

# Nature-based solutions (NbS) for enhanced climate resilience of informal settlements: Honiara, Solomon Islands

An integrated approach to strengthening climate action, improving urban environment, and providing more resilient settlements for the urban poor:  
Koa Hill case study

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## Executive Summary

This report provides a summary of the design, implementation, and outcomes of the SIDA-funded project *'An integrated approach to strengthening climate action, improving the urban environment, and providing for more resilient settlements for the urban poor'*, focusing on the Koa Hill settlement in Honiara, Solomon Islands. The short-term project was administered by UN-Habitat and led by RMIT University, in partnership with Pacific Solomon Engineering and Consultancy Limited (PacSol) – a Honiara-based urban planning and engineering consultancy; and Kastom Gaden Association, a Solomon Islands horticultural NGO specialising in urban organic farming. Community engagement was supported by the local UN-Habitat office.

The project had four main components:

- 1) Community and stakeholder workshops to raise awareness, as well as identifying climate-related issues in the community and potential Nature-based Solutions (NbS);
- 2) The design and implementation of at least three NbS pilots validated by the community;
- 3) Dissemination of the NbS actions and their benefits; and
- 4) A NbS training workshop.

Initial community feedback, and field analysis by PacSol, identified three types of interventions: flood defence, landslide prevention, and an urban garden to improve local food security. In the end, a total of four actions for piloting nature-based solutions in Koa Hill were implemented at sites chosen by the community:

1. An urban garden project at Central Valley Community (Koa Hill Riverbank Zone 27), including a plant nursery;
2. Flood prevention along Koa Hill riverbank by planting vetiver grass and bamboo (Zone 26 and Zone 27);
3. Landslide prevention on the top hill of Koa Hill Zone 26 (vetiver grass);
4. Landslide prevention using vetiver grass for slope stabilization in Central Valley Community (Koa Hill Riverbank Zone 27).

Additional settlement upgrading activities were also undertaken as part of the project. These included the construction of new steps to the river punts, known locally as 'floaters' (transportation across the river being the main access route for the community), new jetties, a raised footpath for the rainy season, bridges, a plant nursery of vetiver and lemon grass, a play area for young children, and a volleyball court for teens (including new sporting equipment). It is intended that building community resources on the flood plain will discourage new house building in such a high-risk area.

The underpinning rationale for the project was to generate a proof of concept and approach for similar urban poor communities in Solomon Islands, the wider Pacific region, and other countries in the Global South. In this case, community members of Koa Hill actively participated in the development and actual implementation of NbS, contributing 50% of labour as well as traditional ecological knowledge and cultural management practices, and can be considered representative of a successful 'community-led' initiative to reduce disaster risk and improve local food security through NbS. Local consultants, PacSol, also contributed funds from their budget to the local community fund to maintain assets beyond the life of the project, thus maximising the longer-term sustainability of the NbS actions.



# 1. Introduction

## 1.1. Project background

This project is a component of the UN-Habitat *Integration of nature-based solutions (NbS) in country-level operations of the Resilient Settlements of the Urban Poor (RISE UP)* programme with funding provided by the Swedish International Development Agency (SIDA). Honiara, the capital city of the Solomon Islands, was selected as a site to pilot NbS and urban biodiversity actions in the context of upgrading and building climate resilience in informal settlements. As part of this programme, Nature-based Solutions (NbS) were identified as a cost-effective and inclusive way of enhancing the climate resilience of urban informal residents while working closely with the natural environment; at the same time as improving urban liveability.

The Koa Hill informal settlement along the Mataniko River was previously identified by the Honiara Urban Resilience and Climate Action Plan (HURCAP)<sup>1</sup> as a climate vulnerability hotspot and profiled in detail in the 2017 Report *Koa Hill Community Climate Resilience Report*<sup>2</sup>. The settlement was severely impacted by a record-breaking extreme rainfall event in April 2014, when flash flooding resulted in a number of fatalities and the destruction of many houses. At the time, flood mitigation measures along the riverbank and landslide prevention on the steep slopes were identified as a priority; along with the design of shared community spaces that would allow for urban gardens, sports, recreation, and other community activities. The use of participatory approaches facilitating and promoting community ownership was also considered a key action to help to deter new housing construction in this area of high flood risk.

A multi-disciplinary team from RMIT University led the project, with the local pilot NbS interventions implemented by Honiara-based partners Pacific Solomon Engineering and Consultancy Ltd (PacSol) and Kastom Gaden Association (KGA), with the support of the UN-Habitat local office. PacSol led the community engagement processes and also provided the local technical expertise to design and implement the flood and landslide actions; ensuring that they were fit for local purpose (implementation being supported by staff and students from the Solomon Islands National University). KGA, a local NGO working on customary (traditional) food production combined with modern approaches to create an environmentally sustainable approach to small-scale food production, were responsible for the urban garden and nursery.

The project was implemented over a four-month period, from September to December 2022, in the Koa Hill informal settlement area of central Honiara.

## 1.2. Case study context: Koa Hill Settlement

The settlements around Koa Hill were established on vacant government land in the early 1970s primarily by people from the island of Malaita seeking access to the resources, employment, and educational opportunities offered by a central Honiara location. The legal title to the land is held by the Commissioner of Lands in the Ministry of Lands, Housing and Survey (MLHS), with most of the occupied land broadly categorised by the community as being under Temporary Occupation Licenses (TOLs). However, in many cases, these have lapsed, and occupation has become informal.

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<sup>1</sup> [https://rmit.figshare.com/articles/report/Honiara\\_Urban\\_Resilience\\_and\\_Climate\\_Action\\_Plan\\_HURCAP\\_/19311944](https://rmit.figshare.com/articles/report/Honiara_Urban_Resilience_and_Climate_Action_Plan_HURCAP_/19311944)

<sup>2</sup> Alexei Trundle, 2017. *Koa Hill Community Climate Resilience Report*. Unpublished.

Koa Hill is close to central Honiara on a steep hillside next to the Mataniko River. It covers an area of 0.17 km<sup>2</sup> and ranges in elevation from around five to 70 metres above sea level. The area's steep topography prevented formal development and subdivision and lacks road access. The main road is on a steep ridgeline to the southeast, inaccessible to the communities of Koa Hill except by crossing the Mataniko river on community-constructed floating punts.



**Community-constructed 'floaters' for crossing the Mataniko river**

The upper parts of the settlement are at risk from landslips following heavy rainfall, while dwellings on the floodplain or near the riverbanks are at severe risk of riverine and flash flooding from the Mataniko River. Indeed, Koa Hill was one of the key vulnerability hotspots identified in the 2014 UN-Habitat *Honiara Vulnerability & Adaptation Assessment* (VAA). Shortly after the VAA was released, the Koa Hill area was severely impacted by a record-breaking extreme rainfall event (April 2014). The floods resulted in 22 fatalities and the destruction of an estimated 675 houses, with a total damage and loss bill estimated to be more than US\$100 million.



**Houses built on steep slopes in zone 26 and inaccessible pathways in zone 27**



The Koa Hill communities face several climate-related vulnerabilities, in particular:

- **Informal water supply** (a strong pull factor for people that have come to the area); drawn from community-built wells and pipe networks. However, this resource is at risk from encroachment-driven contamination;
- **Landslides**, particularly at the top of the Koa Hill escarpment;
- **Inadequate drainage**, with erosion, septic and solid waste pollution, and stagnation-driven disease providing secondary sources of hazard exposure to the community.



**Central Valley landslide risk hotspot in Zone 27 with community-built water pipes**

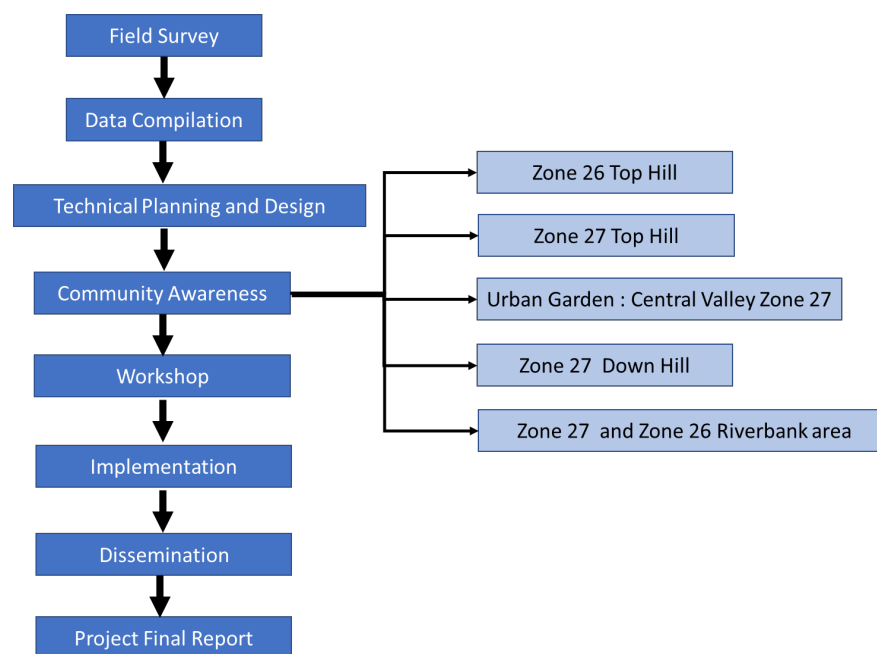
Other community issues include a lack of road access and safe footpaths, lower-quality housing, poor waste sanitation, and overcrowding. There is no sewerage infrastructure or rubbish collection services (a consequence of limited road access), with pit toilets constructed out of locally found materials on a per-household basis; leading to heavy pollution of the Mataniko River.



**Dumping of waste, pit toilets, and poor-quality housing affect Koa Hill informal settlement**

## 2. Community engagement

The project was deliberately designed to be highly participatory, engaging directly with community members in the Koa Hill informal settlement to identify their issues of most concern, and to co-design locally appropriate NbS. Community engagement took the form of multiple formal and informal consultative meetings, co-design workshops, and a variety of activities to implement validated actions. These further facilitated community awareness and support for the project, and resulted in the active participation of community members. The figure below gives an overview of the project phases, with a detailed schedule of project events included in Appendix 1. Although not shown in the figure below, which is restricted to the timeline of the project, a small fund was provided to the community for ongoing maintenance and the local lead of the project, PacSol, continue with local monitoring activities to maximise sustainability of the NbS actions.



**Phases of the NbS project**

PacSol designed and led the local engagement activities together with the Kastom Gaden Association; in consultation with the RMIT University team, the UN-Habitat Honiara local office, and Solomon Water. This collaborative, multi-sector, partnership approach brought in technical expertise and resources including civil engineers, landscape architects, experts on gender and land tenure, horticulture, and hydrology; as well as local, traditional, and Indigenous knowledge and a deep understanding of local social, political, and cultural contexts.

### 2.1 Community awareness-raising

A series of meetings to inclusively engage residents and raise awareness of the NbS project took place throughout September, October, and November 2022. Formal Community Development Committee (CDC) groups, local church groups, youth and women's groups, and children were all involved in the consultative processes.





**Community consultation meetings with CDCs in Zone 26 and 27, Koa Hill**

On-site face-to-face meetings between the local project team and community members representing women, youth, elders and the disabled were critical in ensuring community buy-in; thus enabling successful project implementation and sustainability. During initial site visits the project team also became aware that the Central Valley (riverbank) community, though not included in the formally recognised Koa Hill CDCs in Zones 26 and 27, had its own Chairperson and representative committee. Their commitment to the project proved critical, as the flat land around the Mataniko River floodplain fell under the ownership of the Central Valley Community and was identified as the preferred site for the urban garden pilot.



**On-site awareness raising meetings**

Local community participants gave their observations and advice on design, preferred siting of the pilot NbS and urban garden (and ongoing management), issues that might provoke potential social conflicts, as well as expressing interest in learning more about NbS.



## 2.2 Community co-design workshop

Following on from the awareness-raising activities, an intensive co-design workshop with self-nominated representatives from all three communities was held on 6 November to design and validate locally appropriate NbS to pilot in the Koa Hill area. Workshop activities were informed by aerial and satellite imagery, as well as landscape designs that had been developed in student studios at RMIT during 2019-22 (School of Global, Urban and Social Studies and the School of Architecture and Urban Design). These were developed during the COVID-19 lockdowns when international travel was not possible. The input of local knowledge was actively encouraged at the workshop.



**Participatory workshop held at Tuvaruhu Secondary School**



**The PacSol team leader facilitating group discussions (l), aerial photos used in the community workshops (r)**

Participants were divided into four break-out groups according to the NbS projects to be implemented in Koa Hill: urban garden, riverbank protection, and landslide prevention (zones 26 and 27). The groups discussed a range of social, cultural, and site issues relating to the pilot projects, as well as possible solutions for addressing various local social and environmental challenges.

### 2.2.1 Urban garden group discussion



Community workshop discussions and issue identification

#### Issues discussed:

- Human resources (the existence of youth and women's groups) available to initiate and maintain the urban garden project.
- Agreed that the Urban Garden will help the community economically, such as saving money on having buy vegetables (by producing their own), as well as potentially generating income from sales of produce.
- Involving the youth in the urban gardening project could make them more productive and reduce their unproductive activities such as drinking the locally brewed 'kwaso'.
- The urban garden will also have health impacts by helping the community obtain a more balanced diet as vegetables will be available on site and can provide both short- and long-term produce.

**Problem:** Lack of soil space, use of pesticides, and presence of African Snail in Central Valley. Free range animals can destroy the garden (ducks, chicken, dogs), and drunken people could spoil the garden.

**Solutions:** A fence is needed to protect the garden from animals and intruders, and community engagement and training is needed so the whole community takes responsibility for looking after the garden.

### 2.2.2 Riverbank protection group discussion

**Issues discussed:** Causes of flooding. Rubbish dump site on Mataniko River, riverside garden clearing, no proper drainage, uncontrolled development, soil erosion and heavy rain.

**Impact of flooding:** Property damage, soil erosion, swampy places after flooding, breeding grounds for mosquitos, people sick after flooding, hunger because of gardens being destroyed.





**Koa Hill community members discussing riverbank protection issues**

#### **Solutions:**

- Rubbish management, by separating organic and inorganic rubbish.
- Re-use of inorganic rubbish needs to be a whole-of-community responsibility: both community and individual responsibility is the key.
- Planting bamboo and vetiver grass along the river side, vetiver grass to reduce erosion and bamboo to protect riverbank by slowing down the current hitting the riverbank.
- Human activity and attitudes to look after the project when it goes back to the community responsibility.
- Riverbank wetland: prior to flooding it was dry land, after flooding it became a wetland or swamp area.
- Planting vetiver grass is a solution to dry up the area, and the grass also can be used for feeding domestic animals.

### **2.2.3 Landslide prevention zone 26**



**Community members discussing pilot landslide interventions**

**Issues discussed:** Cause of landslides. Runoff from the main road comes though overflow of rainwater from the road to the residential area through the side of the road and Jacob's ladder (steep concrete stairs built for community access to the main road on the hill top).

**Solutions:** Planting vetiver grass along the road to direct runoff water to the proper drainage channel to prevent soil saturation.



#### 2.2.4 Landslide prevention zone 27



Community members discussing landslide prevention actions in Zone 27

##### Issues discussed: causes of landslide

- Soil on the slopes is saturated.
- 17 privately constructed community dams are adding to the problem because of water leakage.
- Waste dumping on public bath and laundry area are adding to the weight of the cliff face, and during the rainy season the rubbish will wash down and cause landslides.
- Impact: health problems because of lack of proper rubbish disposal including contaminated water sources.

##### Solutions:

- There are no simple solutions for this issue, however planting vetiver grass can reduce the risk of landslide.
- Use 3 layers of brick or a drum for drainage.
- Community awareness-raising and warnings not to throw rubbish in the public baths and laundry area.
- Create an organic farm to grow vetiver to plant on the slopes for greater soil stabilisation.

#### 2.2.5 Actions arising:

- Following on from the workshop, an additional activity was agreed upon for the local project team to provide on-site training for the community to cultivate vetiver in the quantities needed.
- It was also decided that a dedicated nursery house was needed in order to have a safe place for propagating plants including vetiver, bamboo and lemongrass for NbS interventions.



**Koa Hill community workshop participants**

## **2.3 Additional community-led actions**

### **2.3.1 Construction of nursery house for NbS plant propagation**

The construction of a nursery house for the propagation of vetiver grass, bamboo and lemongrass needed for NbS in the Koa Hill settlement was a direct outcome of the community co-design workshop. The rationale for this additional project was that there is no vetiver nursery centre in Honiara and it is quite difficult to source vetiver grass locally for replanting (vetiver grass is non-invasive and must be propagated by hand). A nursery would provide vetiver grass and bamboo for replacing and replanting beyond the initial SIDA-funded project. Furthermore, the nursery is a future-proofing mechanism for both project sustainability and scaling up, enabling Koa Hill residents to provide bamboo and vetiver ready to plant for other communities in the future.

The nursery house construction took 4 days including one day preparing and transporting materials across the Mataniko River on the floating platform, as well as floating bamboo down the river. This activity highlights the difficulty and inaccessibility of Koa Hill and the heightened vulnerability of the inhabitants of the settlement. A 5 x 7 m greenhouse was built for the nursery near the 'sup sup' urban garden site on the Central Valley riverbank floodplain.



**Transporting bamboo and vetiver grass across the Mataniko River on floater**





**Volunteers staking out site for urban garden and constructing the nursery out of bamboo**



**Nursery house for plant propagation**



### 2.3.2 Vetiver grass nursery training

A hands-on training workshop on vetiver grass and lemongrass propagation was held on 16 November (as requested by community members during the co-design workshop). The PacSol team explained the characteristics and multiple benefits of vetiver grass and lemongrass, and methods of propagation. Waste materials (plastic water bottles and cups) were recycled to use as containers, and grass was prepared for propagation. 3,500 slips of vetiver grass and 200 slips of lemongrass were produced during the training session to be used in the NbS implementation phase.



**Vetiver grass propagation training workshop**

## 3. Field surveys and design of NbS pilots

A series of technical field surveys of the Koa Hill area in Zones 26, 27, and Central Valley were conducted concurrently to the community engagement process by PacSol, Kastom Gaden, UN-Habitat, staff and students from the engineering department of the Solomon Islands National University (SINU), and local community volunteers. The field surveys sought to identify the root causes and history of problems such as landslides in Koa Hill, to locate appropriate sites for NbS interventions, and provide further feedback into stakeholder consultations.

Plant varieties to be used for the NbS pilot projects were finalised with input from RMIT researchers and Kastom Gaden. Bamboo and vetiver grass were the main plant varieties selected, along with lemongrass, which has mosquito repellent properties, is a culinary herb with economic value, and provides riverbank stability together with vetiver grass. The planting of NbS occurred prior to the start of the monsoon season (October), thus allowing the plants to mature prior to the onset of the dry season.

Once the sites and technical concepts for the pilot NbS were finalised by the RMIT and PacSol teams, permission was sought from the Commissioner of Lands (MLHS) and the Director of Environment at the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECCDM). With permissions in place, a planning permit was approved by Honiara City Council (HCC) to undertake the proposed NbS pilots. This was to ensure that all actions taken were legal and all relevant local stakeholders, including government, were aware of the project actions.





### Field surveys in landslide and flooding hotspots

Findings from the field surveys included information that landslides in Zone 26 tend to be caused by water runoff from the main road on the top of the escarpment, which erodes the soil at the top of the hill because there are no road drainage channels or protective vegetative groundcover. Critical attention and diversion of water is needed to prevent soil saturation. Landslides at Central Valley are caused by the water intrusion from sewerage and water runoff from the public bath and laundry water sources. The field surveys were also utilised by the PacSol-SINU team as another avenue for inclusive participation and to benefit from applied learning opportunities for a range of stakeholders, particularly university students from SINU and local community volunteers.



### SINU students benefiting from on-the-ground learning during field surveys



## 4. Implementation of pilot nature-based solutions in Koa Hill

### 4.1. Overview of implementation actions

Four projects were chosen for the final NbS pilots:

1. Urban garden project at Central Valley Community (Koa Hill Riverbank Zone 27)
2. Flood prevention along Koa Hill Riverbank planting vetiver grass and bamboo (Zones 26 and 27)
3. Landslide prevention on the top hill of Koa Hill Zone 26 planting vetiver grass
4. Landslide prevention using vetiver grass for slope stabilization in Central Valley Community (Koa Hill riverbank zone 27)

Several additional infrastructure projects were also implemented outside of the original scope of the project brief. These occurred at the request of the Koa Hill community arising from co-design processes and in response to some unforeseen hazards, including a rainfall-triggered riverine flooding event and a magnitude 7 earthquake during the project implementation period. These additional low-cost but high-value activities were funded from the budget of the local project team; adding value to the originally-proposed pilot NbS activities. Additional activities included:

- Vetiver grass nursery build,
- Site clean-up after river flooding on 11 Nov 22 (Central Valley),
- Bamboo fencing preparation,
- Jetty construction, bridges and staircase, footpath upgrading, plus volleyball and futsal fields on the riverbank floodplain for community recreation and to further prevent housing encroachment in the flood risk zone.

### 4.2 Pilot 1: Urban garden, Koa Hill Central Valley riverbank zone 27



Location of urban garden on riverbank

Locally named the 'Sup Sup Garden' the pilot urban garden was located on the upper reaches of the riverbank floodplain in Central Valley, but not in an immediate flood danger zone. Several previous options had been put forward by the community for consideration but were located on private property or were inaccessible due to tightly surrounding housing (making those sites a trigger for

potential social conflicts in the future). The location needed to be easily accessible by the public as a demonstration project by the Kastom Gaden Association to teach community members how to grow various plants in different conditions.

The final site on the Central Valley Riverbank area was chosen by PacSol and Kastom Gaden in consultation with key community representatives as it had ready access to water and sunlight and was easily accessible by the public on flat, open space, land despite being on a flood prone area of the Mataniko riverbank. This land was privately owned by the Chairman of the Koa Hill Central Valley Mataniko Riverbank, whose house overlooked the site, thereby providing security (e.g. from vandalism or theft) and safety for both people and infrastructure.

Following the flooding event on 11 November, PacSol requested that Kastom Gaden create raised beds to protect the garden during flooding, so that the garden would have a greater chance of survival in future rain events.

The site was approximately 146m<sup>2</sup> with a seating area integrated into the design. The nursery greenhouse for NbS plant cultivation was co-located with the urban garden, creating an integrated public space.



**Completed urban garden with raised beds**





**Urban garden demonstration plots**



**Community exhibition (December 2022)**



**Vetiver nursery next to urban garden with vetiver, bamboo, and lemongrass propagation**



### 4.3 Pilot 2: Flood mitigation: Koa Hill riverbank (zones 26 and 27)



NbS flood mitigation pilot site along riverbank (l), flood risk map (r)

Flood mitigation and riverbank protection NbS actions included planting vetiver grass and bamboo along the riverbank. 1,800 slips of vetiver grass along 650 metres of riverbank were planted by Koa Hill children, women and youth. Bamboo fences were prepared by community volunteers and erected along the track marked out for the pilot NbS intervention to mark out and protect the new plantings, and bamboo that had previously been planted along the riverbank by the Anglican church youth was replaced and replanted after many were washed away by flash flooding.

#### 4.3.1 Riverine flood Mataniko River 11 November 2022

An unexpected event occurred during the project implementation period. Heavy rainfall on Friday 11 November caused flooding to areas along the Mataniko River. Gardens on the Central Valley riverbank sedimentation side were washed away, flood debris littered the pilot vetiver planting sites, and a landslide occurred in Zone 27 near the local church. The location for the garden pilot in Central Valley was not inundated however, being located further away from the lower floodplain.



Flooding debris and damage along Mataniko riverbank (zone 27)



#### 4.3.2 Community flood clean-up actions

Koa Hill community members, including children, spent considerable efforts over several days between 12-17 November cleaning up flood debris and damage on the riverbank prior to planting the vetiver and bamboo for the NbS pilot.



**Riverbank clean-up of debris after flooding**

#### 4.3.3 Riverbank protection – flood mitigation

150 modules of bamboo fencing were made by the community to protect vetiver grass planted along the riverbank to assist with flood mitigation.



**Bamboo fencing constructed to help protect vetiver grass and young bamboo along riverbanks**





**Vetiver grass planting, bamboo replanting and fencing installation on riverbank**

#### **4.4 Pilot 3: Landslide prevention, Koa Hill zone 26**

Vetiver grass was planted at the top of Koa Hill Zone 26 in a pattern designed to channel water runoff from the road that is causing soil saturation and slope destabilisation. The slopes above the concrete stairway (Jacob's Ladder) leading to the main road to Honiara CBD was cleared prior to planting 180 metres (400 slips) of vetiver grass, led by SINU students and the PacSol team.



**NbS pilot site for landslide prevention at the top of Koa Hill Zone 26**





**Clearing the track along Jacob's Ladder prior to planting vetiver grass to channel road runoff**

## **4.5 Project 4: Landslide prevention and slope stabilization, zone 27**

### **4.5.1 Effects of rainfall and earthquake events on project implementation**

On 11 November 2022, following a heavy rainfall event in Honiara, a landslide occurred in Zone 27 near the Southern Seas Evangelical Church (SSEC - close to the concrete stairway, Jacob's Ladder 3). Then on 22 November 2022 a powerful magnitude 7.0 earthquake was recorded offshore from Honiara, followed by a second quake of magnitude 6.0 thirty minutes later. Widespread power outages were reported though there was no major damage to infrastructure and no fatalities. The earthquake and previous landslide in Zone 27 necessitated a change in the planned NbS pilot project activities on 23 November, as the team could not conduct any interventions on the cliff base due to cliff instability.



**Landslide in Zone 27 following a heavy rainfall event on 11 Nov**



#### 4.5.2 Revised NbS pilot landslide intervention around water sources in Zone 27



**Original pilot site (l). Revised site following landslide and earthquake in Zone 27 (r).**

The PacSol-SINU implementation team decided to focus on the upper slope by planting 250 slips of vetiver grass in a pattern that would redirect water from the public bath and leaking pipes into a proper drainage channel to reduce water intrusion into the cliff face. An additional 120 metres of vetiver grass were planted along the downslope riverside track to further reinforce the embankment below the landslide area.

#### 4.6 Additional settlement upgrading activities

A number of settlement-upgrading activities outside of the immediate scope of the NbS pilot projects were undertaken by the PacSol-SINU team and community volunteers between 22-26 November. These included the construction of concrete steps and two new jetties to consolidate and improve river crossing safety and access between Koa Hill and the main road to Honiara Central District (Kunsao area), a small wooden connecting bridge across a water channel in South Central Valley area, 60 metres of upgraded gravel footpaths from the new jetty to the main Koa Hill field on the riverbank, plus designated recreational sporting areas on the flood plain as a deterrent to other uses of this high risk area (e.g. housing). These initiatives demonstrate a broader range of settlement upgrading that have directly benefited the community.

##### 4.6.1 New futsal field and volleyball field on riverbank flood plain

Following the flooding event on 11 November, PacSol and the Central Valley CDC committee reviewed the existing Koa Hill NbS concept plans and made a joint decision to prevent further incursions and losses to the community by designating the lower flood plain as a public recreation area. The community decided that a dirt volleyball court and futsal field would be instated on the riverbank, thus providing much-needed recreational space for young people and children, as well as deterring new development.



**Designated public recreation areas with volleyball and futsal fields on flood prone area  
Visiting RMIT team gifted sports equipment to community youth**

#### 4.6.2 New concrete stairway and jetties for Mataniko River crossing

Access to the Koa Hill community was greatly improved by the construction of a concrete stairway 6 metres in length and 2 metres wide from the main road in the Kunsao area to the main 'floater' ferry crossing.



**Steps and jetty before construction (left). Stairway construction (middle and right)**

## 5. NbS training workshop

A workshop was held at the Honiara Youth Council Hub on 28 November 2022 offering NbS training to invited local and international NGOs, government representatives, students and local communities. The day-long event was led by RMIT landscape architect, Ata Tara, and structured according to the stages of the UN-Habitat Urban EbA toolkit (understanding EbA, vulnerability assessment, setting objectives and identifying adaptation options, and implementation). The workshop also involved co-design activities for hands-on experience.

The agenda for the day was:

- Introduction to the workshop (Darryn McEvoy)
- Overview of Honiara's climate vulnerability (Alexei Trundle)
- What are NbS, what are the benefits, and examples of international best practice (Erich Wolff)

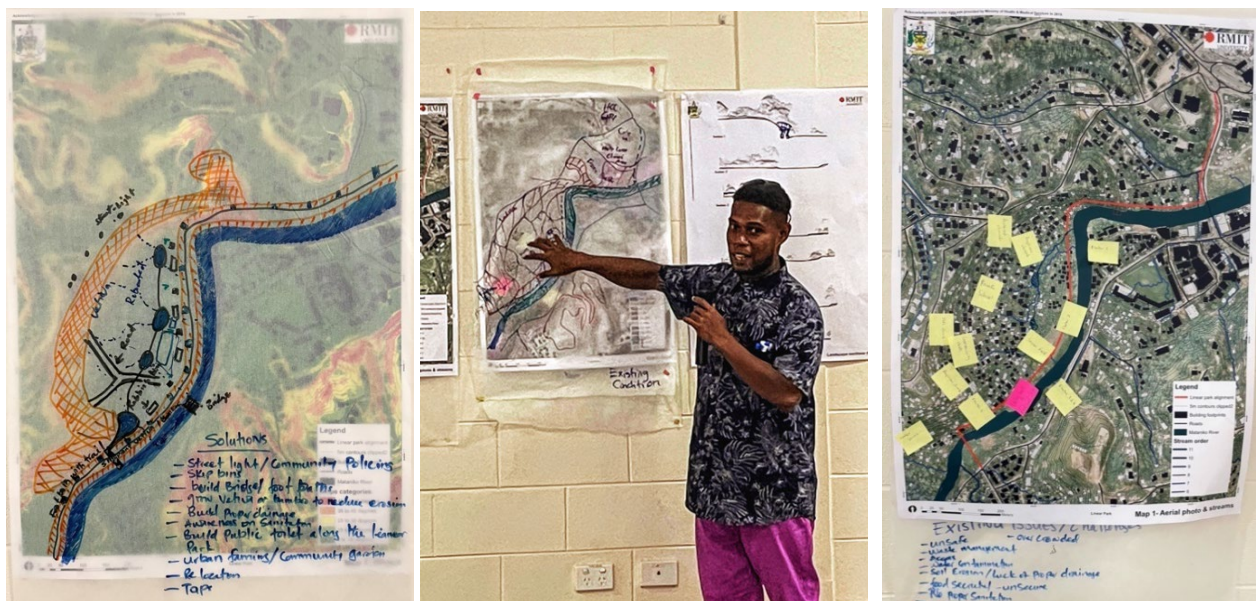


- Group discussions of what NbS means in the context of Honiara (all)
- Vulnerability and context setting for linear park case study (Ata Tara)
- Climate adaptation planning, including RMIT student examples (Ata Tara)
- Technical aspects of NbS being implemented in Koa Hill (Yuyun Qomariyah)
- Co-design of a linear park case study (west bank of Mataniko River between Koa Hill and China town; aligning with the development proposed in the ADB Greater Honiara Urban Strategy).

The workshop was well-attended with a high level of engagement, resulting in new local insights and considerations to feed into adaptation planning as part of the Greater Honiara Urban Strategy.



Workshop presentations and group discussions



Workshop participants presented their linear park NbS designs

## 6. Project dissemination and community exhibition of NbS

PacSol worked closely with the Koa Hill community to showcase the SIDA-funded NbS pilots through a public exhibition. The event was held in Koa Hill on 29 November 2022 to present the pilots, their purpose, and the societal and environmental benefits of NbS. It was a whole-of-community, highly inclusive event involving women, men, youth, children, and students from the Solomon Islands National University who had been closely involved with the project implementation activities.



PacSol, Kastom Gaden, SINU staff and students spent two days planning and preparing for the public exhibition on 29 November held in Central Valley Koa Hill riverbank. A festival of traditional and contemporary dance was performed by community members of all ages.

This was a significant milestone event for the Koa Hill settlement, who publicly expressed their gratitude to SIDA, UN-Habitat, RMIT, PacSol and project partners for bringing the NbS pilot project to their three communities and creating real opportunities for improvements to public safety, amenity, and climate and disaster resilience. The engagement and implementation processes around the pilot NbS projects and urban garden created a renewed sense of hope and self-determination in the communities of Koa Hill, catalysing leadership, and a sense of pride in a place that generations have called home.



**The project's 'welcoming' committee**



**Children and adults excited to see photos of themselves on banners prepared for the exhibition**





**Traditional costumes, song, and dances performed by members of Koa Hill community**



**Community exhibition and showcasing of NbS pilots**

## 7. Summary and lessons learned

Despite the challenges of a time-constrained project, a significant flood event, and even a large earthquake, this SIDA-funded project has successfully delivered four NbS pilots for the Koa Hill informal settlement in Honiara. These target riverbank stabilisation and flood protection, landslide prevention, and an urban garden for local food security (complete with a nursery to propagate vetiver, lemongrass, and bamboo). The energy, enthusiasm, and sense of community ownership generated by the project were so great that several other community-led settlements-upgrading projects were also undertaken, thereby improving amenity and safety in the community.

The highly participatory and inclusive processes underpinning this small-scale ‘proof-of-concept’ pilot project, were instrumental in the successful implementation of NbS actions in the informal settlement and provide valuable lessons that can be transferred and upscaled to other urban poor communities in Honiara, the wider Pacific, and to other urban poor contexts in the Global South. Indeed, an incremental program of inclusive small-scale pilot projects may be a key to generating the critical ingredient of local community ownership. Some of the key take home lessons are summarised below.

Commitment to community engagement, trust building, and empowerment: the success of the project was very much driven by enthusiastic community buy-in and willing ownership of the NbS pilots that were implemented. This was achieved by early engagement with the community, ensuring that they were able to self-determine the main issues for their community and could influence the type and location of the different NbS interventions. Local workshops directly influenced the choice of implementation actions and outcomes e.g. the construction of a nursery house next to the urban garden for cultivation of vetiver, bamboo, and lemongrass, to support the longer-term sustainability of NbS.

By exhibiting dedicated commitment to improvements in the community, and encouraging regular engagement in the planning stages, the local project leader, Yuyun Qomariyah, helped to build trust between the local project team and members of the community. She noted that several formal and informal meetings must be held until a relationship is formed that will give benefits to both parties. *Both PacSol and Kastom Gaden Association have continued to engage informally and on an unpaid basis with the communities in Koa Hill even beyond the formal completion of the NbS pilot projects and are keen to support further community actions to scale up the various interventions.* The personal qualities and characteristics of local project facilitators should not be overlooked or underestimated given their critical roles in building trust in this way. The ability to build relationships, identify and influence leaders, tap into social networks and appropriately utilise social and cultural capital to facilitate agreements, create consensus, and mobilise outcomes are essential in these catalytic roles. Emotional intelligence and skill are also needed to manage or reduce potentially counterproductive individual “egos”, with explanations focused on whole-of-community needs and generating understandings about public good versus private needs. As an example, the urban garden was developed as a best practice showcase for all the community (which could also be used for future training) rather than as a private resource.

During the project engagement process, family and kinship networks, university, school, social contacts, and personal relationships were key to galvanising community support for the project and spreading knowledge of the benefits of NbS. This resulted in a large volunteer labour force (including all members of the community) and whole-of-community mobilisation efforts over the life of the project (and hopefully beyond). The commitment of locally based actors and inclusive, intersectional, community engagement activities mobilised women, youth and children, and offered opportunities for genuine participation in the project. This inclusive approach also contributed to the success of the project.

Commitment and transparency: visible commitment, transparency, and the ability to deliver on agreed actions are necessary to overcome community reluctance and any barriers to participation. The local project team also noted that project budget transparency is needed to avoid any misinterpretation from the community about the scope and scale of the project. Transparency and expectation setting by the project coordinator/facilitator with the community is important so that community members do not feel exploited. Sensitivity to local customs and protocols in the procurement and payment for services, gift-giving, or exchange of goods is very important to observe.

Local agency: it is important to recognise the value of local discretionary funds, which allows for greater local agency and a degree of flexibility in how money could be spent most effectively, rather than controlled centrally. This flexibility allowed for payment of local costs that were unforeseen in the original proposal, such as the provision of lunch costs during the implementation process, electricity bills for venue use etc., new activities that were identified by community engagement i.e.



the plant nursery, additional activities that were necessary due to flooding such as the riverbank clean-up and the inclusion of raised beds in the urban garden for increased flood resistance, the provision of more information and awareness-raising resources for the community (including pamphlets and a vetiver grass training workshop), and even the allocation of labour costs for the construction of public facilities for settlement upgrading beyond the NbS contracted deliverables. This flexibility, and greater local agency, greatly enhanced community participation and satisfaction with the project.

The active involvement of the PacSol-SINU implementation team at every step of the way demonstrated not only inclusive, energetic, leadership and genuine care for the wellbeing of the Koa Hill community, but also had the effect of encouraging community participation and ownership of the projects by modelling positive behaviour and by example. This demonstrates the critical importance of collaborating with and empowering committed local partners in NbS project design and implementation, who bring deep knowledge of local contexts (social, cultural, political) and are in the best position to facilitate trust-building through personal and longer-term engagement with communities on the ground.

Partnership working: each of the project teams brought different but complementary skill sets that contributed to the success of the project. The lead RMIT team was multi-disciplinary, contributing knowledge of climate adaptation, NbS and their benefits, gender and land, and the use of satellite imagery for NbS planning. Long-term engagement with informal settlements in Honiara also benefited. PacSol led the local engagement processes very successfully, supported by the local UN-Habitat team, as well as contributing local NbS and construction experience, whilst Kastom Gaden Association developed the urban garden and nursery, and input organic farming best practice.

Understanding context: land tenure and socio-cultural community groupings can have significant implications for NbS project implementation given that formal governance structures such as the CDCs may not align with actual local self-government or leadership arrangements in local communities. During this project, the Central Valley community, which was not previously represented by a CDC, became an important sponsor and participant in the NbS implementation thus underscoring the critical importance of inclusive stakeholder engagement processes and understanding local context.

Site surveys and feedback from community engagement was also important to better understand the root causes of some of the climate-related risks. In the case of landslide prevention, it was discovered that two of the human influences of increased risk were run-off from a road at the top of the hill and water and wastewater saturation from community bathing and laundry areas.

It was also important to have the local partner on board to help navigate the legal requirements that needed to be met before the NbS pilots could be implemented. This required approval from two different Ministries before successfully applying for a permit from Honiara City Council. The need to complete formal administrative processes before NbS is implemented needs to be explicitly accounted for in any NbS project. In the case of Honiara (due to the legacy of World War 2), a check for unexploded ordinance is also a consideration.

Capacity building: multiple learning opportunities for different groups were built into the program – both planned and incidental as the project progressed. No opportunity was wasted to create applied and participatory learning experiences for community members, women, children, university students etc. This helped to create additional buy-in and ownership of the project.

Community-based events and activities were designed to raise awareness of the benefits of NbS, educate participants on technical aspects such as vetiver cultivation and urban gardening, as well as identifying and co-designing locally appropriate NbS actions addressing riverbank protection, landslide mitigation and food security. The high level of participation was evidence of the potential for the pilot NbS interventions to be sustained and also to be scaled up in the longer term in other informal settlements.

NbS as a win-win solution: not only do the NbS pilots address disaster resilience and local food security they also create opportunities for improved amenity and livelihoods. As noted earlier in the report, the engagement and implementation processes around the pilot NbS projects and urban garden created a renewed sense of hope and self-determination and acted as a catalyst for leadership. Bringing the community together and creating a new sense of pride in their settlement was a welcome additional outcome.

Monitoring and evaluation: by their very nature, NbS are a long-term investment with full benefits only experienced after a period of time, therefore ongoing management after the project is finished will be needed. A small budget for this was provided to a local community fund but it would also be useful to continue monitoring and evaluating the performance of the pilots over time.

Further research: on a final note, although this project was very much focused on the implementation of NbS and achieving local environmental benefits for Koa Hill community, it also raises interesting research questions on environmental justice, the role of culture and traditional knowledge in NbS, as well as an investigation of intersectional and gender aspects.

Koa Hill community were very proud of their achievements. A poster was made with the statement:

*“Together as a strong community, we can save our life and our future generations through NbS”.*





## 7. Acknowledgments

<b>Pacific Solomon Engineering and Consultancy Limited (PacSol)</b>		
1	Yuyun Qomariyah	Local Team Leader / Implementation Team Leader
2	Eddie Ramoni	Site Coordinator
<b>Solomon Islands National University (SINU)</b>		
3	Cyril Bernard Rachman	Chief Civil Engineer – Head of School Built Environment Solomon Islands National University
4	Elizabeth Bokosina	Project implementation Assistant – Assistant Lecturer Civil Engineering, SINU
5	Filia Lawrence Torea, Follenger Christopher, Florence O. Araoa, Carlos Simae, Rose Maelanga, Hansford Takika, Terenz T. Atu, Philworth Avui, Hendry Palmer, Huatia Tango	Civil Engineering Students
6	Shessmin Vave	Civil Engineering Students – Miss SINU
<b>Koa Hill Community Members</b>		
7	Eddie Gaso	Chairman – Central Valley Mataniko Riverbank Koa Hill
	Titus Kwauna	Koa Hill Zone 27 Representative and community spokesperson
3	Benjamin Ereanimae	Secretary of Koa Hill Zone 27
4	Charlie Fatadi	Assistant site coordinator, Koa Hill Zone 27
5	Michael Aba	Secretary of Koa Hill Zone 26
6	George Gnagnafu	Community Leader Mataniko Riverbank Koa Hill Zone 26
7	All the members of Central Valley Mataniko Riverbank Community Hannie Miniti (Central Valley Koa Hill)	
<b>UN-Habitat</b>		
Steve Likaveke, UN-Habitat Project Coordinator Lorraine Livia, UN-Habitat local team		
<b>Kastom Gaden Association</b>		
Pitakia Tikai and Esther Lodu		
<b>Research Team</b>		
Professor Darryn McEvoy, RMIT University Dr Ata Tara, RMIT University Dr Mittul Vahanvati, RMIT University Dr Serene Ho, RMIT University Dr Kim Gordon, RMIT University Dr Alexei Trundle, University of Melbourne Dr Erich Wolff, Nanyang Technological University (NTU, Singapore)		
<b>Others</b>		
Honiara Youth Council Dudley Tauwauri, Honiara City Council Youth Division Solomon Water		

## 8. Appendix

### Appendix 1: Schedule of Project Events

Date	Event	Where	Who	Report
21 Sept 2022	Preliminary Meeting with Koa Hill CDC Representatives	Koa Hill Church	PacSol SINU Zone 26 CDC Rep Zone 27 CDC Rep	1
23 Sept 2022	Schedule Consolidation with Kastom Garden	Kastom Garden Office	PacSol SINU Kastom Gaden	2
27 Sept 2022	First CDC Meeting	Koa Hill Church Hall	PacSol Kastom Gaden Zone 26 & 27 community members	3
30 Sept 2022	Coordination Meeting Consolidation of project schedule Site Visit with UN-Habitat Check location for Urban Garden	Koa Hill survey	PacSol SINU UN-Habitat Kastom Gaden Zone 27 reps	4
4 Oct 2022	Consolidation of site for Urban Farming for Kastom Gaden decision Checking location of landslide	Central Valley Field	PacSol SINU Zone 27 reps Chairman Central Valley	5
4 & 6 Oct 2022	Survey Zone 26 and Landslide investigation on Central Valley Zone 27	Koa Hill survey	PacSol SINU Zone 26, 27 & Central Valley reps	6
22 Oct 2022	Preparation for community awareness Discuss technique for riverbank protection	Central Valley	PacSol SINU Zone 26, 27 & Central Valley reps Kastom Gaden Solomon Water	7
26 Oct 2022	Discussion of Koa Hill Land Tenure Planning permits HCC, Commissioner of Lands for NbS actions	UN-Habitat Honiara Office	PacSol SINU UN-Habitat	8
26 Oct 2022	Consultation meeting RMIT	Online	PacSol SINU RMIT	9
29 Oct 2022	Field Survey – Landslide investigation Zone 27	Central Valley and Anglican Church Water Source	PacSol SINU students Zone 27 rep	10
30 Oct 2022	Community Awareness meetings x 3	Central Valley, Anglican Church, Zone 26	PacSol Koa Hill community members in all 3 zones	11
6 Nov 2022	Community co-design Workshop Brainstorming problem identification & solutions	Tuvaruhu Secondary School	PacSol SINU 38 Koa Hill community members	12
9-11 Nov, 14 Nov 2022	Materials procurement and construction nursery house	Central Valley Koa Hill	PacSol Central Valley community members	13
16 Nov 2022	Community Workshop: Vetiver Nursery training	Central Valley	PacSol, SINU Koa Hill community members (55 participants)	14



11 Nov 2022	Flooding event	Mataniko Riverbank		
12-17 Nov 2022	Community riverbank clean-up after flooding	Central Valley	PacSol Community members	15
21 Nov 2022	Implementation: Vetiver grass planting top of Zone 26 landslide area	Zone 26 – top of hill	PacSol SINU Community members	16
12-17 Nov 2022	Bamboo fencing materials & preparation	Central Valley	PacSol, SINU Community members	17
22-24 Nov 2022	Implementation: Vetiver, bamboo planting and fence installation for Riverbank protection	Central Valley	PacSol, SINU, Community members	18
22 Nov 2022	Earthquake Magnitude 7.0	Honiara		
23 Nov 2022	Implementation: Landslide prevention zone 27	Water source Zone 27		19
22-26 Nov 2022	Extra community improvement activities: construction of steps, bridge, footpath upgrading, volley ball and futsal field	Central Valley	PacSol, SINU, Community members	20
26 Nov 2022	RMIT site visit to Koa Hill	Koa Hill	PacSol, RMIT, Community members	
28 Nov 2022	NbS Training Workshop and co-design studio	Honiara Youth Council Hub conference room	RMIT, Guest experts, Koa Hill community members, NGOs, local govt, SINU	
27-28 Nov 2022	Community preparation for Exhibition showcase event	Central Valley	PacSol, SINU, Community members	21-22
29 Nov 2022	Koa Hill Community Exhibition	Koa Hill Central Valley	PacSol, SINU, RMIT, Koa Hill community, NGOs, media	

## Appendix 2: Solomon Islands media report

A media article was released in the Island Sun Solomon Islands newspaper reporting on the Koa Hill Community Exhibition event on 29 November.

Local news article: Ned Gagahe, "[Nature-based solutions for floods and landslides in Central Valley community](#)." The Island Sun, November 30, 2022