American Samoa Water Quality

Climate Change Vulnerability Assessment Summary

An Important Note About this Document: *This document represents an initial evaluation of vulnerability for water quality based on workshop input and existing information. The aim of this document is to expand understanding of ecosystem service vulnerability to changing climate conditions, and to provide a foundation for developing appropriate adaptation responses.*

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Ecosystem Service Description

Water quality in American Samoa is compromised by increased population growth, clearing for agriculture, and increased pesticide, pathogen, and nutrient pollution from poorly constructed human and pig waste disposal systems. Most of the wells and pumps for groundwater distribution are found in the Tafuna-Leon plain, which is also where most residents and businesses are located.[1] Since the Tutuila volcanic stratum is very permeable, it is also very vulnerable to contamination and pollution from rain events, causing runoff of pollutants such as oil and gas from automobiles, and pathogens and nutrient loading from poorly constructed humans and pig waster systems. Stream water, which was traditionally used as the primary potable water, has also been compromised by development along streams causing sedimentation, increased erosion, and nutrient loading from animal and human waste.[1] Along the coastal shoreline, poor water quality has been threatening nearby fringing reefs. Since the construction of the airport, which altered natural circulation patterns in the Pala Lagoon, the area has had poor water quality and low biodiversity.[1,2] The Pago Pago Harbor also has poor water quality due to degraded conditions from fuel/oil spills and toxins, and high eutrophication from nutrient loading from land-based sources of pollution.[3] The fish and invertebrates in the harbor are even contaminated with heavy metals.

Ecosystem Service Vulnerability

Moderate-High Vulnerability

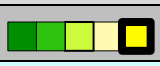
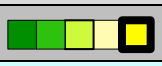
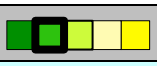
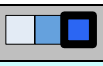
High Confidence

The relative vulnerability of water quality in American Samoa was evaluated by workshop participants to be moderate-high due to high sensitivity to climate and non-climate stressors, high exposure to projected future changes, and moderate to high adaptive capacity. Water quality is sensitive to climate drivers that alter hydrology of rivers and streams, such as air temperature, tropical storms, precipitation, and drought, causing soil erosion, pollution, and nutrient loading. Other climate drivers, such as ocean acidification and sea surface temperature, will impact water quality of nearshore coastal waters. Potable water in American Samoa is a limited resource found in groundwater and streams, and is very vulnerable to increased demand due to development and population growth. Sea level rise and increased storms may cause saltwater intrusion into groundwater reserves.[4]

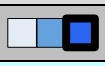
Sensitivity

High Sensitivity

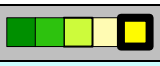
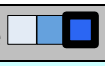
Water quality, both potable water supply and coastal waters, are highly sensitive to several climate drivers. Potable water, both from rivers and streams and groundwater, is sensitive to increased precipitation and possible saltwater intrusion during periods of droughts.[1] Non-climate stressors can further impact ecosystem service and enhance climate vulnerability of water quality and quantity in the region.

SENSITIVITY FACTORS AND IMPACTS*	
CLIMATE STRESSORS High sensitivity  High confidence 	
FACTOR	**IMPACT**
Warmer sea surface temperature	• Can cause low oxygen and promote algal blooms.
Warmer air temperature	• Affect periods of drought and limiting water storage and groundwater recharge.
Tropical storms and Wave height	• Increased contaminants into groundwater. • Increased groundwater recharge. • Possible increased vegetation during increased precipitation events causing erosion control.
Ocean acidification/ pH	• Ocean acidification is degrading seawater quality impacting calcifying organisms growth and coral reefs stability and increasing vulnerability to damage, erosion, and mortality.[3]
DISTURBANCE REGIMES Low-moderate sensitivity  High confidence 	
FACTOR	**IMPACT**
Wind	• Changes in wind patterns can result in changes in circulation either helping or further impacting near shore coastal water quality.
Tsunamis/ Flooding	• Causing coastal erosion, destruction of infrastructure, and flooding damaging coastal ecosystems, infrastructure, and agriculture causing more pollutant and nutrient loading. • Can deliver new nutrients and organic matter, redistribute sediments, and increases erosion.
Disease	• Increased disease due to poor water quality.
ENSO/PDO/ IPO phases	• Causing periods of increased precipitation events and increased sea surface temperatures.

* Factors presented are those ranked highest by workshop experts.

SENSITIVITY FACTORS AND IMPACTS*	
NON-CLIMATE STRESSORS	High sensitivity  High confidence 
FACTOR	**IMPACT**
Land use change	• Development and clearing for agriculture has increased erosion and sedimentation impacting fresh water streams and groundwater recharge. • Land use changes and agriculture has impacted stream hydrology and shading leading to increased erosion and sedimentation.
Pollution & poisons	• Pollution and poisons can result in significant impacts to the nearshore water quality as well as streams, rivers, and groundwater.
Recreation	• Coastal recreation (e.g. swimming, diving, and fishing) is dependent on good water quality and a healthy coral reef ecosystem. • Possible issues from high-strength wastes from tuna canneries that are dumped in designated zones 5 miles offshore.[1]
Aquaculture/ Harvest	• Increased water demand for aquaculture businesses (mostly Tilapia).[5]
Energy production	• Energy is used to pump and treat drinking water in American Samoa; increased water use due to population growth with increased energy demand.[6]
Nutrient loading	• Nutrient loading from stormwater, improper disposal of human and pig waste, and solid waste.[1]
Dredging	• Possible increased sedimentation and impacts on habitat and benthic communities. • Sedimentation can impact other habitat nearby such as coral reefs. • Disposable of dredging material could be limited due to possible high levels of contaminants. • Some direct effects in changing currents and alternation of sediment pathways which could lead to reduction or improvement of water quality.

Roads/ armoring	• Increased stormwater pollutants.
	• Armoring structure increases erosion of beaches and beach communities.
	  ○ Does not allow for habitats to migrate inland from sea level rise.
	  ○ Possible increase of invasive species from artificial structures.

Invasive species	• Increased invasive species and harmful algal blooms.
Overwater/ underwater structures	• Possible increased conflicts with shipping/and possible shipwrecks.
OTHER SENSITIVITY FACTORS	High sensitivity  High confidence 
FACTOR	**IMPACT**
Infrastructure	• Wastewater systems and piping human waste management need to be retrofitted to become resilient to changing conditions.

SENSITIVITY FACTORS AND IMPACTS*	
Oil spills	• From ship groundings and land-based sources of pollution and stormwater.

Exposure†

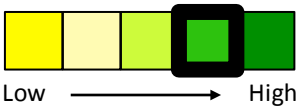
High Exposure

Under future conditions in the next 20 years, water quality in American Samoa will likely degrade due to significant sea level rise threatening groundwater with saltwater intrusion; increased tropical storm intensity causing more flooding, nutrient loading, and coastal erosion; increased sea surface temperatures making harmful algal blooms more prevalent; and ocean acidification impacting calcareous organisms' ability to form shells.

PROJECTED CLIMATE AND CLIMATE-DRIVEN CHANGES	
CLIMATE STRESSORS	**PROJECTED CHANGES**
Sea level rise/coastal erosion	Region will experience roughly same mean average sea level rise as global trends by 2100 between 0.2 m-2.0 m • Sea level rise will threaten groundwater reservoirs and increase coastal erosion • Sea level rise and coastal erosion will also reduce mangrove extent impacting the near shore water filtration provided by mangroves and wetlands[7]
Tropical storms	Potential reduction in cyclone activity in American Samoa as storm tracks shift toward the Central North Pacific, but potential increases in storm intensity over the next 70 years.
Ocean acidification/pH	By 2060: aragonite saturation state will fall below 3.5, and continue declining thereafter
Sea surface temperature	Sea surface temperatures in the Pacific Islands are projected to increase +1.1 to +1.7°F by 2030, +1.8 to +2.3°F by 2055, and +2.5 to +4.7°F by 2090. • Promoting increase disease and lower dissolved oxygen resulting in possible harmful algal blooms

Adaptive Capacity

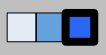
Moderate-High Adaptive Capacity



Water quality is a life-sustaining limited resource threatened by increased population growth and increased demands. It can be resilient to climate change through proper management such as increased water conservation programs and waste and stormwater programs. Other

† Relevant references for regional climate projections can be found in the Climate Impacts Summary Table.

management potential to increase resilience and adaptive capacity is to decrease use of contaminants and nutrients that can impact water quality.

ADAPTIVE CAPACITY FACTORS AND CHARACTERISTICS‡	
OTHER SENSITIVITY FACTORS	High sensitivity  High confidence 
Value	• Has high value for potable water, life sustaining • Is a limited resource in the region
Management potential	• Protected by American Samoa Environmental Protection Agency and 314 of the Clean Water Act[1] • Increase water management, including wastewater and storm water • Decrease use of contaminants and nutrients • Decrease marine debris • Increased in demands from population growth will impact ground water sources and alternative water supplies will need to be explored such as water conservation methods, desalinization, and waste/storm water reuse.

Literature Cited

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[5] Adams, T., Bell, J. and Labrosse, P. 2001. Current status of aquaculture in the Pacific Islands. In R.P. Subasinghe, P. Bueno, M.J. Phillips, C. Hough, S.E. McGladdery & J.R. Arthur, eds. Aquaculture in the Third Millennium. Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand, 20-25 February 2000. pp. 295-305. NACA, Bangkok and FAO, Rome.

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‡ Please note that the color scheme for adaptive capacity has been inverted, as those factors receiving a rank of "High" enhance adaptive capacity while those factors receiving a rank of "Low" undermine adaptive capacity.