038**	**$72,555**	**$81,525**	**$90,968**	**$100,905**	**$111,356**	**$122,343**	**$133,889**	**$146,018**	**$158,754**	**$172,122**	**$186,150**	**$200,865**	**$216,295**	**$232,470**	**$249,421**
Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$9,816	$10,110	$10,414	$10,726	$11,048	$11,379	$11,721	$12,072	$12,434	$12,808	$13,192	$13,588	$13,995	$14,415	$14,847	$15,293	$15,752	$16,224	$16,711	$17,212	$17,729	$18,260	$18,808	$19,373	$19,954
Interest		$0	$294	$607	$937	$1,287	$1,657	$2,048	$2,461	$2,897	$3,357	$3,842	$4,353	$4,892	$5,458	$6,054	$6,681	$7,341	$8,033	$8,761	$9,525	$10,327	$11,169	$12,052	$12,978	$13,948
End of Year Balance		**$9,816**	**$20,221**	**$31,241**	**$42,904**	**$55,239**	**$68,276**	**$82,045**	**$96,579**	**$111,910**	**$128,075**	**$145,109**	**$163,050**	**$181,937**	**$201,810**	**$222,711**	**$244,686**	**$267,778**	**$292,035**	**$317,507**	**$344,245**	**$372,301**	**$401,730**	**$432,590**	**$464,941**	**$498,843**
Pipeline Pipeline and Infrastructure Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$19,632	$20,221	$20,827	$21,452	$22,096	$22,759	$23,441	$24,145	$24,869	$25,615	$26,383	$27,175	$27,990	$28,830	$29,695	$30,586	$31,503	$32,448	$33,422	$34,424	$35,457	$36,521	$37,617	$38,745	$39,907
Interest		$0	$589	$1,213	$1,874	$2,574	$3,314	$4,097	$4,923	$5,795	$6,715	$7,685	$8,707	$9,783	$10,916	$12,109	$13,363	$14,681	$16,067	$17,522	$19,050	$20,655	$22,338	$24,104	$25,955	$27,896
End of Year Balance		**$19,632**	**$40,442**	**$62,482**	**$85,809**	**$110,479**	**$136,552**	**$164,090**	**$193,157**	**$223,821**	**$256,150**	**$290,218**	**$326,100**	**$363,873**	**$403,619**	**$445,423**	**$489,371**	**$535,556**	**$584,071**	**$635,015**	**$688,490**	**$744,602**	**$803,460**	**$865,181**	**$929,881**	**$997,685**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 25% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 50% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Pump/Electrical Equipment Replacement Fund (For Funding Replacement of 100% of System):																										
Deposits		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
End of Year Balance		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Operating Expenses																										
Staff Salaries (Manager + Admin)		$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191	$53,757	$55,369	$57,030	$58,741	$60,504	$62,319	$64,188	$66,114	$68,097	$70,140	$72,244	$74,412	$76,644	$78,943	$81,312
Insurance		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Benefits		$8,500	$8,755	$9,018	$9,288	$9,567	$9,854	$10,149	$10,454	$10,768	$11,091	$11,423	$11,766	$12,119	$12,483	$12,857	$13,243	$13,640	$14,049	$14,471	$14,905	$15,352	$15,813	$16,287	$16,775	$17,279
Transportation Costs		$3,000	$3,090	$3,183	$3,278	$3,377	$3,478	$3,582	$3,690	$3,800	$3,914	$4,032	$4,153	$4,277	$4,406	$4,538	$4,674	$4,814	$4,959	$5,107	$5,261	$5,418	$5,581	$5,748	$5,921	$6,098
Utilities, Phones, Communications		$4,000	$4,120	$4,244	$4,371	$4,502	$4,637	$4,776	$4,919	$5,067	$5,219	$5,376	$5,537	$5,703	$5,874	$6,050	$6,232	$6,419	$6,611	$6,810	$7,014	$7,224	$7,441	$7,664	$7,894	$8,131
Maintenance, Small Repairs, Supplies		$5,000	$5,150	$5,305	$5,464	$5,628	$5,796	$5,970	$6,149	$6,334	$6,524	$6,720	$6,921	$7,129	$7,343	$7,563	$7,790	$8,024	$8,264	$8,512	$8,768	$9,031	$9,301	$9,581	$9,868	$10,164
Contracted Labor Costs		$1,500	$1,545	$1,591	$1,639	$1,688	$1,739	$1,791	$1,845	$1,900	$1,957	$2,016	$2,076	$2,139	$2,203	$2,269	$2,337	$2,407	$2,479	$2,554	$2,630	$2,709	$2,790	$2,874	$2,960	$3,049
Total O&M Expenses		**$66,000**	**$67,980**	**$70,019**	**$72,120**	**$74,284**	**$76,512**	**$78,807**	**$81,172**	**$83,607**	**$86,115**	**$88,698**	**$91,359**	**$94,100**	**$96,923**	**$99,831**	**$102,826**	**$105,911**	**$109,088**	**$112,361**	**$115,731**	**$119,203**	**$122,779**	**$126,463**	**$130,257**	**$134,164**
Pumping Power Expense		**$5,114**	**$5,267**	**$5,425**	**$5,588**	**$5,755**	**$5,928**	**$6,106**	**$6,289**	**$6,478**	**$6,672**	**$6,872**	**$7,078**	**$7,291**	**$7,509**	**$7,735**	**$7,967**	**$8,206**	**$8,452**	**$8,705**	**$8,967**	**$9,236**	**$9,513**	**$9,798**	**$10,092**	**$10,395**

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:
1) Total Construction Cost is from the Engineer's Opinion of Probable Costs, which includes construction costs and contingency
2) Current Cost is equal to the Engineer's opinion of the probable total field cost for the project at beginning of project life
3) Future cost is value at end of life cycle of the facility, or the current cost inflated at the rate shown through the life cycle of the facility

Cascade Orchards - Appraisal Study
Life Cycle Cost Analysis
Alternative 3 - Full Lining of Open Ditch, Gravity System

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Replacement Account Balance at end of Life Cycle Equal to Future Value of Replacement Cost

TOTAL REPLACEMENT COST SUMMARY: (ESTIMATED PRESENT VALUE OF REPLACEMENT COSTS THROUGH 50-YEAR LIFE OF OVERALL PROJECT)	**PIPE/ INFRA.**	**PUMPS**	**OVERALL PROJECT**
Probable % of Facility Replaced	25%	100%	
Life Cycle of Facility	50	25	
Assumes Equal Deposit Made to Replacement Fund Each Year:			
Overall (Per Probable % of Facility Replaced)			**$238,250**
25% Replacement	$238,250	$0	
50% Replacement	$476,500	$0	
100% Replacement	$953,000	$0	
Assumes Deposits to Replacement Fund Increase at Rate of Inflation:			
Overall (Per Probable % of Facility Replaced)			**$238,250**
25% Replacement	$238,250	$0	
50% Replacement	$476,500	$0	
100% Replacement	$953,000	$0	

26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,044,466
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,088,931
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,177,862
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$10,276	$10,584	$10,902	$11,229	$11,566	$11,913	$12,270	$12,638	$13,018	$13,408	$13,810	$14,225	$14,651	$15,091	$15,544	$16,010	$16,490	$16,985	$17,494	$18,019	$18,560	$19,117	$19,690	$20,281	$20,889
$7,483	$8,015	$8,573	$9,158	$9,769	$10,409	$11,079	$11,779	$12,512	$13,278	$14,078	$14,915	$15,789	$16,703	$17,656	$18,652	$19,692	$20,778	$21,911	$23,093	$24,326	$25,613	$26,955	$28,354	$29,813
$267,180	**$285,780**	**$305,255**	**$325,642**	**$346,977**	**$369,299**	**$392,649**	**$417,066**	**$442,596**	**$469,282**	**$497,171**	**$526,310**	**$556,751**	**$588,544**	**$621,744**	**$656,407**	**$692,589**	**$730,352**	**$769,757**	**$810,869**	**$853,755**	**$898,484**	**$945,129**	**$993,763**	**$0**
$20,552	$21,169	$21,804	$22,458	$23,132	$23,826	$24,541	$25,277	$26,035	$26,816	$27,621	$28,449	$29,303	$30,182	$31,087	$32,020	$32,980	$33,970	$34,989	$36,039	$37,120	$38,233	$39,380	$40,562	$41,779
$14,965	$16,031	$17,147	$18,315	$19,539	$20,819	$22,158	$23,559	$25,024	$26,556	$28,157	$29,830	$31,579	$33,405	$35,313	$37,305	$39,384	$41,555	$43,821	$46,185	$48,652	$51,225	$53,909	$56,708	$59,626
$534,360	**$571,560**	**$610,511**	**$651,284**	**$693,954**	**$738,599**	**$785,297**	**$834,133**	**$885,192**	**$938,564**	**$994,341**	**$1,052,621**	**$1,113,502**	**$1,177,089**	**$1,243,489**	**$1,312,813**	**$1,385,178**	**$1,460,703**	**$1,539,513**	**$1,621,737**	**$1,707,509**	**$1,796,968**	**$1,890,257**	**$1,987,527**	**$0**
$41,105	$42,338	$43,608	$44,916	$46,264	$47,652	$49,081	$50,554	$52,070	$53,632	$55,241	$56,898	$58,605	$60,364	$62,174	$64,040	$65,961	$67,940	$69,978	$72,077	$74,240	$76,467	$78,761	$81,124	$83,557
$29,931	$32,062	$34,294	$36,631	$39,077	$41,637	$44,316	$47,118	$50,048	$53,112	$56,314	$59,660	$63,157	$66,810	$70,625	$74,609	$78,769	$83,111	$87,642	$92,371	$97,304	$102,451	$107,818	$113,415	$119,252
$1,068,720	**$1,143,120**	**$1,221,021**	**$1,302,568**	**$1,387,909**	**$1,477,197**	**$1,570,594**	**$1,668,266**	**$1,770,384**	**$1,877,128**	**$1,988,683**	**$2,105,242**	**$2,227,004**	**$2,354,178**	**$2,486,978**	**$2,625,627**	**$2,770,356**	**$2,921,407**	**$3,079,027**	**$3,243,475**	**$3,415,019**	**$3,593,936**	**$3,780,515**	**$3,975,054**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
$83,751	$86,264	$88,852	$91,517	$94,263	$97,090	$100,003	$103,003	$106,093	$109,276	$112,554	$115,931	$119,409	$122,991	$126,681	$130,482	$134,396	$138,428	$142,581	$146,858	$151,264	$155,802	$160,476	$165,290	$170,249
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$17,797	$18,331	$18,881	$19,447	$20,031	$20,632	$21,251	$21,888	$22,545	$23,221	$23,918	$24,635	$25,374	$26,136	$26,920	$27,727	$28,559	$29,416	$30,298	$31,207	$32,144	$33,108	$34,101	$35,124	$36,178
$6,281	$6,470	$6,664	$6,864	$7,070	$7,282	$7,500	$7,725	$7,957	$8,196	$8,442	$8,695	$8,956	$9,224	$9,501	$9,786	$10,080	$10,382	$10,694	$11,014	$11,345	$11,685	$12,036	$12,397	$12,769
$8,375	$8,626	$8,885	$9,152	$9,426	$9,709	$10,000	$10,300	$10,609	$10,928	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,440	$13,843	$14,258	$14,686	$15,126	$15,580	$16,048	$16,529	$17,025
$10,469	$10,783	$11,106	$11,440	$11,783	$12,136	$12,500	$12,875	$13,262	$13,660	$14,069	$14,491	$14,926	$15,374	$15,835	$16,310	$16,799	$17,303	$17,823	$18,357	$18,908	$19,475	$20,059	$20,661	$21,281
$3,141	$3,235	$3,332	$3,432	$3,535	$3,641	$3,750	$3,863	$3,979	$4,098	$4,221	$4,347	$4,478	$4,612	$4,751	$4,893	$5,040	$5,191	$5,347	$5,507	$5,672	$5,843	$6,018	$6,198	$6,384
$138,189	**$142,335**	**$146,605**	**$151,003**	**$155,533**	**$160,199**	**$165,005**	**$169,955**	**$175,054**	**$180,306**	**$185,715**	**$191,286**	**$197,025**	**$202,936**	**$209,024**	**$215,294**	**$221,753**	**$228,406**	**$235,258**	**$242,316**	**$249,585**	**$257,073**	**$264,785**	**$272,729**	**$280,910**
$10,707	**$11,028**	**$11,359**	**$11,699**	**$12,050**	**$12,412**	**$12,784**	**$13,168**	**$13,563**	**$13,970**	**$14,389**	**$14,820**	**$15,265**	**$15,723**	**$16,195**	**$16,681**	**$17,181**	**$17,696**	**$18,227**	**$18,774**	**$19,337**	**$19,917**	**$20,515**	**$21,130**	**$21,764**
26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**