Staff Report

TO: Board of Directors

FROM: Doug Roderick, P.E., Director of Engineering

DATE: April 10, 2024

SUBJECT: Lower Cascade Canal and Upper Grass Valley Canal Tree
Health, Canopy Cover and Pond Monitoring Report – Year 10
(Project No. 6593-2)

ENGINEERING

RECOMMENDATION:

Informational item.   Receive presentation from Stantec to review the Lower
Cascade Canal and Upper Grass Valley Canal Tree Health, Canopy Cover, and
Pond Monitoring Report – Year 10.

BACKGROUND:

The District contracted with Stantec to facilitate environmental compliance with the
Mitigation Monitoring and Reporting Program (MMRP) with the Banner Cascade
Pipeline Project, which replaced the Lower Cascade Canal (LCC) and Upper
Grass Valley Canal (UGVC), which had reached capacity.

The District kept the canals in limited service with reduced flows and water levels
that were thought to have a negative effect on vegetation and wildlife adjacent to
the canals.   Due to damage caused since the last report, the UGVC has been
turned off since April 12, 2023.

The Environmental Impact Report specified mitigation measures that the District
develop long-term monitoring of riparian and ponded areas on a specific schedule.

Study Type	Duration	Frequency
1. Tree Health Assessment	10 years	Every 2 years
2. Canopy Cover Assessment	10 years	Every 4 years
3. Pond Study	10 years	Every 4 years

2021 is the eighth year since the pipeline was completed, and the flows were reduced in the LCC and UGVC canals. This monitoring cycle required the Tree Health Assessment, Canopy Cover Assessment, and Pond Study.

No action is necessary at this time. As this is the 10th year of the monitoring, this is the final monitoring report that will be prepared and presented to the Board.

BUDGETARY IMPACT:
No additional budget is necessary for this project as no additional monitoring or adaptive management actions are recommended .

DR

Attachments: (2)
- Banner Cascade Pipeline Project Tree Health, Canopy Cover, and Pond Monitoring Report
- PowerPoint Presentation

![Stantec](Stantec logo)

**Banner Cascade Pipeline Project
Tree Health, Canopy Cover, and
Pond Monitoring Report – Year 10**

Lower Cascade Canal, Upper Grass
Valley Canal, and DS Canal

March 6, 2024

Prepared for:

Nevada Irrigation District
1036 Main Street
Grass Valley, CA 95945

Prepared by:

Stantec Consulting Services Inc.
101 Providence Mine Road, Suite 202
Nevada City, CA 95959

This document entitled Banner Cascade Pipeline Project Tree Health, Canopy Cover, and Pond Monitoring Report – Year 10 was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Nevada Irrigation District (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by _____
(signature)

Meghan Oats, Botanist/Biologist

Technically Reviewed by _____
(signature)

Emily C. Eppinger, Wildlife Biologist

Senior Review by _____
(signature)

Bernadette Bezy, Principal Biologist/Regulatory Specialist

Table of Contents

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

Note: All figures are located at the end of the report.

LIST OF APPENDICES

Abbreviations

CEQA	California Environmental Quality Act
CFS	cubic feet per second
CRLF	California red-legged frog
DBH	diameter at breast height
FEIR	Final Environmental Impact Report
LCC	Lower Cascade Canal
MM	Mitigation Measure
NID	Nevada Irrigation District
Project	Banner Cascade Pipeline Project
Report	Lower Cascade Canal and Upper Grass Valley Canal Long Term Canopy Cover and Pond Studies Report
UGVC	Upper Grass Valley Canal

1.0 EXECUTIVE SUMMARY

As part of the Banner Cascade Pipeline Project (Project), Nevada Irrigation District (NID) developed a plan to implement three types of long-term ecological monitoring along the Lower Cascade Canal (LCC) and Upper Grass Valley Canal (UGVC). Within the Project's California Environmental Quality Act (CEQA) Final Environmental Impact Report (FEIR) Mitigation Monitoring and Reporting Program, NID developed Mitigation Measure (MM) 3.8-1: Monitor for Evidence of Dewatering Impacts to Riparian Habitats and MM 3.8-2: Prepare and Implement a Mitigation and Monitoring Program to determine Impacts to Special-Status Species Using Adjacent Seeps and Ponds (NID 2006). This report details the monitoring results for Year 10 as well as summarizes the results for the life of the monitoring study that took place from 2013 to 2023.

In 2023, NID implemented the Year 10 Canopy Assessment (which includes the Canopy Cover Assessment and Tree Health Assessment) and Pond Study monitoring along the LCC and UGVC. The 2013 Baseline (Year 0) to 2023 (Year 10) results are slightly variable with an overall small increase in tree health at the LCC sites while still remaining within the "good health" category[1]. There was a some dieback in trees at all sites, however the most dieback occurred at the DS Canal reference site, which did not have flows diverted to a pipeline. Per observations at the monitoring sites, the trees primarily died from mechanical removal (i.e., thinning), storm damage, and natural sessation due to competition. Therefore, the overall analysis concludes that after 10 years of flow reduction along the LCC and UGVC, the tree health is overall consistent with Baseline Year 0 surveys (prior to flow reductions) and the Year 0-10 findings along the DS Canal reference site (which did not receive flow reduction).

Similarly, pond area and depth have varied slightly over the monitoring period. However, Year 10 and Baseline Year 0 pond characteristics were similar in both the study sites and reference site.

Per MM 3.8-1 and MM 3.8-2, water replacement standards should be developed if it is apparent that canopy cover, tree health, and special-status species habitat has been lost as a result of disease, parasitism, and/or water stress caused directly from the reduced flow in the canal (NID 2006). Overall, over the past 10 years, the data show a relative consistency when compared to baseline (2013), pre flow reduction conditions and the unaltered DS Canal reference sites. Therefore, the reduced flow in the canal cannot be directly atributable to canopy cover loss, decreased riparian tree health, or significant decreased pond size (i.e., special-status species habitat). Last year, 2023, was the final year (Year 10) of the monitoring events for the Canopy Assessment and the Pond Study as a part of the CEQA required long-term ecological monitoring. This Canopy Cover and Pond Studies Report (Report) provides data and analysis for Monitoring Year 10, the final year of monitoring surveys, the data from which are provided in the context of the whole of the monitoring record (Years 0-10). Therefore, this report also is the 10 year

---

[1]The "good health" category or score that an evaluated tree receives has the following general parameters: partial to medium canopy cover, new growth present, minimal bark and leaf discoloration, no significant disease, normal surface growth, and little to some insect infestations/damage.

summary report, including final findings.Based on those findings, no additional monitoring or adaptive management actions are recommended.

v

2.0   INTRODUCTION

2.1   PROJECT DESCRIPTION

NID constructed the Project to help ensure reliable water deliveries to the areas of Grass Valley and Nevada City, as well as the Loma Rica and Elizabeth George Wastewater Treatment Plants in Nevada County, California. The Project replaced both the LCC and UGVC, which had reached capacity and no longer met the needs of the area. NID kept both the LCC and UGVC in service as historical, cultural, scenic, and recreational amenities, but with reduced flows. DS Canal is also located in Nevada City and maintained by NID. It is not part of the Project and therefore did not experience flow reductions as a result of the Project. Given its location parallel to the affected canals (LCC and UGVC), the DS Canal was utilized as a reference site.

In 2013, flows in LCC were reduced from approximately 45 to 5 cubic feet per second (CFS) as part of the Project. Branching from LCC, flows in the UGVC were reduced from 12 to 1 CFS as part of the Project. On April 12, 2023, the UGVC was turned off (i.e., 0 CFS) because they are no longer any customers on the UGVC. Flows in DS Canal have continued per normal operating conditions at rates averaging approximately 50 CFS during the summer (May−September) and 15 CFS during winter months (October−April) (Sindt, pers. comm. 2019; Larsen, pers. comm. 2024) (Graph 2-1). NID had available data from 2016-2023, as shown in Graph 2-1.

Graph 2-1   Canal Flow in Lower Cascade Canal and DS Canal, 2016−2023

Source: pers. com. Sue Sindt, NID 2019, Thor Larsen, NID 2024

1
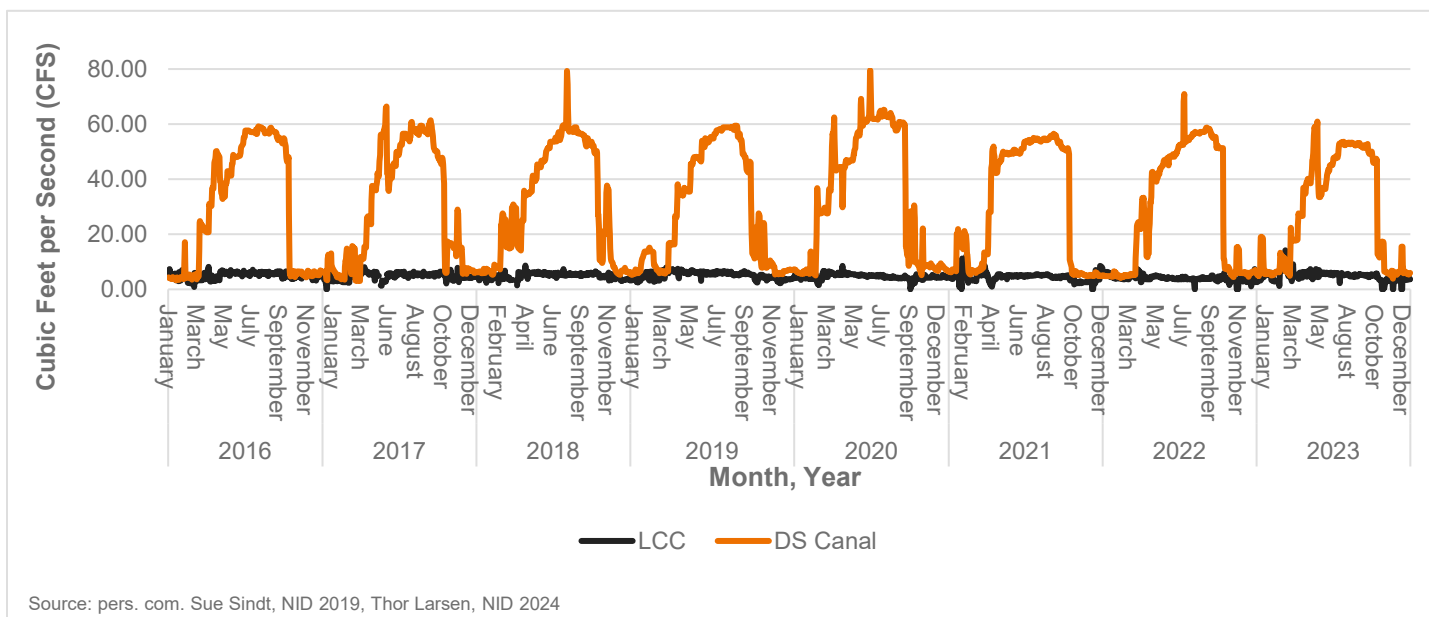
2.2   ENVIRONMENTAL SETTING

The LCC, UGVC, and DS Canal are located on Banner Mountain in Nevada County, California, in the western foothills of the Sierra Nevada mountain range at approximately 3,000 to 3,325 feet (920 to 1,010 meters) above mean sea level. These canals contain water diverted from Deer Creek above (LCC/UGVC) and below (DS Canal) Scotts Flat Reservoir (Figure 1 located at the end of this Report). The primary vegetation community present along all three canals is Sierran Mixed Conifer-Hardwood Forest, comprised of both upland and riparian, or wet-adapted (i.e., emergent, hydrophytic, mesic) plant species (Sawyer et al. 2009).

Over the course of the implementation of the Ten-Year Canopy Study Monitoring Plan (Appendix A) and the Ten-Year Pond Study Monitoring Plan (Appendix B), the climate has fluctuated in the region as noted by the temperature and overall precipitation in each water year. Water years (October−September) are designated by the calendar year in which it ends (i.e., Year 2013 represents the overall water during October 2012–September 2013). While the water years of 2014, 2015, 2018, 2020, 2021, and 2022 were considered drought conditions (i.e., there was an overall decrease in annual precipitation as well as a spike in overall seasonal temperatures), 2013, 2016, 2017, 2019, and 2023 experienced average to above-average rainfall (DWR 2023, NRCS 2023) (Table 2-1 and Table 2-2).

Table 2-1.   Water Year (October−September) Totals for the Project Region

Location/Water Year		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Nevada City, CA	Precipitation (inches)	56.8	37.6	37.1	62.8	103.8	49.9	76.6	35.9	29.1	45.7	66.7
	Percent of average	106%	70%	70%	118%	194%	93%	144%	67%	54%	86%	125%
Grass Valley, CA	Precipitation (inches)	47.2	33.9	32.1	55.7	95.9	48.0	68.2	32.7	25.0	46.9	68.0
	Percent of average	88%	63%	60%	104%	179%	89%	127%	61%	46%	87%	127%

Source: DWR 2023

2

Table 2-2. **Highest Temperatures for the Project Region**

Location/Calendar Year		2013	2014	2015	2016	2017	2018	2019	2020[2]	2021	2022	2023
Nevada City, CA	Temperature (degrees Fahrenheit)	98	99	98	99	101	99	94	–	98	107	102
	Percent of average	110%	112%	110%	112%	114%	112%	106%	–	110%	122%	115%
	Month of Occurrence	Jun	Jul	Jun/ Jul	Jul	Sept	Jul	Jul/ Aug	–	July	Sept	July
Grass Valley, CA	Temperature (degrees Fahrenheit)	100	98	99	99	102	98	104	101	105	108	101
	Percent of average	114%	112%	113%	113%	116%	112%	118%	115%	120%	124%	115%
	Month of Occurrence	Jun	Aug	Jul	Jul	Sept	Jul	Jul	Aug/ Sept	July	Sept	July

Source: NRCS 2023

2.3   PROJECT PURPOSE

Reducing flows in the LCC and UGVC reduces the wetted perimeter in each canal and the head on the remaining wetted perimeter. As identified in the Project's Draft Environmental Impact Report, this change in hydraulic conditions may reduce the amount of leakage and seepage from the canals and has the potential to impact the environment created and maintained by canal leakage over the years (NID 2004). Possible stress from the flow reductions could lead to increased susceptibility of riparian trees to disease and parasitism and, in turn, result in loss of trees, associated shade canopy, and habitat for common and special-status wildlife species. As such, the FEIR deemed it necessary to study the effects of the reduced flows on riparian vegetation adjacent to the affected canals (NID 2006). The purpose of NID's long-term monitoring is to evaluate and make interpretations based on potential observed changes in spatial and compositional land cover as canal flows decreased/were shifted to the Lower Cascade Pipeline.

---

[2]NRCS data not available for the Nevada City station for 2020.

3.0   METHODS

3.1   CANOPY COVER STUDY

3.1.1   Tree Health Assessment

A total of six representative Tree Health Assessment study sites were selected (Figure 1). The six Tree Health Assessment sites are comprised of four study sites along the LCC (Sites 1−4), one study site along UGVC[3] (Site 5), and one reference site along the DS Canal (Site 6). Representative sites were specifically selected based on vegetation type, areas suspected of maximum leakage (i.e., unlined stretches of the canal), and other associated riparian plant species that have the greatest potential to be adversely impacted by reductions in canal flows. Each study site is approximately 20 meters in length and includes riparian trees both downslope and upslope of the canals. However, the majority of the study trees are located downslope of the canal (Figure 2).

The Tree Health Assessment includes the following parameters (NID 2012):

- Evaluations of changes in vegetation patterns over time conducted along the impacted LCC and UGVC and the DS Canal reference site;

- Data collection within each of the appropriate study years in the late summer (August through October) when the trees are most water stressed, but prior to abscission or leaf shedding;

- Surveys completed by a qualified botanist and/or biologist; and

- Data collected for a total of 10 years, at 2-year intervals.

Surveys required for Baseline Year 0 (2013), Monitoring Year 2 (2015), Monitoring Year 4 (2017), Monitoring Year 6 (2019), and Monitoring Year 8 (2021) have been conducted and presented to the NID Engineering Committee and Board of Directors. Surveys conducted in Monitoring Year 10 (2023) are detailed in this Report. Monitoring Year 10 is the final survey and marks the completion of the monitoring effort required by MM 3.8-1: Monitor for Evidence of Dewatering Impacts to Riparian Habitats (NID 2012).

For Monitoring Year 10, visual inspections of previously tagged trees at the six study site locations were conducted by two qualified Stantec botanists on October 11−12, 2023, along the LCC (Sites 1−4), UGVC (Site 5), and DS Canal (Site 6). Diameter at breast height (DBH) and tree health was measured and evaluated using a variety of criteria, including the amount of canopy present, leaf and bark health, and presence of new growth, disease, parasites, and insect infestations (Appendix C). Normal seasonal variations were considered in overall health scoring. Data was documented in ArcGIS Collector, and general site conditions were also recorded. Photographs were taken to document site conditions and

---

[3]Due to limited suitable study sites, only one site was established along the UGVC.

4

trees assessed and are included in Appendix D Photo Record. Field datasheets and notes for Monitoring Year 10 are included in Appendix E.

3.1.2 Canopy Cover Assessment

A Canopy Cover Assessment (via Densiometer Analysis) was conducted as part of the Canopy Cover Study. Canopy data was collected in conjunction with the Tree Health Assessment data (i.e., within the same Ten-Year monitoring period) every four years- Years 0, 4, 8, and 10 (NID 2012). Like the Tree Health Assessment data collection period, Canopy Cover Assessment data collection occurred within each of the appropriate study years in the late summer (August through September).[4]

The Canopy Cover Assessment survey reaches were established along the same canal segments as the Tree Health Assessment sites. However, the Canopy Cover Assessment reaches do not directly correlate to the Tree Health Assessment study sites, but rather extend along the canal, in what we consider a "study reach". Canopy cover data was collected along each reach of (1) approximately seven miles of the LCC, (2) 0.5 mile of the UGVC, and (3) along one mile of the DS Canal as a reference site. Figure 3 shows each observation point along each canal where data was collected.

Canopy data for Monitoring Year 10 was collected on October 16−19, 2023, by a qualified Stantec Botanist. Observations were made using a densiometer and methods described in the Riparian Monitoring Procedures Section of the Clean Water Team Guidance Compendium for Watershed Monitoring and Assessment (SWRCB 2012), and the canopy cover monitoring protocols referenced in the Project Impact Assessment Workplan (NID 2012). Specifically, the densiometer method uses the Strickler modification (17-point) of a convex spherical densiometer to correct for overestimation of canopy density (thickness and consistency of plant foliage) that occurs with unmodified readings (Strickler 1959). Observations were made facing upstream, downstream, facing right bank, and facing left bank (i.e., north, south, east, and west to the greatest extent possible) of each canal. Each observation location was documented with an Arrow 100 GPS unit. During Year 4 monitoring, the Canopy Cover Assessments on the LCC (7-mile Reach) had less observation points from the previous monitoring Year 0 (Baseline 2013) due to the standardization of observation intervals (79 less observation points). During Year 8 and Year 10 monitoring (2021 and 2023), the same observation points were measured as the Year 4 (2017) location.

3.2 POND STUDY

The objective of the Pond Study was to evaluate whether reductions in canal flows (and associated subsurface leakage) within NID's LCC and the UGVC would result in negative impacts to sensitive habitats and species, specifically the federally threatened California red-legged frog (*Rana draytonii*, CRLF) (NID 2012). The ponds evaluated include two ponds located adjacent to the LCC (Pond 1 and

---

[4] The Canopy Cover Assessment interval specification in the Workplan outlines 5- year intervals for Canopy Cover Assessments; however, this is contradicted with a specification to occur every 2–4 years (i.e., 0, 4, 6, 10). Considering ongoing environmental conditions within the time frame of tree health and canopy studies (e.g., drought), to be complimentary to the Tree Health Assessments, and to increase study time and efficiency, it has been recommended and adopted as an adaptive management strategy to update the Canopy Cover Assessments to occur every 4 years with one final assessment to conclude the study on year 10 (i.e., 0, 4, 8, 10).

Pond 2) and one pond adjacent to the DS Canal (Pond 3), which serves at the control site (Figure 4). No ponds are located along the UGVC, and therefore, no ponds were evaluated for the Pond Study. The Pond Study is conducted every four years in conjunction with the Canopy Cover Study beginning in 2013. An evaluation also took place in Year 10 (2023), the final year of the study (NID 2012)[5]. Therefore, to date, the Pond Study has been conducted a total of four times and the final assessment took place in 2023. Similar to the tree health and canopy cover data collection period, data collection for the Pond Study occurred in the late summer, August through October[6].

On September 6, 2023, a qualified Stantec biologist conducted a habitat assessment at each of the three Pond Study sites. For each site, the previous years' study results were reviewed. The field habitat assessment included the collection of the following data parameters:

- Delineation of inundated area/ soil saturation
- Hydrology pattern(s)
- Estimated range of water depths
- Soil type(s) present
- Vegetation communities present
- Wildlife species observed
- California red-legged frog habitat assessment
- Site photos

---

[5]Ponds and/or seep wetlands that are located within 50 meters of the downslope side of the canals were targeted for pond study site locations. Sites were also targeted based on property access. Due to the lack of ponds/seep wetlands and access along the LCC, UGVC, and DS Canal, fewer than five seep wetlands/ponded areas were identified as originally targeted by the Workplan (NID 2012).

[6]Like the Canopy Cover Assessment, it was recommended as an adaptive management strategy to update the Pond Study to occur every 4 years with one final assessment to conclude the study on year 10 (Years 0, 4, 8, 10), which differs from the original Work Plan of conducting these surveys every 5 years.

6

4.0   RESULTS AND ANALYSIS

4.1   CANOPY COVER STUDY: TREE HEALTH ASSESSMENT

A total of 76 live riparian trees were assessed at the six study sites along the LCC, UGVC, and DS Canal. Riparian tree species surveyed included bigleaf maple (*Acer macrophylum*), Pacific dogwood (*Cornus nuttallii*), Oregon ash (*Fraxinus latifolia*), gray alder (*Alnus incana*), and white alder (*Alnus rhombifolia*), The species most surveyed were bigleaf maple and Pacific dogwood. Figure 2 shows the location and health category of each tree.

For the sites surveyed in 2023, there was overall normal to partial (50-100%) canopy coverage and the general bark health of surveyed trees was good, with minimal trees (0-25%) exhibiting bark sloughing. All sites exhibited some foliage discoloration from normal seasonal changes and abscission, the process of deciduous plants seasonally shedding leaves. Other observed foliage discolorations included spotting from potential disease (i.e., rust spots) and insect and herbivory damage (i.e. from plant-eating animals), which was extensive across all sites. Most trees exhibited new vascular growth of leaf buds, basal sprouts, or epicormic stems. Surface growths were mostly biological (e.g., moss, lichen, and fungi). There was very low occurrence of disease at all sites, with few trees exhibiting root rot or other visible diseases on trunks. In some cases, parasites were noted as vining species growing up the trunk and sometimes into the tree canopy, and included honeysuckle (*Lonicera hispidula*), Himalayan blackberry (*Rubus armeniacus*), English ivy (*Hedera helix*), California wild grape (*Vitis californica*), and poison oak (*Toxicodendron diversilobum*).

Riparian shrub and herbaceous species observed included Himalayan blackberry, cut-leaved blackberry (*Rubus laciniatus*), and English ivy. Upland habitats and species were also present at all study site locations. Upland overstory species included black oak (*Quercus kelloggii*), canyon live oak (*Quercus chrysolepis*), Douglas-fir (*Pseudotsuga menziesii*), beaked hazelnut (*Corylus cornuta*), incense cedar (*Calocedrus decurrens*), Pacific madrone (*Arbutus menziesii*), Ponderosa pine (*Pinus ponderosa*), and tanoak (*Notholithocarpus densiflorus*). Upland shrub species included coyote brush (*Baccharis pilularis*). Non-native and invasive species, including landscaping cultivars and grasses, have also encroached into the study sites from residences and roads along each of the canals.

The following sections outline the Tree Health Assessment findings for each study site and provide a comparison analysis for Tree Health Assessment data between study years (Baseline Year 0 and Monitoring Years 2, 4, 6, 8, and 10) and locations (LCC, UGVC, and DS Canal). Data collection varied slightly per year based on weather and drought conditions. Flow rates, climate (i.e., the region's precipitation and temperatures), and general botanical bloom and abscission periods were considered in the analysis.

The compiled tree health data for all LCC sites (Sites 1−4) yielded a relative score of 11 during the 2023 survey, and a relative score of 8 to 12 over the past 10 years. The tree health data for the UGVC site (Site 5) yielded a score of 10 during the 2023 survey, and a relative score of 8 to 11 over the past 10

years. The tree health data for the DS Canal reference site (Site 6) yielded a score of 11 during the 2023 survey and a relative score of 8 to 11 over the past 6 years. Overall, the tree health for all sites (including the DS Canal reference site) has been categorized as "good health", with the exception of LCC Site 4 that had a score of 12 in 2013 and again in 2023, which falls within the "excellent health" category. Refer to Appendix A for a detailed description of Assessment Descriptions and their associated Assessment Scores.

4.1.1   Site Specific Results and Analyses

4.1.1.1   Lower Cascade Canal Site 1 Results and Analyses

Monitoring Year 10

In Monitoring Year 10, 14 riparian trees were surveyed at Site 1 on the LCC on October 11, 2023, including bigleaf maple and Pacific dogwood. Four study trees were absent since the last survey largely due to tree thinning in the monitoring area (likely by landowners). Most trees surveyed had full to partial canopy cover and good bark health, and exhibited DBH growth, new growth, surface growths, some foliage discoloration, and insect damage. Disease and parasites were minimal at this site; however a few tree trunks were encroached by honeysuckle. Overall tree health at Site 1 was good, with a range of health scores from 8 to 14 and an average health score of 11 (Table 4-1, Graph 4-1).

General site conditions included down woody debris in the understory on both up and downslope portions of Site 1. As noted above, there was evidence of tree thinning in the monitoring area, as well as continuing thinning downslope from the monitoring area during the surveys. Various upland tree species are also present at Site 1, including Douglas-fir, beaked hazelnut, incense cedar, and Pacific madrone (Appendix F).

Monitoring Year Comparisons

Since Baseline Year 0, trees at Site 1 improved from partial to medium to full canopy cover, and bark health remained good. However, presence of insects increased from barely present at Site 1 to present in most trees. Presence of new growth greatly decreased from Baseline Year 0 to Monitoring Year 4 but made a substantial recovery in Monitoring Year 6 and sustained that into Monitoring Years 8 and 10. Surface growth remained highly prevalent, and diseases and parasites remained minimal across monitoring years. Two tree deaths were observed at Site 1 between Baseline Year 0 and 6, and three new trees were confirmed dead in Monitoring Year 8. In 2023, five tree deaths were confirmed. There was fuel reduction and tree thinning being conducted adjacent to the monitoring site in 2023; however, it appears that some of the trees included in the study were removed as well. In comparison with Monitoring Year 8, trees surveyed in Monitoring Year 10 exhibited overall increases in DBH and new growth. Overall tree health at Site 1 remains good since Baseline Year 0, oscillating on health between Monitoring Years 2 through 10 (Table 4-1, Graph 4-1). Although five more trees were found dead or were missing, the other surviving trees are showing better health at this site as compared to Monitoring Years 4 and 6 and the same health as Monitoring Year 8. The five trees that were missing/dead this past year were primarily due to the forest thinning project and had been removed.

Table 4-1.   Lower Cascade Canal Site 1 Tree Health Assessment Data

Site 1 Lower Cascade Canal						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/12	10/7	9/12	9/20	9/14	10/11
Trees Surveyed[1]	23	23	21	21	19	14
Tree Death[2]	0	1	1	0	3	5
Canopy Cover[3]	2	3	3	3	3	4
Bark Health	3	3	3	3	3	4
Overall Tree Health	10	10	8	9	11	11

[1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems were not included in final calculations).
[2]Number of new trees confirmed dead each year, not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

Graph 4-1   Lower Cascade Canal Site 1 Tree Health Assessment Data
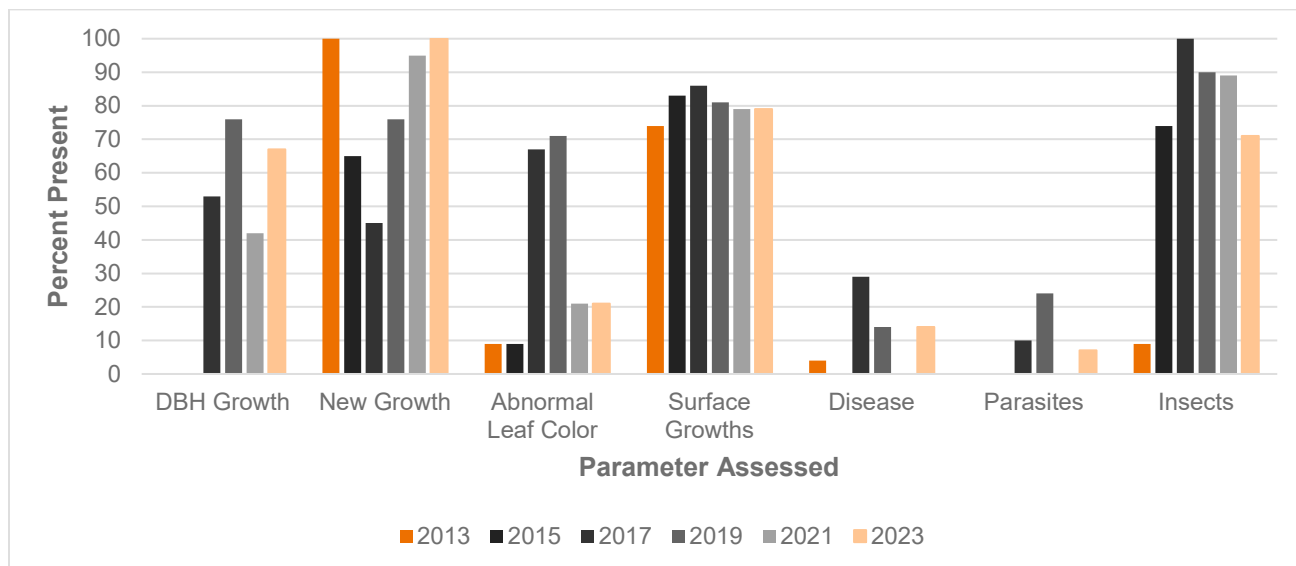
4.1.1.2 Lower Cascade Canal Site 2 Results and Analysis

Monitoring Year 10

During Year 10 monitoring, 13 riparian trees were surveyed at Site 2 on the LCC on October 12, 2023. Tree species surveyed include bigleaf maple, gray alder, and Pacific dogwood. No new trees were found dead. Most trees surveyed had full to partial canopy cover and good bark health, and exhibited new growth, surface growths, and insect damage and infestation. Disease was minimal at this site, but approximately half the trees surveyed exhibited foliage discoloration and parasites such as honeysuckle and Himalayan blackberry on trunks and branches. Overall tree health at Site 2 is good, with a range of health scores from 7 to 13 and an average health score of 11 (Table 4-2, Graph 4-2).

9

General site conditions included excessive encroachment by non-native understory species (e.g., Himalayan blackberry), as noted in previous years. Mechanical removal of upslope study trees in 2018 and installation of fencing by private landowners rendered the upslope portion of the site inaccessible. . As such, the upslope trees are no longer a part of the study. Drainage fed by the LCC and rainfall/runoff was observed near trees surveyed downslope of the LCC; water was present at the time of the survey this year. Various upland tree species are also present at Site 2, including black oak, beaked hazelnut, and incense cedar.

Monitoring Year Comparisons

Since Baseline Year 0, canopy cover of trees at Site 2 remained consistent, and bark health varied over the years but remained in the good health category in Monitoring Year 8. DBH growth has steadily declined since Baseline Year 0 and then was consistent between Monitoring Years 8 and 10, however new growth has oscillated over the years and increased in Monitoring Years 8 and 10. Abnormal leaf color and parasites decreased during Monitoring Year 10, however surface growths, diseases, and insect presence increased. Only one tree death was observed at Site 2 since Baseline Year 0, and no new trees were confirmed dead in Monitoring Year 10. In comparison with Monitoring Year 8, trees surveyed in Monitoring Year 10 exhibited consistent DBH growth and new growth, and less abnormal leaf color and parasites. However, there was an increased presence of surface growth, disease, insects and insect damage. Overall tree health at Site 2 remains good since Baseline Year 0, with a slight decrease between Monitoring Years 2 through 6 (Table 4-2, Graph 4-2), but increasing in Monitoring Years 8 and 10.

Table 4-2.   Lower Cascade Canal Site 2 Tree Health Assessment Data

| Site 2 LCC						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/11	10/6	9/8	10/17	9/15	10/12
Trees Surveyed[1]	20	21	20	12	13	13
Tree Death[2]	0	1	0	0	0	0
Canopy Cover[3]	3	3	3	3	3	3
Bark Health	3	3	3	2	3	3
Overall Tree Health	10	10	9	8	10	10

[1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems were not included in final calculations).
[2]Number of new trees confirmed dead each year, not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

10

Graph 4-2.   Lower Cascade Canal Site 2 Tree Health Assessment Data
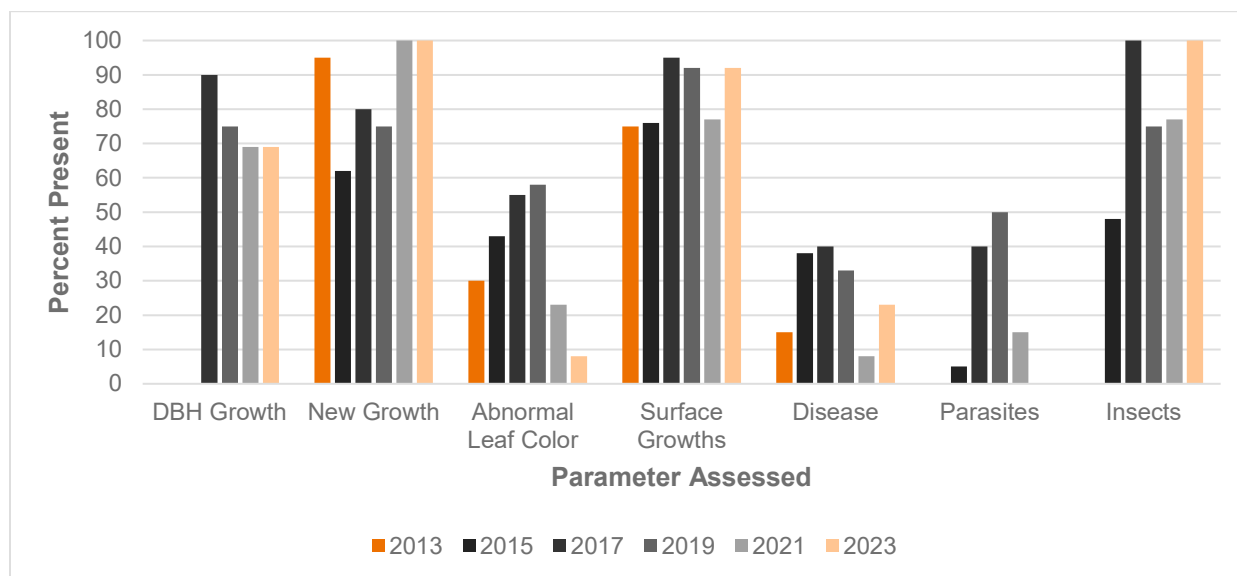
4.1.1.3 Lower Cascade Canal Site 3 Results and Analysis

Monitoring Year 10

During Monitoring Year 10, 20 riparian trees were surveyed at Site 3 on the LCC on October 12, 2023. Tree species surveyed include bigleaf maple, gray alder, and Pacific dogwood. No new trees were found dead. Most trees surveyed had full to partial canopy cover and good bark health. Trees exhibited some surface growth, in the presence of and insect damage and infestation. The trees exhibited new growth. Disease amongst some of the trees was observed at this site, in addition to presence of parasites. Additionally, California wild grape and English ivy were present on several tree trunks and branches. Some abnormal leaf color was observed. Overall tree health at Site 3 was good, with a range of health scores from 4 to 14 and an average health score of 10 (Table 4-3, Graph 4-3).

General site conditions included encroachment by non-native and invasive understory species that also were vining up the tree trunks (e.g., English ivy). Various upland tree species are also present at Site 3, including Douglas-fir and incense cedar.

Monitoring Year Comparisons

Since Baseline Year 0, trees at Site 3 improved from partial to medium canopy cover, as well as fair to good bark health. However, between Monitoring Year 6 and Monitoring Year 8, more disease was detected throughout the trees and it was consistent from Monitoring Year 8 and Monitoring Year 10. The presence of new growth declined over the years but rebounded in Monitoring Year 8 and Monitoring Year 10, and parasites declined as compared to the last monitoring year. Presence of insects also increased from barely present at Site 3 to present in a majority trees, and the prevalence of insect damage oscillates from Monitoring Year 6 to Monitoring Year 10. Surface growths remained highly and

consistently prevalent, although slightly decreased in Monitoring Year 8 and stayed consistent in Year 10. No tree deaths were observed at Site 3 since Baseline Year 0. In comparison with Monitoring Year 8, trees surveyed in Monitoring Year 10 exhibited a reduction in parasites. The trees surveyed exhibited less growth in DBH and a greater presence of abnormal leaf color and insect damage. There was consistence between new growth, surface growth, and disease between Monitoring Year 8 and Monitoring Year 10. Overall tree health at Site 3 remained consistently good in Monitoring Year 10 (Table 4-3, Graph 4-3).

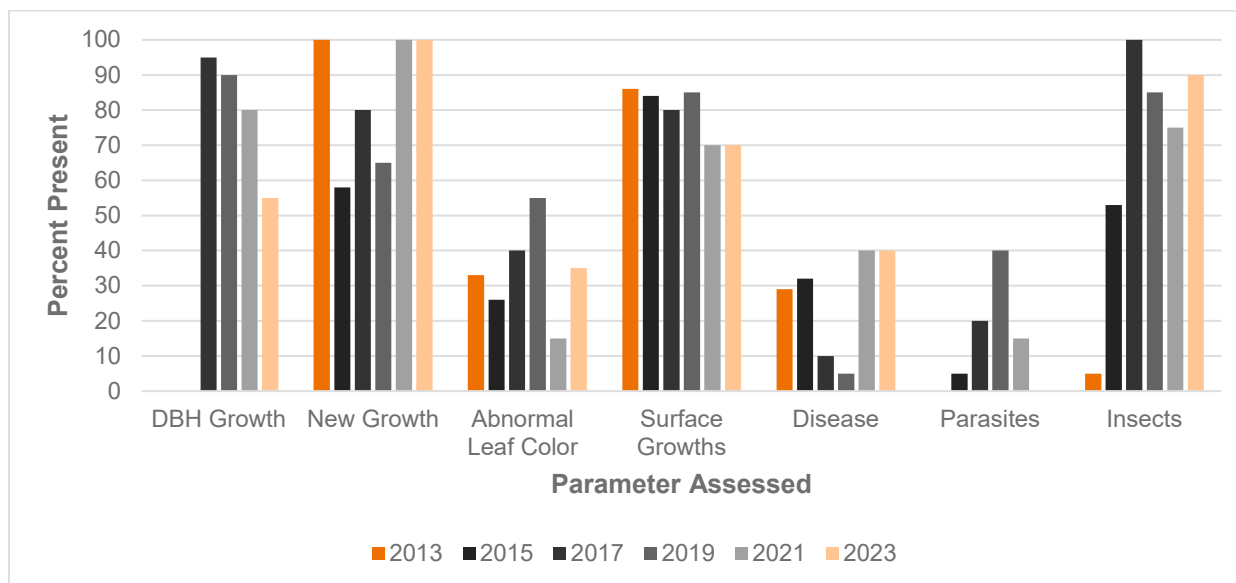**Table 4-3.   Lower Cascade Canal Site 3 Tree Health Assessment Data**

Site 3 LCC						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/11	10/8	9/8	10/17	9/15	10/12
Trees Surveyed[1]	21	19	20	20	20	20
Tree Death[2]	0	0	0	0	0	0
Canopy Cover[3]	2	3	3	3	3	3
Bark Health	2	3	3	3	3	3
Overall Tree Health	9	9	9	8	10	10

[1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems were not included in final calculations).
[2]Number of new trees confirmed dead each year; not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

Graph 4-3.   Lower Cascade Canal Site 3 Tree Health Assessment Data

4.1.1.4 Lower Cascade Canal Site 4 Results and Analysis

Monitoring Year 10

During Year 10 monitoring, 17 riparian trees were surveyed at Site 4 on the LCC on October 11, 2023.
Tree species surveyed include bigleaf maple, gray alder, and Oregon ash. Two study trees were found
dead. Most of the trees surveyed exhibited insect damage and infestation. On average, trees surveyed
had full to partial canopy cover and good bark health, and over half the trees surveyed exhibited new
growth. Disease, abnormal foliage discoloration, surface growth, and parasites were minimal at this site,
though English ivy and root rot were present on some tree trunks. Overall tree health at Site 4 is good,
with a range of health scores from 9 to 13 and an average health score of 12 (Table 4-4, Graph 4-4).

General site conditions included beaked hazelnut, thimbleberry (*Rubus parviflorus*), and poison oak.
Various upland tree species are also present at Site 4, including black oak, Douglas-fir, incense cedar,
and tanoak.

Monitoring Year Comparisons

Since Baseline Year 0, trees at Site 4 remained consistent in partial to full canopy cover and good bark
health. However, presence of new growth declined but then rebounded to the same rate in Monitoring
Year 10. Insects increased from barely present at Site 4 to present in most to all trees. Surface growths,
abnormal leaf color, diseases, and parasites remained low but also generally increased since Baseline
Year 0. In comparison with Monitoring Year 8, trees surveyed in Monitoring Year 10 exhibited
improvements in the presence of new growth and parasites, but also exhibited slightly less evidence of
DBH growth and slightly more insect damage. Overall tree health at Site 4 decreased from excellent to
good since Baseline Year 0, but rebounded to excellent in Monitoring Year 10 (Table 4.4, Graph 4-4).

Table 4-4.   Lower Cascade Canal Site 4 Tree Health Assessment Data

| Site 4 LCC						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/11	10/6	9/12	9/20	9/14	10/11
Trees Surveyed[1]	18	21	19	18	19	17
Tree Death[2]	0	0	0	1	0	2
Canopy Cover[3]	3	3	3	3	3	3
Bark Health	3	3	3	3	3	4
Overall Tree Health	12	11	9	9	10	12

[1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems
were not included in final calculations).
[2]Number of new trees confirmed dead each year, not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

13

Graph 4-4.   Lower Cascade Canal Site 4 Tree Health Assessment Data
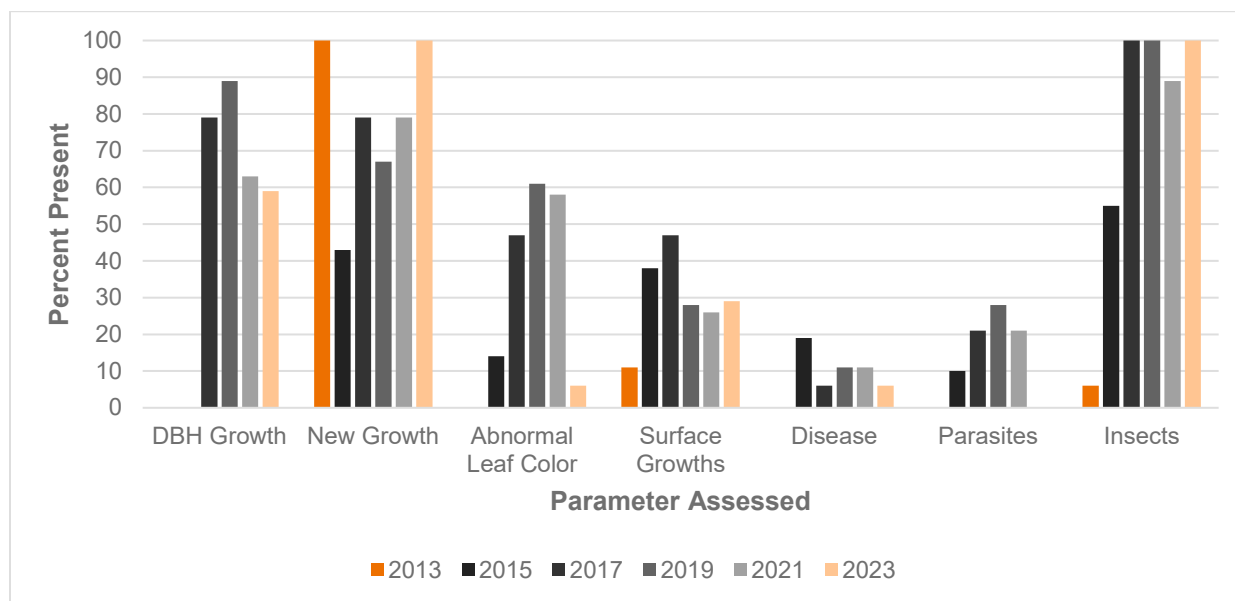
4.1.1.5 Upper Grass Valley Canal Site 5 Results and Analysis

Monitoring Year 10

During Year 10 monitoring, three riparian trees were surveyed at Site 5 on the UGVC on October 16, 2023. Tree species surveyed include bigleaf maple, Pacific dogwood, and white alder. One additional tree appeared to have been mechanically removed due to a tree thinning project. All trees surveyed exhibited insect damage and infestation, but also new growth. Most trees surveyed exhibited full to partial canopy cover, excellent bark health, and no disease. There was no presence of abnormal foliage discoloration. Parasitic honeysuckle was present on some tree trunks and adjacent saplings. Mechanical damage to trees from roadside tree-trimming was observed, as well as new growth of various riparian tree species saplings within the site. Overall tree health at Site 5 is good, with a range of health scores from 9 to 12 and an average health score of 10 (Table 4-5, Graph 4-5).

General site conditions included some mechanical damage to trees due to proximity to the road. Various upland tree species are also present at Site 5, including black oak and incense cedar.

Monitoring Year Comparisons

Since Baseline Year 0, trees at Site 5 exhibited oscillating canopy cover and bark health, though bark health remained steady in Monitoring Year 10 and canopy cover slightly decreased. From Monitoring Years 8 to 10, canopy cover decreased to partial canopy and bark health remained excellent. DBH growth slightly decreased and there was an increase in surface growth. Diseases, abnormal leaf color, and parasites were absent from this site with some fluctuations in presence over the years. The presence of new growth has oscillated greatly since Baseline Year 0 (with an increase in Monitoring Year 8 and

consistent in Monitoring Year 10), and surface growths and insects remained highly prevalent and present in a majority to all trees. There was an increase in trees that were mechanically removed at Site 5 since Baseline Year 0, with two trees confirmed missing in Monitoring Year 8 and one more tree removed in Monitoring Year 10. Overall tree health at Site 5 remains good since Baseline Year 0, oscillating in health over the years and slightly increasing in health since Baseline Year 0 (Table 4-5, Graph 4-5). Through the study, this site continued to have mechanical removal of trees, and therefore became more difficult to monitor the overall health of the riparian trees. By Monitoring Year 10, only three trees originally assessed in Year 0 remained.

Table 4-5.   Upper Grass Valley Canal Site 5 Tree Health Assessment Data

Site 5 UGVC						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/10	10/7	9/7	10/17	9/15	10/16
Trees Surveyed[1]	8	7	6	6	4	3
Tree Death[2]	0	1	0	0	2	1
Canopy Cover[3]	2	3	4	3	3	2
Bark Health	2	3	4	3	4	4
Overall Tree Health	9	8	11	10	10	10

 [1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems were not included in final calculations).
[2]Number of new trees confirmed dead each year, not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

Graph 4-5.   Upper Grass Valley Canal Site 5 Tree Health Assessment Data
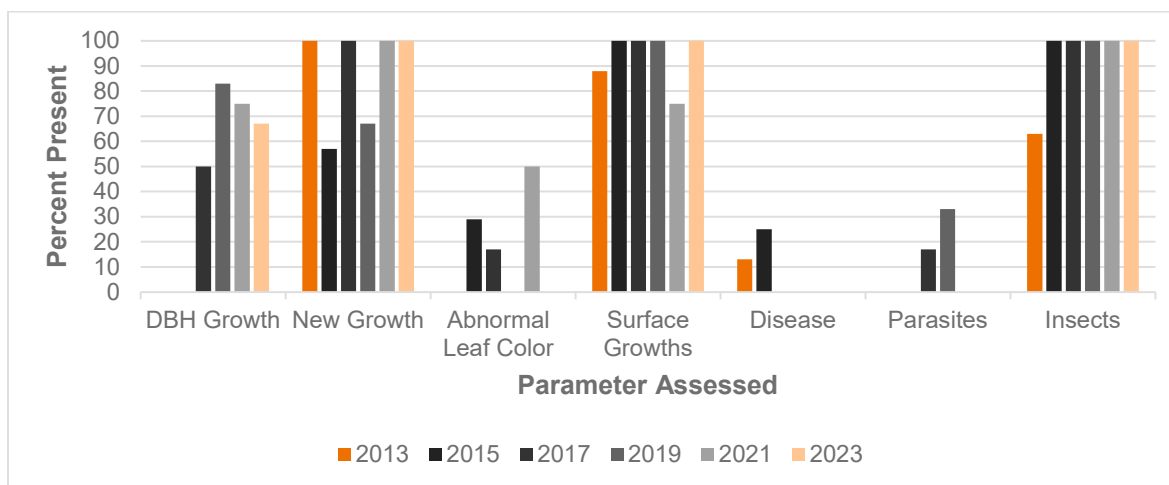
4.1.1.6   DS Canal (Reference Site) Site 6 Results and Analysis

Monitoring Year 10

During Year 10 monitoring, 10 riparian trees were surveyed at the reference site, Site 6, on the DS Canal on October 12, 2023. Tree species surveyed include bigleaf maple, gray alder, and Pacific dogwood. Due

15

to some heavy snowfall in February 2023, there was excessive down trees at this site. It appeared that three of the study trees had been crushed by other fallen trees. A majority of trees surveyed exhibited insect damage and infestation, new growth, full canopy cover, and good bark health was also observed in most trees. Foliage discoloration and surface growth was observed on approximately half to less than half of the trees surveyed. There was moderate disease and little parasitic presence observed, though there was some root rot and parasitic honeysuckle present on some tree trunks and branches, similar to previous years. Overall tree health observed at Site 6 was good, with a range of health scores from 8 to 13 and an average health score of 11 (Table 4-6, Graph 4-6).

General site conditions included multiple down large woody debris from the previous winter's snowfall, and vining plant encroachment on tree trunks primarily by honeysuckle. Various upland tree species are also present at Site 6, including Douglas-fir, incense cedar, and Ponderosa pine.

Monitoring Year Comparisons

Since Baseline Year 0, trees at Site 6 exhibited improvements in canopy cover and bark health. However, abnormal leaf color, surface growths, parasites, and insects increased since Baseline Year 0, though observations of all dropped in Monitoring Year 8, with a slight increase in Monitoring Year 10. Presence of new growth also greatly decreased from Baseline Year 0 to Monitoring Year 2 but recovered to baseline by Monitoring Year 6 and increased in Monitoring Year 8 and again in Monitoring Year 10. In comparison with Monitoring Year 8, trees surveyed in Monitoring Year 10 exhibited improvements in the presence of new growth, abnormal leaf color, bark health, and canopy cover, but the presence of surface growth, disease, and parasites increased slightly. Overall tree health at Site 6 remained consistently good between Baseline Year 0 through Monitoring Year 10. The health score decreased slightly during Monitoring Year 4 but recovered to baseline health scores by Monitoring Year 8 and even improved slightly in Monitoring Year 10 (Table 4-6, Graph 4-6).

Table 4-6.   DS Canal Site 6 Tree Health Assessment Data

| Site 6 DS Canal						
Monitoring Year	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Survey Date	9/10	10/7	9/15	10/18	9/16	10/12
Trees Surveyed[1]	22	20	14	13	13	10
Tree Death[2]	0	3	2	1	0	3
Canopy Cover[3]	2	3	4	3	3	4
Bark Health	2	3	3	3	3	4
Overall Tree Health	10	10	8	10	10	11

[1]Tree Heath Assessment criteria values are averages of all individual live trees surveyed per site (dead stems were not included in final calculations).
[2]Number of new trees confirmed dead each year, not cumulative.
[3]Individual tree foliage cover values, not total canopy cover as assessed in the canopy cover study.

16

Graph 4-6.   DS Canal Site 6 Tree Health Assessment Data
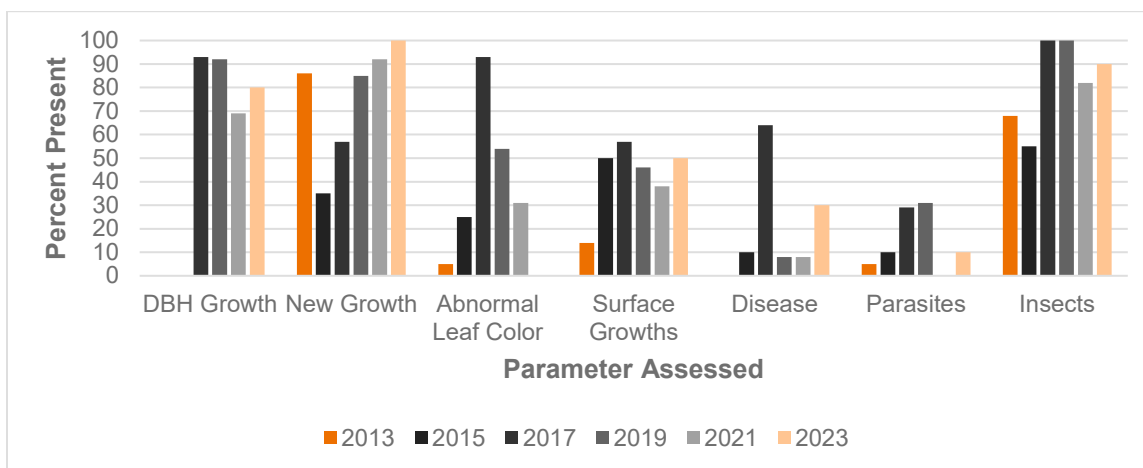
4.1.2   Site Comparisons

Overall tree health at Sites 2 and 4 on the LCC increased from Monitoring Years 8 to 10 (Graph 4-7). Overall tree health at Sites 1 and 3 on the LCC was consistent from Monitoring Years 8 to 10. Health on the UGVC and DS Canal were consistent and even slightly increased between Monitoring Years 8 and 10. The overall tree health is higher at Site 4 than any of the other sites. Slightly decreased growth in DBH as compared to previous years was the only negative factor amongst the sites in Monitoring Year 10 as compared to previous years. Otherwise, canopy cover remained consistent at all sites, so it can be concluded that associated riparian shade canopy remains intact. There was a slight decrease in Canopy Cover along the UGVC but it is still consistent with Baseline Monitoring Year 0. There has been some limb trimming on those trees due to the adjacency to the roadway (UGVC runs parallel to Banner Lava Cap Road). There was minimal loss of riparian tree species along the LCC study sites the first 8 years of the study; however, due to tree thinning and a heavy winter storm in early 2023, there were more riparian tree deaths in Monitoring Year 10 than the last 8 years combined. From Monitoring Year 0 to 8, there were seven total confirmed tree deaths (primarily at LCC Site 1) out of 84 trees total amongst the sites for the duration of the study. This year (differing from the previous 8 years), more trees were mechanically removed and/or crushed by fallen conifers. There was a total of eight tree deaths during Monitoring Year 10 (five of which occurred at Site 1). It can be concluded (due to observed factors and comparing to that of the reference site) that the tree deaths were due to outside affects, not as a result of the lowered flows in the canal. Despite the increase in tree death, the remaining trees had a 100 percent rate of new growth observations (i.e., riparian forest regeneration) rebounding to baseline levels.

Overall tree health at Site 5 on the UGVC is consistent from Monitoring Year 8 to 10, and greater than Baseline Year 0 (Graph 4-7). In Monitoring Year 10, overall tree health at Site 5 was consistent with LCC Site 3 and only slightly lower than LCC Site 1, 2, 4, and Site 6 on the DS Canal. Unfortunately, two of the trees had been removed since Monitoring Year 6 likely for road maintenance purposes and then another tree had been removed by a landowner since Monitoring Year 8 on the uphill side of the canal. There was consistency in overall bark health, presence of new growth, and a decreased presence of abnormal leaf

color that contributed to the consistent overall health at Site 5. However, Monitoring Year 10 showed an increase in surface growth and consistent presence of insects and insect infestation. Canopy cover decreased slightly from Monitoring Year 8 to 10 but was overall consistent with Baseline Year 0, so it may be concluded that associated riparian shade canopy remains intact of the trees that remain along the canal.

Overall tree health at DS Canal slightly increased from Monitoring Year 8 to 10, and also increased slightly from baseline overall health levels (Graph 4-7). In Monitoring Year 10, overall tree health at Site 6 was consistent with Sites 1 and 2 on the LCC and slightly higher than at LCC Site 3 and UGVC Site 5. It had slightly lower tree health than at LCC Site 4. Increased presence of new growth, canopy cover, bark health, and a decrease of abnormal leaf color on the trees are the primary drivers leading to increased overall health at Site 6. Canopy cover and bark health generally increased from Baseline Year 0, so it may be concluded that associated riparian shade canopy remains intact. Over the past 10 years, there was a moderate loss of riparian tree species at Site 6, with nine total confirmed tree deaths out of 22 trees. Site 6 had a high loss of trees (three in total) in 2023 due to large conifers falling on the smaller riparian trees as a result of storm damage from a heavy snowfall in February 2023.

Graph 4-7.   Average Overall Tree Health Scores[7] by Study Site

---
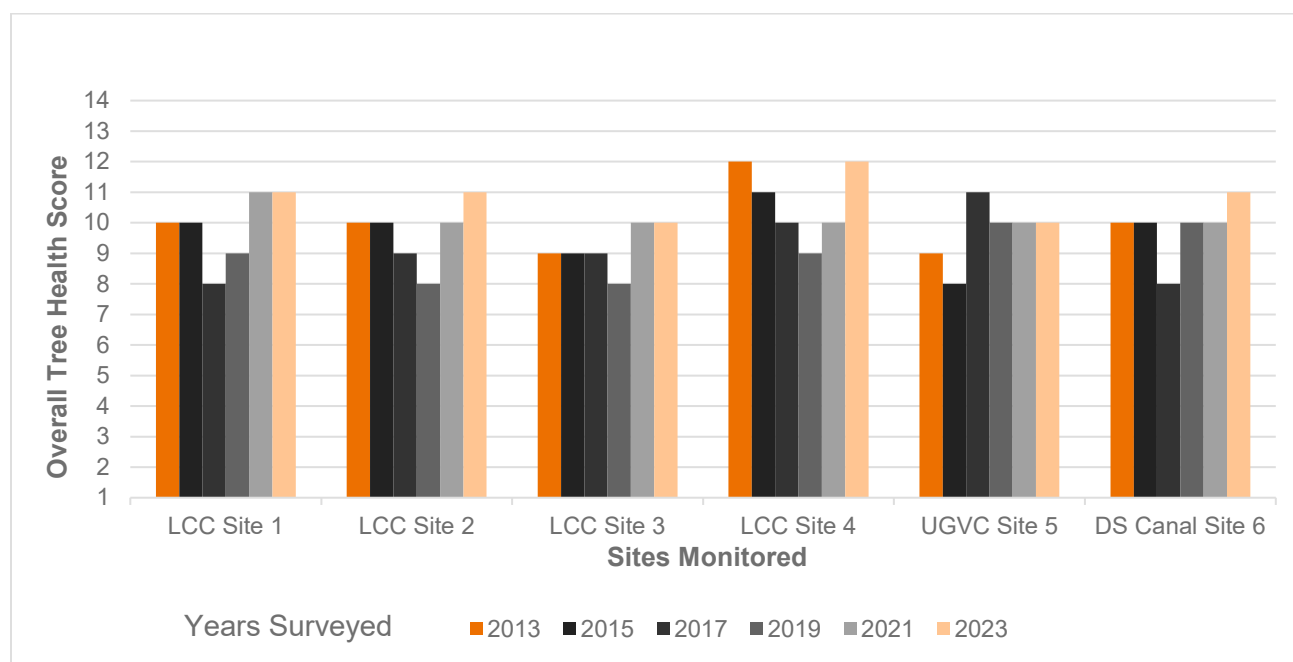
[7] Health scores: 1-4, poor health; 5-7, fair health; 8-11, good health; 12-14, excellent health.

18

4.2   CANOPY COVER STUDY: CANOPY COVER ASSESSMENT

Monitoring Year 10 (2023) Canopy Cover Assessment data was collected on October 16−19 for each assessment reach. Data collection and canopy density percentages were calculated based on methods and formulas for calculating the density of the canopy described in the *Use of the Densiometer to Estimate Density of Forest Canopy on Permanent Sample Plots* (Strickler 1959). The following results average and summarize the overall canopy cover data densiometer readings collected on each canal reach during Monitoring Year 10 monitoring. Baseline Year 0, Monitoring Year 4, and Monitoring Year 8 have also been provided. A compiled data summary of Canopy Cover Assessment metrics has been provided below in Table 4.7. The locations of the observation points can be referenced in Figure 3.

4.2.1   Canopy Cover Assessment Results

4.2.1.1   LCC Canopy Cover Assessment Results

An approximate 7-mile reach of the LCC was sampled for Canopy Cover Assessment in Year 8 monitoring. A total of 273 canopy cover densiometer observation points were identified and collected. The LCC canopy cover ranges from a minimum density of zero to a maximum density of 100 percent. The average density of canopy cover along the LCC Reach was 82.7 percent, therefore yielding medium to high canopy cover.

4.2.1.2   Upper Grass Valley Canal Canopy Cover Assessment Results

An approximate 0.5-mile reach of the UGVC was sampled for Canopy Cover Assessment in Year 10 monitoring. A total of 27 canopy cover densiometer observation points were identified and collected. The UGVC canopy cover ranges from a minimum density of 64.6 percent to a maximum density of 92.7 percent. The average density of canopy cover along the LCC was 76.7 percent, therefore yielding medium to full canopy cover.

4.2.1.3   DS Canal (Reference Site) Canopy Cover Assessment Results

An approximate one-mile reach of the DS Canal was sampled as a control for Canopy Cover Assessment in Year 10 monitoring. Canopy cover data was collected at a total of 85 observation points with a densiometer along approximately one mile of the canal. The DS Canal canopy cover ranges from a minimum density of 16.7 to a maximum density of 100 percent. The average density of canopy cover along the DS Canal reach was 63.1 percent, yielding medium canopy cover.

19

Table 4-7.   Canopy Cover Assessment Results

	LCC				UGVC				DS Canal (Reference Site)			
	2013	2017	2021	2023	2013	2017	2021	2023	2013	2017	2021	2023
Survey Date(s)	9/19; 9/30	9/19; 9/22	9/10; 9/15	**10/17; 10/18**	9/10	9/22	9/15	**10/16**	9/10	9/15; 9/22	9/16	**10/19**
Study Reach Length (miles)	7	7	7	**7**	0.5	0.5	0.5	**0.5**	1	1	1	**1**
Total Observation Points	351	272	273	**273**	24	27	27	**27**	48	85	85	**85**
Minimum Density Canopy Cover (percent)	33.5	0	0	**0**	71	47	2.1	**64.6**	57.5	33.5	4.2	**16.7**
Maximum Density Canopy Cover (percent)	100	99.5	100	**100**	100	96.5	95.1	**92.7**	96.5	92	98.7	**100**
Average Density Canopy Cover (percent)	83.2	76.3	62.9	**82.7**	89.4	78.2	75.6	**76.7**	78.8	71	57.7	**63.1**

[1]Variation in the total number of observation points along each canal reach for the Canopy Cover Assessment is due to the interval distance for each set of observations. Baseline Year 0 (2013) observation interval for LCC and DS Canal (reference site) was averaged at approximately 50–65 feet for each densiometer reading along the canal reach. UGVC was averaged at 100 feet for each densiometer reading along the canal. To be consistent with baseline and create a standard, Year 4 (2017) averaged all observation intervals for the LCC, UGVC, and DS Canal (reference site) to 100 feet for each set of densiometer readings. This same methodology continued in Year 8 (2021) and Year 10 (2023).

4.2.2   Canopy Cover Assessment Monitoring Year Comparisons

From Year 0 to Year 4, average canopy cover density marginally decreased by approximately 7 percent on the LCC and 6 percent on the DS Canal reference site. From Year 4 to Year 8, average canopy cover density had a greater decrease by approximately 13.4 percent on the LCC and 13.3 percent on the DS Canal reference site. From Year 8 to Year 10, average canopy cover density had an increase by approximately 19.8 percent on the LCC and 5.4 percent on the DS Canal reference site. The UGVC site experienced a 1.1 percent increase in canopy cover. Graph 4-8 shows the minimum, maximum, and average density of canopy cover over the 10-year study. Because there is a similar decrease and then increase in canopy cover at the LCC and DS Canal sites, it indicates that the changes are correlated potentially to seasonal climate conditions and natural abscission variation from year-to-year. Additionally, the UGVC site has a higher proportion of conifer trees which likely allows for less abscission and therefore less variability year-to-year.

Graph 4-8.   Average Overall Canopy Cover Study

Canopy Cover Study

Legend: ■ Minimum Density Canopy Cover (%) ■ Maximum Density Canopy Cover (%) ■ Average Density Canopy Cover (%)
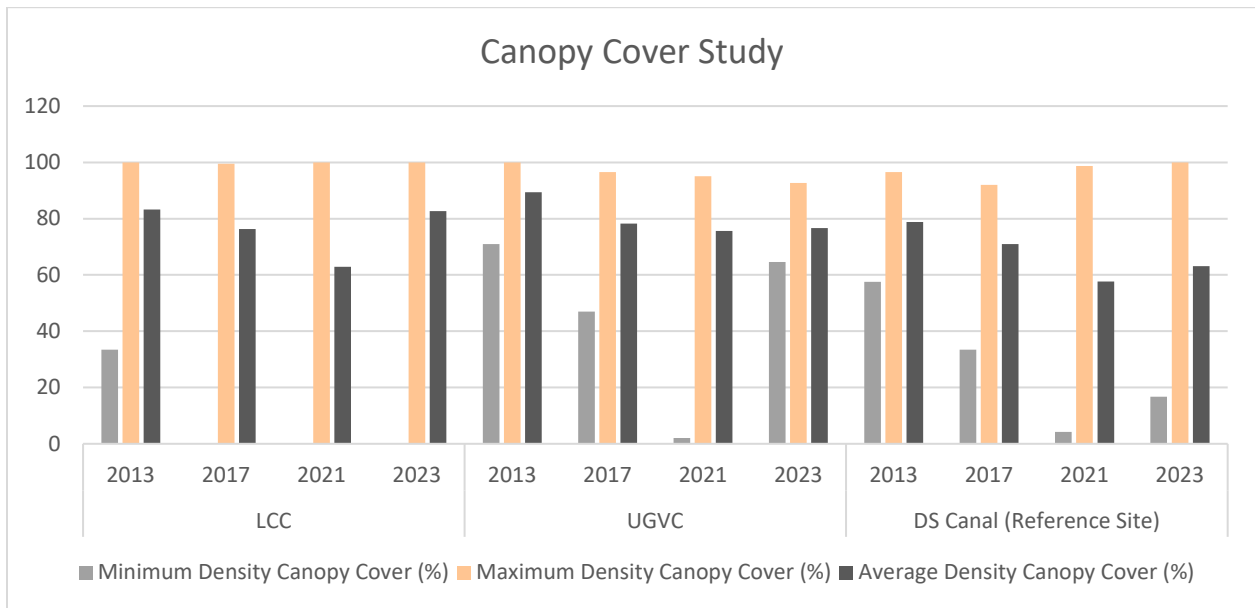
4.3   POND STUDY

Data for the Pond Study was collected on Tuesday, September 6, 2023 at the three Pond Study sites adjacent to the LCC (Pond 1 and Pond 2) and DS Canal (Pond 3). As stated in the methods section above, no data was collected along the UGVC because no ponds were identified during the initial development of the study. During the field assessment, the parameters evaluated included the area of inundation and soil saturation, approximate water depth(s), apparent hydrology patterns, soil type(s) present, vegetation communities present, wildlife species present, and habitat for CRLF. Table 4.8 summarizes the Pond Study results for metrics collected during surveys conducted in 2013, 2017, 2021, and 2023 (Year 0, Year 4, Year 8, and Year 10). Figure 4 includes maps of LCC Ponds 1 and 2 and the DS Canal reference site, Pond 3.

4.3.1   Pond Study Results Summary

4.3.1.1 Lower Cascade Canal

POND 1

Pond 1, located at latitude 39.23571 and longitude -120.988615 (WGS-84) and adjacent to the LCC is within an upland forested habitat in a rural residential area. The dominant tree species is incense cedar (*Calocedrus decurrens*) and the dominant understory species is Himalayan blackberry, as well as various other non-native and ornamental species. Apart from a few (mostly dead) branches present on the north-northwest side of pond, little to no vegetation overhangs into the pond, and emergent vegetation within the area of inundation is minimal. The northwest and west sides of the pond are steep and at the time of the assessment, the shoreline included approximately one to two feet of bare mud and dead leaves before meeting with vegetation. As found in previous years, habitats surrounding Pond 1 appear to be healthy despite the fluctuating drought conditions in recent years. For a list of observed wildlife species at Pond 1, please refer to Appendix F of this report.

Pond 1 is supplied with purchased water from April 15 through October 15 from the LCC. During the 2023 assessment, water was observed entering the pond through an approximate 4-inch diameter pipe on the north slope as well as from a seepage from the LCC on the northeastern shore of the pond. During the 2017 survey, two seepages were identified. The property owner has previously indicated that the additional seepage from the LCC is sub-surface most of the year but experiences above-ground flow during heavy winter rains. The landowner also indicated that both seepage inputs were highly variable based upon NID flow controls. In a typical year, Pond 1 annually overflows and flushes out. Pond 1 is a perennial body of water due to the relatively consistent supply of water despite fluctuating water levels throughout the year (NID 2012).

Pond 1 is adjacent to but physically separated from Pond 2 by a dirt access road. However, the two ponds are connected via an approximate 6-inch diameter culvert, which allows water to flow from Pond 1 to Pond 2 when water levels allow. At the time of the 2023 assessment, water levels were too low to be hydrologically connected.

POND 2

Pond 2 is located at latitude 39.235182 and longitude -120.989522 (WGS-84) and adjacent to the LCC. As described above, Pond 2 is situated within an upland forest habitat and includes the same dominant overstory and understory vegetative species. Pond 2 is also a perennial wetland, with little to no overhanging vegetation; but approximately 50 percent of its surface is comprised of emergent vegetative species including narrowleaf plantain (*Alisma lanceolatum*) and narrowleaf cattail (*Typha angustifolia*). Pond 2 is located adjacent to and downslope of Pond 1 and is surrounded by dirt access roads on all sides. As mentioned above, Pond 1 is supplied with purchased water from April 15 through October 15 from the LCC, and feeds Pond 2 via a culvert approximately 6 inches diameter when water levels allow. Potential seepage from the NID canal located upslope and to the northeast may also supply Pond 2 with water.

In 2017, the landowner indicated that the landowner has been using Pond 2 for irrigation via a 1-inch PVC (polyvinyl chloride) pipe since 2014. Usage of Pond 2 water for irrigation is intermittent, minor, and has negligible effects on the water level. Additionally, the property owner indicated that water levels vary widely over the course of the year due to debris blockages to the inflow culvert and overflows caused by winter precipitation events. Both the inflow culvert (i.e., culvert between Pond 1 and Pond 2) and the outflow culvert were replaced in early August 2017 due to rust, debris blockage, and subsequent seasonal overflows from each pond. The relatively consistent supply of water in Pond 2 allows for its perennial state despite fluctuating water levels throughout the year (NID 2012). For a list of observed wildlife species at Pond 2, please refer to Appendix F of this report.

4.3.1.2 DS Canal (Reference)

POND 3

Pond 3, the reference site for the Pond Study, is located at latitude 39.24093 and longitude -121.02055 (WGS-84) and adjacent to a piped section of the DS Canal. Pond 3 is in upland forest habitat including incense cedar and ponderosa pine. No overhanging vegetation is present; however, emergent species including common cattail (*Typha latifolia*) is choking out much of the pond's surface area. There is a water service agreement on the parcel where Pond 3 is located that purchases water through the irrigation season (i.e., April 15 through October 15) from DS Canal. No water is purchased through the winter months; however, the water service could potentially leak water due to residual canal flows and increased annual precipitation. The water purchased from the DS Canal feeds through a culvert and/or overflows directly into Pond 3, which is otherwise confined by the surrounding topography. There is also an additional culvert that drains from Pond 3 to an additional pond below. For a list of observed wildlife species at Pond 3, please refer to Appendix F of this report.

4.3.1.3 California Red-legged Frog and Other Special Status Species Habitat Assessment

All sites within the Pond Study on the LCC and the DS Canal (reference site) were assessed for CRLF and other potentially occurring special status species and their associated habitat. As with previous study

23

years (2013, 2017, and 2021), no CRLF were observed during the habitat assessments conducted in 2023, and all Pond Study sites were found to have marginal potential suitable CRLF habitat. Therefore, CRLF are unlikely to occur within the three Pond Study sites. Rationale for this determination is provided below.

- Pond 1: Lack of known observations within 1-mile of the study site (CDFW 2023); minimal to no emergent and overhanging vegetation present; annual flushing; and presence of potential predatory species including American bullfrog (*Lithobates catesbeianus*) (observed in previous years' studies but not in 2021) and mosquitofish (*Gambusia affinis*) (observed in 2013, 2017, and 2023).

- Pond 2: Lack of known observations within 1-mile of the study site (CDFW 2023); annual flushing; observations of potential predatory species including American bullfrog, mosquitofish, brown trout (*Salmo trutta*), and red-eared slider (*Trachemys scripta elegans*).

- Pond 3: Lack of known observations within 1-mile of the study site (CDFW 2023), annual flushing, and the presence of fish and American bullfrog.

Additionally, no special-status species or special-status species habitat was observed within the Pond Study sites.

4.3.2   Pond Study Monitoring Year Comparisons

During Year 10 monitoring, the Pond Study on the LCC (i.e., Ponds 1 and 2) yielded very little change from the previous monitoring years, Year 0 (Baseline 2013), Year 4 (2017), and Year 8 (2021). The most notable variation observed during Year 10 of the Pond Study was the overall decrease in pond size/area of inundation (i.e., wetted perimeter- Pond 1 had a decrease of 836 square feet; Pond 2 had a decrease of 161 square feet). This subsequently influenced the overall visual approximation of pond depth by one to two feet. Overall, Pond 1 has showed a decrease of 909 square feet and Pond 2 has shown a decrease of 603 square feet from the 2013−2021. These fluctuations in surface area and/or volume of water is likely due to the amount of water the landowner has purchased from and is supplied by NID. As for the reference site, DS Canal, the pond increased in size between 2017 and 2021 by 1,493 square feet and overall increased by 638 square feet between the years of 2013 and 2023 (Table 4-8).

The water levels at all of the ponds (Ponds 1, 2, and 3) are controlled by NID, as fluctuating canal flows are the primary input. Conversations with the property owner along the LCC have also indicated that Ponds 1 and 2 are generally used for on-site irrigation; however, during 2017 and 2023, irrigation was likely minimal due to increased natural precipitation in the region. Therefore, it can be deduced that variation in the inundated area of the ponds, as well as visual estimations of pond depth, are likely influenced by both factors.

Table 4-8.   Pond Study Results

Study Pond	Lower Cascade Canal Pond 1				Lower Cascade Canal Pond 2				DS Canal Pond 3 (Reference Site)			
Survey Year	2013	2017	2021	2023	2013	2017	2021	2023	2013	2017	2021	2023
Study Pond Result Parameters												
Approximate Pond Size/ Inundation Area (square feet)[1]	2,010	2,355	1,937	1,101	3,090	5,028	2,648	2,487	3,885	2,730	4,223	4,523
Approximate Visual Pond Depth (feet)	4	6	3	2	4	5	4	6	4	8	5	3
Perennial or Ephemeral Site[2]	Perennial				Perennial				Perennial			
NWI Classification[3]	PUBFh				PUBFh				PUBk			
Soil Map Unit[4]	AfB				AfB				AfD			
Presence of Over-Hanging Vegetation	Yes	Minimal	No	No	Yes	Minimal	No	No	Yes	Minimal	No	No
Presence of Emergent Vegetation	Yes	Minimal	Minimal	Minimal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Site in Current and/or Historic CRLF Range[5]	Yes				Yes				Yes			
Known Records of CRLF within One Mile[5]	No				No				No			

[1] In 2013, Approximate Pond Size/Inundation Area (square feet) was completed via visual estimation. In 2017 and 2019, estimation of pond size was (re)calculated from GIS via the mapped boundary collected during the field surveys to improve assessment accuracy over time.
[2] All ponds contain water year-round, but likely experience fluctuating water levels due to changes in seepage amounts from the LCC and DS Canal as well as flushing during annual rains.
[3] <u>National Wetlands Inventory (NWI) Classifications</u> (USFWS 2023)
PUBFh = Palustrine (P), Unconsolidated Bottom (UB), Semi-permanently Flooded (F), Dike/Impounded (h)
PUBK = Palustrine (P), Unconsolidated Bottom (UB), Artificially Flooded (k)
[4] <u>National Resources Conservation Service Soil Classification </u>(USDA 2019)
AfB = Aiken Loam, two to nine percent slopes, well-drained.
AfD = Aiken Loam, 15 to 30 percent slopes, well-drained.
[5] CDFW 2023.

25

5.0   DISCUSSION

As discussed in previous monitoring reports, the riparian tree species along NID canals are predominantly in upland habitats (i.e., surrounded by mixed coniferous forest). As such, it was hypothesized that the canals sustain these trees and a reduction in flows would reduce the hydraulic head, water infiltration, root uptake and eventually cause potential loss of the existing riparian trees.

These riparian forests along canals are complex ecological systems that have the potential to support dynamic levels of biodiversity and special-status species, exhibit high rates of nutrient cycling, and perform important ecological functions. As these vegetation communities are located at the land-water margin, riparian plant species are greatly dependent on hydrology and generally more vulnerable to water-induced stress (Naiman and Bilby 2001).

Decreased water availability subsequently can drive increases in non-native and upland species encroachment and decreases native growth, whereas wet years can drive increases in tree growth and in the overall density of vegetation (Naiman et al. 2000). Shifts in climate may also inflate broad scale tree disease, as well as insect infestation (Liebhold and Bentz 2011). The aforementioned factors may compound with a decrease in overall canal flows to impact tree health at the sites on LCC and UGVC, complicating the differentiation between the effects of decreased canal flows and drought in the region.

During monitoring years 2015 and 2021, the region experienced an ongoing drought (2014−2015 and 2020−2022) and decreased annual precipitation. Published research states that there is a highly significant overall effect of drought on the amount of total biomass (dry weight) of riparian wetland plants which becomes critical when droughts last longer than approximately 30 days. It is noted that different species display a different tolerance to drought (Garssen et al. 2014). In addition, trees often have a delayed response to water and temperature stress. This may explain why tree health remained relatively stable along the LCC, UGVC and the DS Canal reference site during the drought years. As such, with an increase in precipitation over the years of 2017, 2019, and 2022, we may be seeing the results of those wet years during our final year, Monitoring Year 10 in 2023.

Over the past decade, the region has experienced intermittent drought conditions. In 2023 there was consistent tree health documented (i.e., an average health score of 11) on the LCC, UGVC, and at the DS Canal reference site. As noted above, over the course of the 10-year monitoring, there was sometimes an increase in tree health during a drought year (i.e., 2021) and this may be due to a latent reaction to wet years (2017 and 2019). Specifically, the drought conditions may have influenced riparian species, and the above-average precipitation years may compensate for such impacts. We continue to see an oscillation of tree health and canopy cover which appears to parallel the oscillation of wet and dry water years that the region has experienced over the past decade.

Overall, the Tree Health Assessment results indicate an ever-changing habitat that is likely continuously responding to changes in water regimes, property management (i.e., fencing installation at LCC Site 2 and mechanical removal at LCC Site 1 and UGVC Site 5), climate, and non-native vegetation encroachment. There is explicable die-off (25%) of trees at the study sites, however, there continues to

be consistent overall good tree health at the sites along with new growth and resprouts. The die-off appears primarily caused by mechanical removal due to forest health and tree thinning projects and adjacent conifers falling due to heavy snowfall and crushing the study trees, especially in 2023. The die-off of trees at the LCC and UGVC sites is consistent with or reduced, relative to the reference site at DS Canal. The overall tree health on the study canals and the reference canal remains in the "good health" category, as defined in the Executive Summary. Furthermore, the findings are consistent with baseline (2013) conditions. Therefore, at the conclusion of the 10-year monitoring period, it appears that during drought years, there may have been a slight reduction in the overall riparian tree health; but with wet water years, the trees were able to recover, irrespective of lowered canal flows ten years ago. The assessment of key health factors such as the canopy cover, bark health, new growth, and presence of disease display overall healthy riparian trees that were not affected by the lowered water levels of the adjacent canals.

The canopy cover assessment showed a steady decline among the canopy cover over eight years along the study reaches, but then recovered slightly from 2021 to 2023. There is, however, a similar oscillation in canopy cover at the LCC site as the DS Canal reference site indicating that the minor decline over the first eight years was potentially due to seasonal climate conditions and natural abscission variation from year-to-year.

The pond study results indicate little to no variability in ponded habitat. Based on information from landowners and NID, the documented pond area and depth variation has been primarily attributable to water delivery purchases and irrigation use on the properties where the ponds are located, and not associated with lowered flows in the LCC.

As a part of MM 3.8-1 and MM 3.8-2 defined in the Final EIR for the Lower Cascade Canal-Banner/Cascade Pipeline Project (NID 2006), this monitoring year (Year 10, 2023) concludes the required monitoring for the Project. There is not a need for water replacement standards because the reduced flow in the LCC and UGVC is not causing a reduction in tree health, and thus canopy cover (NID 2006).

27

6.0   REFERENCES

CDFW (California Department of Fish and Wildlife). 2023. California Natural Diversity Database via Biogeographic Information and Observation System (BIOS) online viewer. Available online: https://wildlife.ca.gov/Data/BIOS. Accessed February 2024.

DWR (Department of Water Resources). 2023. California Data Exchange Center – Precipitation. Monthly Precipitation Summary for Water Year, 2013-2019. Available online: http://cdec.water.ca.gov/dynamicapp/QueryWY. Accessed February 2024.

Garssen, A.G., J.T. Verhoeven, and M.B. Soons. 2014. Effects of climate-induced increases in summer drought on riparian plant species: a meta-analysis. Freshwater Biology (2014) 59, 1052-1063. Available online: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4493900/pdf/fwb0059-1052.pdf. Accessed February 2024.

Larsen, T., Water Resources Superintendent, Nevada Irrigation District, January 2022 and January 2024. Personal communication Thor Larsen, regarding canal flow rates with Meghan Oats, Stantec Consulting Services Inc. Biologist.

Liebhold, A., B. Bentz. 2011. Insect Disturbance and Climate Change. U.S. Department of Agriculture (USDA). Forest Service (USFS). Climate Change Resource Center. Accessed online: www.fs.usda.gov/ccrc/topics/insect-disturbance/insect-disturbance. Accessed February 2024.

Naiman, R., R.E. Bilby, P.A. Bisson. 2000. Riparian Ecology and Management in the Pacific Coastal Rain Forest. BioScience 2000, 50 (11), 996-1011. Available online: https://academic.oup.com/bioscience/article-pdf/50/11/996/26889904/50-11-996.pdf= Accessed February 2024.

Naiman, R., R.E. Bilby. 2001. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer Science and Business Media. Pages 315-316.

NRCS (National Resources Conservation Service). 2023. Agricultural Applied Climate Information for Nevada County, California. Available online: http://agacis.rcc-acis.org. Accessed December 2023.

NID (Nevada Irrigation District). 2004. Draft Environmental Impact Report for Lower Cascade Canal – Banner/Cascade Pipeline Project. Prepared for NID by Jones & Stokes, Sacramento, California. May 2004. State Clearinghouse # 2003012104.

——. 2006. Final Environmental Impact Report for the Lower Cascade – Canal Banner/Cascade Pipeline Project. Prepared from NID by Jones & Stokes, Sacramento, California.

——. 2012. Lower Cascade Canal and Upper Grass Valley Canal Canopy and Wetland Impact Assessment Workplans. Prepared for NID by Stantec Consulting Services Inc., Nevada City, California.

Sawyer, J.O., T. Keeler-Wolf, J. Evans. 2009. A Manual of California Vegetation, 2nd edition. California Department of Fish and Game. California Native Plant Society. California Native Plant Society Press. Sacramento, CA.

Sindt, S., Water Resources Superintendent, Nevada Irrigation District, January 2018 and December 2019. Personal communication with Sue Sindt regarding canal flow rates with Meghan Oats, Stantec Consulting Services Inc. Biologist.

Strickler, G. 1959. Use of the densiometer to estimate density of forest canopy on permanent sample plots. PNW Old Series Research Notes No. 180, p. 1−5.

SWRCB (State Water Resources Control Board). 2012. Guidance Compendium for Watershed Monitoring and Assessment. Available online: https://www.waterboards.ca.gov/water_issues/programs/swamp/clean_water_team/guidance.html. Accessed December 2023.

USFWS (U.S. Fish and Wildlife Service). 2005. U.S. Fish and Wildlife Service. Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog (CRLF). USFWS, Sacramento, California. Available online: https://www.fws.gov/media/revised-guidance-site-assessments-and-field-surveys-california-red-legged-frog. Accessed February 2024.

USFWS. 2023. National Wetlands Inventory (NWI). Wetlands Mapper. Available online: https://www.fws.gov/wetlands/Data/Mapper.html. Accessed February 2024.

USDA. 2023. U.S. Department of Agriculture Natural Resources Conservation Service. Web Soil Survey online database. Available online: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed February 2024.

FIGURES

Tree Health Assessment

- ⊙ LCC Site 1
- ⊙ LCC Site 2
- ⊙ LCC Site 3
- ⊙ LCC Site 4
- ⊙ UGVC Site 5
- ⊙ DS Canal Site 6

— Canopy Cover Assessment

▢ Pond Study Location

— NID Canal

DS Canal

Lower Cascade Canal

Upper Grass Valley Canal

Project Location

N

0   1,800   3,600
Feet
(At original document size of 8.5x11)
1:42,000

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Stantec

V:\1857\Active\185706532\03_data\gis_cad\gis\mxd\Fig1_185706532_StudyArea.mxd   Revised: 2024-02-06 By: pglendening

Lower Cascade Canal Site 1

Tree Health Assessment Results

Nevada Irrigation District
Banner Cascade Pipeline Project

NID Canal

Tree Health Assessment Collection
Overall Health Score
- 1 - 4 (Poor Health)
- 5 - 7 (Fair Health)
- 8 - 11 (Good Health)
- 12 - 14 (Excellent Health)

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Page 1 of 6

V:\185\TActive\185706532\03_data\gis_cad\gis\mxd\Fig2_185706532_TreeHealth.mxd   Revised: 2024-02-07 By: pglendening

Lower Cascade Canal Site 2

NID Canal

**Tree Health Assessment Collection
Overall Health Score**

- 🔴 1 - 4 (Poor Health)
- 🟠 5 - 7 (Fair Health)
- 🟡 8 - 11 (Good Health)
- 🟢 12 - 14 (Excellent Health)

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Stantec

0   25   50 Feet
(At original document size of 8.5x11)
1:600

Revised: 2024-02-07 By: pglendening

V:\1857\Active\185706532\03_data\gis_cad\gis\mxd\Fig2_185706532_TreeHealth.mxd

43

Lower Cascade Canal Site 3

Tree Health Assessment Collection
Overall Health Score

— NID Canal

- 🔴 1 - 4 (Poor Health)
- 🟠 5 - 7 (Fair Health)
- 🟡 8 - 11 (Good Health)
- 🟢 12 - 14 (Excellent Health)

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

🌀 Stantec

0   25   50 Feet
(At original document size of 8.5x11)
1:600

V:\1857\Active\185706532\03_data\gis_cad\gis\mxd\Fig2_185706532_TreeHealth.mxd   Revised: 2024-02-07 By: pglendening

Lower Cascade Canal Site 4

NID Canal

Tree Health Assessment Collection
Overall Health Score

- 1 - 4 (Poor Health)
- 5 - 7 (Fair Health)
- 8 - 11 (Good Health)
- 12 - 14 (Excellent Health)

N

0   25   50 Feet
(At original document size of 8.5x11)
1:600

Stantec

Project Location   Prepared by PG on 2024-02-06
                                      TR by MO on 2024-02-07
Nevada County, California

Client/Project   185706532
Nevada Irrigation District
Banner Cascade Pipeline Project

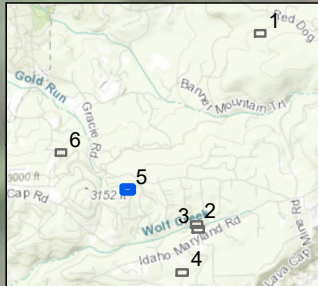*Figure No.*
2

Title
Tree Health Assessment Results

Page 4 of 6

V:\1857\Active\185706532\03_data\gis_cad\gis\mxd\Fig2_185706532_TreeHealth.mxd   Revised: 2024-02-07 By: pglendening

45

Upper Grass Valley Canal Site 5

Tree Health Assessment Collection
Overall Health Score
- ● 1 - 4 (Poor Health)
- ● 5 - 7 (Fair Health)
- ● 8 - 11 (Good Health)
- ● 12 - 14 (Excellent Health)

— NID Canal

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

0 25 50 Feet
(At original document size of 8.5x11)
1:600

Project Location   Prepared by PG on 2024-02-06
                            TR by MO on 2024-02-07
Nevada County, California

Client/Project   185706532
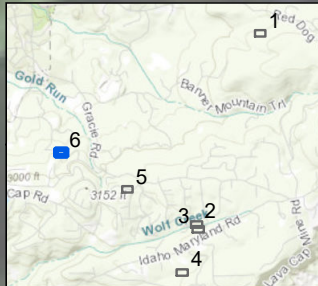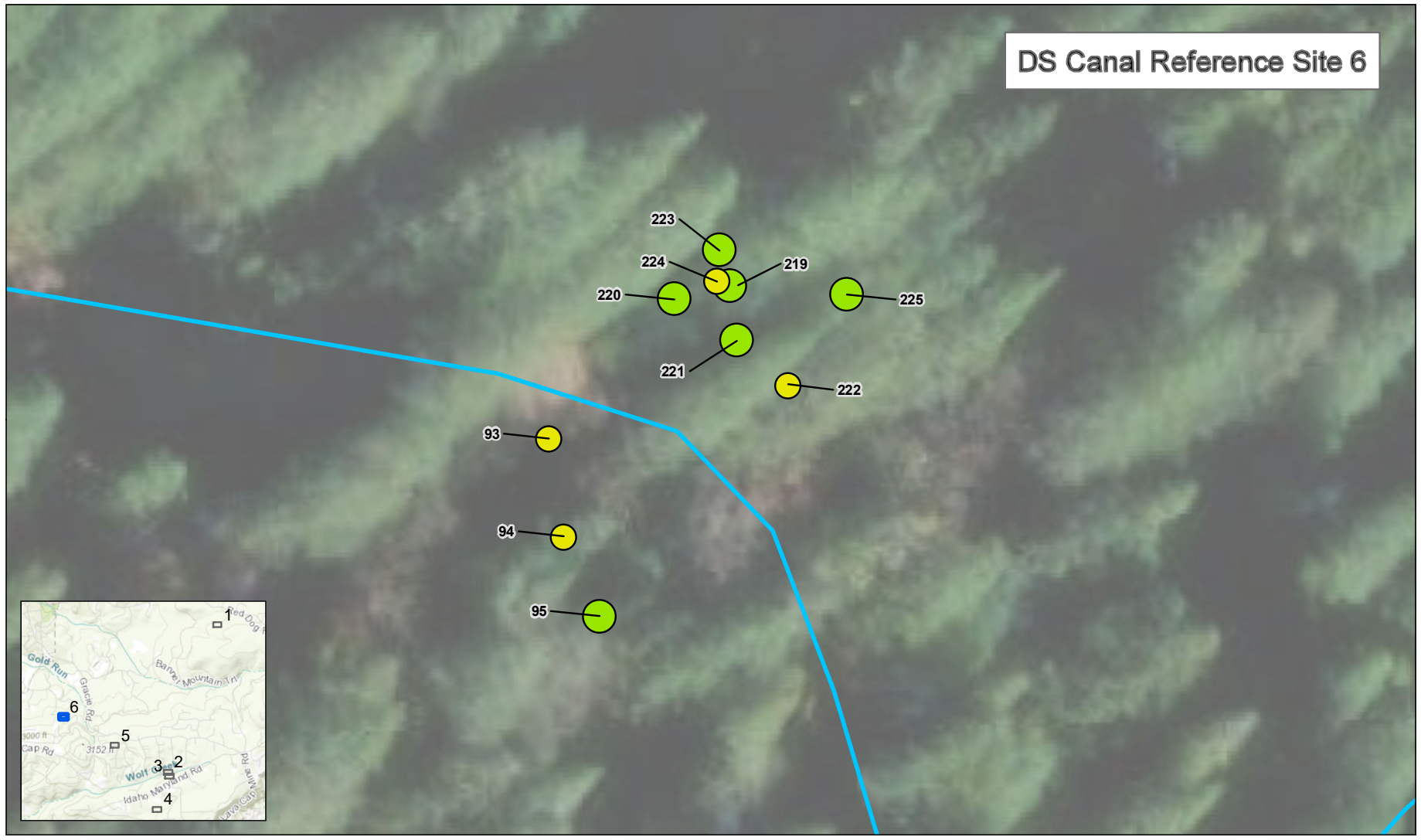Nevada Irrigation District
Banner Cascade Pipeline Project

Figure No.
2
Title
Tree Health Assessment Results

Page 5 of 6

Stantec

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

V:\185\TActive\185706532\03_data\gis_cad\gis\mxd\Fig2_185706532_TreeHealth.mxd   Revised: 2024-02-07 By: pglendening
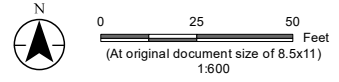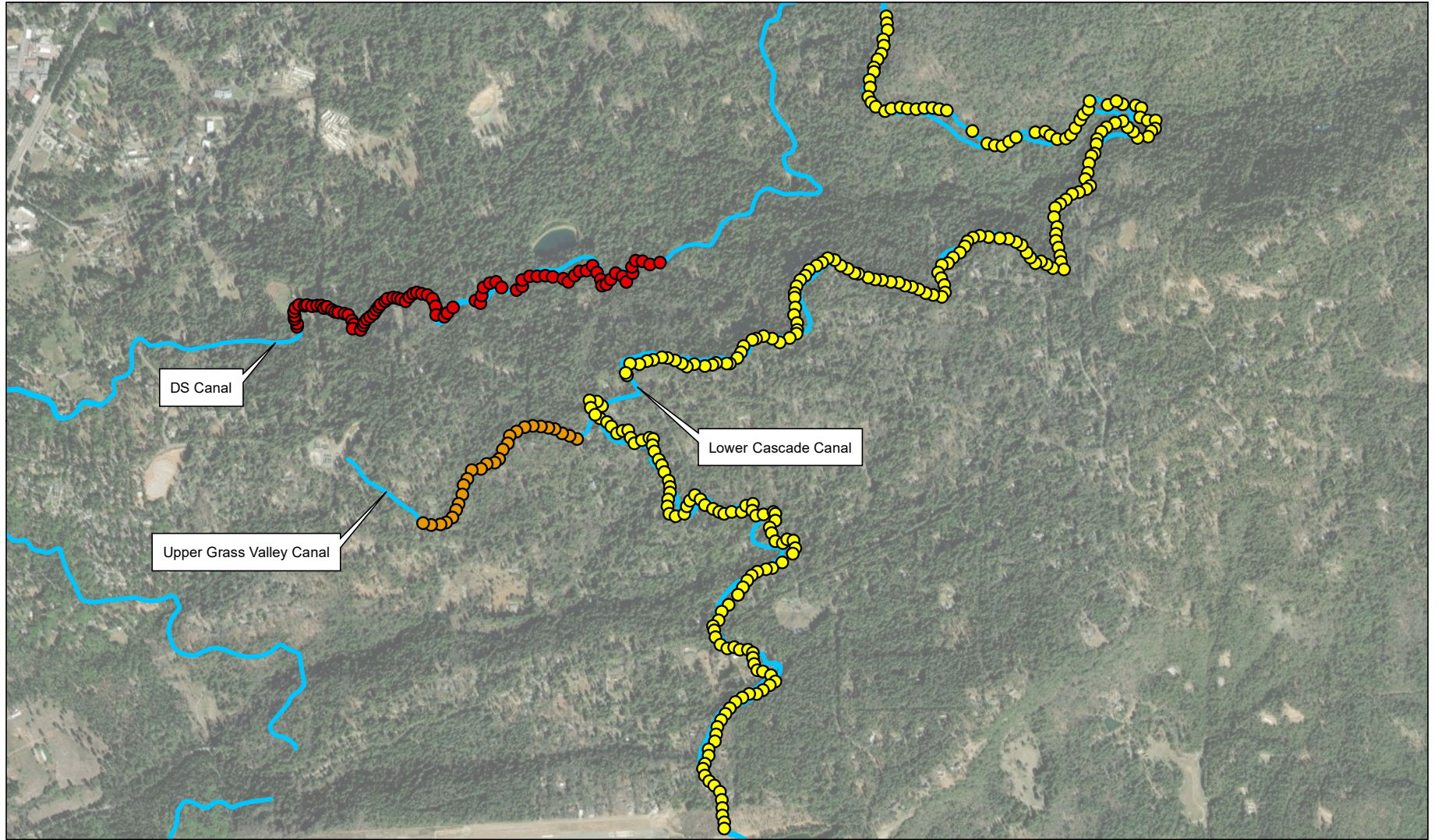
DS Canal Reference Site 6

Tree Health Assessment Collection Overall Health Score

- 1 - 4 (Poor Health)
- 5 - 7 (Fair Health)
- 8 - 11 (Good Health)
- 12 - 14 (Excellent Health)

— NID Canal

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

0   25   50 Feet
(At original document size of 8.5x11)
1:600

Project Location   Prepared by PG on 2024-02-06
                                        TR by MO on 2024-02-07
Nevada County, California

Client/Project   185706532
Nevada Irrigation District
Banner Cascade Pipeline Project

Figure No.
2

Title
Tree Health Assessment Results

Page 6 of 6

Stantec

DS Canal

Lower Cascade Canal

Upper Grass Valley Canal

Project Location

NID Canal

Canopy Cover Assessment

● DS Canal Survey Point

● Lower Cascade Canal (LCC) Survey Point

● Upper Grass Valley Canal (UGVC) Survey Point

N

0   1,000   2,000
Feet
(At original document size of 8.5x11)
1:24,000

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Project Location   Prepared by PG on 2024-02-07
                                      TR by MO on 2024-02-08
Nevada County, California

Client/Project   185706532

Nevada Irrigation District
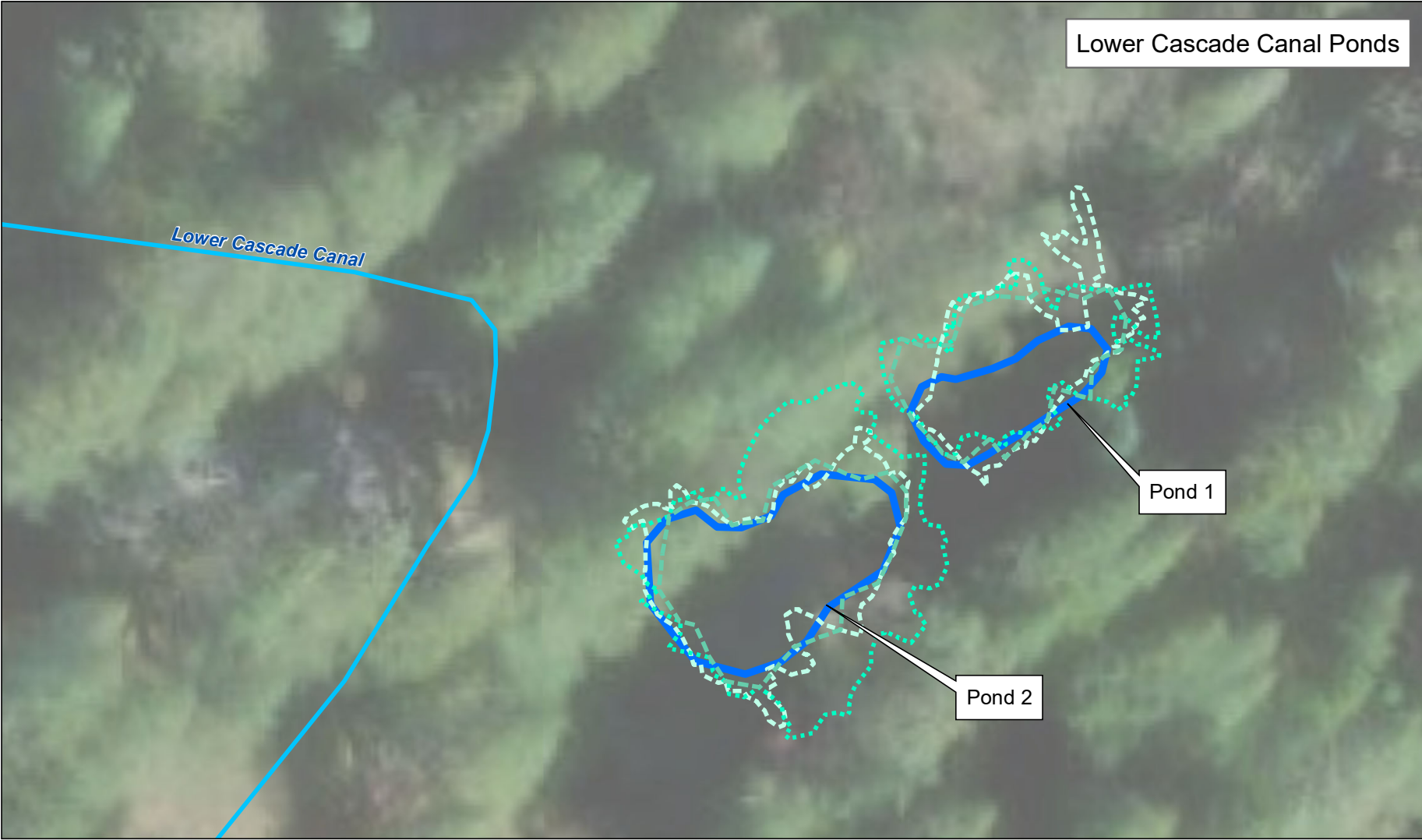Banner Cascade Pipeline Project

Figure No.
3

Title
Canopy Cover Survey Points

Stantec

V:\1857\Active\185706532\03_data\gis_cad\gis\mxd\Fig3_185706532_CanopySurveyPoints.mxd   Revised: 2024-02-07 By: pglendening

48

Lower Cascade Canal Ponds

Lower Cascade Canal

Pond 1

Pond 2

Project Location

— NID Canal

▭ Pond 2023

▢ Pond 2021

⋯ Pond 2017

⋯ Pond 2013

N

0   20   40
                    Feet
(At original document size of 8.5x11)
1:500

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Stantec

Project Location   Prepared by PG on 2024-02-14
                                                    TR by MO on 2024-02-14
Nevada County, California

Client/Project   185706532

Nevada Irrigation District
Banner Cascade Pipeline Project

Figure No.
4

Title
Pond Study Results

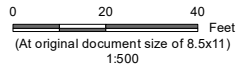Page 1 of 2

V:\185T\Active\18570653Z\03_data\gis_cad\gis\mxd\Fig4_185706532_Ponds.mxd   Revised: 2024-02-14 By: pglendening

DS Canal Reference Pond

Pond 3

DS Canal

Legend

— NID Canal
▢ Pond 2023
▢ Pond 2021
▢ Pond 2017
▢ Pond 2013

Project Location

N

0 — 20 — 40 Feet
(At original document size of 8.5x11)
1:500

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Project Location
Nevada County, California

Prepared by PG on 2024-02-14
TR by MO on 2024-02-14

Client/Project
185706532

Nevada Irrigation District
Banner Cascade Pipeline Project

Figure No.
4

Title
Pond Study Results

Stantec

Page 2 of 2

APPENDICES

Appendix A   TEN-YEAR CANOPY COVER STUDY MONITORING PLAN

PURPOSE

The purpose of the Ten-Year Canopy Cover Study Monitoring Plan is to summarize and detail requirements for the future monitoring efforts for the Canopy Cover Study, and to comply with Mitigation Measure 3.8-1 defined in the Final EIR for the Lower Cascade Canal- Banner/Cascade Pipeline Project (NID 2006). The Canopy Cover Study is comprised of the Tree Health Assessment Study and the Canopy Cover Assessment for the Lower Cascade Canal, and Upper Grass Valley Canal, and DS Canal (control-site). This Ten-Year Canopy Cover Study Monitoring Plan is specific to a study timeline and data collection methods which are detailed below.

STUDY TIMELINE

- Tree Health Assessments – Assessment data will be collected over a period of ten years, at an interval of every two years, for a total of six surveys (i.e., 2013-2023; Years 0, 2, 4, 6, 8, 10). Surveys shall be conducted in the late summer (i.e., August to September/ October).

- Canopy Cover Assessments – Canopy cover data will be collected every four years, with one final assessment to conclude the study on Monitoring Year 10 (i.e., Years 0, 4, 8, and 10). Surveys shall be conducted in the late summer (i.e., August to September) and concurrent with the Tree Health Assessments.

Summary of Canopy Cover Studies and Monitoring Timeline Requirements

Canopy Cover Study	Monitoring Year & Requirement					
	2013 Year 0	2015 Year 2	2017 Year 4	2019 Year 6	2021 Year 8	2023 Year 10
Tree Health Assessment	X	X	X	X	X	X
Canopy Cover Assessment	X		X		X	X

X- Indicates a study year for monitoring to be completed

STUDY LOCATIONS

The study sites locations for the Tree Health Assessment, and Reach locations for the Canopy Cover Assessment are detailed below.

A.1

Tree Health Assessment

- Lower Cascade Canal
  Site 1: Latitude 39.257104, Longitude -120.978144
  Site 2: Latitude 39.234850, Longitude -120.987938
  Site 3: Latitude 39.234282, Longitude -120.987857
  Site 4: Latitude 39.229272, Longitude -120.990137
- Upper Grass Valley Canal
  Site 5: Latitude 39.238957, Longitude -120.9982466
- DS Canal (control-site)
  Site 6: Latitude 39.243292, Longitude -121.008359

Canopy Cover Assessment

Summary of Canopy Cover Assessment Locations and Reach Lengths

Canal	Lower Cascade Canal	Upper Grass Valley Canal	DS Canal (control-site)
Canal Reach Length (miles)	7	0.5	1
Reach Start Coordinate (North)	39.259642872, -120.966559692	39.238985195, -120.998306278	39.245783455, -120.992624265
Reach End Coordinates (South)	39.225052309, -120.990948424	39.23597992, -121.005289880	39.243120641, -121.010794363

DATA COLLECTION

Tree Health Assessments

Data should be recorded and assessed considering the following factors (Zobrist 2011):

- Presence of foliage decline or evidence of crown fading;
- Color of foliage: out of season discoloration of foliage; and
- Evidence of disease, parasite, and/or insect damage.

To capture the data above, visual inspections of each tagged tree at each of the six Tree Health Assessment study sites should be made using the criteria listed in the table below. Each tree should be assigned a score for each category or criteria using the Project specific datasheets associated with this Monitoring Plan.[8] Data shall be documented with a Trimble Series 6000 GeoXH GPS, and post-processed in GIS.

---

[8] The Tree Health Assessment data collection form was updated in 2015, Year 2 Monitoring, to be consistent with study requisites and ongoing monitoring efforts.

A.2

Tree Health Assessment Data Criteria

Assessment Type	Assessment Description	Assessment Score
Canopy Cover	Canopy cover die-back by a percentage based on density and presence of foliage at the crown of the tree.	1- None: no canopy present, 0% 2- Sparse: most canopy absent, 0-25% 3- Partial: canopy 25-50% 4- Medium: canopy 50-75% 5- Full: canopy 75-100%
Bark Health	Bark health is assessed through the absence/ sluffing of bark on the bole and limbs of the tree.	1- Dead: 100% sluffing off, extensive damage 2- Poor: decaying or dead; 75-100% bark absent from bole and limbs of tree; abundant root rot; extensive insect damage; overall discoloration and bark shape irregularities; abundant surface growth 3- Fair: 50-75% bark absence; some root rot and insect damage; discoloration and bark shape irregularities; bark sluffing 4- Good: 25-50% bark absence; some root or heart rot present; bark only missing from tree limbs 5- Excellent: 0-25% bark absence. Present bark generally intact and of high vigor
Leaf Color	Leaf color is assessed based on abnormal colorations that are not typical for the species or season, uniform throughout all present foliage, etc.	1- Normal: no abnormalities present, color normal 0- Abnormal: abnormal color present (e.g., spotting, insect tracks, necrotic tips, etc.)
New Growth Presence	"New growth" is any new vascular growth including leaf buds, basal sprouts, epicormic stems, and saplings.	0- Present 1- Not present
Surface Growth Presence	Surface growth on trunk and stems includes lichen, moss, and all other normal terrestrial algal plants (i.e., non-vascular plants, bryophytes).	0- Present 1- Not present
Disease	Disease includes fungal/mold presence and other pathogens, tubers, cankers, structural decay (e.g., basal decay, irregular growth pattern of tree), root and heart rot, etc.	0- Present 1- Not present
Parasites	Parasites can include, but are not limited to, the presence of mistletoe, red pustules, etc.	0- Present 1- Not present
Insect Infestation	Signs of insects include burrowing/bore holes; frass, larvae or larva galleries, or insect presence; leaf notching; epicormics stems, galls, etc.	0- Present 1- Not present

A.3

Assessment Type	Assessment Description	Assessment Score
Overall Tree Health	Overall tree health was assessed through leaf/ foliage health and other associated physical leaf characteristics, the amount of canopy foliage present, stem, and bark health (e.g., decay), abnormal tree shape, and/or increased presence of disease, parasites, and insect infestations. Normal seasonal variations were considered in overall health scoring.	1- Dead Overall 2- Poor Overall: partial-full discoloration; severe insect damage; disease presence; tissue damage 3- Fair Overall: partial discoloration; some insect damage, heart rot 4- Good Overall: some discoloration 5- Excellent Overall: no physical abnormalities

Canopy Cover Assessment

The Canopy Cover Assessment data will be collected along each canal study Reach using a densiometer following the methods described in The Clean Water Team Guidance Compendium for Watershed Monitoring and Assessment State Water Resources Control Board Standard Operating Procedure for Measuring Canopy Cover Using a Seventeen Point Spherical Convex Densiometer (Burres 2010; Ode 2007). Field data for each site will be collected on the datasheet within this Monitoring Plan as well as using a sub-meter Trimble GPS.[9] Post-processed will be completed using GIS. The analysis will average the overall canopy cover data collected based on densiometer readings along each canal Reach. Results will then be synthesized from the canopy cover data. Data collection and canopy density percentages will be calculated based on methods and formulas described in Use of the Densiometer to Estimate Density of Forest Canopy on Permanent Sample Plots (Strickler 1959).

STUDY REPORTING

Reporting shall be completed at the end of each monitoring year and will be drafted to summarize the Canopy Cover Study findings (i.e., Tree Health and Canopy Assessment data and results) for that year. The data for the study year will also be discussed in conjunction with previous monitoring years and California's water year data and NID LCC and the UGVC flow data. Each report will include adaptive management recommendations, if necessary. NID is not required to adhere to any interim recommendations but may want to take them into consideration when reducing or limiting flow that may have canopy impacts, should they be documented. On the last year of study (i.e., Year 10, 2023) a comprehensive final report will be compiled summarizing data collection methods, results, analysis as well as make findings and recommendations.

---

[9] The Canopy Cover Assessment data collection form was updated in 2017, Year 4 Monitoring, to be consistent with study requisites and ongoing monitoring efforts.

Appendix B   TEN-YEAR POND STUDY MONITORING PLAN

PURPOSE

The purpose of the Ten-Year Pond Study Monitoring Plan is to summarize and detail requirements for the future monitoring efforts for the Pond Studies and to comply with Mitigation Measure 3.8-2 defined in the Final EIR for the Lower Cascade Canal- Banner/Cascade Pipeline Project (NID 2006). The Pond Study is comprised of study sites on the Lower Cascade Canal, and DS canal (control-site). There are no Pond Study sites located on the Upper Grass Valley Canal.[10] This Ten-Year Pond Study Monitoring Plan is specific to a study timeline and data collection methods which are detailed below.

STUDY TIMELINE

Pond data will be collected every four years, with one final assessment to conclude the study on Monitoring Year 10 (i.e., Years 0, 4, 8, and 10). Surveys shall be conducted in the late summer (i.e., August to September) and concurrent with the Canopy Cover Assessment portion of the Canopy Cover Study.

Summary of the Pond Study and Monitoring Timeline Requirements

Pond Study (all sites)	Monitoring Year and Requirement					
	2013- Year 0	2015- Year 2	2017- Year 4	2019- Year 6	2021- Year 8	2023- Year 10
	X		X		X	X

X- Indicates a study year for monitoring to be completed

STUDY LOCATIONS

The study sites locations for the Pond Study are detailed below.

- Lower Cascade Canal
  Pond 1: 39.235710, -120.988615
  Pond 2: 39.235182, -120.989522
- DS Canal (control-site)
  Pond 3: 39.240913, -121.020355

DATA COLLECTION

As part of the Pond Study, wildlife and habitat suitability assessments will be conducted. At each of the three Pond Study sites, the following data will be collected and assessed:

- Delineation of inundated area/ soil saturation;
- Hydrology pattern(s);
- Range of water depths;
- Soil type(s);

---

[10] No ponds were identified along the UGVC; therefore, no Pond Study sites are located along the UGVC.

B.1

Appendix B Ten-Year Pond Study Monitoring Plan

- Vegetation observed and overarching vegetation community type;
- Wildlife species observed;
- California red-legged frog habitat assessment; and
- Site photos.

Each pond assessment will include a GPS delineation, and information on hydrology, soils, and vegetation, in accordance with U.S. Army Corps of Engineers Guidelines for Wetland Delineations (Environmental Library 1987). Each Pond Study site should be assessed for the presence of potential CRLF habitat, and other associated special status species, based on the Revised Guidance on Site Assessments and Field Surveys for the CRLF (USFWS 2005). Pond Study data will be recorded on the Project specific datasheet associated with this Monitoring Plan.[11] Data shall also be documented with a Trimble Series 6000 GeoXH GPS, and post-processed in GIS

STUDY REPORTING

Reporting shall be completed at the end of each monitoring year, and will be drafted to summarize the Pond Study findings for that year. The data for the study year will also be discussed in conjunction with previous monitoring years and California's water year data and NID LCC and the UGVC flow data. Each report will include adaptive management recommendations, if necessary. NID is not required to adhere to any interim recommendations, but may want to take them into consideration when reducing or limiting flow that may have canopy impacts, should they be documented. On the last year of study (i.e., Year 10, 2023), a comprehensive final report will be compiled summarizing data collection methods, results, analysis as well as make findings and recommendations.

---

[11] The Pond Study data collection form was updated in 2017, Year 4 Monitoring, to be consistent with study requisites and ongoing monitoring efforts.

Appendix C Tree Health Assessment Criteria

Appendix C   TREE HEALTH ASSESSMENT CRITERIA

The following table of Tree Health Assessment Criteria was updated in Monitoring Year 4 (2017) to be consistent with study requisites and on-going monitoring efforts.

Table C.1 Summary of Tree Health Assessment Parameters

Assessment Type	Assessment Description	Assessment Score
Canopy Cover	Canopy cover is based on the density and presence of foliage.	1- None 2- Sparse 3- Partial 4- Full
Bark Health	Bark health is based on the integrity and vigor of bark on the bole and limbs of the tree; abnormalities include bark discoloration, damage, sluffing, or absence.	1- Dead 2- Poor 3- Fair 4- Good
New Growth	New growth is any new vascular growth, including leaf buds, basal sprouts, or epicormic stems.	0- Not present 1- Present
Abnormal Leaf Color	Abnormal leaf color includes spotting, insect tracks, necrotic tips, etc., that are not typical for the species or season and are present throughout most foliage.	0- Abnormal 1- Normal
Surface Growth	Surface growth on the trunk and stems includes lichen, moss, and all other normal terrestrial algal plants (i.e., non-vascular plants, bryophytes).	0- Present 1- Not present
Disease	Disease includes fungal/mold presence and other pathogens, tubers, cankers, basal decay, root and heart rot, etc.	0- Present 1- Not present
Parasites	Parasites include mistletoe, honeysuckle, red pustules, etc.	0- Present 1- Not present
Insects	Signs of insects include burrowing/bore holes, leaf notching, frass, larvae or larva galleries, galls, insect presence, etc.	0- Present 1- Not present
Overall Tree Health	Overall tree health was calculated as the sum of all the tree health characteristics above.	0-4- Poor 5-9- Fair 10-14- Good
DBH Growth	DBH growth is based on the increase in DBH measurements, or lack thereof, from previous survey efforts. This metric was not used to calculate Overall Tree Health.	0- No growth 1- Growth

C.1

Appendix C Tree Health Assessment Criteria

Table C-2. Overall Tree Health Score Descriptions

Overall Score	Score Type	Score Description
1 to 4	poor health	Absent to little canopy cover (<25%), no new growth, bark damaged or absent, surface growth present, foliage present is discolored and/or damaged
5 to 7	fair health	Sparse to partial canopy cover (25-50%), minimal to no new growth present specifically in the canopy, bark sluffing off or damaged yet intact in some places, abnormal surface growths, potential disease presence, some parasite and/or insect damage and/or infestation
8 to 11	good health	partial to intact canopy cover (50-75%), new growth present, minimal bark and leaf discoloration, no significant disease, normal surface growth, minimal insect infestations/damage
12 to 14	excellent health	Intact to full canopy cover, new growth present, no surface growth, excellent bark and leaf health, no disease present

C.2

Appendix D   PHOTOGRAPHIC RECORD

The following photographs present an overall representation of site conditions present during the Canopy Cover Study and the Pond Study conducted in 2023 within the Lower Cascade Canal (LCC), Upper Grass Valley Canal (UGVC), and the DS Canal (reference site). This photographic record also provides a visual comparison for studies including the baseline assessment conducted in 2013 as well as subsequent monitoring years including 2015, 2017, 2019, and 2021.

Canopy Cover Study: Tree Health Assessment (2013-2023)

Photograph 1: 2013: LCC Site 1. East facing aspect.

Photograph 2: 2015. LCC Site 1. West facing aspect.

D.1

Appendix D Photographic Record

Photograph 3: 2017: LCC Site 1. Near upslope location. Northwest facing aspect.

Photograph 4: 2019: LCC Site 1. Downslope location.

Photograph 5: 2021: LCC Site 1. Downslope location.

Photograph 6: 2023: LCC Site 1. Downslope location.

D.2

Appendix D Photographic Record

Photograph 7: 2023: LCC Site 1. Upslope location.

Photograph 8: 2013: LCC Site 2. Southwest facing aspect.

Photograph 9: 2015: LCC Site 2. East facing aspect.

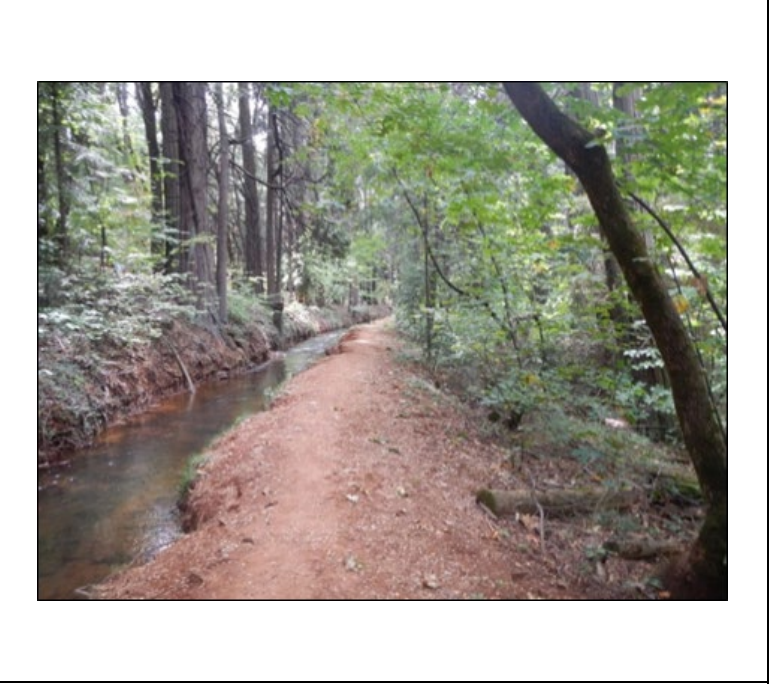**Photograph 10:** 2017. LCC Site 2. Downslope location. West facing aspect.

D.3

Appendix D Photographic Record

Photograph 11: 2019: LCC Site 2. Downslope location.

Photograph 12: 2021: LCC Site 2. Downslope location.
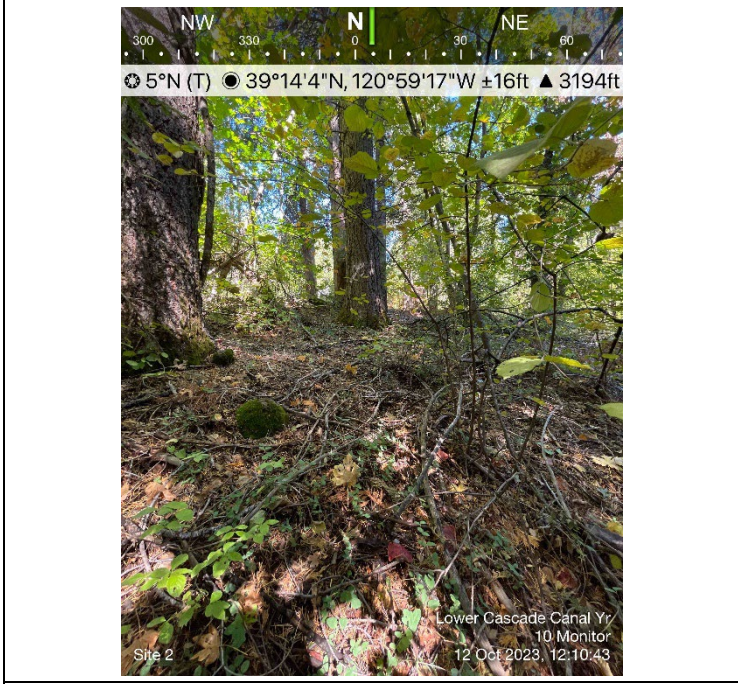
Photograph 13: 2023: LCC Site 2. Downslope location.

Photograph 14: 2013: LCC Site 3. East facing aspect.

D.4

Appendix D Photographic Record

Photograph 15: 2015: LCC Site 3. West facing aspect.

Photograph 16: 2017: LCC Site 3. Downslope location. Southwest facing aspect.

Photograph 17: 2019: LCC Site 3. Downslope location.

Photograph 18: 2021: LCC Site 3. Upslope location.

D.5

Appendix D Photographic Record
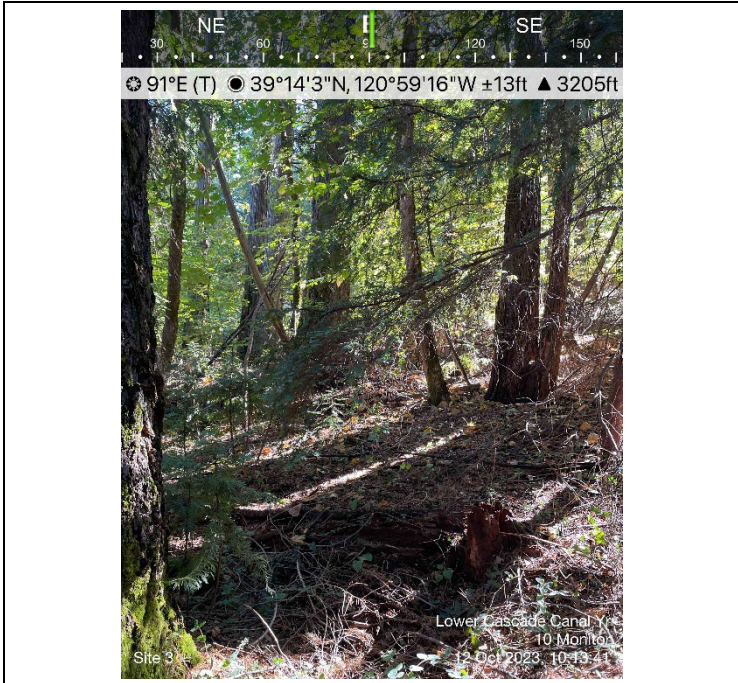
Photograph 19: 2023: LCC Site 3. Downslope location.

Photograph 20: 2013. LCC Site 4. Southwest facing aspect.

Photograph 21: 2015: LCC Site 4. Northeast facing aspect.

Photograph 22: 2017: LCC Site 4. Downslope location. Northeastern facing aspect.

D.6

Appendix D Photographic Record
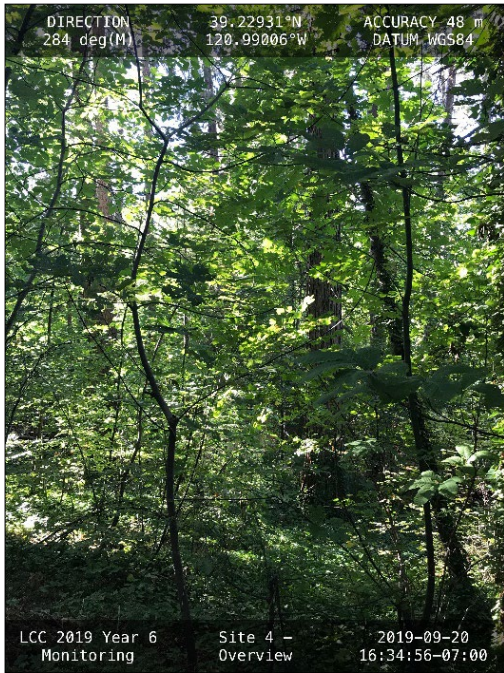
Photograph 23: 2019: LCC Site 4. Downslope location.

Photograph 24: 2021. LCC Site 4. Upslope location.
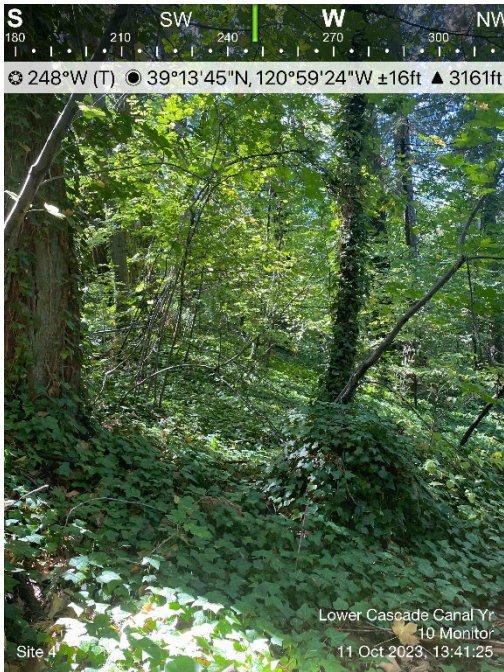
Photograph 25: 2023. LCC Site 4. Downslope location.
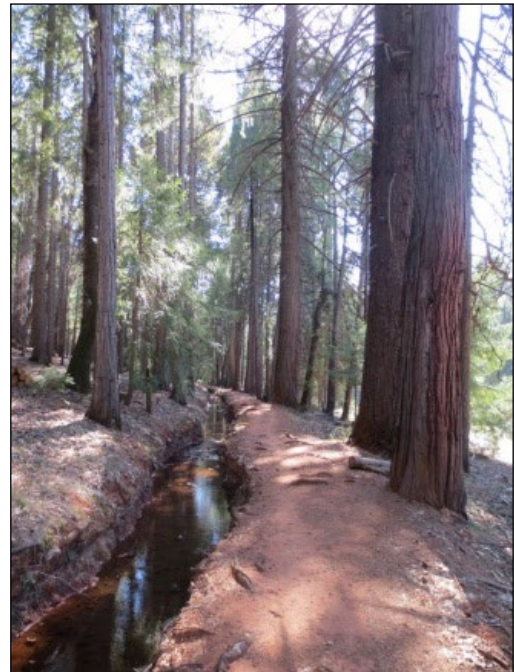
Photograph 26: 2013. UGVC Site 5. West facing aspect.

D.7

Appendix D Photographic Record

Photograph 27: 2015. UGVC Site 5. West facing aspect.

Photograph 28: 2017. UGVC Site 5. Downslope location. North facing aspect.

Photograph 29: 2019. UGVC Site 5. Downslope location.

Photograph 30: 2021. UGVC Site 5. Downslope location.

D.8

Appendix D Photographic Record
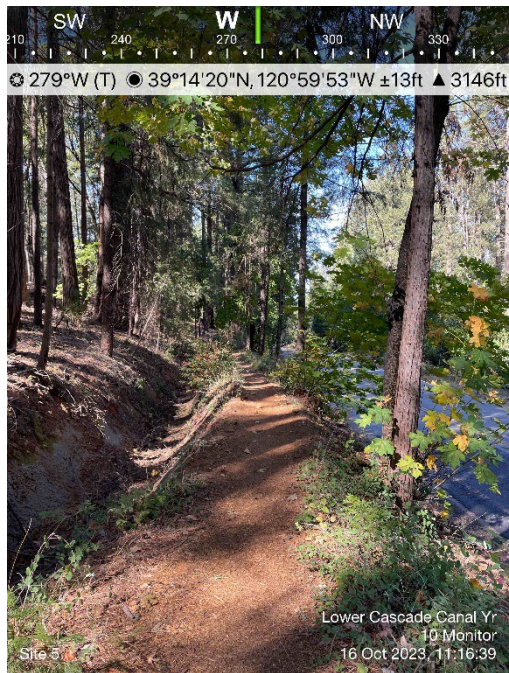
Photograph 31: 2023. UGVC Site 5. Downslope location.
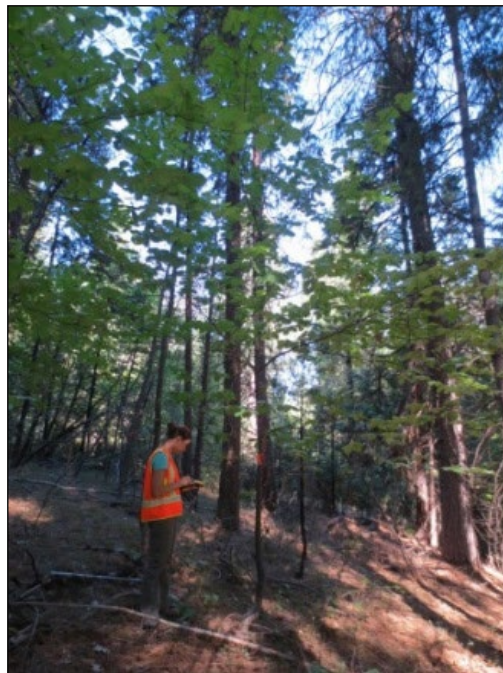
Photograph 32: 2013. DS Canal Site 6 (reference site).

Photograph 33: 2015: DS Canal Site 6 (reference site).

Photograph 34: 2017. DS Canal Site 6 (reference site). Southeast facing aspect.

Appendix D Photographic Record

Photograph 35: 2019. DS Canal Site 6 (reference site). Downslope location.

Photograph 36: 2021. DS Canal Site 6 (reference site).
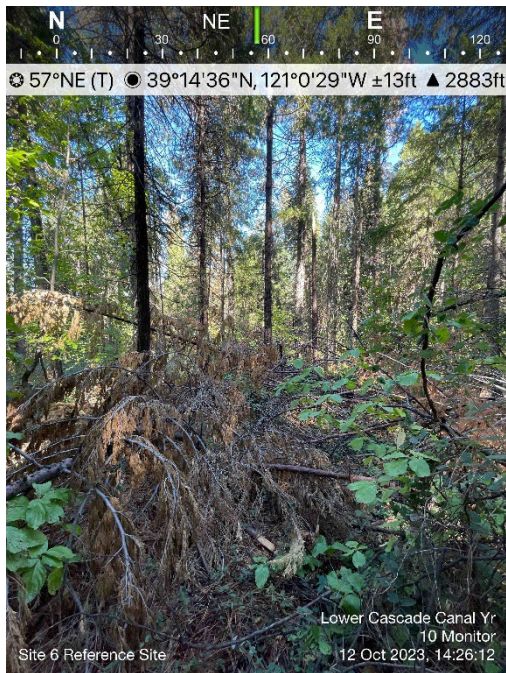
Photograph 37: 2023. DS Canal Site 6 (reference site). A lot of downed trees from February 2023 winter storm.
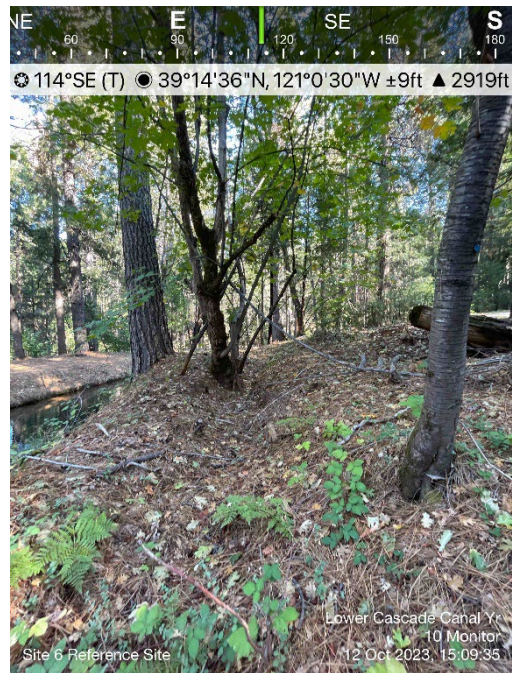
Photograph 38: 2023. DS Canal Site 6 (reference site).

D.10

Appendix D Photographic Record

Canopy Cover Study: Canopy Cover Assessment (2013, 2017, 2021, & 2023)

Photograph 39: 2013: LCC Reach. Southwest facing aspect.

Photograph 40: 2017. LCC Reach. North facing aspect.

Photograph 41: 2021: LCC Reach. West facing aspect.

Photograph 42: 2021: LCC Reach. North facing aspect.

D.11

Appendix D Photographic Record
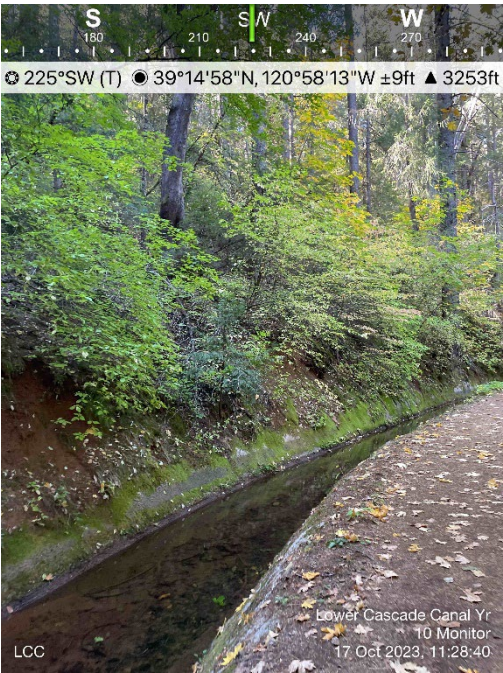
Photograph 43: 2023: LCC Reach. North facing aspect.
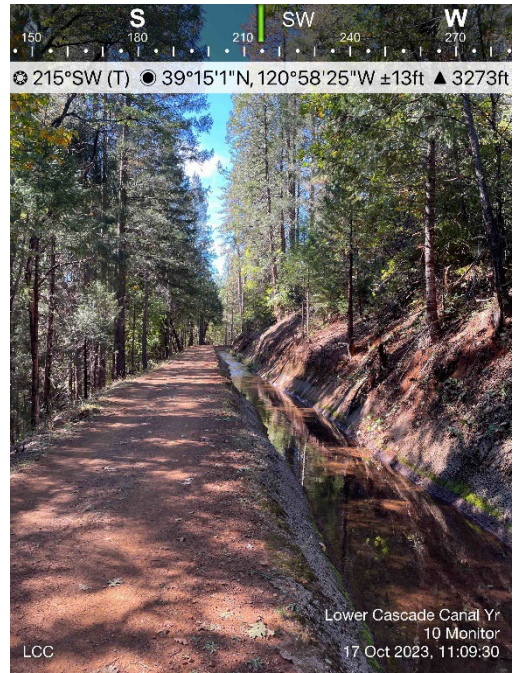
Photograph 44: 2023: LCC Reach. Southwest facing aspect.

Photograph 45: 2013: UGVC Reach. Northwest facing aspect.

Photograph 46: 2021: UGVC Reach. Southeast facing aspect.

D.12

Appendix D Photographic Record

Photograph 47: 2021: UGVC Reach. Northeast facing aspect.

Photograph 48: 2021. UGVC Reach. Southwest facing aspect.
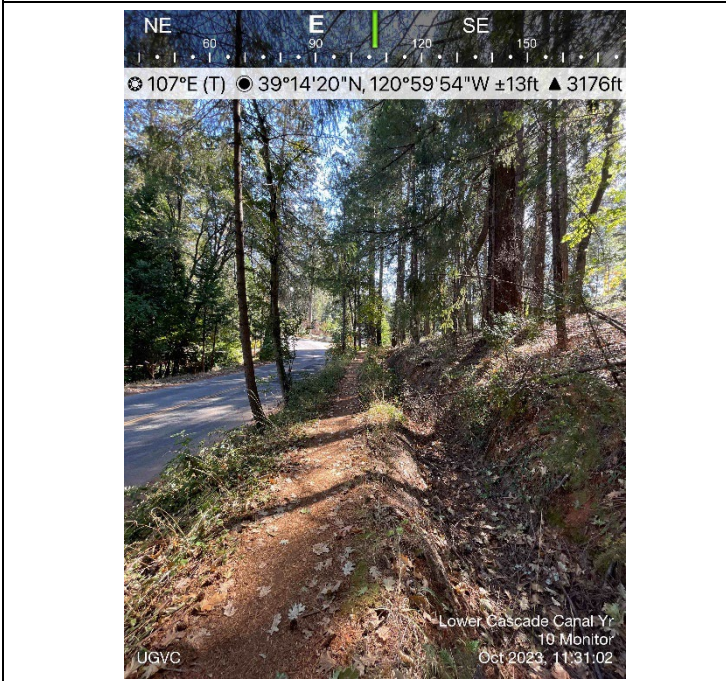
Photograph 49: 2023. UGVC Reach. East facing aspect.
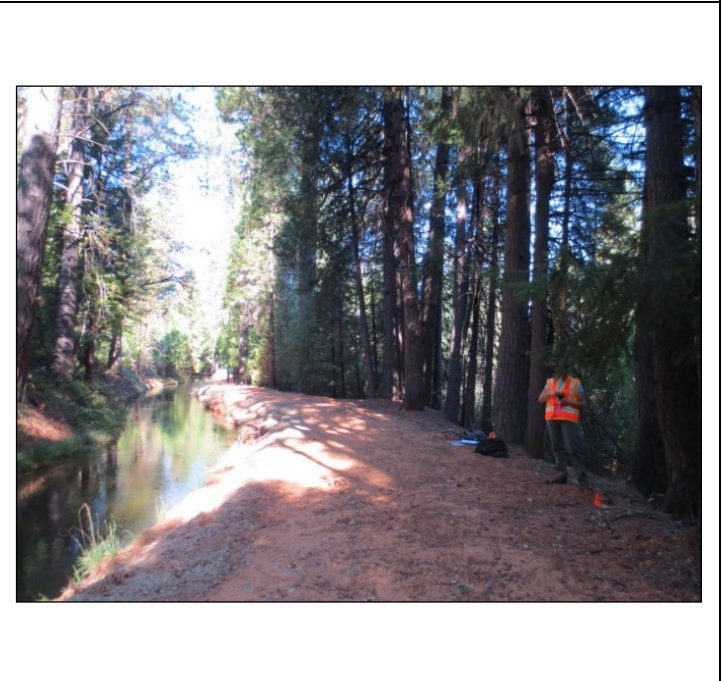
Photograph 50: 2013: DS Canal Reach (control). General west facing aspect.

D.13

Appendix D Photographic Record
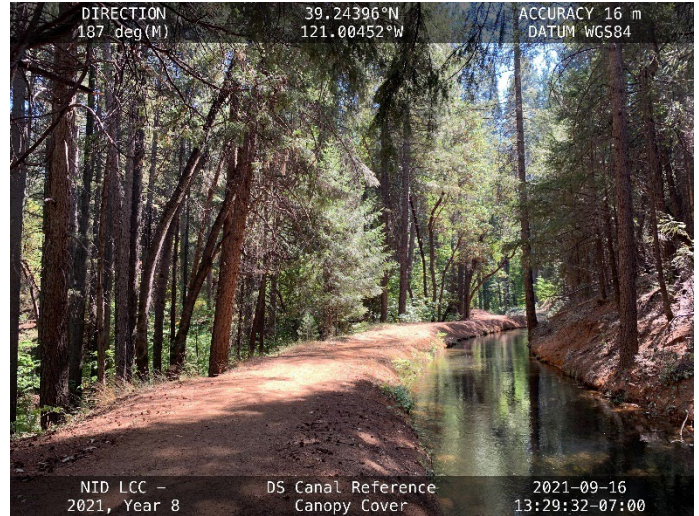
Photograph 51: 2017: DS Canal Reach (reference site). West facing aspect.

Photograph 52: 2021: DS Canal Reach (reference site). South facing aspect.

Photograph 53: 2021 DS Canal Reach (reference site). West facing aspect.

Photograph 54: 2023 DS Canal Reach (reference site). West facing aspect.

D.14

Appendix D Photographic Record

Pond Study (2013, 2017, 2021, & 2023)

Photograph 55: 2013. LCC Pond 1. Southwest facing aspect.

Photograph 56: 2017. LCC Pond 1. Southwest facing aspect. Sedimentation present from inlet.

Photograph 57: 2021: LCC Pond 1. North facing aspect.

Photograph 58: 2021: LCC Pond 1. Southwest facing aspect. Red arrow indicates the location of the 6-inch culvert connecting Pond 1 and Pond 2 during higher water levels.

D.15

Appendix D Photographic Record

Photograph 59: 2021: Culvert between LCC Pond 1 and Pond 2. Photo taken from the Pond 1 side located in the southern corner of Pond 1.

Photograph 60: 2021: Culvert between LCC Pond 1 and Pond 2. Photo taken from the Pond 2 side located in the northern corner of Pond 2.
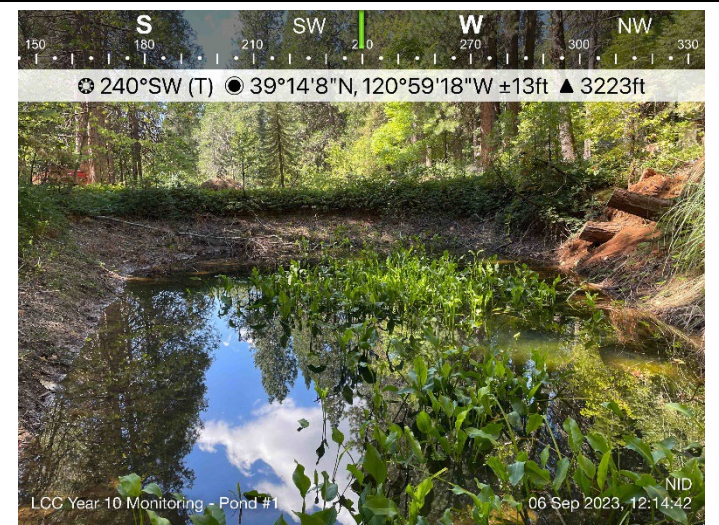
Photograph 61: 2023: LCC Pond 1. Northeast facing aspect.

Photograph 62: 2023. LCC Pond 1. Southwest facing aspect.

D.16

Appendix D Photographic Record
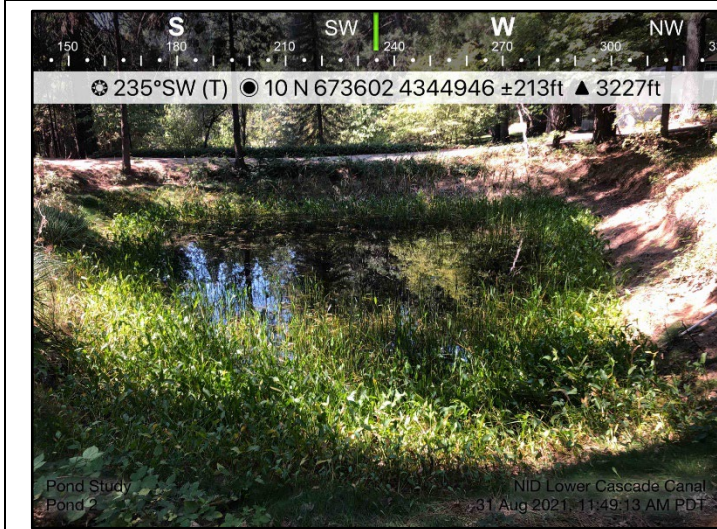
Photograph 63: 2021: LCC Pond 2. Southwest facing aspect.

Photograph 64: 2021. LCC Pond 2. Northeast facing aspect looking towards Pond 1.
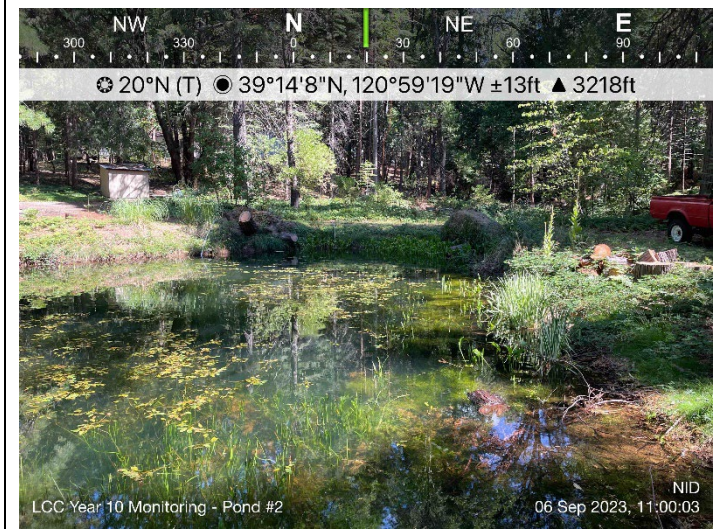
Photograph 65: 2023: LCC Pond 2. North facing aspect.

Photograph 66: 2023. LCC Pond 2. Southeast facing aspect.

D.17

Appendix D Photographic Record

Photograph 67: 2013: DS Canal Pond 3 (reference). Northeast facing aspect.

Photograph 68: 2017: DS Canal Pond 3 (reference).
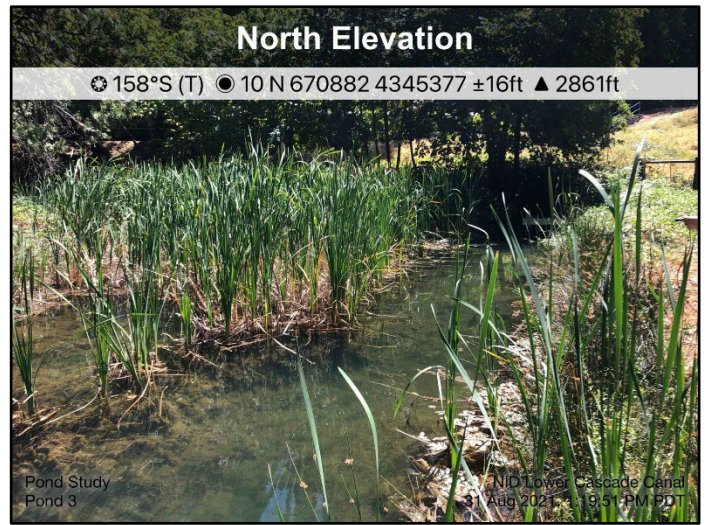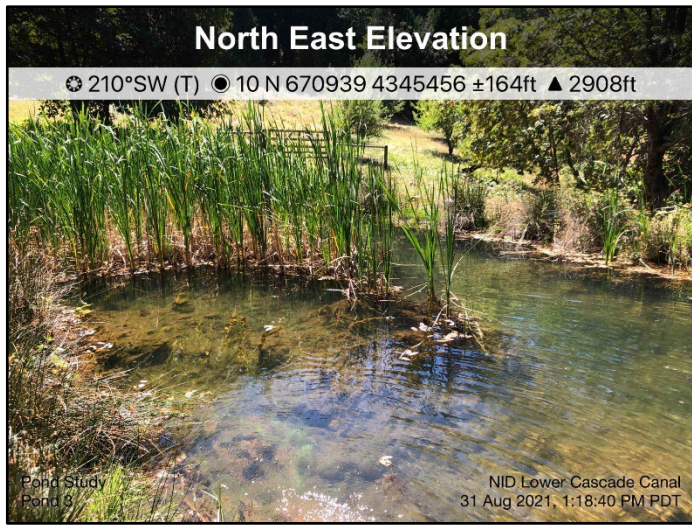
Photograph 69: 2021: DS Canal Pond 3 (reference). Southwest facing aspect.

Photograph 70: 2021: DS Canal Pond 3 (reference). Southeast facing aspect.

D.18

Appendix D Photographic Record

Photograph 71: 2021: DS Canal Pond 3 (reference). West facing aspect.

Photograph 72: 2021: DS Canal Pond 3 (reference). West facing aspect. Water outlet that flows down to a lower pond not included in the Pond Study.

Photograph 73: 2023: DS Canal Pond 3 (reference). Northwest facing aspect.

Photograph 74: 2023: DS Canal Pond 3 (reference). Northeast facing aspect.

D.19

Appendix E   FIELD DATASHEETS

Tree Health Assessment

Pond Study

Baseline Arborist Survey Datasheet

Project LOWER CASCADE CANAL   Site #1

Client NID   Date 10/11/2023

Weather Partly sunny, cool, low levels   Observer(s) Meghan Oats, Danny Shannon

Site Conditions Recently thinned

Notes _____

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
178	D	ACMA	7c, 6.1" 7.4", 5.3"	2	3	1	1	0	1	1	0	9	multi-trunked; 4 trunks 2/4 lost upper canopy
179	D	CONU	6.7"	4	4	1	1	0	1	1	1	13	
182	D	ACMA	7.5", 8.4"	3	3	1	1	0	0	1	0	9	losing canopy
176	D	CONU											"
177	D	CONU											Fallen dead
187	D	ALRH		4	4	1	1	0	1	1	0	12	
186	D	ACMA											"
183	D	CONU											Removed during forest health thinning
184	D	CONU											"
181	D	ALRH											
180	D	CONU											
173	D	CONU	6.7" 2.0"	4	4	1	1	0	1	1	0	12	No longer present, tag only found
210	D	CONU	2.0"	3	4	1	1	0	1	1	1	13	
174	D	CONU	3.1"	4	4	1	1	1	1	1	1	14	Heavy lean
189	D	CONU	3.1"	4	4	1	1	1	1	1	1	14	
188	D	CONU	5.6"	4	4	1	1	0	0	1	0	11	

DBH 182 — 5.8", 9.3", 7.9", 5.1", 4.8", 6.5", 4.2", 4.7", 7.8", 5.4", 8.6", 5.7", 5.1", 5.4", 8.5", 8.4"

Project _LCC_   Site _#1_   Date _10/11/23_

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
		Baseline Data					Tree Health Assessment						
175	D	CONU		3	4	1	0					10	NOT PRESENT
185	D	CONU		4	4	1	1	0	1	1	0	10	NOT PRESENT
190	U	CONU	6.4"	3	4	1	0	0	1	0	0	10	
192	U	ACMA	2.4"	4	4	1	1	0	0	0	0	10	
194	U	CONU	6.2"	4	4	1	1	0	0	1	1	13	
193	U	CONU	2", 4"	4	4	1	1	0	1	0	0	11	
191	U	CONU	5.2", 4.6"	4	4	1	1	1	1	1	0	12	
195	U	ACMA	4"	4	4	1	1	1	1	1	0	13	

ASSESSMENT KEY

Canopy Cover: 1- Sparse to full die-back (0-25%); 2- Partial (25-50%); 3- Medium (50-75%); 4- Full (75-100%)

Bark Health: 1- Poor to No bark (75-100%); 2- Fair (50-75%); 3-Good (25-50%); 4- Excellent (0-25%)

New Growth: 1- Present; 0- Not present

Leaf Color: 1- Normal; 0- Abnormal

Surface Growth: 1- Not Present; 0- Present

Disease: 1- Not Present; 0- Present

Parasites: 1- Not Present; 0- Present

Insects: 1- Not Present; 0- Present

Overall Tree Health: 1-3 Poor Health/Dead; 4-7 Fair Health; 7-10 Good Health; 11-14 Excellent Health

TREE SPECIES REFERENCE KEY

Baseline Arborist Survey Datasheet

Project Lower Cascade Canal   **Site** #2

Client NID   **Date** 10/12/2023

Weather Sunny, warm. High 60s   **Observer(s)** Meghan Oats, Danny Shimmin

Site Conditions Open mixed coniferous/deciduous forest. Dense shrub understory.

Notes _____

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
209		ACMA	13.2	4	4	1	1	O	1	1	O	12	very vigorous
300		ACMA	11.2, 10.0	4	4	1	1	O	1	1	O	12	"
146		COSE	2.8, 19.09	4	4	1	1	O	1	1	O	12	More shrub form. In dense shrubbery.
137		COSE	2.5, 2.5, 2.5	4	4	1	1	O	O	1	O	12	
144		ALIN	6.1										Deceased
143		ALIN	5.4	4	4	1	1	O	O	1	O	12	
136		ACMA	2.9	4	4	1	1	O	1	1	O	12	suppressed by coniferous overstory
139		ACMA	3.1	4	3	1	1	O	1	1	O	11	suppressed by adj. white fir
140		ACMA	4.9	3	3	1	1	O	1	1	O	9	~15% tip dieback / not serious
141		CONU	2.6	4	4	1	1	1	1	1	1	13	Tag on alt'd
213		COSE	*	2	2	1	1	O	O	O	1	7	Tag on alt'd. Shrub form. Much dieback.
212		COSE	*	2	3	1	1	O	1	1	O	9	"
205		ACMA	10.3	4	4	1	O	O	1	1	O	12	Lost small portion of top.
209		ACMA	4.8	3	3	1	O	O	1	1	O	9	dramatic lean.
138		ACMA	10.8, 7.8	3	3	1	1	O	O	1	O	9	significant lean & lost top.

* 213, DBH - 3.6", 1.8", 0.6", 2.2", 4.3", 3.9", 5.1", 3.8", 4.5", 3.6", 6.5", 1.1", 3.5", 2.7"

* 212 → DBH 1.9", 2.2", 4.7", 4.1"

Baseline Arborist Survey Datasheet

Project Lower Cascade Canal **Site** #3

Client NID

Weather Sunny, mild, low 60s **Observer(s)** Meghan Oak, Danny Shimmon

Site Conditions Dense mixed coniferous/deciduous forest PSIME/CADE overstory **Date** 10/12/2023

Notes Most trees onsite significantly impacted by overcrowding.

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
162	D	ACMA	9.8	2	1	1	0	0	0	1	0	6	Dead top, bark sloughing
165	D	ACMA	5.0	3	3	1	0	0	0	1	0	10	Significant lean.
166	D	ACMA	7.1	4	4	1	1	1	1	1	1	12	
104	D	ACMA	4.7	2	2	1	0	0	0	1	0	4	Nearly dead, ~75% dieback
163	D	ACMA	6.2	1	1	1	0	0	0	1	0	8	impacted by acadfall, sig. lean
160	D	ACMA	9.4	3	3	1	1	0	0	1	0	9	~35% dieback, vigorous recover
159	D	CoNL	3.4	4	4	1	0	0	1	1	0	10	Tag engulfed
158	D	ACMA	9.9	1	2	1	0	0	0	1	0	6	~45% top dieback, Ivy encroach.
157.	D	ALIN	2.4	3	4	1	0	0	1	1	0	10	Nearly downed altogether
370	D	ALIN	2.4	4	4	1	0	0	1	1	0	12	
214	D	ACMA	7.5	4	3	1	0	0	1	1	0	10	
165	D	ACMA	9.9	3	3	1	0	0	0	1	0	8	fungal disorder on bark ~85% dieback
152	D	ACMA	7, 8, 7.3	4	4	1	1	0	0	1	0	11	small presence of fungus on bark
153	D	ACMA	2.6, 2.1	3	4	1	0	0	1	1	0	10	two trunks, lost leader
154	D	ACMA	2.4	3	4	1	1	1	1	1	0	10	Tag engulfed
167	D	ACMA	4.1	4	4	1	1	0	1	1	0	12	cavity in lower trunk from lost leader

Project ___LCC___   Site ___#3___   Date ___10/12/23___

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
		Baseline Data					Tree Health Assessment						
171	3	ACMA	4.3	4	4	1	1	1	1	1	0	13	Assessed from a distance, unable to cross
172	4	COMA	5.6	4	4	1	1	1	1	1	1	14	
169	4	COMA	5.	4	4	1	1	1	1	1	1	14	
168	4	COMA	4	4	4	1	1	0	1	1	0	12	←

ASSESSMENT KEY

Canopy Cover 1- Sparse to full die-back (0-25%); 2- Partial (25-50%); 3- Medium (50-75%); 4- Full (75-100%)

Bark Health 1- Poor to No bark (75-100%); 2- Fair (50-75%); 3-Good (25-50%); 4- Excellent (0-25%)

New Growth 1- Present; 0- Not present

Leaf Color 1- Normal; 0- Abnormal

Surface Growth 1- Not Present; 0- Present

Disease 1- Not Present; 0- Present

Parasites 1- Not Present; 0- Present

Insects 1- Not Present; 0- Present

Overall Tree Health 1-3 Poor Health/Dead; 4-7 Fair Health; 7-10 Good Health; 11-14 Excellent Health

TREE SPECIES REFERENCE KEY

Baseline Arborist Survey Datasheet

Project __Lower Cascade Canal Tree__   Site __#4__

Client __NID__

Weather __Sunny, mild/low 60s__   Observer(s) __M. Oaks, D. Shannon__   Date __10/11/2023__

Site Conditions __Dense understory, significant presence of Hedera helix__

Notes ____

Baseline Data				Tree Health Assessment									
Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
106		AcMA	9.3	4	4	1	1	0	1	1	0	12	NOT FOUND LAST YR Hedera helix ascending in canopy
116		ACMA	1.6,1.1	3	4	1	1	1	1	1	0	12	"
117		ALIN	1.3	4	4	1	1	1	1	1	0	12	"
115		ALIN	1.7	2	4	1	0	1	0	1	0	9	impacted by deadfall
119		ALIN	3.1	3	4	1	1	1	1	1	0	12	"
113		ALIN	1.9	2	4	1	1	0	0	1	0	11	Heavily suppressed
114		ACMA	2.5	2	4	1	1	1	1	1	0	11	"
123		FRLA	3.7	4	4	1	1	1	1	1	0	13	
201		ALIN	2.3	4	3	1	1	1	1	1	0	12	Heavy lean, suppressed
215		ACMA	3.2	4	4	1	1	1	1	1	0	13	
200		ACMA	2.0	4	3	1	1	1	1	1	0	12	one broken leader, ivy
202		COCO	1.2	3	3	1	1	1	1	1	0	11	LoHI ascending)
291		ALRU	2.4	4	3	1	1	1	1	1	0	12	lower trunk has minimal impact
199		ACMA	~10	4	4	1	1	0	1	1	0	12	kissed from a distance
292		ACMA	~8	4	4	1	1	0	1	1	0	12	"
197		ACMA	~5	4	3	1	1	0	1	1	0	11	"

110, 109, 129, 111

Project __LCC__ Site __#4__ Date __10/4/23__

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
19u	u	ACMA	~7"	2	4	1	1	0	1	1	0	10	Gone =
129	u	ACMA												

Baseline Data / Tree Health Assessment

ASSESSMENT KEY

Canopy Cover 1- Sparse to full die-back (0-25%); 2- Partial (25-50%); 3- Medium (50-75%); 4- Full (75-100%)

Bark Health 1- Poor to No bark (75-100%); 2- Fair (50-75%); 3-Good (25-50%); 4- Excellent (0-25%)

New Growth 1- Present; 0- Not present

Leaf Color 1- Normal; 0- Abnormal

Surface Growth 1- Not Present; 0- Present

Disease 1- Not Present; 0- Present

Parasites 1- Not Present; 0- Present

Insects 1- Not Present; 0- Present

Overall Tree Health 1-3 Poor Health/Dead; 4-7 Fair Health; 7-10 Good Health; 11-14 Excellent Health

TREE SPECIES REFERENCE KEY

Baseline Arborist Survey Datasheet

Project Lower Cascade Canal / UGVC
Client MD
Weather 60°, sunny
Site Conditions _____
Notes _____

Site UGVC site → #5
Observer(s) Meghan Oates
Date 10/18/2023

More tree thinning throughout site / street-side

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
				Baseline Data → **Tree Health Assessment**									
103	Street	ACMA	7.1	2	4	1	1	0	1	1	0	10	
100		Alnu	9.8	1	1	1	1	0	1	1	0	9	
99		Conu	8.7	4	4	1	1	0	1	1	0	12	
105	↓		/									—	Gone

Baseline Arborist Survey Datasheet

Project **Lower Cascade Canal**   Site **#6-DS canal Reference site**

Client **N17**   Date **10/12/2023**

Weather **Clear, sunny, warm, low 70s.**   Observer(s) **Meghan Oats, Danny Shimmen**

Site Conditions **site significantly impacted in recent deadfall. Dense mixed coniferous –**

Notes **deciduous.**   ↳ snow fall (Feb 2023 – lots of downed trees)

Tree Number	Tree Location	Species	DBH	Canopy Cover	Bark Health	New Growth	Leaf Color	Surface Growth	Disease	Parasites	Insects	Overall Health Score	Notes
		Baseline Data		Tree Health Assessment									
219		CONU	3.7, 2.8	4	4	1	1	0	1	1	0	12	
224		CONU	2.0	3	3	1	1	1	0	1	0	11	
223		CONU	3.0	4	4	1	1	1	0	0	0	13	
220		CONU	2.7	4	4	1	1	1	1	0	0	13	
221		CONU	2.0	4	4	1	1	1	1	0	0	13	
217		CONU	/										completely crushed under recent fallen incense cedar.
216		CONU	4.4, 4.5	2	3	1	1	1	0	1	0	8	
222		CONU	2.9	4	4	1	1	0	0	0	0	12	
225		CONU											=
95		ACMA	3.7	4	4	1	1	0	0	1	1	12	
90		ACMA	8.7, 2.5	3	2	1	1	0	0	1	0	8	Dead
94		ACMA	*										Dead
92		ALRH	7.2										Dead
93		ACMA	4.3	4	3	1	1	0	1	1	0	11	

*4.4, 6.2, 11.3, 34

Pond 1

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by			
	(FWS Field Office)	(date)	(biologist)

Date of Site Assessment: 9/6/23
(mm/dd/yyyy)

Site Assessment Biologists: Phipps   Jacqueline   Oates   Meghan
(Last name)   (first name)   (Last name)   (first name)

(Last name)   (first name)   (Last name)   (first name)

Site Location: Nevada County, Lower Cascade Canal Pond #1
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

ATTACH A MAP (include habitat types, important features, and species locations)

Proposed project name: Lower Cascade Canal Pond Study
Brief description of proposed action:
lowering/decomissions of lower Cascade canal
monitor effects 0-10 years post
evaluate ponds over 4 years

1) Is this site within the current or historic range of the CRF (circle one)? **(YES)** NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **(NO)**
   If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION
(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:

Size: 550 square feet   Maximum depth: 2 foot visual

Vegetation: **(emergent)**, overhanging, dominant species: plantain

Substrate: Silt

(Perennial) or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

water levels much lower than previous years

STREAM:

    Bank full width: _____

    Depth at bank full: _____

    Stream gradient: _____

    Are there pools (circle one)? YES   NO

        If yes,

                Size of stream pools: _____

                Maximum depth of stream pools: _____

    Characterize non-pool habitat: run, riffle, glide, other: _____
    _____
    _____

    Vegetation: emergent, overhanging, dominant species: _____
    _____
    _____

    Substrate: _____
    _____

    Bank description: _____
    _____
    _____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____

Other aquatic habitat characteristics, species observations, drawings, or comments:

    -tree frogs (adult/metamorph/tadpoles)
    -water clear, not as much emergent veg variety
                  as Pond 2

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

Pond / Wetland General Assessment Datasheet

updated 9/1/2017

Project **LCC**   Date **9/6/23**

Client / Owner **NID**   Surveyors **J Phipps, M Oates**

Latitude **39.23571**   Longitude **-120.988615**   Datum **WGS 1984**

Site ID **Pond #1**

Site Location **Spring Street private residence (upper pond) connected to pond #2 via Culvert**

Site Description **pond within upland forest, incense cedar, black oak madrone**

NWI Classification _____

Area of Inundation Description **inundation only within pond - smaller pond**

Water Depth Range (Feet) **~2', 4' below OHWM**

Soil Map Unit Name / Source _____

Area of Soil Saturation Description **3.5 feet below OHWM**

Is site within current and/or historic range of CRLF?   yes(circled)   no

Are there any known records of CRLF within 1 mile of site?   yes   no(circled)

CRLF Habitat Assessment Remarks **emergent veg, plantain**

Observed Vegetation	Hydrophytic	Status	Observed Wildlife	Status
Meghan Oates Notes			- tree frog tadpoles	
			- tree frogs adult	
			- hummingbird spp	
			- dragonflies	
			- water striders	
			- spotted towhee	
			- California scrub jay	
			- Red shouldered hawk	
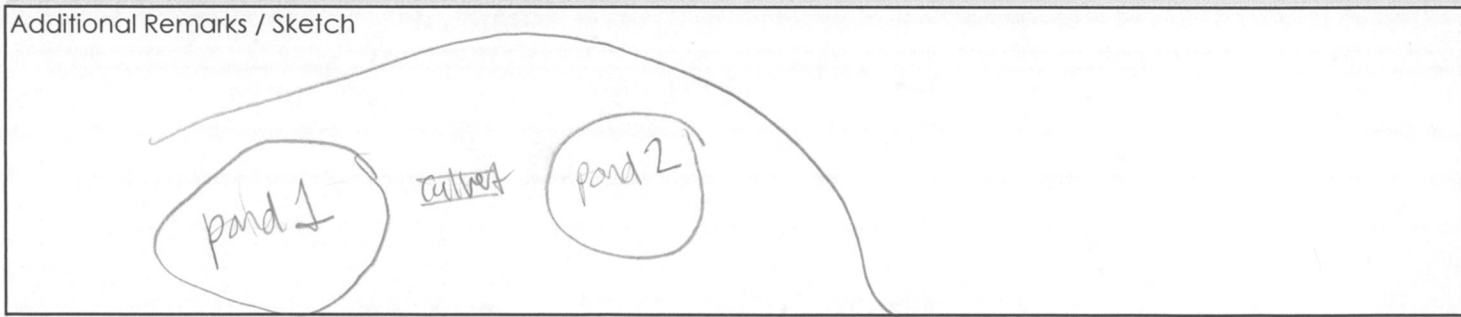
Additional Remarks / Sketch

pond 1 — culvert — pond 2

Pond / Wetland General Assessment Datasheet   updated 9/1/2017

Project __LCC__   Date __9/6/23__

Client / Owner __MD__   Surveyors __M Oats, J. Phipps__

Latitude __39.23574__   Longitude __-120.988015__   Datum __WGS1984__

Site ID __LCC Pond #1__

Site Location __Spring St, private residence (upper pond)__

Site Description __NO longer connected to pond #2; old culvert (rusted out) ~6' above current water line__

NWI Classification __PUB Fh__

Area of Inundation Description __innundation only w/in pond, smaller area than previous survey__

Water Depth Range (Feet) __12-18" visual estimate from edges__

Soil Map Unit Name / Source __AFB - USDA/NRCS - Aiken loam 2-9% slope__

Area of Soil Saturation Description __~1' up from water line__

Is site within current and/or historic range of CRLF?   yes   no

Are there any known records of CRLF within 1 mile of site?   yes   no

CRLF Habitat Assessment Remarks _____

Observed Vegetation	Hydrophytic	Status	Observed Wildlife	Status
Hypericum calycinum (along S & W banks)				
cutleaf blackberry				
cornut				
incense cedar				
Alisma plantago aquatica				

Additional Remarks / Sketch

Pond is 5-6' below OHWM / original boundary - not being fed by any water source like LCC#2

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by			
	(FWS Field Office)	(date)	(biologist)

Date of Site Assessment: 9/6
(mm/dd/yyyy)

Site Assessment Biologists: Phipps   Jacqueline   Oaks   Meghan
(Last name)   (first name)   (Last name)   (first name)

(Last name)   (first name)   (Last name)   (first name)

Site Location: Nevada County, Lower Cascade Canal
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

ATTACH A MAP (include habitat types, important features, and species locations)

Proposed project name: Lower Cascade Canal
Brief description of proposed action:

10 year pond study post canal decomission/
Lowering of water
levels

Evaluate pond over 4 years

1) Is this site within the current or historic range of the CRF (circle one)? **YES** NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **NO**
   If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION
(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:

Size: 2500 Square Feet   Maximum depth: 6'   Visual estimate

Vegetation: **emergent**, overhanging, dominant species: plantain spp., cattail

Substrate: Silt

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____
Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

STREAM:

      Bank full width: _____

      Depth at bank full: _____

      Stream gradient: _____

      Are there pools (circle one)? YES   NO

          If yes,

                Size of stream pools: _____

                Maximum depth of stream pools: _____

      Characterize non-pool habitat: run, riffle, glide, other: _____
      _____

      Vegetation: emergent, overhanging, dominant species: _____
      _____
      _____

      Substrate: _____
      _____

      Bank description: _____
      _____
      _____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____

Other aquatic habitat characteristics, species observations, drawings, or comments:

    – hundreds of treefrogs, and dozens of treefrog tadpoles
                        metamorphis phase –7legs

    – minnows/fish seen – mosquitofish?

Necessary Attachments:

    1. All field notes and other supporting documents
    2. Site photographs
Maps with important habitat features and species location

Pond 2

Pond / Wetland General Assessment Datasheet

updated 9/1/2017

Project __LICC__   Date __9/6/23__

Client / Owner __NID__   Surveyors __J Phipps, M Oates__

Latitude __39.235182__   Longitude __-120.989522__   Datum __WGS 1984__

Site ID __Pond 2__

Site Location __Spring Street private residence, lower pond. Culvert connects to pond #1__

Site Description __Perennial pond with upland forest, NID Canal east__

NWI Classification _____

Area of Inundation Description __Surface of water ≈ 6', about 1' below OHWM__

Water Depth Range (Feet) __≈ 6', emergent veg makes difficult to see bottom__

Soil Map Unit Name / Source _____

Area of Soil Saturation Description __≈ .5' from OHWM / water line perimeter__

Is site within current and/or historic range of CRLF?   (yes)   no

Are there any known records of CRLF within 1 mile of site?   yes   (no)

CRLF Habitat Assessment Remarks __Emergent vegetation, dominant veg - plantain Blackberry__

Observed Vegetation			Observed Wildlife	
	Hydrophytic	Status	Lots of tree frogs	Status
Meghan Oates Notes			Red shouldered hawk	
			fish, mosquito fish?	
			Turkey (feddly feather)	
			Stellars jay	
			Tree frog (tadpoles)	
			Grey squirrel	
			Hairy Woodpecker	

Additional Remarks / Sketch

Tree work being conducted, hard to hear birds

↑ North   (Pond 2) — Culvert — (Pond 1)

Pond / Wetland General Assessment Datasheet

updated 9/1/2017

Project ICC   Date 9/6/23

Client / Owner NID   Surveyors M. Oats, J. Phipps

Latitude _____ Longitude _____ Datum _____

Site ID Pond #2

Site Location Spring St, private residence

Site Description Pond w/ upland forest

NWI Classification PubFH

Area of Inundation Description _____

Water Depth Range (Feet) _____

Soil Map Unit Name / Source _____

Area of Soil Saturation Description _____

Is site within current and/or historic range of CRLF?   yes   no

Are there any known records of CRLF within 1 mile of site?   yes   no

CRLF Habitat Assessment Remarks _____

Observed Vegetation	Hydrophytic	Status	Observed Wildlife	Status
Alisma on banks/edges			tree frogs / tadpoles	
Pteridium aquilinum				
cutleaf blackberry				
Calamus ?				
Juncus torreyi				
Thermopsis mullein				
Typha sp.				
Himalayan blackberry				
Wisteria sp.				

Additional Remarks / Sketch

Recently cut incense cedar on south side of pond ~20" dbh

→ Vinca minor on north side of pond
Potamogeton natans (pondweed) - scattered
deer grass
Poa sp.

pipe coming from N/E
filling pond through 1½"
PVC pipe

Elymus sp.

③

<center>Appendix D.</center>
<center><u>California Red-legged Frog Habitat Site Assessment Data Sheet</u></center>

Site Assessment reviewed by _____ _____ _____
<pre>   (FWS Field Office)   (date)   (biologist)</pre>

Date of Site Assessment: ___9/6/23___
<pre>   (mm/dd/yyyy)</pre>

Site Assessment Biologists: Phipps   Jacquline   Oates   Meghan
<pre>   (Last name)   (first name)   (Last name)   (first name)</pre>

_____ _____ _____ _____
<pre>   (Last name)   (first name)   (Last name)   (first name)</pre>

Site Location: Nevada County   DS Canal
<pre>   (County, General location name, UTM Coordinates or Lat./Long. or T-R-S).</pre>

<center>****ATTACH A MAP** (include habitat types, important features, and species locations)**</center>

Proposed project name: _Lower Cascade Pond Study_

Brief description of proposed action:

10th year pond study - control Pond #3
monitory post decommissioning (10 year study)
Check out

1) Is this site within the current or historic range of the CRF (circle one)? (YES) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (NO)
If yes, attach a list of all known CRF records with a map showing all locations.

<center>## GENERAL AQUATIC HABITAT CHARACTERIZATION</center>
<center>*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*</center>

POND:

Size: ___3500 Square Feet___   Maximum depth: ___3'___ visual observation

Vegetation: (emergent) overhanging, dominant species: ___Cattails, junous along edges___
___cattails within pond___

Substrate: _____

(Perennial) or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____
<center>**Appendix D.**</center>
<center>**California Red-legged Frog Habitat Site Assessment Data Sheet**</center>

STREAM:

    Bank full width: _____

    Depth at bank full: _____

    Stream gradient: _____

    Are there pools (circle one)? YES   NO

        If yes,

                Size of stream pools: _____

                Maximum depth of stream pools: _____

    Characterize non-pool habitat: run, riffle, glide, other: _____

_____

    Vegetation: emergent, overhanging, dominant species: _____

_____

    Substrate: _____

_____

    Bank description: _____

_____

_____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _____

Other aquatic habitat characteristics, species observations, drawings, or comments:

   —Bullfrogs (with) ~~~~~~~~~~~~ (tadpoles)

   —Cattails ~~~~~ at as much ~~~~~ near ~~ of Pod 2

   —Algae

   —Silt w/ lots of algae present

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

Pond 3

Pond / Wetland General Assessment Datasheet   updated 9/1/2017

Project ___LCC___   Date __9/6/23__

Client / Owner ___ND___   Surveyors __JPhipps M Oates__

Latitude __39.24093__   Longitude __-121.620355__   Datum __WGS 1984__

Site ID __Pond 3__

Site Location __off pittsburg Vine Road (upper pond) along DS canal__

Site Description __Pond highest of 3 - tiered into slope__
__Water from pipe from DS canal__

NWI Classification

Area of Inundation Description __At OHWM__

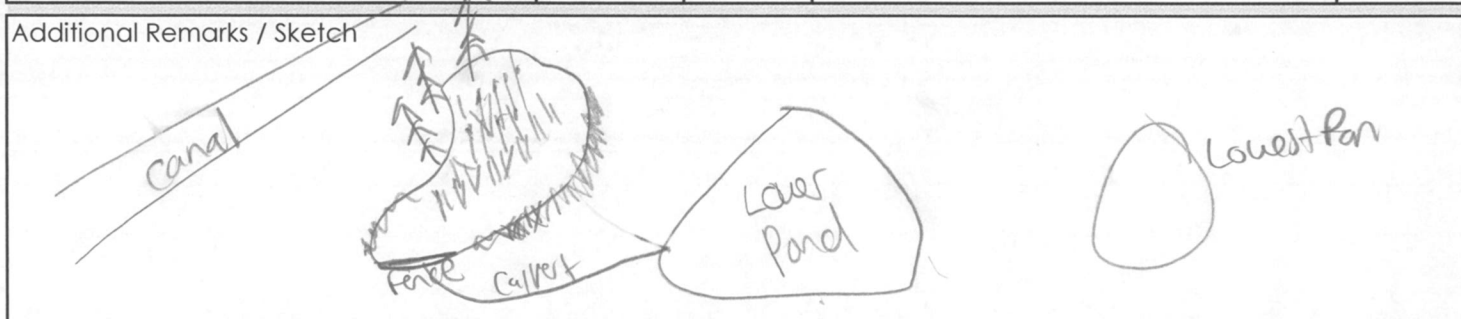Water Depth Range (Feet) __3 feet__

Soil Map Unit Name / Source

Area of Soil Saturation Description __up to OHWM, pipe / culvert through edge looks__
__like it washed out and fence has been placed by culvert / pump__

Is site within current and/or historic range of CRLF?   (yes)   no

Are there any known records of CRLF within 1 mile of site?   yes   (no)

CRLF Habitat Assessment Remarks __Bull frog present, typha 60% pond, cattails 40%__

Observed Vegetation			Observed Wildlife	
	Hydrophytic	Status	- Hairy woodpecker	Status
Meghan Oates (Note)			- scrub Jay	
			- Canada Geese	
			- Bullfrog adult	
			- Acorn woodpecker	
			- Spotted Towhee	
			- House Wren	
			- Red tailed Hawk	

Additional Remarks / Sketch

Pond / Wetland General Assessment Datasheet

updated 9/1/2017

Project LCC/UGVC 104K monitoring   Date 9/6/2023

Client / Owner NID   Surveyors M Oats, J. Phipps

Latitude _____ Longitude _____ Datum WGS 1984

Site ID Pond 3 - IDS canal

Site Location _____

Site Description upper pond

NWI Classification PUBK

Area of Inundation Description OHWM

Water Depth Range (Feet) ~3ft.

Soil Map Unit Name / Source _____

Area of Soil Saturation Description _____

Is site within current and/or historic range of CRLF?   yes   no

Are there any known records of CRLF within 1 mile of site?   yes   no

CRLF Habitat Assessment Remarks _____

Observed Vegetation	Hydrophytic	Status	Observed Wildlife	Status
Typha lat. in pond			bullfrogs	
lots of algae/veg in pond			canada goose	
Juncus effusus			garter snake (near canal)	
Daucus carota			water striders	
Epilobium ciliulatum				
Himalayan blackberry				
Lathyrus latifolius				
Cyperus eragostis				
Poa sp.				

Additional Remarks / Sketch

Appendix F   OBSERVED SPECIES

Vegetation and wildlife species observed during Year 10 monitoring (2023) for the Tree Health Assessments in October 2023, Nevada County, California. Species observed, or not observed, in previous monitoring years (i.e., 2013, 2015, 2017, 2019, & 2023) are also noted.

Common name	Scientific Name	Lifeform	Nativity	Observation Location								
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pond 1	Pond 2	Pond 3
Plants												
annual dogtail species	*Cynosurus echinatus*	Annual grass	Non-native invasive								X	
apple species	*Malus* sp.	Tree	Non-native									X
bigleaf maple	*Acer macrophyllum*	Tree	Native	X	X	X	X	X	X			
black oak	*Quercus kelloggii*	Tree	Native	X	X	X	X	X	X	X	X	X
Bamboo species	*Phyllostachys* sp.	Vine/Shrub	Non-native							X		
California man-root	*Marah watsonii*	Perennial herb/Vine	Native								X	
canyon live oak	*Quercus chrysolepis*	Tree	Native	X	X				X			
common cattail	*Typha latifolia*	Perennial herb	Native							X	X	X
common ladyfern	*Athyrium filix-femina*	Fern	Native	X	X	X	X	X	X			
common wooly mullein	*Verbascum Thapsus*	Perennial herb	Non-native Invasive								X	
coyote brush	*Baccharis pilularis*	Shrub	Native	X					X			
cutleaf blackberry	*Rubus laciantus*	Shrub	Non-native	X	X	X	X	X	X	X	X	
dandelion species	*Agoseris* sp.	Perennial herb	Native									
dock species	*Rumex* spp.	Perennial herb	Non-native				X					X

Appendix F Observed Species

Common name	Scientific Name	Lifeform	Nativity	Observation Location								
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pond 1	Pond 2	Pond 3
Douglas-fir	*Pseudotsuga menziesii*	Tree	Native	X	X	X	X	X	X			
duckweed species	*Lemna* sp.	Perennial herb	Native								X	
English ivy	*Hedera helix*	Vine	Non-native invasive	X	X	X	X					
Fremont's cottonwood	*Populus fremontii*	Tree	Native								X	
gray alder	*Alnus incana*	Tree	Native	X	X	X	X	X	X	X		
Hazelnut	*Corylus cornuta*	Tree	Native	X								
hedge nettle species	*Stachys* sp.	Perennial herb	Native	X								
henbit dead-nettle	*Lamium amplexicaule*	Annual herb	Non-native								X	
Himalayan blackberry	*Rubus armeniacus*	Shrub	Non-native invasive	X	X	X	X	X	X	X	X	X
incense cedar	*Calocedrus decurrens*	Tree	Native	X			X	X	X	X	X	X
interior live oak	*Quercus wislizeni*	Tree	Native	X			X					
mountain grape	*Berberis aquifolium*	Shrub	Native	X	X							
mountain maple	*Acer glabrum*	Tree	Native								X	
mustard species	*Brassica* sp.	Annual herb	Non-native invasive									X
narrowleaf cattail*	*Typha angustifolia*	Perennial herb	Non-native								X	
narrowleaf plantain	*Plantago lanceolata*	Perennial herb	Non-native invasive									X
Oregon ash	*Fraxinus latifolia*	Tree	Native				X					
Pacific dogwood	*Cornus nutallii*	Tree	Native	X	X	X		X	X		X	
Pacific madrone	*Arbutus menziesii*	Tree	Native	X	X	X	X	X	X	X	X	
pink honeysuckle	*Lonicera hispidula*	Vine	Native	X	X	X	X		X	X	X	

Appendix F Observed Species

Common name	Scientific Name	Lifeform	Nativity	Observation Location								
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pond 1	Pond 2	Pond 3
pea species	*Lathyrus* sp.	Perennial herb	—							X		
periwinkle species	*Vinca* sp.	Perennial herb	Non-native invasive								X	
poison hemlock	*Conium maculatum*	Perennial herb	Non-native invasive		X	X	X					
poison oak	*Toxicodendron diversilobum*	Vine/Shrub	Native	X	X	X	X	X	X			
Ponderosa pine	*Pinus ponderosa*	Tree	Native	X	X	X	X	X	X		X	X
Queen Anne's lace, wild carrot	*Daucus carota*	Perennial herb	Non-native									X
quillwort species	*Isoetes* sp.	Fern	Native	X	X		X		X			
rush species	*Juncus* spp.	Perennial grass	Native								X	X
Scotch broom	*Cytisus scoparius*	Shrub	Non-native invasive							X		X
sedge species	*Carex* sp.	Perennial herb	Non-native								X	
Solomon's seal species	*Maianthemum* sp.	Perennial herb	Native							X		
sorrel species	*Oxalis* sp.	Perennial herb	Non-native	X								
sugar pine	*Pinus lambertiana*	Tree	Native	X	X	X	X	X	X			
sweet cicely species	*Osmorhiza* sp.	Perennial herb	Native									X
sword fern	*Polystichum munitum*	Fern	Native							X	X	
tanoak	*Notholithocarpus densiflorus*	Tree	Native	X			X					
thimbleberry	*Rubus parviflorus*	Vine/Shrub	Native							X		
trail plant	*Adenocaulon bicolor*	Perennial herb	Native	X	X		X	X				
tree of heaven	*Ailanthus altissima*	Tree	Non-native invasive							X		

Appendix F Observed Species

Common name	Scientific Name	Lifeform	Nativity	Observation Location								
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pond 1	Pond 2	Pond 3
water parsnip**	*Berula erecta*	Perennial herb	Native									
western goldenrod*	*Euthamia occidentalis*	Perennial herb	Native	X					X			
western raspberry	*Rubus leucodermis*	Shrub	Native	X		X	X					
white alder	*Alnus rhombifolia*	Tree	Native	X		X		X	X			
Wildlife												
American bullfrog	*Lithobates catesbeianus*	Frog	Non-native invasive							X	X	X
Anna's hummingbird	*Calypte anna*	Bird	Native									X
black phoebe	*Sayornis nigricans*	Bird	Native								X	
brown creeper	*Certhia americana*	Bird	Native								X	
brown trout species**	*Salmo trutta sp.*	Fish	Non-native								X	
California scrub jay	*Aphelocoma californica*	Bird	Native	X			X		X			
California sister**	*Adelpha californica*	Insect	Native									
damselfly species	Zygoptera sp.	Insect	—								X	
deer species	*Odocoileus* sp.	Mammal	Native								X	
dragonfly species	Anisoptera sp.	Insect	—								X	
flame skimmer	*Libellula saturata*	Insect	Native									X
hummingbird species*	*Calypte*, *Selasphorus* sp.	Bird	Native									
lesser goldfinch	*Spinus psaltria*	Bird	Native								X	
mosquitofish	*Gambusia affinis*	Fish	Native							X		
mountain chickadee**	*Poecile gambeli*	Bird	Native						X			
northern flicker	*Colaptes auratus*	Bird	Native	X	X	X						

Appendix F Observed Species

Common name	Scientific Name	Lifeform	Nativity	Observation Location								
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Pond 1	Pond 2	Pond 3
orange-crowned warbler*	*Oreothlypis celata*	Bird	Native							X		
owl species**	Strigidae sp.	Bird	Native								X	
Pacific tree frog	*Pseudacris regilla*	Frog	Native								X	
red-breasted nuthatch*	*Sitta canadensis*	Bird	Native							X	X	
red-eared slider**	*Trachemys scripta elegans*	Turtle	Non-native invasive								X	
red-tailed hawk	*Buteo jamaicensis*	Bird	Native									X
spotted towhee	*Pipilo maculatus*	Bird	Native							X		
Steller's jay	*Cyanocitta stelleri*	Bird	Native		X					X		
western gray squirrel**	*Sciurus griseus*	Mammal	Native									X

Note: The Canopy Cover Assessment is not included in this observed species tables, as data metrics are consistent with only densiometer data collection.
Tree Health Assessment Sites = Lower Cascade Canal (LCC) Sites 1, 2, 3, 4; Upper Grass Valley Canal (UGVC) Site 5; DS Canal (control-site) Site 6 Pond 1, 2, and 3
Pond Study = LCC Ponds 1, 3; DS Canal (control-site) Pond 3
* = Notes species observed during Year 10 (2023) field surveys, however not previously observed in monitoring Year 0 (2013), Year 2 (2015), Year 4 (2017), Year 6 (2019), and/or Year 8 (2021).
** = Notes species observed in monitoring Year 0 (2013), Year 2 (2015), Year 4 (2017), Year 6 (2019), and/or Year 8 (20210 however not observed during Year 10 (2023) monitoring.

![Stantec logo]

Nevada Irrigation District

Banner Cascade
Pipeline Project

Long Term Canopy
Cover and Pond Study:

Lower Cascade and
Upper Grass Valley
Canals

Presenter:
Meghan Oats, Botanist / Project Manager

Agenda

1. Background
2. Study Methods
3. Results
4. Discussion

1 Background and Introduction

Banner Cascade Pipeline Project

- NID constructed the Banner Cascade Pipeline to be the primary means for water delivery to areas of Grass Valley and Nevada City, California.

- Lower Cascade Canal (LCC) and the Upper Grass Valley Canal (UGVC) remain in use with reduced flows.

California Environmental Quality Act Compliance

Final Environmental Impact Report [FEIR] (ICF 2007)

- **Potential Impact 3.8.1**: Flow reduction in the LCC could result in impacts to vegetation.

- **Mitigation Measure 3.8-1:** NID committed to "Prepare and Implement a Long-Term Monitoring Program"
  - **Purpose**: Monitor for evidence of dewatering impacts to vegetation surrounding the canals.
  - **Duration**: The monitoring commitment is to study the potential impacts over a 10-year period (2013-2023).

- **Mitigation Measure 3.8-2:** NID committed to "Prepare and Implement a Mitigation and Monitoring Program to Determine Impacts to Adjacent Seeps and Ponds"

  - **Purpose:** Monitor the habitats for special-status species.

  - **Duration**: The monitoring commitment is to study the potential impacts over a 10-year period (2013-2023).

Project Studies

1) Long-Term Canopy Cover Study (FEIR MM 3.8-1):

    a) Tree Health Assessment

    b) Canopy Cover Assessment – via Densiometer Analysis

Canopy Cover Study	Study Year					
	2013 Year 0	2015 Year 2	2017 Year 4	2019 Year 6	2021 Year 8	2023 Year 10
Tree Health Assessment	x	x	x	x	x	x
Canopy Cover Assessment	x		x		x	x

2) Seep Wetland, Pond, & Associated Potential Endangered Species Act Species Habitat Study (Pond Study) (FEIR MM 3.8-2)

Pond Study	Study Year					
	2013 Year 0	2015 Year 2	2017 Year 4	2019 Year 6	2021 Year 8	2023 Year 10
	x		x		x	x

2   Study Methods

- Assess impacts from flow reductions through spatial & temporal comparisons.

- Applied a mixed-method qualitative & quantitative approach for documenting conditions and changes over time.

Study Site Overview
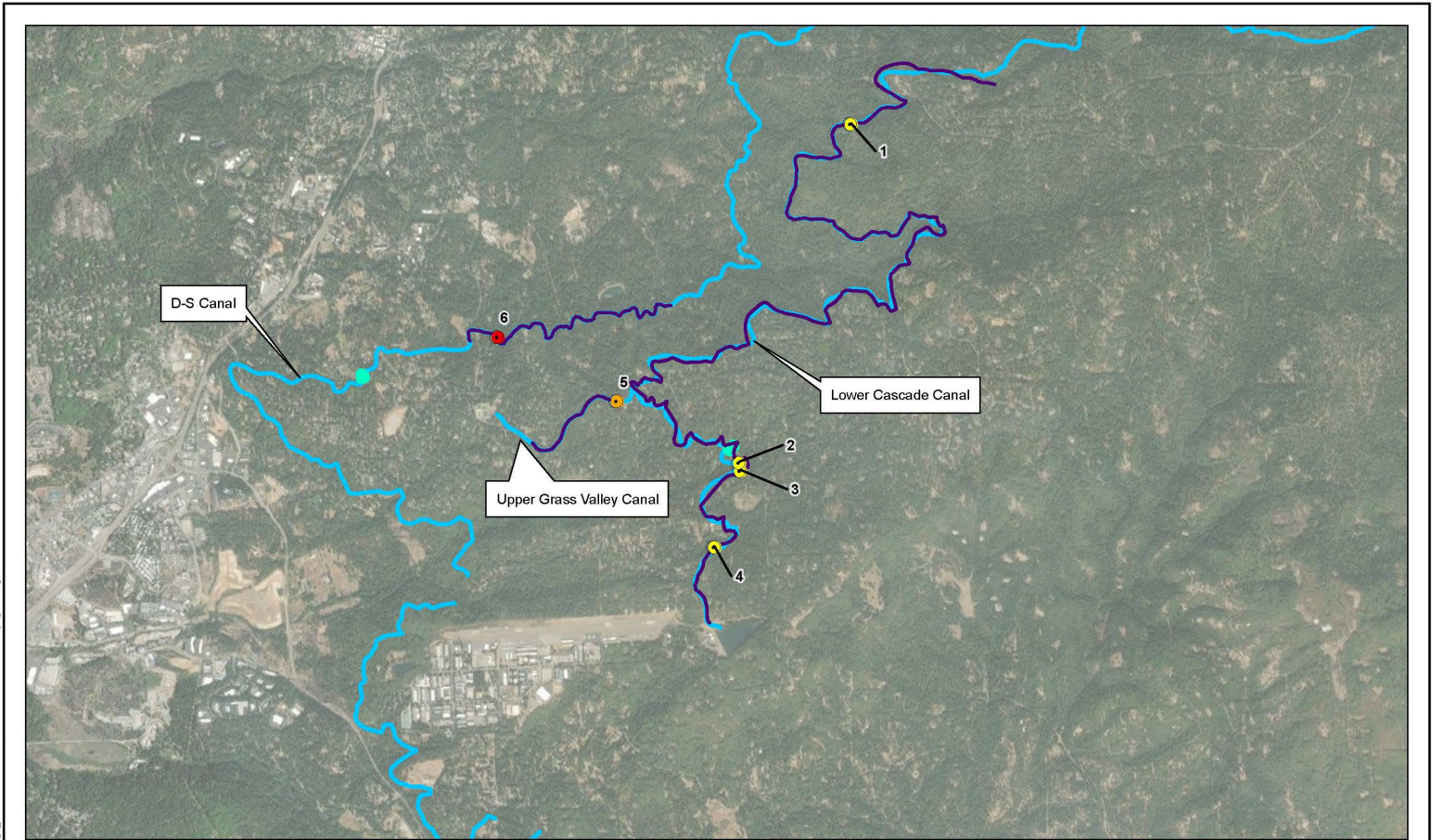
Tree Health Assessment
- ⊙ LCC Site 1
- ⊙ LCC Site 2
- ⊙ LCC Site 3
- ⊙ LCC Site 4
- ⊙ UGVC Site 5
- ● DS Canal Site 6

— Canopy Cover Assessment
▭ Pond Study Location
— NID Canal

Project Location

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

Project Location: Nevada County, California
Client/Project: Nevada Irrigation District — Banner Cascade Pipeline Project — 185705578
Figure No.: 1
Title: **Project and Study Area**

Tree Health Assessment

A total of 6 sites continue to be studied:

- 4 sites on the LCC
- 1 site on the UGVC
- 1 site on the DS Canal (Reference Site)

Up to 20 trees are studied at each site.

The following data are assessed:

- Growth monitoring
- Foliage cover and coloration
- Bark health
- New growth
- Evidence of disease, parasites, insect damage

Canopy Cover Assessment

Sites are along the same canal reaches as the Tree Health Assessment sites; however, sites extend along the entire length of each established reach.

Reach data was collected along approximately:

- **7 miles** of the LCC (273 observation points)
- **0.5 mile** of the UGVC (27 observation points)
- **1 mile** of the DS Canal [Reference Site] (85 observation points)

A total of 385 densiometer observation points were taken.

Pond Study

Two sites along the LCC & 1 along the DS Canal (Reference Site)

Wildlife & habitat suitability assessments

Following data recorded:

- Delineation of inundated area / soil saturation
- Hydrology pattern
- Range of water depths
- Soil type
- Vegetation present
- Wildlife species observed
- California red-legged frog habitat assessment
- Site photographs

3   Results

- All three study components were required in 2023.

- Tree health data from the LCC, UGVC, and DS Canal (Reference Site) has been compared for the following years:
  - 2013
  - 2015
  - 2017
  - 2019
  - 2021
  - 2023

- Canopy Cover and Pond Study has been compared for the following years:
  - 2013
  - 2017
  - 2021
  - 2023

Tree Health Assessment

	Site 1 LCC						Site 2 LCC						Site 3 LCC						Site 4 LCC						Site 5 UGVC						Site 6 DS Canal					
Monitoring Year	2013	2015	2017	2019	2021	2023	2013	2015	2017	2019	2021	2023	2013	2015	2017	2019	2021	2023	2013	2015	2017	2019	2021	2023	2013	2015	2017	2019	2021	2023	2013	2015	2017	2019	2021	2023
Survey Date	12-Sep	7-Oct	12-Sep	20-Sep	14-Sep	11-Oct	11-Sep	6-Oct	8-Sep	17-Oct	15-Sep	12-Oct	11-Sep	8-Oct	8-Sep	17-Oct	15-Sep	12-Oct	11-Sep	6-Oct	12-Sep	20-Sep	14-Sep	11-Oct	10-Sep	7-Oct	7-Sep	17-Oct	15-Sep	16-Oct	10-Sep	7-Oct	15-Sep	18-Oct	16-Sep	12-Oct
Trees Surveyed	23	23	21	21	19	14	20	21	20	12	13	13	21	19	20	20	20	20	18	21	19	18	19	17	8	7	6	6	4	3	22	20	14	13	13	10
Tree Death	0	1	1	0	3	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1	0	0	2	1	0	3	2	1	0	3
Canopy Cover	2	3	3	3	3	4	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	4	3	3	2	2	3	4	3	3	4
Bark Health	3	3	3	3	3	4	3	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3	4	2	3	4	3	4	4	2	3	3	3	3	4
Overall Tree Health	10	10	8	9	11	11	10	10	9	8	10	10	9	9	9	8	10	10	12	11	9	9	10	12	9	8	11	10	10	10	10	10	8	10	10	11

Notes
- Individual tree foliage cover values, not total canopy cover was assessed in the canopy cover study.
- Canopy Cover and Bark Health: Based on a scale of 1-4.
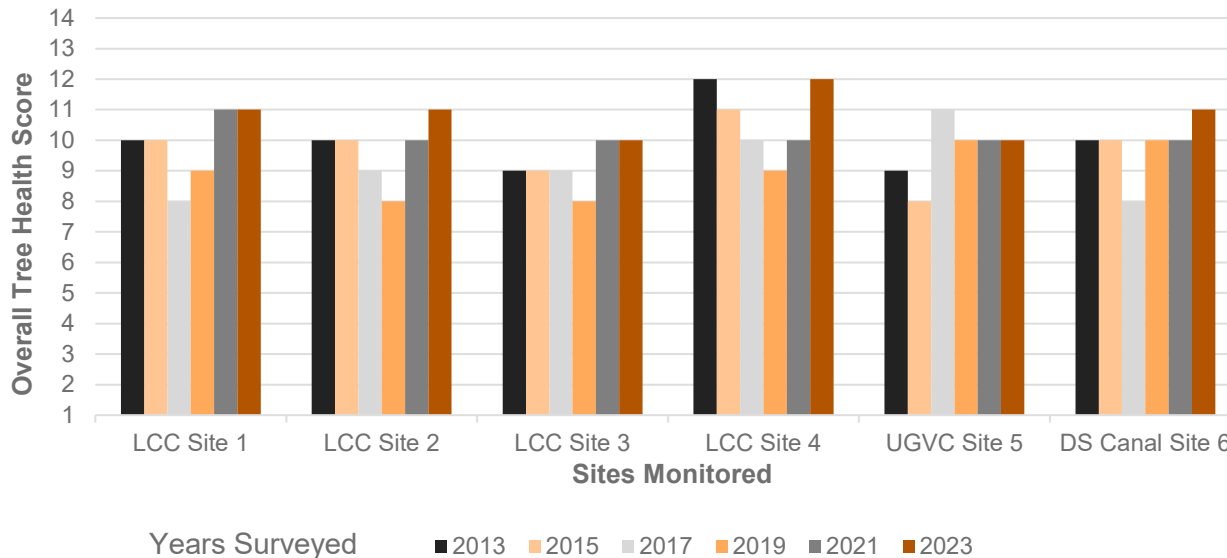- Overall Tree Health: Based on a scale of 1-14.

Overall Tree Health scores
- 1 - 4: poor health
- 5 - 7: fair health
- 8 - 11: good health
- 12 - 14: excellent health

Tree Health Assessment

- Tree health score remains above 10 at all sites = "good health" or above

- Temporal year over year variation noted. In 2023, tree health improved (had a higher score) at two LCC sites and the DS Canal (reference site), while the site along the UGVC remained consistent with previous years' results.

- Contributing Factors

  - Increases noted in new growth

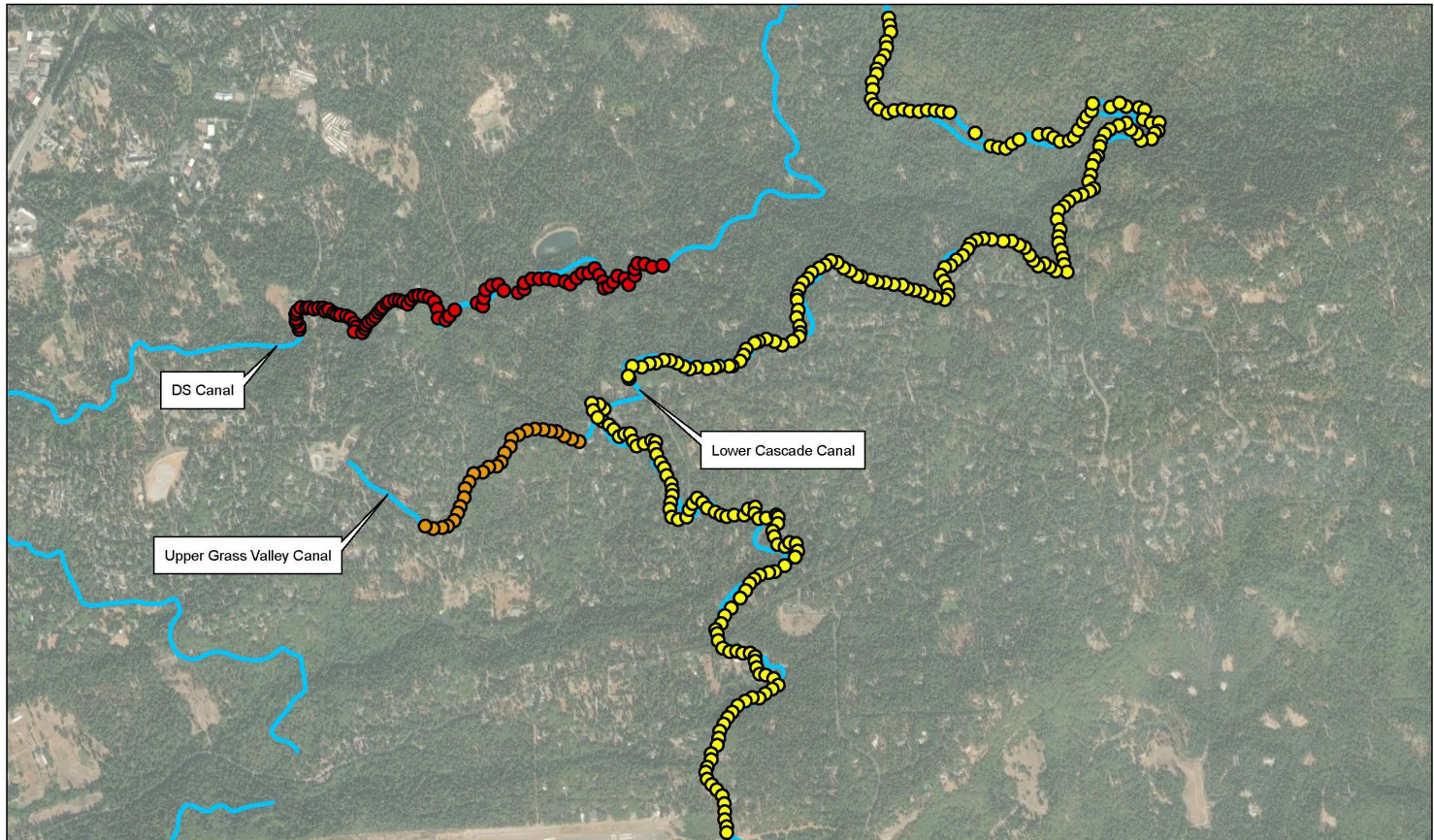 - Overall decrease of insect infestation

  - Disease and parasites limited

Overall Tree Health scores
- 1-4: poor health
- 5-7: fair health
- 8-11: good health
- 12-14: excellent health

Years Surveyed ■2013 ■2015 ■2017 ■2019 ■2021 ■2023

(Bar chart: Overall Tree Health Score vs. Sites Monitored — LCC Site 1, LCC Site 2, LCC Site 3, LCC Site 4, UGVC Site 5, DS Canal Site 6)

119

Canopy Cover Assessment

DS Canal

Lower Cascade Canal

Upper Grass Valley Canal

NID Canal

Canopy Cover Assessment

● DS
● LCC
● UGVC

Project Location

N

0   1,000   2,000
                            Feet
(At original document size of 8.5x11)
1:24,000

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Project Location
Nevada County, California

Client/Project   185705578

Nevada Irrigation District
Banner Cascade Pipeline Project

Figure No.
3

Title
Canopy Cover Survey Points

Stantec

120

Canopy Cover Assessment

Pond Study – LCC Sites

Pond Study – DS Canal Site

DS Canal Reference Pond

Pond 3

DS Canal

NID Canal
Pond 2023
Pond 2021
Pond 2017
Pond 2013

Project Location
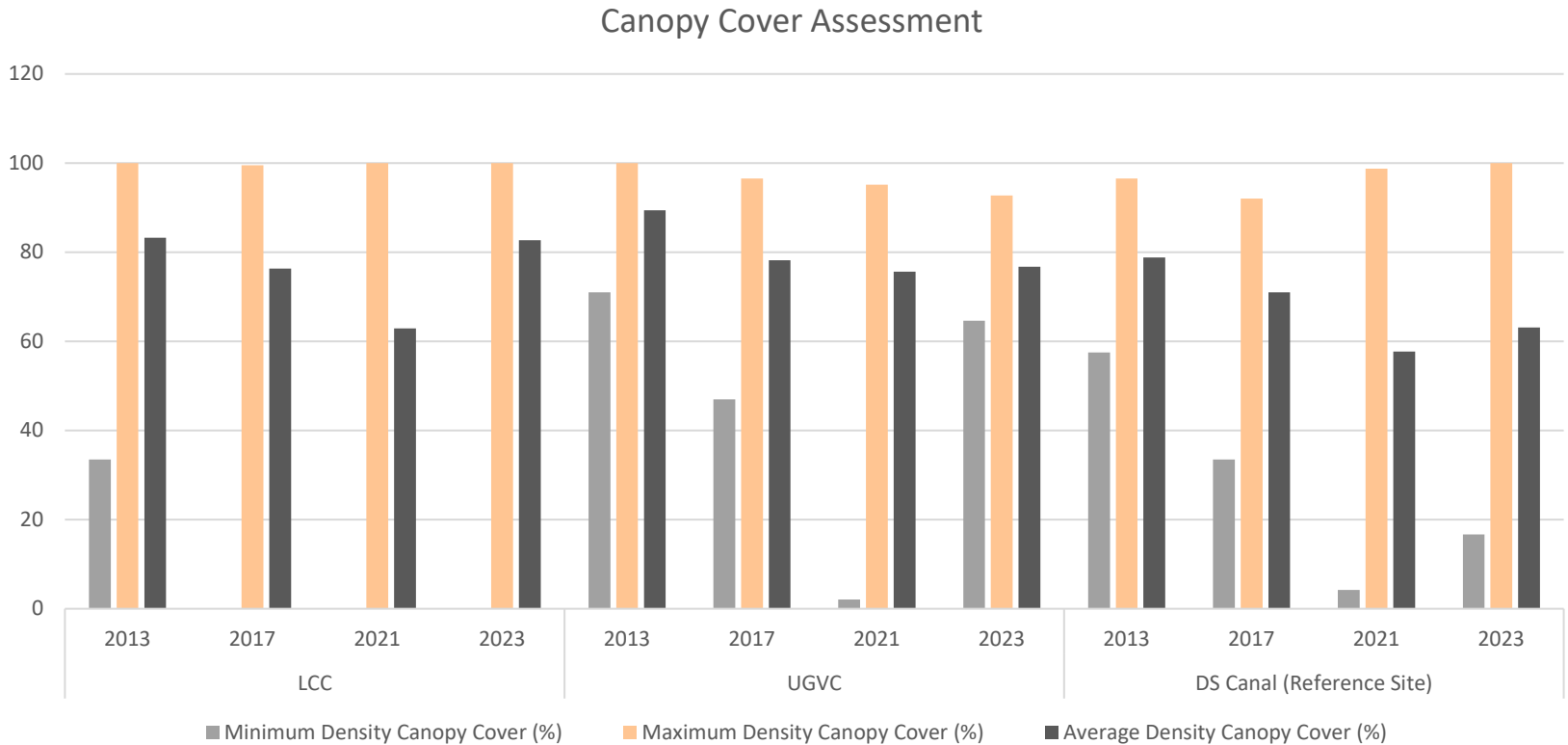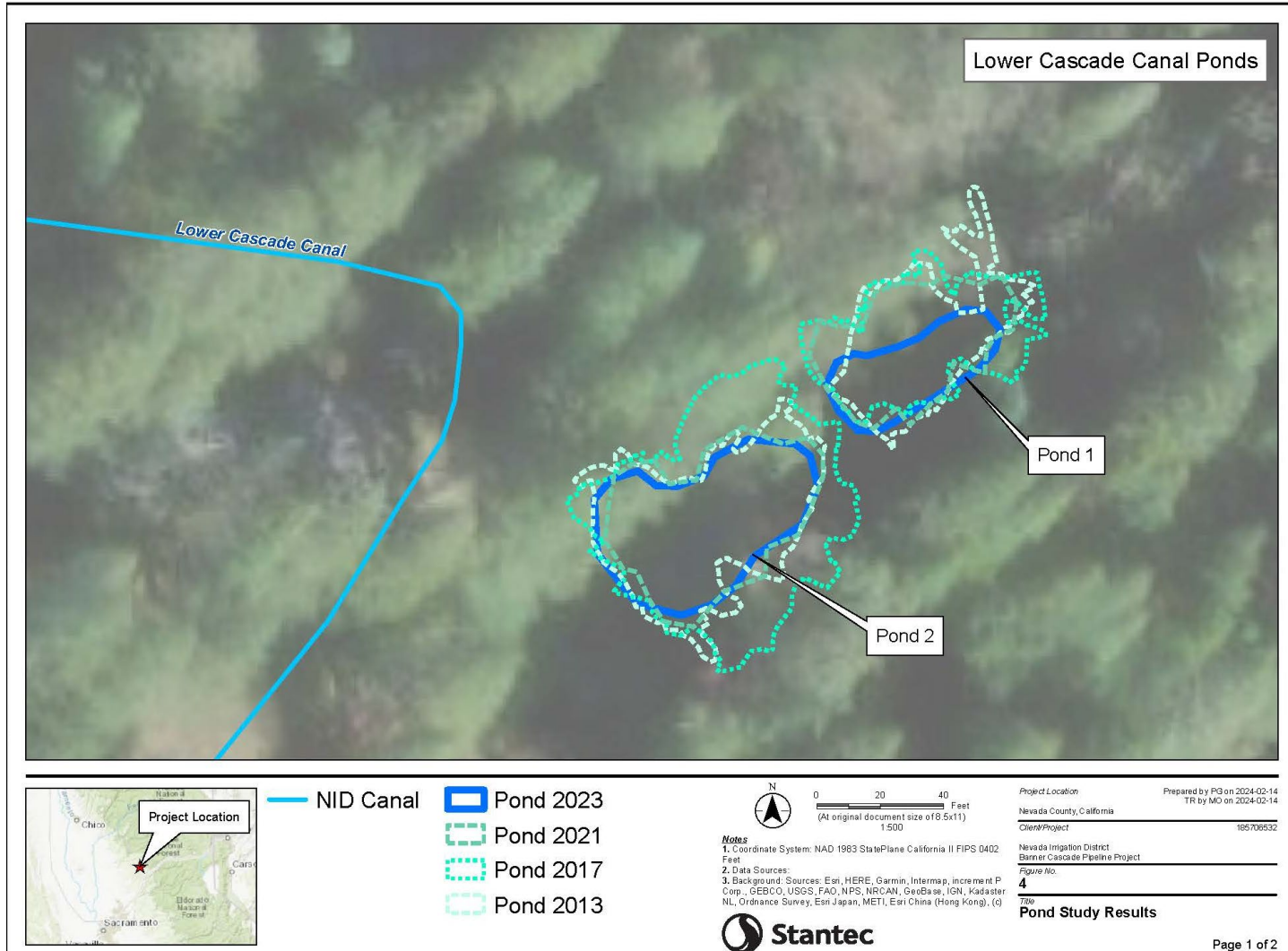
N

0   20   40 Feet
(At original document size of 8.5x11)
1:500

Notes
1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources:
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

Project Location   Prepared by PG on 2024-02-14
                                     TR by MO on 2024-02-14
Nevada County, California
Client/Project   185706532
Nevada Irrigation District
Banner Cascade Pipeline Project
Figure No.
4
Title
Pond Study Results

Stantec

Page 2 of 2

123

- Some annual weather variability may influence results

- To date, tree health remains relatively constant on both temporal and spatial scales
  - Sites conditions remain relatively consistent to baseline conditions in 2013 and remain in "good" health
  - The tree health and canopy cover trends mirror that of the reference site

- Pond study results indicate little variability in ponded habitat

- This year completed the monitoring

- Conclusion: There is not a need for water replacement standards because the reduced flow in the LCC and UGVC is not causing a reduction in tree health, and thus canopy cover

Questions?

Contact Info:
- Meghan Oats, botanist, meghan.oats@stantec.com; (530) 264-6056
- Bernadette Bezy, regulatory specialist, bernadette.bezy@stantec.com; (530) 575-6508