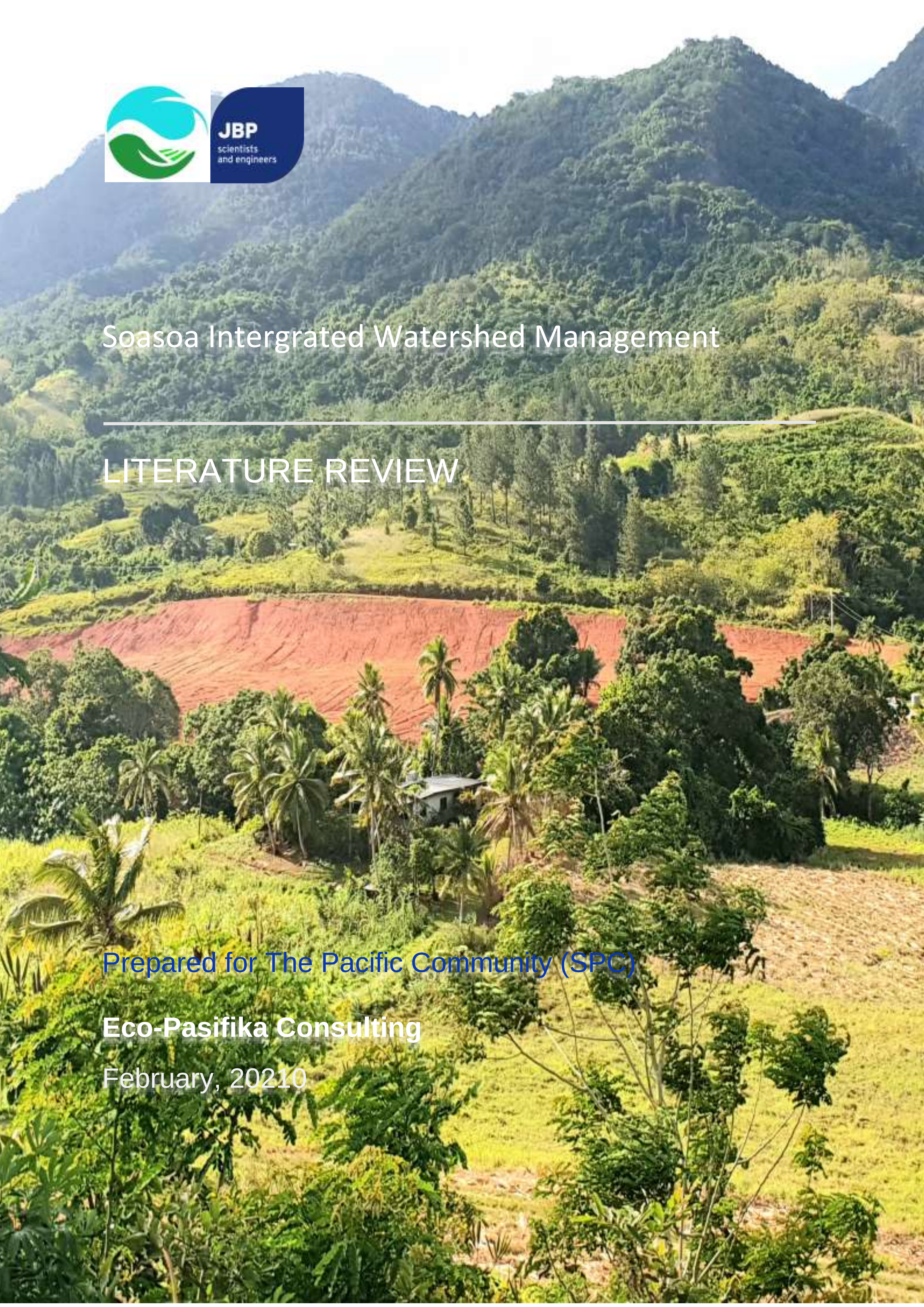

Soasoa Intergrated Watershed Management

LITERATURE REVIEW

Prepared for The Pacific Community (SPC)

Eco-Pasifika Consulting

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Cover photos: Upper Soasoa Watershed system, Labasa, Fiji

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1. Introduction

This literature review is part of the consultancy to prepare an integrated watershed management plan for the Soasoa drainage catchment, Labasa, Vanua Levu, Fiji through the Global Climate Change Alliance Plus Scaling up Pacific Adaptation (GCCA+ SUPA) project, which is funded by the European Union with Euros 14.89 million. The project is implemented over the period 2019-2022, by the Pacific Community (SPC) in partnership with the Secretariat of the Pacific Regional Environment Programme (SPREP) and The University of the South Pacific (USP) and the government and people of Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Tonga and Tuvalu.

A scoping review was undertaken to identify literature related to integrated watershed management planning in Soasoa drainage catchment system. This included a search for publications using Google advanced search features with search terms and search strings for: 'Soasoa' AND integrated watershed management, flood and resilience, IWRM policies Fiji.

The criteria for inclusion were as follows: publications must directly address IWRM in Soasoa and/or related areas as the core topic for analysis and discussion and be published between 1990 and 2020 (relevant publications outside of this period were still reviewed depending on relevancy and applicability). Publications were selected if they include either information on IWRM and resilience and/or if they offer theoretical contributions to the field. Publications that review IWRM and resilience in a different academic disciplines were included. Additional to research articles, guidelines, policies and technical reports were included in the review while blogs, opinion pieces, news articles, training manuals and policy briefs were excluded.

The main topics of the papers were categorized by thematic area considering key theoretical and empirical contributions from each paper. The themes are presented below in a narrative literature review style. Important topics of discussion that the review focused on include: 1) IWRM in Soasoa (2) IWRM general physical, social and environmental settings; and (3) policy and stakeholder analysis for IWRM in Soasoa and related areas.

The literature searches identified 67 articles and from this pool, 53 publications were included for analysis after screening of article titles and abstracts. A smaller pool of around 31 publications was then identified during the full text review with publications that had no substantive content on IWRM in Soasoa being excluded.

2. Watershed management in context

According to Wang et al. (2016), watershed management is the process of organizing and guiding land, water, and other natural resources used in a watershed to provide the appropriate goods and services while mitigating the impact on the soil and watershed resources. During the last few decades, watershed management has gained recognition and importance in both environmental protection and the well-being of people living in watershed areas. For example, in its 'Bhutan 2020' policy document, the Bhutan government named watershed management as the "single most important strategy to maintain the resource base to support the national economy" (Jamtsho and Gyamtsho 2003: 1). It involves socio-economic, human governance and biophysical inter-relationships among soil, water and land-use and the connection between upland and downstream areas (Ffolliott et al. 2002). In principle, it is resource management with the watershed as the basic organizing unit.

Chen (2007) and Gleick (2000) highlighted that the concept of watershed management can be dated back to 2000 BC, and it has continuously evolved and improved over time. Watershed management can be defined as ''the study of the relevant characteristics of a watershed aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed function that affect the plant, animal, and human communities within a watershed boundary'' (California Department of Conservation, 2015).

Watershed management has evolved from a focus on water resource management and the hydrological cycle to the current integrated approach of managing the biological, physical, and social elements in a landscape within a watershed's boundaries (Ffolliott et al. 2002). A strong global consensus is emerging around the idea that watersheds are the best units for the management of not only water resources, but also ecosystems in general (Montgomery et al. 1995). The World Bank uses watershed management assessment approaches as the key to identifying the linkages between landscape improvements, productivity increases, and attainment of true natural resource sustainability. Their approach to watershed management extends well beyond hydrological considerations—it aims to utilize the land and resources within a watershed to obtain the desired goods and services without harming the soil and water, while recognizing the links between upstream and downstream areas (Nearly 2000).

Brooks et al. (2013) adopted a similar definition that emphasized that by having a good perspective of how a watershed functions and a clear understanding of the linkages between the uplands and downstream areas, a watershed manager should be able to design long-term, sustainable solutions to human natural resource problems, and avoid disasters that can cause human suffering due to lack of water or water pollution (Nearly 2000).

These ideas have been expanded in studies of the nature of the relationships between human health and the sustainability of natural ecosystems, particularly as they relate to watersheds (Gleick 2000). However, watershed management for human health and well-being requires the ability to move beyond typical reductionist approaches towards more holistic methods (Bunch et al. 2014). Understanding these complex relationships has required the development of interdisciplinary studies of catchments to resolve complex problems (Rapport et al. 1998) with an emphasis on the links between land-use change and hydrological systems, ecosystems and human health, as well as scientific and political aspects of watershed management (Bakker 2012) and how these all relate to socioeconomic development (Witten et al. 2000). Such ideologies and relationships can be extended to an examination of the links between natural resource management, rural and community development, and public and environmental health (Parkes and Panelli 2001).

Through the evolution of watershed management, the practice of integrated watershed management has now become more prominent. Integrated watershed management builds upon the foundational principles of watershed management to integrate various social, technical, and institutional dimensions, as well as conservation, social, and economic objectives (German et al. 2007). This integration generates ''An adaptive, comprehensive, integrated multi-resource management planning process that seeks to balance healthy ecological, economic, and cultural/social conditions within a watershed. It serves to integrate planning for land and water; it takes into account both ground and surface water flow, recognizing and planning for the interaction of water, plants, animals, and human land use found within the physical boundaries of a watershed'' (Red Deer River Watershed Alliance, 2015).

The integrated watershed management approach shows the importance of looking at multiple uses of watershed resources, rather than simply the hydrology aspect. It attempts to balance human and environmental needs, while simultaneously guarding ecosystem services and biodiversity (Bakker 2012). Managing watersheds in this manner allows the needs of society and the environment to be accounted for, even with increasing population pressures and demand for higher productivity and multiple uses of resources (Blomquist and Schlager, 2005).

According to Ravnborg et al. (1999), the objective of watershed management is to find ways of fostering coordinated actions among users, managers and decision-makers in watersheds for the daily management of resources, and thus to facilitate solutions to the problems of NRM that cannot be resolved effectively in an individual manner. For the case of this assignment, apart from the objective already highlighted, watershed management in Soasoa will also target to reduce flooding and associated risks.

3. Watershed management in Fiji

Watershed management in Fiji is site specific and comes under the umbrella of environmental management. Environmental management in Fiji is provided through the Environment Act, 2005 and the accompanying regulatory instrument the Environment Regulations, 2007. Both are administered by the DOE within Ministry of Environment and Waterways (Pulea, 1992).

The Environment Act (the Act) provides for an integrated system of development control, environmental assessment, and pollution control. Section 3 of the Act states the purpose of the Act which is to 1) apply the principles of sustainable use and development of natural resources and 2) identify matters of national importance for the Fiji Islands.

Matters of national importance and relevant to watershed management are identified in Section 3(3) as:

- The preservation of the coastal environment, margins of wetlands, lakes and rivers;
- The protection of outstanding natural landscapes and natural features;
- The protection of areas of significant indigenous vegetation and significant habitat of indigenous fauna;
- The relationship of indigenous Fijians with their ancestral lands, waters, sites, sacred areas and other treasures;
- The protection of human life and health.

Part 2 of the Act establishes a National Environmental Council and outlines the functions, duties and powers of the Council and the Department.

Section 4 of the Act requires that any proposed development activity that is likely to cause significant impact on the environment must undergo an environmental impact assessment (EIA) process which includes screening, scoping, preparation, reviewing and decision-making. EIA is a formal study used to predict the environmental consequences of the proposed development. In this context, “environment” is taken to include all aspects of the natural and human environment.

Section 32 of the Act states that a condition of any approved EIA must be that proponents are required to prepare and implement an environmental management plan (EMP), monitoring program, protection plan or mitigation measure, which may be subject to inspection by the EIA administrator, or an approving authority.

The Act (Schedule 2) outlines the types of development proposals that require approval by either the EIA Administrator (Part 1) or approving authority (Part 2) or may not require and EIA process or an EIA report (Part 3). For jetties/wharves and channel developments then Part 1 is likely to be triggered as it includes proposals that may result in erosion of coast, beach or foreshore, alter tidal/wave/currents of the sea or the pollution of marine waters. For bridges then Part 1 may be triggered if gravel extraction or dredging of the river bed is required.

Part 5 of the Act establishes a waste and pollution permit system that aims to protect the environment by controlling the release of solid and liquid wastes, the emission of polluting gases, smoke and dust, and the handling, storage and disposal of waste and hazardous substances.

The Environment Management (Waste Disposal and Recycling) Regulations 2007 gives the Waste and Pollution Control Administrator power to issue permits for solid and liquid waste discharge and air discharges (Department of Environment, 2014)

4. Soasoa watershed in context

4.1 Physical setting

3.1.1 Geophysical - location and topography

The Fiji Islands is an archipelago of over 320 Islands located in the South Pacific Ocean. Fiji has 18,272 square kilometres of land, and two largest islands, Viti Levu and Vanua Levu, the latter including the Soasoa catchment.

The geology of Vanua Levu contributes to its catchment hydrology and flood conditions. It is formed of volcanic rock types, which form a chain of volcanic mountains aligned from southwest to northeast. The three tallest peaks extend to approximately 1000m above sea level and are located towards the centre of the volcanic chain, south of Labasa Town and the Soasoa catchment (Yeo 2013). This mountain range causes most river networks to drain northwest or southeast to the coastline. Sub-catchments typically have steep upper catchments that are divided by narrow serrated hills. During flood conditions extreme runoff can merge within the lower catchment, which has flat alluvial terraces and wider floodplains (Terry 2005). The country is subject to a variety of geological, hydrological and climate related hazards due to its volcanic arc coupled with the tropical climate (Nunn, 1998; Parry, 1981; Raj, 1986; SOPAC, 2006c).

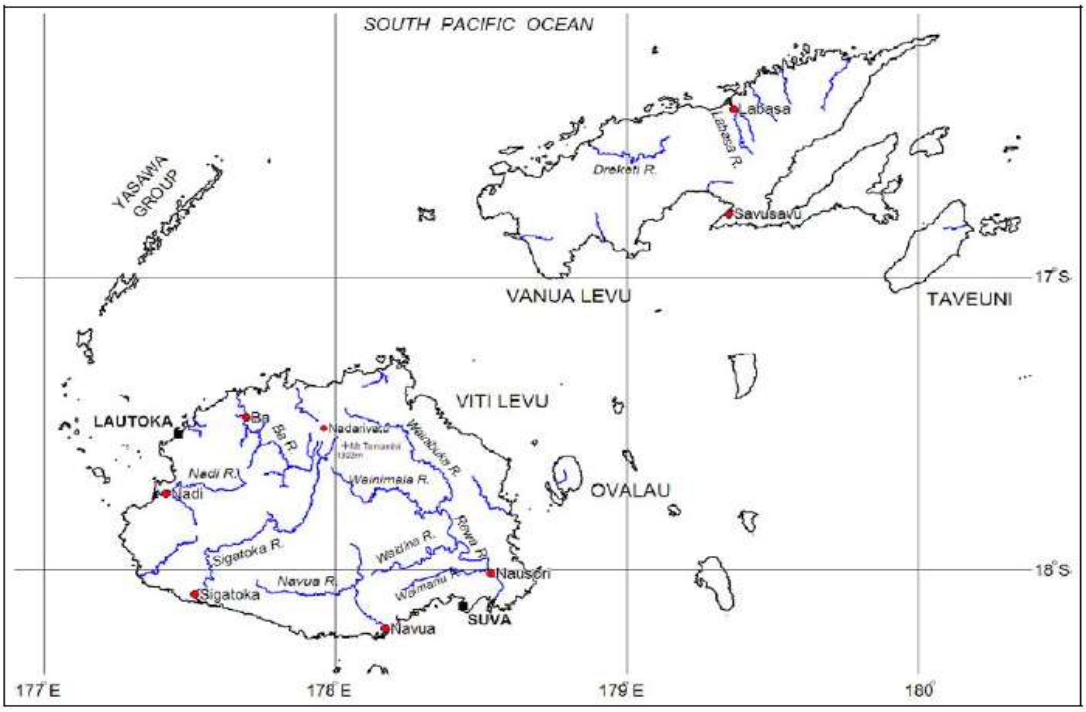

Figure 1: Main islands, rivers, cities and towns of Fiji.

Figure 2: Catchment topography and possible flow paths

3.1.2 Climatology and hydrology

Fiji is second only to Papua New Guinea as the Pacific island country most affected by natural disasters since 1990 (ADB 2005). This is due to the range of extreme weather phenomenon that occur throughout the islands, which includes tropical cyclones, monsoons, extreme rainfall, flooding and coastal surges.

3.1.3 Cyclones

Analysis of the historic cyclone tracks show 40 tropical cyclones have passed through Fiji waters between 1969 to 2018, each with the potential to make landfall (See Figure 3:, based on BoM 2020). Tropical cyclones generate a low atmospheric pressure, have extreme winds, and can deliver extreme precipitation patterns depending on the strength, longevity and organisation of cloud bands (Terry 2005). If coinciding with a high tide the result will be an extreme sea level, which pose a major threat for low lying communities.

3.1.4 Precipitation and flooding

Coinciding with the threat of tropical cyclones is the Fiji wet season, which falls between November to April. Flooding due to heavy rain typically occurs between January to March at the height of wet season, and can be exacerbated by tropical cyclone precipitation.

A range of historic and recent flood events are described in Table 1:, with several images shown in Figure 3:. These include investigations undertaken by McGee (2010), which has been supplemented by recent data.

The most extreme flooding within the region is believed to be during TC Ami, which made landfall in January 2003. During this event, the three rivers surrounding the Soasoa catchment produced record-breaking flows, which coincided with a cyclone-generated storm surge, and caused widespread inundation. The peak discharge for the Labasa River was estimated by the Hydrology Division of the Fiji Public Works Department soon after flood waters receded. Channel cross-sections and TC Ami flood heights are shown in Figure 4:, which includes record-breaking flows for the rivers surrounding the Soasoa catchment:

- Labasa: 2,377 m3/s
- Qawa River: 1,802 m3/s
- Wailevu River: 2,118 m3/s

Table 1: Flood events in Labasa district (adapted from McGree et al 2010)

Date of Peak	Reason for High Rainfall	Flood Description and Areas Affected
1929 Dec 11-12	Hurricane	Qawa River flood peak 3 ft (0.9m) above 1912 peak at Labasa Mill
1938 Dec 22	Cyclone	Qawa River rose 4.5 ft (1.4m) above high tide level
1950 Mar 30	Moderate storm	Significant flood damage in Wainikoro and Bucaisau districts; flood 2 ft (0.6m) over Wainikoro office floor.
1986 Dec 28-30	Hurricane	Labasa River experienced worst flood since 1929, Labasa town's main street under 1m of water for the first time since 1929
1988 Feb 25	Hurricane	Flooding in the area
1997	TC Gavin	Extensive flooding of Labasa town (McInnes et al. 2014).
1998 Dec 24-25	Hurricane	Flooding in Labasa and Northwestern Viti Levu
2000 Apr 14-15	TC Neil	Flood peak in Qawa River estimated 'major' since Labasa Mill flooded, possibly highest event there in 50 years
2003 Jan 14	TC Ami	Strong storm surge along northern coast of Vanua Levu, combined with severe river floods, led to record flooding at Labasa
2007 Mar 9-14	Low pressure trough, leading to heavy rainfall received in the northern and western parts of Fiji.	The Qawa River burst its banks at about 5pm on 10th.
2009 Feb 20	Trough moved eastward than retrogressed across the country between 18th and 24th.	Flash flooding due to heavy local rain and blocked drains.
2018	TC Keni	Roads closed due to flooding in Macuata (see Figure 3:)
April 2020	TC Harold	Roads closed due to flooding in Macuata. Wider impacts included F$100 million of damage across Fiji (FBC 2020)

	
Flooding in Labasa during TC Ami (2003)	Flooding in Labasa during TC Ami (2003)
	
BoM Tropical Cyclone Portal showing historic tracks	Soasoa flats flooding during Cyclone Keni 2018

Figure 3: Flood images for various TC and rainfall events

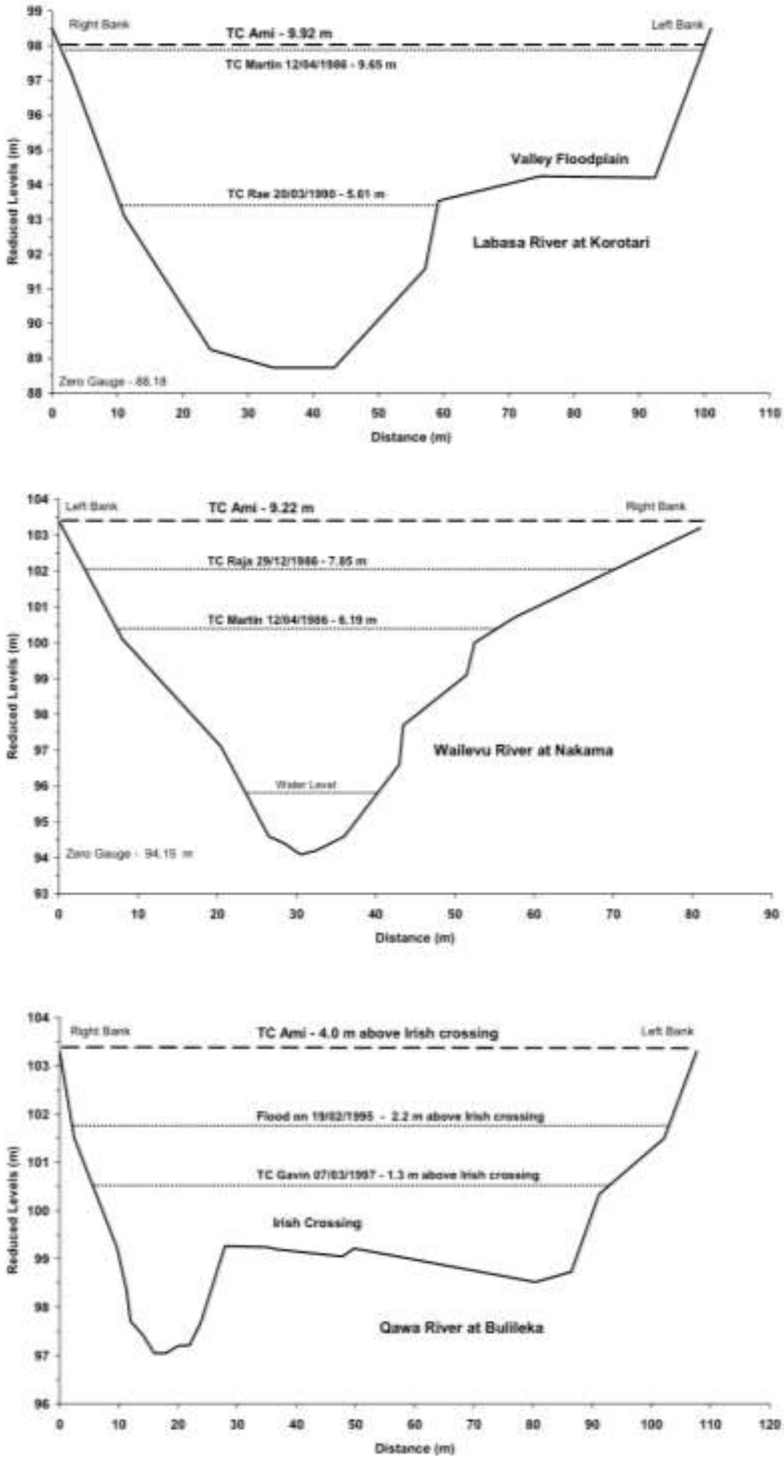

Figure 4: Maximum flood heights produced by TC Ami in three main rivers on Vanua Levu island. Source: Fiji PWD Hydrology Division unpublished flow record images for various TC and rainfall events

3.1.5 Tides and extreme sea levels

Storm surges and extreme sea levels can exacerbate flooding, which is expected to increase with projected sea level rise. An extreme sea level assessment was undertaken for Fiji by McInnes *et al* (2014), which undertook statistical analysis and modelling to estimate cyclone-induced storm surges for a range of return periods without wave effects. Table 2: shows the estimated extreme sea levels. Whilst not specifically stated, this is assumed to be reported to a mean sea level datum.

Table 2: Extreme sea levels at Labasa (McInnes et al 2014)

Return period	Level
20-year	0.91
50-year	1.16
100-year	1.32
200-year	1.46
500-year	1.60
1000-year	1.68

3.1.6 Catchment drainage and engineering

The Soasoa catchment is located within the Macuata Province, on the northern coastline of Vanua Levu. It has a relatively small catchment area, spanning 17.5 km^2, with steep upper regions with a hill slope gradient of 0.24, and a flat lower channel with a 0.12 gradient. The Soasoa catchment forms part of a major three-river estuary system, which includes the Labasa, Qawa and Wailevu rivers, which converge and discharge into the ocean.

Figure 5: Soasoa drainage catchment showing indicative flood exposure

The steep upper catchments include some of the highest mountains on the island, and face into the common north-westerly cyclone direction. This topography creates exceptional orographic rainfalls, which are rapidly converted into runoff (Terry & Raj 1999). Within the lower catchment, the potential for simultaneous flooding within each river may exacerbate flood levels, in addition to the shape of the embayment which can funnel storm surges and elevate downstream sea levels (Terry 2005).

The Macuata Province has a mixed landuse; with open space, natural areas, settlements, transport networks, and agricultural zones. The predominant land uses within the catchment are sugarcane farming. Flooding is believed to have been exacerbated by the widespread replacement of natural vegetation on lower slopes with agricultural land, in particular sugar cane plantations.

Downstream sedimentation is also believed to influence flood conditions. Dredging is undertaken within the lower catchment to improve flood conditions, which include the 2018 dredging works at the mouth of the Qawa River in Labasa, which removed sediments to deepen and widen the river. The dredged area extended 1.5 kilometres from the river mouth to the sea, spanning 70 meters wide and five meters deep (FBC 2018).

A number of drainage and flood management actions have been undertaken within the catchment. This includes:

- In the late of 1970s the Soasoa Drainage Scheme was developed by the then Labasa Drainage Board. It includes a series of levees and floodgates constructed to protect reclaimed areas in the lower catchment. These operated relatively well until the last decade, when a reduction in performance was observed, considered due to an increased frequency of short-lived extreme rainfall events and the effect of sea level rise. (GCCAPlus, 2020).
- Works to the Labasa and Qawa rivers, which are connected by an 8-kilometre canal.
- From 1980s, strategies of flood management have been through structural measures, including dredging of rivers. Dredging at the mouth of the Qawa River began in 1998 and was repeated after each significant flood (Yeo 1997, 1998, 2001). Other structural measures have been applied, such as check dams and seawalls. Seawalls have been constructed along much of the coastline to prevent saline intrusion into farmland during high tides (Raj, 1998). Damage to seawalls was reported during the flood events, for instance in 1997 after they were breached in 10 places after hit by the storm surge associated with Cyclone Gavin (Yeo, 2001)

3.2 Biodiversity and ecology

Previous studies conducted on freshwater macroinvertebrates within the connecting systems to the current waterways of interest include the freshwater biota assessment of Vuinadarai creek downstream of creek draining the Soasoa catchment as part of the Labasa catchment freshwater baseline survey for the UNDP funded Fiji Ridge to Reef Project (IAS, 2020). These include freshwater Benthic Macroinvertebrates (BMI), flora (*macrophyte and periphyton*) and planktonic taxa (phytoplankton and zooplankton). Bioindicator based ecological status of the Vuinadarai creek site was determined using BMI bioindicator taxa. These were then included into an eco-status matrix supported by appropriate threat mitigation measures and enhancement measures to assist the landowning unit for community based biomonitoring, anthropic threat mitigation, ecosystem rehabilitation and (Essential Ecosystem Service) EES maintenance (IAS, 2020).

3.2.1 Water quality

Physio-chemical parameters (Table 3) recorded at Vuinadarai creek site were conducive for tropical aquatic fauna survival.

Table 3: Physio-chemical parameters at Vuinadarai creek site

Creek	Average of Temperature (°C)	Average of pH	Average of Dissolved Oxygen (mg/L)	Average of Conductivity µS/cm
Vuinadarai	27.86	6.01	7.64	137.56

Source: IAS, 2020 page 13

3.2.2 Freshwater Benthic Macroinvertebrates

Freshwater macroinvertebrate density at Vuinadarai creek site was 3013 individuals/m2. The high BMI density was due to the large number of Baetid mayfly nymphs (Pseudocloeon spp.: average abundance=125individuals) and endemic net-building caddis (Abacaria fijiana: average abundance=101 individuals) recorded in riffle habitat which are common across Fijian lotic systems. A total of 30 distinct taxa inclusive of seven endemics was recorded across multiple habitat present (Run, riffle, pool and edge) (IAS, 2020). The Vuinadarai creek site draining sugarcane farms supported a diverse taxa (i.e., 30 taxa) dominated by resilient/pollution tolerant species (net-spinner caddis (Abacaria fijiana), dragonfly naiad (Libeluliidae), purse-case micro-caddis (Paroxyethira sp.1 and 2 and Oxyethira fijiensis), algal grazer aquatic moth (Nymphicula sp.) and a total of eight dipterans (true-flies). The dominance of resilient taxa was most probably owed to the presence of the additional micro-habitats such as invasive weed vegetation belt at bank and silted streambed which would have allowed population establishment of resilient species (IAS, 2020).

3.2.3 Freshwater Flora

The common water hyacinth (*Eichhornia crassipes*) were observed along the bank edges of Vuinadarai creek. A total of 14 periphyton taxa was recorded at Vuinadarai creek dominated by unicellular diatoms. No toxic periphyton species were recorded (IAS, 2020).

3.2.4 Freshwater Plankton

A total of 45 freshwater planktonic taxa were recorded at Vuinadarai creek; 1 zooplankton (water bear-Tadigrada- a first record for Fiji) and 12 phytoplankton dominated by the highly abundant unicellular green micro-algae Chlorophyta (*Ankistrodesmus* sp.) and commonly occurring diatoms (Bacillariophyta). No Harmful Algal Blooms (HAB) were observed at the site and neither any specific responsible species were observed during microscopy (IAS, 2020).

3.2.5 Bio-indicator based eco-status

Based on the BMI taxa collected at Vuinadarai creek site, a total of 10 resilient bio-indicator taxa were present indicating a degraded system. Despite being in close vicinity to the forested part of the catchment, the upper Qawa River creek system, the Vuinadarai creek was impacted by immediately adjacent agricultural activities responsible for the obvious modified riparian system, bank erosion and siltation across streambed which are known to contribute to algal bloom and siltation across streambed and degraded micro-habitats favouring more resilient bioindicator taxa (Table 4) (IAS, 2020) and thus a degraded system indicated via a red coloration as per Traffic Light Bioindicator Guide of the Fiji RiverCare Toolkit (Rippon *et al*., 2015). Ecological status of the Vuinadarai creek site was based on established bioindicators of riverine ecological health for Fijian systems (Rashni 2014a, b) with concept adopted from Chessman (2003).

Table 4: Bioindicator based eco-status matrix for Vuinadarai creek site

Bioindicator Taxa (BMI)	Observed Impacts/ Threats	Ecological status	Proposed Mitigation Measures	Additional Mitigation / Enhancement Measures
Chironominae, *Nymphicula* sp., Tanypodinae, *Nesobasis* sp., *Abacaria ruficeps*, *Barbronia* sp., Ceratopogonidae, *Harrissius* sp., *Limonia* sp. & Polycentropodidae	1. Highly modified riparian 2. Eroded bank areas 3. Bank farming 4.Algal laden & silted streambed substrate 5. Household rubbish 6. Livestock/grazing on bank areas	Degraded	**1**. Identify point and non-point pollution sources to stream draining the village and farmed areas. **2.** Implement Nature-based solutions (long-term) for Sedimentation Control Plan. **3**. Use of engineering control measures (e.g. gabions, straw bale or sandbags) to avoid discharge of contaminated/grey water into the river. **4.** Grey water treatment plan. **5**. Proper rubbish disposal. **6**. Proper fencing for livestock to avoid river access.	**1.** Proper waste management plan in place (including hazardous wastes). **2**. Appoint an Environmental Officer to oversee implementation of the Environmental Management Plan. **3**. Define boundaries of the river rehabilitation project for impact (undercutting, bare bank areas) areas to limit socio-ecological disturbance. **4**. Consider transplanting (when possible) or replacing weeds/grass covered bank with native/endemic plants (Tahitian chestnut, *Pandanus vitiensis* and Sago palm) seedlings in suitable areas (bare bank/eroded areas). **5.** Annual biomonitoring of water quality and invasives in collaboration with forestry, SPC and Ministry of Agriculture. **6**. Establishment of '**banana circles'** close to at least 10m buffer zone at grey water outlets to the creek system.

Source: IAS, 2020 page 36

3.3 Socioeconomic and economic development

From this review, it was found that literature for previous socioeconomic assessment in Soasoa lacks. However, several studies in other areas within Fiji and the region can be relevant to this assignment.

3.3.1 Governance

Fiji has both a contemporary and traditional system of governance.

Central government is housed in Suva the capital city. The country is divided into four Divisions; Central (which includes Suva and all areas that are subsequently discussed in more detail in later sections of this report), Western, Eastern and Northern. Each of these divisions is headed by a Commissioner. Whilst the administrative importance of these divisions has historically waxed and waned, recent efforts by government have promoted planning, budgeting and resourcing at the divisional level. Within each division there are then a number of provinces. There are 14 Provinces in total in Fiji. Areas described in more detail later in this report lie within one of three provinces; Namosi, Naitasiri and Rewa. Rotuma, an island that lies off the north coast of Fiji, is governed semi-autonomously by the Rotuma Council established by the 1927 Rotuma Act.

The functions of central government are decentralised at the provincial level. Each province has a Provincial Office which is staffed by a number of largely government employees who have oversight of the functions of service provision to the population that reside in that province. The Provincial Office is headed by the Roko Tui . Most government functions are controlled at provincial level; though there are notable exceptions such as health care and educational provision which is decentralised to the divisional scale in the first instance.

In addition, there are twelve city (2) and municipal (10) councils that oversee the governance of urban areas. These councils comprise elected officials and are headed by a government appointed Special Administrator. Through the Ministry of Regional Development, rural areas are divided into Local Authorities that have advisory powers and provide a voice to all Fijians irrespective of racial background at the provincial scale. The local authorities also have mandate over the issuance of development licences in the areas they control.

In parallel to the state run-government there is also a governance system linked to the indigenous iTaukei. The indigenous population exist through family-units in a number of villages; with a number of villages comprising an iTaukei Tikina (district); and with a number of tikina comprising a province. Note however, there is a discrepancy between the iTaukei tikina district and the colonial definition of district which is used as an administrative unit for purposes including, in particular, the conduct of national census. Within each tikina there exists the Tikina Council which is comprised of village chief and village headman from the villages within that tikina.

At the top of the iTaukei administrative system within the province sits the Provincial Council which is comprised of indigenous leaders with the paramount chief of the province as the head and the Roko Tui as secretary; providing the link between the Provincial Council and the Provincial Office. The Provincial Council works with the Provincial Office to implement development programmes and address development issues within the Province. Finally, until March 2012 when it was disbanded, members of the iTaukei hierarchy sat on the Great Council of Chiefs.

Typically, each rural iTaukei village will have a number of development committees comprised of community members and leaders. Each committee oversees a specific component of the development of that community. Committees typically include education, church, health, environment and village development. Depending on the communal ownership of assets there may also be, for example, a village carrier (vehicle) committee. In addition, women and youth normally have a committee. Committees report to the wider village meetings. Village meetings are held at least monthly; often every fortnight or weekly. Village meetings are chaired by the village chief with the village headman normally acting as secretary. The village headman is now paid by government to perform their role and acts as a conduit from village to Tikina meetings which in turn pass to the Provincial Council and Provincial Office. Similar governance processes to those in iTaukei villages exist in Indo-Fijian settlements- in which Advisory Councils convene meetings and oversee matters pertaining to development initiatives in the settlement.

4. Existing Gaps

4.1 Socioeconomic and community development

4.1.1 Demographic data

The literature lacks population information for Soasoa watershed are, therefore more data collection is needed for socioeconomic indicators such as total population, age group, and interest in the Soasoa watershed area. It is important to note that community members' interest in resources within this area are often more than financial as they also have cultural, spiritual, recreational and aesthetic values. Depending on how they feel towards watershed management activities, different stakeholders may want to participate in different ways.

Detailed demographic data provides an overall understanding of the levels of community pressure on a given watershed. For instance, higher populations generally cause greater pressure. The information on changes over time can also be useful in determining if pressure on resources are increasing, decreasing or staying the same.

4.1.2 Community infrastructure and technology

Community infrastructure and technology are useful data for determining the level of community development and collective wealth of a village. Information on sewage treatment provides insight as to whether raw sewage may be affecting water quality in the Soasoa communities, while information on the existence of telephones, internet access, radios, televisions, and newspapers is useful to developing education and outreach programs in the site whereby awareness campaigns can be tailored to the most prevalent medium.

By monitoring the changes in the listed items, the Soasoa IWMP can note if community wealth and wellbeing have changed positively, negatively or stays the same and this can be a useful indicator to measure the impacts of the Plan and management interventions within.

4.1.3 Livelihood activities and resource use patterns

Having a good knowledge of how resources within the Soasoa watershed area are harvested and utilized is important in the design and planning for any watershed management activities. Information on how communities are dependent on each ecosystem good and service provides insight into the importance of different resources in terms of food security and income source. This information helps identify threats and opportunities related to a particular resource and can be useful for understanding how management measures may impact upon the food security and income. For example, if households primarily depend on farming as source of protein, then establishing a riparian buffer zone can be expected to have a strong effect on food security and income. When the information of resource use pattern is cross-examined with the information on resource condition, it can also be used to identify threats and possible negative impacts of particular resources on which the community heavily depends on. When it is cross-examined with the information on livelihood alternatives, it can help the Soasoa IWMP to understand limitations and possibilities of a diversified economic structure of the community and help predicting security of food and income in the future.

3.1.4 Governance and decision making processes

Understanding how communities are governed and how community decisions are made is very critical in the planning and design of the Soasoa IWMP and management interventions and strategies within. Information on the different committees/institutions that exist in communities and their linkages to provincial and national level is critical in understanding the socio-political settings of these communities. Also, identifying committees with core responsibilities related to watershed management activities and any experience with previous engagement on similar initiatives are important information. These information can assist the Soasoa IWMP in mapping out entry point for meaningful stakeholder engagement during implementation of the plan.

One of the important components of governance that needs to be assessed is resource conflict. Understanding resource conflicts within the Soasoa watershed area would assist the Soasoa IWMP in understanding whether there are any conflicts of resource access/use, their degree, and who are involved in the conflict. Extensive conflicts of resource use would be a challenge for the Soasoa IWMP and therefore the project needs to respond to conflicts in such a way that community wellbeing and the natural environment can be protected.

4.1.5 Gender Roles and Responsibilities

Understanding the division of activities and responsibilities according to gender groups will help the Soasoa IWMP to better understand resource users in the Soasoa watershed area, particularly their local roles and related social changes. The information helps to address the specific needs of men and women and how watershed management strategies or proposed rules affect the sex groups differently. For example, restricting land-use activates close to the main Soasoa river may affect women in surrounding communities significantly since this is the area that this group harvest most non-timer forest products.. Also, the Soasoa IWMP can better target relevant groups to develop communications programs in order to influence attitudes or behavior.

4. **Annexes**

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4.2 Draft Outline of Soasoa IWMP

Introduction

- Background
- Vision and goals
- Objectives
- Stakeholder engagement and roadmap for development of the Plan

Soasoa catchment in context

- Physical setting
  - Geophysical- location and topography
  - Catchment drainage scheme- Water network and flooding events
  - Landuse system
  - Biodiversity
  - Hydrology- Water
  - Freshwater ecology
  - Terrestrial ecology/Marine ecology in lower Soasoa catchment

- Population
  - Population structures
  - Gender
  - Development activities
  - Economic activities
  - Governance
- Governance
  - Stakeholder analysis related to Soasoa drainage catchment/IWRM
  - Policies and legal framework related to Soasoa drainage catchment/IWRM

- Issues and threats to Soasoa watershed sustainability
- Soasoa Watershed management interventions
- Implementation Plan
- Monitoring and Evaluation Framework

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