

Preliminary Damage Report from the April 2018 Flood Event

as it relates to

The Watershed Implementation Project for the Ahupua'a of Waipā

This brief report is intended to document damage from the 14-15 April 2018 flood event throughout the ahupua'a of Waipā. Among the areas assessed so far, flood damage was most significant along Waipā Stream in areas where restoration activities have been occurring as well as areas located farther upstream and downstream. Damage along Waioli Stream is also documented here, but this is limited to the area near the stream mouth at its outlet into Hanalei Bay; significant flood impacts occurred along much of Waioli Stream but these are not assessed here. The flood event was caused by unprecedented rainfall on the north shore of Kaua'i, with over 54 inches recorded at the Waipā Garden rain gage during the 2-day period of 14-15 April. The peak 24-hour rainfall total of 49.69 inches (ending at 12:45 pm on 4/15) is an unofficial U.S. record. We have seen many large floods in this area that is well-known for flooding, but this event was much more devastating than any previous flood event in the records. Surveys of high water marks around the Hanalei area generally match the 100-year flood elevations from the FEMA Flood Insurance Rate Maps, and while no estimate of recurrence interval has been made yet for the Waipā Stream flood peak, it is likely in the 100-year range.

Extensive flood damage occurred along Waipā Stream including stream segments within the restoration area as well as upstream and downstream. Damage included erosion of streambank and riparian vegetation, erosion of streambank soils, and deposits of flood debris throughout the stream corridor,



including organic material (tree trunks, stumps, and branches) and mineral sediment. Deep scour of the streambed occurred at many of the pool segments and downstream channel filling was evident throughout the area. Sediment deposits on the floodplain up to 2 feet thick have been observed in some areas. In the area of Hau Bush removal within the Stream Restoration BMP site, Hau stands left along the banks were eroded out (at left in photos) and out-

plantings behind the Hau buffers were pushed over forcefully by the floodwaters. These included well-established Coconut Palm (4-5 years old) and Hala trees that typically have deep, strong root systems (center in the photo here). A large volume of coarse sediment (gravel to boulder size) was moved down the stream channel and deposited in this area of the stream channel as well as in the right bank floodplain area. Restoration treatments in this and several other areas will have to be repeated, following flood debris removal.



Substantial streambank erosion from the flood has been observed throughout the stream network, both within and outside the stream restoration area. Stream channels seem to have systematically widened with this flood event by eroding banks, responding to the massive flood discharge. This is not an unexpected outcome for a flood of this magnitude. In addition to smaller-scale bank erosion, several large bank slumps have been observed where landslides essentially ran out into the stream channel. Many new, larger landslides are visible on the hillslopes throughout the ahupua'a, but these were not visited or assessed for this report. Collectively, these areas of mass wasting were likely a significant source of material

contributing to the widespread deposition of silt and sand in downstream channels (including the Waipā and Waikoko irrigation ditch system) and floodplain areas. An example of streambank failure from upstream of the restoration area is shown above, and an example of channel widening within the restoration area (as before and after) is shown below.



Streambank erosion in the area shown in the photo below has removed virtually all vegetation including many large Hala trees and hundreds of out-plantings that were thriving in the banks here. New restoration BMPs are now being installed in this stream reach now, including the use of temporary erosion control fabrics and new out-plantings. The Hawaii Youth Conservation Corps are assisting Waipā project staff and interns with this work. While we have observed extensive erosion and flood damage throughout the Waipā Stream corridor from the historic April storm event, we feel fortunate that the damage was not worse. In comparison, nearby waterways like the mainstem Hanalei River and Waioli Stream experienced major reconfiguration and realignment during the flood, creating new channels that bypassed important irrigation water intakes, requiring extensive earthwork to "repair". Flow was restored to the Waipā auwai within a few days after the flood as the manowai (diversion



structure in the stream) experienced only minor damage. A few large boulders will have to be replaced to make the mano stable again, but this is minor in comparison to the hundreds of cubic yards of material that will need to be moved within the Hanalei River channel after each big flood now that the river's diversion system has been compromised again.

Two of the three gaging stations along Waipā Stream were destroyed during the flood event. The first, installed and operated by landowner Kamehameha Schools, was located just upstream of the area shown in the pictures above. This real-time monitoring station, which measured various water quality parameters as well as water levels, was completely washed out and ended up deposited along the bank in the flood debris across the channel from the boulder deposit in the photo. The station's waterproof enclosure that housed the electronics and battery can be seen in the photo at left, while the water sensors and cables were buried in sediment just upstream of this area. Kamehameha Schools has already replaced this monitoring station in a new location, and it is back online reporting data.



A second station called the Waipā Stream Gage, operated by the Waipā Foundation, was also washed out in the flood. This rated stream gage had a multi-probe sonde deployed for continuous measurements of water level, streamflow, and water quality at a point upstream of all stream restoration work at Waipā. The station had been in place for over ten years in the same location, but the April 2018 flood caused extensive scour along the streambank where the gage was located and a large bank failure occurred that wiped out the gage's stilling well (left side of channel in the photo here) and snapped the power cable for the measurement device. Fortunately, the sonde got wedged in some boulders just downstream and was retrieved after the flood, and extra fortunately, it still works! The stilling well for this station is currently being re-built and the gage should be back up and running soon.



Observations of flood damage along Waioli Stream in the ahupua'a of Waipā have been limited to the stream mouth area where a large swath of land was eroded by the floodwaters. Similar to the damage observed along Waipā Stream, large trees with deep, strong roots systems (e.g. Hala, Coconut Palm, Ironwood) were eroded out and washed away by the floodwaters. During the flood, the Waioli Stream formed a new channel in a westerly direction along the beach of Hanalei Bay (to the left in this photo) which eroded land from the ocean shoreline as well. Overall, a half-acre or more of land was eroded from this area, and existing banks along Waioli Stream and the



Hanalei Bay shoreline are now under vulnerable conditions. The photo below shows the Bay shoreline near the Waioli Stream mouth.



While no damage has been observed to on-site wastewater treatment systems at Waipā during the flood, several Waipā staff observed sewage smells in areas of known cesspools for weeks after the storm. With over 50 inches of rain in one day after almost 50 inches of rain during the previous 2 ½ months, it would seem that many cesspools in the Hanalei area were basically full and exporting raw sewage to groundwater and surface water during and after the flood event. This was a potent reminder of the need to upgrade these outdated cesspools to septic or more advanced treatment systems.

Fecal Indicator Bacteria (FIB) testing since the flood event has shown high counts at several monitoring sites in Waipā and Waioli Streams, particularly at the stream mouths that include cesspool and other human wastewater influence. However, high counts have also been recorded for the Waipā Boat Crossing site which is upstream of all human habitation so these results are more suggestive of continued fecal pollution from the feral ungulate population (mainly pigs). While we have been actively hunting and trapping feral pigs at Waipā, this program has been temporarily suspended since the flood as staff and other resources have been diverted to clean-up efforts. We hope to continue the Feral Ungulate Removal BMP at Waipā to minimize fecal pollution in the Waipā Stream watershed.