North Shore Hydrological Services
Matt Rosener, MS, PE, Principal

MEMO

Date: 8/1/22

To: Bridget Hammerquist, Kia`i Wai o Wai`ale`ale

Re: 7/3/22 site visit to Wai'ale'ale and Waikoko Stream diversions

Aloha Bridget,

This memo provides a summary of the site visit to the Ili'ili'ula-North Wailua Ditch diversions on Wai'ale'ale and Waikoko Streams that I performed on 7/3/22 along with Joe, Kamal, Uncle Liko, and Kainoa. For me, the objective of the site visit was to make a streamflow measurement near the CWRM gaging station on Wai'ale'ale Stream and to make general observations in this area to better understand current operations and maintenance status of the diversion and ditch system. In addition to the streamflow measurement, I also collected photos and GPS data during the site visit, some of which are presented here. And I got some video footage at both the Wai'ale'ale and Waikoko Stream diversion areas which I am sharing with you via Google Drive.

It has been a dry year on Kaua'i so far, with all of the NWS rain gages on the island recording well under 100% of average rainfall as of the end of June [1]. The NWS North Wailua Ditch rain gage station, located at the Wai'ale'ale Stream diversion is at 69% of its long-term average rainfall during the first half of 2022. Streamflows have been low all around Kaua'i this summer, and even with some recent rainfall, we observed low flow levels in Wai'ale'ale and Waikoko Streams on the day of this site visit.

Because the Ili'ili'ula-North Wailua Ditch has not been diverting water down-ditch to the Upper Waiahi Hydropower Plant for the last several years because of a break in the ditchline, the CWRM gaging station 2-191 'NF Wailua blw Bluehole Intake' has recently been producing a record of the total (undiverted) streamflow available in the North Fork Wailua River (aka Wai'ale'ale Stream). This dataset may prove to be extremely valuable in the establishment of a new Interim Instream Flow Standard (IIFS) for this stream. For this reason, I wanted to make a flow measurement at the CWRM gage station site as a spot check on its accuracy. The measurement was made using a Sontek FlowTracker2 acoustic velocity meter at a cross section approximately 20 feet upstream of the gage station's water level sensor (see inset photo). The staff gage readings during the measurement were 2.30 – 2.34 feet. The measurement was performed between 10:00 and 10:40am on 7/3/22, and the resulting flow value was 25.7 cfs. The CWRM gage station website reported a streamflow value of 25.3 cfs for this time period, which is in remarkable agreement with the field measurement I made. Based on this, I conclude that the gage station is well-

[1] https://www.weather.gov/images/hfo/hydrosum/kauai_ytd_0622.gif

calibrated, and the records from it should be considered high in quality, for flows in this range. I shared my streamflow measurement with Dr. Ayron Strauch, the CWRM hydrologist who manages this gage station, and he was appreciative of the data-sharing and the good agreement in records. For reference, the measured flow on this day (25.7 cfs) is very close to the median flow (50% exceedance) estimated by the USGS for this location (26 cfs), while the recent lower flows in the range of 17 cfs recorded at the CWRM gage station are more in-line with the Q95 (95% exceedance) estimated by the USGS.[2]

The Ili'ili'ula-North Wailua Ditch was filled in with sediment near the intake at Wai'ale'ale Stream during the site visit (see inset photo), so no measurable flow was being diverted from the stream into the ditch. The headgate in the ditch was fully boarded just down-ditch of the return flow "throw-out" which means that any water diverted from the stream into the ditch at higher flow should be blocked by the headgate and re-routed back to the stream channel through the throw-out. Because no water was passing the headgate at this diversion, no water was overtopping the flow measurement weir just down-ditch from the headgate. On this day, no water was being diverted from Wai'ale'ale Stream into the Ili'ili'ula-North Wailua Ditch.

At the Waikoko Stream point of diversion, rocks had been stacked in an apparent attempt to limit the amount of water captured into the ditch, but this was largely ineffective (see inset photo, at right). I estimate that over 97% of the combined flow from the two branches of Waikoko Stream was being captured by the ditch intake, with less than 3% spilling past the diversion dam via a small pipe through the dam and cracks in the dam structure. This resulted in

only a trickle of flow in the Waikoko Stream channel between the diversion dam and the point roughly 300 feet downstream at the confluence with the throw-out channel (see inset photo, at left). Just like at the Wai'ale'ale Stream diversion site, the headgate just down-ditch of the throw-out was well-boarded to prevent flow from passing further down the ditch to the south. Instead, all of the flow from Waikoko Stream captured by the ditch was being returned

[2] Low-Flow Characteristics of Streams from Wailua to Hanapēpē, Kauaʻi, Hawaiʻi. Scientific Investigations Report 2020-5128

to the stream through the throw-out on this day. Although some rocks had been stacked in the ditch intake to limit water capture by the ditch, most of the stream water was still being taken into the ditch intake. It seems a headgate could be installed without too much cost or effort at the intake section that would allow for the ability to "turn off" this diversion. Flashboards could be used in steel channels mounted to the ditch's concrete sidewalls, and when fully closed, this control would allow the full streamflow of Waikoko Stream to pass over the dam face, rather than being routed through the ditch to the throw-out channel. This would result in a much more natural flow pattern and improve conditions for passage of native aquatic species in this stream reach.

No measurements of flow in Waikoko Stream or the ditch were made. At the first tunnel approximately 100 feet down-ditch of the Waikoko headgate, there is a short weir in the ditch channel with a stilling well made of a vertical steel pipe on the ditch bank. This set-up is clearly intended as a water level / flow measurement station, but it is unclear if this station is operated by CWRM or the water diverter, or if it is functional at this time.

Following the Ili'ili'ula-North Wailua Ditch for a ways in a southerly direction (towards Ili'ili'ula), I generally observed poor conditions of the ditch itself and it's access trail, which I expect is due to a lack of regular maintenance since the ditchline break in 2019. In some places where the ditch crossed small, ephemeral stream channels, spillway notches have been left open to allow stream water to bypass the ditch channel. In others, there is no spillway notch, meaning that the ditch will continue to capture and transport water during rainfall events that produce runoff. This means that even though the ditch is not actively diverting water from Wai'ale'ale and Waikoko streams, it is still capturing water from other small streams in this area. This is resulting in reduced flows in some of these feeder streams and increased flows in others at ditch spillway points. So, although the ditch might be considered "inactive" in it's current operational status, it continues to impact the hydrology of several headwater streams in this area.

At one site along the ditch, I observed a spillway at a location where there was no natural stream channel upslope of the ditch, but there was a deep gully eroded immediately downslope of the ditch (see inset photo at left). I estimate this gully to be 10 feet deep, and it was clearly formed by water flowing through the spillway notch in the concrete ditch wall. The notch has slots for a wooden "pani board' or flashboard, but without the board in

place, this location serves as an overflow spillway during high rainfall events. It is not known how much of the gully erosion observed at this site is due to recent storm events, but judging by the vegetation on the gully walls, the erosion in this area appears to be active.

My understanding has been that the siphon break in the ditchline between Waikoko and Ili'ili'ula Streams was caused by a large Albizia tree falling on the siphon and a subsequent landslide in the same area in 2019. This is confirmed by the transcript of the 12/10/21 BLNR meeting (on Items D-1 and D-2) and the KIUC letter to the BLNR requesting renewal of Revocable Permit No. S-7340 dated 11/19/21. I am not surprised after walking the segment of the ditchline south of Waikoko Stream as there are countless large and small Albizia trees growing in the area, with many having branches hanging above open ditch sections (see inset photo at left, showing the area around the Waikoko diversion). This suggests to me that even if repairs were eventually made to the broken siphon, there would be substantial and perpetual maintenance and repairs needed in this area to keep the ditch functional, as debris loading from the Albizia overgrowth is problematic now and can be expected to become much worse in the future due to the prodigious growth rate of this tree species in this environment. On the day of this site visit, I observed several open ditch segments where piles of organic debris from falling Albizia branches was clogging the ditch.

These are my observations from the site visit to the Ili'ili'ula-North Wailua Ditch in the vicinity of Wai'ale'ale and Waikoko Streams on 7/3/22. I am sharing all of my photos and videos from the site visit via Google Drive. If you have any questions or need any clarification on any of the information presented here, please do not hesitate to contact me.