Laolao Bay Watershed
Existing Conditions and Opportunities
Interim Report

September 2020 DRAFT

Prepared for:
CNMI Bureau of Environmental and Coastal Quality
Division of Coastal Resource Management

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1.0 Introduction

The Laolao Bay watershed has been a focus of restoration and conservation planning and action for over a decade. Declining trends in reef health triggered development of a Conservation Action Plan (CAP) in 2009 (updated in 2012), as well as the successful implementation of badland revegetation efforts, stormwater and unpaved improvements, and public stewardship and education campaigns in subsequent years. The Laolao watershed is considered one of Saipan's ecological jewels for marine habitats and relatively undeveloped uplands, and the socio-economic importance of the resource cannot be overstated (**Figure 1**). The Marianas Visitors Authority (2017) estimated that over 4,000 locals and tourists visit Laolao bay each month to recreate (fishing, diving, beach use, etc.). Water quality issues with bacteria and nutrients have been improving over the past few 305(b) and 303(d) reporting cycles, in part, presumably, due to these restoration efforts.

This interim report provides an evaluation of the 2009-2012 CAP, an initial look at watershed conditions, and a summary of potential watershed restoration and conservation opportunities moving forward. It is intended to summarize information compiled to date, identify gaps in data, and provide background material for future public engagement activities. COVID19 has delayed much of this effort by at least six months. Ultimately, the information provided here will be used as a foundation for a comprehensive Watershed Management Plan to guide the CNMI's stewardship of this resource over decades to come.

Figure 1. Looking out across the LaoLao Bay watershed towards Kagman.

2.0 Watershed Conditions

For the purposes of this report, the Laolao Bay Watershed is defined as a 2525 acre area (3.9 square miles) that contributes surface drainage to Laolao Bay on the eastern side of Saipan (**Figure 2**). The watershed is divided into three major subwatersheds: Laolao (858 acres), Kagman (477 acres), and Dandan (1190 acres). The Laolao subwatershed is equivalent to the watershed boundary that was previously established by DCRM. The watershed has been expanded to include portions of the Kagman and Dan Dan watersheds that, based on a 2017 LIDAR analysis, also drain to Laolao Bay. There are two conservation areas of interest, including the Laolao Bay Sea Cucumber Reserve and the Forbidden Island Marine Sanctuary (**Figure 3**).

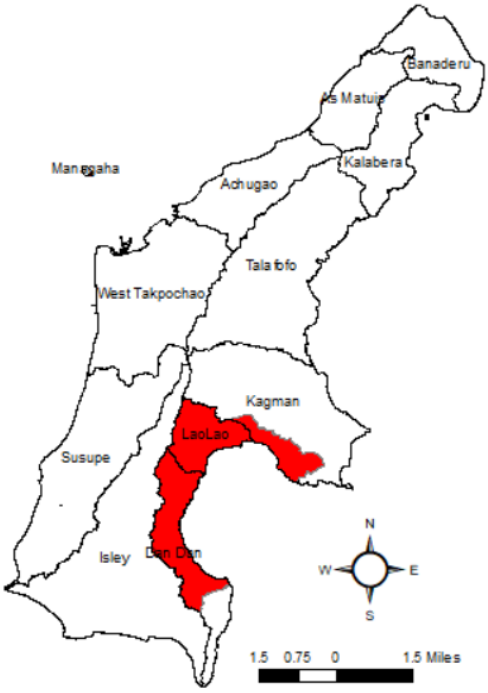


Figure 2. Laolao Bay Watershed (2020)

Land Use/Cover

The Laolao subwatershed is steep, mostly forested, and contains several streams. The area has historical and cultural significance with archeological findings and an ancient latte stone site (Bapot), as well as providing habitat for many traditional medicinal plants. The area also has recreational significance with Laolao Beach and a popular scuba diving site, which are accessed via Laulau Bay Drive, the only road along the shore. The upland vegetation is predominantly mixed forest, patches of tangantangan, other shrub land and savannah, and a small area of coconut/agroforest along the coast (**Figure 4**). On the eastern subwatershed boundary with Kagman, there is a revegetation site that is part of the "Bring Back Our Trees" program managed by the Micronesia Islands Nature Alliance (MINA). Development consists of low density residential along Railroad Rd., scattered along Laulau Bay Dr., and along Isa Dr. The southwestern boundary with the Dandan subwatershed straddles the village of San Vicente, which is more densely residential, commercial, and institutional development (**Figure 5**). There is a large parcel of public land in the upper portion of the subwatershed and several small, disconnected parcels along Laulau Bay Dr. The dive site is located on privately-owned land, as is much of the coastal corridor (**Figure 6**). There is an area designated as prime agricultural land in the upper portion of the subwatershed.

The Kagman subwatershed has less sloped lands, but a steep/cliff-like immediate shoreline. Gap Gap Road, the former Titimu Avenue Detention Center, and portions of the Laoloa Bay Resort and Golf Course are the defining land use features of this subwatershed. Erosion and sedimentation from Gap Gap Rd. is extensive and remains an unresolved issue for both local access and water quality. Residential development along Laulau Bay Rd. is most evident in the Kagman subwatershed. At the end of the road is the East Bay/Punta Laolao access point where locals, tourists, and scientists can enter the bay via jumping or by climbing a sketchy ladder. The access road and trail is highly eroded. There are small strips of undeveloped public land along the road ROW and adjacent to Punta Laolao.

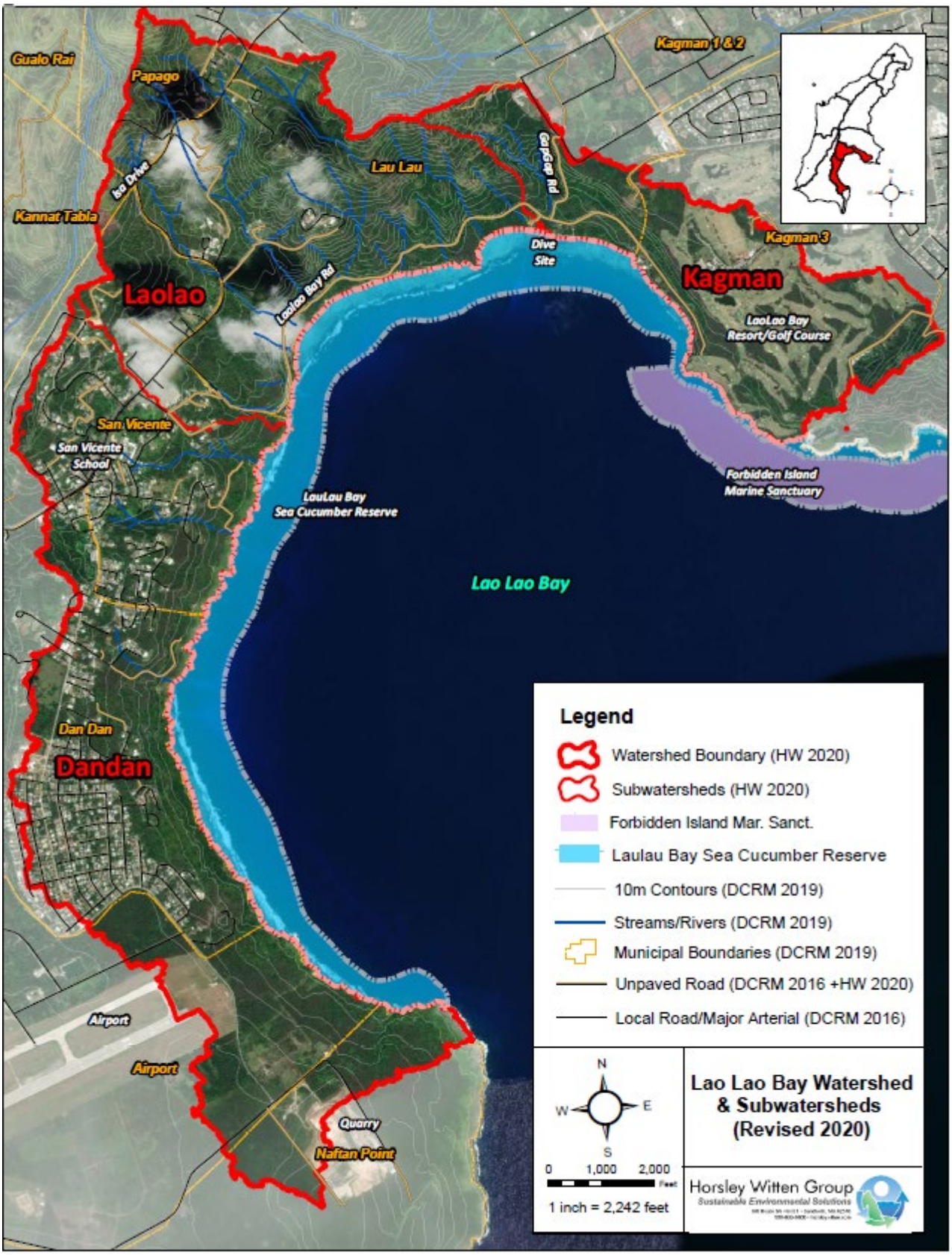


Figure 3. Laolao Bay Watershed

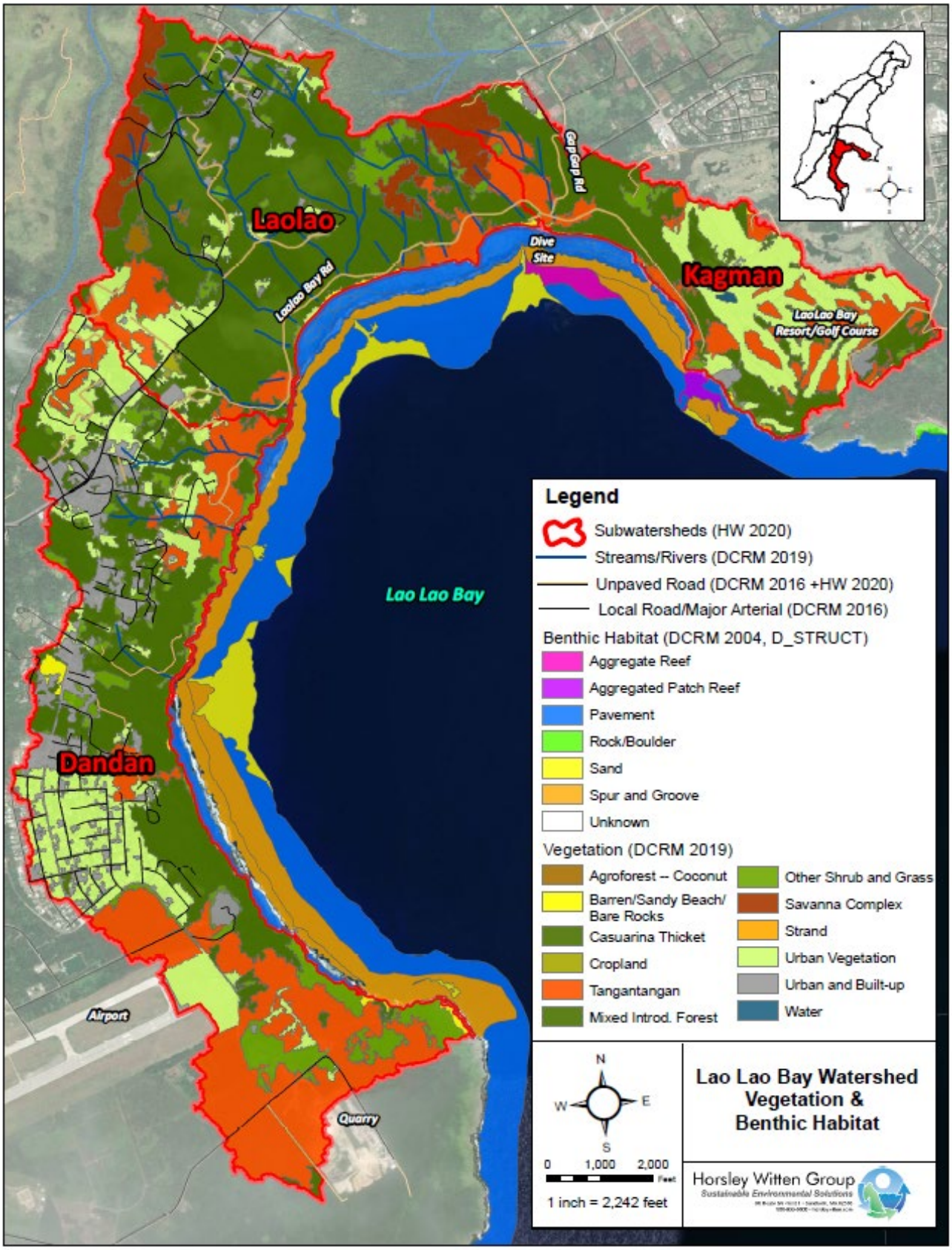


Figure 4. Vegetative Land Cover and Benthic Habitats in the Laolao Watershed

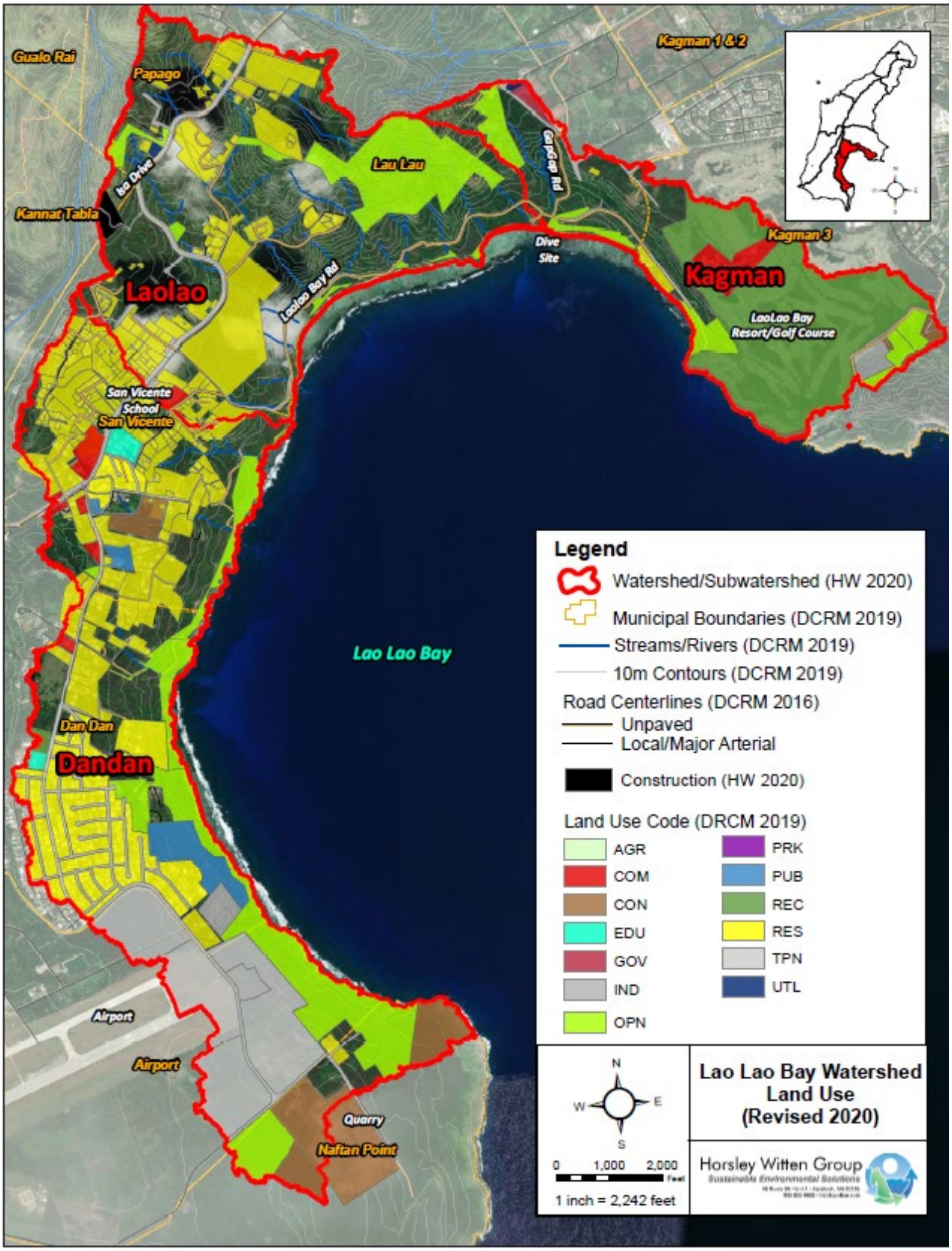


Figure 5. Laolao Bay Watershed Land Use Map with some revisions by HW based on verification during field assessments in 2020.

The Dandan subwatershed also has a steep, undeveloped shoreline that is dominated by mixed forest vegetation. This subwatershed is the most urbanized of the three and contains the villages of San Vicente and Dandan with medium to high density residential and commercial development. Key land use features here include the San Vicente Elementary School, a youth center, the Dandan Middle/Elementary School, the Dandan Children's Park, a portion of the airport and adjacent quarry, and a small beach area where water quality monitoring takes place. A recently constructed (or renovated) cultural center is also in this subwatershed. There are three mapped streams in the northern portion of this subwatershed. The vegetation in the Dandan subwatershed is more reflective of urban impacts, as evidenced by larger areas dominated by tangantagan and urban lawn. There are some extensive undeveloped public land holdings along the shoreline and between the airport/quarry and the bay. Many of the homes in Dandan and Kagman watersheds are homestead sites provided by the CNMI government.

For a more detailed breakdown of watershed land use and other characteristics, see the section of this report on watershed modeling input.

Figure 6. Public lands, shown here in green (from CRMOGIS, 2019). Some of these areas are still undeveloped and may be opportunities for conservation and restoration.

Infrastructure

The watershed is outside of the sanitary sewer service area for the Agingan wastewater treatment plant, therefore all development relies on individual onsite systems. Long-term beach campers at Laolao Bay are asked to provide their own portable toilets. More information is needed on the following to better characterize wastewater management in the watershed:

1. Results of the survey of onsite systems conducted by DCRM in 2014;
2. Better understanding of the wastewater system at the Dan Dan and San Vicente Schools
3. Information on the location and system components of the Laoloa Bay Resort/Golf Course (see CNMI Sustainable Hotel Guide);
4. Information from CUC on the wastewater expansion plans for Kagman area, do they include Dan Dan?
5. Findings from groundwater nutrient source tracking- Kiho Kim
6. Dive Site portable toilets- is there an effort to establish composting toilets similar to Jeffery's Beach initiative?

Isa Drive and the San Vicente neighborhood have existing stormwater infrastructure (e.g., catchbasins and culverts), while smaller residential roads have less formal drainage structures (e.g., broad dips) or no structures to manage runoff. Recent repaving of Isa Dr. included significant drainage upgrades. The 2014 ARRA project for LauLau Bay Dr. resulted in the installation of piped drainage infrastructure on the paved portions of the road and a large sediment trapping device. Stream crossings were formalized along the unpaved portions of LauLau Bay Dr. with broad dips and waterbars to reduce erosion and sedimentation, and a permeable parking lot was installed at a popular beach access site. A study done by The Nature Conservancy has shown that visitors to the site have noticed and appreciated these changes (TNC & NOAA, 2014).

During field assessments the week of January 20, 2020, HW field crews mapped and assessed over 150 drainage structures including inlets and catch basins, culverts, manholes, BMPs, outfalls/outlets, stream crossings, and other (**Figure 7**). Field crews mapped the locations and documented materials, dimensions, and conditions of each structure. Just under 30% of the structures evaluated require maintenance, repair, or other attention, such as investigation of dry weather discharge. These structures were identified based on clogging, high sediment accumulation, visible damage, associated erosion, or other observations.

Tables 1-6 summarize the data collected on each structure. An online map at can be accessed for each location that includes this information as well as photos.
https://www.arcgis.com/home/webmap/viewer.html?webmap=ddf0e4fd056b4211a5b6f53ca83425f8&extent=145.6635,15.1289,145.9171,15.2707

More information is needed on the following to better characterize stormwater management in the watershed:

1. Better understanding of formal and informal drainage infrastructure in Dan Dan; and
2. Information on the water quality treatment elements of drainage improvements along Isa Dr.

Table 1 Laolao Drainage Infrastructure Inventory—Inlets and Catch Basins

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL164	48" metal; 9.3 ft invert	○				
LL177	Conc swale. Metal 30" Pipe across road. ~3.7 ft invert.	○			○	
LL179	2x2’ box structure. 3.5 ft invert. Metal. Pipe going downhill along road.					
LL180	2x2’ grate. 3.7 to bottom of road.					
LL191	12" estimated pipe at 3.5 ft bottom of structure. Headwall	●			◖	●
LL193	12" metal pipe with invert at 6.3 ft	○			○	
LL195	Curb cut. Totally clogged with grass. 5’ wide					●
LL196	Curb cut. Overgrown. 5’ wide					●
LL300	18” W, 5” Depth brown grate; 5 ft invert.	○			○	
LL301	Grate 3x3, 2 pipes; RCP 18" with 4.5 ft invert; one on back and one on right in position of photo 1					
LL302	18" RCP with 3 Ft invert. Same as LL301					
LL305	Trench drain at back of property. 18"W;1 ft invert	○				
LL308	12" RCP with 3' invert. Connects to large concrete structure in playground	◖				
LL310	concrete. Same as LL309					
LL313	Same trench drain, takes flow in front of library					
LL314	Same as all for school 18”. Junction between different trench drains	○	●			●
LL315	Same trench drain corner, drainage comes from parking lot and maybe road and follows trench drain down to rain garden					
LL319	18" HDPE with 3.5 ft invert. Sediment 2x3grate; connects from intersection of Katbon and Shoko	◖				
LL320	18" HDPE with 3 ft invert. Connects to LL319, invert out only, connects to concrete swale	○				
LL321	18" HDPE with 2.5 ft invert. Sediment flowing into catch basin, filled with sediment, maybe 2 inches from top of pipe to sediment,2x3 grate	●			◖	●
LL322	18" HDPE with 3.5 ft invert. Connects to other side of street; invert out only	○			○	
LL323	18" HDPE, invert 4 ft.; Invert in from up the road, invert in from across the road, invert out down the road	◖			◖	
LL325	18" HDPE, invert 3.5 ft.	○				
LL326	20’ lLx1’W Trench drain needs to be cleaned. Porous pavement parking lot	●			○	●
LL328	18" HDPE, invert 3.5 ft. Connects one-way cross to other side of Street	○			○	
LL330	18" HDPE pipe for all on street drainage; invert 3.5 Ft.	◖				
LL332	18" HDPE. One pipe in and one out	○				
LL334	18" HDPE, invert 4 ft. Invert out only	◖				
LL335	18" HDPE, invert 3.5 ft. Grass on top of grate-needs cleaning	◖				●
LL337	18" concrete with 3.5 invert. 2 in, one out same as rest	○				
LL342	18" HDPE with ~ 3.5 ft invert. Wet muck at bottom	○			○	
LL345	18" HDPE with ~ 3 ft invert. Standing water inside-one way, inlet2’x3”	◖	●		○	●

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL346	24" HDPE with ~ 3.5 ft invert.2 inlets curb and one open inlet	○			○	
LL347	24" HDPE with ~ 4 ft invert. Goes to detention basin	○			◖	
LL353	36" pipe along ISA Dr. and goes into 18" HDPE into forested area; structure at 4 ft invert	◖			◖	
LL354	Found catch basin in vegetated area next to other catch basin; 2.5 ft invert					
LL355	concrete, 36" with ~2.0 invert. Slopes into manhole adjacent	●			◖	●
LL357	9" deep; Grate 2x2	●			◖	●
LL358	Filled completely. Saw construction up the road					●
LL359	12" concrete; 4 ft invert; dry weather flow	◖		●		●
LL360	24" RCP at 4 ft invert from road. Runs along Isa Dr.	◖				
LL361	48" RCP at 5 ft invert. Sump 9' down; 24" coming from inlet across the street. Outlet is box 2'Hx4'W into ponding basin. 24" pipe coming in from Isa Dr.					
LL364	24" HDPE with 4 ft invert. Goes to ponding basin	○			◖	
LL365	24" RCP. Goes toward CB to ponding basin	○				
LL368	12" concrete; 3 ft invert. Hooded outlet; dry weather flow observed	◖		●		●
LL369	12" HDPE, ~4 ft invert. 8' to bottom, 1' muck	●			○	●
LL370	24" HDPE at 3.5 ft invert. One-way pipe towards San Vicente	◖				
LL372	24" HDPE, 4 ft invert. Angled pipe goes to culvert across street LL371	●				●
LL378	48" HDPE, ~9 ft invert. Pipe comes from across road and lets out into wooded area	○				
LL381	24" HDPE, ~8 ft invert.2 pipes headed diagonally across street. standing water	○				
LL382	Full of veg - needs to be cleaned out. Post office	●		?		●
LL384	36" HDPE, ~20 ft invert. Little standing water	?				
LL385	24" HDPE, ~18 ft invert.	?		?		
LL386	24" HDPE, ~14 ft invert. Comes from further away circular CB	?			○	
LL388	24" HDPE, ~8.5 ft invert. Little water	○				
LL389	24" HDPE, 4 ft invert. Little standing water	○			○	
LL391	24" HDPE, 3.5 ft invert. Connects only to adjacent manhole. CB located in depression in grass	◖				
LL393	24" HDPE, 3 ft invert. Standing water	?			○	
LL394	36" HDPE, 5 ft invert. Connected to manhole	○				
LL396	36" HDPE, ~7 ft invert. Standing water	◖				
LL398	24" HDPE, ~7 ft invert. Connected to manhole	◖				
LL400	24" HDPE, 3 ft invert. Pipe directs towards Laolao	○			○	
LL401	18" with 3 ft invert. Connect from across the street and towards Laolao. Standing water	?	●			●
LL402	12" HDPE, ~2 ft invert. Some parts of grate clogged. Standing pipe inside. Standing water	●			◖	●

[1] Sediment accumulation observed is ●high, ◖medium, ○low, or ? unknown

[2.] Visible damage, dry weather flow, or observed erosion is ●yes or ? unsure

[3] Structure was identified as ●yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

Table 2 Laolao Drainage Infrastructure Inventory—Culverts

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL111	Low point. 4'x4' culvert/formal channel 11' down on upstream. 14' on downstream side.	○				
LL128	Lower culvert. Good condition swale and culvert. 24" PVC; 3' invert	○			○	
LL129	Concrete box culvert. 2.8x1.25' with 1.5' invert					🔴
LL130	To be cleaned. Concrete box 2x1.25'; 2ft invert					
LL163	Isa Dr. culvert at railroad road.					
LL165	PVC, 2'x4' diameter with 5' invert on upstream side. Curb cut uphill (40' wide). Stone lined.	◖		?		
LL178	Road crossing. Sediment at barriers. 5x0.75' gaps in barriers.	○				
LL181	24" PVC; 3 ft invert. Two pipes, one from LL181, one from LL180	○			◖	🔴
LL186	4'x4.5' with 9 ft invert. Very scoured.					
LL200	36" PVC at 5.3 ft invert. From manhole LL200.					
LL201	8'x4.2' concrete box culvert. 28' long	●			○	
LL303	18" concrete; 3ft invert. Two points of entry, one from left side and one from center area	●	●		◖	🔴
LL304	Come from roof drains and trench drain down center of school into rain garden; concrete	◖			◖	
LL306	Flume is adjacent to this 12" RCP culvert, water coming from roof drains, black middle pipe and culvert above into flume; ~2ft invert		●			🔴
LL307	12"W x 4"H concrete	◖				
LL309	16"x4" concrete culvert. Water flows directly through and to back of school	●			○	
LL311	Concrete swale leads to 12" concrete culvert pipe then to another culvert both with sediment on the end; invert 1.5'					
LL312	2.5'W concrete; 0.5' invert	●	●		◖	🔴
LL316	Comes from 18" pipe trench drain through school; 12" concrete culvert with 1' invert	●				
LL363	24" concrete, 6' invert. Coming from Isa drive	◖				
LL366	24' HDPE, invert 5 ft. Lets out into vegetation	?		?		
LL367	Can see concrete structure but not outlet. Discharge from circular grate goes to vegetated depression	◖			○	
LL371	24" HDPE with 5.5 ft invert. Pipe coming from CB at Lantana and from angle at Papago	◖			◖	
LL373	24" HDPE with 4.5 ft invert	○				
LL374	24" HDPE with 4' invert from Isa Dr.	○				
LL375	24" HDPE with 3.5 ft invert	◖				
LL376	24" HDPE with 5 ft invert	○				
LL379	48" HDPE with ~8 ft invert. Standing water. Goes towards cb and outlet across street	○				
LL380	24" HDPE. Invert is 8' on low and 6' high side	○				

[1] Sediment accumulation observed is ●high, ◖medium, ○low, or ? unknown

[2.] Visible damage, dry weather flow, or observed erosion is ●yes or ? unsure

[3] Structure was identified as 🔴yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

Table 3 Laolao Drainage Infrastructure Inventory—Outfalls and Stream Outlets

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL102	Low erosion, vegetated with beach morning glory.				○	
LL105	Varies in depth, 5' avg. 10' wide. Very concentrated flow.					
LL106	3x9' at end. Less erosion at top.				◖	
LL107	12x1' lots of stone. Not very eroded.					
LL141	Outfall of broad based dip.					
LL150	Up to 20' wide, 3' deep					
LL153					○	
LL174	Conc swale and spillway. Needs cleaning.					●
LL187	Outfall from Isa Drive/RR drive					●
LL188	21' wide at top. 17' wide at bottom of channel					
LL190	Outfall from Laolao bay road. Deep ravine				?	
LL333	concrete flume to road from property. Pipe coming from property in ground into ditch, pvc black 3", coming from wetland?	●			○	
LL348	stream outlet; Tuturam					
LL377	concrete outlet. Washout along side- naturalish check dam at bottom	◖	●		●	●
LL383	24" HDPE. Pipes from across road let out into wooded area	?				

[1] Sediment accumulation observed is ●high, ◖medium, ○low, or ? unknown

[2.] Visible damage, dry weather flow, or observed erosion is ●yes or ? unsure

[3] Structure was identified as ●yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

Table 4 Laolao Drainage Infrastructure Inventory—Manholes

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL192	12" metal pipe (estimate)					
LL194	Two metal pipes in, one out					
LL197	One in and out. Did not open.					
LL198	One in one out. Did not open.					
LL199	Out into channel: 3' HDPE. inv 5.3' from road.					
LL324						
LL327						
LL329	Cleaned out in July, high sediment, 36" HPDE	●	no		◖	●
LL331						
LL340						
LL344						
LL356						
LL387						
LL390						
LL392						
LL397						
LL399						

[1] Sediment accumulation observed is ●high, ◖medium, ○low, or ? unknown

[2.] Visible damage, dry weather flow, or observed erosion is ●yes or ? unsure

[3] Structure was identified as ●yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

Table 5 Laolao Drainage Infrastructure Inventory—Crossings and Other

ID	Description/Notes	Needs Attention[1]
LL158	Stream crossing. Small eroded outfall from road.	●
LL159	Stream crossing. Not concentrated upstream, local low pt concentrates. No formal drainage. *Consider formalizing w broad dip*	●
LL160	Possible crossing from driveway?	
LL162		
LL168	Good condition	
LL175	Informal crossing	
LL114	Inflow of LL116 in informal channel	●
LL115	Severe erosion of road surface. Needs improvement from high point to LL114.	●
LL121	Minor road surface repair (this is high point)	
LL166	Informal spillway	
LL171	No evidence of crossing	
LL176	No crossing.	

[1] Structure was identified as ●yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

Table 6 Laolao Drainage Infrastructure Inventory—BMPs

ID	Description/Notes	Sediment[1]	Damage[2]	Flow[2]	Erosion[1]	Needs Attention[3]
LL131	Raingarden with clogged PVC (2) 6" inlet; 3.25' invert.	◖			○	●
LL142	Outlet of formalized swale.					
LL317	Sediment chambers follows path of natural stream- stream crosses the road and comes to right side of road. Concrete wall is 8'-10' high, invert is 8 ft. Recommend cleaning out sediment.	●			○	●
LL350	Infiltration basin, riprap. Overflows and goes to silt fence area when raining	◖			◖	
LL362	Ponding basin	◖				
LL403	Rain garden at San Vicente School, inlets clogged.	●				●
LL120	13' wide. 95' long concrete broad dip w wall overflow					
LL135/ 136	LWC, concrete dip and swale—needs cleaning and repair along edge	●			●	●
LL137/ 138	Swale and broad dip- concrete- needs cleaning and removal of vegetation at outlet	●			◖	●
LL149	LWC3. Needs cleaning (branches and debris); broad dip with wall (same as LL204)					●
LL156	Broad dip. 14x144'. Upstream is not concentrated and come in multiple points. May want to armor downstream more to prevent scour.					
LL184	Broad dip. 13'x127'. Needs cleaning. Put hole at edge of conc.					●
LL189	Dip at Isa Dr./railroad intersection.	◖			◖	
LL134	6" wide, 38' long concrete waterbar. Eroded from high point down. Formalized swale below.					●
LL169	Informal waterbar					
LL170	Informal waterbar					

[1] Sediment accumulation or erosion observed is ●high, ◖medium, ○low, or ? unknown

[2] Visible damage/dry weather flow is ●yes or ? unsure

[3] Structure was identified as ●yes, needs cleaning, repair, or inspection due to clogging, high sediment levels, visible damage, or other notes from field crews.

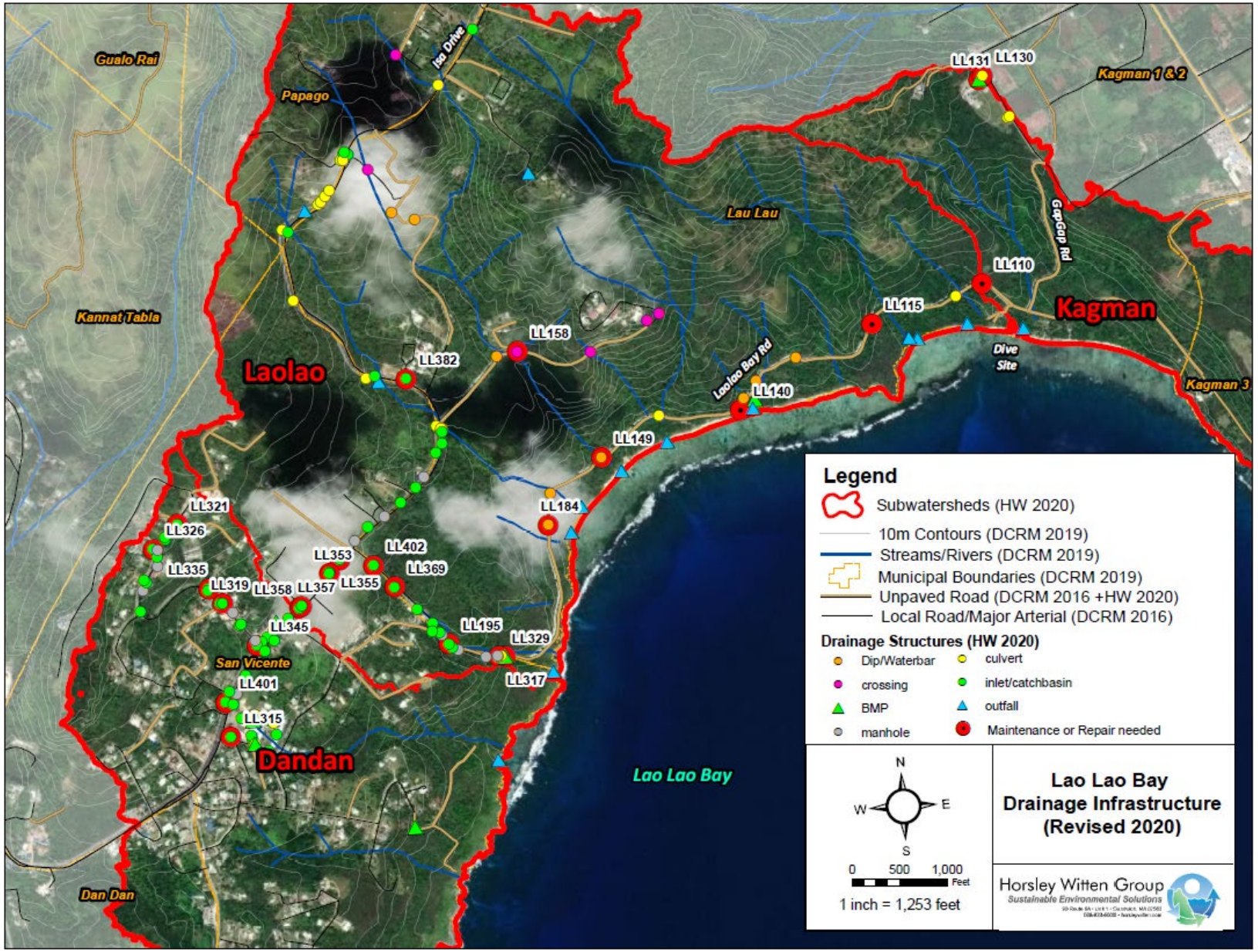


Figure 7. Drainage structures assessed by HW in 2020

Hydrology & Climate

Mean annual precipitation for the watershed is approximately 75 inches per year, of which approximately 50 inches occurs between July and November. Several streams exist in the volcanic areas of the watershed (Laolao and Dandan subwatersheds). The 2018 305(b) and 303(d) Integrated Report state that several of these streams are ephemeral for at least a portion of the year, at least enough flow for water quality sample collections. These streams are steep and can have high volume flow during heavy rain events, while smaller rain events may infiltrate in vegetated areas and not produce any runoff. The majority of these streams cross Laulau Bay Drive before discharging into the bay and were contributors to road erosion and sedimentation issues in the Bay. There are no freshwater wetlands in the watershed, except for a small wetland in riparian wetland in the upper/mid portion of Dandan subwatershed. There may be a small wetland or pond associated with the golf course.

The hydrology for the limestone portions of the watershed, particularly for Kagman, may be more significantly influenced by groundwater. Monitoring studies by Houk and others showed extreme shifts in nearshore salinities in the bay depending on tides and rainfall. They found a larger influence of groundwater input from eastern side of the bay (limestone) when interactions with the aquifer were enhanced as opposed to higher inputs from the western (volcanic) side of the watershed during rain events (**Figure 8**). This has implications for watershed nutrient contributions in these areas from the golf course, agriculture, and onsite wastewater systems, which we currently know little about. **Figure 9** includes is a map showing well locations and groundwater protection zones, as well as water table depths and flow directions. More information on the protection zones is needed to better understand the implications for watershed management planning.

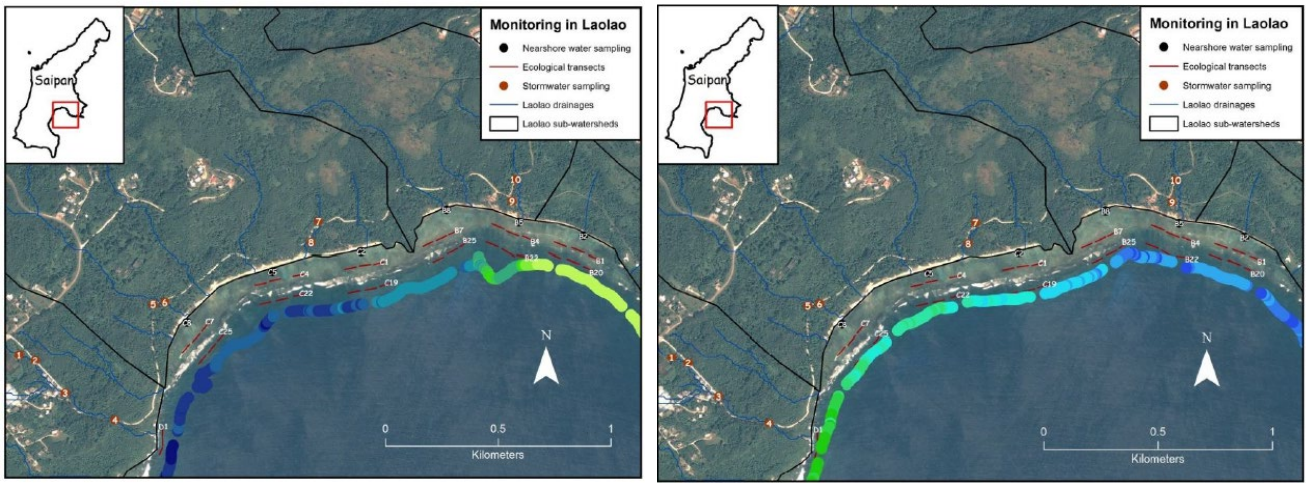


Figure 8. Salinity profiles on the left (where yellow is low and dark blue is high salinity) shows the influence of aquifer connectivity during maximal tidal influence. This pattern (reversed on the right), during minimal tidal exchange and periods of high rainfall (Houk et al, 2011).

Due to the steep geography of Laolao only a small strip of uplands between Laulau Bay Drive and the shoreline is at risk for damage from flood events (**Figure 10**). The social vulnerability index completed in 2014 as part of the NOAA-funded Climate Change Vulnerability Assessment indicates a low vulnerability for the areas in the Laolao watershed; southern Dandan and Kagman are at a slightly higher risk (see **Figure 10** inset). The social vulnerability index values range from 26 (dark green) to 72 (red) with higher values equating to greater vulnerability.

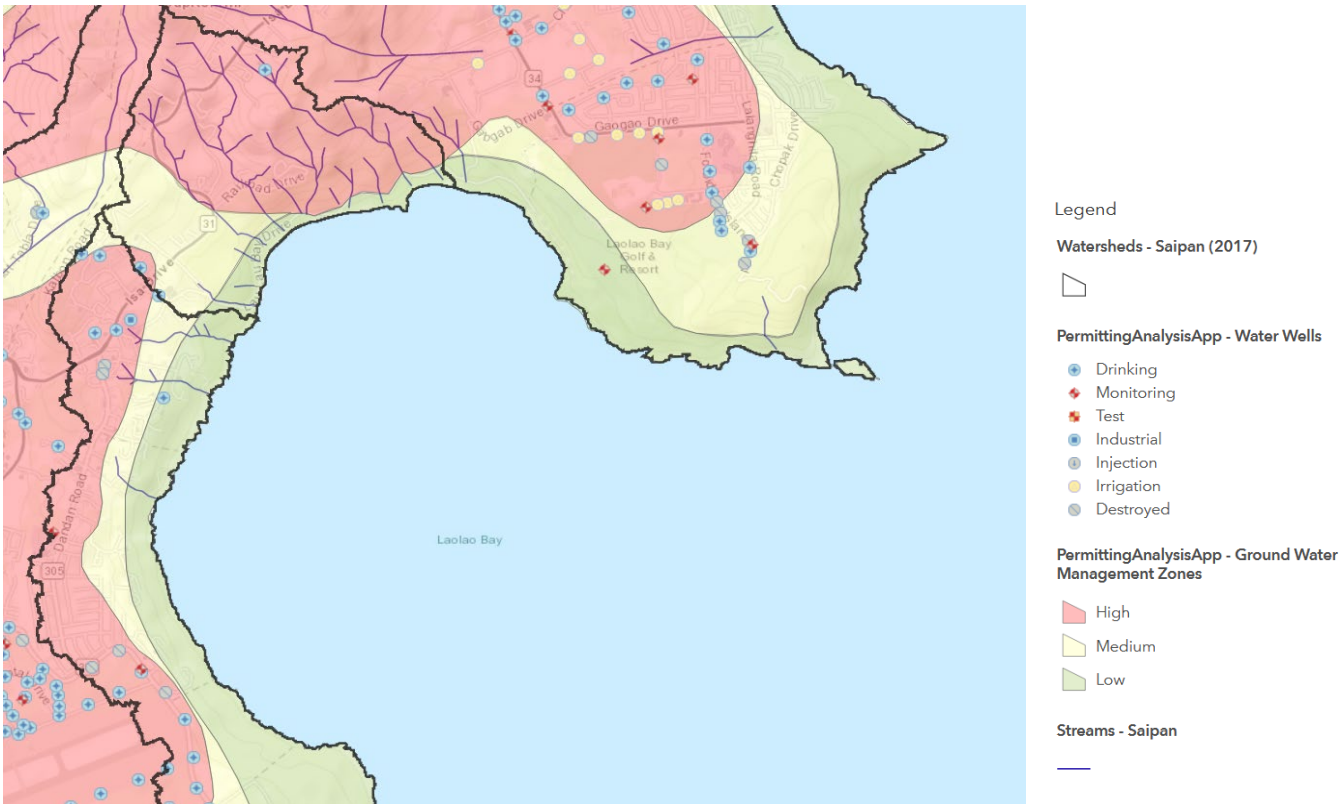


Figure 9a. Groundwater Management Zones and wells from CRMOGIS (BECQ, 2017).

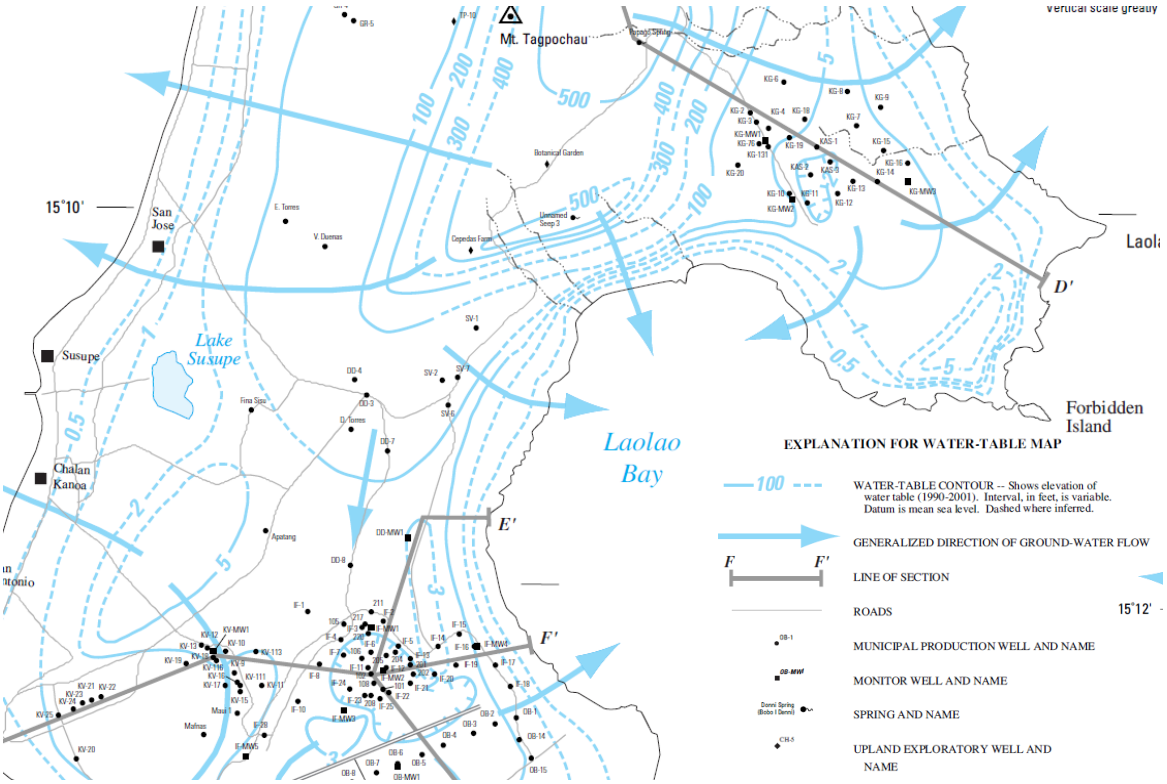


Figure 9b. Water Table Contour and Flow Map (Carruth, 2003)

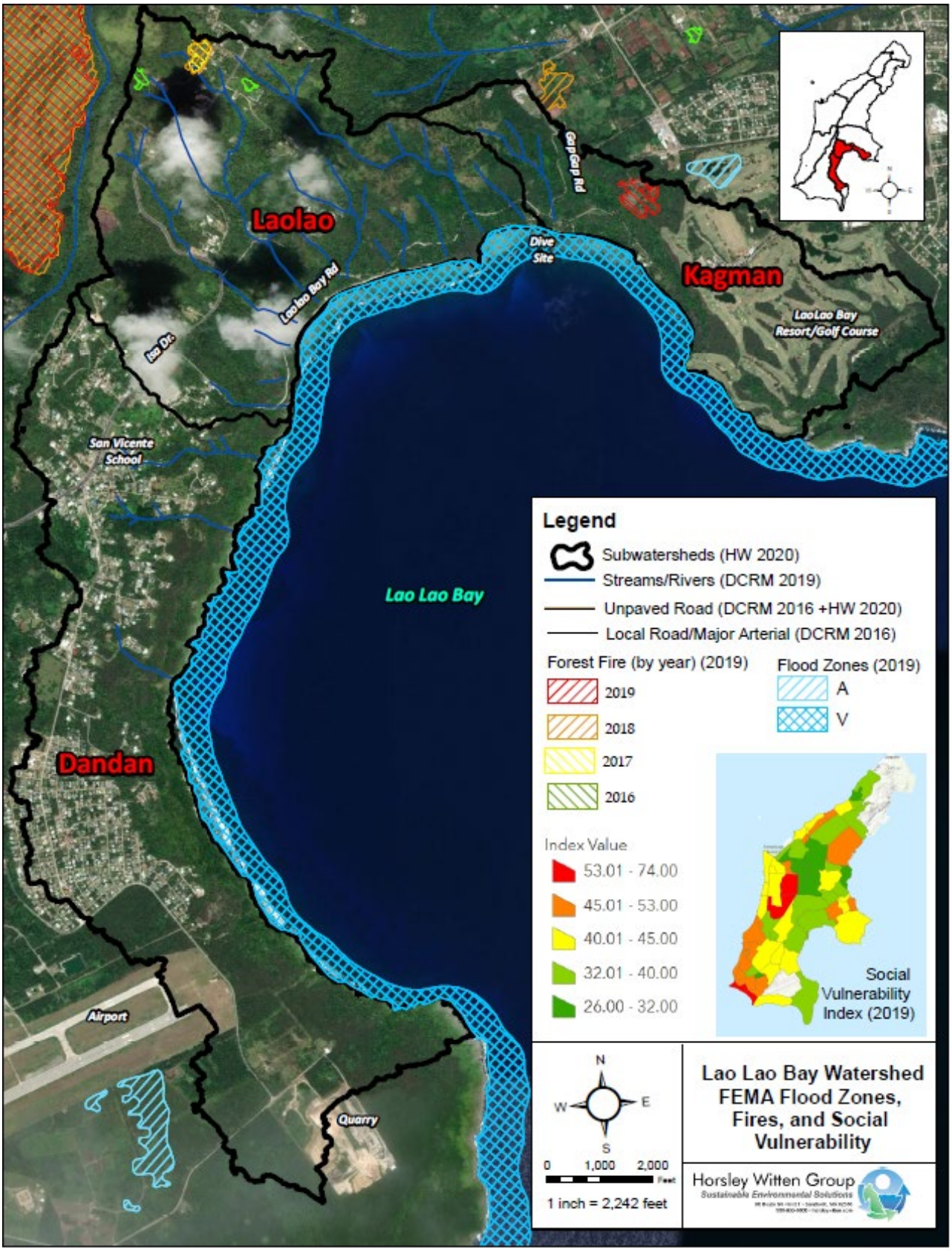


Figure 10. FEMA Flood zone, fire, and social vulnerabilities

Maximum Tsunami impacts are predicted to have a small influence in the watershed (**Figure 11**). Similarly, sea level rise is not predicted to affect a large area of the watershed, although Laulau Bay Drive is at risk for erosion and storm damage, as evidenced by destruction of the permeable paking lot and undermining of portions of the coastal road during Typhoon Yutu in October, 2018 (**Figure 12**). While there is limited coastal infrastructure in Laolao, sections of Laulau Bay Dr. appear even more susceptible to storm damage post-Yutu. This road serves as the primary access for numerous properties and recreational locations on the eastern side of the bay. Loss of access along Laulau Bay Dr. elevates the importance of Gap Gap Rd. as a critical secondary access; therefore, stabilization or relocation of GapGap Rd. may have become a higher priority.

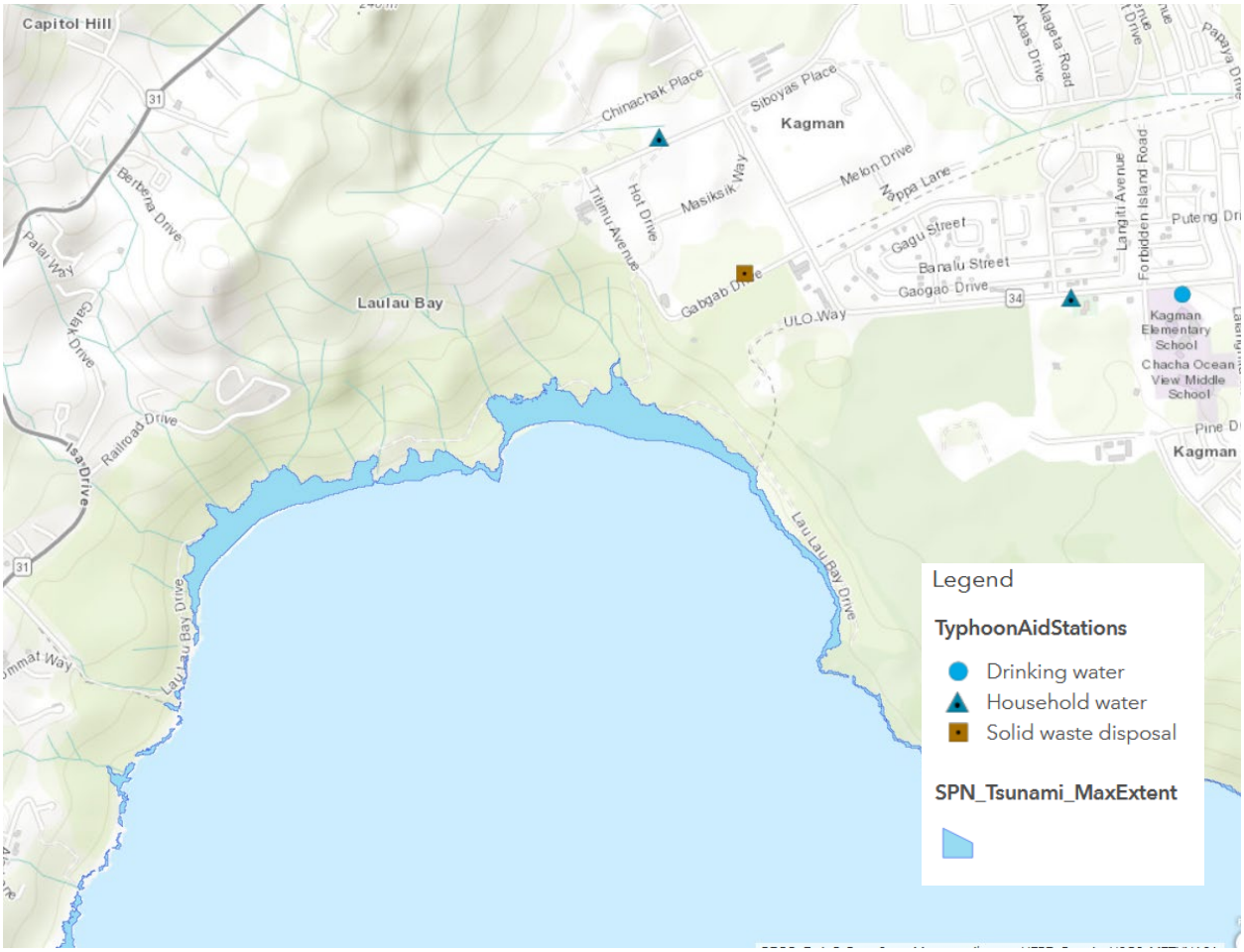
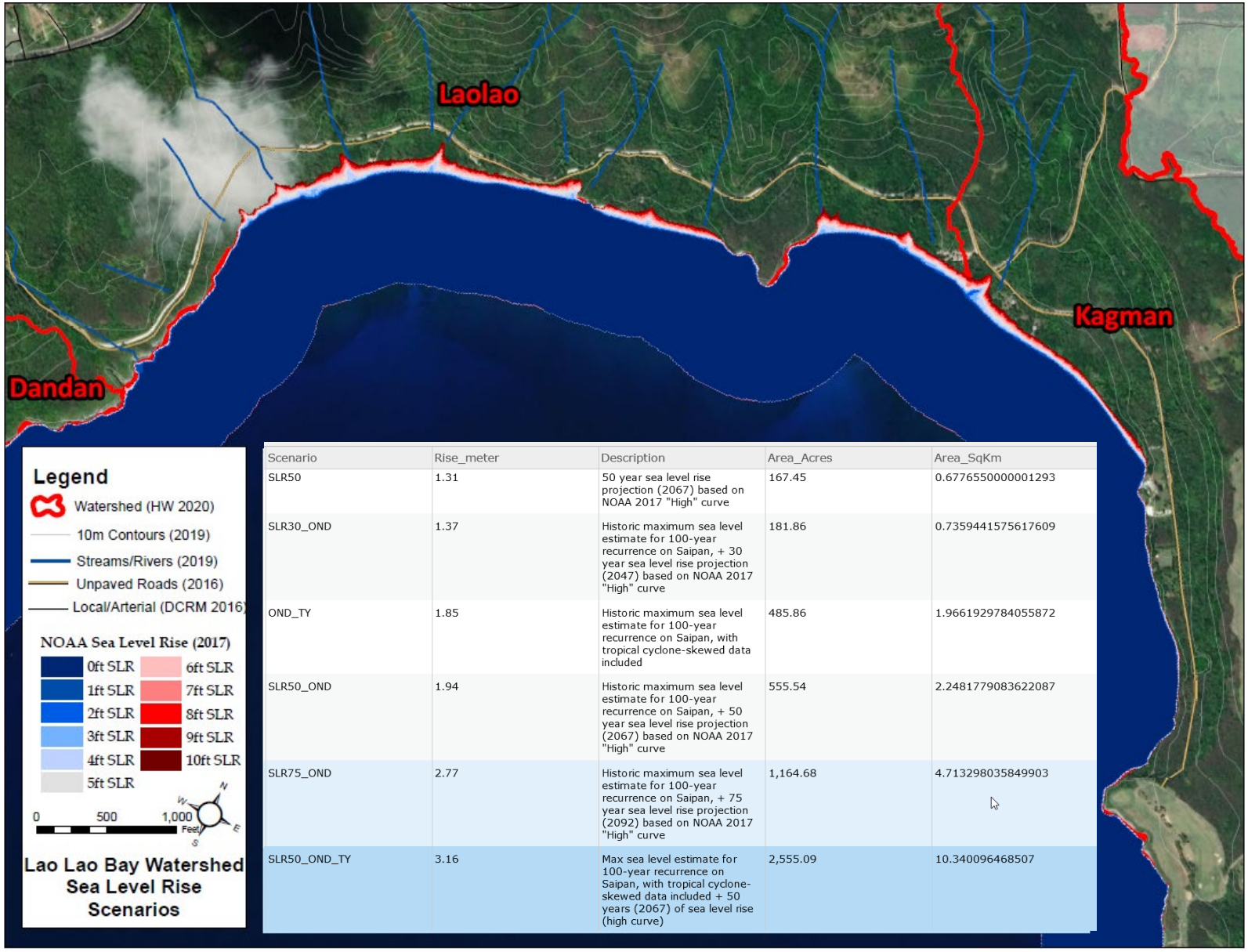


Figure 12. Tsunami Maximum Extent Predictions (CRMOGIS, 2020)



Scenario	Rise_meter	Description	Area_Acres	Area_SqKm
SLR50	1.31	50 year sea level rise projection (2067) based on NOAA 2017 "High" curve	167.45	0.6776550000001293
SLR30_OND	1.37	Historic maximum sea level estimate for 100-year recurrence on Saipan, + 30 year sea level rise projection (2047) based on NOAA 2017 "High" curve	181.86	0.7359441575617609
OND_TY	1.85	Historic maximum sea level estimate for 100-year recurrence on Saipan, with tropical cyclone-skewed data included	485.86	1.9661929784055872
SLR50_OND	1.94	Historic maximum sea level estimate for 100-year recurrence on Saipan, + 50 year sea level rise projection (2067) based on NOAA 2017 "High" curve	555.54	2.2481779083622087
SLR75_OND	2.77	Historic maximum sea level estimate for 100-year recurrence on Saipan, + 75 year sea level rise projection (2092) based on NOAA 2017 "High" curve	1,164.68	4.713298035849903
SLR50_OND_TY	3.16	Max sea level estimate for 100-year recurrence on Saipan, with tropical cyclone-skewed data included + 50 years (2067) of sea level rise (high curve)	2,555.09	10.340096468507

Figure 13. Sea Level Rise estimates (NOAA 2017) predict very little inland inundation (table from CRMOGIS, 2019)

Geology & Soil

The geology of Saipan consists of limestone over older volcanic rock. In the Laolao Watershed, limestone karst in the eastern part of the bay (near Kagman) transitions toward bedrock and volcanic soils on the west side (near Dandan). **Figure 14** describes the features of the geological formations in the watershed as presented in **Figure 15**.

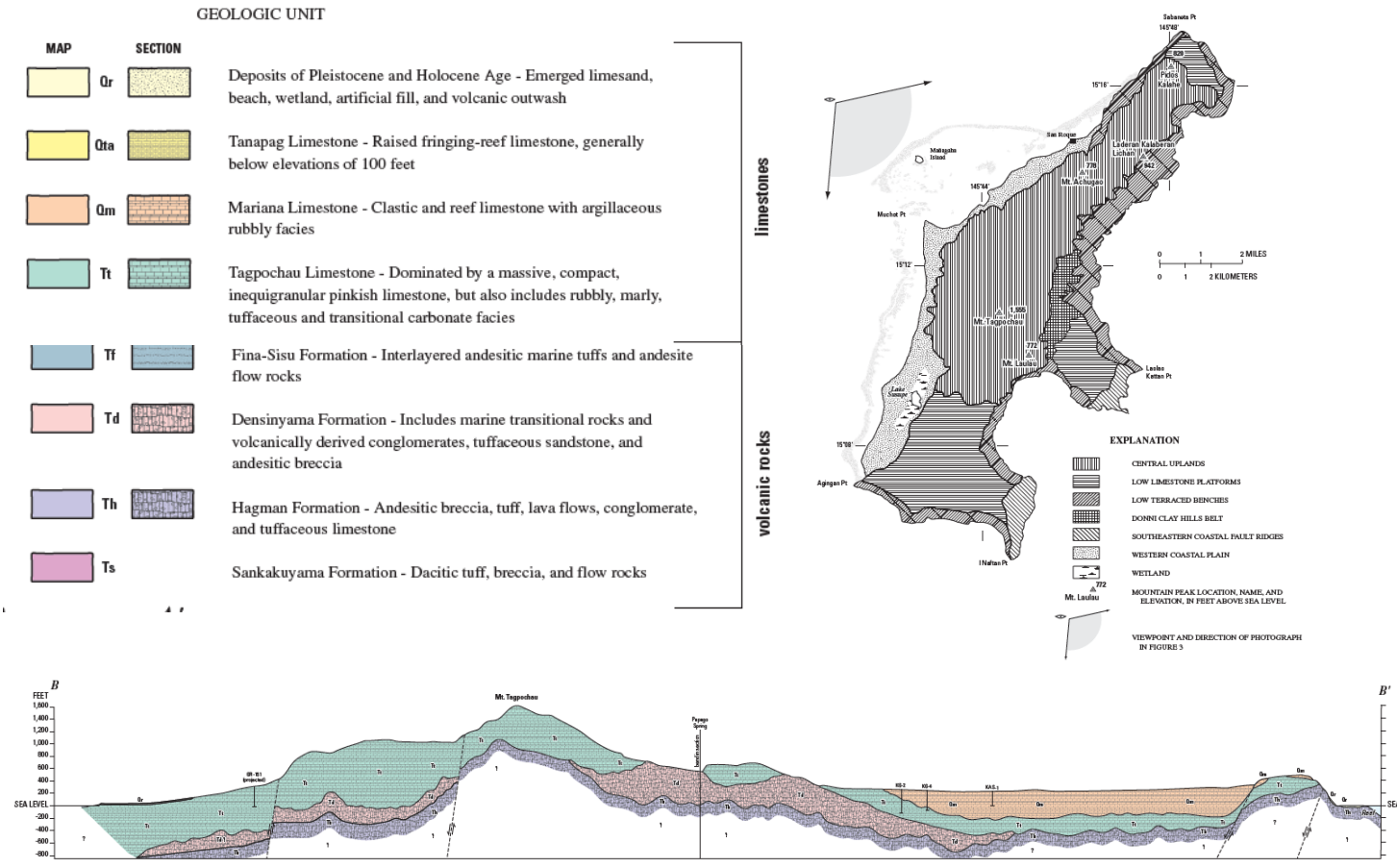


Figure 14. Explanations of geological units and representative cross-section (from Carruth 2003)

The majority of soils in the Laolao watershed are volcanic, consisting of clay, clay loam, or other poorly drained soils. Per the USGS soil classification hydrologic soil groups (HSGs), most of the watershed is HSG D soils (very low infiltration capacity and very high runoff potential), with HSG C soils (low infiltration capacity and high runoff potential) and small pockets of HSG B soils (higher infiltration capacity and lower runoff potential).

Figure 16shows the location of hydrologic soil groups across the watershed. According to USGS, depth to water table across all the soil types present in the watershed is greater than 80 inches.

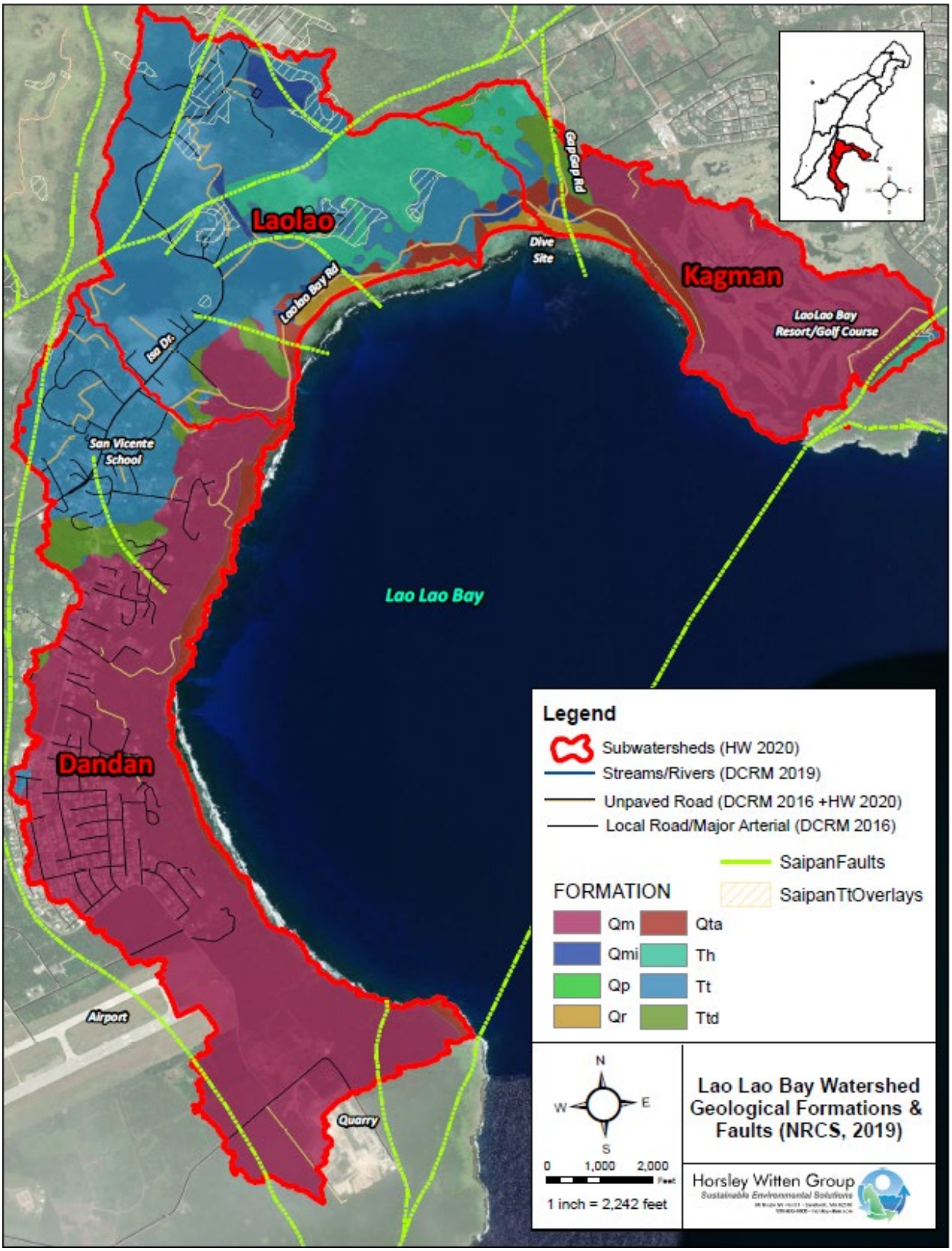


Figure 15. Laolao geological formations and faults (NRCS, 2019)

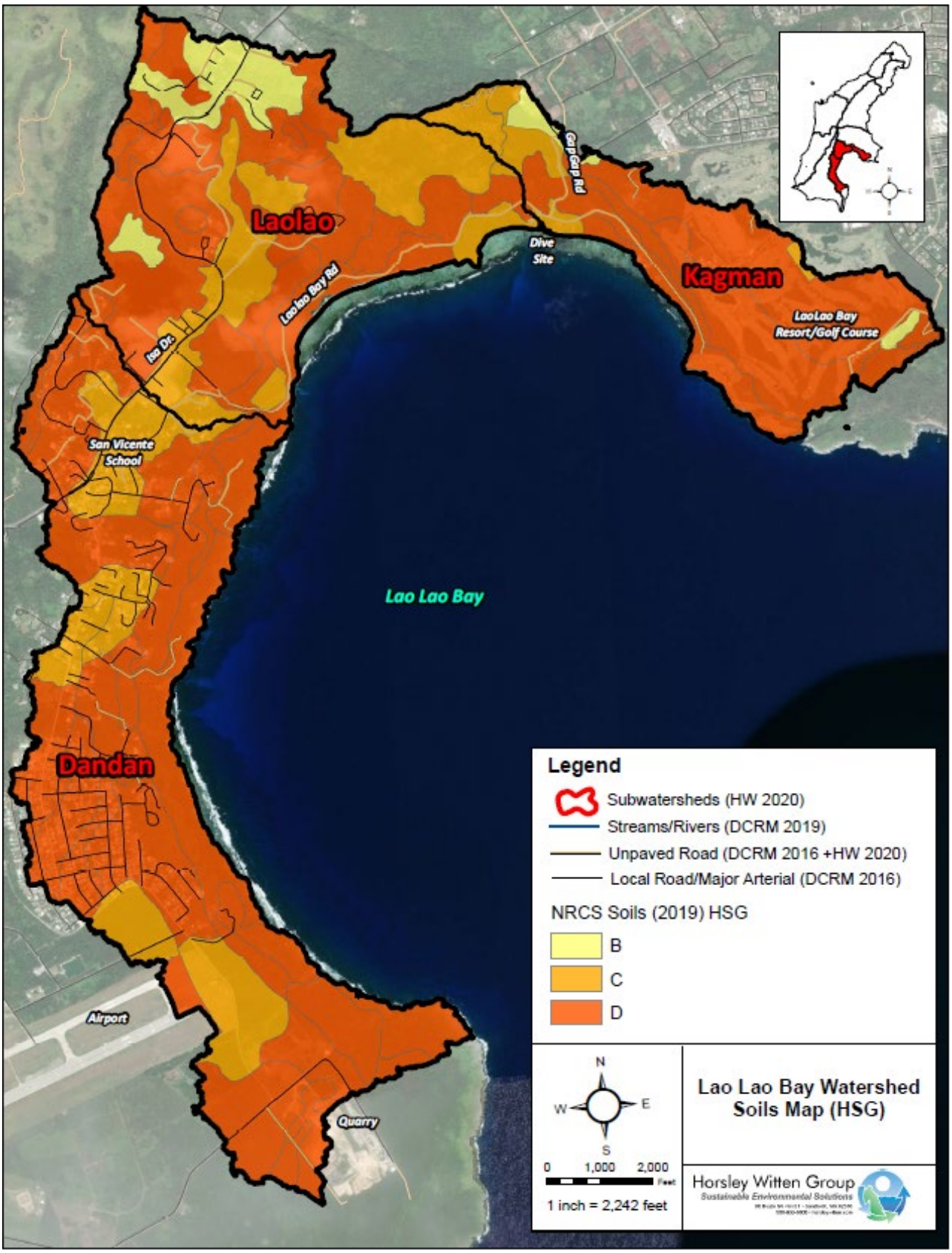


Figure 16. Laolao hydrologic soil groups (NRCS, 2019)

Ecology

Recent benthic habitat maps are not readily available; thus, we are limited to a 2004 map that only covers the nearshore portions of LaoLao Bay (see **Figure 4**). In general, the reefs in Laolao are considered relatively diverse. The eastern portion of the bay (wave-sheltered and high groundwater input) is dominated by *Porites*, carpet corals, and faviids. The central and western portions of the bay (less groundwater input) have a coral community dominated by encrusting and branching corals (e.g., *Montipora*, *Acropora*, *Astreopora*, and *Poillopora*). It is well-documented that the bay historically had a higher coral cover (>40%), which has seen significant declines presumably due to sedimentation, storm damage, and corallivous starfish. Reef health has decreased significantly due to a bleaching event in 2017. Conversely, increased turf, fleshy coralline, and macroalgae coverage has been observed, potentially due to nutrient inputs from the watershed and/or lack of herbivory fish and urchins. These issues were the driver for watershed planning and restoration project implementation (reforestation, road improvements, etc.) over the past decade.

According to the 2009 Conservation Action Plan (CAP), the biodiversity in Laolao Bay was in "fair" condition, meaning that it requires human intervention to prevent serious degradation. The CAP identified the coral and vegetation in Laolao Bay as the most susceptible to threats, including runoff, lack of herbivory, fire, invasive species and development. While few fires have occurred in Laolao in 2007-2019, a large area to the west (Isley watershed) burned in 2018 and 2019 (see Figure 10). **Table 7** shows the total areas burned in Laolao. **Figure 17** from CRMOGIS 2020 shows areas of fire potential.

Table 7. Summary of Acres Burned in Laolao Subwatershed

Year	Area burned (ac)	% of Subwatershed
2016	2.1	0.2
2017	3.9	0.3
2018	4.8	0.4
2019	0	0.0

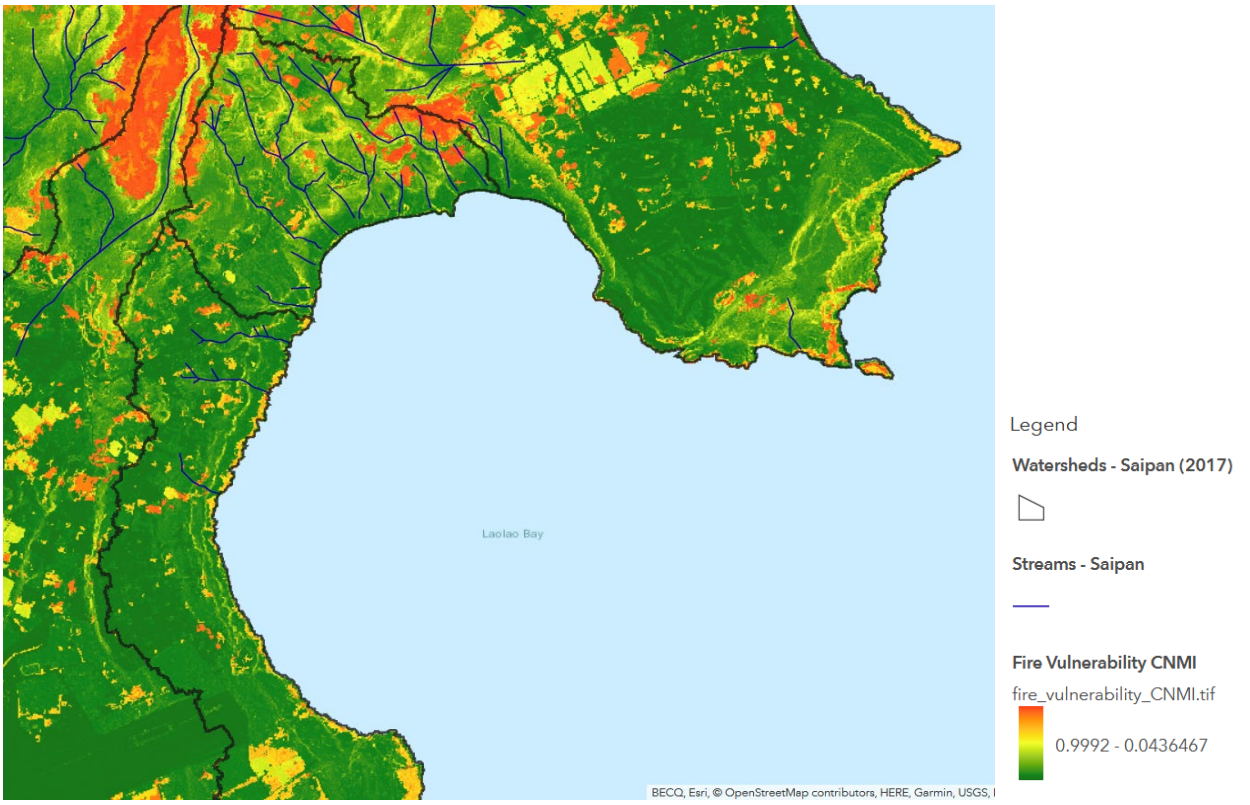


Figure 17. Fire vulnerability map for the Laolao bay watershed area (CRMOGIS, 2020).

The CAP update identified several monitoring priorities related to sea turtle nesting and foraging, and sea urchin density; however, no data was reviewed at this time.

A coral economic valuation study for the CNMI estimated that across several ecosystem services, coral reefs in CNMI generated over $104.5M annually (ERG, 2019). Unlike the reefs in Saipan lagoon which contribute to infrastructure protection, the reefs in Laolao contribute on a per hectare basis for tourism, recreation, fishing, and biodiversity revenue. Economic value is increased when reefs are close to shore and accessible (**Figure 18**).

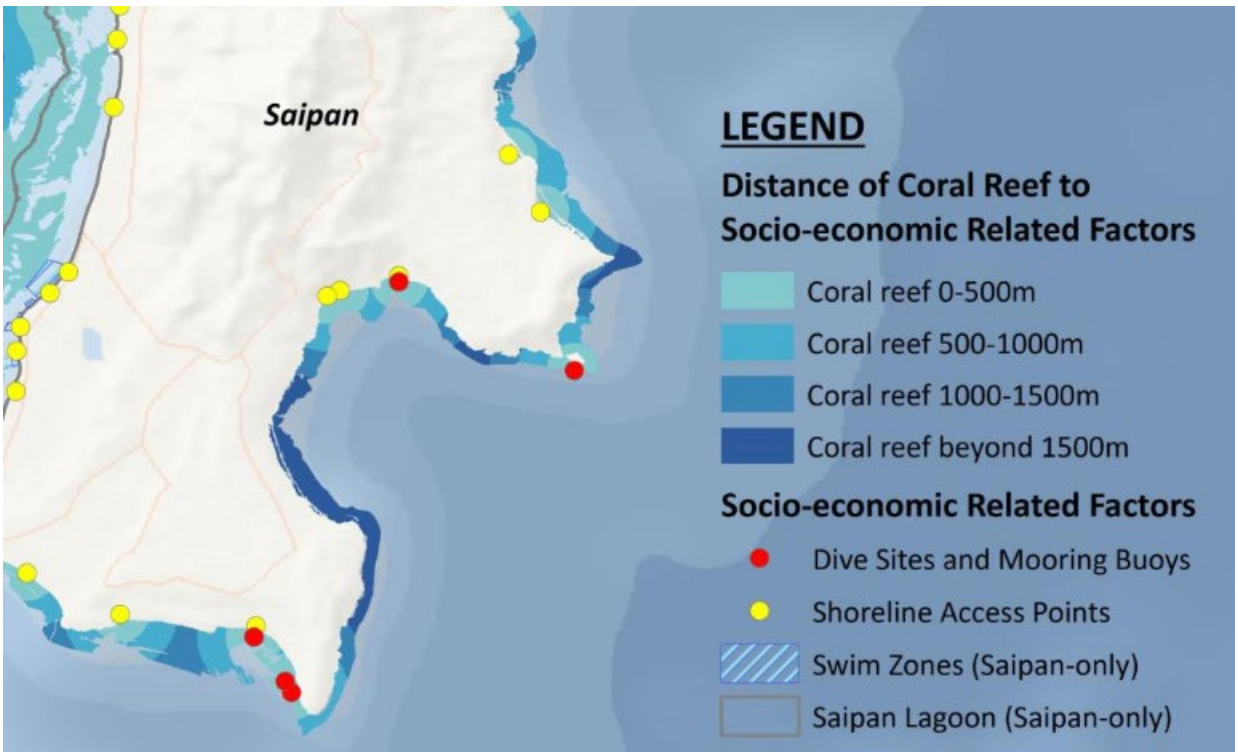


Figure 18. Distance to reefs (ERG, 2019)

The Wildlife Action Plan for the CNMI 2015-2025 does not include the Laolao Bay Sea Cucumber Sanctuary (483 acres) in its inventory of protected areas. The sanctuary prohibits sea cucumber harvest from mean high tide line to the 40-foot depth contour and was established in 2000 with goal of supporting future harvests. The Action Plan does include a goal of reducing runoff from land-based sources of pollution and highlights continued implementation of the Laulau Bay CAP as a strategic action. The Action Plan also cites coral farming, invasive vine management and forest monitoring as important objectives, which all have relevance in the Laolao Bay watershed.

Given the socio-economic importance of the Bay to users, and the remaining acreage of undeveloped public lands, additional information on the following topics would be helpful for better addressing the ecological aspects in watershed management planning:

1. Badland reforestation succession data;
2. Need a better understanding of where high value habitats and species of concern generally are in the upland watershed;

3. Are there Forest, invasive species, bat, and bird monitoring (or other) activities that are taking place or are planned;
4. Understanding of DPL priorities for undeveloped public lands or any pending lease expirations;
5. Sea grass information
6. Sea turtle data and density of urchins monitoring data; also we need to be able to evaluate if statistically significant positive trends in the abundance of a) carnivorous fish, surgeon fish and adult parrot fish; b) sea urchins and sea cucumbers; and c) the coral density per unit area and mean colony size by FY2015 compared to baseline.
7. Need better mapping of benthic habitat and understanding of; and
8. Completion of stream assessments in the watershed.

Water Quality

The 2018 305(b) and 303(d) Integrated Waters Report listed Laolao Bay's waters as "poor" quality, under the Aquatic Life Support Function (ALUS) ranking. **Table 8a** summarizes the 2018 listings for each assessment unit in the watershed; **Table 8b** includes the number of bacteria exceedances at stations within each of the three assessment units. In 2010, water quality exceedances were detected for ammonia, TSS, temperature, and turbidity. Stormwater improvements in the watershed have substantially reduced surface runoff since then. Laolao's coastal waters have been delisted for phosphate, as well as for bacteria. There were only two *Enterococci* exceedances in marine waters after storm events in 2017 (attributed to naturally occurring bacteria associated with sediment) and a TMDL was established in 2017. During the periods when freshwater streams were flowing, there were also exceedances, likely due to sediment and septic systems. The topography, geology, and rain fall patterns make it difficult for streams in the watershed to sustain pools needed for aquatic life. Sediment and road runoff have decreased with road improvements.

Table 8a. Designated Use Summary (2018 305(b) and 303(d) WQ Assessment Integrated Report)

Designated Use	Type	Water Body Segment		
		16 DanDan CNMI 72	15 Lao Lao (south) SEB03, CNMI-21, ARRA C2,5,8	14 Kagman (North Lao Lao) ARRA B2,5,8
Aquatic Life	Coastal	Fully Supportive	Not Supporting DU Poor Habitat Good Nutrient levels	Fully Supportive Good Habitat & Good Nutrient levels
	Streams	--	--	Fully-supportive Native Habitat
	Wetlands	--	--	Fully Supportive
Fish Consumption	Coastal	Insufficient data	Insufficient data	Insufficient data
	Streams	--	--	Insufficient data
Recreation	Coastal	Fully Supportive	Not Supporting* Enterococcus Exceeded	Fully Supportive
	Streams	Insufficient data	Insufficient data	Insufficient data
Aesthetic enjoyment	Coastal	Fully Supportive	Fully Supportive	Fully Supportive
	Streams	Fully Supportive	Fully Supportive	Fully Supportive
CALM Assessment Category	Coastal	2	4a	3
	Streams	2	3	3
	Wetlands	--	--	1

** did show improvement due (reportedly) to Isa Rd. improvements and ARRA projects.*

Table 8b.Percentage of annual bacteria exceedances (2018 305(b) and 303(d) WQ Assessment Integrated Report)

Enterococci % Violations																
Sample Station ID	Sampling Station Name	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Segment Class
	SEGMENT 14: KAGMAN															
SEB 02	North LaoLao Beach	19	30	14	19	13	19	7	10	23	16	8	9	4	0	AA
ARRA B2	North Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	0	8	AA
ARRA B5	North Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	8	0	AA
ARRA B8	North Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	8	0	AA
	SEGMENT 15: LAO LAO															
CNMI-21	Central LaoLao Beach reef flat	*	*	*	*	*	*	*	*	*	*	*	*	0	0	AA
SEB 03	South Laolao	19	25	10	33	37	15	25	14	23	16	0	5	15	0	AA
ARRA C2	South Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	8	15	AA
ARRA C5	South Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	0	8	AA
ARRA C8	South Laolao Reef Flat	*	*	*	*	*	*	*	*	*	*	*	*	0	0	AA
	SEGMENT 16: DAN DAN															
CNMI-72	DanDan Reef Flat	*	*	*	*	*	*	0	*	*	0	0	*	0	0	AA

Several monitoring projects have taken place or are ongoing in Laolao Bay. **Figures 19** and **20** show the locations of monitoring stations: (2) BEACH monitoring sites used for water quality samples, physical and chemical water quality analysis, and biological data collection; (6) ARRA and (2) National Coastal Condition Assessment (NCCA) reef flat sites; and 10 SWQAMP (Surface Water Quality and Assurance Monitoring Plan) sites.

Five streams in the Laolao bay watershed were assessed during a previous reporting cycle, however based on the data collected, no locations of stream bank erosion, two locations of trash/dumping, and one marked location of an unexploded ordinance (UXO) were identified (see Figure 19). Larry Maurin (BECQ) expects to conduct another round of stream assessment in 2021-2022 using a newly adopted assessment protocol.

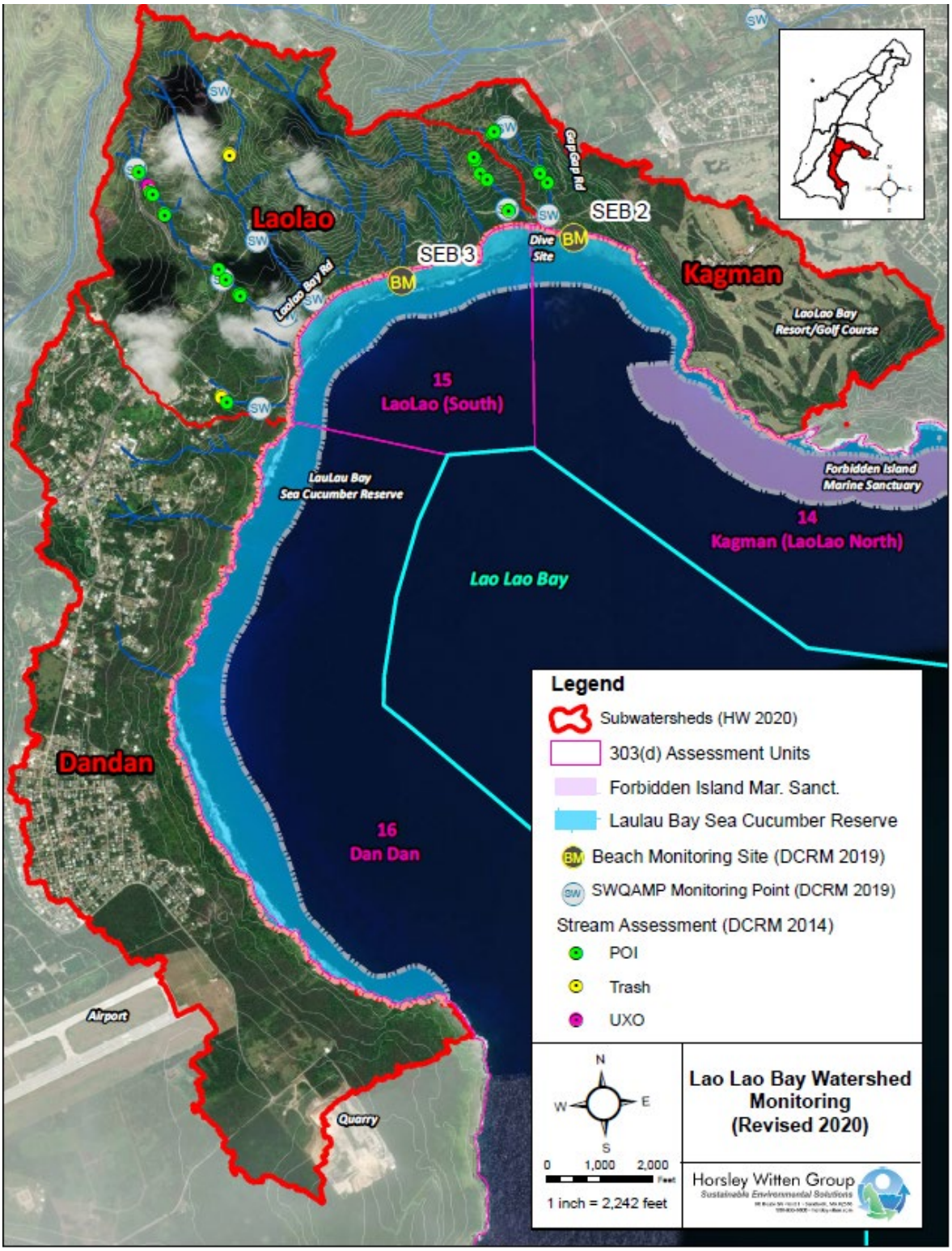


Figure 19. Monitoring locations and 303(d) assessment units

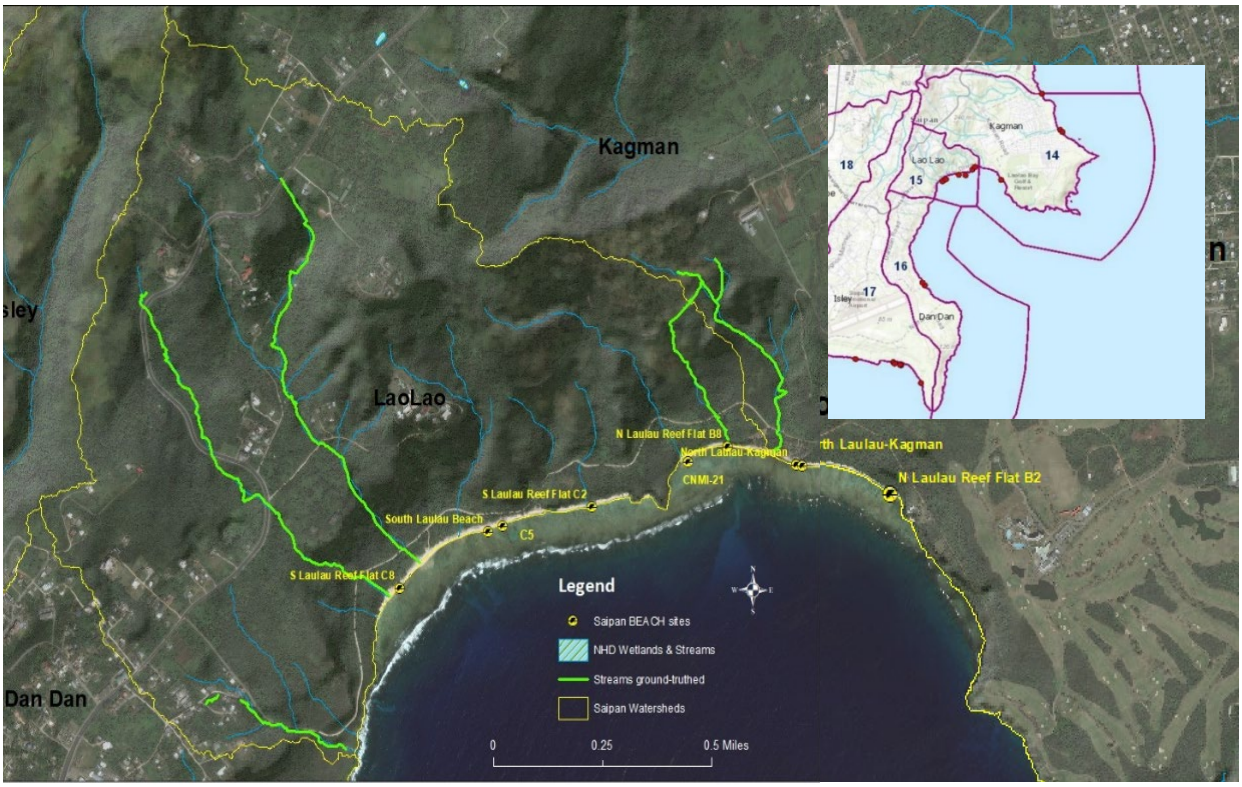


Figure 20. Reef flat monitoring sites from 2018 303(d) report. Streams highlighted in green were walked under a previous reporting cycle.

Nutrient contributions from groundwater is a concern in the CNMI and our understanding of groundwater transport of nutrients is evolving. Research on Guam has been conducted looking at nitrogen isotopes in seagrass to evaluate the impact of anthropogenic sources of nutrient loading (Pinkerton et. al 2015). This effort has expanded into recent studies by Dr. Kiho Kim and others to understand the source of nutrients and the spatial and temporal variations of nutrient-enriched groundwater discharges into the Saipan Lagoon. They collected benthic algae and seagrasses for isotope analysis as well as water quality samples for nutrient and radon analysis. As part of this study, four monitoring stations were also included in Laolao Bay. **Figure 21** shows monitoring station locations. Results have not been widely distributed, however, initial findings indicate that for Saipan Lagoon, there are several nitrogen "hotspots" from sewage derived-Nitrogen; groundwater nitrogen concentrations are an order of magnitude higher than surface waters; and wastewater improvements vs stormwater retrofitting priorities can be determined by nutrient dynamics (Kim, 2019). Results for Laolao have not been published. We currently know very little about the potential contributions of nutrients from the golf course, onsite wastewater disposal systems or agricultural areas in the watershed.

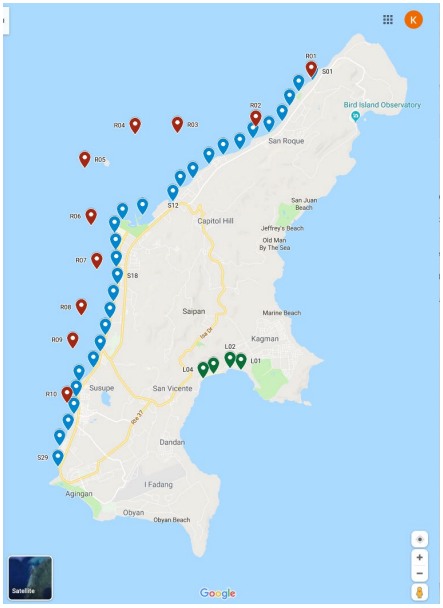


Figure 21. Nutrient dynamics sampling stations

The 2017 bacteria TMDL establishes several reduction targets for Laolao Bay based on rainfall season and duration curves (Table 9). Implementation recommendations for each watershed include the following:

In Laolao:

- Assist in planning associated with unpaved roads in the area, particularly short sections that contribute sediment and pollutants directly to stream channels
- Support monitoring of septic systems and potential discharge from golf courses to identify any point source contaminants

In Kagman:

- Active engagement with operating agencies to address Kagman water quality issues, including completion of stormwater structures, mitigating upland sediment sources (e.g., burned areas and roads)
- Support efforts and necessary feasibility studies to address wastewater treatment needs, especially in development of a potential third wastewater treatment plant
- Support water quality testing facility and staff to stay ahead of potential water quality issues associated with high development rates
- Support inspectors with BECQ (coastal zone management, etc.) to curb development violations pertaining to wastewater
- Improve overall watershed functioning to reduce burning, improve riparian function, and reforest upland areas to slow stormwater flow
- Work with NRCS and NOAA Fisheries staff directly on stormwater enhancement activities that could be supported across agency programs – expand to include USDA Forest Service and Federal Highways, where applicable, to best identify synergies in support mechanisms.

Table 9. Summary of *Enterococcus* load reductions in the 2017 TMDL for Laolao (Segment 15)

	Count	Exceedances	WQS	% Reduction				
				Duration Curve Zone				
				Dry (0 - 10%)	Low - Mid (10 - 40 %)	Mid (40 - 60 %)	Mid - High (60 - 90 %)	High (90 - 100%)
DRY SEASON								
STV	184	6	130	0%	0%	0%	0%	70%
Geomean	184	19	35	0%	0%	0%	0%	0%
WET SEASON								
STV	84	14	130	0%	27%	0%	44%	57%
Geomean	84	33	35	0%	0%	0%	41%	55%

To better understand current trends in water quality as they relate to watershed management goals and conservation action plan targets, we need to:

1. Locate the Appendix 2 technical report in the updated CAP comparing 1992 and 2010 marine monitoring data to determine the baseline water quality data from which CAP targets were established;
2. Confirm whether SWQAMP sites have been established and samples collected. If yes, where is the data?
3. Compile data collected since 2016 to update the follow trends graphics (**Figures 22a-d)** is a compilation of those trend graphics for reference convenience.
4. Check back in with Kiho Kim on Laolao results from Nitrogen studies.
5. Find nitrogen loading information from golf course, agriculture, and onsite systems;
6. Is there any bacteria loading information on domesticated or feral animals or wastewater, including from recreationalists in isolated areas without facilities?

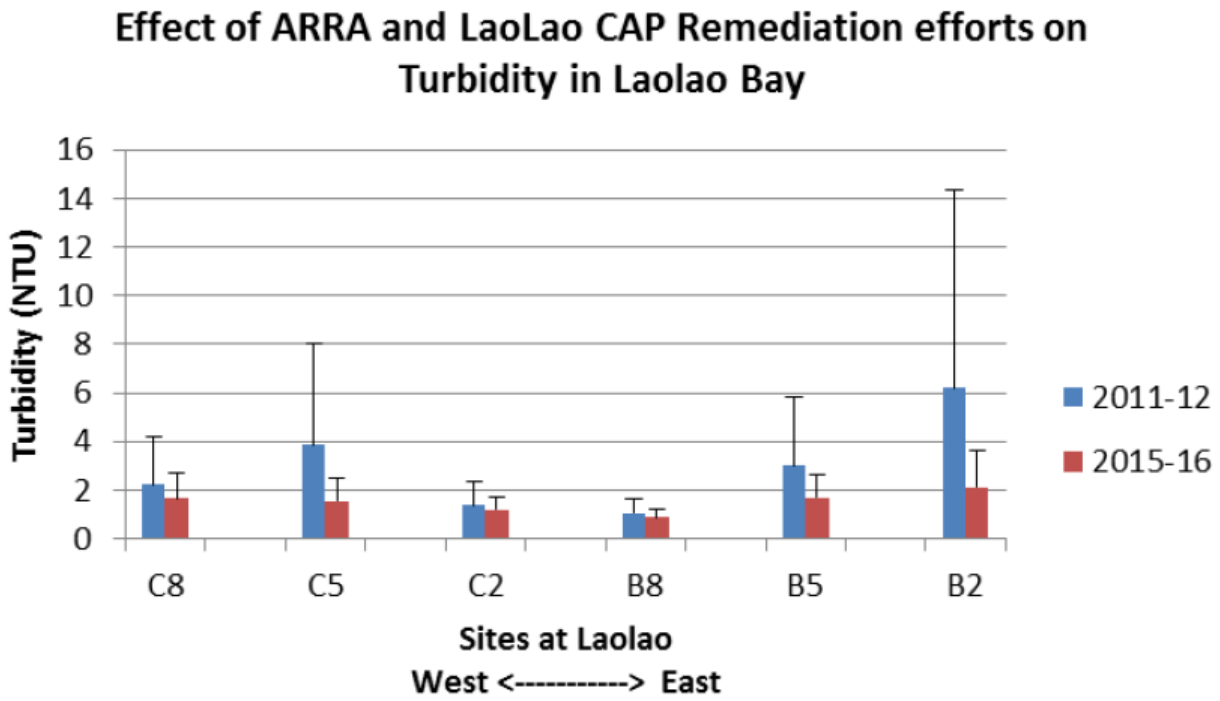


Figure 22a. Improvement in turbidity over baseline conditions measured at reef flat sites associated with the Laulau Bay ARRA project.

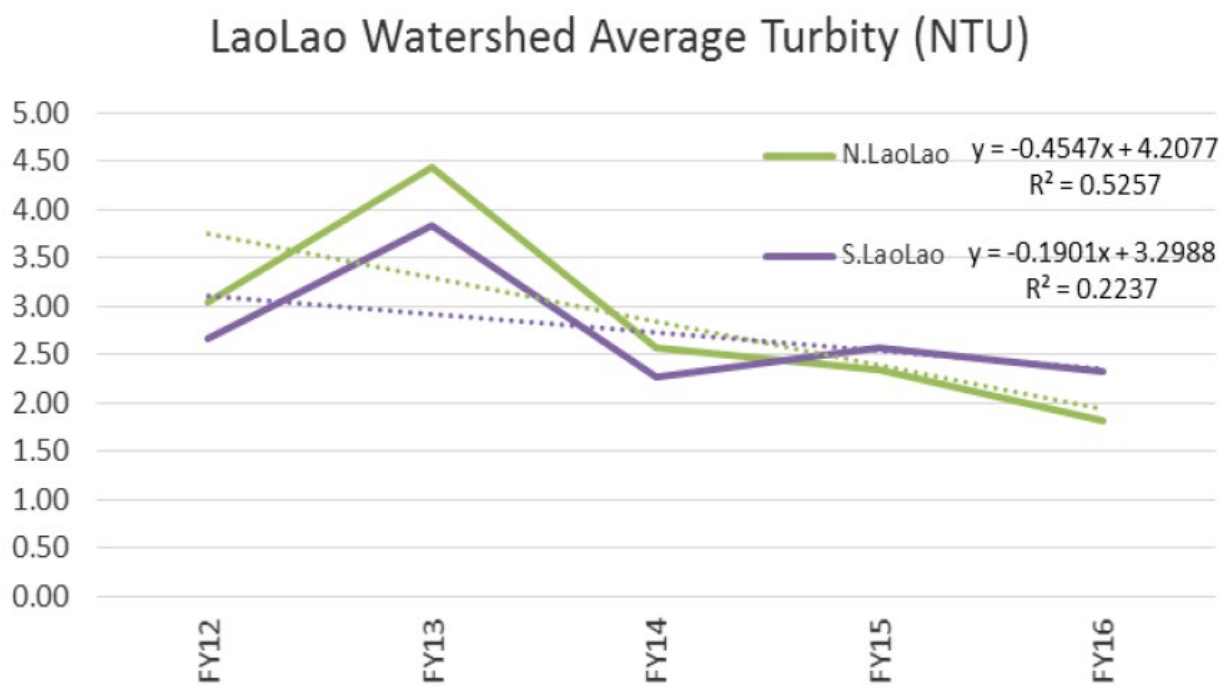


Figure 22b. Improvement in turbidity measured at BEACH sites.

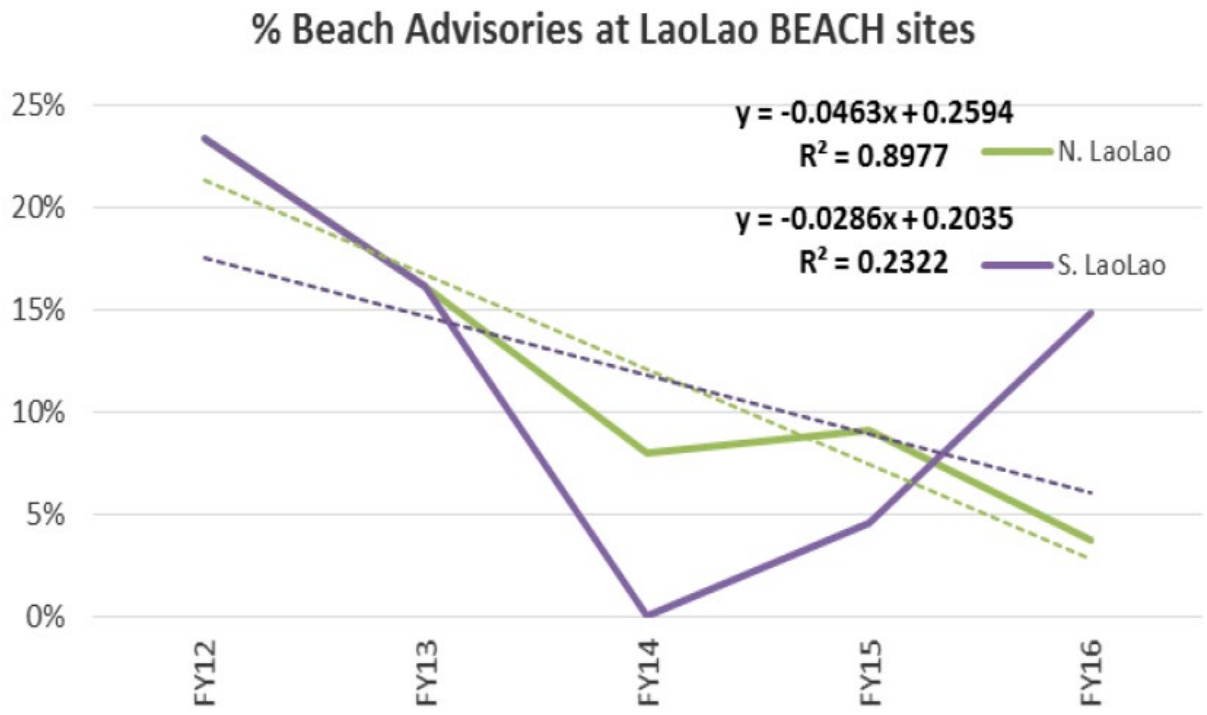


Figure 22c. Reductions in beach advisories at BEACH sites.

Enterococci % Violations													
Sample Station ID	Sampling Station Name	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
SEGMENT 15: LAO LAO													
SEB 02	North Laolao	19	30	14	19	13	19	7	10	23	16	8	9
SEB 03	South Laolao	19	25	10	33	37	15	25	14	23	16	0	5
								Phase I Cross Island Roadway Reconstruction Begins Oct '09, Phase IIa begins in Aug '10	Revegetation project, Road Engineering Training & LaoLao Bay Dr. graded '11	LaoLao Bay Dr. 0.4mi paved and BMPs constructed & Phase I Cross Island Roadway Sep '12	Phase IIb begins in Aug '13	Phase IIa completed in Aug '14	Phase IIb completed in May '15

Figure 22d. Reductions in number of bacteria violations at BEACH sites against timelines (consider adding in restoration and large storm events).

3.0 Pollutant Load Modeling

One element of EPA's watershed planning criteria is to estimate watershed loads and load reduction based on the implementation of priority restoration projects. To this end, we used the Watershed Treatment Model (WTM), Version 3.0 (Caraco, 2013). The WTM is a public-domain, spreadsheet model used to estimate annual watershed pollutant loads for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and fecal coliform bacteria (FC), as well as annual stormwater runoff volume. The model relies principally on the following primary inputs: annual rainfall; drainage area sizing; land use and corresponding standard pollutant loading and runoff coefficients; and soil data, including type and depth to groundwater. In addition, the WTM allows the user to evaluate a host of other secondary sources of pollutants, such as onsite wastewater systems, channel erosion, and livestock, if known.

The WTM also has the capability to evaluate load reduction potential for structural (e.g., stormwater practices, sewer improvements) and non-structural management practices (e.g., efficiency of erosion and sediment control enforcement programs), which makes it a useful watershed planning tool for predicting current and future scenarios. Depending on the quality of input data, the WTM can be used to quickly generate relative comparisons across watersheds, or it can be used to quantify loads that can be verified by or calibrated with actual water quality monitoring data. The model is a GIS-based tool, utilizing available data from sources such as DCRM, CUC, NOAA, NRCS, and others. Field observations on pollutant sources, stream characteristics, and other watershed observations can be used to adjust model input variables. Unless the user inputs watershed-specific data, the WTM uses default values derived from US national averages for the primary and secondary sources. For the Laolao Bay watershed, we used the WTM to estimate the relative contributions of watershed pollutants from each of the three subwatershed areas. The water quality parameters we focused on here are TN, TSS, and FC.

WTM Inputs and Assumptions

Table 10 provides a summary of the significant data input assumptions that were used to generate existing loads. These can be (and should be) adjusted as more information is collected if numerical loads are considered important. The model inputs are based on a combination of available mapping information and our observations of watershed conditions, existing management measures, and potential opportunities for restoration. It should be noted that:

- At this time, we have only run a preliminary model to estimate existing pollutant loads. Once management priorities are established, we can run future load reduction scenarios.
- We conducted a rapid field assessment to identify pollutant sources and opportunities and verify land use maps; however, not all input parameters were verified.
- While the WTM can be used to generate qualitative load estimates, it is better used as a planning level tool to compare contributions between subwatersheds and various sources. As part of this effort, no model calibration or validation was conducted.
- The model does not account for explicit geographic locations, routing, or attenuation in the watershed; therefore, the smaller the watershed area modeled the better.
- The model estimates load to groundwater from infiltration practices and septic systems but does not include those loads in the total loads to the receiving waters. This could be important for the watershed, particularly the Kagman subwatershed where nitrogen loading from groundwater discharge is being studied.
- The model also does not account for BMPs on unpaved roads, so the user must get creative.
- Stream erosion is not well accounted for in the model, although the user can provide a broad estimate of the contribution of stream erosion to TSS loading.

Table 10. Input Data Used to Estimate Existing Loads

Input Parameter	Value			Description
	LL	KGM	DD	
PRIMARY SOURCES				
Avg annual rainfall	75 inches			From NOAA Atlas 14.
Watershed Area	858 acres	476 acres	1190 acres	Expanded watershed by consensus during watershed meetings in January 2020 to include portions of Dandan and Kagman watersheds that drain to bay based on 2017 LIDAR-derived basin mapping from NOAA/CRM.
Land Use	**See Table 11.** DCRM/NOAA provided the most current landuse GIS layer, which we found incomplete and that did not effectively distinguish between residential densities. HW added additional residential land based on observations, by inspecting aerial imagery and the USFS Vegetation Classification, and by selecting all parcels with visible buildings or which contained areas classified as urban land. HW reclassified Open Space area using the USFS Vegetation Classification to find more accurate estimates for agricultural land, beach/recreation area and forested area. We did not adjust for commercial areas or multifamily residential. The land use data contains a transportation class, whose subclasses (primary road, access road, etc.) could clearly be defined as either paved or unpaved road. Field investigation added several unpaved road segements. Unpaved driveways were not accounted for.			
Impervious Cover	80 (9%) may overestimate low density residential	52 acres (11%) may be overestimate for golf course	270 acres (23%)	Based on the IC coefficients for each land use category. There is a building footprint layer, but no IC layer available. The CCAP data for 2016 may be useful for deriving IC. HW used mostly cloud free 2019 LandSat satellite imagery from USGS to calculate the Normalized Difference Vegetation Index to estimate non-vegetated land cover. The resulting estimate of impervious cover is only an estimate, due to the low resolution (30 meters) and the cloud cover. An analysis of average impervious cover by land use type was not within the scope of this effort. Impervious cover was used to create estimates for average impervious cover for each residential category to refine the WTM.
Pollutant Event Mean Concentrations (EMCs)	**See Table 11.** EMCs and loading rates from various land uses are typically based on values from the National Stormwater Quality Database (NSQD), which is a summary of stormwater data from over 200 jurisdictions across the US (Pitt et. al., 2003). Land uses with impervious cover are assigned an EMC. Land uses without impervious cover use an assigned loading rate. We have adjusted the default values for sediment using data from the USVI/PR, but they should be adjusted for CNMI if data is available.			
Soils (% of watershed)	62% HSG D; 27% HSG C; 10% HSG B;	83% D 12% C 4% B	78% D 21% C	Based on NRCS mapping. The HSGs are used to estimate surface conditions for infiltration potential, with A soils generally having a high permeability rate (e.g., sandy soils) and D soils generally having a low permeability rate (e.g., clay soils).
Depth to Groundwater (% of watershed)	2% <3 ft; 2% 3-5f; 96% >5 ft	100% >5ft	100% >5ft	Based on NRCS mapping. Shallow depths to groundwater (e.g., <24”) can signify a higher potential for nutrients to enter groundwater, while deeper depths (e.g., > 48”) can provide better pollutant removal.
Stream length	8 miles	1 mile	2 miles	DCRM/NOAA hydrography shapefile. Length excludes piped sections.

Input Parameter	Value			Description
	LL	KGM	DD	
SECONDARY SOURCES				
Sanitary Sewer Overflows (SSO)	0 miles			Most of the watershed is sewered (CUC's Sadog Tasi sewershed boundaries). Length of sewer lines are from CUC dataset, and include gravitational sewer line, pressurized sewer line and lateral lines. We assume 2.5 sewer overflows per mile (this could be low).
Onsite Disposal Systems	102; 12% within 100' of stream; >2-acre density	8 (includes large system at golf course?); >2-acre density	523; 5% within 100' of waterway; <1-acre density	All buildings are unsewered (from DCRM buildings layer). We assumed all OSDS are conventional design (i.e., not enhanced for nutrient removal). Model default values are used for concentrations and removal efficiencies for OSDS. We assume a 30% failure rate.
Illicit discharge into the stormdrain or stream	5% of residents and businesses	0%	5%	This is non-stormwater runoff discharge into stormdrain or stream. Not based on any CUC data, just best professional guess. Model default values used for concentrations in sewage and washwater. We assumed a 0.1 fraction of dwellings are commercial.
Livestock	100 pigs and 500 chickens	0	400 chickens	Not based on any data. This is probably low by an order of magnitude. It doesn't account for feral or household dogs…
Stream Channel Erosion	Low. 25% of total sediment load			Not based on any field data. Selected default method 1 in the model that back calculates a % for channel erosion based on total sediment load and miles of stream. Stream visual assessments did not indicate level of erosion, however new assessments are anticipated to do so.
EXISTING MANAGEMENT PRACTICES				
Structural stormwater BMPs (post-construction)	**See Table 12**. We included several BMPs we were aware of in the model that currently provide some level of stormwater management. There are likely more that BECQ and DPW are aware of. We used default pollutant removal rates for each type of practice, assumed 50% capture rate for target volume (90th percentile storm of 1.5 inch). We estimated the area managed for each in google earth. We assumed maintenance of these practices was low.			
Erosion and Sediment Control	50% program efficiency			CNMI has a relatively strong ESC inspection program. Program efficiency factors could probably be higher.
Catch basin cleaning	Semi-annual cleaning for 4 acre contributing drainage area	none	none	We are aware of cleaning of the sediment chambers along Laulau Bay Dr. We made some basic assumptions. This could be refined based on DCRM, DPW, and CUC guidance. There are default removal efficiencies of 8% for nutrients and 13% for TSS assigned to this level of cleaning.
Riparian Buffers	7 miles	1 mile	2 miles	Assumes 100 ft buffer for length of stream, with 0.4 regulatory protection factor.

Table 11. Assumed Land Use Acres, % Coverage, and Runoff Concentrations

LU Category	Area (Acres)			% Cover		Event Mean Concentrations		
	LL	KGM	DD	Impervious	Turf	TN* (mg/l)	TSS (mg/l)	FC (MPN/100 ml)
LDR > 1 ac	130	5	84	20%	16%	1	102	20300
MDR .25-1 ac	35	1	116	40%	12%	1	102	20300
HDR <.25 ac	9	0	148	65%	7%	1	102	20300
Municipal/Institutional	0	4	10	72%	6%	1.2	49	20000
Recreational/Beach	5	249	10	10%	72%	1.2	49	20000
Commercial	4	15	13	72%	6%	1.2	56	20000
Roadway -Paved	21	7	85	100%	0%	1.2	36	13700
Roadway - Unpaved	10	5	3	90%	2%	1.2	2895	13700
Active Construction	5	2	71			1	680	0
Industrial	1	1	10	53%	9%	2.2	81	20000
						Annual Loading Rate		
						(lb/yr)	(lb/yr)	(# billion)
Forest/Park or Open	622	180	640	0%	0%	1.8	147	12
Ag	16	6	0.03	0%	0%	5.3	147	39
Open Water	0	1.4	0	--	--	12.8	155	--
Total Acres	858	476	1190			--		

*TN values used here are considerably lower than standard concentrations for urban runoff which are generally 2 mg/L or higher for mainland US land uses. Lower values were based on assumption of lack of fertilizer usage in CNMI.

Table 12. BMPs and Pollutant Removal Rates

BMP	Drainage Area acres			Impervious acres			Pollutant Removal (% Removal)*		
	LL	KGM	DD	LL	KGM	DD	TN	TSS	FC
Unpaved road BMPs	3			2			0%	80%	50%
Grassed swale							30%	60%	0%
Dry detention basin							10%	55%	0%
Ponding basin (wet)		?	1.1		?	0.6	30%	80%	70%
Constructed wetland							65%	85%	90%
Bioretention/rain garden		1	5		0.5	1	55%	95%	85%
Infiltration (various)			1			1	45%	80%	0%
Rooftop disconnection	5	1	10	5	1	10	25%	85%	0%
rain tanks and cisterns	10	1	20	10	1	20	40%	40%	0%
Total Acres	**18**	**3**	**37.1**	**17**	**2.5**	**32.6**			

*removal rates should be updated per the CNMI stormwater manual, except sediment chambers and unpaved road BMPs

Existing Loads

Table 13 summarizes existing loads from various watershed sources. Quantification of the numeric annual load, while useful, is highly dependent on specific data inputs, such as runoff concentrations, number of pigs, volume of sewer overflows, etc. We don't recommend putting much stock in these numbers until more refined input data can be obtained and the model compared with findings from the water quality monitoring program. For the purposes of the Laolao WMP, it is the relative change in value between existing and future conditions, all data input assumptions being equal, that will be more relevant.

Table 13a. Existing Annual Pollutants Loads in the Laolao Watershed

Source	Existing TN Loads(lbs/yr)			
	LL	KGM	DD	Total Watershed
Urban Land	923	1,739	4,366	7,028
Active Construction	35	15	499	549
Channel Erosion	196	110	303	609
Forest	1,120	324	1,152	2,596
Rural Land	85	32	-	117
Livestock	490	-	8	498
Illicit Connections	131	25	618	774
Septic Systems	295	25	1,258	1,578
Open Water	-	18	-	18
Total Load to Surface Waters	**3,276**	**2,287**	**8,204**	**13,767**
Urban Land	515	3,911	936	5,362
Septic Systems	1,226	96	5,934	7,256
Total Load to Groundwater*	**1,741**	**4,007**	**6,871**	**12,619**

*not added to load to surface water; infiltrating practices may cause increase in groundwater loads

Table 13b. Existing Annual TSS Loads in the Laolao Watershed

Source	Existing TSS Loads(lbs/yr)			
	LL	KGM	DD	Total Watershed
Urban Land	265,414	267,965	443,136	
Active Construction	23,729	10,327	339,342	
Channel Erosion	196,292	109,945	302,696	
Forest	91,434	26,460	94,080	
Rural Land	2,352	882	5	
Livestock	-	-	-	
Illicit Connections	897	169	4,128	
Septic Systems	1,970	164	8,388	
Open Water	-	217	-	
Total Load to Surface Waters	**582,088**	**416,130**	**1,191,775**	

Table 13c. Existing Annual FC Loads in the Laolao Watershed

Source	Existing FC Loads(#billion/yr)			
	LL	KGM	DD	Total Watershed
Urban Land	82,074	169,946	347,918	
Active Construction	-	-	-	
Channel Erosion	-	-	-	
Forest	7,464	2,160	7,680	
Rural Land	624	234	1	
Livestock	16,330	-	264	
Illicit Connections	94,154	18,694	465,990	
Septic Systems	2,241	37	4,772	
Open Water	-	-	-	
Total Load to Surface Waters	**202,888**	**191,072**	**826,625**	

Figure 23 graphically illustrates which of the subwatersheds and sources are the biggest contributors to each of the pollutants of concern.

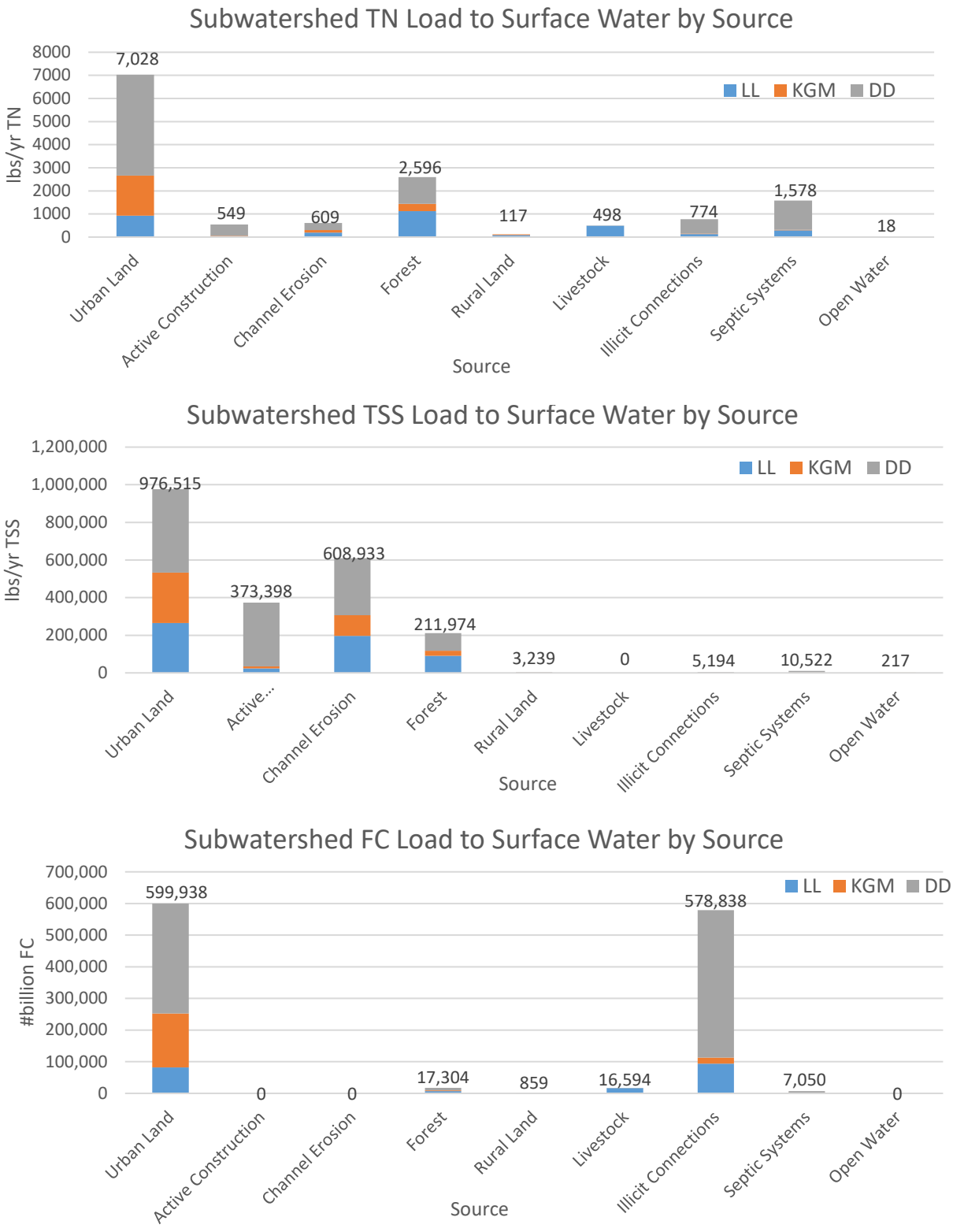


Figure 23. Allocation of loads to surface water by subwatershed and source

Future Management Measures

What can we do in the Laolao Bay watershed to reduce existing pollutant loads? The WTM includes several structural and non-structural measures that can be used to estimate the benefit of management actions including, removal of illicit connections, stormwater BMPs, erosion control, channel restoration, and septic system upgrades. These will be evaluated during Phase II of the watershed planning process.

Attached to this memo are summary field sheets documenting a few of the potential retrofit opportunities we saw in the Laolao watershed while we were on island for the pre-COVID week of workshops and watershed assessments. We recommend conducting additional watershed inventories in San Vicente and in Dandan.

Next Steps

It is important to keep in mind that a model is only as good as the data that goes into it. The purpose of this exercise ultimately is to identify the load reduction potential of restoration projects. The WTM offers a lot of flexibility to accommodate better data as it becomes available, but also provides a comprehensive framework that is perfect for big picture watershed planning purposes. The next steps are likely to be:

1. Consider how these model results fit into the priority strategies identified during the watershed workshops and if specific restoration actions in the watershed plan update are adequately accounted for.
2. Review water quality data for the watershed and broadly evaluate how representative you think the model results are at this stage.
3. Refine input variables where assumptions are wrong and data is readily available to correct input, such as primary land use acres, and secondary sources that other agencies have better insight on (e.g. # of SSOs, # of septic systems, boat contributions, concentrations in effluent, livestock estimates).
4. Research and review completed field assessments to better evaluate stream erosion and estimate island appropriate EMCs for runoff.
5. Consider conducting a future buildout analysis (maybe not as critical for Laolao as others).
6. Compare Laolao Bay model results with Achugao and Garapan watersheds.

4.0 Conservation Action Plan (CAP) Evaluation

Laoloa Bay is a model watershed to showcase successful planning, implementation of strategic restoration activities, and engagement with the stakeholders and resource users. The 2009 Laolao Bay CAP was updated in 2012. As part of the update, the implementation status of 2009 objectives and goals was evaluated and additional 2012-2013 objectives and strategies were added. Dave Benavente, Sam Sablan, and 2020 workshop participants looked at both the 2009 and 2012 plans to document which actions had been achieved, were in progress, or were not completed. Our understanding of status of these strategic actions is summarized in **Table 14**.

The following objectives and actions from the 2009 CAP were completed prior to 2012:

1. Reduce the acreage burned by fires in the Laolao Bay watershed by 50% under normal weather conditions by the end of FY2010. 2012 update: No wildfires have been reported since 2008
2. Establish at least four canopy species in the Laolao Bay Revegetation Site (by demonstration of a 50% total survival rate over 24 acres) by the end of FY2009. Final phase of revegetation was completed in 2011 and plants showed 67% survival
3. Installed educational signage
4. Revegetated badlands using student and community volunteers
5. Continuation of the sea cucumber moratorium beyond 2010

The original 2009 CAP and 2012 update had some clear successes in implementation. These success stories were often those objectives and projects that aligned with existing agency projects. Some notable accomplishments from the CAP include the achievement or good progress toward the following objectives:

- Objective 09-7: Under normal weather conditions the acreage burned by fires in the Laolao Bay Watershed has been reduced by 50% by the end of FY2010*. (Achieved)*
- Objective 09-8: Using the NRCS Planting Plan, at least 4 canopy species are established in the Laolao Bay Revegetation Site by the demonstration of a 50% total survival rate (24 acres) by the end of FY2009. *(Achieved)*
- Objective 09-3: By the end of 2009, develop a Social Marketing Campaign to Address Priority Threats in Laolao *(Achieved)*
    - The anti-littering campaign managed by Seaweb was launched in March 2012 and is scheduled to run through 2013. "Our Laolao" completed
    - Socio economic Survey was complete in 2015
    - Laolao Pride Campaign was implemented in 2013 and included:
        i. Rangers maintaining revegetated area
        ii. Strengthening partnerships, especially between MINA and other agencies
        iii. Building raingardens and cleaning BMPs
    - Tasi Watch: Ongoing 2012-2016, then shifted efforts to Garapan
        i. [pust] year focus on revegetation

ii. MINA: 5 full time staff, 6 Tasi rangers

- Objective 09-9: Initial increase in federal prosecutions of turtle poachers followed by decrease in prosecutions by 2012. *(in progress)*
    - Five individuals were locally prosecuted in 2010 and 2011; one case is currently being locally prosecuted. Federal prosecution numbers could not be obtained
- In 2016, Laolao Bay was removed from 303(d) list for Bacteria Impairment with the improvement of water quality largely due to implementation of road improvements
- Invasive vines? Not sure what this means?
- Grant proposals referenced CAPs to justify priorities and tapped into funding sources
- Leveraged funding through grant applications that referenced the CAP as a local priority

While there were several accomplishments in implementing the CAP, several challenges were faced during implementation. These include:

- A lack of a master plan to define a vision for the watershed and to guide activities and uses.
- There is a lack of collaboration in Zoning and Permitting to ensure all aspects are considered during the permitting process
- A large amount of the watershed is private land and some landowners do not engage in management or cooperate with road improvements
- The soil and terrain of the watershed is highly erosive making revegetation difficult
- The erosion control measures (i.e., sediment traps) are not working due to jurisdictional confusion

- CAP objectives did not always align with existing monitoring efforts making tracking difficult to know who's responsible or requiring new monitoring approaches. Finally, some of the indicators did not always reflect progress or outcomes.
    - The site is highly used and impacted by tour groups for marine activities which are difficult to regulate
    - There is no public toilet facilities in area

Other topics for consideration during future updates include (excerpts):

1. We can implement comprehensive monitoring in 2020. Add sediment objectives/actions from Garapan CAP: helps make connections between marine/benthic habitats and land-based sources of pollution.

2. Social targets were identified in Laolao Bay that were recommended to be added to the model. These targets (such as divers, fisherman or historical sites) were ultimately left out of this addendum because they seemed better suited to a social action plan than to a natural resource conservation plan.

3. Soil and birds were two targets that were not considered to be necessary to add as focal conservation targets at this point in time, but it is recommended that they be re-evaluated at each CAP review and be included at any time if they are considered to be separate enough from the other targets and sufficiently important and threatened to warrant being added to the model.

4. The threats of habitat loss (in terms of forests/vegetation/birds) and overharvesting of Tangantangan (for charcoal) were not considered to be issues at this point in time but should be re-evaluated frequently to make sure that they are discussed and addressed before they have devastating effects on the focal conservation targets of Laolao Bay.

5. The strategy of encouraging landowner conservation practices was heavily discussed at this year's meeting as well, but was ultimately left out of the 2012-2013 workplan because the two main federal programs that would have contributed to this strategy – the Coastal and Estuarine Land Conservation Program (CELCP) and the Wildlife Habitat Incentive Program (WHIP, coordinated through the USDA-NRCS program) – have been defunded. In order to promote landowner stewardship practices, conservation easements and preservation, these programs should be revisited in future years as possible strategies that can contribute to the Laolao Bay CAP.

Next Steps

To adequately complete this evaluation, we need to have at least one more meeting with agency staff to confirm and finalize our evaluation. This may require some local assistance with data compilation and analysis in advance of the meeting to determine if water quality or biological targets have been achieved.

Table 14. Summary of progress on achieving objectives and completing strategic actions from 2009-2012 Laolao Bay CAP

Objective/Action	Attainment Status (2012 and 2020)	Status of Specific Implementation Actions (as of 2020)
Habitat and Wildlife Related Objectives and Actions		
Objectives 09-1/4/5: Statistically significant positive trends in the abundance of a) carnivorous fish, surgeon fish and adult parrot fish; b) sea urchins and sea cucumbers; and c) the coral density per unit area and mean colony size by FY2015 compared to baseline.	***IN PROGRESS*** *(in 2012 and 2020)* Have not done full benthic surveys, trends not complete. Reduction in sedimentation and illegal beach/fishing activities may lead toward completion by the target date. Monitoring is taking place so information can be evaluated in 2015	**COMPLETE** • Maintain and improve fisheries regulations --maintaining • Continue the sea cucumber moratorium beyond 2010. ONGOING • Work with community to form a Volunteer Tasi-watch Team **IN PROGRESS** • Hire a charismatic community leader to work with local fisherman to create a locally managed marine area (LMMA). *The reduction of sea urchins and sea cucumbers during the 1980's through the 1990's was a result of the influx of Chinese garment workers. It would be better to choose a Chinese community leader to work with tourist and local Chinese residents about avoiding the harvesting these animals.* • Provide non-destructive diver access from shore to both reef cuts. *Toshi-President of NMDOA. They do underwater cleanups as well and are mostly responsible for installing all the ropes at all the dive sites*
Objective 09-7: Under normal weather conditions the acreage burned by fires in the Laolao Bay Watershed has been reduced by 50% by the end of FY2010.	***ACHIEVED*** *(in 2012).* No wildfires have been reported since 2008 (per 2012 assessment)	
Objective 09-8: Using the NRCS Planting Plan, at least 4 canopy species are established in the Laolao Bay Revegetation Site by the demonstration of a 50% total survival rate (24 acres) by the end of FY2009.	***ACHIEVED*** *(n 2012).* Final phase of revegetation was completed in 2011 and plants showed 67% survival	
Objective 12-7: Continue recent record of "no fires" through 2014	**ACHIEVED** (presumably, 2020)	
Objective 12-8: Maintain >50% survival of plants in revegetation sites.	**ACHIEVED** (presumably, 2020)	**GAP/NOT COMPLETED** • Weed/fertilize upland revegetation sites twice a year for the next two years until the plants grow above the level of the grass • Partner with NRCS to create an invasive plant monitoring plan for upland and lowland areas (by 2014) • Plant native vegetation on beach and road edges • Partner with NRCS to create a revegetation plan for beach and road edges

Water Quality & Engineering Related Objectives and Actions		
Objective 09-2: By the end of FY2015 water turbidity is reduced below 1997 ambient levels by 10%, and by 50% by the end of FY2018, at both Laolao water quality sample sites.	**IN PROGRESS** (in 2012 and 2020?) Reduction in sedimentation should lead toward completion by the target date. Monitoring data indicates turbidity reduction >10% in Laolao N site between 2012 and 2016. 2018 and 1997 values not provided. Laoloa S site did not show same level of improvement	**COMPLETE** • Implement road improvement plan –Done but needs maintenance, especially hardened stream crossings. damaged by Yutu? • Revegetate badlands using student and community volunteers-- *Done/ongoing, but needs better maintenance. Monitor growth (check against old GIS lay*ers.) This project was led by Ryan O'Kano but left when he moved back to Hawaii. DCRM provided the plants, garden tools, and fertilizers. Worked with MINA, NMC CREES/NR Program and clubs; and hotel guests (Ritz-Carlton Give Back Get-Away Tour Package). **GAP/NOT COMPLETED** • Reduce the number of failing septic systems- No progress. Expand watershed area to encompass Dandan /residential area upstream (source of water pollutants). • Gap Gap Road improvements- two proposed designs, none implemented • Dive site parking lot drainage improvements and shoreline setback revegetation—designs completed, no implementation due to ownership issues
Objective 12-6: See a 10% reduction in turbidity at two water quality monitoring sites by 2015; 50% by 2018	**ACHIEVED** ??(by 2020)	**COMPLETE** • Harden six stream crossings to prevent chronic erosion on Laulau Bay Drive • Secure permissions to finish improvements on remaining 3 stream crossings • Clean Laulau Bay Drive sediment traps from improved road twice a month **GAP/NOT COMPLETED** • Find funding for Gapgap Road improvements • Begin realignment and stormwater control construction on Gapgap Rd • Improve dive site parking lot with permeable pavers and re-vegetation • Improve dive site access with signs/markers on beach/reef • Determine plan for barriers to vehicle access to beaches in high traffic areas • Consult with sea turtle program to coordinate activities during the nesting season to minimize risks to turtles
Outreach and Education Related Objectives and Actions		
Objective 09-3: By the end of 2009, develop a Social Marketing Campaign to Address Priority Threats in Laolao	**ACHIEVED.** *The anti-littering campaign managed by Seaweb was launched in March 2012 and is scheduled to run through 2013. "Our Laolao" completed*	**COMPLETE** • The anti-littering campaign managed by Seaweb was launched in March 2012 and was scheduled to run through 2013. Our laolao campaign completed (see Jihan) **GAP/NOT COMPLETED** • Hire one full time or up to three part time community conservation coordinators – include MINA • Contract party to develop, create and install 4 Educational and Outreach signs.
Objective 12-3: DEQ/CRM Education and Outreach Coordinators will provide coral reef-focused educational presentations to all 4th grade	?	•

classrooms throughout the CNMI each year from 2013-2015.		
Objective 12-4: The DEQ Education and Outreach Coordinator will organize an Environmental Expo in April each year from 2013-2015 for 1,500 students from 4th and 5th grade classes from public and private schools to learn from participating private and government agencies working to improve, protect, and conserve Saipan's natural resources.	?	•
Objective 12-5: Tasi-Watch volunteers will conduct outreach to Laolao Bay users for 4 hours each day on all weekend days and holidays from June 2012 through 2015.	?	**GAP/NOT COMPLETED** • Continue working with Seaweb on anti-littering campaign, consider expanding it to include trash burning • Re-emphasize "Walk It, Don't Drive It" campaign as part of CRMO's "Love Our Beaches" campaign to educate against beach driving in Laolao • Continue planning the Annual Environmental Expo during April each year. • Fill education and outreach-based positions at DEQ and CRM and have these personnel work collaboratively with one another and other Laolao Bay stakeholders.
Enforcement Related Objectives and Actions		
Objective 09-6: Eliminate all unsustainable beach activities by 2011.	**NOT OBTAINED/IN PROGRESS (2020).** *"Unsustainable" and "beach activities" were not defined previously. Many illegal and unsustainable activities still take place.*	**COMPLETE** • Work with NGOs to form a Volunteer Tasi-watch Team • Promote Crimestoppers to increase compliance with laws and regulations-- *Check with MINA. Took over the turtle program after the non-profit disbanded. Some improvement observed; divers call with issues* • Barricade vehicular traffic access to beaches - *Done but then washed away by Yutu. DCRM tried to do this awhile back but did not succeed. It became too expensive. But not impossible. Can we turn this into a community-based project? Let the local community build barricade to protect their beaches from poachers, litters, etc. This can be a LMMA strategic action.* • Provide parking areas for Laolao Bay Beach by end of FY2015-- Completed but got completely destroyed during Typhoon Yutu. **IN PROGRESS** • Hire one full time or up to three part time community conservation coordinators **GAP/NOT COMPLETED** • Install and check answering machines daily at DFW, DEQ, and CRM. *Not done. Needs more elaboration, or just remove. Offices have phones but no answering machines.*
Objective 09-9: Initial increase in federal prosecutions of turtle poachers followed by decrease in prosecutions by 2012	*IN PROGRESS (2012). Five individuals were locally prosecuted in 2010 and 2011; one case is currently being locally prosecuted. Federal*	**COMPLETE** • Secure buy-in from local natural resource agency directors • Work with DOJ to provide training for local enforcement officers and with NOAA fisheries enforcement to increase Guam staff to visit/support Saipan-- *Done in 2015 or 2016 (DCRM + DFW); linked with Guam action.* **GAP/NOT COMPLETED**

	prosecution numbers could not be obtained	• Obtain information from US Attorney's office on procedural strategy to deal with poaching violators-- *No procedural strategy for poaching. NOAA legal fellow opportunity.*
2012-1. Achieve thirty violations phoned in to DFW/DEQ/CRM/Fire enforcement per year in 2012 and 2013	?	**GAP/NOT COMPLETED** • Assist (Tasi-Watch personnel) with record-keeping to track data on reports/calls, citations/violations, prosecutions and fines paid
2012-2. Increase Tasi-Watch ranger capacity by 50% by the end of 2014 compared to start-up program numbers	?	**GAP/NOT COMPLETED** • Contact Department of Justice (federal) about providing training sessions to law enforcement and Tasi-Watch personnel • DEQ/CRM/DFW enforcement officers assist with ranger trainings • Strengthen Tasi-Watch program o DEQ provide training to Tasi-Watch rangers explaining the projects going on in Laolao
Monitoring Related Objectives and Actions		
No specific objective, link with **Objectives 09-1/4/5:** Statistically significant positive trends in the abundance of a) carnivorous, surgeon and adult parrot fish; b) sea urchins and sea cucumbers; and c) the coral density per unit area and mean colony size by FY2015 compared to baseline.	**IN PROGRESS (2020)**	**IN PROGRESS** • Perform additional in water fisheries surveys in Laolao Bay-- Not done (DFW responsible). *DCRM has fishery-independent data from 2 sites (East and West Bay), comprehensive surveys not started (12 sites).You can tie this in with MINA's Tasi Watch Program. It was established to be primarily the "The Face of the Sea" or "I Mattan I Tasi". Similar to Guam's Guardians of the Reef or Makai Watch.* • Hire a new Creel data collection employees and a new vehicle- *Ongoing (DFW), 3-4x/wk, old crew not so good but new crew is better*
Objective 12-9: Survey two existing and one new marine monitoring program site in Laolao Bay biannually	**IN PROGRESS (2020)**	**COMPLETED** • Expand long-term marine monitoring program to include third Laolao site at Tuturam Beach drainage (downstream of 2011 ARRA road improvement) **IN PROGRESS** • Continue marine monitoring program benthic habitat, invertebrate and fish surveys, and water quality monitoring • Evaluate marine monitoring data in the 4-year CNMI State of the Reefs report (to be completed in 2013/14) **GAP/NOT COMPLETED** • Create and implement a surface water quality assurance monitoring plan for Laolao Bay's watersheds

5.0 Stakeholder Engagement

Watershed Workshop

From January 21–24, 2020 over 40 stakeholders from CNMI government agencies and NGO's came together to discuss and complete watershed management planning activities for the three priority watersheds of Garapan, Laolao, and Achugao. The facilitation team was a collaboration of technical partners hired to develop the different watershed plans that consisted of The Nature Conservancy, Sea Change Consulting, Koa Consulting, and Horsley Witten Group. To reduce stakeholder fatigue, utilize different technical skills from each consultant group, and enable discussions that compare and contrast watersheds, planning for all three watersheds was carried out over one week. During the workshop, participants reviewed required components of watershed management plans to meet EPA standards including: identifying watershed benefits, causes of impairments based on monitoring and other data, and strategies to reduce impairments and pollutant loads. The group updated core components (e.g. goals, objectives, actions) of the Garapan and Laolao Bay CAPs to reflect successes, lessons learned, existing efforts, and updated modeling and monitoring results and developed the core components of the Achugao Watershed Management Plan.

Additional input was provided on financial and technical assistance needed, outreach required to support strategies, implementation schedules, and monitoring and evaluation approaches after the workshop through the CNMI Watershed Working Group and meetings with key implementation partners in the plan.

Several presentations were made on island-wide comprehensive planning, monitoring program updates, public outreach, infrastructure planning, and climate change. Each presenter included specific information relevant to the Laolao area. These items need to be revisited to ensure that they are adequately documented in this characterization report.

Box 1. Notes from speakers

Comprehensive Planning- Erin Derrington, OPD Not much specific to Laolao, however there are homesteading priorities in Kagman/Laolao areas. What does outreach look like for the comprehensive plan and can we tag on with watershed survey?
Infrastructure- DPW & CUC A lot of work has gone into Isa Dr. improvements and those phases are complete. There is some talk about Kagman WWTP, but would that include connecting San Vicente and Dandan? What are the wastewater systems for the schools, laoloa resort?
Monitoring- Larry Maurin, BECQ It is a little confusing, but laolao appears to have been removed from bacteria and phosphate listing. Will need to look at the 2020 integrated report for clarity. What does the bacteria source tracking data reveal about the watershed? Stream visual assessments are scheduled next after Achugao. Dave Benavente indicated that developing a robust stream monitoring program to evaluate turbidity and stream discharge and erosion was a priority for the watershed plan.
Climate- Robbie Greene NOAA Not a high priority area for vulnerability when compared to west coast, however typhoon took its toll on shoreline and coastal road
Public Outreach- MINA Tasi watch program has been a big success. Reveg. site and trash collection still a big focus.

Vision

Workshop participants expanded on the vision for Laolao that was outlined in the original CAP, as follows:

> *Laolao is world renowned as a beautiful tropical destination where pristine nature is balanced with cultural and economic opportunities. Through the protection of its corals, shorelines, forests, and water resources, it provides a place where local residents and eco-tourists alike can visit to learn, enjoy natural beauty, and share cultural practices and historical knowledge. Laolao Bay is full of abundant resources for all to enjoy above and below the waves of Saipan.*

Causes of Watershed Impairments

The box below summarizes a brainstorming session used to identify the key causes of watershed impairment.

Box 2. Notes from breakout sessions

Marine Environment:

- Coral reef health is very poor but the trend is improving,
- Dive sites are in poor condition and the trend is maintaining the same status

Threat/Driver of Change:

- Trampling of coral (divers):
  - Lack of user capacity enforcement
  - Insufficient enforcement/compliance (regulations do exist)
- Sedimentation:
  - unpaved/paved roads due to lack of proper drainage (inadequate BMP), construction
  - site development BMP
  - insufficient infrastructure for stormwater management/lack of maintenance of drainage system
  - groundwater seepage:
- Failing/insufficient septic systems entering into groundwater – nutrient loading into coastal area
  - land based sources of pollutants, illegal dumping or dump sites, NPS
  - golf course? Last survey 10 years ago. Need to run assessment again.
  - Military dumpsite not an issue. Have been assessed.
- Sea surface temperature increases

Shoreline and Recreational Facilities

- Beaches/access points/visitor infrastructure (currently not existing) is in poor condition and the trend is downward (getting worse)

Threat/Driver of Change:

- Yutu (storm damage)
- Lack of maintenance
  - lack of jurisdictional controls
  - unclear roles between department/agencies (DPL/DLNR/MVA)
  - budgetary structuring
- Heavy use – drivers/Driving on the beach
- Inadequate/lack of toilet facilities
  - lack of funding, jurisdictional issue, if MOUs in place then efficiency
  - ickiness factor – no one wants to manage it
- Littering/illegal dumping

- lack of access to proper disposal or cheap
- lack of compliance; lack of signage

- Vandalism
- Lack of user capacity
  - self enforcing of # of visitors
  - currently assessing # of visitors allowed in an area before negative impact (working at Grotto site) – Kelsey's project
  - insufficient enforcement

Uplands

- Re-vegetation sites are in good condition and the trend is improving with active maintenance/management
- Streams/forests are in very poor condition and the trend is is downward (getting worse)
- Cultural sites are in very poor condition

Threat/Driver of Change:

- Invasive species, especially invasive vines pervasive
  - Lack of management control
  - Lack of awareness
- Illegal dumping in streams
  - Lack of proper waste disposal – maybe closer dumpsite or transfer station or pick-up services, if it's free or low cost for households to afford
  - Lack of surveillance/enforcement
- Development pressures from building residential homes
  - All activities are permitted
  - Lack of urban planning
  - Lack of understanding of carrying capacity
  - BMPs for lots, lack/insufficient enforcement of BMPs
- Fire
  - Hunters/foragers - carelessness
  - Lack of mindfulness – behavioral
- Green-waste improper management – can cause combustion

Goals, Strategies, Objectives, Actions

Several strategies and goals discussed by workshop participants are summarized below and grouped into long-term and short-term goals. These priorities will be used as the basis for establishing watershed goals and objectives, but will first be refined then further vetted through a broader public input process.

10- YR goals. By 2030, the Laolao will:

- Exclusively allow eco-tourism and sustainable use of the watershed through:
  - Designation of Laolao as a Park and associated rules for sustainable activities
  - Implementation of user fees to provide sustainable financing for management/ maintenance
  - Safe drug-free environment

- Maintain or improve water quality to meet the EPA Water quality standards (WQS) for the designated uses of Protection and propagation of fish, shellfish and wildlife and Recreation through:
    - Upgraded infrastructure to handle future loads and storm impacts
    - Reduced stormwater runoff
    - Maintenance of revegetated sites
    - Green infrastructure to reduce flooding events
    - Installation of composting toilet facilities
    - Improved monitoring of sediment loading
- Improve ecosystem function of beaches, coral, streams, and forest to provide critical watershed services including habitat, recreation, erosion prevention, and lessening of extreme events through:
    - Elimination of illegal dumping
    - Inter-agency collaboration and decision-making to sustainably plan for of upper portion of watershed and maintain storm drains
    - Invasive species prevention and management
    - Greater compliance and enforcement of natural resource management regulations and permit conditions for fertilizer use
    - Sustainable Agricultural and Aquaculture
    - Restoration measures such as coral nursery (out planting) and revegetation of native species
- Create educational opportunities for tourists and residents to learn and experience the cultural, historical, and natural resources of the watershed through:
    - Preservation of culture and cultural sites
    - The development of a visitor's center
    - Multi-media community outreach in Dan Dan, Papago, Kagman

<u>5-Year SMART Objectives and Actions to Achieve Load Reductions</u>

The following list of objectives and actions were identified as priorities for the next five years toward achieving the 10-year goals of the plan.

- By 2024 Laolao Bay watershed is legally designated and managed as a "Nature Park" that only permits eco-tourism and activities that do not damage natural, cultural, or historic resources.
- By 2025 management activities (e.g. outreach, monitoring, enforcement) and maintenance of Laolao Bay site facilities (e.g. bathrooms, trash bins) are sustainably funded through user fees.
- By 2025 a visitor center is providing weekly in-person and online opportunities for residents and visitors to learn and experience the cultural, historical, and natural resources of the watershed
- By 2025 monitoring and enforcement presence reduces illegal activities and violations by 50% of the 2021 baseline measures (including illegal dumping, fishing violations, fertilizer violations)
- By 2022, the presence of solid waste is reduced through the installation and weekly maintenance of X# of trash bins
- By 2025, XX invasive species/vegetation are reduced or maintained from 2021 baseline levels and new invasive species are prevented
    - baseline maps are developed for top 3(?) invasive species by 2021

    - priority BMPs are identified that will reduce and manage invasive species
    - invasive species management plan.
- Specific objectives to achieve WQ goals listed in the workshop notes:
    - Upgraded infrastructure to handle future loads and storm impacts
    - Reduced stormwater runoff
    - Maintenance of revegetated sites
    - Green infrastructure to reduce flooding events
    - Installation of composting toilet facilities
        - Improved monitoring of sediment loading
        - Address gaps in data re: sediment loading
- By 2025 storm drains and residential BMPs are updated, monitored, and maintained through an inter-agency agreement and plan (?) From notes:
    - Strategy: Incorporate USACE study & development plan
    - Implement residential development BMPs
    - Address jurisdiction issue of stormdrain maintenance
- Address road jurisdiction confusion: DPW, MOS
    - Strategy: Get Laolao area into prioritized area of highway projects (DOT) – ie Kanat Tabla strategy
- Coral farming?

This is an old objective from the last CAP that they may want to revisit to see if it makes sense to keep it/revise it.

- Objectives 09-1/4/5: Statistically significant positive trends in the abundance of a) carnivorous fish, surgeon fish and adult parrot fish; b) sea urchins and sea cucumbers; and c) the coral density per unit area and mean colony size by FY2015 compared to baseline.

Stakeholder Engagement Plan

COVID19 has derailed the public engagement components of the Laolao and Achugao watershed planning projects. Our plan moving forward to engage stakeholders may include the following elements:

1. Updates and input from agency staff as part of the monthly Watershed Working Group - Becky Skeele is participating; this forum could be used specifically to:
    a. Help fill any remaining data gaps described in previous sections of this report, including finalizing CAP achievement evaluation
    b. Solicit input on revised goals and objectives
    c. Provide input on selection of priority watershed projects
    d. Provide a forum for review and comment on draft WMP

2. Reach out to watershed residents through one of more of the following:
    a. a shared engagement process with OPD as part of their comprehensive planning communications
    b. One or more socially-distanced meetings targeting Laolao residents (hosted by Derek), Dandan residents (Carlos to organize), and San Vicente residents (start with the school), and one for MVA , dive operators, and the fishermen's association. Tap into MINA media resources.

c. Host 3-4 online meetings to: (1) review background on WMP objective and existing conditions; (2)solicit input on goals and priorities; (3) to review draft plan; and (4) to present final watershed plan.
d. Becky to go on the radio show that we did for SCORP to gin up interest in taking an online survey to prioritize Laolao management priorities.

3. Consider conducting a public survey to be distributed online via social media by MINA, dive association, and MVA to solicit input on watershed goals, issues, and awareness. We will likely need to translate into Chinese. We can review previously conducted surveys to determine if there is value in asking some of the same questions to evaluate trends in awareness or shifts in priorities over time. Other surveys include 2009 SEM-Pasifika survey of resource users; Jihan's laolao bay residential survey and engagement program, fishermen survey (pers. Com, Kelsey); MVA 2015 tourist survey; and a recent socio-economic survey.

4. Conduct brief face-to-face surveys/semi-structured interviews with resource users and schools. KOA and Tasi Watch can spend 1-2 days in the watershed interviewing fishermen, divers, campers, and others. If schools are back in session, KOA could engage with San Vicente elementary and Dan Dan middle school to have kids take surveys home to their parents.

5. Populate the story map/project website with updated watershed information and engagement opportunities. https://horsleywitten.com/cnmiwatersheds/

6.0 Field Inventory of Potential Restoration Projects

HW engineers and scientists, KOA Consulting, and knowledgeable staff from BECQ and NOAA conducted a rapid watershed field assessment the week of January 20, 2020 in the Laolao Bay and Achugao watersheds. At the time, the watershed boundary was limited to the Laolao Bay subwatershed; therefore, field teams had not budgeted time or resources to assess the Dandan and Kagman subwatersheds. The purpose of the assessment was to map drainage infrastructure, identify problem areas (pollution sources, flooding, damage, etc.), and identify potential restoration project opportunities. **Table 15** provides a generalized list of the types of watershed projects field crews were considering during field inventories, the data collected at each site, and the watershed benefits presented by each opportunity.

Table 16 summarizes each of the sites identified as a candidate project site. **Figure 24** shows the locations of potential project sites. Appendix A contains the field sheets from each potential restoration site, including concept sketches, where applicable. An online map with photos can be accessed at https://www.arcgis.com/home/webmap/viewer.html?webmap=ddf0e4fd056b4211a5b6f53ca83425f8&extent=145.6635,15.1289,145.9171,15.2707.
Depending on stakeholder input, modeling, and there will be a few of these projects that rise to the top for further conceptual designing and implementation planning. Additional field assessment is likely needed in Dandan and San Vicente in order to get to know those parts of the watershed a better.

General observations made by field crews in the Laolao Bay watershed include the following (in no particular order):

1. Development along Isa Drive near San Vicente is extremely dense. We were unable to spend significant time in Dandan or San Vicente since they were not included in our initial planning scope. Clearly these areas offer opportunities for source control/pollution prevention, stormwater retrofitting, and community engagement.
2. A wide spectrum of roadway designs are on display in the watershed, from dirt roads to curb and gutter/closed pipe systems. Isa Drive feels like a highway. The new construction meets stateside design standards, though it would be worthwhile to better understand the water quality benefits derived from the improvements.
3. The San Vicente School has a rain garden and an extensive drainage network within the confines of the school. The school was used as a shelter during Typhoon Yutu. More display/demonstration sites are possible. Some examples of other stormwater management practices can also be found, including detention basins, rain gardens, deep sump catch basins, porous pavement, and sediment traps, but they are not widespread.
4. The terrain is steep sloping towards LaoLao Bay where roads have not broken the natural hillside. There has been minimal development in much of the Laolao Subwatershed despite the subdivision of land. This area should be treated like a national park. Metered access could reduce use impacts and help generate revenue to maintain the shoreline and road/drainage system.
5. There are several large parcels of public land in the watershed that are not developed, but it is uncertain if these areas can be targeted for conservation or swapped for more environmentally sensitive or strategic areas (e.g., uphill side of Lau Lau Bay Dr. to allow retreat, dive site parking lot, etc.). Where are the highest quality habitats in the watershed and how can they be protected moving forward?
6. It is eye-opening to see how much damage the Typhoon has done to the natural shoreline. The forest ecology is changing due to wind damage and storm surge. Views are more open, but invasive plant problems are out-competing the native vegetation. Storm damage has not only undermined the access road and parking lot, but has opened up uncontrolled vehicular access to the beach. Stabilization of the shoreline and improved resiliency of the road infrastructure should be a priority of the watershed management plan. Invasive plant management is another area of importance.
7. It is obvious that road improvements completed within the last 5-6 years have made a significant difference in reducing erosion of Lau Lau Bay Dr. and sediment delivery to the bay. Sediment chambers and broad dips are working, but some sediment was observed clogging the desired flow path and resulting in unnecessary erosion. A reimagining of the maintenance program for these public BMPs may help ensure long-term practice performance.
8. Revegetation efforts in the upper watershed have been considered successful from not only a stabilization perspective, but also for community engagement. It is not clear how successful the transition from meadow for forest has been and a deeper dive into the results from vegetative monitoring is needed to determine if CAP goals have been met.
9. The high volume of traffic coupled with typhoon damage to Laulau Bay Dr. highlight the need for a second access road. If Gap Gap Rd. is to provide additional access, there needs to be a stronger commitment to improving surfacing or drainage conditions.
10. Recent studies into nutrient contributions from groundwater elevate the importance of understanding groundwater in karst topography. More information is needed on nutrient inputs of septic systems, stormwater infiltration, and golf course fertilization. None of the watershed is

sewered. What is the likelihood that a new WWTP in Kagman will happen and would the service area include Dandan?

Table 14. Inventory of Watershed Opportunities

Project type	Info Needed	Opportunities
Drainage Infrastructure Repair*	• Locational landmarks • Type of structure (e.g., culvert, outfall) • Dimensions & materials • Critical elevations • Type and severity of damage • Effect of damage (e.g., flooding) • Access limitations • Ownership/Contact	• Reduced flooding • Public health & safety • Infrastructure protection • Part of bigger project • Improved resiliency • Reduced erosion or resource impacts • Water quality improvement • Fish/aquatic insect passage
Stormwater Retrofits	• Contributing drainage area • Type of practice • Pollutants of concern and description of land use • Conveyance mechanism and pretreatment • Constraints: soils, groundwater, utilities, etc • Space available/footprint of practice • Public vs. private—who will do O&M • Access and visibility	• Upgrade existing BMP • Improve water quality or flood control using new BMP • Encourage GI • Add trees or provide other co-benefits • Education opportunity
Unpaved Road Stabilization	• Length of segment • Type and location of erosion (surface, ditch) • Is there offsite drainage • Shoulder and road dimensions • Slope (flat-steep) and pitch (crowned, inside, outside) of segment • Are there places to discharge? • Traffic volume • Public or private road	• Diversions, • cross drains, water bars, • dips, • turnouts • traps • slope stabilization • resurfacing
Shoreline Stabilization	• Length/height of eroded area • High or low energy area • Substrate and surrounding vegetation • Access • Upland land use	• Living shoreline • Replanting/vegetate upland • Infrastructure protection • Hard structure or combo • Repair existing feature • Retreat?
Stream/Wetland Restoration	• Cross-section dimensions & impacted length • Rate bank erosion/bed scour • Channelization • Trash/debris • Invasives • Buffer impacts • Access and other constraints • Cause of problem?	• Habitat restoration • Infrastructure protection • Reduced erosion, bank stabilization • Link to upland volume controls • Improve buffer • Invasives removal • Replant vs natural revegetation • Reconnect to floodplain
Upland Reveg/restore	• Description of area & Cause of problem • Ownership info • Estimated size • Access limitations	• Invasives removal • Replant vs natural revegetation • education
Wastewater improvement*	• Specific location • Surrounding land use • Dry or Wet weather, Smell, Color, Suds • Discharge point • Source, if known • Public vs. private	• WQ improvement • Health and safety • SSO or pump repair • Upgrade or repair OSDS • IDDE and monitoring • Behavior change/education (dumping washwater)

Project type	Info Needed	Opportunities
	• Type: Violation (intentional dumping) or accident (unintended spill)	• Connect to sewer • WWTP upgrade or package system
Construction Site ESC	• Site name/location • Contractor • Permit # • Describe BMPs in use/failures • downstream/offsite impacts	• Propose BMP installation or maintenance recommendations • Report problems
Pollution Prevention/site remediation (commercial/industrial hotspot)	• Land use/description of activities at site • Observed pollutants • Violations? • Contact info • Storm drains on-site • Nearby wetlands/water resources? • Do they have a SWPP or NPDES permit?	• Structural and non-structural • Monitoring • Trash cleanups/Dumpster cover • Spill prevention • Outdoor material storage • Landscaping • Vehicle maintenance/washwater-dedicated areas • Animal waste management • Buffer encroachment/restoration
Residential Stewardship	• Neighborhood/area delineation • Project contact (HOA)/advocate • Community gathering place? • Confirm sewer/septic • Curb/gutter? SW BMPs?	• Lawn care • Pet waste • Connect to sewer • Downspouts or driveway disconnection • Buffer enhancement • Vehicle maintenance • Trash management • Common space mgmt
Watershed Education/Signage	• Describe location • Who is target audience? • What is the message? • Describe activity or signage?	• Improve watershed awareness • Build community support • Incorporate into E&O plan
Conservation	• Public vs. Private • Surrounding Land Use • Replanting vs Natural Regen • Use (park vs. natural) • Goal (e.g., education, expand buffer, flood control, habitat)	• Habitat protection • Preserving hydrologic functions • Improved resiliency

Table 15 Potential Project Opportunities in Laolao

ID	Description of Condition & *Potential Solution*	Relative Severity[1]	Priority[2]	Cost[3]	Stormwater Retrofit/ Unpaved Road	Upland Veg.	Shoreline/Bank Stabilization	Non-Structural	Education
LL100/ 101	Ongoing revegetation efforts by MINA. Currently maintained and monitored by MINA	0/0	?	$		●			
Dive Site LL103/ 104/ 108/ 109	Uncontrolled pedestrian circulation eroding shoreline at multiple access points to beach. Parking lot runoff eroding shoreline along pedestrian path. *Organize circulation and limit access points to 2 paths/boardwalk. Part of dive site improvement & parking lot reorganization. Educational opportunity with signage etc.* Uncontrolled runoff from Laolao Bay Rd eroding entrance to parking area and shoreline. *Intercept runoff before entering dive site. Water bars with stormwater infiltration. Improve drainage along the road. See concept from PIWI. Remove trash from gully.*	3/4/3/3	H	$$$	●		●	●	●
Lau Lau Bay Dr. LL112	Culvert concentrates flow into narrow channel. Road grading is rough mounds and dips. *Replace and widen culvert (convert to a large box culvert). Construct broad dip or other diversion at low point to direct road runoff into ditch.*	4	H	$$	●				
Lau Lau Bay Dr. LL113	Runoff discharges off road at uncontrolled location causing scouring and erosion down to very deep pool. 9' down to 3' wide plunge pool. Inflow to east comes onto road ~100 ft uphill and runs along road contributing to runoff at shoreline. *Create broad dip and formalize overflow. Upstream drainage: pitch discharges to road. Runs along eastern edge to informal drainage overflow.*	5	H	$	●		●		
Gap Gap Rd. LL124/ 125/ 126	Washout and erosion of steep, unpaved road surface. *See PIWI conceptual plans. Proposed improvements to drainage were confirmed and remain valid.*	5	H	$$	●				
LL127	Swales on both side of paved road are filled with vegetation preventing runoff from entering. Runoff remains on paved surface and drains down Gap Gap Rd. Clean and cut back vegetation & reestablish/clean road swales. *Construct broad dip or waterbar (speed bump) at top of Gap Gap Rd. to keep runoff off Gap Gap. Possibly use bioretention, but may not have space and would require a lot of earthwork.*	4	H	$	●	●			
Detention Center LL132	Tree blown down over retaining wall with root destabilization. Excessively steep slope above retaining wall (which appears too short). Bare dirt/mudslide on steep slope. Sediment source to parking lot/rain garden and is clogging inlet (LL130). *Clean up sediment and slope. Extend wall and stabilize slope with vegetation.*	5	M	$$		●			

ID	Description of Condition & *Potential Solution*	Relative Severity[1]	Priority[2]	Cost[3]	Stormwater Retrofit/ Unpaved Road	Upland Veg.	Shoreline/Bank Stabilization	Non-Structural	Education
LL133	Eroded dirt road to water tank at top of watershed. *Stabilize and remove sediment source. Apply dirt road strategies, such as dips and water bars to shed runoff. Regrade & stabilize.*	4	L	$$	●				
Lau Lau Bay Dr. LL135/136	Broad dip with swales (formalized downstream). *Clean/repair dip and swale, regrade road. Add second broad dip uphill.* Clogged formalized swale. *Clean and redirect to restore flow*.	3/5	M/H	$	●				
Lau Lau Bay Dr. LL139/143/ 144	Seaward edge of road. 3' drop at start. Guess low energy. Rocky sand. Trees present. *Create living shoreline. Use gabion walls or green walls. Road abuts top of shoreline, so limited space. High traffic, exposure to future storms.* Low point in road. Discharges toward LL139 & LL143. *Address stormwater and road stabilization/relocation as part of shoreline restoration.*	4/4/2	M	$$$	●		●		
Lau Lau Bay Dr. LL145/146	Shoreline restoration. *Create living shoreline (see notes for LL139/143/144)*	4	M	$$	●		●		
Lau Lau Bay Dr. LL147	Informal outlet off road. *Formalize and repair. Incorporate into shoreline restoration (LL145/146). Could also be addressed during road regrading. Limited space, road is against shoreline. Exposure risk with storms.*	2	H	$	●		●		
Boat Ramp LL151/152	Driving on beach. *Prevent driving on beach. Signage or physical barrier to formalize?* Runoff drains down boat ramp access eroding and washing out onto beach. *Water bar or broad dip at top of access to direct runoff away from ramp and into vegetation. Heavy use.*	3/4	M	$	●				●
Former Parking Lot LL154/155	Lots of trash. *Trash pickup, educational signage, reinstitute trash collection bins.* Former pervious parking lot washed out during Yutu. Parking now uncontrolled and new areas east and west of former parking area now degraded. *Restore a parking lot (redesign) and establish living shoreline. Receding shoreline, heavy use, exposure to storms. Very little room.*	5	H	$$$	●		●	●	●
Railroad Dr. LL157	Gravel driveway (private residence) flows onto road. Sediment ends up in broad dip. *Waterbar on driveway. Intercept runoff before reaching road.*	4	M	$	●				●
Railroad Dr. LL161	Paved road runoff flows to informal discharge point. *Formalize drainage/control outfall.*	4	M	$	●				●
Railroad Dr. LL167	Low point at a dirt/pavement transition. Runoff discharges off site. *Formalize/stabilize low point to reduce erosion. Could be built in conjunction with LL173.*	3	M	$	●				

ID	Description of Condition & *Potential Solution*	Relative Severity[1]	Priority[2]	Cost[3]	Stormwater Retrofit/ Unpaved Road	Upland Veg.	Shoreline/Bank Stabilization	Non-Structural	Education
Isa. Dr. LL173	Appears to be an existing vegetated swale with heavily clogged inlet. Runoff from dirt road bypasses swale and discharges to main road. *Clean and re-establish inlet. Consider broad dip to intercept runoff upgradient. See LL167-- can be same project.*	4	H	$	●				
San Vicente Elem. School LL311	Channel with 2:1 slope. Carlos reports grass erodes and soil slopes wash into swale. *Erosion control blanket or drought tolerant vegetation like vetiver. Gabion basket!*	2	L	$			●		
LL318	Dirt road gullying. Top of Bentana Dr., gullying on SW edge for 50 LF. pitch 20% +/-. *Install waterbars 25' O.C. (see sketch)*	3	M	$	●				
LL336	Sinkhole on private property - connects to a stream and then directly to the ocean. It is currently an illegal trash dumping site. *Clean up trash/eliminate access for easy dumping. Create educational opportunity (geology/hydrology) and potential location for people to go into the hole and listen to the ocean.*	4	L	$				●	●
LL351	Serious erosion on one side of the road/ Road across from Lau Lau Bay Dr - James Ln road (private) - southwest edge is gullying. *Space available for sediment basins & waterbars.*	4	H	$	●				
LL352	Palu Road construction. No ESC - full catch basin at Isa Dr. No silt sack. No construction entrance/track pad. Staging area at top of hill with brush clear. Street next to Palu Road also has construction and not much ESC was observed. *Enforcement. ESC - lack of awareness by DPW. Silt sack in ex. cbs. cover stockpiles, silt sock around stockpiles.*	5	H	$				●	
LL377	Washout alongside of concrete swale into woods. Flume into woods is blown out on roadside where runoff can't turn. *Add berm or curb edge. simple and easy to avoid sediment input.*	3	M	$					
LL400	Punta Laolao vehicle access and trail down to ladder is eroded. *Consider stabilization options for eroding trailhead*.	3	L	$	●				
LL401	Dan Dan Children's Park is on the SCORP inventory list and is in need of repair and upgrades post typhoon Tutu. *Consider stormwater retrofit options and watershed education.*	3	M		●			●	●

[1] Relative severity (or condition) indicates how critical it is to address this site, based on professional judgement on a scale of 0-5, where 5 is high.

[2.] Implementation Priority (preliminary) is based on professional judgement of importance, feasibility, visibility, etc. This has not gone through a formal ranking or stakeholder input process; where ●high, ◖medium, ○low

[3] Relative cost is a placeholder for additional development; $$$>$50,000, $$=$25-50k, $<$25k. Don't hold us to this.

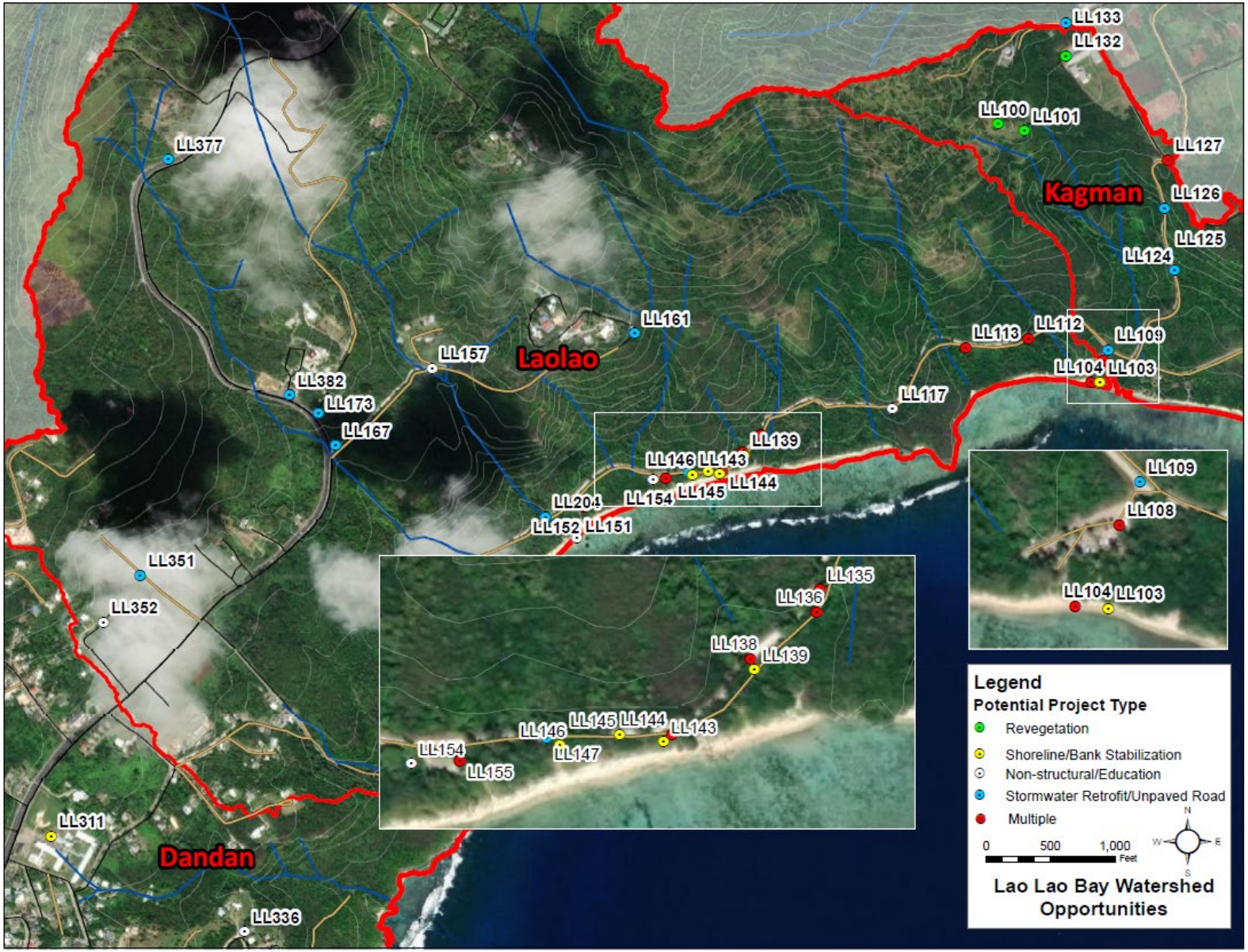


Figure 24. Potential restoration opportunities identified by HW field crews, January 2020

Appendix A

Restoration Opportunities
Field Data Collection Sheets

Site ID: LL100	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 7:09 PM
Project Type: • Revegetation site	
Enforcement Needed: No	
Severity Rating: 0 (Not significant)	
Implementation Priority: Unsure	

Descriptions of Existing Conditions:
Ongoing revegetation efforts by MINA. Met with Wayne and Dan onsite on 1/20/20. See LL101 as well.

Description of Proposed Opportunity:
Nothing proposed. Currently maintained and monitored by MINA.

Challenges/Constraints:
Accessibility

Additional Notes:

Site Photo

Site Overview Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-100 & 101

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☒ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

ONGOING REVEGETATION EFFORTS BY MINA

MEET WAYNE & DAN ON SITE

Severity/Rating (circle): 5 *Severe* 4 3 2 1 (0) *Not significant*

Description of Proposed Opportunity:

NOTHING PROPOSED. CURRENTLY MAINTAINED & MONITORED BY MINA

Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

ACCESSIBILITY

Additional Notes and/or Sketch:

NONE

Site ID: LL103	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 8:44 PM
Project Type: • Shoreline Stabilization • Watershed Education/Signage	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Uncontrolled pedestrian circulation eroding shoreline. Multiple access points to beach.

Description of Proposed Opportunity:
Organize circulation. Limit access points to 2. Stabilize path, add boardwalk? Part of dive site improvement/organization. Educational opportunity with signage etc.

Challenges/Constraints:
Heavy use, storms, hard to change user habits.

Additional Notes:
See previous dive site concept.

Site Photo

Site Overview Caption: East

Additional Site Photos

Additional Photo Caption: West

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: ~~XS~~ LL-163

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☒ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

UNCONTROLLED PEDESTRIAN CIRCULATION TRADING SHORE LINE - MULTIPLE ACCESS POINT

Severity/Rating (circle): 5 *Severe* 4 (3) 2 1 0 *Not significant*

Description of Proposed Opportunity:

ORGANIZE CIRCULATION LIMIT ACCESS POINTS TO 2
- STABILIZED PATH / BOARDWALK?

PART OF DIVE SITE IMPROVEMENT / ORGANIZATION

EDUCATIONAL OPPORTUNITY

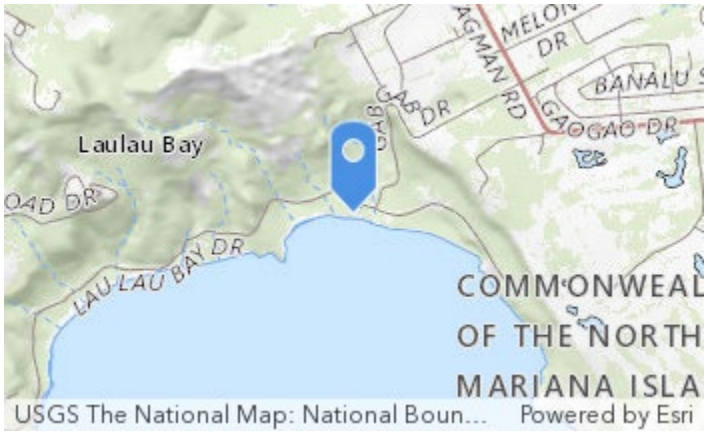
Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

HEAVY USE, STORMS / CHARGING USER HABITS

Additional Notes and/or Sketch:

SEE DIVE SITE CONCEPT

Site ID: LL104	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 8:48 PM
Project Type: • Stormwater Retrofit • Shoreline Stabilization • Watershed Education/Signage	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Parking lot runoff eroding shoreline along pedestrian path.

Description of Proposed Opportunity:
Parking lot reorganization. Control drainage. Stabilization and reorganization of circulation. Stabilize path.

Challenges/Constraints:
Heavy use, hard to change user habits.

Additional Notes:
See previous dive site concept and new sketch.

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption: Trash in gulley.

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-104

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☑ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☑ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☒ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

PARKING LOT RUNOFF CROSING SHORELINE & ALONG PCD PATH

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

PARKING LOT REORGANIZATION / CONTROLED DRAINAGE / STABILIZATION REORGANIZATION OF CIRCULATION

STABILIZE PATH

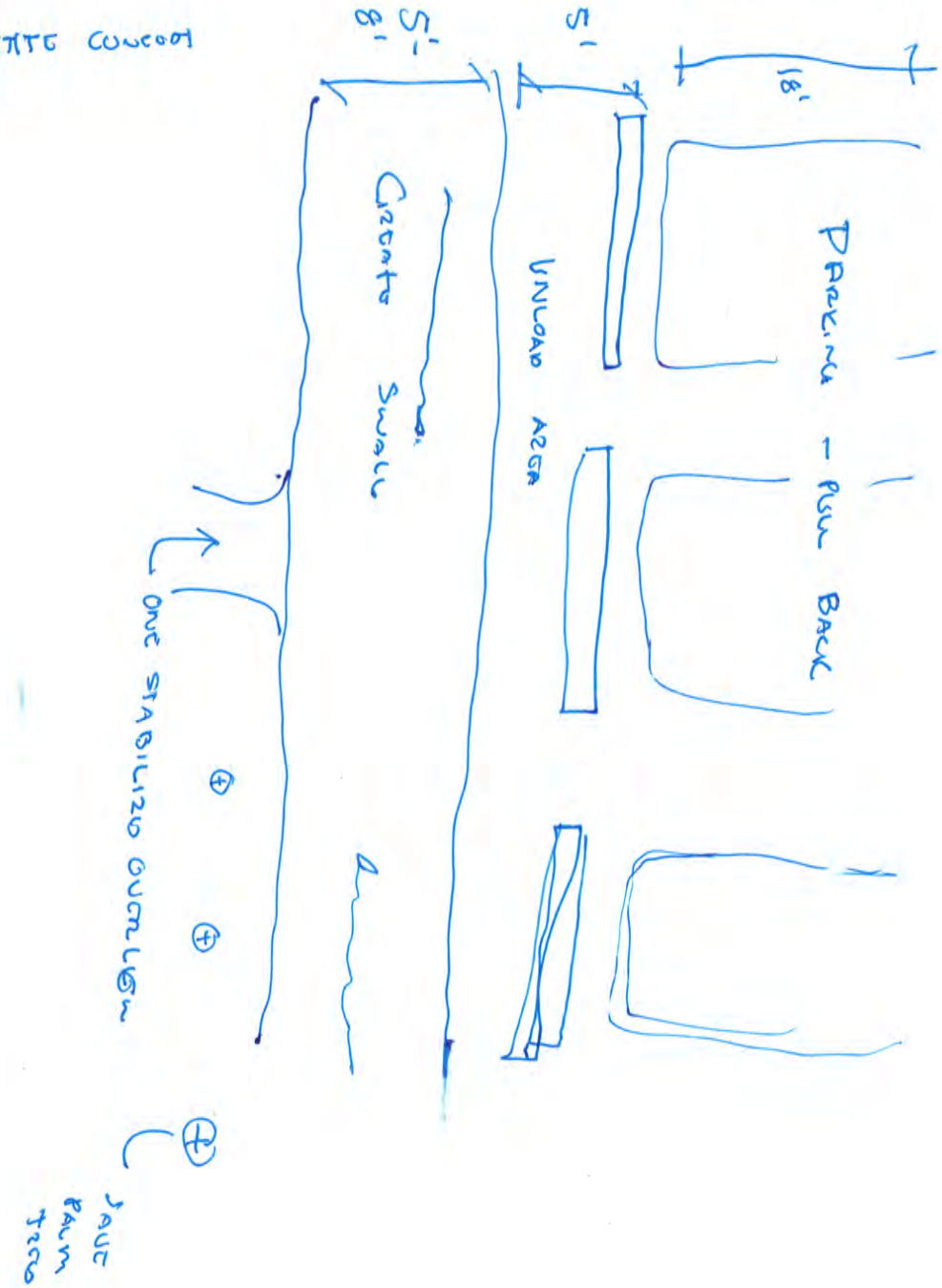
Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

HEAVY USE / CHANGING USE PATTERNS

Additional Notes and/or Sketch:

SEE ALSO BIKE STATE CONCEPT



BROAD-BASED DIP

BROAD-BASED DIP

SEDIMENT FOREBAY

RAIN GARDEN

PERMEABLE PAVEMENT

COVERED PAVILION

REAR-IN VAN PARKING

PICNIC AREA

DEDICATED ACCESS PATH

RESTORE NATURAL VEGETATION

NORTH

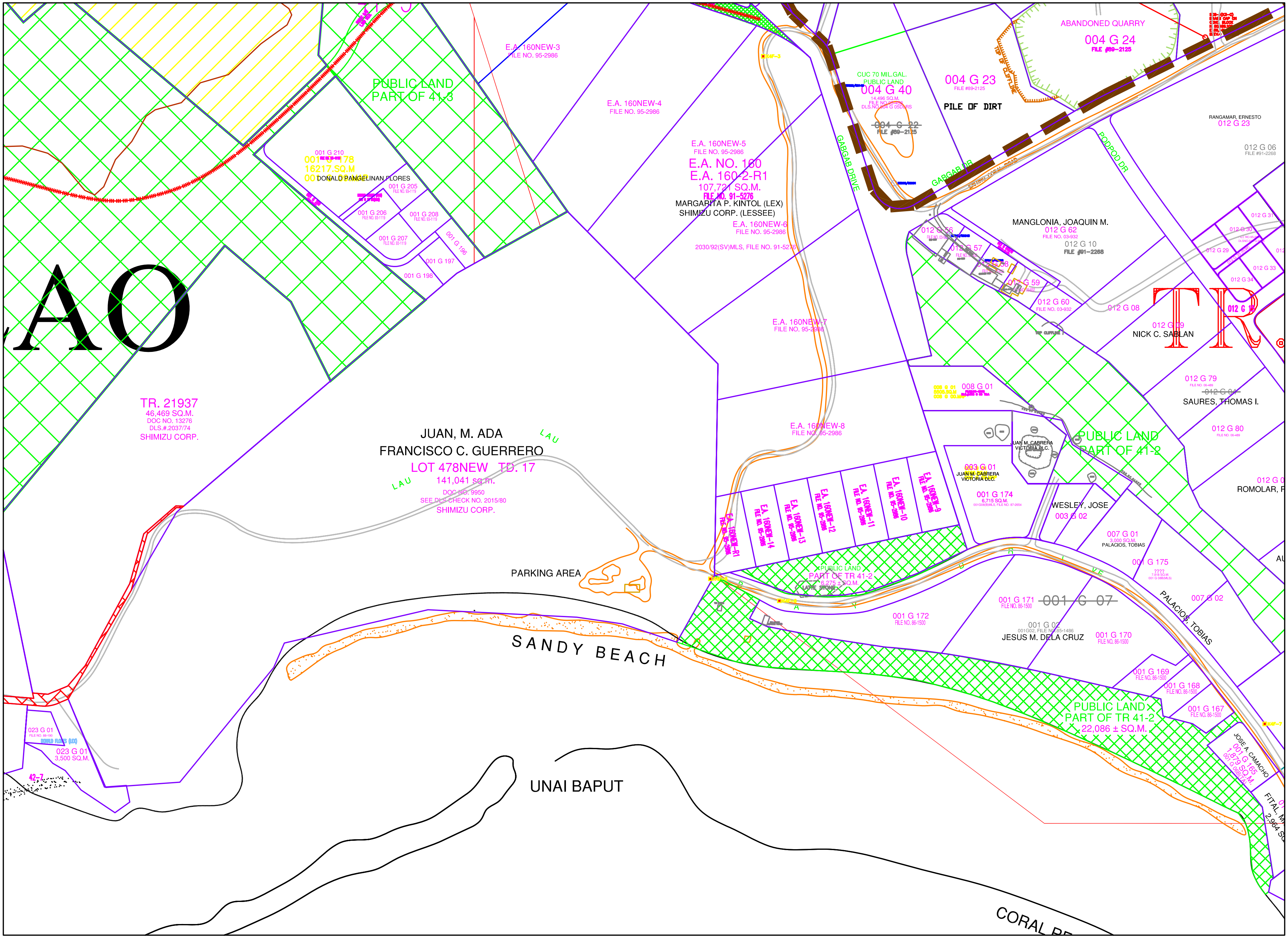
LOCUS MAP

5
0
15

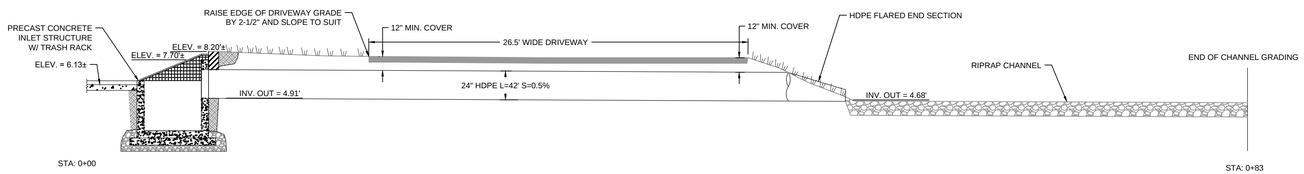
1 INCH = 10 FEET

CONCEPT PLAN FOR UNAI BAPUT TOURIST DIVE SITE, LAO LAO BAY
CNMI BUREAU OF ENVIRONMENTAL AND COASTAL QUALITY
NOVEMBER, 2015

Horsley Witten Group
Sustainable Environmental Solutions
90 Route 6A • Sandwich, MA • 02563
Tel: 508-833-6600 • Fax: 508-833-3150 • www.horsleywitten.com

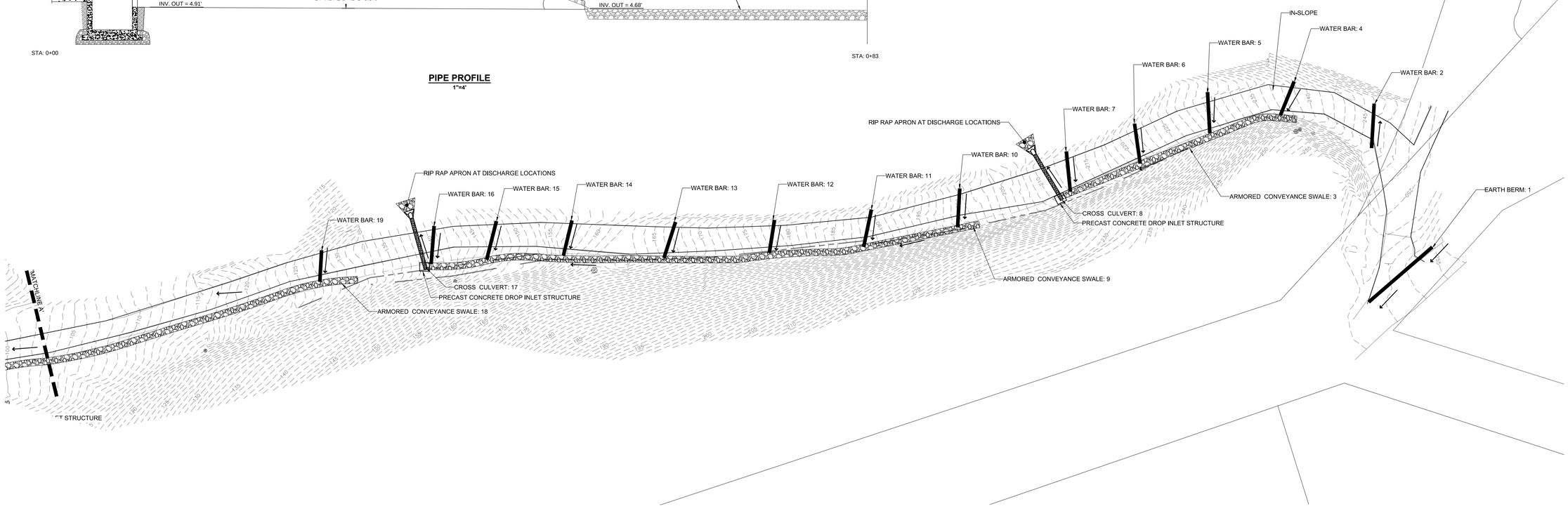


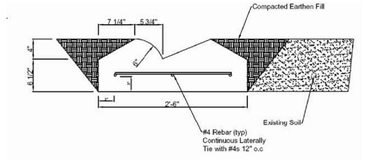
E.A. 160NEW-3
FILE NO. 95-2986
PUBLIC LAND
PART OF 41-3
E.A. 160NEW-4
FILE NO. 95-2986
E.A. 160NEW-5
FILE NO. 95-2986
E.A. NO. 160
E.A. 160-2-R1
107,721 SQ.M.
FILE NO. 91-5276
MARGARITA P. KINTOL (LEX)
SHIMIZU CORP. (LESSEE)
E.A. 160NEW-6
FILE NO. 95-2986
2030/92(SV)MLS, FILE NO. 91-5276
001 G 210
16217 SQ.M
DONALD PANGELINAN FLORES
001 G 205
001 G 206
001 G 208
001 G 207
001 G 196
001 G 197
001 G 198
ABANDONED QUARRY
004 G 24
004 G 23
CUC 70 MIL.GAL.
PUBLIC LAND
004 G 40
14,496 SQ.M.
PILE OF DIRT
004 G 22
GABGAB DRIVE
GARGAB DR
PODPOD DR
RANGAMAR, ERNESTO
012 G 23
012 G 06
MANGLONIA, JOAQUIN M.
012 G 62
012 G 10
012 G 56
012 G 57
012 G 59
012 G 60
012 G 08
012 G 09
NICK C. SABLAN
012 G 31
012 G 30
012 G 29
012 G 33
012 G 34
TR
AO
TR. 21937
46,469 SQ.M.
DOC NO. 13276
DLS.#.2037/74
SHIMIZU CORP.
JUAN, M. ADA
FRANCISCO C. GUERRERO
LOT 478NEW TD. 17
141,041 sq.m.
DOC NO. 9950
SEE DLS CHECK NO. 2015/80
SHIMIZU CORP.
LAU
LAU
E.A. 160NEW-7
FILE NO. 95-2986
E.A. 160NEW-8
FILE NO. 95-2986
E.A. 160NEW-9
E.A. 160NEW-10
E.A. 160NEW-11
E.A. 160NEW-12
E.A. 160NEW-13
E.A. 160NEW-14
E.A. 160NEW-R1
008 G 01
JUAN M. CABRERA
VICTORIA DLC.
003 G 01
001 G 174
PUBLIC LAND
PART OF 41-2
012 G 79
012 G 04
SAURES, THOMAS I.
012 G 80
ROMOLAR, F
WESLEY, JOSE
003 G 02
007 G 01
PALACIOS, TOBIAS
001 G 175
007 G 02
PARKING AREA
PUBLIC LAND
PART OF TR 41-2
LATTE STONE
001 G 171
001 G 07
001 G 172
001 G 02
JESUS M. DELA CRUZ
001 G 170
PALACIOS, TOBIAS
SANDY BEACH
001 G 169
001 G 168
001 G 167
PUBLIC LAND
PART OF TR 41-2
22,086 ± SQ.M.
JOSE A CAMACHO
001 G 165
023 G 01
023 G 01
3,500 SQ.M.
42-7
UNAI BAPUT
CORAL RE



PIPE PROFILE

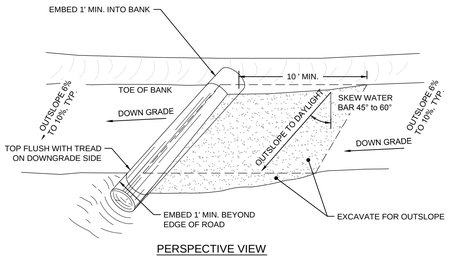
1"=4'



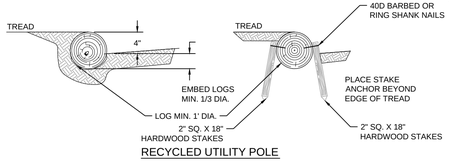


CONCRETE WATERBAR

NOT TO SCALE



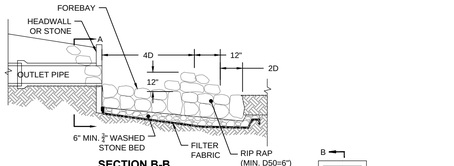
PERSPECTIVE VIEW



RECYCLED UTILITY POLE

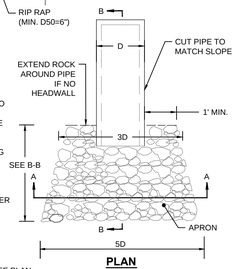
WATERBAR

NOT TO SCALE

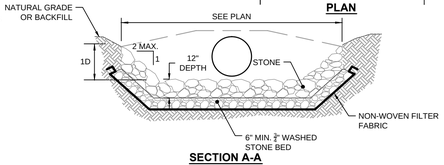


SECTION B-B

NOTES:
1. RIPRAP SHOULD EXTEND UP BOTH SIDES OF THE APRON AND AROUND THE END OF THE PIPE OR CULVERT AT THE DISCHARGE OUTLET AT A MAXIMUM SLOPE OF 2:1 AND A HEIGHT NOT LESS THAN TWO THIRDS THE PIPE DIAMETER OR CULVERT HEIGHT.
2. THE AREA TO BE RIPRAPPED TO BE UNDERCUT SO THAT THE INVERT OF THE APRON TO BE AT THE SAME GRADE (FLUSH) WITH THE SURFACE OF THE RECEIVING CHANNEL.
3. THE WIDTH OF THE END OF THE APRON TO BE EQUAL TO THE BOTTOM WIDTH OF THE RECEIVING CHANNEL. MAXIMUM TAPER TO RECEIVING CHANNEL 5:1
4. ALL SUBGRADE FOR STRUCTURE TO BE COMPACTED TO 95% OR GREATER.
5. HORIZONTAL ALIGNMENT OF THE APRON TO BE PER THE SITE PLAN.
6. ANY DISTURBED AREA FROM END OF APRON TO RECEIVING CHANNEL MUST BE STABILIZED.



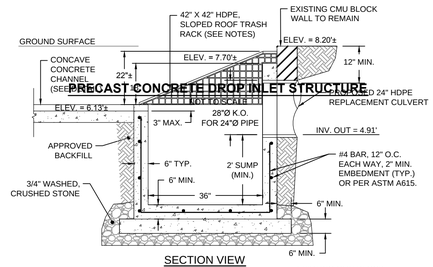
PLAN



SECTION A-A

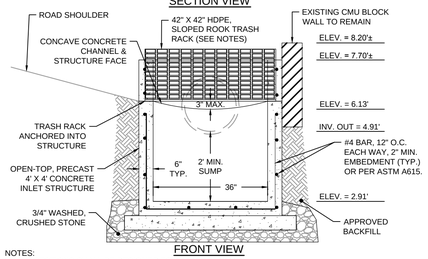
TYPICAL RIP RAP OUTFALL DETAIL

NOT TO SCALE



PRECAST CONCRETE DROP INLET STRUCTURE

SECTION VIEW



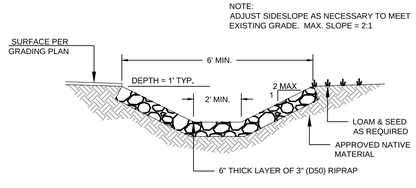
FRONT VIEW

NOTES:
1. ALL SECTIONS SHALL BE DESIGNED FOR H-20 LOADING.
2. PROVIDE BUTYL RUBBER JOINT SEALANT BETWEEN PRECAST SECTIONS.
3. TRASH RACK BY PLASTIC SOLUTIONS INC. OR APPROVED EQUIVALENT.
4. TRASH RACK TO BE MOUNTED TO TOP OF CONCRETE OUTLET STRUCTURE WITH 3/8" STAINLESS STEEL ANCHOR BOLTS AND SECURED WITH FLAT WASHERS AND NUTS PER MANUFACTURER SPECIFICATIONS.
5. ANCHOR BOLT MOUNTING LOCATION AND SPACING TO BE DETERMINED BY PRE-DRILLED MOUNTING HOLES ON TRASH RACK PER MANUFACTURER SPECIFICATIONS.
6. PROVIDE "V" KNOCKOUTS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE. MORTAR ALL PIPE CONNECTIONS.
7. COMPACT SUBGRADE TO 95% STANDARD PROCTOR.

PRECAST CONCRETE INLET STRUCTURE W/ TRASH RACK

NOT TO SCALE

FEATURE NUMBER	BEST MANAGEMENT PRACTICE	DISTANCE BETWEEN TECHNIQUE	PERCENT SLOPE
1	EARTH BERM	N/A	N/A
2	WATER BAR	70 FEET	11.4%
3	ARMORED SWALE	LENGTH =150 LINEAR FEET	N/A
4	WATER BAR	60 FEET	15.0%
5	WATER BAR	50 FEET	16.0%
6	WATER BAR	45 FEET	20.0%
7	WATER BAR	45 FEET	17.8%
8	CULVERT	10 FEET	20.0%
9	ARMORED SWALE	LENGTH = 330 LINEAR FEET	N/A
10	WATER BAR	60 FEET	18.3%
11	WATER BAR	60 FEET	18.3%
12	WATER BAR	60 FEET	18.3%
13	WATER BAR	60 FEET	18.3%
14	WATER BAR	60 FEET	15.0%
15	WATER BAR	45 FEET	22.0%
16	WATER BAR	35 FEET	20.0%
17	CULVERT	7 FEET	14.0%
18	ARMORED SWALE	LENGTH = 235 LINEAR FEET	N/A
19	WATER BAR	60 FEET	18.3%



ARMORED SWALE DETAIL

NOT TO SCALE

GRAPHIC SCALE

30 0 15 30 60 120

(in feet)

1 INCH = 30 FEET

Revisions

Rev.	Date	By	Appr.	Description

Checked By:

Drawn By:

Designed By:

Date: MARCH 2016

Plan Set: GAP GAP ROAD DRAINAGE IMPROVEMENTS SAIPAN

Plan Title: GAP GAP ROADWAY CONCEPT PLAN (1)

Registration:

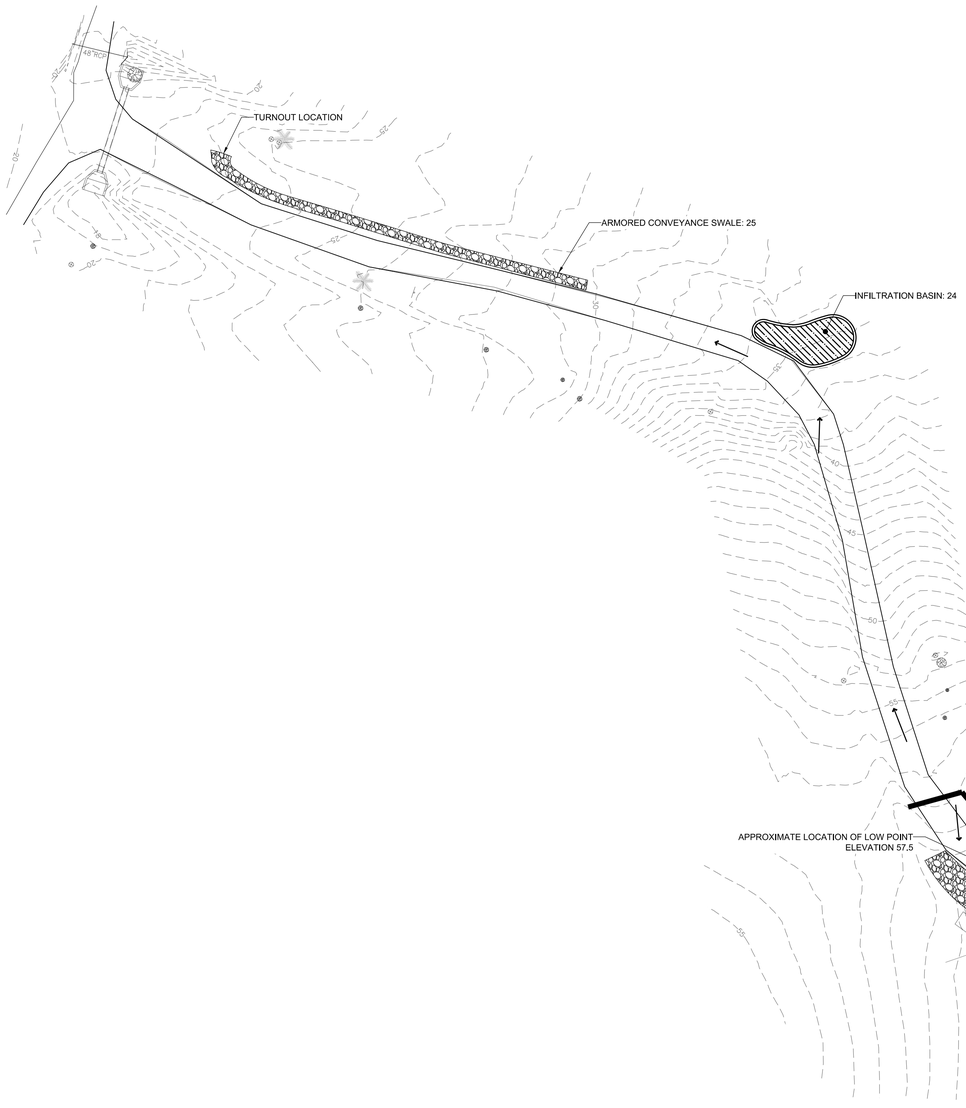
DRAFT NOT FOR CONSTRUCTION

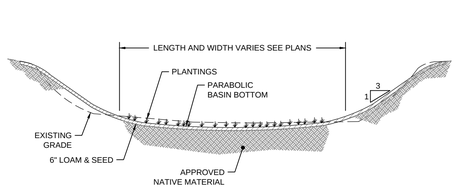
Project Number: 14133

Sheet : 1 of 2

Sheet Number: C - 1

last modified: 03/03/16 printed: 03/03/16 by bl H:\Projects\2014\141133 CNMI_PIWI SW Design\Drawings\160229-GAP-14133.dwg





INFILTRATION BASIN
NOT TO SCALE

FEATURE NUMBER	BEST MANAGEMENT PRACTICE	DISTANCE BETWEEN TECHNIQUE	PERCENT SLOPE
20	CULVERT	230 FEET	14.3%
21	ARMORED SWALE	LENGTH = 115 LINEAR FEET	N/A
22	ARMORED SWALE	LENGTH =110 LINEAR FEET	N/A
23	BROAD-BASED DIP	270 FEET	LOW POINT = 57.5 @ 17.0%
24	INFILTRATION BASIN	195 FEET	14.4%
25	ARMORED SWALE	LENGTH = 165 LINEAR FEET	N/A

GRAPHIC SCALE

30 0 15 30 60 120

(in feet)
1 INCH = 30 FEET

Revisions

Rev.	Date	By	Appr.	Description
1	---	---	---	---
2	---	---	---	---
3	---	---	---	---
4	---	---	---	---
5	---	---	---	---
6	---	---	---	---
7	---	---	---	---
8	---	---	---	---

Date: MARCH 2016
Designed By:
Drawn By:
Checked By:

Plan Set: GAP GAP ROAD DRAINAGE IMPROVEMENTS SAIPAN

Plan Title: GAP GAP ROADWAY CONCEPT PLAN (2)

Registration:

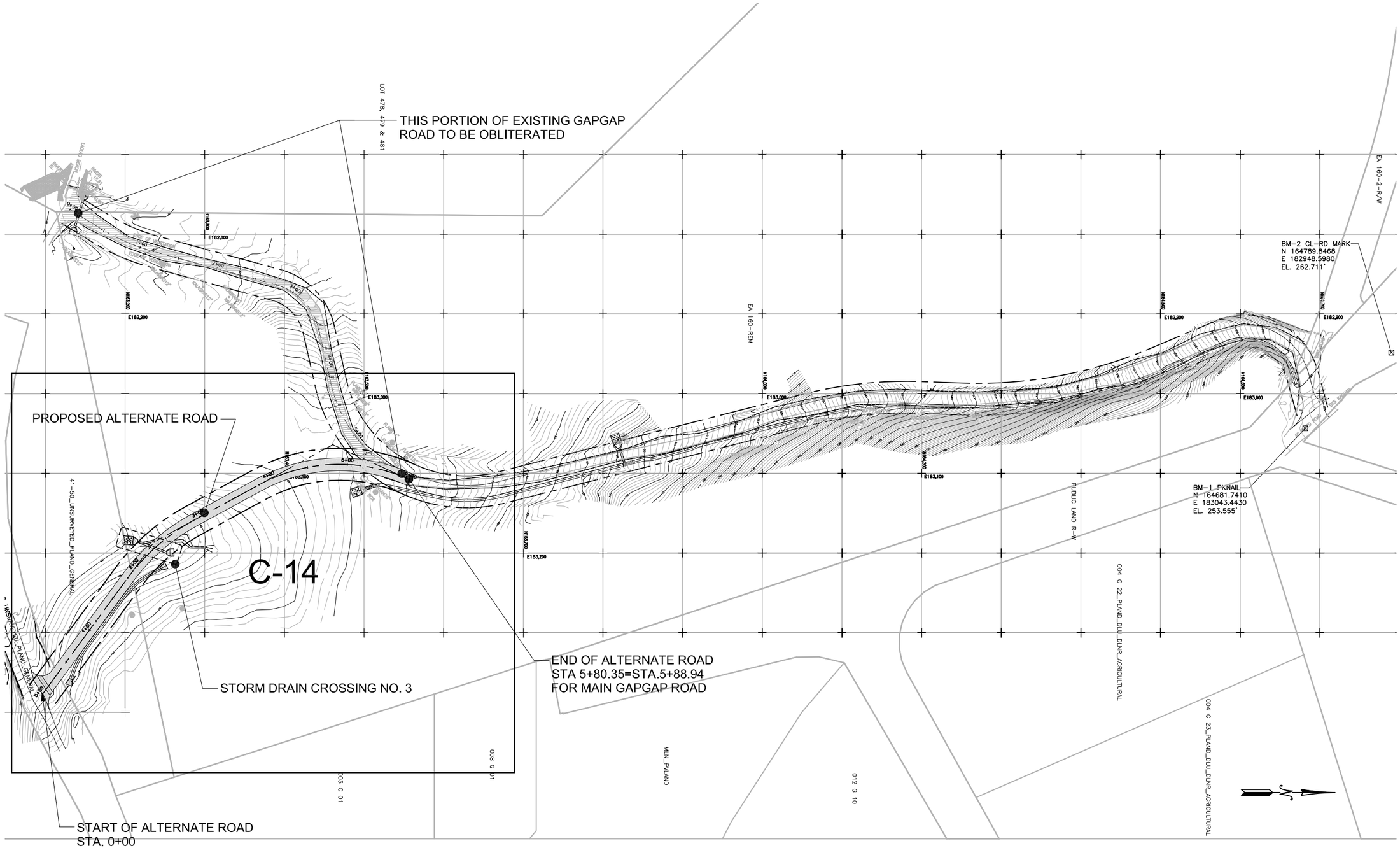
DRAFT
NOT FOR CONSTRUCTION

Project Number: 14133

Sheet : 2 of 2

Sheet Number: C - 2

last modified: 03/03/16 printed: 03/03/16 by bl H:\Projects\2014\14133 CNMI_PIWI SW Design\Drawings\160229-GAP-14133.dwg



1 KEY PLAN – ALTERNATE ROAD
NOT TO SCALE

IF SHEET IS LESS THAN 24" X 36"
REDUCED PRINT – USE GRAPHIC SCALES

REVISIONS		
No.	Description	Date

Design Consultant:

DCA DUEÑAS · CAMACHO
- ENGINEERING (CIVIL/STRUCTURAL)
- CONSTRUCTION MANAGEMENT
- PLANNING
- ENVIRONMENTAL SERVICES
- SURVEYING
- DEVELOPMENT CONSULTATION
- GEOGRAPHIC INFORMATION SYSTEMS

P.O. Box 8900 Tamuning, Guam 96931

EDUARDO M. SALAMATIN
CERTIFICATE NO. 321
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

EXPIRATION: FEB. 4, 2012

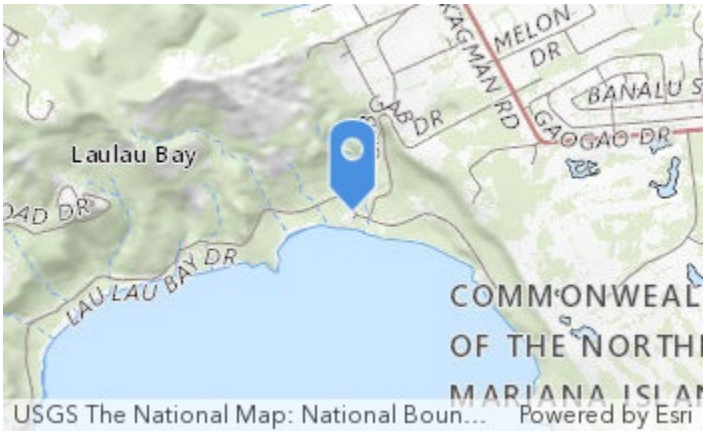
I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

Project:
GAPGAP ROAD DESIGN

Title:
KEY PLAN
ALTERNATE ROAD

Designed:	ELV
Drawn:	ELV
Checked:	EMS
Supv:	EMS
Scale:	SEE PLAN
Date:	09/01/2011
Project No.	AutoCAD File

Drawing No.
KP-2
Sheet No. 3 of 29

Site ID: LL108	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 9:22 PM
Project Type: • Drainage Infrastr., Maint. & Repair • Stormwater Retrofit • Unpaved Road Stabilization • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Runoff from Laolao Bay Rd eroding entrance to parking area and shoreline. Uncontrolled runoff.

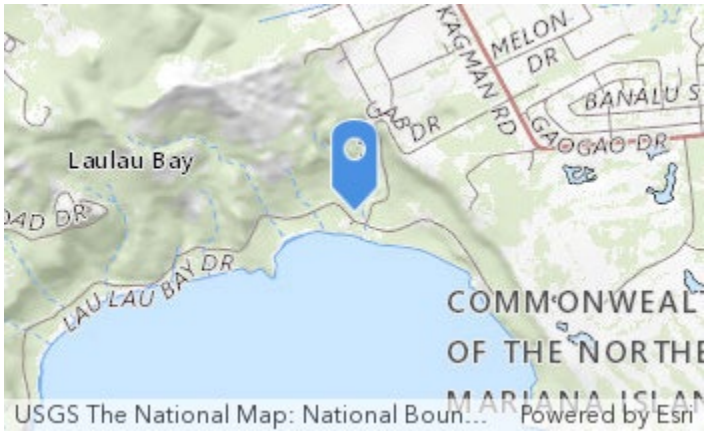
Description of Proposed Opportunity:
Intercept runoff before entering dive site. Water bars with stormwater infiltration. Improve drainage along the road.

Challenges/Constraints:
Amount and velocity of runoff. Soils and infiltration capacity may be limited?

Additional Notes:

Site Photo

Site Overview Caption:

Site ID: LL109	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 9:35 PM
Project Type: • Stormwater Retrofit • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Entrance to parking. See LL108.

Description of Proposed Opportunity:
See LL108.

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL-108, 109 DIVE SITE ENTRANCE PARKING

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☒ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☒ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

RUNOFF FROM LAO LAO BAY RD TRAVELING DIVE ENTRANCE & SHORE LINE

UNCONTROLLED RUNOFF

Severity/Rating (circle): 5 *Severe* 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

INTERCEPT RUNOFF BEFORE ENTERING DIVE SITE

WATER BARS / STORMWATER INFILTRATION?

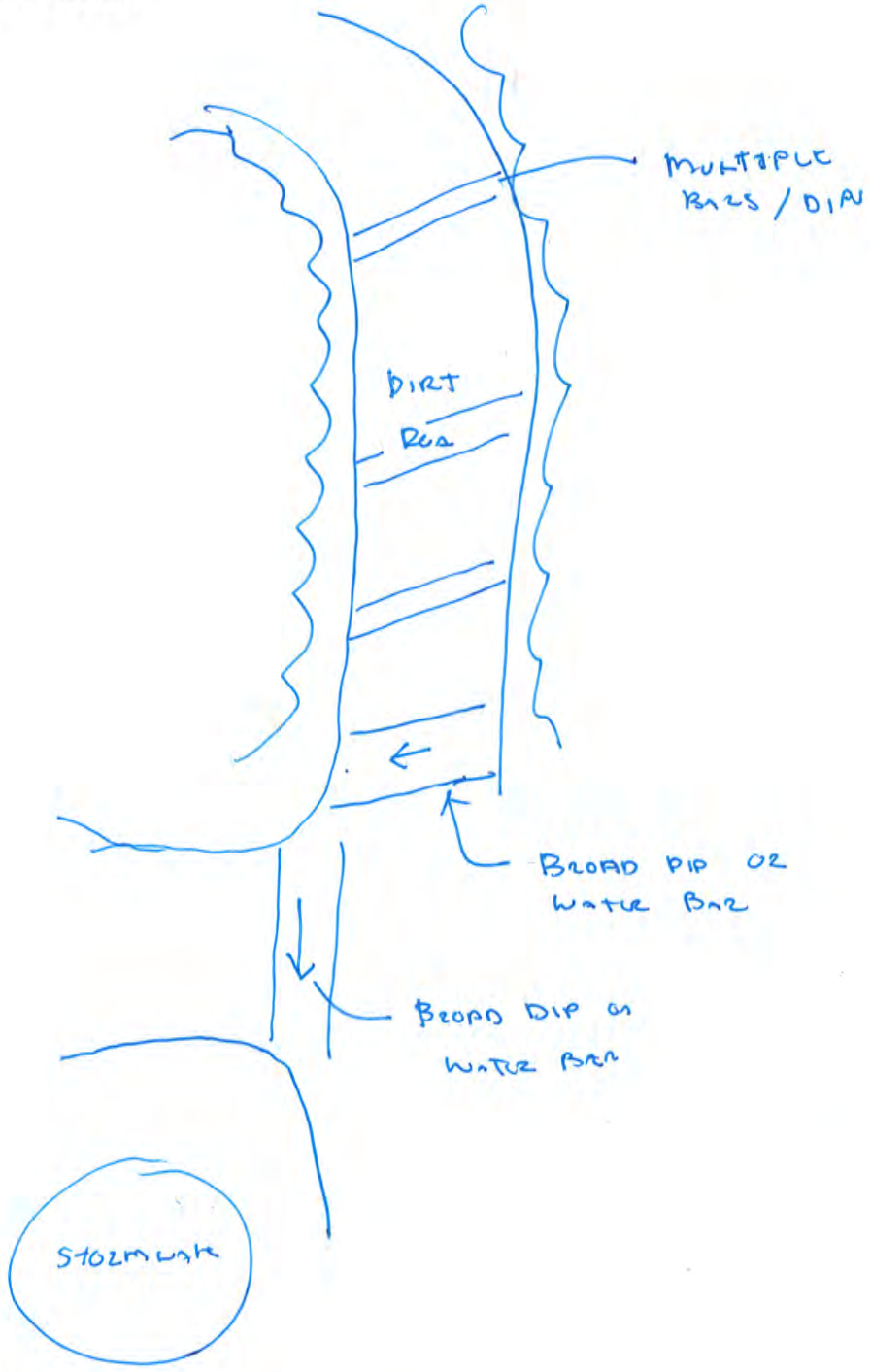
DRAINAGE ROAD.

Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

AMOUNT ; VELOCITY OF RUNOFF
SOILS / INFILTRATION CAPACITY

Additional Notes and/or Sketch:



Site ID: LL112	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 9:45 PM
Project Type: • Drainage Infrastr., Maint. & Repair • Stormwater Retrofit • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Culvert at road concentrates flow into narrow channel. Road grading is rough mounds and dips.

Description of Proposed Opportunity:
Replace and widen culvert (convert to a large box culvert). Construct broad dip or other diversion at low point to direct road runoff into ditch.

Challenges/Constraints:
Road traffic and frequency of use. Subsurface material? Depth of culvert (very deep from road surface).

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption: culvert crossing in red

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL - 112 -

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☒ Pollution Prevention (hotspot)
- ☐ Residential Stewardship (NOT HOTSPOT)
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

CULVERT @ ROAD CONCENTRATES FLOW INTO NARROW CHANNEL
ROAD CROSSING IS ROUGH & MOWED ; PIPS

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

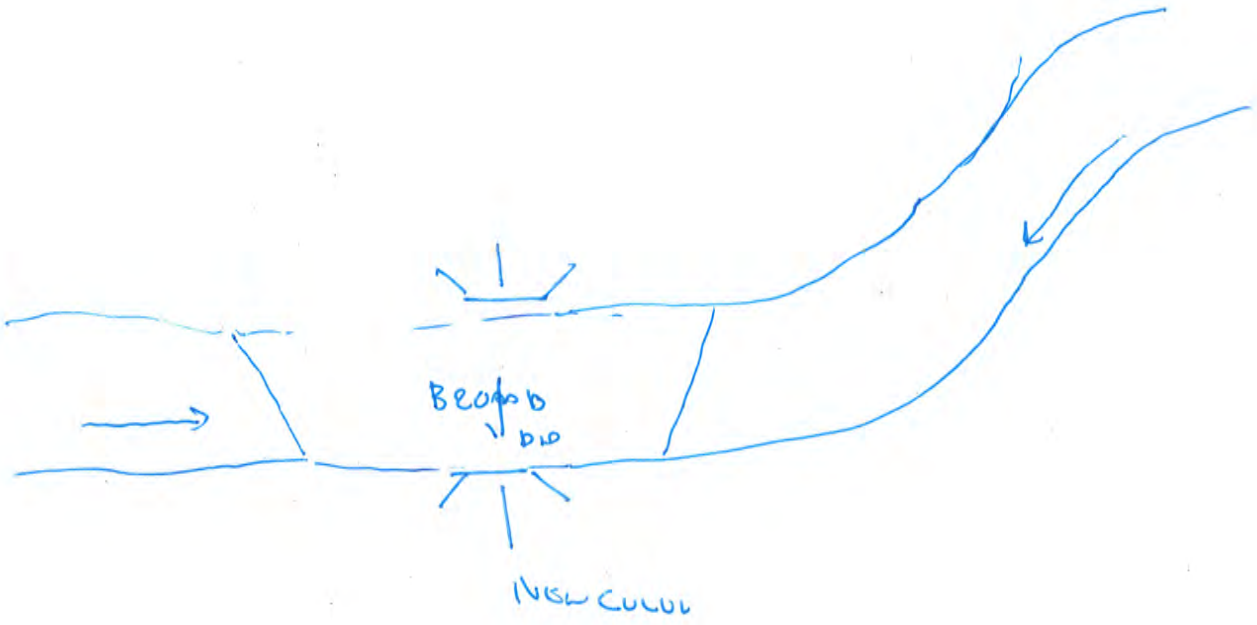
REPLACE / WIDEN CULVERT - ~~STAGED~~ LARGE BOX CULVERT
CONSTRUCT ROAD DIP OR OTHER DIVERSION @ LOW POINT
TO DIRECT ROAD RUNOFF INTO DITCH

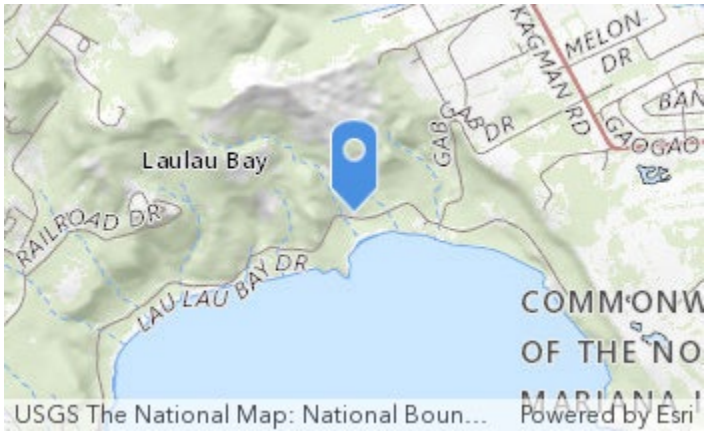
Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

ROAD TRAFFIC / FREQUENCY OF USE
SUBSURFACE MATERIAL
DEPTH OF CULVERT

Additional Notes and/or Sketch:



Site ID: LL113	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 9:57 PM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Runoff discharges off road at uncontrolled location causing scouring and erosion down to very deep pool. 9’ down to plunge pool. 3’ wide. Inflow to east comes onto road ~100 ft uphill and runs along road. Contributing

Description of Proposed Opportunity:
Create broad dip and formalize overflow. Upstream drainage: pitch discharges to road. Runs along eastern edge to informal drainage overflow.

Challenges/Constraints:
Large volume and high velocity of runoff discharge onto road. No culvert crossing.

Additional Notes:

Site Photo

Site Overview Caption: Out

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption: In

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL - 113 DRAINAGE DITCH CROSSING

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

RUNOFF DISCHARGES OFF ROAD & UNCONTROLLED LOCATION CAUSING SCOURING & EROSION - CONTRIBUTING TO RUNOFF ON SHORELINE

Severity/Rating (circle): (5) 4 3 2 1 0

Severe *Not significant*

Description of Proposed Opportunity:

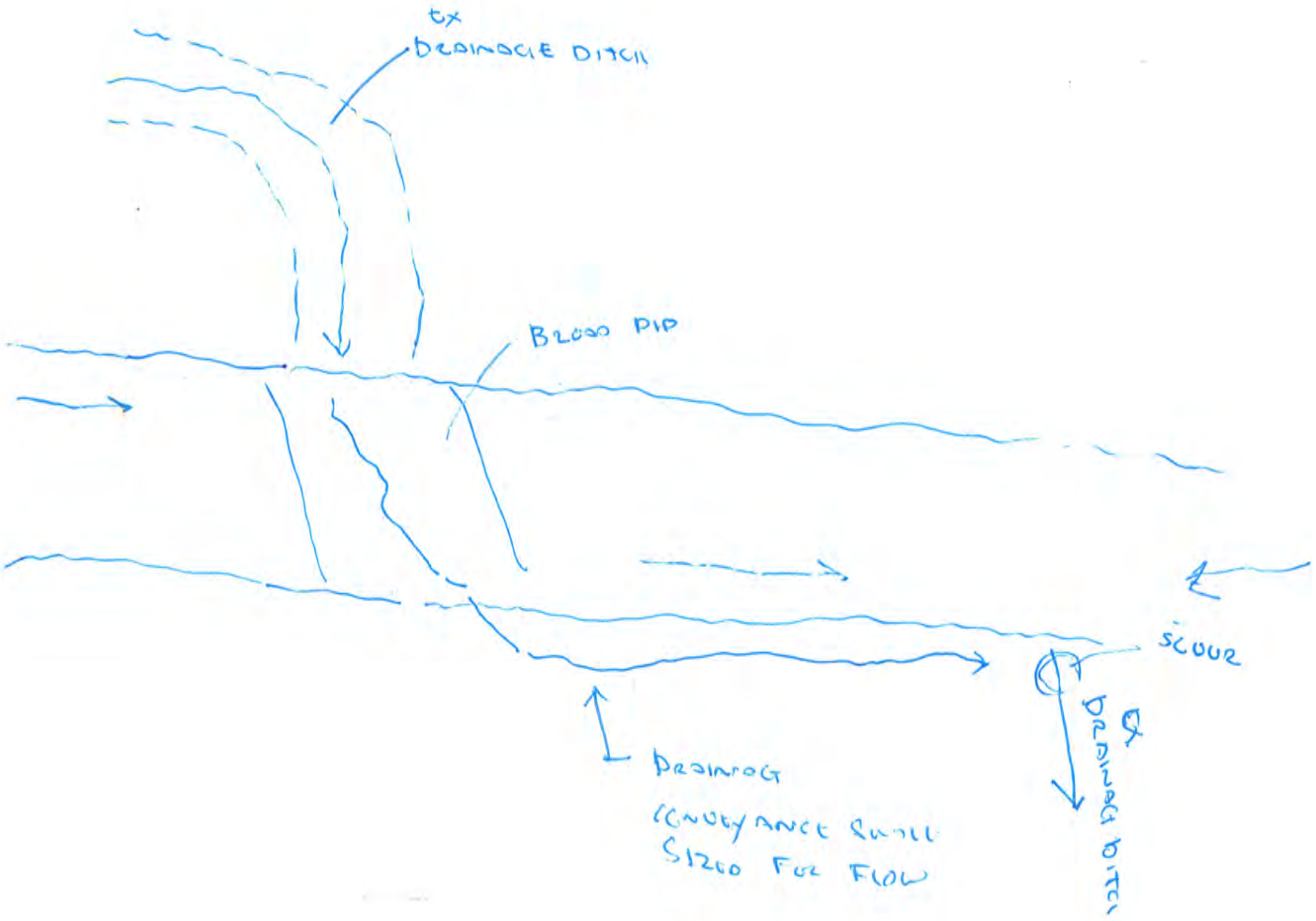
CREATE BRIDGE PIP: FORMALIZE ~~QUITTY~~ OVERFLOW UP STREAM DRAINAGE DITCH DISCHARGES TO ROAD - RUNS ALONG EASTERN EDGE ~~OF~~ TO INFORMAL DRAINAGE OVERFLOW

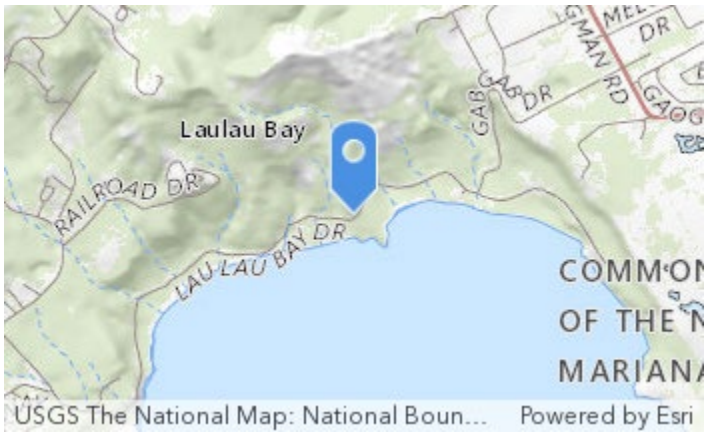
Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

LARGE VOLUME / HIGH VELOCITY RUN OFF DISCHARGE ONTO ROAD – NO CULVERT CROSSING

Additional Notes and/or Sketch:



Site ID: LL117	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 10:21 PM
Project Type:	
Enforcement Needed: No	
Severity Rating: 1	
Implementation Priority: Not that important (Low)	

Descriptions of Existing Conditions:
Grass track, possibly to homestead or lookout?

Description of Proposed Opportunity:
Monitor for possible issues.

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-117

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☒ Other GRASS ROAD

Description of Existing Conditions:

GRASS ROAD

Severity/Rating (circle): 5 *Severe* 4 3 2 1 (0) *Not significant*

Description of Proposed Opportunity:

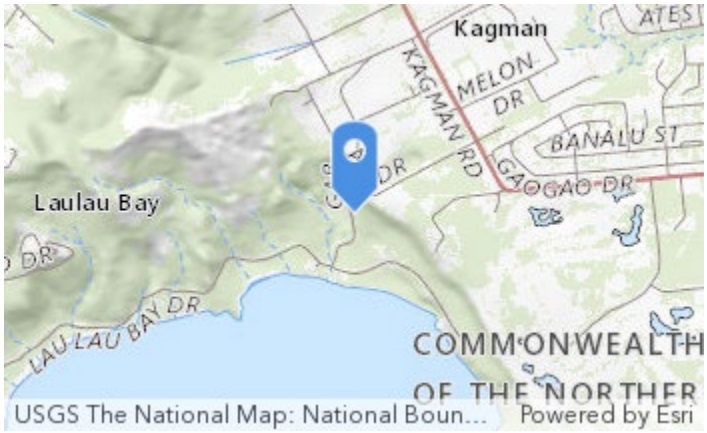
NOTHING

Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☒ unsure

Challenges/Constraints: NO COMMENT

Additional Notes and/or Sketch:

NONE

Site ID: LL124	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 11:06 PM
Project Type: • Stormwater Retrofit • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Washout and erosion along Gap Gap Road. See previous conceptual plans

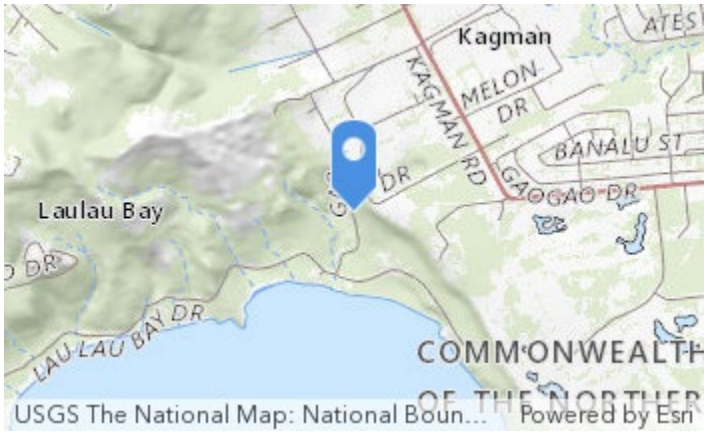
Description of Proposed Opportunity:
See previous plans. Proposed improvements to drainage were confirmed and remain valid.

Challenges/Constraints:
Very steep road, accessibility and long-term maintenance.

Additional Notes:

Site Photo

Site Overview Caption:

Site ID: LL125	**Watershed:** Laolao
Crew: BK	**Date/Time:** 01/21/2020 11:08 PM
Project Type: • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

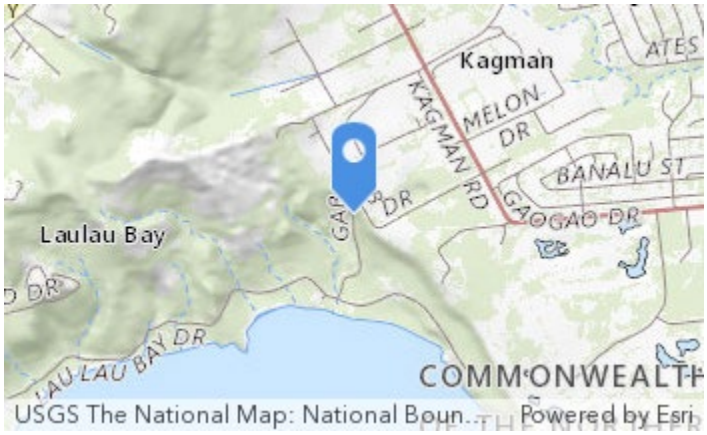
Descriptions of Existing Conditions:
Washout and erosion along Gap Gap Road. See previous conceptual plans

Description of Proposed Opportunity:
See previous plans. Proposed improvements to drainage were confirmed and remain valid.

Challenges/Constraints:
Very steep road, accessibility and long-term maintenance.

Additional Notes:

Site Photo

Site ID: LL126	**Watershed:** Laolao
Crew: BK	**Date/Time:** 01/21/2020 11:14 PM
Project Type: • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Washout and erosion along Gap Gap Road. See previous conceptual plans

Description of Proposed Opportunity:
See previous plans. Proposed improvements to drainage were confirmed and remain valid.

Challenges/Constraints:
Very steep road, accessibility and long-term maintenance.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL - 124, 125, 126

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

WASHOUTS / & SIGNIFICANT EROSION ALONG GAP GAP ROAD

Severity/Rating (circle): (5) 4 3 2 1 0

Severe *Not significant*

Description of Proposed Opportunity:

SEE PREVIOUS PLANS FOR GAP GAP. PROPOSED IMPROVEMENTS TO DRAINAGE WERE CONFIRMED AND REMAIN VALID.

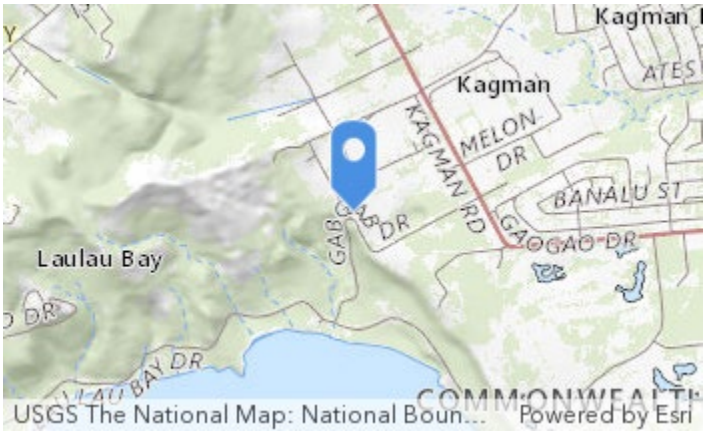
Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

VERY STEEP ROAD, ACCESSIBILITY AND LONG-TERM MAINTENANCE.

Additional Notes and/or Sketch:

SEE PREVIOUS DESIGN PLANS.

Site ID: LL127	**Watershed:** Laolao
Crew: BK	**Date/Time:** 01/21/2020 11:25 PM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Swales on both side of paved road are filled with vegetation and runoff cannot get into swales. Runoff remains on paved surface and drains down Gap Gap Road.

Description of Proposed Opportunity:
Clean and cut back vegetation & reestablish/clean road swales. Construct broad dip or waterbar (speed bump) at top of Gap Gap Road to keep runoff on pavement/off Gap Gap. Possibly use bioretention, but may

Challenges/Constraints:
Swale maintenance. Has been difficult to get anything implemented at this site, which has been identified several times. Bioretention would have slope/grading changes.

Additional Notes:
None

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-127

Project Type (check box):

☒ Drainage Infrastr. Maint. & Repair	☐ Upland Revegetation/Restoration	☐ Watershed Education/Signage
☐ Stormwater Retrofit	☐ Wastewater Improvement	☐ Land Conservation
☒ Unpaved Road Stabilization	☐ Construction Site ESC	☐ Other _____
☐ Shoreline Stabilization	☐ Pollution Prevention (hotspot)	_____
☐ Stream/Wetland Restoration	☐ Residential Stewardship	_____

Description of Existing Conditions:

SWALES ON BOTH SIDE OF PAVED ROAD ARE FILLED W/ VEGETATION ; ROAD RUNOFF CAN NOT GET INTO SWALES. RUNOFF REMAINS ON PAVED SURFACE AND DRAINS DOWN GAP GAP ROAD

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

CLEAN / CUT BACK ROAD SWALES. AND CREATE A BROAD DIP OR WATER BAR (SPEED BUMP) DIVERSION TO KEEP RUNOFF OF GAP GAP ROAD.

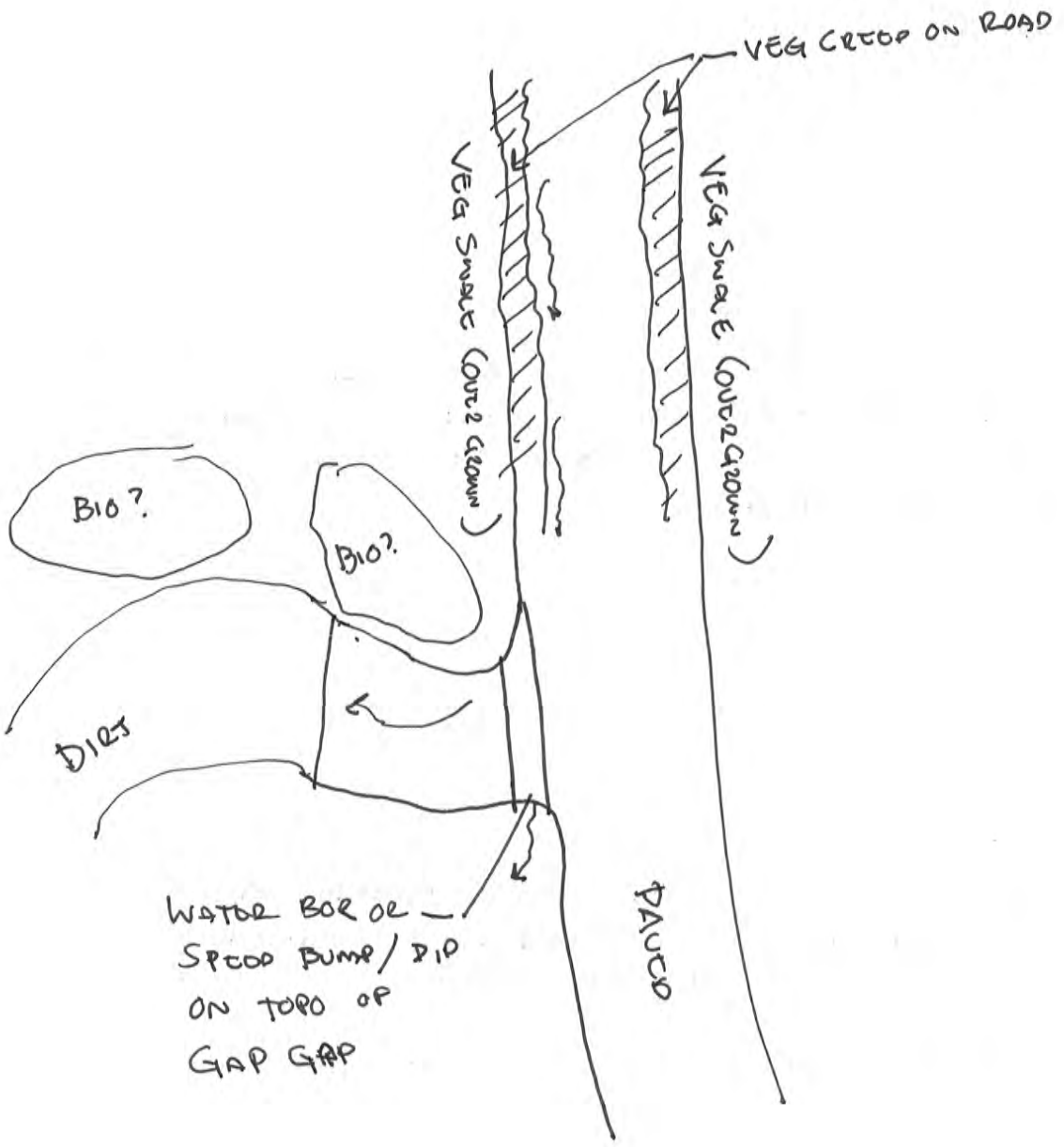
POSSIBLE BIORETENTION OPPORTUNITY, BUT REQUIRE A LOT OF EARTHWORK.

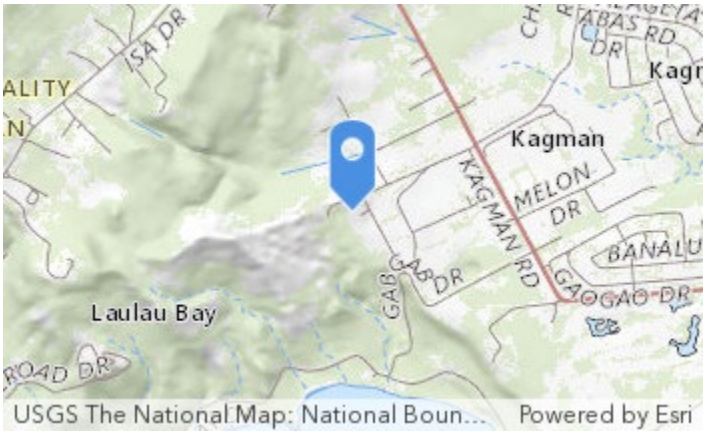
Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

MAINTAINING SWALE AND GETTING IMPLEMENTED THIS SITE HAS BEEN IDENTIFIED NUMEROUS TIMES.
BIORETENTION WOULD HAVE SLOPE / GRADING CHANLENGES

Additional Notes and/or Sketch:



Site ID: LL132	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/21/2020 11:51 PM
Project Type: • Upland Revegetation/Restoration	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Tree blown down over retaining wall with root destabilization. Excessively steep slope above retaining wall (which appears too short). Bare dirt/mudslide on steep slope. Sediment source to parking lot/rain garden and

Description of Proposed Opportunity:
Clean up sediment and slope. Extend wall and stabilize slope.

Challenges/Constraints:
Very steep slopes. Detention center may be abandoned so may only be feasible if detention center is in use.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☒ Yes ☐ No ?

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-132

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☒ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☒ Other SEDIMENT SOURCE

Description of Existing Conditions:

+ TREE BLOWN DOWN / ROOT DE STABILIZATION, EXCESSIVELY ~~STEEP~~ UNSTABILIZED STEEP SLOPE ABOVE RETAINING WALL
+ SLOPE EROSION & SEDIMENT SOURCE FROM UPLAND DRAINAGE
+ WALL APPEARS TO SHORT
+ SEDIMENT HAS CLOGGED RAIN GARDEN (LL-130) INLET

Severity/Rating (circle): (5) 4 3 2 1 0

Severe *Not significant*

Description of Proposed Opportunity:

CLEAN UP SEDIMENT & ~~SLOPE~~ SLOPE. EXTEND WALL, DE STABILIZATION

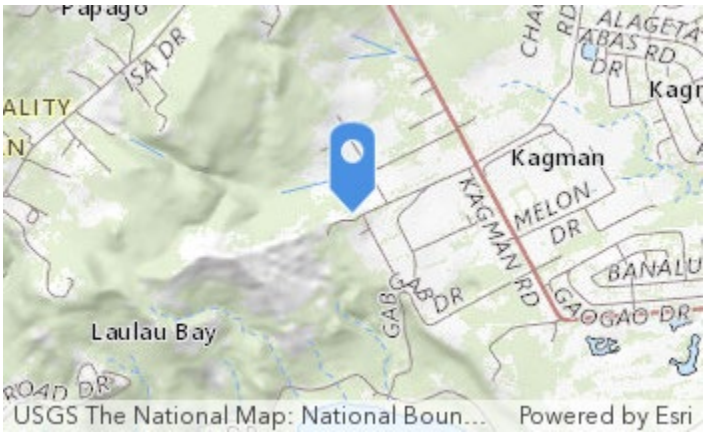
Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

VERY STEEP SLOPES. DETENTION CENTER APPEARS TO BE ABANDONED.

Additional Notes and/or Sketch:

NONE

Site ID: LL133	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 12:00 AM
Project Type: • Unpaved Road Stabilization	
Enforcement Needed: Yes	
Severity Rating: 4	
Implementation Priority: Not that important (Low)	

Descriptions of Existing Conditions:
Eroded dirt road to water tank at top of watershed.

Description of Proposed Opportunity:
Stabilize and remove sediment source. Apply dirt road strategies, such as dips and water bars to shed runoff. Regrade & stabilize.

Challenges/Constraints:
Steep slopes.

Additional Notes:

Site Photo

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL - ~~RD~~ 133

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

ERODED DIRT ROAD TO WATER TANK @ TOP OF WATERSHED

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

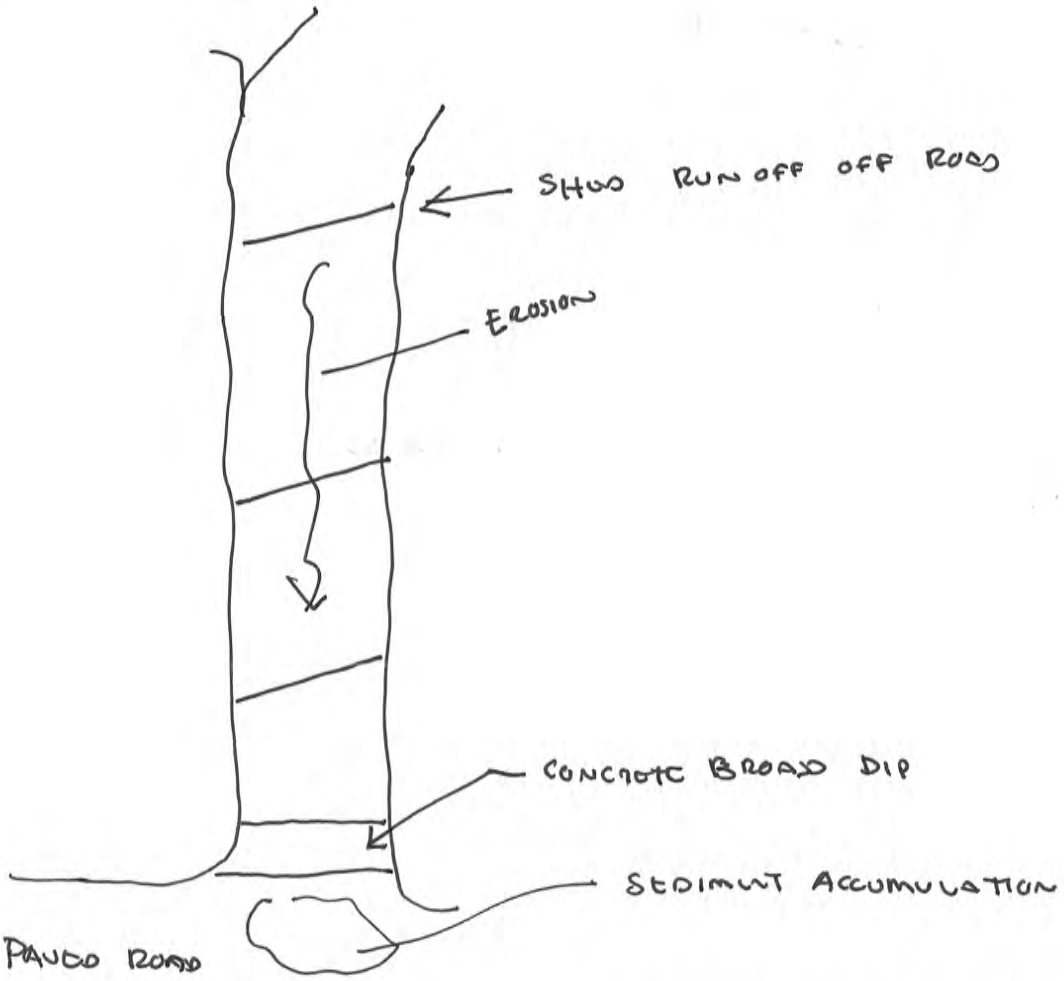
~~DO~~ APPLY DIRT ROAD STRATEGIES SUCH AS DIPS ; WATER BARS TO SHED RUNOFF. REGRADE / STABILIZE ROAD

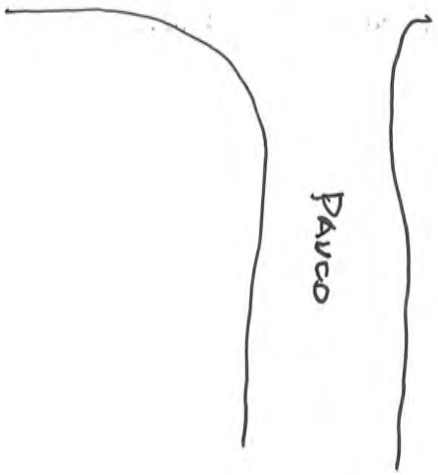
Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☒ not that important (low) ☐ unsure

Challenges/Constraints:

STEEP SLOPES

Additional Notes and/or Sketch:





Site ID: LL135	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 12:45 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Broad dip with swales (formalized downstream)

Description of Proposed Opportunity:
Clean swale, regrade road. Add second broad dip uphill.

Challenges/Constraints:
Steel slope, erosion at edge of conc. Ongoing maintenance and erosion at interface of concrete and dirt road.

Additional Notes:
Appears to be functional.

Site Photo

Site Overview Caption: Clean.

Additional Site Photos

Additional Photo Caption: Uphill

Additional Photo Caption: Downhill

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL-135

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

+ BROAD DIP (LOW WATER CROSSING - LWC) NEEDS REPAIR
+ SWALES NEED TO BE CLEANED

Severity/Rating (circle): 5 *Severe* 4 (3) 2 1 0 *Not significant*

Description of Proposed Opportunity:

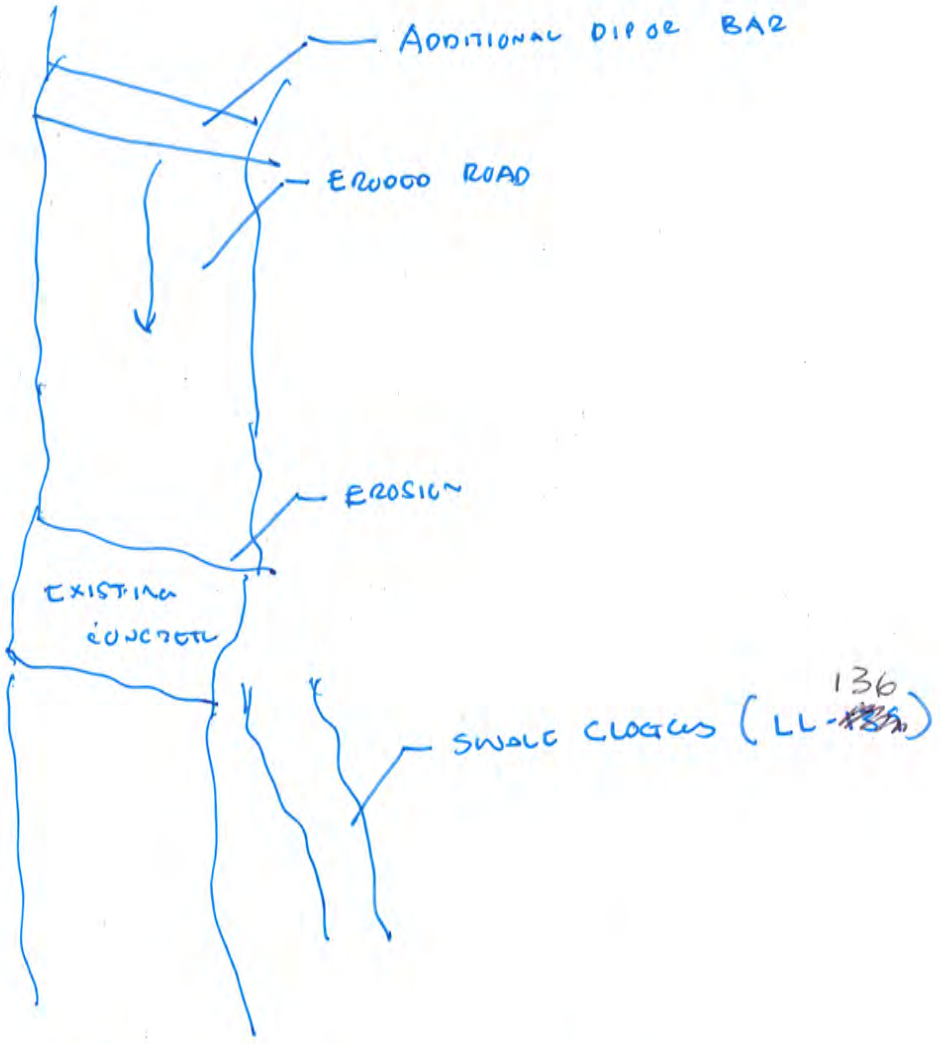
#1 CLEAN SWALE, REGRADE ROAD, ADD ADDITIONAL WATER BAR OR BROAD DIP UP HILL TO REDUCE EROSIVE VELOCITIES

SWALE - LL-139

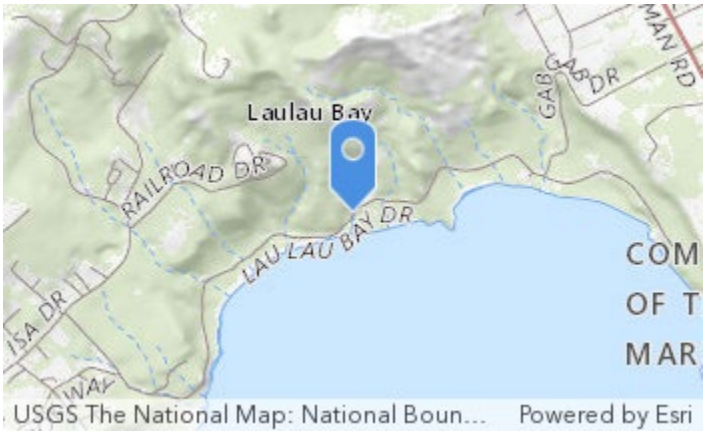
Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: ON GOING MAINTENACE AND EROSION ALONG INTERFACE OF CONCRETE & DIRT ROAD

Additional Notes and/or Sketch:



SEE ALSO LOW WATER CROSSING DESIGN PLANS.

Site ID: LL136	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 12:51 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Clogged formalized swale. See LL135.

Description of Proposed Opportunity:
Clean and redirect to restore flow.

Challenges/Constraints:
Maintenance.

Additional Notes:

Site Photo

Site Overview Caption: Formalized channel to right. Current flow to left.

Additional Site Photos

Additional Photo Caption: Current flow path.

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☑ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-136

Project Type (check box):

- ☑ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

CLOGGED SWALE FROM BROAD DIP - SEE ALSO LL-135

Severity/Rating (circle): (5) 4 3 2 1 0

Severe *Not significant*

Description of Proposed Opportunity:

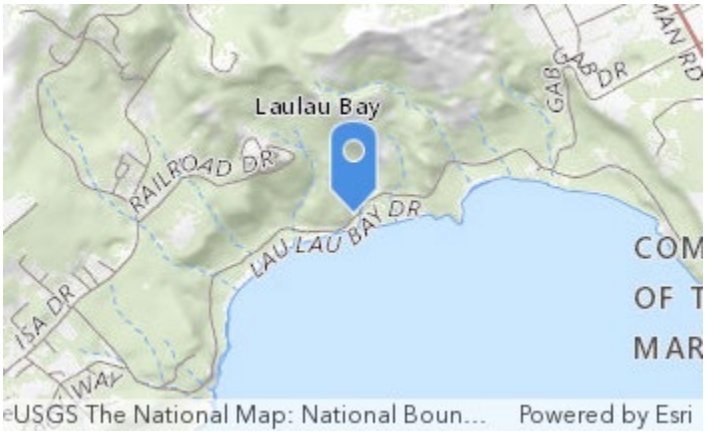
CLEAN, REGRADE TO REDIRECT AND RESTORE FLOW

Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: MAINTENANCE

Additional Notes and/or Sketch:

NONE - SEE LL-135

Site ID: LL138	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:02 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Stormwater Retrofit • Unpaved Road Stabilization	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Lots of sediment on broad dip and in swales.

Description of Proposed Opportunity:
Clean! Remove vegetation at outlet.

Challenges/Constraints:
Maintenance.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption: intended flow path middle left (pile of dirt). Current flow path on right.

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL138

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

CLOGGED BROAD DIP (LWC) AND CONCRETE SWALE

Severity/Rating (circle): (5) 4 3 2 1 0

5 = *Severe*; 0 = *Not significant*

Description of Proposed Opportunity:

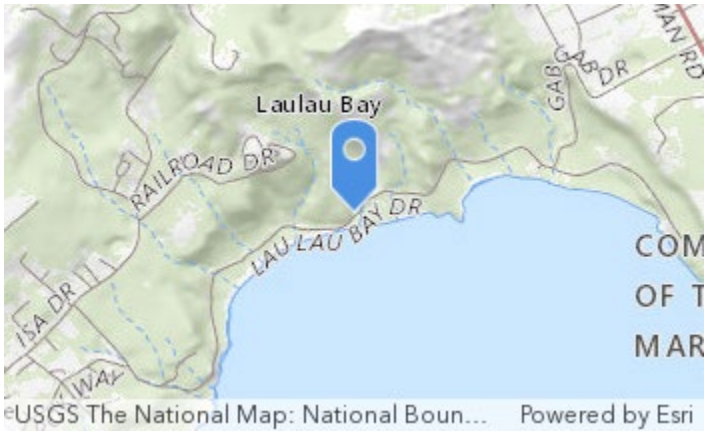
CLEAN SEDIMENT & ONCE GROWN VEGETATION

Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: REQ. ON GOING MAINTENANCE

Additional Notes and/or Sketch:

NONE - SEE PHOTOS. AN LWC DESIGN PLANS.

Site ID: LL139	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:08 AM
Project Type: • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Seaward edge of road. 3’ drop at start. Guess low energy. Rocky sand. Trees present. (with LL143)

Description of Proposed Opportunity:
Start living shoreline. Use gabion walls or green walls.

Challenges/Constraints:
Road abuts top of shoreline, so limited space. High traffic, exposure to future storms.

Additional Notes:

Site Photo

Site Overview Caption: Start.

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption: From above

Site ID: LL143	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:24 AM
Project Type: • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
End living shoreline/shoreline restoration. (with LL139)

Description of Proposed Opportunity:
See LL139.

Challenges/Constraints:
See LL139.

Additional Notes:

Site Photo

Site Overview Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): (BK) BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-139 (BEGIN) LL-~~#~~ 143 (END) + LL1H4

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

ERODED SHORE LINE FROM YUTU. SOME STONE/ROCK STABILIZATION HAS OCCUERED.

REPAIRS UNSIGHTLY. LOCATION APPEARS TO BE LOW ENERGY AREA

Address road runoff (LL1H4)

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

SHORE LINE RESTORATION

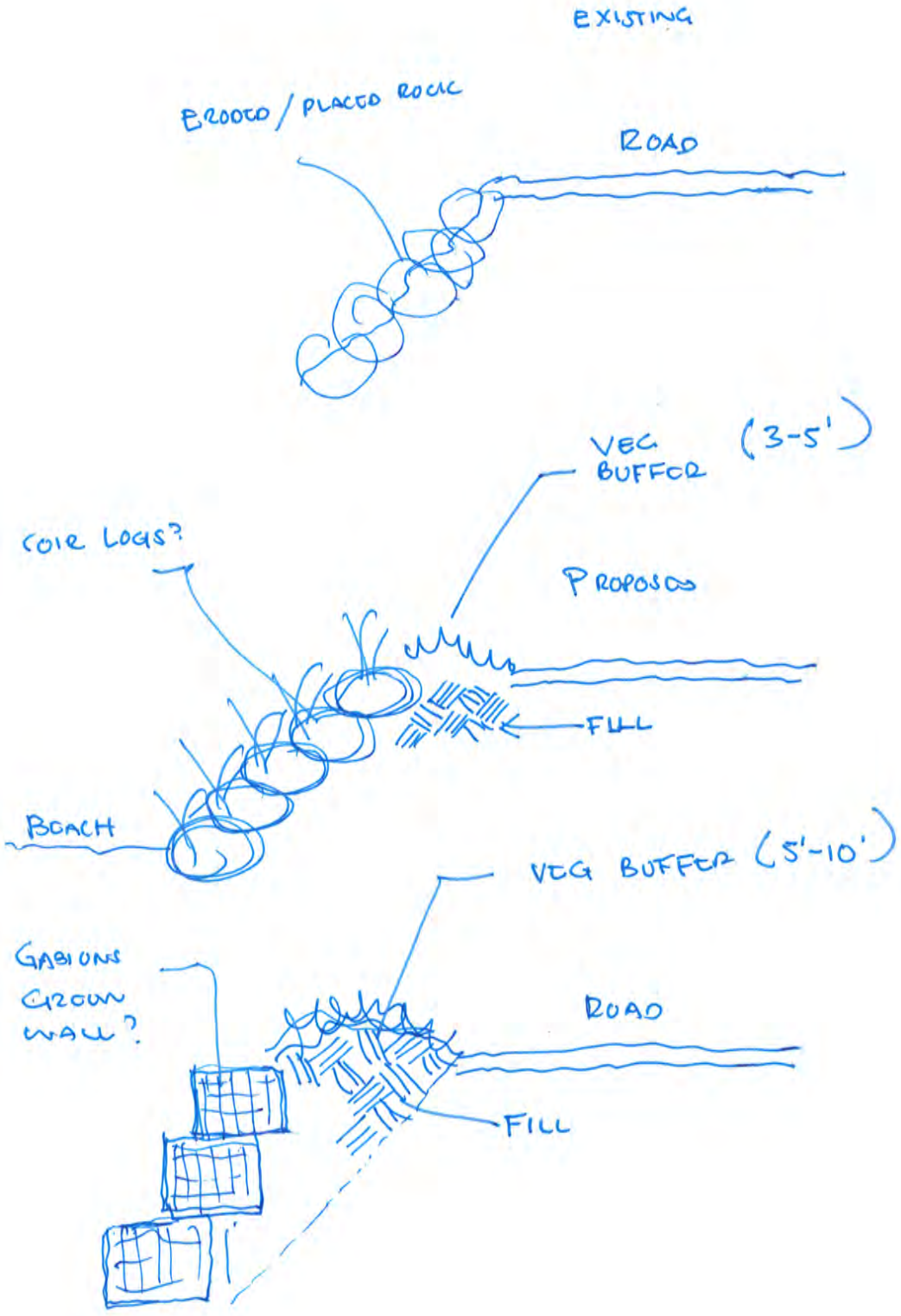
LIVING SHORE LINE / GABION / GREEN WALL

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

ROAD ABUTS TOP OF SHORELINE – LIMITED SPACE
HIGH TRAFFIC
EXPOSURE TO FUTURE STORMS

Additional Notes and/or Sketch:



Site ID: LL144	**Watershed:** Laolao
Crew: BK	**Date/Time:** 01/22/2020 1:25 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 2	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Low point in rd. Discharges toward LL139 & LL143.

Description of Proposed Opportunity:
Address stormwater as part of shoreline restoration

Challenges/Constraints:
Erosion

Additional Notes:
None

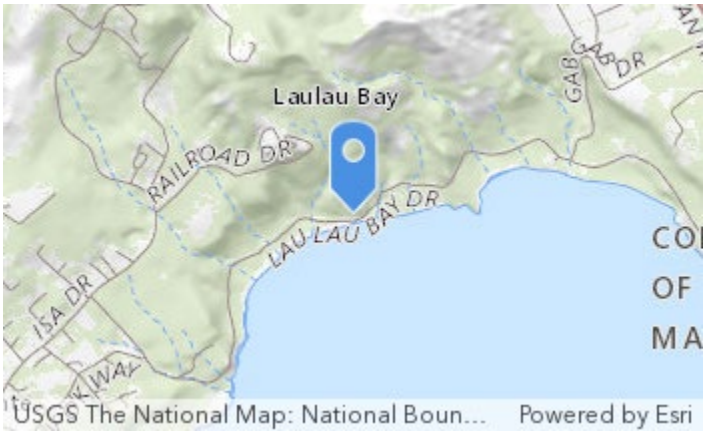
Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

Site ID: LL145	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:30 AM
Project Type: • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Start shoreline restoration. (with LL146)

Description of Proposed Opportunity:
Living shoreline (see notes for LL139/LL143/LL144)

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Site ID: LL146	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:31 AM
Project Type: • Shoreline Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
End shoreline restoration. (with LL145)

Description of Proposed Opportunity:
Living shoreline (see notes for LL139/LL143/LL144)

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL145 (begin) & LL146 (end)

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

see field notes LL139/LL143/LL144

Severity/Rating (circle): 5 *Severe* 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

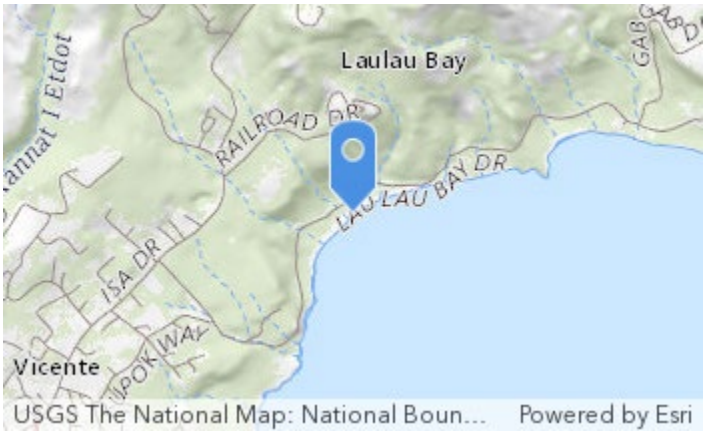
see LL139/LL143/LL144

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

Additional Notes and/or Sketch:

See LL139/143/144

Site ID: LL151	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 1:57 AM
Project Type: • Residential Stewardship	
Enforcement Needed: Yes	
Severity Rating: 3	
Implementation Priority: Unsure	

Descriptions of Existing Conditions:
Driving on beach

Description of Proposed Opportunity:
Prevent driving on beach. Signage or physical barrier?

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Site ID: LL152	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 2:00 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Runoff drains down boat ramp access eroding and washing out onto beach.

Description of Proposed Opportunity:
Water bar or broad dip at top of access to direct runoff away from ramp and into vegetation.

Challenges/Constraints:
Heavy use, not a lot of space to discharge.

Additional Notes:

Site Photo

Site Overview Caption: Top of ramp

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL-152 ~~153~~ ~~154~~ – BOAT RAMP

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

RUNOFF DEMINS DOWN BOAT RAMP ACCESS ERODING & WASHING OUT ONTO BEACH

Severity/Rating (circle): 5 *Severe* 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

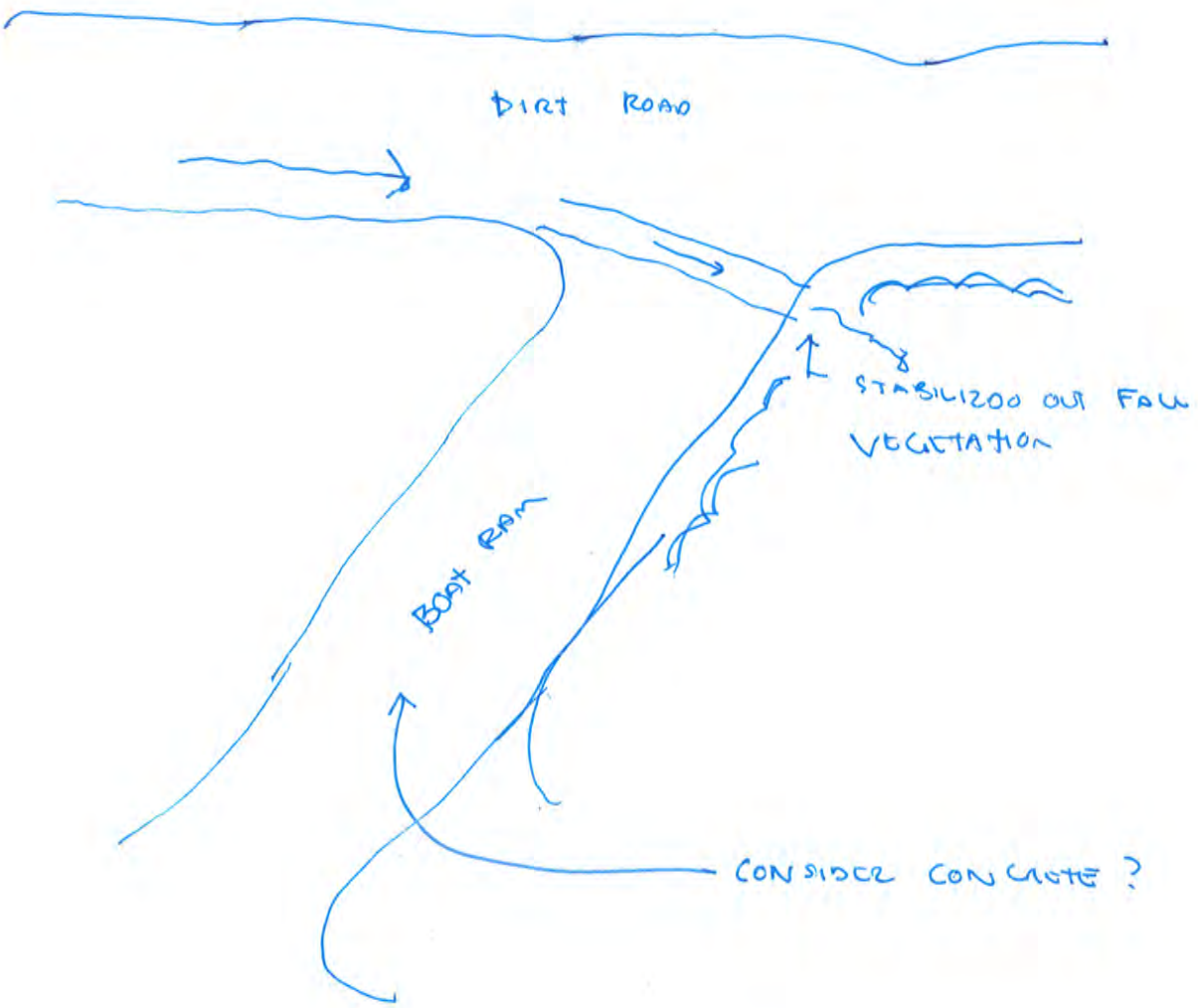
WATER BAR OR BROAD DIP @ TOP OF ACCESS TO DIRECT RUNOFF AWAY FROM RAMP & INTO VEGETATION

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

HEAVY USE, SPACE TO DISCHARGE

Additional Notes and/or Sketch:



Site ID: LL154	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 2:19 AM
Project Type: • Residential Stewardship	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Lots of trash

Description of Proposed Opportunity:
Trash pickup, educational signage.

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Site ID: LL155	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 2:23 AM
Project Type: • Drainage Infrastr., Maint. & Repair • Unpaved Road Stabilization • Shoreline Stabilization • Watershed Education/Signage	
Enforcement Needed: No	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Former parking lot washed out during Yutu. Parking now uncontrolled and new areas east and west of former parking area now degraded.

Description of Proposed Opportunity:
Restore parking lot and shoreline. Living shoreline.

Challenges/Constraints:
Receding shoreline, heavy use, exposure to storms. Very little room.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL - ~~157~~ 155 ~~153~~

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☒ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☒ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

FORMER PARKING LOT WASHED OUT DURING TUTU PARKING NOW UNCONTROLLED.

NOW AREAS @ BOTH NORTH & SOUTH OF PARKING AREA NOW DEGRADED

Severity/Rating (circle): (5 Severe) 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

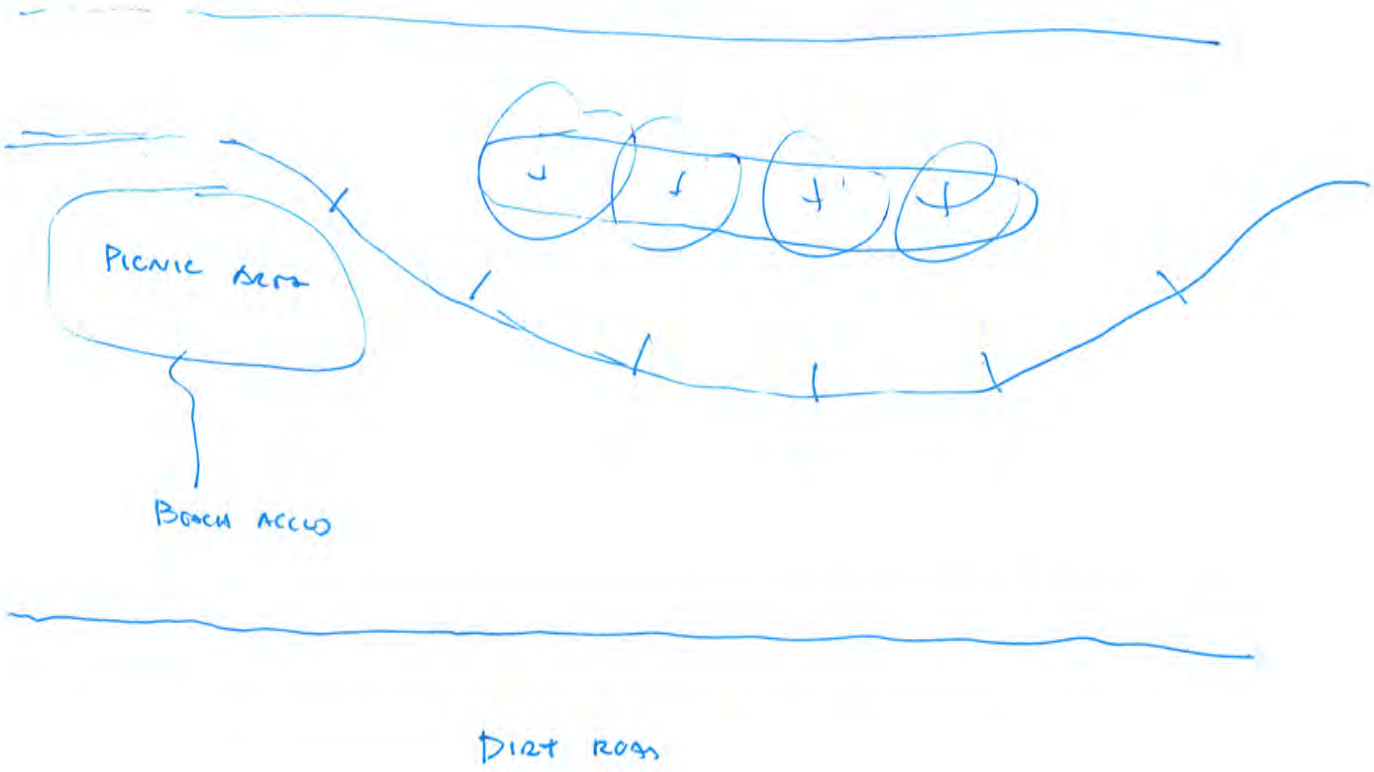
+ RESTORE PARKING LOT / SHORELINE (LIVING SHORELINE)

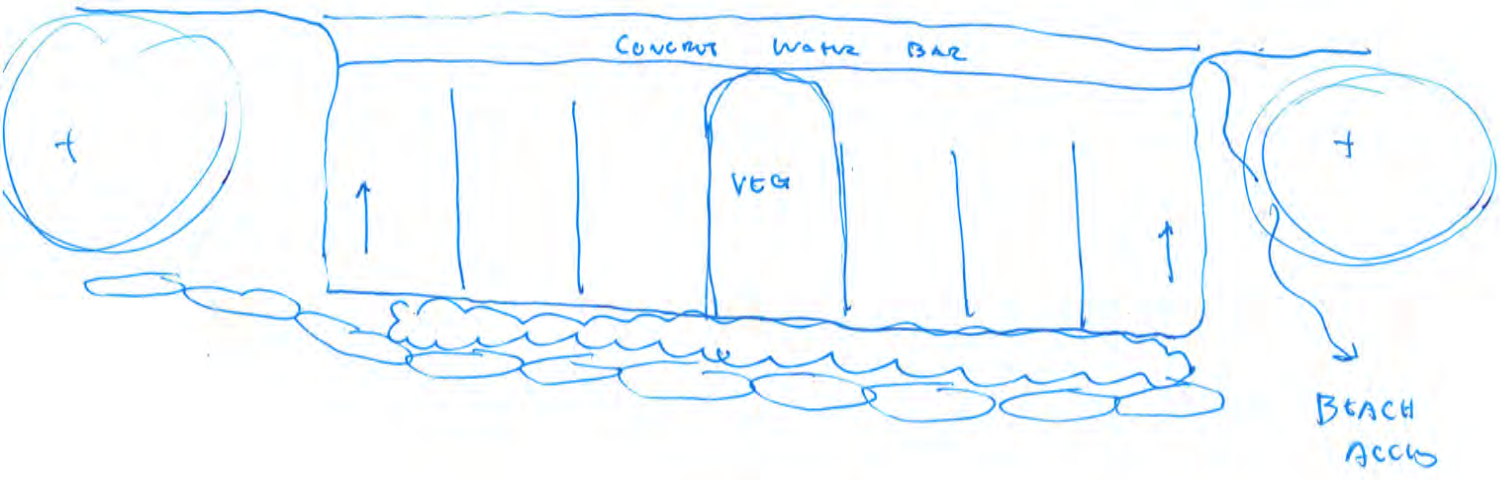
Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

HEAVY USE, EXPOSED TO STORMS - HIGH SURFACE
~~TEA~~. NO ROOM TO RETREAT

Additional Notes and/or Sketch:





OPTION 1

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL ~~153~~ 155 con't

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Severity/Rating (circle): 5 4 3 2 1 0

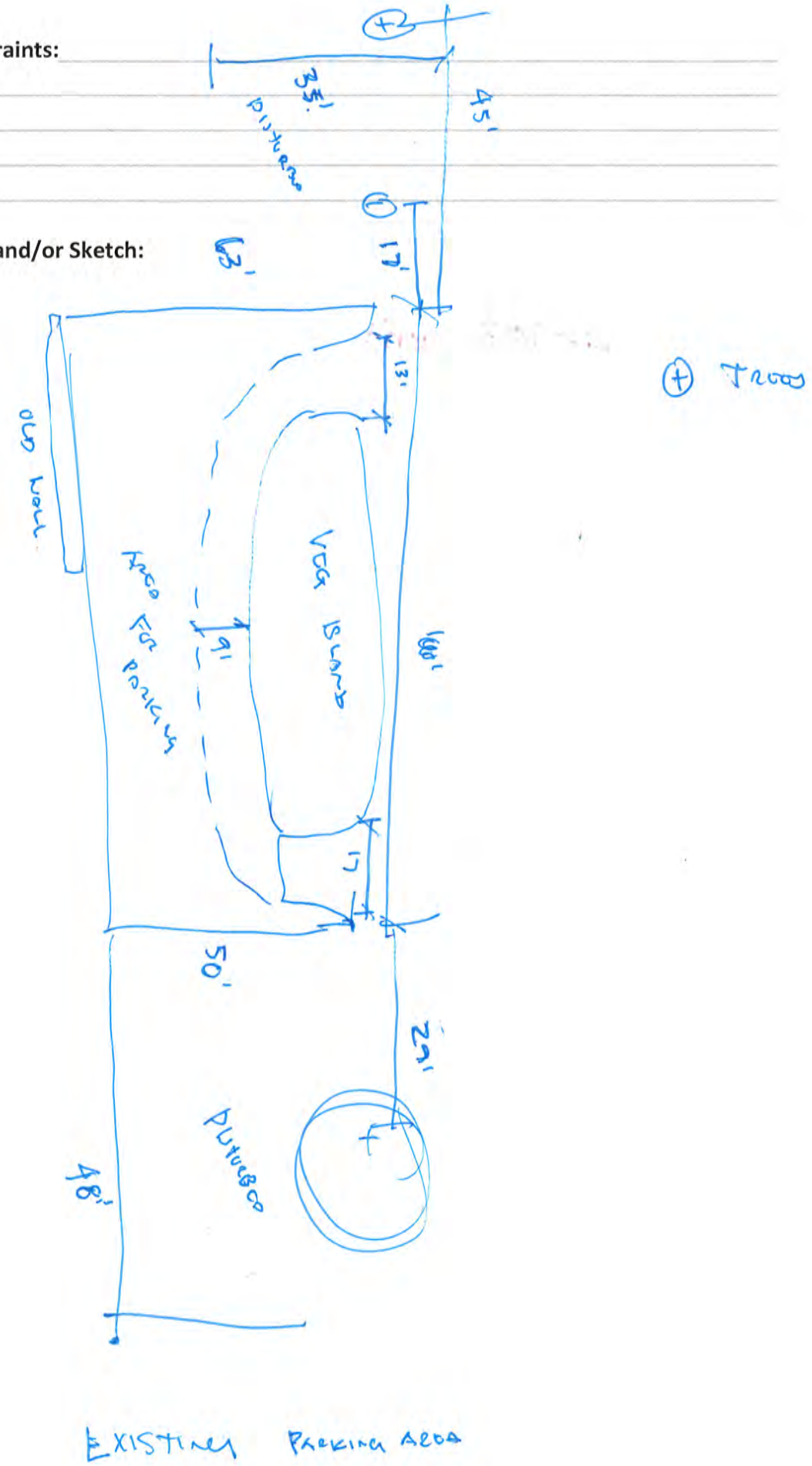
Severe *Not significant*

Description of Proposed Opportunity:

Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

Additional Notes and/or Sketch:



Site ID: LL157	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 7:16 PM
Project Type: • Residential Stewardship	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Gravel driveway flows onto road. Sediment ends up in broad dip.

Description of Proposed Opportunity:
Waterbar on driveway. Intercept runoff before reaching road.

Challenges/Constraints:
On private land, would require landowner cooperation.

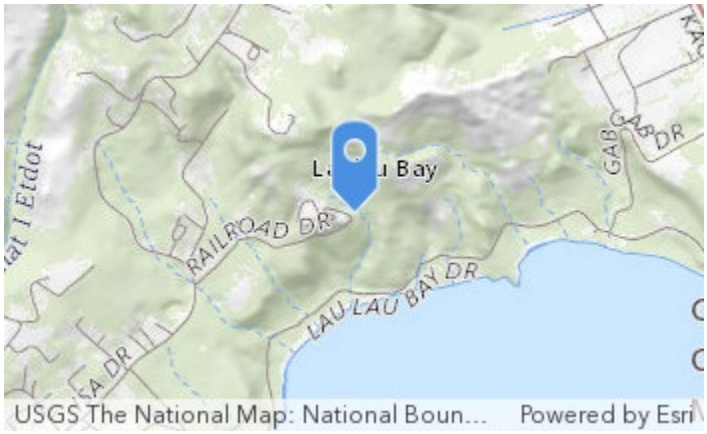
Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Site ID: LL161	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 7:52 PM
Project Type: • Drainage Infrastr., Maint. & Repair • Stormwater Retrofit	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Paved road runoff flows to informal discharge point.

Description of Proposed Opportunity:
Formalize drainage/control outfall.

Challenges/Constraints:
Very steep, not much room.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL - ~~167~~ 161 ~~159~~

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

PAVED RUNOFF STEEP SLOPE TO ~~DITCH~~ INFORMAL DISCHARGE POINT

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

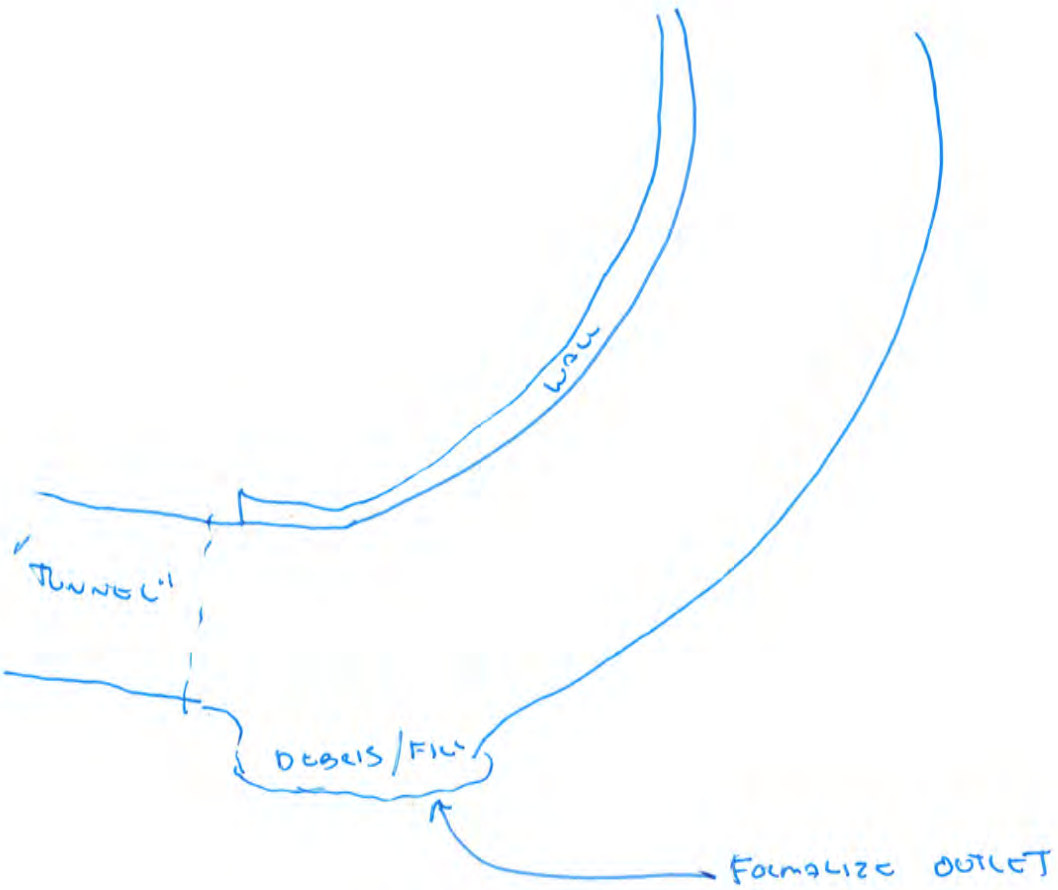
FORMALIZE DRAINAGE — CONTROLLED OUTFALL ?

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

STEEP SLOPES - LIMITED SPACE) CONCENTRATED HIGH VELOCITY FLOW

Additional Notes and/or Sketch:



Site ID: LL167	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 8:22 PM
Project Type: • Stormwater Retrofit	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Low point at at dirt/pavement transition. Runoff discharges off site.

Description of Proposed Opportunity:
Formalize/stabilize low point to reduce erosion. Could be built in conjuction with LL173.

Challenges/Constraints:
May cause erosion further up the road at new trnasition between stabilized low point and dirt road.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Site ID: LL173	**Watershed:** Laolao
Crew: EH	**Date/Time:** 01/22/2020 8:54 PM
Project Type: • Drainage Infrastr., Maint. & Repair	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Appears to be an existing vegetated swale with heavily clogged inlet. Runoff from dirt road bypasses swale and discharges to main road.

Description of Proposed Opportunity:
Clean and re-establish inlet. Consider broad dip to intercept runoff upgradient. See LL167-- can be same project.

Challenges/Constraints:
Future clogging from dirt road. Ongoing maintenance.

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Site ID: LL204	**Watershed:** Laolao
Crew: EH	**Date/Time:**
Project Type: • Drainage Infrastr., Maint. & Repair	
Enforcement Needed: Yes	
Severity Rating: 2	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Broad dip across road (see LL149) with branches and debris.

Description of Proposed Opportunity:
Clean and clear.

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

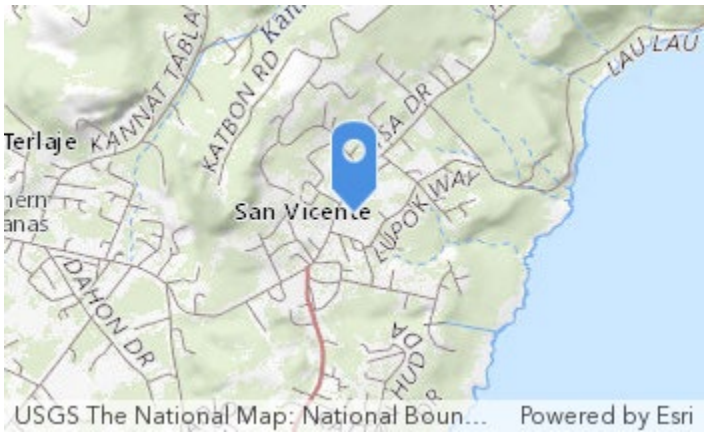
Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

Site ID: LL311	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/21/2020 11:31 PM

Project Type:
- Bank stabilization



Enforcement Needed: No

Severity Rating: 2

Implementation Priority: Not that important (Low)

Descriptions of Existing Conditions:
channel with 2:1 slope. Munch says grass erodes and soil slopes wash into swale.

Description of Proposed Opportunity:
ERSC blanket or drought tolerant vegetation. Gabion basket!

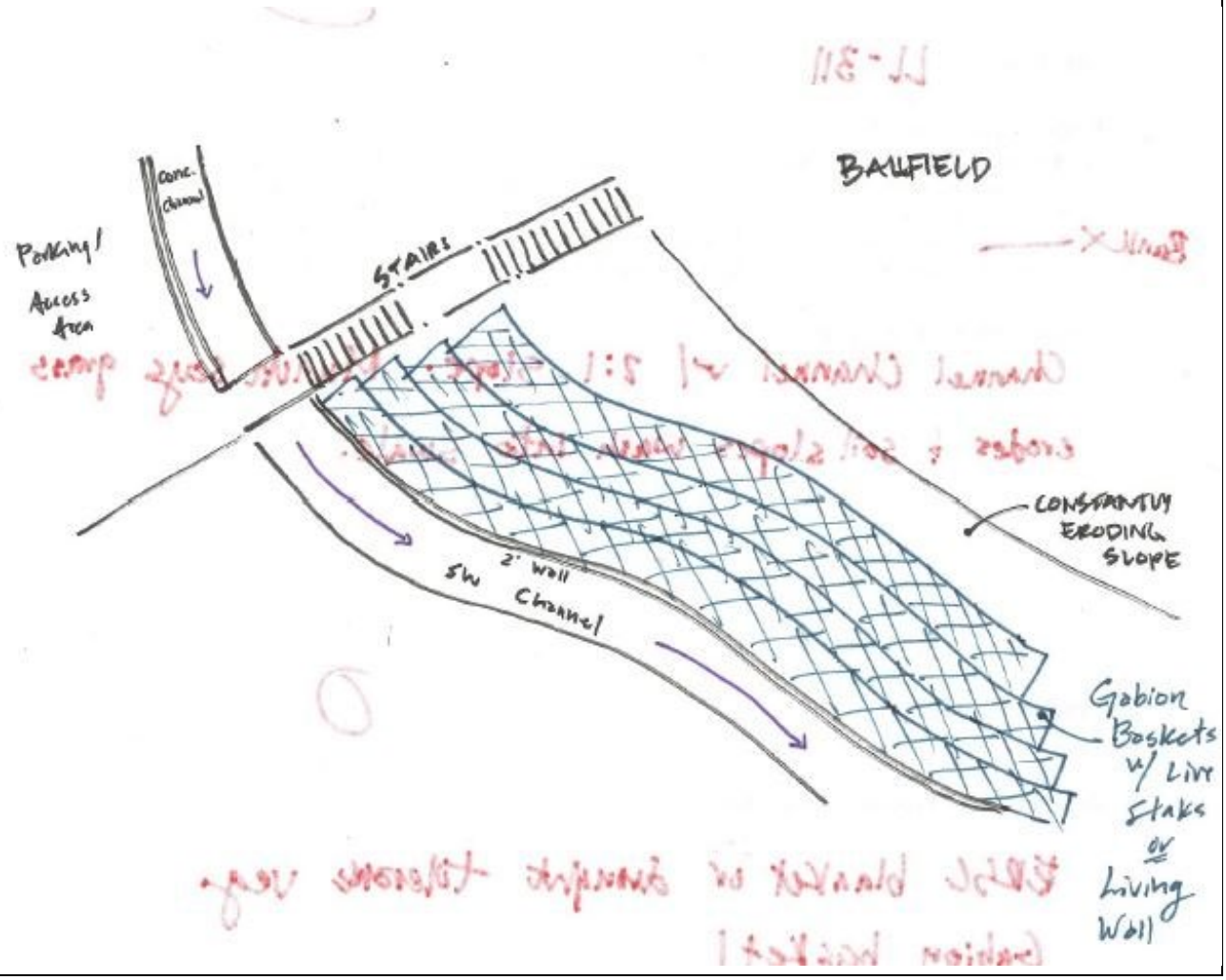
Challenges/Constraints:
Flex MSE wall? stone gabions? ground cover with ERSC blanket?

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos



2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL-311

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☒ ~~Shoreline~~ Bank Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Channel Channel w/ 2:1 slope. Munch says grass erodes & soil slopes wash into swale.

Severity/Rating (circle): 5 *Severe* 4 3 (2) 1 0 *Not significant*

Description of Proposed Opportunity:

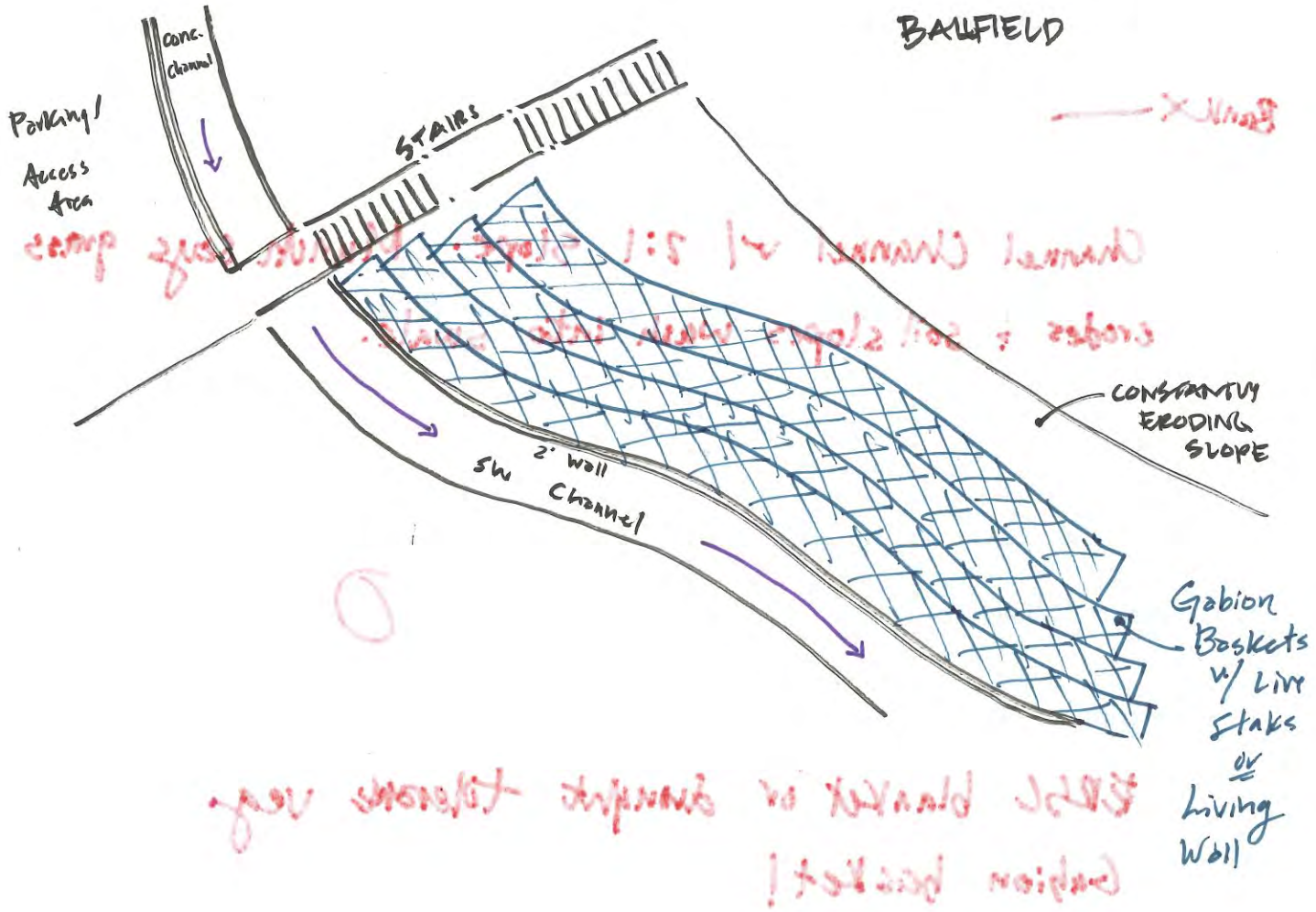
ERSC blanket or drought tolerant veg. Gabion basket!

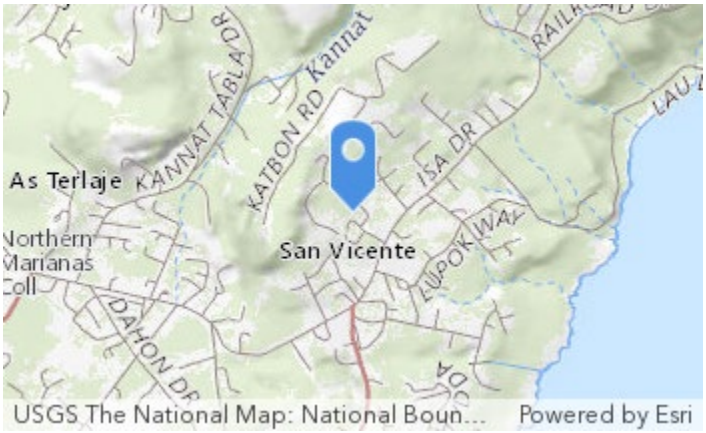
Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☒ not that important (low) ☐ unsure

Challenges/Constraints: Flex MSE Wall ? Stone Gabions ?

Ground cover with ERSC blanket ?

Additional Notes and/or Sketch:



Site ID: LL318	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/22/2020 1:27 AM
Project Type: • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Dirt road gullying. Top of Bentana Drive, gullying on SW edge for 50 LF. pitch 20% +/-

Description of Proposed Opportunity:
Waterbars 25' O.C.

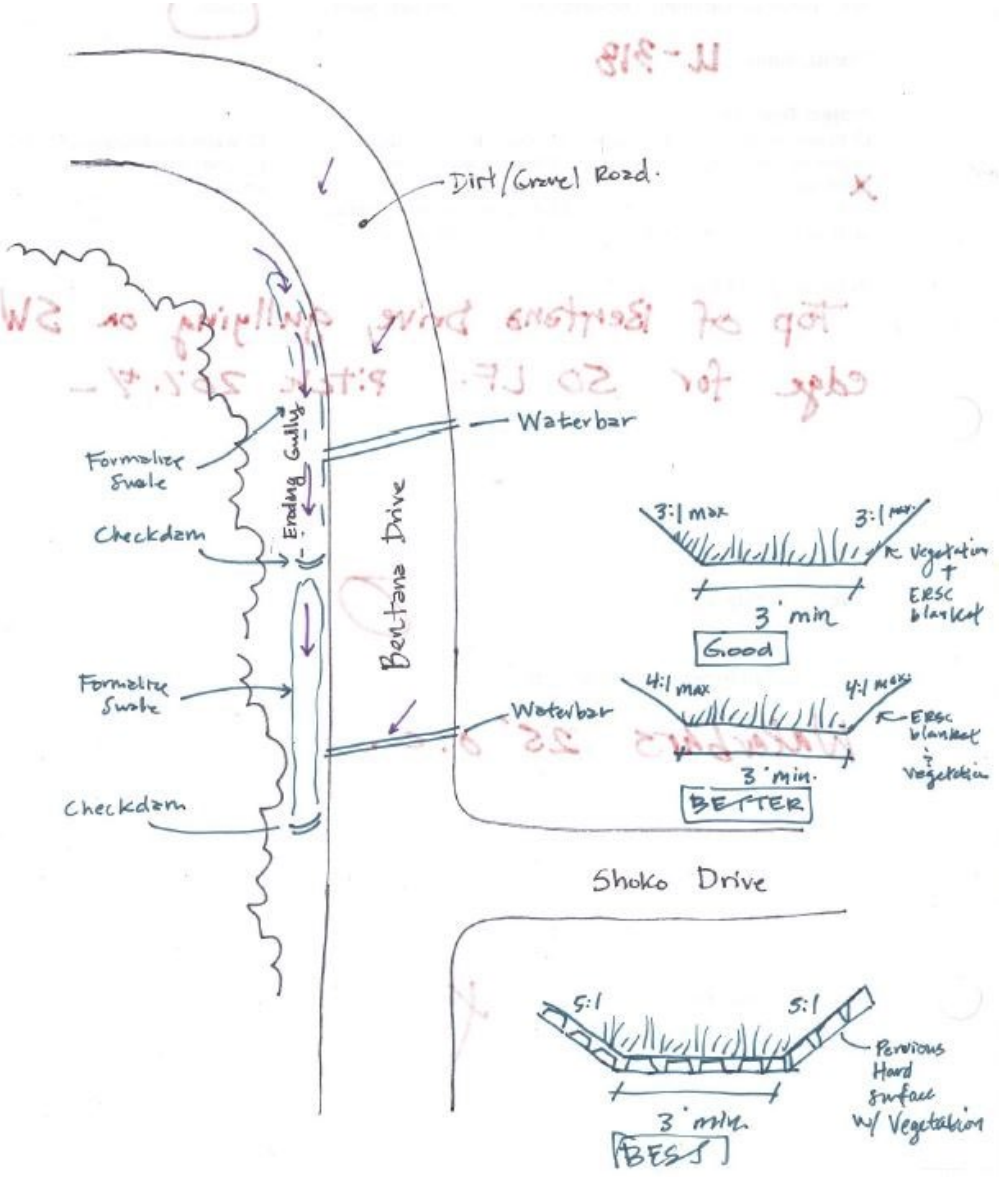
Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos



2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK (BL) AK EH JI

* Delete DR point

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-318

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Top of Bentana Drive, gullying on SW edge for 50 LF. Pitch 20% +/-

Severity/Rating (circle): 5 *Severe* 4 (3) 2 1 0 *Not significant*

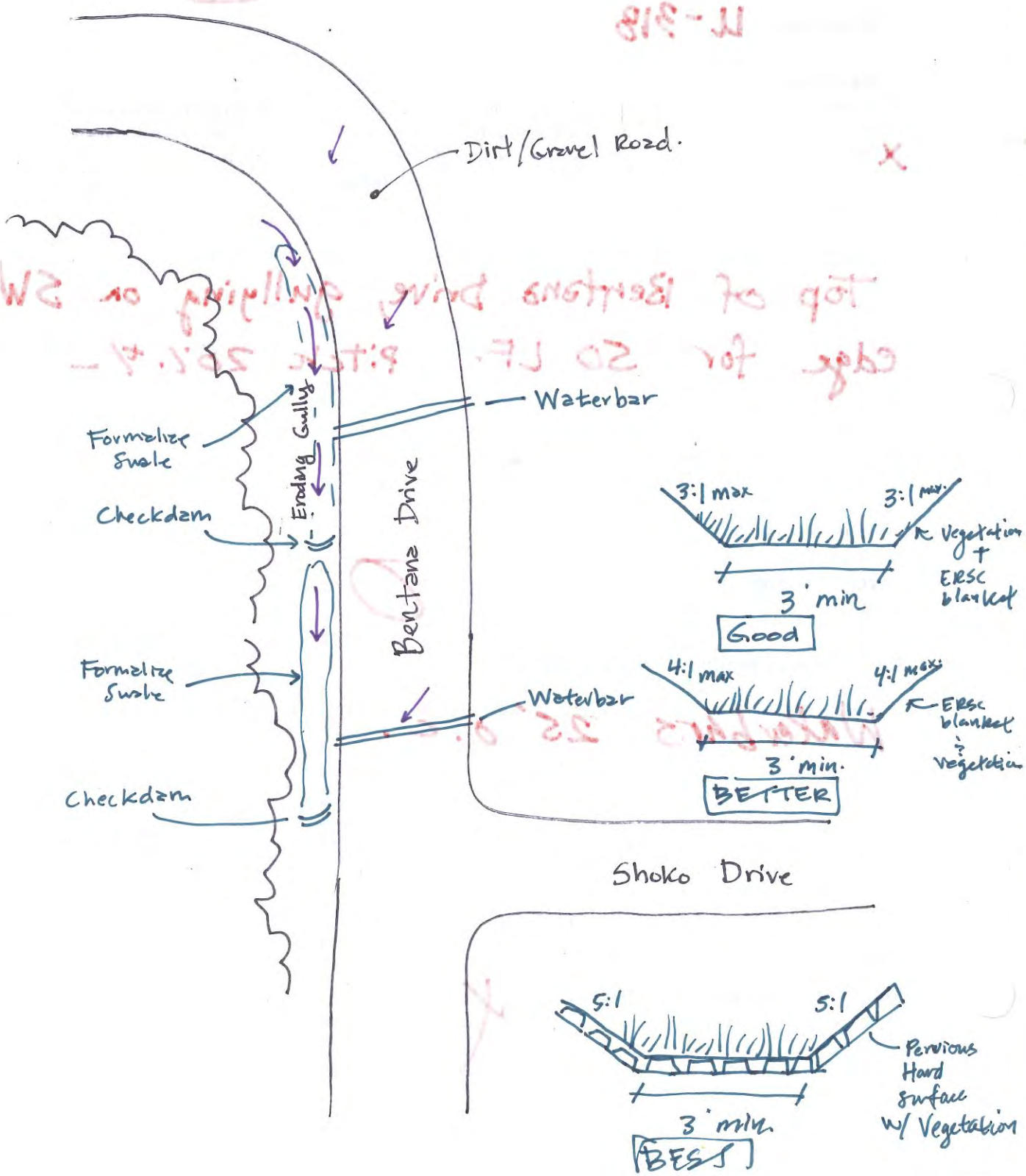
Description of Proposed Opportunity:

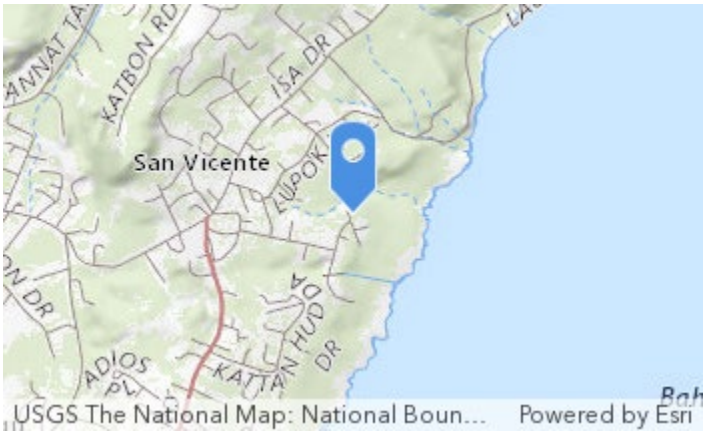
Waterbars 25' o.c.

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints:

Additional Notes and/or Sketch:



Site ID: LL336	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/22/2020 12:04 AM
Project Type: • Watershed Education/Signage	
Enforcement Needed: Yes	
Severity Rating: 4	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Sinkhole on private property - connects to a stream and then directly to the ocean. It is currently an illegal trash dumping site.

Description of Proposed Opportunity:
Clean up trash. Create educational opportunity and tourist attraction for people to go into the hole and listen to the ocean.

Challenges/Constraints:
Private property

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption: side of road

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☐ No

Completed by (circle): BK BL AK EH (JI)

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL 336

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☒ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

sinkhole on private property - connects to stream and ocean directly; currently an illegal trash dumping site

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

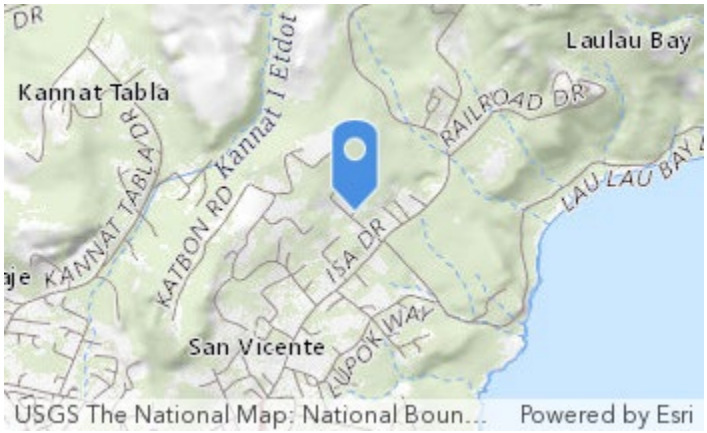
Description of Proposed Opportunity:

Clean up trash. Create educational opportunity & tourist attraction for people to go into the hole and listen to the ocean

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: private Property

Additional Notes and/or Sketch:

Site ID: LL351	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/22/2020 8:25 PM
Project Type: • Unpaved Road Stabilization	
Enforcement Needed: No	
Severity Rating: 4	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Serious erosion on one side of the road/ Road across from Lao Lao Bay Drive - James Lin road (private) - southwest edge is gullying. space is available for pocket settlement basins. waterbars.

Description of Proposed Opportunity:
2-3 settling basins with waterbars

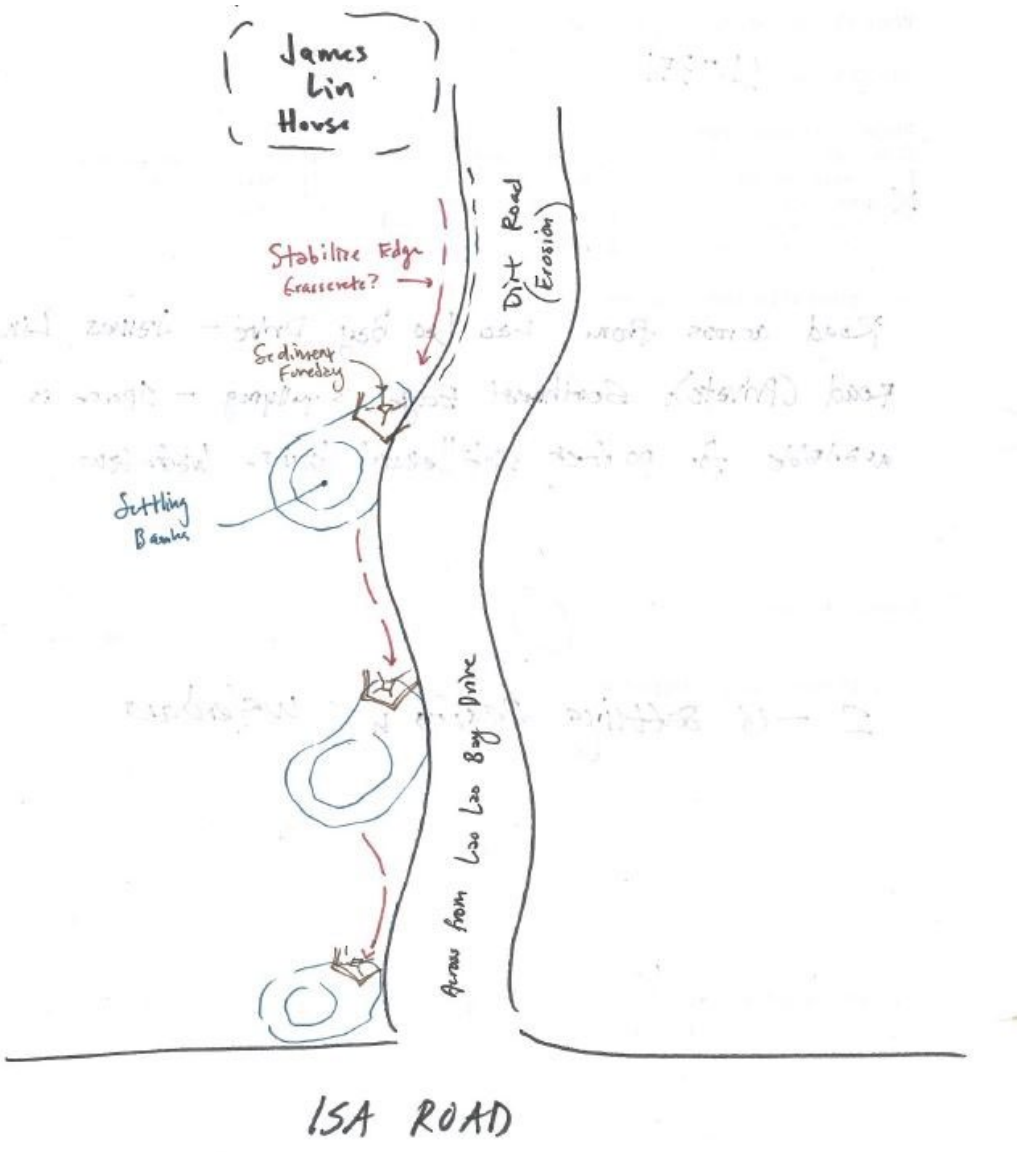
Challenges/Constraints:
Private road, need to go to dpw or mayor

Additional Notes:
Contributing to Lao Lao Bay settling basin (target source not symptom)

Site Photo

Site Overview Caption:

Additional Site Photos



2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☒ Yes ☐ No

Completed by (circle): BK (BL) AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-351

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☒ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Road across from Lao Lao Bay Drive — James Lin Road (Private). Southwest Edge is gullying — Space is available for pocket settlement basins. Water bars

Severity/Rating (circle): 5 *Severe* (4) 3 2 1 0 *Not significant*

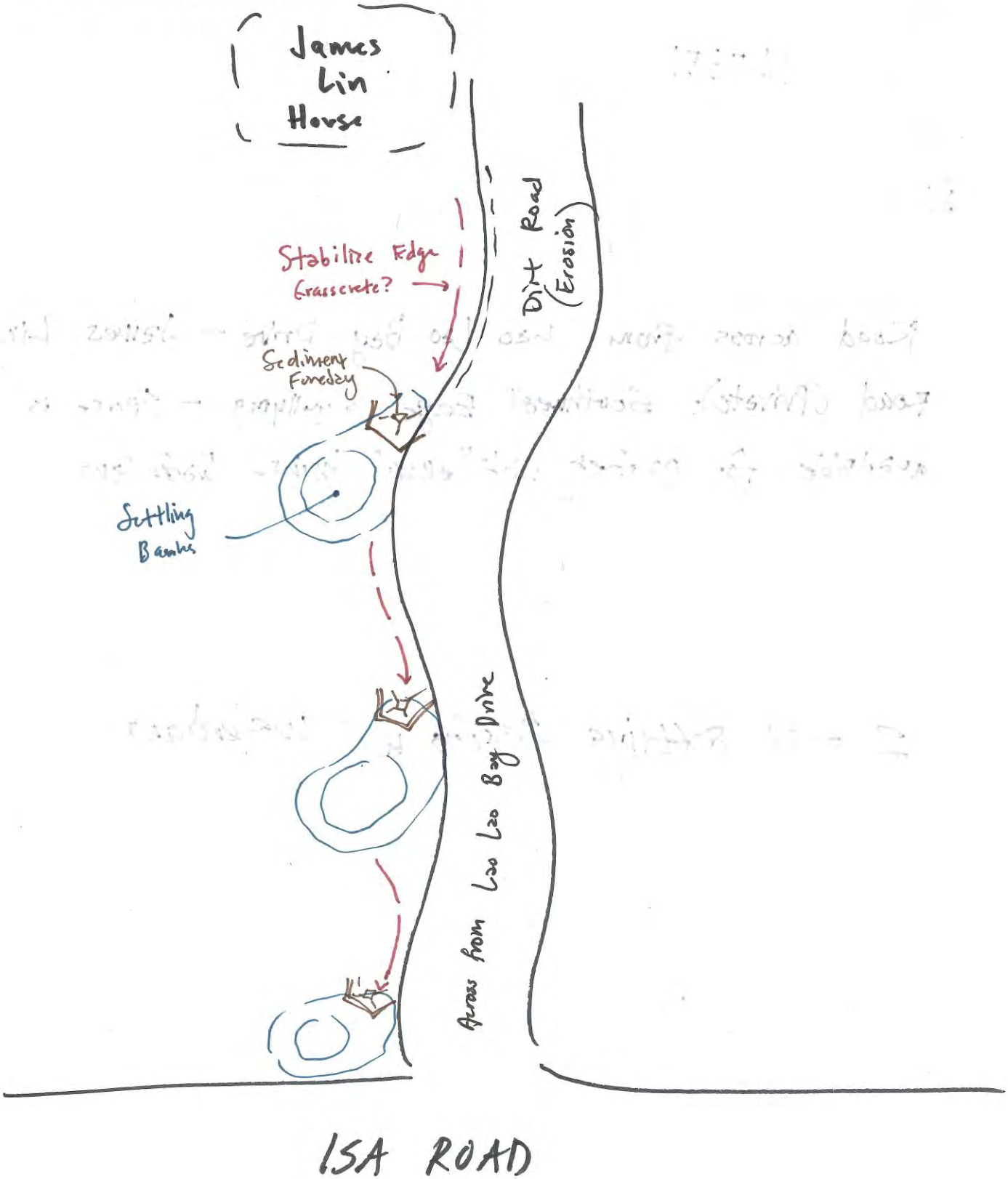
Description of Proposed Opportunity:

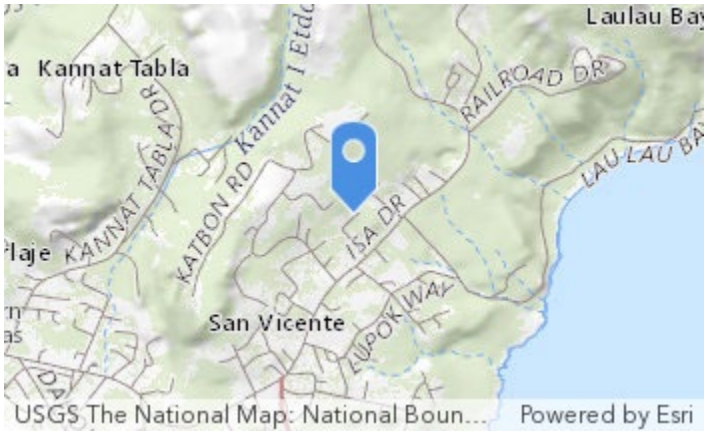
2 — 3 settling basins w/ waterbars

Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: Contributing to Lao Lao Bay Settling Basin (Target Source not Symptom)

Additional Notes and/or Sketch:



Site ID: LL352	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/22/2020 8:46 PM
Project Type: • Construction Site ESC	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: Love it! (High)	

Descriptions of Existing Conditions:
Palu Road construction. No ERSC - full catch basin at Isa Dr. No silt sack. No track pad. Staging area at top of hill with brush clear. Street next to Palu Road also has construction and not much ESC was observed.

Description of Proposed Opportunity:
Enforcement. ERSC - lack of awareness by DPW. Silt sack in ex. cbs. cover stockpiles, silt sock around stockpiles.

Challenges/Constraints:
Saw this too much at construction site. clearing before ERSC.

Additional Notes:
No erosion control measures from construction up above, staging area at top of hill but no ESC

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☒ Yes ☐ No

Completed by (circle): BK (BL) AK EH JI

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL-352

Project Type (check box):

- ☐ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Palu Road construction. NO ERSC- full CB @ 1st no silt sack. Staging area @ top of hill with brush clew

Severity/Rating (circle): (5 *Severe*) 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

ERSL - Lack of awareness by DPW

Silt sack in ex. cbs.

Cover stockpiles

Silt Sock around Stockpiles

Implementation Priority: ☒ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: SAW this too much @ construction site. Clearing before ERSC.

Additional Notes and/or Sketch:

Site ID: LL377	**Watershed:** Laolao
Crew: JI	**Date/Time:** 01/22/2020 11:56 PM
Project Type: • Drainage Infrastr., Maint. & Repair	
Enforcement Needed: No	
Severity Rating: 3	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
Washout along side of concrete swale into woods. Flume into wooded area is blown out on road side. runoff can't make turn.

Description of Proposed Opportunity:
Add berm or curb edge. simple and easy to avoid sediment input.

Challenges/Constraints:

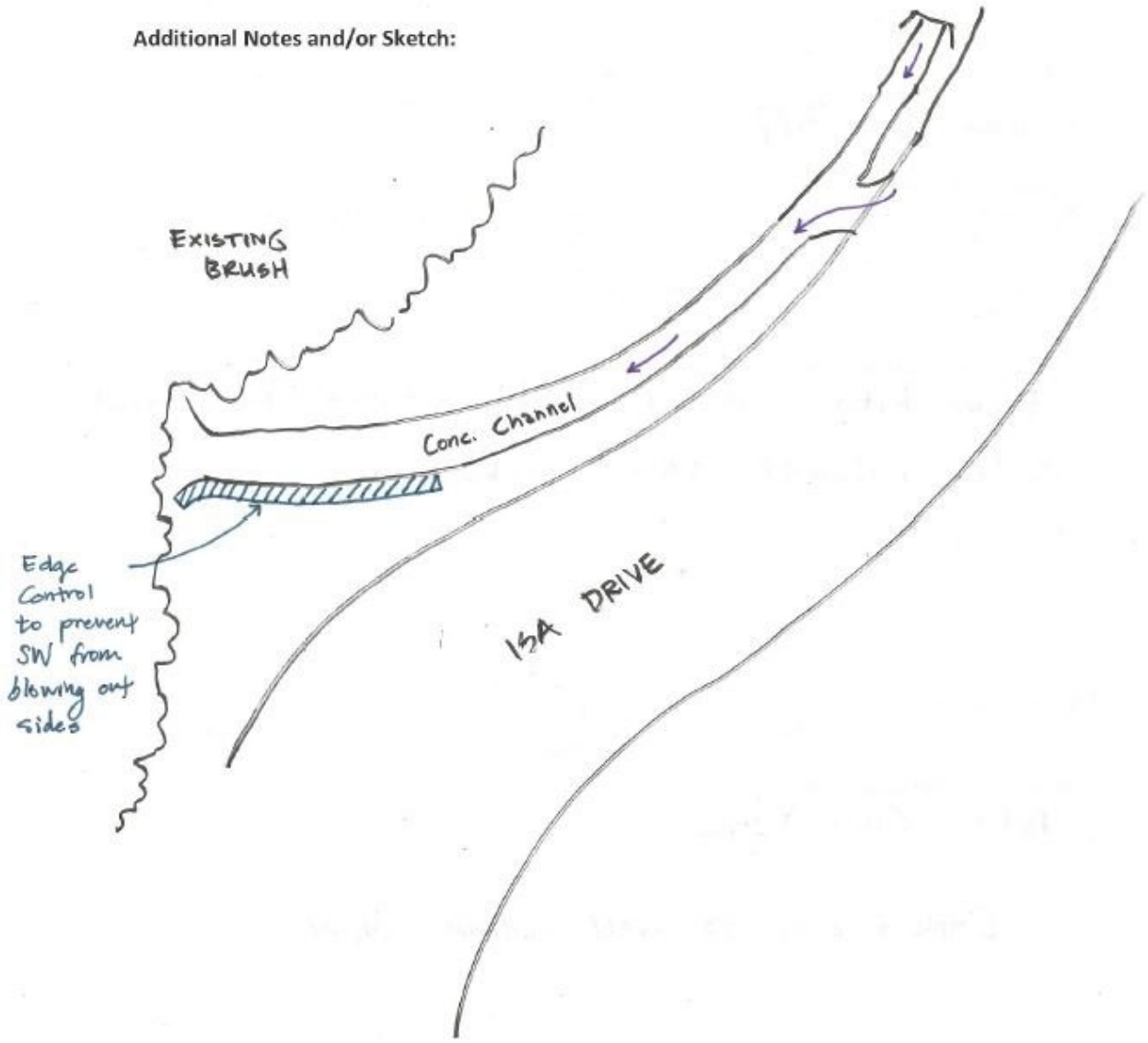
Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Notes and/or Sketch:



2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☐ Yes ☒ No

Completed by (circle): BK BL AK EH JI

Watershed (circle one): Achugao North Achugao South Laolao Garapan

Site ID/Name: LL-377

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

Flume into wooded is blown-out on road side. Runoff can't make turn

Severity/Rating (circle): 5 *Severe* 4 3 2 1 0 *Not significant*

Description of Proposed Opportunity:

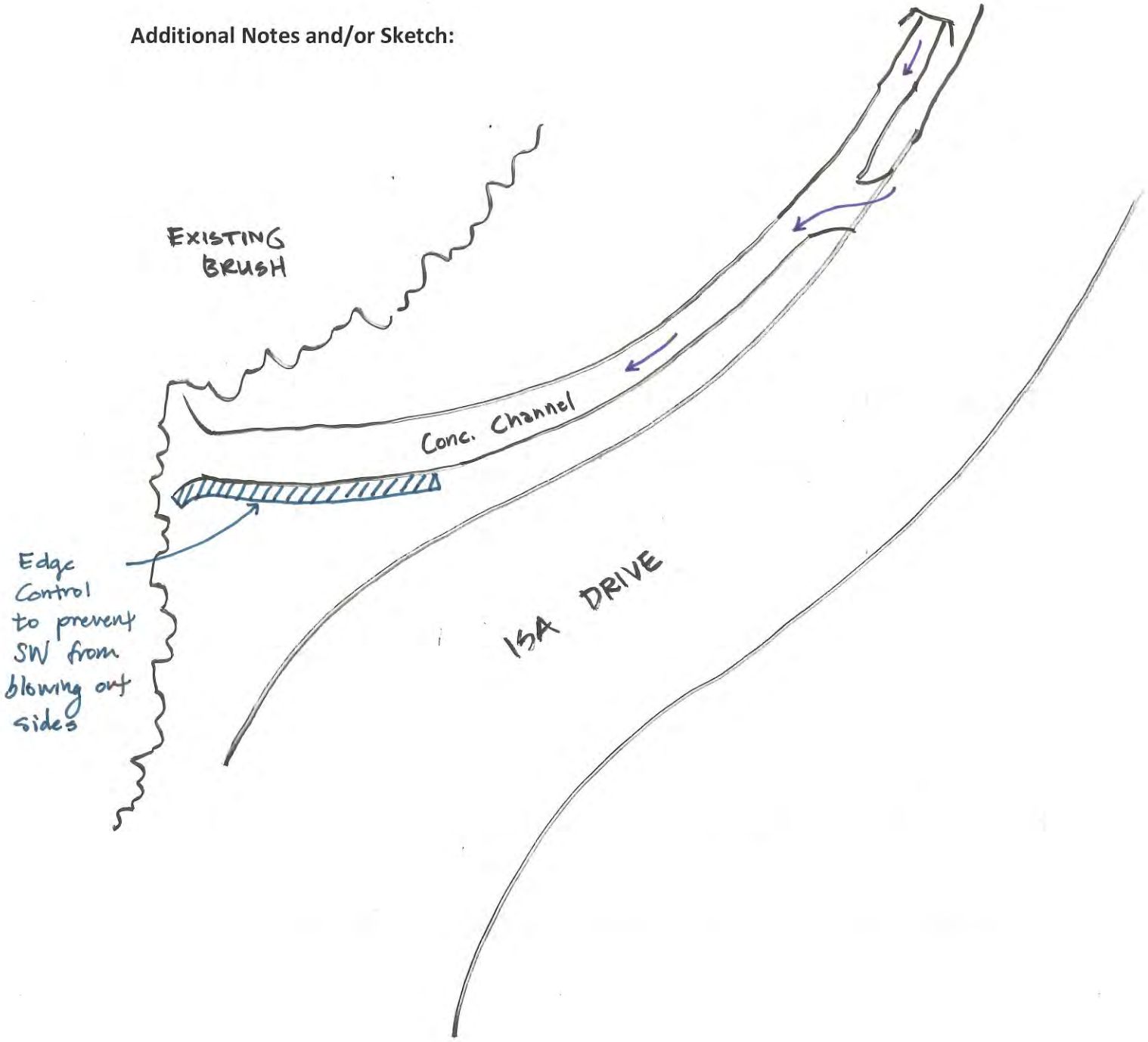
Add Curb Edge

Simple & easy to avoid sediment input.

Implementation Priority: ☐ Love it! (high) ☒ It is OK (med) ☐ not that important (low) ☐ unsure

Challenges/Constraints: SW is moving extremely fast downhill & doesn't want to make turn with Channel. Side slope is being eroded as result.

Additional Notes and/or Sketch:



Site ID: LL382	**Watershed:** Laolao
Crew: JI	**Date/Time:**
Project Type: • Drainage Infrastr., Maint. & Repair	
Enforcement Needed: Yes	
Severity Rating: 5 (Severe)	
Implementation Priority: It's OK (Med)	

Descriptions of Existing Conditions:
catch basin in post office parking lot is full of vegetation

Description of Proposed Opportunity:
clean out catch basin

Challenges/Constraints:

Additional Notes:

Site Photo

Site Overview Caption:

Additional Site Photos

Additional Photo Caption:

Additional Photo Caption:

2020 SAIPAN WATERSHED FIELD NOTES

Enforcement Needed: ☒ Yes ☐ No

Completed by (circle): BK BL AK EH (JI)

Watershed (circle one): Achugao North Achugao South (Laolao) Garapan

Site ID/Name: LL 382

Project Type (check box):

- ☒ Drainage Infrastr. Maint. & Repair
- ☐ Stormwater Retrofit
- ☐ Unpaved Road Stabilization
- ☐ Shoreline Stabilization
- ☐ Stream/Wetland Restoration
- ☐ Upland Revegetation/Restoration
- ☐ Wastewater Improvement
- ☐ Construction Site ESC
- ☐ Pollution Prevention (hotspot)
- ☐ Residential Stewardship
- ☐ Watershed Education/Signage
- ☐ Land Conservation
- ☐ Other _____

Description of Existing Conditions:

catch basin in post office parking lot is full of vegetation

Severity/Rating (circle): (5) 4 3 2 1 0

Severe *Not significant*

Description of Proposed Opportunity:

clean out catch basin

Implementation Priority: ☐ Love it! (high) ☐ It is OK (med) ☐ not that important (low) ☐ unsure